

FLIGHT LINE TOW TRACTOR MB-4

16,000 DBP

OPERATION, MAINTENANCE AND PARTS MANUAL

MODEL 200-DF

**NSN: 1740-01-375-5849 YW
PART # 2016 (NON-AIR EQUIPPED)**

AND

**NSN: 1740-01-487-3996YW
PART # 2016AIR (AIR EQUIPPED)**

TO: 36A10-3-46-1

NMC-WOLLARD, Inc.

2021 Truax Blvd.

Eau Claire, WI 54702

715-835-3151

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nmc-wollard.com

General Email nmc-wollard@nmc-wollard.com

This manual is available on CD-ROM P/N 43532

Keep a copy of your NMC-Wollard, Inc. manuals on your computer or CD-ROM! You will be able to print pages and adjust page view anywhere between 25%-400%. Our view-only manuals contain hypertext links in the tables of contents, so by mouse-clicking on a table of contents entry, the page containing that item will automatically be displayed.

Requirements (minimum): PC with Windows 95 or newer, 486 processor (586 recommended), 8MB RAM, VGA monitor, mouse.

CALIFORNIA**Proposition 65 Warning**

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive

The information contained in this manual is
subject to change without notice.

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IMPORTANT SAFETY NOTICE

There are numerous variations in procedures, techniques, tools, and parts for servicing tow tractors, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who does not follow the instructions provided in this manual must first make sure that they do not endanger their personal safety or tractor integrity by their choice of methods, tools, or parts.

Prior to starting any task, first read the WARNINGS or CAUTIONS included in the text for that task.

CAUTION is used in this manual to indicate hazards or unsafe practices which could result in equipment damage.

WARNING is used in this manual to indicate hazards or unsafe practices which could result in personal injury or death.

TO: HOLDERS OF NMC-Wollard, Inc. OPERATION AND MAINTENANCE MANUAL number 42975

REVISION NO. 1 DATED 02/09/01

Pages that have been revised are outlined below, together with highlights of the revision. Please delete the affected pages and enter Revision No. 1 dated 02/09/01.

Chapter/Page No.	Description of Changes	Effectivity
	Revision added Effectivity Code page updated	
9/5	Change lug nut torque specs from 550 to 420; remove lubed torque	
10/3-7	Parts Index updated	
10/42 & 43	Drawing update and added new parts	
10/56 & 57	Drawing update and added new part	A

TO: HOLDERS OF NMC-Wollard, Inc. OPERATION AND MAINTENANCE MANUAL number 42975

REVISION NO. 2 DATED 03/31/01

Pages that have been revised are outlined below, together with highlights of the revision. Please delete the affected pages and enter Revision No. 2 dated 03/31/01

Chapter/Page No.	Description of Changes	Effectivity
All		

TO: HOLDERS OF NMC-Wollard, Inc. OPERATION AND MAINTENANCE MANUAL number 42975

REVISION NO. 3 DATED 07/15/01

Pages that have been revised are outlined below, together with highlights of the revision. Please delete the affected pages and enter Revision No. 3 dated 07/15/01

Chapter/Page No.	Description of Changes	Effectivity
All	Funk Transmission Repair Parts Added	All
All	Air Brakes System Operation, Maintenance And Repair Parts Added	All

TO: HOLDERS OF NMC-Wollard, Inc. OPERATION AND MAINTENANCE MANUAL number 42975

REVISION NO. 4 DATED 10/30/01

Pages that have been revised are outlined below, together with highlights of the revision. Please delete the affected pages and enter Revision No. 4 dated 10/30/01

Chapter/Page No.	Description of Changes	Effectivity
1/2	Changed towing load weight from 16,000 lbs to 160,000 lbs	

TO: HOLDERS OF NMC-Wollard, Inc. OPERATION AND MAINTENANCE MANUAL number 42975

REVISION NO. 5 DATED 01/15/02

Pages that have been revised are outlined below, together with highlights of the revision. Please delete the affected pages and enter Revision No. 5 dated 01/15/02

Chapter/Page No.	Description of Changes	Effectivity
Intro/5, 7, 17	Updated Page Revision & TOC	
10/1	Updated TOC	
10/5-9	Updated Part Index	
10/161	38906 Hitch added	

REVISION NO. 6

DATED 06-30-02

Pages that have been revised are outlined below, together with highlights of the revision.
Please delete the affected pages and enter Revision No. 6 dated 06/30/02

Chapter/Page No.	Description of Changes	Effectivity
Cover	Revised to correct model designation	all
Introduction/6,7	Revision record updated	all
10/16,17	Axle spring part added	all
10/141,146,147	Wheel/Tire parts updated	
	Relays, engine accessories updated	all

REVISION NO. 7

DATED 01-02-03

Pages that have been revised are outlined below, together with highlights of the revision.
Please delete the affected pages and enter Revision No. 7 dated 01-02-03

Chapter/Page No.	Description of Changes	Effectivity
6,7	Rev 7 added	All
1-6,7	Air Brake instruction updated	All
10-1,2,5-9,32,33,36-41,44-46,95,96-105,111,118-121,161,162	TOC updated, Index updated, battery, decals and cab updated. Park brake pads added. Exhaust, frame, fuel sys. Updates, Trans Sensor added, #NW35892 was corrected, air sys. updated. Hitch option added.	All

REVISION NO. 8

DATED 07-31-03

Pages that have been revised are outlined below, together with highlights of the revision.
Please delete the affected pages and enter Revision No. 8 dated 07-31-03

Chapter/Page No.	Description of Changes	Effectivity
Intro/14-17	TOC updated	All
3/2-4,10-16	TOC updated, accumulator maintenance added	All
6/6.1,6.2,7	Effectivity Codes moved to pg. 6.2, Rev 8 added	All
1/10,15,17,18	Axle lube specs added. Air diagram updated, Fig 9, Fig 10 Updated	All
2/2,2-7	Air Brake instructions updated. Emergency stop revised.	All
8/5,6	Park Brake Service added	all
10/5-9,13,39,55,94,95,101,102,103 118-121,133,136,137,142-145,162	Parts Index updated, duplicate filler deleted, Caliper Components added, 43481-1 added, door handle parts revised, filter element revised, NW35401 Components added, air system updated, 203004 added, blower motor parts added shifter components added. Alarms added. Winterization kit added.	All

REVISION NO. 9 DATED 01-31-04

Pages that have been revised are outlined below, together with highlights of the revision.

Please delete the affected pages and enter Revision No. 9 dated 01-31-04

Chapter/Page No.	Description of Changes	Effectivity
Intro/6.1,7,12-16	Rev. 9 added, TOC updated, pages renumber	All
10/1,2,5-9,21,23,25,27,31,37,39,45,57-93,95,102-104,143	TOC Updated, Parts index updated, Axle parts updated,Vendor Part Nos. corrected,YZ17606 added,Funk Transmission Parts updated, heater updated, NW030236 added	All

REVISION NO. 10 DATED 07-31-04

Pages that have been revised are outlined below, together with highlights of the revision.

Please delete the affected pages and enter Revision No. 10 dated 07-31-04

Chapter/Page No.	Description of Changes	Effectivity
Intro/6.1-6.2	Rev. 10 added, Added Eff B&C	All
Chapt. 1/1,5-7,12,14,15,17,18	TOC update, park brake indicator added, Updated schem.#43840, 42989, 43748, 42958 & 43886.	All
Chapt. 2/2-7	Parking brake instructions, pages reformat	All
Chapt. 8/1,5-8	TOC update, parking brake service added. Revised 8.10, revised figure 8-3, added figure 8-4.	All
Chapt. 10/1,2,5-9,34-35,94-95,118-121,142-147,153,157,161-164	TOC Updated, Parts index updated, updated park brake lever ill & parts list, added item 9A, update schem 43840 w/ 44704 parts (Eff B & C), # 29 was #27, added 37247, NW035383, deleted 41441, added 2 relays and switch to firewall, updated harnesses, added 44782, pages renumbered	All

REVISION NO. 11 DATED 11/30/05

Pages that have been revised are outlined below, together with highlights of the revision.

Please delete the affected pages and enter Revision No. 11 dated 11/30/05

Chapter/Page No.	Description of Changes	Effectivity
Intro/Cover,6.1, 7	Rev. Cover, Rev. 11 added	All
2/TOC.2-3.9-10	Update TOC.Update Operator's Control.Added Certification Letter	All
3/TOC.4,6-15	Update TOC.Update Trans. Lubrication, misc. text flow. Add air/hyd actuator service & inspect air system.	All
8/TOC.5.6-8.	Update TOC.Delete Brake Pedal Angle Adjustment. Update adjust Park Brake Lever, misc. Text flow.	All
10/5-9. 45,49,51. 58-95. 119	Update Parts Index.Misc chgs. Trans repair kits added. Changed 43730 to 45545, add chap 5 ref - 2 places	All
11/	Mfr's info added for Mico Air/Hyd actuators, Bendix Air Dryer, Allied Signal Air Brake Valve	All

REVISION NO. 12

DATED July 31, 2006

Pages that have been revised are outlined below, together with highlights of the revision.

Please delete the affected pages and enter Revision No. 12 dated 07/31/06

Chapter/Page No.	Description of Changes	Effectivity
Intro/6.2, 7	Revision 12 added	All
1/1/18	Update 43886	All
3/1-16	Periodic maintenance wheel bolt torque revised. Pintle hitch re-torque added. Wheel bolt, 400 ft-lbs was 550.	All
	Air brake maintenance added (3.6.5.2 and 3.6.6). All following pages renumber. TOC updated	All
9/4,7	Wheel bolt, 400 ft-lbs was 550.	All
10/21. 39. 45. 162	Kit 45868 added. NW035744-45 added. Kits 45866-7 added. Pintle hitch bolts updated	All
10/42,43	U-Joint parts and repair kits updated	All

REVISION NO. 13

DATED January 31, 2007

Chapter/Page No.	Description of Changes	Effectivity
Intro/6.2, 7	Revision 13 added	All
1/3	It is not uncommon to hear clutches engage.....added	All
1/9	Bolt torque SAE reference updated	All
6/2	Fuel tank removal procedure corrected	All
10/42,43	Trans & Axle ends of drive shaft switched, corrected	All

REVISION NO. 14

DATED July 31, 2007

Chapter/Page No.	Description of Changes	Effectivity
3/10-15	Note to restart hydraulic system after draining fluid added, pages renumber.	Hydraulic Brakes

EFFECTIVITY CODE

This manual is effective on units having the following serial numbers:

Effectivity Code

A

B

C

Serial Numbers

13013-00 & later

13084-03 & earlier

13085-03 & later

REVISIONS RECORD

Rev. #	Issue Date	Date Inserted	Initial
1	02/09/01	02/09/01	NMC-Wollard, Inc.
2	03/31/01	03/31/01	NMC-Wollard, Inc.
3	07/15/01	07/15/01	NMC-Wollard, Inc.
4	10/30/01	10/30/01	NMC-Wollard, Inc.
5	01/15/02	01/15/02	NMC-Wollard, Inc.
6	06/30/02	06/30/02	NMC-Wollard, Inc.
7	01/02/03	01/02/03	NMC-Wollard, Inc.
8	07/31/03	07/31/03	NMC-Wollard, Inc.

Rev. #	Issue Date	Date Inserted	Initial
9	01/31/04	01/31/04	NMC-Wollard, Inc.
10	07/31/04	07/31/04	NMC-Wollard, Inc.
11	11/30/05	11/30/05	NMC-Wollard, Inc.
12	07/31/06	07/31/06	NMC-Wollard, Inc.
13	01/31/07	01/31/07	NMC-Wollard, Inc.
14	07/31/07	07/31/07	NMC-Wollard, Inc.

GENERAL SPECIFICATIONS

Type of Vehicle:	
Four Wheel Drive, Four Wheel Steer, Model 200 Towing Tractor	
Gross Weight	- - - - - 19,600 lbs.
Drawbar Pull	- - - - - 16,000 lbs.
<i>DBP/GVW may vary ±15%. DBP measured at 14".)</i>	
Turning Radius (4 Wheel)	- - - - - 130"
Turning Radius (2 Wheel)	- - - - - 210"
Speed, Front	- - - - - 25 mph +/-1.5
Speed, Rear	- - - - - 2.4 mph
Fuel Tank	
Capacity	- - - - - 20.7 Gals. (78.3 L)
Cooling System	
Capacity	- - - - - 40 qts.
Pressure Cap-	- - - - - 14 psi.
Front Axle	
Make	- - - - - Clark Hurth (Dana)
Ratio	- - - - - 12.3:1
Type	- - - - - Steerable, Fixed Center
Rear Axle	
Make	- - - - - Clark Hurth (Dana)
Ratio	- - - - - 12.3:1
Type	- - - - - Steerable, Oscillating Center

ENGINE AND TRANSMISSION SPECIFICATIONS

Transmission

Make Funk
Type . . Power Shift W/Torque Converter
Model 2000
Fluid C3
Filter Converter Mounted Cartridge
Part No. NW32664
Suction Screen Assembly Part No. 37075

Gear Ratios

Forward

F1 5.5:1
F2 3.53:1
F3 2.94:1
F4 2.00:1
F5 1.41:1
F680:1

Reverse

R1 5.2:1
R2 3.53:1
R3 1.41:1

Engine For Tractor w/Hydraulic Brake

Model. Cummins 6BT5.9
Displacement 5.9
Horsepower @2200 RPM. . . . 152 BPH
Torque @1200 RPM. 414 ft. lbs.
Number of Cylinders. 6
Firing Order 1.5.3.6.2.4
Aspiration. Turbo Charged
Cooling
Coolant Capacity 40 qt.
Thermostat 181 deg. F
Oil Capacity. 17.3 qt.

Engine For Tractor w/Air Brakes

Model. Cummins 6BT5.9
Displacement 5.9
Horsepower @2200 RPM. . . . 148 BPH
Torque @1600 RPM. 440 ft. lbs.
Number of Cylinders. 6
Firing Order 1.5.3.6.2.4

Aspiration. Turbo Charged
Cooling Liquid
Coolant Capacity 40 qt.
Thermostat 181 deg. F
Oil Capacity 17.3 qt.

CORROSION PROOFING

All frame and body surfaces are shot blasted, primed and painted with weather resistant paint. Standard bolts are SAE grade 5, zinc-phosphate coated to resist corrosion.

STANDARD EQUIPMENT

Four wheel drive
Power Shift transmission
Four wheel steering, coordinated/crab/2 wheel
Engine shutdown system
Spark arresting muffler
Cab assembly
Heater/defroster
Suspension seat, driver's
Passenger seat
Seat belts
Mirror kit
Gauges, full instrumentation
Hi-low beam headlights
Rotating beacon, amber
Spotlight, rear center
Turn signals
Fire extinguisher (2)
Coupler-Holland PH30 front and rear
Air transportable per MIL-STD-1791
Paint: Dark green or desert sand

OPTIONAL EQUIPMENT

Undercoating
Ozone protection for tires

1 YEAR LIMITED WARRANTY

NMC-Wollard, Inc.

NMC-Wollard, Inc. warrants to the original owner that all components of the equipment are free from defects in material and workmanship under normal use and service for 12 months or 1,000 hours, whichever comes first, from the date of shipment.

This warranty provides for NMC-Wollard, Inc. equipment components that fail because of defects in material or workmanship during the warranty period, without charge to the owner for parts or labor. The owner must provide prompt notice of the defect and allow a reasonable time for replacement or repair.

This warranty applies only to parts manufactured by NMC-Wollard, Inc. Components installed on NMC-Wollard, Inc. equipment but not manufactured by NMC-Wollard, Inc. shall be covered under the original manufacturer's warranty. NMC-Wollard, Inc. will assist in administering all such warranties, with the exception of tires, battery, and other expendable parts, for which the owner will be required to deal directly with the original manufacturer for warranty service. Neither tune-ups, normal maintenance and repair or replacement of expendable parts (such as oil, lubricants, belts, filters, tires, battery, etc.) are covered by this warranty.

This warranty does not cover damage resulting from carelessness or neglect; accidents, fire, or other casualties; improper repair, operation, transportation, or storage; or failure to provide necessary or appropriate maintenance. This warranty does not cover deterioration or failure caused by chemicals, falling objects, dirt and sand, or excessive heat or moisture. The NMC-Wollard, Inc. equipment must be maintained according to the instructions provided with it or this warranty may be considered void. Warranted components must be replaced with parts manufactured or approved by NMC-Wollard, Inc. Warranty determination will be made after NMC-Wollard, Inc. inspects the failed part.

NMC-Wollard, Inc. is not liable for damage or injury resulting from improper installation, use, abuse, inability to use or misapplication of NMC-Wollard, Inc. equipment, nor is NMC-Wollard, Inc. liable for damage resulting from equipment repaired or modified by persons not authorized by NMC-Wollard, Inc. NMC-Wollard, Inc. does not warrant any part or product to meet local, municipal, state, provincial, or national laws or regulations.

This Limited Warranty is in lieu of all other warranties, whether express, implied, or statutory. No other express warranty is given or authorized by NMC-Wollard, Inc. NMC-Wollard, Inc. expressly disclaims any implied warranty of merchantability or fitness for a particular purpose or otherwise. NMC-Wollard, Inc. shall not be liable for loss of use of equipment, loss of time, loss of business, or for any other incidental, or consequential damages. No authorized NMC-Wollard, Inc. representative has the right to change or modify this warranty in any respect.

This warranty is non-transferable.

TO OBTAIN WARRANTY SERVICE

Warranty can be obtained by contacting NMC-Wollard, Inc., 2021 Truax Blvd., Eau Claire, WI. 54702, (Phone 715 835-3151) (Fax 715 835-6625).

What should you do when you receive a new unit?

Check that you have received all the equipment ordered. Check inside the product manual for engine warranties. Some OEM manufacturers supply a registration card that must be filled out and returned immediately to initiate the warranty. If a survey card or delivery checklist is enclosed from NMC-Wollard, Inc. please return it.

What should you do when you discover a possible warranty problem?

Call NMC-Wollard, Inc. (715-835-3151). We will require the serial number, number of hours on the unit, and a description of the problem. You will be given a warranty authorization number and assistance in troubleshooting.

IMPORTANT!

Clear and immediate communication with the factory is the key to obtaining a satisfactory and timely resolution of your warranty problem.

Every warranty situation is different and so there are no hard rules. We will work with your maintenance personnel and service managers to equitably resolve all claims.

What should you do after warranty problem has been resolved?

Complete and return the warranty claim form within 10 days. Place the assigned warranty authorization number we gave you when you first called us with the problem on your claim.

Return defective parts immediately. Your claim cannot be processed until all defective parts have been returned to NMC-Wollard, Inc. Identify returned parts with the assigned warranty authorization number.

What should you use for labor rate and labor time?

Labor rate are reviewed annually, if you do not have an established rate, call NMC-Wollard, Inc. We do not publish a rate book; instead, we have accumulated average times for repairs. We will authorize repair time once we have approved the repair. If unforeseen circumstances cause a significantly greater repair time than originally approved, please contact us before submitting your claim.

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GENERAL SAFETY PRECAUTIONS

IMPORTANT!

There are numerous variations in procedures, techniques, tools, and parts for servicing the tractor, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who does not follow the instructions provided in this manual must first make sure that they do not endanger their personal safety or tractor integrity by their choice of methods, tools, or parts.

This manual describes processes which might require the use of chemicals, solvents, paints, or other commercially available material. Users of this manual should obtain the material safety data sheets (OSHA Form 20 or equivalent) from the manufacturers or suppliers of any materials to be used.

Know and follow the instructions provided by the manufacturer/supplier for the safe handling, use, storage, and disposal of these materials.

Prior to starting any task, first read the WARNINGS or CAUTIONS included in the text for that task.

INSTRUCTIONS FOR OPERATORS

Safety is your business. Obey the rules of the road, be alert at all times, operate the vehicle defensively, stop at all intersections, be aware of all clearances, and obey special safety regulations.

1. When approaching other traffic, slow down, sound horn, and if vision is obstructed, keep right. Under all conditions, with a load or without, operate at a speed that will permit you to come to a stop safely.
2. Use special care when operating on inclines. Travel slowly and do not angle or turn.
3. Do not operate on excessive grades.
4. Tow the tractor only with the drive shafts disconnected. Failure to do so will damage the transmission.
5. Maintain a safe distance from the edge of ramps and platforms.
6. Observe all traffic regulations including speed limits.
7. Under normal traffic conditions, keep to the right.
8. Maintain a safe distance from the vehicle ahead and always keep the tractor under control.
9. Conform to local traffic regulations when operating on public roads.
10. Never allow anyone to ride on the tractor with you except in the passenger seat.

11. Avoid abrupt moves. Be a professional driver and **HANDLE WITH CARE**.
12. When towing loads, take extra care in securing and transporting the load.
13. Watch out for obstructions. Check overhead clearances.
14. If the tractor has to be parked on an incline, set the parking brake and chock the wheels.
15. Report accidents involving persons, building structures, and equipment to the proper authority.

INSTRUCTIONS FOR MAINTENANCE PERSONNEL

1. Before attempting to repair the tractor, read and understand the maintenance procedures.
2. Only qualified and authorized persons should be permitted to maintain, repair, adjust, and inspect the tractor.
3. Properly vent the work area.
4. Avoid fire hazards and have fire protection equipment present. Do not use open pans of fuel or flammable fluids for cleaning parts.
5. Brakes, steering mechanisms, warning devices, lights, safety guards, etc., should be inspected regularly and maintained in a safe operating condition.
6. Keep the tractor clean to lessen fire hazards and allow loose or defective parts to be better seen.
7. Before working on the tractor, make sure jacks and jack stands have a lifting capacity of at least 10,000 lbs.
8. Prevent water from entering into internal tractor parts. Before cleaning, be sure all openings are closed or covered.
9. Sparks or open flames in the maintenance area are dangerous. Explosive vapor can easily escape from a vehicle into the work area.
10. Never add engine oil from a jug or a bottle. The chance of contamination is too great. Use oil from a sealed container.
11. Keep unnecessary personnel away from tractor while it is running.
12. Only one person must control the engine.
13. Operate engine only from the driver's seat.
14. Properly disposal of all used fluids. If you do not know the proper disposal procedures, read the labels or ask your supervisor.

PRODUCT SAFETY

A brief description of signal words that may be used in this manual:

⚠ DANGER

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

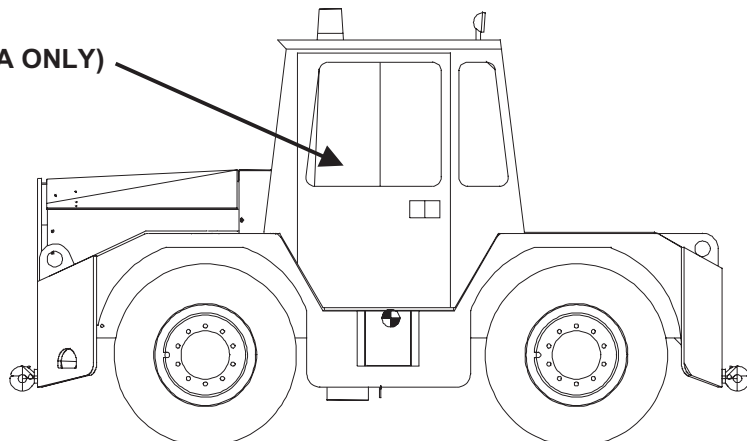
⚠ WARNING

Indicates a potentially hazardous situation that, if not avoided could result in death or serious injury, and indicates hazards that are exposed when guards are removed.

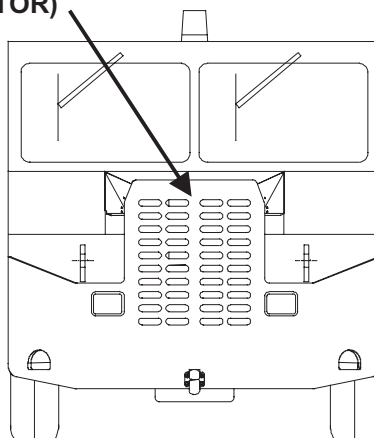
⚠ CAUTION

Indicates a potentially hazardous situation that, if not avoided may result in minor or moderate injury.

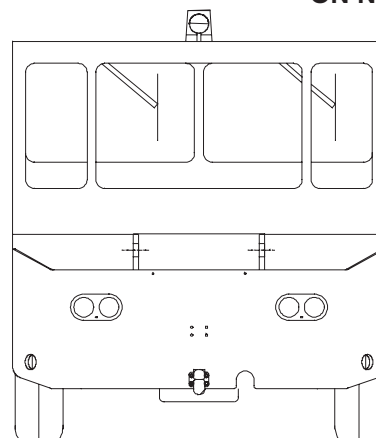
B,C (CALIFORNIA ONLY)



D (ON RADIATOR)



(SEE SAFETY DECALS
ON NEXT PAGE)



⚠ CAUTION Read all safety signs on the machine and in this manual. Replace any lost or damaged signs by ordering the part numbers shown on the safety decals page.

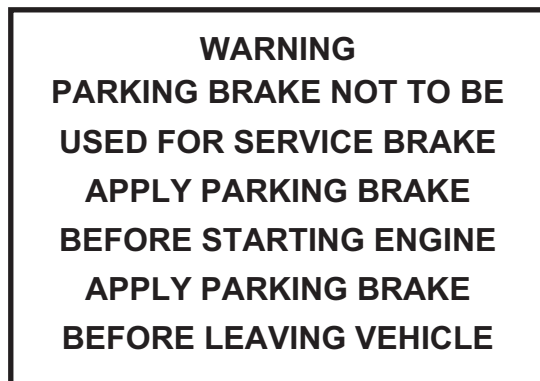
SAFETY DECALS

SAFETY SIGN CARE

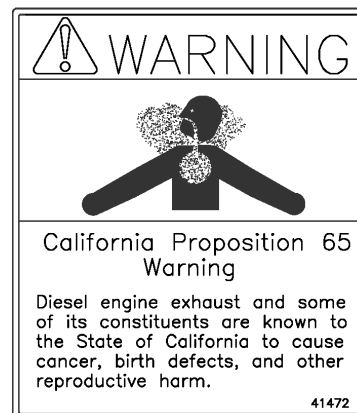
- Keep Safety Signs Clean And Legible At All Times.
- Replace Safety Signs That Are Missing Or Have Become Illegible.
- Replaced Parts That Displayed A Safety Sign Should Also Display The Current Sign.
- Safety Signs Are Available From Your Dealer.
-

HOW TO INSTALL SAFETY SIGNS

- Be Sure That The Installation Area Is Clean And Dry.
- Remove The Smallest Portion Of The Split Backing Paper.
- Align The Decal Over The Specified Area And Carefully Press The Small Portion With The Exposed Adhesive Backing In Place.
- Remove Second Backing And Press Remaining Decal In Place.



DECAL B. PART NO. NW17237



DECAL C. PART NO. 41472



DECAL D. PART NO. 1018145

1 INTRODUCTION AND DESCRIPTION OF TRACTOR

Chapter 1 TOC

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1.1 PURPOSE OF THIS MANUAL

This manual is meant to provide the information necessary to operate, maintain, and repair the aircraft towing tractor ("tractor"), model number 200, manufactured by **NMC-Wollard, Inc., Eau Claire, WI 54702, phone 715-835-3151.**

1.2 ARRANGEMENT OF THIS MANUAL

This manual is divided into Sections. Sections 1 through 9 are the introduction, specification, preventive maintenance, operation, and repair sections.

Section 10 is the Illustrated Parts Breakdown (IPB). The IPB shows all parts and part numbers necessary for support of the tractor. The IPB can be used for requisitioning and identifying parts. It is arranged in alphabetical order.

1.3 DESCRIPTION OF THE TRACTOR

The tractor is designed for towing loads weighing up to 160,000 lbs. Towing couplers are on the front and rear of the tractor.

The four-wheel-drive tractor operates like most automotive vehicles powered by an internal combustion engine. The major difference between this tractor and an automobile having a similar size engine is the higher gear ratio in the rear axle. The higher gear ratio allows great pulling (towing) ability.

1.3.1 Frame

Heavy-duty precision aligned, 1-piece structure. Main frame plates are 1.25" thick. Side panels and fenders are .75" thick. Front and rear bumpers are 1.00" thick.

1.3.2 Engine for Tractor w/Hydraulic Brakes

Cummins 6BT5.9, 6 Cylinder, 5.9 Liter, 152 BPH @ 2200 rpm, Torque 414 ft. lbs. @ 1200 rpm.

1.3.3 Engine for Tractor w/Air Brakes

Cummins 6BT5.9, 6 Cylinder, 5.9 Liter, 148 BPH @ 2200 rpm, Torque 440 ft. lbs. @ 1600 rpm.

1.3.4 Cooling System

40 quart coolant capacity for engine-radiator system. Radiator insulated from vibration.

1.3.5 Transmission

Standard Funk 2000 Power Shift automatic with 6 speed forward and 3 reverse, full time four wheel drive (4x4), canister type oil filter, separate transmission fluid cooler, gear-driven pump for power steering and brakes. Integral no-spin differential allows front and rear axles to rotate independently-prevents drive line windup and stress. No spin feature joins axles together for maximum tractive effort if wheel slippage occurs.

Forward and reverse speed ranges are obtained through the use of hydraulically actuated multiple disc clutches. these clutches are power absorbing members that can be engaged at full engine power. Shifting under full engine power makes this model a full power shift for the forward and reverse motion in all four speeds.

The clutches in this unit are hydraulically applied and spring released. Because wear, which eliminates the need for adjustment. Each clutch uses eleven semi metallic friction plates, and eleven polished steel

reaction plates, except for the high gear clutch that uses eight of each plate.

The power from the engine is transmitted to the Shift-O-Matic through a torque converter. The use of the torque converter has two distinct advantages, one is the converter is essentially a fluid drive, there being no direct mechanical connection through it. This feature creates a very smooth and shock free drive eliminating engine stalling and lugging. A second advantage is that the converter transmits the engine power directly at almost engine speed, and there is no torque multiplication. The net result is an action like a transmission, with infinitely variable and automatic speed ratios. The need for shifting gears, although present, is greatly reduced.

1.3.6 Lubrication System

An oil pump draws oil through a strainer in the oil pan and circulates the oil through the engine. Before entering the engine, all the oil from the pump passes through the oil filter. Surplus oil drains back into the pan. Engine oil pressure is maintained by a spring-loaded pressure-relief valve in the oil pump.

The screw-on oil filter has an internal relief valve to bypass the filter if the element becomes clogged.

Engine oil flows through the oil cooler cavity to be cooled by coolant which flows through plates inside the oil cooler.

1.3.7 Fuel System

The lift pump draws fuel from the fuel tank through a pre-filter, and delivers it to the water separator and fuel filter. The fuel exits the fuel filter and flows to the four injectors.

1.3.8 Fuel Capacity

20.7 gallon; 78.3 liters.

1.3.9 Air Cleaner

The air cleaner is a dry element type and is located on the right front fender. It prevents dirt and other foreign materials from entering the engine.

1.3.10 Exhaust System

The exhaust system consists of an exhaust manifold, catalytic converter, exhaust pipe, muffler and tail pipe. The exhaust manifold has large radius curves which permit exhaust gases to leave the cylinders with a minimum of back pressure and power loss. All parts of the exhaust system are well supported with clamps and hangers.

1.3.11 Corrosion Proofing

All frame and body surfaces are shot blasted, primed and painted with weather resistant paint. Standard bolts are SAE grade 5, zinc-phosphate coated to resist corrosion.

1.3.12 Tires

Front and rear tires are 10.00 x 20 16 ply rated, load range H.

1.3.13 Electrical System

1000 CCA battery and 95 amp alternator with internal regulator. Has starter lock out switch (prevents started and ring gear damage when engine is running). Tractor starts only in neutral. All circuits protected with circuit breakers.

1.3.13.1 Battery

The battery is a conventional 12-volt type with a positive cable and a negative ground cable. The cables have protective boots at the battery end.

1.3.13.2 Alternator

Electrical power is supplied by a belt-driven alternator mounted on the front of the engine. It produces three-phase alternating current and voltage, rectified to DC by a full-wave rectifier bridge using six diodes. The alternator does not require a cutout relay.

1.3.13.3 Current Regulator

The current regulator is part of the alternator assembly. It determines output current according to load, such as headlights, rear lights, etc.

1.3.13.4 Starter

The starter motor is a gear-reduction type mounted on the automatic transmission housing at the rear of the engine. The starter motor is used to turn the engine fast enough to start the engine.

1.3.13.5 Lights and Accessories

Two head lights are on the front of the tractor. The stop/tail lights and rear backup lights are in the rear body. The backup lights can also be used as work lights (there is a separate switch for this purpose).

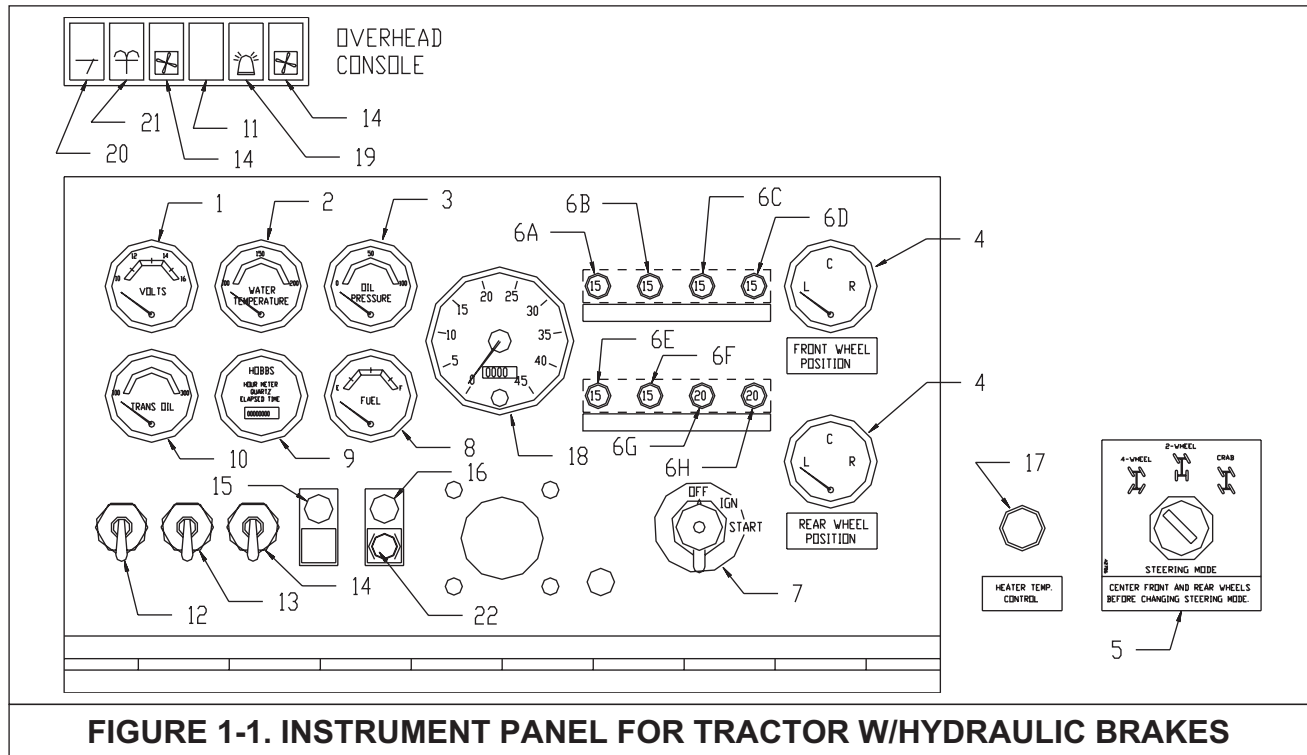


FIGURE 1-1. INSTRUMENT PANEL FOR TRACTOR W/HYDRAULIC BRAKES

1.3.14 Instrument Panel for Tractor w/Hydraulic Brakes

All driver instruments are conveniently located on the instrument panel (see Figure 1-1):

1. Voltmeter
2. Engine Coolant Temperature Gauge
3. Oil Pressure Gauge
4. Axle Direction Indicators
5. Switch, Steering Mode Selector
6. Circuit Breakers
 - 6.a. Instrument Panel, 15a
 - 6.b. Shift/Bk-Up, 15a
 - 6.c. Steering Mode, 15a
 - 6.d. Fuel Filter, 15a
 - 6.e. Tail Light, 15a
 - 6.f. Work/Brake Lights, 15a
 - 6.g. Horn, 20a
 - 6.h. Heater, 20a
7. Ignition Switch
8. Fuel Gauge
9. Hourmeter

10. Transmission Temperature Gauge
11. Blank, Switch
12. Headlight Switch
13. Worklight Switch
14. Switch, Heater
15. High Beam Indicator
16. Brake Warning Indicator
17. Heater Temperature Control
18. Speedometer
19. High Beam Switch
20. Windshield Wiper Switch
21. Windshield Washer Switch
22. Park Brake On

1.3.15 Instrument Panel for Tractor w/Air Brakes

All driver instruments are conveniently located on the instrument panel (see Figure 1-2):

1. Transmission Temperature Gauge

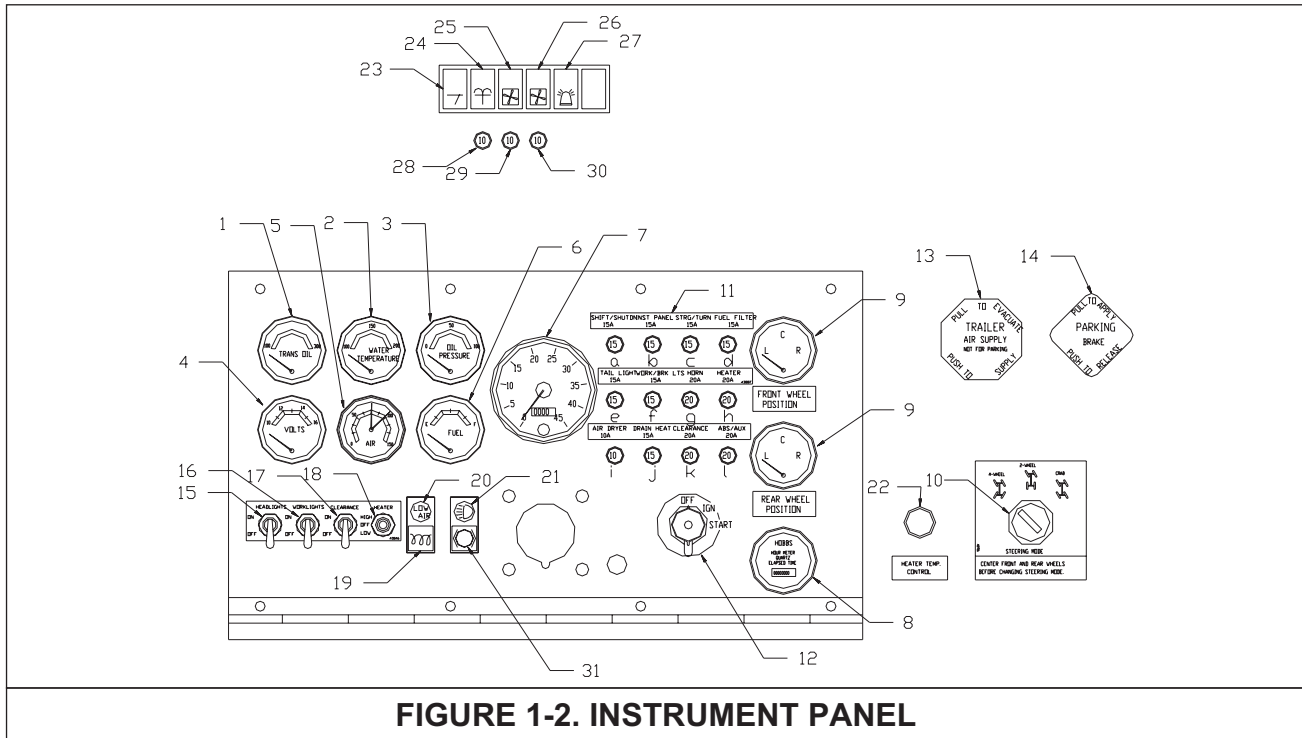


FIGURE 1-2. INSTRUMENT PANEL

- | | |
|-------------------------------------|------------------------------------|
| 2. Engine Coolant Temperature Gauge | 14. Parking Brake |
| 3. Oil Pressure Gauge | 15. Headlight Switch |
| 4. Voltmeter | 16. Worklight Switch |
| 5. Air Pressure Gauge | 17. Trailer Clearance Light Switch |
| 6. Fuel Gauge | 18. Heater Switch |
| 7. Speedometer | 19. Pre-Heat Indicator |
| 8. Hourmeter | 20. Low Air Indicator |
| 9. Axle Direction Indicators | 21. High Beam Indicator |
| 10. Switch, Steering Mode Selector | 22. Heater Temp Control |
| 11. Circuit Breakers | 23. Windshield Wiper Switch |
| 11.a. Shift/Shutdown 15a | 24. Windshield Washer Switch |
| 11.b. Instrument Panel, 15a | 25. Rh Fan Switch |
| 11.c. Steering Mode, 15a | 26. Lh Fan Switch |
| 11.d. Fuel Filter, 15a | 27. Beacon Switch |
| 11.e. Tail Light, 15a | 28. Circuit Breaker 10a Wipers |
| 11.f. Work/Brake Lights, 15a | 29. Circuit Breaker 10a Fans |
| 11.g. Horn, 20a | 30. Circuit Breaker 10a Beacon |
| 11.h. Heater, 20a | 31. Park Brake On |
| 11.i. Air Dryer 10a | |
| 11.j. Drain Heater 15a | |
| 11.k. Clearance Lights 20a | |
| 11.l. Abs/Auxiliary | |
| 12. Ignition Switch | |
| 13. Trailer Air Supply | |

1.3.16 Drive/Steering Axles

Planetary axles, double reduction, heavy-duty bearing mounted differential assembly. Second reduction planetary gears set in wheel hubs multiply torque and reduce drive line stress. Rear axle center pivot mounting allows tractor to negotiate obstructions-axle has 4" oscillation. Front axle solid mounted to tractor frame.

1.3.17 Brake System

Power assisted four wheel service brakes, hydraulic wet disc type. Dual brake system serves front and rear tires independently. Emergency back-up provided should engine fail.

1.3.17.1 Service Brake

The brake pedal is located on the floor, to the right of the steering column. The service brakes, both front and rear, are "wet" disk type, fully enclosed and oil cooled. They will withstand repetitive use without excessive fading, provide short stopping distances, and are spark free.

⚠WARNING Do not use the service brake as a park brake. Leakage could cause the service brake to release.

1.3.17.2 Parking Brake for Tractor w/Hydraulic Brakes

The parking brake (hand brake) is on the operator's right. When pulled, the lever pulls a cable which pulls the brake shoes together against the parking brake drum. The parking brake is attached to the transmission output shaft and is completely mechanical.

1.3.17.3 Parking Brake for Tractor w/Air Brakes

The parking brake is to the right of the control panel. It is yellow and reads System Park. When pulled the air is released from the parking brake chamber and the springs force the brake shoes together against the parking brake disk. Pull to apply, push to release. The parking brake is attached to the transmission.

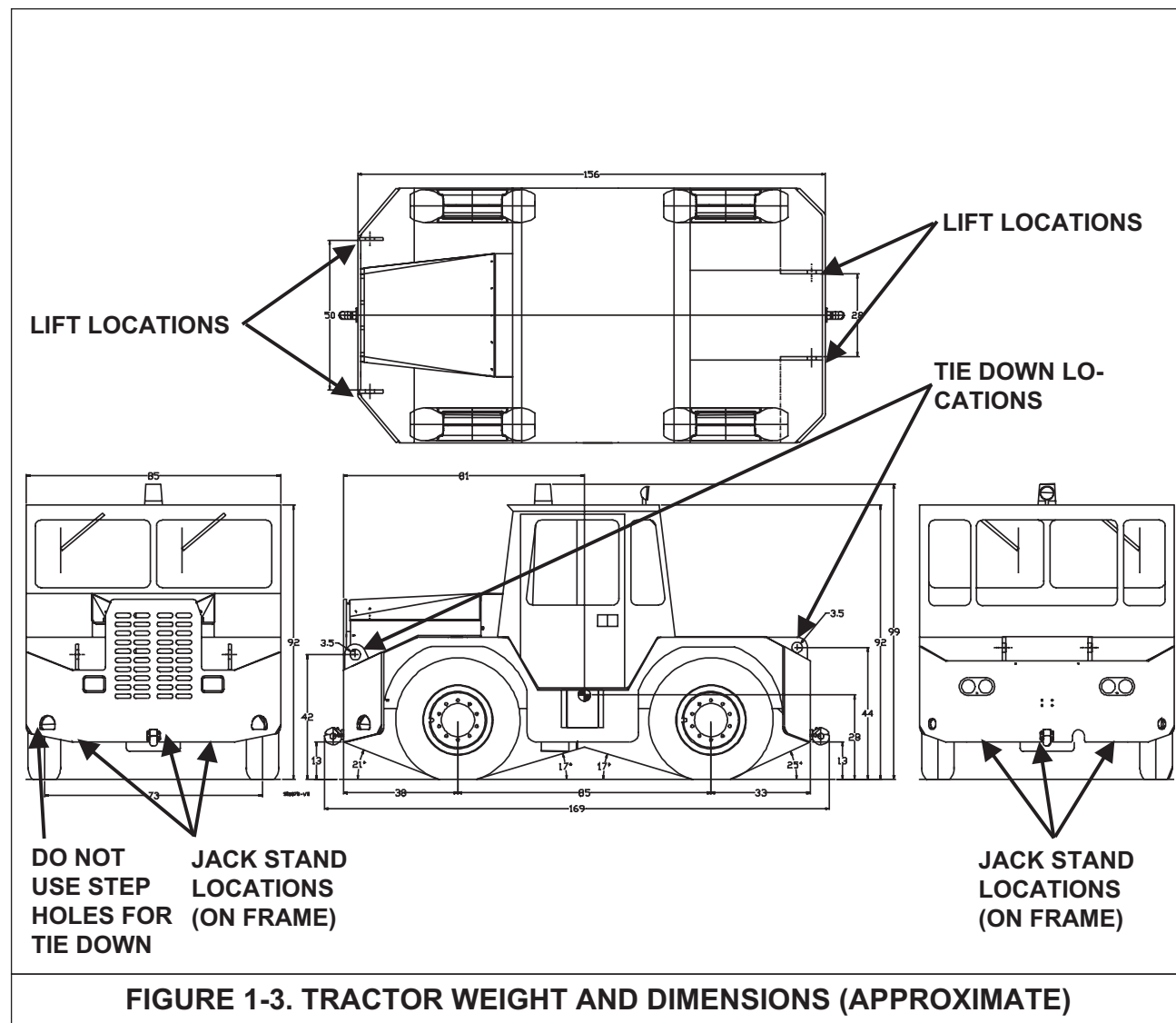
1.3.17.4 Parking Brake Shutdown

An indicator light on the dash will come on when the parking brake is applied. See figure 1-1 or 1-2. Release the parking brake before shifting from neutral. If the shift selector is moved from neutral while the parking brake is applied, the engine will shut down.

1.3.18 Steering System

Full Power hydraulic driver select 4-wheel coordinated, 4-wheel crab, or front 2-wheel steer. Emergency back-up provided should engine fail.

IMPORTANT! Before switching steering modes, turn the steering wheel to align both axles straight ahead. Do this to maintain synchronization of the axles, i.e., do not lock the rear axle in a skewed position.



⚠ WARNING

Make sure jack and jack stands have the capacity for the weight of the tractor.

Jacks may be used at the hitches or on any point on the bottom edge of frame on which hitches are mounted.

1.3.19 Bolt Tightening Data

The following data is excerpted from SAE Report J1701, March, 1999. The complete report is available from SAE at www.sae.org. It contains detailed information about variables for torque management to achieve correct fastener joint tightening. This is an advisory guide and responsibility for its application lies with the user. Individual application discretion is recommended.

INCH SERIES TIGHTENING TORQUE, FT-LB						
Bolt Size	Grade 2 Dry	Grade 2 Lubed	Grade 5 Dry	Grade 5 Lubed	Grade 8 Dry	Grade 8 Lubed
0.250-28	7	5	10	8	14	11
0.250-20	6	5	9	7	12	9
0.3125-24	13	10	20	15	28	21
0.3125-18	12	9	18	14	25	19
0.375-24	23	17	35	27	50	38
0.375-16	20	15	31	24	44	33
0.4375-20	36	27	56	42	78	59
0.4375-14	32	24	50	38	70	53
0.500-20	55	42	85	64	120	90
0.500-13	49	37	76	32	107	80
0.5625-18	78	59	121	91	171	128
0.5625-12	70	53	109	82	154	115
0.625-18	110	82	170	127	240	180
0.625-11	97	73	150	113	212	159
0.750-16	192	144	297	223	420	315
0.750-10	172	129	269	201	376	282
1.000-12	-	-	704	528	995	746
1.000-8	-	-	644	483	909	681

METRIC TIGHTENING TORQUE, N-m						
Bolt Size	Class 8.8 Dry	Class 8.8 Lubed	Class 9.8 Dry	Class 9.8 Lubed	Class 10.9 Dry	Class 10.9 Lubed
8.0 x 1.25	26.40	19.80	28.50	21.40	36.50	27.30
10.0 x 1.50	52.20	39.20	56.60	42.40	72.20	54.20
12.0 x 1.75	91.00	68.00	99.00	74.00	126.00	94.00
14.0 x 2.00	145.00	109.00	157.00	118.00	200.00	150.00
16.0 x 2.00	226.00	170.00	245.00	184.00	313.00	235.00
20.0 x 2.50	441.00	331.00	478.00	358.00	610.00	458.00
24.0 x 3.00	762.00	572.00	826.00	620.00	1055.00	791.00
30.0 x 3.50	1515.00	1136.00	1641.00	1231.00	2095.00	1572.00
36.0 x 4.00	2647.00	1985.00	2868.00	2151.00	3662.00	2746.00

37° TUBE FITTINGS & PIPE FITTINGS						
Dash #	37° Swivel Nut	37° Jic Flats from Finger Tight	O-Ring Lock Nut Ft.-lbs.	Pipe Dia. (Inch)	NPT Ft.-lbs.	NPT Turns from Finger Tight
-04	10	2	8	1/4	25	2 ½
-06	20	1 1/4	13	3/8	40	2 ½
-08	40	1	21	½	54	2 ½
-10	60	1	33	-	-	2 ½
-12	80	1	48	3/4	78	2 ½
-16	110	1	63	1	112	2 ½
-20	130	1	-	1 1/4	154	2 ½
-24	160	1	-	1 1/2	211	2 ½
-32	250	1	-	2	300	2 ½

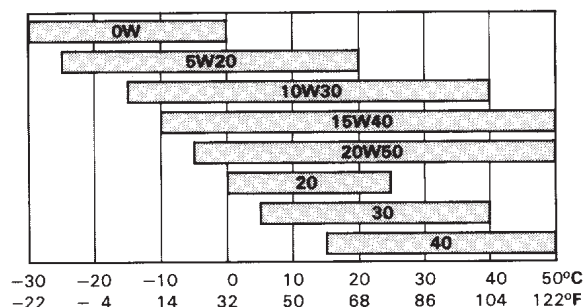
Torque Conversion: Ft-Lbs = 0.7376xN-m N-m = 1.356xFt-Lbs

NOTE: Do not use these values if a different torque value is given for a specific procedure.

1.3.20 Fluid specifications

Oil

Specification API CD/SE CCMC D4



AMBIENT TEMPERATURE

Transmission

See Section 5.

Axle

SAE 85 W90 API GL5-MIL 2105-B

Center Housing, 12 qts. (11.3L)

Reduction Housing, 1.8 qts.(1.75L)Each

End

Hydraulic System

Mineral oil only, ATF Dextron III

1.3.21 Schematics And Diagrams

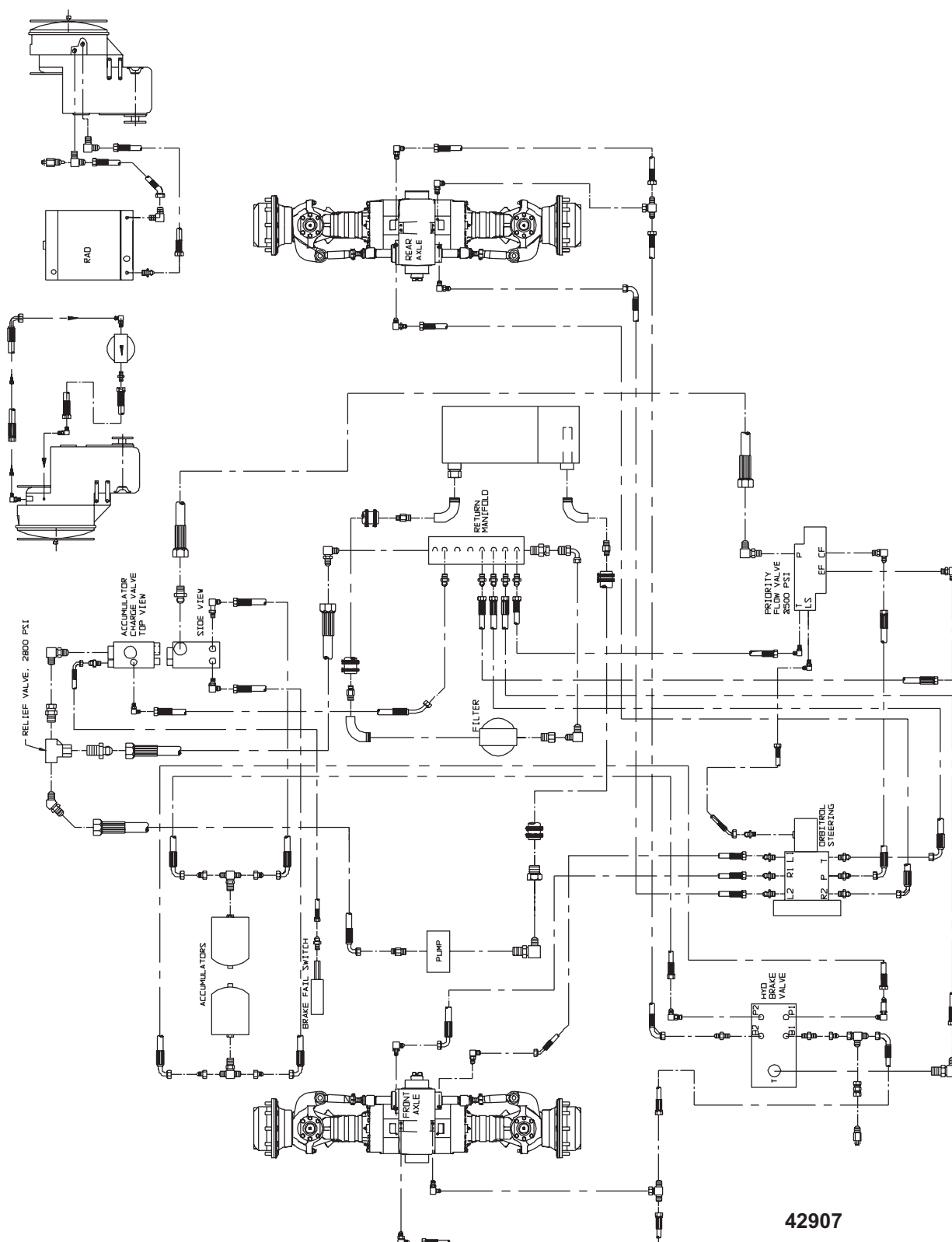


FIGURE 1-4. HYDRAULIC DIAGRAM, CUMMINS W/HYDRAULIC BRAKES

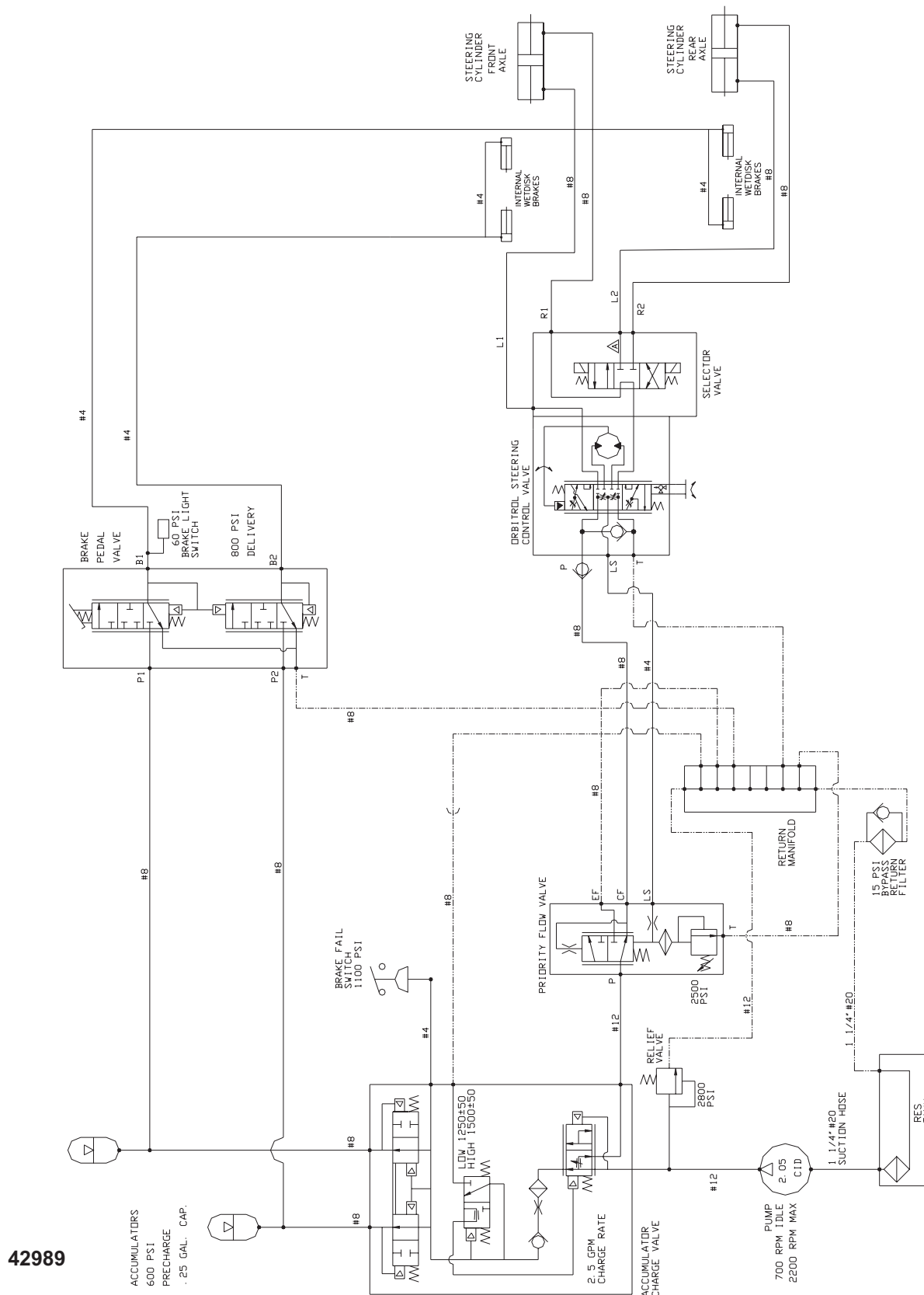
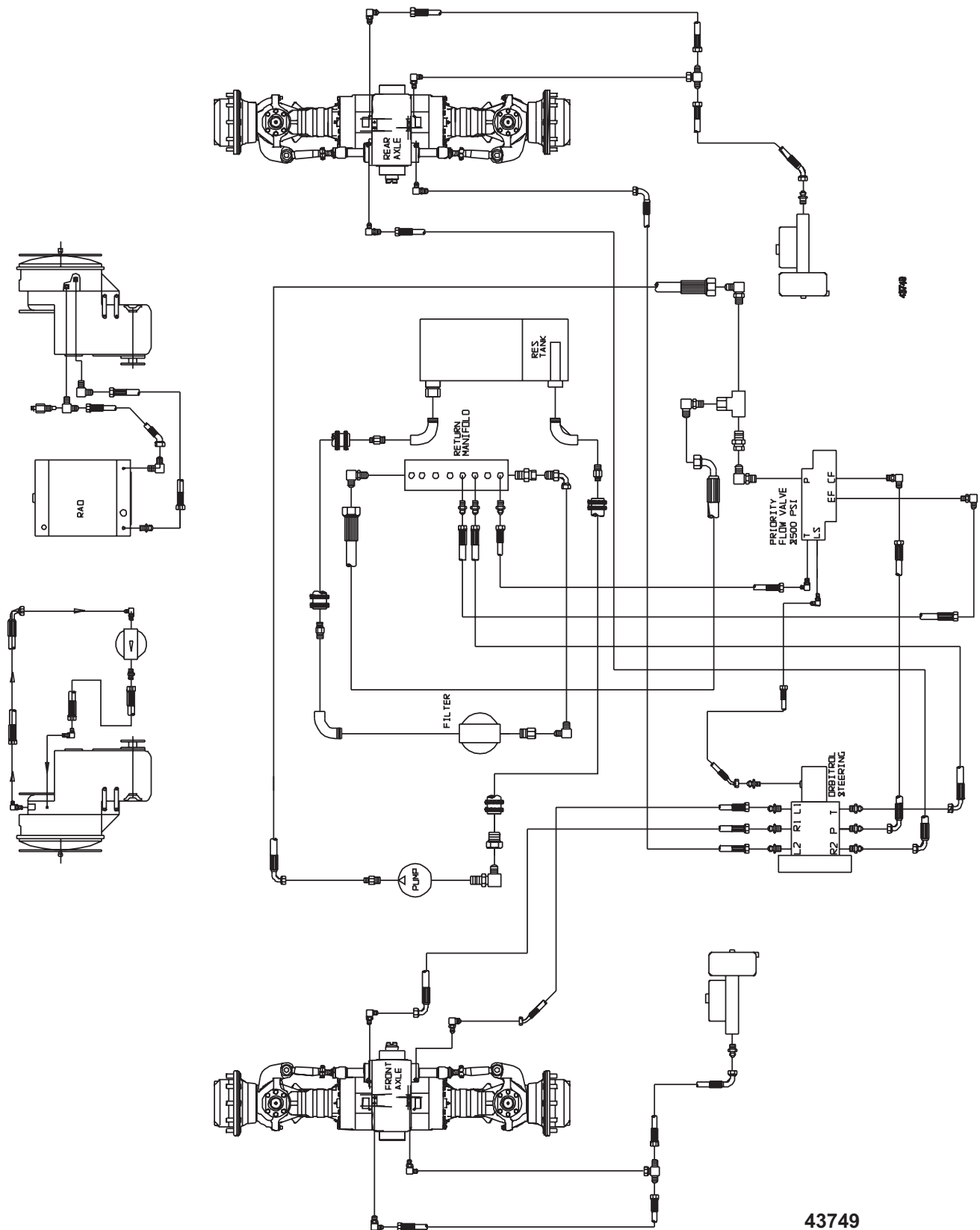
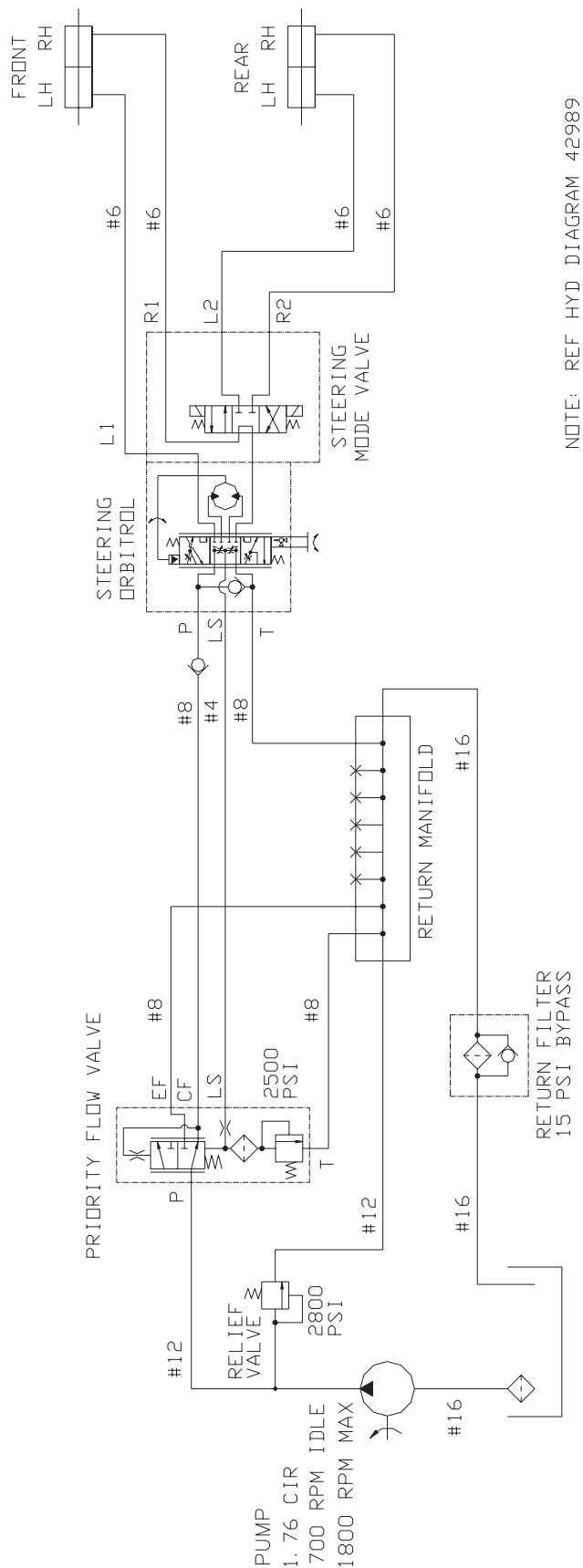


FIGURE 1-5. HYDRAULIC SCHEMATIC, CUMMINS W/HYDRAULIC BRAKES



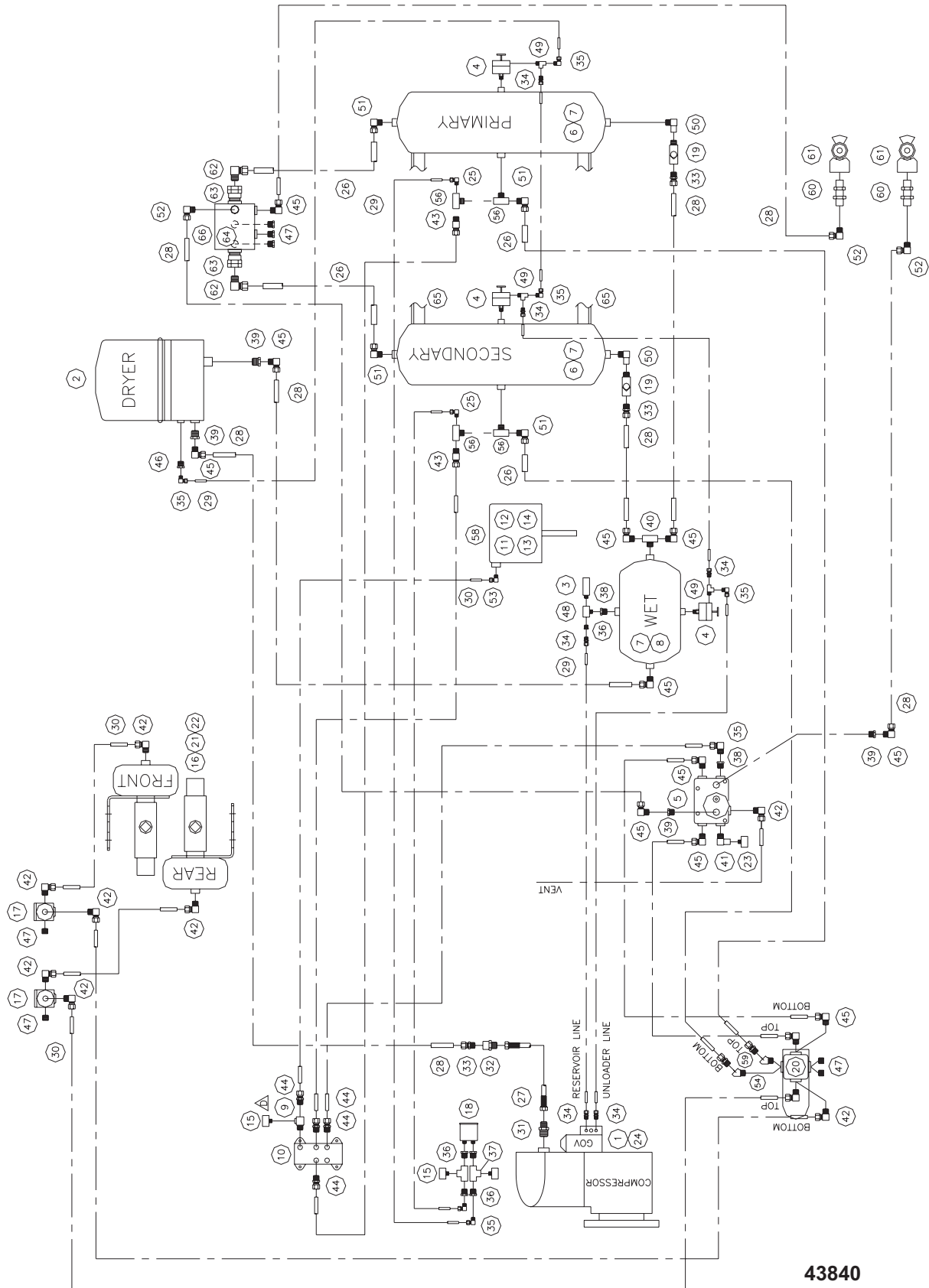
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FIGURE 6. HYDRAULIC DIAGRAM, CUMMINS W/AIR BRAKES



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FIGURE 7. HYDRAULIC SCHEMATIC, CUMMINS W/AIR BRAKES



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FIGURE 8. AIR DIAGRAM

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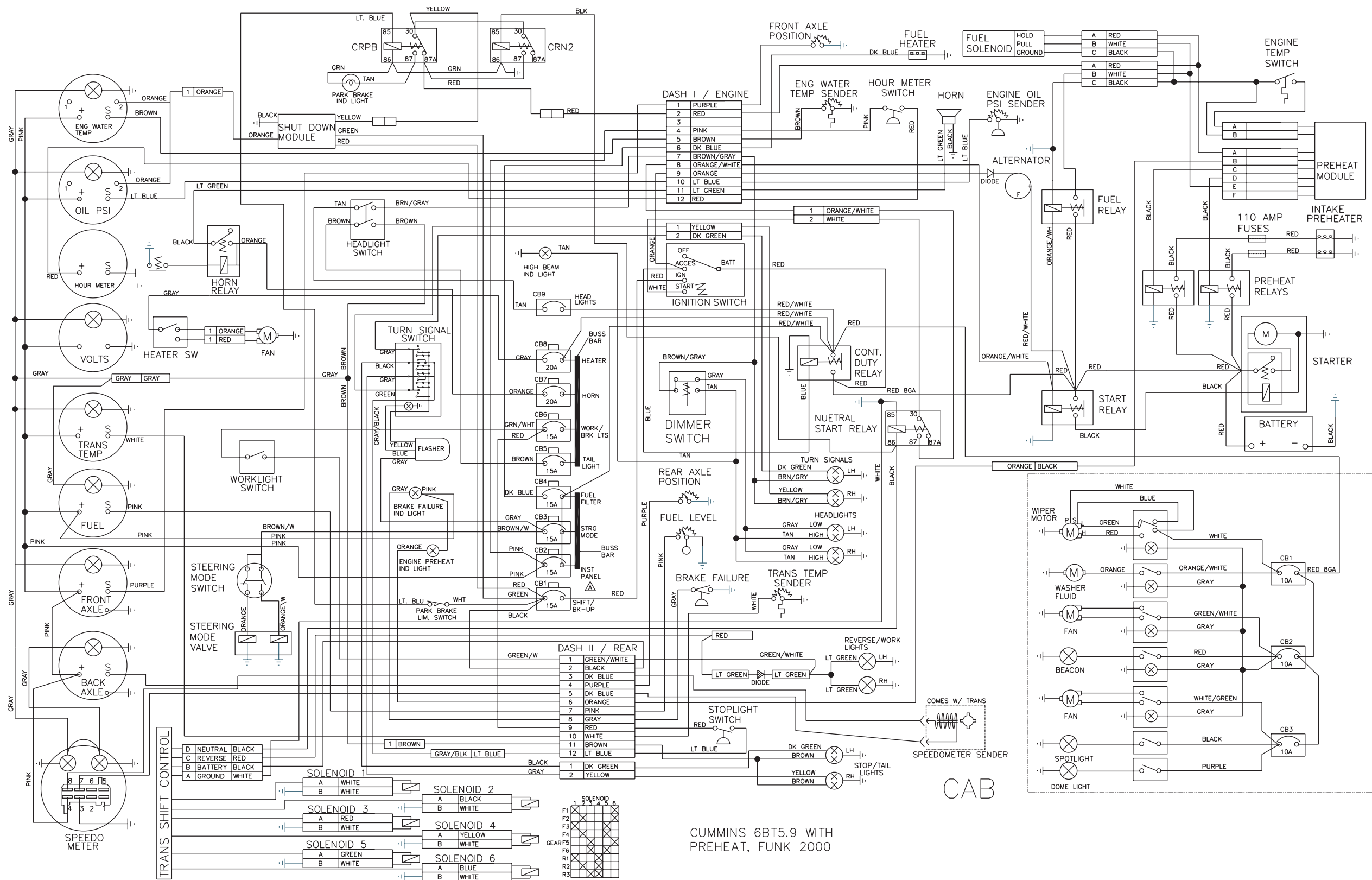


FIGURE 9. ELECTRICAL SCHEMATIC, CUMMINS DIESEL 6BT5.9 FOR TRACTOR W/HYDRAULIC BRAKES

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FIGURE 10. ELECTRICAL SCHEMATIC, CUMMINS 6BT5.9 W/PREHEAT, FUNK 2000, 200MB4-1 W/AIR BRAKES

2 OPERATION

Chapter 2 TOC

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2.1 CHECK TRACTOR BEFORE OPERATING

Inspect the tractor for shipping damage. A thorough visual examination will usually reveal any damage that may have occurred in transit. Report damage to the proper authorities so that repairs and claims may be made.

The tractor is shipped with all fluids except fuel. As a precaution, however, check all fluid levels, brakes, electrical system, engine, steering, axles, and transmission as described in Section 3 and perform the prescribed lubrication.

2.2 CONTROLS AND INSTRUMENTS

Before driving the tractor, become familiar with all operating controls and instruments as described below. Then drive the tractor without a tow load until you can handle the vehicle properly.

2.2.1 Operator's Controls

1. The **ignition switch** is a rotary type marked O (off), IGN (ignition), and START.
2. The **head and tail light** rocker switch controls the two sealed beam headlights and the tail lights.
3. The **rear work light** rocker switch controls the rear work lights.
4. The **gear shift lever** is on the driver's right. It permits selection of forward or reverse gears and a neutral position.

IMPORTANT: If the shift lever is moved from the neutral position with the parking brake applied, the engine will shut down.

5. The **accelerator pedal** is to the right of the brake pedal and is connected by mechanical linkage to the carburetor.

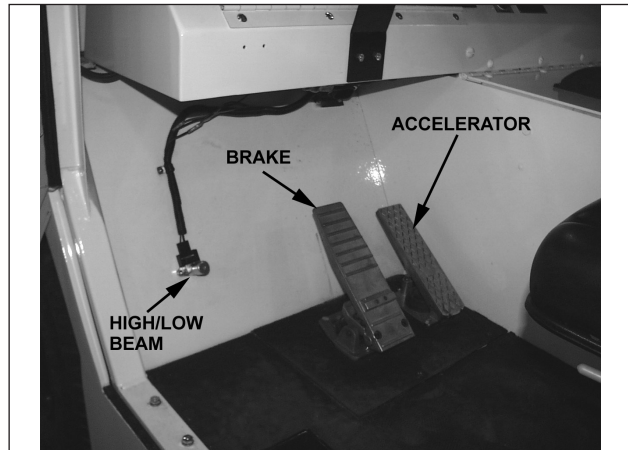


FIGURE 2-1. FOOT CONTROLS

6. The **service brake pedal** is to the left of the accelerator pedal. Pushing this pedal also applies air brakes to a trailer if so equipped. Hydraulic brakes have accumulators which store energy and allows several brake applications after the engine is off.



FIGURE 2-2. HYDRAULIC PARKING BRAKE LEVER

7. The **park brake lever (for Tractor w/Hydraulic Brake)** is on the dash to the right of the driver. It must

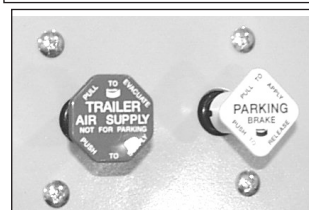


FIGURE 2-3. AIR PARKING BRAKE

be pushed forward to disengage the park brake. See Section 8.9 for adjustments.

The **park/emergency brake button (for Tractor w/Air Brake)** is to the right of the instrument panel. It must be pushed in to disengage the park brake. Pull out to engage. See figure 2-3.

The **trailer park brake air supply button** is to the left of the park/emergency brake button. It must be pushed in to supply air to the trailer service brakes after trailer brake lines are connected to the tractor. The trailer park/emergency brakes cannot be released unless this button is pushed in. See figure 2-3. Pull this button out before disconnecting trailer couplings. (Note that when trailer brake lines are not connected to the tractor air couplers, this button will automatically pop out to prevent escaping air at the open couplers.)

NOTE: Park/Emergency brakes are applied when air is released, and disengaged by application of air.

2.2.2 Warning Lights for Tractor w/Hydraulic Brakes

The “brake failure” light operates if either the front or rear brake systems lose hydraulic pressure.

The “high-beam” warning light is activated when the high-beams are on. A foot switch toggles “high-beam”.

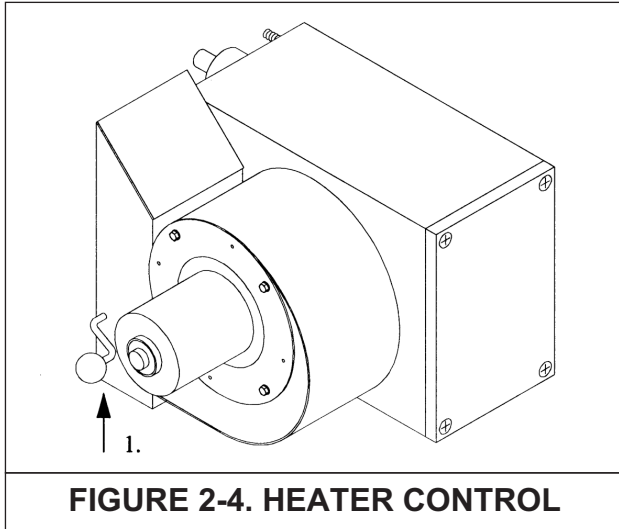
2.2.3 Warning Lights for Tractors w/Air Brakes

The “low air pressure” warning light and buzzer comes on when air pressure in either tank drops below 60 psi.

The “high-beam” warning light is activated when the high-beams are on. A foot switch toggles “high-beam”.

2.2.4 Instruments

1. The engine **hourmeter** registers how many hours the engine has operated. It is sealed and can record 99999.9 hours before it returns to zero.
2. The **fuel gauge** shows the amount of fuel in the fuel tank. A sending unit in the tank is connected to the gauge. The gauge is marked **E** and **F** to indicate the relative quantity of fuel in the tank. Keep the needle in the green part of the gauge.
3. The **oil pressure gauge** indicates oil pressure only (not oil level). It is marked 6 to 100 with intermediate index marks. If the gauge registers in the red area, stop the engine and troubleshoot the cause.
4. The **voltmeter** registers voltage across the battery terminals. The needle should be in the green area while the tractor is operating. If the needle registers in the red while the tractor is operating, this indicates that the battery is not being charged by the alternator. Stop the tractor and inspect the battery, cables, and alternator connections.
5. The **coolant temperature gauge** shows the coolant temperature in the engine’s water jacket. The gauge needle should rise when the engine is started, then level out at between 160 and 200 as the engine warms up. If the needle goes into the red, stop the engine and check for a cooling system problem.
6. The **transmission oil temperature gauge** shows the temperature of the transmission fluid. Normal operating temperature is in the 120°F to 280°F range. If the needle goes into the red, stop the engine and troubleshoot the cause.
7. The dual air pressure gauge (on the tractor w/air brakes) has two needles that registers both the air pressure in the primary air tank and the secondary air tank.



2.2.5 Heater Operation

1. Change lever position to direct air from windshield to cab.
2. Pull heater temperature knob on dash to increase air temperature.

2.3 STARTING THE ENGINE

Several things affect engine start, such as battery power, starter motor performance, and oil viscosity.

The Shift-O-Matic should always be in the neutral position before starting the engine, or when the vehicle is parked and the engine is running.

Starting a cold engine:

⚠ WARNING Do not use ether. Engine equipped with electric heater starting and ether may cause explosion and serious injury.

1. Turn the start key to the “IGN” position and keep it there for 15 seconds.
2. Adjust the engine speed control to the maximum speed position.

3. Turn the start key to the “START” position in order to engage the starter motor. Allow the start key to return to the “IGN” position, when the engine starts. Then adjust the engine speed control to give an even idle speed.
4. If the engine does not start in 15 seconds, turn the start key to the “IGN” position and hold it there for 10 seconds. Then engage the starter motor again.
5. Observe instruments to be sure each is working. Do not operate engine if oil pressure fails to rise or if voltmeter does not show any charge.

Starting a warm engine:

1. Adjust the engine speed control to the quarter open position.
2. Turn the start key to the “START” position to engage the starter motor.
3. Allow the start key to return to the “IGN” position, as soon as the engine starts.
4. Always ensure that the engine and starter motor are stationary before the starter motor is engaged again.

2.4 HARD STARTING

If the tractor fails to start in the normal way, the engine probably needs service.

NOTE: The tractor cannot be started by towing or pushing.

⚠ CAUTION When using a battery booster, observe proper polarity or you may damage the electrical system and battery.

A worn out or badly sulfated battery will produce numerous problems that cannot be corrected until the battery is replaced.

Always check battery condition and connections before condemning other tractor systems.

2.4.1 Jump Starting The Tractor

Cold weather reduces battery efficiency. For example, at 32°F, battery capacity is reduced to 65%, and at 0°F, capacity is reduced to 40%.

A 12-volt booster battery can be connected in parallel with battery on the tractor to aid in cold weather starting. Heavy duty jumper cables will supply significantly more current than cheap cables.

⚠WARNING Battery gas can explode. Keep sparks and flames away from batteries. Always remove black (negative) battery clamp first and replace it last. Never let cable ends touch.

1. To jump start a tractor using another vehicle, make sure the two vehicles are not touching each other.
Wear protective glasses, and **do not lean over battery when making connections.**

2. Loosen vent caps from BOTH batteries, if present.
In very cold weather, check for frozen electrolyte or no visible electrolyte. If either condition exists, warm the battery until it reaches a temperature of at least 40°F before attaching booster. This will reduce chance of battery rupture or explosion.

NOTE: Charging vehicle should not be running.

Connect the POSITIVE jumper cable clamps to the POSITIVE posts of the two

batteries. Then connect the NEGATIVE jumper clamp to the good battery. Finally, place the other NEGATIVE jumper clamp on a solid unpainted metal bolt or bracket located on the disabled machine.

⚠WARNING Do not make the connection at the discharged battery because a spark is caused when attaching the clamp.

Start vehicle having the good battery, then crank starter of disabled vehicle. Do not over-crank.

Remove jumper cables in order applied.

2.5 DRIVING THE TRACTOR

When the engine is warmed up, the tractor is ready for work. Use lights as required.

Release the tractor and trailer (if towing a trailer) parking brake and apply foot brake.

1. You can start out in any gear depending on load pulled and speed desired. If you pick a gear that is too high the engine may lug or stall.

The following performance characteristics are provided to aid in your particular application. Safety issues should be considered. Some trial and error may be advised. Each operator will get used to this transmission and learn to pick the appropriate gear and when to shift.

Gear	Approximate Drawbar Pull (LBS)	MPH
F1	16000	2
F2	11000	3
F3	9000	3.5
F4	6000	5
F5	4125	7.25
F6	2200	13

NOTE: Position wheels straight ahead before selecting steering mode.

2. Position selector valve lever, located to the right of the shift control to select desired steering mode. See figure 2-5.
3. Release the foot brake and depress the accelerator pedal slowly and evenly. As the tractor starts to move and increase speed, move the transmission lever up through the gears as engine rpm's increase. Do not over-rev or lug down the engine.
4. When towing, allow tractor to decelerate by releasing accelerator pedal before applying foot brake. It may be necessary to use the trailer hand brake in some cases. Apply the hand trailer brake only when conditions warrant.

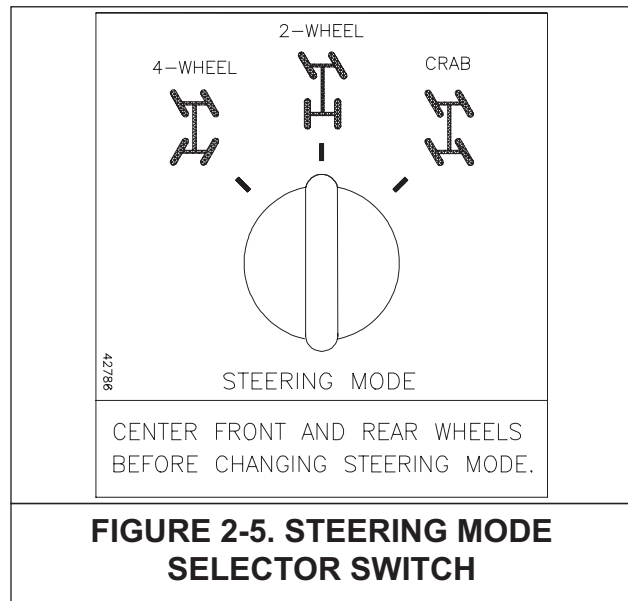
⚠ CAUTION Secure the towing pintle before moving the load.

When driving or towing, avoid the tendency to oversteer and turn too sharply. Allow enough clearance for the towed load.

2.6 STEERING MODE SELECTION & OPERATION

NOTE: Always be sure the wheels are aligned with the tractor before selecting a steering mode.

The operator has a choice of operating in any of the three steering modes. By positioning the selector switch located to the right of the dash panel, he may choose the coordinating mode (COOR) which will automatically steer the rear wheels as he operates the steering wheel. The action of the rear wheels is proportional and opposite of the action of the front wheels to give the shortest turning radius.



NOTE: The front wheels are controlled by the steering wheel in all three modes.

The operator may select to operate the tractor in the two wheel (2W) or front steering mode. THE REAR WHEELS MUST BE TURNED STRAIGHT AHEAD PRIOR TO SELECTING THE TWO WHEEL STEERING MODE. This will insure that the tractor will "track" properly.

The third position of the steering selector valve allows the driver to steer the rear wheels in the same direction as the front wheels (CRAB). This steering mode is used for accurate positioning for trailer hook-up or for crab steering around or away from obstacles.

Before switching steering modes, the driver must check the front and rear wheels to make sure that the wheels are positioned straight and ahead. The wheels must be aligned straight ahead when changing steering modes to synchronize the front and rear axles. This will give the proper perfor-

mance when using the "COOR" and "CRAB" modes.

If the axles become unsynchronized, straighten the rear wheels first, then switch the selector lever to the "2W" position and straighten the front wheels. The driver may then switch to "COOR" and "CRAB" and the axles will again be synchronized.

2.7 TRANSMISSION OPERATION

If the oil temperature gauge, which is the converter oil out temperature, rises above 250° or the warning light comes on, stop the vehicle immediately. Shift to neutral and run the engine at 1000-1200 RPM. The temperature should drop rapidly to the engine water temperature. If the temperature does not drop, trouble is indicated. The trouble should be determined before the vehicle is operated again. Overheating generally occurs due to working in too high of a gear ratio. Shifting to a lower gear will help eliminate overheating.

Do not shut off engine when unit is overheating.

2.8 SHUTTING DOWN THE TRACTOR

Bring tractor to a safe and complete stop and set parking brake.

Place gear shift lever in neutral (N).

Turn off all lights.

Turn off ignition switch.

Always set the parking brake when parking

NOTE: The tractor. The automatic transmission does not have an internal parking lock.

2.9 EMERGENCY STOPPING

If the brakes fail, follow this procedure:

Downshift to next lower gear, unless already in "F1" or "R1".

Use parking brake to stop tractor by pulling on parking brake lever or pulling out on the air parking brake button. When towing a trailer with brakes, pull out on the trailer air parking brake button to apply the parking brake.

2.10 TOWING THE TRACTOR

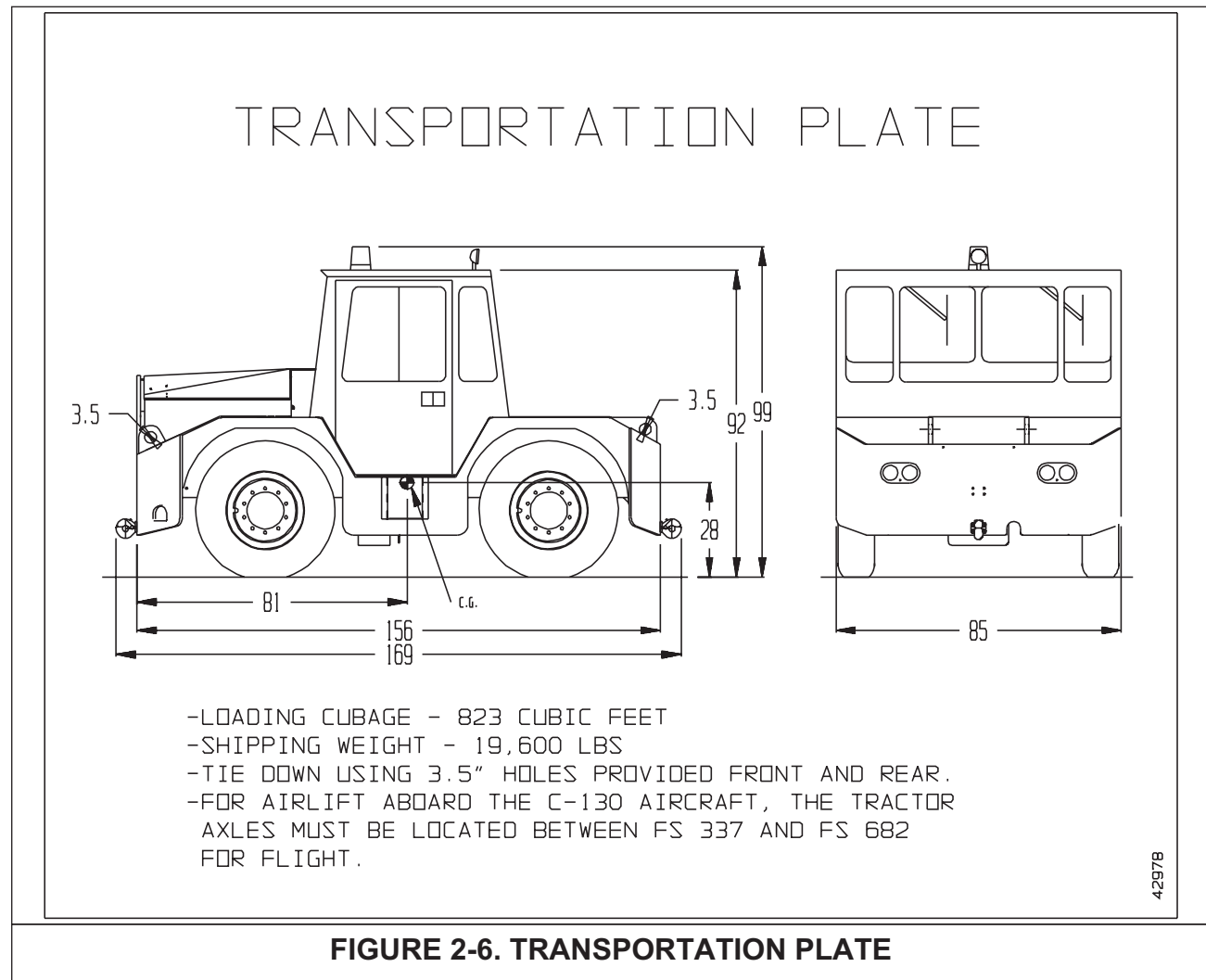
The tow tractor can be towed for 1 mile maximum at no more than 3 MPH. Towing longer will result in transmission damage.

If the vehicle is to be towed, it will be necessary to run the engine at idle speed to lubricate the clutches.

If further towing is required, disconnect the drivelines from the front and rear of the transmission will be damaged.

Because of the design of the hydraulic system, the engine cannot be started by pushing or towing.

IMPORTANT! Failure to follow these instructions will void the warranty.

2.11 SHIPPING

2.12 AIR TRANSPORT CERTIFICATION**DEPARTMENT OF THE AIR FORCE**HEADQUARTERS AERONAUTICAL SYSTEMS CENTER (AFMC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

16 Sep 2005

MEMORANDUM FOR WR-ALC/LEEV
ATTN: ROBERT WOODRUFF
295 BYRON STREET
ROBINS AFB GA 31098-1611

FROM: ASC/ENFC (ATTLA)
2530 Loop Road West
Wright-Patterson AFB OH 45433-7101

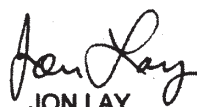
SUBJECT: Air Transport Certification of Type MB-4 Tow Tractors, NMC-Wollard Model 200 and Model 200MB4V2

Note: This memo adds a new model and supersedes our previous memo of 7 Apr 2003, which should be discarded.

1. Subject tow tractors, built by NMC-Wollard, are described in the following table:

	Model 200	Model 200MB4V2
Length (less pintle)	164"	163"
Width	85"	91"
Height	92"	93"
Gross Vehicle Weight	20 000 lbs	19 200 lbs
Front Axle Weight max	10 000 lbs	9 600 lbs
Rear Axle Weight max	10 000 lbs	9 600 lbs

2. Based on the data provided by the manufacturer, the subject items are approved for airlift on USAF C-130, C-141, C-5, and C-17 aircraft with the following comments:
- Tire inflation pressure shall not exceed 100 psi.
 - No shoring appears to be required to load these items.
 - Shipper certifies that the item has restraint provisions in sufficient number, and located such that it is capable of being restrained to at least 3g forward, 2g up, and 1.5g aft and laterally with respect to the aircraft, and is also capable of withstanding a potential 4.5g down load. Anything stowed in, or attached to it must meet this same requirement.
 - The vehicle will self-ventilate in the event of an in-flight rapid decompression of up to 8.3 psi within ½ second, thus contents should be packaged with this in mind.
 - Fuel tank level, starter battery, and any associated hazardous materials and components shall be in compliance with AFMAN 24-204(I) / TM 38-250. This air transport certification is not considered approval for hazardous materials, which must be obtained separately. Your servicing aerial port can assist in this regard.
 - For C-130E/H/J airlift, the tractor axles must be located between FS 337 and FS 682 for flight, and between LS 537 and LS 882 for C-130J-30.
3. The Shipper shall give a copy of this memo to the Air Terminal Operations Center (ATOC) representative when the item is presented for airlift. This memo shall be part of the official cargo manifest documentation package and will be briefed to the aircraft loadmaster prior to loading this item. Point of contact (ref file code 99.10.26) is the undersigned at DSN 785-1821 or (937) 255-1821. Email jon.lay@wpafb.af.mil or ATTLA@wpafb.af.mil.


JON LAY
Aerial Delivery Group

cc:
HQ AMC/A37V
SDDC TEA

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3 PREVENTIVE MAINTENANCE AND GUIDELINES FOR REPAIR

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3.1 CHAPTER PROPERTIES

This chapter provides a preventive maintenance schedule with the necessary procedures. Tools required are those normally available in any organizational tool shop.

NOTE: Consult the Cummins "Operation and Maintenance B Series Engines" manual included with this manual when so directed.

Also, guidelines for repairing the tractor are located on the last two pages of this chapter. Before attempting to repair the tractor, be familiar with the information on these pages.

3.2 PERIODIC MAINTENANCE AND INSPECTION

Use the engine hour meter to keep track of when preventive maintenance is required.

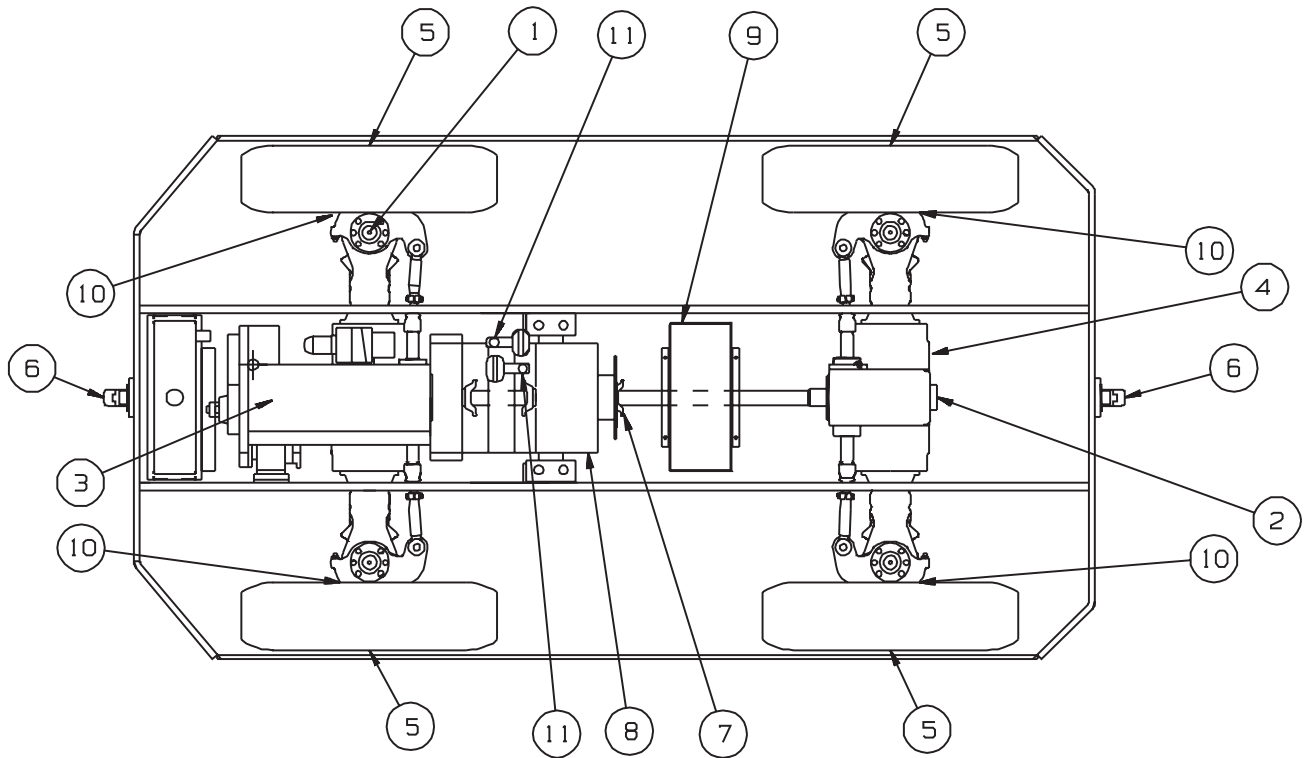
Use the table below to schedule your maintenance.

NOTE: Recommended service intervals are for normal operating conditions. Service **MORE OFTEN** if machine is operating under sandy, dusty, or wet conditions.

⚠ CAUTION **NEGLECTING MAINTENANCE CAN RESULT IN FAILURES OR PERMANENT DAMAGE TO TRACTOR COMPONENTS AND MAY VOID THE WARRANTY.**

PREVENTIVE MAINTENANCE SCHEDULE		
COMPONENT	SERVICE REQUIRED	REFERENCE
AT INITIAL OPERATION		
Accumulators For Hyd. Brakes	Check pressure at initial intervals in procedure referenced	3.10
DAILY OR REFUELING (PRE-START-UP)		
Engine Cooling System	Check coolant level.	3.4.1
	Check for coolant leaks.	3.4.2
Engine Oil	Check level.	3.4.3
Transmission	Check oil level for leaks.	3.4.4
Electrical System	Check lights.	3.4.5
Fuel System	Check for fuel leaks.	3.4.6
	Drain water separator.	3.4.7
Brakes	Check brake pedal free play.	3.4.8
Wheels and Tires	Inspect condition and check pressure.	3.4.9
Axles	Check for leaks.	3.4.10
Belts	Inspect condition.	3.4.11
EVERY 50 OPERATING HOURS		
Hydraulic Reservoir	Check level.	3.5.1

COMPONENT	SERVICE REQUIRED	REFERENCE
EVERY 250 OPERATING HOURS OR 3 MONTHS		
Perform 50 hour service		3.5
Engine Oil and Filter	Change	3.6.1
Air Cleaner Restriction	Check	3.6.2
Grease Fittings	Lubricate	3.6.3
Exhaust System	Inspect	3.6.4
Brakes	Inspect brake lines.	3.6.5
Brakes, Air Only	Check brake air/hydraulic actuators, fluid level (two units located in hydraulic compartment).	3.6.5.2
Park Brake	Apply park brake on incline to determine if it holds tractor. If not, adjust.	8.9
Air dryer desicant filter-air brake units only	Check filter.	3.6.6
Air Intake System	Check	3.6.6
Wheel Bolts	Check torque.	3.6.8
EVERY 500 OPERATING HOURS OR 6 MONTHS		
Perform 250 hour service		3.6
Pintle Hitch	Re-torque to 175 ft-lbs (Initial 500 hrs, one time)	
Fuel Filter	Change	3.7.1
Coolant	Check concentration.	3.7.2
Axles	Check oil level.	3.7.3
Brakes	Inspect	3.7.4
Electrical System	Clean and inspect wiring, battery, and cables.	3.7.5
Transmission (Funk)	Check oil level/Change filter.	3.7.6
Hydraulic System	Check level/Change filter.	3.7.7
EVERY 1000 OPERATING HOURS OR 1 YEAR		
Accumulators For Hyd. Brakes	Check pressure	3.10
Perform 500 hour service		3.7
Transmission	Change oil.	3.8.1
Hydraulic Supply	Change fluid.	3.8.2
Axles	Change oil and repack bearings.	3.8.3
Valve Clearance	Adjust	3.8.4
Belt Tension	Check	3.8.5
Belt	Check	3.8.6
EVERY 2000 OPERATING HOURS OR TWO YEARS		
Perform 1000 hour service		3.8
Vibration Damper	Inspect	3.9.1
Coolant and Antifreeze	Change	3.9.2



LUBRICATION LOCATIONS

ITEM	COMPONENTS	LUBRICANT	HOUR
1	STEERING KNUCKLE	KENDALL #673-7894, SHP M/P CORROSION INHIBITED GREASE	50
2	OSCILLATION JOINT	KENDALL #673-7894, SHP M/P CORROSION INHIBITED GREASE	50
3	ENGINE CRANKCASE	15W-40	50
4	REAR AXLE	SAE 80W85W-140	50
5	PLANETARY HUBS	SAE 80W85W-140	200
6	PINTLE HOOK	KENDALL #673-7894, SHP M/P CORROSION INHIBITED GREASE	50
7	UNIVERSAL JOINTS	KENDALL #673-7894, SHP M/P CORROSION INHIBITED GREASE	50
8	TRANSMISSION	ATF, TYPE A, DEXRON III	50
9	HYD. RESERVOIR	ATF, TYPE A OBMRIII	50
10	WHEEL BEARINGS	SAE 80W85W-140	200
11	BRAKE FLUID	ATF, TYPE A, DEXRON III	50

FIGURE 3-1. LUBRICATION LOCATIONS

3.3 TRACTOR BREAK-IN

Engine. Do not operate the new engine at more than 3/4 throttle for the first 8 to 10 hours. This will permit the bearings to seat properly. Change engine oil after the first 25 hours of operation.

Transmission (Funk). Change lubricant and filter after first 20 hours of operation of the new transmission. Use ATF, Type A, Dextron III, 4 gal. [15.1L].



FIGURE 3-2. TRANSMISSION FLUID LEVEL

Axles. Check axles for fluid leaks, check differential oil level, check wheel hub oil level, tighten wheel retainer capscrews or nuts to torque recommended in torque chart after the first 10 hours of operation. Change differential and wheel hub oil after the first 100 working hours.

3.4 DAILY SERVICE

3.4.1 Check Coolant Level

See page 3-4 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.4.2 Check for Coolant Leaks

After tractor has been parked overnight, check ground under engine for leaked coolant (green-colored). If found, try to locate exact source of the leak. If source is a loose hose, tighten hose clamp or replace hose if necessary. If radiator or water pump is leaking, report condition to a supervisor.

3.4.3 Check Engine Oil Level

See page 3-3 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.4.4 Inspect for Transmission Oil Leaks

After tractor has been parked overnight, check ground under tractor for evidence of oil leakage (red-colored fluid). Try to find exact source of any leak and report condition to your supervisor.

Check oil level daily, with engine at idle speed and Shift-O-Matic in neutral. Make sure the area around oil level check plug is clean before removing plug.

3.4.5 Check Lights

Check operation of all tractor lights. Replace any burned-out lights.

3.4.6 Check for Fuel Leaks

Raise engine cover and inspect fuel line connections for leaks. Be sure fuel lines are securely fastened by retaining clips.

3.4.7 Drain Water Separator

See page 3-3 of the Cummins "Operation and Maintenance Manual B Series

Engines” manual included with this manual.

3.4.8 Check Brake Pedal Free Play

There should be ample travel remaining when brakes are fully applied. The pedal should be firm with no spongy feeling. If free travel is excessive, but braking improves after “pumping” the pedal several times, there may be air in the brake lines. Report condition to your supervisor. Also see 8.3.

Excessive free travel may also be caused by worn brake linings, pads, or both.

3.4.9 Check Tire Condition and Pressure

Inspect tire for cuts, nails, stones in the tread or deterioration. Remove stones and other foreign material imbedded in the tires. If damaged, report condition to supervisor. Also see 9.6.

Inspect wheels for cracks and other damage. If damaged, report condition to supervisor. Check air pressure using a proper gauge. Pressure should be 90 PSI max. Add air as required.

3.4.10 Check for Axle Oil Leaks

After tractor has been parked overnight, check ground under axles for spots of oil. Try to find the exact source of any leak and report condition to your supervisor.

3.4.11 Inspect Drive Belt

See page 3-5 of the Cummins “Operation and Maintenance Manual B Series Engines” manual included with this manual.

3.5 EVERY 50 OPERATING HOURS

3.5.1 Check Hydraulic Oil Level

Remove the filler cap and observe fluid level mark on filler screen. Maintain fluid level within 1" - 2" on the screen.

3.6 EVERY 250 OPERATING HOURS OR 3 MONTHS

3.6.1 Change Engine Oil and Oil Filter

See page 4-4 of the Cummins “Operation and Maintenance Manual B Series Engines” manual included with this manual.

3.6.2 Check Air Cleaner Restriction

1. Remove the cover from the filter housing can. Then pull the outer, primary filter out of the can.
2. Do not remove the inner, secondary filter unless it is to be replaced. It is not serviceable (cannot be cleaned).
3. If the secondary filter is removed, use a rag to wipe the inside of the filter can and can cover clean.
4. If the secondary filter is being replaced, do so now. Do not attempt to clean this filter.
5. Check the primary element for any damage, and replace if any is discovered. Typically this element can be cleaned and reused about six times, or up to one year of service. To clean the element, tap the sides to loosen dirt. Then apply compressed air from the inside, through the pleats in the element to force dirt out of the filter. The element can also be washed in a warm water and detergent solution. The element must be allowed to air dry before reinstalling. Do not dry with compressed air or damage will result. See Figure 3-3.

3.6.3 Lubricate Grease Fittings

At each oil change, apply a high-quality grease to all grease fittings. See Figure 3-1 for locations.

1. Wipe grease and dirt from fitting with a clean rag.
2. Using a grease gun, apply grease until clean grease oozes from between the mating parts.
3. Wipe off all excess grease.

3.6.4 Inspect Muffler, Exhaust, and Tail Pipe

With engine off and cool, check for loose mounting straps and fasteners. Check for damage such as rusted-through areas and report condition to supervisor.

3.6.5 Inspect Brakes

3.6.5.1 Inspect Brake Lines

Access to brake lines can be obtained from the underside of the tractor. Check brake lines and hoses for leaks, deterioration, swelling, cuts, kinks and other damage. Report abnormal conditions to your supervisor.

3.6.5.2 Check Air Brake Hydraulic Actuator

Maintain fluid level in front and rear Air/Hydraulic Actuators. See item 11 on figure 3-1 for fluid specifications. Also see chap 11.

3.6.6 Inspect Air system

⚠WARNING Drain air pressure from the system before performing any inspection or maintenance to the air system.

1. To drain the air pressure it is recommended to push the trailer park brake air supply button (figure 2-3) partially in without any trailer brakes connected to the glad hands. Hold the button in until no more air release can be heard.
2. Presence of water can be checked by opening the drain valves on the main, primary and secondary air tanks.

3. If water is present, refer to the Bendix Service Data, SD-08-2414, Preventative Maintenance and Appendix A sections, in chapter 11, for recommendations on the air dryer desiccant filter cartridge replacement.
4. For typical air system trouble shooting, refer Bendix Service Data, SD-08-2414, Air Dryer Troubleshooting Chart and Appendix B sections in chapter 11.

3.6.7 Check Air Intake System.

See page 4-10 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.6.8 Check Wheel Bolt Torque

Torque should be 400 ft-lbs (dry).

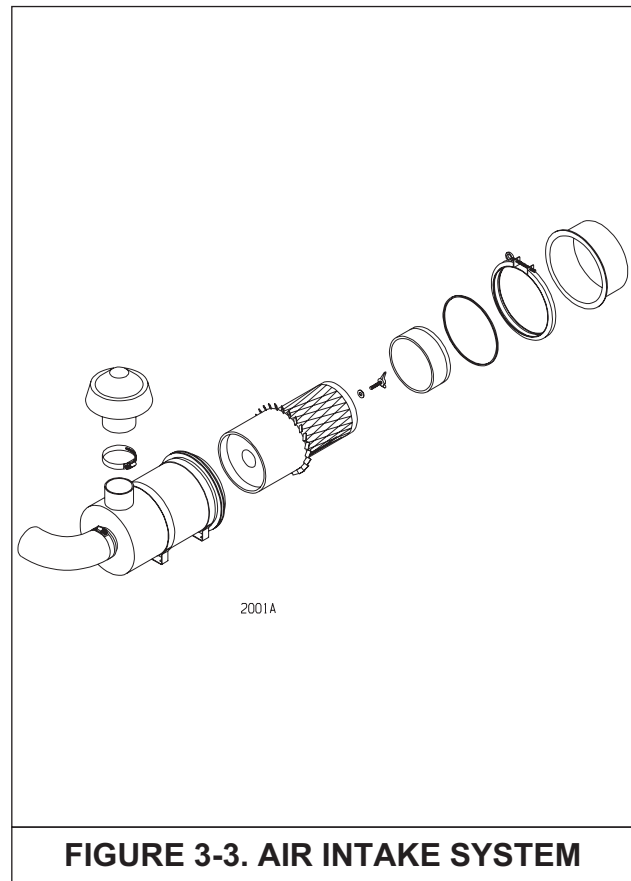


FIGURE 3-3. AIR INTAKE SYSTEM

3.7 EVERY 500 OPERATING HOURS OR 6 MONTHS

3.7.1 Change Fuel Filter

See page 5-3 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.7.2 Check Coolant and Antifreeze

See page 5-9 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.7.3 Check Axle Oil Level (Front and Rear)

The axles have three fill plugs each: one on the outside of each wheel end and one on the axle housing.

1. Park tractor on a level surface. Shut off engine and set parking brake.
2. Using a rag and wire brush, thoroughly clean dirt and rust from around fill plugs. The axle housing fill plug is the upper plug.
3. Check oil level in wheel ends, turn wheel so wheel end plug is horizontal to axle shaft.
4. Remove each fill plug and check oil level with a finger. Level should be to height of fill plug hole. Add oil, SAE 80W-85-140 as required.

3.7.4 Inspect Linings, Pads, Calipers, Wheel Cylinders, etc.

See 8.3.1

3.7.5 Clean and Inspect Wiring, Battery, and Cables

1. Inspect all wiring and cable harnesses for loose connections, evidence of shorting

(burned insulation or terminals) and frayed wires.

2. Check that retaining clips are secure.
3. Remove exterior dirt and grease by wiping with a cloth dampened with solvent P-D-680.
4. Allow parts to air dry after cleaning.

⚠ CAUTION Disconnect the positive cable if charging battery in the vehicle.

5. When disconnecting the battery, first disconnect the negative cable, then disconnect the positive cable.
6. Remove cables from battery posts.
7. Inspect battery for evidence of electrolyte loss. Inspect case for cracks and leaks.
8. Check that posts are secure. If loose, replace battery. (Send battery to overhaul personnel for salvage.)
9. If corrosion or dirt is present, clean top of battery with a solution of clean warm water and baking soda. Scrub areas with a stiff bristle brush being careful not to scatter corrosion residue. Wipe clean with a cloth moistened with baking soda in water.
10. Using a common wire-brush type battery tool, brush battery posts and inside of cable ends.

3.7.6 Change Transmission Filter Element (Funk Transmission)

Refer to the Funk Transmission Maintenance and Service Manual enclosed with this manual. See Figure 3-4.

3.7.7 Service Hydraulic Filter And Suction Screen

1. Shut the gate valve on the reservoir.

2. Change the hydraulic return filter cartridge.
3. Remove the suction screen clean with pressure air directed inside the screen.
4. Replace the screen and open the gate valve.

3.8 EVERY 1000 OPERATING HOURS OR 1 YEAR

3.8.1 Change Transmission Oil (Funk Transmission)

Refer to the Funk Transmission Maintenance and Service Manual enclosed with this manual.

3.8.2 Change Hydraulic Supply Fluid And Filter

See page 1-10 for specifications.

IMPORTANT: Whenever the hydraulic pump is repaired/replaced or whenever the hydraulic fluid is drained, resulting in loss of fluid in the suction hose, the output (pressure) hose fitting **MUST** be cracked open to allow air to escape from the system until fluid flow through the pump is established. This is necessary because the hydraulic system does not allow a free flow of fluid until the accumulators are charged up to operating pressure.

3.8.3 Change Axle Oil.

Refer to 9.2.

3.8.4 Adjust Valve Lash Clearances

See page 6-9 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.8.5 Check Belt Tension

See page 6-9 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.8.6 Check Belt

See page 6-10 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.9 EVERY 2000 OPERATING HOURS OR 2 YEARS

3.9.1 Inspect Vibration Damper

See page 7-9 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.9.2 Change Coolant

See page 7-3 of the Cummins "Operation and Maintenance Manual B Series Engines" manual included with this manual.

3.10 ACCUMULATORS FOR HYDRAULIC BRAKE SYSTEMS

To maintain system performance the manufacturer (HYDAC) recommends a regular check of the gas precharge pressure. A loss in the gas precharge pressure will



FIGURE 3-4. TRANSMISSION FILTER

cause a drop in the system efficiency and could cause damage to the bladder, diaphragm, or piston accumulator as well as brake failure with the engine off.

By means of a charging and gauging unit, hydro-pneumatic accumulators are precharged with dry nitrogen or their existing gas precharge pressure is checked. For these purposes, a charging and gauging unit is connected to a commercially available nitrogen bottle via a flexible charging hose.

Charging units may vary, so follow the instructions of the manufacturer.

These instructions are for a HYDAC type FPS unit. Typical charging and gauging units incorporate a gauge, check valve in the charging connection, manual bleed valve, and T-handle.

3.10.1 GENERAL

Hydraulic accumulators are pressurized vessels and only qualified technicians should perform maintenance. Read all instructions thoroughly before beginning any type of service or repair.

Tools Required

1. Gas Valve Core Tool.
2. Torque Wrenches.
3. Wrench(es).

Intervals Between Checking Gas Precharge Pressure

The proper gas precharge pressure should be set after each new installation or repair by following the instructions under the Operating and Installation Instructions below. It should be rechecked at least once

during the first week of operation. If there is no loss of gas precharge pressure, it should be rechecked again in 3 to 4 months. Thereafter, it should be checked at least once a year. Recharge accumulator when necessary.

Temperature Effect

To ensure that the recommended gas precharge pressure is maintained, even at relatively low or high operating temperatures, the gas precharge pressure should be adjusted for temperature. The formula

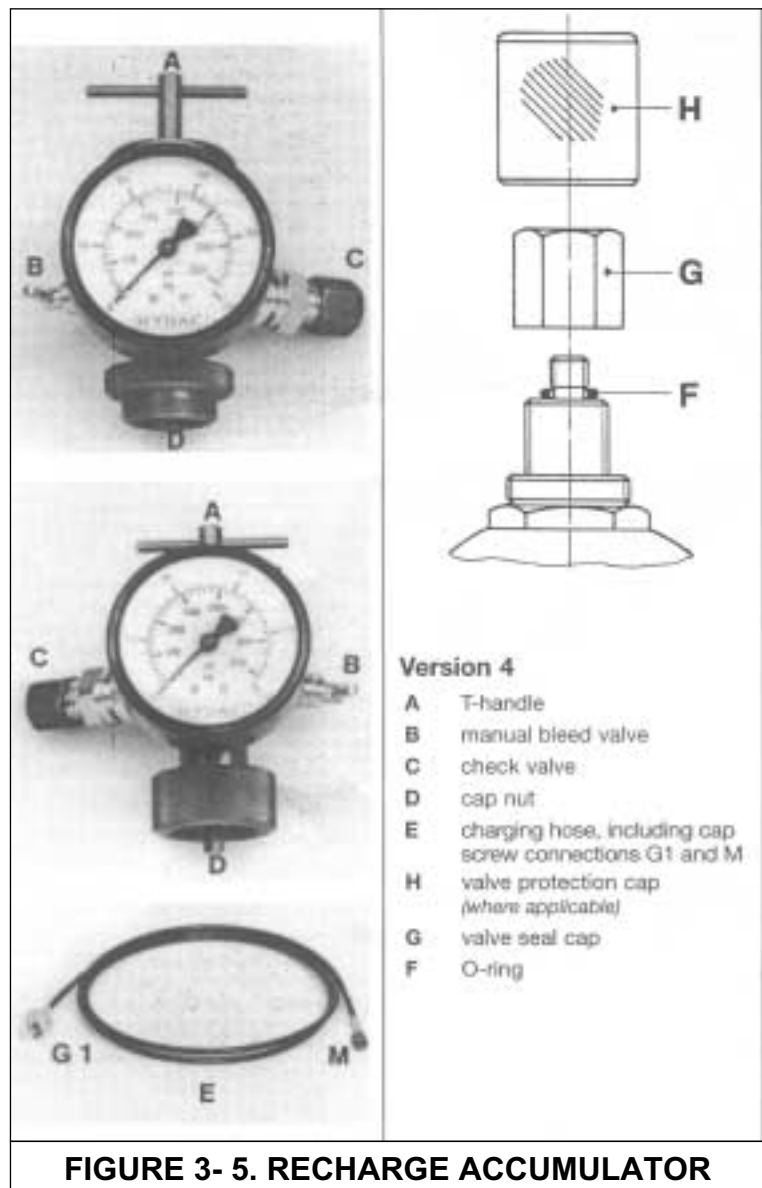


FIGURE 3- 5. RECHARGE ACCUMULATOR

below relates the precharge temperature (T_o) to the operating temperature (T).

Fahrenheit

$$P_o, T_o = P_o, T_2 \times (T_o + 460) / (T_2 + 460)$$

T_o = precharge temperature

T_2 = maximum operating temperature

P_o, T_o = gas precharge pressure at precharge temperature

P_o, T_2 = gas precharge pressure at maximum operating temperature

NOTE: Substitute 273 for 460 in above formulas for Celsius calculation.

3.10.2 OPERATING AND INSTALLATION INSTRUCTION

Preparation

To check the gas precharge pressure in an accumulator, it must first be isolated from the system shut off, and all hydraulic pressure relieved.

For accumulators with HYDAC gas valve version 4, unscrew the valve protection cap "H" (where applicable) and the valve seal cap 'G' (see fig. 5).

FPS Unit

Prior to connecting the charging and gauging unit to an accumulator, turn T-handle "A" counter clockwise until resistance is felt. Close manual bleed valve 'B' by hand tightening. Connect the unit to the accumulator by screwing cap nut "D" onto HYDAC gas valve version 4; hand tighten (see fig 5).

Checking Gas Precharge Pressure

Connect the appropriate charging and gauging unit to the accumulator following the instructions under "Preparation", following.

NOTE: Temperature affects the gas precharge pressure, please refer to previous "Temperature Effect" instructions.

FPS Unit

Turn T-handle "A" clockwise a maximum of 3 full turns from the full counterclockwise position. The gauge needle should indicate the existing gas precharge pressure. If there is no gas precharge pressure indicated or if it is too low or too high, please follow instructions under the appropriate section, either "Pressure Release" or "Charging". If desired gas precharge pressure registers, please follow the instructions under "Removal of Charging and Gauging Unit".

Pressure Release

With the appropriate charging and gauging unit attached as previously described, gas precharge pressure can be released by carefully opening manual bleed valve "B". Release the gas precharge pressure very slowly until the desired gas precharge pressure is reached (this insures that the gas temperature does not fluctuate greatly, providing an accurate gas precharge pressure). Close the manual bleed valve "B". Allow the gas precharge pressure to stabilize. (5 to 10 minutes) recheck, adjust if required. Once the desired gas precharge pressure is reached, please follow the instructions under "Removal of Charging and Gauging Unit".

Charging

⚠ WARNING Never use oxygen or air, this could cause an explosion. Use dry nitrogen or other recommended gases.

The use of a pressure regulator on the commercially available nitrogen bottle to regulate pressure to the charging and gauging unit is highly recommended.

NOTE: Full nitrogen pressure may damage the gauge.

Connect the charging hose to a commercially available nitrogen bottle by means of the G4 adapter (other adapters are available, check with factory for type); the adapter connects to the cap screw "G1". Connect cap nut "M" of the charging hose to check valve "C" of the charging and gauging unit (see fig. 5). Connect the appropriate charging and gauging unit to the accumulator by following the instructions previously described.

Initial Charging

When charging an accumulator that has no initial gas precharge, allow 20 to 30 minutes for the gas temperature and thus pressure to stabilize. Recheck the gas precharge pressure and adjust if necessary.

Turn T-handle 3 full turns to open. Proceed to "Filling".

Pressure Increase

When charging an accumulator that has an existing gas precharge, allow 5 to 10 minutes for the gas temperature and thus pressure to stabilize.

FPS Unit

Turn T-handle "A" clockwise until the gauge needle begins to deflect, then turn it another full turn.

Filling

Open the shut-off valve on the commercially available nitrogen bottle and slowly fill the accumulator with dry nitrogen gas.

Precharge very slowly until the pressure in the accumulator reaches 100 psi. Once 100 psi is reached, the charging rate can increase. Charging too quickly may damage the accumulator.

NOTE: The gauge registers the line pressure, not necessarily the accumulator pressure while charging.

After allowing the appropriate time for the gas temperature and thus pressure to stabilize, adjust the gas precharge pressure as required, refer to "Pressure Increase" or "Pressure Release".

Once the desired gas precharge pressure is reached close the shutoff valve on the commercially available nitrogen bottle. Remove the charging and gauging unit from the gas valve as described under "Removal of Charging and Gauging Unit", following.

Removal Of Charging And Gauging Unit

Close the shut-off valve on the commercially available nitrogen bottle before removing the charging and gauging unit.

FPS Unit

Turn T-handle "A" counter clockwise until resistance is felt to close the gas valve. Open manual bleed valve "B" to relieve pressure in the charging and gauging unit. Proceed to "Disconnecting".

Disconnecting

Unscrew the charging and gauging unit from the gas valve. Check for leaks. None are permissible.

Completion



FIGURE 3-6. ADJUST POSITION SENSOR

For HYDAC gas valve version 4, screw on valve seal cap “G” torquing to 30 Nm (22 lb-ft), and valve protection cap “H” (where applicable); hand tighten.

3.11 ADJUST POSITION SENSOR

With the wheels parked straight ahead, both axle directions indicators should point to C (Center). If the indicators require adjustment, position wheels straight ahead. Stop engine. Turn ignition switch to IGN but do not start engine. On the driver's side on top of the front wheel hub, move the position sensor tension spring in the holes on the anchor bracket until the front axle indicates aligns C (Center). Adjust the rear wheel hub position indicator the same to align the rear axle direction indicator. See Figure 3-6.

3.12 GUIDELINES FOR REPAIRING THE TRACTOR

⚠WARNING Before attempting any repairs on the tractor, know the safety precautions located in the front part of this manual.

The following are general instructions for the removal, disassembly, cleaning, inspection, reassembly, and installation of tractor components within the capabilities of the using organization. Common shop practices are not described. Use the exploded views in Section 10.

3.12.1 Special Tools

There are no special tools required for this tractor. Common automotive shop tools are all that is required to service the tractor.

3.12.2 Removal and Disassembly

Removal and disassembly should be performed using the exploded views in Chapter 10. Special instructions are noted in the appropriate text. Disassemble components only to the extent necessary to do repairs.

3.12.3 Cleaning

When cleaning, keep related parts together so reassembly is easier. Valves, pistons, sleeves and other internal parts that have close tolerance fits in mating bores should be cleaned individually to prevent surface scoring and marking. Special cleaning instructions are given where required.

3.12.3.1 Proper Cleaning Solvent

Unless otherwise specified, cleaning should be done using dry cleaning solvent, Federal Specification P-D-680. This can be applied with clean cloths or used as an immersion solution for small parts.

NOTE: Do not apply the cleaning solvent to wiring or electrical parts except to remove foreign materials from housings.

3.12.3.2 Using Compressed Air

Use low-pressure compressed air to remove debris and dirt as necessary.

3.12.3.3 Frame, Engine, and Transmission

IMPORTANT: Be sure all openings are closed or covered adequately before cleaning to prevent the entry of water into internal parts.

Structural parts are best cleaned using soap and water and suitable brushes. Steam cleaning may also be done before disassembly to remove heavy accumulations of grease, oil, and dirt from exterior of engine, transmission and rear axle assembly.

3.12.3.4 Metal Parts

IMPORTANT: Reassemble and oil metal parts as soon as possible after cleaning. Do not operate parts unless a film of lubricating oil is applied.

Wash metal parts in cleaning solvent. Allow to air dry. Do not use compressed air to dry parts. The moisture generally present in air systems may cause corrosion. Lubricate metal parts as soon as possible after cleaning.

3.12.3.5 Gears

Clean gears using a soft bristle brush and cleaning solvent. Remove foreign matter from the gears.

3.12.4 Inspecting Parts

Inspect all parts visually for cracks, breaks, scratches, dents, bends, punctures, galling, wear, scoring, stripped threads, distortion and deformation. Give special attention to bearing surfaces, mating surfaces, gaskets and seals. Specific dimensional checks and tests are given where required.

3.12.5 Repair and Replacement

3.12.5.1 Structural Parts

Structural parts, enclosing, and supporting members may be repaired by welding, brazing and refinishing. Major repairs should be performed by overhaul facilities. Where repainting is required, the surface should first be suitably prepared and primed.

3.12.5.2 Wiring

Wiring should be repaired in accordance with standard automotive practices.

3.12.5.3 Gaskets and Seals

Gaskets, oil seals, preformed packing, and seals should be replaced instead of being cleaned and reused, unless otherwise specified by local directives. Replace any seals and packings that show any deterioration or damage.

NOTE: Use repair kits when available.

3.12.6 Reassembly and Installation

Unless otherwise specified, reassembly and installation are the reverse of removal and disassembly. Use the illustrations in Section 10 as a reference.

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4 ENGINE

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4.1 MAJOR REPAIRS

If you intend to perform your own engine repairs, you may wish to obtain additional service literature from your local Cummins industrial engine distributor. See "Section L" of the Cummins "Operation and Maintenance Manual" provided with this manual for ordering instructions.

4.2 ENGINE REMOVAL

1. Block rear wheels in both directions to prevent tractor from rolling when drive shaft is disconnected. Do not apply parking brake. Shift transmission into neutral.
2. Remove engine hood, side panels, and access plates.
3. Remove air cleaner and hose assemblies.
4. Disconnect battery cables.
5. Raise front of tractor with suitable stands.
6. Drain engine crankcase, cooling system and transmission.
7. Remove radiator hoses and radiator.
8. Remove fan blade.
9. Tag and disconnect all wire harnesses to engine and transmission components.
10. Disconnect air lines.
11. Remove ground strap.
12. Disconnect and cap fuel lines at required engine locations.
13. Disconnect accelerator linkage.
14. Disconnect exhaust pipe at the exhaust manifold. Tape over opening to prevent debris from entering engine.
15. If needed, remove screws from hood support and slide back to allow clearance for removing engine assembly.

⚠WARNING

The engine assembly is large and heavy. Use proper slings and hoists for removal and installation.

16. Attach a suitable hoisting bracket to engine and transmission assembly for support and lifting. Attach hoisting bracket to a hoist.
17. Remove converter drain plug access cover from lower end of converter housing. Matchmark torque converter with drive plate (for easier installation).
18. Remove converter-to-flywheel attaching nuts.
19. Remove converter housing-to-engine attaching bolts.
20. Lower tractor for easier engine removal, if necessary.
21. Remove engine mount capscrews.
22. Move engine away from transmission.

⚠CAUTION

The driveplate (flywheel) will not support a load.

23. Lift engine assembly upward slowly from tractor frame.
24. Lower engine assembly onto a suitable support or repair stand.
25. To install engine assembly, reverse this procedure. Make sure plugs are secure and hoses are tight. Refill engine crankcase, cooling system, and transmission with recommended fluids and check for leaks.

5 TRANSMISSION

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5.1 INTRODUCTION

The Funk Series 2000 Shift-O-Matic is a six-speed forward, three-speed reverse transmission. Forward and reverse motion and speed are obtained through electrically controlled solenoids and hydraulically actuated multiple disk clutches. Maintenance is limited to changing the fluid and filter at the recommended service intervals.

The Funk Model 2000 Service Manual has been included with this manual.

If internal repairs are required, the transmission must be sent to a specialized repair facility. In this event, use the removal and installation procedures included in this section.

Routine checks will help prevent down time. Report weak or borderline malfunctions at once. It is especially important in this transmission to keep the oil clean.

IMPORTANT! The transmission should always be in neutral position before starting engine or when tractor is parked and engine is running.

5.2 BREAK-IN

Lubricant and filter should be changed after the first 20 hours of transmission operation. See 3.7.6 and 3.8.1.

5.3 MALFUNCTIONS

Transmission malfunctions may be caused by poor engine performance or dirty or contaminated oil.

Always begin by checking engine performance, then fluid level and condition. If oil temperature gauge rises to 250°F, stop tractor immediately. Shift to neutral and run engine at 1000-1200 RPM. Trans-

mission temperature should drop rapidly to ambient air temperature across heat exchanger. If temperature does not drop, trouble is indicated. The cause should be determined before tractor is operated again. Overheating generally occurs due to working in too high a gear ratio.

Do not shut off engine when transmission is overheating (as long as cooling system is in working order).

If problem continues, remove tractor from service and refer transmission to a transmission repair facility.

IMPORTANT! If you ever notice unusual noises such as gear noise or grinding, a buzz or whine, knocks, scraping, clicking, etc., remove tractor from service and refer it to a transmission repair facility.

5.4 TOWING THE TRACTOR

If tractor must be towed, see 2.10.

5.5 CHECKING FLUID LEVEL AND CONDITION

1. Bring transmission to normal operating temperature (about 160-200°F). Five minutes of driving, including frequent stops and starts, will usually produce normal fluid temperature.
2. Put gear selector in neutral (N), set parking brake. Make sure area around dipstick is clean before removing.
3. With engine running at idle speed, withdraw transmission dipstick (located on driver's right under the access plate) to check oil level.

IMPORTANT! If oil is discolored and has a foul (burned) smell, it may be caused from high operating temperatures. Oil and filter should be changed immediately. If oil has a

milky look, water has entered transmission. Air bubbles mean there is a leak in the suction lines. Report any of these conditions to your supervisor.

⚠CAUTION Do not overfill transmission. Overfilling can result in transmission damage. It is easy to overfill the transmission. To avoid overfilling, add oil in small amounts and recheck level frequently.

4. Check level indicated on dipstick. Add fluid as needed to maintain level between "FULL" and "ADD" marks on dipstick.

5.5.1 Changing Transmission Fluid

When changing oil, dirty oil should be drained while unit is warm. Examine for contamination and dispose of properly.

Clean suction screen thoroughly before re-installing.

1. Fill unit with 4 gallons of recommended lubricant.
2. Start engine and run at idle to let converter and oil lines fill.
3. Check level according to 5.5.

Recommended Hydraulic Transmission Fluid:

ATF type A Dextron III fluid is used in the transmission and hydraulic reservoir. This fluid will give good operating characteristics for all temperature ranges.

5.6 TRANSMISSION ADJUSTMENTS

The clutches in this transmission are hydraulically applied and spring released. This

gives automatic compensation for normal wear, eliminating the need for adjustment.

5.6.1 Shift Linkage.

The shift linkage is electronically and hydraulically controlled and does not require adjustment.

To assure smooth operation, periodically inspect all shifter components and replace any that are worn or damaged. Clean any grease, dirt, or rust from shifter components.

5.7 NEUTRAL START SWITCH

The neutral start switch is a safety device which prevents engine from starting if transmission in any shift position other than NEUTRAL.

The neutral start switch is integrated in the shifter control and does not require testing.

5.8 REMOVING ENGINE AND TRANSMISSION AS A UNIT

The engine must be removed first or the engine and transmission must be removed as a unit. The transmission is a very large unit and most hoists, jacks, etc. will not allow enough room to drop the transmission from the bottom of the tractor.

To remove the engine only, see 4.2

1. Block rear wheels in both directions to prevent vehicle from rolling when drive shafts are disconnected. Shift transmission into neutral. Do not apply parking brake.
2. Drain cooling system coolant, engine oil, and transmission oil and dispose of properly. Remove pump from rear of transmission.

3. Disconnect battery cables and remove battery.
4. Disable fuel system, disconnect and plug ends of fuel tubes.
5. Disconnect coolant lines from engine, transmission and radiator. Plug hose ends.
6. Unplug engine harness from under dash. Disconnect all wiring leading to transmission and engine.
7. Remove capscrews and washers securing rear drive shaft flange to park brake disk. Force driveshaft back until flange clears, swing drive shaft down and away from transmission.
8. Remove brake cable from park brake caliper.
9. Remove capscrews and washers securing front driveshaft flange to transmission. Force driveshaft flange toward front of tractor until flange clears, swing driveshaft down and away from transmission.
10. Remove belts and fan from engine.
11. Remove radiator and shroud.
12. Remove fasteners from rear hood support and deck plate and slide back far enough to enable you to remove the engine/transmission unit.
13. Remove fasteners securing engine and transmission to their respective mounts. Pull engine/ transmission unit up and out of tractor. Be careful of protruding parts.

IMPORTANT: The drive plate (flywheel) will not support a load. None of the weight of the transmission must be allowed to rest on the drive plate during removal or installation.

14. Secure engine/transmission unit to prevent tipping or falling.

15. Match-mark torque converter with drive plate to provide easier installation.

IMPORTANT: Do not attempt to rotate the drive plate or torque converter by prying or using force or you will damage the drive plate.

16. Remove capscrews securing drive plate to torque converter.
17. Install a small "C" clamp on transmission housing to keep torque converter from falling out when transmission is removed from engine.
18. Remove capscrews and washers securing transmission bell housing to engine.
19. Carefully move transmission straight back to disconnect it from the engine.
20. Remove "C" clamp from torque converter.

IMPORTANT! The torque converter should not be disassembled.

5.9 INSTALLING ENGINE AND TRANSMISSION AS A UNIT

Installation is generally the opposite of removal.

1. When unit is installed in tractor, secure engine and transmission to their respective mounts with fasteners.
2. Connect rear drive shaft to parking brake disk. Connect front driveshaft to front of transmission.
3. Unplug and connect coolant lines to transmission and engine. Remount pump to rear of transmission.

4. Connect all transmission and engine wiring.
5. Unplug and connect fuel lines to engine.
6. Slide rear hood support and deck plate into place and secure.
7. Plug harnesses into receptacles in hood support.
8. Put radiator and shroud into place and secure. Reconnect coolant hoses to radiator.
9. Put fan and belts back on engine.
10. Return battery to battery holder and reconnect cables to engine and battery.
11. Replace drain plugs if you haven't, replace filters and fill engine, transmission and radiator with proper fluids.
12. Place gear shift lever in neutral position. Install gear shift cable.
13. Reconnect park brake cable.
14. If unit has not been refilled, fill unit with 4 gallons of recommended lubricant
15. Check for leaks.
16. Start engine and run at idle to let converter and oil lines fill. Check for leaks.
17. With engine at idle, finish filling according to 5.5.

5.10 DISASSEMBLY/ASSEMBLY OF ENGINE TO TRANSMISSION

Consult the supplied Funk Service Manual for this procedure.

5.11 CALIBRATING THE SPEEDOMETER

Manual Calibration With a Known Value (PULSE)

The exact calibration value for the vehicle and type of sensor you are using (pulse-per-mile or pulse-per-kilometer) is 31201.3. However, the tenths place is fixed

at 0 and will not be entered during calibration. The actual calibration value that will be used during calibration is 31201.

To calibrate your VDO Speedometer manually:

1. Press and hold in the button on the front of the speedometer as you turn on the ignition. Hold in the button until the word "PULSE" is displayed on the LCD readout. (See Diagram F)
2. As soon as you see the word "PULSE", release the button. After a few seconds, the display will start flashing a series of numbers (factory default setting) that

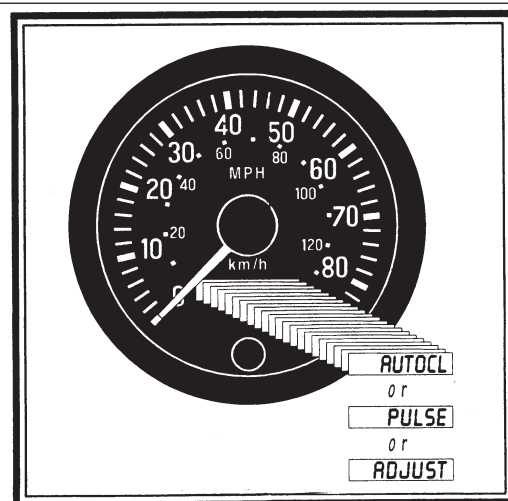


Diagram F

Calibration modes as displayed on the Speedometer's LCD

you can change to represent the correct calibration impulse value (31201). For example, a number like 50000 will show on the display, with each digit flashing in turn, except for the last digit on the right, which represents the tenths place and is fixed. First, the second 0 from the right will flash; then the third 0 from the right; then, the next 0; and finally, the 5. (See Diagram H.)

3. As each number flashes, press the button to change it until the correct digit of

31201 appears (that is, the number you wish to input).

4. When you have properly entered the correct calibration value (31201) – when that value is displayed on the LCD read-out — take your finger off the button and wait. After a few seconds, the value you have entered will be down-loaded into the speedometer's microprocessor, and the speedometer will revert back to normal operating mode. At this point, the manual calibration process is complete.

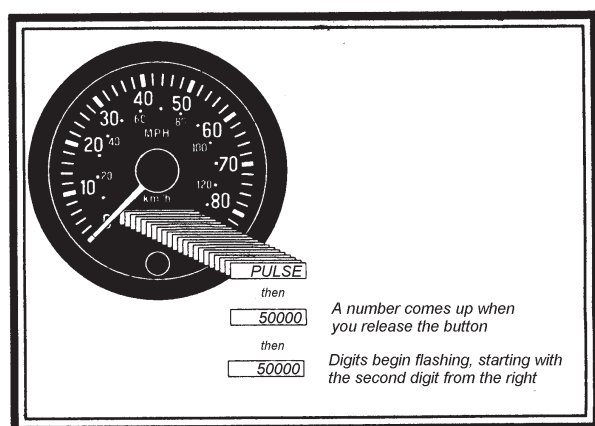


Diagram H

LCD Sequences as they appear during Manual Calibration

6 FUEL TANK

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6.1 FUEL TANK

If excessive amounts of water appear in the filter/separator, the tank may be contaminated and will require removal and cleaning or replacement.

⚠WARNING Fuel vapors create fire and explosion hazards which can result in severe personal injury or death. Do not allow any open flame, smoking materials or other potential igniters near the fuel system.

6.1.1 Removal and Disassembly

⚠WARNING Disconnect the negative battery cable. An electrical arc at the sending unit can act as an igniter creating a fire and explosion hazard, which can result in personal injury or death.

1. Disconnect cables from battery and remove battery from tractor (to prevent a possible spark when removing tank and related components).
2. Remove the rear deck plate from over the tank. It is secured by four 5/16 x 1" HHCS and nylock nuts.
3. Place a suitable container beneath drain opening at bottom rear of tank, accessible through hole in frame.
4. Remove drain plug from fuel tank and drain tank. Clean up any spillage.
5. Remove filler cap and cover filler hole to keep out debris. Remove tank straps from tank attached at top rear of tank and at lower front of tank.
6. Disconnect fuel sending wire and fuel hoses. Tank can now be lifted from tractor for cleaning and inspection.

IMPORTANT! Use care when handling the sending unit to prevent damaging it.

6.1.2 Cleaning and Inspection.

1. Install drain plug on bottom of tank.
2. Pour a detergent and water solution into tank.
3. Agitate mixture by rotating tank. Make sure solution contacts entire interior surfaces of tank.
4. Drain cleaning solution from tank. Rinse and repeat steps 1-4.
5. Flush interior of tank with clean water and allow to air dry.
6. Inspect filler cap and sending unit for corrosion and damage.
7. Inspect tank protectors for deterioration.
8. Inspect fuel tank for damage. Repair or replace tank as needed.
9. Check tank mounting straps for rust and corrosion.
10. Inspect elbows for damage.

6.1.3 Repair or Replacement.

⚠DANGER Fuel tanks can be lethal bombs capable of instantly killing anyone nearby. Before soldering or brazing, clean the tank thoroughly. Fill tank with an inert gas such as carbon dioxide or nitrogen, or completely fill with water.

1. Repair tank by soldering or brazing if needed. Re-prime and paint any repaired areas of tank.
2. Test any repair with wet soap lather. Place an air hose in tank and admit air. By holding a rag around hose where it enters, a mild pressure will be built up. If

the repair is sound, no bubbles will appear.

3. Replace corroded or damaged cap or sending unit.
4. Replace protectors if they are damaged or deteriorated.
5. Replace straps if weakened by either of these conditions.
6. Replace damaged parts.
7. If there is any doubt as to the integrity of the tank, replace the tank.

6.1.4 Reassembly

1. Install new gasket on sending unit opening on tank, then carefully lower sending unit into tank. Do not use gasket cement.
2. Secure sending unit with its hardware.
3. Temporarily tape or cover tank filler opening to prevent entry of dirt when installing tank.
4. Apply thread sealer to drain plug threads and install drain plug.

6.1.5 Installation

1. When ready to install tank, place a quart of fuel in the tank, slosh around, and pour out.
2. Install hoses and sending unit wire.
3. Position tank under frame and raise into position.
4. Install tank supports and straps. Tighten mounting hardware to proper torque.
5. Install battery and connect battery cables.
6. Fill tank with fuel and check for leaks.

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7 STEERING

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7.1 STEERING SYSTEM OVERVIEW

The system is hydraulically assisted and uses a hydraulic cylinder built into the axles to move the tie rods which in turn pivot the wheel hubs.

Before servicing the steering system, inspect and clean steering system components.

Also see Section 9 for axle lubrication information.

7.2 STEERING COLUMN

7.2.1 Removal

1. Disconnect external horn wire from under dash panel.
2. Remove rubber horn button from steering wheel by peeling it from plastic horn base.
3. Remove plastic horn base by turning and pulling it. There is a spring and spring seat assembly under the base. Take care not to lose them when removing the horn base.
4. Remove nut and flat washer from top of steering column shaft. Hold your hand under steering wheel while removing wheel. There are two carbon brushes and a spring which will fall out. Remove steering wheel assembly. Wheel is keyed to serrations on steering shaft.
5. Place nut and washer on steering column shaft to prevent loss.
6. Remove bolts at top of dash panel and tip panel toward driver's seat.
7. Remove bolts holding orbitrol (steering gear) to steering column and push orbitrol toward front of tractor to clear steering column.
8. Remove bolts holding steering column in bracket and push steering column out through back of dash panel.

7.2.2 Installation

1. Push steering column through back of dash panel and attach column to bracket with fasteners. Push orbitrol up and onto steering column, check engagement, and reattach with screws.
2. Tip dash panel back and fasten into place with screws.
3. Remove nut and washer from steering shaft and install steering wheel assembly. Tap into place on shaft serrations with a soft-faced hammer. Install nut and washer to secure steering wheel to column.
4. Insert plunger into counterbored hole in steering wheel. Install horn parts.
5. Connect external horn wire. Test operation of horn.

7.3 ORBITROL STEERING GEAR

7.3.1 Removal

1. Remove screws from top of dash panel and tip panel toward driver's seat.
2. Remove screws holding steering column to orbitrol and push orbitrol away from column.
3. Relieve pressure on hydraulic system.
4. Mark and remove hoses from orbitrol. Plug ends to eliminate system contamination.

7.3.2 Installation

1. Unplug and reattach hoses at proper ports.
2. Push orbitrol onto steering column and check engagement.
3. Tip dash panel back and fasten with screws.

8 BRAKES

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8.1 BRAKE SYSTEM DESCRIPTION FOR TRACTOR W/HYDRAULIC BRAKES

The service brake system consists of fully enclosed, oil-cooled, wet disk brakes inside front and rear axles.

The tractor hydraulic system is powered by a gear driven pump on the transmission and is used to activate the brakes and steering. This system is separate from the oil system used to cool brake disks and fill the axle.

Periodically check fluid level in the hydraulic reservoir.

The axle brakes effectively withstand repetitive use without excessive fading and will provide short stopping distances. These brakes may remain effective over the life of tractor and never require adjustment.

The park brake is a caliper type, completely mechanical brake. The rotor is attached to the output shaft on the transmission. The brake is applied by pulling back on the handle.

The Clark-Hurth (Dana) axle service manual is included with this manual. It includes detail information for maintenance, service, and repair.

The brakes are powered by the tractor hydraulic system. See page 1-10 for hydraulic system fluid specifications.

8.2 BRAKE SYSTEM DESCRIPTION FOR TRACTOR W/AIR BRAKES

The service brake system consists of an air over hydraulic system. An air compressor mounted to the engine supplies the air. Air is dried in the air dryer and stored in a three tank system. The first tank is a reservoir.

From there the air divides into two tanks, the primary and secondary. Both tanks are equipped with check valves so if air pressure is lost in one, the other will still maintain air pressure. When the brake pedal (foot valve) is pressed down air pressure from the primary tank flows to the rear air/hydraulic brake actuator. Air pressure is also sent to the front air/hydraulic brake actuator from the secondary tank. The air/hydraulic brake actuators are a combination of a fluid actuator and an air chamber. The pressurized air enters the air chamber and pushes on a diaphragm, which creates hydraulic pressure in the hydraulic cylinder, and hydraulic pressure is put to the brakes in the axles. The front and rear are separate brake systems. The brakes are enclosed, oil-cooled, wet disk brakes inside front and rear axles.

Periodically check the fluid level in the hydraulic reservoirs on top of the air/hydraulic brake actuators.

The brakes effectively withstand repetitive use without excessive fading and will provide short stopping distances. These brakes may remain effective over the life of tractor and never require adjustment.

The parking brake is to the right of the control panel. It is yellow and reads System Park. When pulled the air is released from the parking brake chamber and the springs force the brake shoes together against the parking brake disk. The parking brake is attached to the transmission.

The Clark-Hurth (Dana) axle service manual is included with this manual. It includes detail information for maintenance, service, and repair.

⚠CAUTION Never use common automotive hydraulic brake fluid such as dot or SAE J70. Seals used at each brake piston are incompatible with this fluid and rapid seal deterioration will occur if such fluid is used.

Any brake service other than periodic inspection or bleeding brakes should be performed only by personnel specially trained in brake service.

Never touch rubber parts with oily or gasoline-soaked fingers. Wash hands with soap and water before handling parts.

Never place brake system rubber parts in contact with gasoline, diesel fuel, or any other type of cleaner other than an approved type.

Clean brake system rubber parts in clean, denatured (isopropyl) alcohol, approved brake cleaning solution, or brake fluid.

8.3 BRAKE SYSTEM INSPECTION

Periodic brake inspections are a must for safe and efficient operation. Your inspection should be thorough.

8.3.1 Inspect Brake Disks and Linings Every 2000 Tractor Operating Hours.

Inspection ports are provided in axle housing near center differential to inspect brake pads without removal of axle assembly.

1. Remove brake inspection port plug.
2. Inspect brake linings on both sides of brake disk.

3. If brake lining material is worn down to the bottom of the oil grooves, brake disks must be replaced.

8.4 BLEEDING THE BRAKES

8.5 BRAKE LINES

Check brake metallic lines and hoses for leaks whenever servicing the brakes. Check the lines for signs of deterioration, cuts, kinks and other damage. Replace any line that is questionable.

⚠WARNING Failure of a brake line or fitting can result in a serious accident and possible personal injury. Always replace lines that are questionable.

⚠WARNING Never use your hand to check for leaks. High pressure hydraulic oil can cut through skin.

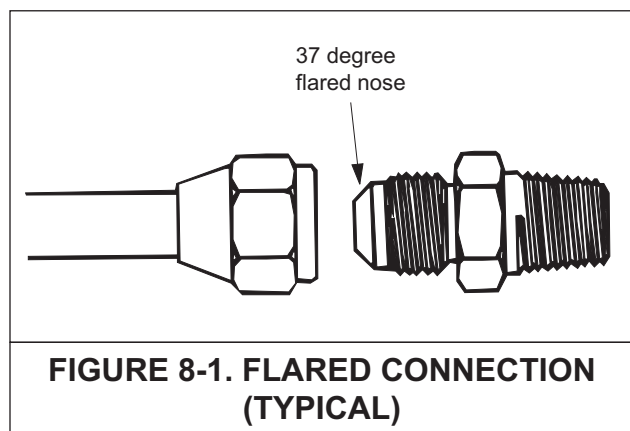
⚠WARNING Always wear eye protection when working with hydraulics to avoid injury. Wear heavy gloves when working with heated components.

8.5.1 SAE 37° Flare Connection (JIC)

Flared fittings are essential on high-pressure applications. Most of the leaks that occur at this connection are due to lack of tightening or human error. You can't tell if the nut has been tightened just by looking at the connection. If it is more than finger tight, you can't tell by observation by how much.

Assembling flared connections

Proper tightening is essential. Since torque wrenches are not always used when they should be, here is a foolproof method of tightening:



1. Tighten nut finger tight until it bottoms the seat.
2. Mark a line lengthwise on the nut and extend it onto the adapter.
3. Using a wrench, rotate the nut to tighten. Turn the nut the amount shown on the following chart.

IMPORTANT! When tightening hydraulic fittings, always use two wrenches to avoid twisting hoses or lines.

<u>Hose Size</u>	<u>Rotate this no. of hex flats</u>
4	2-1/2
5	2-1/2
6	2
8	2
10	1-1/2 – 2
12	1
16	3/4 – 1
20	3/4 – 1
24	1/2 – 3/4

If joint leaks after proper tightening, disconnect hose and check for the following:

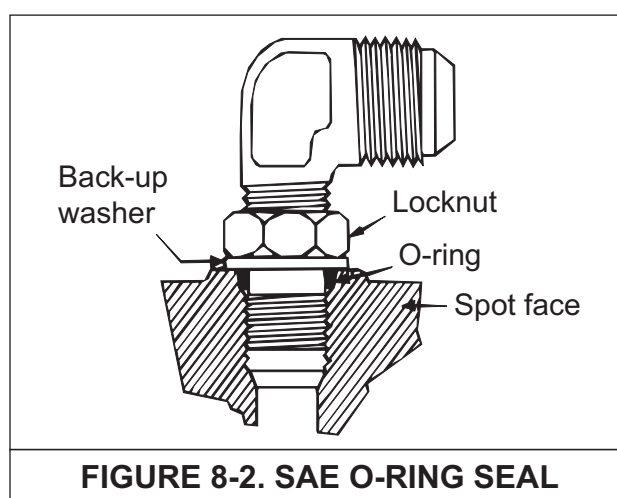
Problem	Solution
Foreign particles in joint	Clean
Cracked seats	Replace
Seat mismatched	Replace adapter
Nicks in seat	Replace

Excessive seat impression Replace SAE 45° nuts . Use all SAE 37° flare parts

IMPORTANT! Leaks on this type of connection won't show until unit has been in service for a few hours.

8.5.2 SAE Straight Thread O-Ring Seal

The O-ring fitting uses straight threads and depends on an O-ring to prevent leaks.



IMPORTANT! If an O-ring seal leaks after tightening, you will have to replace the O-ring.

To install an O-ring seal:

The following procedure properly sets the O-ring.

1. Back up jam nut and washer to unthreaded portion of elbow adapter.
2. LUBRICATE the O-ring.
3. Thread elbow into port until washer bottoms onto spot face.
4. Position elbows by backing up adapter.
5. Tighten jam nut.

8.6 BRAKE PEDAL FOR TRACTORS W/HYDRAULIC BRAKES

The brake pedal is a pressure control valve. It controls hydraulic pressure to brakes. The normal position for the brake pedal is up. To apply the brakes, push the pedal down. To release the brake, let the pedal up.

8.7 BRAKE LIGHT SWITCH ADJUSTMENT FOR TRACTORS W/HYDRAULIC BRAKES

1. Thread adjusting screw until switch activates. Then, thread screw into the pedal 1/4 to 1/2 more turns.
2. Slowly apply pedal and note the point at which the switch trips. Threading adjusting screw in will raise the "trip" point, backing screw out will lower the "trip" point. Secure with jam nut once proper setting is achieved.
3. Internal adjustments and tests are not included with this manual. You may obtain directions for them from the component manufacturer or from NMC-Wollard, Inc.

8.8 BRAKE PEDAL FOR TRACTORS W/AIR BRAKES

The brake pedal is a dual pressure control valve. It controls air pressure to the air/hydraulic intensifiers. The normal position for the brake pedal is up. To apply the brakes, push the pedal down. To release the brake, let the pedal up.

8.9 PARKING BRAKE AND CALIPER

See figure 8-3.

Shift to neutral and turn tractor off and chock the wheels to prevent rolling while servicing the parking brake.

8.9.1 Friction Pad Inspection And Service

1. Replace the friction pads when the required adjustment of the castle nut (in-

structions follow) goes beyond the cotter pin hole center line and there is not full contact of the cotter pin in the castle nut slots. Friction pads that wear down to .060" minimum thick are no longer useable.

2. Unhook the parking brake cable clevis from the cam lever noting which hole it is assembled to. On air brake systems, unhook the air chamber linkage clevis from the cam lever noting which hole it is assembled to.
3. Remove the cotter pin and castle nut from the cam stud. Remove the two push pins. Clean and lubricate all surfaces of the push pins, cam face where it contacts the push pins and the threaded cam stud. Use lube specification 20-003.
4. Pad/holder assemblies are secured to the to the cam side casting and the carrier side subassembly with pad retainer springs. Remove the springs to remove pads. Slide new pad/holder assemblies in place and secure by reinstalling the pad retainer springs over the cam side casting and carrier side sub assembly as illustrated.
5. Install the caliper lever on the cam spline so it points to the 9:00 position or toward the driver and thread the castle nut onto the threaded cam stud.
6. Rehook the parking brake cable clevis or air chamber linkage clevis to the cam lever which was removed in step 2. The linkage should attach to the cam lever without applying any force to the lever with the brake released. If not, refer to instructions following for parking brake lever or air chamber linkage.

8.9.2 Installing A New Caliper

1. The caliper is assembled to the caliper support bracket so it is located on the disc at the 9:00 position when viewed

facing forward (on the side toward the driver).

2. The caliper lever must also point to the 9:00 position or toward the driver. New calipers may be shipped with this lever located differently. If so, remove the cotter pin from the castle nut and remove the nut. Remove the lever from the cam spline and reassemble it so it points to 9:00. See figure 8-3.

8.9.3 Adjust Caliper

1. Tighten the castle nut to remove all clearance between the pads and the disk but not tight enough to force the pads and disc together, ie, finger tight and no pressure on the cam lever.
2. Next, back off the castle nut $\frac{1}{2}$ turn (180 degrees) and then line up the closest cotter pin hole with a slot in the castle nut. Install the cotter pin and secure it.

8.9.4 Adjust the Parking Brake Lever on Hydraulic Brake Systems, Replace Parking Brake Cable

1. Adjust the calipers first without the park brake cable clevis attached to the caliper lever. See 8.9.3.
2. Connect the clevis at the upper end of the cable to the button head pin on the park brake lever if not already connected.
3. With the park brake lever released, check that there is no cable slack at the park brake lever end. This is indicated by there being no space between the crimped ferrule (on the cable core) and the upper cable clevis (with lever fully released). Only if necessary, make the following adjustment. With the park brake lever released, at the lower end of the cable assembly, adjust the two jam nuts of the cable housing to the transmission mounting bracket or adjust the clevis at the end of the cable core so the clevis pin

can be installed to the caliper lever without applying any up or down pressure on the lever. Tighten all jam nuts after adjusting.

4. When the park brake lever is released the lever linkage will hit a stop and this position is not adjustable. When the park brake lever is applied, it must go "over center" to lock in the applied position. It should also be in approximately a vertical position. If the lever can not be pulled to this position with 33 lb (147 N) or less (hand force), the adjuster knob on the end of the lever is too tight. If it pulls too easily, the knob is too loose. This adjustment does not affect the cable adjustment at the lower end.

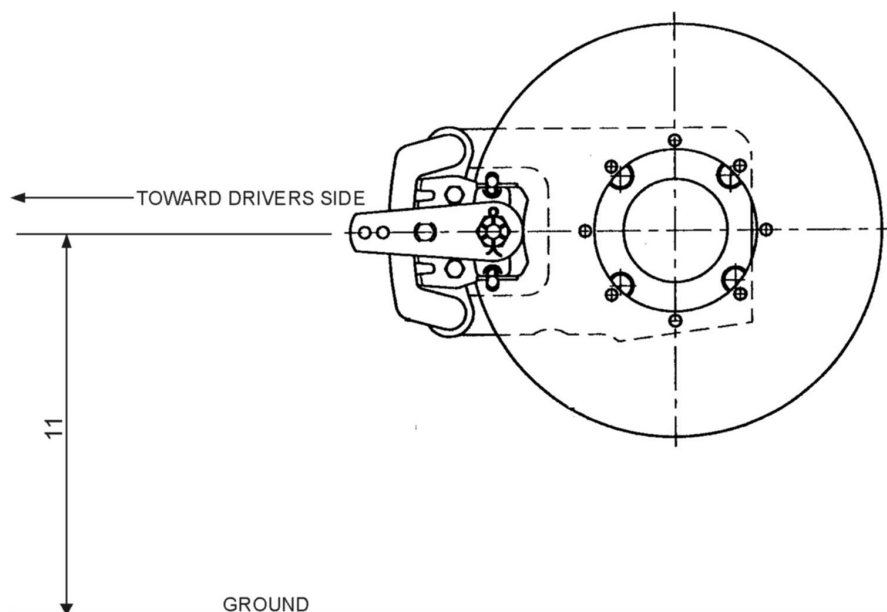
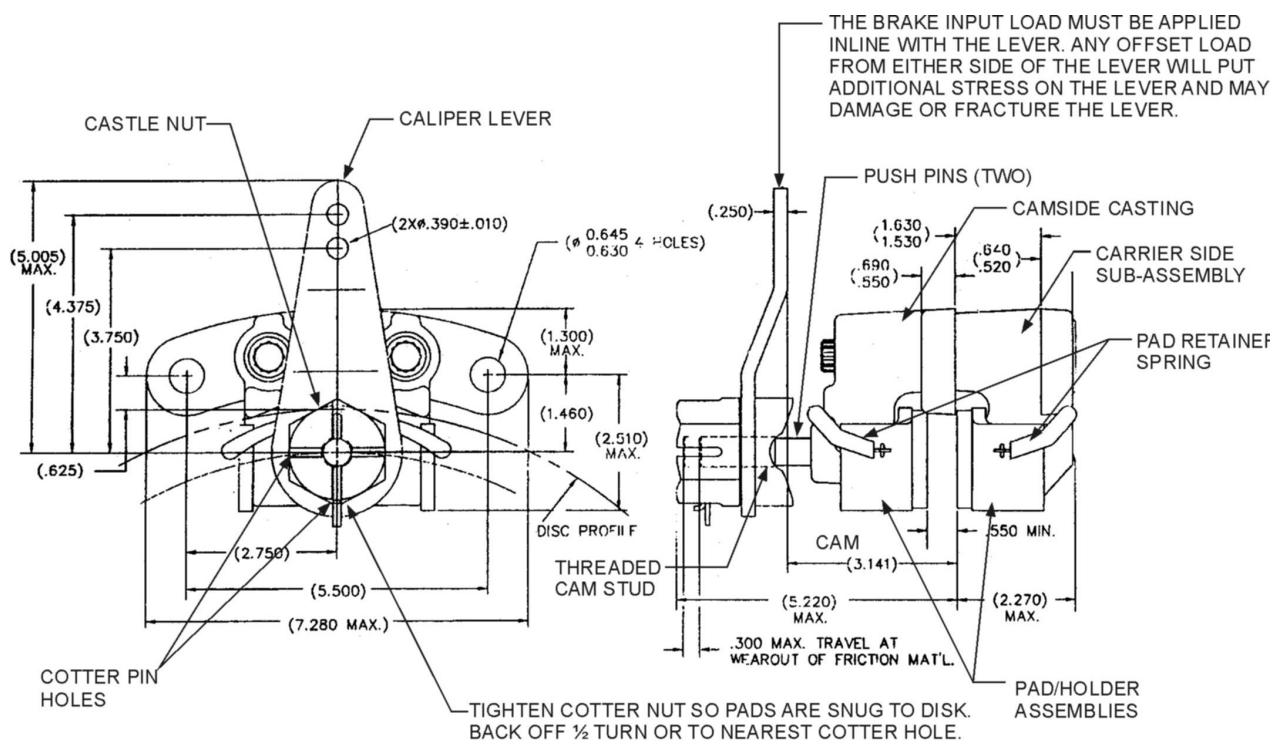


FIGURE 8-3. PARKING BRAKE CALIPER

8.9.5 Air Chamber Linkage Adjustment (Air Brakes)

1. This adjustment is linkage adjustment. To adjust calipers refer to Adjust Caliper. Caliper must be adjusted before this procedure is performed.
2. Start the engine and release the parking brake, which applies pressure to the air chamber. Then turn engine off but do not apply the parking brake, ie, keep the chamber pressurized.

⚠WARNING Pushrod moves very quickly with a very large force. Keep clear of pushrod and caliper lever while pressurizing and de-pressurizing. Do not attempt to uncouple from caliper lever while under tension.

⚠WARNING Improperly adjusted park brake may not apply enough force, or may apply too much force and break caliper. In either situation, park brake will be non-functional with no obvious signs to operator. Replace components until assembly can be adjusted within ALL limits in figure 8-4.

3. Set the linkage to the 14.37" length shown on Figure 8-4 while maintaining the two 1.56" minimum dimensions.
4. The air chamber linkage clevis should now connect to the innermost of the three holes on the cam lever without applying any pressure to the lever. If it does not, make slight adjustments at either the clevis or the linkage link so it does.

NOTE: If installing a new caliper assembly or new cam lever, the caliper lever will require drilling a new hole to hook the air chamber linkage clevis to. See Figure 8-4.

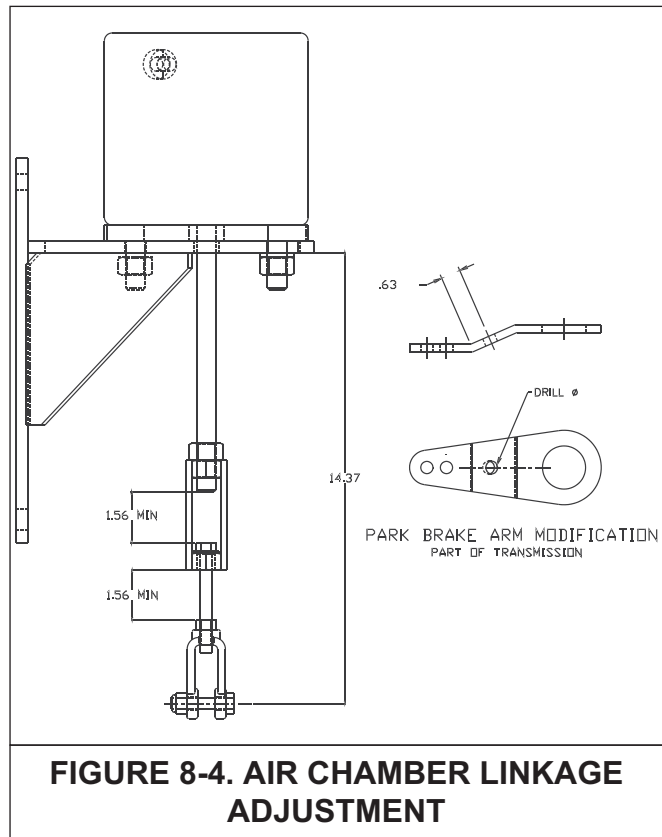
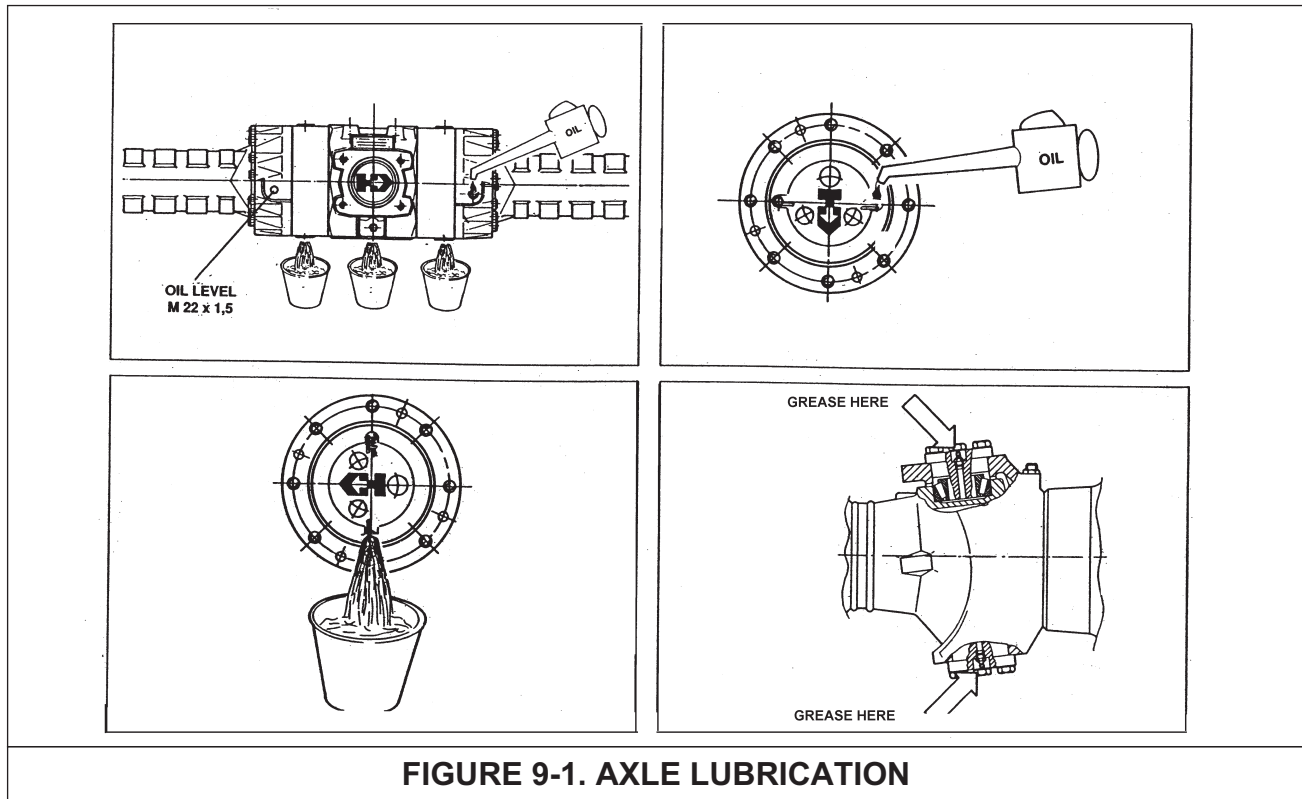


FIGURE 8-4. AIR CHAMBER LINKAGE ADJUSTMENT

9 AXLES, DRIVE SHAFTS, AND WHEELS

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**FIGURE 9-1. AXLE LUBRICATION**

9.1 OVERVIEW

The front axle is steerable and rigidly attached to the frame

The rear axle is a steerable, drive axle attached to the frame by an oscillating center mount.

Before beginning any repair, review the Clark-Hurth (Dana) manual for guidelines. These are provided to emphasize the need for attention to detail and care when servicing the axle assembly.

9.2 CHANGING AXLE OIL

The rear axle has three drain plugs: one on outside of each wheel end and one on axle housing. The wheel end drain plugs are also fill plugs.

1. Move tractor to a level surface. Shut off engine and set parking brake.
2. Raise tractor and set on suitable supports. Make sure tractor is level.
3. Remove wheels from axle.
4. Using a clean rag and wire brush, thoroughly clean dirt and rust from around the three drain plugs, axle housing fill plug, and axle breather.
5. Place a catch pan under each drain plug.
6. To drain wheel ends, rotate wheel end until plug hole is at its lowest position.
7. Remove each drain plug. Inspect and remove metal particles from axle housing plug. Normally, these particles are very fine. If they appear to be irregular or of a large size, there may be damage inside axle. Notify your supervisor of this condition.
8. When oil has drained, replace and tighten axle housing drain plug.
9. Turn wheel ends so plug holes are above level of axle shaft. If necessary,

install plug to prevent housing oil from leaking out.

10. Remove axle housing fill plug (upper plug) and fill with oil to plug hole.
11. To fill wheel ends, turn wheel so wheel end plug is horizontal to axle shaft. Fill wheel ends with oil to plug hole. Install and tighten plug.
12. Remove, clean, and then reinstall drive axle breather. Replace if required.

Axle Oil Specification & Capacity

SAE 85 W90 Specification API GL5-MIL 2105-B

Center Housing, 12 qts. (11.3L)

Reduction Housing, 1.8 qts.(1.75L)Each End

9.3 AXLE REMOVAL

1. Provide adequate working space under tractor. Raise tractor with jacks and support tractor with appropriate jack stands, positioning to not interfere with axle removal.
2. Remove wheel and tire assemblies.

⚠WARNING Both front and rear axles weigh approximately 1100 lbs. Support axles properly to avoid injury.

3. Position axle jack under axle. Raise to relieve pressure on attaching hardware.
4. Clean area around hose ends.
5. Relieve pressure in hydraulic system and remove hoses. Plug ends of hoses to prevent system contamination.
6. Remove axle u-bolts. Remove the outer u-bolts first. After the other ones are removed, used the supplied u-bolt wrench tool and a ½" breaker bar to remove the inner u-bolt nuts. See figure 9-2.

NOTE: The u-bolt wrench can be purchased from NMC-Wollard, Inc., part #42906

7. Lower axle jack until axle clears frame and remove.

9.4 AXLE INSTALLATION

1. Position axle under tractor and raise into position with an axle jack.
2. Attach axle to frame mounting with inner u-bolts, nuts, and lockwashers first. Tighten nuts to 332 ft-lbs. using the supplied u-bolt wrench tool and ½" drive torque wrench. See figure 2. After installing the inner u-bolts, the outer u-bolts can be installed with standard socket and torque wrench.
3. Remove plugs from hydraulic hoses, being careful so no contamination enters system. Reattach hoses to axle.
4. Lower axle jack and remove from under tractor.

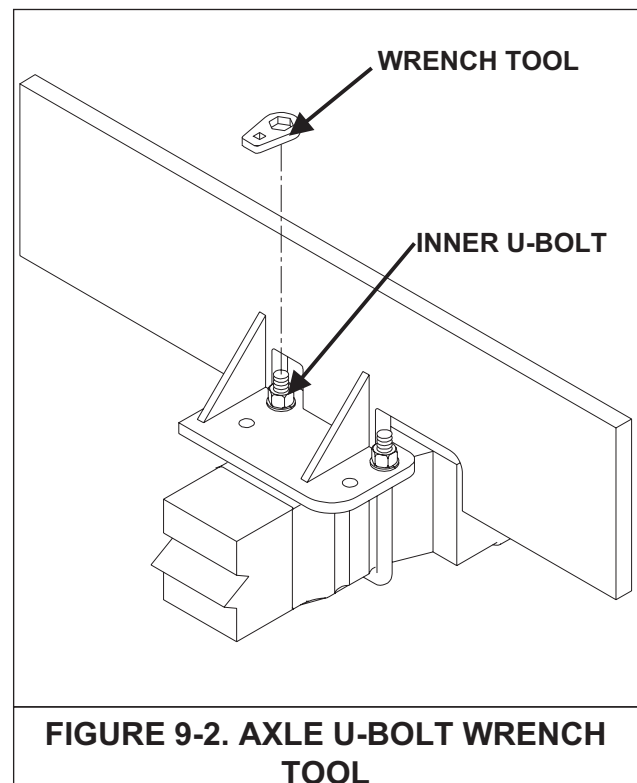


FIGURE 9-2. AXLE U-BOLT WRENCH TOOL

5. Reattach wheel/tire assemblies and torque bolts to 400 ft-lbs (dry).

9.5 DRIVE SHAFT AND U-JOINT REPAIR

A drive shaft at front and one at rear transmits torque from the transmission to each axle assembly. Universal joints at each end of the drive shaft compensate for any angular misalignment between the transmission and the axle.

Repair of the drive shaft assembly is limited to replacing universal joints, the slip joint components, or the complete drive shaft.

9.5.1 Removal

1. Chock wheels so tractor does not move. Place transmission in neutral.
2. Remove four capscrews securing each end of driveshaft.
3. Carefully strike the yoke to push drive shaft slip joint together. Remove drive shaft assembly from tractor. Be careful not to allow bearing caps to fall off spider.

9.5.2 Installation

1. Install drive shaft assembly and secure with capscrews and lock washers.
2. Grease universal joints with a high-quality grease (MIL-G-10924).

9.5.3 Universal Joint Repair

9.5.3.1 Removal—Flange Yoke End

1. Match mark the flange yoke bearing caps and spider to ensure that bearings are assembled on same spider journals.
2. Remove retaining ring clips securing bearing caps to flange yoke and separate flange yoke from drive shaft.

3. Support drive shaft in a way that will allow bearings to be pressed from yoke without interference.
4. Using a short piece of pipe or a solid rod (about same diameter as bearing cap) and a hydraulic press, press a bearing cap until spider bottoms on yoke.
5. Use a hammer to tap loosened bearing cap from yoke.
6. Turn drive shaft over and repeat steps 4 and 5 to remove remaining bearing cap.

9.5.3.2 Removal—Slip Yoke End

1. Loosen slip yoke dust cap and remove slip yoke from drive shaft.
2. Remove retaining rings securing bearing caps in slip yoke.
3. Repeat previous steps 3-6 under 'Flange Yoke End' to disassemble universal joint.

9.5.3.3 Assembly—Slip Yoke End

1. Clean and inspect yokes for damage and replace if necessary.
2. Apply automotive grease to new needle bearings to retain them in caps.
3. Start one of the caps into slip yoke bearing bore.

IMPORTANT: Protect bearings before installation and handle carefully during installation to prevent entry of dirt or other foreign matter into bearings.

4. Pack grease passage in spider with automotive type grease before installation.
5. Install new seals on spider journals.

6. Install spider in yoke and start one journal into bearing cap assembled to yoke. Be careful to not dislodge needle bearings.
7. Start remaining bearing cap into remaining yoke bore and start journal into that bearing. Do not dislodge needle bearings in either bearing.
8. Using either a press or bench vise, carefully push bearing caps into bores and onto bearing journals. If substantial resistance is encountered, a needle bearing may have been dislodged and is impeding progress. Carefully remove bearing caps and make sure bearings are in place. If a bearing is damaged, replace it with a new one.
9. Continue pressing on one side until retaining ring groove is exposed. Install retaining ring. Turn yoke over and press the other bearing into its bore. Install the retaining ring.
10. Install remaining seals and bearings on spider journals. Tape these bearings to yoke to prevent them from falling off spider.
11. Loosely assemble dust cap. Lubricate splines on drive shaft and insert shaft into slip yoke, insuring that front and rear yokes are aligned.
12. Lubricate slip joint through grease fitting before installing drive shaft on tractor.

Assembly—Flange Yoke End.

1. Apply automotive grease to needle bearings to retain them in cap.
2. Pack grease passage in spider with automotive-type grease before installation.
3. Slide two bearing assemblies onto spider journals 180 deg. apart. Use match marks to get correct bearing on correct journal.

4. Position spider and bearing assembly on flange yoke and secure bearing assemblies with retaining ring clips.
5. Install remaining two bearing assemblies on spider journals and position flange assembly on drive shaft. Install retaining rings.

9.6 WHEELS AND TIRES

The front and rear wheels are similar in maintenance, cleaning, and inspection.

9.6.1 Removal

1. Move tractor to a level surface. Shut off engine and set parking brake.
2. Using a jack, overhead crane, or some other suitable lifting device (minimum 10 ton), raise end of tractor until wheel comes off ground. See Section 1 for jack stand locations.
3. Place jack stands under tractor to support it while wheel is off.
4. Remove lug nuts and tire and wheel assembly.

9.6.2 Disassembly

1. Let air out of tire and remove valve core.

⚠CAUTION Use proper tire removal tools to prevent possible damage to the tire bead.

⚠WARNING If a bead breaker slips, it can fly off with enough force to cause serious injury.

2. Remove tire from wheel using standard safety equipment, tire changing equipment, and safety practices.
3. Remove valve stem if damaged or defective.

9.6.3 Inspection And Cleaning

1. Wash dirt and grease from tire with soap and water and a soft bristle brush or a clean cloth. Rinse with clean water and allow to air dry.
2. Remove dirt and grease from wheel with a cloth dampened with solvent. Allow to air dry.

⚠CAUTION Do not use cleaning solvent on tires. Solvents cause deterioration of the rubber.

3. Inspect tire for uneven wear. Replace any badly worn tire.
4. Inspect tire for cuts, nails, stones in tread, or deterioration. If damage is severe, replace tire.
5. Inspect wheels for cracks and other damage. If damaged, replace wheel.

Repair

1. Remove stones and other foreign material imbedded in tires.
2. Repair punctures or cuts if possible.
3. Remove nicks, burrs, and rust from wheels. Clean rim sealing area with coarse steel wool. Repaint wheel if necessary.

⚠CAUTION Never mix rim parts of different manufacturers or different sizes. Do not use damaged parts.

9.6.4 Assembly

1. If removed, install a new valve stem in wheel.
2. Mount tire on wheel using standard safety equipment, tire changing equipment, and safety practices. To help get

tire on, always use an approved rubber lubricant or use a small amount of soapy water for lubricating tire bead.

⚠WARNING Do not attempt to use extremely high air pressure to seat a tire bead. If a tire cannot be seated using normal pressure, contact the manufacturer for advice.

⚠WARNING Make sure no one is in the blow-out trajectory area. Always stand to one side when inflating tires.

3. Install valve core and place entire assembly in restraining device and inflate tire to 90 PSI. Make sure bead has seated all around and on both sides.

⚠CAUTION Do not lean or rest your body or repair equipment against the restraining device while the wheel/tire is in the device.

⚠WARNING Never inflate tires with air from systems using alcohol evaporators.

4. Inspect tire and wheel components while still in restraining device to make sure they are properly seated. If further adjustment is necessary, first deflate tire and remove valve core. Check for leaks. If none are detected, install valve cap.

9.6.5 Installation

1. Thoroughly clean the cap screws, washers, and tapped holes in the axle flange.

2. Assemble valve stems, if not already done.
3. Slide wheel over final drive carrier and onto wheel pilot.
4. Install capscrews by hand to insure screws are not cross-threaded.

⚠ CAUTION If using a power wrench, first hand engage capscrews to prevent stripping.

5. Do not start lug nuts with power tools or cross threading may result.
6. If using a power wrench, first hand-engage capscrews to prevent stripping. Operate wrench slowly to prevent damage to threads.
7. Tighten gradually in an alternating pattern to final torque value.

MODEL 200 TRACTORS

WHICH WHEEL	STUD SIZE	TIGHTENING TORQUE (DRY)
Front	22mm	400 ft-lbs.
Rear	22mm	400 ft-lbs.

8. Always recheck lug nut torque one hour after mounting wheel and tire assembly. Failure to do so may result in loose wheels and/or broken wheel studs.
9. Lower tractor and remove jack stands and jacks from beneath tractor.
10. Run unit and check wheels after one hour and periodically thereafter to be sure wheels are set.

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This chapter contains the Illustrated parts breakdown (IPB) for the model 200 tow tractor manufactured by NMC-Wollard, Inc. of Eau Claire, WI, 54702. Any part in listed this IPB can be obtained from NMC-Wollard by calling 715-835-3151.

NOTE

Parts obtained from sources other than NMC-Wollard, Inc. will not be covered under the NMC-Wollard Inc. warranty. Damage to the tow tractor caused by the use of non-NMC-Wollard parts will not be warranted by NMC-Wollard.

Abbreviations Used in the IPB

- A/R. As Required
- COMM Common item
- NS Not Shown
- NSS Not Sold Separately
- HHCS. Hex Head Cap Screw
- RHMS. Round Head Machine Screw
- THMS Truss Head Machine Screw
- SHCS Socket Head Cap Screw
- REF for Reference only
(this means the part is listed elsewhere)
- L.H. Left Hand
- R.H. Right Hand

All capscrews and bolts are zinc plated, grade 5, unless otherwise stated.

NOTE

Because most customers can obtain fasteners locally, they are not included with any order unless you specifically request them.

NUMERICAL PARTS LIST

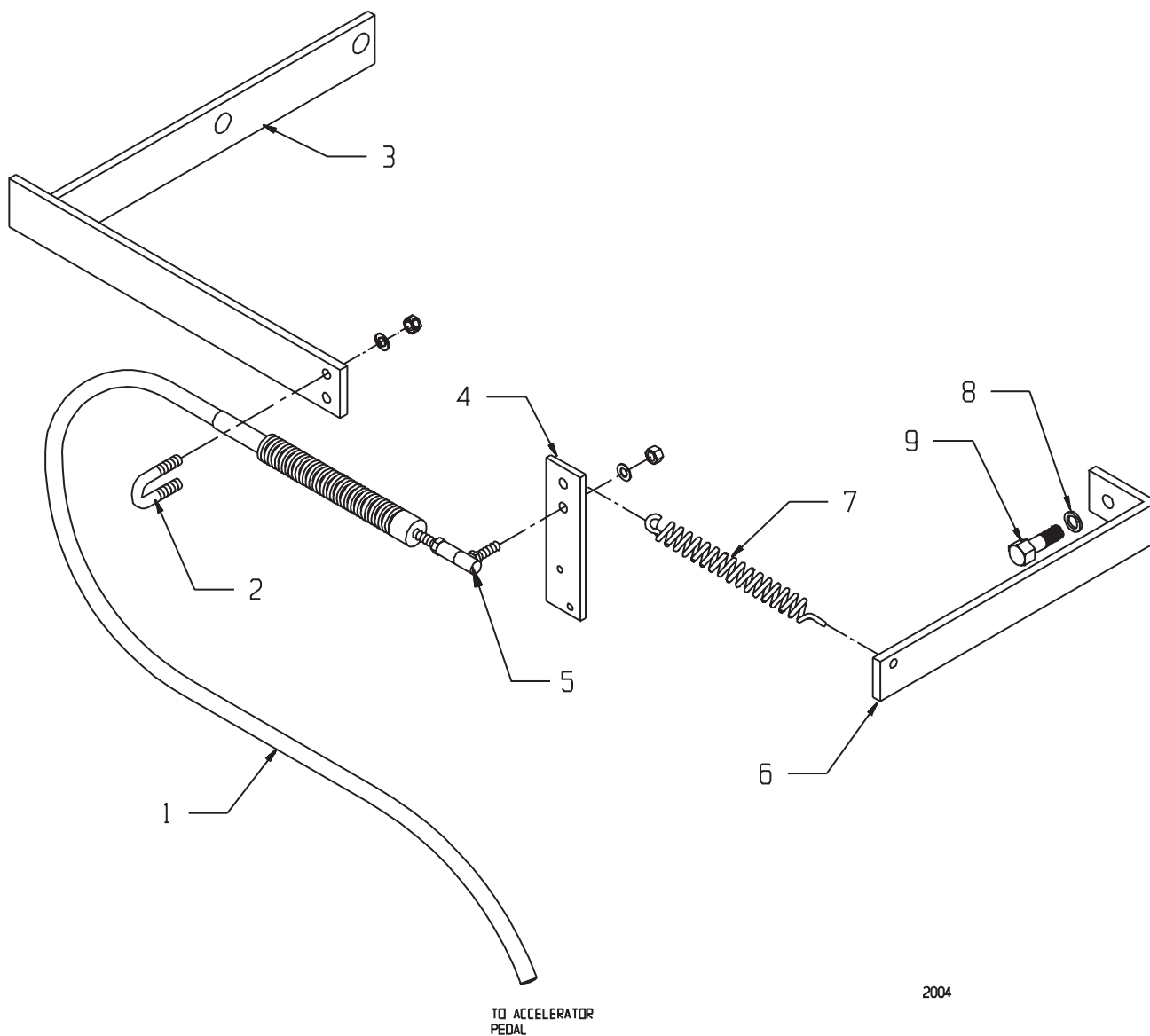
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1011156	119	205784	97	37322	133
1011157	119	205785	97	37326	35
1011267	109,111	206090	113	37403	99
1011270	107,111	26797E	129	37407	107,115
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1012029	107,111	3.0248	121	37535	45
1012226	107,111	3.0263	121	37604	99
1012697	109,111,115,117,139	3.0328	121	37625	133
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10384.39	109,113,133	3.0746	103	37838	107
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14762.21	109	3.1678	107,111,133	38635	143
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153768	41	3.2118	107,111,133	38906	162
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200533	109,113	305020	45	41389	99
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200709	121	306745	147	41433	101
200715	109	306746	147	41434	143,145
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201913	105	37023	45	41529	45
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202927	129	37202-1	103	41846	109,113
203004	133	37213	143,145	41855	163
203082	109,113	37214	143,145	41856	163
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41964	39	42836	99	43107	47,55
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42056	35	42869	103	43145	147
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42362	17	42918	151	43469	99
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43648	25	43861	47	44350	163
43649	25	43862	47	44361	121

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44377	41	F015973	162	NW017063	133
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90415	111	F101637	125	NW30992	107,111
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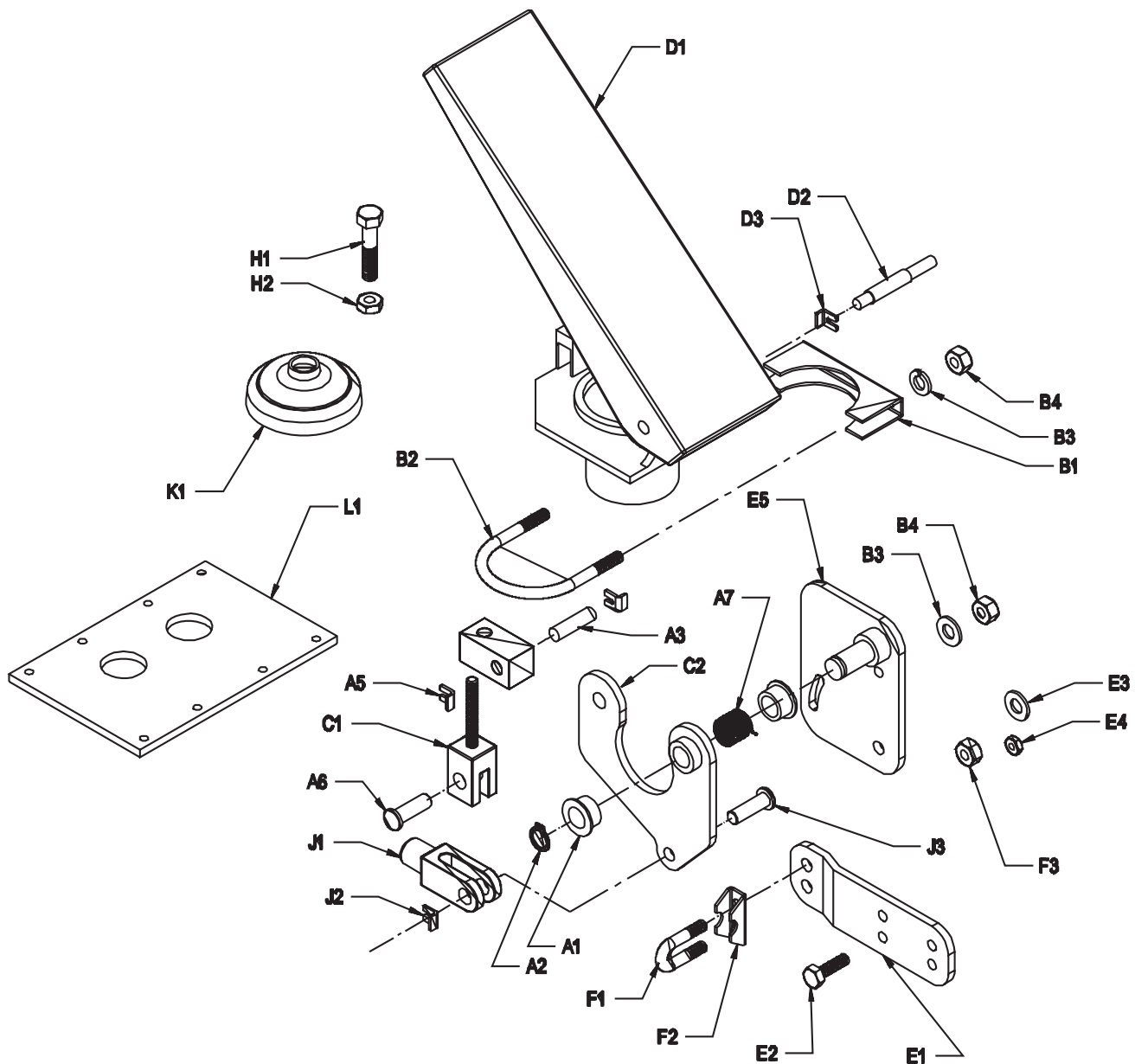
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NW35606	97	T427979-18	15		
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ACCELERATOR LINKAGE

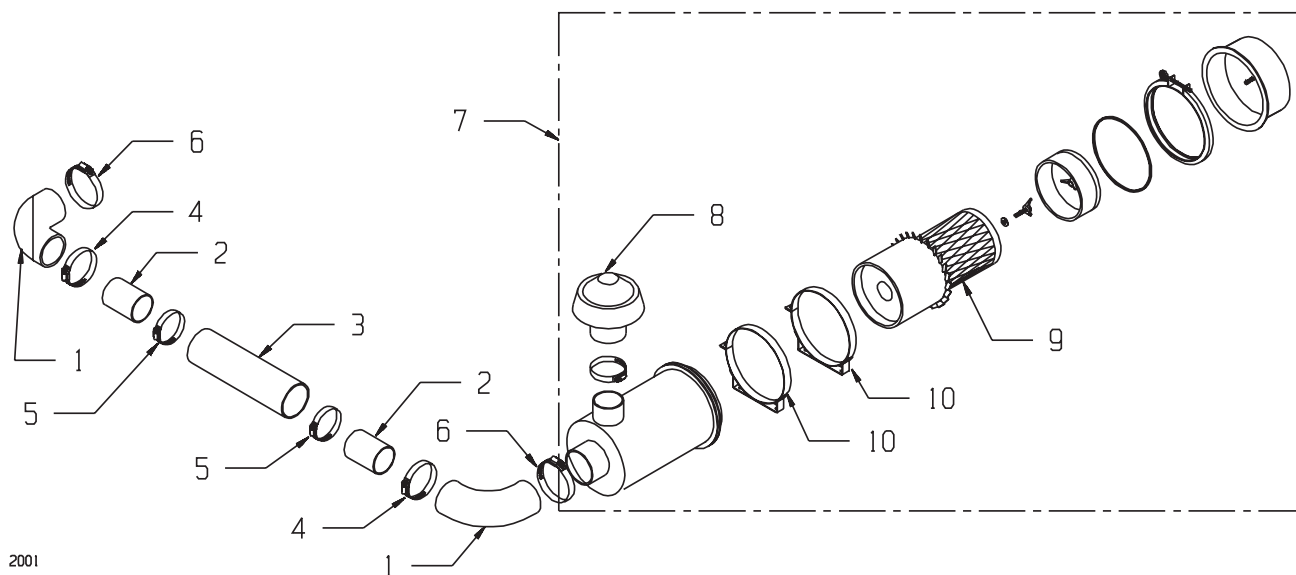
2004

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T446832-16		Linkage System 200MB4-1		Ref
1	41536		Cable, Accelerator		1
2	F101865		Clip, U-bolt		1
3	42973		Bracket Weldment, Throttle		1
4	42132		Plate, Throttle Lever Ext		1
5	F101863		Ball Joint		1
6	42974		Bracket, Spring		1
7	NW21911		Spring		1
8	Comm		Washer, M12 Lock		1
9	42981		HHCS, M12 x 1.5 x 25		1

Also See Page 34.

ACCELERATOR PEDAL

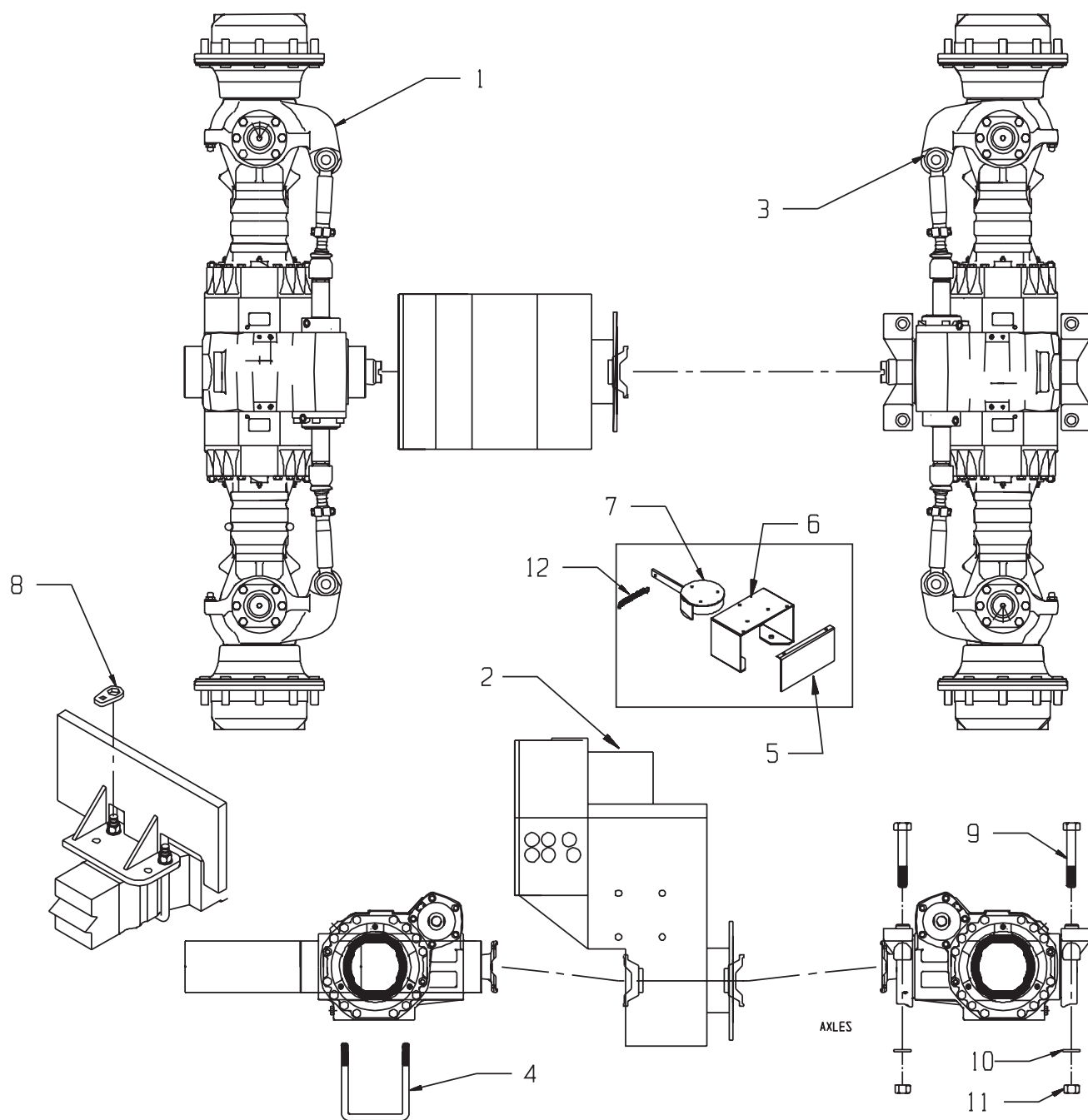
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T446832-16		Linkage System 200MB4-1		Ref
	NW35401	208994	Accelerator Pedal Assembly (Morse Controls - Hudson)		1
A1	NW35401-1	210490	Bearing Kit, Contains:		2
A2			Nyliner Bearing		1
A3			Circlip		1
A4			Long Pin Bearing		1
A5			Block Assembly		3
A6			Spring Clip		1
A7			Short Pin Bearing		1
B1	NW35401-2	301783	U-bolt Kit, Contains:		1
B2			Hanger Bracket		1
B3			U-bolt Lock Washer, Internal 5/16		2
B4			Hex Nut, 5/16-24		2
C1	NW35401-3	210491	Lever and Push Rod Kit, Contains:		1
C2			Fork Push Rod Lever Assembly		1
D1	NW35401-4	210796	Treadle Conversion, Contains:		1
D2			Pedal		1
D3			Pivot Spring Clip		1
E1	NW35401-5	301790	Cable Hanger and Support Bracket, Contains:		1
E2			Cable Support Bracket		2
E3			HHCS, M6 x 1.0 x 16MM		2
E4			Hex Nut, M6 x 1.0		2
E5			Flat Washer, M6 Hanger Plate Assembly		1
F1	NW35401-6	301791	Cable Anchor Kit, Contains:		1
F2			U-bolt Clamp		1
F3			Shim Stop Nut, #10-32		2
H1	NW35401-8	295398 & 303138	Stop Kit, Contains:		1
H2			HHCS, M8 x 1.25 x 40MM Hex Jam Nut, M8 x 1.25		1
J1	NW35401-9	301046	Clevis Terminal Kit, Contains:		1
J2			Fork End		1
J3			Spring Clip Clevis Pin		1
K1	NW35401-10	208468	Bellows Kit, Contains: Bellows		1
L1	NW035802		Brake/Accelerator Cover Plate (Hyd Brakes)		1
	43762		Brake/Accelerator Cover Plate (Air Brakes)		1
NS	NW36793	CE9112 6	Switch, Push Button, Moment (V00506)		

AIR INTAKE ASSEMBLY

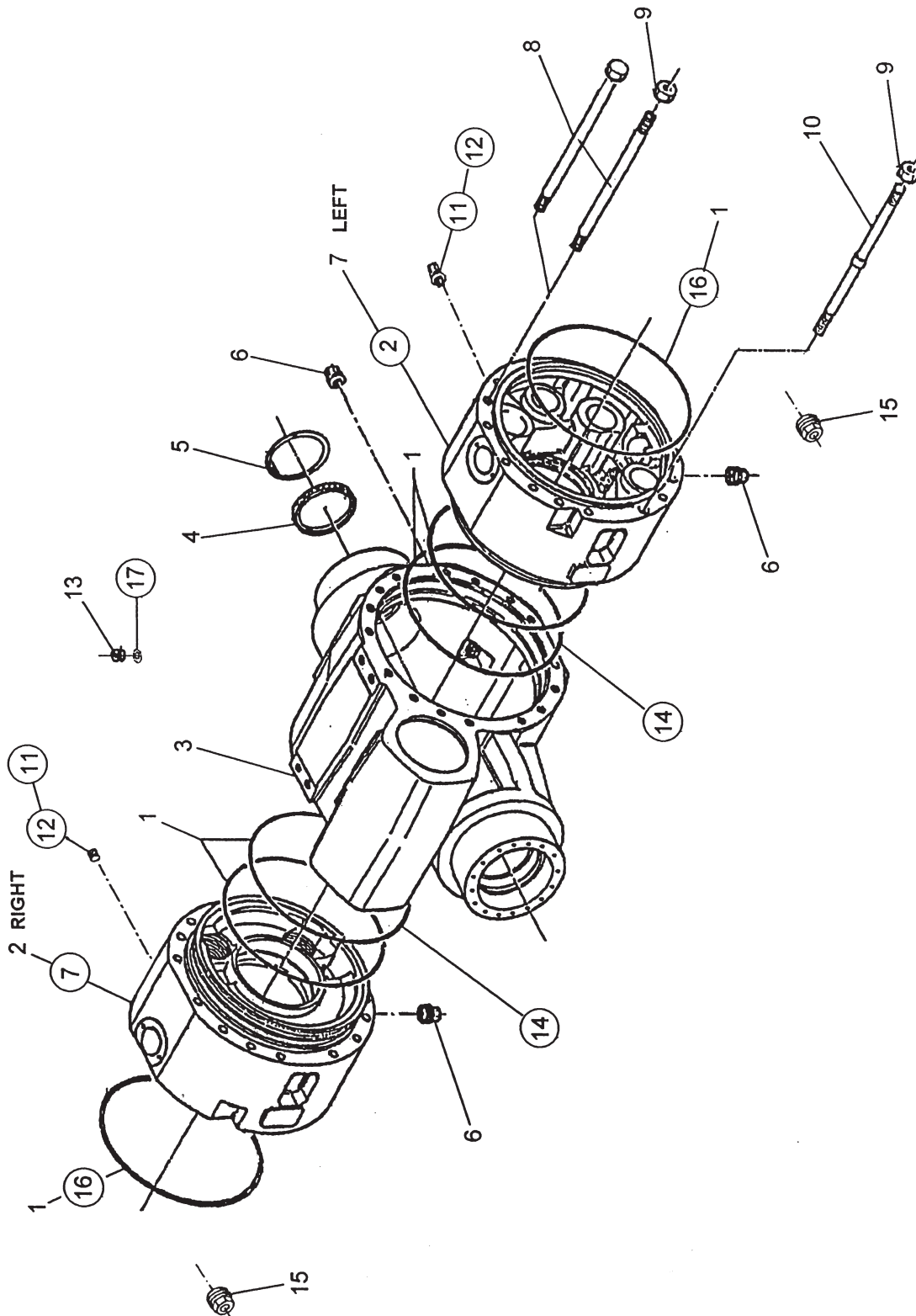
2001

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-18		Air Intake Assembly		Ref
1	NW035733		Elbow, Air Intake		
2	200223		Tube, Air Cleaner, 240		2
3	NW35624		Hose, Air Intake, 200		14"
4	NW33103		Clamp, T-Bolt, 3.00		2
5	NW35623		Clamp, T-Bolt, 2.75"		2
6	NW35628		Clamp, T-Bolt, 4"		2
7	NW35295	G10-0003	Air Cleaner Assembly, Donaldson, G-10 (8S377)		1
8	NW35297		Hood, Air Cleaner		1
9	42261	P181045	Filter, Primary, Air Clean, 10 (8S377)		1
10	NW35298		Band, Mount, Air Cleaner, 10"		2

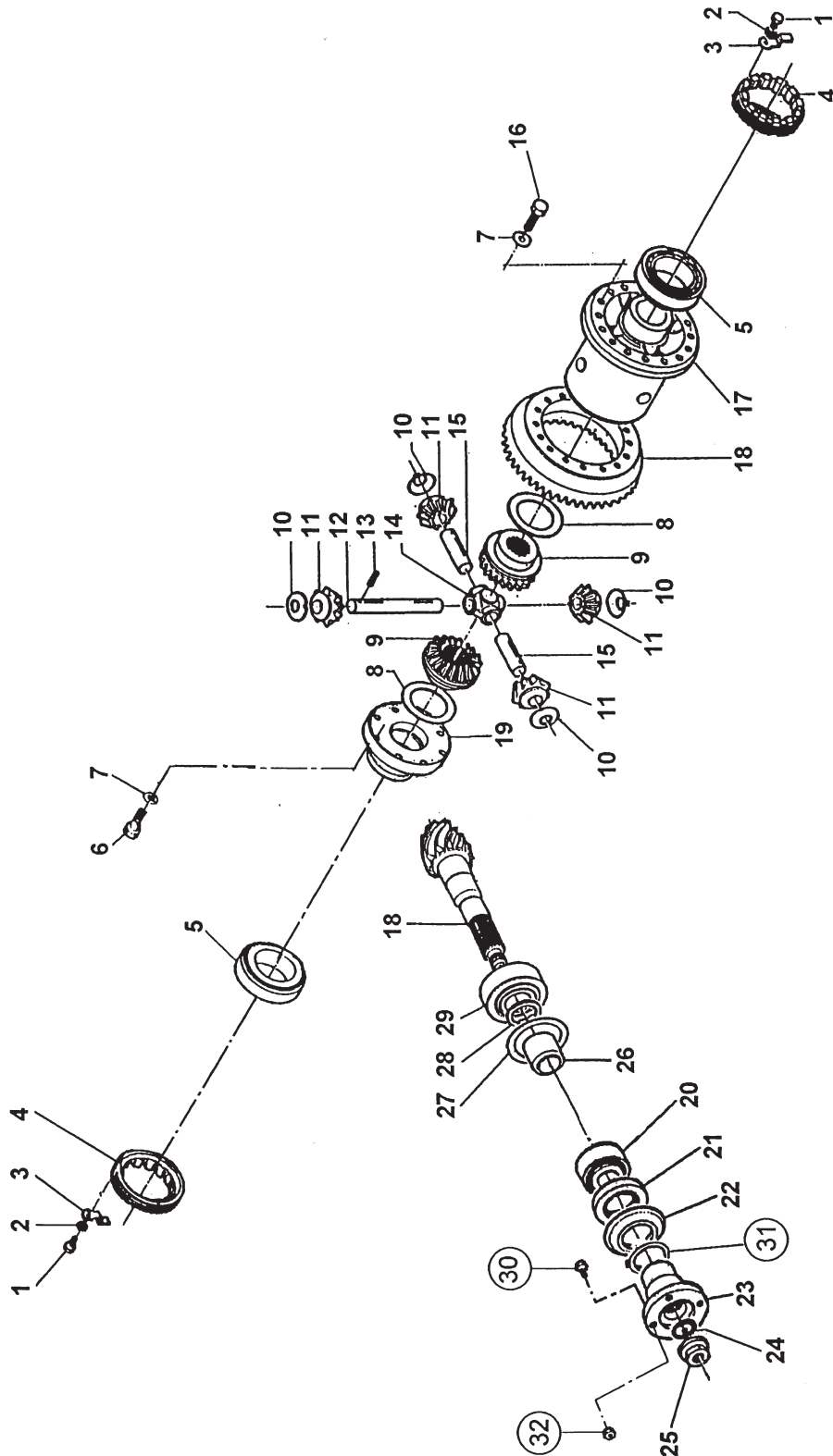
AXLE - FINAL DRIVE



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	42362		Axle Assembly		1
1	42311		Axle Front (see separate parts listing)		1
2 NS	42503 NW30236		Transmission, Funk (See Pgs 46, 56) Sender Trans. temp.		1 1
3	42312		Axle, Rear (see separate parts listing)		1
4	42651		U-Bolt 7/8-14 x 7 x 10		4
5	42720		Guard, Rheostat		2
6	42719		Bracket, Rheostat		2
7	37154		Axle Indicator		2
8	42906		Tool, U-Bolt Wrench		1
9	203929		HHCS 1-8 x 6.50 GR		4
10	204715		FW 1" SAE, Hard		4
11	204717		Nut Hex 1-8 Top Loc		4
12	NW21911		Spring		2
NS	1003235		Zerk, Grease, 1/8x45B		2

AXLE REPAIR PARTS - FRONT/REAR**1 OF 5**

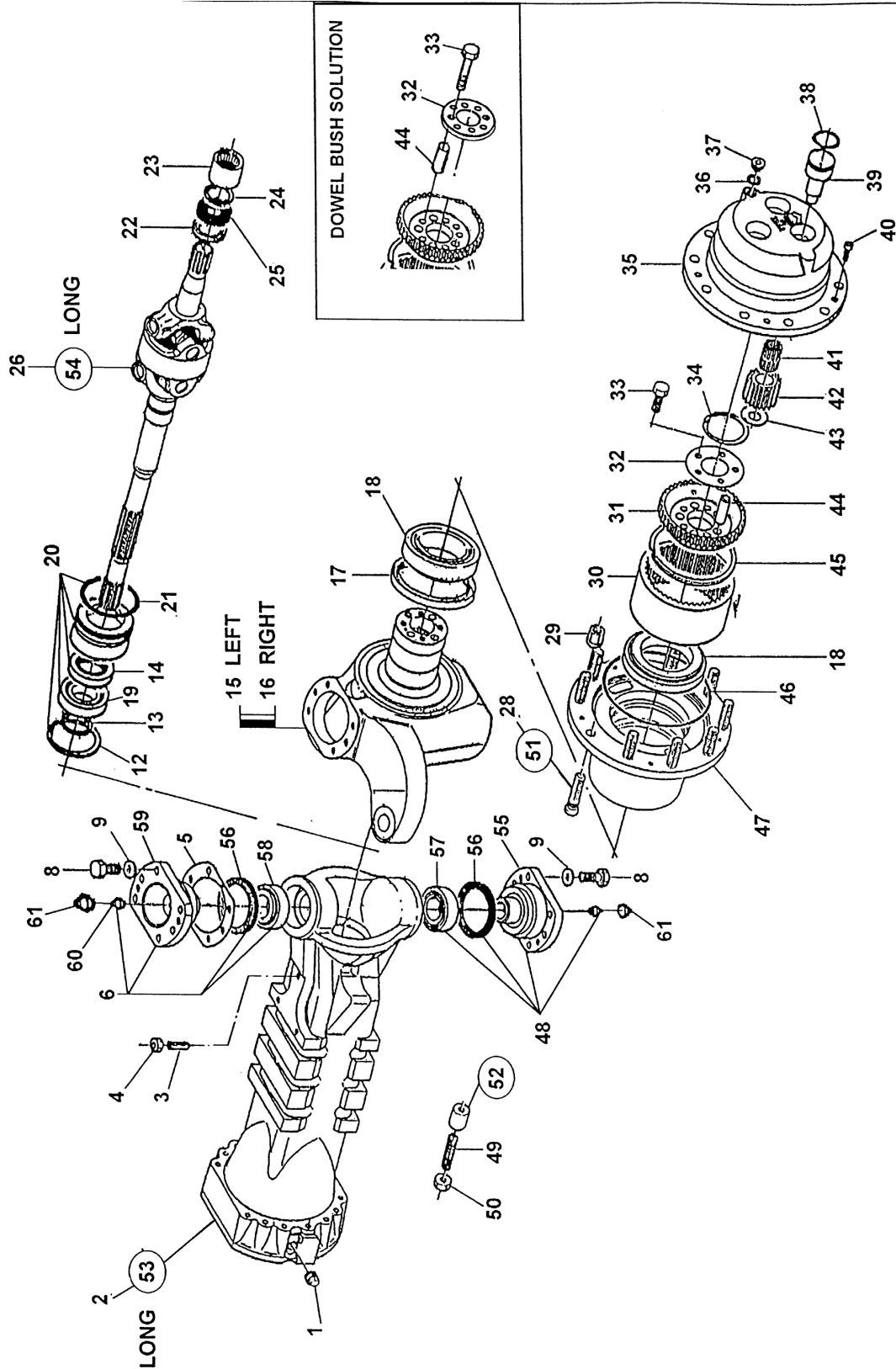
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	42311		Axle, Front		1
	42312		Axle, Rear		1
1	43476	176.07.029.01	O-Ring		2
2	43477	176.01.003.13	Intermediate Cover		1
3	43478	276.01.004.01	Housing		1
4	43479	171.01.015.01	Plug		1
5	43480	002.02.0088	Circlip		1
6	43489	819.01.610.01	Magnet Plug		3
7	43490	176.01.002.12	Intermediate Cover		1
8	43491	016.03.3141	Bolt		28
9	43492	006.01.1489	Nut		4
10	43493	276.06.008.01	Stud		4
11	43494	016.14.1138	Plug		1
12	43495	702.01.003.01	Vent		1
14	43496	176.07.029.02	O-Ring		2
15	43533	808.01.017.01	Plug		4

AXLE REPAIR PARTS - FRONT/REAR
2 OF 5

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	42311		Axle, Front		1
	42312		Axle, Rear		1
1	43534	016.01.1495	Bolt		2
2	43535	011.05.0232	Lock Washer		2
3	43536	176.04.010.01	Locking Plate		2
4	43537	176.04.009.01	Ring Nut		2
5	43538	005.09.0762	Taper Roller Bearing		1
6	43539	016.02.1268	Hexagon Bolt		8
7	43540	011.04.0758	Spring Washer		8
8	43541	734.04.010.01	Friction Washer		2
9	43542	734.04.005.02	Differential Side Gear		2
10	43543	734.04.009.01	Friction Washer		4
11	43544	734.04.007.02	Differential Pinion		4
12	43545	734.04.008.03	Pin		1
13	43546	014.03.1166	Roll Pin		3
14	43547	176.04.013.01	Shaft Retainer		1
15	43548	734.04.008.04	Pin		
16	43601	016.02.1374	Hexagon Bolt		
17	43602	176.04.001.01	Differential Carrier		
18	43603	734.04.507.08	Bevel Gear Set		
19	43604	176.04.011.01	Cover		
	45868		Kit, Bearing, Seal (includes items 20,21)		1
20	43605	005.09.0831	Taper Roller Bearing		1
21	43606	001.13.1234	Seal		1
22	43607	276.01.005.01	Cover Plate		
23	43608	734.04.073.01	Flange		
24	43609	001.05.0818	O-Ring		
25	43610	734.04.035.01	Nut		
26	43611	734.04.036.03	Spacer		
27	43612	013.01.0322	Shim		
28	43613	013.01.3282	Shim		
29	43614	005.10.1457	Taper Roller Bearing		

AXLES REPAIR PARTS - FRONT/REAR

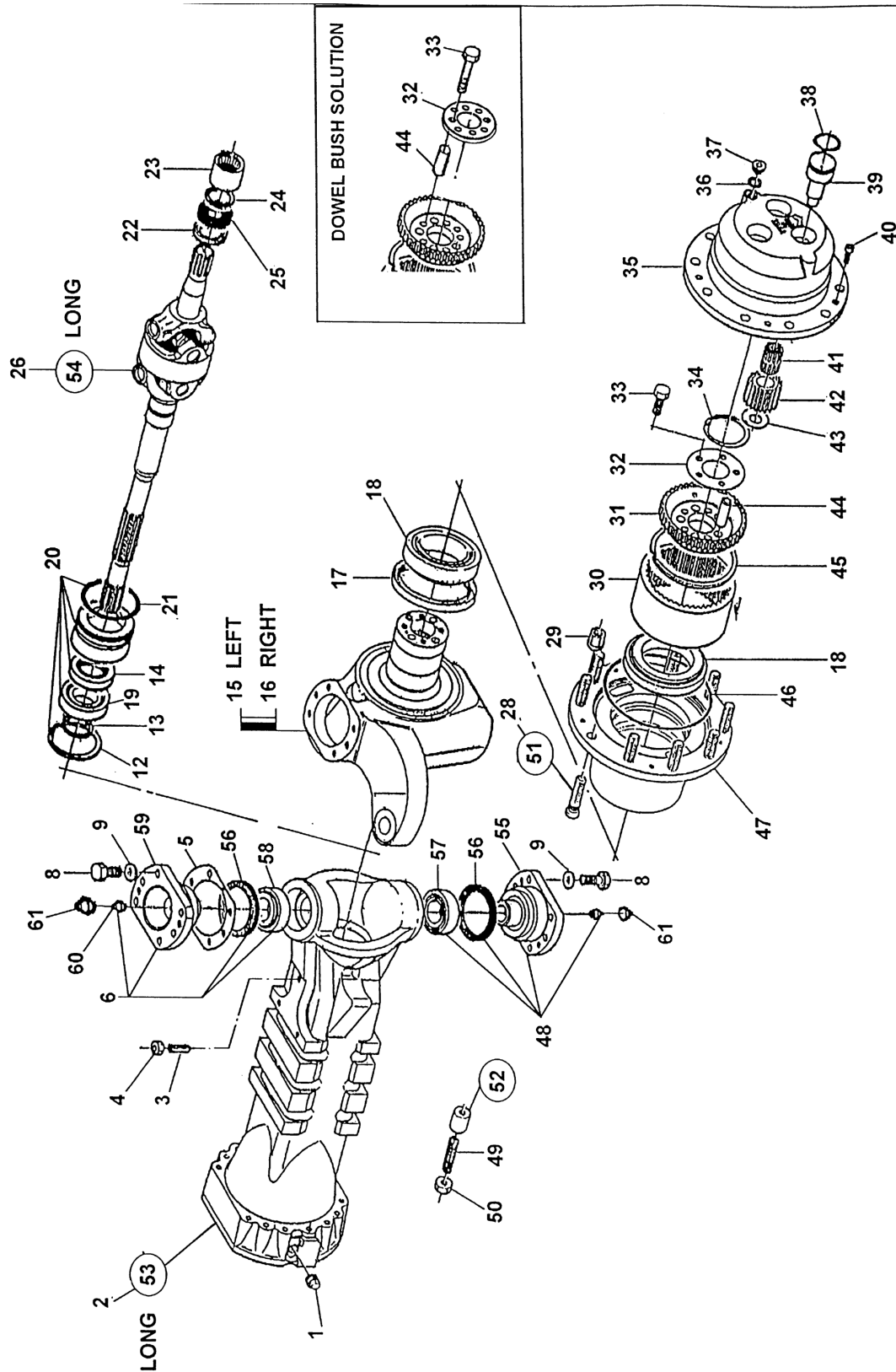
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Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
	42311		Axle, Front		1
	42312		Axle, Rear		1
2	43615	276.06.001.06	Lateral Axle Housing		2
3	43616	016.13.0717	Grub Bolt		4
4	43617	006.05.0684	Nut		4
5	43618	243.06.015.03	Shim		2
6	43619	243.06.700.02	Pivot Pin		2
8	43620	016.01.0786	Hexagon Bolt		24
9	43621	011.04.0858	Spring Washer		24
12	43622	002.02.0088	Circlip		2
13	43623	002.01.0078	Circlip		2
14	43624	729.06.009.01	Seal		2
15	43625	276.06.002.03	Steering Case, Left		1
16	43626	276.06.003.03	Steering Case, Right		1
17	43627	001.25.1544	Seal		2
18	43628	005.10.1427	Taper Roller Bearing		4
19	43629	005.01.0121	Ball Bearing		2
20	43630	276.06.700.01	Reduction Bushing		2
21	43631	001.05.0820	O-Ring		2
22	43632	276.06.010.01	Dust Excluder		2
23	43633	005.15.0599	Needle Bearing		4
24	43634	002.06.2729	Ring		2
25	43635	001.03.0621	Seal		2
26	43636	276.06.611.01	Joint		2
28	43637	932.06.704.01	Wheel Stud		20
29	43262	006.11.1413	Nut		20
30	43639	176.06.021.02	Ring Gear		2
31	43640	176.06.023.02	Ring Gear Support		2
32	43641	176.06.074.01	Locking Plate		2
33	43642	277.06.013.01	Bolt		20
34	43643	002.02.0089	Circlip		2
35	43644	176.06.022.03	Planet Gear Carrier		2

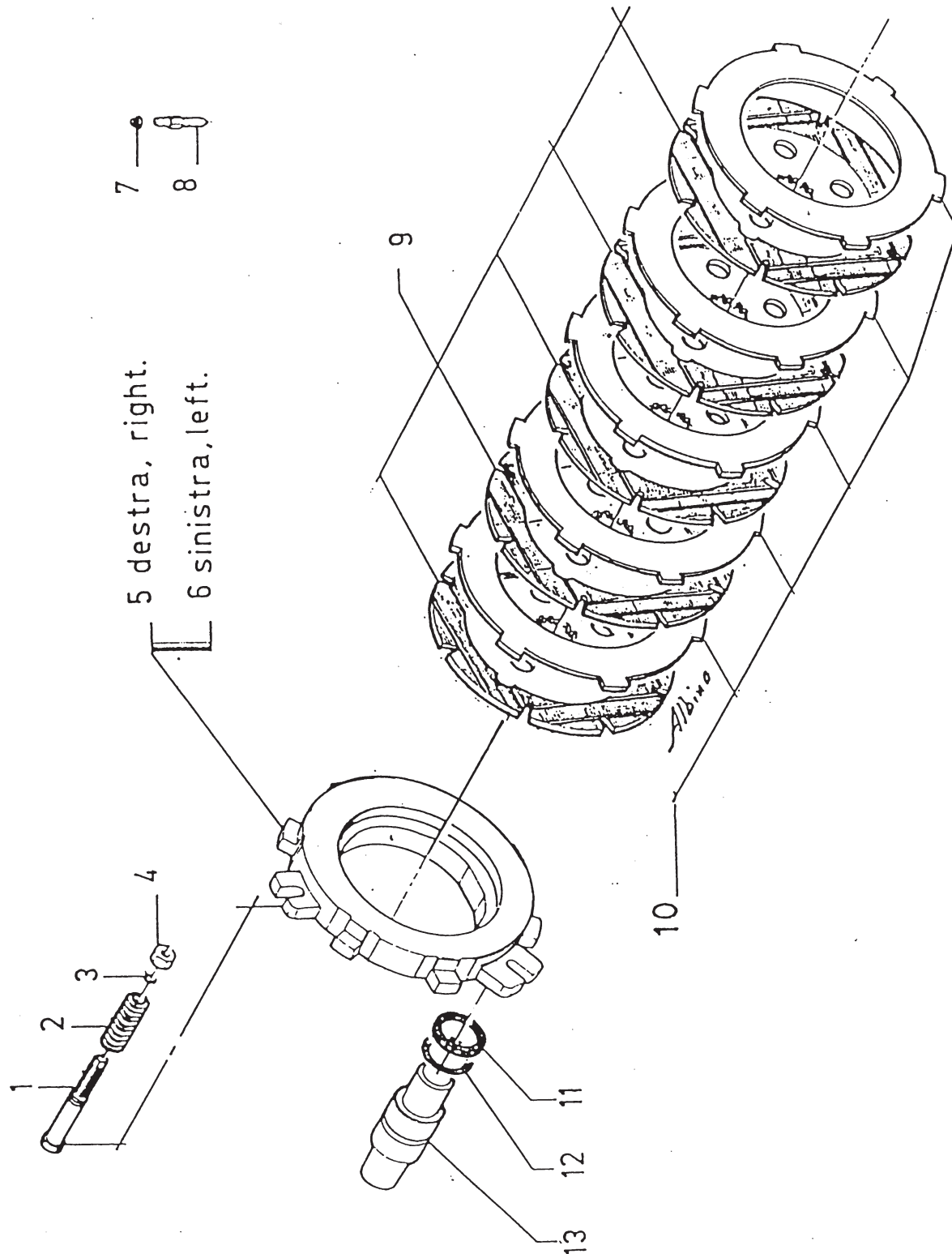
AXLE REPAIR PARTS - FRONT/REAR

4 OF 5

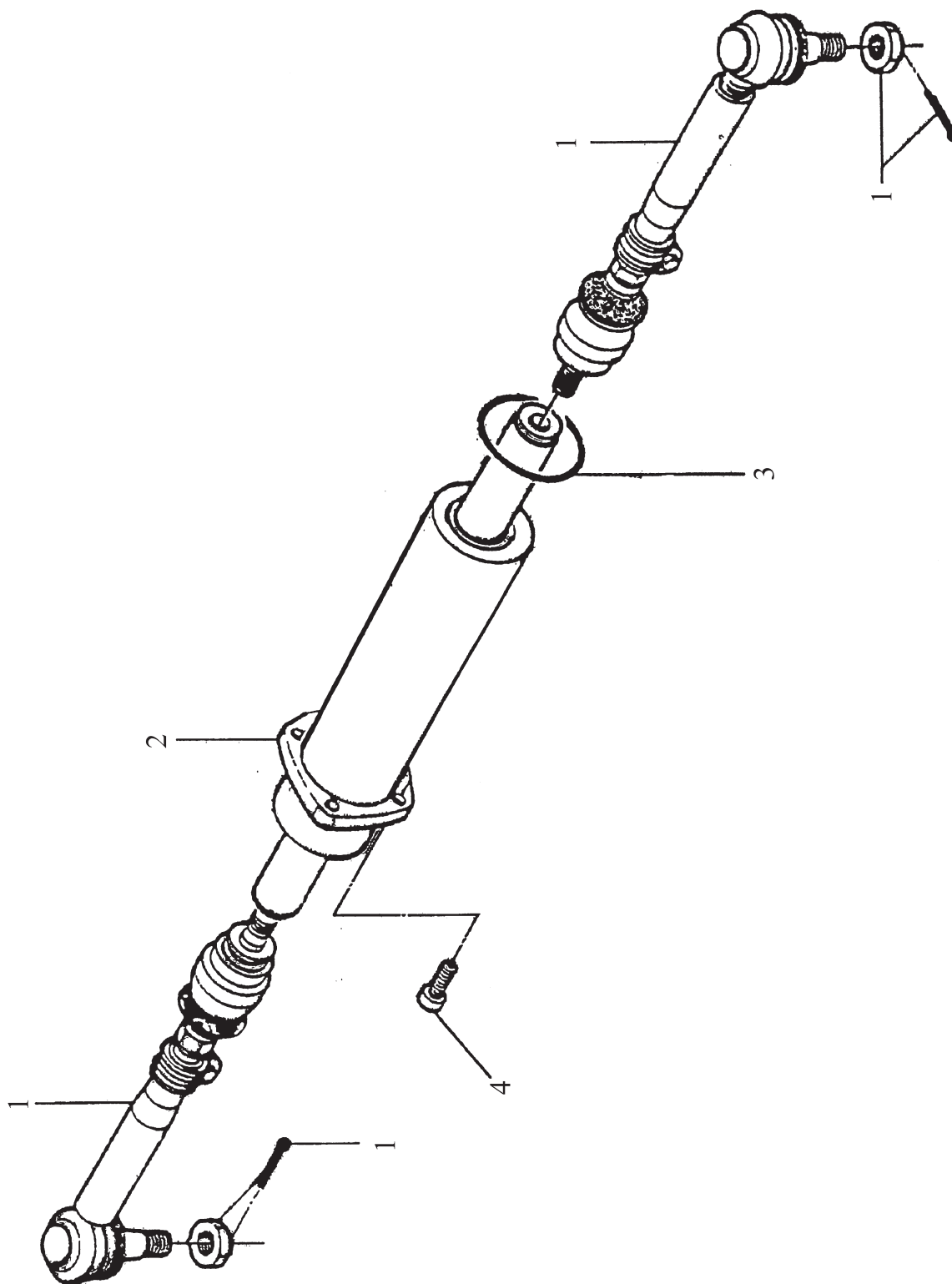


Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
36	43645	011.07.0704	Seal		2
37	43646	728.06.011.01	Plug		2
38	43647	001.05.1248	O-Ring		6
39	43648	176.06.024.02	Pin		6
40	43649	016.05.0437	Cylinder Bolt		4
41	43650	005.13.2772	Needle Bearing		6
42	43651	176.06.020.02	Planet Gear		6
43	43652	176.06.039.01	Friction Washer		6
44	43653	112.06.022.01	Reduction Bushing		20
45	43654	002.06.0610	Snap Ring		2
46	43476	176.07.029.01	O-Ring		2
47	43656	276.06.004.03	Wheel Hub		2
48	43657	243.06.700.01	Pivot Pin		2
49	43658	739.06.028.01	Adjusting Bolt		4
50	43659	006.05.1521	Nut		4
55	43660	243.06.003.01	Pivot Pin		2
56	43661	001.20.1392	Seal		2
57	43662	005.10.1381	Taper Roller Bearing		2
58	43663	005.10.1382	Taper Roller Bearing		2
59	43664	243.06.003.02	Pivot Pin		2
60	43665	008.01.0213	Grease Fitting		2
61		734.07.015.01	Plug		4

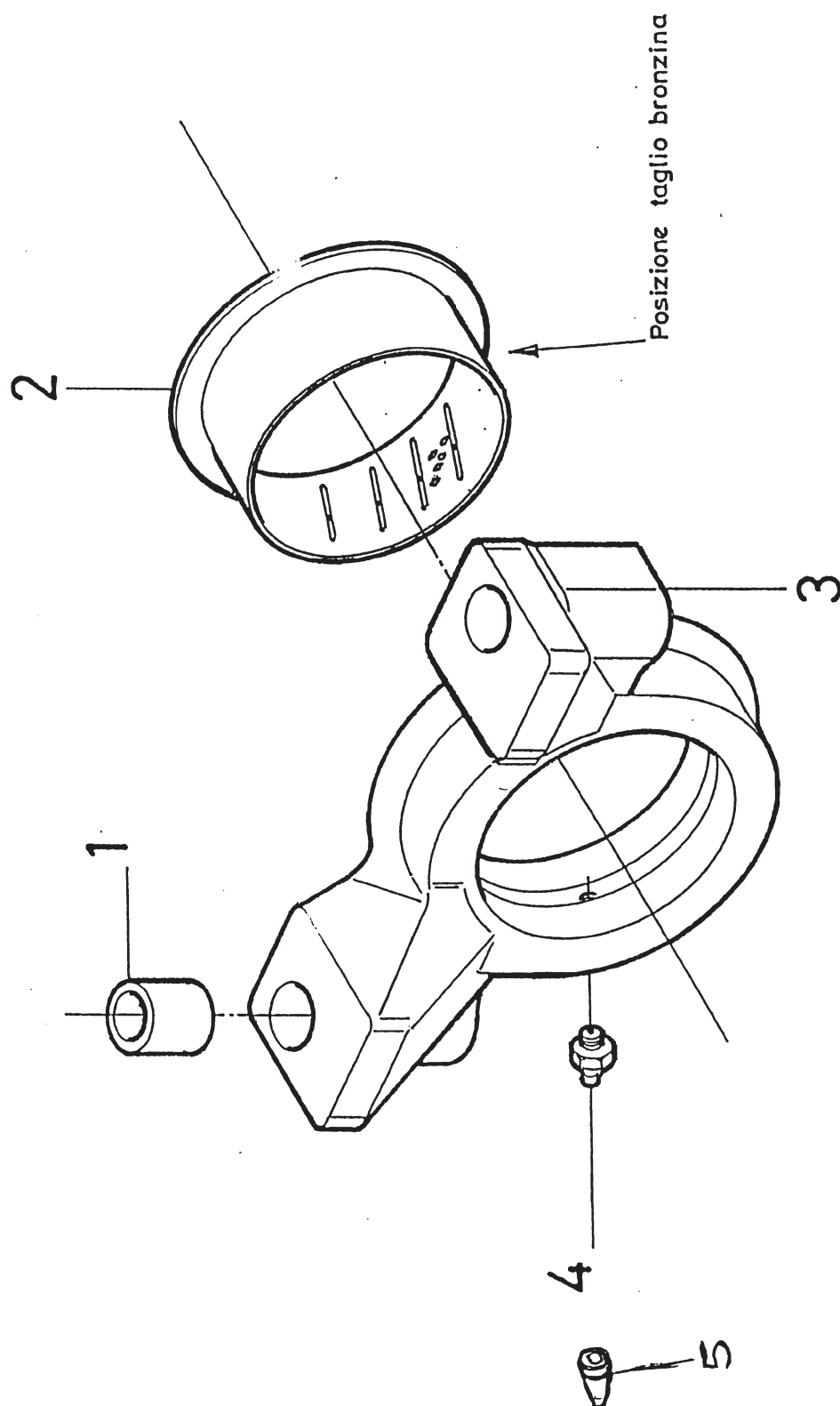
AXLE REPAIR PARTS - FRONT/REAR 5 OF 5



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
	42311		Axle, Front		1
	42312		Axle, Rear		1
1	43667	176.07.005.02	Adjusting Bolt		6
2	43668	176.07.006.01	Spring		6
3	43669	001.05.1353	O-Ring		6
4	43670	006.04.1430	Nut		6
5	43671	176.07.002.02	Disc		1
6	43672	176.07.003.02	Disc		1
7	43673	734.07.015.01	Plug		2
8	43674	276.01.003.01	Bleeding Bolt		2
9	43675	734.07.610.02	Brake Disc		10
10	43676	734.07.004.02	Brake Disc		10
11	43677	176.07.015.01	O-Ring		6
12	43678	176.07.010.01	Back-Up Ring		6
13	43679	176.07.004.02	Piston		6

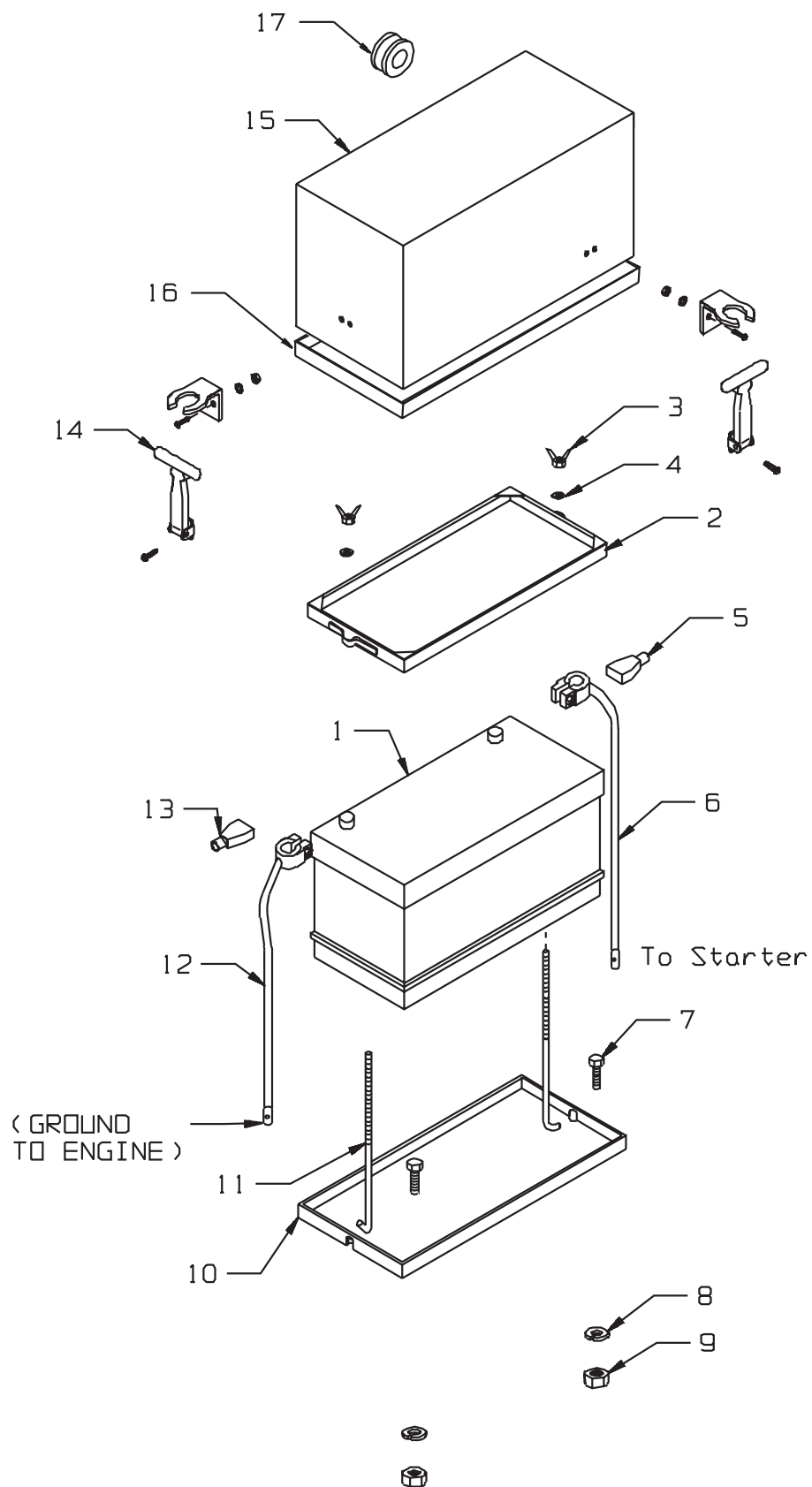
AXLE , STEERING CYLINDER, - FRONT/REAR

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
	42311		Axle, Front		1
	42312		Axle, Rear		1
1	43680	276.24.622.01	Articulated Tie Rod		2
2	43681	276.24.620.01	Cylinder		1
3	43682	001.05.1629	O-Ring		2
4	43683	016.04.0429	Cylinder Bolt		5

AXLE , TRUNNION - REAR

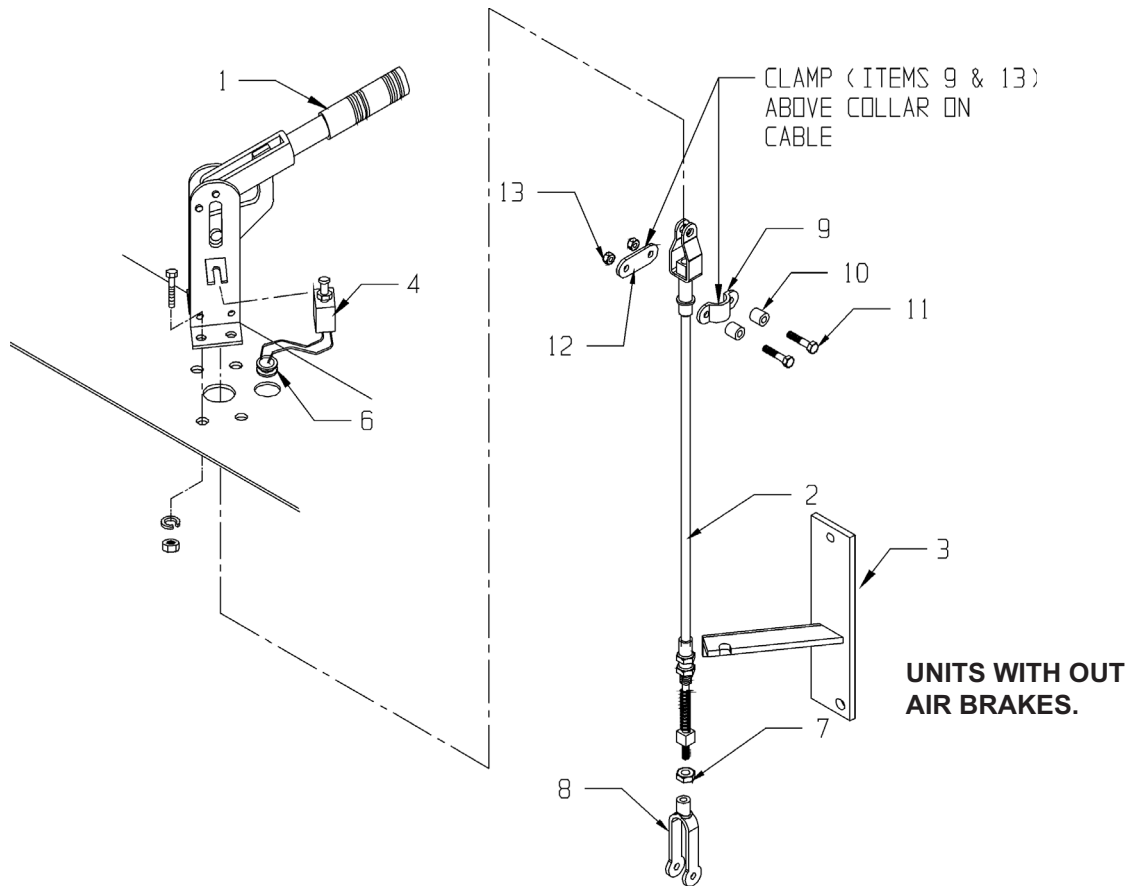
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
	42312		Axle, Rear		1
1	43684	276.25.002.01	Reduction Bushing		4
2	43685	276.25.003.01	Thrust Bushing		2
3	43686	276.25.001.01	Support		2
4	43665	008.01.0213	Grease Fitting		2
5	43688	734.07.015.01	Plug		2
6	43514-44	276.25.610.01	Rear Trunnion, Complete (Includes all items)		1

BATTERY

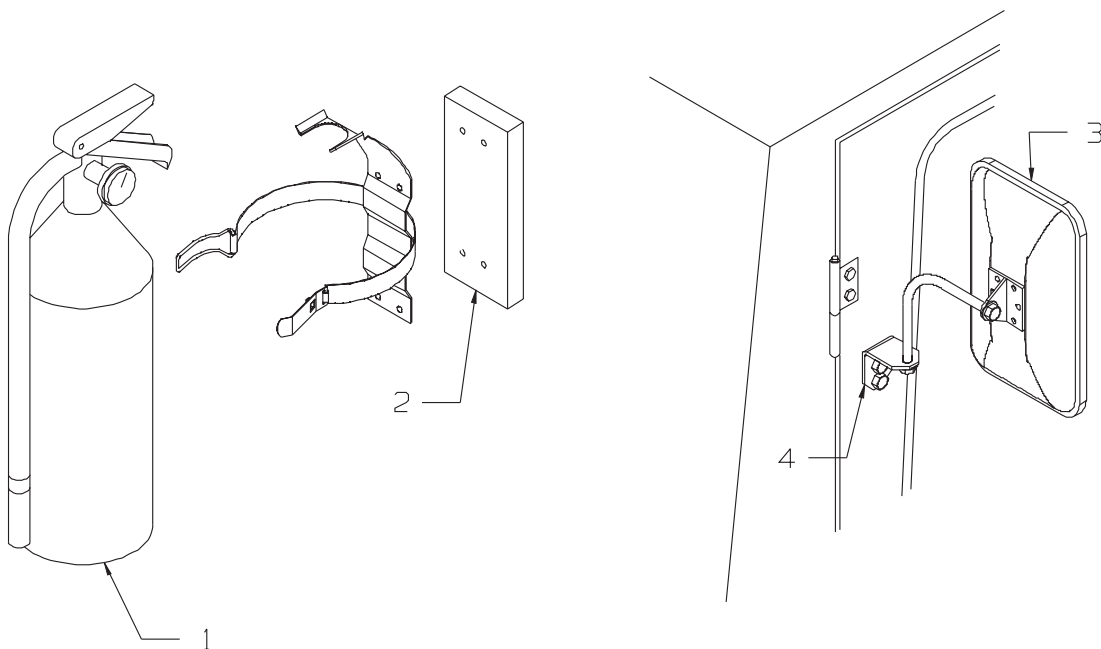


Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-6		Battery System 200MB4-A		Ref
1	42942	31-5	Battery, 12V, Top, 1000CCA, Gr (Freeman Tire Corp)		1
2	NW29923		Battery Hold-down		1
3	NW21810		Nut, Wing 5/16-18		2
4	F9549		Flat Washer		2
5	F100930		Battery Cable Boot, Red		1
6	44378		Cable, Battery, 120" Black, 3/8" Stud Starter		1
7	F100311		HHCS, 3/8-16 x 1		2
8	F9665		Lock Washer, 3/8		2
9	F9666		Hex Nut, 3/8-16		2
10	NW29866		Pan, Battery Box		1
11	NW22821		J-Bolt, 5/16-18		2
12	44379		Cable, Battery, 120" Black, 1/2" Stud Ground		1
13	F100931		Battery Cable Boot, Black		1
14	NW22814		Latch Assembly., Flex Draw, Hood (94222)		2
15	NW34156		Box		1
16	F101603		Bead, Protective		AR
17	302754		Grommet		1

BRAKE, PARKING



FIRE EXTINGUISHER MIRRORS

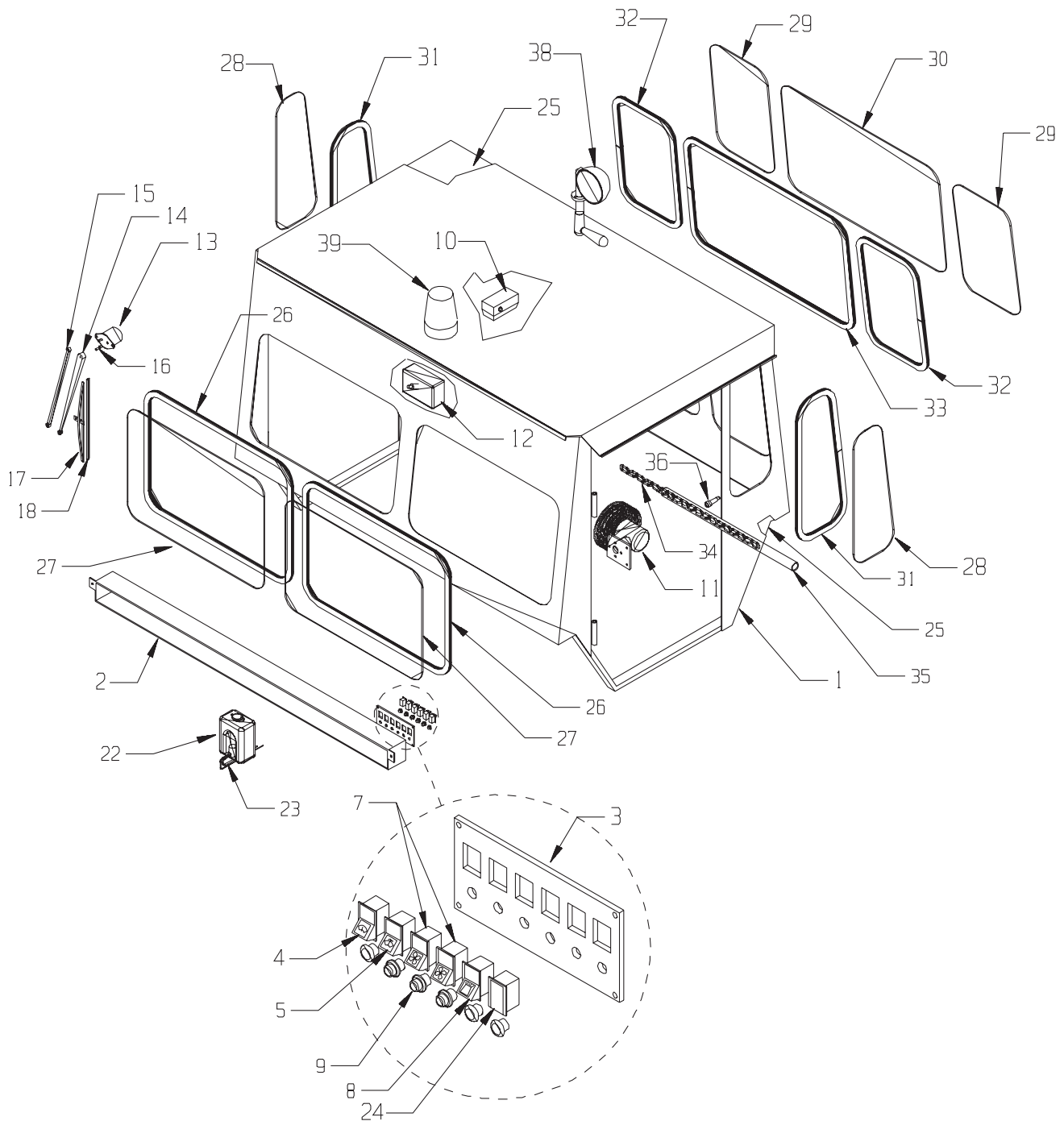


Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW036860		Lever, Park Brake (92867)		1
2	39457	15787700	Cable, Park Brake, 50" w/Spring (92867)		1
3	37326		Bracket Weldment		1
4	NW036793		Switch		1
6	37715		Grommet		1
7	F100569		Nut, Jam, 3/8-16		1
8	90562		Clevis, Cable W1-1203		1
9	NW036860-3	81000108	U-Clamp		1
10	NW036860-3	81000246	Spacer		2
11	F100308		Bolt, 5/16-18 x 1.5		2
12	NW036860-2	81000131	Link Spacer		1
13	F014476		Nut, 5/16-18, Lock		2

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	1.8786		Fire Extinguisher (Nyhus Fire & Safety)		2
2	42960		Spacer, Fire Ext MB4		2
3	NW20686	821	Mirror (12662)		2
4	42056		Bracket, Mirror		2
NS	44163		Brkt, Fire Ext (For shipping)		2

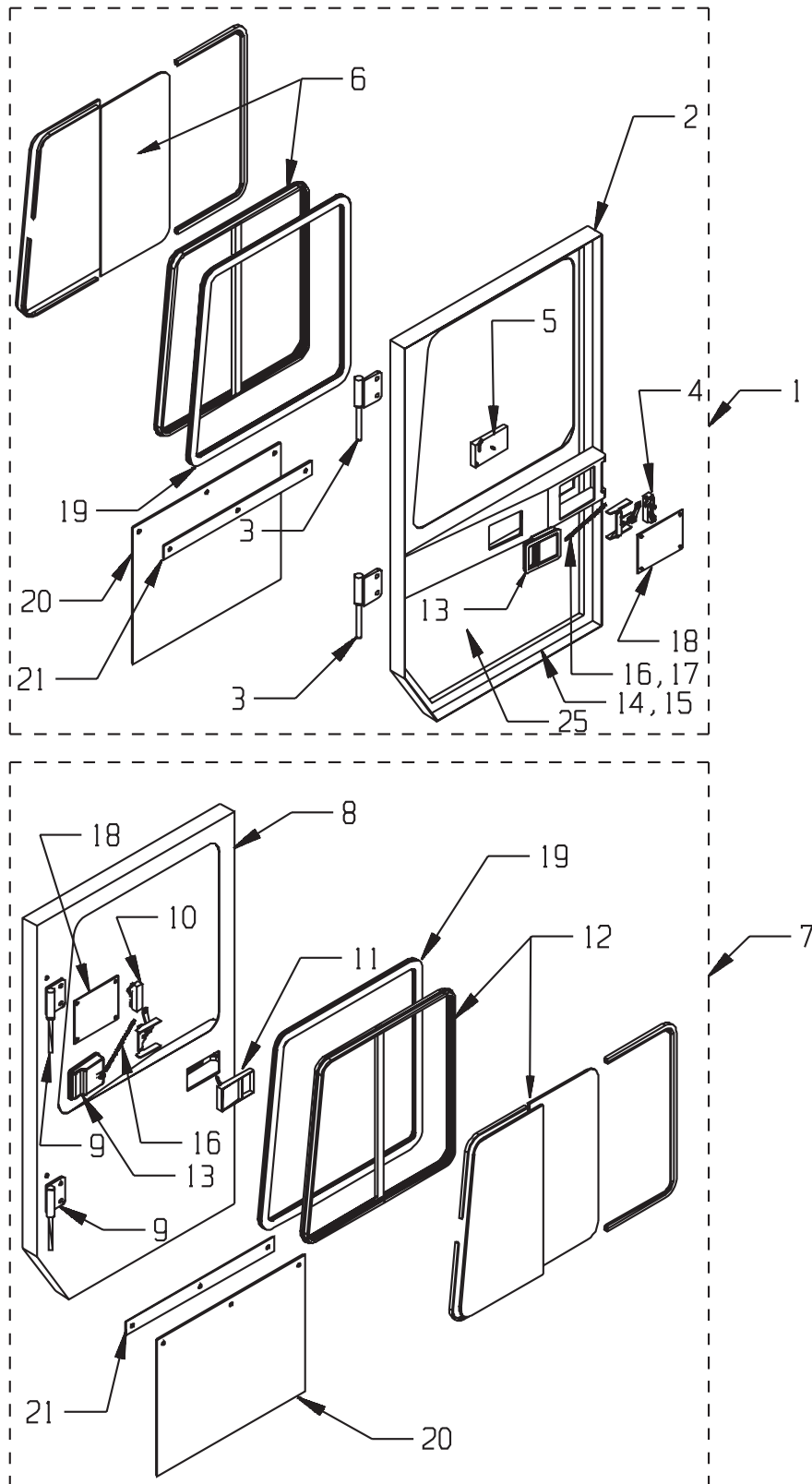
CAB ASSEMBLY GROUP

1 OF 2



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	NW035744	NS006618	Cab Assembly		Ref
NS	44666		Air Conditioning Kit, M2016 (MB4)		Ref
1	NW035744-1	NS006616	Cab Weldment		1
2	NW035744-2	NS006437	Switch Panel, Wiper Cover		1
3	NW035744-3	NS006438	Switch Plate		1
4	NW035744-4	NS003601	Wiper Switch 511.048/625		
5	NW035744-5	NS003602	Washer Switch 511.010/627		1
6	NW035744-6	NS003604	Light Switch 511.003/473		
7	NW35394	NS003603	Fan Switch 511.029/195		2
	NW35395		Insert Switch, Blower, Green		2
8	NW035744-7	NS006628	Beacon Switch		
9	NW35268	NS003609	Breaker 10A 1600-235		1
10	43023	NS003428	Dome Light M-391		1
11	43024	NS003376	Fan R-73-9052 12V		2
12	NW035744-8	NS005809	Mirror Peterson #609		1
13	NW035744-9	NS00619	Wiper Motor WWJ 6577540		1
14	NW035744-10	NS006620	Wiper Motor Drive Arm 6211340		1
15	NW035744-11	NS006621	Wiper Motor Link 22.5 LK721035-8		2
16	NW035744--12	NS006622	Wiper Motor Pivot Shaft 3 Inch 6271440		2
17	NW035744--13	NS006623	Wiper Arm 16 Inch 6702440		2
18	NW035744-14	NS006624	Wiper Blade 16 Inch 5217040		2
NS	NW035744-24	NS006625	Panto Post Kit 48519		2
NS	NW035744-25	NS006626	Washer Cowl Fitting 5036440		2
NS	NW035744-26	NS006627	Wet Arm Adapter Kit 521940		2
22	43142	NS003774	Washer Bottle and Motor		1
23	NW035744-15	NS003776	Washer Tubing 3/16 ID		1
24	NW35382	NS010059	Bland Switch Covers (Where Applicable)		1
25	NW035744-16	NS006069	Foam Insulation 3/4 Black Perforated		A/R
26	43040	NS003380	Window Gasket AS1615, Front, 118"		2
27	43011	NS004576	Front Glass		2
28	43006	NS004562	Side Tear Drop Glass		2
29	40649	NS004577	Rear Side Glass		1
30	NW035744-17	NS006072	Rear Solid Glass (Where Applicable)		1
31	43005	NS003380	Window Gasket AS1615, Side Tear Drop Glass, 73"		2
32	43019	NS003380	Window Gasket AS1615, Rear Side Glass, 86"		2
33	NW035744-18	NS003380	Window Gasket AS1615		A/R
34	NW035744-19	NS006059	Door Holdback Chain 3/16 DIA 19 Links		2
35	NW035744-20	NS006065	Door Holdback Chain Sleeve Yel 1/2 X 16 Long		2
36	NW035744-21	NS003807	Door Latch Striker Stud EMC40052ZN		2
38	NW32893		Spot Light		1
	NW32893-1	7309530	Replacement Switch For Spot Light		1
39	NW31334		Beacon		1

CAB ASSEMBLY GROUP (2 OF 2) DOORS



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW035744-27	NS006617	Door Assembly, Right w/Window, Latch, & Handles		1
2	NW035744-28	NS006630	Right Door Weldment		1
3	NW035744-29	NS004503	Right Door Hinge		2
4	NW035744-30	NS001925	Right Door Latch EMC-1-400ZN RH		1
5	NW035744-31	NS001928	Right Door Outside Handle TM1195037		1
6	NW035744-32	NS006631	Right Door Aluminum Slider Assembly 64-7812R		1
7	NW035744-33	NS006059	Door Assembly Left w/Window, Latch & Handles		1
8	NW035744-34	NS006056	Left Door Weldment		1
9	NW035744-35	NS003417	Left Door Hinge		2
10	NW035744-36	NS006063	Left Door Latch EMC-1-400ZN LH		1
11	NW36723	NS001927	Left Door Outside Handle TM1197337		1
12	NW035744-38	NS006632	Left Door Aluminum Slider Assembly 64-7812L		1
13	NW36722	NS001926	Inside Door Paddle Handle EMS249ZN		2
14	43018	NS003375	Door Gasket TL4100 B3X.06, 143"LG		2
15	NW035744-40	NS006633	Door Edge Trim Trim-Loc Edge Molding		2
16	NW035744-41	NS006062	Door Latch Chain, Sash Type		2
17	NW035744-42	NS006061	Door Latch Link		2
18	NW035744-43	NS006634	Door Latch Mech Cover		2
19	NW035744-44	NS003380	Window Gasket, AS1615		A/R
20	41964		Flap, Cap, Door		2
21	41965		Plate, Cab, Door Flap		2
25	NW035744-45	NS006069	Foam Insulation 3/4 Black Perforated		A/R
NS	NW035744-46	NS006060	Cover, Door Latch		2

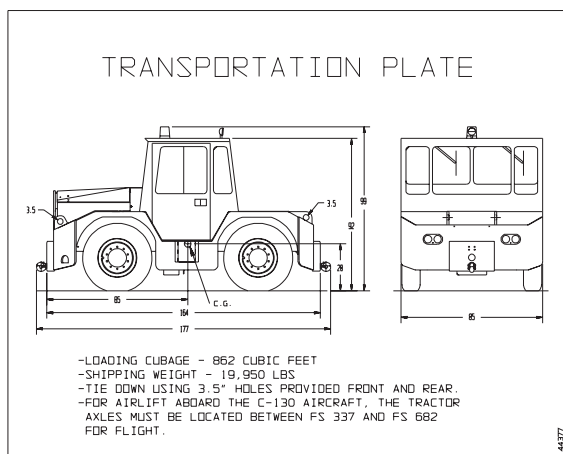
DECALS

FLIGHTLINE TOW TRACTOR, 16,000 DBP	
NMC-WOLLARD	
EAU CLAIRE, WI 54703, USA, (715) 835-3151 WWW.NMC-WOLLARD.COM	
MODEL NO.	200MB4
SERIAL NO.	
DATE OF MFR	
REG. NO.	
CONTRACT NO. F09603-00-F-0071	
NSN NO. 1740-00-580-7990 YW	
TECHNICAL MANUAL NO. 42975	
CAGE NO. 44185	

1

WARNING <i>PARKING BRAKE NOT TO BE USED FOR SERVICE BRAKE</i> <i>APPLY PARKING BRAKE BEFORE STARTING ENGINE</i> <i>APPLY PARKING BRAKE BEFORE LEAVING VEHICLE</i>
--

2



3

DIESEL FUEL ONLY

4

HYDRAULIC OIL USE AUTOMATIC TRANSMISSION FLUID
--

6



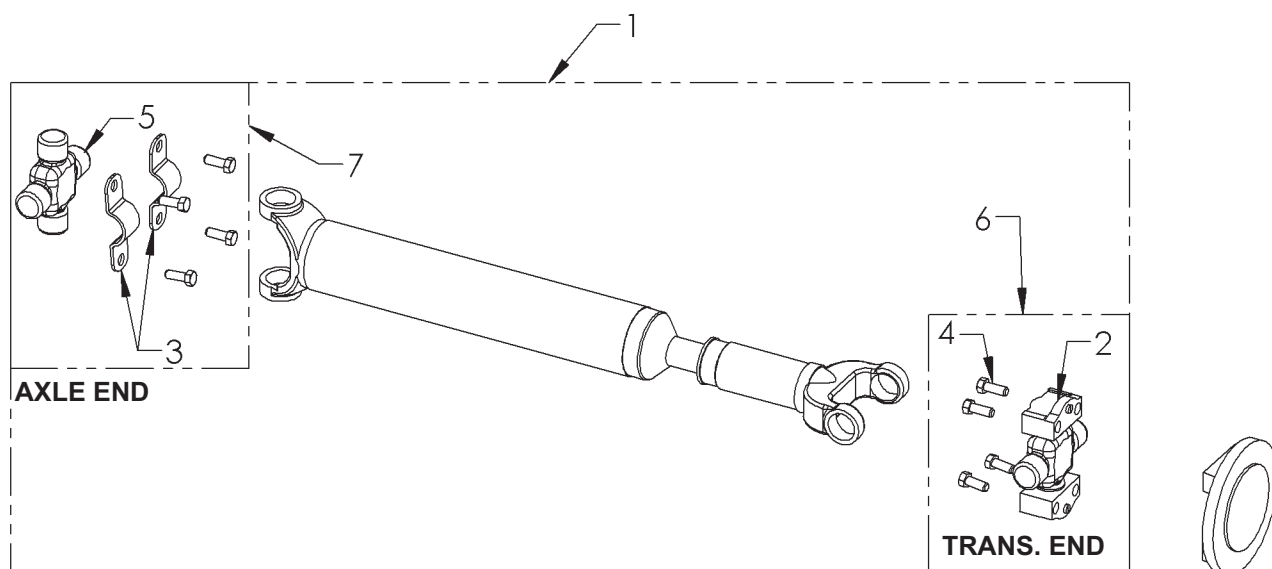
5

DO NOT ATTACH MHU-196 OR MHU-204 TRAILERS TO THE FRONT OF THIS VEHICLE

7

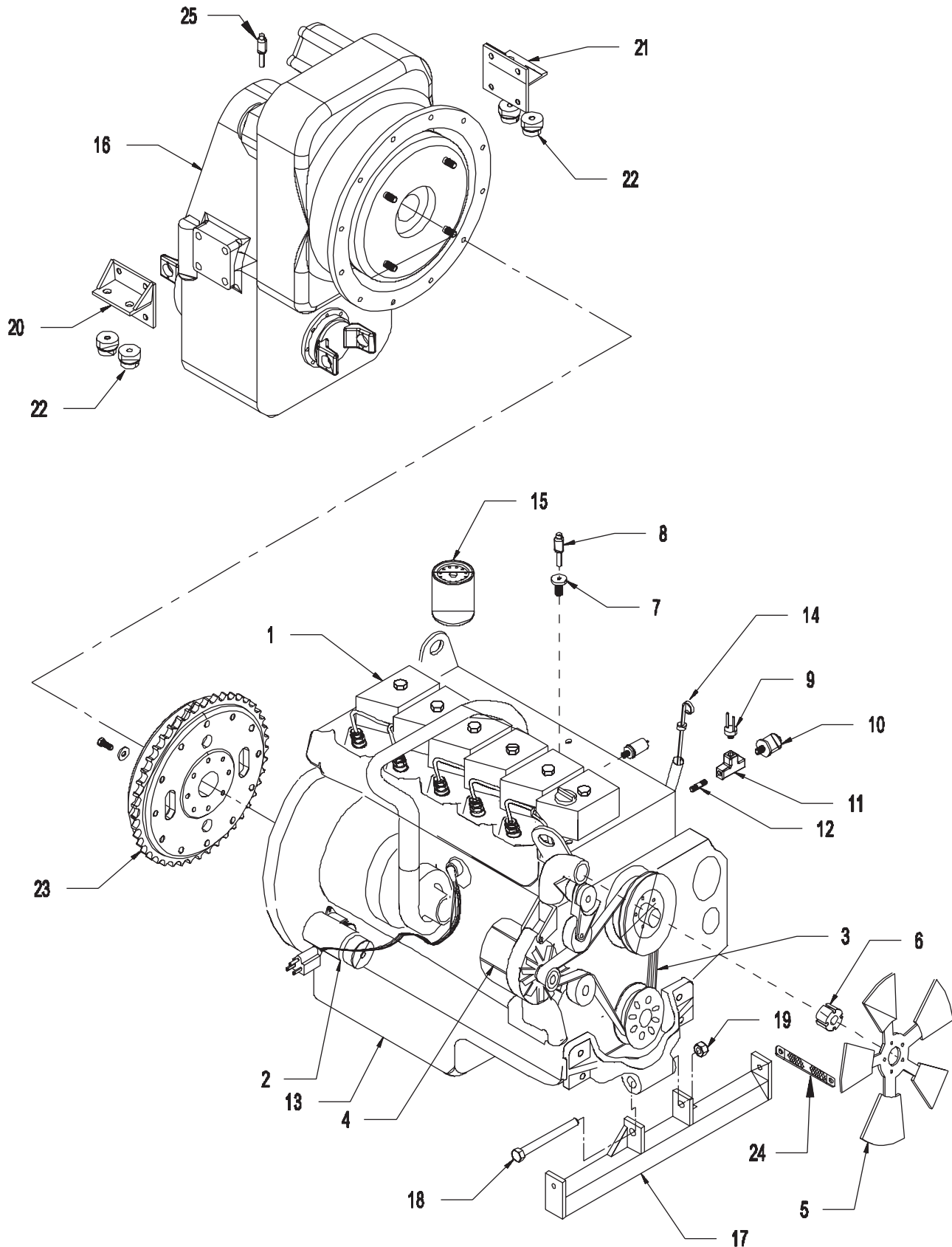
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-11		Placard Assembly		Ref
1	42976		Plate, Serial No. (Hyd Brake Units)		1
	44744		Plate, Serial No. (Air Brake Units)		1
2	NW017237		Plate, Warning		1
3	44377		Plate, MB4 Transportation (w/Air Brakes)		1
	42978		Plate, MB4 Transportation (w/Hydraulic Brakes)		
4	153768		Decal, Diesel Fuel Only		1
5	42537		Decal, NMC - 1.75 x 6.38		2
6	SW10H2688		Decal, Hydraulic		1
7	44392		Decal, Do Not Attach		1
NS	37244		Decal, NMC - 60S & 100S		2
NS	42977		Plate, Lubrication (Hyd Brake Units)		1
	43934		Plate, Lubrication (Air Brake Units)		1
NS	42786		Decal, Steering Mode (See Instrument Panel)		1

Also See Pages 142 and 144.

DRIVE SHAFT

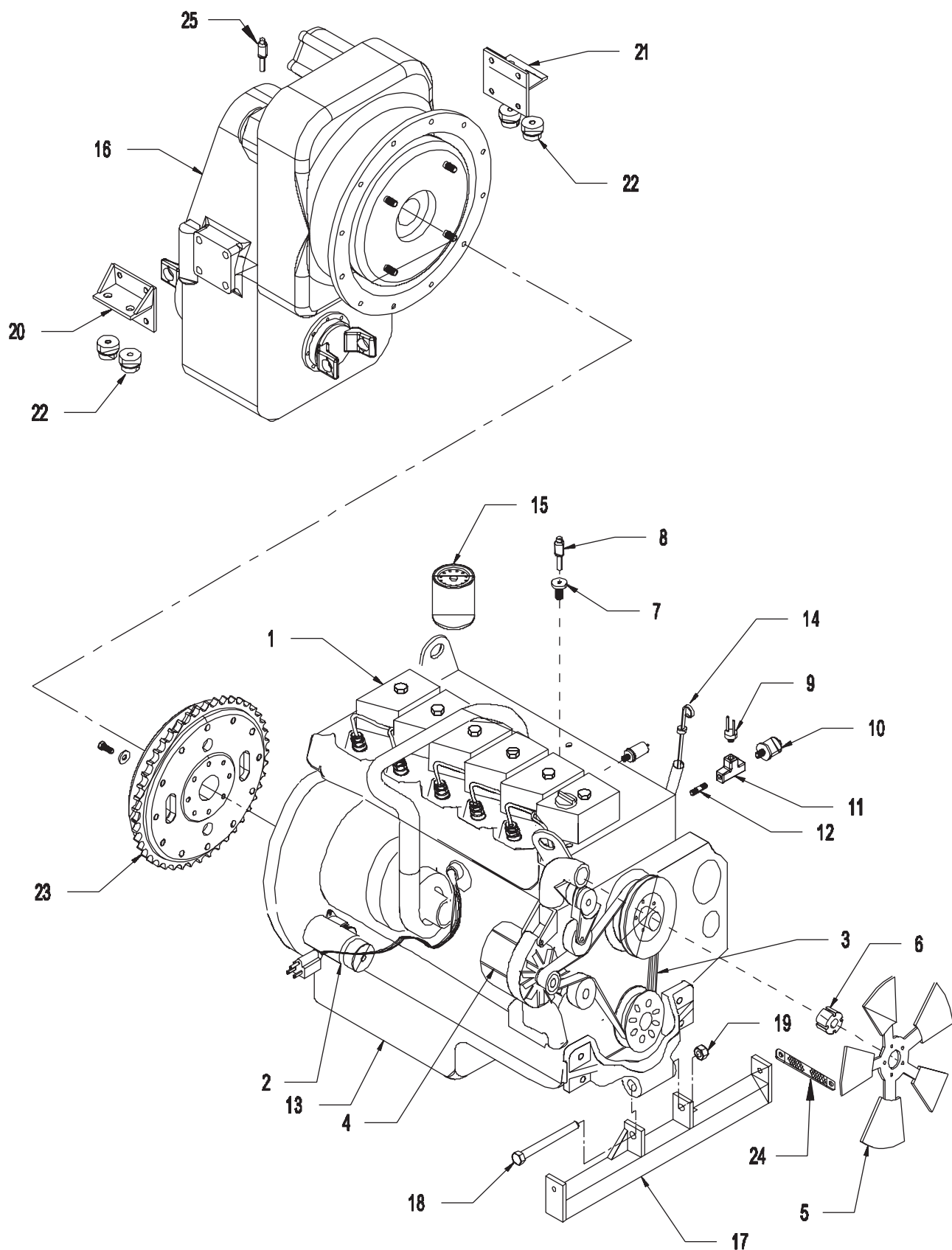
ITEM	NMC-WOLLARD PART NO.	DESCRIPTION	EFF	Units Per Assy
1	42815	Driveshaft, Dana/Funk, 14.12" (Front)		1
	42816	Driveshaft, Dana/Funk, 29.69" (Rear)		1
2	44943-2	Cross & Bearing Assy 5-303-1X		1
3	203761	Strap & Bolt Kit 3-70-38X		1
4		HHCS, 3/8-24 x 1.75 Gr8		4
5	44943-3	Cross & Bearing Assy 5-263X		1
6	44943-5	U-Joint Kit, Transmission End (Inc. 4 & 5)		Ref
7	44943-6	U-Joint Kit, Axle End (Inc. 2 & 3)		Ref
	43992	Slip Yoke		Ref

ENGINE (1 OF 2)

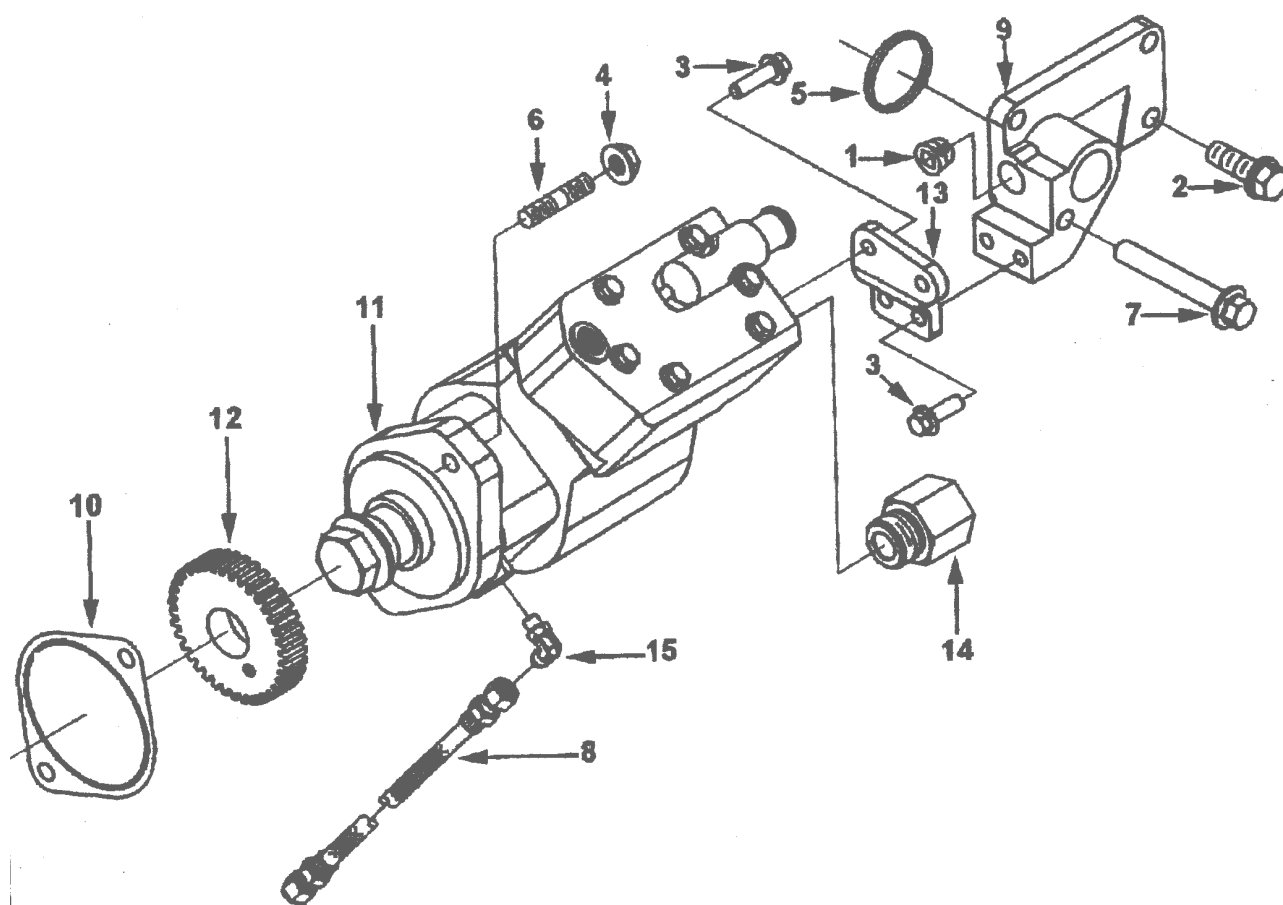


Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T445688-13 T427979-13		Engine/Transmission/Mounting, 200MB4-1 Engine/Transmission/Mounting, 200MB4-A		Ref Ref
1	43441 42652		Engine, Cummins 6BT5.9 (For Air Brakes) Engine, Cummins 6BT5.9 (For Hydraulic Brakes)		1 1
2	43071	3916854	Starter		1
3	43143	3911587	Belt, Engine		1
4	43070	3282554	Alternator		1
5	43484	3912751	Fan, Cummins 6BT5.9		1
6	43485	3903816	Spacer, Fan, Cummins 6BT5.9		1
7	F100780		Ftg, 08MP-02 FP		1
8	F101526		Sender, Water Temperature		1
9	NW21649	8647	Switch, Pressure (13445)		1
	45866		Kit, Oil Sender (includes items 10,11,12,13)		1
10	42039		Sender, Oil Pressure		1
11	3.1820		Fitting, Hydraulic, Tee, 02FP-02FP		1
12	41528		Fitting, M10, OR, 1/8 NPT		1
12a	41529		O-Ring, M10 for 41528 Ftg		1
13	43483	3900960	Pan, Oil, Cummins 6BT5.9		1
	43871	3937072	Gasket, Oil Pan		1
14	43482	3279228	Dipstick, Cummins 6BT5.9		1
15	43481	FS1251	Filter, Fuel, Cummins 6BT5.9		1
16	42503	YZ17606	Transmission, Funk 2000, 200MB4 (See Pg 56)		1
17	38922		Engine, Cross Member		1
18	39452		HHCS 3/4-10 x 7, GR8		1
19	F100040		Nut, Stop 3/4-10		1
	45867		Kit, Transmission Mounting (includes items 20,21,22)		1
20	37022		Transmission Mount, RH		1
21	37023		Transmission Mount, LH		1
22	NW36947		Isolator, Transmission Mount		4
23	43864	3905587	Flywheel		1
24	305020		Cable, Ground Strap		1
25	NW30236		Sender, Temperature, Trans		1
NS	F100281		HHCS 3/8-24 x 1.75		8
NS	NW31820		HHCS M10 x 1.5 x 40mm		18
NS	37535		Flatwasher, 66 ID x 3.12 OD		2
NS	41528		Fitting, Hydraulic, M10B-02NPT		1
NS	41529		O-Ring, M10		1
NS	42980		Harness, Ground Wire		2

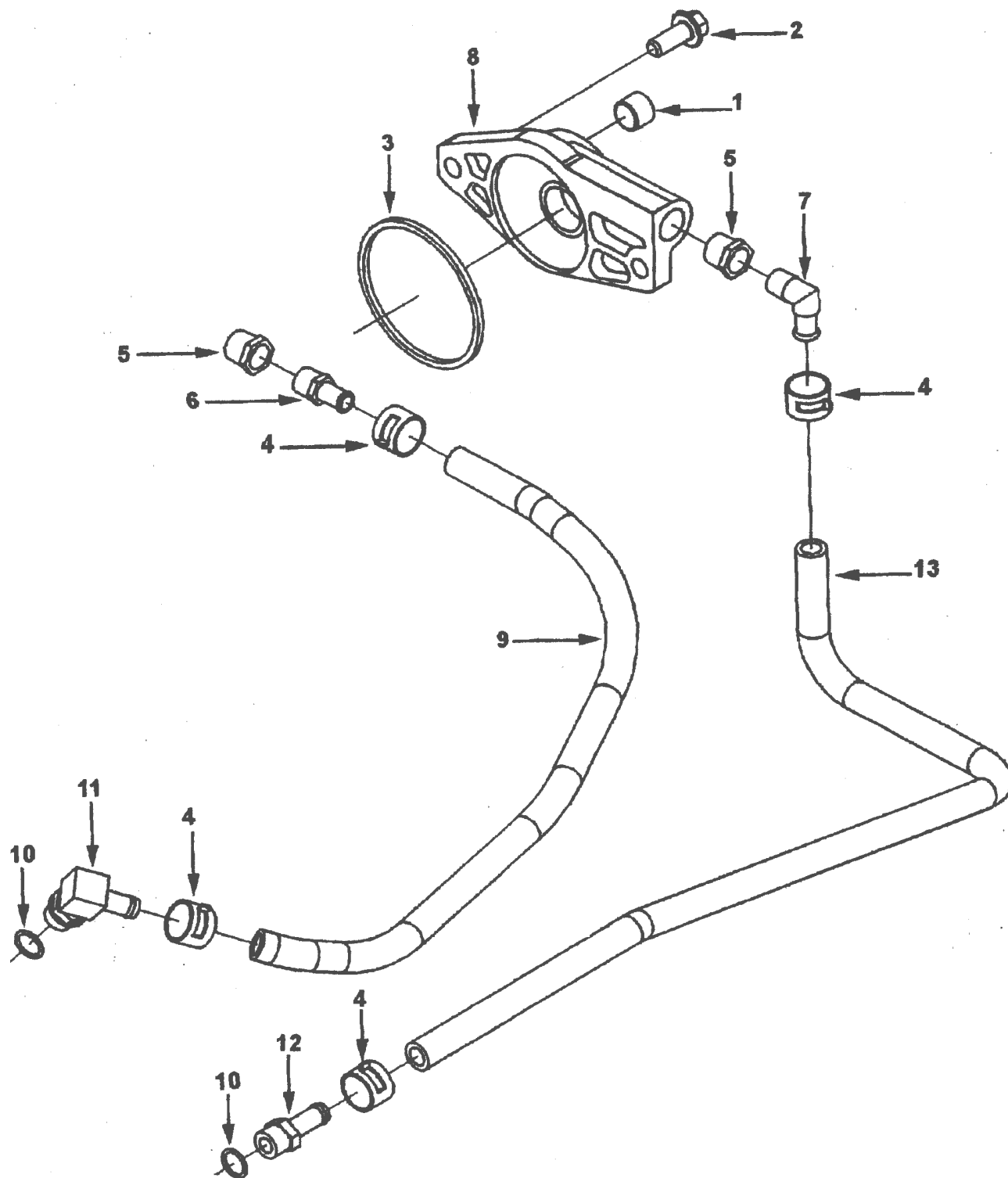
ENGINE(2 OF 2)



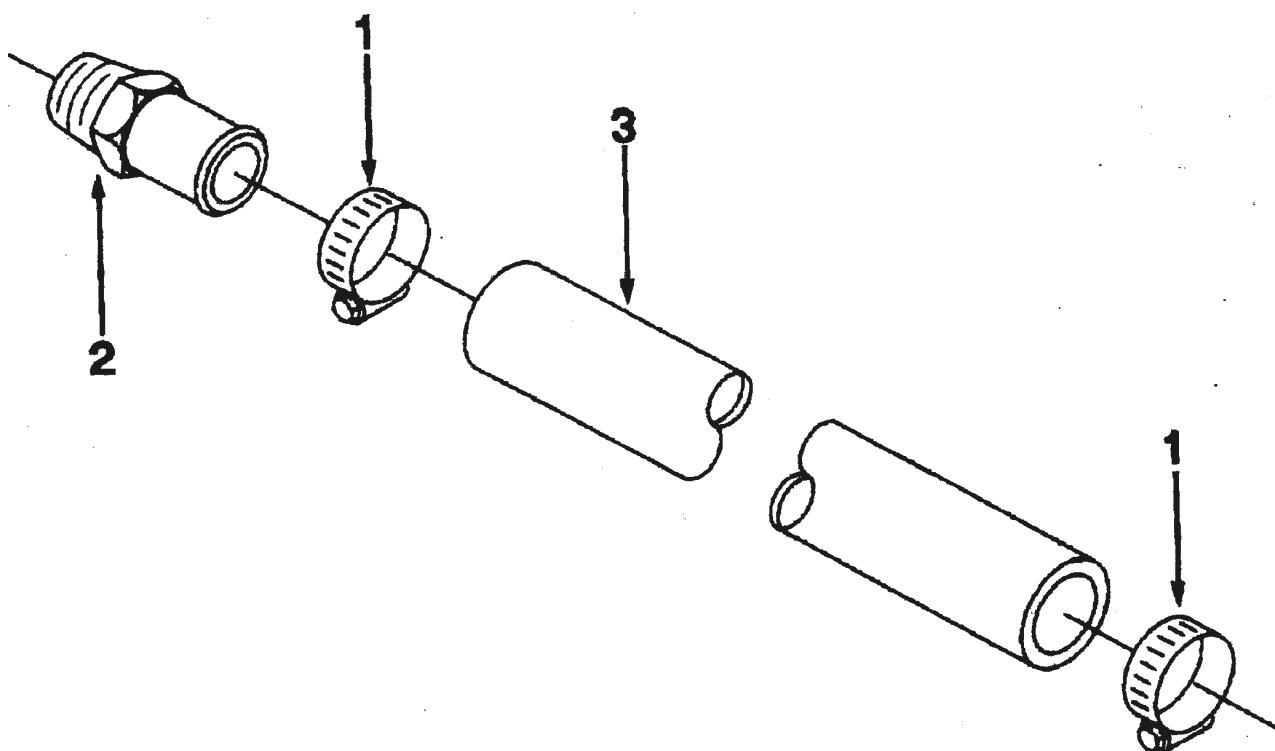
Item	Nmc-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
NS	F101519		HHCS 3/4-10 X 4, Gr 8		4
NS	F016241		Flatwasher 3/4		4
NS	F100040		Nut Stop 3/4-10		4
NS	NW36536		Plate, Trans Mount		4
NS	43146		Harness, Grid Heater		1
NS	43483	3400960	Pan, Oil 6BT5.9		1
NS	43107	LF3935	Element, Oil Filter		1
NS	43108	HH6981	Filter Head, Oil		1
NS	43858	3802273	Thermostat		1
NS	43859	3914463	Pulley, Fan Drive		1
NS	43860	3929404	Pump, Injection		1
NS	43861	3936316	Lift Pump, Fuel		1
NS	43862	3939258	Gasket, Cover Plate Lift Pump		1
NS	43863	3935171	Washer, Sealing Lift Pump		2
NS	43866	3901774	Gear, Starter Ring		1
NS	43867	3938152	Gasket, Intake Manifold		1
NS	43868	3921558	Core, Oil Cooler		1
NS	43869	3942914	Gasket, Oil Cooler		1
NS	43870	3937404	Pump, Engine Oil		1
NS	43872	3802677	Injector Nozzle, Fuel		1
NS	43873	3283335	Gasket, Head 6BT5.9		1
NS	43874	3536973	Turbo Charger		1
NS	43875	3901356	Gasket, Turbo		1
NS	43876		Kit, Turbo Repair		1
NS	43877	3906660	Gasket, Exhaust Manifold		1
NS	43878	3930906	Gasket, Valve Cover		6
NS	43879	3286275	Pump, Water		1
NS	43880	3932529	Solenoid, Fuel		1
NS	43881	3906698	Seal, Water Pump		1
NS	43882	3901895	Cap, Valve Cover Filler		1
NS	43883	3936876	Seal, Valve Cover Filler Cap		1
NS	43884	3937210	Heater, Intake Air		1
NS	43885	3938158	Gasket, Intake Crossover		1

AIR COMPRESSOR

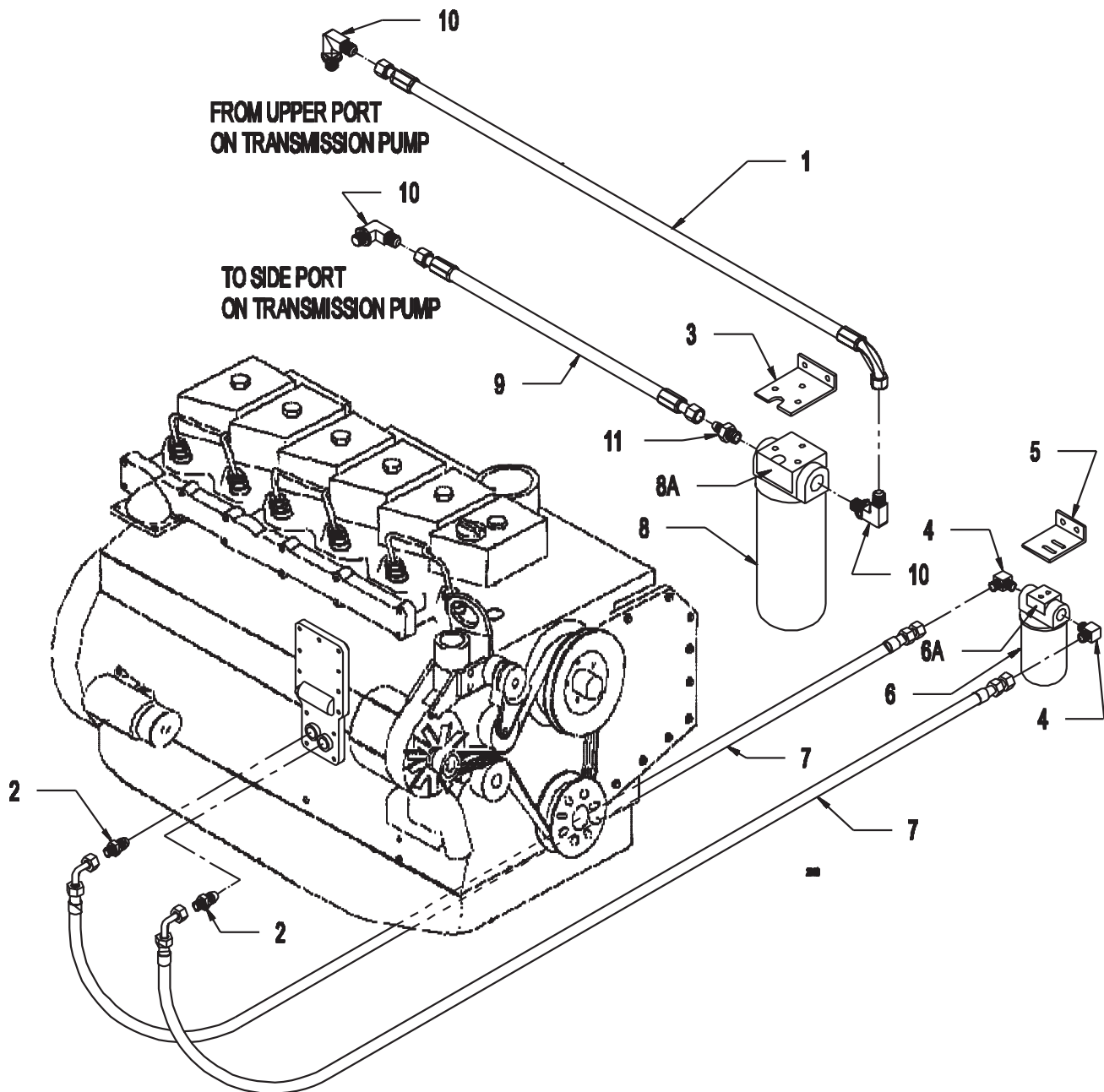
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0			Air Compressor		Ref
1	43441-1	3008468	Plug, Pipe		1
2	43441-2	3900637	Screw, Hex Flange Head Cap		3
3	43441-3	3903112	Screw, Hex Flange Head Cap		4
4	43441-4	3903210	Nut, Hexagon Flange		2
5	43441-5	3906696	Seal, Rectangular Ring		1
6	43441-6	3913370	Stud		2
7	43441-7	3914177	Screw, Hex Flange Head Cap		1
8	43441-8	3924867	Hose, Flexible		1
9	43441-9	3924869	Connection, Oil Drain		1
10	43441-10	3929751	Gasket, Acc Drive Cover		1
	43441-11	3936808	Compressor, Air		1
11	43441-12	3936807	Compressor, Air		1
12	43441-13	3944516	Gear, Accessory Drive		1
13	43441-14	3936812	Brace, Air Compressor		1
14	43441-115	3936834	Union, Female Adapter		1
15	43441-16	3945212	Elbow, Plain Union		1
NS	43441-17	3800822	AC 1-Cyl Head Assembly Kit		A/R
NS	43441-18	3800824	Kit, Piston Assembly		A/R

AIR COMPRESSOR COOLANT PLUMBING

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0			Air Compressor Coolant Plumbing		Ref
1	43441-19	3008468	Plug, Pipe		1
2	43441-20	3910495	Screw, Hex Flange Head Cap		2
3	43441-21	3910530	Seal, Rectangular Ring		1
4	43441-22	3923369	Clamp, Hose		4
5	43441-23	3924146	Bushing, Reducing Pipe		2
6	43441-24	3924632	Coupling, Plain Hose		1
7	43441-25	3924633	Coupling, Elbow Hose		1
8	43441-26	3925226	Connection, Water Transfer		1
9	43441-27	3925855	Hose, Plain		1
	43441-27A	3927325	Coupling, Elbow Hose		1
10	43441-28	3046201	Seal, O-Ring		1
11	43441-29	3927732	Coupling, Elbow Hose		1
	43441-29A	3931014	Coupling, Plain Hose		1
12	43441-30	3932443	Coupling, Plain Hose		1
13	43441-31	3936832	Hose, Plain		1

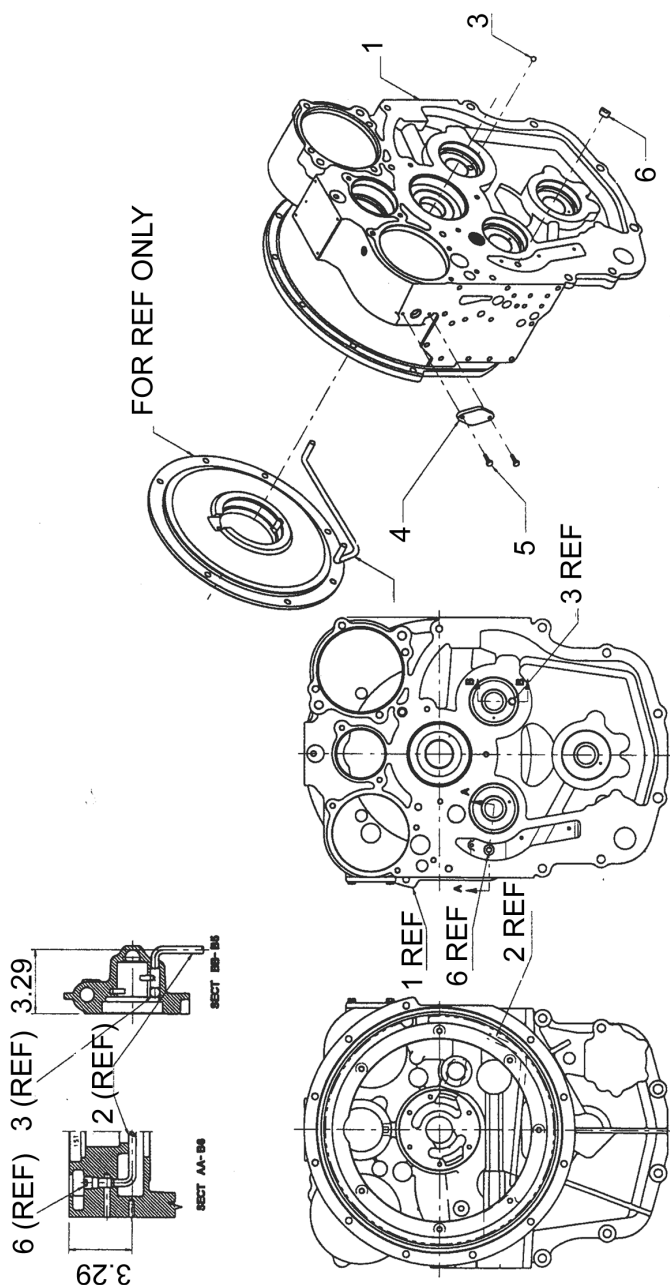
AIR COMPRESSOR CONNECTION

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0			Air Compressor Connection		Ref
1		43828-A	Clamp, Hose		2
2		215921	Coupling, Plain Hose		1
3		3928207	Hose, Plain		1

ENGINE OIL & TRANSMISSION FILTERS

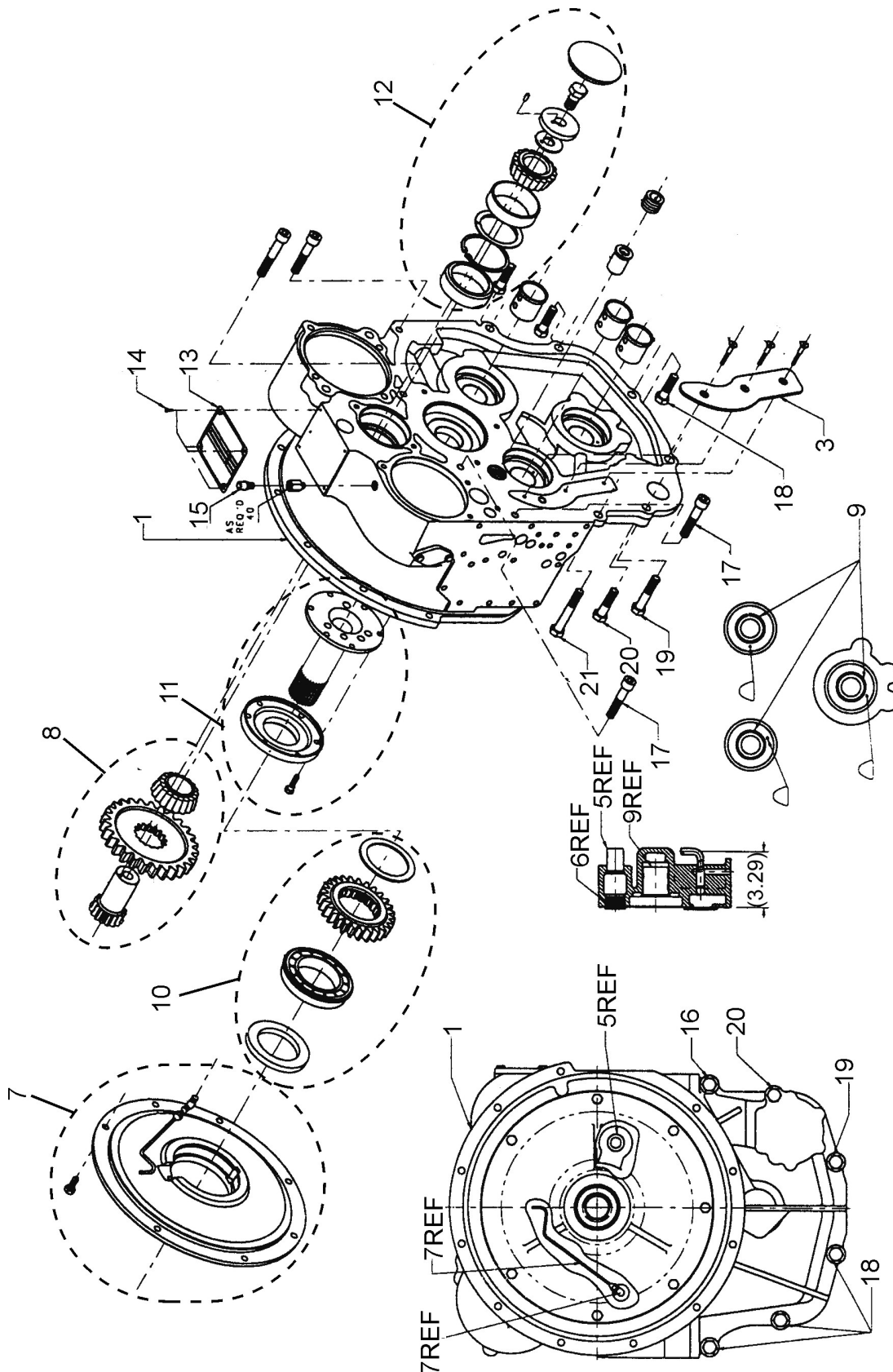
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-23		Filter Assembly, Oil, Engine/Transmission		Ref
1	43043.2		Hose Assembly, #16, 42.00, ST/EL		1
2	203852		Fitting, Hydraulic, 12MJ-10MB		2
3	37320		Bracket, Trans Filter, Funk *B*		1
4	3.0143		Fitting, Hydraulic, Ell, 12MJ-12MBP90		2
5	42927		Bracket, Oil Filter Mount		1
6	43107	LF3885	Filter Element, Oil		1
6a	43108	HH6981	Filter Head, Oil		1
6b	NW35703		Filter Element, Engine Oil		1
7	200609		Hose Assembly, #12L, 36.0', ST/EL		2
8	37315	4003483	Filter Element, Transmission (03718)		1
8a	43106	4003489	Filter Head, Transmission (03718)		1
9	43043.1		Hose Assembly, #16M, 34.50, ST/EL		1
10	NW030992		Fitting, Hydraulic, Ell, 16MJ-16MB90		3
11	NW30842		Fitting, Hydraulic, 16MB-16MJ		1

TRANSMISSION REPAIR PARTS



Item	Nmc-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	43902	40A2357	Group Front Cover		1
1	43902-1	40A2221	Cover, Front Assembly		1
2	43902-27	4002855	Tube, Front Cover		1
3	43902-40	F7400016D	Ball		2
4	43902-41	YZ101113	Plate, Cover		1
5	43902-42	F100108	Capscrew		2
6	43902-6	F190036	Plug, Pipe		1

TRANSMISSION REPAIR PARTS

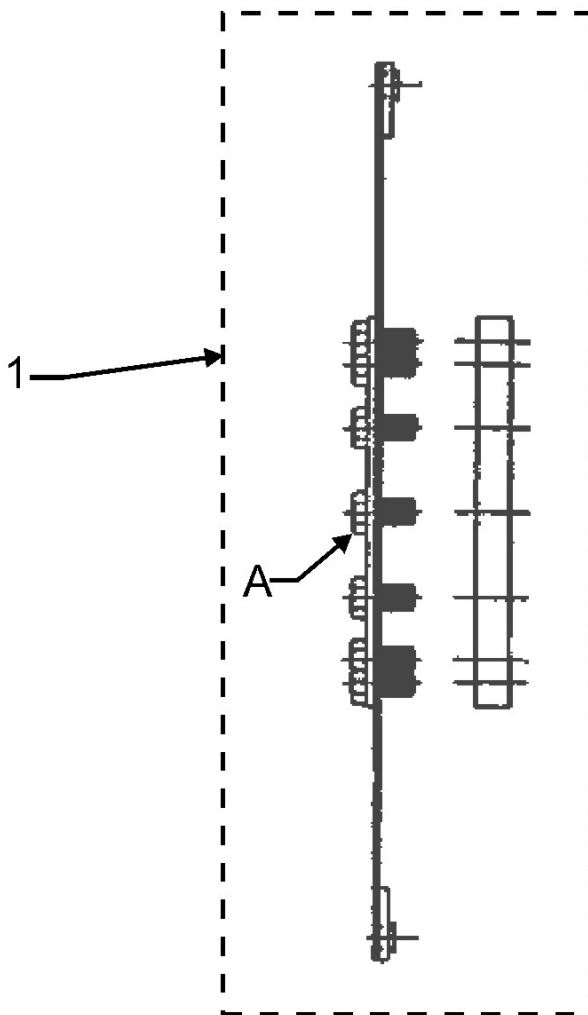


Item	Nmc-Wollard Part No.	Description	Eff	Units Per Assy
0	43902	Group Front Cover (96105) 40A2357		1
1	43902-1	Cover, Front Assembly 40A2221		1
3	43902-3	Cover, Oil Passage 4102021		1
4	43902-4	Capscrew F11211824		3
5	44734-2	Valve, Relief YZ250263		1
6	43902-6	Plug, Pipe F1900316		1
7	43902-45	Lubrication Assembly Tube Kit		1
8	43902-46	Idler Gear Kit		1
9	43902-9	Sleeve, Bore Front 4005295		3
10	43902-47	Impeller Hub Gear Kit		1
11	43902-43	Stator Support Tube Kit		1
12	43902-44	Bearing Kit		1
13	43902-29	Plate, Identification 4001660		1
14	43902-30	Screw, Drive F310063		4
15	43902-31	Breather, 0 PSI F68105		1
16	43902-38	Capscrew F1005052		1
17	43902-34	Capscrew F1100940		3
18	43902-35	Capscrew F1005024		3
19	43902-36	Capscrew F1005032		1
20	43902-37	Capscrew F1005040		1
NS	43902-33	Capscrew F1100948		1
NS	43902-24	Retainer, Bearing 4001041		1

TRANSMISSION REPAIR PARTS**ASM. NOTES:**

REF #A

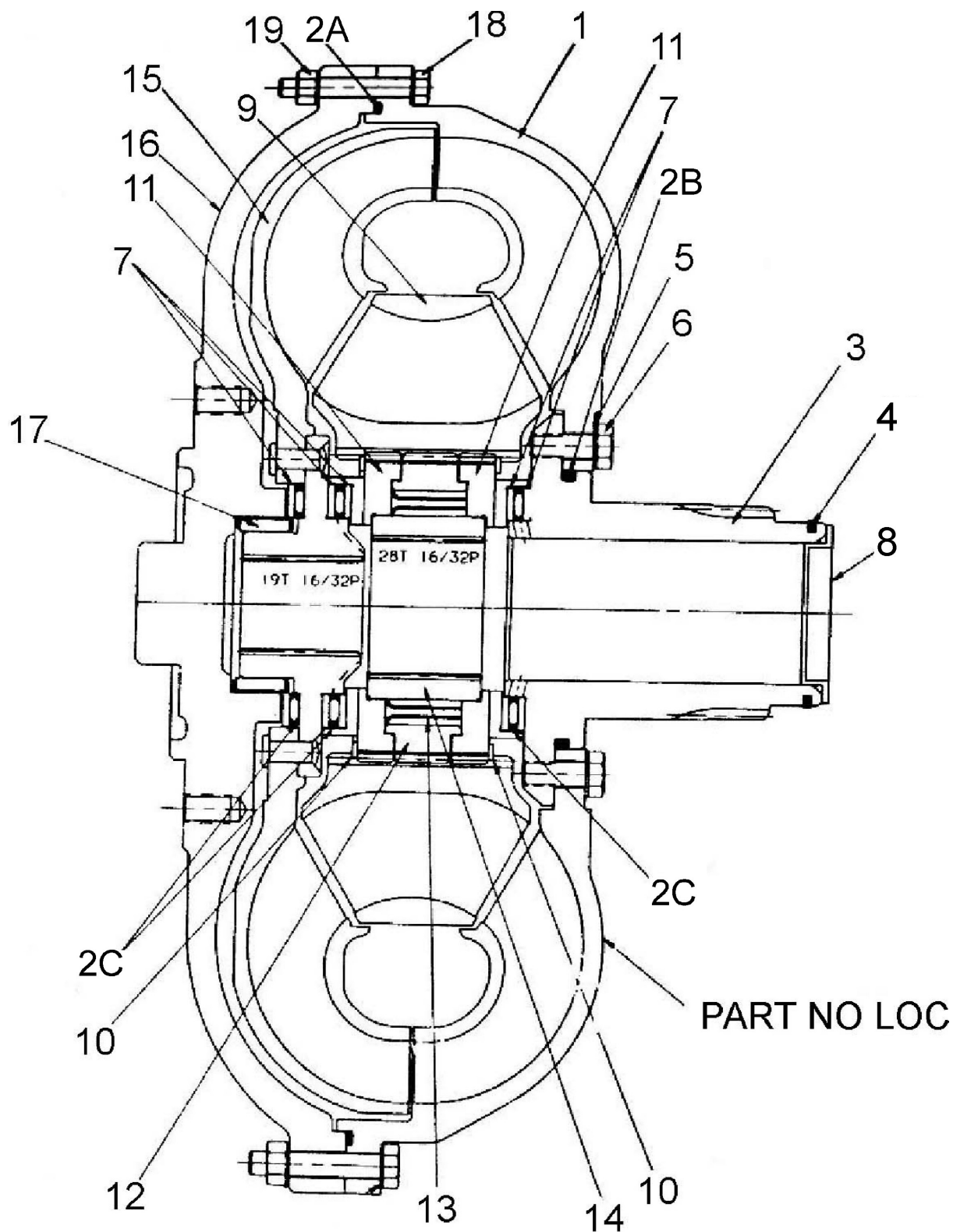
APPLY LOCKTITE #262. TORQUE
34LBS. FT. $\pm$ 3LBS. FT. PER
S.I.M. 765. (TYP. 12 PLACES)

**NOTE:**

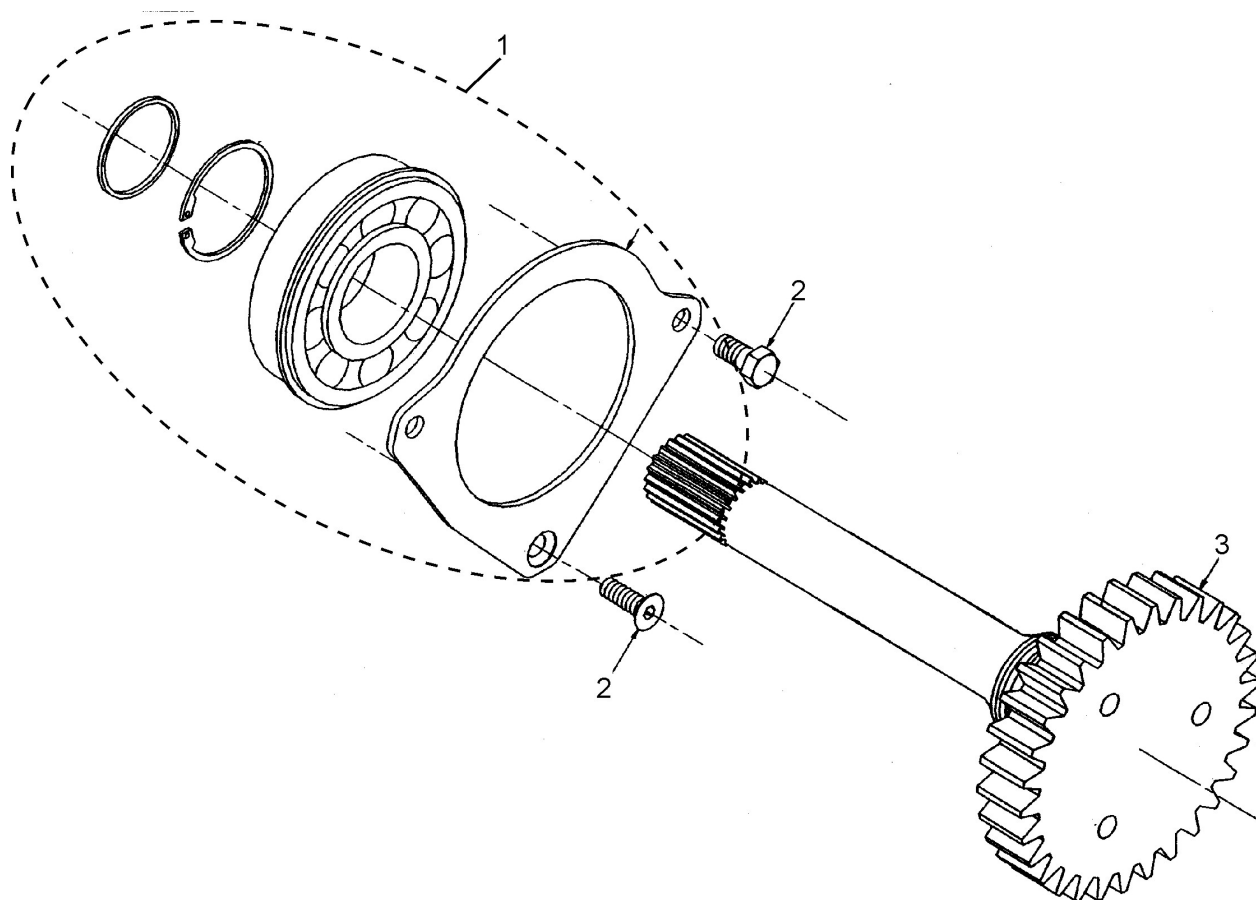
WHEN THESE DRIVE PLATES ARE USED
WITH 11.75 CONVERTERS THEY MUST
BE ASSEMBLED TO CONVERTER PER
DWG. #404345 TO AVOID POSSIBLE
INTERFACE PROBLEMS.

Item	Nmc-Wollard Part No.	Description	Eff	Units Per Assy
1	43903	Group, Plate Drive (96105) 4046763		1

TRANSMISSION REPAIR PARTS

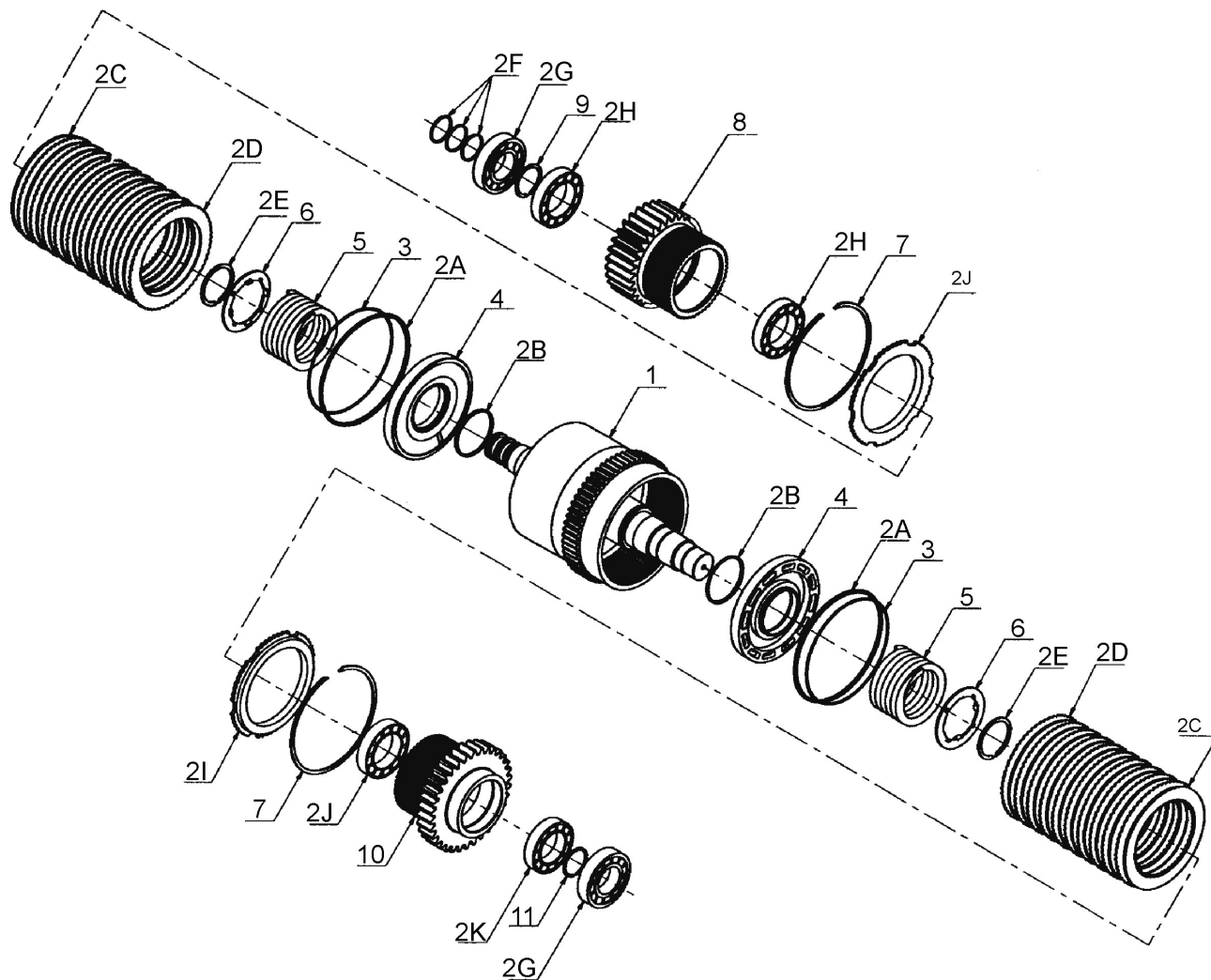


Item	Nmc-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	44734-5	Converter, 1275BAA, Assembly (96105) 4145131		
1	44734-6	Impeller, 1275B 4045872		1
2	44734-11	Bearing Needle & O-Ring Kit (Includes 2A, 2B & 2C)		1
2A		O-Ring		1
2B		O-Ring		1
2C		Bearing, Needle Thrust		3
3	44734-10	Impeller, Hub 4145029		1
4		Seal, Ring 4000497		1
5	43904-24	Washer, Flat 4003680		60
6		Capscrew F1002014		12
7	43904-26	Washer, Thrust 4045901		5
8		Plug, Shipping F2310042		1
9	44734-8	Stat. Conv 1275A 4145012		1
10	43904-12	Ring, Retaining 4003456		2
11	44734-27	Retainer, Clutch 4145011		2
12	44734-29	Race, Clutch Outer 4045723		1
13	43904-16	Sprag, Clutch Assembly 4045081		1
14	44734-28	Race, Inner Clutch 4045076		1
15	44734-9	Turb Assembly 1275A 4145013		1
16	44734-7	Turbine, A 4045195		1
17	44734-26	Turbine, Hub 4145014		1
18	44734-30	Capscrew F1002528H 8NP		24
19	44734-31	Nut, Hex F1300400U		24

TRANSMISSION REPAIR PARTS

Item	Nmc-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	43905	Group, Shaft Input (96105) 40A2222		
1	43905-7	Ball Bearing Kit		1
2	43905-4	Capscrew F1003012		3
3	43905-1	Shaft, Input 30 Tooth 40A2019		1

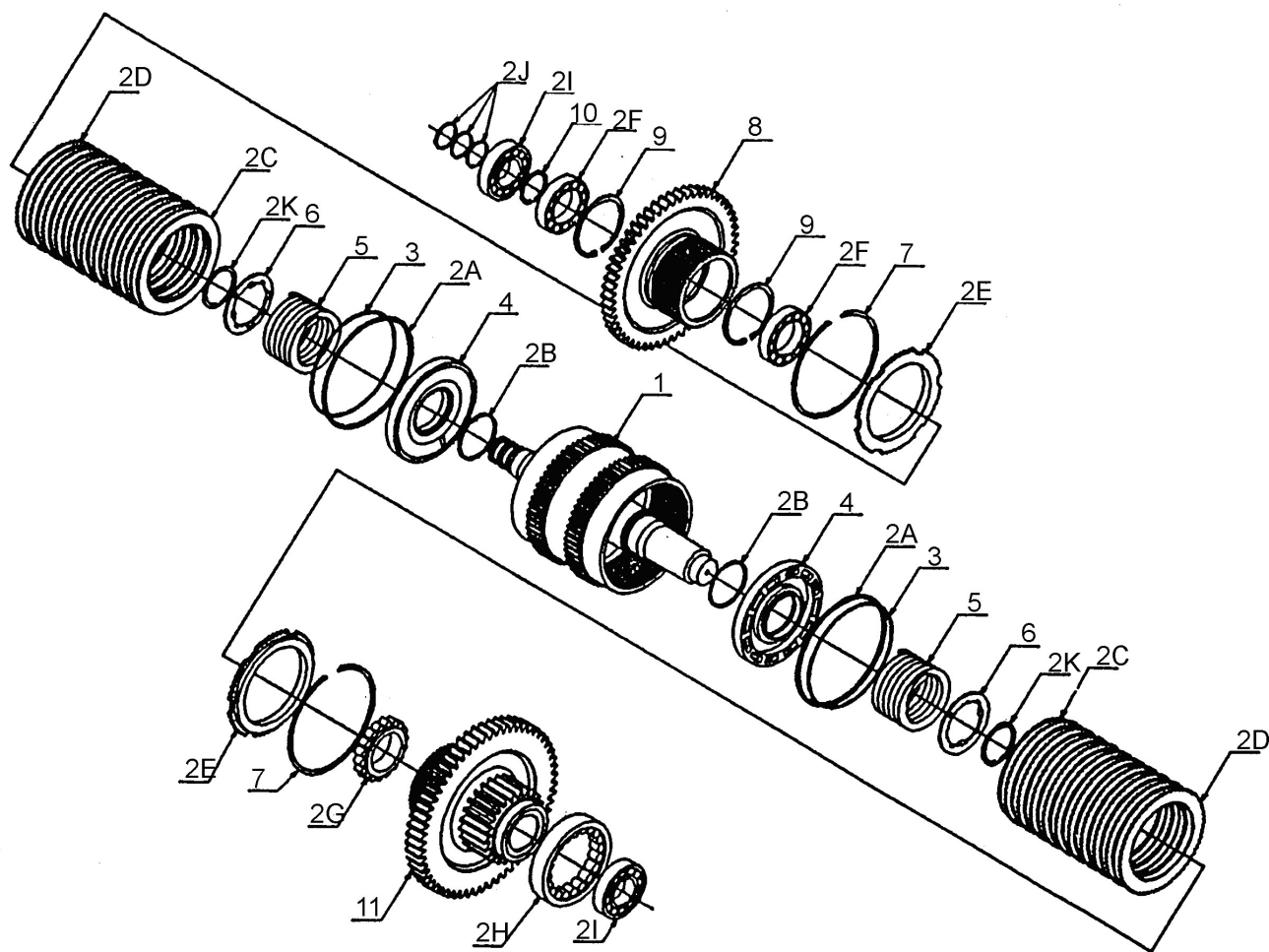
TRANSMISSION REPAIR PARTS



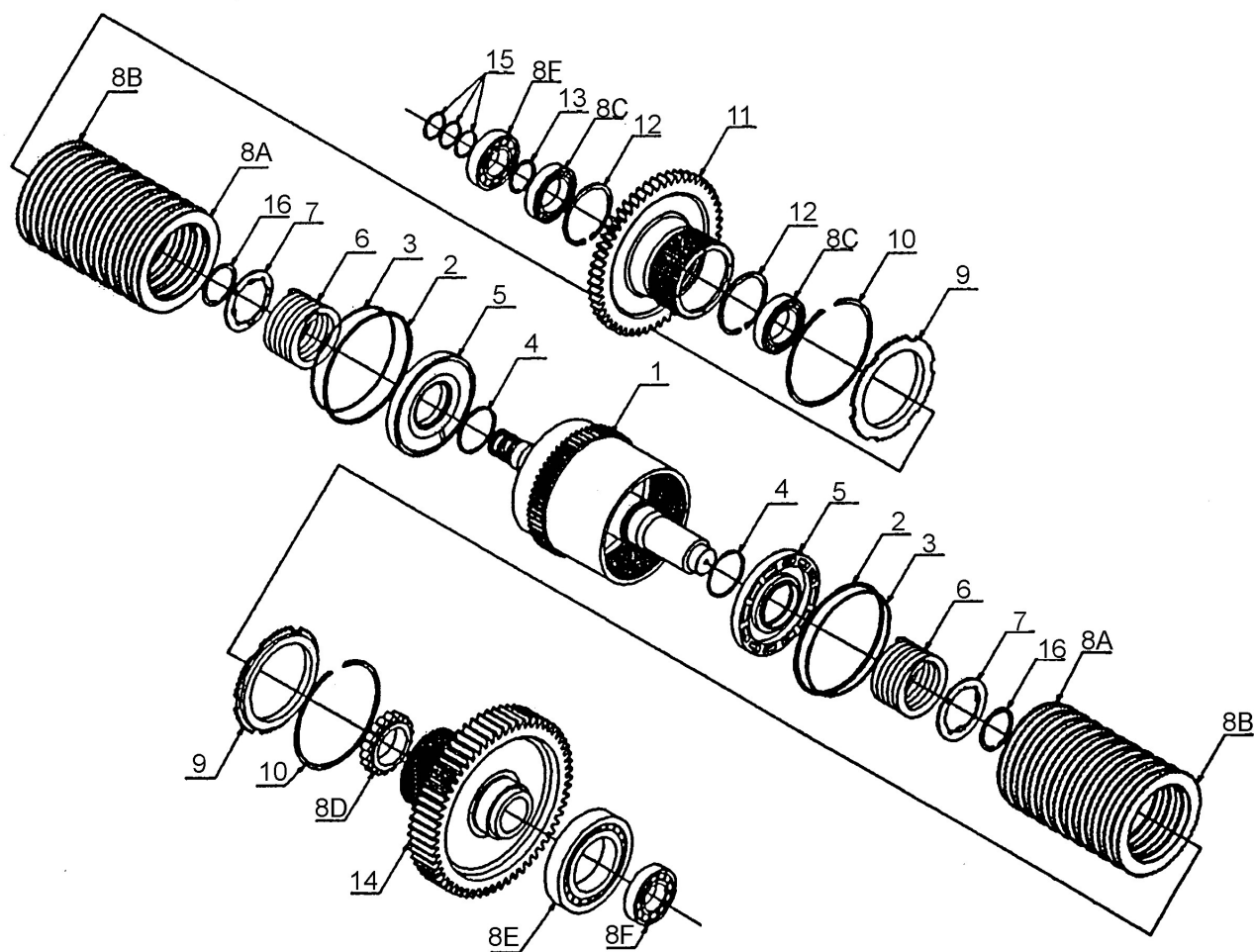
NOTES:

- REF #8, #9, #10, #11
ASSEMBLE (1) REF #9 SEPARATOR PLATE
AGAINST THE REF #5 PISTON AND THEN ALTER-
NATE WITH (1) REF #8 CLUTCH PLATE UNTIL A
REF #8 CLUTCH PLATE IS THE LAST PLATE IN
THE CLUTCH ASSEMBLY. INSTALL REF #10
CLUTCH RETAINER & REF #11 SNAP RING.
- CHECK CLUTCH ASSEMBLY FOR CLEARANCE BE-
TWEEN THE LAST REF #8 CLUTCH PLATE & REF
#10 CLUTCH RETAINER.
- ALLOWABLE CLUTCH ASSEMBLY CLEARANCE
.050 MINIMUM TO .120 MAXIMUM
- IF THE MINIMUM CLEARANCE IS LESS THAN .050
CORRECT BY EXCHANGING CLUTCH PLATES AS
REQUIRED TO OBTAIN .050 OR MORE CLEAR-
ANCE.
- IF THE MAXIMUM CLEARANCE IS MORE THAN
.120 CHECK AND MAKE SURE THAT A REF #8
CLUTCH PLATE OR A REF #9 SEPARATOR PLATE
HAS NOT BEEN LEFT OUT.
- IF THE MAXIMUM CLEARANCE IS STILL MORE
THAN .120 CORRECT BY REMOVING THE LAST
REF #8 CLUTCH PLATE FROM THE CLUTCH AS-
SEMBLY & ASSEMBLING AN ADDITIONAL REF #9
SEPARATOR PLATE ON TOP OF THE LAST REF #9
SEPARATOR PLATE.
- ASSEMBLE THE LAST REF #8 CLUTCH PLATE AND
FINISH THE CLUTCH ASSEMBLY & RECHECK THE
CLEARANCE.
- REF #17 & #19
SPECIAL ANGULAR CONTACT BALL BEARINGS
MUST BE INSTALLED PROPERLY TO FUNCTION
PROPERLY.
- ONE SIDE OF THE BEARING OUTER RACE IS
MARKED "THRUST HERE" THIS IS THE BEARING
OUTER RACE THRUST SHOULDER.
- THIS THRUST SHOULDER MUST BE ASSEMBLED
AGAINST THE GEAR SHOULDER OR SNAP RING
ON THE INSIDE DIAMETER OR REF #15 GEAR &
HUB ASSEMBLY.
- THE BEARING OUTER RACE THRUST SHOUL-
DERS OF REF #17 & #19 BEARINGS WILL BE
FACING EACH OTHER IN THIS APPLICATION.
- REF #21
CYLINDRICAL ROLLER BEARING INNER RACE IS
PRESSED ON REF #1 SHAFT ASSEMBLY WITH
THE BEARING INNER RACE SHOULDER AGAINST
THE SHAFT SHOULDER ON THE SNAP RING.
BEARING OUTER RACE ASSEMBLY TO BE
STOCKED LOOSE WITH THIS CLUTCH ASSEMBLY,
TO BE ASSEMBLED AT THE NEXT ASSEMBLY
LEVEL.
- REF #22
CONTINUOUS SEAL RINGS MUST BE SIZED IMME-
DIATELY PRIOR TO ASSEMBLY AT THE NEXT AS-
SEMBLY LEVEL.

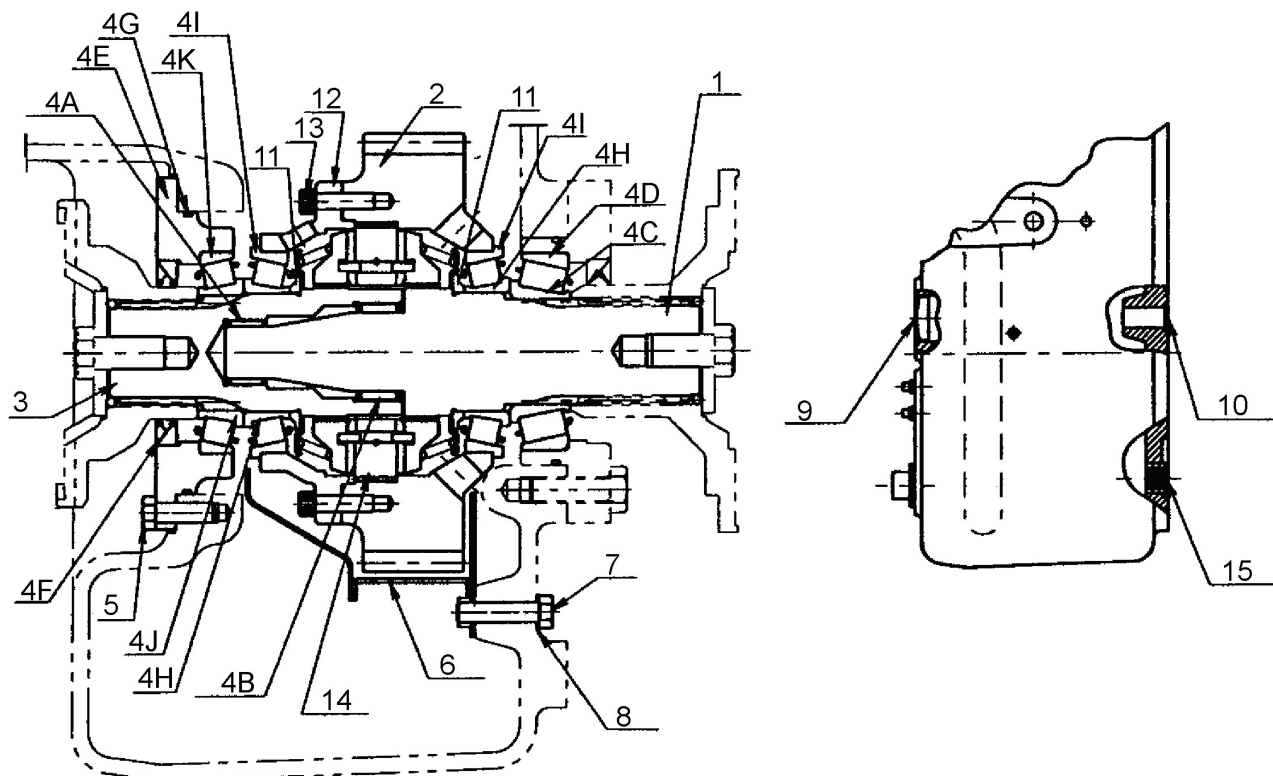
Item	NMC-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	43906	Clutch, 1st Gear Assembly (96105) YZ102403		
1	43906-1	Shift Clutch, 1st Assembly 40A2216		1
2	43906-24	Bearing & Ring Kit(Includes 2A-K)		1
2A	43906-2	Seal, Lip		2
2B	43906-4	O-Ring, Arp144		2
2C	43906-8	Plate, Clutch		20
2D	43906-9	Plate, Clutch Separator		22
2E	43906-23	Ring, Retaining		2
2F	43906-22	Ring, Seal		3
2G	43906-21	Bearing		2
2H	43906-13	Bearing		2
2I	43906-10	Retainer, Clutch		2
2J	43906-17	Bearing, Ball		1
2K	43906-19	Bearing, Ball		1
3	43906-3	Ring, Back-Up 4102398		2
4	43906-5	Clutch, Piston 40A2034		2
5	43906-6	Spring, Clutch Return 40A6261		2
6	43906-7	Spring, Retainer 40A2038		2
7	43906-11	Ring, Snap YZ103040		2
8	44734-36	Gear & Hub YZ4102496		1
9	43906-15	Ring, Retaining F81696		1
10	43906-16	Gear & Hub YZ4102506		1
11	43906-20	Ring, Retaining F81675		1

TRANSMISSION REPAIR PARTS

Item	NMC-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	43907	Clutch 2nd, Assembly (96105) YZ102404		
1	43907-1	Shift Clutch, 2nd Gear Assembly 40A2218		1
2	43906-25	Bearing & Ring Kit (Includes 2A-K)		1
2A	43906-2	Seal, Lip		2
2B	43906-4	O-Ring		2
2C		Plate, Clutch		20
2D		Plate, Clutch Separator		22
2E		Retainer, Clutch Plates		2
2F		Bearing		2
2G		Bearing		1
2H		Bearing		1
2I		Bearing		2
2J		Ring, Seal		3
2K		Ring, Retaining		2
3	43906-3	Ring, Back-Up 4102398		2
4	43906-5	Clutch, Piston 40A2034		2
5	43906-6	Spring, Clutch Return 40A6261		2
6	43906-7	Spring, Return 40A2038		2
7	44734-38	Ring, Snap YZ103040		2
8	44734-17	Gear & Hub YZ4102504		1
9	43907-14	Ring, Snap F39000315		2
10	43906-15	Ring, Retaining F81696		1
11	44734-18	Gear & Hub YZ4102503		1

TRANSMISSION REPAIR PARTS

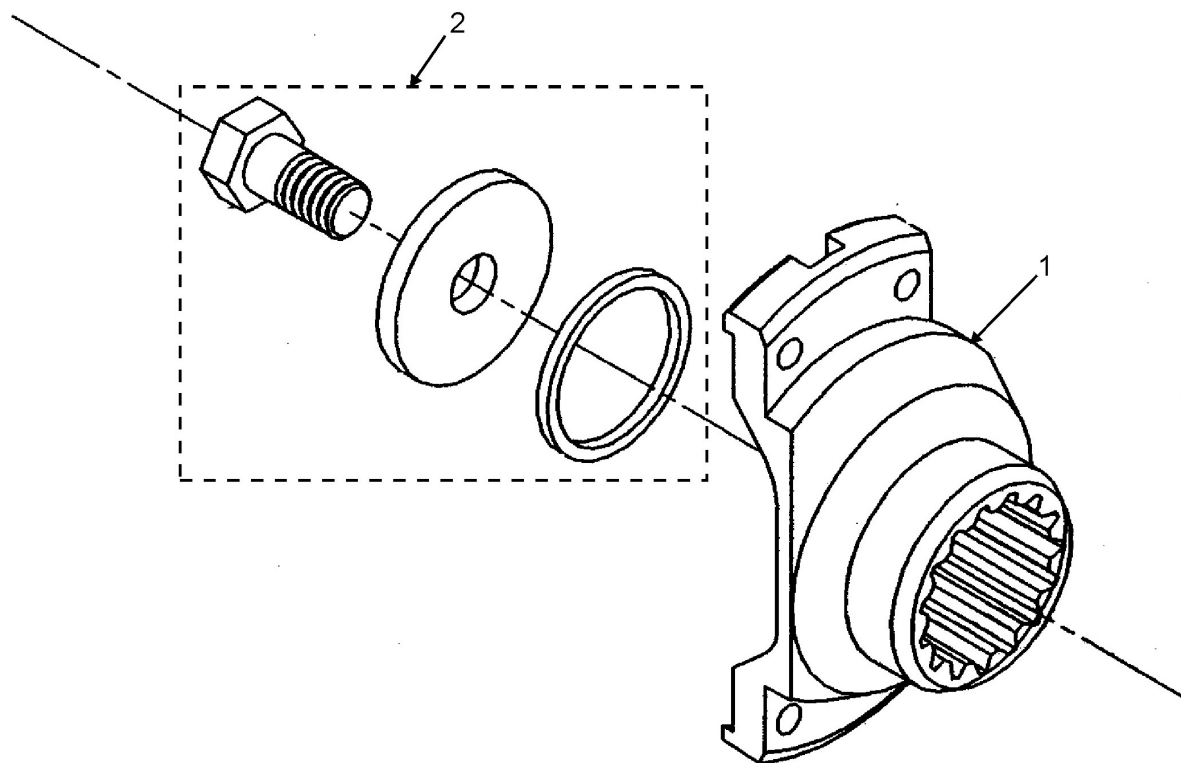
Item	Nmc-Wollard Part No.	DESCRIPTION	Vendor Part No.	Eff	Units Per Assy
0	43908	Clutch 3rd, Assembly (96105)	YZ102415		
1	43908-1	Shift Clutch, 3rd Gear Assembly	40A2219		1
2	43906-2	Seal, Lip	40A2565		2
3	43906-3	Ring, Back-Up	4102398		2
4	43907-4	O-Ring	F37020144		2
5	43906-5	Clutch, Piston	40A2034		2
6	43906-6	Spring, Clutch Return	40A6261		2
7	43906-7	Spring, Return	40A2038		2
8	43908-2	Bearing Kit (Includes 8A-F)			1
8A		Plate, Clutch			20
8B		Plate, Clutch Separator			22
8C		Bearing			2
8D		Bearing			1
8E		Bearing			1
8F		Bearing			2
9		Retainer, Clutch			2
10	44734-38	Ring, Snap	YZ103040		2
11	44734-23	Gear & Hub	YZ4102497		1
12	43907-14	Ring, Snap	F39000315		2
13	43906-15	Ring, Retaining	F81696		1
14	44734-24	Gear & Hub	YZ4102495		1
15	44734-12	Ring, Seal	YZ250161		3
16	43906-23	Ring, Retaining	F81750		2

TRANSMISSION REPAIR PARTS**ASM NOTES:**

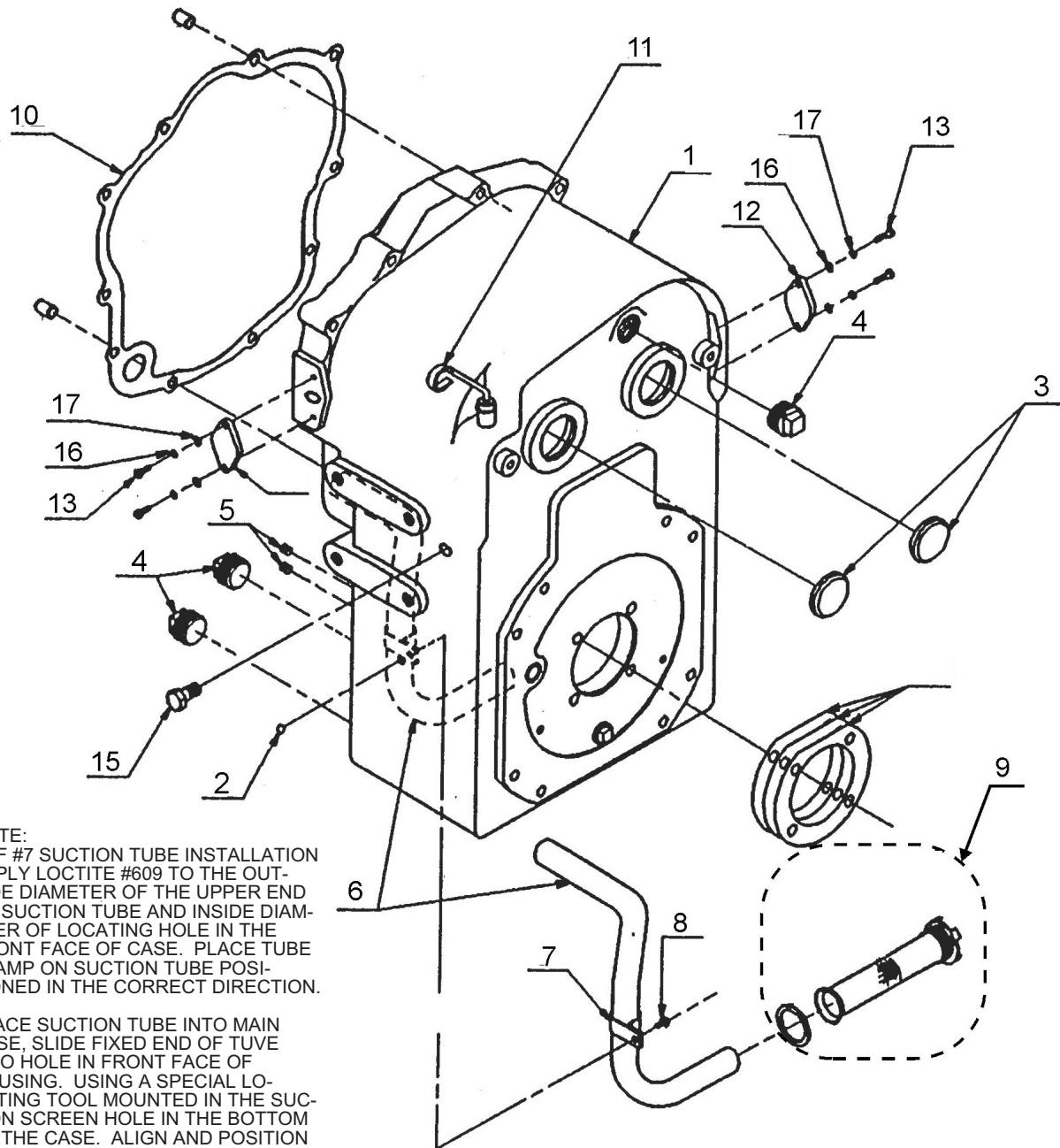
- 1) PRESS BEARING CUPS (#19) INTO GEAR (#2) & RETAINER (#16).
- 2) SPLINE NO-SPIN ASM (#20) UNTO GEAR (#2).
- 3) INSTALL RETAINER (#16).
- 4) INSTALL CAPSCREWS WITH LOCTITE #262 & TORQUE TO 27 LBS. FT. PER S.I.M. 765.
- 5) REMOVE WASHERS & BOLT HOLDING NO-SPIN ASM. (#20) TOGETHER, LETTING SPRINGS PUSH RETAINERS OUT AGAINST BEARING CUPS (#19).
- 6) INSTALL TROUGH (#10) INTO MAIN HOUSING WITH CAPSCREWS (#11) & WASHERS (#12) APPLY LOCTITE #262 UNDER HEAD OF CAPSCREWS.
- 7) PLACE NO-SPIN GEAR ASM. INTO TROUGH LOCATED IN MAIN HOUSING.
- 8) INSTALL BEARINGS (#3-2 & #3-3) INTO SHAFT (#3-1). INSTALL SPRING RETAINER (#15) & BEARING CONES (#18 & #21) ON SHAFT (#3-1). INSTALL THIS SHAFT ASSEMBLY THROUGH ENGINE SIDE OUTPUT BORE INTO NO-SPIN ASM.
- 9) INSTALL BEARING CUP (#22). OIL SEAL (#7) & O-RING (#8) INTO BEARING RETAINER (#6) & INSTALL THIS ASM. INTO ENGINE SIDE OUTPUT BORE. THEN INSTALL RETAINER CAPSCREWS (#9).
- 10) INSTALL SPRING RETAINER (#15) & BEARING CONES (#18 & #4) ONTO SHAFT (#1) & INSTALL THIS ASM. THROUGH OPPOSITE ENGINE SIDE OUTPUT BORE INTO NO-SPIN ASM.
- 11) INSTALL BEARING CUP (#5) & SEAL (#2 OF REFERENCE GROUP 9) INTO OUTPUT BEARING RETAINER (#1 OF REFERENCE GROUP 9). DO NOT INSTALL O-RING AT THIS TIME.
- 12) INSTALL OPPOSITE ENGINE SIDE BEARING RETAINER ONTO TRANSMISSION WITH TWO CAPSCREWS (OMIT 'O-RING').
- 13) PUSH RETAINER INWARD & TIGHTEN CAPSCREWS FINGER TIGHT.
- 14) TO SEAT ALL COMPONENTS TIGHTEN EACH CAPSCREW TO 175 IN. LB. IN (3) EVEN STEPS. (50, 125, & 175 IN. LB.) ROTATE SHAFT AT EACH STEP, THEN LOOSEN BOTH CAPSCREWS BACK DOWN TO FINGER TIGHT.
- 15) LOCK-UP OUTPUT GEAR WITH FIXTURE TO PREVENT ROTATION.
- 16) TIGHTEN EACH CAPSCREW TO 50 IN. LB. & ROTATE EACH OUTPUT SHAFT.
- 17) TIGHTEN EACH CAPSCREW TO 100 IN. LB. & ROTATE EACH OUTPUT SHAFT.
- 18) MEASURE THE SHIM GAP WITH TAPER GAGE AT EACH CAPSCREW LOCATION. (PLACE EDGE OF TAPER GAGE ON CAPSCREW FOR A GUIDE).
- 19) MAKE AN AVERAGE OF THE TWO READINGS. EXAMPLE: $.040" + .047" = (0.87/2) = .0435"$.
- 20) ADD .018" TO THE SHIM GAP FOUND IN STEP #18.
- 21) INSTALL "O" RING ON RETAINER. APPLY CORRECT SHIM PACK (FROM STEP #19) & TORQUE CAPSCREWS.
- 22) CHECK BEARING SETTING WITH DIAL INDICATOR. SHOULD BE IN RANGE OF .0025" PRE-LOAD TO .0025" EBD-PLAY.
- 23) INSTALL EXPANSION & CUP PLUGS (#13 & 14) USING LOCTITE #262 IB O.D. OF PLUGS.
- 24) INSTALL PIPE PLUG (#23) USING SLICITE THREAD COMPOUND.
- 25) AFTER ASSEMBLY OF NO SPIN GROUP AND BEFORE THE REST OF THE GEAR RATIO IS ASSEMBLED CHECK TORQUE REQUIRED TO ROTATE BOTH OUTPUT SHAFTS. WITH THE OUTPUT GEAR HELD STATIONARY IT SHOULD REQUIRE FROM 15 TO 80 LBS FT OF TORQUE TO BREAK EACH SHAFT LOOSE.

IF IT TAKES MORE OR LESS TORQUE THAN LISTED, THERE IS SOMETHING ASSEMBLED INCORRECTLY OR OUT OF SPEC PARTS.

Item	Nmc-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	43909	Group, No Spin Assembly (96105) YZ101590		
1	43909-1	Shaft, Output YZ101458		1
2	43909-2	Hub, Drive 40A2281		1
3	43909-3	Shaft, Output Assembly (Includes 4A & 4B) YZ101549		1
	43909-3a	Shaft, Output YZ101457		1
4	43909-23	Bearing Kit (Includes 4A-K)		1
4A		Bearing		1
4B		Bearing, Needle		1
4C		Bearing		1
4D		Cup		1
4E		Bearing, Retainer		1
4F		Seal, Oil		1
4G		O-Ring		1
4H		Bearing, Cone		2
4I		Bearing, Cup		2
4J		Cone, Bearing		1
4K		Cup, Bearing		1
5	43902-28	Capscrew F1003014		6
6	43909-10	Bfl, Assembly 40A2286		1
	43902-30	Cyl, Bfl 40A2284		1
	43902-31	Clinch Nut 4003800		1
7	43909-11	Capscrew F1002532		2
8	43909-12	Washer F18002		2
9	43909-13	Plug, Expansion F21026		1
10	43909-14	Plug, Expansion F22012		1
11	43909-15	Spacer, Spring Retainer YZ101461		2
12	43909-16	Housing, No-Spin 40A2280		1
13	43909-17	Capscrew F1100416		4
14	43909-20	No-Spin Assembly 4006927		1
15	43902-6	Plug, Pipe F1900316		1

TRANSMISSION REPAIR PARTS

Item	Nmc-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	43910	Group, Yoke Fitting 6C (96105) 40A2230		
1	43910-1	Yoke, 6C YZ4102789		1
2	43910-22	O-Ring Kit		1

TRANSMISSION REPAIR PARTS

NOTE:
REF #7 SUCTION TUBE INSTALLATION
APPLY LOCTITE #609 TO THE OUT-
SIDE DIAMETER OF THE UPPER END
OF SUCTION TUBE AND INSIDE DIAM-
ETER OF LOCATING HOLE IN THE
FRONT FACE OF CASE. PLACE TUBE
CLAMP ON SUCTION TUBE POSI-
TIONED IN THE CORRECT DIRECTION.

PLACE SUCTION TUBE INTO MAIN
CASE, SLIDE FIXED END OF TUBE
INTO HOLE IN FRONT FACE OF
HOUSING. USING A SPECIAL LO-
CATING TOOL MOUNTED IN THE SUC-
TION SCREEN HOLE IN THE BOTTOM
OF THE CASE. ALIGN AND POSITION
THE BOTTOM END OF THE SUCTION
TUBE..

ATTACH REF #8 SUCTION TUBE
CLAMP WITH REF #9 CAPSCREW
LOOSELY TO THE CASE. USING AP-
PROPRIATE SWAGING TOOL. SWAGE
SUCTION TUBE INTO LOCATING HOLE
IN FRONT FACE OF CASE. END OF
TUBE CAN BE FLUSH TO .25 BELOW
FLUSH WITH FRONT FACE OF CASE.

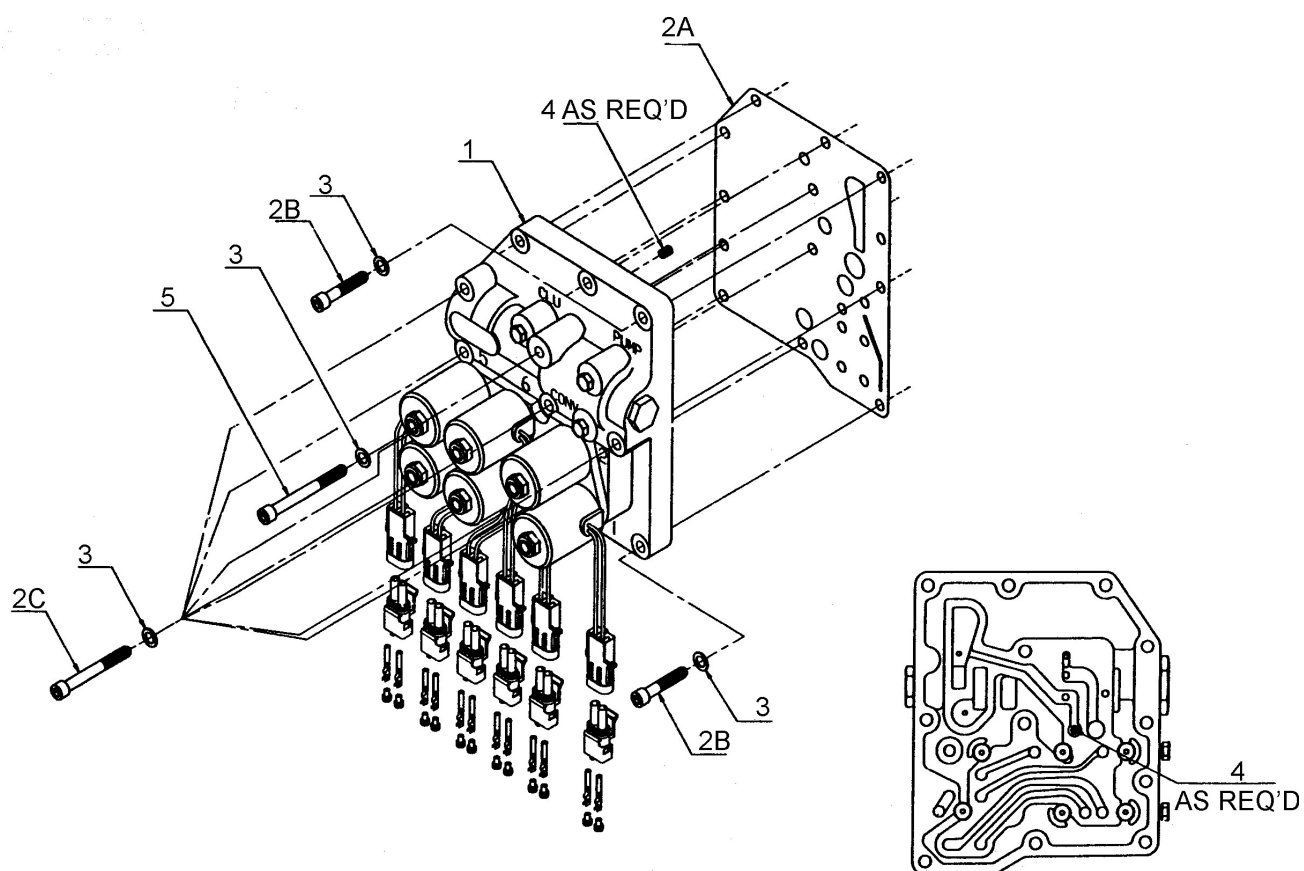
CHECK TUBE AFTER SWAGING PRO-
CESS TO ASSURE A SOUND JOINT.

SWAGE JOINT MUST NOT HAVE ANY AIR LEAKAGE.

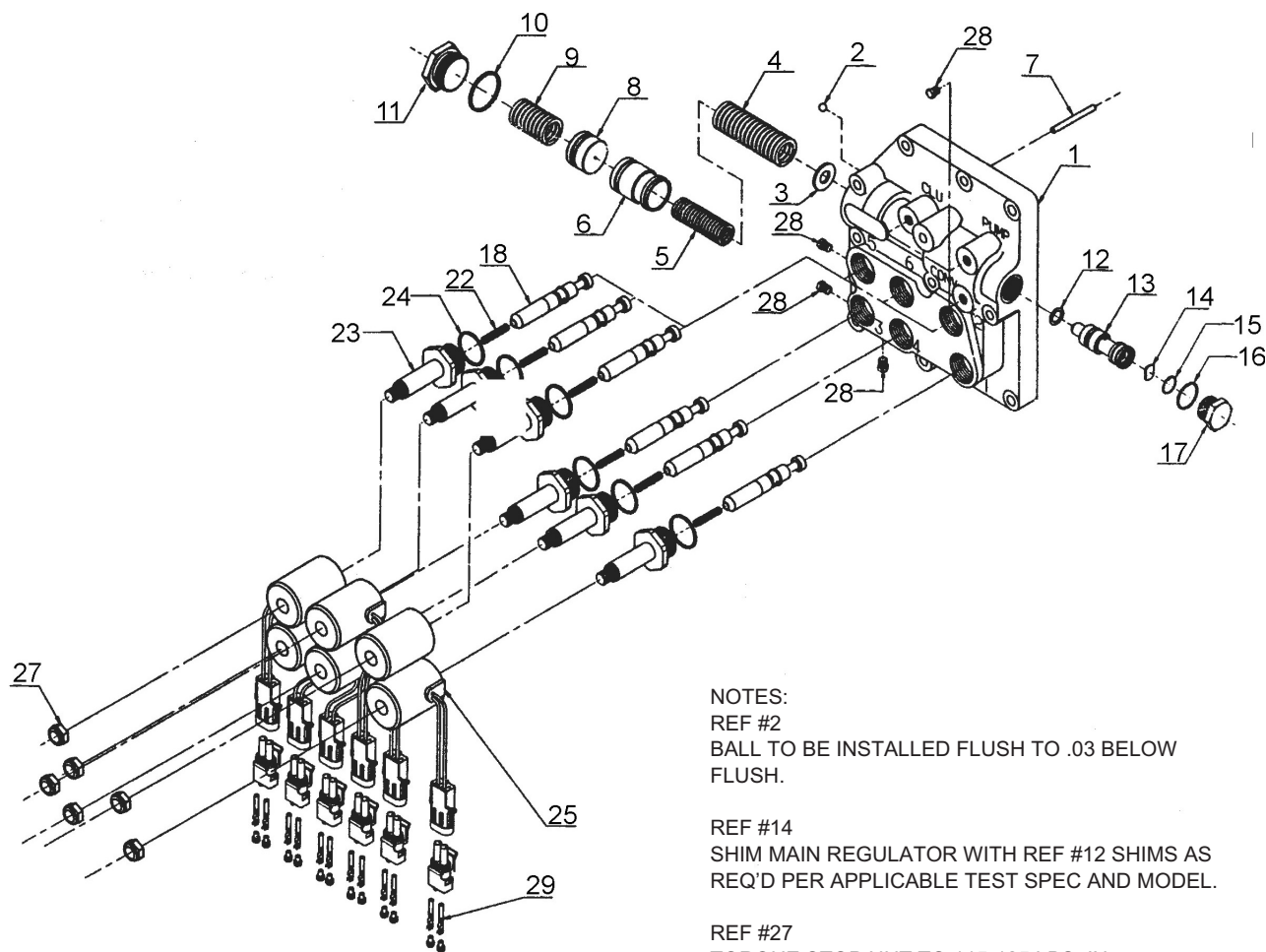
SWAGE JOINT MUST NOT ROTATE WITH ANY APPLIED HAND TORQUE.

FINISH TIGHTENING REF #6 CLAMP WITH REF #9
CAPSCREW TO CASE.

Item	Nmc-Wollard Part No.	DESCRIPTION	Vendor Part No.	Eff	Units Per Assy
0	44734-40	Group, Case Main (96105)	YZ101397		Ref
1	44734-41	Case, Main	YZ101241		1
2	43911-2	Ball, Steel	F7400012D		1
3	43911-3	Plug, Expansion	F21043SC		2
4	43911-4	Plug, Pipe	F1900120GVS		3
5	43911-5	Plug, Pipe	F190034		2
6	43911-7	Tube, Suction	40A2035		1
7	43911-8	Clamp, Tube	4003307		1
8	43911-9	Capscrew	F100108		3
9	43911-11	Suction Screen Kit	40A6020		1
10	43911-28	Gasket Kit, Main Housing	4101088		1
11	43911-27	Dipstick Kit	4102007		1
12	43911-15	Plate, Cover	YZ101113		2
13	43911-16	Capscrew	F1001010		4
14	43911-18	Kit, Shim	40A2040		1
15	43911-19	Capscrew	F1007516		1
16	43911-25	Washer, Flat	F17001N		4
17	43911-26	Washer, Lock	F16200		4

TRANSMISSION REPAIR PARTS

Item	Nmc-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	43912	Group, Valve Electric (96105) YZ100597		
1	43912-1	Valve, Electric Assembly YZ100594		1
2	43912-8	Gasket Kit, Valve Body (Includes 2A-C)		1
2A		Gasket, Valve Body		1
2B		Capscrew, Socket Head		4
2C		Capscrew, Socket Head		7
3	43912-4	Washer, Flat 4003680		12
4	43912-5	Plug, Orifice 4004247E		1
5	43912-7	Capscrew, Socket head F1100344		1

TRANSMISSION REPAIR PARTS**NOTES:****REF #2**

BALL TO BE INSTALLED FLUSH TO .03 BELOW FLUSH.

REF #14

SHIM MAIN REGULATOR WITH REF #12 SHIMS AS REQ'D PER APPLICABLE TEST SPEC AND MODEL.

REF #27

TORQUE STOP NUT TO 115-125 LBS. IN.

REF #28

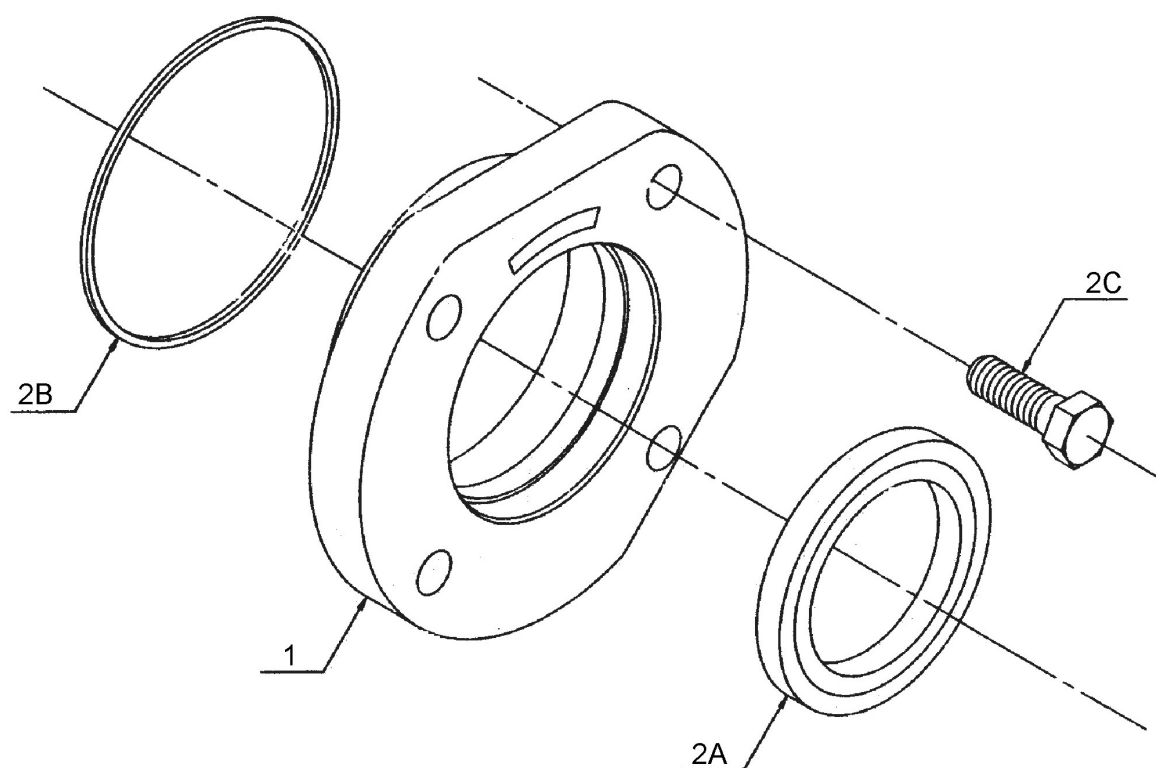
APPLY SLICTITE THREAD COMPOUND TO THREADS OF PLUGS AT ASM.

REF #29

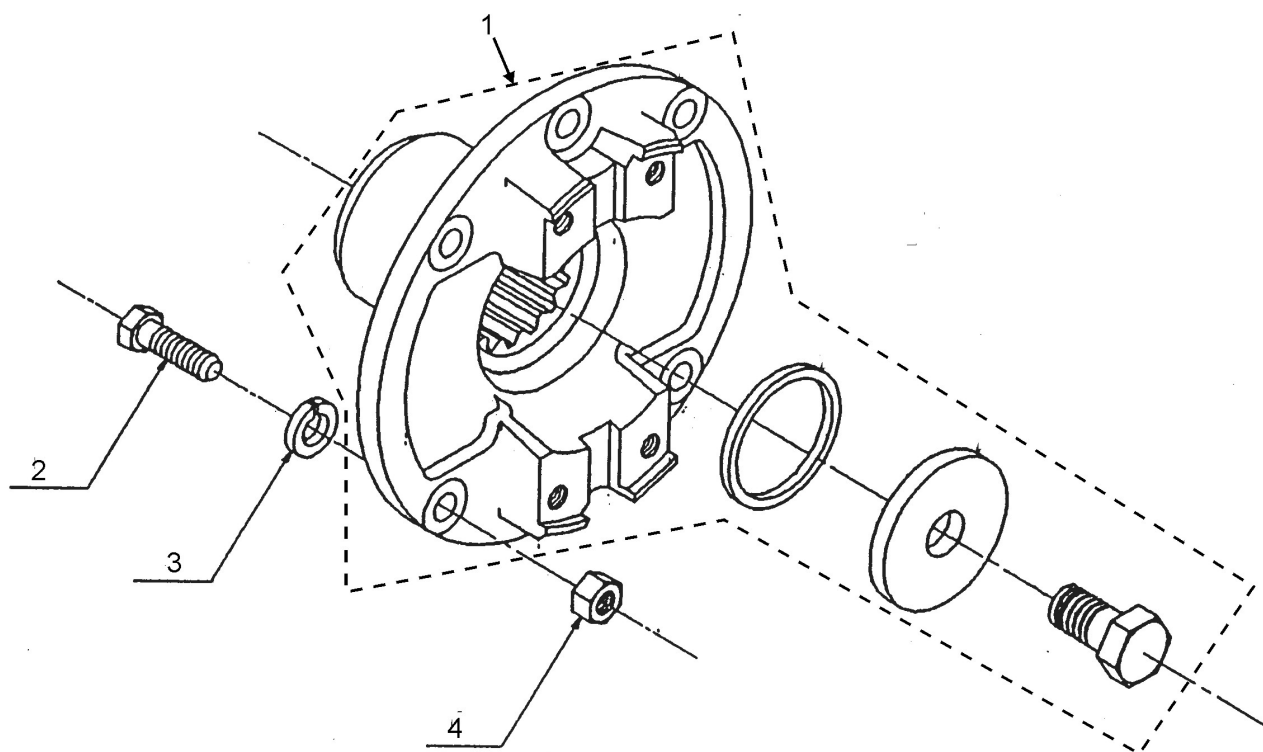
TO INSTALL SOCKET INTO CONNECTOR, PUSH PIN INTO CONNECTOR FROM THE REAR UNTIL LOCKED IN PLACE. FIRMLY SEAT SEALS. USING PACKARD CABLE SEAL, INSERT TOOL P/N 12033495. CLOSE FIRMLY SEAT SEALS, USING PACKARD CABLE.

TO REMOVE SOCKET FROM CONNECTOR: INSERT REMOVAL TOOL P/N 12014012 INTO CONNECTOR ON THE SIDE OPPOSITE THE WIRE. THE TOOL MUST REMAIN IN PLACE WHILE THE WIRE IS PULLED GENTLY FROM THE REAR OF THE CONNECTOR.

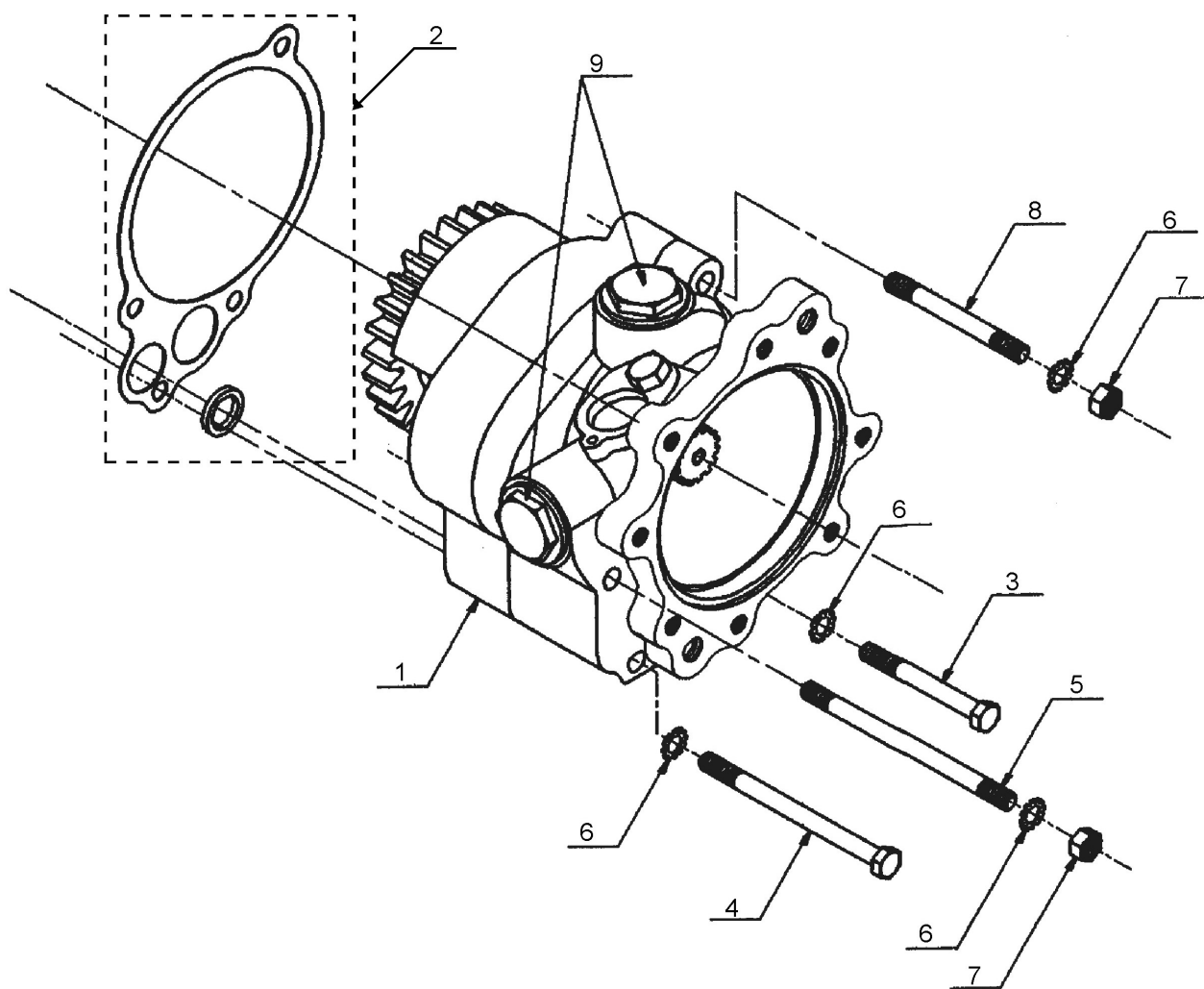
Item	Nmc-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	44734-42	Group, Valve Assembly (96105) YZ100597		
1	43913-1	Body, Valve 40A2520		1
2	43913-2	Ball F740007D		1
3	43913-3	Washer 40A2510		1
4	43913-4	Spring, Outer 40A2563		1
5	43913-5	Spring, Inner 40A2564		1
6	43913-6	Piston, Accumulator 40B1065		1
7	43913-7	Pin, Dowel F2710132		1
8	43913-8	Valve, Dump 4001081		1
9	43913-9	Spring, Dump Valve 4001074		1
10	43913-10	O-Ring F37060916		1
11	43913-11	Plug, Dump Valve 4001080		1
12	43913-12	Shim, Spring 40A2511		3
13	43913-13	Spool, Regulating 40A2512		1
14	43913-14	Plate, Orifice 40A1335		1
15	43913-15	Ring, Snap F3900056		1
16	43913-16	O-Ring F37060910		1
17	43913-17	Plug 4001290		1
18	43913-18	Plunger & Spool Assembly 4102315		6
22	43913-22	Spring, Solenoid 40A2269		6
23	43913-23	Core, Assembly 4005293		6
24	43913-24	O-Ring, Arp912 F37060912		6
25	43913-25	Pin & Coil Assembly YZ100593		6
	43913-21	Coil, Solenoid 12 VDC 4005299		1
27	43913-27	Stop Nut, Thin F7824320511		6
28	43913-28	Plug, Pipe F190042		6
29	43913-29	Kit, Connector YZ100837		6
	43913-30	Sleeve Contact R78060		2
	43913-31	Seal Cable R78059		1

TRANSMISSION REPAIR PARTS

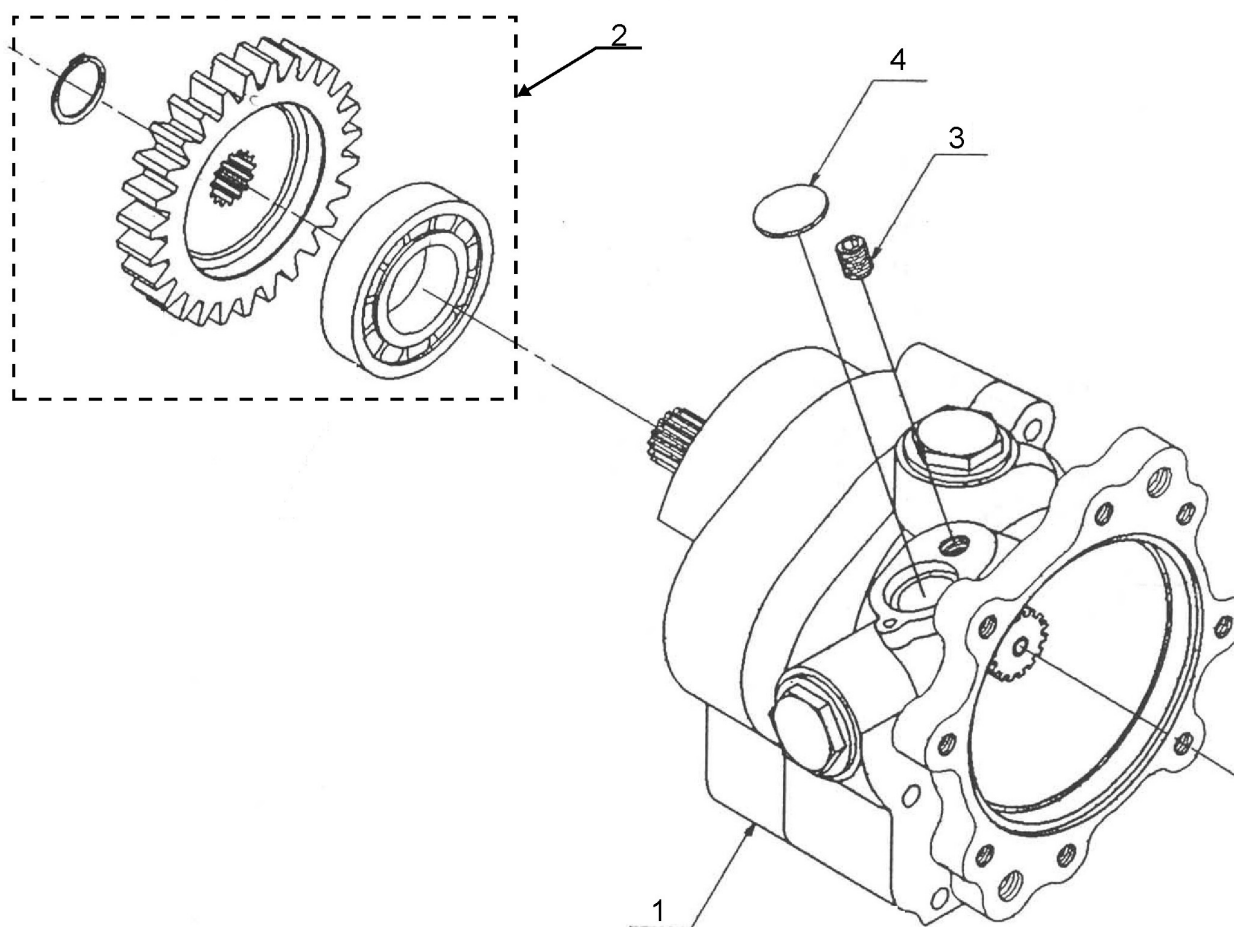
Item	Nmc-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	44734-43	Group, Retainer Bracket (96105) 40A2061		
1	43914-1	Retainer, Bearing 40A2275		1
2	43914-2	Seal Kit (Includes 2A-C)		1
2A		Seal, Oil		1
2B		O-Ring, Arp155		1
2C		Capscrew		4

TRANSMISSION REPAIR PARTS

Item	Nmc-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	44734-44	Group, Bracket Flange 6c (96105) 40A2238		
1	44734-47	Flange Kit		1
2	43915-5	Capscrew F1003520H8		6
3	43915-6	Nut, Hex F1300600U		6
4	43915-7	Washer, Lock F16202		6

TRANSMISSION REPAIR PARTS

Item	Nmc-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	44734-45	Group, Charge Pump (96105) 40A2059		
1	43916-1	Pump, Charge Assembly (See pg) 4102062		1
2	43916-11	Gasket Kit, Pump		1
3	43916-3	Capscrew F1003052		1
4	43916-4	Capscrew F1003080		1
5	43916-5	Stud 40A2273		1
6	44734-46	Washer, Lock F16202		4
7	43916-7	Nut, Hex F1300500T		2
8	43916-8	Stud 40A2274		1
9	43916-10	Plug, Shipping R66408		2

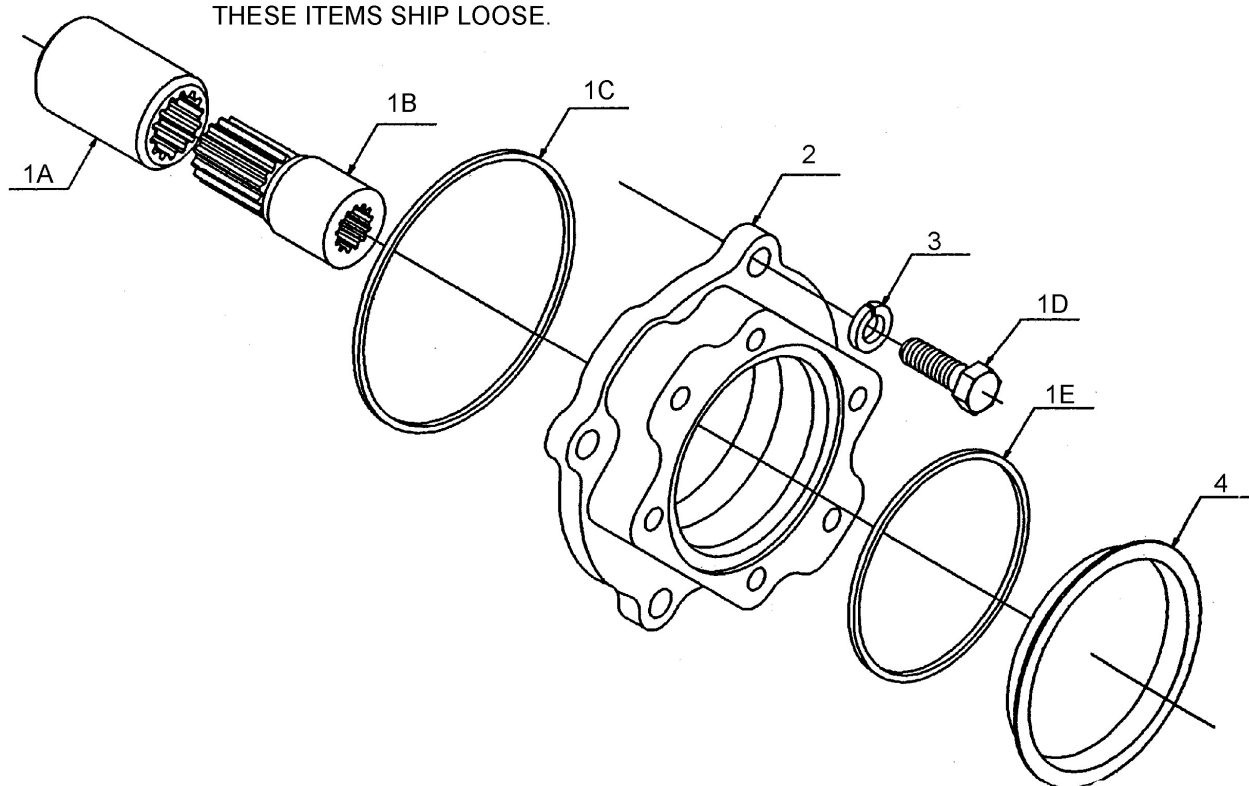
TRANSMISSION REPAIR PARTS

Item	NMC-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	43916-1	Pump, Charge Assembly (96105) 4102062		
1	43917-1	Pump, Charge Complete YZ4102523		1
2	43917-7	Bearing & Gear Kit		1
3	43917-5	Screw, Set F300848V		1
4	43917-6	Plug, Cup F21018SC		1

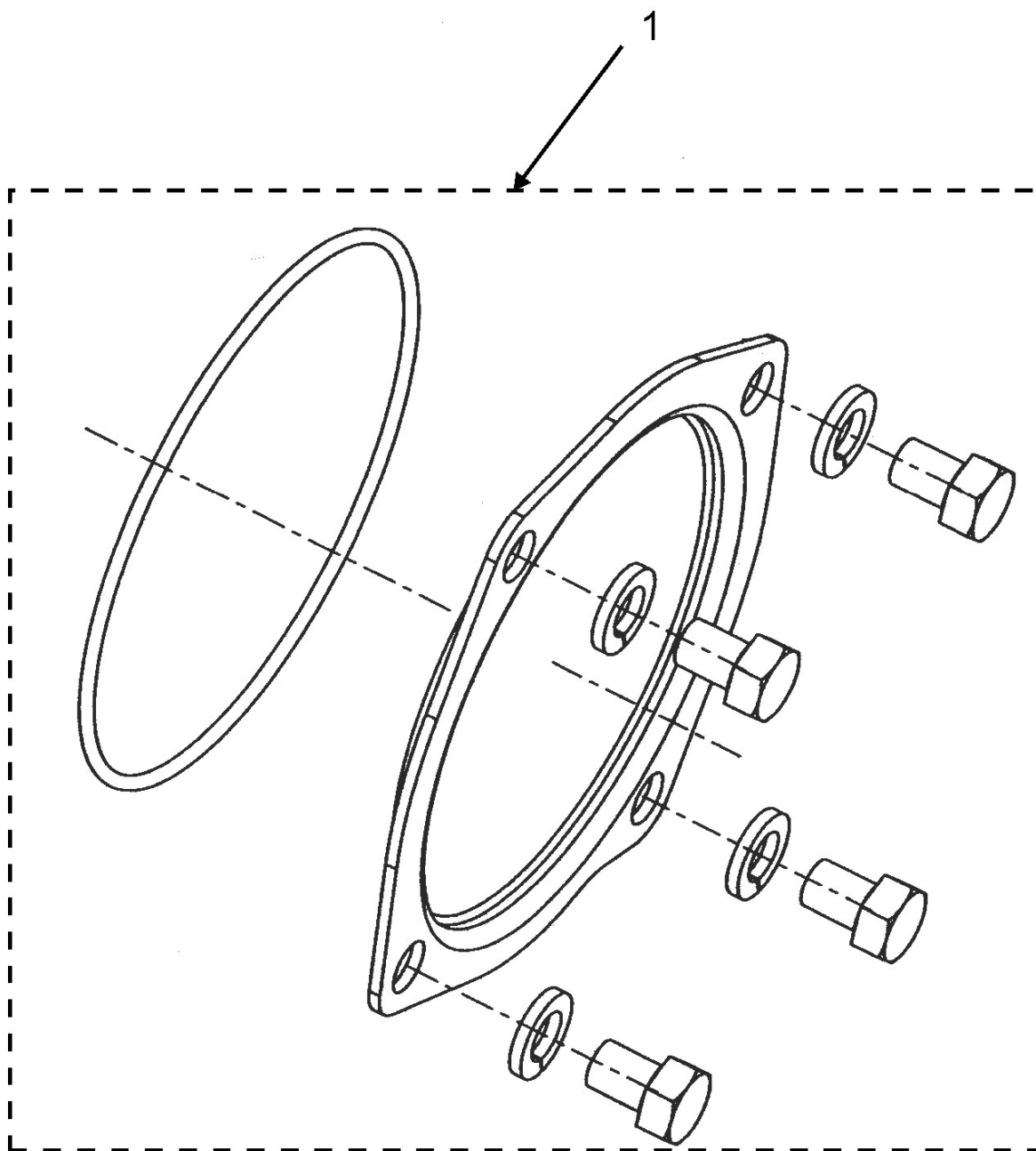
TRANSMISSION REPAIR PARTS**ASM NOTE:**

REF # 1A & 1B

THESE ITEMS SHIP LOOSE.

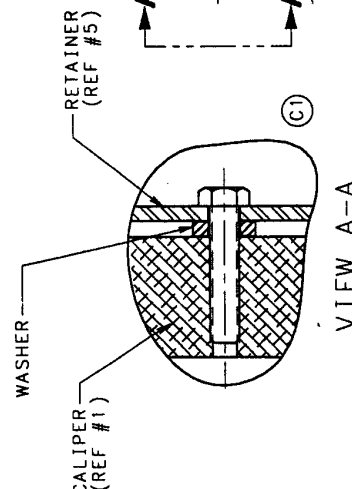
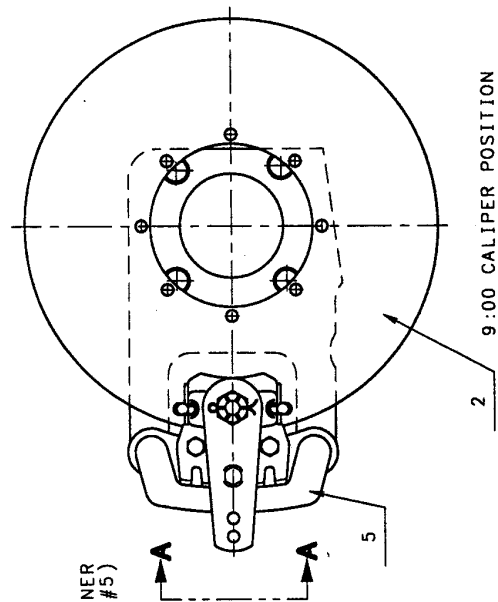
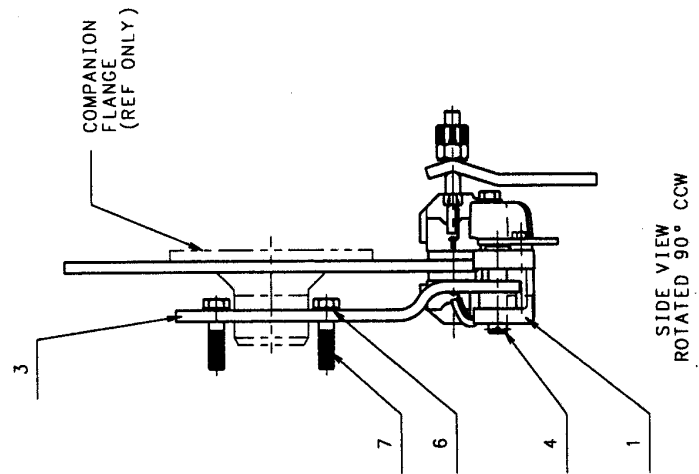
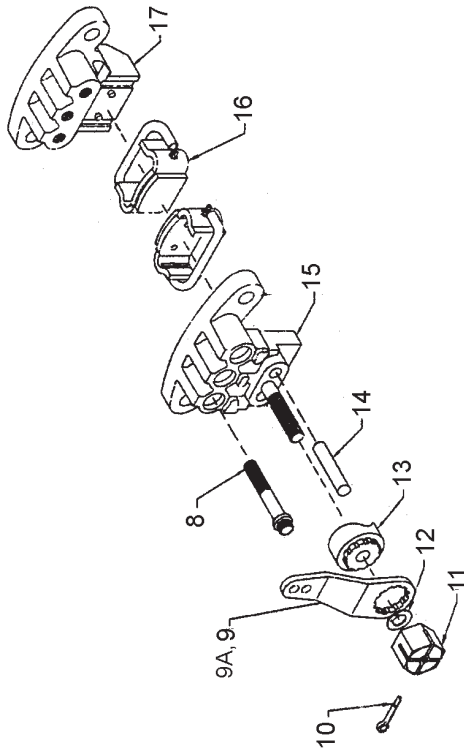


Item	NMC-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
0	43918	Pump, Hardware (96105) 40A2158		
1	43918-9	O-Ring & Adapter Kit (Includes 1A-E)		1
1A		Spacer, Sleeve		1
1B		Adapter, Sleeve Assembly		1
1C		O-Ring, ARP250		1
1D		Capscrew		4
1E		O-Ring, ARP242		1
2	43918-4	Plate, Adapter YZ102370		1
3	43918-8	Washer, Lock F16204		4
4	43918-3	Plug, Shipping F23378		1

TRANSMISSION REPAIR PARTS

Item	NMC-Wollard Part No.	DESCRIPTION	Eff	Units Per Assy
1	43919	Group, Plate Cover (96105) 4001842		1

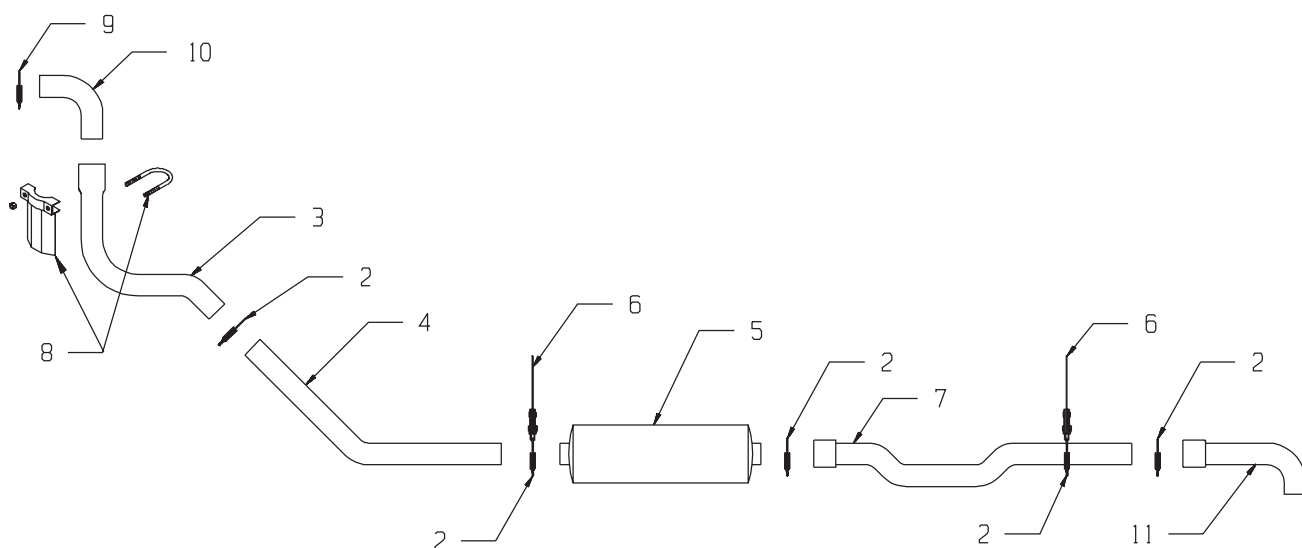
BRAKE, PARKING CALIPER



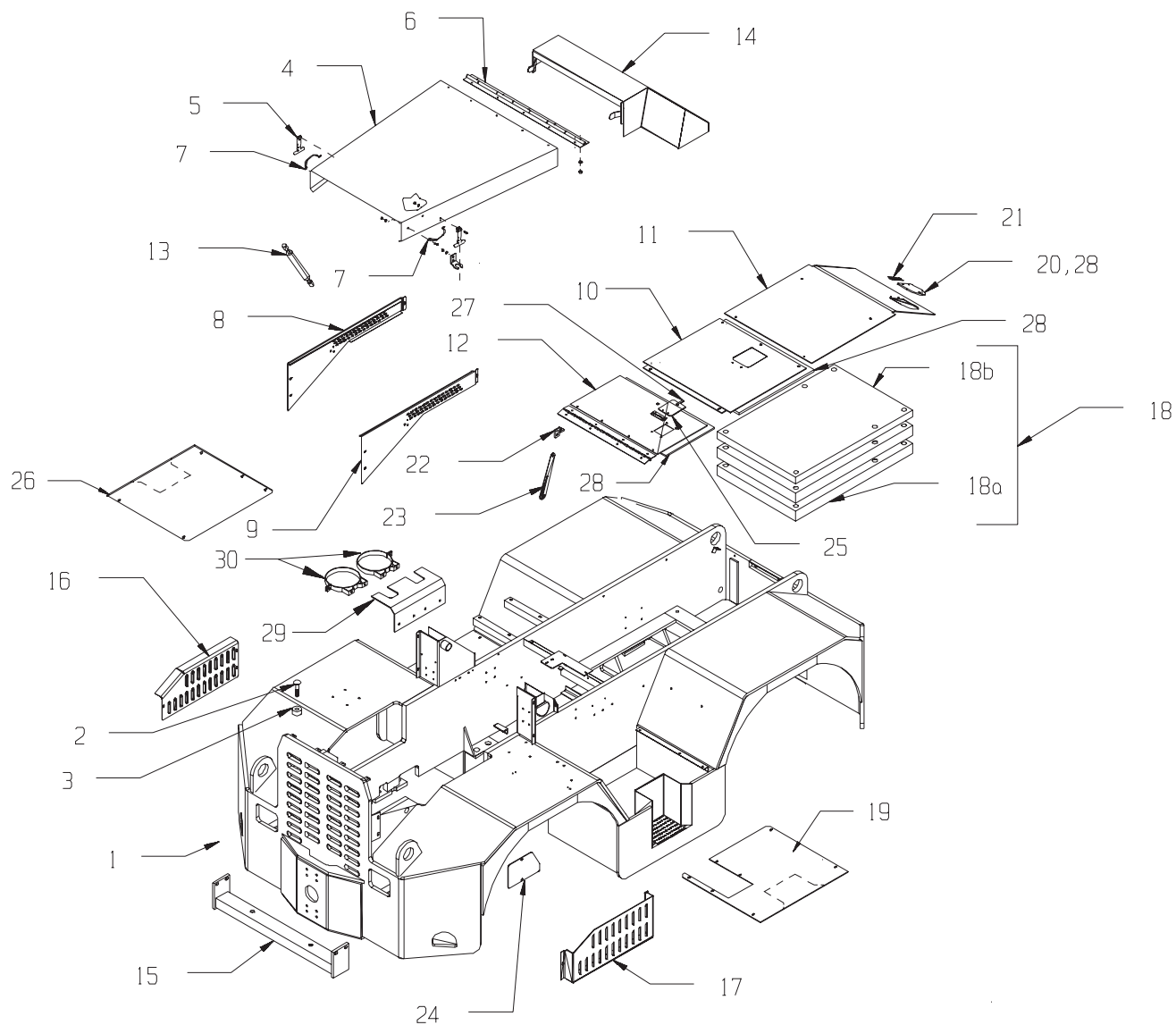
ASM NOTES

REMOVE THE SHORT CENTER CAPSCREW THAT COMES WITH THE CALIPER ASM. (REF. #1) OVER DISK AND PLACE CLEVIS PINS (REF. #4) THRU CALIPER AND SUPPORT BRACKET (REF. #3) REPLACE THE WASHER AND CAPSCREW FROM CALIPER ASM. THRU HOLE IN CLEVIS PIN RETAINER (REF. #5). WITH WASHER NEXT TO THE CALIPER CASTING. (C) AND THE RETAINER (REF. #5) BETWEEN THE WASHER AND THE CAPSCREW HEAD, TORQUE CAPSCREW INTO CALIPER CASTING 30 TO 35 LBS. FT. TO LOCK CAPSCREW.

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	43920	40A2299	Group, Brake Disk Assembly		1
1	43920-1	4003783	Caliper, Assembly (22075)		1
2	43920-2	4001362	Disk, Brake Funk		1
3	43920-3	4002436	Bracket, Support Assembly		1
4	43920-4	F2400775	Pin, Clevis		2
5	43920-5	40A1311	Retainer, Pin		1
6	43918-8	F16204	Washer, Lock		4
7	43902-36	F1005032	Capscrew		4
8	43920-7	A01-03658	Bolt (22075)		3
9	44734-50	4003779	Lever (22075)		1
9A	44819		Lever, Reworked, Air Brake Units Only		1
10	43920-9	A05-07250	Cotter Pin (22075)		1
11	43920-10	C02-12701	Castle Nut (22075)		1
12	43920-11	A03-12702	Washer (22075)		1
13	44734-51	4003793	Cam (22075)		1
14	44734-49	4003263	Push Pin (22075)		2
15	44734-52	4003782	Camside Casting (22075)		1
16	43920-15	B99-07542	Pad, Holder & Spring Assembly (22075)		2
17	43920-16	A99-08290	Carrierside Sub-Assembly (22075)		1
NS	43920-6	98-09277	Kit, Park Brake Pads, Funk, Set of 2		1

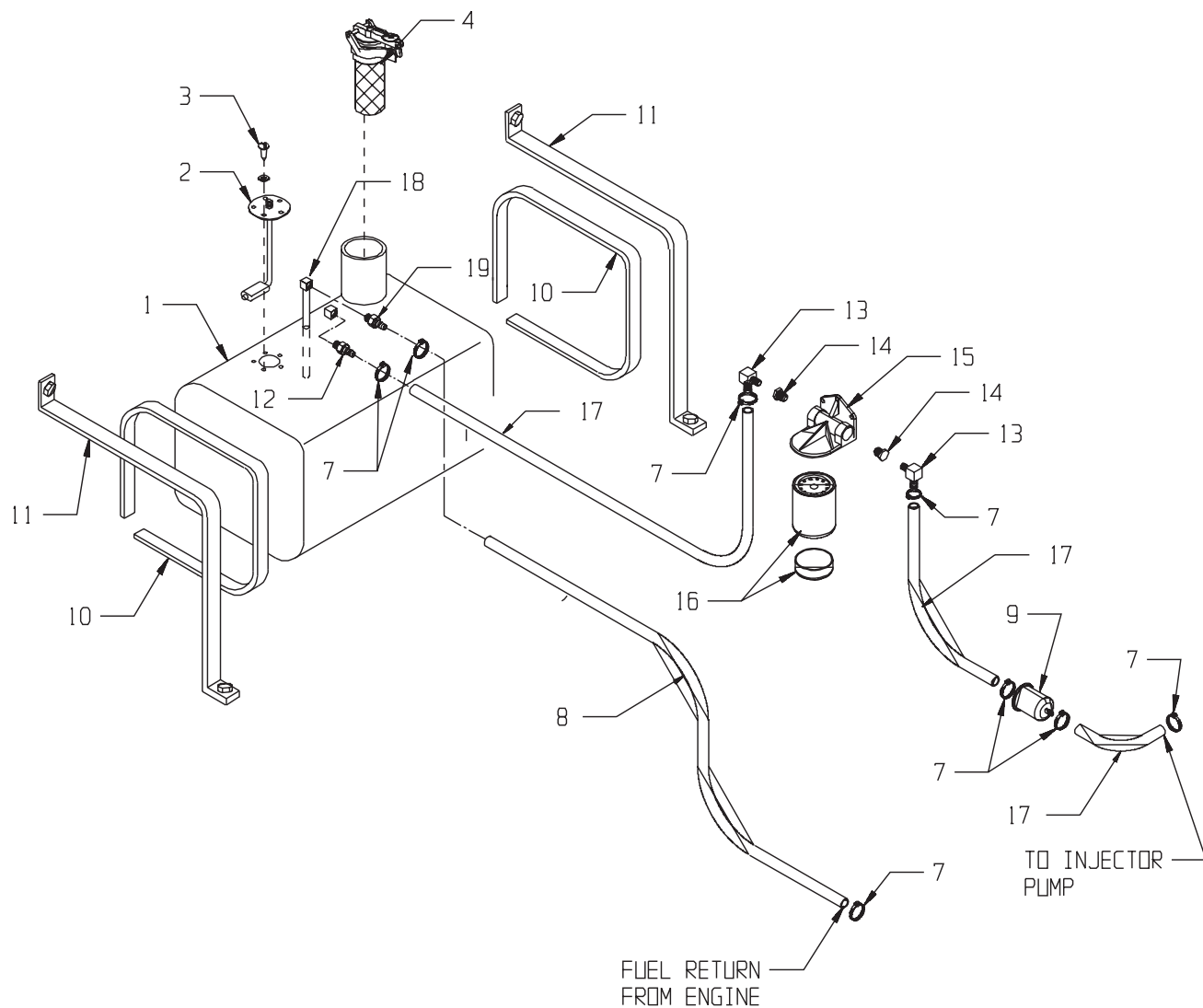
EXHAUST

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-17		Exhaust System 200MB4		Ref
2	NW35606		Clamp, Muffler, 3"		4
3	42797		Pipe, Exhaust, Front		1
4	42939		Pipe, Exhaust, Middle		1
5	NW34812	24189N	Muffler (Nelson Division)		1
6	NW023112		Hanger Tail Pipe		2
7	42798		Pipe Exhaust, Tail (w/hyd brakes)		1
	44423		Pipe Exhaust, Tail (w/air brakes)		1
8	NW36668		Heat Shield Weldment		1
9	205785	3903652	Clamp, Exhaust, CMNS Turbo (Cummins)		1
10	205784	3910993	Connector, Exhaust, 90D, EII (Cummins)		1
11	NW35583		Ext., Exhaust Pipe, 3" ID		1

FRAME

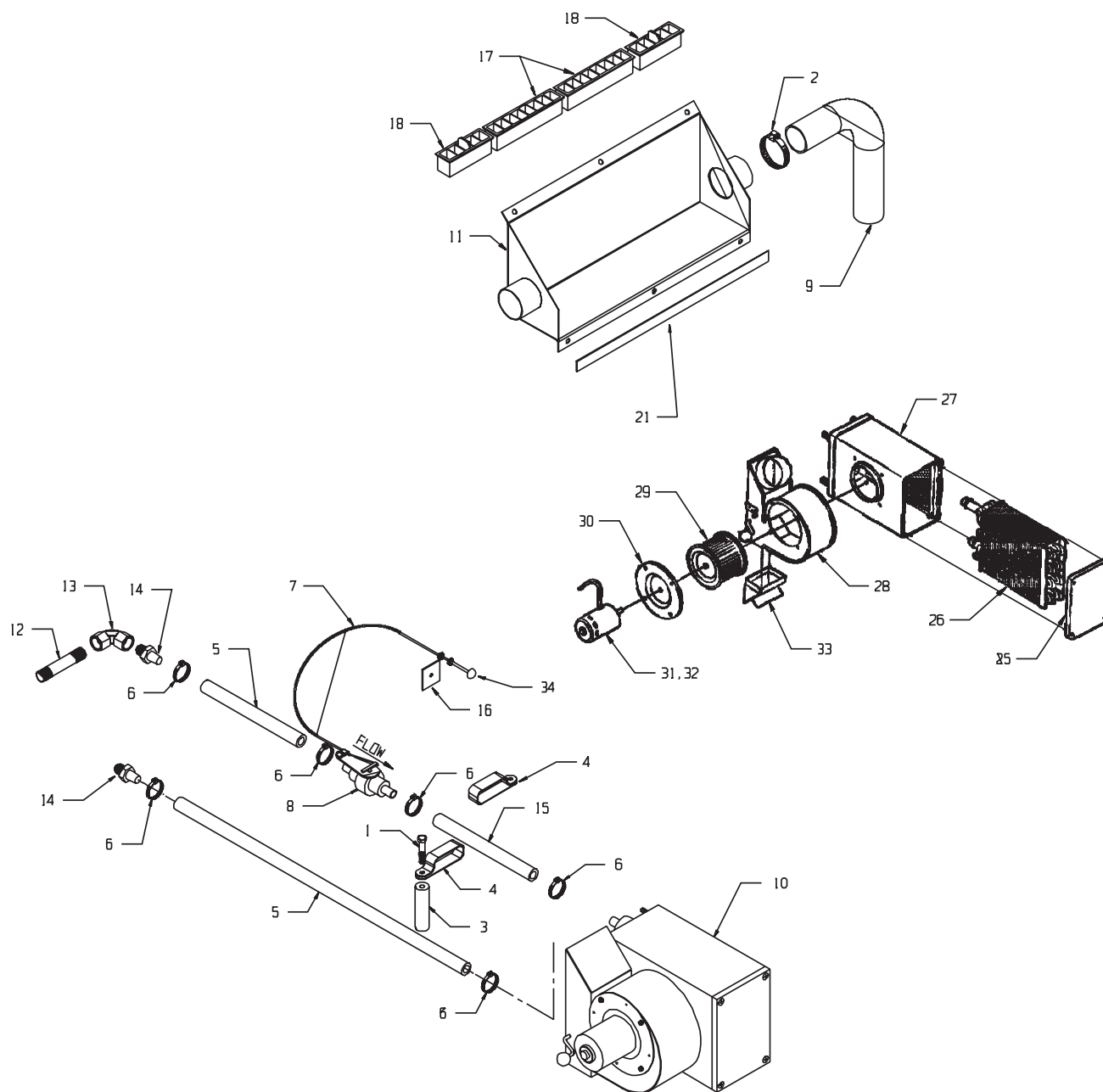
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	42776-2		Frame Weldment 200MB4-1 w/Air Brakes		1
	44525		Frame Weldment 200MB4-2 w/Hydraulic Brakes		1
2	NW23066		Hood Bumper		4
3	NW23065		Screw, Hood Bumper		4
4	37403		Hood Weldment		1
5	NW22814		Latch Assembly		2
6	37604		Hood Hinge		1
7	NW34658		Handle, Hood, Black		2
8	42782		Panel Side, RH		1
9	42781		Panel Assembly, LH		1
10	42845		Deck Plate, Middle 200		1
11	42437		Deck Plate, Rear, 200 w/Hydraulic Brakes		1
	43972		Deck Plate, Rear w/Air Brakes		1
12	42438		Deck Plate, Front, 200		1
	NW36611		Deck Hinge		1
13	NW35891		Gas Shock		2
	NW35714		Ball Stud		4
	NW35715		Clip		4
14	43469		Support Weldment, Hood w/Air Brakes		1
	42701		Support Weldment, Hood w/Hydraulic Brakes		1
15	40022		Mount, Radiator		1
16	42440		Louver, RH		1
17	43448		Louver, LH w/Air Brakes		1
	42439		Louver, LH w/Hydraulic Brakes		1
18	42834		Counterweight Assembly w/Hydraulic Brakes		Ref
18a	42836		CWT, 3x27x40, Long		3
18	T446832-25		Counterweight Assembly w/Air Brakes		Ref
18a	42836		CWT, 3x27x40, Long		2
18b	42835		CWT, 2x27x40, Long		1
19	NW35535		Floor Plate, LH		1
20	NW36670		Cover, Fuel Cap		1
21	NW35688		Hinge, Fuel Cap Cover		2
22	203227		Angle, Rod Mount		1
23	203228		Plate, Hood Pivot		1
24	42775		Cover, Solenoid		1
25	41389		Plate, Access Door		1
26	NW335293		Floor Plate, RH		1
27	NW22813		Latch Assembly		2
28	NW34579		Seal, Rubber Trim		A/R
29	NW35773		Bracket, Accum Mount		1
30	F102489		Band, Accum Mount		2
NS	42839		Angle Deck Plate Mount		4
NS	NW36710		HHCS 3/4-10x12,GR5		4

FUEL SYSTEM



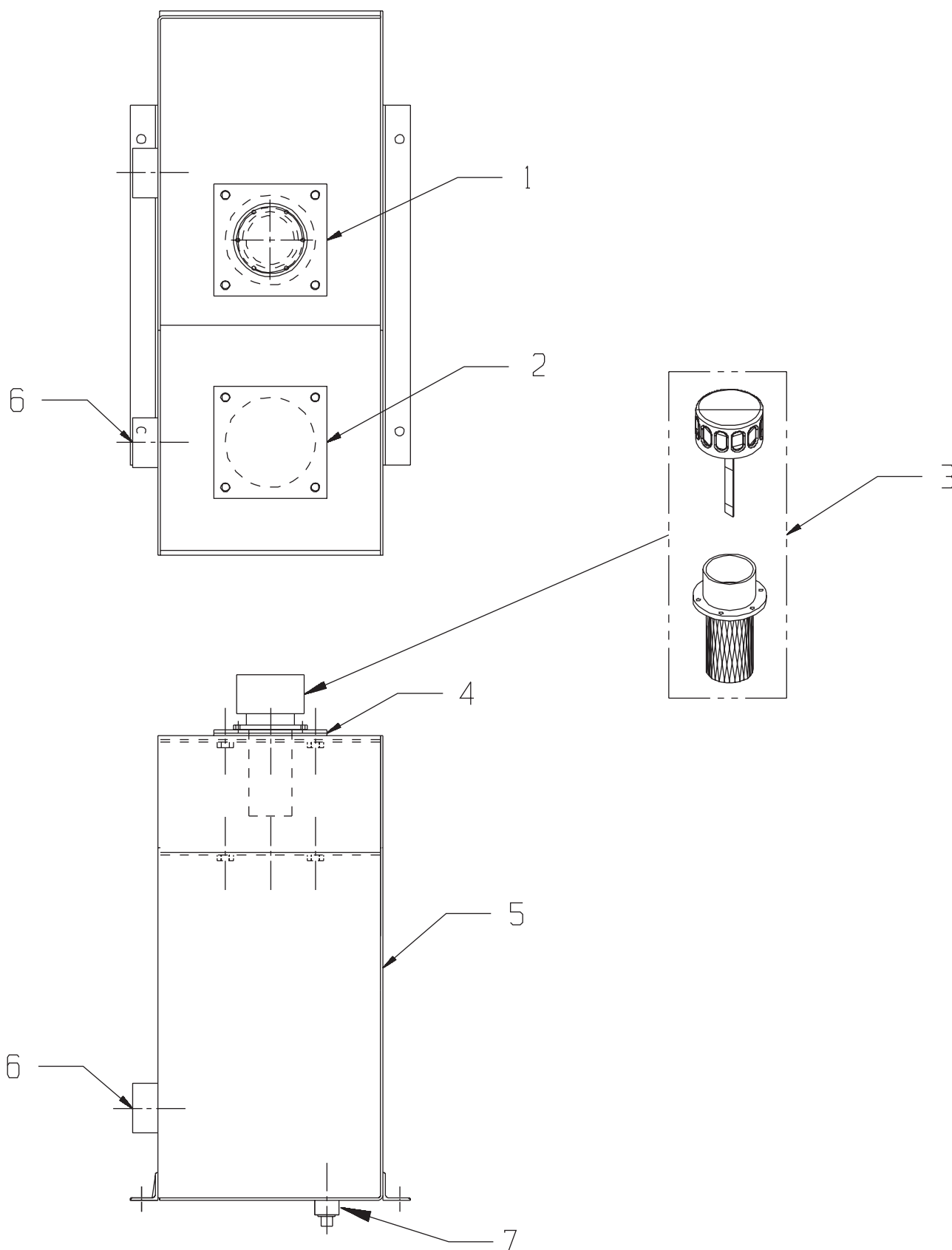
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-19		Fuel System		Ref
0	42358		Fuel Tank Assembly		Ref
1	NW36194		Fuel Tank		1
2	NW30330		Sending Unit, Fuel Level (includes gasket)		1
	F101529		Gasket		Ref
3	Comm		RHMS, #10-32 x 3/8, Brass		5
	Comm		Flat Washer, SAE, 3/8		5
4	41433		Cap, Fill 2" NPSF, Red, W/Screen		1
7	F101150		Hose Clamp, .25 - .62		6
8	F101015		Hose, Fuel Feed		144"
9	43481-1	FS9033	In-Line Filter		1
10	F101588		Tank Protection Strip		120"
11	NW26327		Fuel Tank Strap		2
12	NW36198		Fitting, Hydraulic, 05H-04MP		1
13	NW34736		Fitting, Hydraulic, Ell, 06H-04MP90		2
14	F011079		Fitting, Pipe, 3/8 x 1/4		2
15	37287		Filter, Fuel, W/Water Sep.		1
16	37287-1		Element, Filter, Fuel / Water Sep.		1
17	F101679		Hose, .37ID - .66OD		126"
18	NW36196		Tube, Fuel Return 9.50		1
19	42051		Fitting, Hydraulic, 06M-04MP		1

HEATER/DEFROSTER



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	Comm		Bolt		1
2	F101140		Clamp, Hose, #32		4
3	40399		Defroster, Tube		1
4	3.1081		Clip, Insulated, 1.75" ID		2
5	NW21634		Hose, 5/8 ID x .906 OD		144"
6	F101156		Clamp, Hose, #12		6
7	NW22828		Cable, Control		1
8	NW23205	14-2387	Valve, Heater Shut-off (Murray) (Danhard, Inc)		1
9	NW32066		Hose, Defroster 2" ID		A/R
10	41986		Heater/Defroster		1
11	41879		Duct, Defroster		1
12	3.0746		Ftg, P, N, 08MP, Close, Galv		1
13	3.0716		Ftg, P, ELL, 08FP-08FP90		1
14	NW32352		Ftg, P, 08MP-10H		2
15	39512		Hose, Heater		1
16	42814		Decal, Heater Control		1
17	42870		Lower, Fixed Vane Defroster 2.0		1
18	42869		Lower, Adjustable Defroster 2.0		1
25	37202-2	RD-3-2624-1	Cover Assembly		1
26	37202-3	RD-1-0147-2	Heater Core		1
27	37202-4	RD-1-0453-0	Housing Assembly		1
28	37202-5	RD-1-0455-0	Blower Plenum Assembly		1
29	37202-6	RD-3106-9	Blower Wheel		1
30	37202-7	RD-4101-4	Motor Mount		1
31	37202-1	RD-3106-13	Motor, 12V		1
32		RD-3106-13-24	Motor, 24V		1
33	37202-8	RD-RD-3187-0	Hose Adapter, 2nd		1
34	37202-9	RD-4120-0	Knob		1
NS	37506		Insulation, 1" Foam, 54" Width		22"

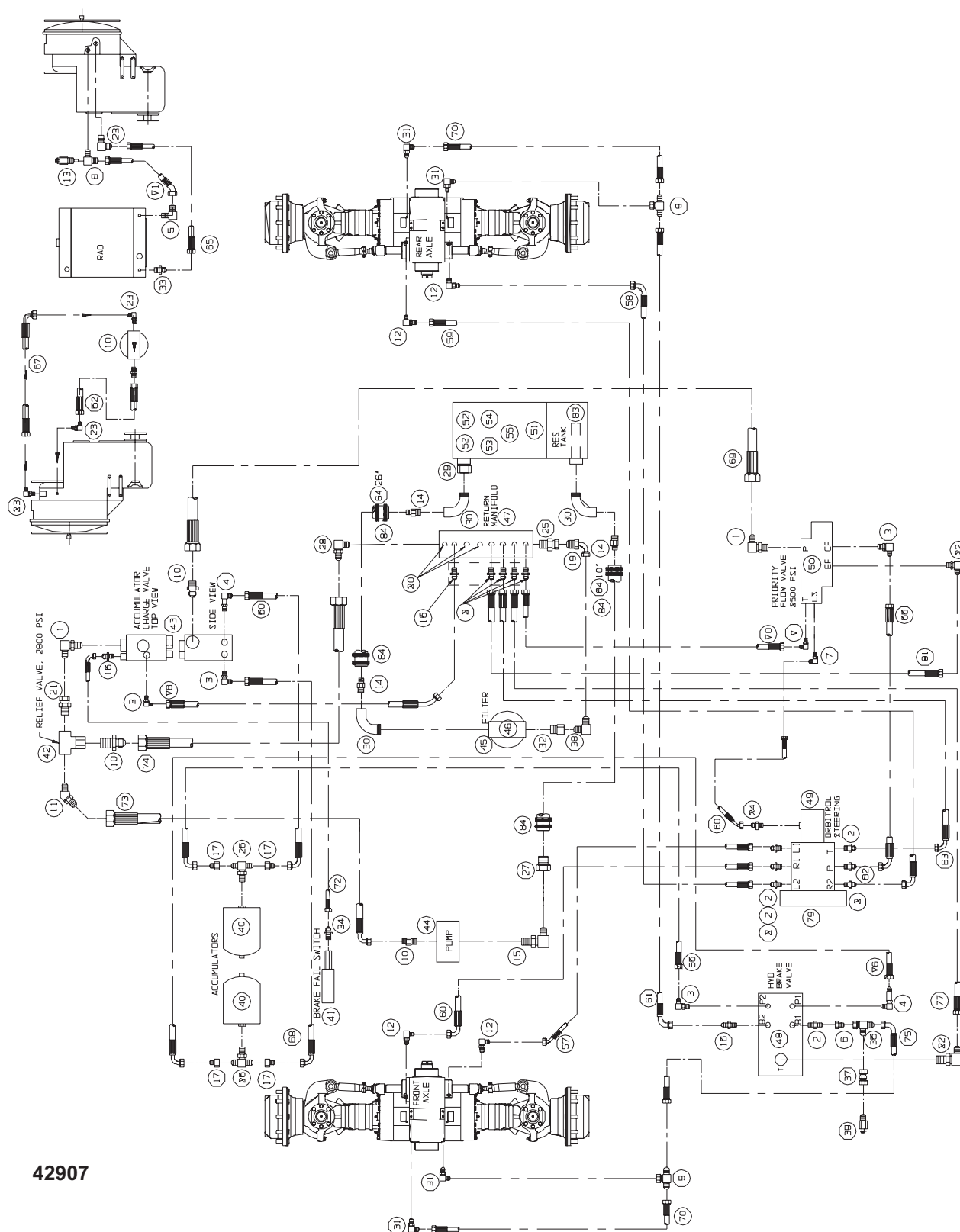
HYDRAULIC RESERVOIR



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW35852		Plate, Cover, Hydraulic Reserve		1
2	12763		Cover, Tank		1
3	43414		Fill Unit, w/8" Basket/7.5 DI		1
4	166572		Gasket, Tank		2
5	41388		Reservoir, Hydraulic		1
6	42871		Strainer		1
7	201913		Plug, Pipe, 3/8 NPT		1

HYDRAULIC DIAGRAM, CUMMINS-FOR HYDRAULIC BRAKES

1 OF 2

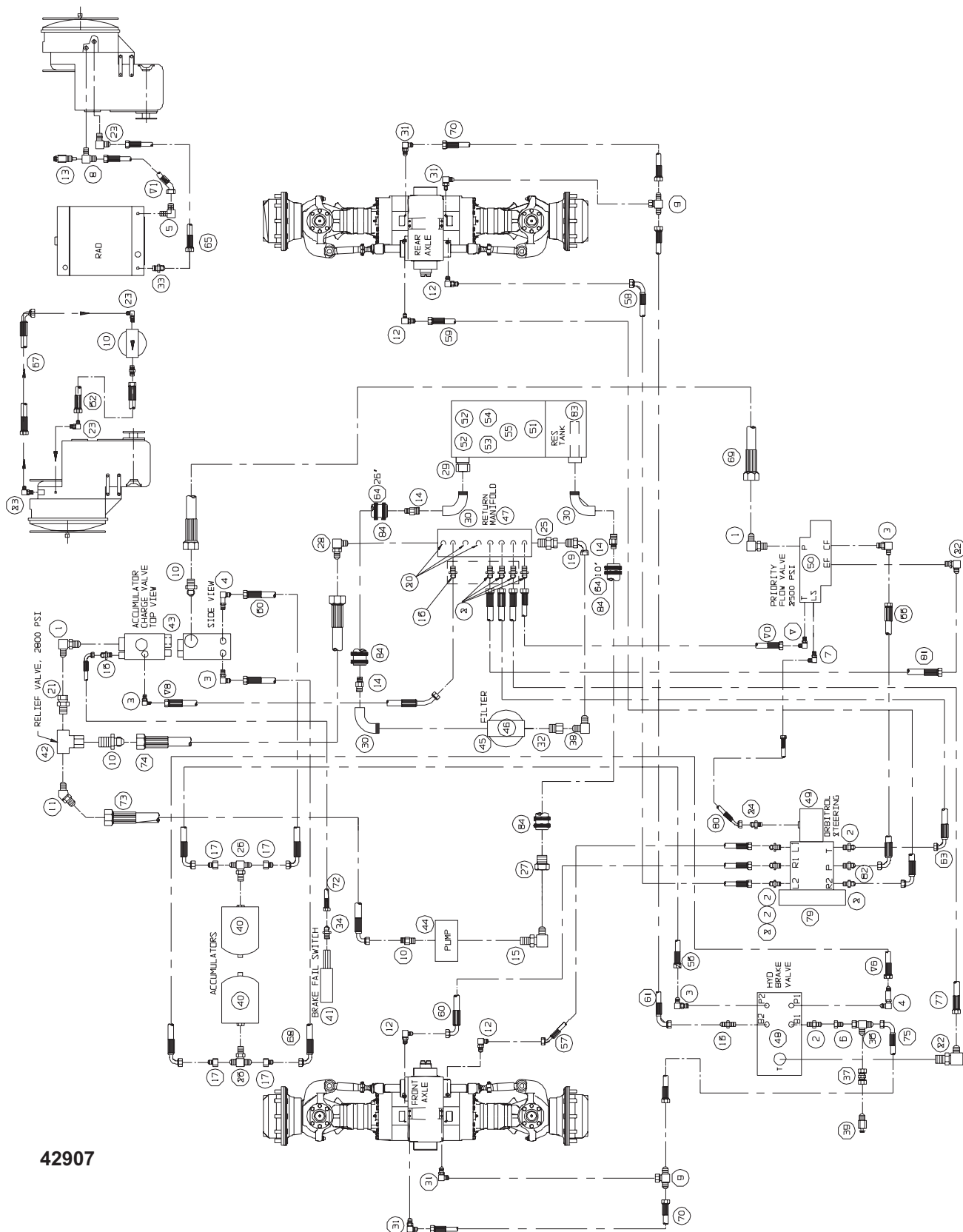


42907

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-9		Hydraulic Asm-For Hydraulic Brakes		Ref
1	91938		Fitting, Hydraulic, Ell, 12MJ-12MB90		2
2	90413		Fitting, Hydraulic, 08MJ-08MB		10
3	91930		Fitting, Hydraulic, Ell, 08MJ-08MB90		4
4	90375		Fitting, Hydraulic, Ell, 08MJLL-08MB90		2
5	3.1678		Fitting, Hydraulic, Ell, 16MJ-12MP90		1
6	3.2965		Fitting, Hydraulic, 08FJ-04MJ		1
7	90424		Fitting, Hydraulic, Ell, 04MJ-04MB90		2
8	37199		Fitting, Hydraulic, Mod		1
9	3.3085		Fitting, Hydraulic, Tee, 4MJ-4MJ-4F JX		2
10	F10119		Fitting, Hydraulic, 12MB-12MB		1
11	921728		Fitting, Hydraulic, 12B-12MJ45		2
12	42713		Fitting, Hydraulic, 18MM-08MJ90		4
13	NW30236	2023-00	Sender, Temp, Trans, 1/4 NPTF (V00542)		1
14	42697		Fitting, Hose, Barb, 20H-20MP		3
15	1012226		Fitting, Hydraulic, Ell, 20MJ-20MB90		1
16	NW35837		Fitting, Hydraulic, 04MJ-08MB		2
17	NW33945		Fitting, Hydraulic, 08MJ-12FJ		4
18	1008549		Fitting, Hydraulic, 08MJ-12MB		1
19	NW35810		Fitting, Hydraulic, Ell, Swivel, M/F		1
20	F101318		Fitting, Hydraulic, Plug, 8MB		3
21	F101301		Fitting, Hydraulic, 12MB-12FJX		1
22	F102080		Fitting, Hydraulic, Ell, 08MJ-12MB90		2
23	NW30992		Fitting, Hydraulic, Ell, 16MJ-16MB90		4
24	1011270		Fitting, Hydraulic, 04MJ-04MB		1
25	1012029		Fitting, Hydraulic, 16MB-16FJX		1
26	1008303		Fitting, Hydraulic, Tee, 12MJ-12MJ-12MB		2
27	42698		Fitting, Hose Barb, 20H-20FJ		1
28	F101258		Fitting, Hydraulic, Ell, 12MJ-16MB90		1
29	3.1905		Fitting, Hydraulic, 24MP-20FP		1
30	200211		Fitting, Hydraulic, El, 1-1/4, BMI-M/F		3
31	42790		Fitting, Hydraulic, El, 14MM-04MJ90		4
32	SWXPF589		Fitting, Hydraulic, 20MP-16FP		1
33	3.2118		Fitting, Hydraulic, 16MJ-12MP		1
34	91925		Fitting, Hydraulic, 04MJ-04MP		1
36	3.2966		Fitting, Hydraulic, Tee, 04MJ-04FJX-04MJ		1
37	42794		Fitting, Hydraulic, 02FP-04F JX		1
38	NW31421		Fitting, Hydraulic, Ell, 16MJ-16MP90		1
39	37838		Switch, Press, 60# SPND		1
40	37407		Accumulator, 0.5 Gal, Diaphragm		2

HYDRAULIC DIAGRAM, CUMMINS-FOR HYDRAULIC BRAKES

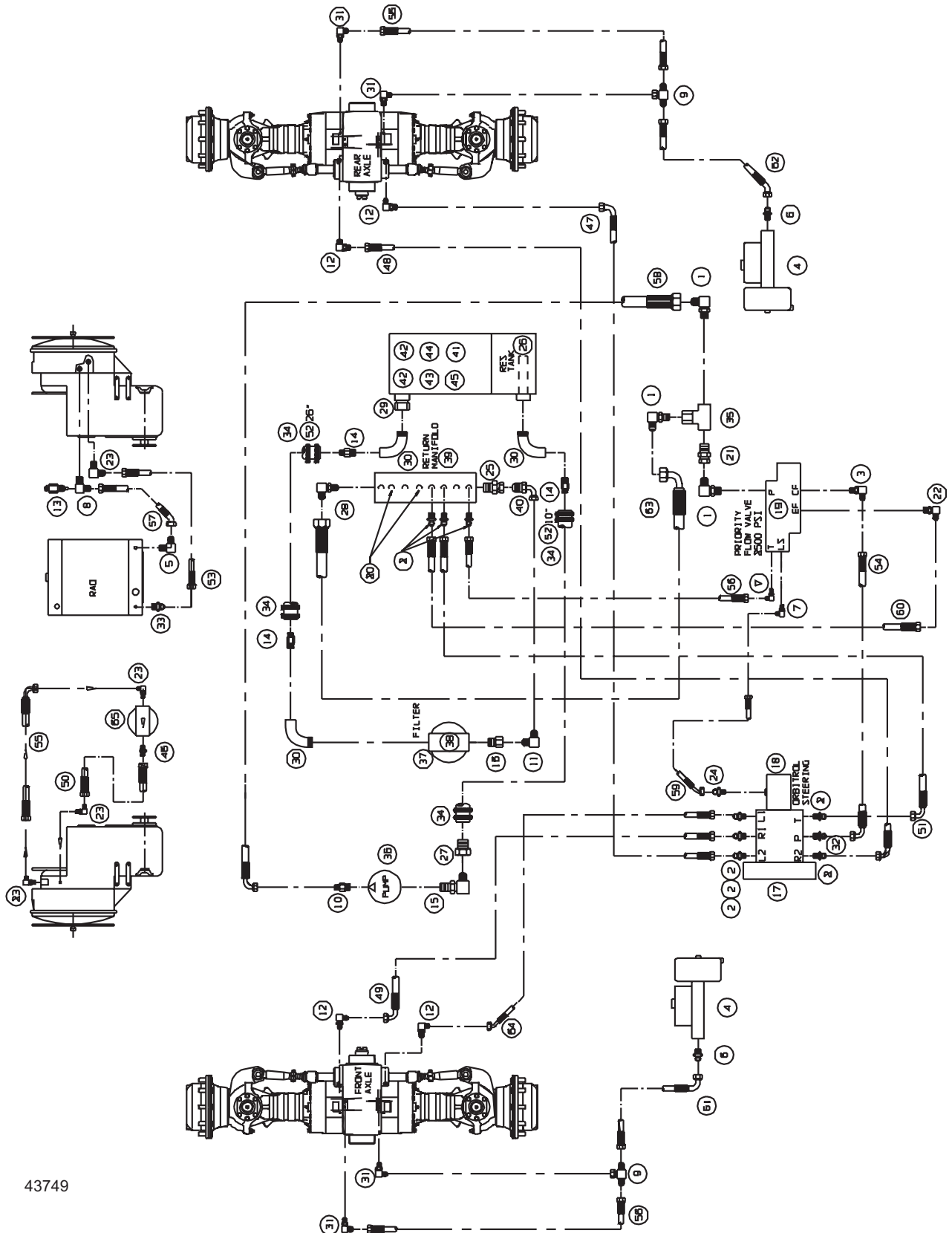
2 OF 2



42907

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
41	NW35839	20-580-040D1100	Switch, Pressure, Brake Fail (Mico Inc)		1
42	NW35892	603-1015	Valve, Relief, 2800 PSI (V00534)		1
43	NW35233		Valve, Accumulator Charge		1
44	42391	L25503-R-SB	Pump, Hydraulic, 2.05 CID (V00534)		1
45	NW36354	SE-10	Filter, Oil (1FDW0)		1
46	NW36355		Head, Oil Filter		1
47	41846		Manifold, Hydraulic, Return #8(8) x 16(2)		1
48	NW36172	2102-155	Valve, Hydraulic Brake, 200 (Carlisle Braking Systems)		1
49	1012697	213-1101-002	Steer Unit, 17.9 CI, LS, NLR (V00534)		1
50	NW35890	606-1094-2500	Valve, Flow Divid, 2500 PSI (V00534)		1
51	41388		Reservoir Assembly, Hydraulic, 200		1
52	166572		Gasket, Tank		2
53	12763		Cover, Tank, 12GA, 5x5, 304 SS		1
54	NW35852		Plate, Cover, Hydraulic, Reservoir		1
55	43414		Fill Unit, w/8" Basket/7.5 DI		1
56	8797.44		Hose Assembly, #8M, 32.58", ST/90		1
57	8797.83		Hose Assembly, #8M, 53.00", ST/EL45		1
58	201938		Hose Assembly, #8M, 84.00", ST/EL		1
59	8797.84		Hose Assembly, #8M, 108.00", ST/EL		1
60	203082		Hose Assembly, #8L, 61.00", ST/EL		2
61	14762.21		Hose Assembly, #4M, 72.00", ST/EL		1
62	43043.1		Hose Assembly, #16L, 34.50", ST/EL		1
63	42827		Hose Assembly, #8L, 64.00", ST/EL		1
64	200533		Hose 1.25 ID Suction Clampable		36"
65	10384.14		Hose Assembly, #16L, 73.00", ST/ST		1
66	8797.55		Hose Assembly, #8M, 72.00", ST/90		1
67	43043.2		Hose Assembly, #16M, 42.00", ST/90		1
68	202610		Hose Assembly, #8M, 68.00", ST/EL		1
69	18914.1		Hose Assembly, #12H, 42.00", ST/ST		1
70	14762.20		Hose Assembly, #4M, 16.00", ST/ST		3
71	10384.39		Hose Assembly, #16L, 88.00", ST/45		1
72	NW36024		Hose Assembly, #4, 12.00", ST/EL		1
73	200715		Hose Assembly, #12M, 31.00", ST/90		1
74	200613		Hose Assembly, #12M, 17.50", ST/ST		1
75	14762.19		Hose Assembly, #4M, 52.00", ST/EL		1
76	8797.81		Hose Assembly, #8M, 41.00", ST/90		1
77	42828		Hose Assembly, #8L, 51.00", ST/ST		1
78	42825		Hose Assembly, #8L, 32.50", ST/EL45		1
79	42392	02-372167	Valve, Steering (V00534)		1
80	14762.22		Hose Assembly, #4M, 69.00", ST/45EL		1
81	42826		Hose Assembly, #8L, 15.50", ST/ST		1
82	1011267	21228	Valve, Check (V00534)		1
83	42871	TM25100RVE	Strainer		1
84	F101122		Hose Clamp, #24		8

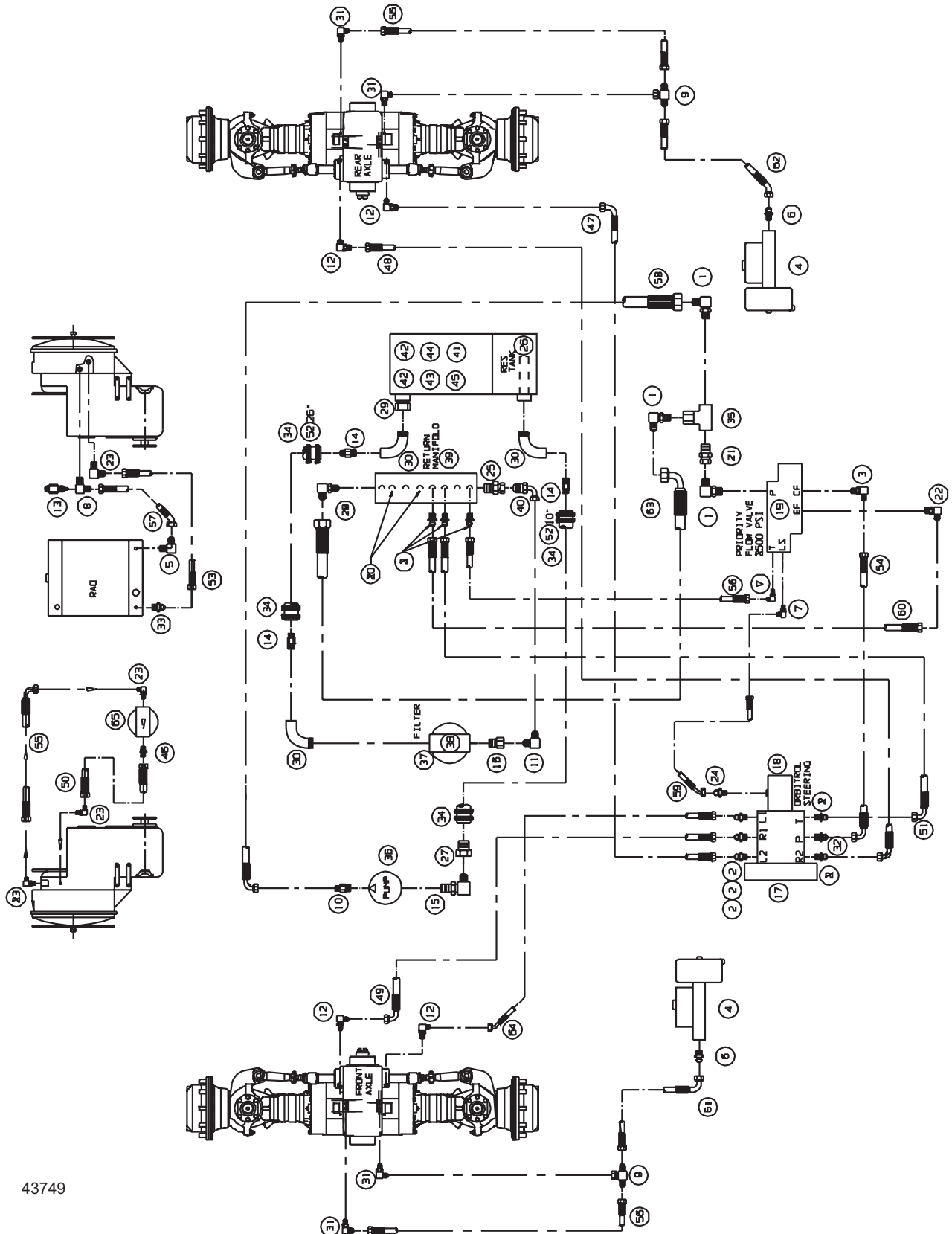
HYDRAULIC DIAGRAM, CUMMINS-FOR AIR BRAKES 1 OF 2



43749

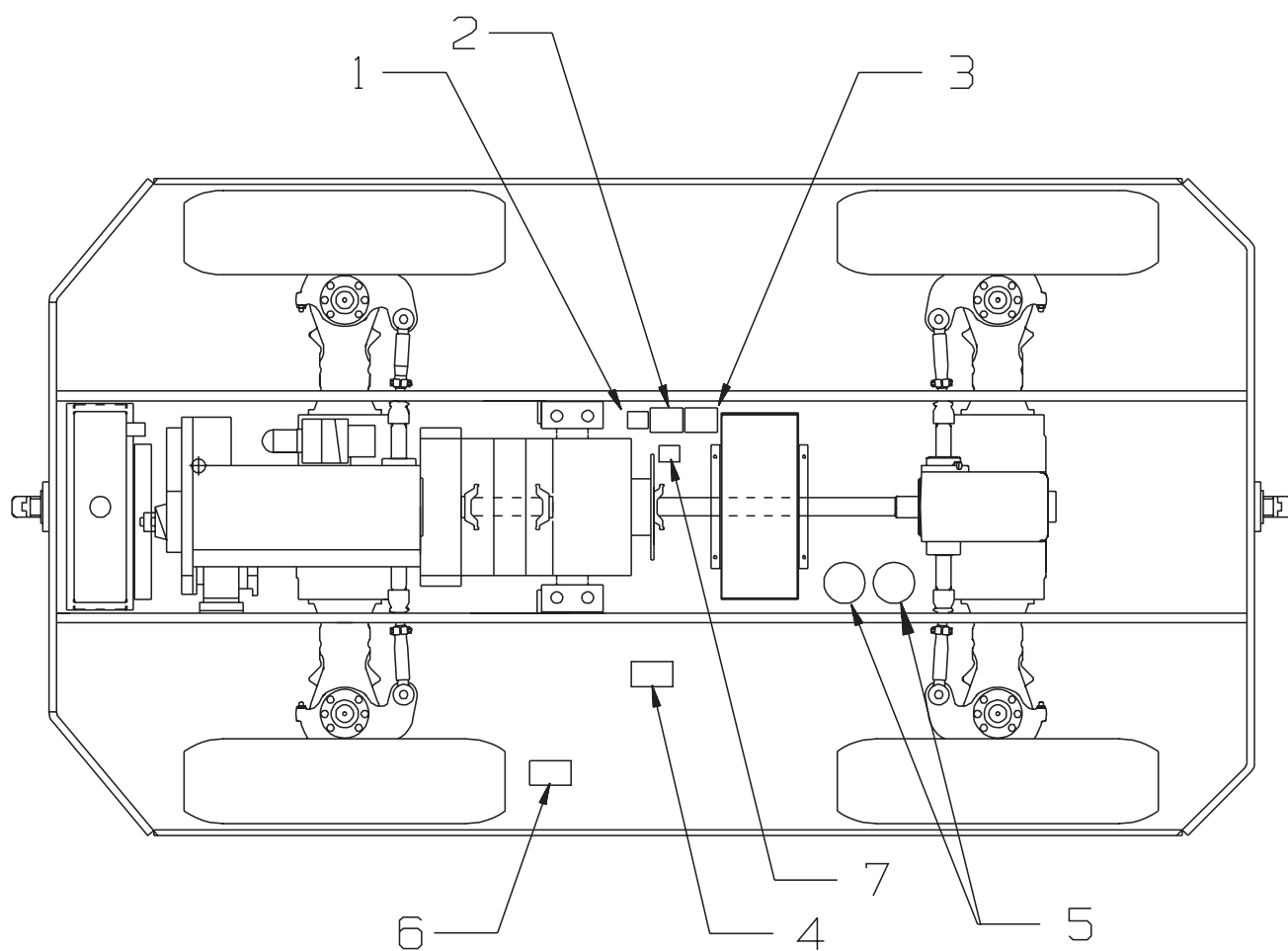
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0			Hydraulic Diagram, Cummins		Ref
1	91938		Fitting, Hydraulic, Ell, 12MJ-12MB90		3
2	90413		Fitting, Hydraulic, 08MJ-08MB		8
3	91930		Fitting, Hydraulic, Ell, 08MJ-085MB90		1
4	45545		Air/Hydraulic Actuator, Modified		Ref
5	3.1678		Fitting, Hydraulic, Ell, 16MJ-12MP90		1
6	1008737		Fitting, Hydraulic, 04MJ-05MB		2
7	90424		Fitting, Hydraulic, Ell, 04MJ-04MB90		2
8	37199		Fitting, Hydraulic, Modified (NW30992)		1
9	3.3085		Fitting, Hydraulic, Tee, 04MJ-04MJ-04FJX		2
10	90415		Fitting, Hydraulic, 12MJ-12MB		1
11	NW31421		Fitting, Hydraulic, Ell, 12MJ-12MP90		1
12	42713		Fitting, Hydraulic, Ell, 18MM-08MJ90		4
13	NW30236		Sender, Trans Temp, 04NPTF		1
14	42697		Fitting, Hydraulic, 20H-20MP		3
15	1012226		Fitting, Hydraulic, Ell, 20MJ-20MB90		1
16	F017687		Fitting, Hydraulic, 20MP-16FP		1
17	42392		Valve, Hydraulic Steering Mode		1
18	1012697		Orbitrol, Steering, 17.9 CI		1
19	NW35890		Valve, Priority Flow Div 2500PSI		1
20	F101318		Fitting, Hydraulic, Plug, 08MB		5
21	F101301		Fitting, Hydraulic, 12MB-12FJX		1
22	F102080		Fitting, Hydraulic, Ell, 08MJ-12MB90		1
23	NW30992		Fitting, Hydraulic, Ell, 16MJ-16MB90		4
24	1011270		Fitting, Hydraulic, 04MJ-04MB		1
25	1012029		Fitting, Hydraulic, 16MB-16FJX		1
26	42871		Strainer, Hydraulic		1
27	42698		Fitting, Hydraulic, 20H-20FJ		1
28	F101258		Fitting, Hydraulic, Ell, 12MJ-16MB90		1
29	3.1905		Fitting, Hydraulic, 24MP-20FP		1
30	200211		Fitting, Hydraulic, Ell, 20MP-20FP90		3
31	42790		Fitting, Hydraulic, Ell, 14MM-04MJ90		4
32	1011267		Check Valve		1
33	3.2118		Fitting, Hydraulic, 16MJ-12MP		1
34	F101122		Clamp, Hose, #24		8
35	NW35892		Valve, Relief, 2800PSI		1

HYDRAULIC DIAGRAM, CUMMINS-FOR AIR BRAKES 2 OF 2

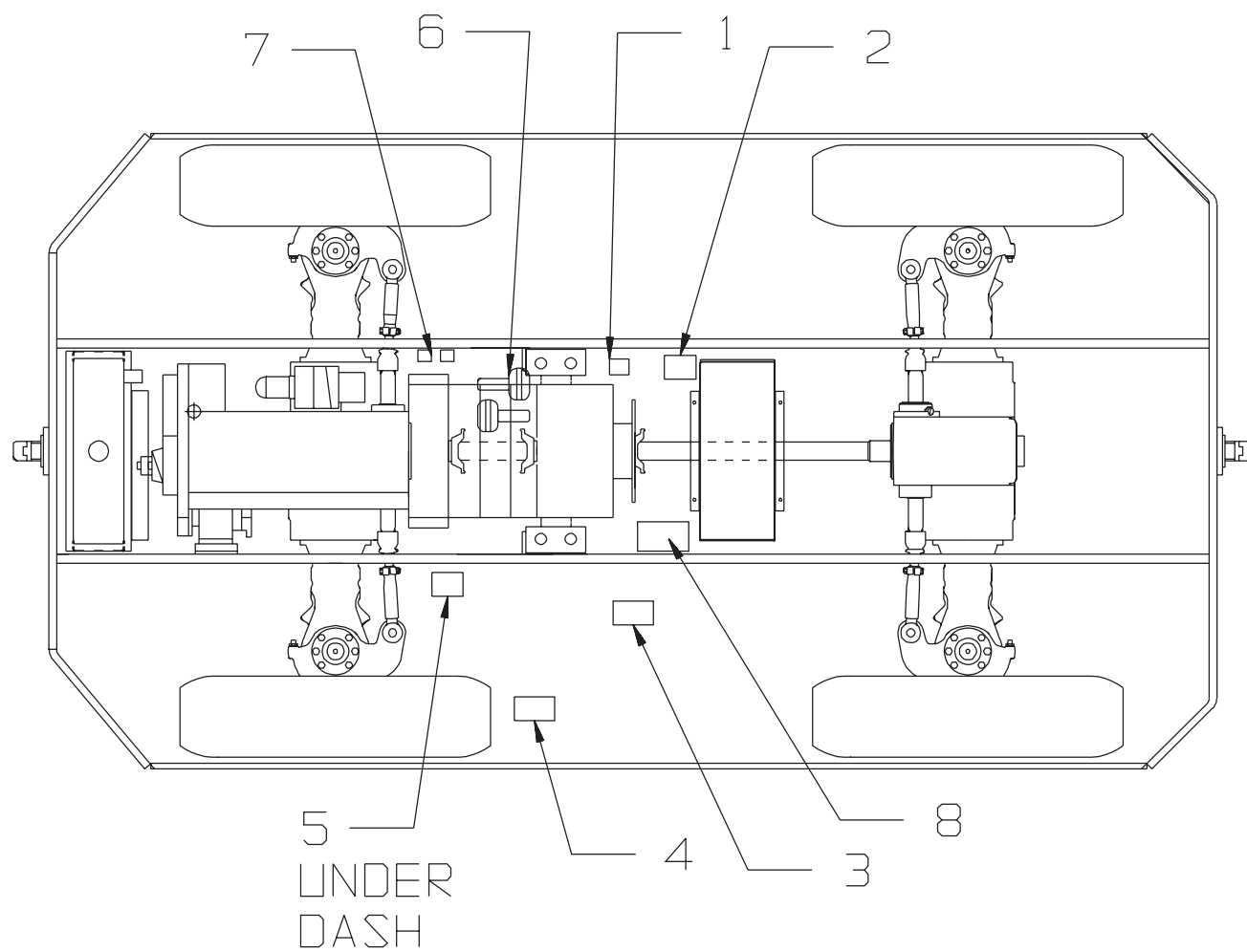


43749

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
36	42391		Pump, Hydraulic, 2.05 CIR		1
37	NW36354		Filter, Oil		1
38	NW36355		Head, Oil Filter		1
39	41846		Manifold, Hydraulic, #08(8) x #16(2)		1
40	NW35810		Fitting, Hydraulic, Ell, 16MJ-16FJX90		1
41	41388		Reservoir, Hydraulic		1
42	166572		Gasket, Reservoir		2
43	12763		Cover, Reservoir		1
44	NW35852		Plate, Cover, Reservoir		1
45	43414		Fill Unit w/Dipstick & Basket		1
46	NW30842		Fitting, Hydraulic, 16MJ-16MB		1
47	201938		Hose Assembly, #8M x 84", ST/90		1
48	8797.84		Hose Assembly, #8M x 108", ST/90		1
49	203082		Hose Assembly, #8M x 61", ST/90		1
50	43043.1		Hose Assembly, #16M x 34.5", ST/ST		1
51	42827		Hose Assembly, #8L x 64", ST/90		1
52	200533		Hose 1.25 ID Suction, Clampable		36'
53	10384.14		Hose Assembly, #16L x 73", ST/ST		1
54	8797.55		Hose Assembly, #8M x 72", ST/90		1
55	43043.2		Hose Assembly, #16M x 42", ST/90		1
56	14762.20		Hose Assembly, #4M x 16", ST/ST		3
57	10384.39		Hose Assembly, #16 x 88", ST/45		1
58	200758		Hose Assembly, #12M x 22", ST/90		1
59	14762.22		Hose Assembly, #4M x 69", ST/45		1
60	42826		Hose Assembly, #8L x 15.5", ST/ST		1
61	206090		Hose Assembly, #4M x 48", ST/90		1
62	14762.24		Hose Assembly, #4M x 53", ST/90		1
63	8798.10		Hose Assembly, #12M x 20", ST/90		1
64	8797.83		Hose Assembly, #8M x 53", ST/90		1
65			Cartridge, Filter		Ref

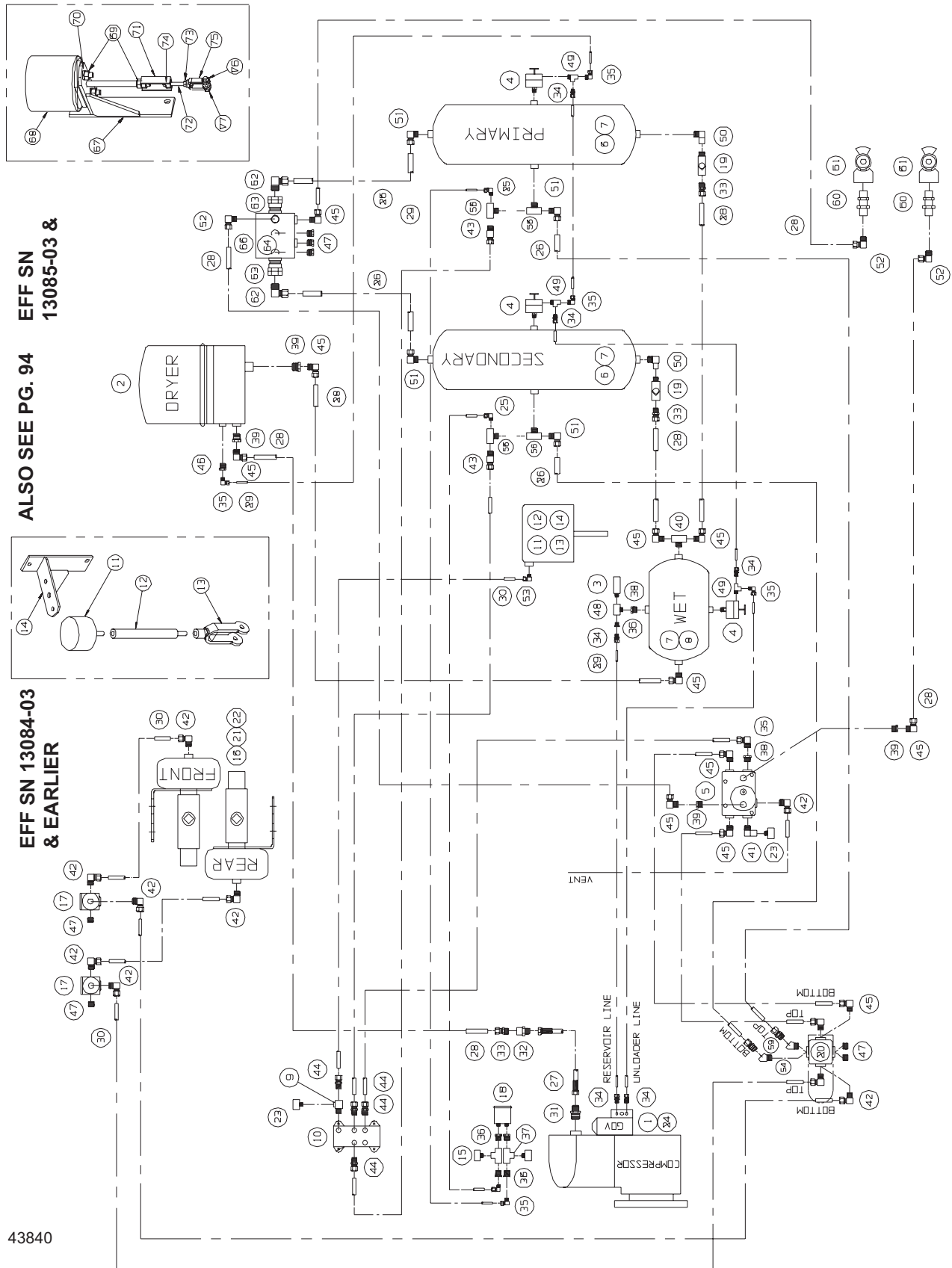
HYDRAULIC VALVES-FOR HYDRAULIC BRAKES

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW35892	603-1015	Relief Valve (V00534)		1
2	NW35233	06-463-212	Accumulator Charge Valve (Mico Inc)		1
3	NW35890	606-1094-2500	Priority Valve (V00534)		1
4	NW36172	2102-155	Hydraulic Brake Valve (Carlisle Braking Systems)		1
5	37407		Accumulators (Fluid Systems Components Inc)		2
6	1012697	213-1101-002	Steering Orbit (V00534)		1
7	NW35839	20-580-0040 D1100	Pressure Switch (Mico Inc)		1

HYDRAULIC VALVES-FOR AIR BRAKES

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW35892		Relief Valve		1
2	NW35890		Priority Valve		1
3	43743	289808	Valve, Air Brake Foot w/ TRDL		1
4	1012697		Steering Orbit		1
5	NW35066		Low Air Pressure, 60PSI		1
6	45545		Air/Hydraulic Brake Actuator Valve, Modified		2
7	43731		Air Limiting Valve		2
8	43732		Air Tractor Protection Valve		1

AIR SYSTEM, AIR CHAMBER AND LINKAGE (1 OF 2)



EFF SN 13085-03 &

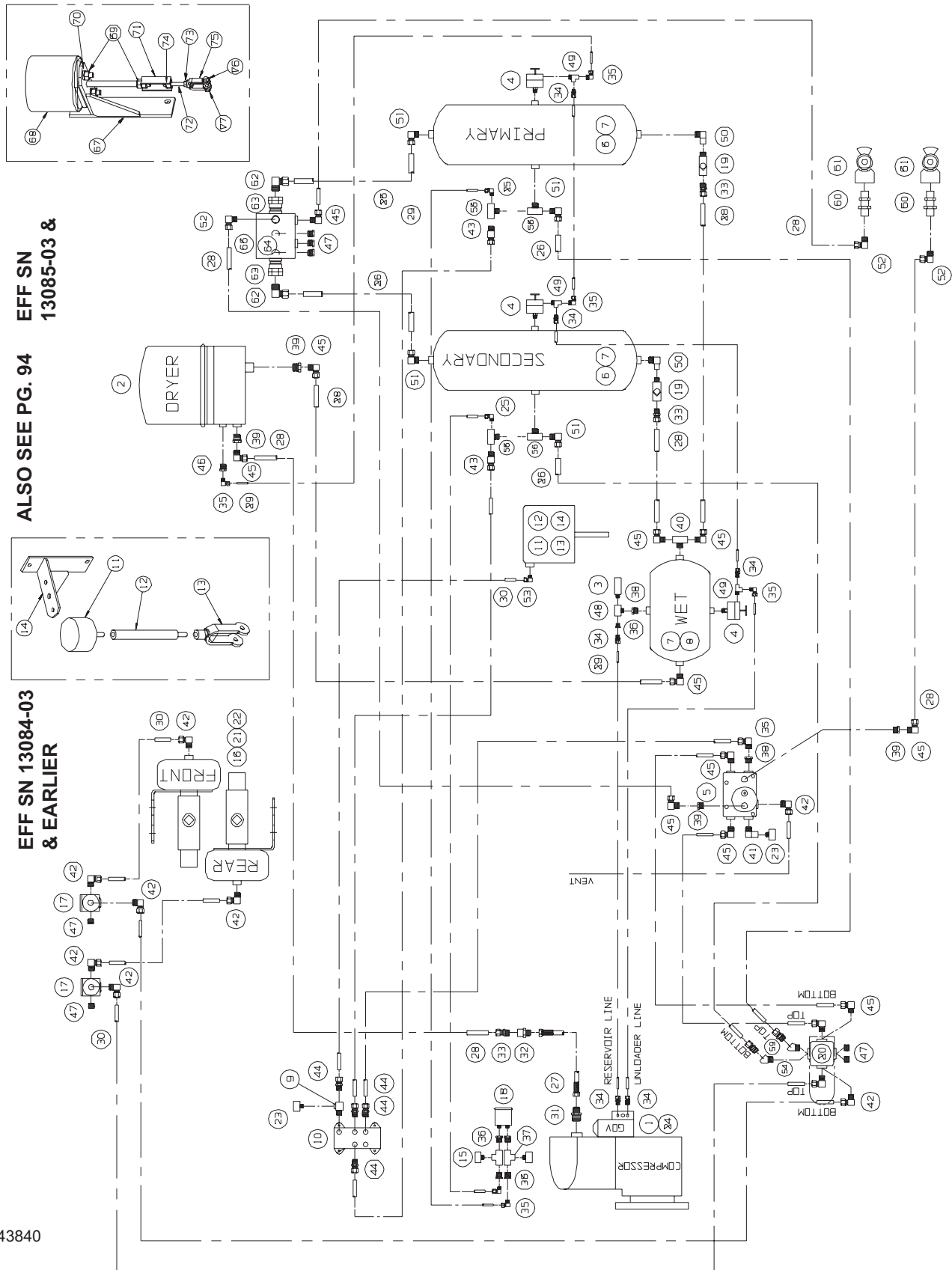
ALSO SEE PG. 94

EFF SN 13084-03 & EARLIER

43840

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW35073		Governor, Compressor		1
2	43504		Dryer, Air, Bendix, AD-IP		1
	43505		Replacement Cartridge, Desiccant		1
3	NW35063		Valve, Safety, 150 psi		1
4	NW35927		Valve, Auto Air Drain		3
5	43732		Valve, Tractor Protection TP-5		1
6	NW35074		Reservoir, Air 836 ci		2
7	NW35079		Bracket, Air Reservoir, 7"		6
8	NW35064		Reservoir, Air 390 ci		1
9	NW34729		Ftg, Hyd, Tee ,04MP-04FP-04FP		1
10	43507		Valve, Air, Bendix, MV-3		1
11	NW35075		Air Chamber, Air Brake	B	1
12	43836		Rod Weldment, Air Brake	B	1
13	90562		Clevis, 3/8-16x3/8 Pin	B	1
14	43510		Bracket Weldment, Air Park Brake	B	1
15	NW35066		Switch, Pressure, Low Air		2
16	45545		Actuator,Air/Hyd,Modified (See Chapter 11)		2
17	43731		Valve, Limiting, Quick Rel. LQ-2		2
18	NW34978		Gauge, Dual Air Pressure		1
19	NW35065		Valve, Check, Single Air		2
20	43743		Valve, Air Brake, Foot w/Trol (See Chapter 11)		1
21	43801		Bracket, Air/Hydraulic Mounting		1
22	43824		Brace, Air/Hydraulic Mounting		1
23	NW35067		Switch, Pressure, Stoplight		1
24	NW36142		Gasket, Governor		1
25	44381		Fitting, Air, Ell, 04T-06MP		2
26	418700		Tubing Nylon, Air Brake, 5/8"		375"
27	NW35062		Hose Asm, #10x72" St/St		1
28	1011157		Tubing Nylon, Air Brake, 1/2"		575"
29	1011430		Tubing Nylon, Air Brake, 1/4"		600"
30	1011156		Tubing Nylon, Air Brake, 3/8"		400"
31	43820		Fitting, Hydraulic, 10MJ-12MP		1
32	43557		Fitting, Hydraulic, 10MJ-06FP		1
33	NW35538		Fitting, Air, 08T-06MP Brass		3
34	NW35536		Fitting, Air, 04T-02MP Brass		6
35	NW35539		Fitting, Air, Ell, 04T-02MP90 Brass		7

AIR SYSTEM, AIR CHAMBER AND LINKAGE (1 OF 2)

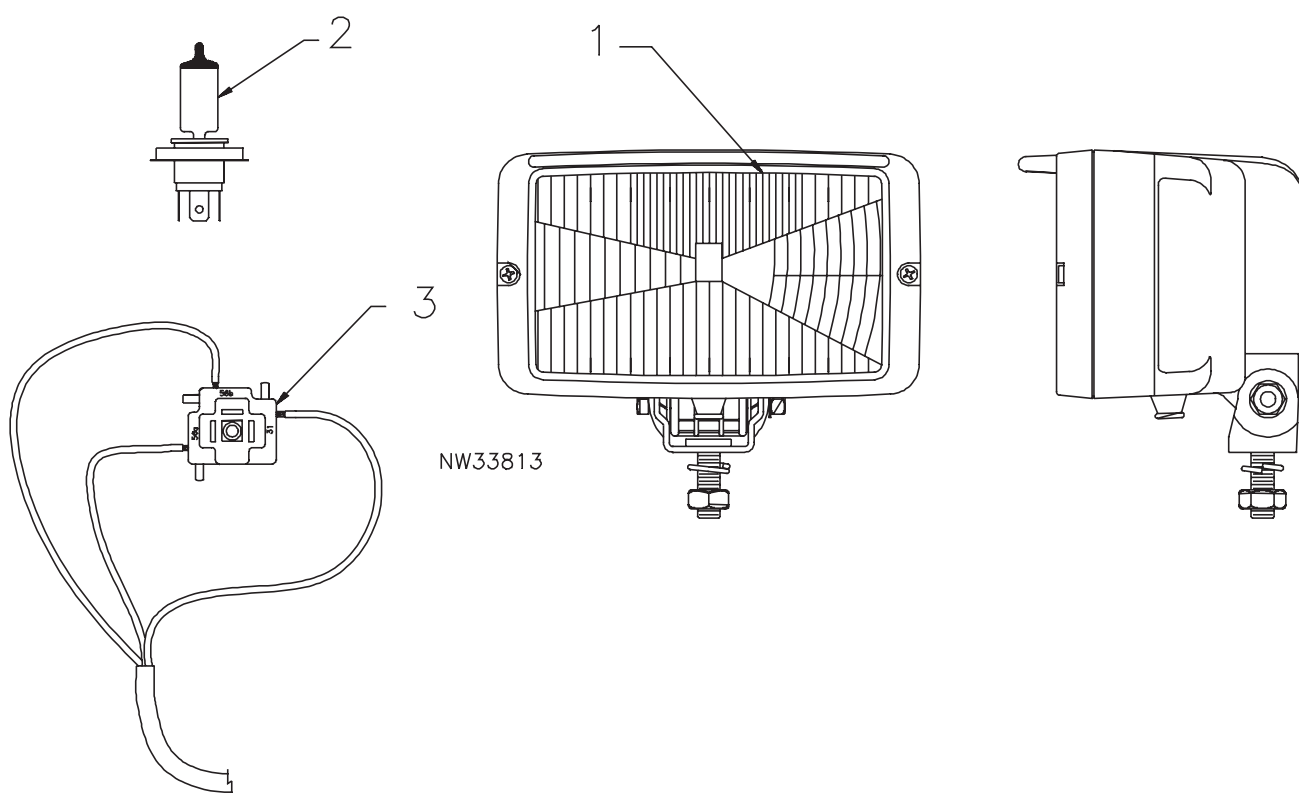


EFF SN 13085-03 &

ALSO SEE PG. 94

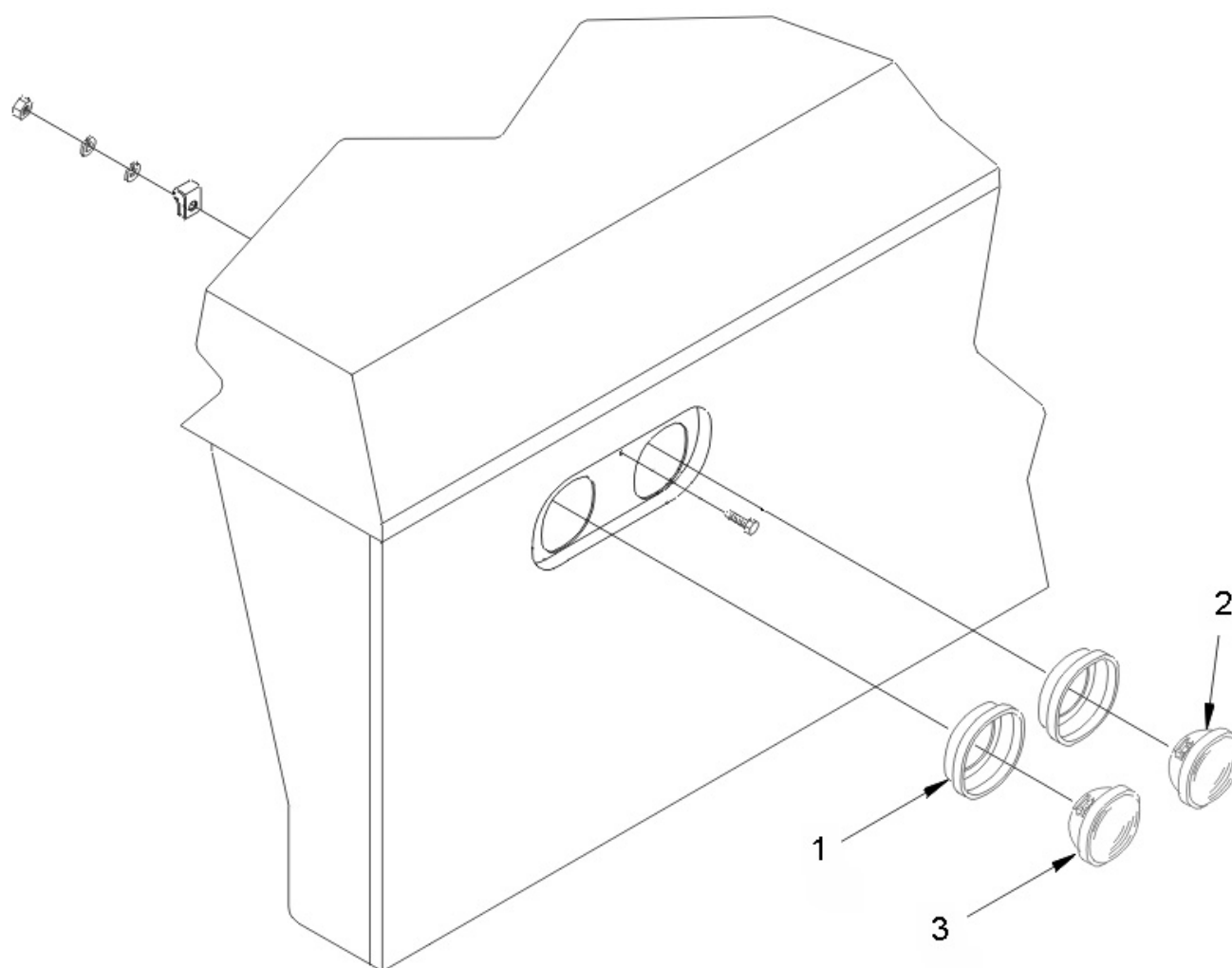
EFF SN 13084-03 & EARLIER

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
36	3.2283		Fitting, Hydraulic, 04MP-02FP		5
37	3.0263		Fitting, Hydraulic, Tee 04FP-04FP-04FP		2
38	3.1920		Fitting, Hydraulic, 06MP-04FP		2
39	200709		Fitting, Hydraulic, 08MP-06FP		4
40	3.1422		Fitting, Hydraulic, Tee 06FP-06FP-06MP		1
41	3.0248		Fitting, Hydraulic, Ell 04MP-04FP90		1
42	43802		Fitting, Air, Ell 06T-06MP90 Brass		8
43	43803		Fitting, Air, 06T-06MP Brass		2
44	37296		Fitting, Air, 06T-04MP Brass		4
45	NW35542		Fitting, Air, Ell 08T-06MP90 Brass		13
46	F100671		Fitting, Pipe, 04MP-02FP Brass		1
47	3.1925		Fitting, Hydraulic, Plug 06MP HH		5
48	3.1604		Fitting, Hydraulic, Tee 04FP-04FP-04MP		1
49	3.1820		Fitting, Hydraulic, Tee 02MP-02FP-02FP		3
50	154074		Fitting, Hydraulic, Ell 06MP-06FP90		2
51	44388		Fitting, Air, Ell, 10T-06MP90		4
52	NW35581		Fitting, Air, Ell, 08T-04MP90		3
53	NW35541		Fitting, Air, Ell 06T-04MP90 Brass		1
54	44390		Fitting, Hydraulic, Ell 06MP-06FP45, Brass		2
56	44380		Fitting, Air, Tee, 06FP-06MP-06FP, Brass		4
59	44386		Fitting, Air, 10T-06MP		2
60	NW35930		Fitting, Air, Bkhd, 08MP-04FP		2
61	1011142		Coupler, Hose, Air Brake		2
62	44389		Fitting, Air, Ell 10T-08MP90		2
63	44362		Valve, Check, High Flow		2
64	44361		Valve, Relay		1
66	44387		Bracket, Valve Mount		1
67	44703		Bracket Weldment, Air Chamber 200	C	1
68	44702		Chamber, Air, 3" Stroke, 40#	C	1
69	F100003		Nut, Hex 5/8-18	C	3
70	3.0328		LW 5/8	C	2
71	44741		Link Weldment, Prk Brk, M200	C	1
72	F100644		HHCS 3/8-16 x 3.25m Gr 5	C	1
73	F009666		Nut, Hex 3/8-16, Full	C	1
74	41631		FW 3/8 SAE, Hard	C	1
75	302239		Clevis, 3/8-16 x 3/8 Pin (Short)	C	1
76	F100376		HHCS 3/8-16 x 1.75, Gr 5	C	1
77	9413534		Nut, Hex, 3/8-16, Nylock	C	1
78	44704		Instl, Air Chamber Link, 200 (Includes Item #67-77)	C	1

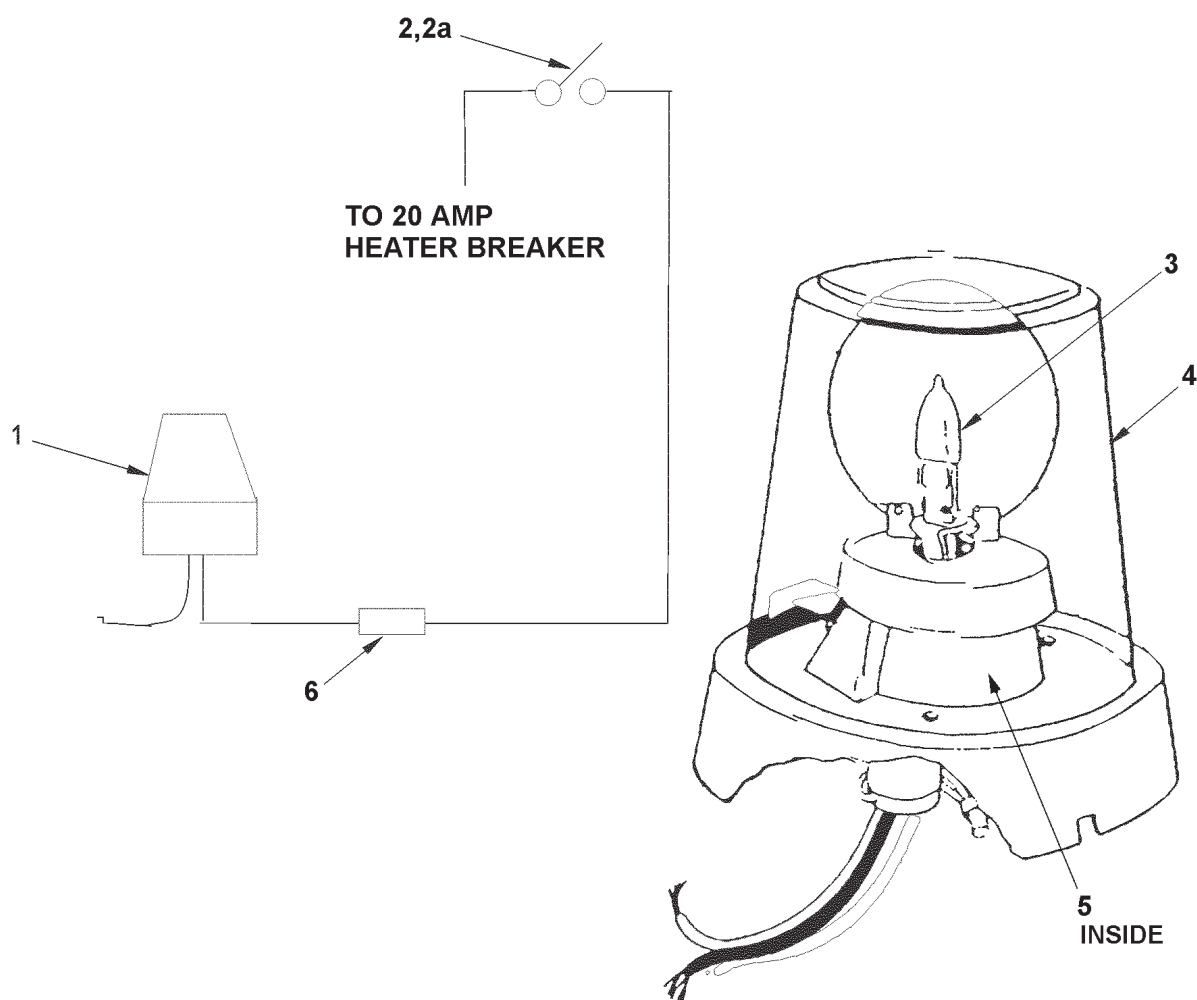
LIGHTS - HEADLIGHT

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW33813		Light, Head (1CW22)		2
2	43056	78155	Bulb, H4 12V 60/55W, 78155 (Hella) (1CW22)		1
3	43055		Connector, 87274 (Hella)		1

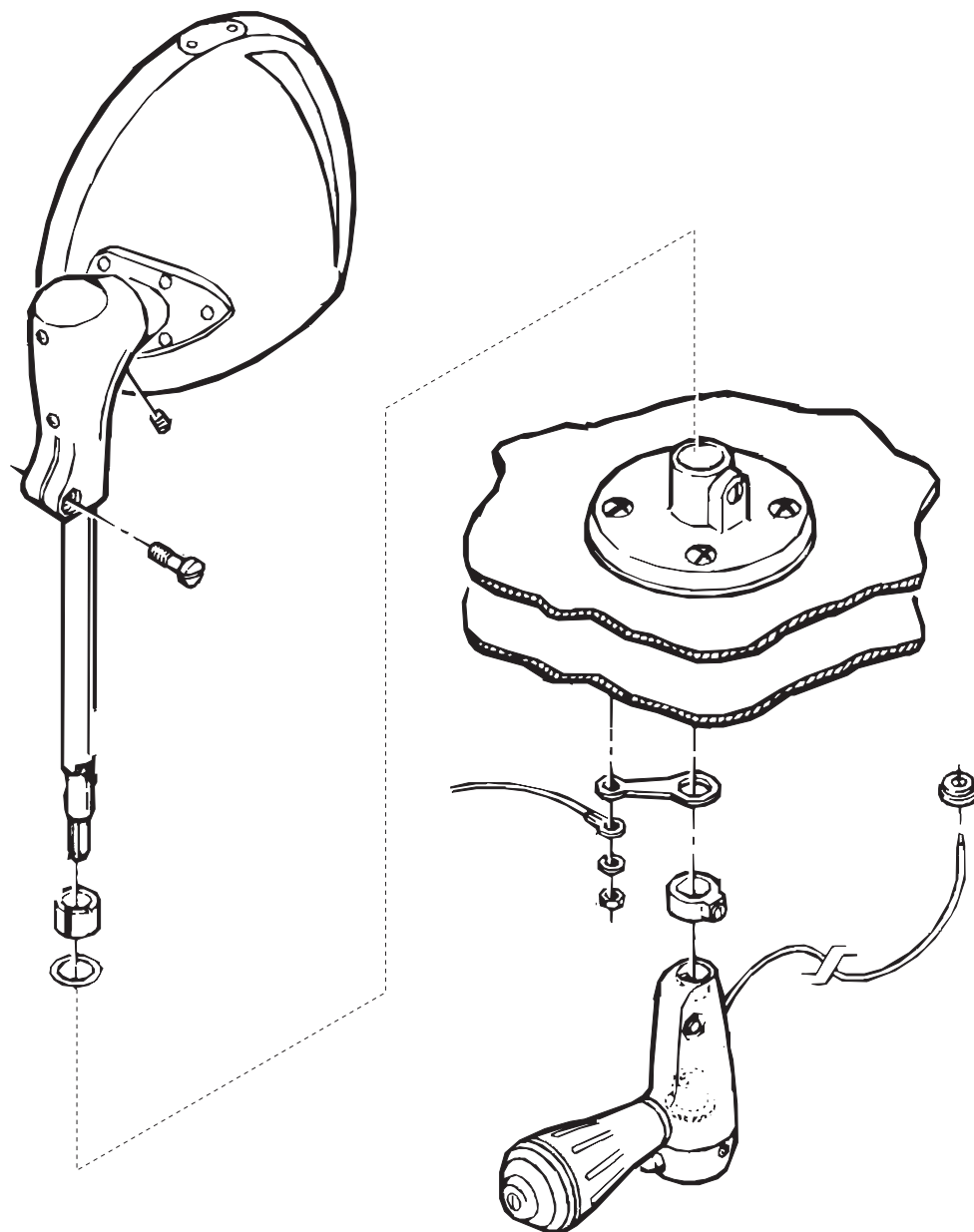
LIGHTS - REAR



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW35843	91740	Grommet (81834)		4
2	NW35842	62271	Back-up/Work Light Assembly, 2-Wire, Clear-w/Hydraulic Brakes (81834)		2
3	NW35844	52772	Tail/Stop Light Assembly, 3-Wire, Red-w/Hydraulic Brakes (81834)		2
	NW35844	52772	Tail/Stop Light Assembly, 3-Wire, Red-w/Air Brakes (81834)		4
NS	2.3608		Back-up/Work Flood Light w/Air Brakes		1
NS	F101518		Plug, Connector, 7 Pole		1
NS	F101514		Cover, Rubber, 7 Pole		1
NS	F101637		Bolt, Eye, 3/8-16 x 2		1

ROTATING AMBER LIGHT

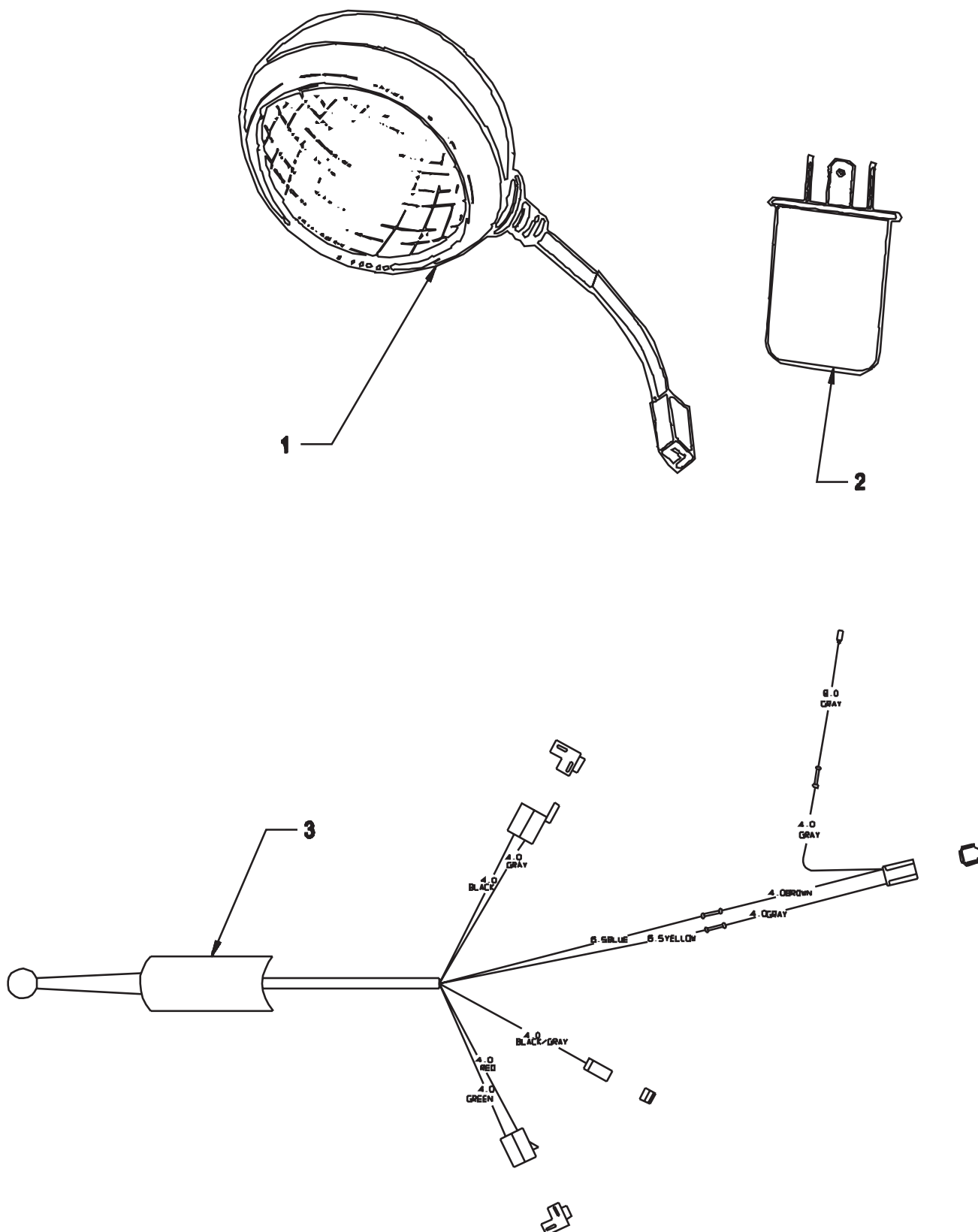
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW31334	R5700LA	Light, Amber (62465)		1
2	NW34176	511005	Rocker Switch (65439)		1
2a	NW35384	596628	Switch Insert, Beacon, Green (65439)		1
3	38495	R5012BH	Bulb, 55 Watt		Ref
4	38493		Lens, Beacon, Amber		Ref
5	38494	R5015MGA	Motor, Beacon		Ref
6	F100851		Terminal, Butt		1

SPOTLIGHT FOR CAB OPTION

1

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
	26797E		Spotlight Option		Ref
1	NW32893	7301380	Light, Spot (V00523)		1
	NW32893-1	7309530	Replacement Switch For Spot Light		1
	Comm		Wire, 16 Ga, Black		14"
	Comm		Terminal		1
	Comm		Terminal, Ring		1
	Comm		Tie, Cable		4
	202927		HHCS, 5/16-24 x 1.00, Gr. 5		2

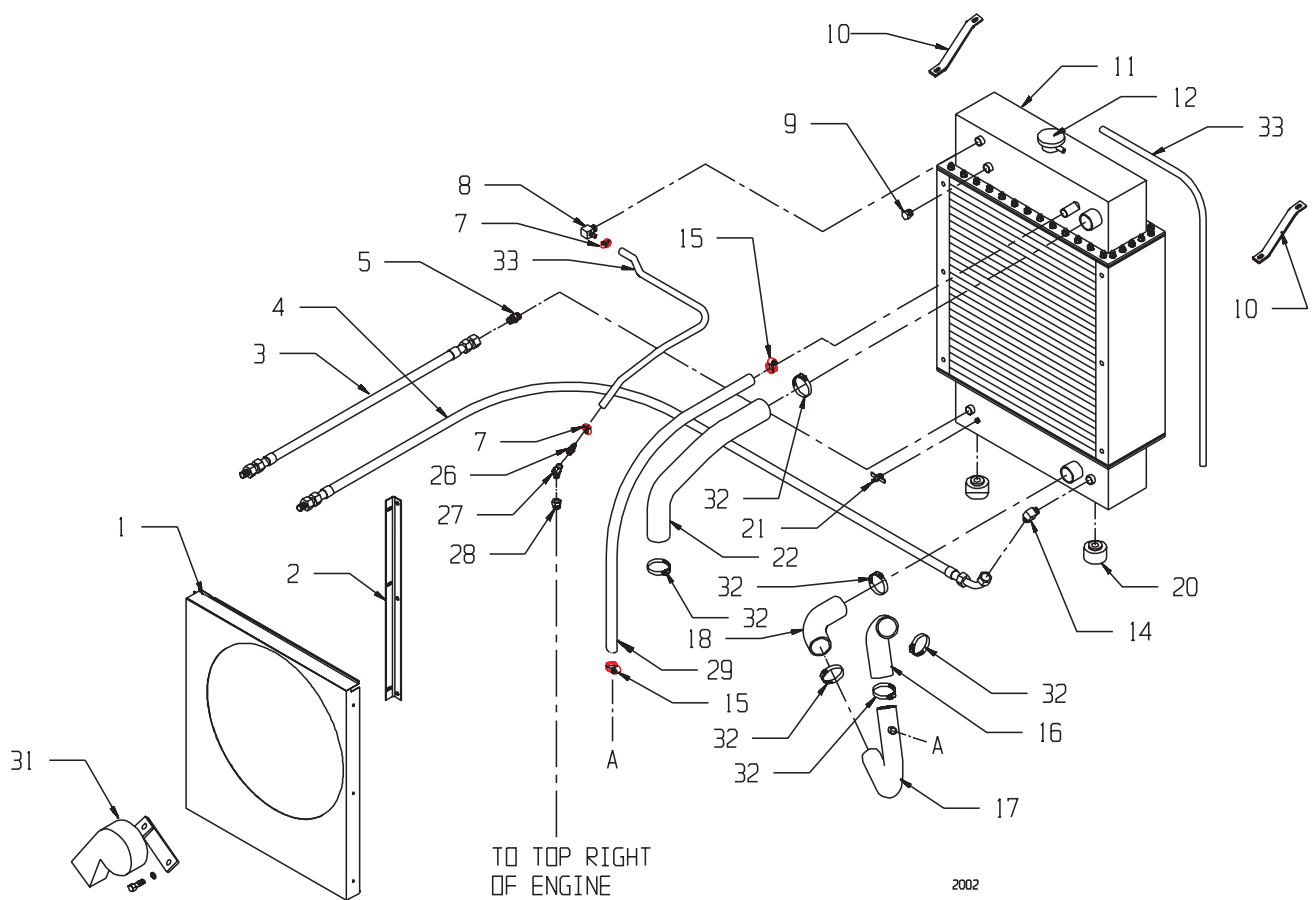
TURN SIGNAL OPTION



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-24		Turn Signal Assembly200MB4		Ref
1			Light Assembly		1
	NW30220		Light, Amber Turn Signal		2
	F101550		Connector, 2-Position, Female		4
	F101552		Terminal, Male		4
	F101793		Loom, 1.350 ID Flex Guard		11"
2	F101567	44820-5	Flasher (NVC)		1
3	304542		Switch Assembly, Signal Light		1
NS	NW19009		Strap, Adjustable Ratchet		2
NS	F100899		Terminal, Butt, 12-10ga.		3

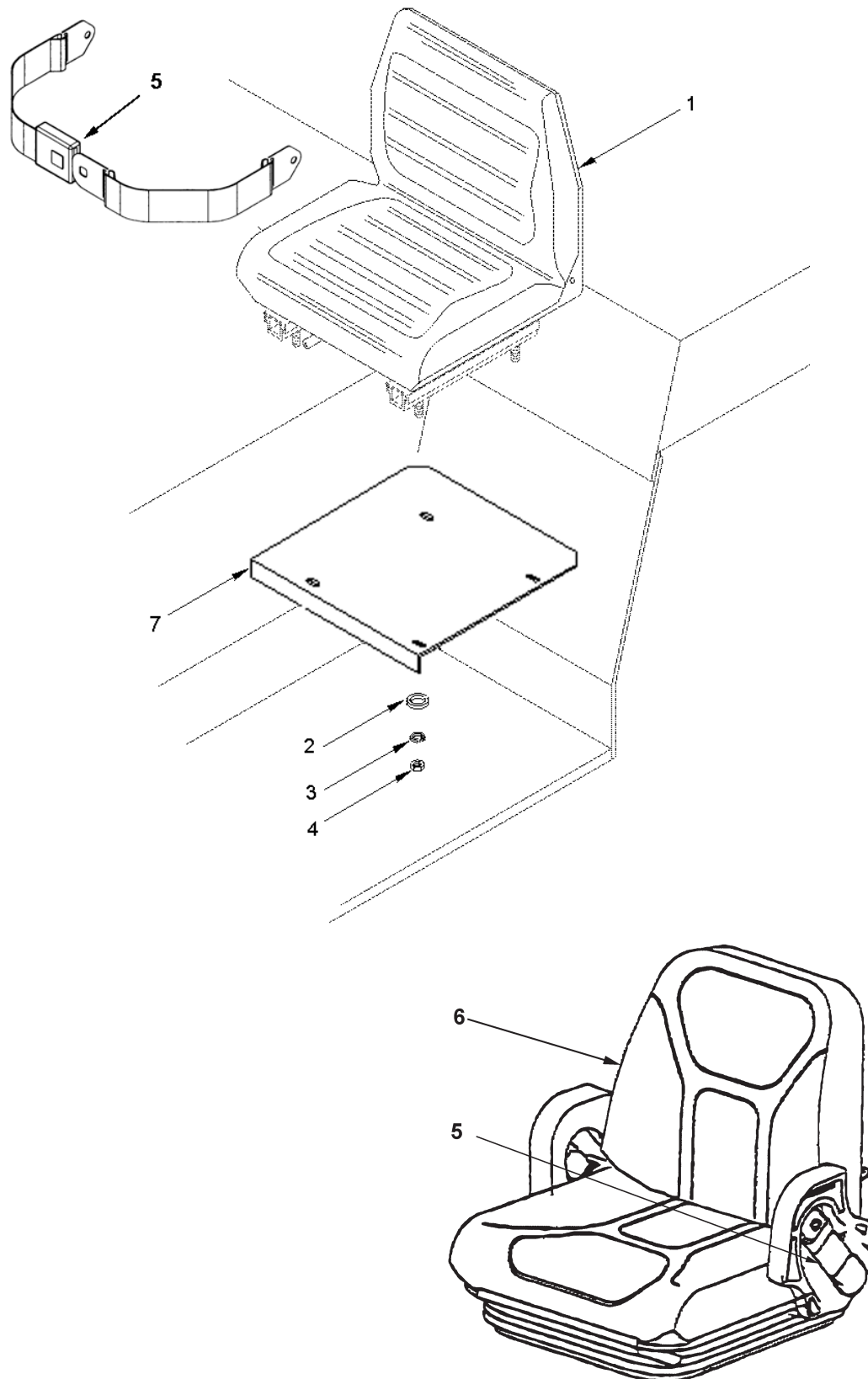
Also See Page 138.

RADIATOR



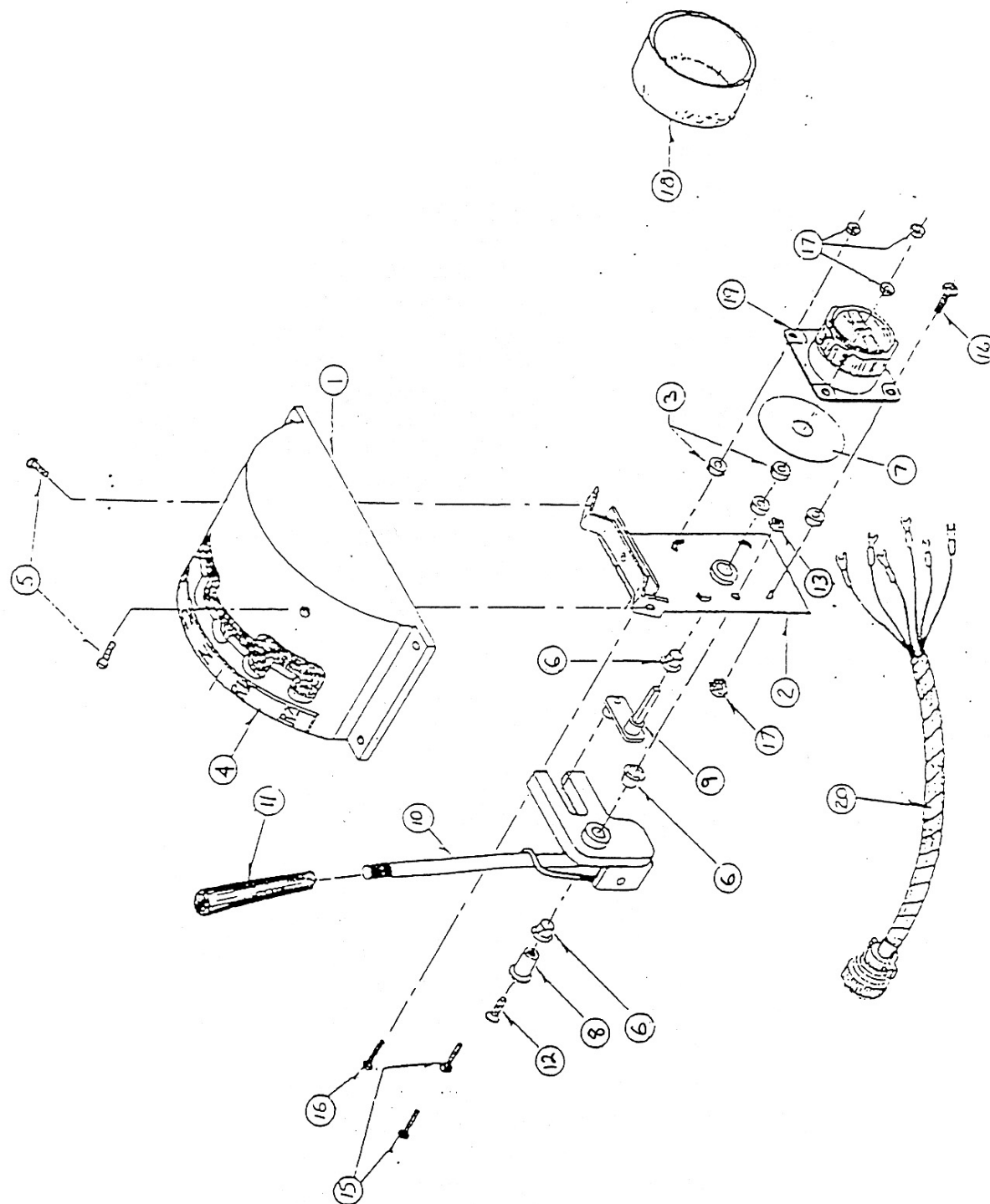
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-15		Cooling System 200MB4		
1	42774		Shroud, Radiator		1
2	42847		Bracket, Shroud Mount		1
3	10384.14		Hose Assembly #16L, 73", ST/ST		1
4	10384.39		Hose Assembly #16L, 88", ST/45		1
5	3.2118		Fitting, Hydraulic, 16MJ-12MP		1
7	F101161		Clamp, Hose, #16, .81-1.50		2
8	NW34736		Fitting, Hydraulic, Ell, 06H-04MP90		1
9	Comm		Pipe, Plug		1
10	42780		Bracket, Radiator, Top		2
11	42715	12019	Radiator, 200 (0J567)		1
12	305875	206912	Cap, Pressure, 7 PSI for Rad. 42715 (0J567)		1
14	3.1678		Fitting, Ell, 16MJ-12MP90		1
15	F101156		Clamp, #12 Hose		2
16	40657		Hose		1
17	37322		Pipe, Radiator (SN13002-00 & below)		1
	43209		Pipe, Radiator (SN13003-00 and up)		1
18	42948		Hose, Radiator, Lower, 2.25		1
20	NW017063		Insulator, Front - M60/100		2
21	F100669		Chock, Shut-off, 1/4-18 NPT		1
22	37625		Hose, Rad 1.75 x 14.5		1
26	NW36006		Fitting, Hydraulic, Mod (F100716)		1
27	3.2642		Fitting, Hydraulic, Ell, 02MP-02FP45		1
28	F100780		Fitting, Hydraulic, 08MP-02FP		1
29	NW35596		Hose, 1", Heater		36"
31	152864	7200021	Horn, 12V, 5 amps, 125 DBR (V00544)		1
32	F011057		Clamp #36 Hose		4
33	F101679		Hose 5/16		A/R
34	203004		Sight Gauge		1

SEATS

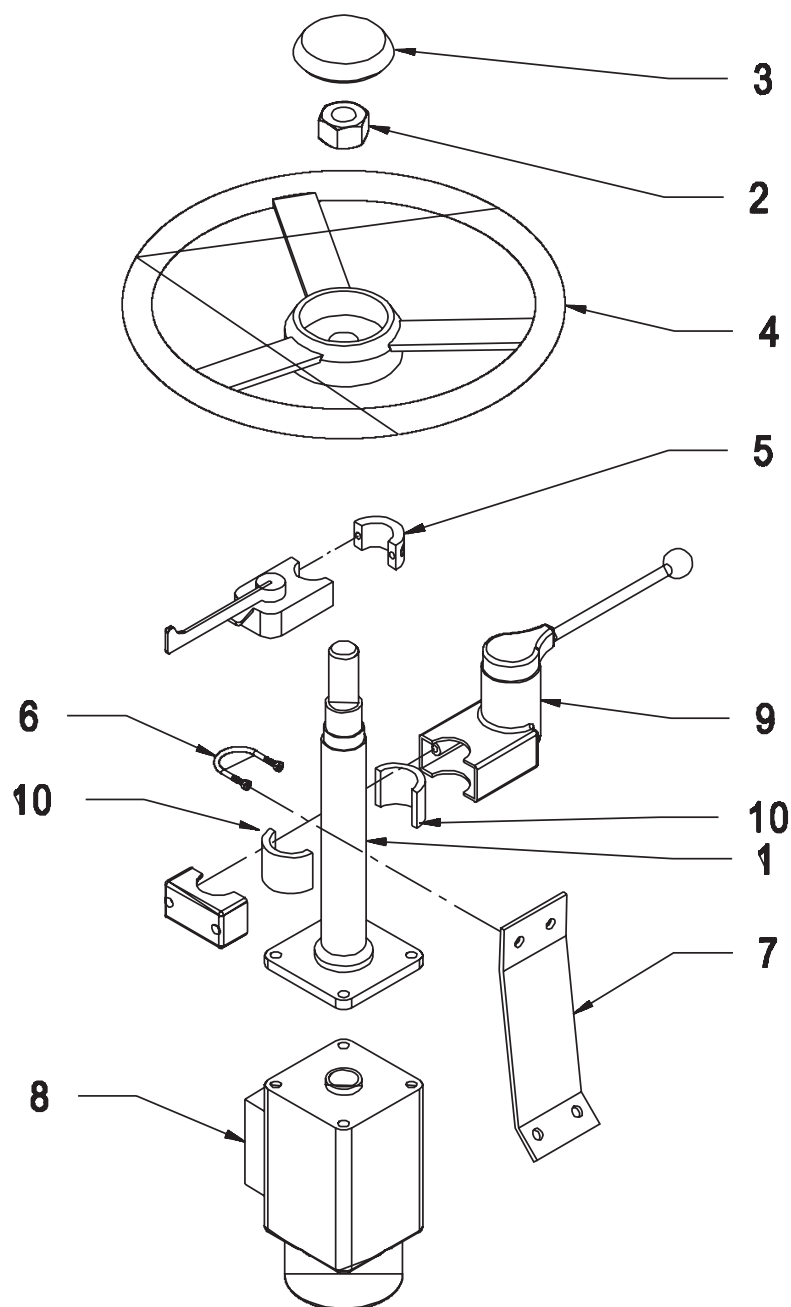


Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-8		Seat Assembly 200MB4		Ref
1	NW23843		Seat Assembly, w/Slide (0X0P8)		2
2	F9549		Flat Washer, 5/16		8
3	F9546		Lock Washer, 5-16		8
4	F9547		Hex Nut, 5/16-18		8
5	NW34728		Seat Belt		1
6	42499		Seat		1
7	42866		Plate, Seat Mount		1

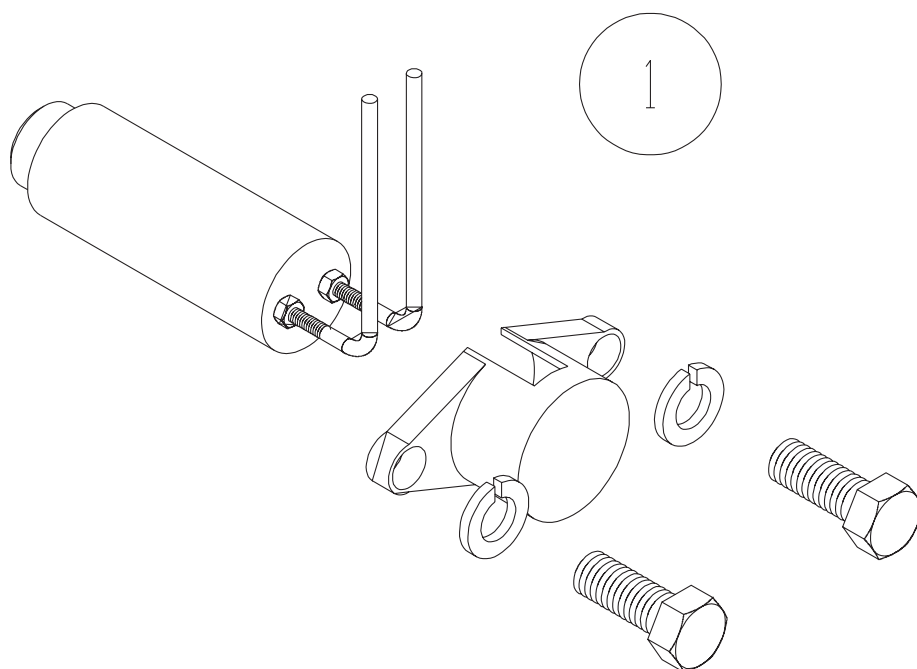
SHIFTER



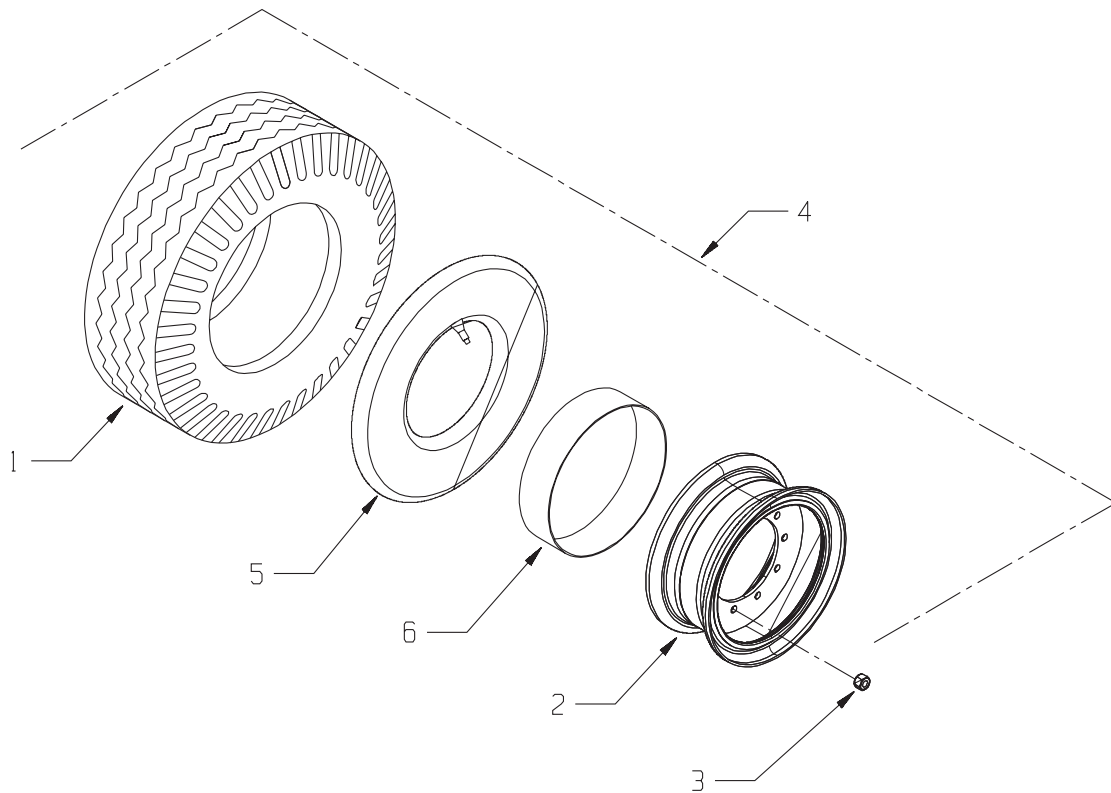
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	42480	RCQ100 NMC2	Control, Shift, Funk (United Equipment Accessories)		Ref
1	42480-1	RCFA007662	Aluminum Casting		1
2	42480-2	RCAB007662	Plate, Switch Mounting		1
3	42480-3	RCFA013371G0	Spacer, Aluminum		4
4	42480-4	RCPADD7883A	Decal, Left Side		1
5	42480-5	P5631032050Z	Screw, Flat Head		2
6	42480-6	P144050	Bearing, Nylon		3
7	42480-7	RCPA007743	Seal, Switch Face		1
8	42480-8	RCPA007601	Pilot Shaft, Geneva		1
9	42480-9	RCAA007600	Roller, Switch Drive Assy		1
10	42480-10	RCAB007617B	Spring Lever Assy		1
11	42480-11	P4413824A	Handle, Moulded		1
12	42480-12	RC13292-1.25	Screw, Mounting		1
15	42480-13	P56163207555	Screw, Roundhead		21
16	42480-14	P56163207555	Screw, Roundhead		2
17	42480-15	P592632	Nut, Press In		4
18	42480-16	P156300263	End Cap, Heatshrink		1
19	42480-17	RCAA070565	Switch, Rotary		1
20	42480-17	RCAA070565	Harness, Wire		1

STEERING

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	NW35372		Column, Steering, 10" w/Horn		1
2	150526		Nut, Steering Wheel		1
3	202736		Button, Horn		1
4	NW36491		Wheel, Steering		1
5	304542		Turn Signal Switch, Optional		1
			Switch Turn Signal		1
6	NW35692		Clamp, Muffler, 1-3/8		1
7	NW35603		Bracket, Steering Column Support-w/Hydraulic Brakes		1
	43890		Bracket, Steering Column Support-w/Air Brakes		1
8	1012697		Steer Unit, 17.9 CI, LS, NLR		Ref
9	37290		Air Trailer Control Valve		Ref
10	43896		Split Bushing Spacer		2
NS	43046		HHCS, 3/8-24x2.75 Gr. 5		2
NS	3.1081		Clamp, Loop Type		2

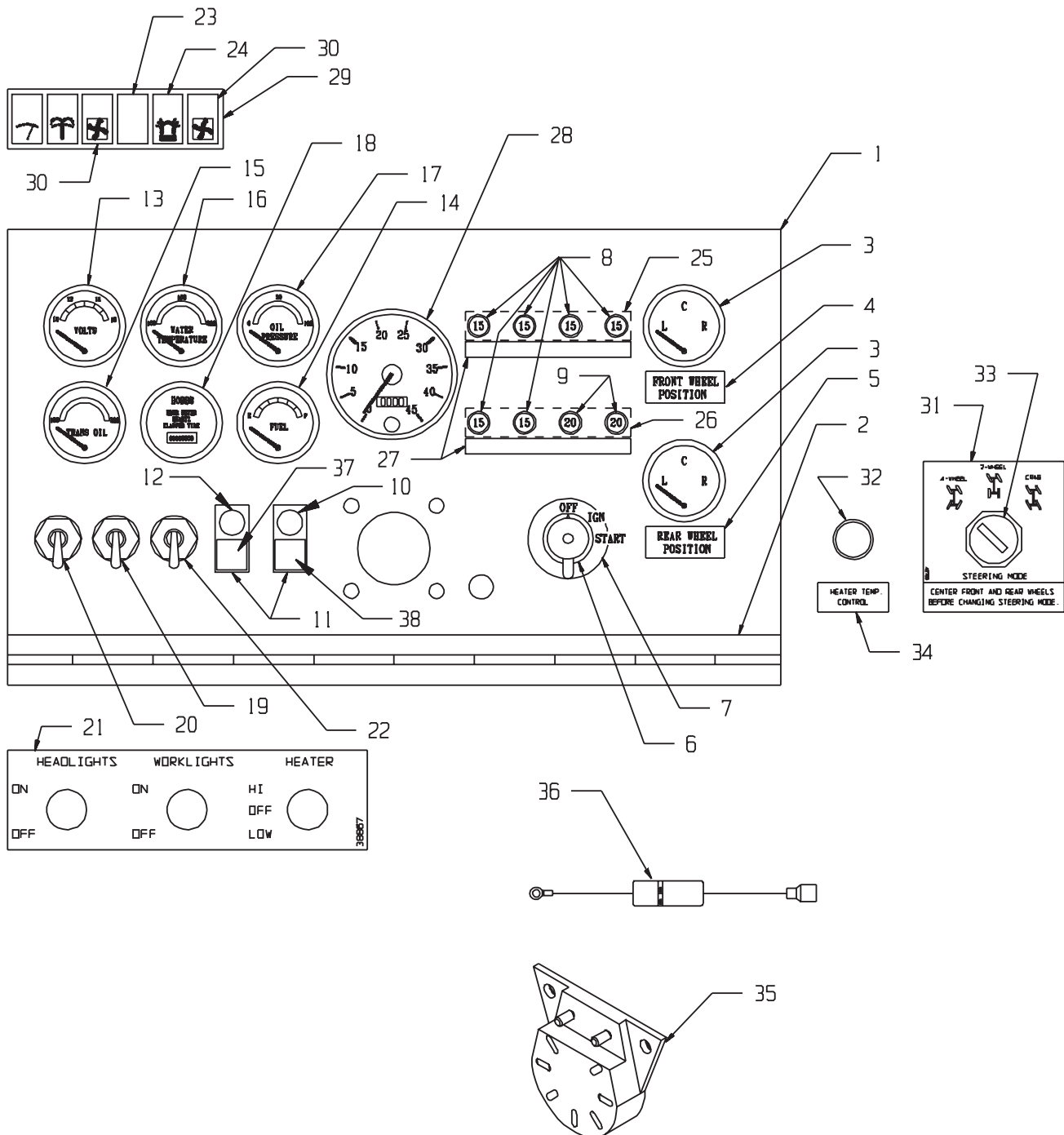
TRANSMISSION & SPEEDOMETER SENDER

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	43098	YZ4102792	Sender, Speedometer (Funk Manufacturing Co)		1

WHEELS & TIRES

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-22		Wheel/Tire Assembly 200MB4		Ref
1	41146		Tire, 10.00 R20, 16 Ply		1
2	38924		Wheel		1
3	204610		Nut, Wheel, M22 x 1.5 Fitting		AR
4	44417		Wheel/Tire Ass		4
5	44420		Tube, Radial Tire		1
6	44421		Flap, Radial Tire (included with item 4)		1

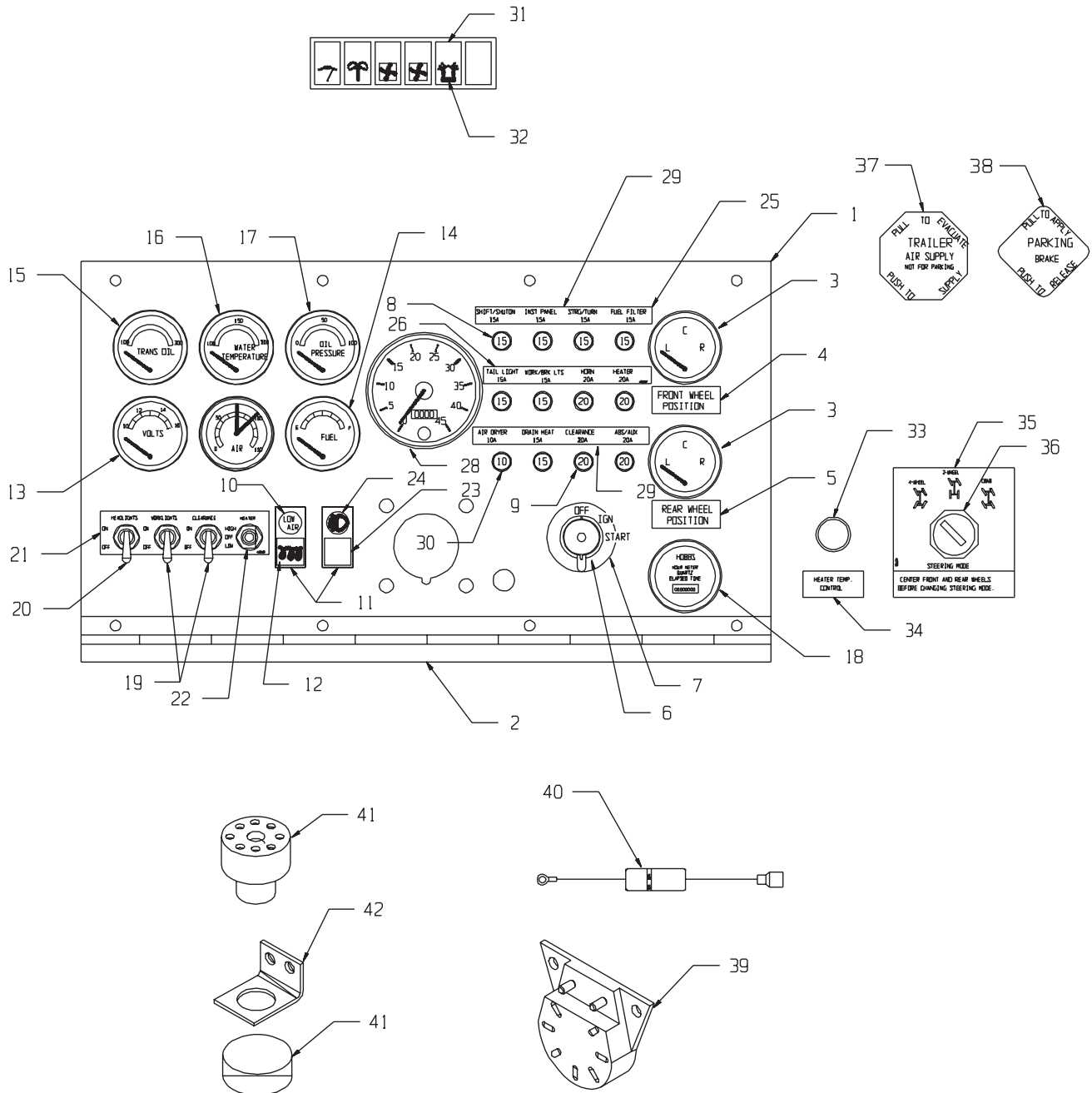
INSTRUMENT PANEL-FOR HYDRAULIC BRAKES



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-4		Panel Assembly, 200MB4-For Hydraulic Brakes		
1	43088		Instrument Panel		1
2	NW36477		Instrument Panel Hinge		1
3	37153		Indicator, Axle Direction		2
4	37213		Decal, Front Axle Position		4
5	37214		Decal, Rear Axle Position		1
6	F104281		Switch, Ignition, Anti-Restart, Keyless		1
7	NW30247		Disc, Ignition		1
8	NW35268		Circuit Breaker, 15A		6
9	NW35269		Circuit Breaker, 20A		2
NS	38635		Seal, Circuit Breaker		8
10	NW35388		Insert, Brake Warning Indicator		1
11	NW35378		Housing, Light Indicator		2
12	NW035385		Insert, Switch, Glo Plug, Green		1
13	NW036129		Gauge, Voltmeter		1
14	NW024702		Gauge, Fuel		1
15	NW024701		Gauge, Transmission Temp.		1
	NW030236		Sender, Transmission Temp.		1
16	41401		Gauge, Engine Temperature		1
17	41400		Gauge, Oil Pressure		1
18	41434		Gauge, Hourmeter		1
19	38863		Toggle Switch SPST		1
20	38864		Toggle Switch DPST		1
21	38867		Plate, Switch		1
22	38865		Toggle Switch SPDT		1
23	NW35382		Blank, Switch		1
24	NW35387		Insert, Switch, High Beam		1
25	43075		Bar, Buss		1
26	43090		Bar, Buss		1
27	43089		Decal, Instrument Panel Breakers		1
28	43097		Speedometer		1
29	NW35381		Frame, 6 Switch		1
30	NW35394		Switch, Rocker, Off-On-On, 1PDT		2
	NW35395		Insert, Switch, Blower, Green		2
31	42786		Decal, Steering Mode		1
32	NW22828		Heater Temp Control		1
33	303278		Switch, Selector, 3 Pos		1
34	42814		Decal, Heater Temp Control		1
35	NW24637		Alarm, Backup		1
36	42280		Diode Assembly		1
37	NW35382		Insert, Switch, Blank, Black		1
38	37247		Insert, Switch, Park Brk, Red (92484)		1

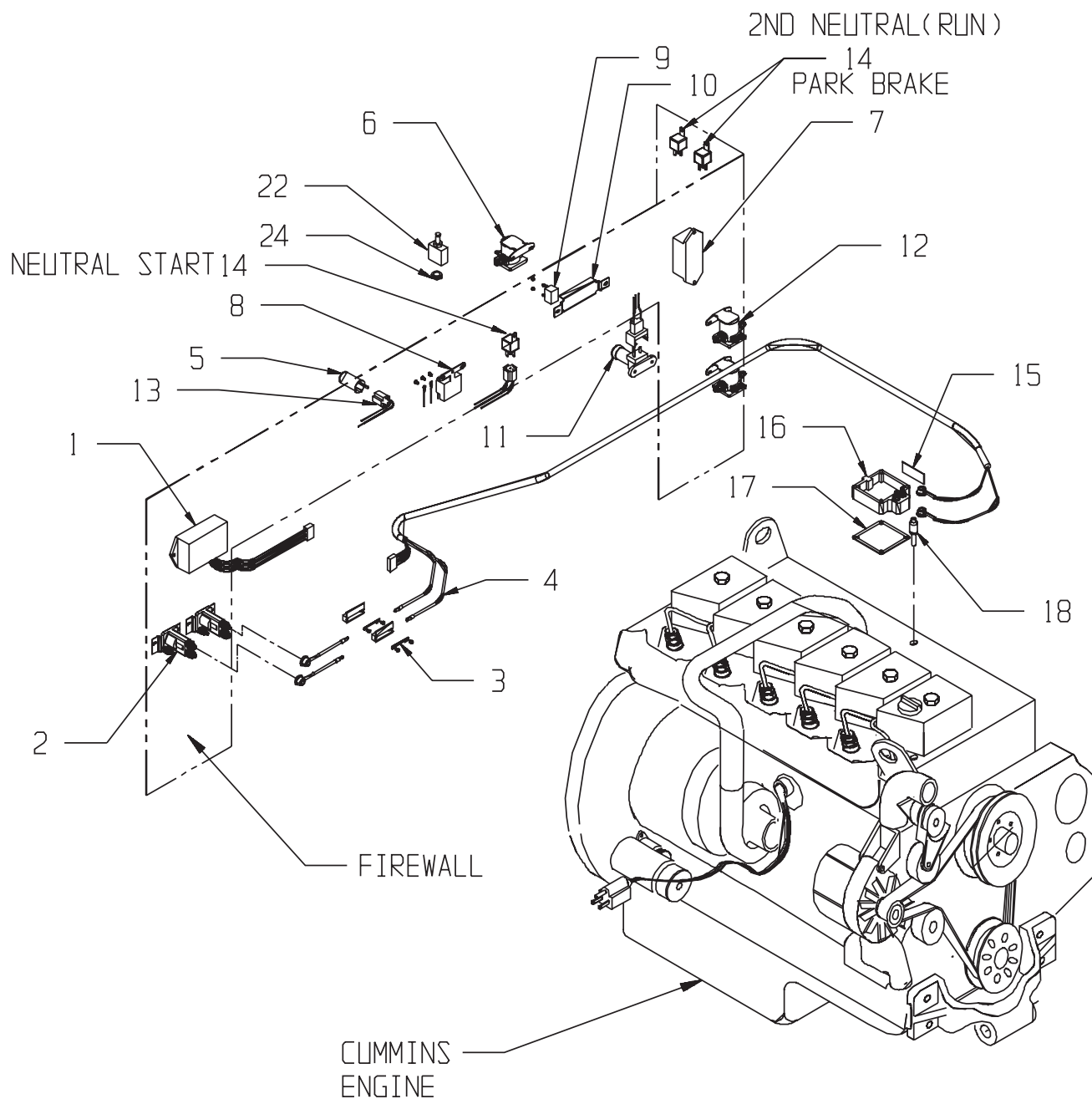
INSTRUMENT PANEL-FOR AIR BRAKES

ALARMS



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T446832-4		Panel Assembly Instrument 200MB4-1		1
1	43579		Panel Instrument 200MB4-1		1
2	43580		Hinge, Instrument Panel		1
3	37153		Gauge, Axle Position		2
4	37213		Decal, Front Wheel Position		1
5	37214		Decal, Rear Wheel Position		1
6	F104281		Switch, Ignition, Anti Restart, Keyless		1
7	NW30247		Disc, Ignition		1
8	NW35268		Breaker, Circuit, 15A Manual Reset		7
9	NW35269		Breaker, Circuit, 20A Manual Reset		3
10	NW35388		Insert, Switch, Brake Fluid, Red		1
11	NW35378		Housing, Light Indicator		2
12	NW35385		Insert, Switch, Glo Plug, Green		1
13	NW36129		Gauge, Volt Meter, 8VDC-18VDC		1
14	NW24702		Gauge, Fuel, JGPT16		1
15	NW24701		Gauge, Transmission Temperature		1
16	41401		Gauge, Water Temperature		1
17	41400		Gauge, Oil Psi		1
18	41434		Gauge, Hour Meter, Sol State		1
19	38863		Switch, Toggle, SPST MS35058-22		2
20	38864		Switch, Toggle, DPST MS35059-22		1
21	43846		Placard, Switch Plate		1
22	38865		Switch, Toggle, SPDT MS35058-21		1
23	37247		Insert, Switch, Park Brk, Red (92484)		1
24	NW35387		Insert, Switch, High Beam, Blue		1
25	43075		Bar, Buss, 4 Hole		1
26	43090		Bar, Buss, 3 Hole		2
28	43097		Speedometer, w/ODO, 0-45, Program		1
29	43888		Decal, Breakers, Instrument		1
30	2.3508		Breaker, Circuit, 10A		1
31	NW34176		Switch Assembly, Light		1
32	NW35384		Insert, Switch, Beacon		1
33	NW22828		Heater Temperature Control		1
34	42814		Decal, Heater Temperature Control		1
35	42786		Decal, Steering Mode		1
36	303278		Switch, Selector, 3 Position		1
39	NW24637		Alarm, Backup		1
40	42280		Diode Assembly		1
41	NW35338		Alarm, In-Dash		1
42	41940		Bracket, Warning, Buzzer		1

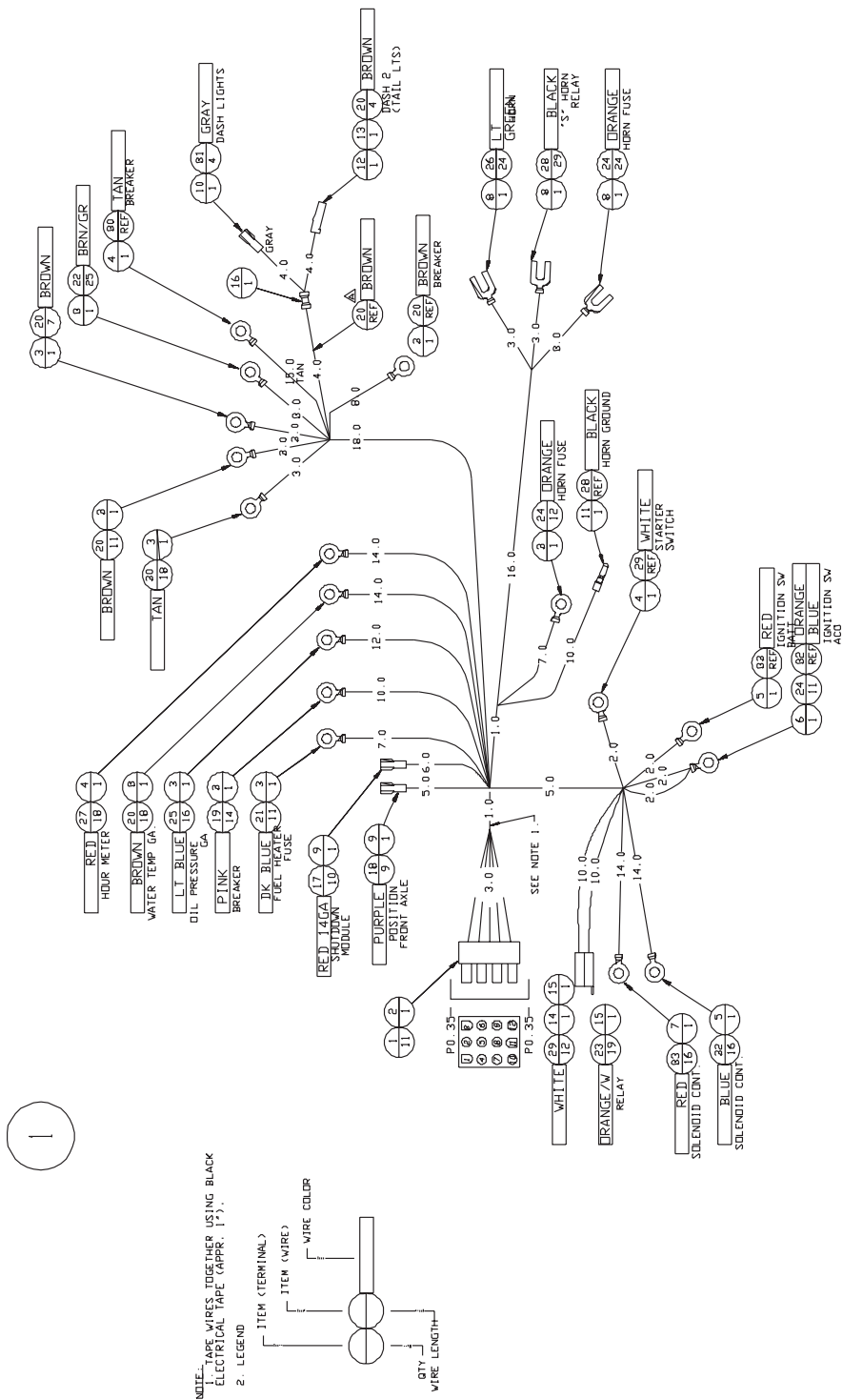
RELAYS, CIRCUIT BREAKERS & MODULES



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0			Electrical Assembly, Chassis		Ref
1	43144	3926828	Module, Engine Computer		1
2	43145	3916301	Relay, Pre-heater		2
3	43147	3622064	Fuse Link		2
4	43146	3926913	Harness, Cummins Engine		1
5	F101567		Flasher, 12V, 3 Terminal		1
6	2.1401		Solenoid, 12V Cotnin, 80 Amp		1
7	41705		Shutdown Module Assembly, 100		1
8	NW23700		Relay, Horn, 12V/30 Amp		1
9	2.0134		Breaker, Circuit, 20A Auto-Reset		1
10	2.0364		Holder, Circuit Breaker, 4-Gang		1
11	F101622		Switch, Dimmer, Hi-Lo		1
12	F102160		Relay, Starter, CC		2
13	NW31880		Flasher, Socket		1
14	NW35766		Relay, 12V SPDT		3
15		3927335	Tag, Instructions		1
16	306744	3924594	Heater, Engine		1
17	306745	3913352	Gasket		1
18	306746	3926903	Sensor, Temperature		1
22	NW036793		Switch, Park Brake (Non-Air Brake Units Only)		1
24	37715		Grommet (Non-Air Brake Units Only)		1
NS	F100905		Connector, Inline		1
NS	NW36097		Clip, Retain		6
NS	NW32329		Wire, Assembly, Diode, Delco		2
NS	42980		Harness, Ground		3

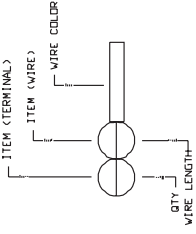
ELECTRICAL HARNESS

1 OF 14



NOTE:
1. TAPE WIRES TOGETHER USING BLACK ELECTRICAL TAPE (APPR. 1\"/>

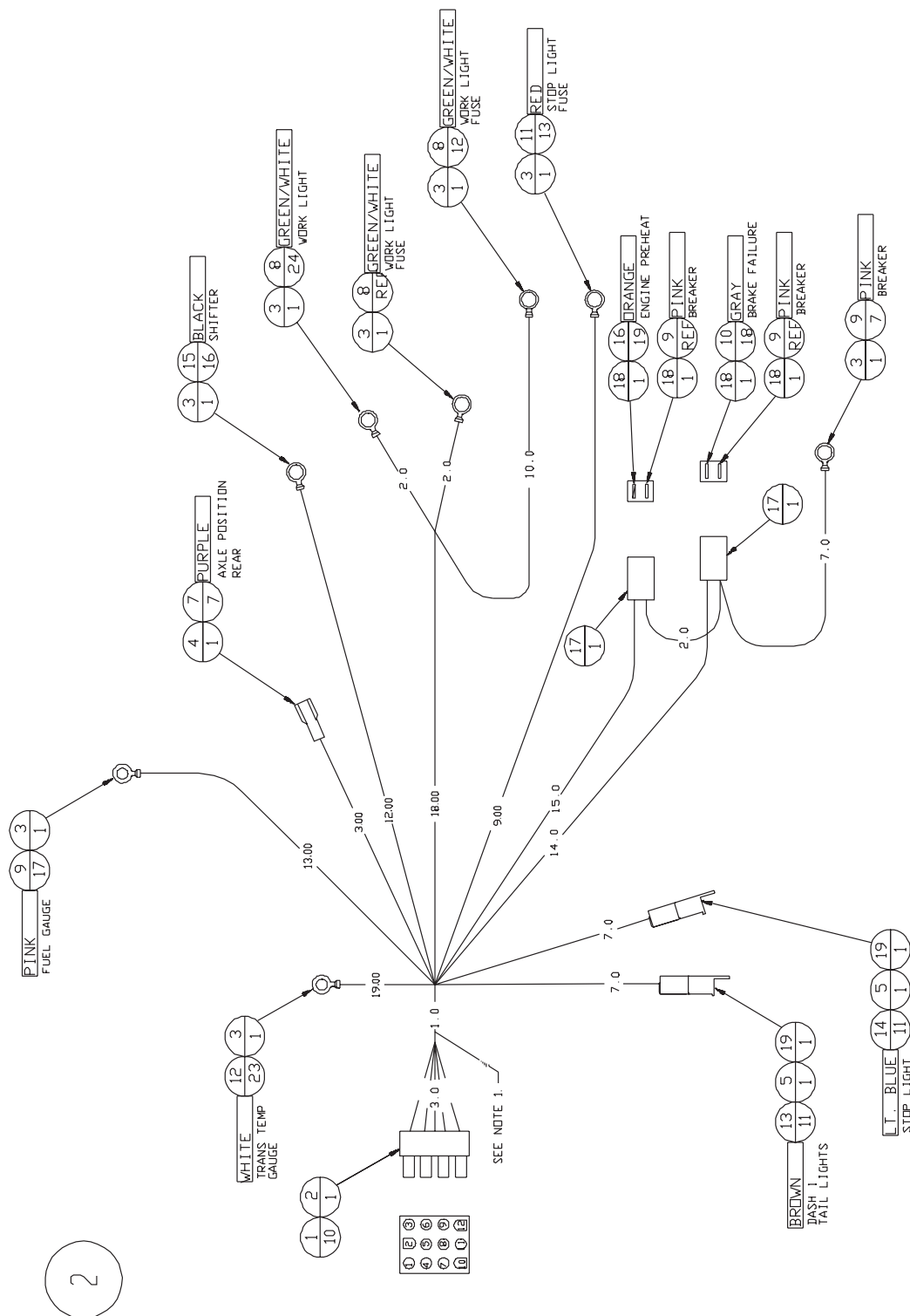
2. LEGEND



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	42914		Harness, Dash I, 200MB4		1

ELECTRICAL HARNESS

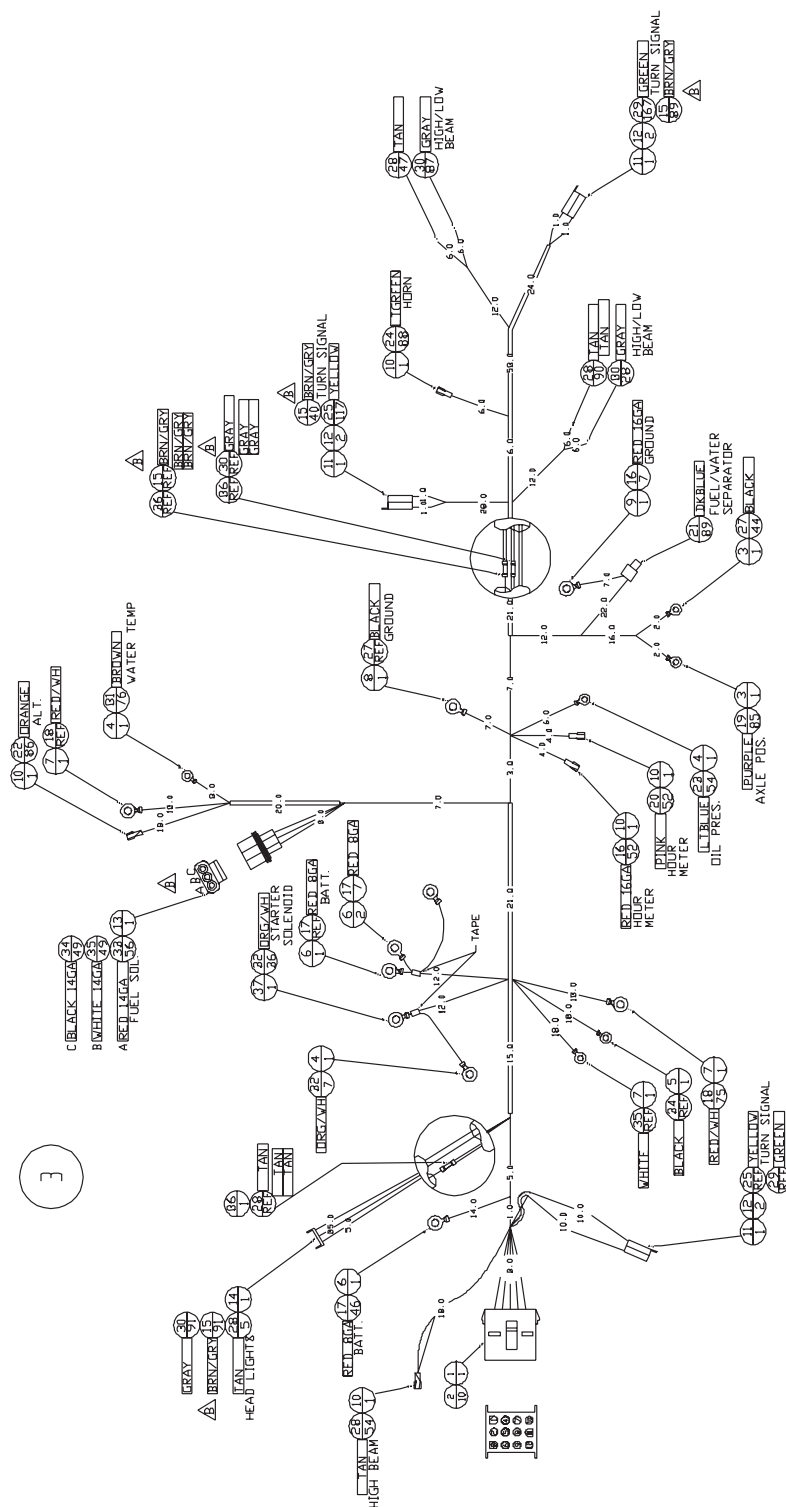
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Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
2	42915		Harness, Dash II, 200 MB4		1

ELECTRICAL HARNESS

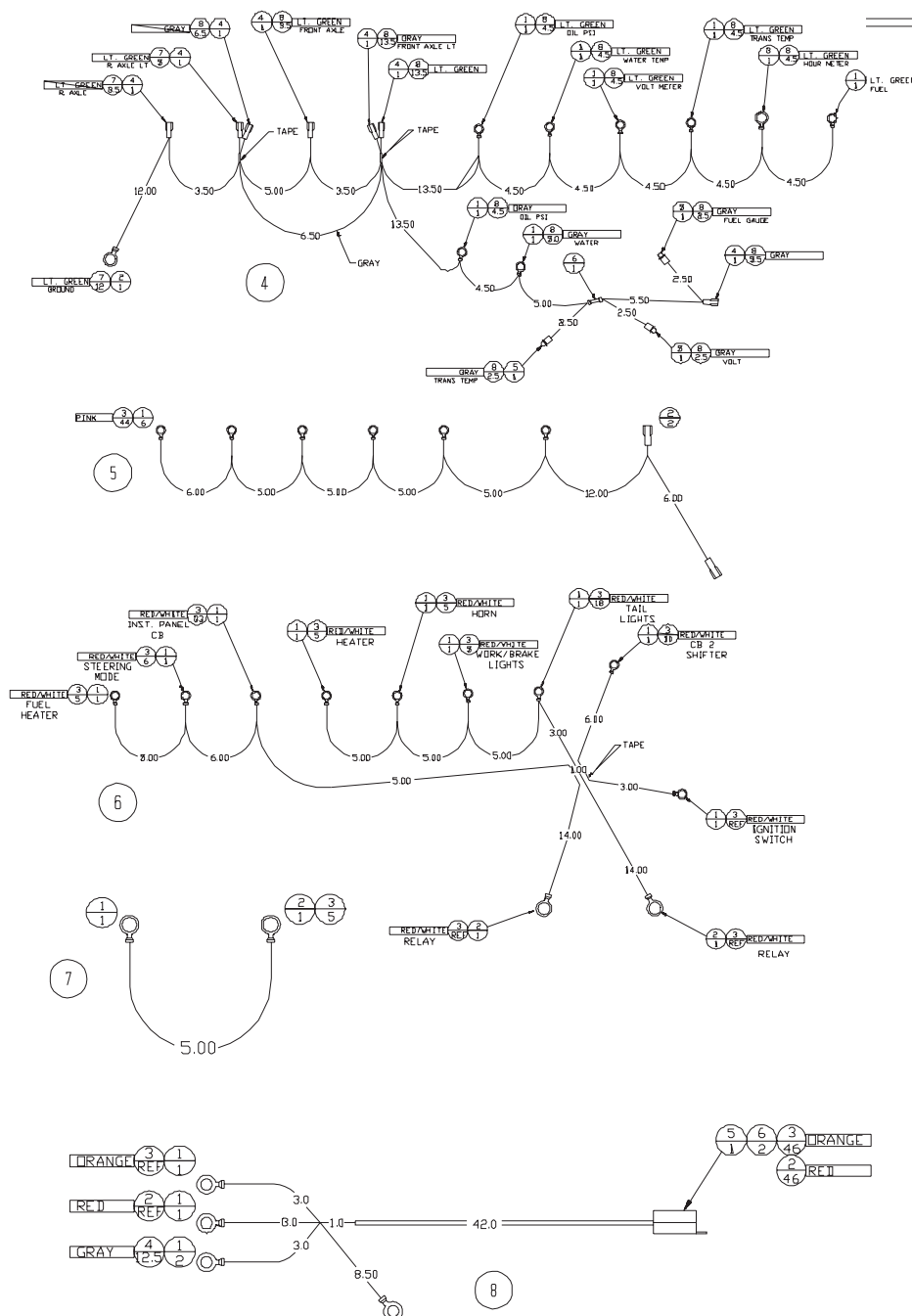
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Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
3	42916		Harness, Engine, 200 MB4		1

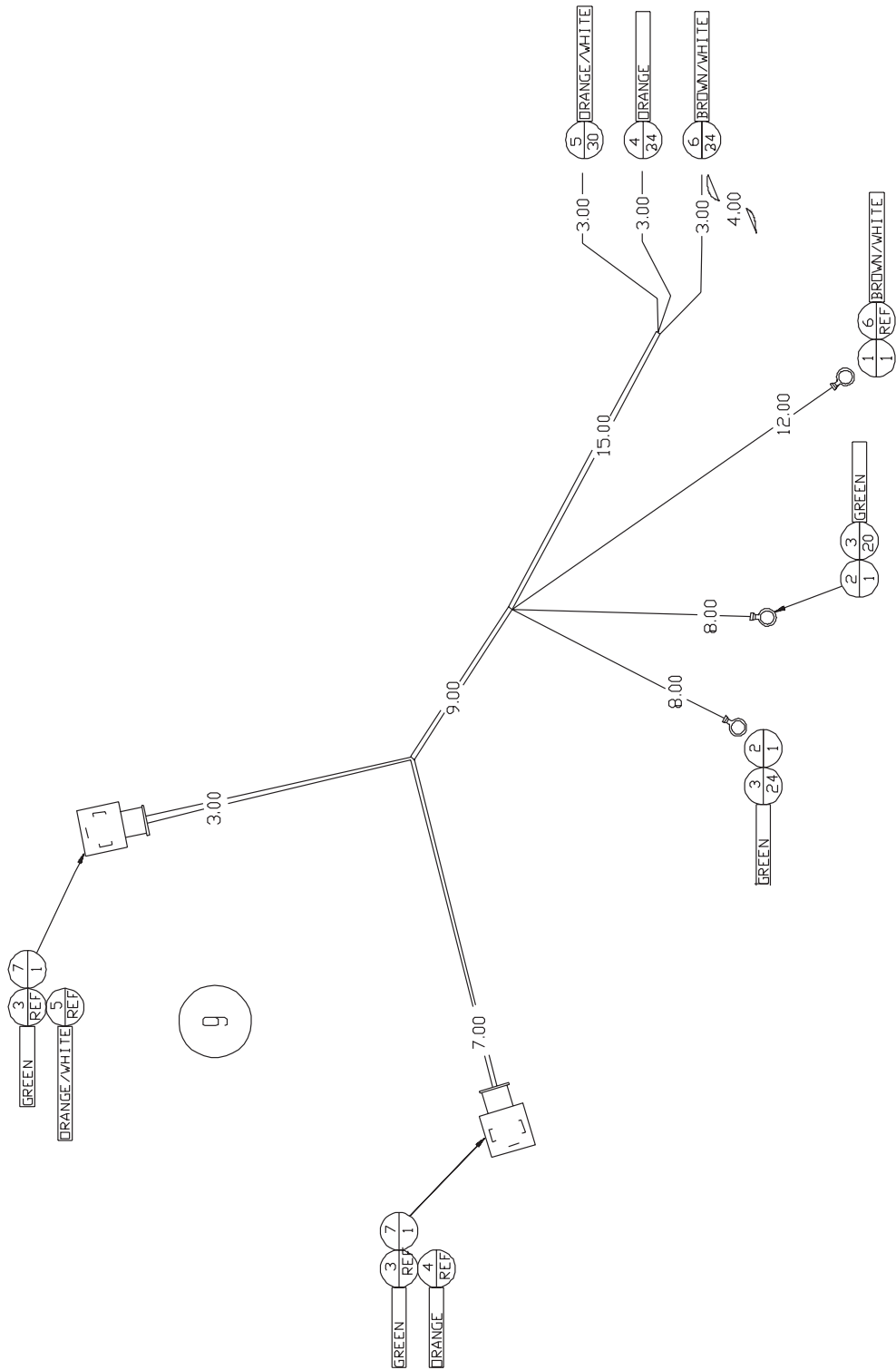
ELECTRICAL HARNESS

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Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
4	42918		Harness, Light-Ground, 200MB4		1
5	42919		Harness, Positive, 200MB4		1
6	42920		Harness, Breaker, 200MB4		1
7	42921		Harness, Ignition		2
8	42922		Harness, Heater, 200 MB4		1

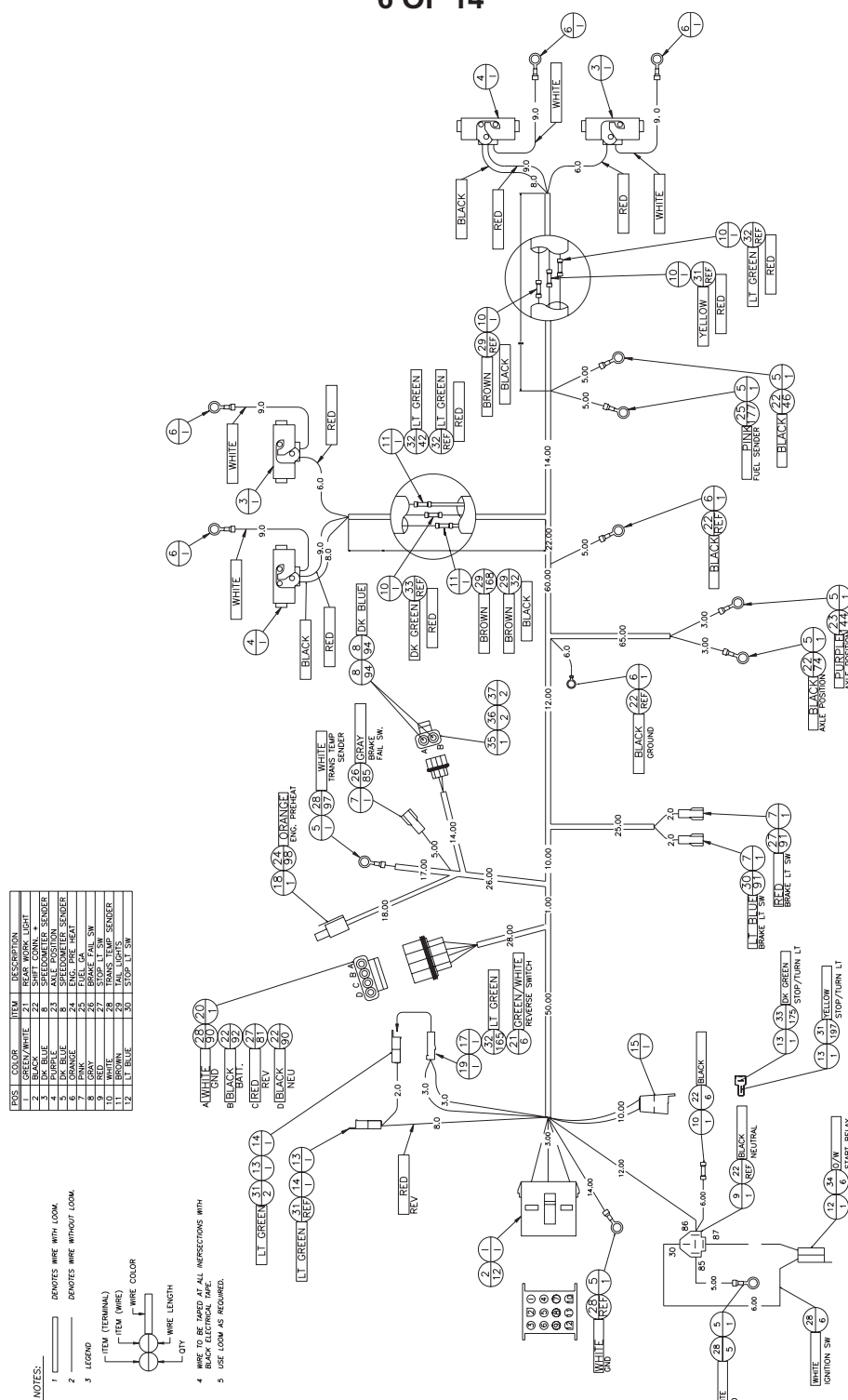
ELECTRICAL HARNESS
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Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
9	42917		Harness, Steering, 200MB4		1

ELECTRICAL HARNESS

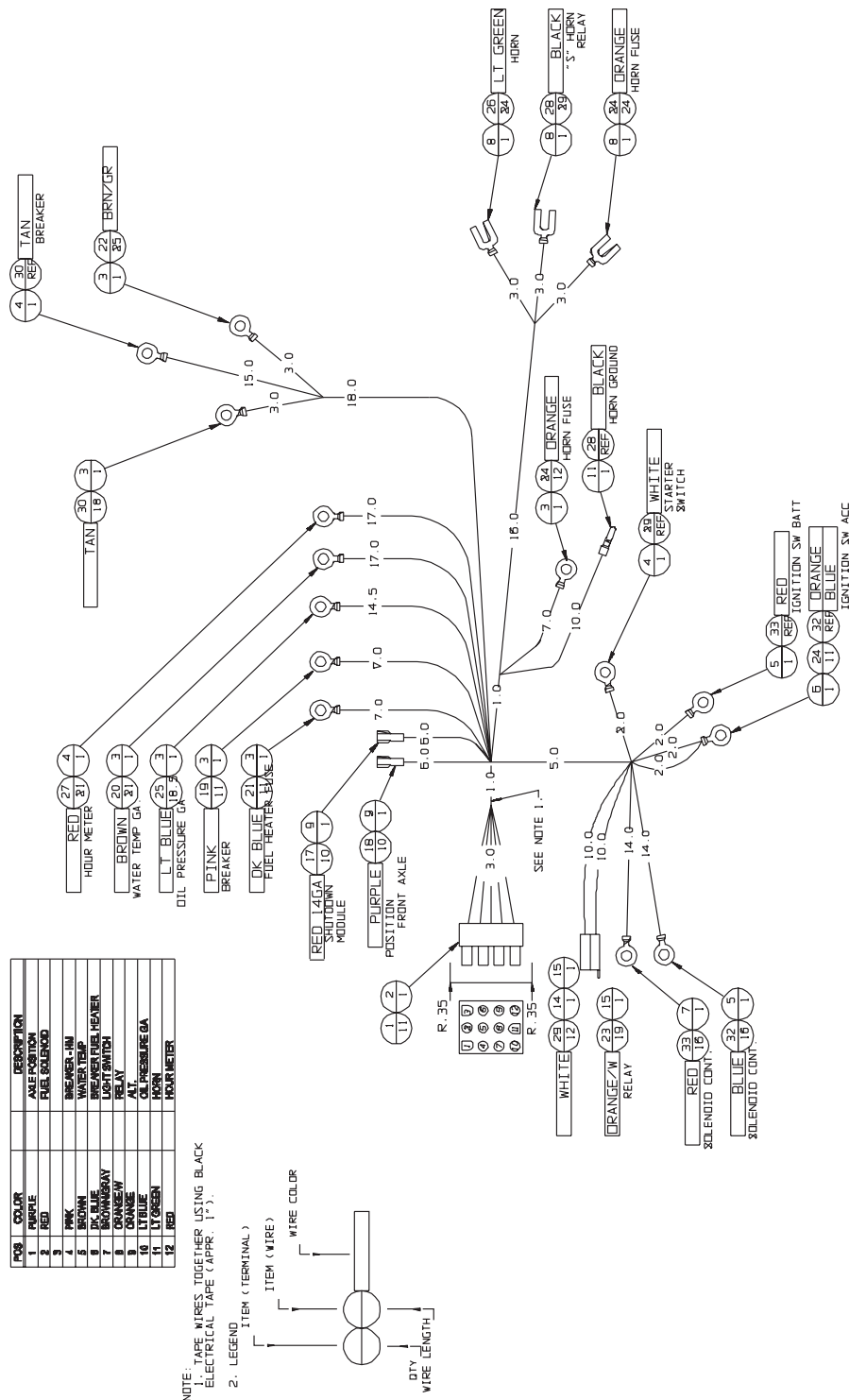
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Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
10	42979		Harness, Rear		1

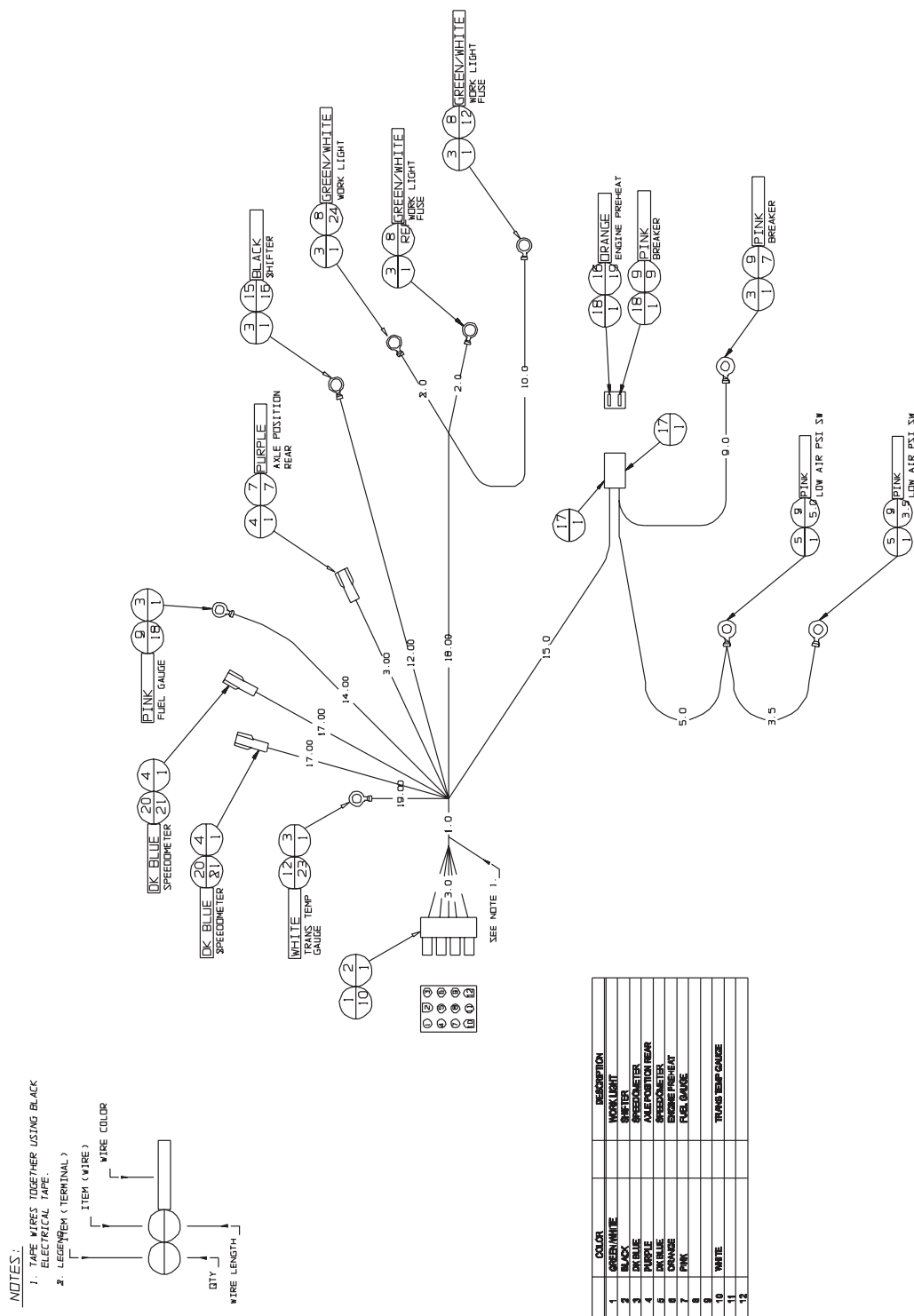
ELECTRICAL HARNESS

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Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	43897		Harness, Dash I 200MB4-1		1

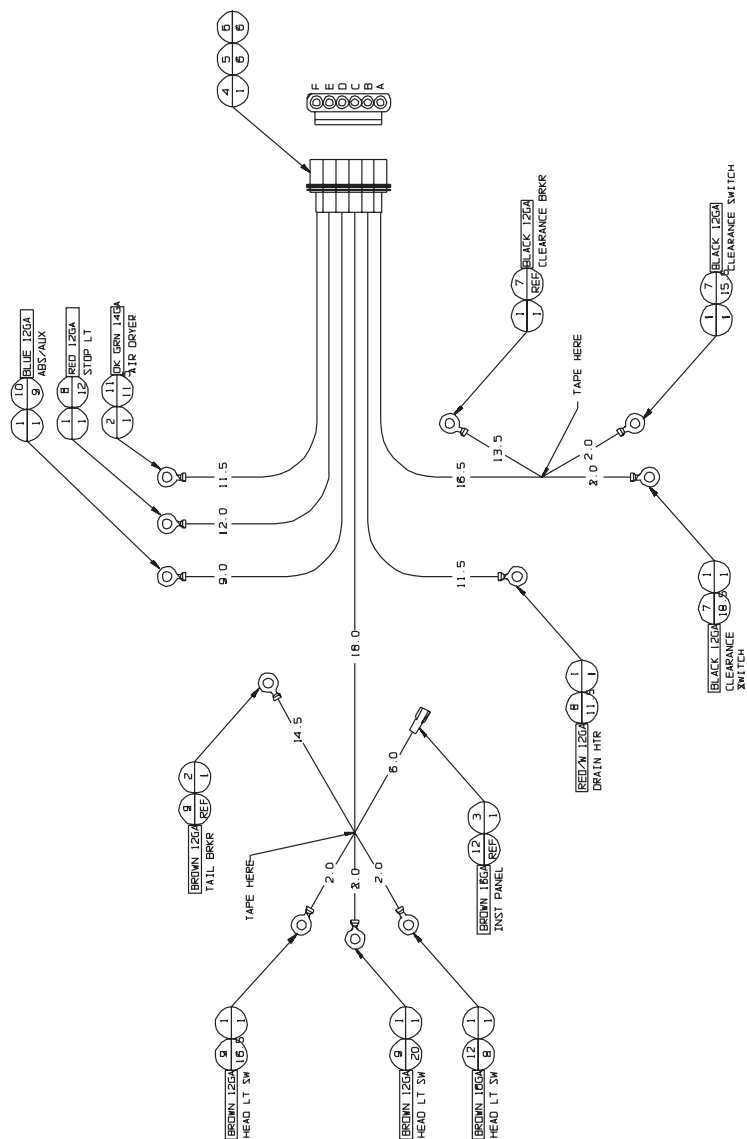
ELECTRICAL HARNESS 8 OF 14



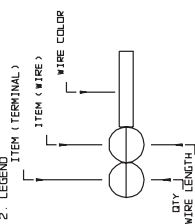
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	43898		Harness, Dash II 200MB4-1		1

ELECTRICAL HARNESS

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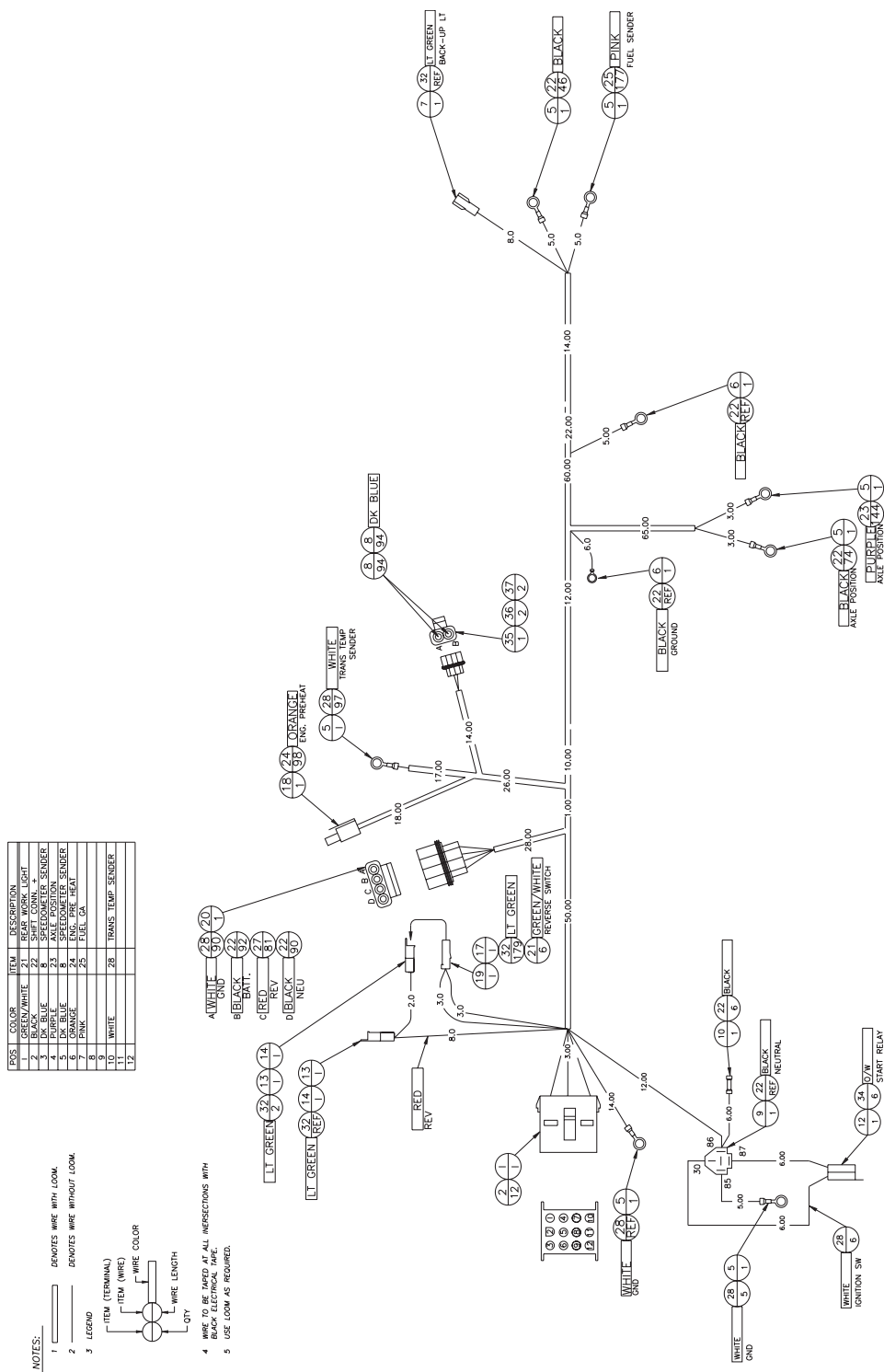


NOTE: 1. TAPE WIRES TOGETHER USING BLACK ELECTRICAL TAPE (APPR. 1").



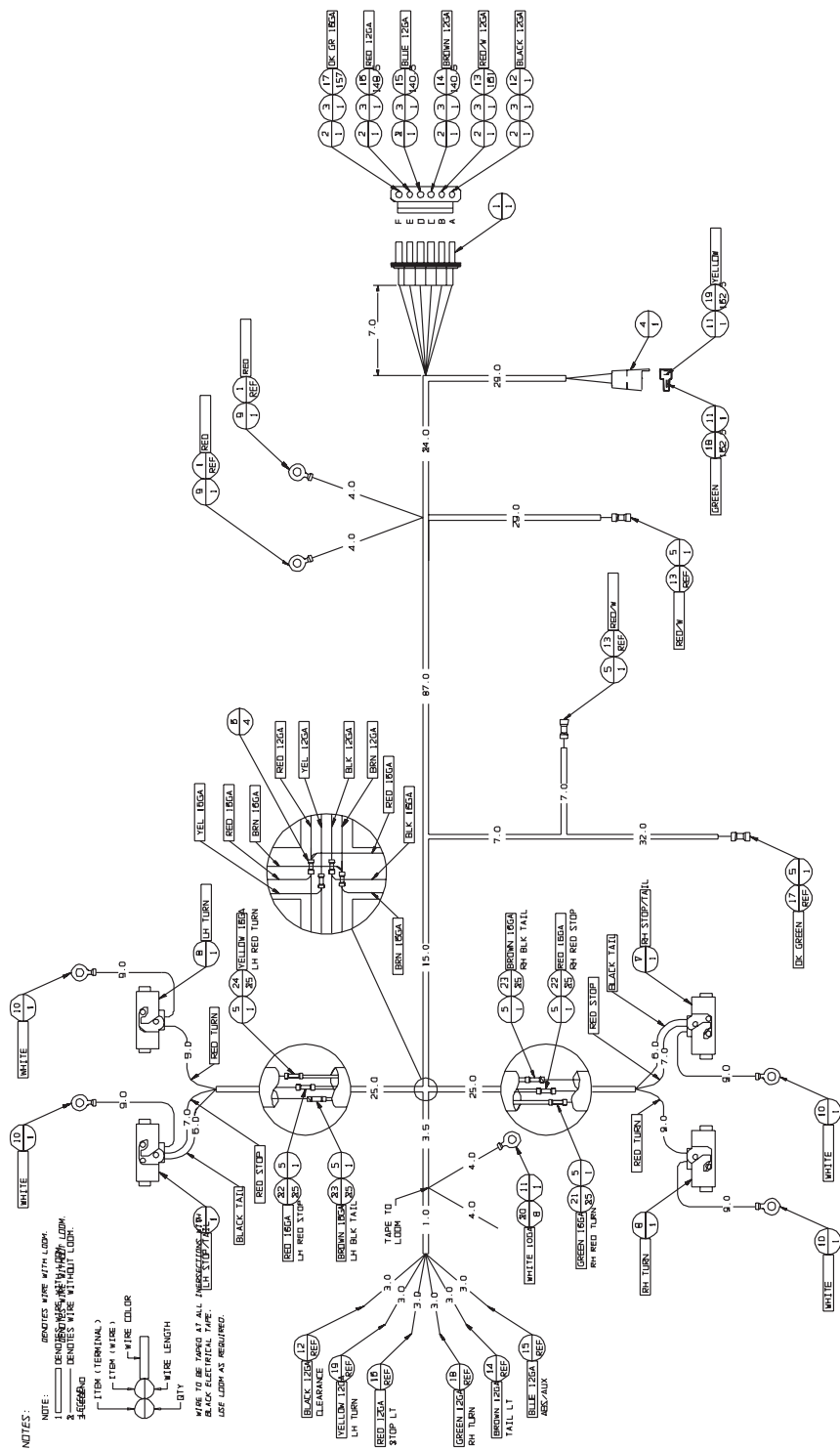
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	43899		Harness, Dash III 200MB4-1		1

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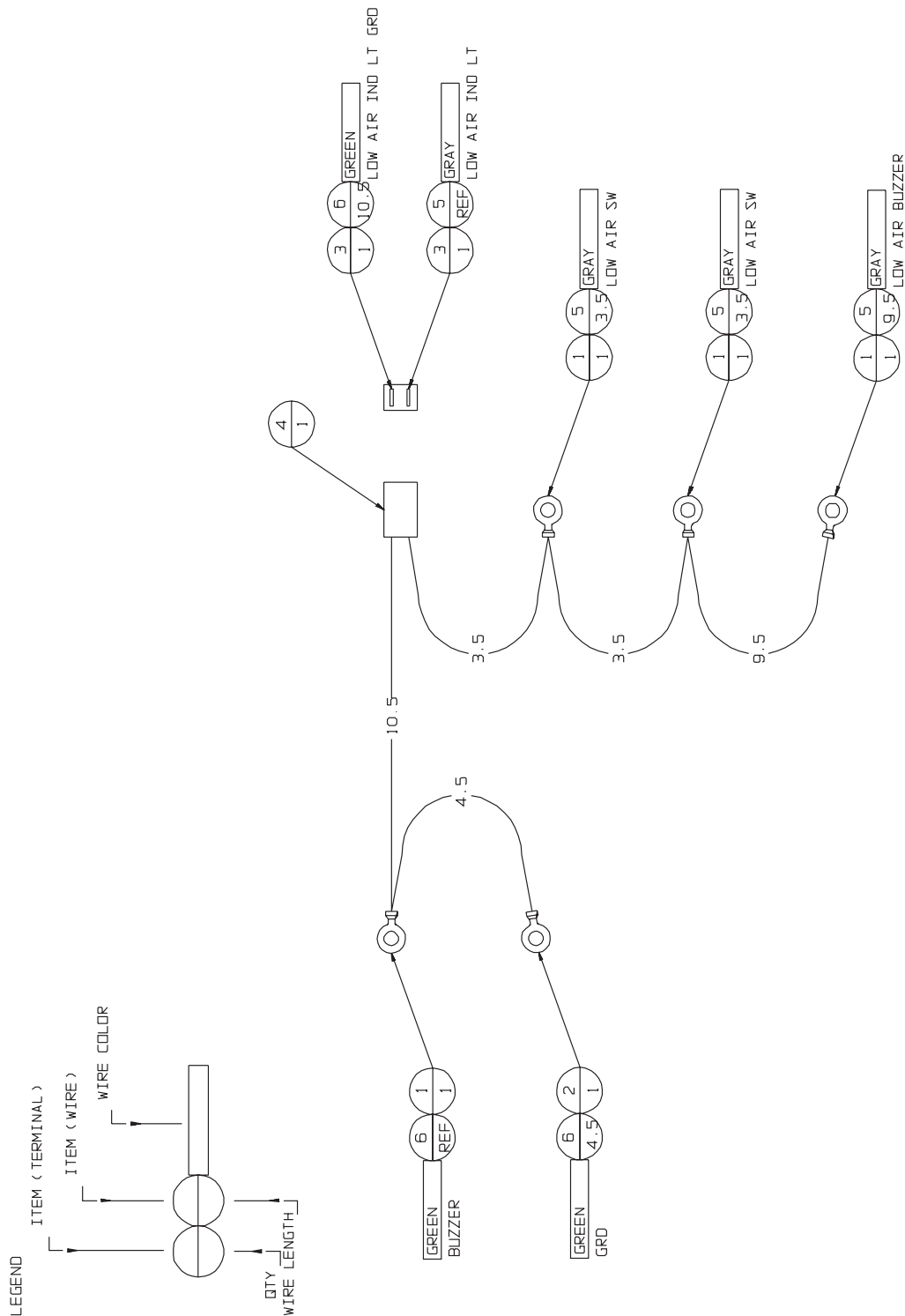
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	43900		Harness, Rear I 200MB4-1		1

ELECTRICAL HARNESS
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Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	43901		Harness, Rear II 200MB4-1		1

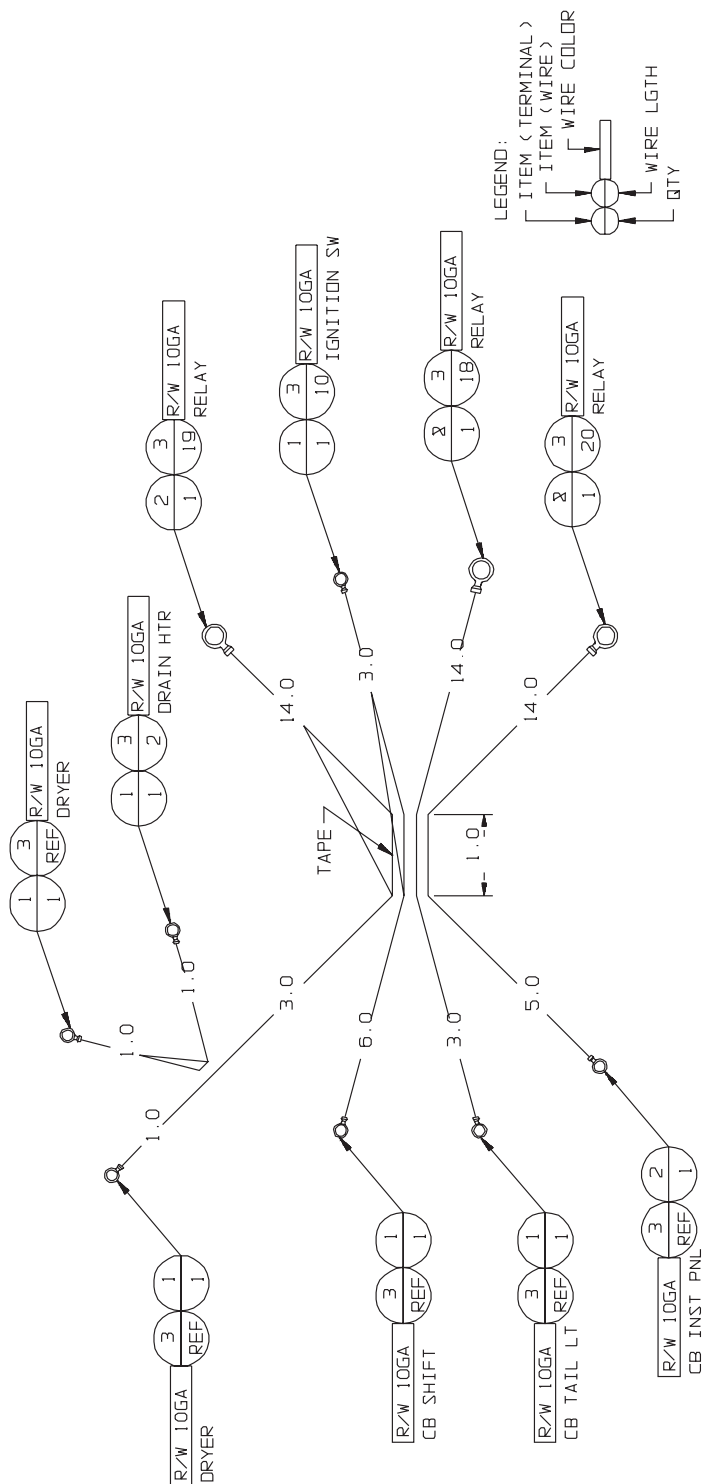
ELECTRICAL HARNESS 12 OF 14



Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	43922		Harness, Low Air Pressure 200MB4-1		1

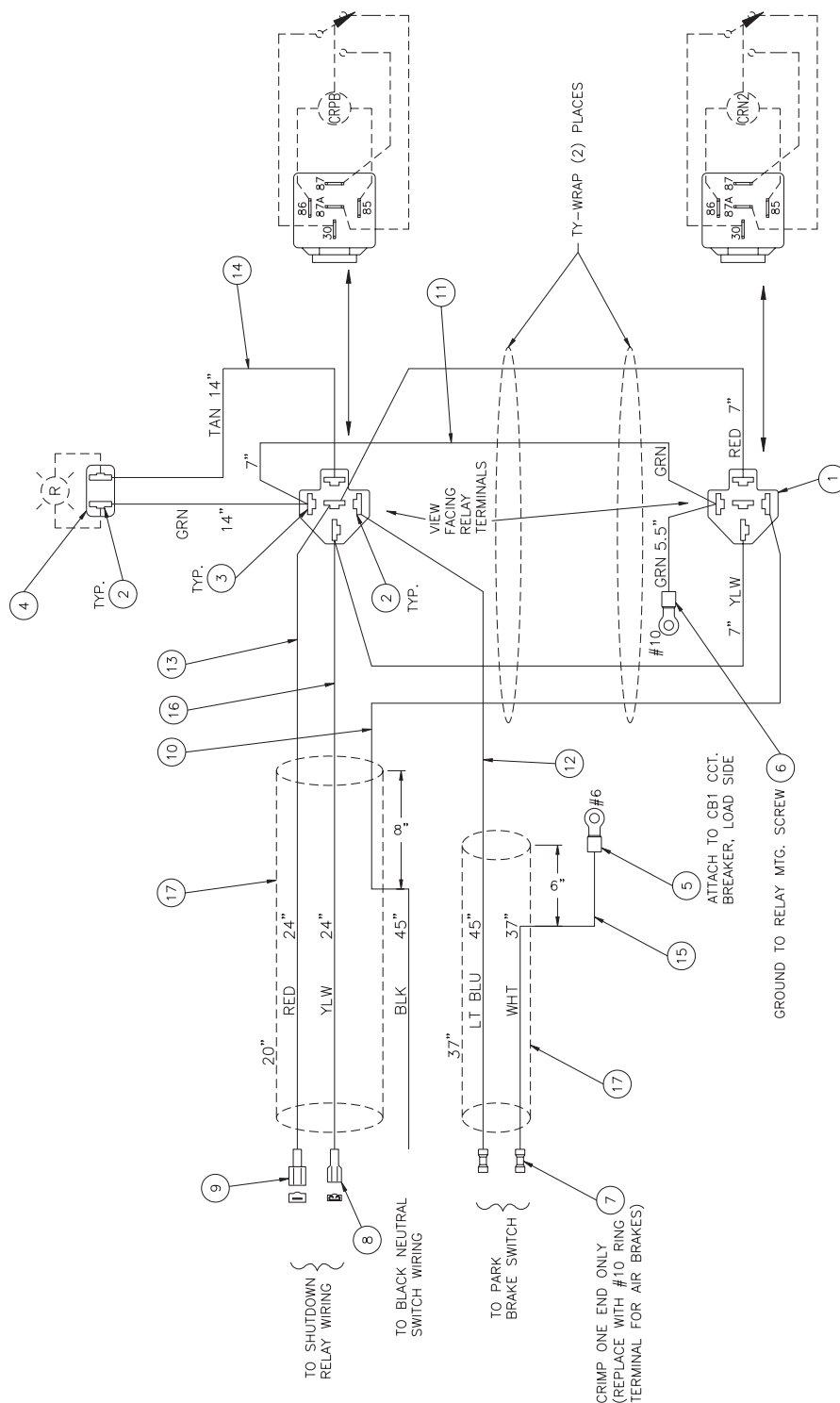
ELECTRICAL HARNESS

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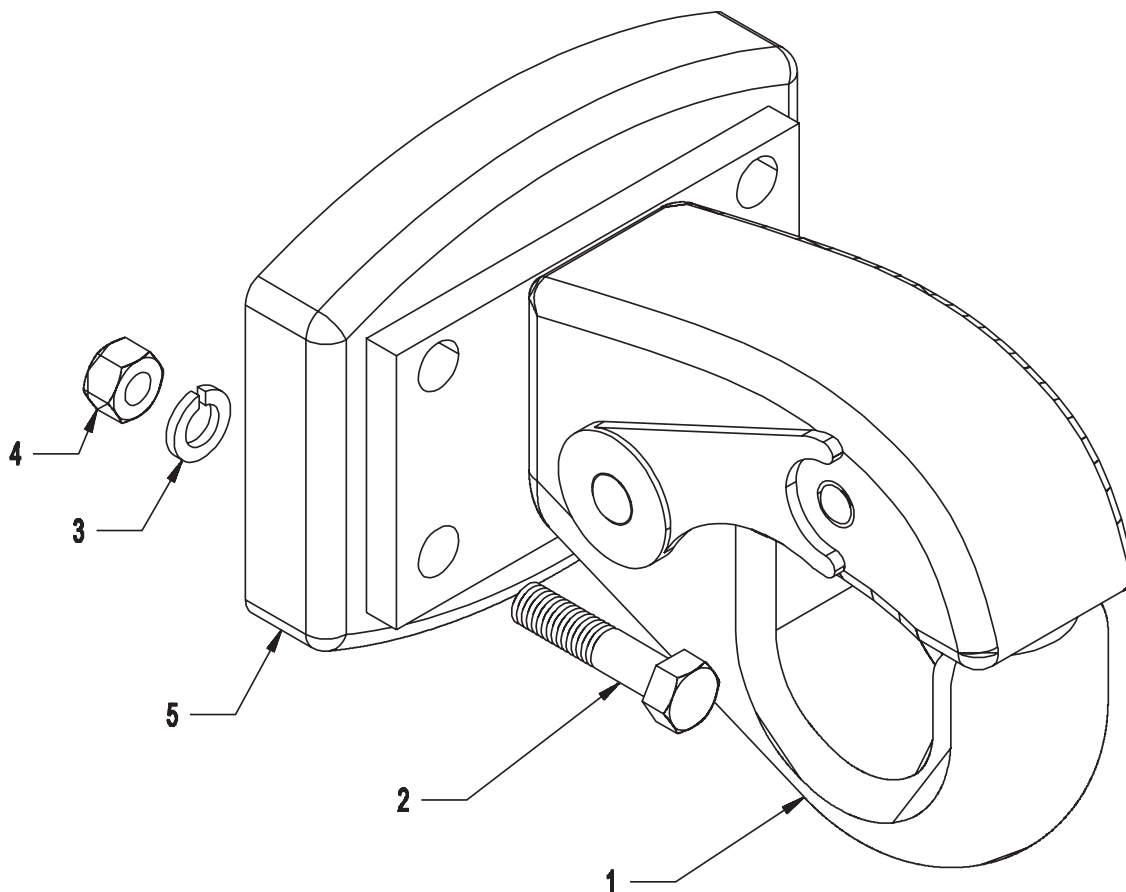
Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	43932		Harness, Breakers, 200MB4-1		1

ELECTRICAL HARNESS
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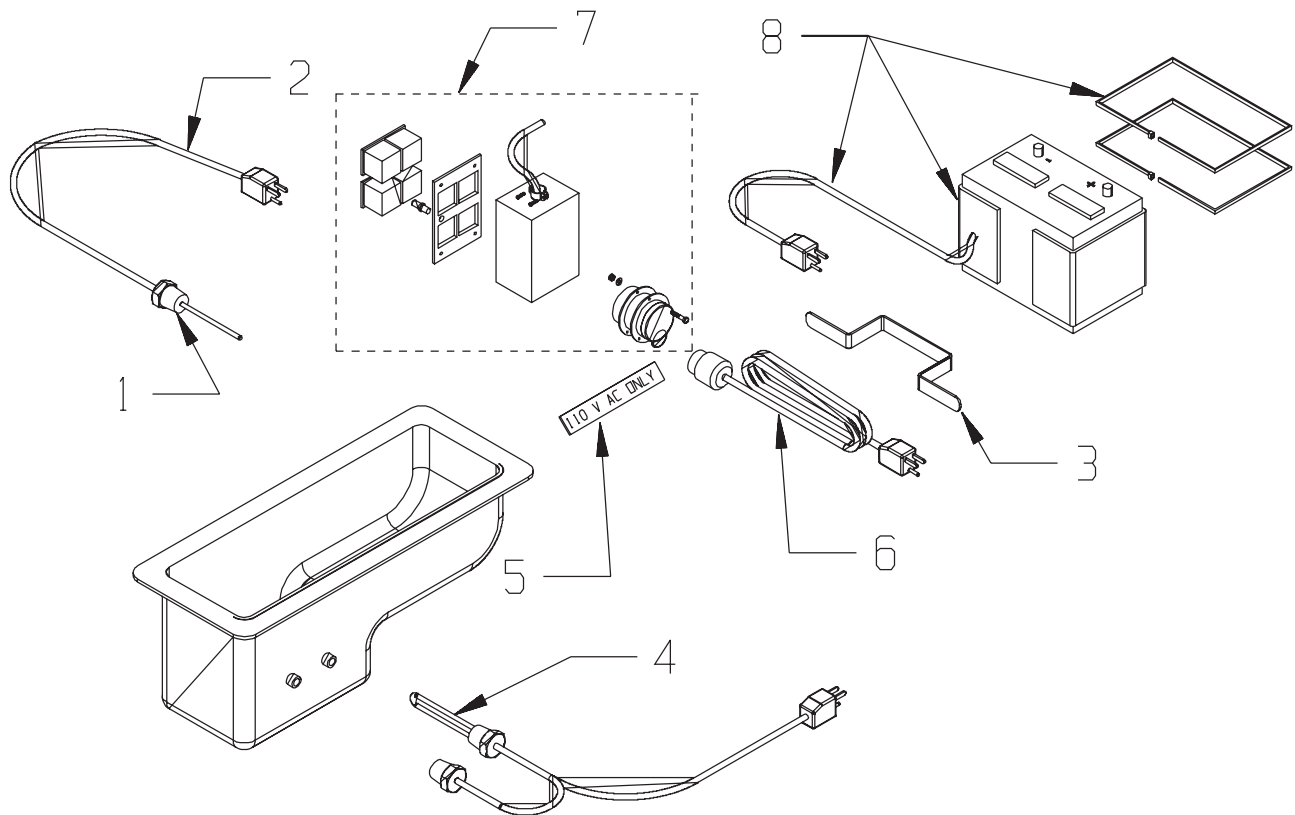


NOTE: ADDITIONAL TY-WRAPS AS REQUIRED TO HOLD FORM, AND FOR NEAT APPEARANCE

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	44782		Harness, Park Brake Shut Down M200MB4		1

HITCH, COUPLER, PINTLE HOOK, OPTION

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	T427979-21		Hitch, Coupler, Pintle Hook		Ref
	T464359-21		Hitch Asm, Pintle Hook, 200MB4		Ref
1	38906	PH-30	Hitch, Pintle Hook, Holland, Option		2
	NW22773	PH-T60-AOL-8	Hitch, Pintle Hook 30,000		2
2	203194		HHCS, 1/2-13 x 2.50 GR 8, Front, All Units		4
	203194		HHCS, 1/2-13 x 2.50 GR 8, Rear, Hyd Brake Units		4
	F100416		HHCS, 1/2-13 x 3.00 GR 8, Rear, Air Brake Units		4
3	F015973		Lock Washer, 1/2		8
4	45832		Hex Nut, 1/2-13, GR 8 Lock		4
5			Plate, Hitch Extension (Not Used)		1

WINTERIZATION KIT

Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
0	44350		Winterization System, Opt		Ref
1	41855		Heater, Block, 3/4 NPT		1
2	41856		Cord, Block Heater For Cummins		1
3			Bracket, Cord		1
4	44625		Heater, Immersion		1
5	562A54		Placard		1
6	44627		Cord, Extension, Winterization		1
7	44626		Box, Junction, w/Receptacle (Katco Service Parts)		1
7a	44626-1		Outlet		2
7b	44626-2		Circuit Breaker		1
8	300301		Heater, Battery, Blanket		1

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11 MANUFACTURERS INFORMATION

This chapter contains the following OEM publications

Transmission, Funk, 2000 Series Service Manual

Axle, Front And Rear, Dana Spicer (Clark Hurth), Maintenance and Repair Manual, 212 MO212S20

Hydraulic Brake Master Cylinder Service Instructions, Mico

Hydraulic Brake Power Assist Service Instructions, Mico

Air/Hydraulic Actuators, Mico, Part No. 43730

UEA Shift Quadrant Service Instructions

Air Dryer, Bendix, Part No. 43504

Air System MV-3 Control Valve, Bendix, Part No. 43507

Air System TP-5 Protection Valve, Bendix, Part No. 43732

Air System, Air Limiting Valves, Bendix, Part No. 45397 & 43731

Drain Valve, Expello Pneumatic, Part No. NW035927

E-6 Dual Brake Valve 43743

Engine, Cummins, QSB5.9-44, Operation and Maintenance Manual

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2000 Series Service Manual



For complete service information also see:
2000 Series Transmission Manual..... 4003558

FunkManufacturingCompany
CTM195 (28JUN99)
LITHO IN U.S.A.
ENGLISH

4003557

Introduction

FOREWORD

This manual is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use.

Live with safety: Read the safety messages in the introduction of this manual and the cautions presented throughout the text of the manual.



This is the safety-alert symbol. When you see this symbol on the machine or in this manual, be alert to the potential for personal injury.

Information is organized in groups for the various components requiring service instruction. At the beginning of each group are summary listings of all applicable essential tools, service equipment and tools, other materials needed to do the job, specifications, wear tolerances, and torque values.

Component Technical Manuals (CTM) are concise guides for specific machines. They are on-the-job guides containing only the vital information needed for diagnosis, analysis, testing, and repair.

DX,TMIFC -19-22MAY92-1/1

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2000 Series Transmission

- Group 05—Safety
- Group 10—General Information
- Group 15—Oil Recommendation
- Group 100—Test and Troubleshooting

INDX

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2000 Series Transmission

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RECOGNIZE SAFETY INFORMATION

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.



DX,ALERT -19-07DEC88-1/1

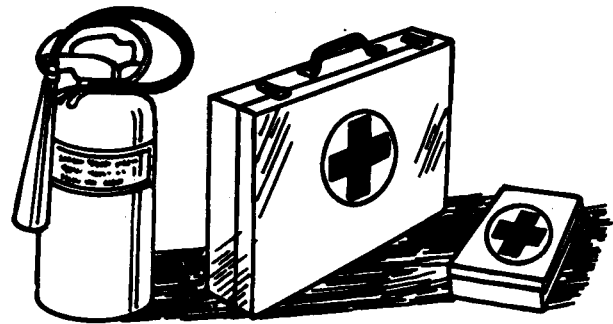
T81389 -UN-07DEC88

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



DX,FIRE2 -19-03MAR93-1/1

TS291 -UN-23AUG88

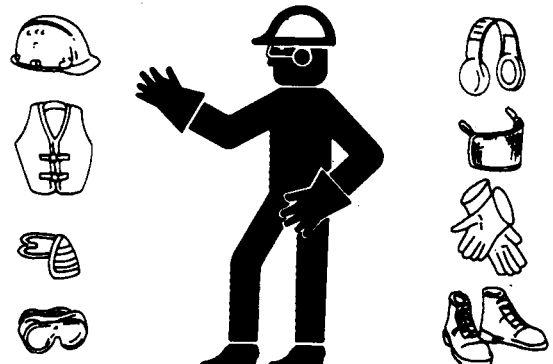
WEAR PROTECTIVE CLOTHING

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



DX,WEAR -19-10SEP90-1/1

TS206 -UN-23AUG88

WORK IN VENTILATED AREA

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.



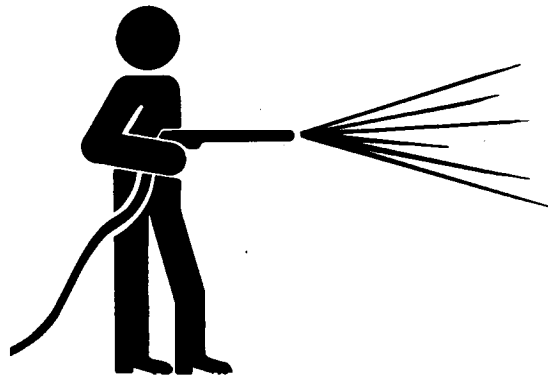
DX,AIR -19-23AUG88-1/1

TS220 -UN-23AUG88

WORK IN CLEAN AREA

Before starting a job:

- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.

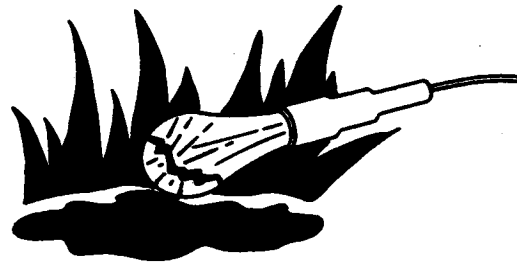


DX,CLEAN -19-04JUN90-1/1

T6642EJ -UN-18OCT88

ILLUMINATE WORK AREA SAFELY

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

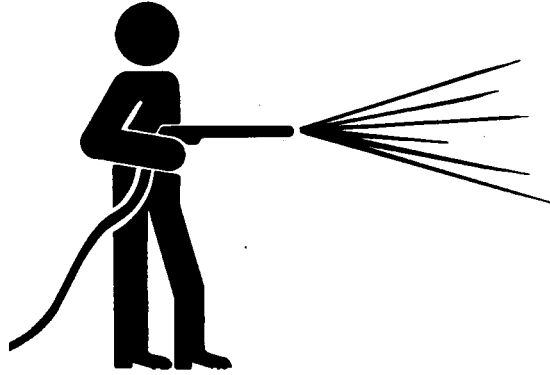


DX,LIGHT -19-04JUN90-1/1

TS223 -UN-23AUG88

USING HIGH-PRESSURE WASHERS

IMPORTANT: Directing pressurized water at electronic/electrical components or connectors, bearings and hydraulic seals, fuel injection pumps or other sensitive parts and components may cause product malfunctions. Reduce pressure, and spray at a 45 or 90 degree angle.



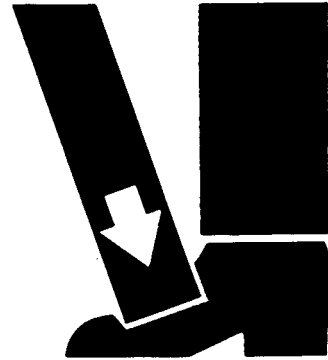
T6642EJ -UN-18OCT88

DPSG,YZ07927,186 -19-04MAR99-1/1

USE PROPER LIFTING EQUIPMENT

Lifting heavy components incorrectly can cause severe injury or machine damage.

Follow recommended procedure for removal and installation of components in the manual.



TS226 -UN-23AUG88

DX,LIFT -19-04JUN90-1/1

USE PROPER TOOLS

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only service parts meeting John Deere specifications.



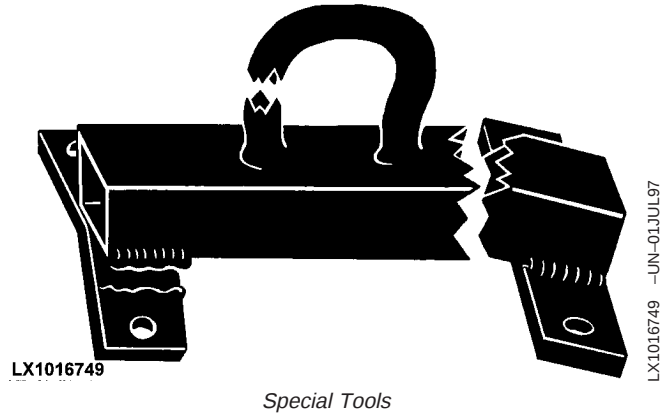
TS779 -UN-08NOV89

DX,REPAIR -19-04JUN90-1/1

USING SPECIAL TOOLS

Faulty or broken tools can result in serious injury. When constructing tools, use proper, quality materials and good workmanship.

Do not weld tools unless you have the proper equipment and experience to perform the job.

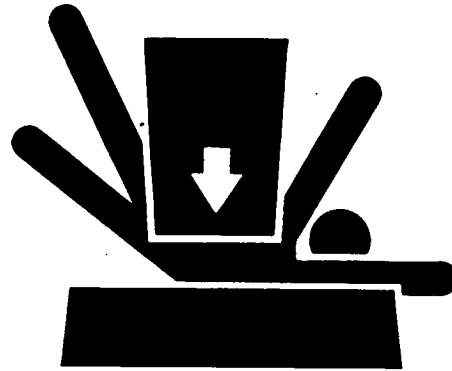


DPSG,YZ07927,122 -19-06JUL99-1/1

SUPPORT MACHINE PROPERLY

Always lower the attachment or implement to the ground before you work on the machine. If you must work on a lifted machine or attachment, securely support the machine or attachment.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.



TS229 -UN-23AUG88

DX,LOWER -19-04JUN90-1/1

HANDLE FLUIDS SAFELY—AVOID FIRES

When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags; they can ignite and burn spontaneously.



TS227 -UN-23AUG88

DX,FLAME -19-04JUN90-1/1

PREVENT BATTERY EXPLOSIONS

Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).



TS204 -UN-23AUG88

DX,SPARKS -19-03MAR93-1/1

PREVENT ACID BURNS

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

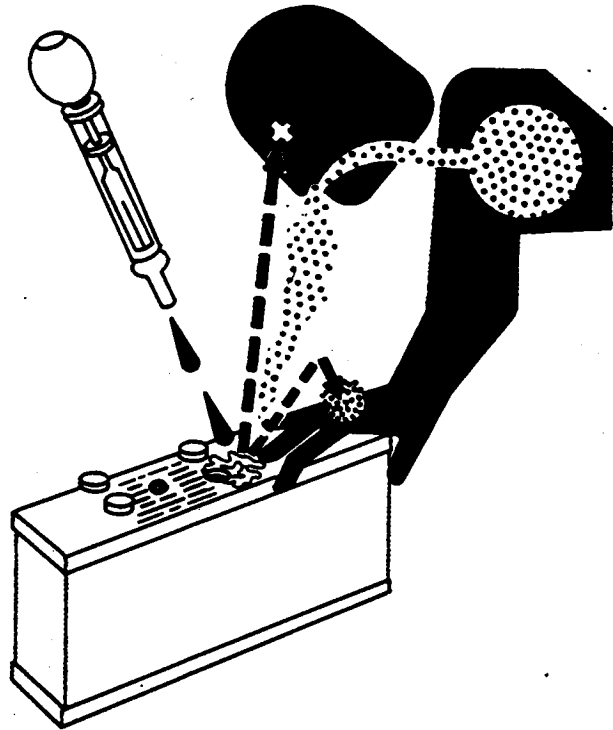
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 15—30 minutes. Get medical attention immediately.

If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.



TS203 -UN-23AUG88

DX,POISON -19-21APR93-1/1

AVOID HEATING NEAR PRESSURIZED FLUID LINES

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.



TS953 -UN-15MAY90

DX,TORCH -19-03MAR93-1/1

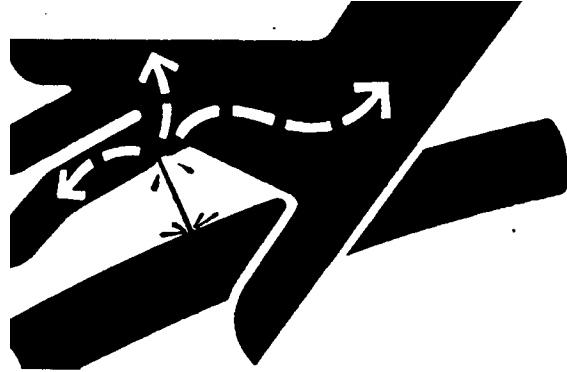
AVOID HIGH-PRESSURE FLUIDS

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.



X9811 -UN-23AUG88

DX,FLUID -19-03MAR93-1/1

LIVE WITH SAFETY

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.



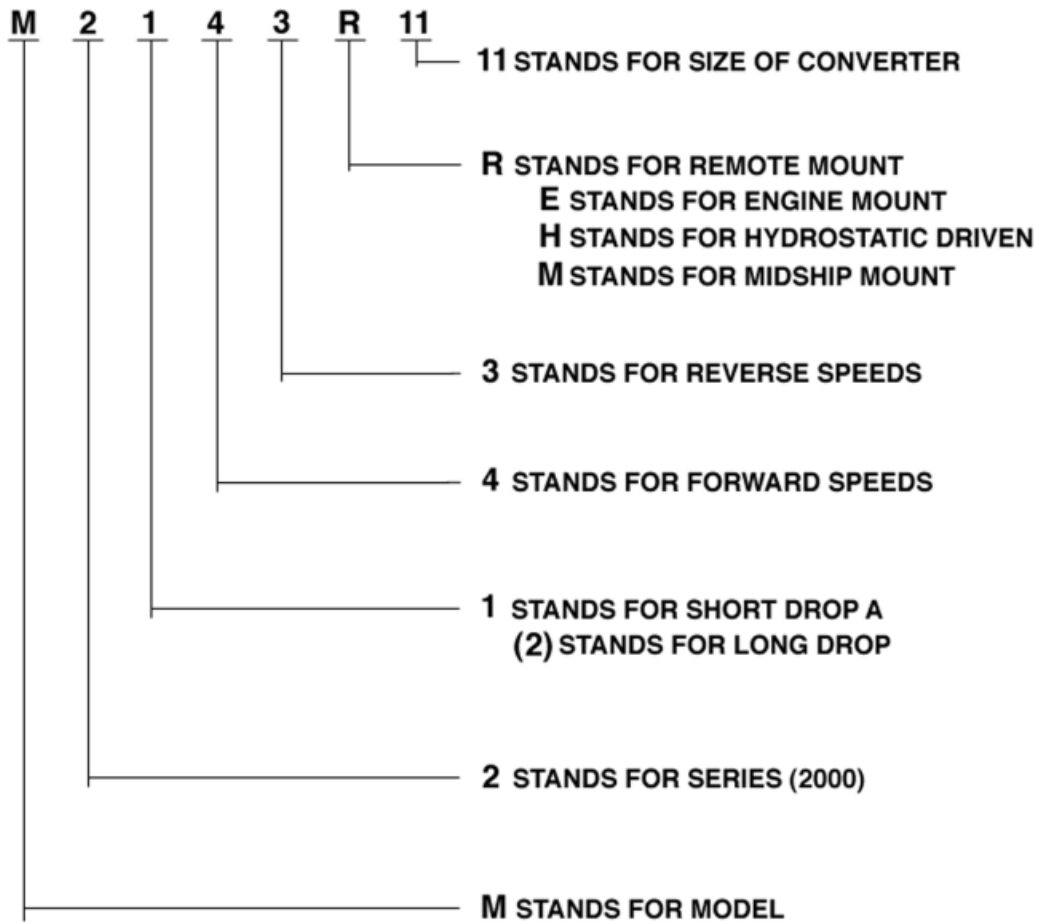
TS231 -19-07OCT88

DX,LIVE -19-25SEP92-1/1

SPECIFICATIONS

Item	Measurement	Specification
2000 Series Transmission	Oil	Hydraulic transmission fluid.
	Filter	Remote mounted spin-on type filter.
Transmission Operating Conditions	Pressures and Flows at Control Valve. All pressure and flow tests must be accomplished at 2000 rpm at a converter out temperature of 40.6—51.7°C (105—125°F).	Maximum input speed (3000 rpm)
		Test input speed (2000 rpm) at a converter out temperature of 40.6—51.7°C (105—125°F).
		Maximum continuous operating temperature 93°C (200°F)
		Maximum intermittent temperature 110°C (230°F)
		Maximum temperature 121°C (250°F)
		Normal operating temperature 71—93°C (160—200°F)
		Check oil level temperature 71—93°C (160—200°F)
		Port # 2 (Refer to Setting The Clutch Pressure in group 100) Pump pressure is higher than clutch pressure, not to exceed clutch pressure by 105 kPa (15 psi)
		Pump out flow at 2000 rpm, 40.6—51.7°C (105—125°F) is 74.5 Lpm (19.6 gpm) (Refer to "PRESSURE AND FLOW CHECKS AT OTHER LOCATIONS" group 100).
		Converter out flow at 2000 rpm, 40.6—51.7°C (105—125°F) is 64.6 Lpm (17 gpm) (Refer to "PRESSURE AND FLOW CHECKS AT OTHER LOCATIONS" group 100).
Towing	Voltage Requirements	Converter out pressure at full throttle stall is not to be less than 241 kPa (35 psi) at 82.2—93.3°C (180—200°F) (Refer to "PRESSURE AND FLOW CHECKS AT OTHER LOCATIONS" group 100).
		Port #1 (Refer to Setting The Clutch Pressure in group 100) Clutch pressure 1655—1790 kPa (240—260 psi)
		Port #3 (Refer to "SETTING THE CLUTCH PRESSURE" and "PRESSURE AND FLOW CHECKS AT THE VALVE" in group 100) Converter in pressure 585 kPa (85 psi)
		Lube, in pressure at 2000 rpm, 40.6—51.7°C (105—125°F) is not to exceed 170 kPa (25 psi) or be less than 70 kPa (10 psi) (Refer to "PRESSURE AND FLOW CHECKS AT OTHER LOCATIONS" group 100).
Voltage Requirements		Do not exceed 5 km/h (3 mph)—Tow no further than 2 km (1 mile)
		See group 100 "CLUTCH SOLENOID VOLTAGE REQUIREMENTS"

MODEL IDENTIFICATION



2000 Model Identification

YZ1883 -UN-20JUL99

DPSG,YZ07927,124 -19-08JUL99-1/1

PARTS ORDERING

Should repair parts be required, please specify the model, specification, serial numbers and equipment numbers of your unit. The identification plate is located on the top of the front cover (refer to "2000 SERIES TRANSMISSION COMPONENT IDENTIFICATION" this group for location). All information on identification plate is needed when contacting FUNK.

Contact:

Funk Manufacturing Company

Attn.: Parts Department

Industrial Park, Highway 169 North

P.O. Box 577

Coffeyville, Kansas 67337-0577

Phone: 316-252-3400 or 800-844-1337

Fax: 316-252-3252



2000 Series Tag

YZ1873 -UN-24JUN99

DPSG,YZ07927,131 -19-19JUL99-1/1

SERVICE INFORMATION

When contacting our Service Department include equipment number.



Current 2000 Series ID Tag

YZ1881 -UN-22JUL99

DPSG,YZ07927,75 -19-21JUN99-1/1

2000 SERIES POWERSHIFT TRANSMISSION THEORY OF OPERATION

The Series 2000 Shift-O-Matic is a six speed forward, three speed reverse transmission. However, several different ranges can be achieved such as: 4-1, 5-1, 3-3 etc.

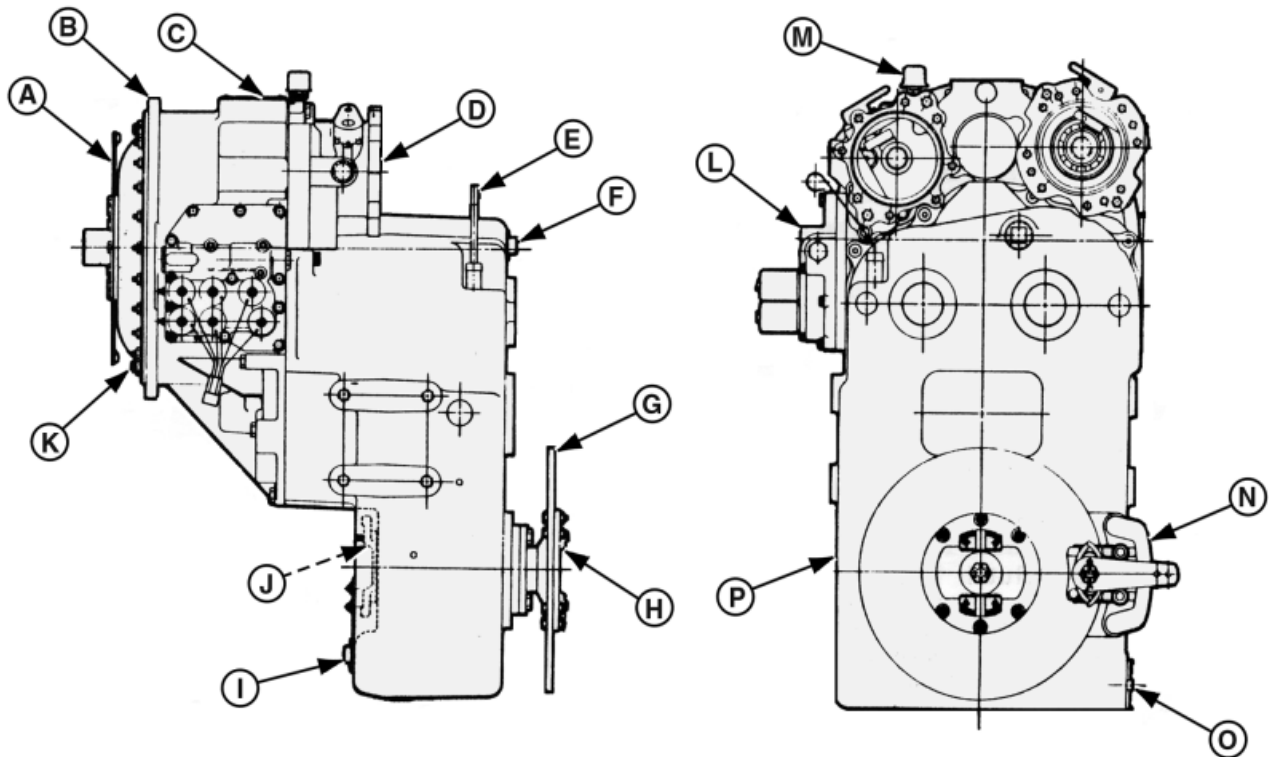
Forward motion, reverse motion, and the speeds are obtained through the use of electrically controlled solenoids and hydraulically actuated multiple disc clutches. These clutches are power absorbing members that can be engaged at full engine power. Shifting under full engine power makes this a full powershift for the forward and reverse motion in all speeds.

The clutches in these units are hydraulically applied and spring released. Because the clutches are hydraulically controlled, there is automatic compensation for normal wear, which eliminates the

need for adjustment. Each clutch uses a composition friction plate and a polished steel reaction plate.

The power from the engine is transmitted to the Shift-O-Matic through a torque converter. The use of the torque converter has two distinct advantages: (1) The converter is essentially a fluid drive, there being no direct mechanical connection between the engine and transmission assembly. This feature creates a very smooth and shock-free drive eliminating engine stalling. (2) The converter multiplies torque during heavy pull-down loads. When loads are light, the converter transmits the engine power directly at almost engine speed, and there is no torque multiplication. The net result is an action like a transmission, with infinitely variable and automatic speed ratios. The need for shifting gears, although present, is greatly reduced.

DPSG,YZ07927,76 -19-21JUN99-1/1

2000 SERIES TRANSMISSION COMPONENT IDENTIFICATION*2000 Series Identification*

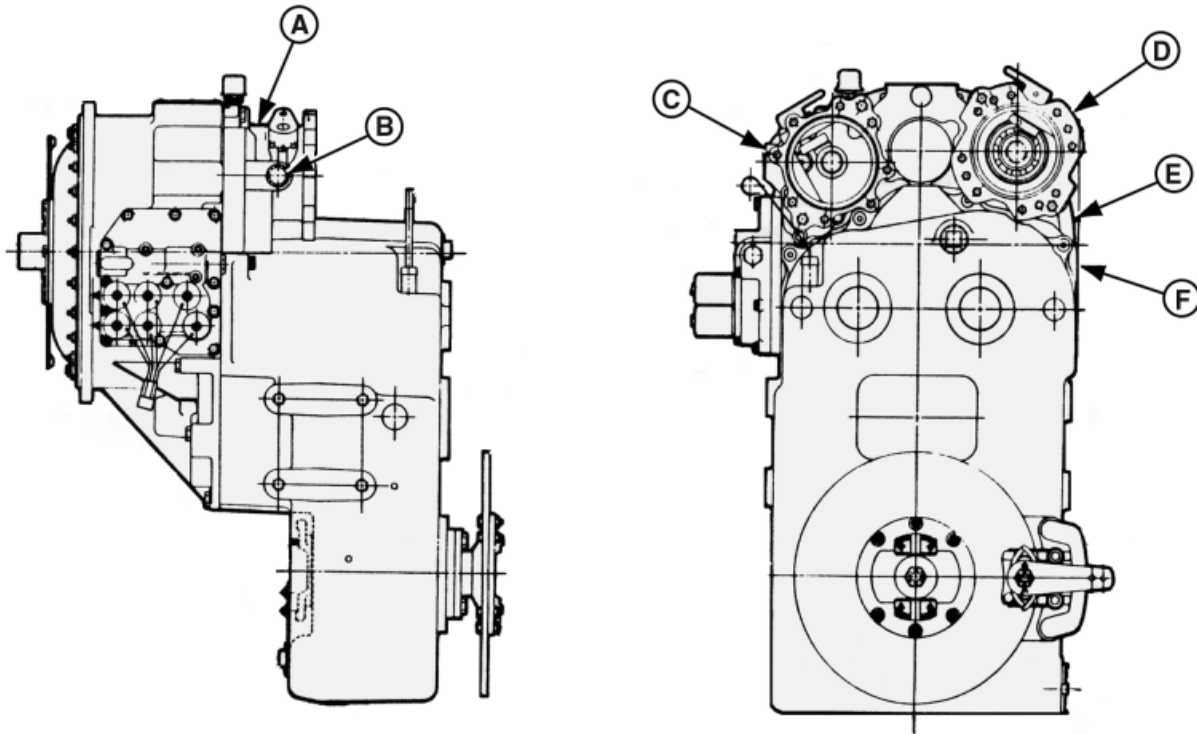
A — Laminated Drive Plate
B — Front Cover
C — Serial Tag Location
D — Charge Pump
E — Dip Stick
F — Oil Fill Plug
G — Parking Brake Disk
H — Output Yoke

I — Location for Customer Supplied Dip Stick
J — Output Yoke
K — Converter
L — Control Valve
M — Breather
N — Parking Brake
O — Suction Tube Screen

YZ1875 -UN-28JUN99

DPSG,YZ07927,114 -19-28JUN99-1/1

2000 SERIES TRANSMISSION PORT IDENTIFICATION



2000 Series Port Identification

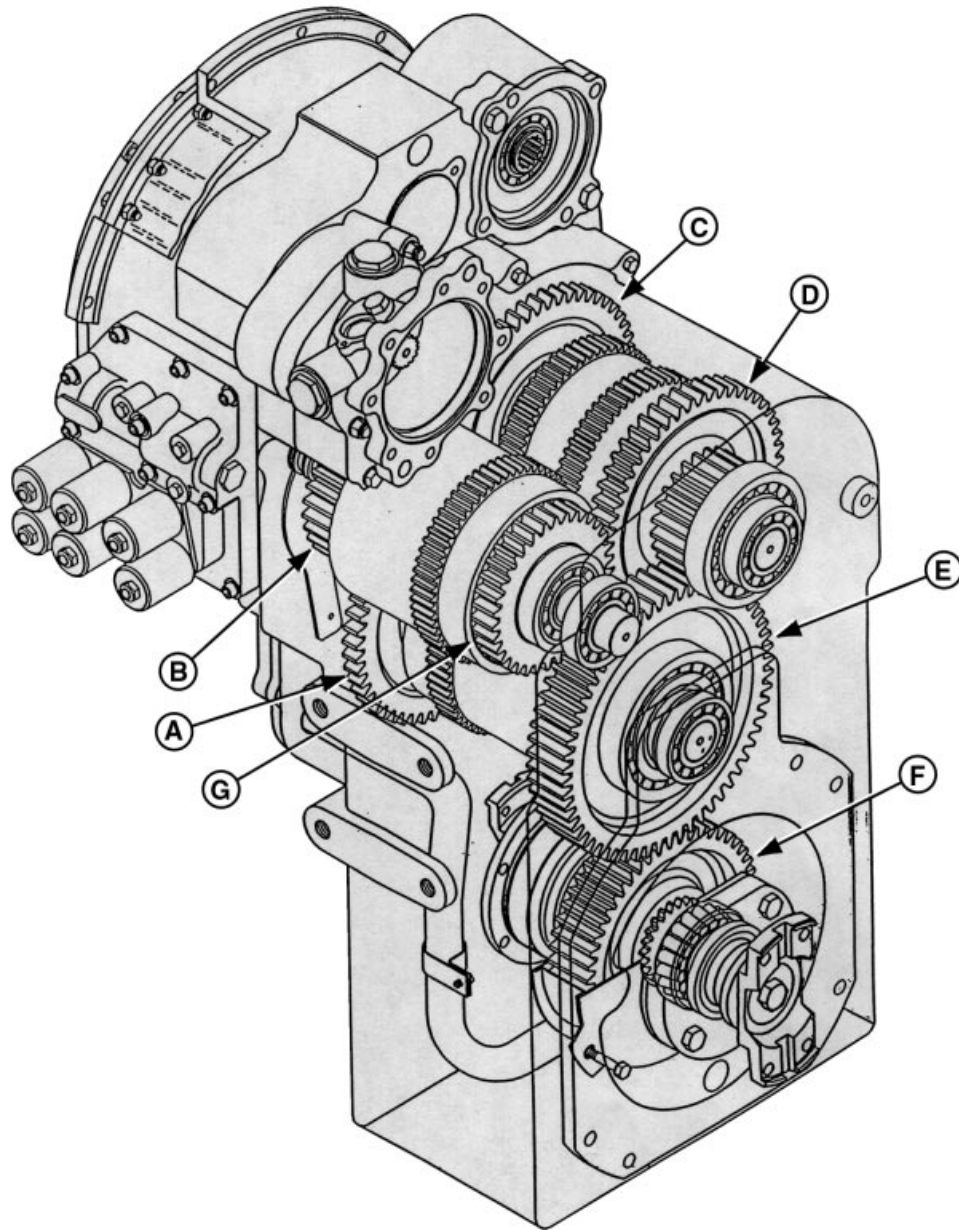
- A** — Pump Out to Filter
- B** — To Control Valve from Filter
- C** — Charge Pump with Auxiliary Disconnect

- D** — Auxiliary Pump Drive
- E** — Converter to Heat Exchanger
- F** — Lube in from Heat Exchanger

YZ1876 -UN-28JUN99

DPSG,YZ07927,115 -19-28JUN99-1/1

2000 SERIES CLUTCH GEAR IDENTIFICATION



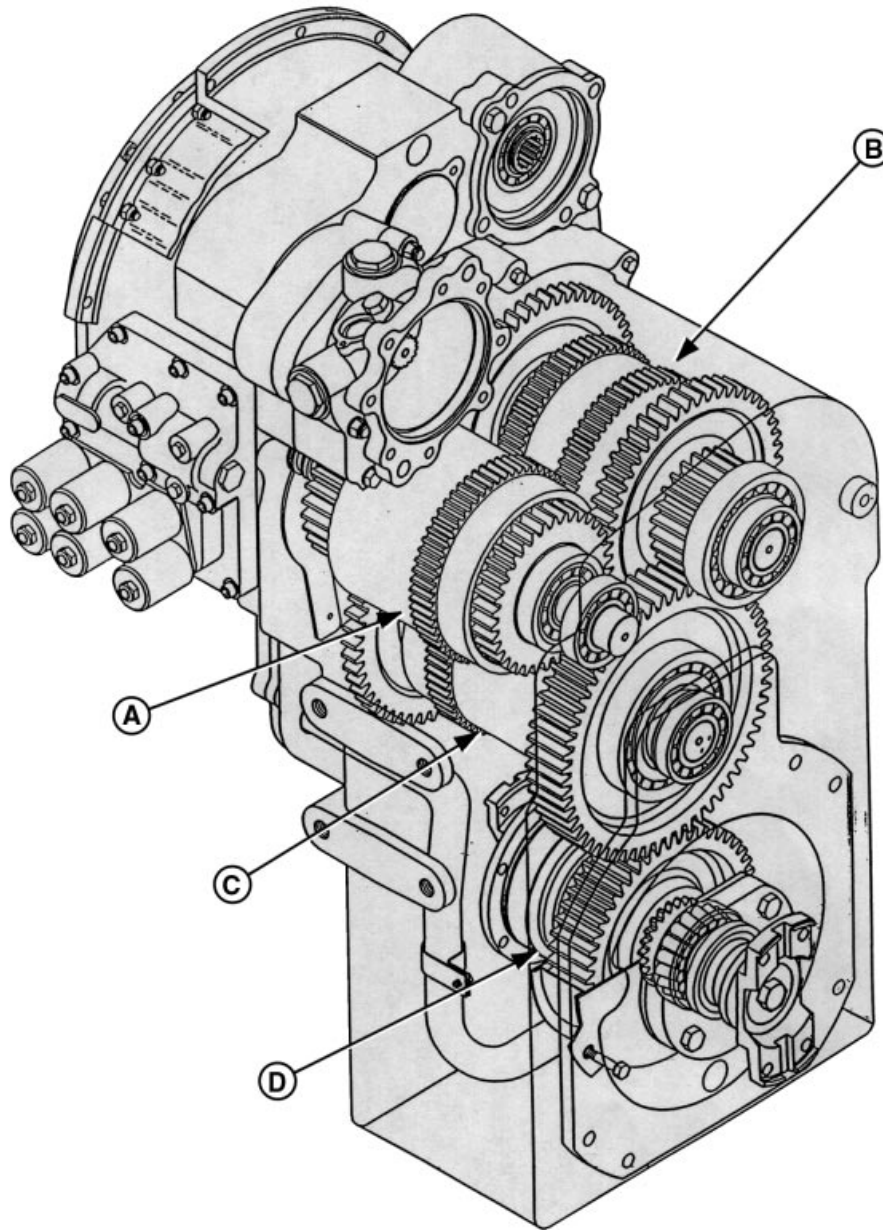
2000 Clutch Gears

A — Reverse Gear
B — Forward Hi Range
C — Forward Lo Range
D — Second Gear

E — Third Gear
F — Output
G — First Gear

YZ1878 -UN-30JUN99

2000 SERIES CLUTCH LOCATION LONG DROP



Clutch Location - Long Drop

A — First Stage Clutch Assembly
B — Second Stage Clutch Assembly

C — Third Stage Clutch Assembly
D — Output Assembly

YZ1879 —UN—30JUN99

OPERATION

Like all mechanical equipment, the Shift-O-Matic Drive will need attention and servicing. Routine checks will help prevent down time. The operator can aid in preventative maintenance by reporting weak or borderline malfunctions.

Because the unit operates "in" oil and "by" oil, most of the maintenance is concerned with oil replenishment

and oil cleanliness. The type of service and operating conditions shall determine the maintenance interval. However, as previously stated, it is especially important that the oil be kept clean.

DPSG,YZ07927,77 -19-21JUN99-1/1

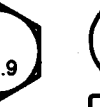
RULES OF OPERATION

NOTE: Clean area around the dip stick before removing.

1. Check the oil level daily, with the engine at idle speed, the Shift-O-Matic in neutral, and the transmission oil temperature 160—200°F (71—93.5°C).
2. The Shift-O-Matic must always be in neutral position before starting the engine, or when the vehicle is parked and the engine is running.
3. If the vehicle is to be towed, it will be necessary to run the engine at idle speed to lubricate the clutches.
4. If the engine cannot be run, towing must be limited to 4.82 km/h (3 mph) Maximum distance towing 2 km (one mile). If these conditions are to be exceeded, then the drive lines must be disconnected, and towing then, is permissible at speeds not to exceed the vehicle manufacturer recommended speeds.
5. If the oil temperature gauge, which is the converter oil out temperature, rises to 250°F (121.1°C) or the warning light comes on, stop the vehicle immediately. Shift to neutral and run the engine at 1000—2000 rpm. The temperature should drop rapidly to the engine water temperature, or if an air to oil exchanger is used, the temperature should drop rapidly to ambient air temperature across the heat exchanger. If the temperature does not drop, trouble is indicated, The trouble should be determined before the vehicle is operated again. Overheating generally occurs due to working in too high of a gear ratio.
6. Do not shut off the engine when unit is overheating, if the cooling system is known to be in working order.

DPSG,YZ07927,78 -19-21JUN99-1/1

10 10 METRIC BOLT AND CAP SCREW TORQUE VALUES

Property Class and Head Markings	4.8		8.8		9.8		10.9		12.9	
										
Property Class and Nut Markings	5		10		10		10		12	
										

Metric

Applies to non-lubricated plain or zinc plated fasteners.

Size	-	Class 8.8		Class 10.9	
		N •m	lb-ft	N•m	lb-ft
M5	-	6.1	4.5	9.0	6.6
M6	-	10.4	7.7	15.3	11.3
M8	-	25	19	37	27
M10	-	50	37	73	54
M12	-	87	64	128	94
M14	-	139	102	204	150
M16	-	216	160	318	234
M20	-	435	321	620	457
M24	-	730	555	1072	790
M30	-	1450	1103	2129	1570
M36	-	2533	1927	3721	2744

NOTE: Torque tolerance is $\pm 20\%$

Do not use these values if a different torque value or tightening procedure is given for a specific application.

METRIC BOLT AND CAP SCREW TORQUE VALUES chart meets Funk Engineering Procedures Manual Torque Specifications FEP 14.1.

UNIFIED INCH AND CAP SCREW TORQUE VALUES

SAE Grade and Head Markings	1 or 2 ^b			5	5.1	5.2	8	8.2
	NO MARK							
SAE Grade and Nut Markings	2			5		8		
	NO MARK							

TS1162 -19-04MAR91

Size	Grade 5		Grade 8	
	N•m	lb-ft	N•m	lb-ft
-				
1/4-20	11.1	8.2	16	11.6
1/4-28	12.8	9.4	18	13.3
5/16-18	23	16.9	32	23.9
5/16-24	25	18.7	36	26.4
-	-	-	-	-
3/8-16	41	30	57	42
3/8-24	46	34	65	48
7/16-14	65	48	92	68
7/16-20	73	54	103	76
-	-	-	-	-
1/2-13	99	73	140	103
1/2-20	111	82	159	117
9/16-12	144	106	202	149
9/16-18	160	118	225	166
5/8-11	198	146	280	206
5/8-18	224	165	316	233
3/4-10	350	258	495	365
3/4-16	392	289	554	408
-	-	-	-	-
7/8-9	566	417	799	589
7/8-14	624	460	881	649
1-8	848	625	1199	884
1-12	928	684	1312	967

Applies to non-lubricated plain or zinc plated fasteners.

Continued on next page

DPSG,YZ07927,20 -19-11MAY99-1/2

NOTE: Torque tolerance is $\pm 20\%$

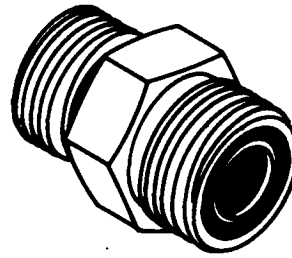
DO NOT use these values if a different torque value or tightening procedure is given for a specific application.

Torque values listed are for general use only. UNIFIED INCH BOLT AND CAP SCREW TORQUE VALUES chart meet Funk Engineering Procedures Manual Torque Specifications FEP 14.2

DPSG,YZ07927,20 -19-11MAY99-2/2

SERVICE RECOMMENDATIONS FOR FLAT FACE O-RING SEAL FITTINGS

1. Inspect the fitting sealing surfaces. They must be free or dirt or defects.
2. Inspect the O-ring. It must be free of damage or defects.
3. Lubricate O-rings and install into groove using petroleum jelly to hold in place.
4. Push O-ring into the groove with plenty of petroleum jelly so O-ring is not displaced during assembly.
5. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place.
6. Tighten fitting or nut to torque value shown on the chart per dash size stamped on the fitting. Do not allow hoses to twist when tightening fittings.



T6243AD -UN-18OCT88

FLAT FACE O-RING SEAL FITTING TORQUE

Nominal Tube		Dash	Thread Size	Swivel Nut		Bulkhead Nut	
O.D.	in.	Size	in.	N• m	lb-ft	N• m	lb-ft
6.35	0.250	-4	9/16-18	16	12	5.0	3.5
9.52	0.375	-6	11/16-16	24	18	9.0	6.5
12.70	0.500	-8	13/16-16	50	37	17.0	12.5
15.88	0.625	-10	1-14	69	51	17.0	12.5
19.05	0.750	-12	1 3/16-12	102	75	17.0	12.5
22.22	0.875	-14	1 3/16-12	102	75	17.0	12.5
25.40	1.000	-16	1 7/16-12	142	105	17.0	12.5
31.75	1.250	-20	1 11/16-12	190	140	17.0	12.5
38.10	1.500	-24	2-12	217	160	17.0	12.5

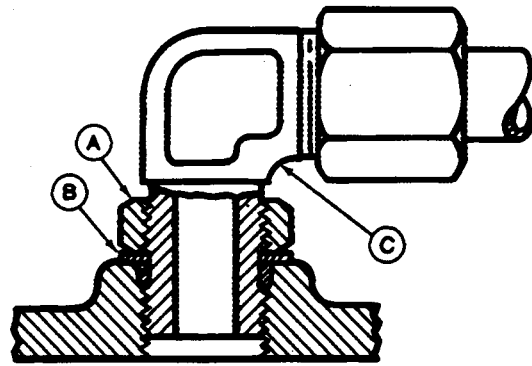
NOTE: Torque tolerance is $+ 15\%$ -20%

DPSG,YZ07927,12 -19-30APR99-1/1

SERVICE RECOMMENDATIONS FOR O-RING BOSS FITTINGS¹**ANGLE FITTING**

1. Back-off lock nut (A) and back-up washer (B) completely to head-end (C) of fitting.
2. Turn fitting into threaded boss until back-up washer contacts face of boss.

NOTE: Do not allow hoses to twist when tightening fittings.



Angle Fitting

T6520AB -UN-18OCT88

3. Turn fitting head-end counterclockwise to proper index (maximum of one turn).
4. Hold fitting head-end with a wrench and tighten lock nut and back-up washer to proper torque value.

STRAIGHT FITTING OR SPECIAL NUT TORQUE CHART

Thread Size	N•m	lb-ft
3/8-24 UNF	8	6
7/16-20 UNF	12	9
1/2-20 UNF	16	12
9/16-18 UNF	24	18
3/4-16 UNF	46	34
7/8-14 UNF	62	46
1-1/16-12 UN	102	75
1-3/16-12 UN	122	90
1-5/16-12 UN	142	105
1-5/8-12 UN	190	140
1-7/8-12 UN	217	160

NOTE: Torque tolerance is + 15% -20%.

¹SERVICE RECOMMENDATIONS FOR O-RING BOSS FITTINGS charts meet Funk Engineering Procedures Manual Torque Specifications FEP 14.3.

**SUGGESTED WRENCHING TORQUE FOR
TAPERED PIPE THREAD¹**

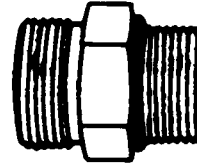
TAPERED PIPE THREAD WITH SEALANT CHART		
Thread Size	N• m	lb-ft
1/16-27 UNF	15	10
1/8-27 UNF	20	15
1/4-18 UNF	25	20
3/8-18 UNF	35	25
1/2-14 UNF	45	35
3/4-14 UNF	60	45
1-11 1/2 UN	75	55
1-1/4-11 1/2 UN	95	70
1-1/2-11 1/2 UN	110	80
2-11 1/2 UN	130	95

TAPERED PIPE THREAD WITHOUT SEALANT CHART		
Thread Size	N•m	lb-ft
1/16-27 UNF	20	15
1/8-27 UNF	25	20
1/4-18 UNF	35	25
3/8-18 UNF	45	35
1/2-14 UNF	60	45
3/4-14 UNF	75	55
1-11 1/2 UN	90	65
1-1/4-11 1/2 UN	110	80
1-1/2-11 1/2 UN	130	95
2-11 1/2 UN	160	120

¹ SUGGESTED WRENCHING TORQUE FOR TAPERED PIPE THREAD
charts meet Funk Engineering Procedures Manual Torque Specifications
FEP 14.4.

**SERVICE RECOMMENDATIONS FOR O-RING
BOSS FITTINGS¹****STRAIGHT FITTING**

1. Inspect O-ring boss seat for dirt or defects.
2. Lubricate O-ring with petroleum jelly. Place electrical tape over threads to protect O-ring. Slide O-ring over tape and into O-ring groove of fitting. Remove tape.
3. Tighten fitting to torque value shown on chart.

*Straight Fitting With O-ring*

T6243AE -UN-18OCT88

STRAIGHT FITTING OR SPECIAL NUT TORQUE CHART

Thread Size	N•m	lb-ft
3/8-24 UNF	8	6
7/16-20 UNF	12	9
1/2-20 UNF	16	12
9/16-18 UNF	24	18
3/4-16 UNF	46	34
7/8-14 UNF	62	46
1-1/16-12 UN	102	75
1-3/16-12 UN	122	90
1-5/16-12 UN	142	105
1-5/8-12 UN	190	140
1-7/8-12 UN	217	160

NOTE: Torque tolerance is + 15% - 20%.

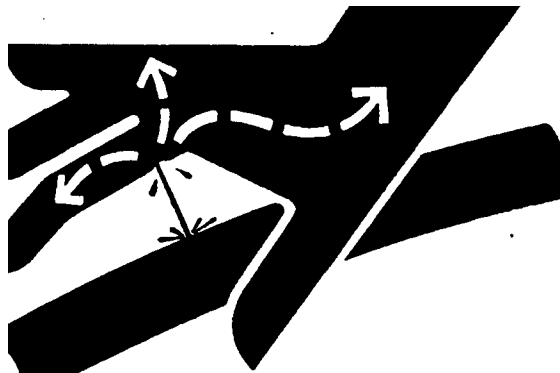
¹SERVICE RECOMMENDATIONS FOR O-RING BOSS FITTINGS
charts meet Funk Engineering Procedures Manual Torque Specifications
FEP 14.3.

DPSG,YZ07927,10 -19-30APR99-1/1

10
16 **CHECK OIL LINES AND FITTINGS**

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



X9811 -UN-23AUG88

Check all oil lines, hoses, and fittings regularly for leaks or damage. Make sure all clamps are in position and tight. Make sure hoses are not twisted or touching moving machine parts. If abrasion or wear occurs, replace immediately.

Tubing with dents may cause the oil to overheat. If you find tubing with dents, install new tubing immediately.

IMPORTANT: Tighten fittings as specified in torque chart.

When you tighten connections, use two wrenches to prevent bending or breaking tubing and fittings.

DPSG,YZ07927,13 -19-30APR99-1/1

COLD WEATHER OPERATION

IMPORTANT: Viscosity grade selection is critical for cold weather operation of the transmission. Preheat procedures are required when operating transmission below the oil's MINIMUM critical temperature which is viscosity grade dependent.

NOTE: Refer to AIR TEMPERATURE RANGE chart for the MINIMUM transmission operating temperature viscosity grades.

PREHEAT TRANSMISSION FLUID WITH AUXILIARY SOURCE

- Preheat the transmission fluid to the MINIMUM temperature before operating.

ALTERNATE WARM-UP PROCEDURE:

- Operate transmission in neutral for approximately 20 minutes or until oil is warmed to the MINIMUM temperature.

HOT WEATHER OPERATION

Use higher viscosity grades (Refer to AIR TEMPERATURE RANGE chart) for:

- Ambient temperatures consistently above 30°C (86°F).
- Frequent stop-and-go driving in hot weather.
- High grade climbing in hot weather.

DPSG,YZ07927,23 -19-12MAY99-1/1

TOWING THE VEHICLE**AVOID DAMAGE TO TRANSMISSION:**

- Run engine at idle speed to lubricate the clutches.
 - Do not exceed normal vehicle speeds while towing.
- If the engine cannot be run:
 - Disconnect drive line from transmission.
- If drive line can not be disconnected:
 - Do not exceed 5 km/h (3 mph)
 - Tow no further than 2 km (1 mile)

DPSG,YZ07927,29 –19–12MAY99–1/1

PUT TRANSMISSION IN STORAGE

This procedure applies to those transmissions and components that have been tested according to Funk Manufacturing test specifications and have had the oil drained from them prior to shipment.

The following actions will help protect the unit and component items from internal rust and corrosion damage for approximately one year, provided the transmissions are stored in a dry area:

- Seal all openings with moisture-proof covers or tape.
- Spray 113 ml (4 oz.) of atomized NOX RUST^{®1} VCI No. 10 oil or an equivalent into oil drain hole. This fluid is covered and approved per (MIL-P-46002 and MIL-I-23310).
- Dip, spray, or brush all exposed unpainted surfaces with NOX RUST X-110 or equivalent:

¹ NOX RUST is a trademark of Daubert Chemical Company.

DPSG,YZ07927,30 –19–12MAY99–1/1

REMOVE TRANSMISSION FROM STORAGE

- Wash off all external grease with a safety solvent.
- Remove covers or tape from all openings.
- Drain transmission completely.
- Tag transmission to indicate it needs to be filled with oil after installing in vehicle.
- Fill the unit with Funk approved transmission fluid.

DPSG,YZ07927,31 -19-12MAY99-1/1

RECOMMENDED OIL

Ambient Temperature/Oil Specifications	
Above -23°C (-10°F)	Hydraulic Transmission Fluid Type C-4 (except grade 30)
Below -23°C (-10°F)	Hydraulic Transmission Fluid Type C-4 (except grade 30) auxiliary preheat required to raise temperature in the sump to above -23°C (-10° F).
Above 0°C (32°F)	Hydraulic transmission fluid type C-4 or C-4 grade 30.

NOTE: The words “oil”, “fluid” and “transmission fluid” are used in this manual to mean, HYDRAULIC TRANSMISSION FLUID, the operating and lubricating oil for this transmission.

IMPORTANT: Funk Manufacturing Company does not recommend the use of any hydraulic transmission fluid that uses an “EP” (extreme Pressure) additive.

Funk Manufacturing Company does not recommend the use of any multi-viscosity oil. Use of multi-viscosity oil will damage the transmission.

DPSG,YZ07927,81 –19–21JUN99–1/1

FILL THE 2000 SERIES TRANSMISSION WITH OIL

AFTER INSTALLING TRANSMISSION IN VEHICLE:

IMPORTANT: The oil level is always checked with the engine running at idle speed, the Shift-O-Matic in neutral, and transmission oil temperature 71—93.5°C (160—200°F). Do not overfill transmission. This will cause overheating. Damage to the transmission will result.

In some applications that use an air to oil heat exchanger, the transmission temperature will be below the temperature recommended for checking oil level. Due to the expansion of oil as it heats up it is important that the oil level be checked at the recommended temperature.

- Park machine on level surface.

- Engage parking brake, block wheels.
- Put transmission in neutral.
- Remove oil fill plug (refer to “2000 SERIES TRANSMISSION COMPONENT IDENTIFICATION” group 10).
- Begin filling operation by adding 15.1 liters (4 gal) of recommended oil.
- Start the engine, run at idle speed to fill oil lines.
- Check oil level on dip stick with engine running at idle speed.
- Check oil level when the transmission is above the temperature of 71—93.5°C (160—200°F).

NOTE: For checking oil levels, the recommended oil temperature is 71—93.5°C (160—200°F).

Fill transmission to the full mark on dipstick with engine running at idle speed.

DPSG,YZ07927,87 –19–22JUN99–1/1

CHECK AND SERVICE THE 2000 SERIES TRANSMISSION REGULARLY

Routine checks will help prevent down time. The operator can aid in preventative maintenance by reporting signs of leaks or malfunctions.

The transmission operates in and by oil, most of the maintenance is concerned with oil replenishment and oil cleanliness. The type of service and operating conditions shall determine the maintenance interval.

NOTE: Engage park brake before checking oil level.

OIL LEVEL

IMPORTANT: The transmission should always be in the neutral position before starting the engine, or when the

vehicle is parked and the engine is running.

CHECK THE OIL LEVEL DAILY

- Set parking brake.
- Put the gear selector lever in neutral position.
- Operate the engine at idle speed.
- Heat oil temperature to 71—93.5°C (160—200°F).

NOTE: For checking oil levels, the recommended oil temperature is 71—93.5°C (160—200°F).

- Clean area around dipstick before removing.
- Keep oil level at the “FULL” mark on the dipstick.

DPSG,YZ07927,86 –19–22JUN99–1/1

INTERVALS FOR CHANGING TRANSMISSION OIL AND FILTERS

IMPORTANT: Change oil and filter after the first 20 hours of transmission operation. The oil and filter change intervals given here are for normal service conditions. If the transmission is to be operated in severe conditions contact the Funk Service Department for additional recommendations.

RECOMMENDED LUBRICANT AND FILTER CHANGE INTERVALS:

Recommendations utilizing the Funk filter with the bypass indicator inoperative or not connected:

- Change oil and filter after first 20 hours of transmission operation. Change filter every 200 hours of operations and the lubricant be changed every 600 hours of operation.

Some vehicles are equipped with devices to alert the operator when oil is bypassing the filter. Change the oil filter if a "filter Bypass Signal" is indicated and the transmission is at normal operating temperature. In cold weather operation and/or initial start-up the transmission oil is cold and will have a higher viscosity which allows the filter to bypass intermittently. The filter bypass indicator will be activated. Check the converter out oil temperature. If the temperature is in the normal working range, change the filter.

IMPORTANT: When stalling the converter make sure the transmission is in high gear, the vehicle brakes set, and the immediate area is clear of personnel and obstructions. Do not exceed 30 seconds or 121°C (250°F) converter out oil temperature at full governed engine rpm stall speed.

If the converter out oil temperature is below the normal working range, stop the machine and warm the oil up to the normal working range by stalling the converter, and observing the bypass indicator to be deactivated as the oil warms up. If this disarms the system, work the transmission in a higher gear to keep the converter out oil temperature in the normal working range. If this does not disarm the system, change the filter.

ROUTINE OIL AND FILTER MAINTENANCE:

- Change oil filter anytime the transmission is at normal operating temperature and a Filter Bypass Signal" is indicated.
- Change oil and filter anytime there are signs of contamination in the oil or the oil has a burnt odor.
- Change filter at every 200 hours, change filter and oil every 600 hours of transmission operation.

DPSG,YZ07927,82 -19-21JUN99-1/1

OIL TEMPERATURE WARNING SIGNAL

- If the oil temperature gauge, indicating the converter oil-out temperature, rises to 115°C (230°F) or the transmission oil temperature warning light comes on, stop the vehicle immediately. Shift to neutral and run the engine at 1000—1200 rpm.

IMPORTANT: Do not stop the engine when the transmission is overheating if the cooling system is known to be in working order.

- The transmission oil temperature should soon lower to the engine water temperature, or if an air-to-oil exchanger is used, the temperature should soon lower to ambient air temperature across the heat exchanger. If the temperature does not lower, trouble is indicated.
- Correct overheating problem before the vehicle is operated again.

DPSG,YZ07927,28 -19-12MAY99-1/1

OIL ANALYSIS

Oil analysis is best used by sampling at regular intervals to establish a base line analysis for the oil and operation conditions present. Changes from this base line may indicate unusual wear.

IMPORTANT: Change the oil and filter if an analysis of the used transmission oil indicates any of the following limits are exceeded.

- Glycol (Antifreeze), must not exceed 0% by volume.
- Water, must not exceed 0.05% by volume.
- Viscosity increase at 38°C (100°F), not more than 40% over new oil value.
- Total Acid Number (TAN) per ASTM D664, limit of 3.0 over new lubricant value.

DPSG,YZ07927,27 -19-12MAY99-1/1

SUCTION LEAK TEST

Some indications of a suction leak includes:

- Erratic oil pressure, Look for rapid fluctuation of gauges.
- Pump and filter hoses jumping.
- Excessive air entrapment in the transmission oil.
- A long prime time (time elapsed from engine start to an indication of pump pressure).

TEST FOR SUCTION LEAK:

1. Fill to normal level with transmission fluid.
2. Install a 21 bar 2068 kPa (300 psi) pressure gauge

in the pump port.

3. Start the engine.

4. See if there is an indication of erratic oil pressure.

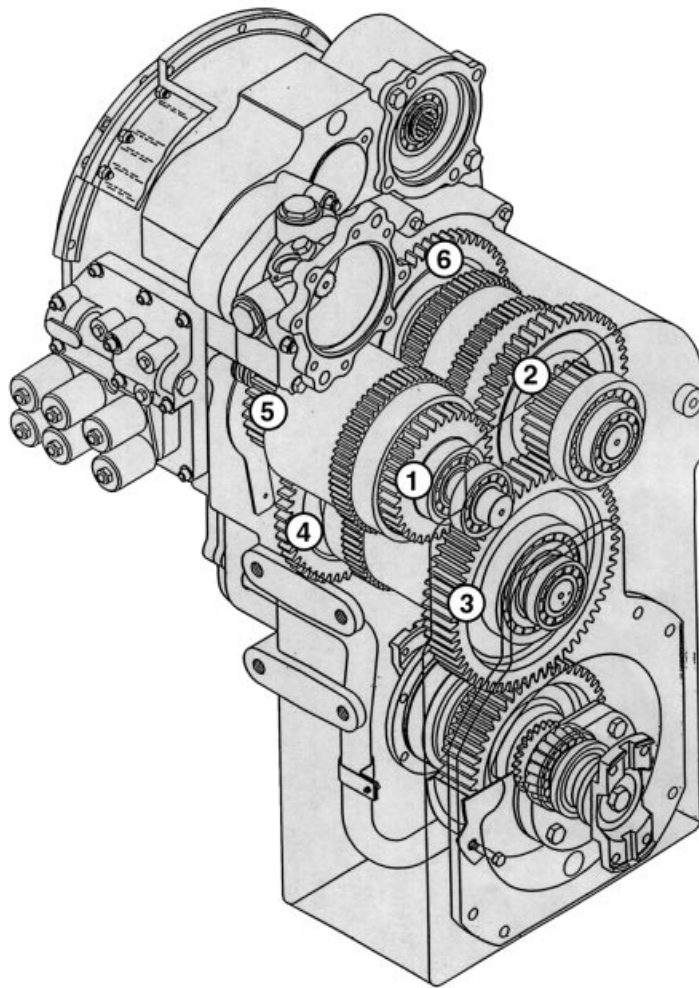
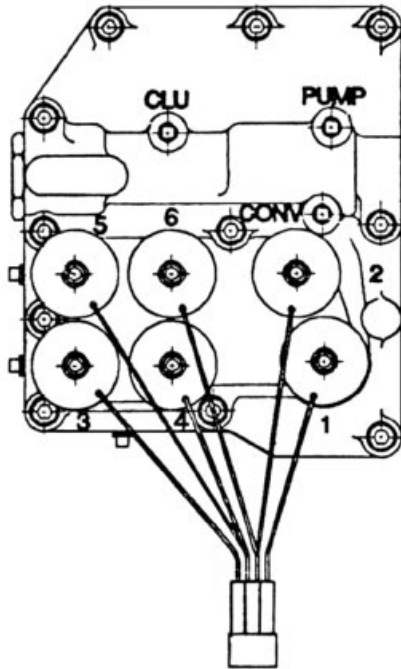
IMPORTANT: Check suction tube fitting for tightness.

5. Check the transmission oil level.

IMPORTANT: Check transmission oil level; failure to do so will result in poor performance and over heating.

DPSG,YZ07927,83 -19-21JUN99-1/1

SOLENOID CHARGED AND GEAR ENGAGED_{LONG DROP}



2000 Series Solenoid/Gear Selection

The numbers on the valve shows what solenoid is charged and what clutch gear is activated.

YZ1880 -UN-30JUN99

SOLENOID VALVE OPERATION FOR 6 FORWARD 3 REVERSE

Before troubleshooting the electric circuit of the valve, the table shows what solenoids are charged when that gear is selected.

2000 Series 6 Speeds Forward 3 Speeds Reverse 5.2 Gear Set							
Input Rotation E (CCW) * Clutch 5 & 6 Forward and Clutch 4 Reverse							
Direction Designation	Solenoids Charged	Short Drop (9 5/8 in. Drop)			Long Drop (18 5/8 in. Drop)		
		Ratio	Output Rotation		Ratio	Output Rotation	
-	-						
F1	1 and 6	6.50	OE	CW	5.20	E	CCW
F2	2 and 6	4.42	OE	CW	3.53	E	CCW
F3	1 and 5	3.68	OE	CW	2.94	E	CCW
F4	2 and 5	2.50	OE	CW	2.00	E	CCW
F5	3 and 6	1.77	OE	CW	1.41	E	CCW
F6	3 and 5	1.00	OE	CW	0.80	E	CCW
Neutral	-	-	-	-	-	-	-
R1	1 and 4	6.50	E	CCW	5.20	OE	CW
R2	2 and 4	4.42	E	CCW	3.53	OE	CW
R3	3 and 4	1.77	E	CCW	1.41	OE	CW
*E= Engine Rotation (CCW) *OE= Opposite Engine Rotation (CW)							
* Looking at the rear of transmission toward the rear of the engine.							

2000 Series 6 Speeds Forward 3 Speeds Reverse 8.2 Gear Set							
Input Rotation E (CCW) * Clutch 5 & 6 Forward and Clutch 4 Reverse							
Direction Designation	Solenoids Charged	Short Drop (9 5/8 in. Drop)			Long Drop (18 5/8 in. Drop)		
		Ratio	Output Rotation		Ratio	Output Rotation	
-	-						
F1	1 and 6	10.25	OE	CW	8.20	E	CCW
F2	1 and 5	4.42	OE	CW	3.53	E	CCW
F3	2 and 6	4.42	OE	CW	3.53	E	CCW
F4	2 and 5	2.50	OE	CW	2.00	E	CCW
F5	3 and 6	1.77	OE	CW	1.41	E	CCW
F6	3 and 5	1.00	OE	CW	0.80	E	CCW
Neutral	-	-	-	-	-	-	-
R1	1 and 4	10.25	E	CCW	8.20	OE	CW
R2	2 and 4	4.42	E	CCW	3.53	OE	CW
R3	3 and 4	1.77	E	CCW	1.41	OE	CW
*E= Engine Rotation (CCW) *OE= Opposite Engine Rotation (CW)							
* Looking at the rear of transmission toward the rear of the engine.							

SOLENOID VALVE OPERATION FOR 3 FORWARD 3 REVERSE

2000 Series 3 Speeds Forward 3 Speeds Reverse 5.2 Gear Set

Input Rotation E (CCW) * Clutch 5 & 6 Forward and Clutch 4 Reverse

Direction Designation	Solenoids Charged	Short Drop (9 5/8 in. Drop)			Long Drop (18 5/8 in. Drop)		
		Ratio	Output Rotation		Ratio	Output Rotation	
-	-						
F1	1 and 6	6.50	OE	CW	5.20	E	CCW
F2	2 and 6	4.42	OE	CW	3.53	E	CCW
F3	3 and 6	1.77	OE	CW	1..41	E	CCW
Neutral	-	-	-	-	-	-	-
R1	1 and 4	6..50	E	CCW	5.20	OE	CW
R2	2 and 4	4.42	E	CCW	3.53	OE	CW
R3	3 and 4	1.77	E	CCW	1.41	OE	CW

*E= Engine Rotation (CCW) *OE= Opposite Engine Rotation (CW)

* Looking at the rear of transmission toward the rear of the engine.

2000 Series 3 Speeds Forward 3 Speeds Reverse 8.2 Gear Set

Input Rotation E (CCW) * Clutch 5 & 6 Forward and Clutch 4 Reverse

Direction Designation	Solenoids Charged	Short Drop (9 5/8 in. Drop)			Long Drop (18 5/8 in. Drop)		
		Ratio	Output Rotation		Ratio	Output Rotation	
-	-						
F1	1 and 6	10.25	OE	CW	8.20	E	CCW
F2	2 and 6	4.42	OE	CW	3.53	E	CCW
F3	3 and 6	1.77	OE	CW	1.41	E	CCW
Neutral	-	-	-	-	-	-	-
R1	1 and 4	10.25	E	CCW	8.20	OE	CW
R2	2 and 4	4.42	E	CCW	3.53	OE	CW
R3	3 and 4	1.77	E	CCW	1.41	OE	CW

*E= Engine Rotation (CCW) *OE= Opposite Engine Rotation (CW)

* Looking at the rear of transmission toward the rear of the engine.

SOLENOID VALVE OPERATION FOR 3 FORWARD 3 REVERSE

The model 2000 with 3 forward and 3 reverse speeds, utilizes directional headset gears on 1st and 2nd stage shafts. Solenoid number five is for forward clutch in long drop which gives the transmission output shaft engine-wise rotation.

NOTE: In some vehicles, forward and reverse solenoids may be reversed depending on transmission location, direction and/or axle rotation.

2000 Series 3 Speeds Forward 3 Speeds Reverse 5.2 Gear Set							
Input Rotation E (CCW) * Clutch 5 & 6 Forward or Reverse							
Direction Designation	Solenoids Charged	Short Drop (9 5/8 in. Drop)			Long Drop (18 5/8 in. Drop)		
-	-	Ratio	Output Rotation		Ratio	Output Rotation	
**F1 or R1	1 and 5	3.68	OE	CW	2.94	E	CCW
**F2 or R2	2 and 5	2.50	OE	CW	2.00	E	CCW
**F3 or R3	3 and 5	1.00	OE	CW	0.80	E	CCW
Neutral	-	-	-	-	-	-	-
**R1 or F1	1 and 6	3.68	E	CCW	2.94	OE	CW
**R2 or F2	2 and 6	2.50	E	CCW	2.00	OE	CW
**R3 or F3	3 and 6	1.00	E	CCW	0.80	OE	CW
*E= Engine Rotation (CCW) *OE= Opposite Engine Rotation (CW) * Looking at the rear of transmission toward the rear of the engine. ** Application dependent on location and direction of transmission in vehicle.							

2000 Series 3 Speeds Forward 3 Speeds Reverse 8.2 Gear Set							
Input Rotation E (CCW) * Clutch 5 & 6 Forward or Reverse							
Direction Designation	Solenoids Charged	Short Drop (9 5/8 in. Drop)			Long Drop (18 5/8 in. Drop)		
-	-	Ratio	Output Rotation		Ratio	Output Rotation	
**F1 or R1	1 and 5	5.80	OE	CW	4.64	E	CCW
**F2 or R2	2 and 5	2.50	OE	CW	2.00	E	CCW
**F3 or R3	3 and 5	1.00	OE	CW	0.80	E	CCW
Neutral	-	-	-	-	-	-	-
**R1 or F1	1 and 6	5.80	E	CCW	4.64	OE	CW
**R2 or F2	2 and 6	2.50	E	CCW	2.00	OE	CW
**R3 or F3	3 and 6	1.00	E	CCW	0.80	OE	CW
*E= Engine Rotation (CCW) *OE= Opposite Engine Rotation (CW) * Looking at the rear of transmission toward the rear of the engine. ** Application dependent on location and direction of transmission in vehicle.							

CLUTCH SOLENOID VOLTAGE REQUIREMENTS

Checks must be at the valve.

Clutch Solenoid Voltage Requirements			
Nominal Voltage	6V*	12V	24V
Allowable Voltage	4.8—7.2 V	9—14V	23—26V
Current Draw	-	2 amps	1 amp
Current Draw Max.	3.2 amps	2.29 amps	1.4 amps
Resistance	1.72 ohm $\pm$ 4%	6.3 ohm $\pm$ 3%	24 ohm $\pm$ 3%

* This coil must be used with a Funk approved electronic control module.

DPSG,YZ07927,88 -19-22JUN99-1/1

PRESSURE AND FLOW CHECKS AT THE VALVE

All pressure and flow tests must be accomplished at 2000 rpm at a converter out temperature of 40.6—51.7°C (105—125°F).

Port #1 — is for clutch pressure, which must be 1655—1790 kPa (240—260 psi).

Port #2 — is for pump pressure which will be higher than clutch pressure but, is not to exceed clutch pressure by more than 105 kPa (15 psi).

Port #3 — is for converter in pressure which is not to exceed 585 kPa (85 psi) at operating temperature.

NOTE: In cold weather operation until the transmission is warmed up, pressures above 585 kPa (85 psi) can be expected.

DPSG,YZ07927,89 -19-22JUN99-1/1

PRESSURE AND FLOW CHECKS AT OTHER LOCATIONS

Pump out flow at 2000 rpm, 40.6—51.7°C (105—125°F) is 74.5 Lpm (19.6 gpm).

Converter out flow at 2000 rpm, 40.6—51.7°C (105—125°F) is 64.6 Lpm (17 gpm).



CAUTION: When stalling the converter set the vehicle brakes and clear the immediate area of personnel and obstructions.

IMPORTANT: When stalling the converter make sure the transmission is in high gear, do not exceed 30 seconds or 121°C (250°F) converter out oil temperature.

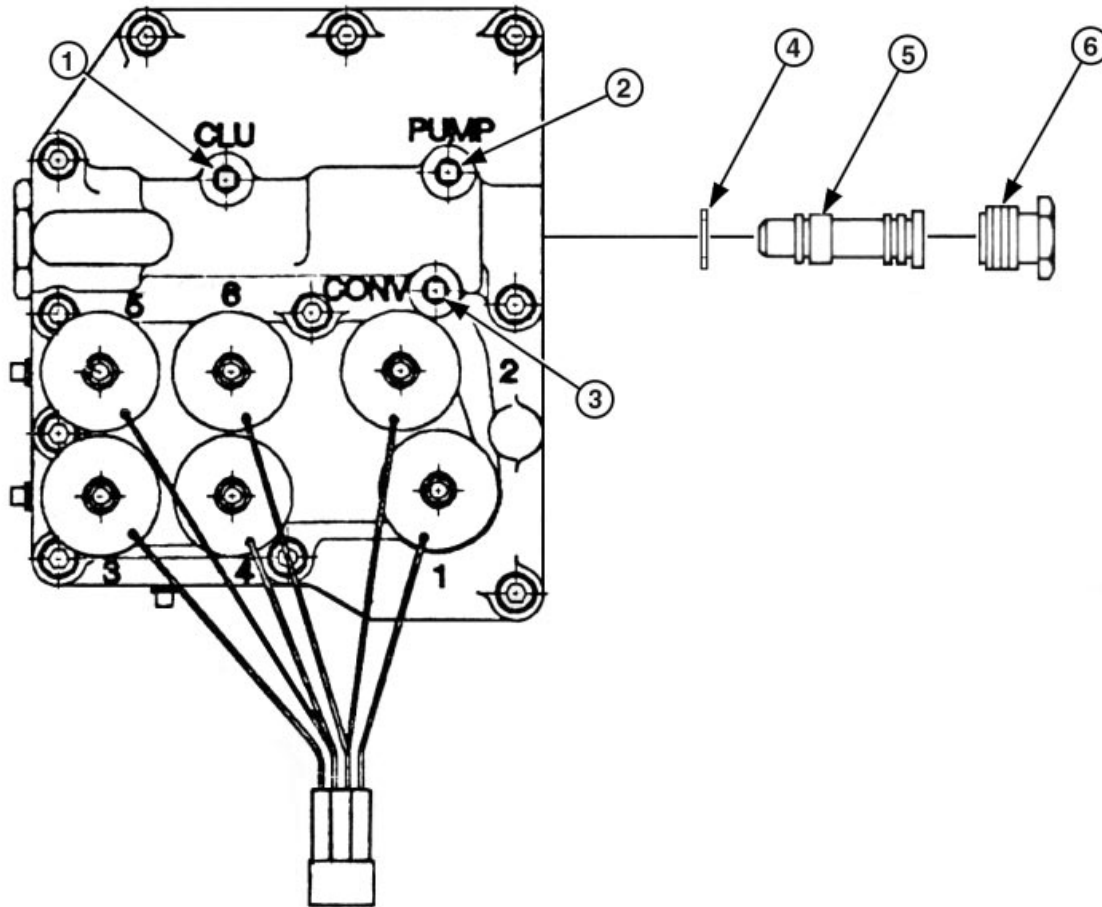
NOTE: Full throttle stall speeds will vary depending on the engine and torque converter being used. Check with the vehicle manufacturer for stall speed.

Converter out pressure at full throttle stall is not to be less than 241 kPa (35 psi) at 82.2—93.3°C (180—200°F).

Lube in pressure at 2000 rpm, 40.6—51.7°C (105—125°F) is not to exceed 170 kPa (25 psi) or be less than 70 kPa (10 psi).

DPSG,YZ07927,90 -19-22JUN99-1/1

SETTING THE CLUTCH PRESSURE



Clutch Pressure

On initial assembly of the pressure regulator, install two 7.62 mm (.030 in) shims.

NOTE: A maximum of five shims may be used.

To adjust the clutch pressure, remove the regulator cap #6, and the pressure regulator #5. The shims #4 will be installed onto the regulator valve.

With the transmission in neutral, the engine speed at idle 750 rpm minimum, and the converter out oil temperature at 40.6—51.7°C (105—125°F), the clutch pressure must be 1380 kPa (200 psi) minimum. If the

clutch pressure is below 1380 kPa (200 psi) add one 7.62mm (.030 in) shim.

Advance the engine speed to 2000 rpm, with the same temperatures and check the clutch pressure to be 1655—1790 kPa (240—260 psi).

If the clutch pressure is below 1655 kPa (240 psi) add one 7.62 mm (.030 in) shims, to achieve the 1655 kPa (240 psi) minimum pressure.

If the clutch is above 1790 kPa (260 psi) remove one 7.62 mm (.030 in) shim.

YZ1874 -UN-08JUL99

ERRATIC OIL PRESSURE

Symptom	Problem	Solution
Erratic oil pressure.	Low oil level.	Add oil to proper level.
	*Pump gasket not sealing.	Replace gasket.
	*Oil passage cover plate leaking in front cover.	Replace seal, apply sealant per instructions in assembly manual.
	*Foreign object in suction port.	Remove object and check for other contamination.

* Some indications of a suction leak are:

- Erratic oil pressure (rapid fluctuation of gauges)
- Pump and filter hoses jumping.
- Excessive air entrainment in the transmission oil.
- A long prime time (time elapsed from engine start to an indication of pump pressure).

NOTE: * To determine if a suction leak exists, fill the transmission completely full of transmission fluid. Then start the engine to see if there is an indication of erratic oil pressure. If none, a suction leak probably exists.

IMPORTANT: Do not neglect to drain the transmission back to the correct level after the test. Failure to do so will result in poor performance and overheating.

DPSG,YZ07927,92 -19-22JUN99-1/1

EXCESSIVE OIL PRESSURE

Symptom	Problem	Solution
Excessive oil pressure.	Excessive amount of regulator valve shims	Install correct amount of shims
	Sticking main regulator valve.	Check main regulator for contamination and clean orifice.
	Faulty spring.	Change spring.

DPSG,YZ07927,93 -19-22JUN99-1/1

LOW OIL PRESSURE_{IN ALL GEARS}

Symptom	Problem	Solution
Low oil pressure in all gears.	Sticking main regulator valve.	Clean main regulator valve.
	Oil pressure set too low.	Add shims (5 maximum).
	"O"ring on charge pump mount defective.	Replace "O"ring.
	Charge pump defective.	Replace pump.
	Internal disconnect seal damaged or installed incorrectly.	Replace seal and install correctly.
	Faulty regulator spring.	Replace regulator spring.

DPSG,YZ07927,94 -19-22JUN99-1/1

LOW OIL PRESSURE_{IN ONE GEAR}

Symptom	Problem	Solution
Low pressure on one gear but all right in other gears.	Contaminated solenoid valve spool.	Disassemble and clean entire control valve. Replace filter and transmission fluid.
	Broken wire to one solenoid, or dirty connection.	Repair wire (see solenoid chart for electrical valves and locations).
	Outer or inner piston seal leaking.	Replace seals.
	Shaft seal ring leaking.	Replace seal ring.

IMPORTANT: If a solenoid is removed from the valve it has to be reinstalled in the same location.

To determine the defective clutch is simply a matter of elimination. For example, if the gear selected used solenoids 6 and 3, and low pressure is indicated, select another clutch that uses one of those solenoids. If pressure is good, then the solenoid or clutch not selected is the one that is bad. To confirm that this is the faulty circuit, select another clutch that uses this solenoid, to assure that the discrepancy is actually in this solenoid or clutch.

Example:**Clutch Selected**

Uses solenoids 6 & 3
 Uses solenoids 5 & 3
 Uses solenoids 6 & 2

Indiation

Low pressure
 Pressure O.K.
 Low pressure

Action

Solenoid or clutch 6 or 3 is defective.
 Solenoid or clutch 6 is defective.
 Confirms solenoid or clutch 6 is defective.

DPSG,YZ07927,95 -19-22JUN99-1/1

VEHICLE WILL NOT MOVE

Symptom	Problem	Solution
Vehicle will not move but all pressures are normal.	Voltage to wrong solenoids on control valve.	Check wiring and connectors.
	No voltage to all solenoids.	Check wiring, controller and connectors.
	Voltage to all solenoids.	Check wiring and controller.
	Solenoid valve spool stuck	Inspect, clean and replace if necessary. Replace oil and Filter.
	Park brake not released.	Release park brake.

DPSG,YZ07927,96 -19-22JUN99-1/1

NO CONVERTER PRESSURE

Symptom	Problem	Solution
Low or no converter pressure.	Converter bypass valve defective.	Replace converter bypass valve.
	Converter hub seal ring not sealing.	Replace seal ring.
	Converter bypass valve pipe plug left out.	Install plug (see assembly manual).

DPSG,YZ07927,97 -19-22JUN99-1/1

FILTER OR FILTER LINES

Symptom	Problem	Solution
Filter or filter oil lines blow out.	Hose bends too sharp.	Reroute hoses.
	Defective hose	Replace hose.
	Main regulator valve stuck.	Clean valve, change filter and oil.
	Filter base plumbed wrong.	Double check that the oil flow is going in the direction indicated by the arrow on top of oil filter base.

DPSG,YZ07927,98 -19-22JUN99-1/1

CLUTCH PRESSURE DOES NOT RETURN_{IN ONE CLUTCH}

Symptom	Problem	Solution
Clutch selected pressure does not return to normal.	Contaminated solenoid valve spool.	Clean valve and replace oil and filter.
	Excessive internal leakage to clutch.	Inspect seal ring, piston seals, and all sealing surfaces (See assembly manual).

DPSG,YZ07927,123 -19-08JUL99-1/1

CLUTCH PRESSURE DOES NOT RETURN_{IN ALL CLUTCHES}

Symptom	Problem	Solution
Clutch selected pressure does not return to normal.	Contaminated solenoid valve spool.	Clean valve and replace oil and filter.
	Accumulator spring defective.	Replace spring.
	Primary pump defective.	Replace primary pump.

DPSG,YZ07927,99 -19-22JUN99-1/1

EXCESSIVE NOISE

Symptom	Problem	Solution
Excessive Noise	Charge pump defective	Replace pump.
	Excessive backlash in gear train.	Replace bearings and inspect for defective gears.
	Auxiliary driven pump bad.	Remove pump and check for noise.
	Internal problem	Check for contamination in the oil.

DPSG,YZ07927,100 -19-22JUN99-1/1

OIL BLOWS OUT

Symptom	Problem	Solution
Blows oil out of breather or dip stick tube.	Transmission over filled with oil.	Establish proper oil level (check front seal on auxiliary driven hydraulic pump if installed).
	Converter seal ring broken.	Remove transmission and install new seal ring on converter hub.

DPSG,YZ07927,101 -19-22JUN99-1/1

TRANSMISSION OVERHEATING

Symptom	Problem	Solution
Transmission overheating.	Converter stalling.	Shift to lower gear.
	Oil level too high.	Establish proper oil level (check front seal on auxiliary driven hydraulic pump, if installed).
	Engine overheating.	Check engine coolant.
	Water lines defective on heat exchanger.	Clean heat exchanger.
	Clutch slipping.	Check clutch pressure.

DPSG,YZ07927,102 -19-22JUN99-1/1

NO POWER

Symptom	Problem	Solution
Transmission pressure checks okay, but has no power and possibly overheating.	Converter sprag clutch damaged or installed wrong.	Disassemble converter and inspect (see assembly manual for correct installation.)
	Converter relief valve broken.	Replace relief valve.

DPSG,YZ07927,103 -19-22JUN99-1/1

OIL LEAKING FROM ENGINE FLYWHEEL

Symptom	Problem	Solution
Oil leaking from engine flywheel and /or weep hole in transmission bell housing.	Converter front cover seal leaking.	Replace seal.
	Converter hub seal or "O"ring damaged.	Replace seal.
	Bearing retainer plate gasket leaking.	Replace gasket.
	Converter not properly positioned within bell housing, causing converter and seal to leak.	Check engine flywheel offset dimensions and converter pilot bushing length against vehicle manufacture standards.

DPSG,YZ07927,104 -19-22JUN99-1/1

FOUR WHEEL DRIVE WILL NOT ENGAGE^{INTERNAL DISCONNECT ONLY}

Symptom	Problem	Solution
Four wheel drive will not engage.	Solenoid stuck open.	Repair or replace solenoid. Check wiring diagram and connectors.
	Damaged or missing spring.	Replace or install spring.
	Bleed port blocked.	Check for proper installation of gasket and solenoid cap or contamination.
	The transmission is programmed to default too "two wheel drive" if electrical power is lost to the transmission.	Contact vehicle manufacture.

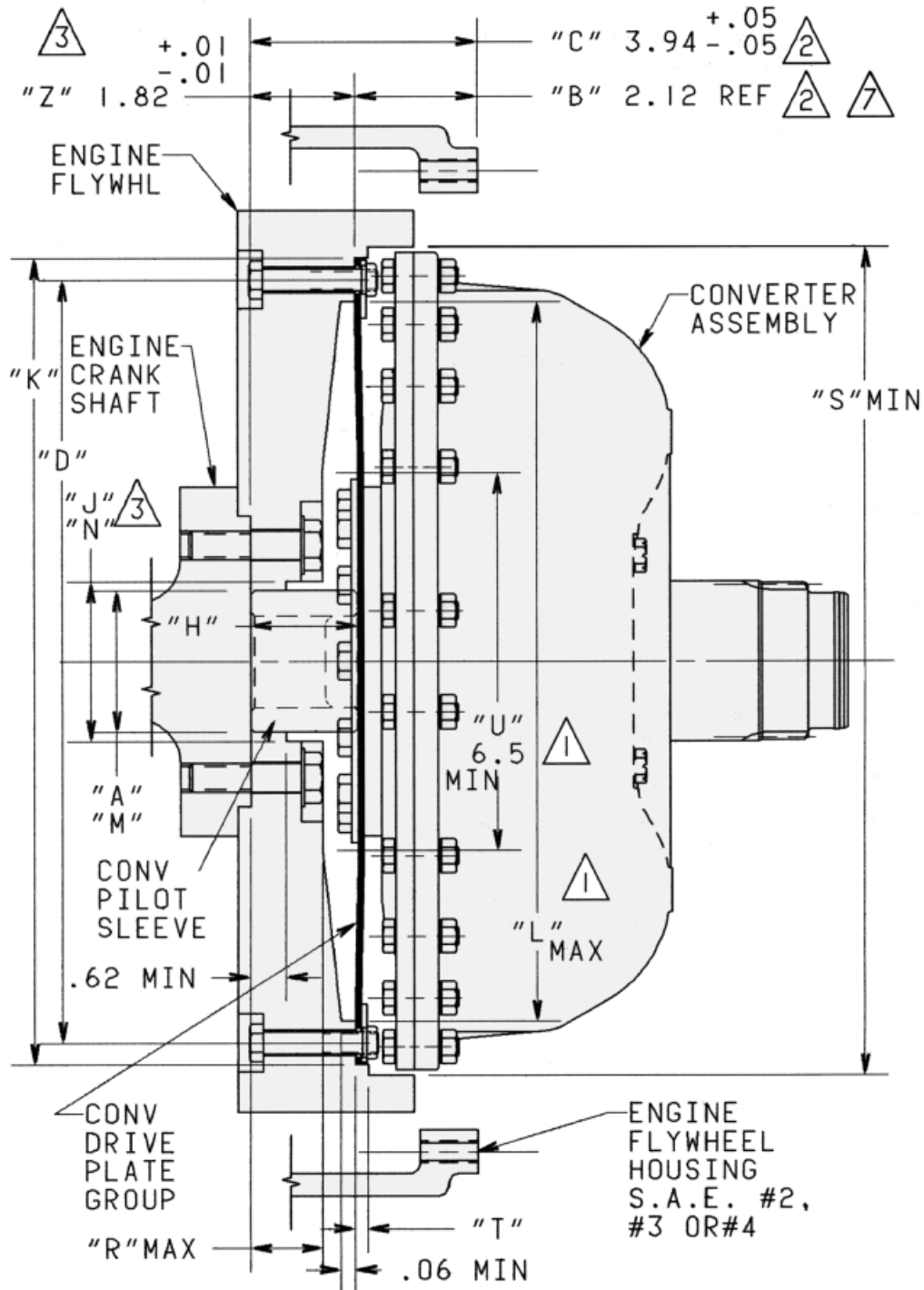
DPSG,YZ07927,105 -19-22JUN99-1/1

FOUR WHEEL DRIVE WILL NOT DISENGAGE^{INTERNAL DISCONNECT ONLY}

Symptom	Problem	Solution
Four wheel drive will not disengage.	No power to solenoid, solenoid inoperative.	Check for electric power to solenoid, check wiring and connectors, replace solenoid.
	Check valve gasket installed backwards.	Install check valve properly.
	Piston seal damaged or installed backwards.	Replace seal or install properly.
	The transmission is programmed to default too "four wheel drive" if electrical power is lost to the transmission.	Contact vehicle manufacture.

DPSG,YZ07927,106 -19-22JUN99-1/1

CONVERTER-TO-ENGINE DIMENSIONS



Converter to Engine

YZ1877 -UN-28JUN99

DIMENSIONAL CHECK

When the following conditions occur dimensional checks must be done.

- An oil leak at the weep hole in the transmission bell housing.
- An oil leak at the drain hole (if any) in the engine flywheel housing.
- If the drive plate and /or converter has been changed.
- If the engine flywheel, or flywheel housing has been changed.
- If the engine has been changed.

NOTE: Refer to "Oil leaking from engine flywheel".

DPSG,YZ07927,107 -19-23JUN99-1/1

DIMENSIONAL CHECK_{REF 1}

Flywheels with dimension "K" must comply with dimensions "S" and "T" (as listed for each Funk converter size), and dimensions "L", "R", and "U" will have to clear the drive plate and converter assemblies.

DPSG,YZ07927,108 -19-23JUN99-1/1

DIMENSIONAL CHECK_{REF 2}

Check the flywheel for the following dimensions:

1. "C" dimension 100 ± 1.27 mm ($3.94 \pm .05$ in.) from the flywheel housing mounting face to the pilot bore positive stop.
2. "Z" dimension $46.23 \pm .25$ mm ($1.82 \pm .01$ in) from the flywheel mounting face to the pilot bore positive stop.
3. "B" dimension 53.85 mm (2.12 in Ref) the flywheel offset.
4. Engines with dimensions "C" 100 ± 1.27 mm ($3.94 \pm .05$ in) "Z" $71.88 \pm .25$ mm ($2.83 \pm .01$ in) and "B" 39.62 mm (1.56 in Ref) requires a 14.22 mm (.56) thick housing adapter.

DPSG,YZ07927,109 -19-23JUN99-1/1

DIMENSIONAL CHECK_{REF 3}

Standard length pilot sleeves — dimension “H”, are set up for dimension “Z” $46.23 \pm .25$ mm ($1.82 \pm .01$ in) from the flywheel mounting face to the pilot bore positive stop.

1. Engine with dimension “Z” $71.88 \pm .25$ mm ($2.83 \pm$

.01 in) requires a 14.22 mm (.56 in) longer standard sleeve.

2. The use of a flywheel that has a shoulder as a positive stop will have to comply with dimension “N” (minimum) to clear the shoulder on the sleeve, dimension “J”.

DPSG,YZ07927,110 –19–23JUN99–1/1

CHECKING FOR THE CORRECT PILOT SLEEVE LENGTH

1. Take dimension “Z” which is from the flywheel mounting face to the pilot bore positive stop, or to the positive stop shoulder in the flywheel.
2. Place the pilot sleeve on the converter front cover pilot knob and push back to the front cover. Measure from the drive plate face (that will be mounted up to the flywheel), out to the end of the sleeve, or to the positive stop shoulder.

NOTE: This step ties to Dimensional check_{ref 3}.

3. The sleeve length (2) should be equal to or 2.54 mm (.10 in) longer than the pilot depth (1) ref “Z” in the flywheel.

The shoulder length (2) should be equal to or 2.54 mm (.10 in) longer than the shoulder depth (1) in the flywheel to properly locate the converter.

4. Check the diameter of the flywheel pilot bore dimension “M” and converter pilot sleeve dimension “A” for a proper fit. There should be .123—.076 mm (.0005—.003 in) diametric clearance. Flywheels that do not fit within this tolerance will require a special sleeve to accurately pilot the converter assembly. If the above dimensions check out, the assembly can continue.
5. Check the engine crankshaft endplay. It should comply with the engine manufacturer's tolerance.

DPSG,YZ07927,111 –19–23JUN99–1/1

CONVERTER ASSEMBLY INSTALLATION

Converter assembly installation into transmission if separated from transmission.

1. Place a light coat of grease on the converter impeller hub gear, and the converter hub seal ring. Also apply a light coat of grease on the transmission input shaft splines, stator support tube splines, and the converter hub oil seal.

NOTE: Reference 7 applies to this step.

2. Support the converter assembly so that it can be positioned directly in line with the transmission input shaft centerline. Carefully insert the converter into the transmission keeping the input shaft centered in the hub bore. Push the converter assembly in slowly to feel when the splines and/or gear teeth begin to engage. If the converter assembly stops at

this point, rock it back and forth and turn the converter slightly to allow the splines and/or gears to line up.

IMPORTANT: Do not at any time force the converter in, damage will result.

When all splines and teeth are lined up, the converter assembly will slide easily into place, to the "B" dimension.

3. Place a light coat of grease on the converter assembly pilot sleeve I.D. and O.D., install the pilot sleeve on the converter pilot knob.
4. A 3/8 in-24 thread stud with a screwdriver slot in one end, threaded into the drive plate, from the engine side, will help in aligning the drive plate to the flywheel.

DPSG,YZ07927,112 -19-23JUN99-1/1

TRANSMISSION TO ENGINE

Installing the transmission to the engine

1. Rotate the engine flywheel until one of the through drilled holes is aligned with the flywheel housing access hole.
2. Support the transmission assembly so that it can be positioned directly in line with the engine crankshaft. Align the pilot sleeve with the flywheel pilot bore, and align the stud (protuding from drive plate face) with one of the through holes in the flywheel.

IMPORTANT: If the transmission does not close up to the flywheel, do not proceed. Forcing the transmission up to the engine with the assembly bolts could preload the engine crankshaft and cause engine and/or transmission problems later. Remove the transmission and check previous assembly steps as listed to determine where the problem is and take corrective action before proceeding.

3. Push the transmission up to the engine.
4. Bolt up the transmission to the engine flywheel housing.
5. Attach the drive plate to the flywheel, using 3/8 in-24 UNF grade 5 or grade 8 cap screws (provided by customer) length to be 12.7 mm (.5 in) longer than that dimension through flywheel.
6. One by one, install the cap screws and hand tighten through the engine flywheel housing access hole, removing the alignment stud when it is encountered. After all the cap screws have been installed, tighten the cap crews to final torque of 47 N•m (35 lb-ft). for grade 5 or 68 N•m (50 lb-ft), for grade 8.
7. Recheck the engine crankshaft endplay and compare it with the endplay from assembly step 5. No endplay could mean that the crankshaft has been preloaded at assembly with the transmission. The engine and transmission should not be run until a reason for the preload is determined.
8. Reinstall the access hole cover.

DPSG,YZ07927,113 -19-23JUN99-1/1

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