SERVICE REPAIR

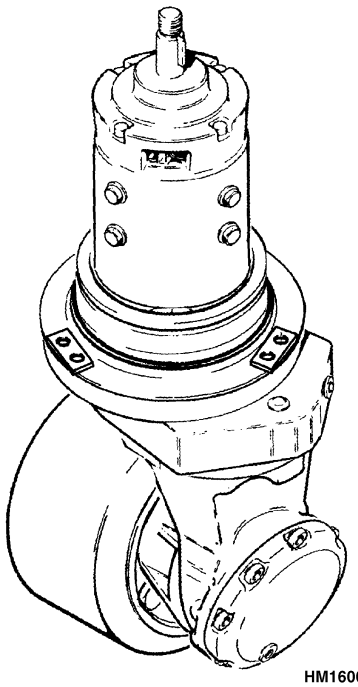
MANUAL

Hyster D135 (W40XL, W60XL, B40XL, B60XL) Forklift

HYSTER

MASTER DRIVE UNIT

T5XL [C142]; R30E/EA/EF [D118]; R30ES [B174]; C60XL [A199]; R30DH [B186]; N40/45FR, N50FA [D138]; N40/50EA, N40/45ER [C138]; R30F/FA/FF [E118]; R30XM/XMA/XMF [F118]; R30XMS [C174]; W40/60XL, B40/60XL [D135]; TWR [A206]; A1.00-1.50XL (A20-30XL) [A203]; N30FR [A217]; R30XMS2 [D174]; R30XM2/XMA2/XMF2 [G118]



HM160012

HYSTER

PART NO. 897065

630 SRM 283

SAFETY PRECAUTIONS
MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks.
- Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:

WARNING

Indicates a condition that can cause immediate death or injury!

CAUTION

Indicates a condition that can cause property damage!

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This section is for the following models:

T5XL [C142];
R30E/EA/EF [D118];
R30ES [B174];
C60XL [A199];
R30DH [B186];
N40/45FR, N50FA [D138];
N40/50EA, N40/45ER [C138];
R30F/FA/FF [E118];
R30XM/XMA/XMF [F118];
R30XMS [C174];
W40/60XL, B40/60XL [D135];
TWR [A206];
A1.00-1.50XL (A20-30XL) [A203];
N30FR [A217];
R30XMS2 [D174];
R30XM2/XMA2/XMF2 [G118]

"THE
QUALITY
KEEPERS"

HYSTER
APPROVED
PARTS

Description

Six capscrews fasten the large ball bearing and MDU to the frame or axle plate. The bearing lets the MDU turn for steering. There is a small helical pinion gear on the motor armature shaft. This gear turns a large helical gear on the shaft of the spiral bevel pinion in the MDU. The spiral bevel pinion turns a spiral bevel gear on the axle to turn the drive wheel. The brake is fastened to the top end of the motor shaft to stop rotation of the shaft. The brake action works through the gears to stop the unit.

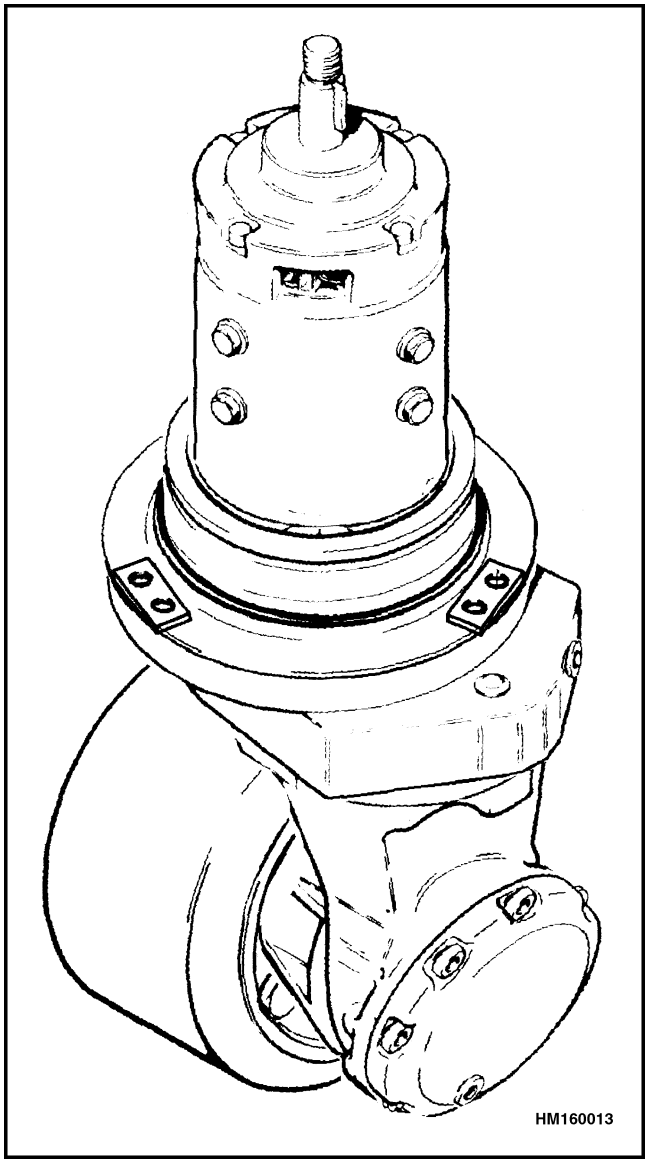
HFK300 and 400 Master Drive Unit

GENERAL

This manual has a description and the repair and adjustment procedures for the parts of the master drive unit (MDU) manufactured by Hurth. See Figure 1. This section is for the Hurth Models HFK 200 through 500. The traction motor, steering, and brake repair procedures are in separate sections. The main parts of the MDU are the case, pinion (motor) and large gear set, the pinion and spiral bevel gear set, bearings, and the axle and wheel. The large ball bearing for steering is part of the top case of the MDU. The traction motor fastens to the MDU (Type A) on the following units: W40XL; W60XL; B40XL; B60XL; C60XL; T5XL; TWR; R30F, FA, FF, XM, XMA, XMF, XM2, XMA2, XMF2, and XMS2. The traction motor and MDU turn as a unit for steering. The traction motor fastens to an adapter ring at the MDU (Type B) on the following units: A1.00XL, A1.25XL, A1.50XL (A20XL, A25XL, A30XL), N40EA, N50EA, N40ER, N45ER, N50FA, N30FR, N40FR, N45FR, R30DH, R30E, R30EA, R30EF, and R30ES. The adapter ring fastens to the lift truck frame or steering axle. The MDU turns for steering and the traction motor does not turn.

NOTE: Early A1.00-1.50XL (A20-30XL) units have a Speth MDU. See the section **Speth Master Drive Unit** 630 SRM 363.

There are three different types of MDUs used on the lift truck models listed. The major difference is the physical size and the top case. There are also two methods of mounting the MDU and traction motor in the lift truck. See Figure 2 and Figure 4. In type A, the traction motor fastens to the MDU and turns with the MDU. In type B, the traction motor fastens to an adapter ring that is fastened to the lift truck or steering axle frame. This adapter ring is part of the large ball bearing and allows the MDU to turn on the axis of the traction motor. The traction motor does not turn with the MDU. The lower case and internal parts of these MDUs are very similar.



NOTE: MDU SHOWN WITH MOTOR AND WHEEL.

Figure 1. Master Drive Unit

NOTE: The manufacturer recommends draining and refilling the drive unit oil after the first 350 hours of use on all new trucks.

There are also three different Hyster part numbers for the main (lower) part of the MDU depending on the truck series. MDU Part No. 2007081 is a replacement for MDU Part No. 338600. Part No. 1335340 is used on the A1.00-1.50XL (A20-30XL). The axle and axle seals are different for the MDUs, so internal parts from one cannot be used in the other. The operation is the same. MDU removal, disassembly, assembly, adjustment, and installation procedures are written for all the lift truck models listed and the MDUs described.

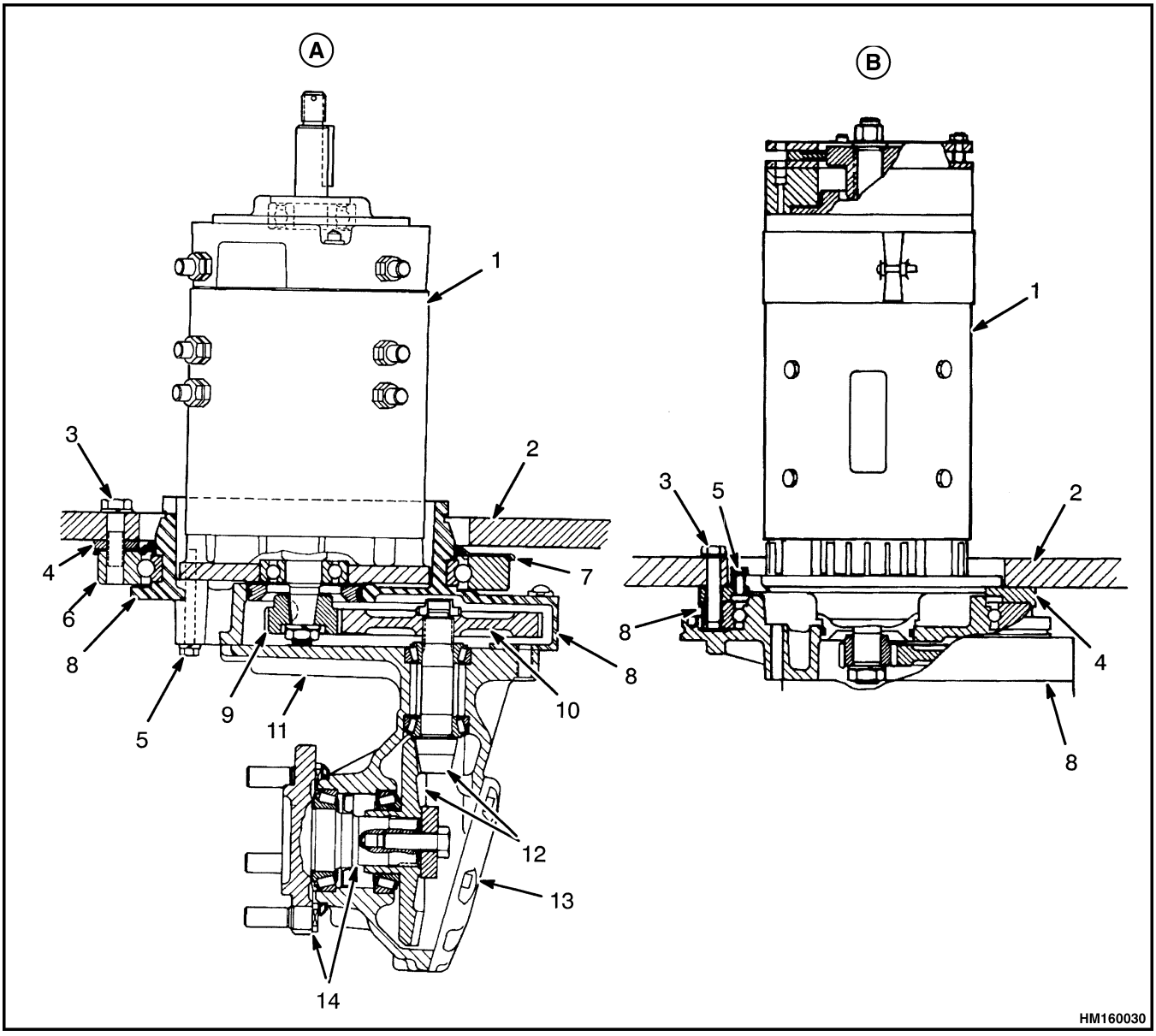


Figure 2. Master Drive Unit Cross Section

Legend for Figure 2

NOTE: MDU PART NO. 338600 SHOWN. MDU PART NO. 2007081 AND 1335340 SIMILAR.

A. MOUNT TYPE A (W/B40-60XL, C60XL, T5XL, AND TWR)
B. MOUNT TYPE B (A1.00-1.50XL, N40/50EA, N40/50ER, N50FA, N30-45FR, R30DH, AND R30E/EA/EF/ES)

1. TRACTION MOTOR
2. FRAME OR AXLE PLATE
3. CAPSCREW TO FASTEN BEARING AND MDU
4. SHIM (W/B40-60XL) OR ADAPTER RING (R30DH)
5. CAPSCREW TO FASTEN MOTOR
6. LARGE BALL BEARING
7. BEARING SHIELD
8. TOP CASE
9. PINION GEAR (MOTOR)
10. LARGE GEAR
11. LOWER CASE
12. SPIRAL BEVEL PINION AND GEAR SET
13. COVER
14. AXLE

REMOVE

Mount Type A

WARNING

If the Master Drive Unit (MDU) falls, it can cause a personal injury. Hold the MDU vertical to prevent it from falling.

CAUTION

The capscrews used to fasten the MDU and traction motor are all metric. Do not damage them using the wrong tools.

The MDU can be removed from the lift truck without removing the motor, steering, or brake assemblies from the lift truck. Remove the MDU as follows. See Figure 2.

1. Remove the hood. Disconnect and remove the battery. Use the battery removal procedure in the **Periodic Maintenance** manual for your lift truck.

2. Put a pan under the drain plug and remove the drain plug. After the oil has completely drained, install the drain plug. Tighten the drain plug to 22 N•m (16 lbf ft).

3. Remove the three capscrews that fasten the motor to the case of the MDU. Carefully lift the motor, steering, and brake assemblies. Do not damage the brake assembly or the pinion gear on the motor shaft. Use rope to fasten the motor to prevent the motor from falling.

4. Remove the six capscrews that fasten the bearing and MDU to the main frame. Hold the MDU to keep it from falling. Use a crane and chains that have a capacity of 450 kg (1000 lb). Carefully lift the main frame and move the MDU from under the main frame. Do NOT lose the shims. Carefully remove the bearing shield.

5. Lower the main frame onto blocks.

Mount Type B (A1.00-1.50XL, N40-50EA/ER, N50FA, N30-45FR, R30E/EA/EF/ES Only)

WARNING

If the MDU falls, it can cause a personal injury. Hold the MDU vertical to prevent it from falling.

1. Align the steering wheel so that the drive wheel is in a position for straight travel. See Figure 2.

2. Disconnect and remove the battery. Use the battery removal procedure in the **Periodic Maintenance** manual for your lift truck.

3. Open the drive unit compartment doors. Fasten the doors so that they are fully open. Put a pan under the MDU drain plug and remove the drain plug. After the oil has completely drained, install the drain plug. Tighten the drain plug to 22 N•m (16 lbf ft).

4. Identify and tag the wires to the brake assembly and the power cables of the traction motor for later installation.

5. Disconnect the power cables and wires.

6. Remove the six capscrews and lockwashers that fasten the traction motor to the adapter ring on the MDU. Carefully lift the motor and set the motor out of the way. Do not damage the pinion gear on the motor shaft. Use rope to fasten the motor to prevent the motor from falling.

7. Loosen the lock nut at the chain anchor for the steering chain. Remove the capscrew at the chain anchor. Put a mark on the MDU for the location of the pin that fastens the chain anchor to the sprocket. Remove the pin. Carefully remove the chain anchor and chain from the sprocket.

8. Carefully put a sling under the lift truck frame on the mast side of the MDU. **Do not damage the guidance sensor if the lift truck has wire guidance.** Make sure the lifting device and sling have the ability to lift approximately 450 kg (1000 lb).

9. Remove the six capscrews and lockwashers that fasten the adapter ring and MDU to the frame or axle plate.

10. Hold the MDU and raise the lift truck frame so that the MDU is free. On the N40/50EA and N40/45ER units, the steer axle will pivot on the articulation shaft. Carefully lower the MDU to the floor and move the MDU from under the lift truck. Lower the lift truck frame on blocks.

Mount Type B (R30DH Only)

WARNING

If the MDU falls, it can cause a personal injury. Hold the MDU vertical to prevent it from falling.

WARNING

There are close clearances between the MDU, drive chassis, and base arm assembly that can cause serious injury. NEVER put hands, arms, head, or legs between these parts unless the parts have blocks to prevent movement.

1. Move the steering wheel so that the drive wheel is in a position for straight travel.

2. Disconnect and remove the battery. Use the battery removal procedure in the section **Periodic Maintenance** 8000 SRM 295.

3. Open the electrical compartment doors. Fasten the doors so that they are fully open. Put a pan under the MDU drain plug and remove the drain plug. After the oil has completely drained, install the drain plug. Tighten the drain plug to 22 N•m (16 lbf ft).

WARNING

The traction motor is heavy. Be sure that all lifting devices (hoists, cables, chains, slings, etc.) are suitable and of adequate capacity to lift the traction motor. The traction motor can weigh around 40 kg (85 lb).

4. Remove the six capscrews and lockwashers that fasten the traction motor to the adapter ring on the MDU. Carefully lift the motor and set the motor out of the way. Do not damage the pinion gear on the motor shaft. Use rope to fasten the motor to prevent the motor from falling.

5. Loosen the lock nut at the chain anchor for the steering chain. Remove the capscrew at the chain anchor. Put a mark on the MDU for the location of the pin that fastens the chain anchor to the sprocket. Remove the pin. Carefully remove the chain anchor and chain from the sprocket. Do not damage the sprocket and steering potentiometer assembly. Do not damage the limit switches. Remove the two capscrews that fasten the bracket for the switches. Move the switches and bracket so that they will not be damaged. Use string or wire to keep the bracket in this location.

6. Carefully put a sling around the drive chassis. Put the sling under the drive chassis and between the drive chassis and the base arms. The sling must also be between the MDU and the pivot for the drive chassis. Make sure the lifting device and sling have the ability to lift approximately 45 kg (100 lb).

7. Remove the six capscrews and lockwashers that fasten the adapter ring and MDU to the drive chassis. Put marks on the MDU for the location of the roller guide for the limit switches and for the stop pins.

8. Hold the MDU and lift the drive chassis so that the MDU is free. Carefully lay the MDU on the floor. Do not damage the sprocket and steering potentiometer assembly or the limit switches. Make sure there is clearance between the MDU and all parts on drive chassis. Carefully lower the drive chassis on the stops.

9. Carefully put a sling under the base arm assembly on the mast side near the casters. Make sure the sling is NOT under the MDU. Slowly raise the base arm assembly for clearance to slide the

MDU under the plate between the caster assemblies. **Do not damage the guidance sensor if the lift truck has wire guidance.** Slide the MDU out from under the lift truck and lower the base arm assembly on the casters. If necessary, remove the roller guide and stop pins.

DISASSEMBLE

CAUTION

Failure to completely straighten the staked portion of the nut prior to removal can cause damage to the shaft threads.

CAUTION

The capscrews and nuts used on the MDU are all metric. Do not damage them using the wrong tool.

NOTE: Before disassembling the drive unit make certain the work area is clean and all necessary tools are available. The nuts retaining the drive axle and upper gear on the pinion shaft are staked in place and the staked portion must be completely removed before attempting any disassembly.

1. Remove the lug nuts and the wheel.

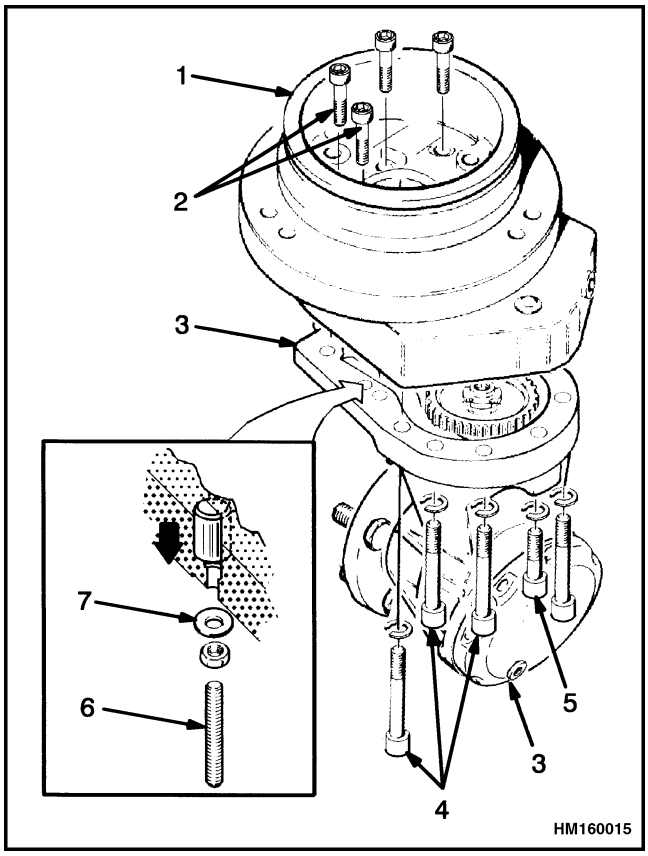
2. Remove the four capscrews inside the top case. See Figure 3. Remove the seven capscrews that fasten the bottom case to the top case. There are three on each side and one at the center.

CAUTION

Do NOT try to separate the top and bottom cases. Two pins must be removed to separate the cases.

3. Remove the two pins to separate the cases. The pins have internal threads. Use a metric capscrew and flat washer together with spacers of different lengths to pull the pins out of the top case. See Figure 3.

4. Carefully separate the top case from the bottom case. Slide the top case for clearance between the top case and large gear. See Figure 4. Remove the top case.



1. TOP CASE
2. CAPSCREWS INSIDE TOP CASE
3. BOTTOM CASE
4. CAPSCREWS (3 EACH SIDE)
5. CAPSCREW (CENTER)
6. CAPSCREW IN PIN
7. SPACER

Figure 3. Separating Cases

5. Use a piece of wood to prevent the axle from turning. Put the wood between the wheel studs on the axle. Remove the special nut at the large gear. See Figure 4. Remove the large gear, bearing cone, and spacer from the spiral bevel pinion.

CAUTION

Keep all shim sets together and labeled for correct location and installation during assembly.

6. Prevent the axle from turning. Remove the special capscrew for the axle. Remove the capscrew, special washer, and shims. Hold the spiral bevel pinion and remove the spiral bevel gear and bearing cone. Do **NOT** let the spiral bevel pinion fall. Remove the spiral bevel pinion and bearing cone.

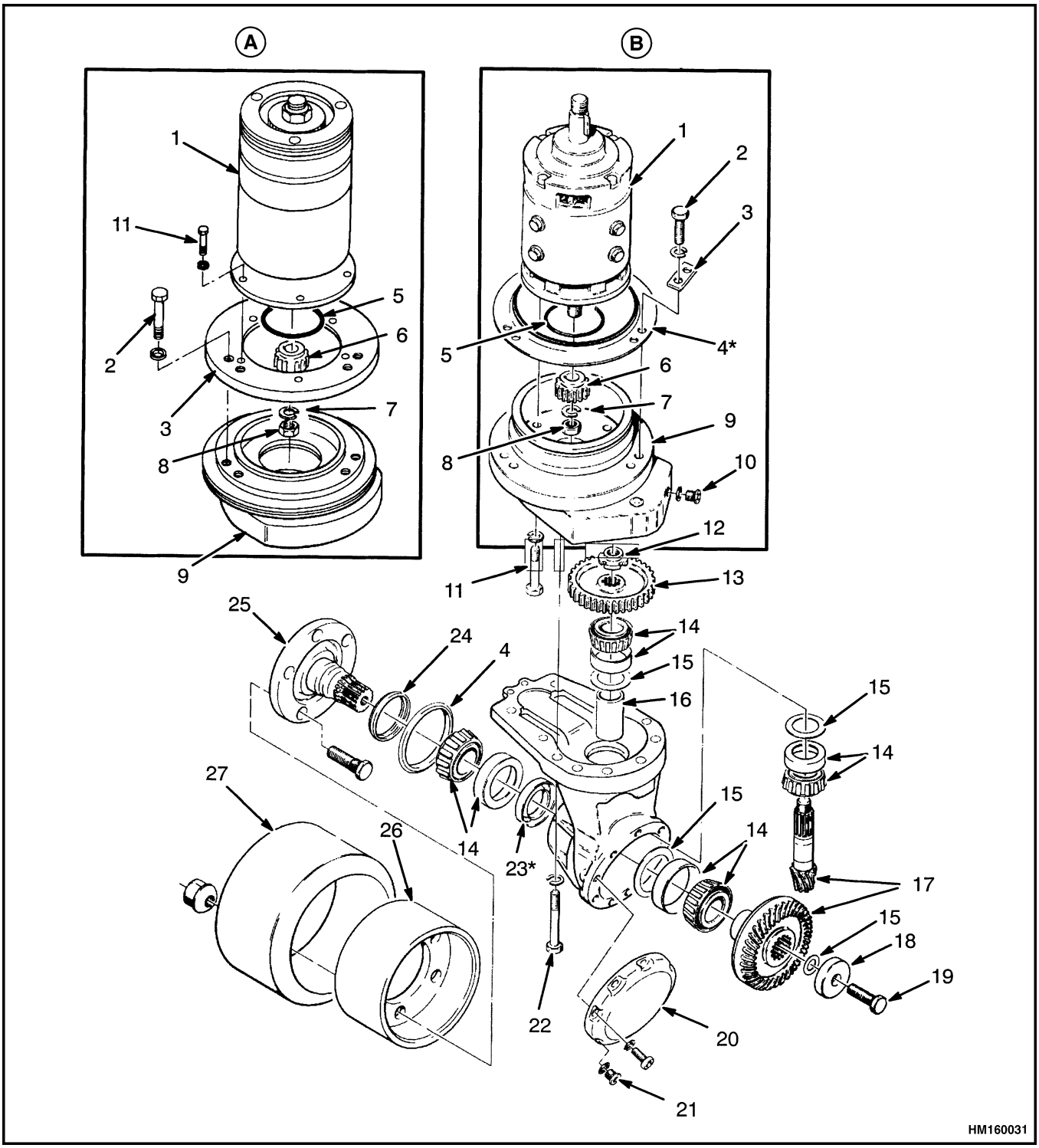


Figure 4. Master Drive Unit Parts

Legend for Figure 4

A. A1.00-1.50XL, N40-50EA/ER, N50FA, N30-45FR, R30D/DH, R30E/EA/EF/ES
B. W/B40-60XL, C60XL, T5XL, TWR

1. TRACTION MOTOR
2. CAPSCREW TO FASTEN BEARING AND MDU
3. ADAPTER RING OR SHIM (3 REQUIRED)
4. BEARING SHIELD
5. O-RING
6. PINION GEAR (MOTOR)
7. LOCKWASHER AND KEY
8. MOTOR NUT
9. TOP CASE
10. LEVEL AND FILL PLUG
11. MOTOR CAPSCREW
12. SPECIAL NUT
13. LARGE GEAR
14. BEARING CUP AND CONE
15. SHIMS
16. SPACER
17. SPIRAL BEVEL PINION AND GEAR SET
18. SPECIAL WASHER
19. SPECIAL CAPSCREW FOR AXLE
20. COVER
21. DRAIN PLUG
22. CASE CAPSCREW (11 REQUIRED)
23. SEAL
24. BEARING SEAL
25. AXLE
26. WHEEL
27. TIRE

NOTE: If the spiral bevel pinion and gear set will **NOT** be replaced, the same shim sets can be used during assembly. Adjustment will not be necessary.

7. Carefully remove the axle, bearing seal, and bearing cone. If necessary, remove the bearing shield (MDU Part No. 383600 only).

8. If necessary, remove each of the bearing cups. Use a puller. Do **NOT** lose the shims between the cups and the bore in the case. Keep each set of shims together and separate from the other sets of shims. Put a label on each set so that the sets can be installed in the correct position during assembly.

9. On MDU Part No. 383600, measure the distance between the edge of the case and the seal at the axle bore. The replacement seal **MUST** be installed in the same position as the old seal. Remove the seal.

10. If necessary, remove the bearing cones from the axle, from the spiral bevel gear, and from the spiral bevel pinion.

11. If necessary, remove the motor nut, lockwasher, pinion gear, and key from the motor shaft. Remove the O-ring from the motor.

ASSEMBLE

General

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the recommendations of the manufacturer. Always wear eye protection.

1. Clean all components thoroughly. Remove all traces of Loctite™. Use Loctite™ Fast Cleaner number 706 to remove Loctite™ from the lower housing in the area where the thread protecting shield was located. Spray the cleaner from a distance of approximately 30 cm (12 in.), while holding the can upright. Allow the cleaner time to work, then thoroughly remove the dissolved dirt from the lower housing using a clean cloth. Spray the surface with the cleaner again and allow to air dry.

CAUTION

The axle and gear assemblies are installed and removed several times during this procedure. Be careful during installation, Do Not Damage the bearing seal.

2. Check all parts for damage or cracks. Replace all worn or damaged parts. When assembling the drive unit, use all new stake nuts, O-rings, and seals.

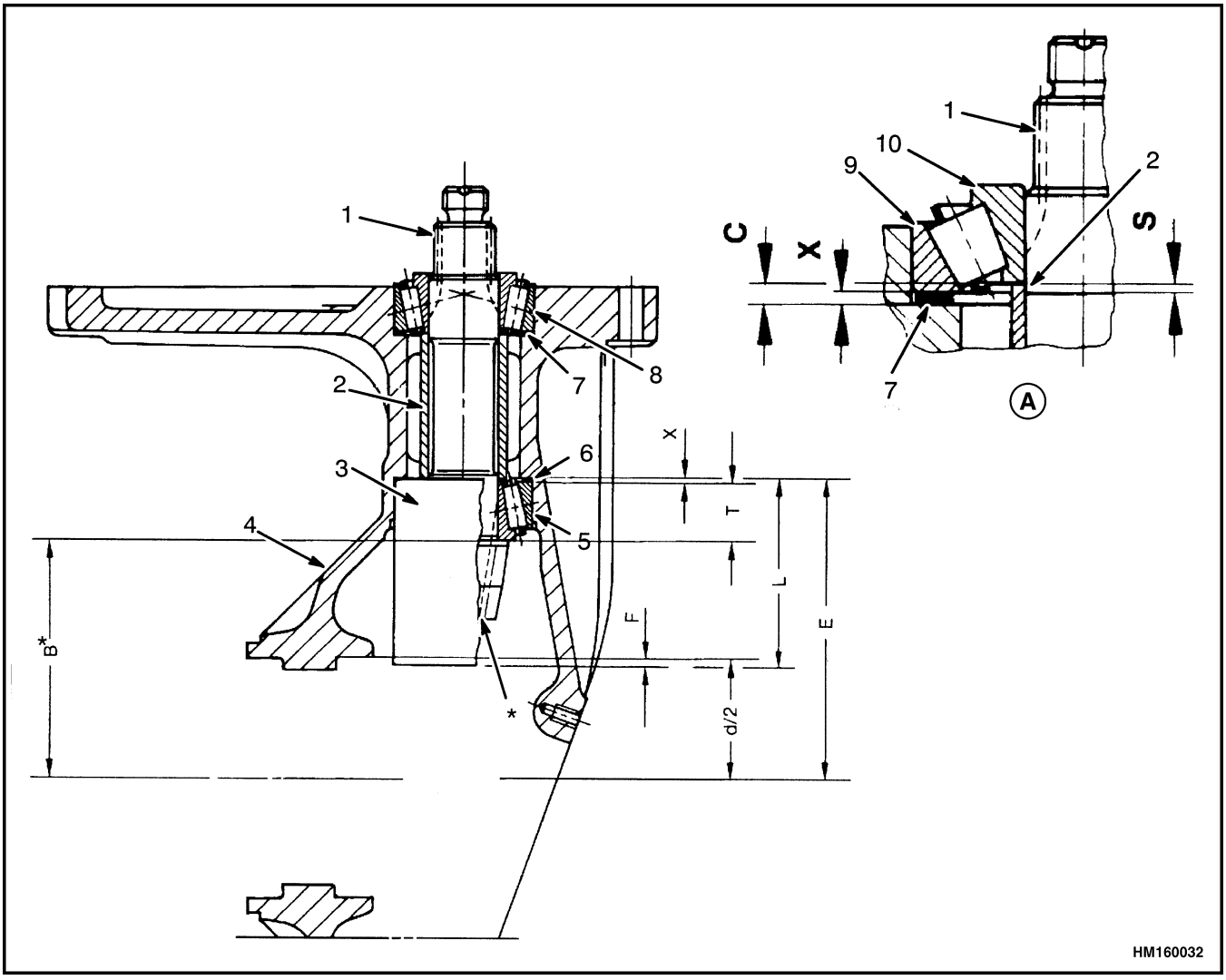
NOTE: The pinion gear and the large gear **MUST** be replaced as a set. The spiral bevel pinion and gear set **MUST** be replaced as a set. When replacing the gear sets, always replace the tapered roller bearings. The inner bearings and outer races **MUST** be from the same manufacturer. Lubricate the bearings with clean transmission oil prior to assembly.

NOTE: Assembly of the drive unit requires the use of a standard micrometer, torque wrench and a dial indicator. The use of other special tools is recommended by the manufacturer of the drive unit.

NOTE: The large ball bearing is part of the top case. The top case and the ball bearing are replaced as a unit.

Spiral Bevel Pinion, Install

This procedure has the necessary steps needed to install the spiral bevel pinion shaft. All of the steps are necessary if a replacement spiral bevel pinion shaft and gear set or a replacement lower case is needed. Normally, it is not necessary to replace the lower case or spiral gear set. See Figure 5.



A. SHOWN WITH BEARING AND SHIMS INSTALLED

1. BEVEL PINION SHAFT
2. SPACER
3. SPECIAL BUSHING
4. LOWER CASE
5. LOWER BEARING
6. SHIM SET X
7. SHIM SET Y
8. UPPER BEARING
9. BEARING CUP
10. BEARING CONE

*DIMENSION B (MM) ON END OF SPIRAL BEVEL PINION

Figure 5. Spiral Bevel Pinion Installation

If the original spiral gear set will be installed in the same lower case, use the original shim sets (x and y). See Figure 5. Install the shim sets, bearing, spiral bevel pinion, large gear, and special nut. Check the bearing clearance as described in Step 7.

If only the spiral gear set is replaced, use the number (*) to find the correct shim set (x). If the new number is smaller than the old number, remove shims. If the old number is larger, add the shims. Add or remove shims equal to the difference between the numbers. Do **NOT** use damaged or distorted shims.

EXAMPLE:

The old number 74.25 minus the new number 74.15, will make removing shims 0.1 mm (0.004 in.) in thickness necessary.

If this method of finding the correct set is used, it is **NOT** necessary to do Step 2 through Step 4. Do Step 1 and Step 5 through Step 7.

Use all of the following steps to assemble, adjust, and install a **NEW** spiral bevel pinion (if you do not have one of the above numbers) or the original spiral bevel pinion in a **NEW** case.

NOTE: There are two numbers on each of the two parts of the spiral gear set. One number on each part is the set number. The numbers **MUST** be the same. The other number on the spiral bevel gear is the gear clearance number. The other number on the spiral bevel pinion is the dimension B value. Check that the numbers are correct.

Install the spiral bevel pinion shaft as follows:

1. Make a bushing to fit the bore for the lower pinion shaft bearing. Different models need different size bushings. The bushing outside diminshed (O.D.) will be either (1) 46.5 mm (1.83 in.), (2) 51.5 mm (2.03 in.), or (3) 63.5 mm (2.50 in.). Bushing (1) must be 55 mm (2.17 in.) long. Bushing (2) must be 67.5 mm (2.66 in.) long. Bushing (3) must be 77.5 mm (3.05 in.) long.

2. Install the bushing in the bore. To find the correct thickness for shim set x, it is necessary to know case dimension E. To find case dimension E, use the formula:

E = L – F + d/2

L = bushing length

F = the difference between the bearing bore for the axle and the end of the bushing. See Figure 5.

d/2 = 37.50 mm (1.48 in.) with bushing (1)

d/2 = 44.45 mm (1.75 in.) with bushing (2)

d/2 = 45.00 mm (1.77 in.) with bushing (3)

3. Measure dimension F. See Figure 6. Subtract value F from the length (L) of the bushing and add the value d/2. The result is dimension E.

4. The shim set thickness X for shim set x for the lower bearing is found as shown in Figure 5.

X = E – B – T

E = the value found in Step 3.

B = the number on the end of the pinion shaft

T = the total thickness of the bearing

5. Install the shim set x and press the bearing cup into the bore. Install the bearing cone and spacer on the pinion shaft. Install the pinion shaft in the case.

6. Install a piece of wood between the end of the pinion and the case to hold the pinion tightly in the bore. Do NOT install shims or bearing. Measure the distance between the top end of the spacer and the bottom of the bore for the bearing. This is distance C in Figure 5.

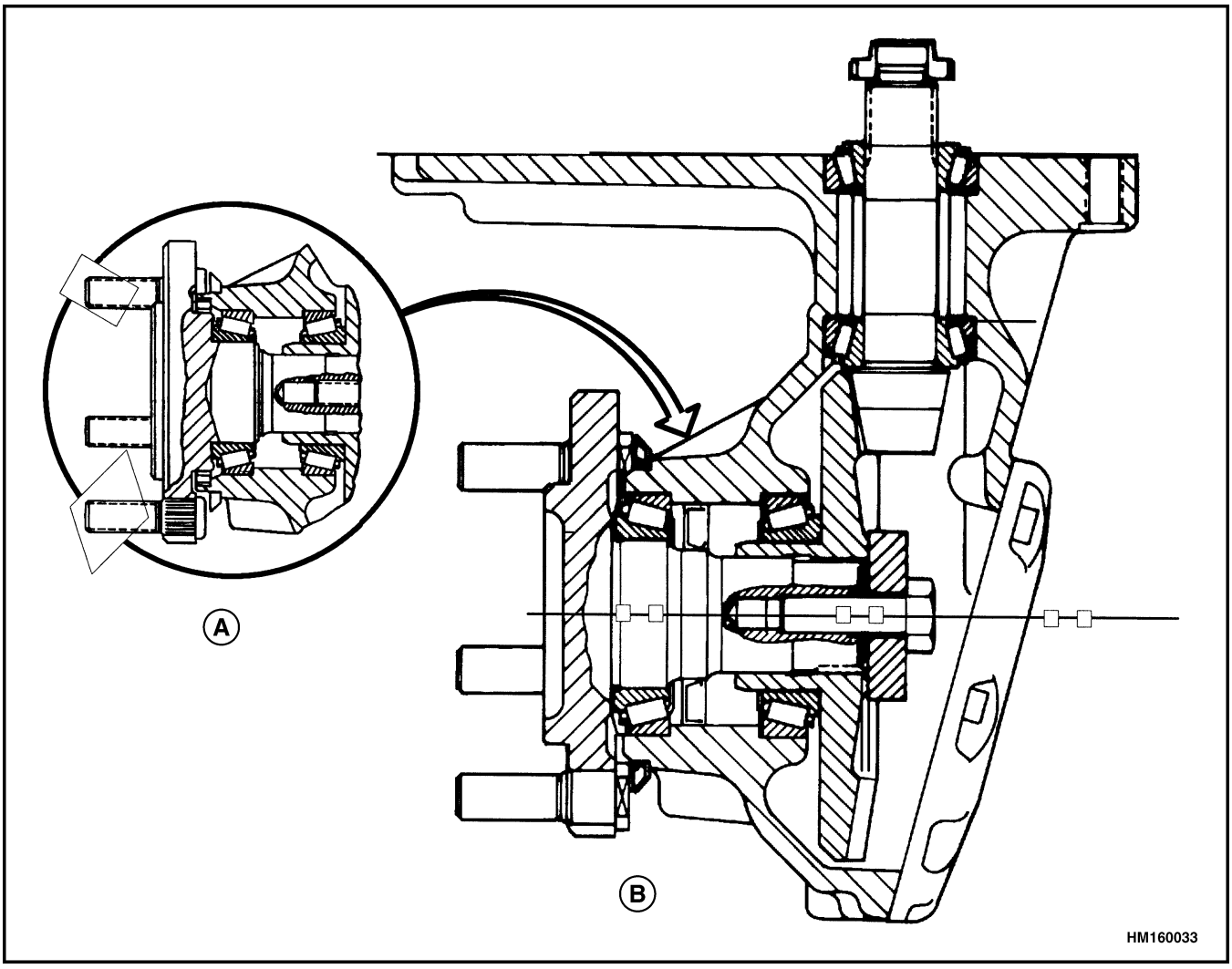
7. Measure distance S between the edges of the bearing cup and cone. See Figure 5. If the cup extends below the cone, dimension S is negative (subtract). If the cone extends below the cup, dimension S is positive (add).

8. Add or subtract (Step 7) dimension S from dimension C. The result minus 0.02 mm (0.001 in.) is dimension X or the thickness of shim set y for the top bearing.

X (in mm) = C + or – S – 0.02 mm

9. Install the shim set y, the bearing cup, bearing cone, large gear, and special nut. Use a press to install the bearing cup.

10. Use a strap wrench or a piece of wood to keep the large gear from turning and tighten the nut to 60 N•m (44 lbf ft). Do NOT use a punch to lock the nut at this time.



A. MDU PART NO. 2007081 AND PART NO. 1335340
B. MDU PART NO. 338600

Figure 6. Spiral Bevel Gear Set Installation

Spiral Bevel Gear, Install

1. Use a press to install the bearing cone on the spiral bevel gear. Also, use a press to install the bearing cup in the case near the axle flange.

2. On MDUs with Part No. 383600, install the seal in the axle bore of the case using Loctite. Use the dimensions measured during disassembly to make sure the seal is installed in the correct position. Make sure the lip of the seal is toward the gear as shown in Figure 6. Use some of the grease to lubricate the lip of the bearing seal and the seal surface of the axle. Fill the outer bearing cone using Shell Alvania R3 grease. Install the nylon ring on the axle, then install the outer bearing cone.

3. Install the bearing shield on the case using Loctite 242 (Hyster 318702). On MDU Part No. 2007081 or 1335340, fill the outer bearing cone using Shell Alvania R3 grease. Install the cone on the axle. Do NOT install the bearing seal in the case until all adjustments are complete.

4. Install the original shims under the inner bearing cup. Use a press to install the bearing cup in the case.

5. Carefully install the axle assembly in the case and spiral bevel gear. Do not damage the seal on MDUs with Part No. 383600.

6. Prevent the axle from turning. Tighten the M12 capscrew to 110 N•m (81 lbf ft). Tighten the special nut at the large gear to 60 N•m (44 lbf ft). See Figure 4. Use a punch at the detent to lock the nut.

7. Use Loctite 574 on the cover. Use Loctite 242 (Hyster 318702) on the threads of the cover capscrews. Install the cover and tighten the capscrews to 9.5 N•m (7 lbf ft).

8. Use Loctite 574 and install the top case on the bottom case. Make sure the top case is aligned correctly and use a punch to install the two pins. See Figure 3. See Step 3 of the Disassemble procedure. Install the case capscrews. Tighten the 8 mm capscrews to 23 N•m (17 lbf ft). Tighten the 10 mm capscrews to 46 N•m (34 lbf ft).

9. On R30DH units, install the roller guide for the limit switches. Install the roller guide in the holes of the top case at the marks made during removal. If necessary, install the stop pins.

10. Use a standard M12 capscrew with the same length as the special capscrew. Install the special washer and use the capscrew to fasten the axle and gear assembly. Tighten the capscrew until there is zero clearance.

11. See Backlash Adjustment and Tooth Contact Pattern and Bearing Clearance Adjustment of this section to check and adjust the backlash and gear clearance BEFORE continuing.

NOTE: To replace the drive tire on the wheel, the wheel must be pressed out of the tire rim. Use a press with a capacity of approximately 36,000 kg (40 ton) to press the tire off the wheel. Press the new tire and rim onto the wheel using the same press. The edge of the wheel near the wheel nuts must be even with the tire rim.

NOTE: Use Loctite to install any new wheel studs.

12. Install the wheel and the wheel nuts or bolts. Tighten the nuts or bolts in a cross pattern to the value specified in the **Periodic Maintenance** section for your lift truck. Tighten the nuts or bolts again using the cross pattern.

INSTALL

Mount Type A

1. If not already in position, install the bearing shield on the large ball bearing. Align the holes. Use a crane and chain or sling with a capacity rating of 450 kg (1000 lb) to lift the main frame. Carefully lift the main frame. Temporarily install blocks under the main frame to prevent it from lowering. Move the MDU into position under the main frame.

2. Lift the main frame, remove the blocks, and carefully lower the main frame to align the capscrew holes. Install and align the three shims on the bearing shield. Install the six capscrews and lockwashers. Slowly tighten the capscrews to approximately 60 N•m (44 lbf ft) using a cross pattern. Make sure the large ball bearing is in the correct position around the complete circumference. Use the cross pattern to tighten the W/B40/60XL capscrews to 120 N•m (89 lbf ft). Use the cross pattern to tighten the TWR capscrews to 82 N•m (60 lbf ft) and all the rest of the units.

3. If the pinion gear on the motor shaft was removed, install the key, gear, lockwasher, and nut. Tighten the nut to 55 to 65 N•m (41 to 48 lbf ft). If an impact wrench is used, make sure it does not tighten the nut to more than the correct torque.

4. Install a new O-ring on the motor using O-ring lubricant. Carefully install and align the motor on the MDU. Make sure the MDU is in the position for straight travel with the tire to the right of the case. Install and tighten the three motor capscrews and lockwashers to 23 N•m (17 lbf ft).

5. Lubricate the large ball bearing using the grease shown in the section **Periodic Maintenance** 8000 SRM 281 or 8000 SRM 921. Fill the MDU to the level/fill plug using the oil shown in the **Periodic Maintenance** section. Add the oil slowly. The oil must go through the bearings to the lower part of the MDU.

6. Install the battery and the hood.

Mount Type B (A1.00-1.50XL, N40/50EA, N40/45ER, N50FA, N30-45FR, R30E/EA/EF/ES Only)

1. Use a crane and chain or sling with a capacity rating of 450 kg (1000 lb) to lift the frame. **Do not damage the guidance sensor if the lift truck has wire guidance.** Lift the frame for clearance to slide the MDU under the frame or steer axle. Temporarily install blocks under the frame to prevent lowering. Lay the MDU on the floor. Slide the MDU under the drive chassis.

2. Move the MDU into approximate alignment under the frame or axle plate.

3. Hold the MDU in the vertical position through the hole in the plate. Do **NOT** put any part of your body between the MDU and the frame or axle plate. Carefully raise the frame and remove the blocks. Carefully lower the frame and align the capscrew holes in the large ball bearing, adapter ring, and the frame or axle plate.

4. Install the six capscrews and lockwashers that fasten the adapter ring and MDU to the frame or axle plate. Use a cross pattern to slowly tighten the capscrews to approximately 25 N•m (18 lbf ft). Make sure the large ball bearing and adapter ring are in the correct position around the complete circumference. Use the cross pattern to tighten the capscrews to 68 N•m (50 lbf ft).

5. If the pinion gear on the motor shaft was removed, install the key, gear, lockwasher, and nut. Tighten the nut to 54 N•m (40 lbf ft). If an impact wrench is used, make sure it does not tighten the nut to more than the correct torque.

6. Install a new O-ring on the motor using O-ring lubricant. Carefully install and align the motor on the adapter ring and MDU. Do **NOT** damage the pinion gear on the motor shaft or the large gear of the MDU. Install the six capscrews and lockwashers. Tighten the capscrews to 20 N•m (15 lbf ft).

7. Make sure the MDU is in the position for straight travel with the tire to the left of the case (facing MDU). Carefully install the steering chain. Use the pin to install the chain anchor on the adapter ring. Use the capscrew to fasten the two chain anchors together. Adjust the steering chain, steering potentiometer, and limit switches using the procedures in the following sections:
   - N40/50EA, N40/45ER, N50FA, N30-45FR - **Steering System** 1600 SRM 378
   - R30E/EA/EF/ES (No Wire Guidance) - **Electric Power Steering** 1600 SRM 418
   - R30E/EA/EF/ES (Wire Guidance) - **Wire Guidance** 2200 SRM 422

Mount Type B (R30DH Only)

WARNING

There are close clearances between the MDU, drive chassis, and base arm assembly that can cause serious injury. NEVER put hands, arms, head, or legs between these parts unless the parts have blocks to prevent movement.

1. Install the adapter ring on the MDU and align the holes. Use a crane and chain or sling with a capacity rating of 450 kg (1000 lb) to lift the base arm assembly at the drive chassis. **Do not damage the guidance sensor if the lift truck has wire guidance.** Install the chain or sling under the base arms on the mast side near the casters. Carefully lift the base arm assembly. Temporarily install blocks under the base arms to prevent lowering. Lay the MDU on the floor. Slide the MDU under the drive chassis. Lift the base arm assembly, remove the blocks, and carefully lower the base arm assembly on the casters. Make sure there is clearance between the MDU and all parts of the drive chassis and base arm assemblies. Do not damage the sprocket and steering potentiometer assembly or the limit switches.

2. Put a sling around the drive chassis. Put the sling under the drive chassis and between the drive chassis and the base arms. Lift the drive chassis. Temporarily install blocks between the drive chassis and base arms to prevent lowering. The sling must also be in a position that will allow installation of the MDU on the frame plate. Move the MDU into approximate alignment.

3. Hold the MDU in the vertical position through the hole in the frame plate. Do **NOT** put any part of your body between the MDU, base arm assembly, or drive chassis. Carefully raise the drive chassis and remove the blocks. Carefully lower the drive chassis and align the capscrew holes in the large ball bearing, adapter ring, and the frame plate.

4. Align the holes and install the plate for the steering potentiometer and the six capscrews and lockwashers. Slowly tighten the capscrews using a cross pattern. Make sure the large ball bearing and adapter ring are in the correct position around the complete circumference. Tighten the capscrews to approximately 30 N•m (22 lbf ft). Use the cross pattern to tighten the capscrews to 66 N•m (49 lbf ft).

5. If the pinion gear on the motor shaft was removed, install the key, gear, lockwasher, and nut. Tighten the nut to 55 to 65 N•m (41 to 48 lbf ft). If an impact wrench is used, make sure it does not tighten the nut to more than the correct torque.

6. Install a new O-ring on the motor using O-ring lubricant. Carefully install and align the motor on the adapter ring and MDU. Do **NOT** damage the pinion gear on the motor shaft or the large gear of the MDU. Install the six capscrews and lockwashers. Tighten the capscrews to 20 N•m (15 lbf ft).

7. Make sure the MDU is in the position for straight travel with the tire to the left of the case (facing MDU). If necessary, install the pins and roller guide on the MDU in the positions marked during removal. Carefully install the switch bracket. The rollers of the limit switches must be aligned with the roller guide. Carefully install the steering chain. Do not damage the sprocket assembly for the steering potentiometer or the limit switches. Use the pin to install the chain anchor on the adapter ring. Use the capscrew to fasten the two chain anchors together. Adjust the steering chain, steering potentiometer and limit switches using the procedures in the section **Electric Steering System** 1600 SRM 311.

WARNING

The steering system MUST be adjusted before operating the lift truck.

8. Lubricate the large ball bearing using the grease shown in the section **Periodic Maintenance** 8000 SRM 295 or 8000 SRM 921. Fill the MDU to the level/fill plug using the oil shown in same **Periodic Maintenance** section. Add the oil slowly. The oil must go through the bearings to the lower part of the MDU.

9. Install the battery and close the electrical compartment doors.

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Lift truck will not move.	Traction motor not operating.	Repair or replace traction motor.
	Damaged gears or bearings.	Replace gears or bearings.
MDU makes noise.	Insufficient lubricant or incorrect lubricant.	Lubricate as needed.
	Dry, damaged, or incorrect bearings.	Lubricate or replace as needed.
	Bearing preload or backlash not properly adjusted.	Adjust backlash.
	Worn or damaged gears.	Replace gears.

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Oil leaks at the housing cover.	Housing cover is not sealed or properly seated.	Seal properly.
	Capscrews not sealed off or not tightened to specified torque.	Tighten to appropriate torque.
Oil leaks at the wheel shaft.	Shaft seal incorrectly mounted or damaged.	Replace shaft seal.
	Surface of axle shaft damaged.	Replace axle shaft.
Oil leaks at the filler plug or drain plug.	Dirt between sealing ring and housing.	Clean sealing ring and housing.
	Plugs not tightened to specified torque.	Tighten to appropriate torque.
Oil leakage between lower and upper housings.	Sealing surface not sealed off.	Seal properly.
	Capscrews not tightened to specified torque.	Tighten to appropriate torque.
Oil leaks in motor compartment.	Too much oil in MDU.	Drain excess oil.
	Breather defective.	Clean or replace breather.
	Traction motor seal defective.	Replace motor seal.
Trunnion bearing difficult to turn, binds, or exceeds maximum clearance.	Centering ring separated, allowing dirt to punctuate into bearing.	Torque capscrews holding centering ring to MDU.
	Cage segments are damaged.	Replace cage segments.
	Deformation of the balls or ball races.	Replace balls and ball races.
	Bearing not properly lubricated.	Lubricate as needed.

Backlash Adjustment and Tooth Contact Pattern

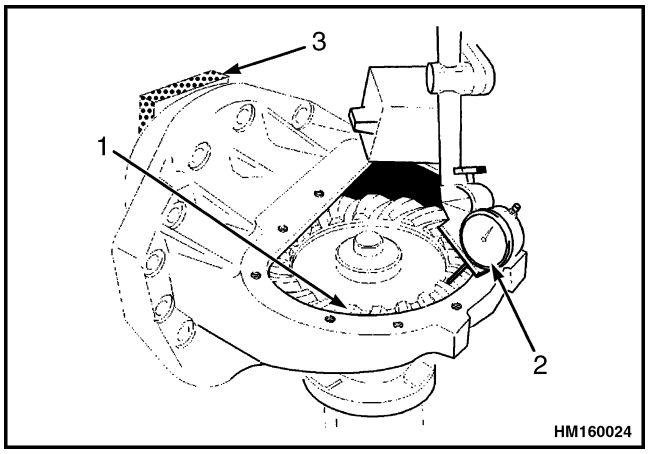
NOTE: Most of the adjustments are done during assembly of the MDU. Bearing clearance for the spiral bevel pinion is adjusted during assembly. See Spiral Bevel Gear, Install in Assemble of this section. Adjust the tooth contact as shown in Table 1.

CAUTION

The axle and gear assemblies are installed and removed several times during this procedure. Be careful during installation of the axle so that the bearing seal is not damaged.

This backlash is the clearance between the teeth of the spiral bevel gear and the teeth of the pinion. Use a dial indicator to measure the clearance. See Figure 7. Put the dial indicator in a position so that the sensor touches a tooth of the spiral bevel gear. Install a wood wedge under the large gear at the top of the MDU to keep the gear and the pinion from moving. Move the spiral bevel gear in the direction away from the sensor of the dial indicator. Adjust the dial indicator for a zero reading. Move the gear toward the dial indicator and read the backlash. The backlash must be 0.1 to 0.15 mm (0.004 to 0.006 in.). If the backlash is too much, the spiral bevel gear must move toward the pinion. If the backlash is not enough, the gear must move away. The spiral bevel gear is moved in the correct direction by adding or removing shims under the bearing cup. The shims for the shim set are available in the following thicknesses: 0.1 mm, 0.15 mm, 0.3 mm, and 0.5 mm.

The tooth contact pattern must also be correct. Remove the wood wedge and check the tooth contact pattern as shown in Table 1. Adjust the position of the spiral bevel gear for the best tooth contact pattern and the correct backlash.



1. SPIRAL BEVEL GEAR
2. DIAL INDICATOR
3. WOOD WEDGE

Figure 7. Check Backlash