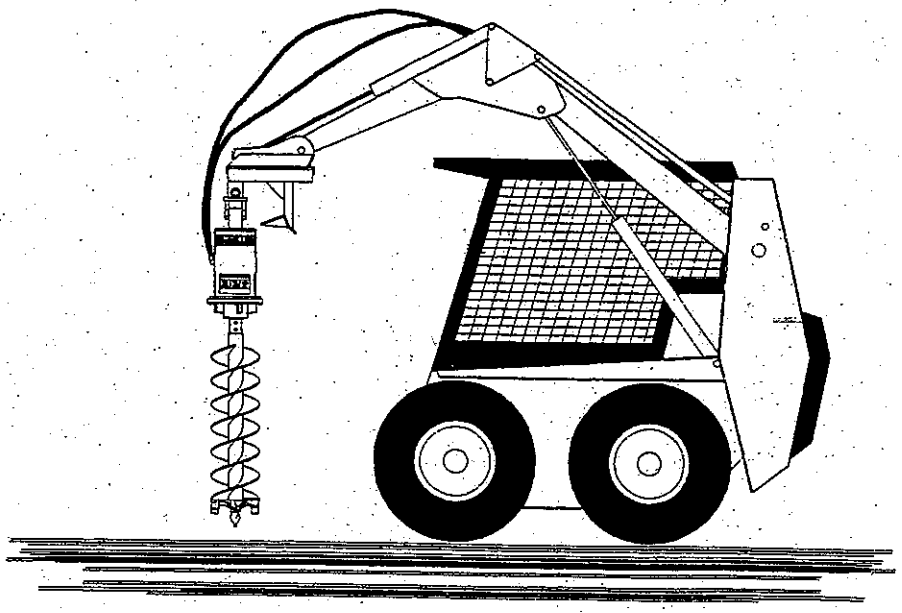
McMILLEN

CONSTRUCTION EQUIPMENT ATTACHMENTS

X-SERIES
HYDRAULIC EARTH DRILL ATTACHMENTS
OPERATOR'S MANUAL

SERIAL NUMBER _____



MODELS
450, 850, 1350,
1850, 2250, 2750 & 3550

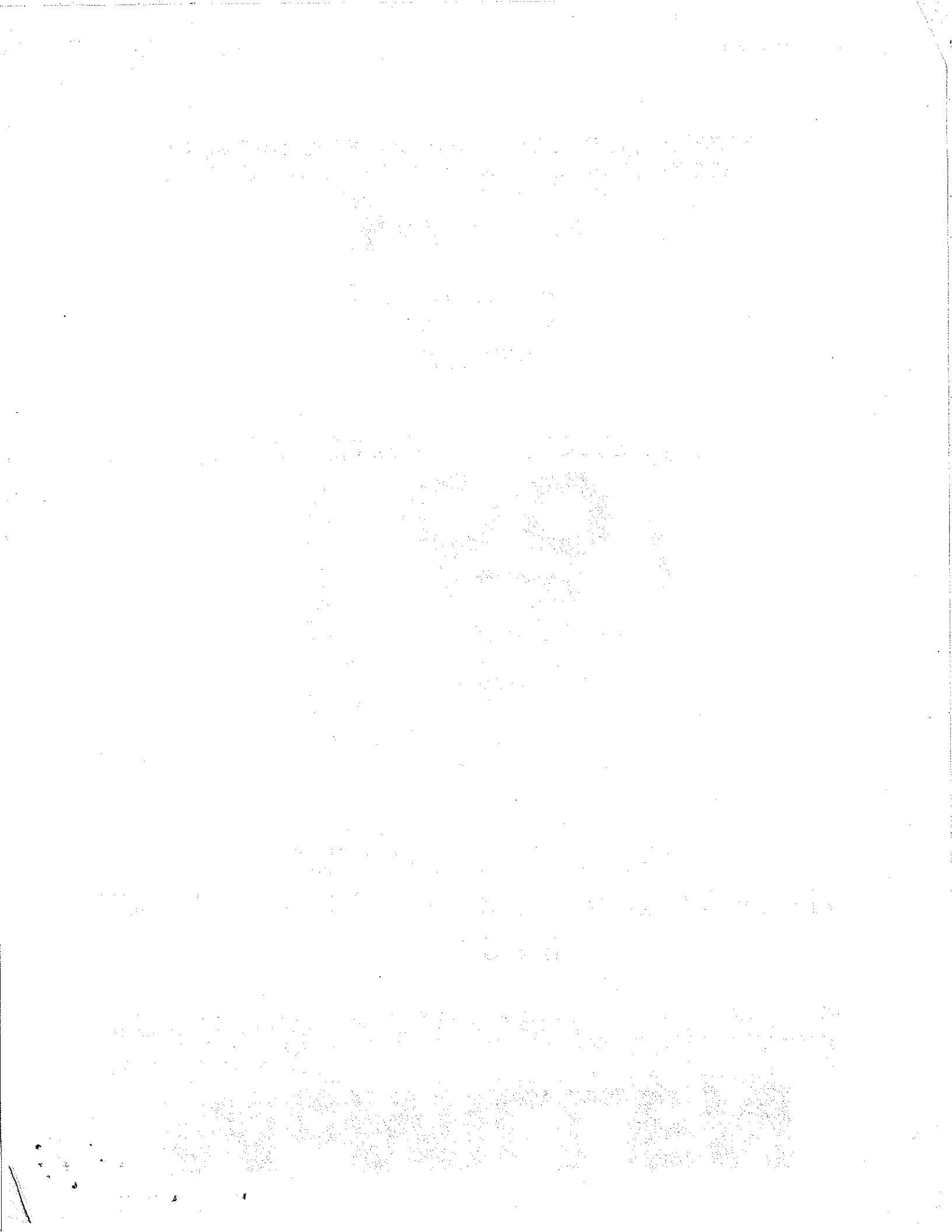
⚠ WARNING!

AVOID DEATH OR INJURY

READ AND UNDERSTAND THIS ENTIRE MANUAL BEFORE INSTALLING, OPERATING OR SERVICING THIS EQUIPMENT

FORM NO.: M95-0001(A)

PRICE $5.00(U.S.)



McMILLEN

CONSTRUCTION EQUIPMENT ATTACHMENTS

To the Owner,

We would like to take the opportunity to thank you for purchasing your McMillen Earth Auger Attachment. You have invested in a quality piece of equipment backed by years of experience and thousands of units in the field. But only by proper installation, operation and maintenance can you expect to receive the dependable performance and long life for which the earth auger was designed.

This operator's manual contains information regarding the installation, operation, safe use, care and maintenance of your McMillen Hydraulic Earth Auger Attachment. **Please be sure all operators study this manual carefully** and keep it on file for future reference.

After reading this manual, if you have any questions about your McMillen Hydraulic Earth Auger Attachment please contact us immediately as follows:

NORTH AMERICAN TOLL FREE:	(800) 234-0964
Outside North America:	(219) 747-6750
Fax:	(219) 747-9161

Once again, we would like to thank you for putting your trust in our product. If we may be of further assistance to you in the future, please feel free to contact us or your nearest McMillen dealer at your convenience.

Yours for better digging,

The McMillen Division of
States Engineering Corporation

P.S. McMillen is continually striving to improve its products. We'd like to hear from you with your ideas and suggestions on ways we can improve our products for the future.

TABLE OF CONTENTS

McMILLEN
WARRANTY REGISTRATION

DATE PURCHASED_____

MODEL NO._____ SERIAL_____

OWNER INFORMATION

OWNER'S NAME_____PHONE_____

COMPANY NAME_____

ADDRESS_____

CITY_____STATE/PROVIDENCE_____

ZIP CODE_____COUNTRY_____

DEALER INFORMATION

DEALER SALESMAN_____PHONE_____

DEALER NAME _____

ADDRESS_____

CITY_____STATE/PROVIDENCE_____

ZIP CODE_____COUNTRY_____

INSTALLATION & APPLICATION INFORMATION

This McMillen Hydraulic Earth Auger Attachment will be mounted on:

MAKE (Brand)_____MODEL_____

APPLICATION_____AUGER SIZE_____

This McMillen Hydraulic Earth Auger Attachment has been accepted in good condition and I have been instructed by the dealer and/or read and understand the entire Operator's Manual for proper installation, proper and safe operation, preventative maintenance and service, warranty and all other information covered in the Operator's Manual. I also understand that all operators must read and understand the entire Operator's Manual.

OWNER'S SIGNATURE_____DATE_____

DEALER'S SIGNATURE_____DATE_____

THIS PAGE MUST BE RETURNED WITHIN 10 DAYS OF PURCHASE TO VALIDATE WARRANTY

RETURN TO: The McMillen Division
4419 Ardmore Ave.
Ft. Wayne, IN 46809

(Staple Here)

Fold

Fold

Place Postage Here

FIRST CLASS MAIL

The McMillen Division
4419 Ardmore Ave.
Fort Wayne, IN 46809-9723
U.S.A.

WARRANTY POLICY

MODEL #_____ SERIAL # _____

The McMillen Division warrants its products to be free from defects in material or workmanship for a warranty period as stated below:

"X" SERIES Drive Unit:	**36 MONTHS**
Auger Bit & Mountings:	**12 MONTHS**

The warranty period begins on the date of purchase by the original retail purchaser.

WARRANTY PERFORMANCE

To make a claim under this warranty, contact your McMillen dealer who will obtain written return authorization. All warranty returns must be accompanied by a McMillen Return Authorization Letter.

All warranty claims must include detailed information regarding date of purchase, make and model of machine on which product was mounted, hours of use, summary of events leading to failure, and any other information helpful in evaluating your claim.

REMEDY

During the applicable warranty period McMillen at its option, will repair or replace, free of charge, any product determined by it to be defective. Such repair or replacement shall take place at a location designated by McMillen.

Freight or other transportation costs incurred in transporting any product to McMillen's designated location for warranty consideration must be pre-paid by the customer. If McMillen determines that the product is subject to warranty performance, the customer will be allowed credit for such costs. Freight or other transportation costs incurred in returning to the customer any product subject to warranty performance will be pre-paid by McMillen. Any parts or labor required to rebuild or replace items not covered under this warranty will be charged to the customer.

EXCLUSIONS FROM WARRANTY COVERAGE

1. THIS WARRANTY AUTOMATICALLY IS VOID IF ANY ATTEMPT IS MADE TO MAKE FIELD REPAIRS TO HYDRAULIC MOTORS OR PLANETARY GEAR REDUCTIONS. TO QUALIFY FOR WARRANTY PERFORMANCE THE COMPLETE UNIT MUST BE AVAILABLE FOR MCMILLEN'S INSPECTION IN ITS ORIGINAL "FAILED" CONDITION.

2. There is no warranty against failures caused by or related to alterations or modifications made without the express written consent of McMillen.

3. Under no circumstances shall McMillen be responsible for the cost of labor for field replacement or repair, nor for damage caused by accident, misapplication, abuse, misuse, operator error or environmental elements.

4. This warranty does not apply to parts subject to normal wear, such as auger teeth and points, nor to damage caused by the failure to perform recommended maintenance or to replace worn parts.

5. Under no circumstances shall McMillen be obligated for the cost of any repair or replacement by anyone other than McMillen, without its express written consent.

LIMITATIONS AND EXCLUSIONS

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES WRITTEN OR ORAL, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE ARISING BY OPERATION OF LAW, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE.

The remedy of repair or replacement provided by this warranty is the some and exclusive for breach of this warranty, or for any other which might arise by operation of law or otherwise. McMillen shall not be liable for any incidental or consequential damages resulting from or contributed to by any defect in materials, workmanship, manufacture or design negligence or failure to warn. McMillen shall in no way be liable for any losses, costs, forfeitures, or damages (including loss of profits, liabilities of the customer to its customers, employees or third persons, and all incidental or consequential damages), whether direct or indirect and whether or not resulting from or contributed to by the default, defect in materials, workmanship, manufacture or design, negligence or failure to warn on the part of McMillen which might be claimed as the result of, or use of malfunction of the products covered by this warranty. **THE LIABILITY OF MCMILLEN ARISING OUT OF THE SUPPLYING OF ANY PRODUCT COVERED BY THIS WARRANTY CONTRACT, NEGLIGENCE OR OTHERWISE SHALL NOT IN ANY CASE EXCEED THE COST OF PARTS OR LABOR REQUIRED TO REBUILD OR REPLACE SUCH DEFECTIVE PRODUCT, TOGETHER WITH THE TRANSPORTATION COSTS ATTRIBUTABLE THERETO. UPON THE EXPIRATION OF THE APPLICABLE WARRANTY PERIOD HEREIN SPECIFIED, ALL SUCH LIABILITY SHALL TERMINATE.**

This warranty constitutes the entire warranty of McMillen, and no oral representations, warranties or guarantees by any agent of McMillen, or the seller shall be binding on McMillen, and no part of this warranty may be modified or extended except upon the express written consent of McMillen.

IMPROVEMENTS

McMillen is continually attempting to make product improvements. It reserves the right to make changes or additions to any product without incurring any obligation whatsoever to make such changes or additions to products previously sold.

SAFETY INFORMATION

TO THE OPERATOR

Your personal safety is a concern of ours. It should also be of concern to you. It is the responsibility of all operators to read and understand this entire manual before installing, operating or servicing this equipment. Pay particular attention to cautions, warnings and safe operating procedures. Be a safe and qualified operator. Operate your equipment with care and good judgement and see to it that it is properly maintained.

SAFETY ALERT SYMBOL

This Safety Alert Symbol Means:
ATTENTION! BECOME ALERT!
YOUR SAFETY IS INVOLVED!
When you see it pay attention and follow the instructions in the safety message.

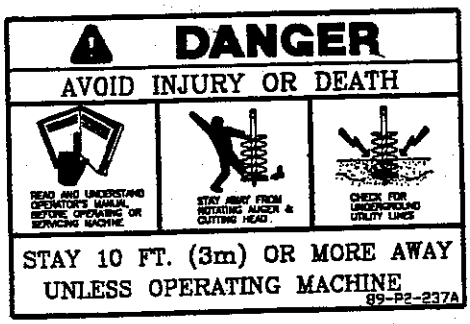
The safety alert symbol is generally used in conjunction with a key signal word to emphasize special information. The signal words listed below carry a specific meaning and should be carefully read and understood:

DANGER.....Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING.....Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION.....Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

REPLACEMENT SAFETY DECALS



WORN, DAMAGED OR ILLEGIBLE SAFETY DECALS MUST BE REPLACED.
New safety decals can be ordered from McMillen.

Two (2) #89-P2-237A Safety Decals must be displayed on each McMillen Hydraulic Earth Auger Drive Unit. Decals should be located on opposite sides of the drive unit from each other.

SAFETY INFORMATION

THE USE OF THIS EQUIPMENT IS SUBJECT TO CERTAIN HAZARDS WHICH CANNOT BE PROTECTED AGAINST MECHANICAL MEANS OR PRODUCT DESIGN. ALL OPERATORS OF THIS EQUIPMENT MUST READ AND UNDERSTAND THIS ENTIRE MANUAL, PAYING PARTICULAR ATTENTION TO SAFETY AND OPERATING INSTRUCTIONS, PRIOR TO USING THE MCMILLEN HYDRAULIC EARTH AUGER. IF THERE IS SOMETHING IN THIS MANUAL YOU DO NOT UNDERSTAND, ASK YOUR SUPERVISOR TO EXPLAIN IT TO YOU. FAILURE TO OBSERVE THESE SAFETY PRECAUTIONS CAN RESULT IN DEATH OR SERIOUS INJURY OR SERIOUS EQUIPMENT DAMAGE.

All bystanders should be kept a minimum of 10 feet (3 meters) away from working area of the earth auger.

Always wear an OSHA approved hard hat and safety eye protection when operating or servicing this equipment. Do not wear loose fitting clothing, flopping cuffs, dangling neckties and scarves, or rings and wrist watches that can catch moving parts.

An operator must not use drugs or alcohol which can change his alertness or coordination. An operator taking prescription or over-the-counter drugs should seek medical advise on whether or not he can safely operate equipment.

Always locate underground electrical wires, telephone cables, gas, water and sewer lines before digging. Maintain safe clearance and avoid contact with any underground or overhead utility lines or electrically charged conductors.

Never alter or remove any safety decals or shields. Replace all missing or damaged safety decals or safety shields. check this manual for location of these items and replace immediately if damaged or illegible.

Never adjust a relief valve for pressure higher than recommended by vehicle manufacturer.

Whenever changing or installing this or other attachments, make sure all connections are securely fastened.

Travel only with the earth auger in a safe transport position to prevent uncontrolled movement. Drive slowly over rough ground and on slopes. Tether earth auger with a chain, if necessary, to prevent uncontrolled swinging of earth auger when moving from hole to hole. Remove earth auger from vehicle when transporting to and from job site.

Before exiting vehicle, lower earth auger to ground, turn off vehicle engine and lock vehicle brakes.

Never check a pressurized system for leaks with your bare hand. Oil escaping from pinhole leaks under pressure can penetrate skin and could cause serious infection. Hold a piece of cardboard up next to suspected leaks and wear a face shield or safety eye protection. If any fluid is injected into the skin, it must be removed within a few hours by a doctor familiar with this type of injury.

Before disconnecting hydraulic lines or fittings be sure to relieve all pressure by cycling all hydraulic controls after shutdown. Remember hydraulic systems are under pressure whenever the engine is running and may hold pressure after shutdown. Before applying pressure to the system make sure all connection are tight and that there is no damage to lines, fittings and hoses.

Flow and pressure gauges, fittings and hoses must have a continuous operating pressure rating of at least 25% higher than highest pressures of the system.

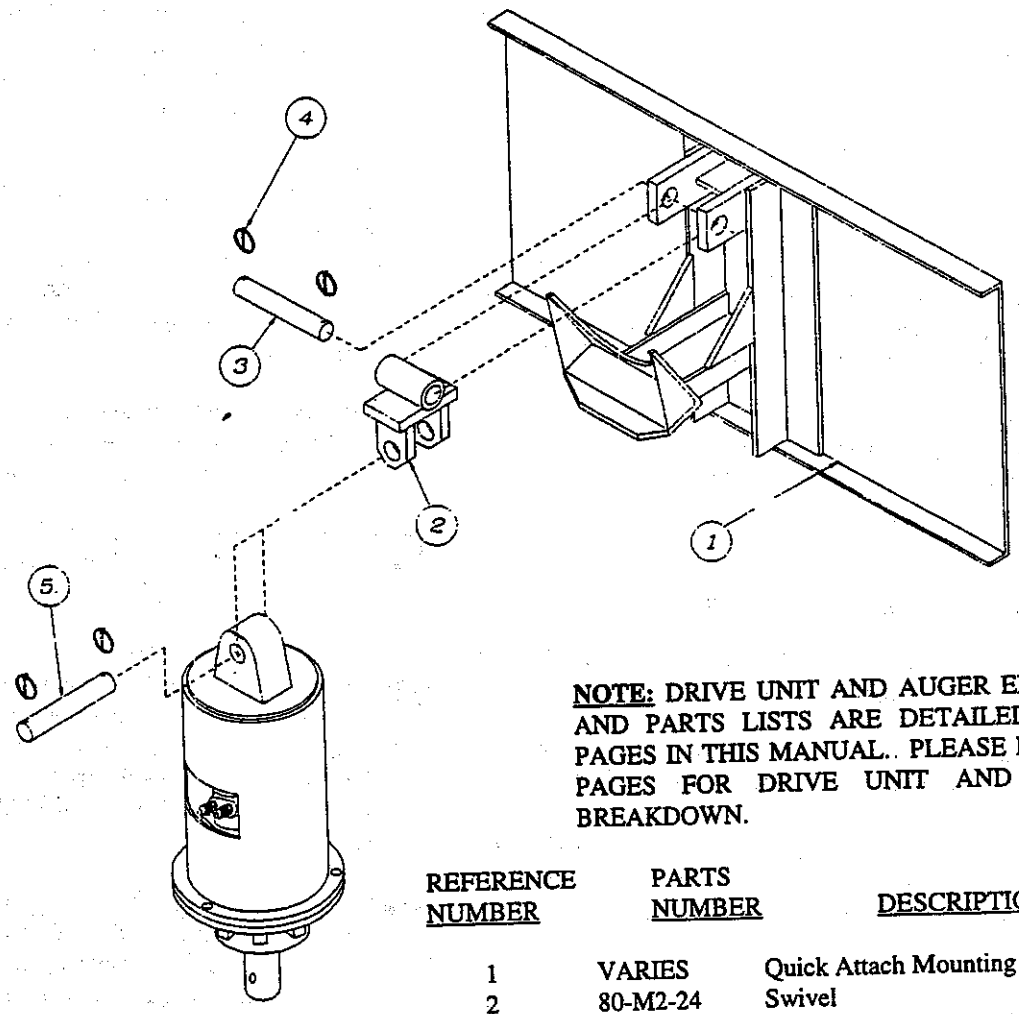
Avoid steep hillside operation which could cause the vehicle to overturn. Consult your vehicle operator's and safety manuals for maximum incline allowable.

Never perform any work on an earth auger unless you are authorized and qualified to do so. Always read the operator service manual(s) before any repair is made. After completing maintenance or repair, check for correct functioning of the earth auger. If not functioning properly always tag "DO NOT OPERATE" until all problems are corrected.

This manual covers the safe use, installation, operation and service instructions for the earth auger only. Always read the operating and safety manuals prepared for your vehicle and any other attachments before using them.

SKID STEER LOADER & OTHER QUICK ATTACH MOUNTINGS
EXPLODED VIEW, PARTS LIST & INSTALLATION INSTRUCTIONS

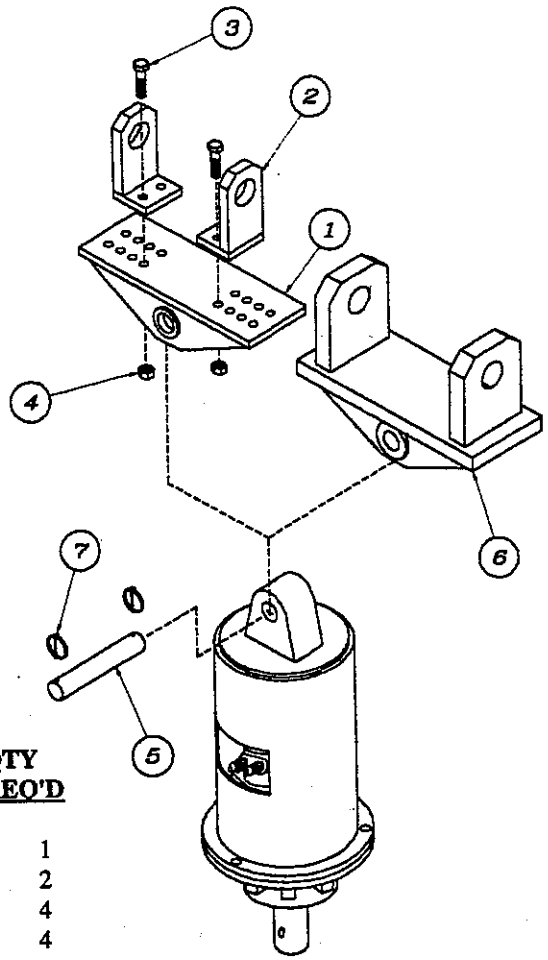
1. READ AND UNDERSTAND ALL SAFETY INFORMATION BEFORE ATTEMPTING INSTALLATION.
2. Remove bucket or other attachment from vehicle quick attach mechanism.
3. Attach quick attach mounting bracket (1) to vehicle quick attach mechanism as per vehicle manufacturer's recommendations.
4. Attach swivel weldment (2) to the quick attach mounting bracket (1) with in (3). secure pin (3) with lynch pins (4).
5. Attach and secure drive unit to swivel weldment (2) with pin(5) and lynch pins(4) provided with the drive unit assembly.
6. Attach and secure auger to drive unit with bolt and nut provided with drive unit assembly.
7. Refer to the "HYDRAULIC SYSTEM HOOK-UP" section in this manual for hydraulic connection instructions and recommendations.



NOTE: DRIVE UNIT AND AUGER EXPLODED VIEWS AND PARTS LISTS ARE DETAILED ON SEPARATE PAGES IN THIS MANUAL.. PLEASE REFER TO THOSE PAGES FOR DRIVE UNIT AND AUGER PARTS BREAKDOWN.

REFERENCE NUMBER	PARTS NUMBER	DESCRIPTION	QTY REQ'D
1	VARIES	Quick Attach Mounting Bracket	1
2	80-M2-24	Swivel	1
3	85-M2-9	Pin, 1-¼" Dia. x 7-¼" Long	1
4	65-P2-109	Lynch Pins	4
5	85-M2-17	Pin, 1-¼" Dia. x 6" long	1

BACKHOE & EXCAVATOR MOUNTINGS
EXPLODED VIEW, PARTS LIST & INSTALLATION INSTRUCTIONS



NOTE: DRIVE UNIT AND AUGER EXPLODED VIEWS AND PARTS LISTS ARE DETAILED ON SEPARATE PAGES IN THIS MANUAL. PLEASE REFER TO THOSE PAGES FOR DRIVE UNIT AND AUGER PARTS BREAKDOWN.

REFERENCE NUMBER	PARTS NUMBER	DESCRIPTION	QTY REQ'D
1	80-M2-21	Backhoe Base Weldment	1
2	Varies	Backhoe Adaptor Ear	2
3	85-P2-45	½"-13 x 1-¾" Gr. 5	4
4	85-P1-119	1/2" - 13 Locknut	4
5	85-M2-17	1-¼" Pin x 6" long	1
6	Varies	Fixed Backhoe Mount	1
7	65-P2-109	Lynch Pins	2

1. READ AND UNDERSTAND ALL SAFETY INFORMATION PRIOR TO ATTEMPTING INSTALLATION.

2. Remove bucket from dipper arm and curl cylinder pin connections. The dipper arm-pin will be used to attach backhoe mounting to backhoe dipper arm. Curl cylinder pin will not be required for earth drill installation.

3. If using a Universal (adjustable width) Backhoe Mounting, assemble by spacing the two ears (2) to the same width as the dipper arm and secure to the backhoe swivel base (1) with four bolts (3). Secure bolts (3) and nuts (4). **After determining correct width, backhoe ears (2) must be welded to backhoe swivel base (1).**

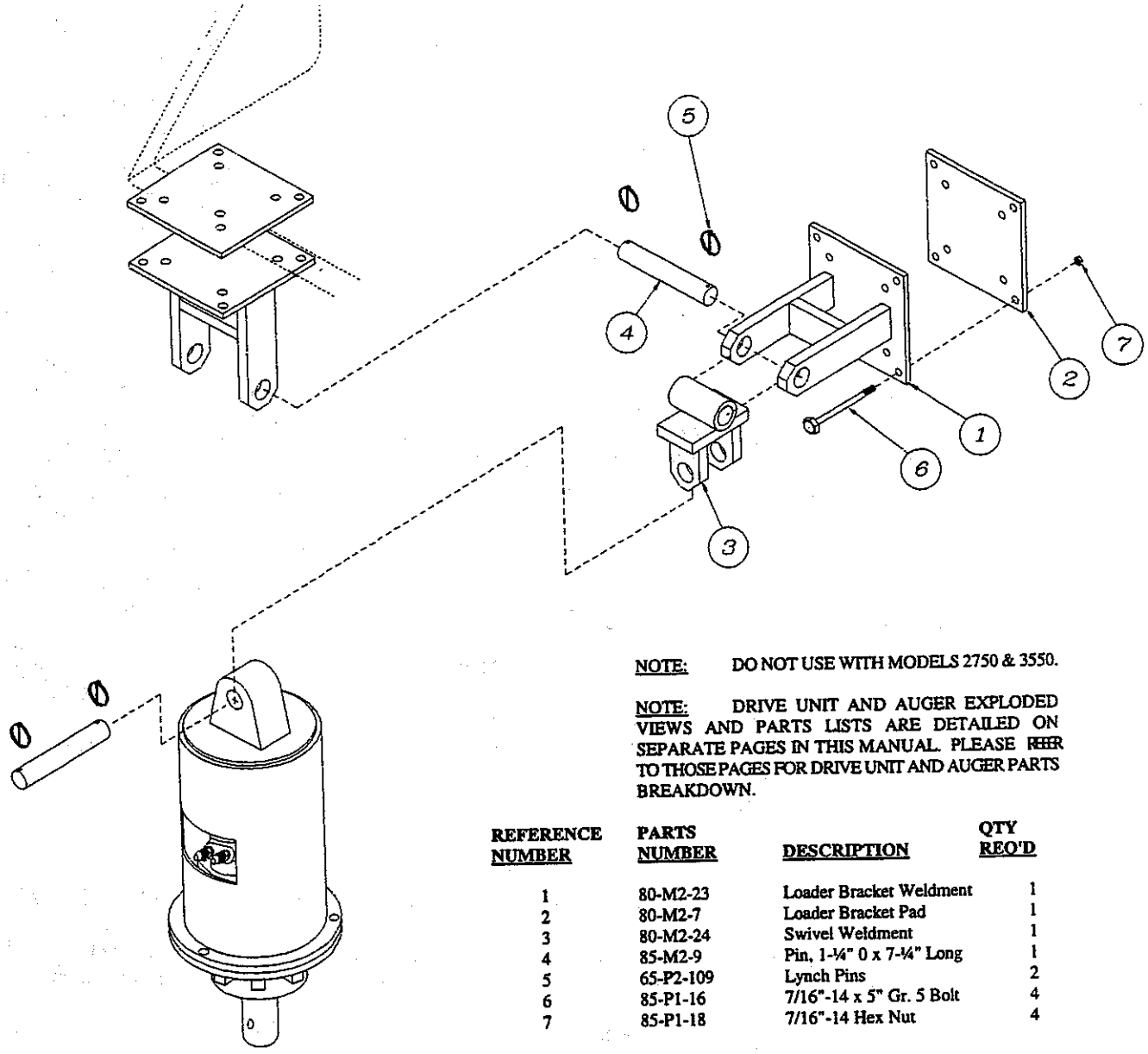
4. Attach backhoe mounting (universal or fixed) to the dipper arm using the dipper arm using the dipper arm pin removed from bucket in step 1. Secure bucket pin as per vehicle manufacturers recommendation.

5. Attach and secure drive unit to backhoe mounting with pin(6) and Lynch Pins(8) provided with the drive unit assembly.

6. Attach and secure auger to drive unit with bolt and nut provided with drive unit assembly.

7. Refer to the 'HYDRAULIC SYSTEM HOOK-UP' section in this manual for hydraulic connections instructions and recommendations.

80-A2-14 UNIVERSAL LOADER MOUNTING
EXPLODED VIEW, PARTS LIST &
INSTALLATION INSTRUCTION



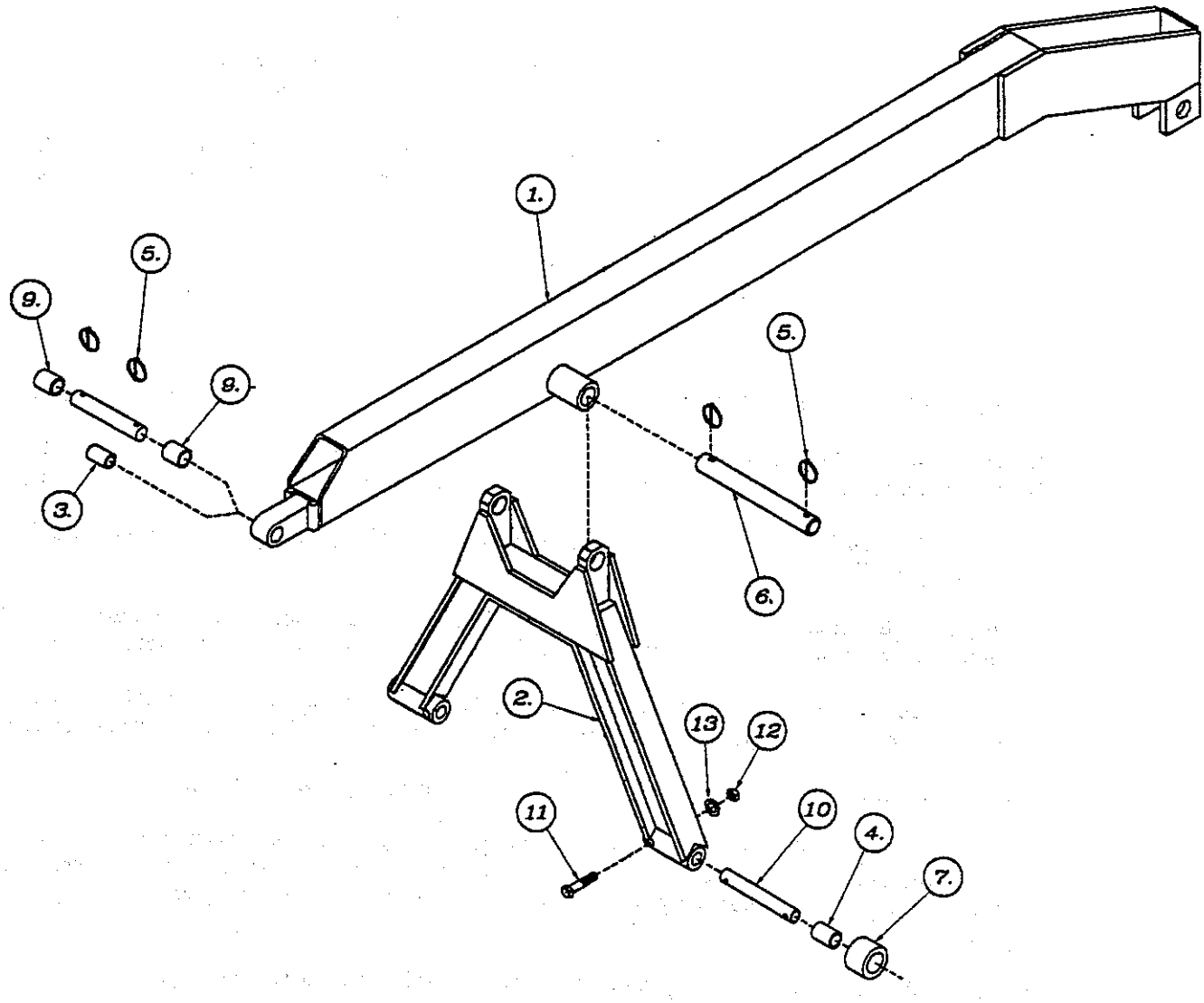
NOTE: DO NOT USE WITH MODELS 2750 & 3550.

NOTE: DRIVE UNIT AND AUGER EXPLODED VIEWS AND PARTS LISTS ARE DETAILED ON SEPARATE PAGES IN THIS MANUAL. PLEASE REFER TO THOSE PAGES FOR DRIVE UNIT AND AUGER PARTS BREAKDOWN.

REFERENCE NUMBER	PARTS NUMBER	DESCRIPTION	QTY REQ'D
1	80-M2-23	Loader Bracket Weldment	1
2	80-M2-7	Loader Bracket Pad	1
3	80-M2-24	Swivel Weldment	1
4	85-M2-9	Pin, 1-¼" 0 x 7-¼" Long	1
5	65-P2-109	Lynch Pins	2
6	85-P1-16	7/16"-14 x 5" Gr. 5 Bolt	4
7	85-P1-18	7/16"-14 Hex Nut	4

1. READ AND UNDERSTAND ALL SAFETY INFORMATION PRIOR TO ATTEMPTING INSTALLATION.
2. The 80-A214 Universal Loader Mounting can be used to adapt your McMillen Hydraulic Earth Drill to the side of the loader arms, lip of bucket or fork lift forks. DO NOT USE ON SKID STEER LOADERS.
3. Place loader bracket pad (2) on the inside of the loader arm, top of bucket lip(for mounting on lip of bucket you'll need to drill two 7/16" diameter holes through bucket), or top of fork lift fork. Opposite side of loader bracket pad (2). Insert four bolts (6) and secure with four nuts (7).
4. Attach swivel Weldment (3) to the loader bracket weldment (1) with pin)4). Secure pin (4) with Lynch Pins (5).
5. Attach and secure drive unit to swivel weldment (3) with pin and pin clips provided with the drive unit assembly.
6. Attach and secure auger to drive unit with bolt and nut provided with drive unit assembly.
7. Refer to the 'HYDRAULIC SYSTEM HOOK-UP' section in this manual for hydraulic connection instructions and recommendations.

80-A2-282 3-POINT HITCH MOUNTINGS
EXPLODED VIEW



80-A2-282 3-POINT HITCH MOUNTINGS
PARTS LIST AND INSTALLATION INSTRUCTIONS

REFERENCE NUMBER	PARTS NUMBER	DESCRIPTION	QTY REQ'D
1	80-M2-167	Boom	1
2	80-M2-168	A-frame	1
3	83-M1-14	Bushing, 1" OD x ¾" ID X 1-9/16" Long	1
4	83-M1-17	Bushing, 1-1/18" OD x ⅞"	2
5	65-P2-109	Lynch Pins	4
6	85-M1-105	Pin, 1-¼" ⌀ x 10-5/16" Long	1
7	83-M1-26	Bushing, 1-7/16" OD x 1-⅛" ID x 1-⅝" Long	2
8	85-M1-31	Pin, 1" x 5-¾" Long	1
9	83-M1-32	Bushing, 1-¼" OD x 1"	2
10	85-M2-106	Pin, ⅞" x 6-7/16 " Long	2
11	85-P1-122	7/16"-14 x 2" Long, HHCS, Gr. 5	2
12	85-P1-18	7-16"-14 Hex Nut	2
13	85-P1-123	7/16" Split Lockwasher	2

1. **READ AND UNDERSTAND ALL SAFETY INFORMATION PRIOR TO ATTEMPTING INSTALLATION.**

2. Connect a-frame (2) to lift arm pins of your tractor three point hitch by sliding a-frame lift arm pins into lift arms on Category II hitch, use bushings (4) on a-frame lift arm pins. Secure a-frame lift arm pins to lift arms with lynch pins (not provided).

   A. For 80-A2-282 if the tractor has a Category III hitch, an additional set of bushings (7) are supplied to slip over the Category II bushings (4).

3. Connect the tractor end of the boom (1) to the top link bracket on your tractor using your tractor upper link pin and secure. If you are attaching to a Category 11 tractor, bushing (3) is not required but should be saved for future use.

   A. For 80-A2-282 if you are attaching to a Category III tractor, replace the tractor top link pin with the top link pin (8) supplied. Use the two bushings (9) in the holes on each side of the top link bracket. Secure pin (8) with two lynch pins (5).

4. Swing a-frame (2) up and attach and secure to boom (1) with pin (6) and lynch pins (5).

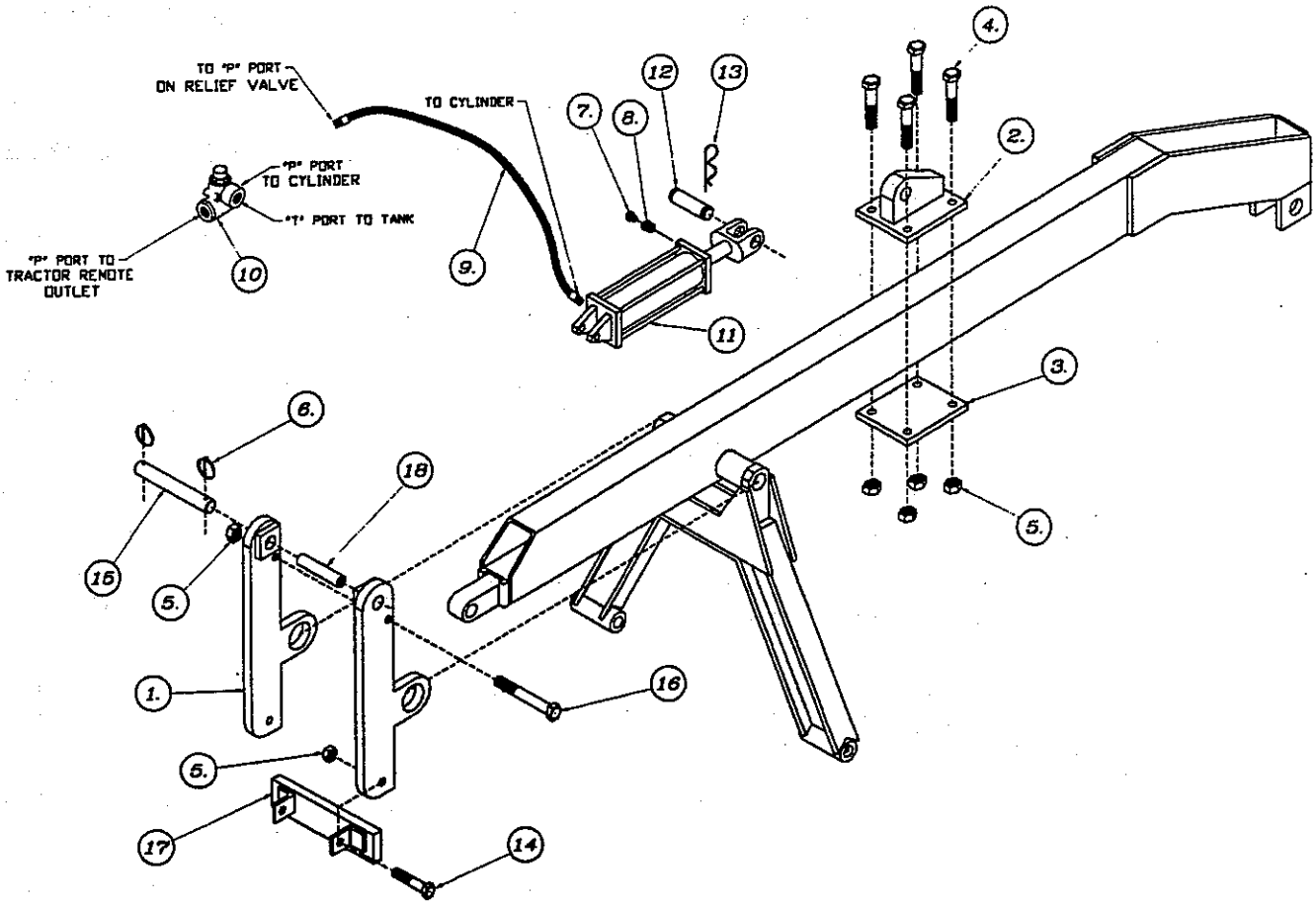
5. Before proceeding further, slowly raise and lower the boom through its complete operating arch and check closely that there are no interferences. If there is any interference, make the proper three point hitch adjustments as per tractor manufacturers recommendations. Consult your tractor dealer before making any modifications as any changes may present a serious safety hazard.

6. Attach and secure auger to drive unit with bolt and nut provided with drive unit assembly.

7. Attach and secure auger to drive unit with bolt and nut provided with drive unit assembly. If additional boom height is required to provide ground clearance for auger, make the proper three point hitch adjustments as per tractor manufacturers recommendations. Consult the tractor dealer before making any modifications as changes may present a serious safety hazard.

8. Refer to the "HYDRAULIC SYSTEM HOOK-UP" section in this manual for hydraulic connection instructions and recommendations.

80-A2-293 DOWN PRESSURE KIT
EXPLODED VIEW & PARTS LIST



REFERENCE NUMBER	PARTS NUMBER	DESCRIPTION	QTY REQ'D
1	80-M2-173A	Pivot Push Arm Weldment	1
2	80-M2-173A	Push Block Weldment	1
3	80-M2-173B2	Push Block Pad	1
4	85-P2-255	Bolt ½"-13 x 6-½" HHCS Gr. 5	4
5	85-P1-119	½" Uni-Torque Lock Nut	7
6	65-P2-109	Lynch Pins	2
7	88-P2-93A	½" Flush Head Bronze Breather Vent	1
8	88-P2-250	½" x ¼" Reducing Bushing	1
9	88-P2-208	½" ID Double Wire Braid 3500 PSI Rated Hydraulic Hose 36" Long, ½" Male NPT Both ends.	1
10	88-P2-205	Relief Valve	1
11	88-P2-204	2" Bore Cyl 8" Stroke with ½" NPT Ports	1
12	88-P2-204A	Pin 1" x 3½" Long	1
13	88-P2-204B	Pin Clips	1
14	85-P2-45	Bolt ½"-13 x 1-¾" HHCS Gr. 5	1
15	80-M2-173C	Pin 1" x 3½" Long	1
16	85-P1-99	Bolt ½"-13 x 6" HHCS Gr. 5	1
17	80-M2-173A-4	Push Bar	1
18	80-M2-173A-3	Spacer Tube	1

80-A2-293 DOWN PRESSURE KIT
INSTALLATION INSTRUCTIONS

1. DOWN PRESSURE KIT ASSEMBLY IS DESIGNED FOR ADAPTION TO MCMILLEN #80-A2-282 3-POINT HITCH MOUNTING ONLY. DO NOT ATTEMPT TO ADAPT TO ANY OTHER MCMILLEN 3-POINT MOUNTING.
2. TRACTOR MUST BE EQUIPPED WITH 3-WAY OR 4-WAY REMOTE CONTROL VALVE AND OUTLETS.
3. TO AVOID POSSIBLE INJURY, REMOVE AUGER AND DRIVE UNIT FROM BOOM BEFORE EACH INSTALLATION OF DOWN PRESSURE KIT.
4. Remove existing a-frame to boom pin. Install pivot push arm weldment (1) to boom. Reconnect boom to a-frame then to upper hitch point on tractor.
5. Raise boom to maximum lift height.
6. Attach rear of cylinder (11), with hose port up. to pivot push arm weldment (1) with pin (15) provided. Secure pin (15) with two lynch pins (6) provided. Retract cylinder (11) to its minimum length. Push pivot push arm weldment (1) so that the face is resting firmly against side of a-frame.
7. Loosely assemble push block weldment (2) and push block pad (3) to boom using four bolts (4), nuts (5), provided. Do not tighten bolts yet.
8. Attach rod end of cylinder (11) to push block weldment (2) using pin (12). Secure with pin clip (13) provided. tighten four bolts (4) on push block weldment (2) and push block pad (3) evenly, making sure bracket is straight and square.
9. Attach hose assembly (9) to cylinder part facing us, at, rear of cylinder. **(NOTE: ONE LAYER OF JOINT TAPE SHOULD BE USED ON ALL TAPER PIPE THREAD FITTINGS. DO NOT LET TAPE EXTEND INSIDE OF FITTING AND DO NOT OVER TIGHTEN FITTING).**
10. Attach other end of hose (9) to one of the "P" port on relief valve (10). See note in step 9 regarding joint connections.
11. Attach a suitable quick coupler tip on the other "P" port on relief valve (10). The coupler tip is not included and must be obtained locally. Connect quick coupler tip and relief valve (10) to a remote hydraulic outlet on rear of tractor. If tractor is equipped with a 4-way remote control valve, there will be two outlets. either one can be used depending upon which direction the operator prefers to move the control valve lever to apply down pressure.
12. The hose fittings to connect the relief valve (port marked "tank") to the tractor reservoir should be obtained locally. Hose and fittings must have a minimum pressure rating of 2500 PSI and should be ½" ID hose. The connection to reservoir can be made at an oil fill, oil level check, breather, or drain opening. It is preferable to connect at a point below the oil level to prevent oil foaming. the "tank" port on relief valve is ½" NPTF.

80-A2-293 DOWN PRESSURE KIT
OPERATING INSTRUCTIONS

1. **BEFORE OPERATING DOWN PRESSURE KIT, MAKE SURE ALL HOSES ARE CLEAR OF ALL BOOM, A-FRAME AND PIVOT PUSH ARM MOVEMENT.**
2. To apply down pressure, move the remote outlet control valve lever in the proper direction. As long as lever is activated down pressure will be applied. Use only enough down pressure to assure positive penetration of auger into the ground. Excessive down pressure will cause the auger to stall.
3. To raise the boom, return control valve lever for down pressure to the neutral position. Activate lift arm control valve lever to raise boom. **(NOTE: NEVER ATTEMPT TO RAISE BOOM WITH DOWN PRESSURE CONTROL VALVE ACTIVATED. SERIOUS PERSONAL INJURY OR EQUIPMENT DAMAGE MAY RESULT).**

HYDRAULIC SYSTEM HOOK-UP INSTRUCTIONS

1. Once the installation instructions are complete you are now ready to make the hydraulic connections necessary to operate your earth drill. **READ AND UNDERSTAND SAFETY INFORMATION PRIOR TO MAKING HYDRAULIC CONNECTIONS.**

2. Your equipment dealer is in the best position to advise you as to where the best place on your machine is to make the hydraulic connections to power your earth drill drive unit. The list below shows the most common places to "tap" into the hydraulic system on various types of machines.

SKID STEER LOADERS - Auxiliary hydraulic outlets.

BACKHOES & EXCAVATORS - Auxiliary hydraulic outlets or bucket curl cylinder circuit.

WHEEL LOADERS & TRACTOR LOADERS - Auxiliary hydraulic outlets or bucket tilt (dump) cylinder circuit.

TRACTOR 3-POINT HITCHES - Remote (auxiliary hydraulic outlets).

FORKLIFTS - Auxiliary hydraulic outlets or side shift circuit.

3. Determine length of hydraulic hoses required to plumb drive unit into the place on your machine where you'll be "tapping" into the hydraulics. Be sure the two hydraulic hoses are long enough to perform at the full range of the earth drills' operating capacity.

Models 450, 850, 1350, 1850 and 2250 require two ½"(12.7mm) or ¾" (19mm) ID hydraulic hoses with ½" male N.P.T. fittings on one end of each hose to connect hoses to drive unit fittings.

4. **Models 2750 and 3550 ONLY.** These models require two ¾" (19mm) hydraulic hoses with ¾" male N.P.T. fittings on one end of each hose to connect hoses to drive unit fittings. These models require a ⅜"(9.5mm) ID drain line be plumbed directly back to the hydraulic reservoir. Permanently attach one piece of ⅜" (9.5mm) ID low pressure hydraulic hose from the hydraulic reservoir out to the quick coupling point for the two drive unit pressure lines. connection to the hydraulic reservoir can be made at an oil fill, oil level check, breather or drain opening. It is preferable to connect at a point below the oil level to prevent oil foaming. Install a ⅜" male quick coupler and dust cap to the other end of the drain line. To prevent seal damage to the drive unit motor, make sure drain line is routed in such a way that pinching or kinking of the hose cannot occur. Back pressure in excess of 50 PSI (3.5kg/cm²) through drain line will cause drive unit motor seal damage.

   Cut a second piece of ⅜" (9.5mm) ID low pressure hydraulic hose to run from drive unit to permanent drain line connection on vehicle. One end of the second ⅜" ID drain line hose will require a ⅜" male N.P.T. fitting to connect drain line hose to drive unit drain line connection. Install a ⅜" female quick coupler on the other end of second drain line hose. connect female quick coupler female quick coupler to male quick coupler permanently attached to vehicle. Always use dust cap and plug on quick couplers when earth drill is removed from vehicle.

   Fittings on the other end of each hydraulic hose should match the threads on hydraulic quick couplers to be used.

⚠ WARNING! HOSES AND FITTINGS MUST HAVE A CONTINUOUS OPERATING PRESSURE RATING OF AT LEAST 25% HIGHER THAN HIGHEST PRESSURES OF THE SYSTEM YOU ARE "TAPPING" INTO.

5. Once all hydraulic connections have been made and checked for leaks and proper hose lengths, you are now ready to operate your earth drill **READ AND UNDERSTAND OPERATING INSTRUCTIONS AND SAFETY INFORMATION PRIOR TO OPERATING YOUR EARTH DRILL.**

OPERATING INSTRUCTIONS

1. After all installation instructions have been completed, safety information read and understood and the rest of this operator's manual has been reviewed, your McMillen Hydraulic Earth Drill is now ready for use.

2. With the auger raised off the ground and the vehicle engine set at a low RPM, activate the earth drill control valve to determine position control valve lever must be in to turn auger in a forward (clockwise) rotation. This is the "digging" position.

3. Before beginning to dig, experiment with auger speed to determine a suitable auger RPM. Generally in light and sandy soil a high RPM is desirable. In hard, rocky, or frozen soils a slower RPM is desirable. To increase auger RPM, increase vehicle engine RPM. to decrease auger RPM, decrease vehicle engine RPM.

4. Return earth drill control valve to neutral position to stop the auger. Lower the auger to the ground so that only the center point penetrates the ground about 2" (51mm).

5. Activate the earth drill control valve so auger is turning in a forward (clockwise) rotation. Use only enough down pressure to assure positive penetration of auger into the ground. Ease up on down pressure if auger rotation slows down drastically or stalls. Excessive down pressure will cause the auger to stall frequently.

6. When auger has penetrated the ground about 24" (610mm), raise the auger from the hole to clean the dirt out. Repeat this procedure until the desired hole depth is obtained.

7. Once the required hole depth is reached, allow the auger to turn a few seconds at this depth to clean the hole.

8. Return the earth drill control valve to the neutral position to stop the rotation of the auger. Raise the auger out of the hole, move away from the hole, then activate the earth drill control valve to spin the loose soil off of the augers.

NOTE: Do not reverse the auger rotation to remove from the hole as loose soil on the auger flights will fall back into the hole.

9. If necessary, repeat steps 7 & 8 to obtain a cleaner hole.

10. In some soil conditions or when excessive down pressure is applied, auger may "screw" itself into the ground and become stuck causing earth drill to stall. If this happens, reverse the auger rotation (counter-clockwise) by moving the control valve lever to the reverse position and slowly raise the auger. Once unstuck, return the control valve lever to the forward rotation position and continue digging.

11. If the auger becomes lodged under rocks, roots, or other large obstructions, do not attempt to raise the auger out of the ground. See step 10 for proper procedure to relieve the auger.

12. Avoid excessive side loading to earth drill which can cause drive unit or auger damage.

13. Keep auger teeth and points in good condition. Check frequently and always keep spares on hand so they can be replaced as wear is detected to avoid damage to tooth holders and auger flighting.

MAINTENANCE INSTRUCTIONS

1. CLEAN HYDRAULIC OIL IS ESSENTIAL! 80% of all hydraulic component failures are caused by contamination of the hydraulic oil. Always keep all dirt and other contaminates from entering hydraulic system during disconnect and connect operations. Always use dust caps and plugs on all quick disconnects when not in use. Tightly cap all hydraulic openings to hold oil in and keep dirt and other contaminates from entering hydraulic systems.

2. CHECK HYDRAULIC OIL DAILY FOR CONTAMINATION. If contamination is present, determine the source of the problem.

3. INSPECT ALL HYDRAULIC HOSE ASSEMBLIES DAILY for cracked and brittle covers caused by excessive heat. Reduced viscosity of hydraulic oil occurs at higher operating temperatures and causes a breakdown of fluid additives such as wear inhibitors. Excessive heat will cause higher internal leakage in drive unit motor which will make the drive unit less efficient. It can also cause seals in the drive unit motor to become brittle and crack. Replacement of hoses before failure will prevent loss of hydraulic oil, time consuming "bleeding" of the system, hydraulic oil contamination, and component damage caused by cavitation. It will also reduce the chance of personal injury caused by hydraulic fluid.

4. CHECK AUGER DAILY for loose, worn or broken cutting teeth and point. Worn teeth or point can drastically affect auger penetration and greatly reduce auger life expectancy. always keep spare teeth and points on hand. Some digging conditions may require checking teeth and point at more frequent intervals.

5. CHECK DRIVE UNIT AND ALL ACCESSORIES DAILY for loose, bent, cracked, or worn bolts and fasteners. Always use grade 5 or harder replacements bolts. Always use lockwashers with standard hex nuts or self locking nuts.

6. CHECK ALL CONNECTING PINS DAILY for bends, cracks, breaks, or wear. Replace if any of these conditions exist.

7. CHECK DRIVE UNIT OUTPUT SHAFT DAILY for bends, cracks, breaks, or wear. Replace if any of these conditions exist.

8. FOR MODELS 850, 1350, 1850 & 2250, CHANGE PLANETARY GEAR REDUCTION OIL AFTER FIRST 50 HOURS OF OPERATION, THEN EVERY 1000 HOURS OR IN ONE YEAR, WHICHEVER COMES FIRST. Use mild extreme pressure lubricant API-GL-5, no. 80 or 90 for filling the planetary gear reduction under normal temperature ranges between 0°-120°F (-18° - 49°C). Approximate oil capacity for models 850, 1350, 1850, and 2250 is two pints (.95 liters). Approximate oil capacity for model 2750 & 3550 is 4-¾ pints(2.23 Liters). CHECK OIL LEVEL DAILY to assure proper lubrication is maintained.

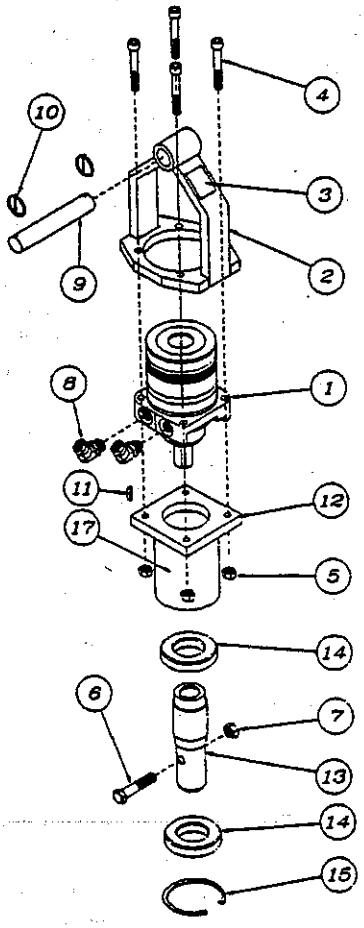
9. WHEN STORING DRIVE UNIT for any length of time be sure drive unit motor and hoses are full of clean oil. For models 850, 1350, 1850, 2250, 2750 and 3550 be sure planetary gear reduction is full (to the recommended capacity for each model as outlined in (8) of clean lubricant.

10. Drive Unit output shaft, inside of auger collar, variable auger extension shaft, inside of variable auger extension collar and all connecting pins should be coated liberally with grease to prevent rust and reduce wear.

11. Once paint has been worn off auger, coat liberally with grease as required, to prevent rusting.

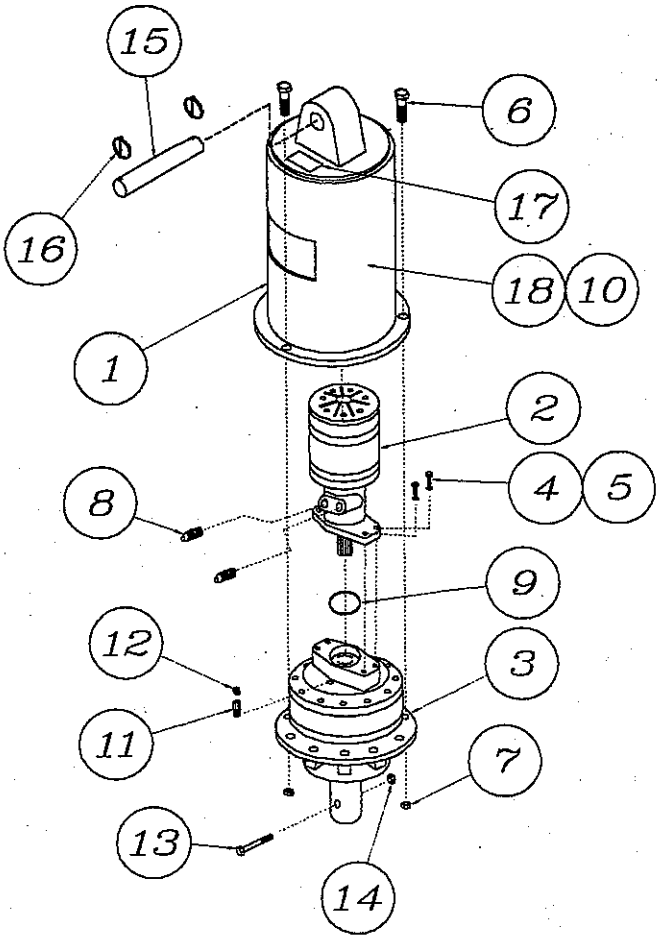
12. Check planetary gear oil as follows. Lie drive unit horizonal with ground place bottom drain plug straight up. Remove plug, tilt drive unit at 2:00 or 10:00. Fill until oil leaks out from hole at one of these positions.

MODEL 450 HYDRAULIC DRIVE UNIT
EXPLODED VIEW AND PARTS LIST



REFERENCE NUMBER	PART NUMBER	DESCRIPTION	QTY REQ'D
1	81-P2-260	Hydraulic Motor 450(motor breakdown on pg.23)	1
2	80-M1-219A	Motor Mount Weldment	1
3	89-P2-234	Model #/Serial # ID Plate	1
4	85-P1-118	½-13 X 3-½" Lg Socket Head Cap Screw	4
5	85-P1-119	½-13 "Uni-Torgue" Lock Nut	4
6	85-P2-17	⅝-11 X 3-½" Long, HHCS, Gr. 5	1
7	85-P2-18	⅝-11 Hex Nut	1
8	88-P1-111	45 "O" Ring Motor Fitting	1
9	85-M2-17	Pin, 1-¼" x 6" Long	1
10	65-P2-109	Lynch Pins	2
11	81-A3-636	Hardened Key or Hydraulic Motor	1
12	80-M1-43	Powerhead Housing	1
13	83-M1-44L	Powerhead Shaft	1
14	84-P1-60	Powerhead Bearing	2
15	85-P1-61	Powerhead Snap Ring	1
16	89-P2-237A	Safety Decal	2
17	89-P2-236	McMillen Decal	2

MODELS 850, 1350, 1850 & 2250 HYDRAULIC DRIVE UNIT
EXPLODED VIEW & PARTS LIST



REFERENCE NUMBER	PART NUMBER	DESCRIPTION	QTY REQ'D
1	80-M2-164A	Motor Housing & Pendant Weldment	1
2	81-P2-261	Hydraulic Motor 850	1
	81-P2-262	Hydraulic Motor 1350	1
	81-P2-263	Hydraulic Motor 1850	1
	81-P2-189A	Hydraulic Motor 2250	1
3	87-P2-228	Planetary Gear Reduction-2" Round	1
	87-P2-228-H2	Planetary Gear Reduction-2" Hex	1
	87-P2-228R256	Planetary Gear Reduction-2 9/16" Round	1
4	85-P2-19	½-13 x 1-½" Long HHCS, Gr. 5	4
5	85-P2-32	½" Split Lockwasher	4
6	85-P2-203	9/16-12 x 2" Long HHCS, Gr. 5	3
7	85-P2-243	9/16-12 "Unit-Torque" Lock Nut	3
8	88-P1-111	45 'O' Ring Motor Fitting	2
9	88-P2-192	'O' Ring	1
10	M94-0065	McMillen Decal	2
11	88-P2-100A	¼" In-Line Check Valve	1
12	88-P2-93A	¼" Bronze Breather Vent	1
13	85-P2-17	⅝-11 S 3-½" Long HHCS (round)R2	1
	85-P2-244	¾-10 x 4" -½" Long HHCS (hex)	1
	85-P2-224	⅞-9 x 4-½" Gr. 5 HHCS (round)R256	1
14	85-P2-18	⅝-11 Hex Nut (round) R2	1
	85-P2-245	¾-10 Hex Nut (hex)	1
	85-P2-225	⅞"-9 Hex Nut (round)R256	1
15	85-M2-17	Pin, 1-¼" x 6 Long	1
16	65-p2-109	Lynch Pins	2
17	89-P2-234	Model # / Serial # ID Plate	1
18	89-P2-237A	Safety Decal	2

MODELS 450, 850, 1350, 1850 & 2250
DRIVE UNIT SPECIFICATIONS

MODEL 450

MAXIMUM AUGER DIAMETER: 12" (305mm)
MINIMUM HYDRAULIC FLOW: 5 GPM (19 lpm)
MAXIMUM HYDRAULIC FLOW: 10 GPM (38 lpm)
MAXIMUM CONTINUOUS OPERATING PSI: 3000 PSI (211 KG/cm²)

OUTPUT SPEED			OUTPUT TORQUE		
FLOW GPM (LPM)		SPEED RPM	PRESSURE PSI(KG/CM²)		TORQUE FT/LBS(Nm)
5 (19)	=	65	2000 (141)	=	470 (637)
6 (23)	=	78	2100 (147)	=	493 (169)
7 (26)	=	91	2200 (155)	=	516 (700)
8 (30)	=	104	2300 (162)	=	540 (732)
9 (34)	=	117	2400 (169)	=	563 (763)
10 (38)	=	130	2500 (183)	=	587 (796)
			2600 (183)	=	610 (827)
			2700 (190)	=	634 (860)
			2800 (197)	=	657 (891)
			2900 (204)	=	681 (923)
			3000 (211)	=	704 (955)

MODEL 850

MAXIMUM AUGER DIAMETER: 24" (610 mm)
MINIMUM HYDRAULIC FLOW: 8 GPM (30 lpm)
MAXIMUM HYDRAULIC FLOW: 15 GPM (57 lpm)
MAXIMUM CONTINUOUS OPERATING PSI: 3000 PSI (211KG/cm²)

OUTPUT SPEED			OUTPUT TORQUE		
FLOW GPM (LPM)		SPEED RPM	PRESSURE PSI (KG/cm²)		TORQUE FT/LBS(Nm)
8 (30)	=	51	2000 (141)	=	855 (1159)
9 (34)	=	60	2100 (148)	=	898 (1218)
10 (38)	=	69	2200 (155)	=	941 (1276)
11 (42)	=	77	2300 (162)	=	984 (1334)
12 (45)	=	86	2400 (169)	=	1027 (1393)
13 (49)	=	95	2500 (176)	=	1069 (1450)
14 (53)	=	103	2600 (183)	=	1112 (1508)
15 (57)	=	112	2700 (190)	=	1155 (1566)
			2800 (197)	=	1198 (1624)
			2900 (204)	=	1240 (1681)
			3000 (211)	=	1283 (1740)

MODEL 1350

MAXIMUM AUGER DIAMETER: 30" (762 mm)
MINIMUM HYDRAULIC FLOW: 10 GPM (38 lpm)
MAXIMUM HYDRAULIC FLOW: 20 GPM (76 lpm)
MAXIMUM CONTINUOUS OPERATING PSI: 3000 PSI (211 KG/cm²)

OUTPUT SPEED			OUTPUT TORQUE		
FLOW GPM (LPM)		SPEED RPM	PRESSURE PSI (KG/cm²)		TORQUE FT/LBS (Nm)
10 (38)	=	51	2000 (141)	=	1204 (1633)
11 (42)	=	56	2100 (148)	=	1264 (1714)
12 (45)	=	61	2200 (155)	=	1324 (1795)
13 (49)	=	66	2300 (162)	=	1384 (1877)
14 (53)	=	71	2400 (169)	=	1444 (1958)
15 (57)	=	76	2500 (176)	=	1504 (2039)
16 (61)	=	81	2600 (183)	=	1565 (2122)
17 (64)	=	86	2700 (190)	=	1625 (2204)
18 (68)	=	91	2800 (197)	=	1685 (2285)
19 (72)	=	96	2900 (204)	=	1745 (2366)
20 (76)	=	101	3000 (211)	=	1805 (2448)

MODEL 1850

MAXIMUM AUGER DIAMETER: 36" (914mm).
MINIMUM HYDRAULIC FLOW: 15 GPM (57 lpm).
MAXIMUM HYDRAULIC FLOW: 30 GPM(114 lpm).
MAXIMUM CONTINUOUS OPERATING PSI: 3000 PSI (211 KG/cm²)

OUTPUT SPEED			OUTPUT TORQUE		
FLOW GPM (LPM)		SPEED RPM	PRESSURE PSI (KG/cm²)		TORQUE FT/LBS(Nm)
15 (57)	=	52	2000 (141)	=	1761 (2388)
16 (61)	=	55	2100 (148)	=	1849 (2507)
18 (68)	=	62	2200 (155)	=	1937 (2627)
20 (76)	=	69	2300 (162)	=	2025 (2746)
22 (83)	=	76	2400 (169)	=	2113 (2865)
24 (91)	=	83	2500 (176)	=	2200 (2983)
26 (98)	=	90	2600 (183)	=	2289 (3104)
27 (106)	=	97	2700 (190)	=	2377 (3223)
30 (114)	=	104	2800 (197)	=	2465 (3343)
			2900 (204)	=	2553 (3462)
			3000 (211)	=	2641 (3581)

MODEL 2250

MAXIMUM AUGER DIAMETER: 36" (914 mm)
MINIMUM HYDRAULIC FLOW: 20 GPM (64 Lpm)
MAXIMUM HYDRAULIC FLOW: 30 GPM (114 Lpm)
MAXIMUM CONTINUOUS OPERATING PSI: 3000 PSI (211 KG/cm²)

OUTPUT SPEED			OUTPUT TORQUE		
FLOW GPM/LPM		SPEED RPM	PRESSURE PSI (KG/cm²)		TORQUE FT/LBS(Nm)
20 (76)	=	54	2000 (141)	=	2267 (3101)
21 (80)	=	56	2100 (148)	=	2831 (3261)
22 (83)	=	59	2200 (155)	=	2494 (3416)
23 (87)	=	62	2300 (162)	=	2608 (3540)
24 (91)	=	64	2400 (169)	=	2721 (3721)
25 (95)	=	67	2500 (176)	=	2834 (3878)
26 (98)	=	70	2600 (183)	=	2948 (4034)
27 (102)	=	72	2700 (190)	=	3061 (4200)
28 (106)	=	75	2800 (197)	=	3175 (4387)
29 (110)	=	78	2900 (204)	=	3288 (4514)
30 (114)	=	81	3000 (211)	=	3401 (4670)

Output speed and torque specifications are based on theoretical values and are provided for comparative purposes only.

McMillen is continually striving to improve its products. Therefore, we reserve the right to make changes to our products or specifications at any time without notice or obligation.

MODELS 2750 & 3550 DRIVE UNITS
SPECIFICATIONS

MODEL 2750

MAXIMUM AUGER DIAMETER: 36" (914mm)
MINIMUM HYDRAULIC FLOW: 25 GPM (95 lpm)
MAXIMUM HYDRAULIC FLOW: 45 GPM (170 lpm)
MAXIMUM CONTINUOUS OPERATING PRESSURE: 3000 PSI (211 KG/CM²)

OUTPUT SPEED

FLOW GPM (LPM)	=	SPEED RPM
25 (95)	=	56
27 (102)	=	61
29 (110)	=	65
31 (117)	=	70
33 (125)	=	74
35 (132)	=	79
37 (140)	=	83
39 (148)	=	88
41 (155)	=	92
43 (163)	=	97
45 (170)	=	101

OUTPUT TORQUE

PRESSURE PSI (KG/CM²)	=	TORQUE FT/LBS (Nm)
2000 (141)	=	2727 (3698)
2100 (148)	=	2864 (3884)
2200 (155)	=	3000 (4068)
2300 (162)	=	3136 (4252)
2400 (169)	=	3273 (4438)
2500 (176)	=	3409 (4623)
2600 (183)	=	3545 (4807)
2700 (190)	=	3682 (4993)
2800 (197)	=	3818 (5177)
2900 (204)	=	3955 (5363)
3000 (211)	=	4091 (5547)

MODEL 3550

MAXIMUM AUGER DIAMETER: 48" (1219mm)
MINIMUM HYDRAULIC FLOW: 30 GPM (114 lpm)
MAXIMUM HYDRAULIC FLOW: 60 GPM (227 lpm)
MAXIMUM CONTINUOUS OPERATING PRESSURE: 3000 PSI (211 KG/CM²)

OUTPUT SPEED

FLOW GPM (LPM)	=	SPEED RPM
30 (114)	=	52
32 (121)	=	56
34 (129)	=	59
36 (136)	=	63
38 (144)	=	66
40 (151)	=	70
42 (159)	=	73
44 (167)	=	77
46 (174)	=	80
48 (182)	=	84
50 (189)	=	87
52 (197)	=	91
54 (204)	=	94
56 (212)	=	98
58 (220)	=	101
60 (227)	=	105

OUTPUT TORQUE

PRESSURE PSI (KG/CM²)	=	TORQUE FT/LBS (Nm)
2000 (141)	=	3506 (4754)
2100 (148)	=	3682 (4993)
2200 (155)	=	3857 (5230)
2300 (162)	=	4032 (5467)
2400 (169)	=	4208 (5706)
2500 (176)	=	4383 (5943)
2600 (183)	=	4558 (6181)
2700 (190)	=	4734 (6419)
2800 (197)	=	4909 (6657)
2900 (204)	=	5084 (6894)
3000 (211)	=	5289 (7172)

Output speed and torque specifications are based on theoretical values and are provided for comparative purposes only.

McMillen is continually striving to improve its products. Therefore, we reserve the right to make changes to our products or specifications at anytime without notice or obligations.

TROUBLESHOOTING

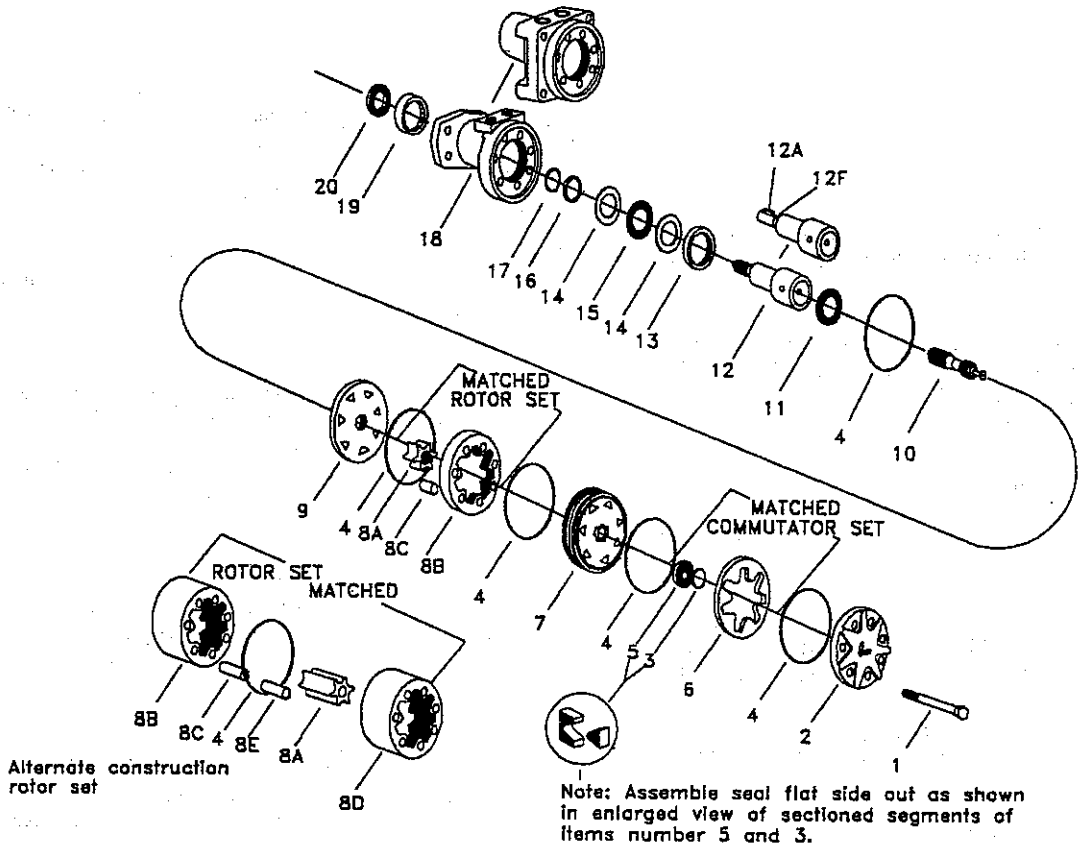
PROBLEM	POSSIBLE CAUSE	SOLUTION
Slow Speed	Low Fluid	Check with flow meter. If low investigate cause.
	Line restrictions	Clear lines
	Fittings or connections too small	Replace with proper sizes.
	Oil filter dirty	Replace
	Hydraulic pump worn or damaged	See Dealer for repair
Insufficient Digging Power	Worn teeth or point	Replace
	Low system Pressure (PSI)	Check with pressure gauge. If low, investigate cause.
	Relief Valve damaged or setting wrong	Adjust or replace as required.
	Excessive load	Reduce load to within machine specifications.
Reverse Direction	Hoses reversed	Re-install hoses correctly.
Excessive Oil Heating	Line restrictions	Clear lines
	Fluid dirty	Replace hydraulic fluid and filter.
	Insufficient quantity of hydraulic fluid	Fill reservoir to proper level. Increase reservoir storage capacity.
Oil Leaks	Hoses loose or damaged	Tighten or replace
	Fittings loose or damaged	Tighten or replace
	Hydraulic motor seals worn or damaged	See Dealer for repair.

FOR FURTHER ASSISTANCE, PLEASE CONTACT OUR SERVICE DEPARTMENT AS FOLLOWS:

NORTH AMERICA TOLL FREE: (800) 234-0964
Outside North America: (219) 747-6750
Fax: (219) 747-9161

MODELS 450, 850, 1350, 1850 & 2250 HYDRAULIC MOTOR

EXPLODED VIEW & PARTS LIST



REFERENCE NUMBER	PART NUMBER	DESCRIPTION	QTY REQ'D	MODEL USED ON
1	81-A3-600	Bolt	7	1350
1	81-A3-601	Bolt	7	450, 1850
1	81-A3-641	Bolt	7	850
1	81-A3-648	Bolt	7	2250
2	81-A3-604	End Cover	1	All Models
3*	81-A3-605	Commutator	1	All Models
4*	81-A3-606	Seal Ring	5	All Models
5 & 6	81-A3-607	Commutator Assy.	1	All Models
7	81-A3-609	Manifold	1	All Models
8	81-A3-613	Rotor Set	1	1350
8	81-A3-614	Rotor Set	1	450, 1850
8	81-A3-642	Rotor Set	1	850
8	81-A2-647	Rotor Set	1	2250
9	81-A3-616	Wear Plate	1	All Models
10	81-A3-620	Drive Link	1	1350
10	81-A3-621	Drive Link	1	450, 1850
10	81-A3-643	Drive Link	1	850
10	81-A3-646	Drive Link	1	2250
11	81-A3-622	Thrust Bearing	1	All Models
12	81-A3-624	Coupling Shaft	1	450
12	81-A3-625	Coupling Shaft	1	850, 1350, 1850, 2250
12A	81-A3-636	Key	1	450
12F	81-A3-640	Retaining Ring	1	450
13	81-A3-626	Inner Bearing	1	All Models
14	81-A3-627	Thrust Washer	2	All Models
15	81-A3-628	Thrust Bearing	1	All Models
16*	81-A3-629	Inner Seal	1	All Models
17	81-A3-630	Backup Washer	1	All Models
18	81-A3-632	Housing Assy.	1	850, 1350, 1850, 2250
18	81-A3-644	Housing Assy.	1	450
19	81-A3-633	Outer Bearing	1	All Models
20*	81-A3-634	Dirt & Water Seal	1	All Models
*	81-A3-635	Seal Kit (Included*)	1	All Models

MODELS 450, 850, 1350, 1850 & 2250

HYDRAULIC MOTOR SERVICE PROCEDURES

GENERAL INSTRUCTIONS

To facilitate the repair of these units and before any work is done, we suggest that you first read all of the steps used in disassembly and assembly of the unit.

Dirt is the enemy of any hydraulic system. The first requirement of good maintenance of hydraulic equipment is cleanliness. **MAKE SURE YOU DISASSEMBLE AND ASSEMBLE YOUR HYDRAULIC EQUIPMENT IN A CLEAN AREA.**

As you disassemble the motor clean all parts, accept seals, in clean petroleum based solvent, and blow dry. do not use cloth to dry parts. Clean parts separately to avoid nicks and burrs. Do not force or abuse closely fitted parts.

⚠ WARNING! SINCE THEY ARE FLAMMABLE, BE EXTREMELY CAREFUL WHEN USING ANY SOLVENT. EVEN A SMALL EXPLOSION OR FIRE COULD CAUSE INJURY OR DEATH.

⚠ WARNING! WEAR EYE PROTECTION AND BE SURE TO COMPLY WITH OSHA OR OTHER MAXIMUM PRESSURE REQUIREMENTS.

CAUTION

If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. Excessive force while prying can result in misalignment and seriously damage parts.

If parts are stubborn during assembly, do not force them and never employ an iron hammer.

Never hammer bearings into bores. Use only an arbor press or other suitable tool.

DISASSEMBLY

1. Place the motor in a soft jawed vise, with coupling shaft (12) pointed down and the vise jaws clamping firmly on the sides of the housing (18) mounting flange or port bosses.

2. Scribe an alignment mark down and across the motor components from the end cover (2) to housing (18) to facilitate reassembly orientation where required.

3. Remove seven bolts (1). Inspect bolts for damaged threads or sealing rings, under the bolt head. Replace damaged bolts.

4. Remove end cover assembly (2) and seal ring (4). Discard seal ring.

5. Thoroughly wash end cover (2) improper solvent and blow dry. Inspect end cover for cracks and the bolt head recesses for good bolt head sealing surfaces. Replace end cover as necessary.

NOTE: A polished pattern (not scratches) on the cover from rotation of the commutator (5) is normal Discoloration would indicate excess fluid temperatures, thermal shock, or excess speed and require system investigation for cause and close inspection of end cover, commutator, manifold, and rotor set.

6. Remove commutator ring (6). Inspect commutator ring for cracks or burns.

7. Remove commutator (5) and seal ring (3). Remove seal ring from commutator, using an air hose to blow air into ring groove until seal ring is lifted out and discard seal ring. Inspect commutator for cracks or burrs, wear, scoring, spalling or brinelling. If any of these conditions exist, replace commutator and commutator ring as a matched set.

8. Remove manifold (7) and inspect for cracks, surface scoring, brinelling or spalling. Replace manifold if any of these conditions exist. A polished pattern of the ground surfaces from commutator or rotor rotation is normal. Remove and discard the seal rings (4) that are on both sides of the manifold.

9. Remove rotor set (8) and wearplate (9) together to retain the rotor set in its assembled form, maintaining the same rotor vane (8C) to stator (8B) contact surfaces. The drive link (10) may come away from the coupling shaft (12) with the rotor set and wearplate. You may have to shift the rotor set on the wearplate to work the drive link out of the rotor (8A) and wearplate. Inspect the rotor set in its assembled from for nicks, scoring or spalling on any surface and for broken or worn splines. If the rotor set component requires replacement, the complete rotor set must be replaced as it is a matched set. Inspect the wearplate for cracks, brinelling or scoring. Discard seal ring (4) that is between the rotor set and wearplate.

NOTE: The rotor set (8) components may become disassembled during service procedures. Marking the surface of the rotor and stator that is facing up with etching ink or grease pencil before removal from motor will ensure correct reassembly of rotor into stator and rotor set into motor. Marking all rotor components and mating spline components for exact repositioning at assembly will ensure maximum wear life and performance of rotor set and motor.

NOTE: Motors may have a rotor set with two stator halves (8B & 8D) with a seal ring (4) between them and two sets of seven vanes (8C & 8E). Discard seal ring only if stator halves become disassembled during service procedures.

NOTE: A polished pattern on the wear plate from rotor rotation is normal.

10. Place rotor set (8) and wearplate (9) on a flat surface and center rotor (8A) in stator (8B) such that two rotor lobes (180° degrees apart) and roller vane (8C) centerline are on lobe to roller vane clearance with a feeler gage at this common centerline. If there is more than .005 inches (0.13mm) of clearance, replace rotor set.

NOTE: If rotor set (8) has two stator halves (8B & 8D) and two sets of seven vanes (8C & 8E) as shown in the alternate construction rotor set assembly view, check the rotor lobe to roller vane clearance at both ends of rotor.

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11. Remove drive link (10) from coupling shaft (12) if it was not removed with rotor set and wearplate. Inspect drive for cracks and worn or damaged splines. No perceptible lash (play) should be noted between mating spline parts.

12. Remove thrust bearing (11) from top of coupling shaft (12). Inspect for wear, brinelling, corrosion and a full complement of retained rollers

13. Check exposed portion of coupling shaft (12) to be sure you have removed all signs of rust and corrosion which might prevent its withdrawal through the seal and bearing. Crocus cloth or fine emery paper may be used. Remove key (12A) and retaining ring (12F) on applicable models.

14. Remove coupling shaft (12), by pushing on the output end of shaft. Inspect coupling shaft bearing and seal surfaces for spalling, nicks, grooves, severe wear or corrosion and discoloration. Inspect for damaged or worn internal and external splines or keyway. Replace coupling shaft if any of these conditions exist.

NOTE: Minor shaft wear in seal area is permissible. If wear exceeds .020 inches (0.51mm) diametrically, replace coupling shaft.

NOTE: A slight "polish" is permissible in the shaft bearing areas. Anything more would require coupling shaft replacement.

15. Remove and discard seal ring (4) from housing (18).

NOTE: Motors have a thrust bearing (15) sandwiched between two thrust washers (14) that cannot be removed from the housing (18) unless bearing (13) is removed for replacement.

16. Remove seal (16) and back up washer (17) from housing (18). Discard both. To remove seal (16) and back up washer (17) from motor housing, work them around unseated thrust washer (14) and thrust bearing (15) and out of the housing.

17. Remove housing (18) from vise, invert it and remove and discard seal (20). A blind hole bearing or seal puller is required.

18. Inspect housing (18) assembly for cracks, the machined surfaces for nicks, burrs, brinelling or corrosion. Remove burrs that can be removed without changing dimensional characteristics. Inspect tapped holes for thread damage. If housing is defective in these areas, discard the housing assembly.

19. If the housing (18) assembly has passed inspection to this point, inspect the housing bearings (19) and (13) and if they are captured in the housing cavity the two thrust washers (14) and thrust bearing (15). The bearing rollers must be firmly retained in the bearing cages, but must rotate and orbit freely. All rollers and thrust washers must be free of brinelling and corrosion. A bearing or thrust washer that does not pass inspection must be replaced. If the housing has passed this inspection the disassembly of the motor is completed.

NOTE: The depth location of bearing (13) in relation to the housing wearplate surface and the depth or location of bearing (19) in relation to the beginning of bearing counter bore should be measured and noted before removing the bearings. This will facilitate the correct reassembly of new bearings.

20. If the bearings, bushings, or thrust washers must be replaced use a suitable size bearing puller to remove bearings (19) and (13) from housing (18) without damaging the housing. Remove thrust washers (14) and thrust bearing (15) if they were previously retained in the housing bearing (13).

GENERAL INSTRUCTIONS

Replace all seals and seal rings with new ones each time you reassemble the motor. Lubricate all seals and seal rings with SAE 10W40 oil or clean grease before assembly.

Unless otherwise indicated, do not oil or grease parts before assembly.

Wash all parts in clean petroleum-based solvents before assembly. Blow them dry with compressed air. Remove any paint chips from mating surfaces of the end cover, commutator set, manifold, rotor set, wearplate housing and from port and sealing areas.

ASSEMBLY

1. If the housing (18) bearing components were removed for replacement, thoroughly coat and pack a new outer bearing (19) with clean corrosion resistant grease. Press the new bearing into the counterbore at the mounting flange end of the housing, using the appropriate sized bearing mandrel which will press bearing (19) into the housing to a required depth of .290/.310 inches (7.37/7.87mm) from outside end of bearing counterbore.

NOTE: Bearing mandrel must be pressed against the lettered end of bearing shell. Take care that housing bore is square with the press base and the bearing is not cocked when pressing a bearing into the housing. **CAUTION:** If a bearing mandrel is not available and alternate methods are used to press in bearing support and correct relationship to adjacent components when assembled. **CAUTION:** Because the bearings (13) and (19), have a press fit into the housing they must be discarded when removed. They must not be reused.

2. The motor housing (18) requires that you assemble a new backup washer (17), new seal (16) with the lip facing out, new thrust washer (14), new thrust bearing (15) and a new second thrust washer (14) in that order before pressing in the inner housing bearing (13). When these components are in place, press new bearing (13) into the housing (18) to a depth of .105/.125 inches (2.67/3.18mm) below the housing wearplate contact face.

3. Apply a small amount of clean grease to a new dirt and water seal 20) and press it into the housing (18) outer bearing counterbore. The dirt and water seal (20) must be pressed in with the lip facing out and until the seal is flush to .020 inches (.51mm) below the end of housing.

4. Place housing (18) assembly into a soft jawed vise with coupling shaft bore down, clamping against the mounting base flange.

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5. Assemble a new backup washer (17) and new seal (16) with the seal lip facing out, into their respective counterbores in housing (18) if they were not assembled in step 2. Housings (18) that did not require replacement of the bearing package will require that the two "captured" thrust washers (14) and thrust bearing (15) be unseated and vertical to the counterbore and that new backup washer (17) and new seal (16) be worked around the thrust bearing package and placed into their respective counterbores. The seal lip must face out of the seal counterbores. Be sure the thrust bearing package is reseated correctly after assembly of the seal and backup washer.

6. Apply masking tape around splines or keyway on coupling shaft (12) to prevent damage to seal.

7. Be sure a generous amount of clean corrosion resistant grease has been applied to the lower (outer) housing bearing (19). Install the coupling shaft (12) into housing (18), seating it against the second thrust washer (14). **CAUTION:** The outer bearing (19) is not lubricated by the system's hydraulic fluid. Be sure it is thoroughly packed with E/M Lubricant #K-70M grease.

8. Install thrust bearing (11) onto the end of coupling shaft (12).

9. Apply a small amount of clean grease to a new seal ring (4) and insert it into the housing (18) seal ring groove.

NOTE: One or two alignment studs screwed finger tight into housing (18) bolt holes, approximately 180 degrees apart, will facilitate the assembly and alignment of components as required in the following procedures. The studs can be made by cutting off the heads of ⅜-24 UNF 2A bolts that are over .5 inch (12.7mm) longer than the bolts (1) used in the motor.

10. Install drive link (10) the long splined end down into the coupling shaft (12) and engage the drive link splines into mesh with the coupling shaft splines.

NOTE: Use any alignment marks put on the coupling shaft and drive link before disassembly to assemble the drive link splines in their original position in the mating coupling shaft splines.

11. Assemble wearplate (9) over the drive link (10) and alignment studs onto the housing (18).

12. Apply a small amount of clean grease to a new seal ring (4) and assemble it into seal ring groove on the wearplate side of the rotor set stator (8B).

13. Install the assembled rotor set (8) onto wearplate (9) with rotor (8A) counterbore and seal ring side down and the splines into mesh with the drive link splines.

NOTE: It may be necessary to turn one alignment stud out of the housing (18) temporarily to assemble rotor set (8) or manifold (7) over the drive link.

NOTE: If necessary, go to the appropriate "ROTOR SET COMPONENT ASSEMBLY PROCEDURES."

NOTE: The rotor set rotor counterbore side must be down against wearplate for drive link clearance and to maintain the original rotor drive link spline contact. A rotor set without a counterbore and that was not etched before disassembly can be reinstalled using the drive link spline pattern on the rotor splines if apparent, to determine which side was down. The rotor set has a seal ring groove on the wearplate contact side of the stator (8B).

14. Apply clean grease to a new seal ring (4) and assemble it in the seal ring groove in the rotor set contact side of manifold (7).

NOTE: The manifold (7) is made up of several plates bonded together permanently to form an integral component. The manifold surface that must contact the rotor set has it's series of irregular shaped cavities on the largest circumference or circle around the inside diameter. The polished impression left on the manifold by the rotor set is another indication of which surface must contact the rotor set.

15. Assemble the manifold (7) over the alignment studs and drive link (10) and onto the rotor set. Be sure the correct manifold surface is against the rotor set.

16. Apply grease to a new seal ring (4) and insert it in the seal ring groove exposed on the manifold (7)

17. Assemble the commutator ring (6) over the alignment studs onto the manifold (7).

18. Assemble a new seal ring (3) flat side up, into commutator (5) and assemble commutator over the end of the drive link (10) onto the manifold (7) with seal ring side up.

19. Assemble a new seal ring (4) into end cover (2) and assemble end cover over the alignment studs and onto the commutator set.

20. Assemble the seven special bolts (1) and screw in finger tight. Remove and replace two alignment studs with bolts after the other bolts are in place. Alternately and progressively tighten the bolts to pull the end cover and other components into place with a final torque of 45-55 FT/LBS (61-75Nm).

21. Replace key (12A) and retaining ring (12F) on motors with a keyed coupling shaft. Assembly of motor is now complete.

ROTOR SET ASSEMBLY PROCEDURE
ONE PIECE STATOR CONSTRUCTION

A disassembled rotor (8A), stator (8B) and vanes (8C) that cannot be readily assembled by hand can be assembled by the following procedures.

1. Place stator (8B) onto wearplate (9) with seal ring (4) side down, after following motor assembly steps 1 through 12. Be sure the seal ring (4) is in place.

2. If assembly alignment studs are not being utilized, align stator bolt holes with wearplate and housing bolt holes and turn two bolts (1) finger tight into bolt holes approximately 180 degrees apart to retain stator and wearplate stationary.

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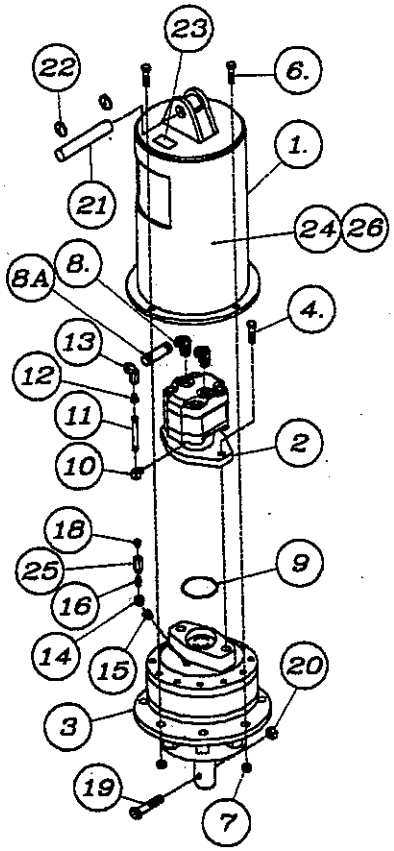
MODELS 2750 & 3550 HYDRAULIC DRIVE UNITS
EXPLODED VIEW & PARTS LIST



REFERENCE NUMBER	PART NUMBER	DESCRIPTION	QTY REQ'D	MODEL USED ON
1	80-M2-169	Motor Housing & Pendent Weldment	1	2750, 3550
2	81-P2-230	2750 Hydraulic Motor	1	2750
2	81-P2-231	3550 Hydraulic Motor	1	3550
3	87-P2-229	Planetary Gear Reduction 2" Round	1	2750 Round
3	87-P2-229-H2	Planetary Gear Reduction 2" Hex	1	2750 Hex, 3550 Hex
4	85-P2-247	⅝-11 x 1-¾" Long, HHCS, Gr. 5	2	2750, 3550
5	85-P2-98	⅝" Split Lockwasher	2	2750, 3550
6	85-P2-203	9/16-12 x 2" Lockwasher	4	2750, 3550
7	85-P2-243	9/16-12 "Uni-Torque" Lock Nut	4	2750, 3550
8	88-P2-248	45° "O" Ring Motor Fitting	2	2750, 3550
8A	88-P2-261	3/4" Hose Assembly, 6-7/8" Long	2	2750, 3550
9	88-P2-246	"O" Ring	1	2750, 3550
10	88-P2-189	¼" 90° Street El Black Pipe	1	2750, 3550
11	88-P2-197	¼" Black Pipe Nipple x 4" Long	1	2750, 3550
12	88-P2-209	⅜" NPT to ¼" NPT Reducing Bushing	1	2750, 3550
13	88-P2-249	45° Fitting ⅜" Female Pipe x ⅜" Female Pipe Swivel	1	2750, 3550
14	88-P2-251	45° Fitting ¼" Female Pipe x ¼" Male Pipe	1	2750, 3550
15	88-P2-250	½" NPT to ¼' NPT Reducing Bushing	1	2750, 3550
16	88-P2-101	¼" Hex Nipple	1	2750, 3550
17	88-P2-100	¼" In Line check Valve	1	2750, 3550
18	88-P2-93A	¼" Bronze Breather Vent	1	2750, 3550
19	85-P2-17	⅝-11 x 3-½" Long, HHCS, Gr. 5	1	2750, 3550
19	85-P2-244	¾-10 x 4" Long, HHCS, Gr. 5	1	2750 Round
20	85-P2-18	⅝-11 Hex Nut	1	2750 Hex & 3550 Hex
20	85-P2-245	¾-10 Hex Nut	1	2750, 3550
21	85-M2-17	Pin, 1-¼" ø x 6" Long	2	2750, 3550
22	65-P2-109	Lynch Pins	1	2750, 3550
23	89-P2-234	Model #/Serial # ID Plate	2	2750, 3550
24	89-P2-237	Safety Decal	1	2750, 3550
25	88-P2-100A	¼" In-Line Check Valve		

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3. Assemble the rotor (8A), counterbore down if applicable, into stator (8B) and onto wear plate (9) with rotor splines into mesh with drive link (10) splines.

NOTE: If the manifold side of the rotor was etched during motor disassembly, this side should be up. If the rotor is not etched and does not have a counterbore, use the drive link spline contact pattern apparent on the rotor splines to determine the rotor side that must be against the wearplate.

4. Assemble six vanes (8C), or as many vanes that will readily assemble into the stator vane pockets.

CAUTION: Excessive force used to push the rotor vanes into place could shear off the coating applied to the stator vane pockets.

5. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and assembled vanes (8C) into stator (8B), creating the necessary clearance to assemble the seventh or full compliment of seven vanes. Assemble the seven vanes using minimum force.

6. Remove the two assembled bolts (1) if used to retain stator and wearplate.

Go to the Motor Assembly step 14 to continue motor assembly.

ROTOR SET ASSEMBLY PROCEDURE TWO PIECE STATOR CONSTRUCTION

A disassembled rotor set (8) that cannot be readily assembled by hand and has a two piece stator can be assembled by the following procedures.

1. Place stator half (8B) onto wearplate (9) with seal ring (4) side down, after following motor assembly steps 1 through 12. Be sure the seal ring is in place.

2. Align stator bolt holes with wearplate and housing bolt holes and turn two alignment studs finger tight into bolt holes approximately 180 degrees apart to retain stator half and wearplate stationary.

3. Assemble rotor (8A), counterbore down if applicable, into stator half (8B), and onto wearplate (9) with rotor splines into mesh with drive link (10) splines.

NOTE: Use any marking you applied to rotor set components to reassemble the components in their original relationship to ensure ultimate wear life and performance.

4. Assemble six vanes (8C), or as many vanes that will readily assemble into the stator vane pockets.

CAUTION: Excessive force used to push the rotor vanes into place could shear off the coating applied to the stator vane pockets.

5. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and the assembled vanes (8C) into stator half (8B), creating the necessary clearance to assemble the seventh of full compliment of seven vanes. Assemble the seven vanes using minimum force.

6. Place second stator half (8D) on a flat surface with seal ring groove up. Apply a small amount of grease to a new seal ring (4) and assemble it into stator half ring groove.

7. Assemble the second stator half (8D) over the two alignment studs and rotor (8A) with seal ring side down onto the first stator half (8B) aligning any timing marks applied for this purpose.

CAUTION: If the stator half (8B) is a different height (thickness) than stator half (8D) the stator vanes (8C) or (8E) of the same length (height) as the stator half must be reassembled in their respective stator half for the rotor set to function properly.

8. Assemble six vanes (8E), or as many vanes that will readily assemble into the stator vane pockets.

9. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and the assembled vanes (8E) into stator (8D), creating the necessary clearance to assemble the seventh or full complement of seven vanes. Assemble the seven vanes using minimum force.

Go to Motor Assembly step 14 to continue motor assembly.

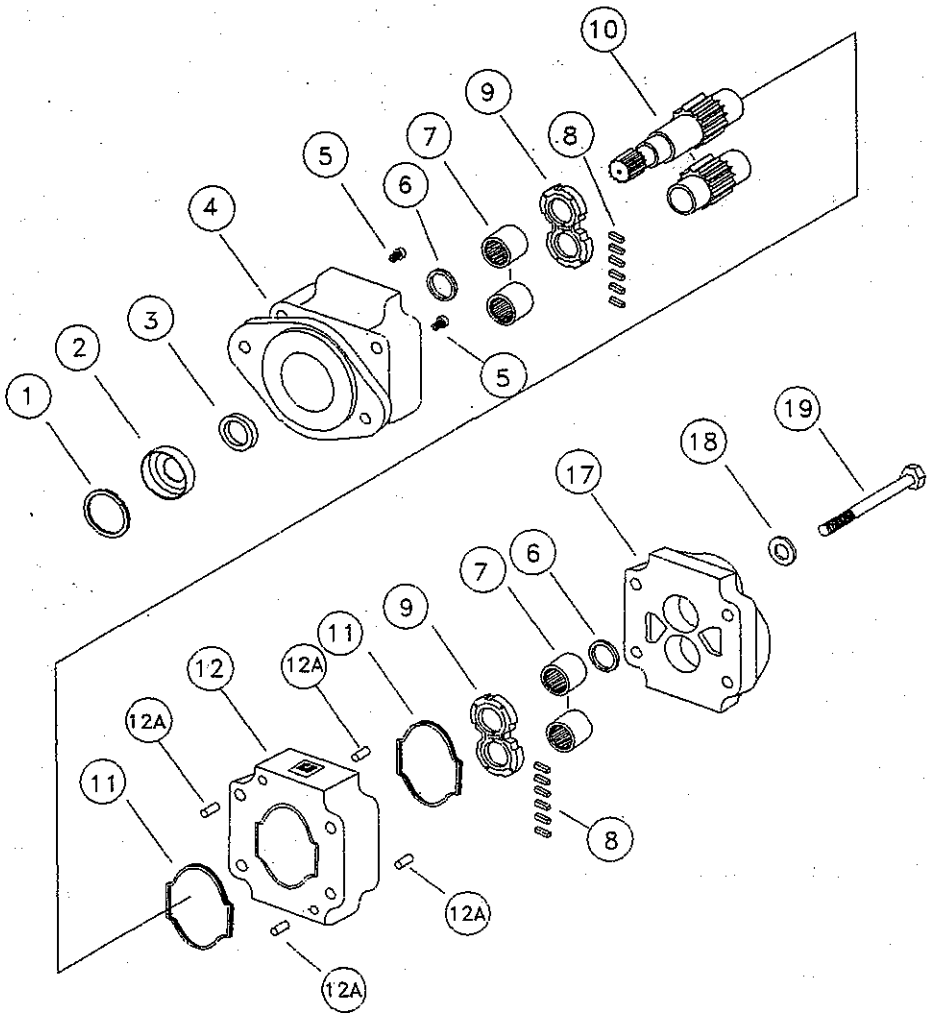
FINAL CHECKS

Pressurize the motor with 100 PSI dry air or nitrogen and submerge in solvent to check for internal leaks.

Check motor for rotation. Torque required to rotate coupling shaft should not be more than 50 FT/LBS (68 Nm).

Use hydraulic test stand if available, to check operation of the motor.

MODELS 2750 & 3550 HYDRAULIC MOTOR
EXPLODED VIEW & PARTS LIST



REFERENCE NUMBER	PARTS NUMBER	DESCRIPTION	QTY REQ'D	MODELS USED ON
1	81-A3-500	Snap Ring	1	All Models
2	81-A3-522	Outboard Bearing Seal	1	All Models
3	81-A3-501	Lip Seal	1	All Models
4	81-A3-533	Shaft End Cover	1	All Models
5	81-A3-503	Check Assembly	2	All Models
6	81-A3-504	Ring Seal	2	All Models
7	81-A3-505	Roller Bearing	4	All Models
8	81-A3-506	Pocket Seal Set	1	All Models
9	81-A3-507	Thrust Plate	2	All Models
10	81-A3-534	Gear-Shaft Set	1	2750
10	81-A3-535	Gear-Shaft Set	1	3550
11	81-A3-511	Gasket Seal	2	All Models
12	81-A3-512	Gear Housing	1	2750
12	81-A3-514	Gear Housing	1	3550
12A	81-A3-515	Dowel Pin	4	All Models
17	81-A3-516	Port End Cover	1	All Models
18	81-A3-517	Washer	4	All Models
19	81-A3-518	Cap Screw	4	2750
19	81-A3-520	Cap Screw	4	3550
NS	81-A3-521	Seal Retainer	1	All Models

MODELS 2750 & 3550 HYDRAULIC MOTOR SERVICE PROCEDURES

GENERAL INSTRUCTIONS

To facilitate the repair of these units and before any work is done, we suggest that you first read all of the steps used in disassembly and assembly of the unit.

Dirt is the enemy of any hydraulic system. The first requirement of good maintenance of hydraulic equipment is cleanliness. **MAKE SURE YOU DISASSEMBLE AND ASSEMBLE YOUR HYDRAULIC EQUIPMENT IN A CLEAN AREA.**

It is important to airblast all parts and wipe them with a clean, lintless cloth before assembly.

USE CAUTION IN GRIPPING ALL PARTS IN THE VISE TO AVOID DAMAGING MACHINED SURFACES.

It is a good idea to check all replacement parts closely before installing to ensure that no damage occurred during shipment.

CAUTION

If prying off section becomes necessary, take extreme care not to mar or damage machined surfaces. Excessive force while prying can result in misalignment and seriously damage parts.

If parts are stubborn during assembly, do not force them and never employ an iron hammer.

Gears are closely matched, therefore they must be kept together as sets when removed from a unit. Handle with care to avoid damage to the journals or teeth.

Never hammer roller bearings into bores. Use only an arbor press or other suitable tool.

DISASSEMBLY

1. Mount the motor in a vise with the shaft end pointing down. Index mark all sections with a punch. Be sure to align these marks when reassembling.

2. Remove four cap screws (19) with a socket wrench.

3. Lift off port end cover (17). If necessary to pry loose, refer to caution note. If the thrust plate (9) remains in the gear housing (12), it can be tapped out later with a wooden hammer handle. Be careful not to distort the thrust plate.

4. Lift or pry off the gear housing (12). Be careful not to damage machined surfaces. If the thrust plate (9) remains in the gear housing (12), remove as described in step 3.

5. Remove the driven gear and the integral gear and drive shaft set (10). Keep these together as they are a matched set. Examine and replace if necessary. Be careful not to damage the machined surfaces of the gears.

6. Pry the thrust plates (9) from the shaft end cover (4) and port end cover (17) with a screwdriver or similar tool. Avoid distorting the thrust plates (9).

Visually inspect thrust plates (9) for wear or damage. Replace if necessary. Remove and discard all rubber pocket seals (8) and gasket seals (11).

7. Examine all roller bearings (7) for scoring, spalling or pitting. If replacement is necessary, remove the bearings (7) with a bearing puller.

8. It is generally advisable to replace ring seals (6) when rebuilding motor. To replace, remove the drive gear bearing (7) with a bearing puller and remove ring seal (6) from the bottom of bearing bore.

9. Grip the shaft end cover (4) in a vise with the mounting face down. Remove double lip seal (3) inserting a screwdriver into the notch between the double lip seal (3) and the shaft end cover (4). Tap the seal out and discard.

ASSEMBLY

1. Stone off all machined surfaces with a medium grit carborundum stone.

2. If bearings (7) have been removed, de-burr bearing bores. Rinse parts in a solvent. Air blast all parts and wipe with a clean lintless cloth before starting assembly.

3. Grip shaft end cover (4) in vise with mounting face down. Examine two check valves (5) to be sure they're tightly in place. Replacement is necessary only if parts are damaged. Remove with screwdriver.

4. If check valves (5) are being replaced, screw in new parts tightly. Peen edge of hole 1/32" to 1/16" with 1-1/2"diameter steel ball.

5. If ring seals (6) are being replaced, insert into bottom of drive gear bearing bore. The notch in the ring seal (6) **MUST BE VISIBLE.** This is a check to be certain the notched side is next to the bearing.

6. If any bearings (7) have been removed from the shaft end cover (4) or port end cover (17), replace the bearings (7) be pressing them into the bearing bore with an arbor press.

7. Before inserting a new lip seal (3) in the shaft end cover (4), coat the outer edge of the lip seal (3) and its recess with Permatex Aviation Form-A-Gasket No. 3 non-hardening sealant or equivalent. With the metal side of the lip seal (3) up, press it into the mounting flange side of the shaft end cover (4) with an arbor press and 2 1/2" diameter round by 2" long steel bar. Do not attempt to bottom-out seal; press in only until it is flush with the face of the recess. Wipe off surplus sealant.

8. Check all thrust plates (9) for wear. Replace if necessary. The relief groove on the thrust plates (9) must be towards the high pressure (outlet) side of the motor.

9. Grip the shaft end cover (4) in a vise with the mounting face down. cut two pocket seals (8) 7/32' long from the pocket seal strip. Grease these pocket seals (8) well and insert them into the middle slots on the reverse side of the thrust plate (9).

10. With the pocket seals (8) facing down, place the thrust plate (9) over the bearings in the shaft end cover (4). Tap thrust plate (9) with a soft hammer to about 1/32" from the machined surface.

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MODELS 2750 & 3550 HYDRAULIC MOTOR SERVICE PROCEDURES

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11. Cut four pocket seals (8) approximately ¼" long from the pocket seal strip. Insert on pocket seal (8) into each of the slots in the thrust plate (9). Push each pocket seal (8) all the way in so that it touches the roller bearings (7). Tap the thrust plate (9) down firmly against the machined surface with a soft hammer. Use a sharp razor blade to trim exposed end of pocket seal (8) square and flush with the thrust plate (9).

12. Apply masking tape to splines on drive shaft (10) to prevent seal damage. Lightly grease the drive shaft (10) and tape. Insert the integral gear and drive shaft (10) into the shaft end cover (4) with a twisting motion. Be careful not to damage the double lip seal (3). Push down carefully until the gear rests against the thrust plate (9). Remove the tape. Insert the driven gear.

13. Grease the new gasket seals (11) and insert them into the grooves in both sides of the gear housing (12). Examine all dowel pins (12A). Before inserting a pin (12A), make certain the hole is clean and free from burrs. Start pin (12A) into the hole gently and straight, tapping lightly with a soft hammer.

14. Slide the gear housing (12) over the gears (10) and tap it with a soft hammer until it rest tightly against the shaft end cover (4). Be careful not to pinch the gasket seal (11). Squirt oil over the gears (10) to provide initial lubrication when motor is started. Line up the dowel pins (12A) with the matching holes. When parts are parallel, squeeze them together or gently tap alternately over pins (12A) with a plastic hammer until the parts become parallel and move smoothly together. **DO NOT FORCE.**

15. Place the port end cover (17) over the gear journals and tap tightly against the gear housing (12). Be careful not to pinch the gasket seal (11).

16. Thread the four cap screws (19) and washers (18) into the shaft end cover (4) and tighten alternately or cross-corner. Rotate the drive shaft (10) with a 6" wrench to make certain there is no binding in the motor.

17. After the four cap screws (19) are tight and you are sure there is no internal binding, torque the diagonally opposite cap crews (19) to 200 FT/LBS (271.1Nm).

RECOMMENDED START-UP PROCEDURE

Before installing a new or rebuilt motor, back off the main relief valve until the spring tension on the adjusting crew is relieved. This will avoid the possibility of immediate damage to the replacement unit in the event that the relief valve setting had been increased beyond the recommended operating pressure prior to removing the old unit.

Before connecting any lines to the motor, fill all ports with clean oil to provide initial lubrication. This is particularly important where the unit is located above the oil reservoir.

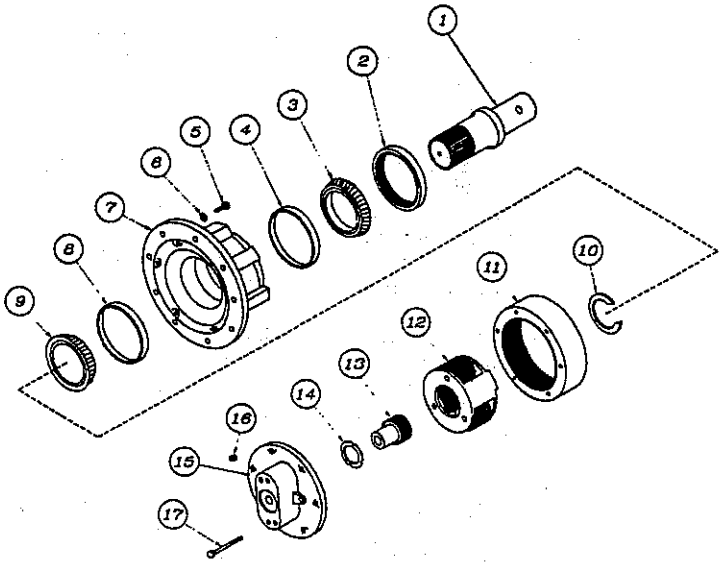
After connecting the lines and mounting the replacement unit, operate the motor at least two minutes at zero pressure at lowest possible RPM. During this break-in period, the unit should run free and not develop an excessive amount of heat. If the unit operates properly, speed and pressure can be increased to normal operating settings.

Reset the main relief valve to its proper setting while the motor is running at maximum operating engine speed for the vehicle.

ALWAYS USE AN ACCURATE GAGE WHEN ADJUSTING THE RELIEF VALVE PRESSURE SETTING.

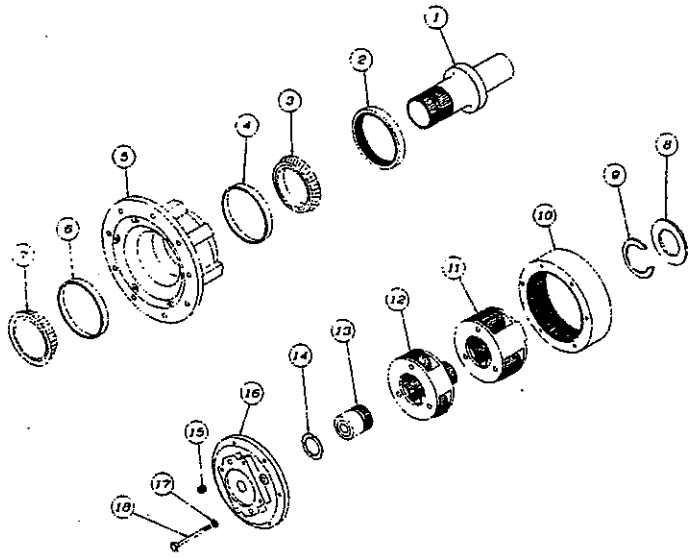
MODELS 850, 1350, 1850 & 2250
PLANETARY GEAR REDUCTION
EXPLODED VIEW & PARTS LIST

REFERENCE NUMBER	PARTS NUMBER	DESCRIPTION	QTY REQUIRED
1	87-A3-700	2" Round Output Shaft	1
1	87-A3-701	2" Hexagon Output Shaft	1
1	87-A3-737	2-9/16" Round Output Shaft	1
2	87-A3-702	Oil Seal	1
3	87-A3-703	Bearing Cones	1
4 & 8	87-A3-704	Bearing Cup	2
5	87-A3-705	Bolt	6
6	87-A3-706	Flat Washer	6
7	87-A3-707	Hub	1
9	87-A3-708	Bearing Cone	1
10	87-A3-709	Retaining Ring Set	1
11	87-A3-710	Ring Gear	1
12	87-A3-711	Carrier Assembly	1
13	87-A3-712	Sun Gear	1
14	87-A3-713	Thrust Washer	1
15	87-A3-714	Cover	1
16	87-A3-715	Magnetic Pipe Plug	1
17	87-A3-716	Bolt	8



MODELS 2750 & 3550
PLANETARY GEAR REDUCTION
EXPLODED VIEW & PARTS LIST

REFERENCE NUMBER	PART NUMBER	DESCRIPTION	QTY REQUIRED
1	87-A3-717	2" Round Output Shaft	1
1	87-A3-718	2" Hexagon Output Shaft	1
2	87-A3-719	Oil Seal	1
3	87-A3-720	Bearing Cone	1
4	87-A3-721	Bearing Cup	1
5	87-A3-722	Hub	1
6	87-A3-723	Bearing Cup	1
7	87-A3-724	Bearing Cone	1
8	87-A3-725	Thrust Washer	1
9	87-A3-726	Retaining Ring Set	1
10	87-A3-727	Ring Gear	1
11	87-A3-728	Secondary Carrier Assy.	1
12	87-A3-729	Primary Carrier Assy.	1
13	87-A3-730	Sun Gear	1
14	87-A3-713	Thrust Washer	1
15	87-A3-731	Magnetic Pipe Plug	1
16	87-A3-732	Cover	1
17	87-A3-706	Flat Washer	12
18	87-A3-733	Bolt	12



MODELS 850, 1350, 1850 & 2250 PLANETARY GEAR REDUCTION SERVICE PROCEDURES

GENERAL INSTRUCTIONS

To facilitate the repair of these units and before any work is done, we suggest that you first read all of the steps used in disassembly and assembly of the unit.

It is important to airblast all parts and wipe them with a clean, lintless cloth before assembly.

It is a good idea to check all replacement parts closely before installing to ensure that no damage occurred during shipment.

CAUTION

If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. excessive force while prying can result in misalignment and seriously damage parts.

If parts are stubborn during assembly, do not force them and never employ an iron hammer.

Never hammer bearing cones or cups. Use only an arbor press or other suitable tool.

DISASSEMBLY

1. Index mark all sections with a punch. Be sure to align these marks when reassembling.
2. Remove bolts (17) from cover (15). Lift cover (15) from assembly. Thrust washer (14) usually remains with cover (15).
3. Lift sun gear (13) from carrier assembly (12).
4. Remove carrier assembly (12).
5. Remove six hex head bolts (5) and washers (6) from hub (7). Pull ring gear (11) from remaining assembly. It may be necessary to strike ring gear (11) with a rubber mallet to loosen from hub (7).
6. **WARNING! EYE PROTECTION SHOULD BE WORN DURING RETAINING RING REMOVAL.** Remove retaining ring (10) from groove in output shaft (1). Pull output shaft (1) from hub (7).

NOTE: To remove retaining ring use retaining ring expander tool.

7. Remove oil seal (2) and bearing cones (3 & 9) from hub (7). Inspect bearing cups (4 & 8) in hub (7) and remove only if replacement is required.

ASSEMBLY

1. Press new bearing cups (4 & 8) into each side of hub (7). It is recommended that bearing cups (4 & 8) and cones (3 &9) be replaced in sets.
2. Assemble bearing cone (3) into cup (4) at seal end of hub (7).
3. Lubricate lips of oil seal (2) and lower hub (7) onto output shaft (1). Keep hub (7) centered to prevent damage to oil seal (2).
4. **WARNING! EYE PROTECTION SHOULD BE WORN DURING RETAINING RING INSTALLATION.** Assemble bearing cone (9) over output shaft (1) and into bearing cup (8). Select the thickest retaining ring (10) that can be assembled into ring groove on output shaft (1) above bearing. Bearings should have from .000-.006 inches (.00-.15mm) endplay when proper retaining ring (10) is installed.
5. Apply a bead of silicone sealant to face of hub (7) that mates with ring gear (11). See instructions on sealant package.

NOTE: Silicone sealant should be applied in a continuous bead, which should be centered on the inside of the hole at each bolt hole location.

6. Assemble ring gear (11) to hub (7) being careful to align all bolt holes.
7. Install six hex head bolts (5) and washers (6). Torque bolts to 52-60 FT/LBS (70.5-81.3 Nm).
8. Place carrier assembly (12) into ring gear (11) aligning the gear teeth. Carrier splines mesh with splines on output shaft (1). Place sun gear (13) into carrier assembly (12). Sun gear (13) should turn freely by hand.
9. Apply a bead of silicone sealant to cover face of ring gear (11). See NOTE in step 5 for proper silicone seal application.
10. Secure thrust washer (14) with tangs engaged in cover (15). NOTE: Thrust washer (14) can be secured to cover (15) with a small amount of grease or silicone sealant. Assemble cover (15) to ring gear (11).
11. Install eight bolts (17) and torque to 20-25 FT/LBS (27.1-33.9 Nm).
12. Position unit with output shaft pointing down (towards ground) and fill until oil just begins to flow from fill plug (approximately 2 pints - .95 liter). Install magnetic pipe plug (16) and standard pipe plug (18). On all models in cover (15). (See drive unit assembly page).

CARRIER ASSEMBLY

The carrier assembly (12) must be serviced in its entirety to protect the integrity of the planetary gear reduction.

LUBRICATION RECOMMENDATIONS

Use mild extreme pressure lubricant API-GL-5, no. 80 or 90 for filling the planetary gear reduction under normal temperature ranges between 0-120°F (-18 to 49°C). Approximate oil capacity is two pints (.95 liter). Change oil after first 50 hours of operation, then every 1000 hours or in one year, whichever occurs first. Check oil level frequently to assure proper lubrication level is maintained.

MODELS 2750 & 3550
PLANETARY GEAR REDUCTION SERVICE PROCEDURES

GENERAL INSTRUCTIONS

To facilitate the repair of these units and before any work is done, we suggest that you first read all of the steps used in disassembly and assembly of the unit.

It is important to airblast all parts and wipe them with a clean, lintless cloth before assembly.

It is a good idea to check all replacement parts closely before installing to ensure that no damage occurred during shipment.

CAUTION

If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. excessive force while prying can result in misalignment and seriously damage parts.

If parts are stubborn during assembly, do not force them and never employ an iron hammer.

Never hammer bearing cones or cups. Use only an arbor press or other suitable tool.

DISASSEMBLY

1. Index mark all sections with a punch. Be sure to align these marks when reassembling.

2. Remove 12 bolts(18) and washers(17) from cover(16). Thrust washer(14) usually remains with cover(16).

3. Lift sun gear(13) from primary carrier assembly(12).

4. Lift primary(12) and secondary(11) carrier assemblies from ring gear(10).

5. Pull ring gear(10) from remaining assembly.
NOTE: It may be necessary to strike ring gear(10) with a rubber mallet to loosen from hub(5).

⚠ 6. **WARNING!** EYE PROTECTION SHOULD BE WORN DURING RETAINING RING(9) REMOVAL. Remove retaining ring(9) from groove in output shaft(1). Lift thrust washer(8) from assembly. Pull output shaft(1) from hub(5).
NOTE: Use snap ring expander to remove retaining ring.

7. Remove oil seal(2) and bearing cones(3 & 7) from hub(5). Inspect bearing cups(4 & 6) in hub and remove only if replacement is required.

ASSEMBLY

1. Press bearing cups (4 & 6) into each side of hub(5).

2. Place a bearing cone(3) in a cup(4) at seal end of hub. Press a new oil seal(2) in until flush with face of hub(5).

3. Lubricate lips of oil seal(2) and lower hub(5) onto output shaft(1). Keep hub centered to prevent seal damage.

4. Assemble bearing cone(7) over output shaft(1) and into bearing cup(6). Install thrust washer(8) over output shaft.

⚠ 5. **WARNING!** EYE PROTECTION SHOULD BE WORN DURING RETAINING RING INSTALLATION. Select the thickest retaining ring(9) that can be assembled into ring groove on output shaft(1) above bearing(7).
NOTE: Use snap ring expander to install retaining ring.

6. Apply a bead of silicone sealant to hub face(5) that mates with ring gear(10). See instructions on sealant package.

7. Assemble ring gear(10) to hub(5) being careful to align bolt holes.

NOTE: Silicone sealant should be applied in a continuous bead, which should be centered on the surface to be sealed but should move to the inside of the hole at each bolt hole location.

8. Place secondary carrier assembly(11) into ring gear(10) aligning gear teeth. Secondary carrier splines mesh with splines on output shaft(1).

9. Place primary carrier assembly(12) into ring gear(10) aligning gear teeth. Place sun gear(13) into primary carrier assembly(12). Sun gear(13) should turn freely by hand.

10. Apply a bead of silicone sealant to large cover face of ring gear(10). See NOTE in step 7 for proper silicone seal application.

11. Secure thrust washer(14) with tangs engaged in cover(16). Install the cover(16) and align with hub such that pipe plug holes on cover align with mounting holes on hub(5).

12. Install twelve washers(17) and bolts(18) and torque to 40 - 45 Ft./Lbs (54.2 - 61.0 Nm) with dry threads. Lubed bolts torque to 20 - 25 Ft/Lbs (27.1 - 33.9 Nm).

13 Position unit with the output shaft down (towards the ground) and fill unit until oil just begins to flow from fill plug(approximately 4-¾ pints - 2.23 liter). Install magnetic pipe plug(15) and breather vent assembly (see drive unit assembly page) in cover(16).

CARRIER ASSEMBLIES

The primary(12) and secondary(11) carriers must be serviced in their entirety to protect the integrity of the planetary gear reduction.

LUBRICATION RECOMMENDATIONS

Use mild or extreme pressure lubricant API-GL-5, No. 80 or 90 for filling the planetary gear reduction under the normal temperature ranges between 0 - 120° F (-18° - 49° C). Approximate oil capacity is 4 3/4 pints (2.23 liter). Change oil after first 50 hours or operation, then every 1000 hours or in one year, whichever occurs first. Check oil level frequently to assure proper lubrication level is maintained.

RTV SEALING COMPOUND

Kit #87-A3-735 Silicone Sealant (3 ozs.) is available from McMillen. Silastic RTV 732 Sealer and General Electric Silimate RTV No. 1473 are approved alternatives for sealing gasket surfaces.

WARRANTY NOTE

If the planetary gear reduction fails within the warranty period, contact McMillen immediately. Warranty will automatically be voided for any attempt to make field repairs without the expressed written consent of McMillen. **Absolutely no exceptions will be made to this policy.**

HDP STYLE AUGER PARTS LIST

AUGER DIAMETER		6" 152mm	8" 203mm	9" 229mm	10" 254mm	12" 305mm	15" 381mm	16" 406mm
PART #	DESCRIPTION	QTY	QTY	QTY	QTY	QTY	QTY	QTY
82-P2-12G	Hardened Drive-In Wisdom Tooth	2	2	2	2	2	2	2
82-P2-13	3-1/2" Fishtail Point	1	1	1	1	1	1	1
82-P2-21	Hardened Drive-In Chisel Tooth		2	2	2	2	4	4

AUGER DIAMETER		18" 457mm	20" 508mm	24" 610mm	30" 762mm	36" 914mm	42" 1067mm	48" 1219mm
PART #	DESCRIPTION	QTY	QTY	QTY	QTY	QTY	QTY	QTY
82-P2-12	Hardened Drive-In Wisdom Tooth	2	2	2	2	2	2	2
82-P2-13	3-1/2" Fishtail Point	1	1	1	1	1	1	1
82-P2-21	Hardened Drive-In Chisel Tooth	4	4	6	8	10	14	18

HDF STYLE AUGER PARTS LIST

AUGER DIAMETER		4" 152mm	6" 203mm	8" 229mm	9" 254mm	10" 305mm	12" 381mm	15" 406mm
PART #	DESCRIPTION	QTY	QTY	QTY	QTY	QTY	QTY	QTY
82-P2-12GBN	Hardened Bolt-on Gauge Tooth	-	2	2	2	2	2	2
82-P2-12BN	Hardened Bolt-on Wisdom Tooth	-	-	-	1	1	2	3
82-P2-13	3-1/2" Fishtail Point	-	1	1	1	1	1	1
82-A2-26	4-½" Fishtail Point	1	-	-	-	-	-	-

AUGER DIAMETER		16" 457mm	18" 508mm	20" 610mm	24" 762mm	30" 914mm	36" 1067mm
PART #	DESCRIPTION	QTY	QTY	QTY	QTY	QTY	QTY
82-P2-12GBN	Hardened Bolt-on Gauge Tooth	2	2	2	2	2	2
82-P2-12BN	Hardened Bolt-on Wisdom Tooth	3	4	4	6	7	9
82-P2-13	3-1/2" Fishtail Point	1	1	1	1	1	1

HTF STYLE AUGER PARTS LIST

AUGER DIAMETER		18" 457mm	24" 610mm	30" 762mm	36" 914mm	42" 1067mm	48" 1219mm
PART #	DESCRIPTION	QTY	QTY	QTY	QTY	QTY	QTY
82-P2-12GBN	Hardened Bolt-on Gauge Tooth	4	4	4	4	4	4
82-P2-12BN	Hardened Bolt-on Wisdom Tooth	3	6	7	9	11	13
82-P2-13	3-1/2" Fishtail Point	1	1	1	1	1	1

NOTE: Contact your dealer for optional hardfaced or carbide wear components. If you have any special auger needs or applications feel free to contact McMillen.