SERVICE MANUAL
SM535

NP 15-20-12D

WARNING

Read and observe all warnings on the unit before operating it. Do not operate this equipment unless all factory installed guard and shields are properly secured in place.

SECTION 05
FRAME INDEX

10-04 HAND LIFT AND SPEED CONTROL

The only routine maintenance that is necessary other than periodic check for tightness of the mounting hardware is greasing of the moving parts.

MASTER CONTROL SWITCH

See Master Control Switch Maintenance instruction in this manual under the "Electrical".

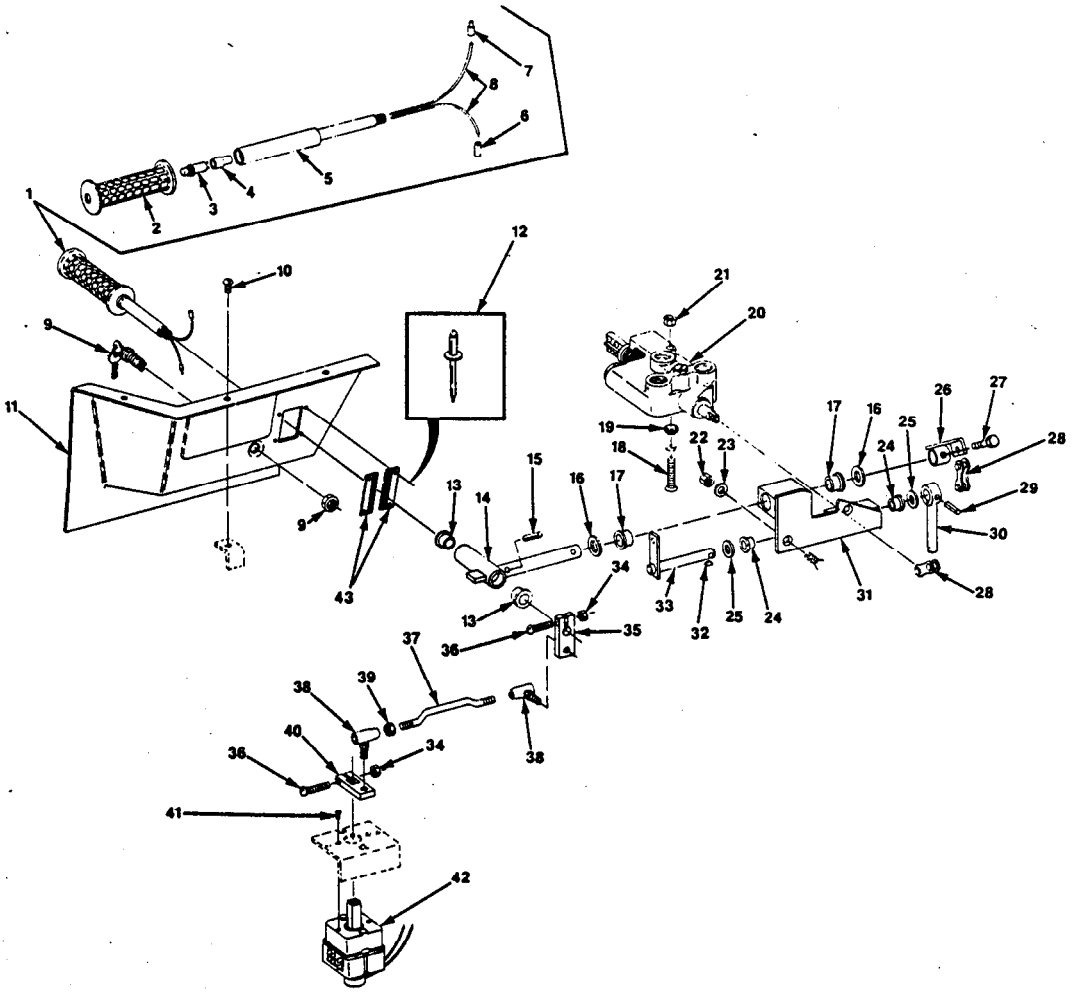
DISASSEMBLY

Disconnect battery before starting disassembly.

1. Remove instrument cover.
2. Loosen screw and remove control handle assembly from block assembly.
   A. Remove hand grip from shaft.
   B. Remove switch from shaft and cut away the heat shrinking tubing.
   C. Desolder horn switch from wires.
   D. Remove wires from shaft.
3. Remove link and nuts holding block assembly from truck.
4. Place block assembly on bench.
5. Drive roll pins out of shaft and remove cap screw to disassembly block removing all parts.
6. Remove ball joints and rod from arm and master control switch.
7. Remove master control switch from truck.

Inspect all parts and replace if needed.

HAND LIFT AND SPEED CONTROL ASSEMBLY



DRIVE MOTOR REMOVAL AND INSTALLATION

The drive motor can be removed without removing the transmission.

DISASSEMBLY

1. Disconnect the battery and open the auxiliary door.
2. Remove brake cable from brake cam arm by removing cotter pin and pin.
3. Disconnect electrical wires and cables.
4. Torque generator and/or auxiliary pump motor must be removed to remove drive motor. (See Hydraulic System Section for instructions.)
5. Remove the four (4) cap screws that holds the drive motor to frame.

   NOTE: Shims are located between the motor and frame. Note their locations and quanity for assembly

6. Pull out drive motor and remove brakes and attaching hardware.

ASSEMBLY

1. Install drive motor on frame and in transmission.
2. Line up the bolt holes and install shims between the motor and frame.

WARNING

Failure to shim properly will result in broken armature shaft in drive motor.

Measure between mounting plate and drive motor base and shim (use old shims) accordingly.

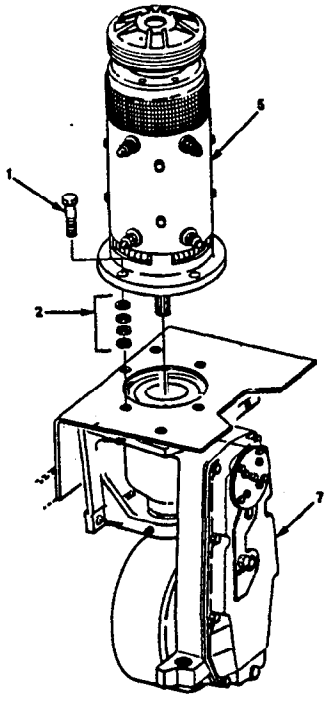
3. Tighten the four (4) capscrews and washers that hold the drive motor. Tighten the opposing capscrews one at a time. Torque first to 10 ft./lbs.m then 15 ft./lbs. and so on up to 90 ft./lbs.

WARNING

Failure to torque evenly all the way round will result in cracked or broken. motor base.

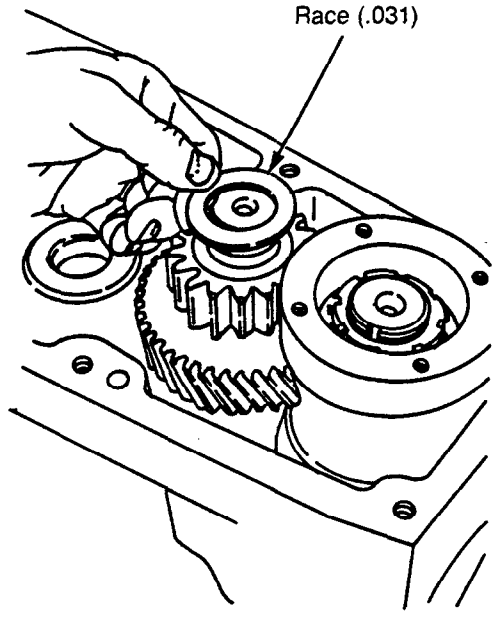
4. Connect electrical wires and cables.
5. Install brake assembly on top of motor and connect brake cable.
6. Install torque generator and/or auxiliary pump motor back on machine. (See Hydraulic System Section for instructions.)
7. Check adjustment of brake cable and brake interlock switch.
8. Close auxiliary door and tighten screw to hold door closed.
9. Connect battery and test operation of truck.

TRANSMISSION AND DRIVE MOTOR INSTALLATION

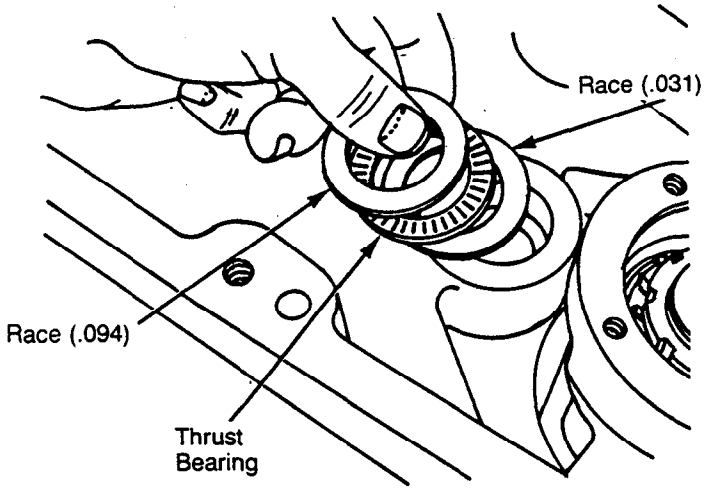


ITEM #	NAME
1	Screw, cap
2	Shim, .005
5	Drive motor assembly
7	Transmission assembly

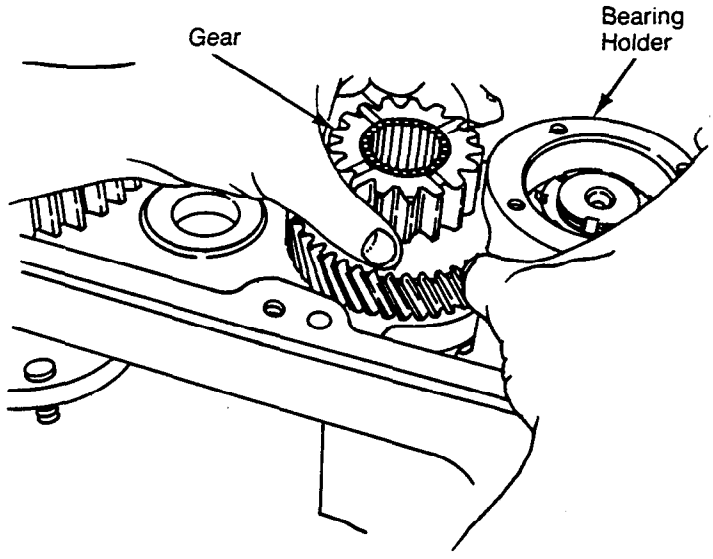
19. Remove race (.094), thrust bearing, and race (.031) from shaft of small gear set and remove gear by pushing the bearing holder away from the gear by pulling straight up and out of gear case.



Remove race (.031), thrust bearing, and race (.094) will need to be removed from the gear case.

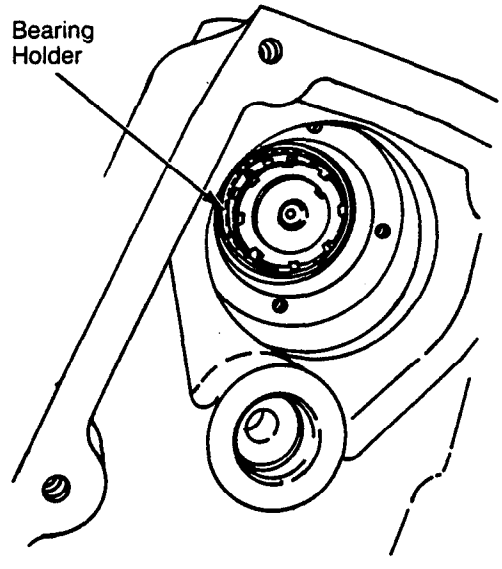


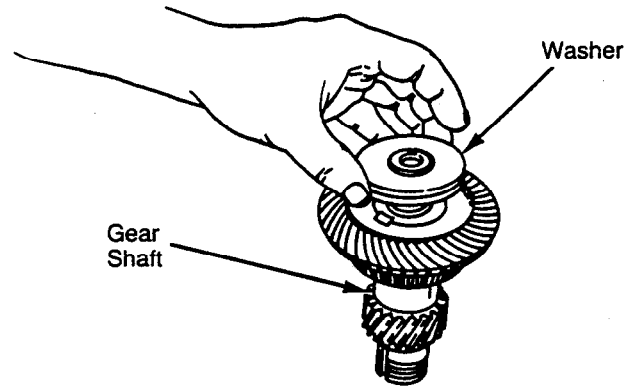
20. Needle roller bearings and spacers will need to be removed from gears if not already removed from gear case. This is done so needle roller bearings and spacers will not be lost in cleaning and inspection of gears.

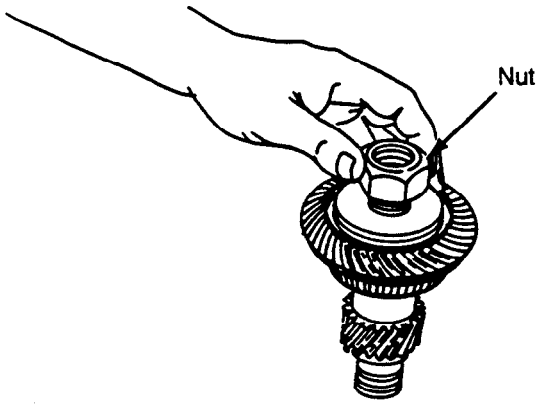


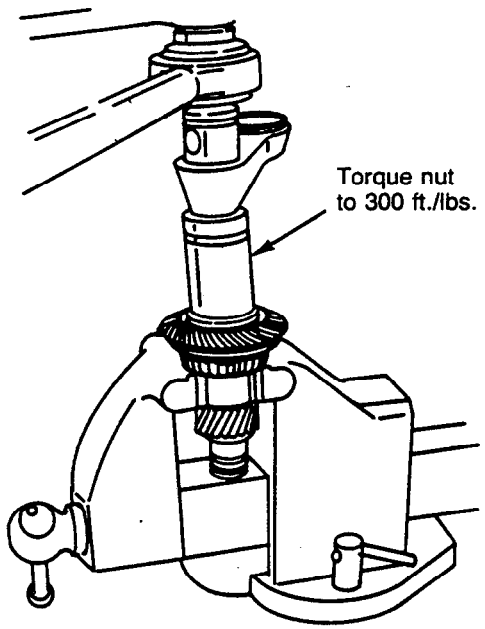
21. Remove bearing holder assembly by sliding assembly down and out the back of the gear case.

NOTE: The gear case maybe laid on its side for ease of bearing holder removal.



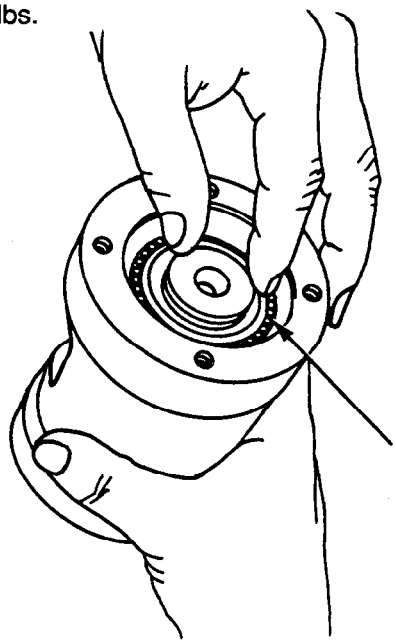


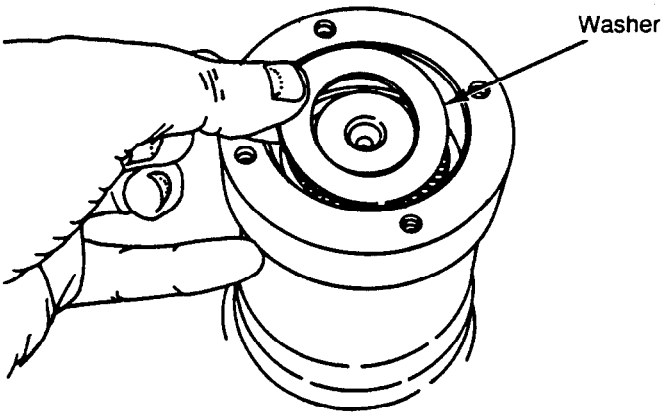


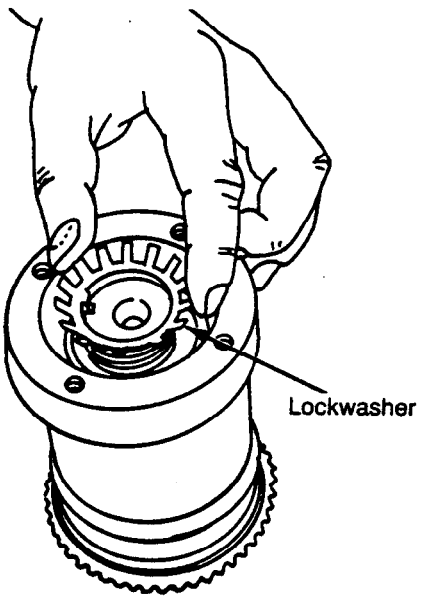


11. Install gear shaft in bearing holder making sure that the four (4) thread holes are on the opposite side as gear.

12. To shim gear shaft, install bearing cone, washer, lockwasher and locknut. Torque to 250 ft./lbs.







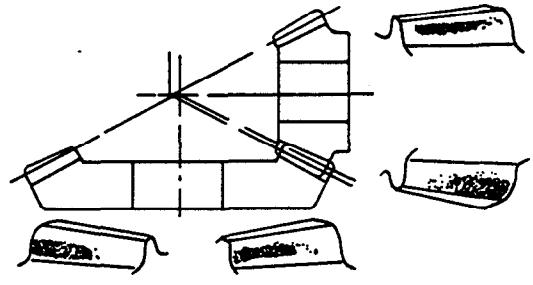
Old Pinion Marking	NEW PINION MARKING								
	-4	-3	-2	-1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003
0	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004
-1	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005
-2	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006
-3	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007
-4	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007	-0.008

Use this chart as guideline to set pinion.

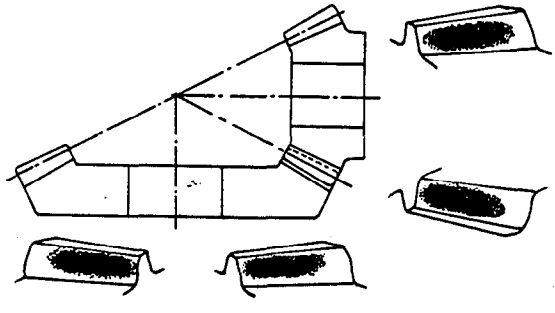
42. Rigidly mount a dial indicator with stem perpendicualar to tooth surface at extreme heel. Hold pinion solidly against rotating and measuring backlash by moving gear back and forth. Adjust backlash by adjusting number of shims on collar and in from of bearing holder. Should be approximately .001 to .005.

43. Tooth pattern

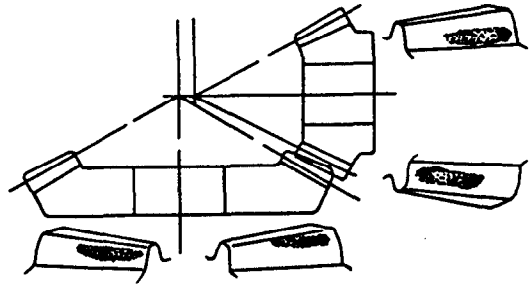
    To check tooth pattern, paint teeth with gear marking compound and run gear briefly back and forth by hand.



TOO MANY SHIMS



CORRECT SHIM PATTERN



TOO FEW SHIMS

Contactor Coil test

This machine contains a number of contactor coils that are used in the electrical system. To eliminate the possibility that they are at fault, a coil test is called out on this section.

Contactor coil can be tested on unit by jumping the negative side of coil to battery negative. With power on positive side of contactor coil it should pull in. If contactor does not pull in, or coil is questionable, continue with test procedure.

1. When checking contactor coils o unit, battery should be disconnected and either positive or negative lead to coil should be disconnected so entire circuit resistance is not being read.

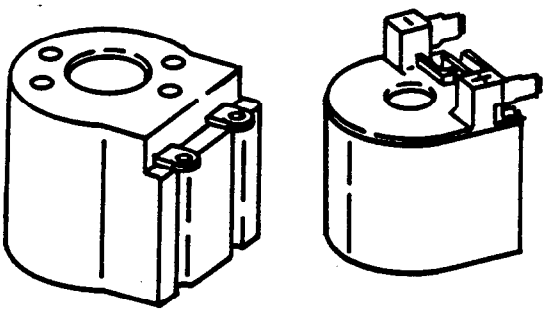
2. Set V.O.M. on R x 1 OHM scale, touch leads together and zero meter.

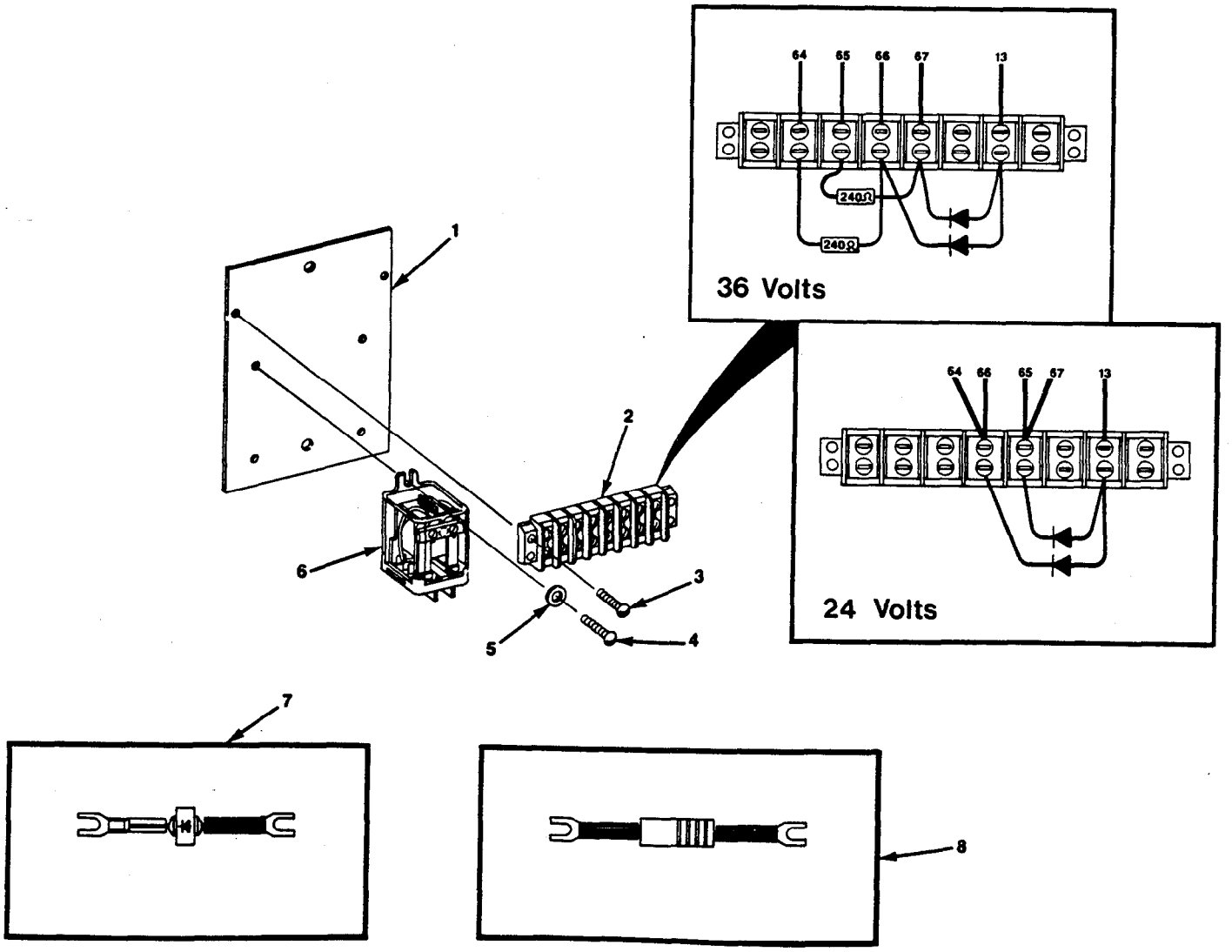
   NOTE: A good quality meter (such as Simpson) must be used when checking low resistance valves. Meter sensitivity should be 20,000 OHM's/V.D.C. or lower. Meter sensitivity is usually displayed on face of meter.

3. The forward and rearward contactor coils are polarity sensitive. The left hand terminal must be connected to positive.

The following table list an approximate resistance for various contactor coils.

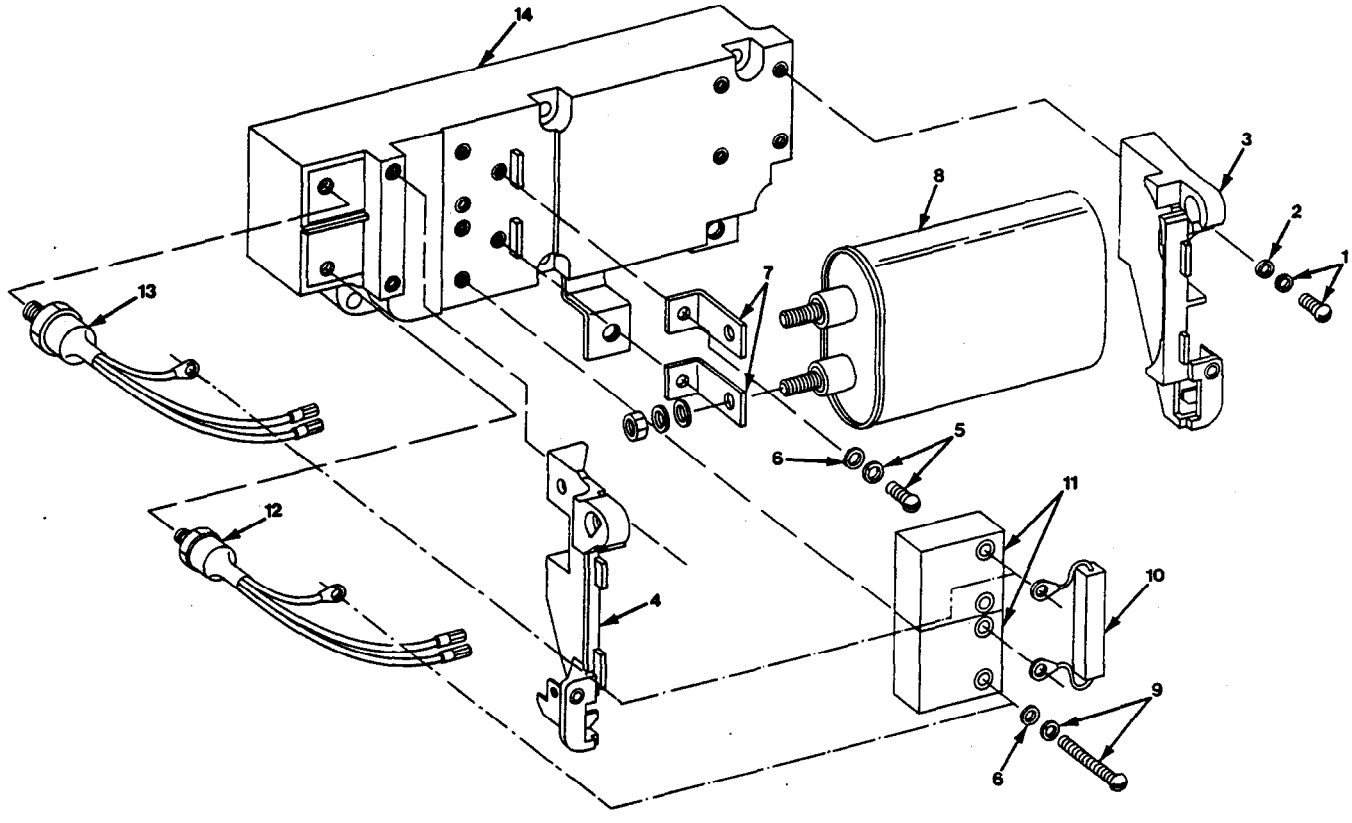
Contactor	Resistance
Forward (F)	7-7.5 OHMs
Rearward (R)	7-7.5 OHMs
Bypass (1A)	13.5 OHMs
Lift Pump	8 OHMS
Auxiliary Pump	42 OHMS





ITEM #	NAME
1	Plate
2	Terminal, block
3	Screw, machine
4	Screw, machine
5	Washer, plastic
6	Relay
7	Diode
8	Resistor

TRANSFORMER ASSEMBLY



ITEM #	NAME
1	Screw with lockwasher
2	Washer, flat
3	Support, card box (right hand)
4	Support, card box (left hand)
5	Screw with lockwasher
6	Washer, flat
7	Bus
8	Capacitor, 200 volts
9	Screw with lockwasher
10	Resister assembly
11	Snubber assembly
12	Rectifier assembly (5 REC)
13	Rectifier assembly (2 REC)
14	Transformer

5. Take moving contact and braid assembly holding it with thumb and fore finger at either side of armature plate retainer.

6. Squeeze side of retainer to allow feet to enter slots in top of armature plate while ensuring that rear protrusions of armature plate retainer are behind magnet frame. Braid can now be placed on rear connection bolt. Check that feet of armature plate retainer have "clicked" in position under armature plate.

7. Front molding can now be refitted with its square headed front connection bolt and slid back in place on front of magnet frame. At same time ensuring that front of moving contact is inside molding between blowout magnets.

8. Fit second compression spring on top spring stud and slide hammer shaped end in slot in moving contact and through armature plate. Press and lock with a 90 degree turn.

9. Place rear slots in magnet frame under base molding. Squeeze front molding to allow assembly to drop down and lock on base molding.

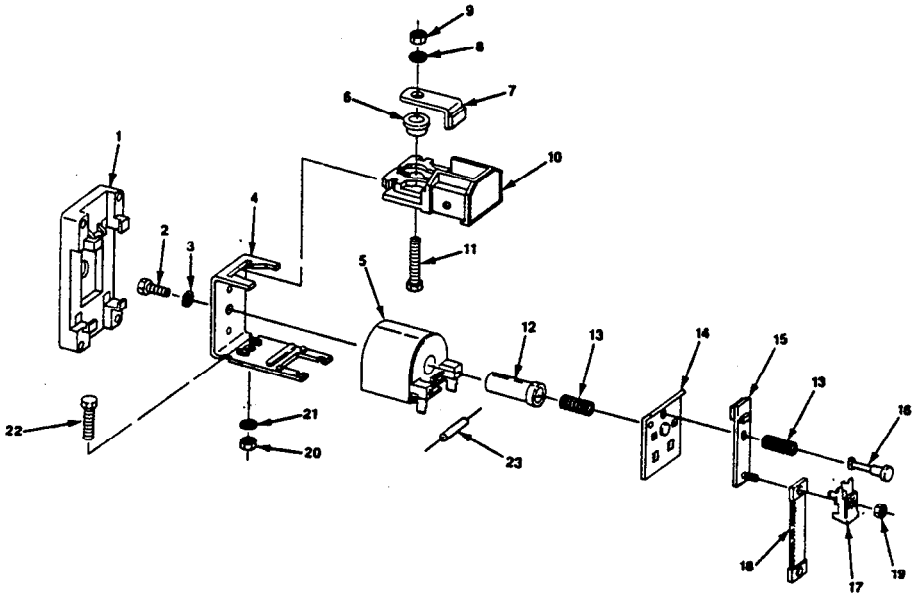
10. Install tubular spacer flange outwards, by sliding on front connection bolt and in body of molding.

11. Install fixed contact on front connection bolt, pressing contact in recess in front molding. This will lock molding in position.l

12. Install lockwashers and nuts on connection bolts.

13. Check that armature plate is corrected at hinge end and that the armature plate and moving contact moves freely and without binding.

CONTACTOR ASSEMBLY (CABLEFORM) A-27185



ITEM #	NAME
1	Base
2	Screw, cap
3	Lockwasher
4	Frame, magnet
5	Coil, magnet
6	Spacer
7	Contact, front
8	Lockwasher
9	Nut
10	Front
11	Screw, cap
12	Pole
13	Spring
14	Plate, armature
15	Contact, moving
16	Stud, top spring
17	Retainer
18	Braid
19	Nut
20	Nut
21	Lockwasher
22	Screw, cap
23	Diode, zener

FAILURES WHICH CAUSE REDUCED OR NO MOTOR TORQUE

Test Procedure	Observation of Truck Behavior	Use Trouble-shooting Table
Close key and brake switch. Operate truck in forward, reverse, raise and lower	No contact or Pickup, truck is "Dead"	1A/3J
	"F" or "R" contactors do not pickup. "P" (pump) contactor does pick up.	1B
	"F" and "R" contactors close. No power and no SCR hum in SCR range.	1C
	"F" and "R" contactors close. Little or no power and normal SCR hum	1D
	"F" and "R" contactors close. Truck little or no power with abnormal SCR hum.	1E
	"F" and "R" contactors close. Little power and no SCR hum	1F
	Only one contactor (F or R) will close with normal operation	1G
	Truck "shuts down" (PMT Trip) in SCR range after operating in 1A	1H
FAILURES WHICH CAUSE FULL MOTOR TORQUE WITH SCR CONTROL		
Close key and brake switch. Operate truck in Forward and reverse.	"F" and "R" contactors close. Full speed immediately audible hum and no PMT trip.	2A
	"F" and "R" contactors close once or twice and then remain open. PMT trips.	2B
	"F" and "R" contactors close. Under SCR operation contactors may open once or twice and then remain open.	2C
MISOPERATION OF OTHER FEATURES		
Close key and brake switch. Operate Truck in forward or reverse at top speed.	"1A" or "FW" contactors close with key switch	3A
	PMT does not open "F" or "R" contactor	3B
	"1A" contactor will not close	3C
	"1A" contactor will not close at timed pickup	3D
	"FW" contactor will not close after "1A" contactor closes	3E
	"FW" contactor will not drop out with increasing load	3F
Close key and brake switch. Operate truck in one direction and reverse the direction for braking purposes. (Plugging).	Stiff plug and severe reversal	3G
	Very soft reversal	3H
Close key and brake switch. Operate truck in forward, reverse, raise and lower.	More than one contactor closes. "F"&"P", "F"&"R" and "R"&"P"	3K

Symptom 3E: FW contactor will not close after 1A contactor closes. Not applicable for "H" card.

MAKE THIS TEST	OBSERVE THIS RESULT	PROCEED AS DIRECTED
Step 1. Remove wire no. 49 from oscillator card terminal R9. Check milliamps from R9 to R4. Operate truck to 1A speed.	5-10 milliamps	Check wire nos. 49, --, and 13 for opens. If OK, check contactor card and FW driver (4E). Proceed to Step 2.
Step 2. Turn FW trimpot fully CW and recheck as done in Step 1.	Remain near 0	Proceed to Step 2.
	No change	Replace oscillator card (4A).

Symptom 3F: FW contactor will not drop out with increasing load.

MAKE THIS TEST	OBSERVE THIS RESULT	PROCEED AS DIRECTED
Step 1. Check drop out (D/O) setting on	If adjustment does not remedy problem	Replace oscillator card

Symptom 3G: Stiff plug and severe reversal.

MAKE THIS TEST	OBSERVE THIS RESULT	PROCEED AS DIRECTED
Step 1. Check plugging trimpot adjustment	OK	Proceed to Step 2.
	Not OK	Adjust trimpot, See Step 2.
Step 2. Check 4 REC for open (4H)	OK	Replace oscillator card.
	Not OK	Replace 4 REC.

Symptom 3H: Very soft reversal

MAKE THIS TEST	OBSERVE THIS RESULT	PROCEED AS DIRECTED
Step 1. Adjustment of trimpot setting.	No change	Replace oscillator card.

20-04 PRESTOLITE MOTOR SERVICE INSTRUCTION

(General Notes)

Prior to any testing or inspection, the motor components except bearings and armature, should be thoroughly cleaned with a good grade petroleum base cleaning solvent and dried with compressed air.

WARNING

Be extremely careful when working with 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 air pressure requirements.

The armature should be blown off with compressed air to remove brush dust and dirt form around the commutator and windings.

Bearings should be wiped clean with a cloth and never submerged in a solvent. Submerging bearings in a solvent will deteriorate internal lubrication which cannot be replaced.

VISUAL INSPECTION

After the motor components have been thoroughly cleaned and dried, they should be inspected for the following:

1. **Drive end head**
   Check bearings recess for any signs of wear. Check mounting holes for any stripped or crossed threads of broken studs.

2. **Commutator end head**
   Check bearing recess for any signs of wear. Check bearing holder insulation for cracks or any signs of burning. Check brush holders and springs for wear.

3. **Oil seal**
   Oil seal, if upon disassembly of the motor, the field coils or commutator are oily. A faulty oil seal is indicated. A good service practice is to replace the oil seal whenever the motor is overhauled. The oil seal seat on the armature shaft should be checked for rough spots, grooves, or scars.

4. **Bearings**
   Check bearings by turning them with your fingers. Feel for binding or gritty effects and for excessive looseness or wobble. A good bearing should also have a small amount of drag or stiffness caused by the lubrication. If the bearing turns freely, it should be replaced.

5. **Frame and field assembly**
   Check the condition of all insulation. If the insulation on the field coils appears blackened of charred, the serviceability of the coils is questionable. Burned of charred insulation is a result of coils over-heating due to overloading conditions, grounded or shorted coil windings. Check condition of all other insulation such as brush rigging, under coil connections, and around terminal.

6. **Armature**
   Check the shaft bearing journals, splines or keyways for wear. Check windings, commutator connections and commutator bars for any signs of burning. If deep burned sections are evident, either in the brush track or on the rider end of the commutator bars, and open circuit in the armature winding is indicated.

TESTING

Frame and Field Assembly

After thorough inspection, the frame and field assembly should be checked for grounded, open, or shorted circuits. Grounded and open circuits can be checked using 110 volt A.C. test leads with a 50 watt bulb in series.

1. **Grounded circuit**
   Touch one test lead to a clean bare metal spot on the frame and check all terminals with the other lead. If a grounding condition exists, the test light lights.

2. **Open circuit**
   Check between all connection terminals with test leads. If the bulb fails to light, an open circuit is indicated.

20-05 MASTER CONTROL SWITCH

The only routine maintenance that is necessary other than periodic check for tightness of the mounting hardware is greasing of the moving parts.

For removal and installation of master switch, see "Control Section" of this manual under 10-04 Hand Lift and Speed Assembly.

> NOTE: Dirt can wear parts and cause failure.

The maintenance chart in this manual will guide you in your preventative maintenance.

Do not dismantle master switch unnecessarily. If a loss of performance occurs, the system as a whole must be investigated before assuming that any components is at fault.

> **WARNING**
> Perform all service routines with the battery disconnected, except where noted without certain procedures outlined.

DISASSEMBLY

1. Remove potentiometer wires and potentiometer.
2. Remove the module retaining screws.
3. Gently pry off potentiometer bracket.
4. Remove the switch housing and cam making sure that the snap switches go with the housing.

> NOTE: The contacts on the switch are silver and need only be replaced when worn thin. Do not file contacts; discoloration and slight pitting of the contacts is not harmful. When contacts need replacing, the switch is replaced; there is up to four (4) switches in the switch housing. There is also a blank spacer used to replace the switch if not all four (4) switches are used.

5. Remove cover from spring return housing.
6. Slide off of the shaft, the shaft bearings, spring drive, spring support, spring and lock nut.
7. Remove the mounting bracket from the spring return housing.

FLARELESS CONNECTIONS

This type of fitting is used to join rigid tube to accessories and to other tubes.

The accessory adapter may connect to the accessory by means of NPTF threads and straight thread "O " ring seal.

INSTALLATION

Most fittings may be used as they come out of the box, they do not need to be disassembled.

1. Cut tube squarely using either a tube cutter or hacksaw. Deburr tube end carefully.

2. Insert tubing into fitting until it bottoms against tube stop. Note that the tube must be held against stop during assembly. If tube is allowed to back out slightly, ferrule may not function properly and a leak may develop.

3. with tube held against stop, tighten nut finger tight and then wrench 1 1/4 turns further.

   NOTE: Fittings work by the nut forcing ferrule toward and inward to a desired point. This is why the 1 1/4 turns is mentioned. Flareless fittings, unlike flared fittings, should never be assembled by torque or "feel" as there are too many tolerances to compensate for. Because of these tolerances, two fittings that "feel" that they are made up identically may be miles apart in amount of actual ferrule action on tube. Assemble by turn, not by "feel".

4. Most fittings in brass, steel and aluminum are supplied in a prelubricated condition. This lubrication may be an oil, grease or wax like coating. Stainless steel fittings, however, always need to be lubricated. It should be noted that manufacturers are starting to lubricate stainless nuts with "Moly" coating. This coating is dark grey in appearance and is a perfect dry film lubricant for stainless. Check your fitting and if it is dry and does not have the "Moly" coating, use a high pressure grease such as lubriplate on nut threads.

5. Most flareless fittings will be assembled many times if the assembly is made carefully. Almost all manufacturers request that you mark the relationship between the nut and body before disassembly and then return the parts to this relationship during assembly. all that is needed then is to tighten the nut a very slight amount further to reestablish the seal. If you can not make the fitting and assuming it is in good condition then just retighten the nut until you feel a load build up. This will be the point at which the ferrule reseats. Remember, do not over do it.

INSTALLATION O RING FITTINGS

Locknut fittings. Installation of locknut fittings for adjustable positioning follows:

1. O ring and back-up washer should be in proper position on under cut unthreaded section nearest to locknut. Lubricate O ring with petroleum jelly (such as vaseline).
   Very Important

2. Screw fitting by hand into straight threads boss until back-up washer contacts face of boss.

3. To position fitting, unscrew as far as necessary (up to none full turn), hold fitting in desired position and tighten locknut with wrench so back-up washer contacts face of boss and contains O ring with boss cavity.

   O ring replacement. Do not push O ring recklessly over threads of fitting which might nick O ring surface. A damaged O ring could lead to leakage trouble.

   Use plastic or metal "thimble" (such as a thread protector) to replace O ring on fitting. Push thimble over threads, then push resilient O ring over thimble and into groove of fitting. Properly installed O ring will assure leak proof seal.

DOWTY LIFT PUMP (D-40459-7) TROUBLESHOOTING

POSSIBLE PUMP TROUBLE	CAUSES	REMEDIES
1. Noisy pump caused by cavitation	1. Oil supply low	1. Fill reservoir
	2. Oil too heavy	2. Change to proper viscosity
	3. Oil filter plugged	3. Clean filters
	4. Suction line plugged or to small	4. Clean line and check for size
2. Oil heating	1. Oil supply low	1. Fill reservoir
	2. Contaminated oil	2. Drain reservoir and refill with clean oil
	3. Setting or relief valve too high or too low	3. Set to correct pressure
	4. Oil in system too light	4. Drain reservoir and refill with proper viscosity oil
3. Shaft seal leakage	1. Worn shaft seal	1. Replace shaft seal
	2. Broken diaphragm seal or back-up gasket	2, 3, 4-- If replacing the shaft seal does not stop leakage, the pump should be disassembled and inspected
	3. Bearings out of position	
	4. Excessive internal wear	
4. Foaming oil	1. Low oil level	1. Fill reservoir
	2. Air leaking into suction line	2. Tighten fittings
	3. Wrong kind of oil	3. Drain and fill reservoir with non-foaming oil

NOTE: To obtain an accurate setting while testing, a test light and dial indicator are used to check spool travel and switch electrical connection. If dial indicator and test light are not available , adjust switch until desired performance of system is achieved. Switch should contact within .020/.060 spool travel in both directions. Spool travel in both directions must be within .010 at point where switch makes contact.

7. Install relief valve. The relief pressure in lift circuit should be 2500 PSI+50 PSI.

   The lift relief pressure is predetemined by relief valve and can not be changed. If relief pressure is found to be incorrect, relief valve must be replaced.

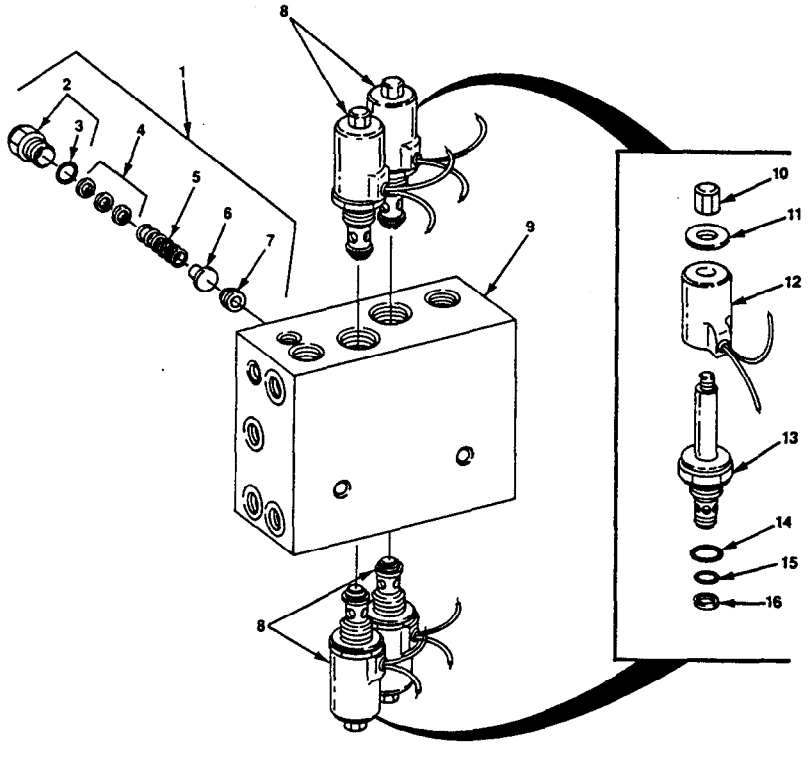
   NOTE: Relief pressure should always be checked with mast cylinder(s) function extended against stops.

ASSEMBLY

Cleanliness is extremely important when repairing a hydraulic system. Work in a clean area.

1. The O rings and back-up ring should be replaced with new parts.
2. Thoroughly clean all parts and air dry. Metal parts must be lightly oiled prior to assembly.
3. Position now O rings and back-up ring in proper grooves in cartridge bore and install in valve block.
4. Install coil on cartridge and mount with nut and flat washer.
5. Install relief valve components and new O ring plug and install in valve block.

DEEP REACH MANIFOLD VALVE ASSEMBLY (C-40646)



ITEM #	NAME
1	Valve, relief
2	Plug, relief
3	O ring
4	Shims
5	Spring
6	Poppet
7	Seat
8	Valve, solenoid
9	Block, valve
10	Nut
11	Washer
12	Coil
13	Cartridge
14K	O ring
15K	O ring
16K	Ring, back-up
K	Kit, seal

(contains parts indicated by letter "K")

INSPECTION

1. Remove nicks and burrs from all parts.
2. Inspect rod and tube for excessive wear.
3. Inspection of O ring, back-up, oil seal, wiper and guide ring is not necessary. It is recommended that these be replaced as new parts.

ASSEMBLY

Replace all seals and wear ring with new ones. DO NOT SAVE.

1. Thoroughly clean all parts and air dry.
2. Install the wear ring on the piston and piston on rod.

   NOTE: Coat the rubber or sealing components with a light coat of petroleum jelly (such as vaseline) before assembly.

3. Install ball, spring, pin, and nut. Torque nut to 250-300 ft./lbs.
4. Slide the rod with piston to the bottom of the cylinder tube, make sure that the wear ring is not damaged over threads.
5. Install back-up ring and O ring on bearing head, making sure that the O is not twisted.
6. Install wear ring and seal into bearing head.
7. Install bearing head assembly onto cylinder tube. Make sure the O ring and back-up ring are not damaged by the threads. Snug the bearing head down.
8. Install the outer seal over the rod and in bearing head.
9. Install seal washer and screw in bleeder hole.
10. Install cylinder on truck and attach (flow control valve) hydraulic hose.
11. Test operation of cylinder and bleed air from bleeder screws at top of cylinder.

8. Remove rod end, jam nut, and bushing from rod end, if necessary.

9. Remove bushing from cylinder tube, if necessary.

NOTE: Replace all seals and guide rings with new ones.

INSPECTION

1. Remove nicks and burrs for all parts.

2. Inspect rod and tube for excessive wear.

NOTE: If internal leakage has been experienced, wear is indicated between the piston and tube. This can be corrected by replacing the seals on the piston.

3. Inspection of O ring, back-up rings, oil seal, wiper and guide ring is not necessary. It is recommended that these be replaced as new parts.

4. Inspect tube ports for damage to threads and seats.

ASSEMBLY

1. Thoroughly clean all parts and air dry.

2. Install the bushing in the cylinder tube, making sure that the bushing is flush or indented slightly with the eye.

3. Install the bushing in the rod end, making sure that the bushing is flush or indented slightly with the eye.

4. Install the rod end and jam nut on the rod.

5. Install in bearing head the wiper, oil seal and guide ring.

NOTE: Coat the rubber or sealing components with a light coat of petroleum jelly (such as vaseline) before assembly.

6. Install on the bearing head the back-up ring and O ring.

7. Install the bearing head on the rod, making sure that the oil seal, wiper and guide ring are not damaged in this step.

8. Install the Belliville washers on the rod in the order they were removed.

9. Install in piston the small O ring.

10. Install on the piston the O ring, back-up ring, and guide ring.

11. Install the piston on the rod, making sure that the O ring inside piston is not damaged.

12. Install the nut on rod and torque to 60-65 ft./lbs,

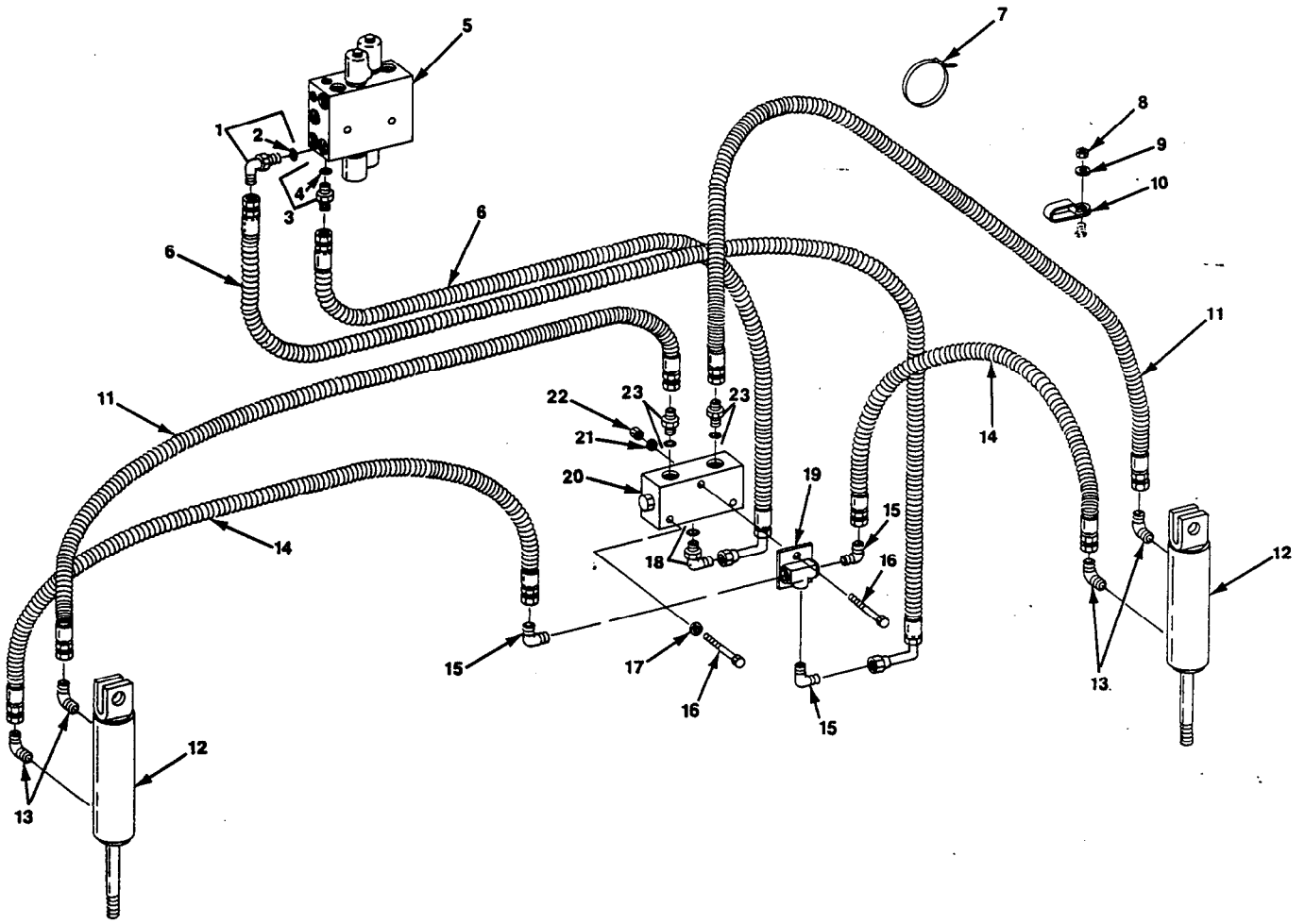
13. Install the cylinder rod in the tube with piston and bearing of rod.

14. Install the retainer wire and turn the bearing head clockwise.

15. Install cylinder in reach attachment.

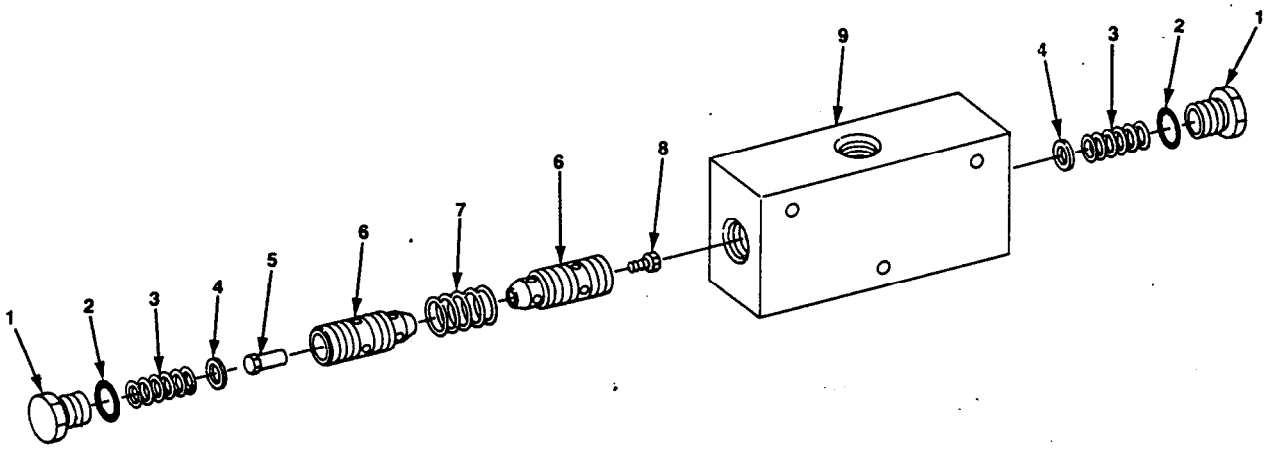
16. Test operation and check for leaks.

DEEP REACH, TILT CYLINDER AND HOSE ASSEMBLY (C-40646)



ITEM #	NAME
1	Elbow, 90°
2	O ring
3	Adapter
4	O ring
5	Valve, assembly
6	Hose assembly
7	Tie, wire
8	Nut
9	Washer
10	Clamp
11	Hose assembly
12	Cylinder, tilt
13	Elbow, 90°
14	Hose assembly
15	Elbow, 90°
16	Screw, cap
17	Lockwasher
18	Elbow, 90°
19	Tee
20	Divider, flow
21	Lockwasher
22	Nut
23	Adapter

FLOW DIVIDER ASSEMBLY (A-49775)



ITEM #	NAME
1	Plug
2	O ring
3	Spring
4	Washer
5	Spacer
6	Piston
7	Spring
8	Screw
9	Body

FOUR INCH HIGH OUTRIGGERS ARTICULATING LOAD WHEEL ASSEMBLY (B-40866)

ROUTINE MAINTENANCE

Routine maintenance consists of periodic checks for tightness of mounting bolts and a visual check for wear. Keeping the bearings of the load wheels well greased will prolong live and decrease wear. Cleanliness is extremely important in the area of the wheel bearing.

NOTE: Dirt can wear bearings and cause failure.

The maintenance chart in this manual will guide you in your preventative maintenance.

DISASSEMBLY

1. Disconnect battery and remove from the truck.
2. Jack load wheel off floor and block up.

WARNING

Always securely block unit before jacking and lower forks.

3. Load wheel assembly maybe removed from outriggers by removing the four (4) cap screws on top.
4. Remove the roll pin through axle.
5. Tap keeper plate out of the wheels.
6. Carefully pry out seal ring from wheels and remove bearings.
7. Complete disassembly, if necessary.

ASSEMBLY

1. Thoroughly clean all parts and air dry.
2. Pack bearings thoroughly with approved lubricant (Tex. Ref. C & C #880). In replacing cups, a bearing race driver is best.

   NOTE: If a punch is used, be sure it is blunt and drive parts in carefully to avoid any cocking of the bearing.

3. Install seal ring in wheels.
4. Slide washer on axle and install wheel with a small and large washer behind.

   NOTE: Shims will go between small washer and seal ring.

5. Repeat step four (4) to other wheel on outrigger.
6. Install plate behind load wheels and slide keeper plate through bracket and secure in place with roll pin.

   NOTE: When reassembling, check the side play on the wheels. If side play does exist, shims will go between small washer and seal ring.

   NOTE: Shimming should be divided equally and used on each side of wheel.

7. Install load wheel assembly on outriggers using four (4) cap screws torque them to 100 ft./lbs.
8. Lower load wheels to the floor.
9. Test operation of load wheels for binding. If binding is found, remove shims and see step two through six.

REACH CYLINDER (Removal from Machine)

Removal of the reach cylinders is accomplished by removing the roll pins and shaft pins from both ends of the cylinders. The reach should be blocked and special care should be taken to secure the reach from moving.

WARNING

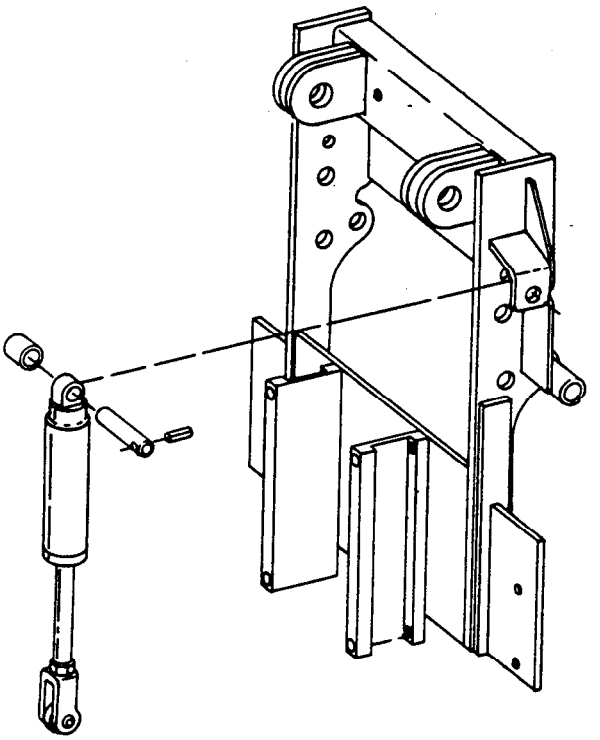
When the reach cylinder(s) are removed the reach frame is free to move.

TILT CYLINDER

Removal of the tilt cylinders is accomplished by removing the roll pins and shaft pins from the top of the cylinders, then remove the cylinders.

MAST

1. Disconnect the battery.
2. Remove reach as described in the section.
3. Remove the electrical cable.
4. Attach a hoist to the top of the mast.
5. Disconnect lift cylinder hydraulic lines from mast convenient end.
6. Remove mast mounting bolts.
7. Remove mast.



45-03 THREE STAGE MAST

Shimming of Mast Bearings on Unit

The mast bearings may be shimmed with mast still on truck. The instructions below may be used for all 3 stage masts except 95/210 mast which can only be shimmed after removal from truck.

1. With reach retracted, disconnect battery and remove battery from truck.

2. Remove fork from lift frame.

3. The truck will have to be hoisted and blocked a foot off floor (see hoisting instructions in this manual) before work can begin.

WARNING

Always make sure unit is on level surface before work can begin.

Shimming Reach

4. Attach a hoist to top of reach rear frame (see hoisting instructions in this manual) and hoist to loosen lift chain. This will allow removal of lift chain anchor pins.

5. Before disconnecting hoses and fittings from reach frame, thoroughly clean off all outside dirt around fittings. After disconnecting hose immediately cap ports on tubes and hoses to prevent contaminates from entering the hydraulic system.

   NOTE: Take note as to which port the hoses are from for easier installation.

6. Determining the amount of shims required by prying the rear of lift frame to one side and slipping shims between the bearings and web on the column. Add shims by hand until no more may be added.

7. Divide shims as equally as possible between the two (2) bearings and install under bearings.

8. Hoist rear of lift frame up the inner column to expose the two (2) top bearings. Remove bearings and add shims.

9. Lower rear of lift frame down the inner column and out the bottom to expose the four (4) bearings and add shims.

10. Raise rear of lift frame up the inner column as far as it will go under normal conditions. Check bearing shimming as the lift frame is raised. Remove shims as required, if tight spots are encountered where assembler cannot roll lift frame smoothly, check for excessive bearing clearance with lift frame in closed position by prying lift frame to one side and checking with a 0.060" shim. Maximum clearance must not exceed 0.060".

    Check for excessive bearing clearance with lift frame in the raised position by prying lift frame to one side and checking with a 0.030" shim. Maximum clearance must not exceed 0.030".

11. Lower rear of lift frame to install lift chain anchor pins. When installing lift chains, chains are to be free of twists and adjusted for equal tension with adjusting nuts and locknuts torqued to 200 ft./lbs. Chains are to be centered on sheave within 1/32".

12. Connect hose and fitting to reach frame. Make sure hoses are attached to the proper fittings (see hydraulic section in this manual for proper hose fitting tightening). Remove hoist from lift frame.

Shimming Mast With Reach Removed

The reach must be removed to shim the mast.

13. Attach hoist to top of inner column (see hoisting instructions in this manual) and raise to loosen lift chains. This will allow removal of lift chain anchor pins.

14. Before disconnecting hoses and fittings from reach frame, thoroughly clean off all outside dirt around fittings. After disconnecting hose immediately cap ports on tubes and hoses to prevent contaminates from entering the hydraulic system.

45-04 SINGLE REACH CYLINDER

ROUTINE MAINTENANCE

No routine maintenance is necessary other than periodic checks for tightness of the mounting pins and a visual check for oil leakage. Keep the cylinder clean externally, especially in the area of the rod oil seal.

> NOTE: Dirt can wear seals and cause leakage.

The cylinder must be operated only with clean oil and the system oil filter element must be replaced according to the maintenance chart in your manual.

Do not dismantle the cylinder unnecessarily. If a loss of performance occurs, the system as a whole must be investigated before assuming that the cylinder is at fault.

REMOVAL

1. Extend the reach and block open.
2. Disconnect the battery.
3. Remove the roll pin and pin on the piston rod eye.

> **WARNING**
> If removing both reach cylinders, block, the reach attachment to keep from closing.

4. Remove the hydraulic hosed from the cylinder.
5. Remove the pin and roll pin from the tube end of the cylinder and remove cylinder.

INSTALLATION

It is recommended that both reach cylinders be replaced at the same time.

1. Install the pin and roll pin through the tube end of cylinder.
2. Install the hydraulic hose on the cylinder.
3. Install the pin and roll pin through the piston rod eye.
4. Remove the blocks in the reach attachment.
5. Connect the battery.
6. Test operation and check for leaks.

SINGLE REACH ASSEMBLY

ROUTINE MAINTENANCE

Routine maintenance consists of periodic checks for tightness of mounting bolts and lubrication of all grease fittings and a visual check for wear. Cleanliness is extremely important in the surface areas around the scissors.

> NOTE: Dirt can wear seals and cause leakage.

The maintenance chart in your manual will guide you in your preventative maintenance.

The reach assembly can be easily removed from truck with hoist for major disassembly of left on for minor repair.

CLEANING

The reach can be steam cleaned, to keep contaminates out of system, making sure that all grease fittings are well greased before and after cleaning.

> NOTE: Make sure that electrical components and wires do not get wet.

VISUAL INSPECTION

After the reach assembly has been thoroughly cleaned and dried with air, it should be inspected for the following:

1. **Roller bearings**

   Check bearing roller surface for only signs of wear. Check mounting shafts and screws for any stripped or crossed threads or broken or worn shafts.

45-05 DOUBLE REACH REMOVAL

HMC REACH CYLINDER ASSEMBLY

ROUTINE MAINTENANCE

No routine maintenance is necessary other than periodic checks for tightness of the mounting nuts and a visual check for oil leakage. Keep the cylinder clean externally, especially in the area of the rod oil seal.

NOTE: Dirt can wear seals and cause leakage.

The cylinder must be operated only with clean oil and the system oil filter element must be replaced according to the maintenance chart in your manual.

Do not dismantle the cylinder unnecessarily. If a loss of performance occurs, the system as a whole must be investigated before assuming that the cylinder is at fault.

HMC REACH CYLINDERS

REMOVAL

1. Extend the reach and block.
2. Disconnect the battery.
3. Remove the toll pin(s) and pin on the piston rod eye.

WARNING

If removing both reach cylinders, block the reach attachment to keep from closing.

4. Before disconnecting hoses and fittings from reach frame, thoroughly clean off all out side dirt around fittings. After disconnecting hose immediately cap ports on tubes and hoses to prevent contaminates from entering the hydraulic system.

   NOTE: Take note as to which port the hoses are from for easier installation.

5. Remove nut and shaft on barrel end of cylinder.

INSTALLATION

It is recommended that both reach cylinders be replaced at the same time.

1. Install shaft and nut on barrel end of cylinder.
2. Install the hydraulic hoses on the cylinder.
3. Install the pin and roll pin through the piston rod eye.
4. Remove the block in the reach attachment.
5. Connect the battery.
6. Test operation and check for leaks.

50-01 GENERAL DESCRIPTION

This section covers the specification charts and schematics used on the NP15-20-12D Electric Reach Truck.

An index has been provided for reference and index numbers.
Illustrations also have been utilized for use in assemblies.

This section also covers special tools used to service this unit.

AMPS draw charts for pump and drive motors are found in this section.

Before disassembling or assembling any major components, read and observe all warnings.

WARNING

Perform all service routines with the battery disconnected, except where noted within certain procedures outlined.

Do not attempt to assemble the unit without the appropriate assembly instructions. See Index at he front of this manual to locate the section and d index numbers for appropriate assembly instructions.

Before accomplishing detail procedures, perform the following general checks.

Check key switch position, determine its proper position.

Check brake pedal is in proper position.

Check that battery is fully charged.

Check that battery connectors are connected and free of corrosion (or disconnected).

Check that all fuses are functioning (control and power).

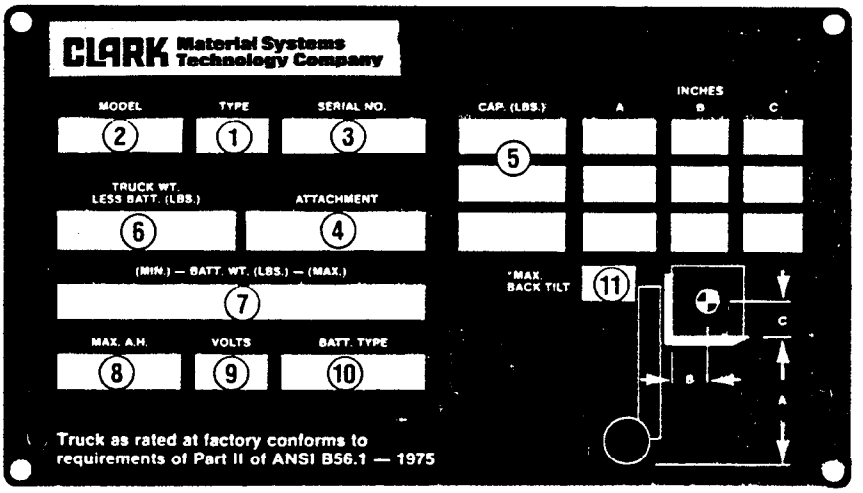
Check that battery voltage with correct polarity is present ant control circuit fuse panel buss bar.

If all checks prove satisfactory, proceed to specification tables and charts.

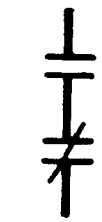
50:02 DATA PLATE AND DECALS

Know the rated capacity on the data plate and understand areas 1 through 11 as shown in the illustration.

1. Truck type
2. Truck model
3. Truck serial number
4. Attachment
5. Capacity
6. Truck weight
7. Battery weight
8. Battery AMP hours
9. Voltage
10. Battery type
11. Back tilt

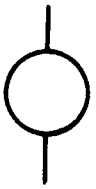


ELECTRICAL SCHEMATIC SYMBOLS



DOUBLE TIP CONTACTOR

SINGLE TIP CONTACTOR

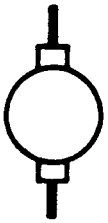


COIL

CONTROL SWITCH

PLUG

FUSE



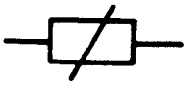
ARMATURE

FIELD

SCR

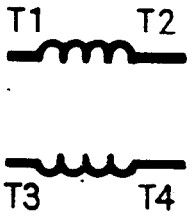
DIODE

CAPACITOR

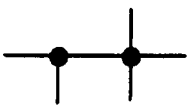


THERMAL PROTECTOR

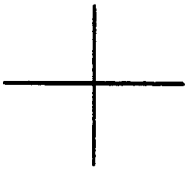
RESISTOR



TRANSFORMER



ELECTRICAL LINES JOINING



ELECTRICAL LINES CROSSING

SYMPTOM	POSSIBLE CAUSE	POSSIBLE CURE
No "Power Assisted" Steering, Auxiliary Pump Runs	Low Oil Level	Fill hydraulic tank. Check for leaks.
	Pinched or Crimped Lines	Inspect lines and repair if necessary.
	Auxiliary Pump Relief Pressure Incorrect	Check relief pressure. It should be 1475-1575 P.S.1. with the reach against the stops. Adjust pressure if incorrect. Change the relief valve.
	Steer Relief Pressure Incorrect	Check steer relief pressure. Should be 700 P.S.1. Check with the steering at the stops. Adjust the relief.
	In and Out Lines to Torque Generator Reversed. (The torque generator can not function in reverse.)	Switch hydraulic lines. If there is still no power assist, the torque generator may have been damaged internally. Change the torque generator.
Steer Handle Turns Free, No Movement of the Wheel	Sheared Roll Pin on Control Handle	Replace the roll pin.
	Sheared Roll Pin/Key on Sprocket at the Torque Generator or on Steer Axle Shaft	Replace roll pin/key. Align sprocket, and tighten the chain. See "Sprocket Alignment and Chain Tightening Procedure".
	Broken Drive Chain on Upper or Lower End of Steer Axle	Replace broken chain. Tighten the chain, see above.

SYMPTOM	POSSIBLE CAUSE	POSSIBLE CURE
Lifts Slowly	Incorrect Relief Pressure	Adjust relief pressure to 2500 to 2600 P.S.I. with mast against the stops. See Hydraulic Section, "Adjusting Relief Pressures".
	Air Leak at Oil Pick-up to the Lift Pump	Repair or replace the line.
Pump Motor Will Not Shut Off	Lift Switch Shorted	Using a VOM on the 50 VDC scale, connect the positive lead of the meter to wire No. 64 on the lift switch. With the lift control in neutral the meter should read zero volts. If voltage is present, change the lift switch.
	Lift Relay Shorted (Located on bottom right hand side)	Remove wire No. 10 from the relay. Using an ohmeter on the R x scale, connect the meter from the wire terminal input, (where wire No. 10 was connected) to wire No. 28 on the relay. When the relay is relaxed, (lift control not actuated) the meter should read infinite resistance. When the relay is energized, (control actuated) the reading should be zero. If these readings are not attained, change the relay.
	Pump Contactor Tips Welded	Visually inspect contactor tips. Replace as necessary.

SYMPTOM	POSSIBLE CAUSE	POSSIBLE CURE
Will Not Shift Left Pump Not Running	Diode Open at Wire No.51(Located above the relays, in the wire harness. The diodes are enclosed in shrink tubing.)	Change the Diode if it is visably burned. If not see the electrical section "Testing Diodes."
	Pump Contactor	See Electrical Section "Pump Contactors"
	Pump Motor	See Electrical Section "Motor Troubleshooting."
Will Not Shift Left Pump Is Running	Low Oil Level	Fill Hydraulic Tank, check for oil leaks.
	Pinched or Crimped Hose or Line	Inspect lines and repair if necessary.
	Incorrect Relief Valve Pressure	Adjustment relief pressure to 1475-1575 against the stops. Change relief valve.
	Open Wire in the Wire Harness to Relay No. 1 (This relay is the upper most relay mounted on the frame.)	Remove wire No. 13 from relay No. 1 and check for continuity from wire No. 13 back to battery negative. This check can be made using an ohmeter or test light. If there is no continuity on this wire, it is an indication of an open wire.
	Relay No. 1	Remove wire No. 61 from the relay. Using an ohmeter on the R x 1 scale and with the shift lever actuated, check the resistance between the wire terminal on the relay and battery negative. If the reading is not near zero, change the relay.
	Open Wire in the Wire Harness to Relay No. 2 (This relay is mounted directly below relay No. 1.)	Using a VOM on the 50 VDC scale, check for battery voltage at wire No. 51 to the relay. If voltage is absent with the shift lever acutated, an open wire is indicated between the relay and the auxiliary valve switch.

SYMPTOM	POSSIBLE CAUSE	POSSIBLE CURE
Will Not Tilt Forward Pump Running	Relay No. 1	Using a VOM on the 60 VDC scale, check for battery voltage at wire No. 59 with tilt lever actuated. If power is present on wire No. 52 but absent on wire No. 59, change the relay.
	Open Wire in the Wire Harness to Relay No.2 (This relay is mounted directly below relay No. 1)	Using a VOM on the 60 VDC scale, check for battery voltage at wire No. 54 to the relay. If voltage is absent with tilt lever actuated, an open wire is indicated between the relay and the tilt control switch.
	Relay No. 2	Remove wire No. 58 from the relay. Using an ohmeter on the R x 1 scale and with the tilt lever acutated, check the resistance between the wire terminal on the relay and battery negative. If the reading is not near zero, change the relay.
	Open Wire to Forward Solenoid	Check for battery voltage at wire No. 59 on the terminal strip next to the manifold valve, with the tilt lever actuated. An open wire between the solenoid and relay No. 1 is indicated if voltage is absent.
	Forward Solenoid (See illustration in Hydraulic Section for location.)	With the tilt lever actuated, check for a magnetic field at the solenoid by touching a steel object to the screw on the end of the solenoid cover. If this field is absent, change the solenoid.