300D, 310D, 315D Backhoe Loader Operation and Test

TECHNICAL MANUAL

TM1496 21SEP05 (ENGLISH)

For complete service information also see:

300D, 310D, 315D Backhoe Loaders Repair (Complete)	TM1497
300D, 310D, 315D Backhoe Loaders Operation and Test (Complete)	TM1496

Worldwide Construction
And Forestry Division
LITHO IN U.S.A.

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.

Technical manuals are divided in two parts: repair and operation and tests. Repair sections tell how to repair the components. Operation and tests sections help you identify the majority of routine failures quickly.

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, service parts kits, specifications, wear tolerances, and torque values.

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

Fundamental service information is available from other sources covering basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes.

See DB1990 Service Publications Catalog to order a complete Technical Manual (TM) or a Technical Manual Section (TMS). A complete Operation and Test manual includes the following sections:

- TMS14969000

Section 9000 General Information
- TMS14969005

Section 9005 Operational Checkout Procedure

Section 9010 Engine
- TMS14969015

Section 9015 Electrical System
- TMS14969020

Section 9020 Power Train
- TMS14969025

Section 9025 Hydraulics
- TMS14969031

Section 9031 Heating and Air Conditioning

TX,1496,RR4512 –19–20JUN94–1/1

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All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

Section 9000
General Information

Contents

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

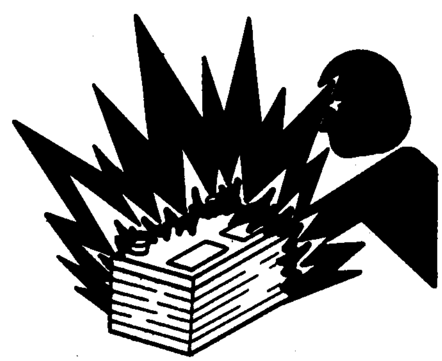
DX,FLAME –19–29SEP98–1/1

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

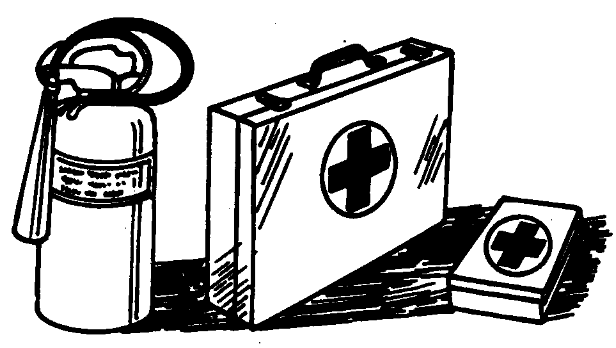
DX,SPARKS –19–03MAR93–1/1

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.



TS291 –UN–23AUG88

DX,FIRE2 –19–03MAR93–1/1

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2

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:

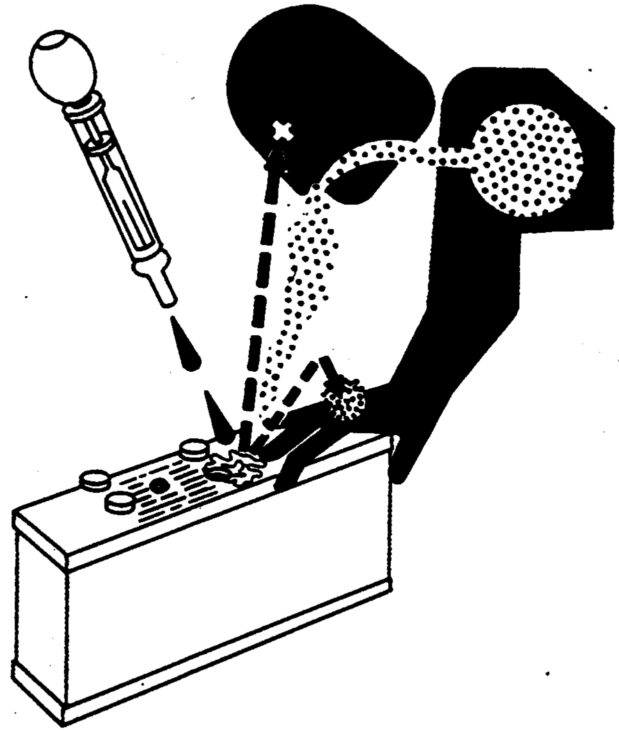
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

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

Handle Chemical Products Safely

TS1132 –UN–26NOV90

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

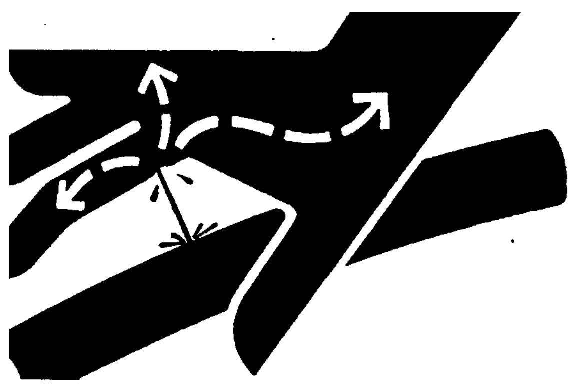
A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)

DX,MSDS,NA –19–03MAR93–1/1

Avoid High-Pressure Fluids



X9811 –UN–23AUG88

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.

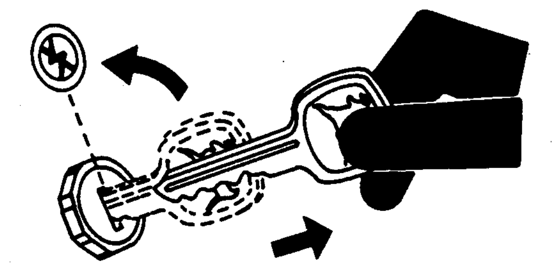
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical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

DX,FLUID –19–03MAR93–1/1

Park Machine Safely

Before working on the machine:

- Lower all equipment to the ground.
- Stop the engine and remove the key.
- Disconnect the battery ground strap.
- Hang a "DO NOT OPERATE" tag in operator station.



TS230 –UN–24MAY89

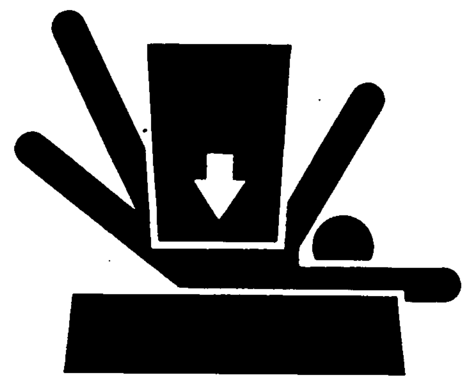
DX,PARK –19–04JUN90–1/1

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. If left in a raised position, hydraulically supported devices can settle or leak down.

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.

When implements or attachments are used with a tractor, always follow safety precautions listed in the implement operator's manual.



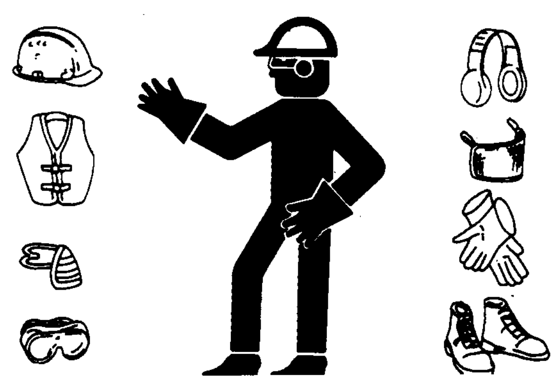
TS229 –UN–23AUG88

DX,LOWER –19–17FEB99–1/1

Wear Protective Clothing

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

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



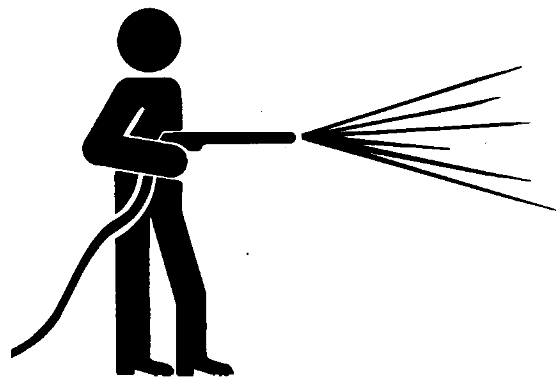
TS206 –UN–23AUG88

DX,WEAR2 –19–03MAR93–1/1

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.



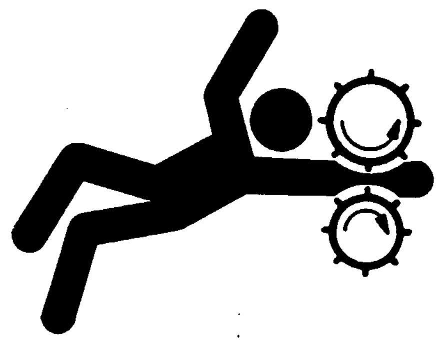
T6642EJ –UN–18OCT88

DX,CLEAN –19–04JUN90–1/1

Service Machines Safely

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



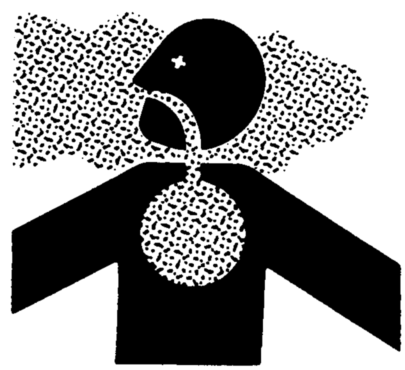
TS228 –UN–23AUG88

DX,LOOSE –19–04JUN90–1/1

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

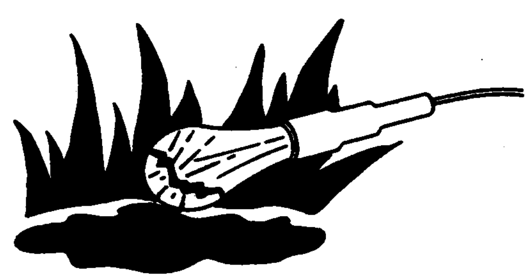


TS220 –UN–23AUG88

DX,AIR –19–17FEB99–1/1

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.

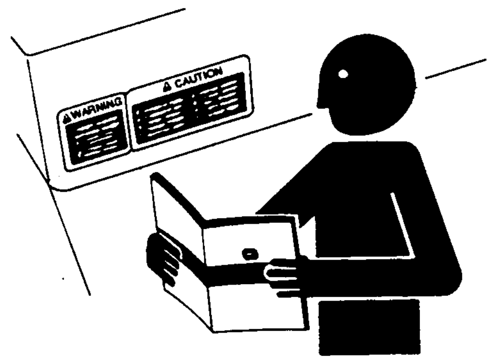


TS223 –UN–23AUG88

DX,LIGHT –19–04JUN90–1/1

Replace Safety Signs

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.



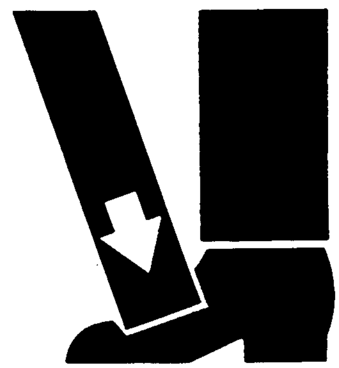
TS201 –UN–23AUG88

DX,SIGNS1 –19–04JUN90–1/1

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

Remove Paint Before Welding or Heating

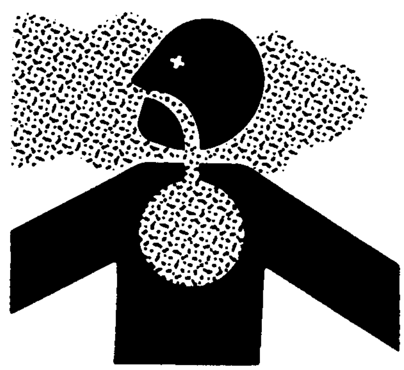
Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.



TS220 –UN–23AUG88

DX,PAINT –19–03MAR93–1/1

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.

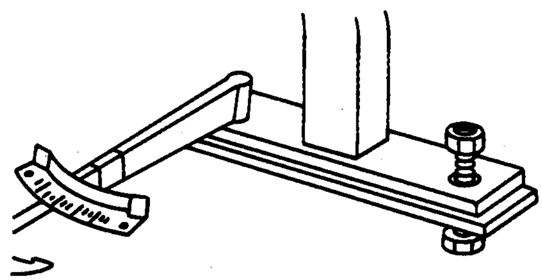
TS953 –UN–15MAY90

DX,TORCH –19–03MAR93–1/1

Keep ROPS Installed Properly

Make certain all parts are reinstalled correctly if the roll-over protective structure (ROPS) is loosened or removed for any reason. Tighten mounting bolts to proper torque.

The protection offered by ROPS will be impaired if ROPS is subjected to structural damage, is involved in an overturn incident, or is in any way altered by welding, bending, drilling, or cutting. A damaged ROPS should be replaced, not reused.



TS212 –UN–23AUG88

DX,ROPS3 –19–03MAR93–1/1

Service Tires Safely

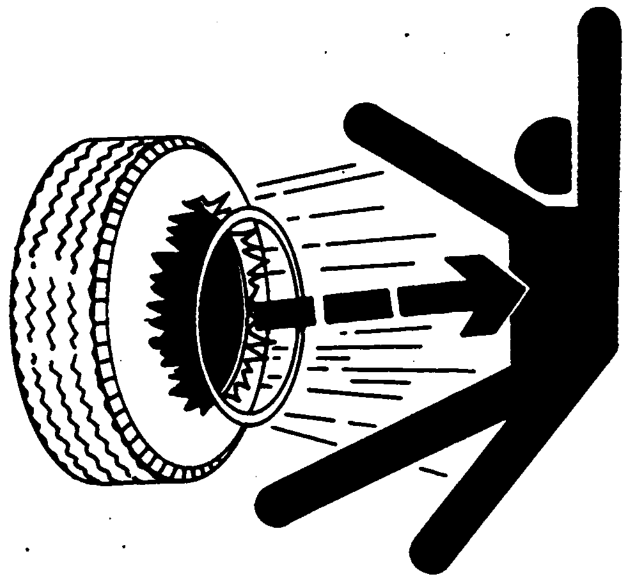
Explosive separation of a tire and rim parts can cause serious injury or death.

Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job.

Always maintain the correct tire pressure. Do not inflate the tires above the recommended pressure. Never weld or heat a wheel and tire assembly. The heat can cause an increase in air pressure resulting in a tire explosion. Welding can structurally weaken or deform the wheel.

When inflating tires, use a clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of or over the tire assembly. Use a safety cage if available.

Check wheels for low pressure, cuts, bubbles, damaged rims or missing lug bolts and nuts.



TS211 –UN–23AUG88

DX,RIM –19–24AUG90–1/1

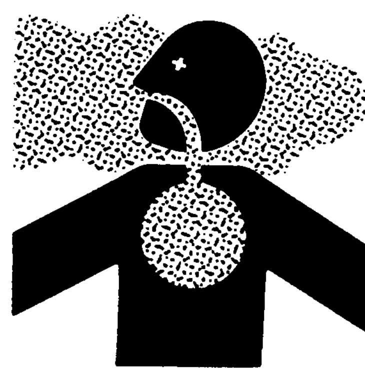
Avoid Harmful Asbestos Dust

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.

Keep bystanders away from the area.



TS220 –UN–23AUG88

DX,DUST –19–15MAR91–1/1

Practice Safe Maintenance

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.

TS218 –UN–23AUG88

DX,SERV –19–17FEB99–1/1

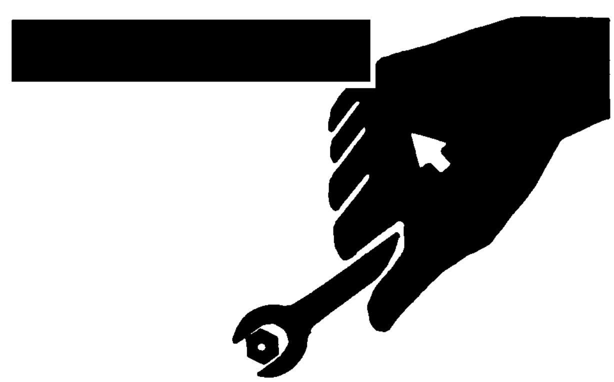
Use Proper Tools

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.

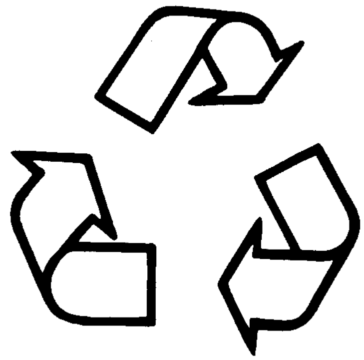
Use only service parts meeting John Deere specifications.



TS779 –UN–08NOV89

DX,REPAIR –19–17FEB99–1/1

Dispose of Waste Properly



TS1133 –UN–26NOV90

Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.

DX,DRAIN –19–03MAR93–1/1

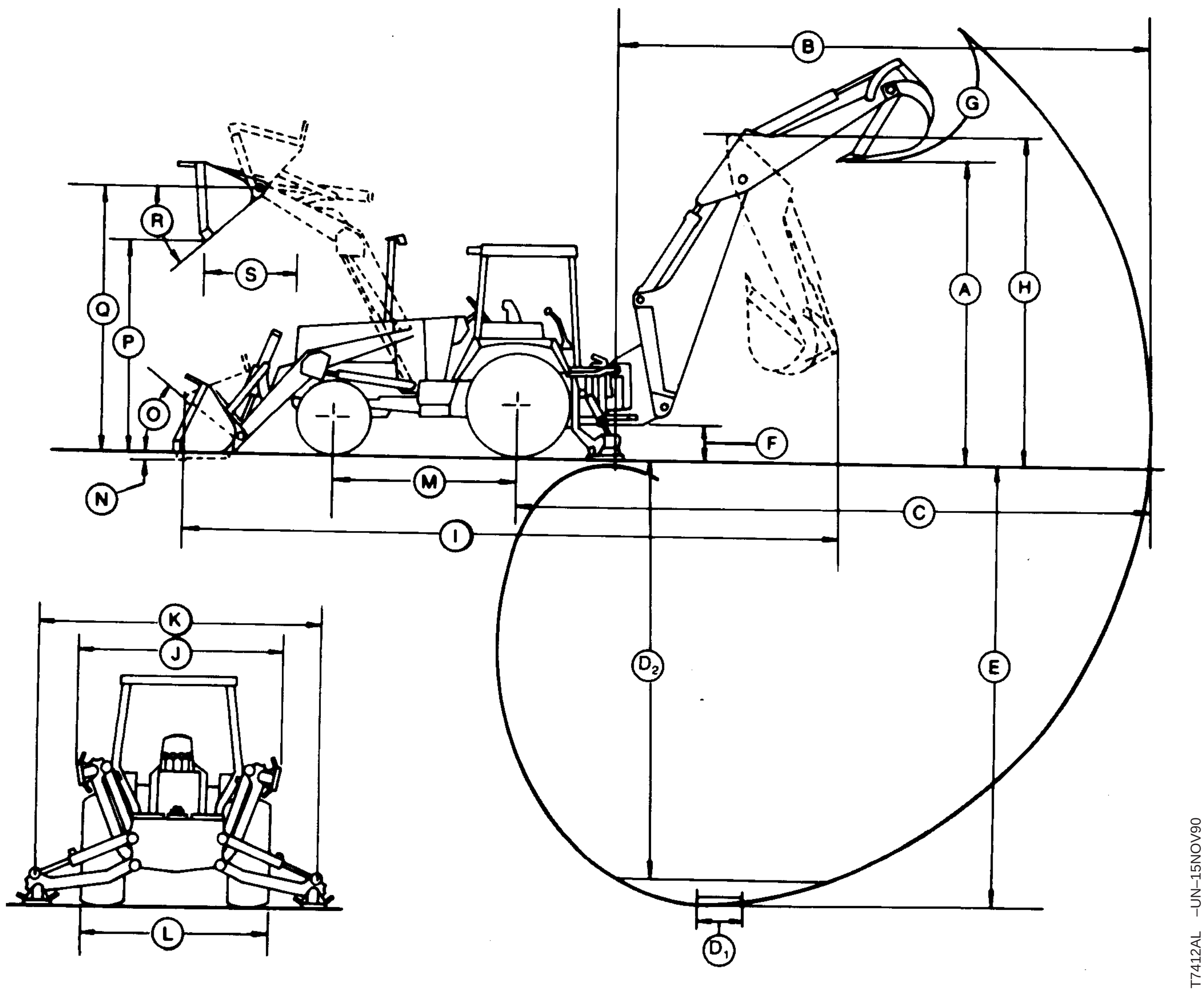
Live With Safety

TS231 –19–07OCT88

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

DX,LIVE –19–25SEP92–1/1

300D Specifications



NOTE: *Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with SAE Standards. Except where otherwise noted, these specifications are based on a standard machine with 16.9-24, 8PR, R4 rear tires; 11L-15, 8PR, F3 front tires with 75 percent $CaCl_2$ fill; 0.67 m^3 (.88 cu. yd.) loader bucket; 610 mm (24 in.) backhoe bucket; ROPS/FOPS; full fuel tank and 79 kg (175 lb) operator.*

TX115DH1384 –19–26SEP91–1/1

300D Backhoe Loader

Key:	Backhoe	Extendible Dipperstick	
Retracted	**Extended**		
A—Loading height, truck loading position	10 ft 9 in. (3.29 m)	11 ft 1 in. (3.37 m)	12 ft 9 in. (3.88 m)
B—Reach from center of swing mast	17 ft 3 in. (5.25 m)	17 ft 3 in. (5.25 m)	20 ft 10 in. (6.36 m)
C—Reach from center of rear axle	20 ft 7 in. (6.28 m)	20 ft 7 in. (6.28 m)	24 ft 3 in. (7.39 m)
D—Digging depth (SAE):			
(1) 2 ft (610 mm) flat bottom	13 ft 10 in. (4.21 m)	13 ft 10 in. (4.21 m)	17 ft 8 in. (5.38 m)
(2) 8 ft (2440 mm) flat bottom	12 ft 8 in. (3.87 m)	12 ft 8 in. (3.87 m)	16 ft 10 in. (5.13 m)
E—Maximum digging depth	14 ft (4.27 m)	14 ft (4.27 m)	17 ft 9. in. (5.41 m)
F—Ground clearance, minimum	13 in. (330 mm)	13 in. (330 mm)	13 in. (330 mm)
G—Bucket rotation	160° or 180°	160° or 180°	160° or 180°
H—Transport height	12 ft 0 in. (3.67 m)	12 ft 0 in. (3.67 m)	12 ft 0 in. (3.67 m)
I—Overall length, transport	22 ft 6 in. (6.85 m)	22 ft 6 in. (6.85 m)	22 ft 6 in. (6.85 m)
J—Stabilizer width, transport	7 ft 4 in. (2.23 m)	7 ft 4 in. (2.23 m)	7 ft 4 in. (2.23 m)
K—Stabilizer spread, operating	8 ft 11 in.(2.71 m)	8 ft 11 in. (2.71 m)	8 ft 11 in. (2.71 m)
L—Overall width (less loader bucket)	6 ft 11 in. (2.11 m)	6 ft 11 in. (2.11 m)	6 ft 11 in. (2.11 m)
Digging force, bucket cylinder (power dig position)	10225 lb (45.5 kN)	10250 lb (45.6 kN)	10225 lb (45.5 kg)
Digging force, crowd cylinder	5530 lb (24.6 kN)	5530 lb (24.6 kN)	3365 lb (15.0 kN)
Swing arc	180 degrees	180 degrees	180 degrees
Operator control	Two levers	Right foot treadle	Right foot treadle
Bucket positions	21° or 30° rollback	19° or 28° rollback	22° or 32° rollback
Stabilizer angle rearward	12°	12°	12°
Lifting capacity, maximum boom @ 65°	2700 lb (1225 kg)	2600 lb (1180 kg)	1550 lb (700 kg)
NOTE: Backhoe specifications are with 24-in. (610 mm) standard bucket.			

Key:	Loader With 1.5 yd ^{3}(1.15 m ^{3}) Bucket
M—Wheelbase	83 in. (2100 mm)
N—Dig below ground—bucket level	4 in. (100 mm)
O—Rollback at ground level	40°
P—Dump clearance, bucket at 40°	8 ft. 10 in. (2.69 m)
Q—Maximum height to bucket hinge pin	10 ft. 11 in. (3.33 m)
R—Maximum bucket dump angle	45°
S—Reach at full height, bucket at 40°	28 in. (711 mm)

TX,115,DH1385 –19–17APR93–1/1

300D Backhoe Loader (Continued)

NOTE: (Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with ICED and SAE Standards.)

Power	**SAE**
Net	60 hp (45 kW)

Engine:	
John Deere 4039D	
Rated power @ 2200rpm	60 SAE net hp (45 kW) 63 SAE gross hp (47 kW)
Cylinders	4
Displacement	239 cu. in. (3.91 L)
Maximum torque @ 1200 rpm	172 lb-ft (233 N•m)
Lubrication	Pressure system w/full-flow filter
Cooling	Pressurized w/thermostat and fixed bypass
Air cleaner	Dry
Electrical system	12-volt
Alternator	65 amps

Transmission:
John Deere 4-speed helical gear, synchronized collar shift transmission with hydraulic reverser. Torque converter 11 in (280 mm) with 2.78:1 stall ratio.

Travel Speeds:	**Gear**	**Forward**		**Reverse**	
mph	**km/h**	**mph**	**km/h**		
With Standard 16.9-24 rear and 11L-15 front tires	1	3.4	5.4	3.3	5.2
2	5.7	9.2	5.6	9.0	
3	12.3	19.8	12.2	19.6	
4	22.4	36.1	22.3	35.9	

Final Drives:
Heavy-duty inboard mounted planetary. Evenly distributes axle shock loads over three oil cooled gears.

Service Brakes:
Manual hydraulic, applied with separate pedals; hydraulically equalized when both pedals are depressed. Wet disks and facings are fully enclosed and self-adjusting.

Park Brake:
Independent system, spring applied, hydraulically released, and controlled by an electric switch on the side console.

Steering: Hydrostatic Power	
Non-powered axle curb turning radius	
(brakes applied)	12 ft 0 in. (3.67 m)
(without brakes)	13 ft 2 in. (4.00 m)
Bucket clearance circle	
(brakes applied)	32 ft 5 in. (9.89 m)
(without brakes)	34 ft 7 in. (10.55 m)
Steering wheel turns	
Stop to stop	2.2 to 2.9
Powered axle (MFWD) curb turning radius	
(brakes applied	11 ft 9 in. (3.57 m)
(without brakes)	13 ft 5 in. (4.10 m)
Bucket clearance circle	
(brakes applied)	30 ft 9 in. (9.38 m)
(without brakes)	34 ft 3 in. (10.44 m)
Steering wheel turns	
Stop to stop	2.5

Hydraulic System: Open center	
Pressure setting	2700 psi (18 620 kPa)
Pump	Gear type
Flow @ 2200 rpm	24 gpm (91 L/min)
Filter, return oil	10 micron replaceable element

Tires:	
Front	11L-15, 8PR, F3
With MFWD	12-16.5, 8 PR
Rear	16.9—24 8PR, R4 17.5L—24 8PR, R4
With MFWD	16.9—24 8PR R4A

Continued on next page

TX,115,DH1388 –19–22JUL99–1/2

Transporting:	
SAE operating weight with ROPS	12,200 lb (5533 kg)
Cab adds	500 lb (227 kg)
MFWD w/tires adds	220 lb (100 kg)
Extendible dipperstick adds	360 lb (163 kg)
Optional front counterweight	370 lb (169 kg)
Optional front counterweight	770 lb (349 kg)

TX,115,DH1388 –19–22JUL99–2/2

300D Backhoe Loader Buckets

Loader:	Width mm (in.)	Heaped Capacity m ^{3}(Cu Yd)	Weight kg (lb)
General purpose	2057 (81)	0.67 (0.88)	249 (550)
2340 (92)	0.76 (1.00)	367 (810)	
Multi-purpose	2134 (84)	0.86 (1.12)	345 (760)

Backhoe:	Width mm (in.)	Heaped Capacity m ^{3}(Cu Yd)	Weight kg (lb)
Standard	305 (12)	0.07 (2.5)	111 (244)
406 (16)	0.10 (3.6)	122 (268)	
457 (18)	0.12 (4.1)	126 (278)	
610 (24)	0.17 (6.0)	149 (328)	
762 (30)	0.22 (7.9)	165 (364)	
914 (36)	0.28 (10.0)	195 (439)	
Heavy	305 (12)	0.07 (2.5)	117 (258)
Duty	457 (18)	0.14 (5.1)	137 (302)
610 (24)	0.17 (6.0)	151 (334)	
610 (24)	0.21 (7.5)	158 (348)	
Extra	457 (18)	0.14 (5.1)	164 (362)
Heavy	610 (24)	0.21 (7.5)	192 (424)
Duty	762 (30)	0.28 (10.0)	215 (474)

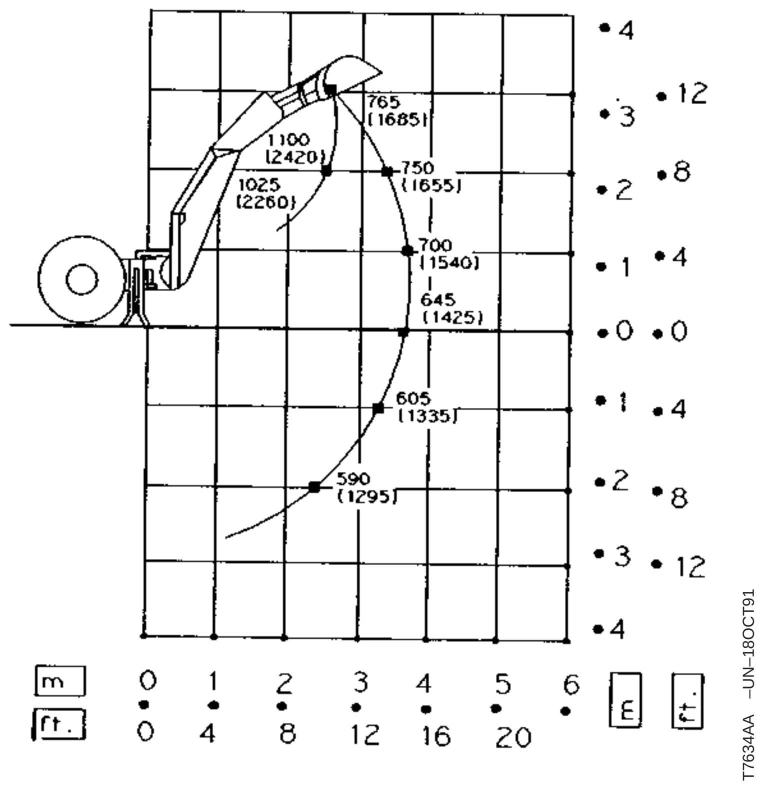
TX,115,DH1386 –19–17APR93–1/1

300D Backhoe Loader Drain And Refill Capacities

	Metric	U.S.
Engine coolant	16 L	17 qt
Engine oil (including filter)	8.5 L	9 qt
Torque converter and reverser	7.5 L	8 qt
Transaxle		
(without MFWD)	21 L	22 qt
(with MFWD)	22 L	23 qt
Fuel tank		
Serial No. —802199	106 L	28 gal
Serial No. 802200—	129 L	34 gal
Hydraulic system reservoir	41.5 L	44 qt

TX,115,DH1387 –19–12OCT94–1/1

300D Backhoe Loader Lifting Capacities—KG (LB)



Lift Capacity, Backhoe With Standard Dipperstick Based On SAE J31 (Except With Loader Bucket On Ground)

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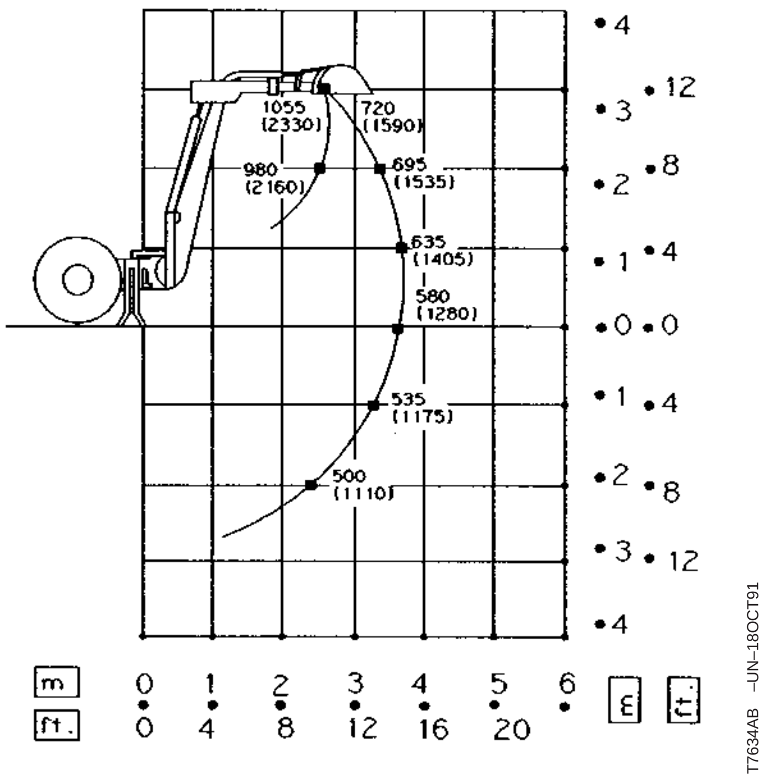
TX,115,DH1390 –19–29OCT91–1/3



Lift Capacity, Backhoe With Extendible Dipperstick, Retracted Based On SAE J31 (Except With Loader Bucket On Ground)

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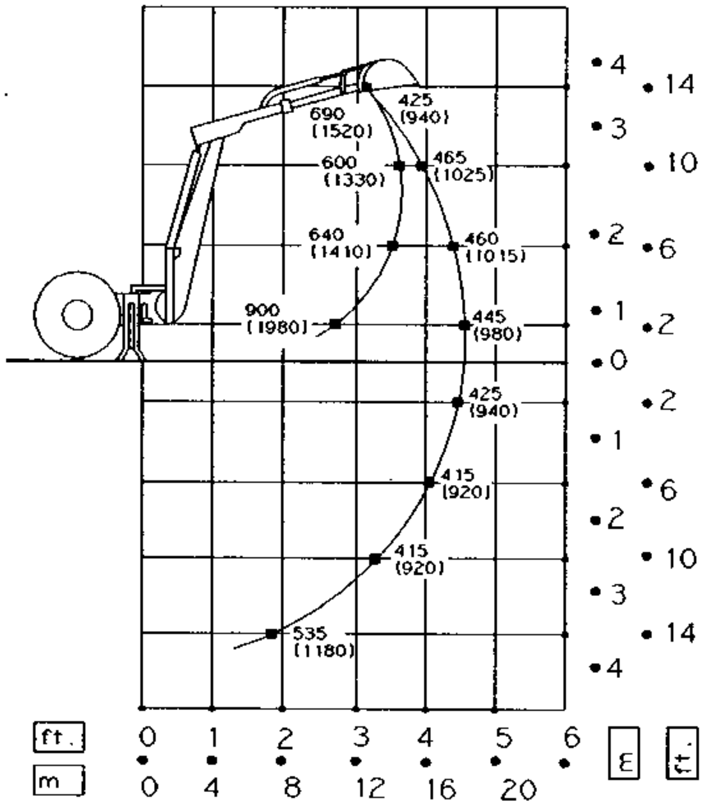
TX,115,DH1390 –19–29OCT91–2/3



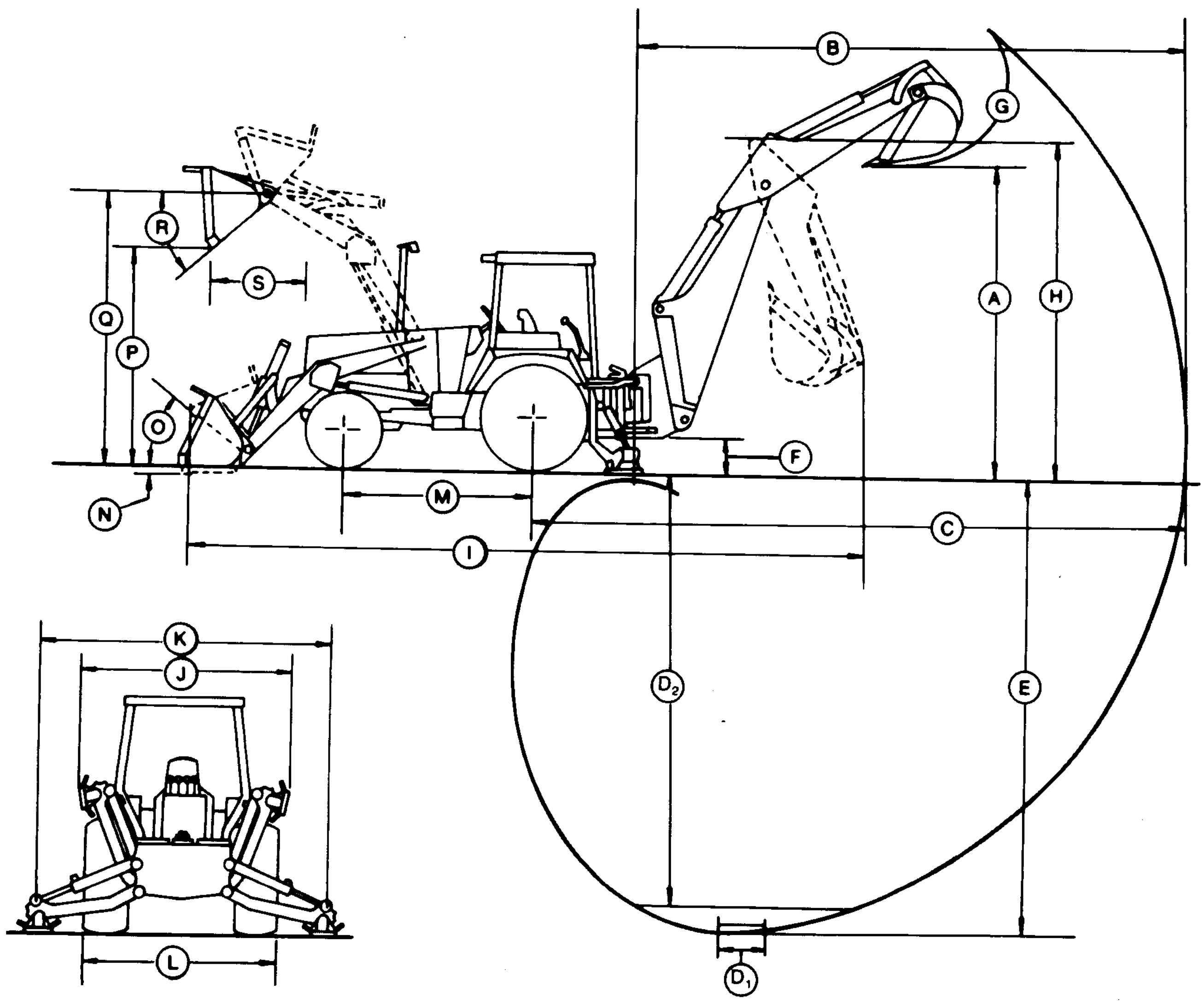
Lift Capacity, Backhoe With Extendible Dipperstick, Extended Based On SAE J31 (Except With Loader Bucket On Ground)

Lifting capacity ratings are made with bucket hinge pin, loader bucket, and stabilizers on firm, level ground. Lift capacities are hydraulically limited. Lifting capacities are 87 percent of the maximum lift over any point on the swing arc and do not exceed 75 percent of the tipping load. Angle between boom and ground is 65 degrees. Machine is equipped with 610 mm (24 in.) standard bucket, standard or extendible dipperstick and standard equipment.

NOTE: *Loader bucket on ground significantly improves side stability, therefore improving lift capacity to the side. Lift capacity over the rear is not affected.*

TX,115,DH1390 –19–29OCT91–3/3

310D Specifications



NOTE: *Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with SAE Standards. Except where otherwise noted, these specifications are based on a standard machine with 17.5L-24, 10PR, R4 rear tires; 11L-15, 8PR, F3 front tires with 75 percent $CaCl_2$ fill; 0.76 m^3 (1.0 cu. yd.) loader bucket; 610 mm (24 in.) backhoe bucket; ROPS/FOPS; full fuel tank and 79 kg (175 lb) operator.*

TX,115,DH1393 –19–26SEP91–1/1

310D Backhoe Loader

Key:	Backhoe	Extendible Dipperstick	
Retracted	Extended		
A—Loading height, truck loading position	11 ft 4 in. (3.45 m)	11 ft 8 in. (3.55 m)	13 ft 11 in. (4.24 m)
B—Reach from center of swing mast	17 ft 7 in. (5.36 m)	17 ft 7 in. (5.36 m)	21 ft 3 in. (6.47 m)
C—Reach from center of rear axle	21 ft 0 in. (6.40 m)	21 ft 0 in. (6.40 m)	24 ft 7 in. (7.50 m)
D—Digging depth (SAE):			
(1) 2 ft (610 mm) flat bottom	14 ft 4 in. (4.37 m)	14 ft 4 in. (4.37 m)	18 ft 2 in. (5.53 m)
(2) 8 ft (2440 mm) flat bottom	13 ft 2 in. (4.02 m)	13 ft 2 in. (4.02 m)	17 ft 4 in. (5.28 m)
E—Maximum digging depth	14 ft 6 in. (4.42 m)	14 ft 6 in. (4.42 m)	18 ft 3 in. (5.56 m)
F—Ground clearance, minimum	13 in. (330 mm)	13 in. (330 mm)	13 in. (330 mm)
G—Bucket rotation	160° or 180°	160° or 180°	160° or 180°
H—Transport height	12 ft 0 in. (3.67 m)	12 ft 2 in. (3.72 m)	12 ft 2 in. (3.72 m)
I—Overall length, transport	22 ft 7 in. (6.88 m)	22 ft 7 in. (6.88 m)	22 ft 7 in. (6.88 m)
J—Stabilizer width, transport	7 ft 0 in. (2.12 m)	7 ft 0 in. (2.12 m)	7 ft 0 in. (2.12 m)
K—Stabilizer spread, operating	10 ft 0 in.(3.05 m)	10 ft 0 in. (3.05 m)	10 ft 0 in. (3.05 m)
L—Overall width (less loader bucket)	7 ft 1 in. (2.15 m)	7 ft 1 in. (2.15 m)	7 ft 1 in. (2.15 m)
Digging force, bucket cylinder (power dig position)	11570 lb (51.5 kN)	11530 lb (51.3 kN)	11530 lb (51.3 kg)
Digging force, crowd cylinder	6650 lb (29.6 kN)	6700 lb (29.8 kN)	4550 lb (20.2 kN)
Swing arc	180 degrees	180 degrees	180 degrees
Operator control	Two levers	Right foot treadle	Right foot treadle
Bucket positions	12° or 21° rollback	8° or 17° rollback	13° or 21° rollback
Stabilizer angle rearward	13°	13°	13°
Lifting capacity, maximum boom @ 65°	4600 lb (2087 kg)	4400 lb (1996 kg)	2700 lb (1225 kg)
NOTE: Backhoe specifications are with 24-in. (610 mm) standard bucket.			

Key:	Loader With 1.5 yd ^{3}(1.15 m ^{3}) Bucket
M—Wheelbase	83 in. (2100 mm)
N—Dig below ground—bucket level	4 in. (100 mm)
O—Rollback at ground level	40°
P—Dump clearance, bucket at 40°	8 ft. 10 in. (2.69 m)
Q—Maximum height to bucket hinge pin	10 ft. 10 in. (3.30 m)
R—Maximum bucket dump angle	45°
S—Reach at full height, bucket at 40°	28 in. (711 mm)

TX,115,DH1394 –19–17APR93–1/1

310D Backhoe Loader (Continued)

NOTE: (Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with ICED and SAE Standards.)

Engine:	
John Deere 4039D and 4039T	
Rated power @ 2200 rpm (Naturally aspirated)	SAE net 67 hp (50 kW)
Rated power @ 2200 rpm (Turbocharged)	SAE net 72 hp (53.7 kW)
Cylinders	4
Displacement	239 cu. in. (3.91 L)
Torque rise at 1200 rpm	
with turbocharger	25%
without turbocharger	20%
Lubrication	Pressure system w/full-flow filter
Cooling	Pressurized w/thermostat and fixed bypass
Air cleaner	Dry
Electrical system	12-volt
Alternator	78 amps

Transmission:
John Deere 4-speed helical gear, synchronized collar shift transmission with hydraulic reverser. Torque converter 11 in. (280 mm) with 2.83:1 stall ratio.

Travel Speeds:	**Gear**	**Forward**		**Reverse**	
mph	**km/h**	**mph**	**km/h**		
With Standard 17.5L-24 rear and 11L-15 front tires	1	3.3	5.3	3.0	4.8
2	5.7	9.2	5.1	8.2	
3	12.3	19.8	11.1	17.9	
4	22.4	36.1	20.2	32.5	
With MFWD and required 19.5L-24 rear and 12-16.5 front tires	1	3.4	5.5	3.1	5.0
2	5.9	9.5	5.3	8.5	
3	12.6	20.3	11.3	18.2	
4	23.0	37.0	20.7	33.3	

Final Drives:
Heavy-duty inboard mounted planetary. Evenly distributes axle shock loads over three oil cooled gears.

Continued on next page

TX,115,DH1397 –19–22JUL99–1/2

Service Brakes:
Manual hydraulic, applied with separate pedals; hydraulically equalized when both pedals are depressed. Wet disks and facings are fully enclosed and self-adjusting.

Park Brake:
Independent system, spring applied, hydraulically released, and controlled by an electric switch on the side console.

Steering: Hydrostatic Power	
Non-powered axle curb turning radius	
(brakes applied)	11 ft 9 in. (3.57 m)
(without brakes)	13 ft 3 in. (4.04 m)
Bucket clearance circle	
(brakes applied)	31 ft 6 in. (9.61 m)
(without brakes)	34 ft 7 in. (10.55 m)
Steering wheel turns	
Stop to stop	2.2 to 2.9
Powered axle (MFWD) curb turning radius	
(brakes applied)	10 ft 11 in. (3.34 m)
(without brakes)	13 ft 8 in. (4.17 m)
Bucket clearance circle	
(brakes applied)	29 ft 9 in. (9.07 m)
(without brakes)	35 ft 3 in. (10.74 m)
Steering wheel turns	
Stop to stop	2.5

Hydraulic System: Open center	
Pressure setting	2700 psi (18 620 kPa)
Pump	Gear type
Flow @ 2200 rpm	35 gpm (133 L/min)
Filter, return oil	10 micron replaceable element

Tires:	
Front	11L-15, 8PR, F3 11L-16, 12PR, F3
With MFWD	12-16.5, 8PR 14-17.5, 8PR, NHS
Rear	16.9-24 8PR, R4 17.5L-24 10PR, R4 19.5L-24, 8PR R4
With MFWD	19.5-24 8PR R4 21L-24, 10 PR R4

TX,115,DH1397 –19–22JUL99–2/2

310D Buckets

Loader:	Width In. (mm)	Heaped Capacity Cu. Yd. (m ^{3})	Weight lb (kg)
General Purpose	92 (2340)	1.00 (0.76)	760 (345)
92 (2340)	1.30 (1.00)	800 (363)	
Long Lip Multi-purpose	89 (2270)	1.25 (0.96)	750 (340)
92 (2340)	1.25 (0.96)	1560 (708)	

Backhoe:	Width In. (mm)	Heaped Capacity Cu. Ft. (m ^{3})	Weight lb (kg)
Standard	12 (305)	2.5 (0.07)	244 (111)
16 (406)	3.6 (0.10)	268 (122)	
18 (457)	5.1 (0.14)	322 (146)	
24 (610)	7.5 (0.21)	370 (168)	
30 (762)	10.0 (0.28)	410 (186)	
36 (914)	9.9 (0.28)	430 (195)	
36 (914)	14.5 (0.41)	556 (252)	
Heavy	12 (305)	2.5 (0.07)	258 (117)
Duty	18 (457)	5.1 (0.14)	334 (151)
24 (610)	7.5 (0.21)	396 (180)	
24 (610)	8.8 (0.25)	476 (216)	
30 (762)	10.0 (0.28)	444 (201)	
36 (914)	10.0 (0.28)	480 (217)	
Extra	18 (457)	5.1 (0.14)	362 (164)
Heavy	24 (610)	7.5 (0.21)	424 (192)
Duty	30 (762)	10.0 (0.28)	474 (215)

Transporting:	
SAE operating weight with ROPS	13,600 lb (6169 kg)
Cab added	500 lb (227 kg)
MFWD w/tires added	220 lb (100 kg)
Extendible dipperstick	430 lb (195 kg)
Optional front counterweight	770 lb (349 kg)
Optional front counterweight	200 lb (91 kg)

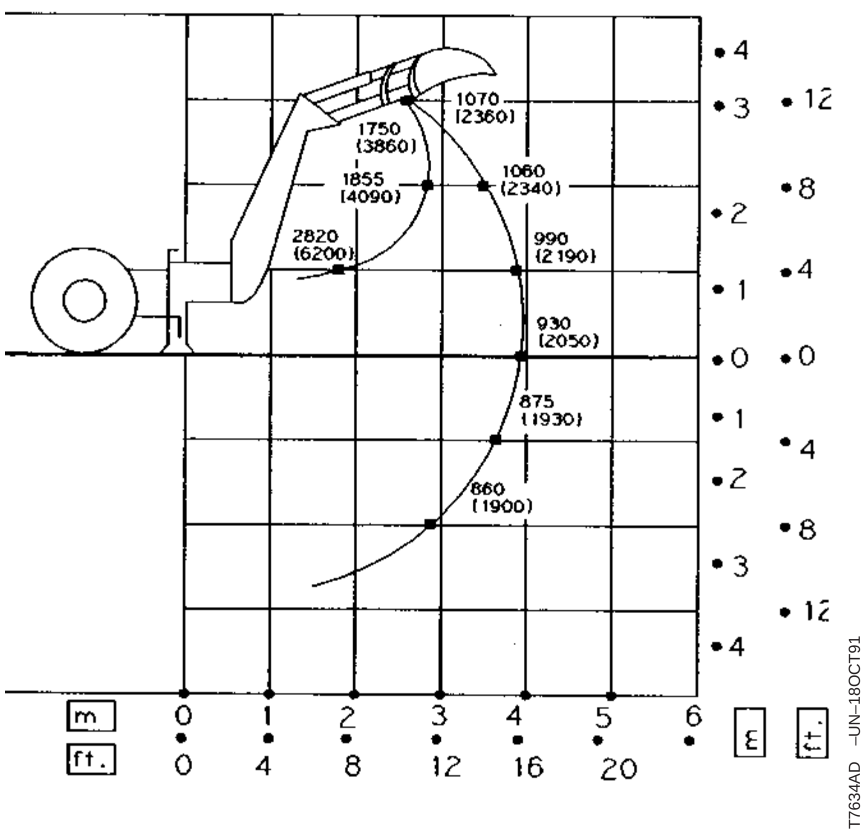
TX,115,DH1395 –19–17APR93–1/1

310D Drain And Refill Capacities

	Metric	U.S.
Engine coolant	16 L	17 qt
Engine oil (including filter)	8.5 L	9 qt
Torque converter and reverser	7.5 L	8 qt
Transaxle		
(without MFWD)	21 L	22 qt
(with MFWD)	22 L	23 qt
Fuel tank		
Serial No. —802199	106 L	28 gal
Serial No. 802200—	129 L	34 gal
Hydraulic system reservoir	41.5 L	44 qt

TX,115,DH1396 –19–12OCT94–1/1

310D Backhoe Loader Lifting Capacities—KG (LB)



Lift Capacity, Backhoe With Standard Dipperstick Based On SAE J31 (Except With Loader Bucket On Ground)

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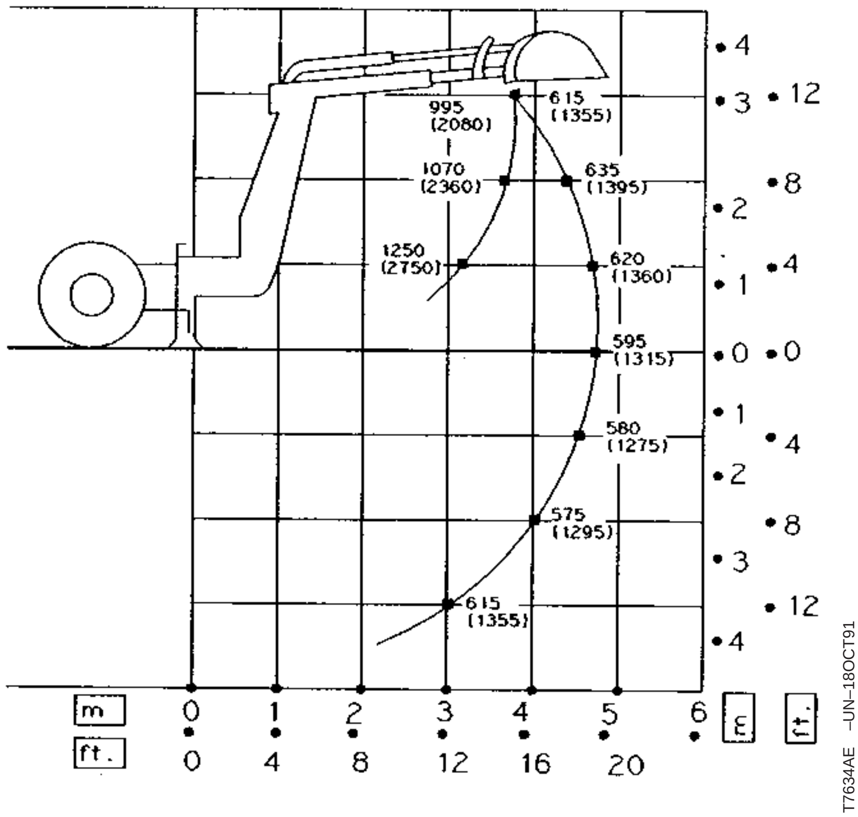
TX,115,DH1398 –19–29OCT91–1/3



Lift Capacity, Backhoe With Extendible Dipperstick, Extended Based On SAE J31 (Except With Loader Bucket On Ground)

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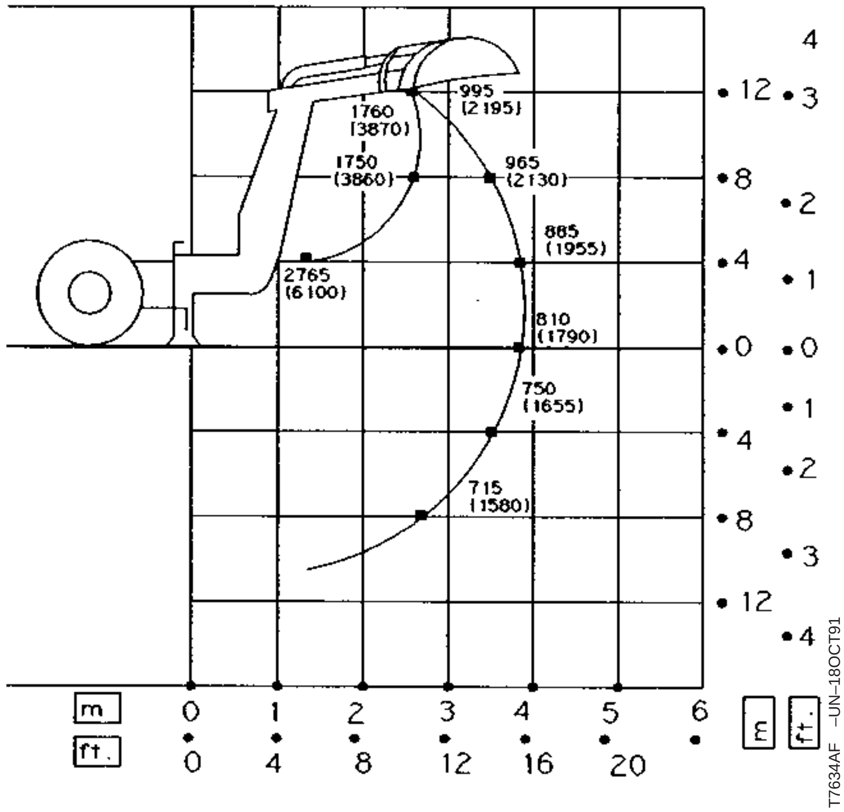
TX,115,DH1398 –19–29OCT91–2/3



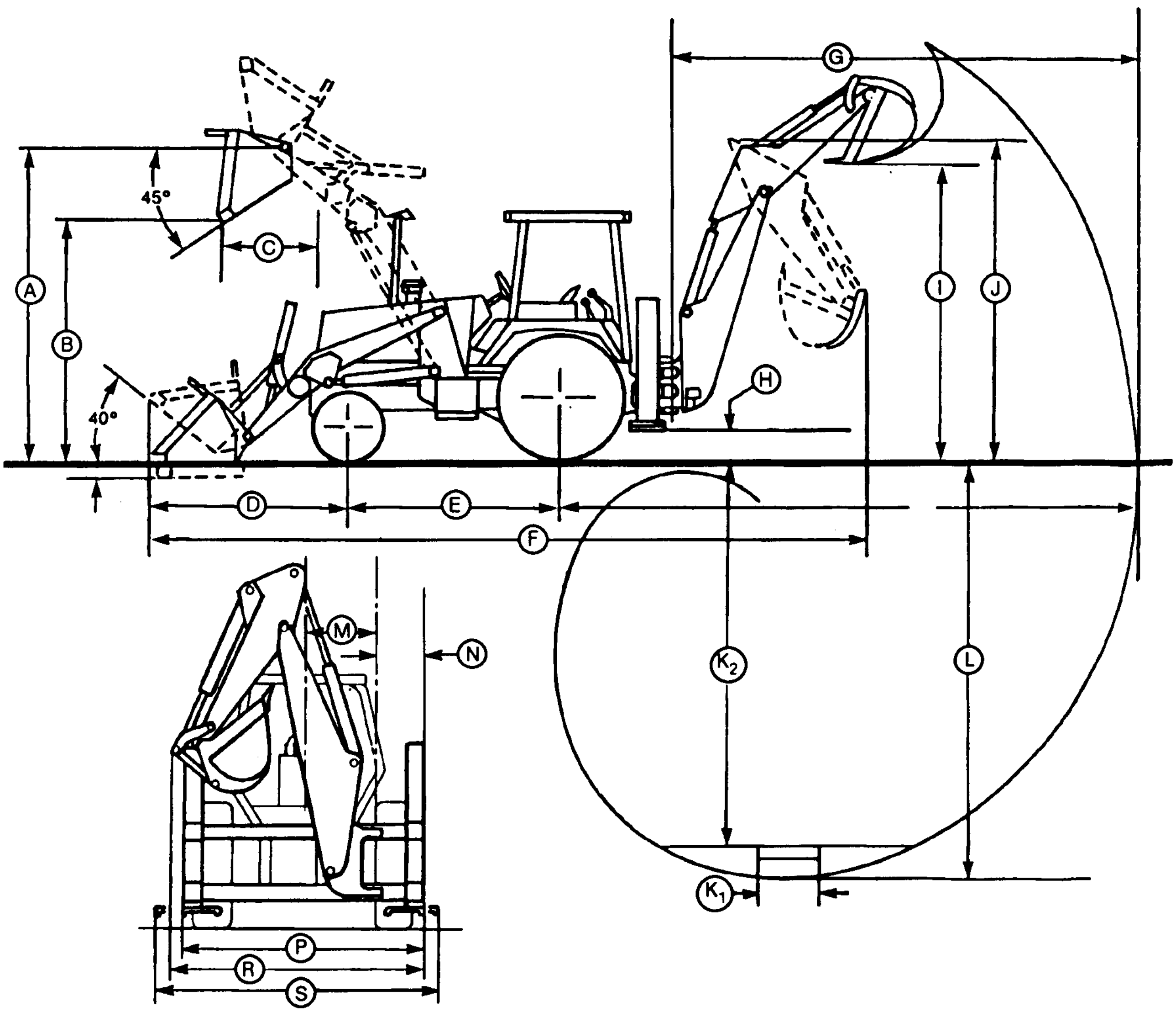
Lift Capacity, Backhoe With Extendible Dipperstick, Retracted Based On SAE J31 (Except With Loader Bucket On Ground)

Lifting capacity ratings are made with bucket hinge pin, loader bucket, and stabilizers on firm, level ground. Lift capacities are hydraulically limited. Lifting capacities are 87 percent of the maximum lift over any point on the swing arc and do not exceed 75 percent of the tipping load. Angle between boom and ground is 65 degrees. Machine is equipped with 610 mm (24 in.) standard bucket, standard or extendible dipperstick and standard equipment.

NOTE: Loader bucket on ground significantly improves side stability, therefore improving lift capacity to the side. Lift capacity over the rear is not affected.

TX,115,DH1398 –19–29OCT91–3/3

315D Specifications



T7181BG –UN–30NOV89

TX,115,DH1611 –19–01DEC90–1/1

315D Sideshift Backhoe Loader

Key:	
A	10 ft 11 in. (3.33 m)
B	8 ft 11.5 in. (2.73 m)
C	28 in. (711 mm)
D	72.4 in. (1839 mm)
E	82.7 in. (2100 mm)

Key:	Backhoe	Extendable Dipperstick	
Retracted	Extended		
F-Overall length, transport	18 ft 6 in. (5.63 m)	18 ft 6 in. (5.63 m)	18 ft 6 in. (5.63 m)
G-Reach from center of swing mast	17 ft 9 in. (5.32 m)	17 ft 10 in. (5.44 m)	21 ft 4 in. (6.41 m)
H-Ground clearance, minimum	13.8 in. (350 mm)	13.8 in. (350 mm)	13.8 in. (350 mm)
I-Loading height, truck loading position	11 ft 7 in. (3.53 m)	12 ft 0 in. (3.66 m)	14 ft 2 in. (4.24 m)
J-Transport height	12 ft 3 in. (3.73 m)	12 ft 5 in. (3.78 m)	12 ft 5 in. (3.78 m)
K-Digging depth (SAE)			
(1) 2 ft (610 mm) flat bottom	13 ft 11.5 in. (4.25 m)	13 ft 11.5 in. (4.25 m)	17 ft 9.5 in. (5.42 m)
(2) 8 ft (2440 mm) flat bottom	12 ft 9 in. (3.89 m)	12 ft 9 in. (3.89 m)	16 ft 10 in. (5.13 m)
L-Maximum digging depth	14 ft 1 in. (4.29 m)	14 ft 1 in. (4.29 m)	18 ft 0 in. (5.49 m)
M-Side shift from tractor centerline	23.5 in. (597 mm)	23.5 in. (597 mm)	23.5 in. (597 mm)
N-Wall to swing centerline	20.6 in. (523 mm)	20.6 in. (523 mm)	20.6 in. (523 mm)
P-Stabilizer width-pads turned in	88.2 in. (2240 mm)	88.2 in. (2240 mm)	88.2 in. (2240 mm)
R-Overall width (less loader bucket)	97.6 in. (2480 mm)	97.6 in. (2480 mm)	97.6 in. (2480 mm)
S-Stabilizer width-pads turned out	103.5 in. (2630 mm)	103.5 in. (2630 mm)	103.5 in. (2630 mm)
Digging force, bucket cylinder (power dig position)	11570 lb (51.5 kN)	11530 lb (51.3 kN)	11530 lb (51.3 kg)
Digging force, crowd cylinder	6650 lb (29.6 kN)	6700 lb (29.8 kN)	4550 lb (20.2 kN)
Swing arc	180 degrees	180 degrees	180 degrees
Operator control	Two levers	Right foot treadle	Right foot treadle
Bucket positions	12° or 21° rollback	8° or 17° rollback	13° or 21° rollback
Lifting capacity, maximum boom @ 65°	4600 lb (2087 kg)	4400 lb (1996 kg)	2700 lb (1225 kg)

NOTE: Backhoe specifications are with 24 in. (610 mm) standard bucket.

TX,115,DH1612 –19–17APR93–1/1

315D Sideshift Backhoe Loader (Continued)

NOTE: (Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with ICED and SAE Standards.)

Power:	**SAE**
Net	67 hp (50 kW)

Engine:	
John Deere 4039T	
Cylinders	4
Displacement	239 cu. in. (3.91 L)
Maximum torque @ 1200 rpm	215 lb-ft (292 N•m)
Lubrication	Pressure system w/full-flow filter
Cooling	Pressurized w/thermostat and fixed bypass
Air cleaner	Dry
Electrical system	12-volt
Alternator	78 amps
Transmission:	
John Deere 4-speed helical gear, synchronized collar shift transmission with hydraulic reverser.	

Travel Speeds:	**Gear**	**Forward**		**Reverse**	
mph	**km/h**	**mph**	**km/h**		
With Standard 17.5L-24 rear and 11L-15 front tires	1	3.3	5.3	3.0	4.8
2	5.7	9.2	5.1	8.2	
3	12.3	19.8	11.1	17.9	
4	22.4	36.1	20.2	32.5	

Final Drives:
Heavy-duty inboard mounted planetary. Evenly distributes axle shock loads over three oil cooled gears.

Service Brakes:
Manual hydraulic, applied with separate pedals; hydraulically equalized when both pedals are depressed. Wet disks and facings are fully enclosed and self-adjusting.

Park Brake:
Independent system, spring applied, hydraulically released, and controlled by an electric switch on the side console.

Steering: Hydrostatic Power	
Non-powered axle curb turning radius	
(brakes applied)	11 ft 9 in. (3.57 m)
(without brakes)	13 ft 3 in. (4.04 m)
Bucket clearance circle	
(brakes applied)	31 ft 6 in. (9.61 m)
(without brakes)	34 ft 7 in. (10.55 m)
Steering wheel turns	
Stop to stop	2.2 to 2.9
Powered axle (MFWD) curb turning radius	
(brakes applied)	10 ft 11 in. (3.34 m)
(without brakes)	13 ft 8 in. (4.17 m)
Bucket clearance circle	
(brakes applied)	29 ft 9 in. (9.07 m)
(without brakes)	35 ft 3 in. (10.74 m)
Steering wheel turns	
Stop to stop	

Hydraulic System:Open center	
Pressure setting	2700 psi (18 620 kPa)
Pump	Gear type
Flow @ 2200 rpm	35 gpm (133 L/min)
Filter, return oil	10 micron replaceable element

Tires:	
Front	14 x 17.5, 10PR NHS 10.5/80 x 18, 10PR, I-3 11L-16, 12PR, F3
Rear	16.9 X 28 8PR R4

Transporting:	
SAE operating weight with ROPS	14,000 lb (6350 kg)

TX,115,DH1613 –19–22JUL99–1/1

315D Buckets

Loader:	Width In. (mm)	Struck Capacity Cu. Yd. (m^3)	Heaped Capacity Cu. Yd. (m^3)
General Purpose	92 (2340)	0.88 (0.67)	1.0 (0.76)
92 (2340)	1.07 (0.88)	1.3 (1.00)	
Long Lip	89.4 (2270)	1.05	1.25

Backhoe:	Width In. (mm)	Struck Capacity Cu. Ft. (m^3)	Capacity Cu. Ft. (m^3)
Standard	12 (305)	2.6 (0.07)	3.0 (0.08)
16 (406)	3.7 (0.10)	4.5 (0.13)	
18 (457)	4.2 (0.12)	5.1 (0.14)	
24 (610)	5.9 (0.17)	7.5 (0.21)	
24 (610)	7.2 (0.20)	8.8 (0.25)	
30 (762)	7.5(0.21)	10.0 (0.28)	
36 (914)	7.5 (0.21)	10.0 (0.28)	
36 (914)	11.2 (0.32)	14.5(0.41)	

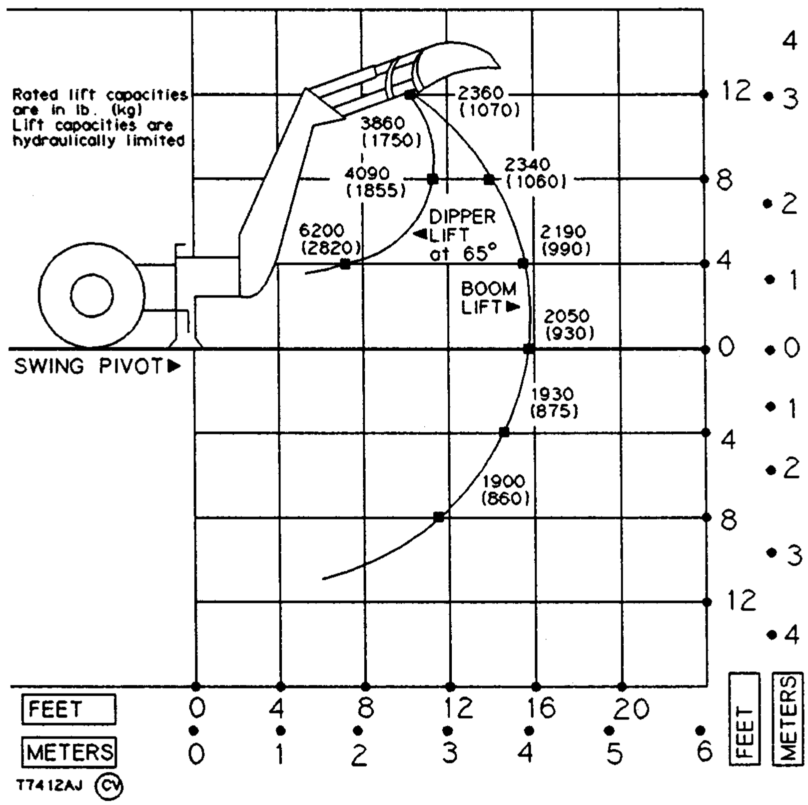
TX,115,DH1614 –19–13DEC90–1/1

315D Sideshift Backhoe Loader Drain And Refill Capacities

	U.S.	Metric
Engine coolant	17 qt	16 L
Engine oil (including filter)	9 qt	8.5 L
Torque converter and reverser	8 qt	7.6 L
Transaxle		
(without MFWD)	22 qt	23 L
(with MFWD)	23 qt	24 L
Fuel tank	28 gal	106 L
Hydraulic reservoir	11 gal	41.5 L
MFWD Planetary	1.1 qt	1 L

TX,115,DH1615 –19–24FEB96–1/1

315D Lift Capacity—LB (KG)



T7412AJ –19–27NOV90

Backhoe With Standard Dipperstick

Lifting capacity ratings are made with bucket hinge pin, loader bucket and stabilizers on firm, level ground. Lifting capacities are 87 percent of the maximum lift over any point on the swing arc and do not exceed 75 percent of the tipping load. Angle between boom and ground is 65 degrees. Machine is equipped with 24 in. (610 mm) standard bucket, standard or extendible dipperstick, and standard equipment. Backhoe in center position.

NOTE: Loader bucket on ground significantly improves side stability, therefore improving lift capacity to the side. Lift capacity over the rear is not affected.

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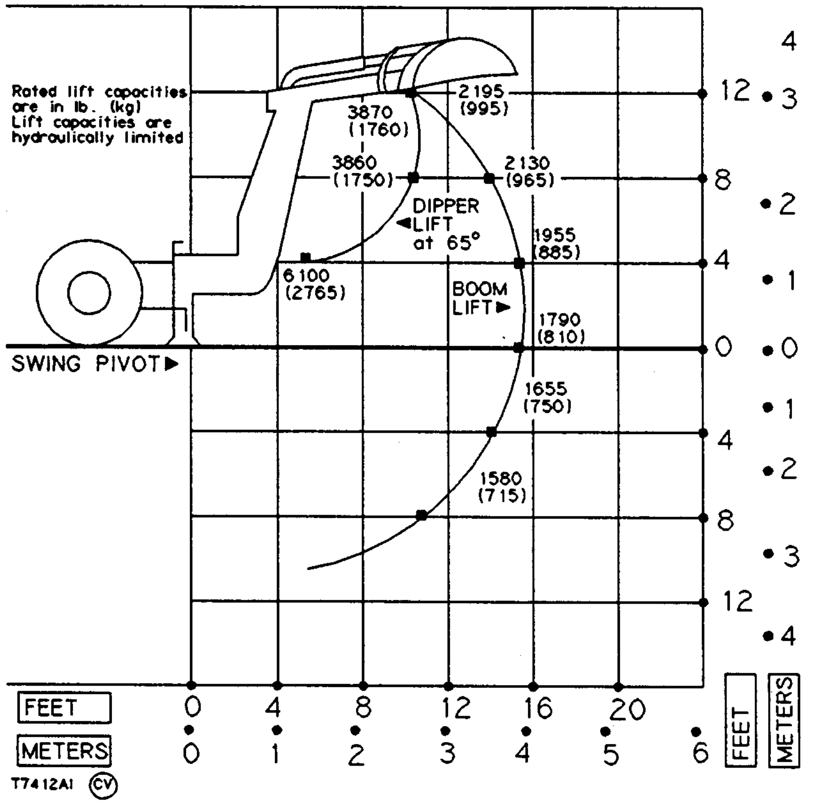
TX115DH1620 –19–11JAN91–1/3



T7412AI –19–27NOV90

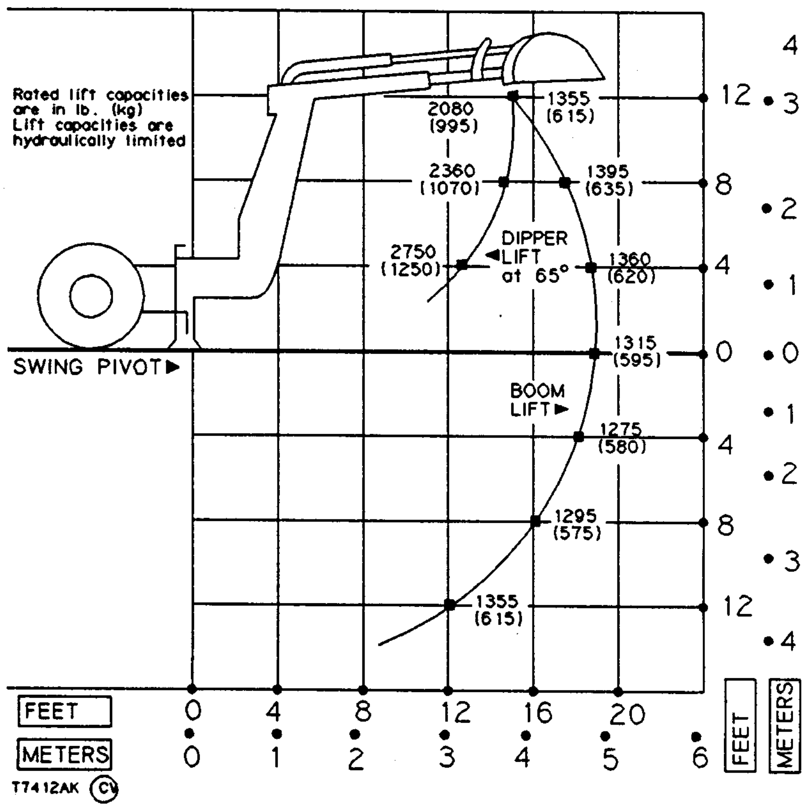
Backhoe With Extendible Dipperstick, Retracted

Lifting capacity ratings are made with bucket hinge pin, loader bucket and stabilizers on firm, level ground. Lifting capacities are 87 percent of the maximum lift over any point on the swing arc and do not exceed 75 percent of the tipping load. Angle between boom and ground is 65 degrees. Machine is equipped with 24 in. (610 mm) standard bucket, standard or extendible dipperstick, and standard equipment. Backhoe in center position.

NOTE: Loader bucket on ground significantly improves side stability, therefore improving lift capacity to the side. Lift capacity over the rear is not affected.

Continued on next page

TX115DH1620 –19–11JAN91–2/3



T7412AK –19–27NOV90

Backhoe With Extendible Dipperstick, Extended

Lifting capacity ratings are made with bucket hinge pin, loader bucket and stabilizers on firm, level ground. Lifting capacities are 87 percent of the maximum lift over any point on the swing arc and do not exceed 75 percent of the tipping load. Angle between boom and ground is 65 degrees. Machine is equipped with 24 in. (610 mm) standard bucket, standard or extendible dipperstick, and standard equipment. Backhoe in center position.

NOTE: Loader bucket on ground significantly improves side stability, therefore improving lift capacity to the side. Lift capacity over the rear is not affected.

TX115DH1620 –19–11JAN91–3/3

Hardware Torque Specifications

Check cap screws and nuts to be sure they are tight. If hardware is loose, tighten to torque shown on the following charts unless a special torque is specified.

TX,90,FF1225 –19–15MAR93–1/1

Checking Wheel Fasteners

T6000AU –UN–18OCT88

T87507 –UN–21OCT88

Tighten wheel cap screws and fasteners.

Front Axle—Specification

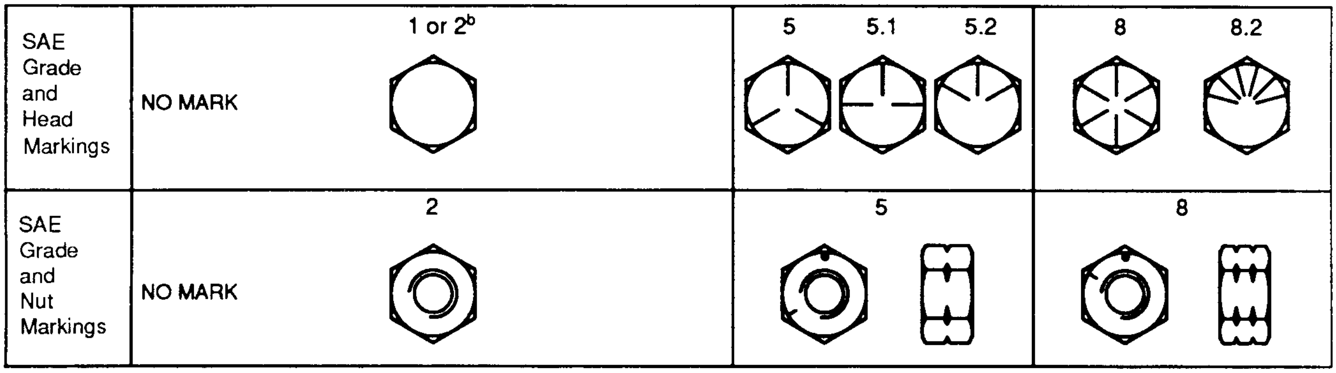
Standard Axle—Torque .... 136 +20 -27 N•m (100 +15 -20 lb-ft)
MFWD Axle—Torque .... 300 +110 -40 N•m (221 +81 -29 lb-ft)

Rear Axle—Specification

Standard Axle—Torque .... 575 +170 -115 N•m (425 +125 -85 lb-ft)

TX,90,DH1383 –19–09DEC93–1/1

Unified Inch Bolt and Cap Screw Torque Values



Size	Grade 1				Grade 2[b]				Grade 5, 5.1, or 5.2				Grade 8 or 8.2			
	Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]	
	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft	N·m	lb-ft
1/4	3.7	2.8	4.7	3.5	6	4.5	7.5	5.5	9.5	7	12	9	13.5	10	17	12.5
5/16	7.7	5.5	10	7	12	9	15	11	20	15	25	18	28	21	35	26
3/8	14	10	17	13	22	16	27	20	35	26	44	33	50	36	63	46
7/16	22	16	28	20	35	26	44	32	55	41	70	52	80	58	100	75
1/2	33	25	42	31	53	39	67	50	85	63	110	80	120	90	150	115
9/16	48	36	60	45	75	56	95	70	125	90	155	115	175	130	225	160
5/8	67	50	85	62	105	78	135	100	170	125	215	160	240	175	300	225
3/4	120	87	150	110	190	140	240	175	300	225	375	280	425	310	550	400
7/8	190	140	240	175	190	140	240	175	490	360	625	450	700	500	875	650
1	290	210	360	270	290	210	360	270	725	540	925	675	1050	750 .	1300	975
1-1/8	400	300	510	375	400	300	510	375	900	675	1150	850	1450	1075	1850	1350
1-1/4	570	425	725	530	570	425	725	530	1300	950	1650	1200	2050	1500	2600	1950
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2150	1550	2700	2000	3400	2550
1-1/2	1000	725	1250	925	990	725	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

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. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

[a] *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated without any lubrication.*

[b] *Grade 2 applies for hex cap screws (not hex bolts) up to 152 mm (6-in.) long. Grade 1 applies for hex cap screws over 152 mm (6-in.) long, and for all other types of bolts and screws of any length.*

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

TS1656 –19–02APR97

DX,TORQ1 –19–20JUL94–1/1

Additional Metric Cap Screw Torque Values

CAUTION: Use only metric tools on metric hardware. Other tools may not fit properly. They may slip and cause injury.

Check tightness of cap screws periodically. Torque values listed are for general use only. Do not use these values if a different torque value or tightening procedure is listed for a specific application.

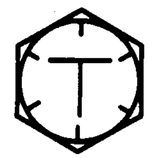
Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and you properly start thread engagement. This will prevent them from failing when tightening.

Tighten cap screws having lock nuts to approximately 50 percent of amount shown in chart.

T6873AA

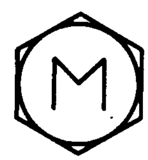


T6873AA –UN–18OCT88

T6873AB

T6873AB –UN–18OCT88

T6873AC



T6873AC –UN–18OCT88

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04T,90,M170 –19–01AUG94–1/2

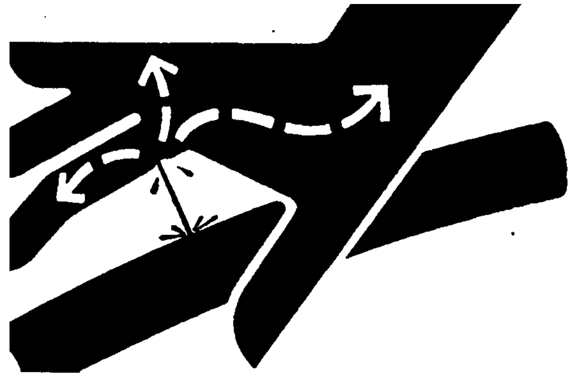
METRIC CAP SCREW TORQUE VALUES[a]

Nominal Dia	T-Bolt		H-Bolt		M-Bolt	
N•m	**lb-ft**	**N•m**	**lb-ft**	**N•m**	**lb-ft**	
8	29	21	20	15	10	7
10	63	46	45	33	20	15
12	108	80	88	65	34	25
14	176	130	137	101	54	40
16	265	195	206	152	78	58
18	392	289	294	217	118	87
20	539	398	392	289	167	125
22	735	542	539	398	216	159
24	931	687	686	506	274	202
27	1372	1012	1029	759	392	289
30	1911	1410	1421	1049	539	398
33	2548	1890	1911	1410	735	542
36	3136	2314	2401	1772	931	687

[a]Torque tolerance is ±10%.

04T,90,M170 –19–01AUG94–2/2

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.

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.

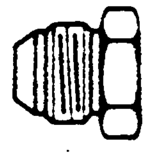
Tubing with dents may cause the oil to overheat. If you find tubing with dents, install new tubing immediately.

IMPORTANT: Tighten fittings as specified in torque chart.

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

TX,90,DH1559 –19–01AUG94–1/1

Service Recommendations for 37° Flare and 30° Cone Seat Connectors



1. Inspect flare and flare seat. They must be free of dirt or obvious defects.

2. Defects in tube flare cannot be repaired. Overtightening a defective flared fitting will not stop leaks.

3. Align tube with fitting before attempting to start nut.

4. Lubricate male threads with hydraulic fluid or petroleum jelly.

5. Index angle fittings and tighten by hand.

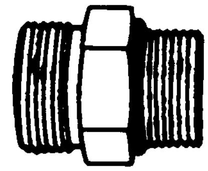
6. Tighten fitting or nut to torque value shown on torque chart. Do not allow hoses to twist when tightening fittings.

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	190	140
1-7/8 - 12 UN	217	160
NOTE: Torque tolerance is ± 10%.		

T82,BHMA,EL –19–19MAR96–1/1

Service Recommendations for O-Ring Boss Fittings

Straight Fitting



T6243AE –UN–18OCT88

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.

Continued on next page

TX, I,DY356 –19–29MAY96–1/2

Angle Fitting

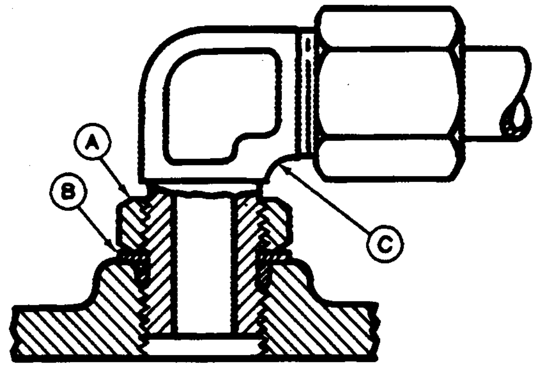
1. Back-off lock nut (A) and back-up washer (B) completely to head-end (C) of fitting.

2. Turn fitting into threaded boss until back-up washer contacts face of boss.

3. Turn fitting head-end counterclockwise to proper index (maximum of one turn).

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

4. Hold fitting head-end with a wrench and tighten locknut and back-up washer to proper torque value.

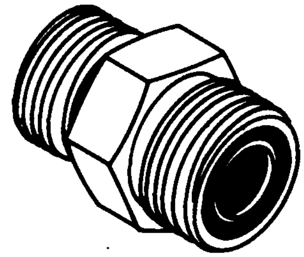


T6520AB –UN–18OCT88

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 ± 10%.		

TX, I,DY356 –19–29MAY96–2/2

Service Recommendations for Flat Face O-Ring Seal Fittings



T6243AD –UN–18OCT88

1. Inspect the fitting sealing surfaces. They must be free of 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.

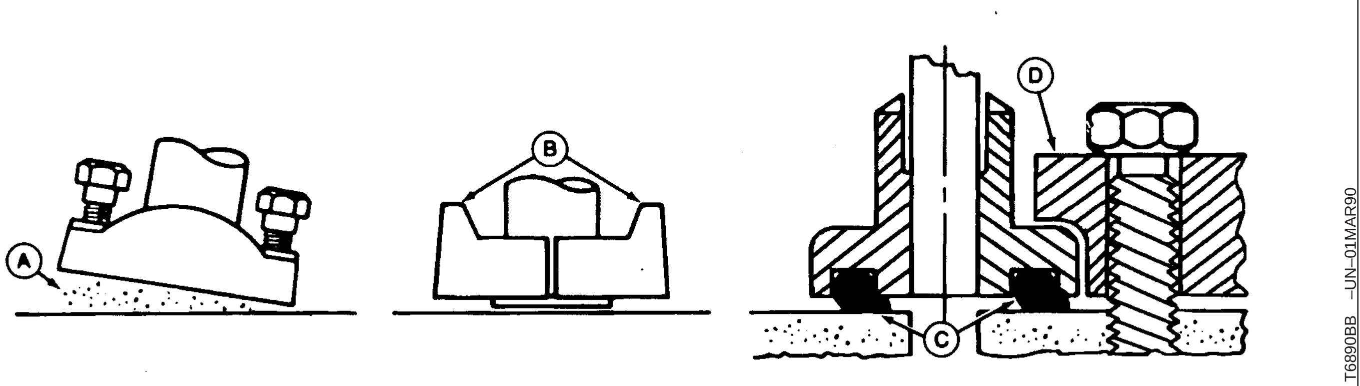
5. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place.

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.

FLAT FACE O-RING SEAL FITTING TORQUE							
Nominal Tube O.D.		Dash Size	Thread Size in.	Swivel Nut		Bulkhead Nut	
mm	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%.							

04T,90,K67 –19–01AUG94–1/1

Service Recommendations For Inch Series Four Bolt Flange Fittings



A—Sealing Surface B—Split Flange C—Pinched O-Ring D—Single Piece Flange

1. Clean sealing surfaces (A). Inspect. Scratches cause leaks. Roughness causes seal wear. Out-of-flat causes seal extrusion. If defects cannot be polished out, replace component.

2. Install O-ring (and backup washer if required) into groove using petroleum jelly to hold it in place.

3. Split flange: Loosely assemble split flange (B) halves. Make sure split is centrally located and perpendicular to port. Hand tighten cap screws to hold parts in place. Do not pinch O-ring (C).

4. Single piece flange (D): Place hydraulic line in center of flange and install cap screws. Flange must be centrally located on port. Hand tighten cap screws to hold flange in place. Do not pinch O-ring.

5. Tighten one cap screw, then tighten the diagonally opposite cap screw. Tighten two remaining cap screws. Tighten all cap screws as specified in the chart below.

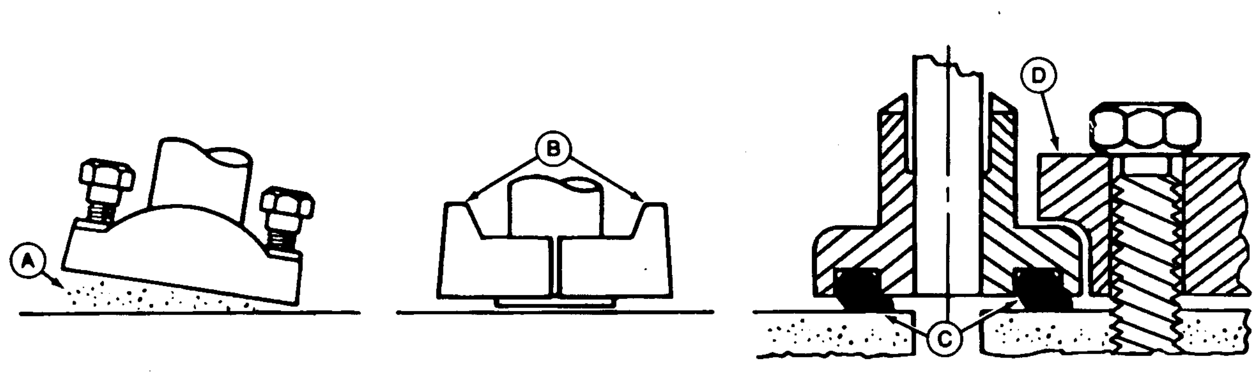
   DO NOT use air wrenches. DO NOT tighten one cap screw fully before tightening the others. DO NOT over tighten.

TORQUE CHART

		N•m		lb-ft	
Nominal Flange Size	**Cap Screw Size**	**Min**	**Max**	**Min**	**Max**
1/2	5/16-18 UNC	20	31	15	23
3/4	3/8-16 UNC	28	54	21	40
1	3/8-16 UNC	37	54	27	40
1-1/4	7/16-14 UNC	47	85	35	63
1-1/2	1/2-13 UNC	62	131	46	97
2	1/2-13 UNC	73	131	54	97
2-1/2	1/2-13 UNC	107	131	79	97
3	5/8-11 UNC	158	264	117	195
3-1/2	5/8-11 UNC	158	264	117	195
4	5/8-11 UNC	158	264	117	195
5	5/8-11 UNC	158	264	117	195

04T,90,K174 –19–01AUG94–1/1

Service Recommendations for Metric Series Four Bolt Flange Fitting



A—Sealing Surface B—Split Flange C—Pinched O-Ring D—Single Piece Flange

1. Clean sealing surfaces (A). Inspect. Scratches cause leaks. Roughness causes seal wear. Out-of-flat causes seal extrusion. If defects cannot be polished out, replace component.

2. Install the correct O-ring (and backup washer if required) into groove using petroleum jelly to hold it in place.

3. Split flange: Loosely assemble split flange (B) halves. Make sure split is centrally located and perpendicular to the port. Hand tighten cap screws to hold parts in place. Do not pinch O-ring (C).

4. Single piece flange (D): Place hydraulic line in center of flange and install four cap screws. Flange must be centrally located on port. Hand tighten cap screws to hold flange in place. Do not pinch O-ring.

5. After components are properly positioned and cap screws are hand tightened, tighten one cap screw, then tighten the diagonally opposite cap screw. Tighten two remaining cap screws. Tighten all cap screws as specified in the chart below.

   DO NOT use air wrenches. DO NOT tighten one cap screw fully before tightening the others. DO NOT over tighten.

TORQUE CHART[a]

Thread[b]	N•m	lb-ft
M6	12	9
M8	30	22
M10	57	42
M12	95	70
M14	157	116
M16	217	160
M18	334	246
M20	421	318

[a]Tolerance ± 10%. The torques given are enough for the given size connection with the recommended working pressure. Increasing cap screw torque beyond these amounts will result in flange and cap screw bending and connection failures.

[b]Metric standard thread.

04T,90,K175 –19–05JAN96–1/1

Fuel Specifications

Use ONLY clean, high-quality fuel.

Use Grade No. 2-D fuel above 40°F (4°C).

	Specification
Grade No. 2-D Fuel—Temperature	Above 40°F (4°C)

Use Grade No. 1-D fuel below 40°F (4°C).

Use Grade No. 1-D fuel for all air temperatures at altitudes above 5000 ft (1 500 m).

IMPORTANT: If fuel sulfur content exceeds 0.5 per cent, the engine oil drain interval must be reduced by 50 per cent (to 125 hours).

Use fuel with less than 1.0 per cent sulfur. If possible, use fuel with less than 0.5 per cent sulfur.

For maximum filter life, sediment and water should not be more than 0.10 per cent.

The cetane number should be 40 minimum. If you operate your machine where air temperatures are normally low or where altitudes are high, you may need fuel with a higher cetane number.

Cloud Point—For cold weather operation, cloud point should be 10°F (6°C) below lowest normal air temperature.

TX,45,DH1223 –19–15MAY92–1/1

Low Sulfur Diesel Fuel Conditioner

When possible, use existing fuel formulations for engines used off-highway. This fuel will not require any additives to provide good performance and engine reliability. However, many local fuel distributors will not carry both low and regular sulfur diesel fuels.

If the local fuel distributor will supply only low sulfur fuel, order and use John Deere TY22030 Diesel Fuel Conditioner. It provides lubricating properties along with other useful benefits, such as cetane improver, anti-oxidant, fuel stabilizer, corrosion inhibitor and others. TY22030 is specifically for use with low sulfur fuels. Nearly all other diesel fuel conditioners only improve cold weather flow and stabilize long-term fuel storage. They do not contain the lubrication additives needed by rotary fuel injection pumps.

TX,45,DH3124 –19–20OCT93–1/1

Storing Fuel

If there is a very slow turnover of fuel in the fuel tank or supply tank, it may be necessary to add a fuel conditioner to prevent water condensation. Contact your John Deere dealer for proper service or maintenance recommendations.

DX,FUEL –19–03MAR93–1/1

Do Not Use Galvanized Containers

IMPORTANT: Diesel fuel stored in galvanized containers reacts with zinc coating on the container to form zinc flakes. If fuel contains water, a zinc gel will also form. The gel and flakes will quickly plug fuel filters and damage fuel injectors and fuel pumps.

DO NOT USE a galvanized container to store diesel fuel.

Store fuel in:

- plastic containers.
- aluminum containers.
- specially coated steel containers made for diesel fuel.

DO NOT USE brass-coated containers: brass is an alloy of copper and zinc.

MX,FLBT,C –19–04JUN90–1/1

Fuel Tank

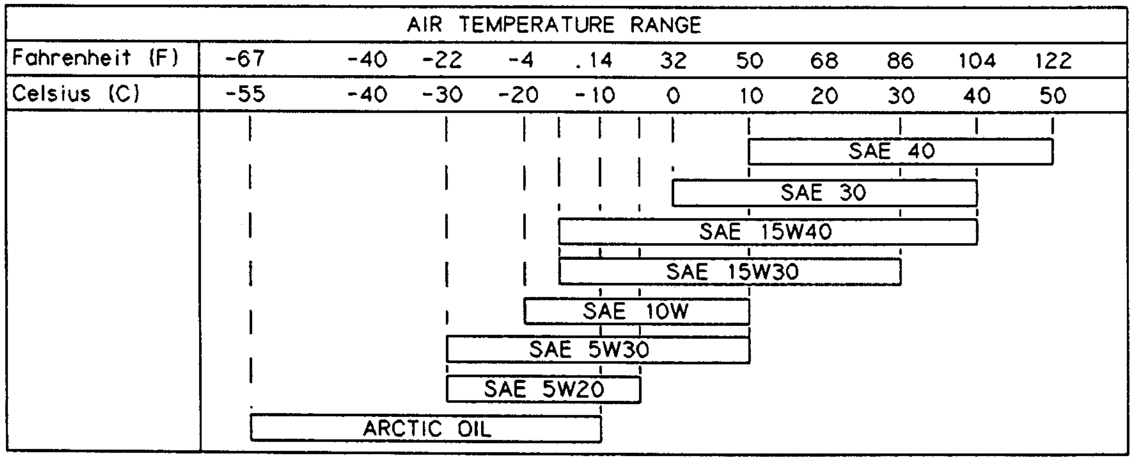
CAUTION: Handle fuel carefully. If the engine is hot or running, DO NOT fill the fuel tank. DO NOT smoke while you fill fuel tank or work on fuel system.

To avoid condensation, fill the fuel tank at the end of each day's operation. Shut off engine before filling.

TS185 –UN–23AUG88

TX,45,DH1588 –19–24AUG94–1/1

Engine Oil



T7396BK –19–19JUN91

Depending upon the expected air temperature range between oil changes, use oil viscosity shown on the temperature chart above.

Additives are not required nor recommended.

John Deere engine oil filters are highly recommended because they are of known high quality and effectiveness.

John Deere TORQ-GARD SUPREME PLUS 50®engine oil is recommended. It is a specifically balanced formulation to provide superior protection against oil thickening, carbon deposits, lacquer, and mechanical wear during high temperature operation.

John Deere TORQ-GARD SUPREME®engine oil is also recommended.

If other oils are used, the required specification is:

- API Service Class CE or CD (1)
- Military Spec MIL-L-2104D or MIL-L-2104C

Most oil containers or specifications list several API Service Classes (such as SC, SG, CE, CC) met by the oil. For the oil you use, either CE or CD must be among the classes listed.

NOTE: Oils meeting API Service Classes CE or CD are not always available in viscosity grades SAE 5W20, SAE 5W30, and Arctic Oils. For these viscosity grades only, the following oil specification may be used but the oil and filter change interval must be reduced to 125 hours

- *API Service Class CC (MIL-L-46152B)*
- *Military Spec MIL-L-46167A (arctic oil)*

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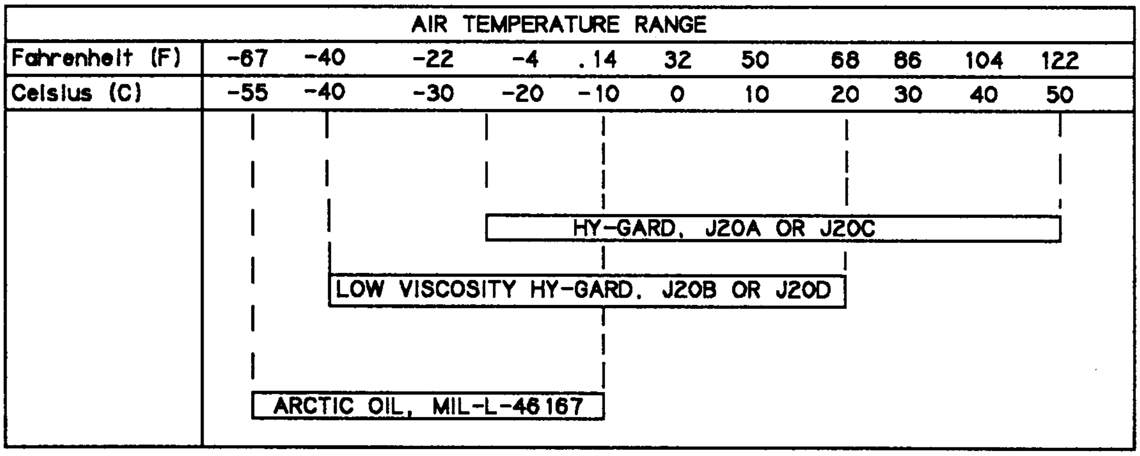
TX,45,DH1532 –19–01AUG94–1/1

Transaxle Oil



T7646AB CV

T6186AG –19–18OCT91

Depending on the expected air temperature range between oil changes, use oil viscosity shown on the chart above.

JOHN DEERE HY-GARD®TRANSMISSION AND HYDRAULIC OIL IS RECOMMENDED because it is specifically formulated to minimize brake chatter, and to provide maximum protection against mechanical wear.

You may also use oils which meet minimum John Deere standards, or other oils meeting John Deere Standard JDM J20A or J20C and J20B or J20D.

Oils meeting MIL-L46167A may be used as arctic oil.

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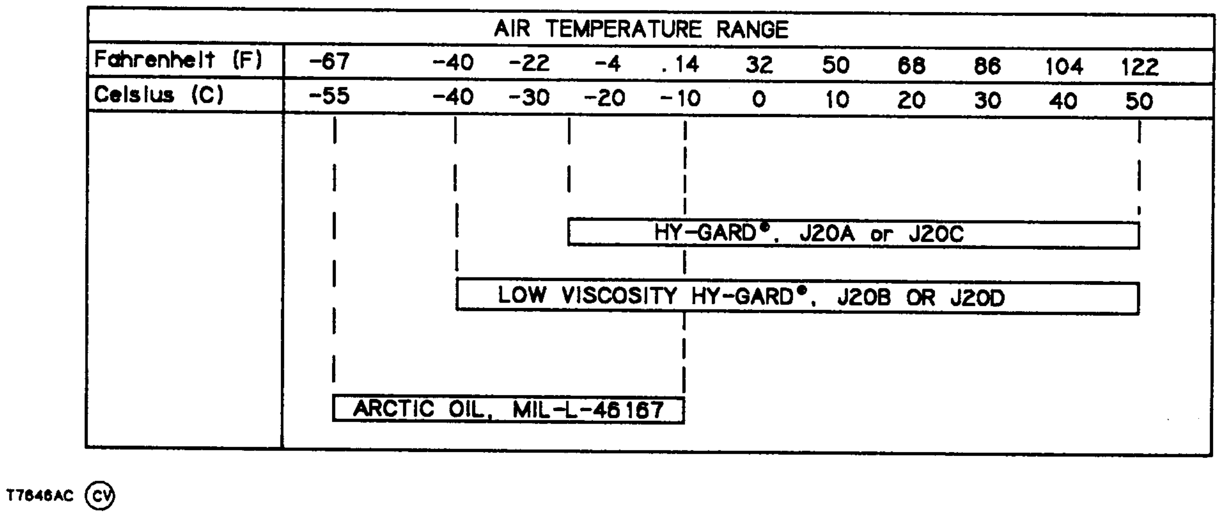
TX,45,DH2079 –19–27NOV91–1/1

Hydraulic And Reverser Oil



T6249AY –19–15NOV91

Depending on the expected air temperature range between oil changes, use oil viscosity shown on the chart above.

JOHN DEERE HY-GARD®TRANSMISSION AND HYDRAULIC OIL IS RECOMMENDED because it is specifically formulated to minimize brake chatter, and to provide maximum protection against mechanical wear.

You may also use oils which meet minimum John Deere standards, or other oils meeting John Deere Standard JDM J20A or J20C and J20B or J20D.

Oils meeting MIL-L46167A may be used as arctic oil.

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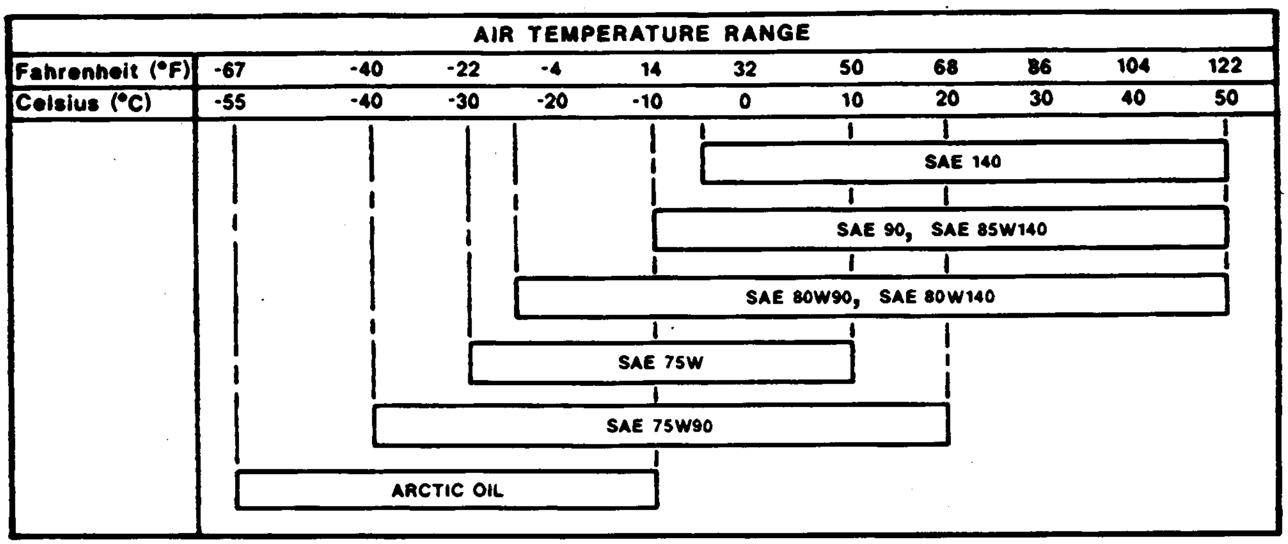
TX,45,DH2074 –19–27NOV91–1/1

Mechanical Front Wheel Drive Oil



T6247AB –19–05JAN89

Depending on the expected air temperature range between oil changes, use oil viscosity shown on the chart above.

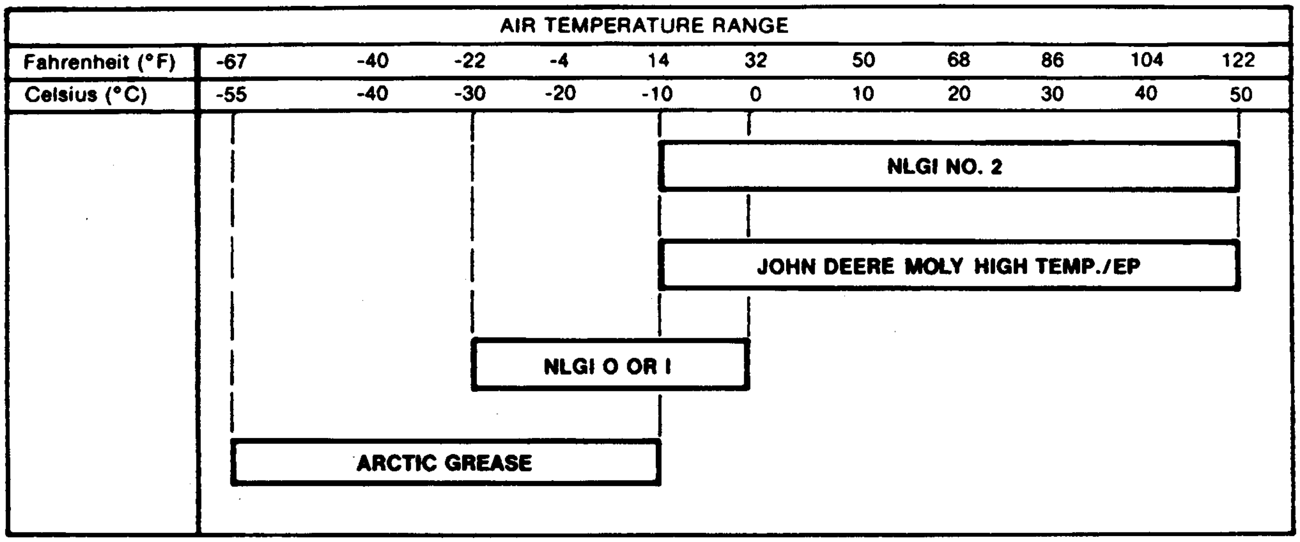
The following oils are recommended:

- John Deere API GL-5 Gear Oil
- Oils meeting API Service GL-5 (MIL-L-2105B or MIL-2105C)

Oil meeting MIl-L-10324A may be used as arctic oil.

T82,45,C11 –19–15MAR93–1/1

Grease



T6722AA –19–27JAN89

Depending on the expected air temperature range, use grease shown on chart above.

Greases recommended are:

- John Deere Moly High Temperature/EP Grease (Preferred)
- SAE Multipurpose Grease with Extreme Pressure (EP) performance and containing 3 to 5 per cent molybdenum disulfide
- SAE multi-purpose EP Grease
- Grease meeting MIL-G-10924C specifications may be used as arctic grease.

02T,45,C49 –19–01AUG94–1/1

Grease For Extendible Dipperstick

SAE Multipurpose Grease with Extreme Pressure (EP) performance and containing 3 to 5 per cent molybdenum disulfide (preferred).

TX,45,DH1576 –19–21JAN92–1/1

Alternative and Synthetic Lubricants

Conditions in certain geographical areas may require lubricant recommendations different from those printed in this manual.

Some John Deere brand coolants and lubricants may not be available in your location.

Consult your John Deere dealer to obtain information and recommendations.

Synthetic lubricants may be used if they meet the performance requirements as shown in this manual.

The temperature limits and service intervals shown in this manual apply to both conventional and synthetic oils.

Re—refined base stock products may be used if the finished lubricant meets the performance requirements.

DX,ALTER –19–18MAR96–1/1

Lubricant Storage

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Whenever possible, store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

DX,LUBST –19–18MAR96–1/1

Mixing of Lubricants

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

Consult your John Deere dealer to obtain specific information and recommendations.

DX,LUBMIX –19–18MAR96–1/1

Diesel Engine Coolant

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F).

The following engine coolant is preferred for service:

- John Deere COOL-GARD Prediluted Coolant

The following engine coolant is also recommended:

- John Deere COOL-GARD Coolant Concentrate in a 40 to 60% mixture of concentrate with quality water.

Other low silicate ethylene glycol base coolants for heavy-duty engines may be used if they meet one of the following specifications:

- ASTM D5345 (prediluted coolant)
- ASTM D4985 (coolant concentrate) in a 40 to 60% mixture of concentrate with quality water

Coolants meeting these specifications require use of supplemental coolant additives, formulated for heavy-duty diesel engines, for protection against corrosion and cylinder liner erosion and pitting.

A 50% mixture of ethylene glycol engine coolant in water provides freeze protection to -37°C (-34°F). If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol base engine coolant concentrate.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

Coolant Drain Intervals

Drain the factory fill engine coolant, flush the cooling system, and refill with new coolant after the first 3 years or 3000 hours of operation. Subsequent drain intervals are determined by the coolant used for service. At each interval, drain the coolant, flush the cooling system, and refill with new coolant.

When John Deere COOL-GARD is used, the drain interval may be extended to 5 years or 5000 hours of operation, provided that the coolant is tested annually AND additives are replenished, as needed, by adding a supplemental coolant additive.

If COOL-GARD is not used, the drain interval is reduced to 2 years or 2000 hours of operation.

DX,COOL –19–04JUN90–1/1

Section 9005
Operational Checkout Procedure

Contents

Operational Checkout Procedure

Use this procedure to check all systems and functions on the machine.

This checkout procedure is designed so technician can make a quick check of the operation of machine while sitting in operator's seat.

A location will be required which is level, has adequate space to complete the driving checks and to work machine. The engine, power train and hydraulic oil must be at operating temperature.

Complete the necessary visual checks (oil levels, oil condition, external leaks, loose hardware, loose linkage) prior to doing the checkout procedure.

No special tools or gauges are needed. Always start in the left column and read completely, follow this sequence from left to right. Read each check completely before performing. Make a copy of the Operational Checkout Record Sheet and record the results of each check on this sheet.

At the end of each check if no problem is found (OK:), you will instructed to GO TO NEXT CHECK. If problem (NOT OK:) is indicated, you will be given repair required or CTM number. If verification is needed, you will be given next best source of information after GO TO:

Group 10 (System Operational Checks)

Group 15 (System Diagnostic Checks)

Group 20 (Adjustments)

Group 25 (Test)

CTM (Component Technical Manual)

TX,D300,DS1984 –19–06APR95–1/1

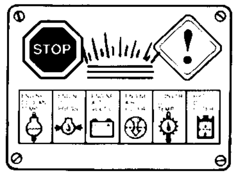
Gauge And Indicator Check With Engine Off

– – –1/1

1 **Gauge And Indicator Check**	Engage park brake. Move FNR lever to neutral (N) position. Apply slight effort to FNR lever forward and reverse. Turn key switch to ON position. *LISTEN: Solenoid "click" should be heard when key switch is turned to ON position.*	**OK:** Go to next check. **NOT OK:** Go to Group 9015-15 , Gauge and Monitor Circuit (Fuel Gauge Does Not Work or Give Accurate Reading). **NOT OK:** Adjust.

– – –1/1

❷ Monitor Indicator Lights And Alarm Checks



T7394BH –UN–10DEC90

Turn key switch to BULB CHECK position and hold.

LOOK: All six monitor indicator lights and CAUTION light must be on. STOP light must flash and alarm must "beep".

LISTEN: Starting motor must NOT operate.

OK: Go to next check.

NOT OK: Check monitor fuse.

NOT OK: Go to Group 9015-15 , Gauges and Monitor Checks, Display Monitor Check.

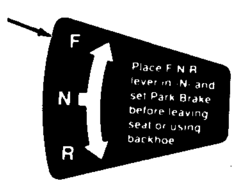
NOT OK: If motor starts and bulb check position is OK, key switch is failed or there is a short in wiring. Go to Group 9015-15 , Key Switch Test.

– – –1/1

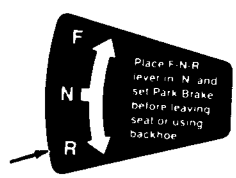
FNR And Neutral Start Switches, Start Circuit And Reverse Warning Alarm Checks

– – –1/1

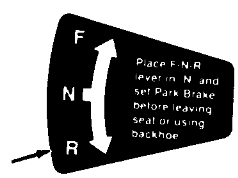
❶ FNR Switch Check



T7447AG –UN–04JAN91



T7447AI –UN–04JAN91



T7447AI –UN–04JAN91

Engine off.

Put FNR lever in neutral.

Turn key switch to ON position.

Move FNR lever to forward (F), reverse (R), then neutral (N) position.

Observe and feel forward, neutral and reverse detents.

LOOK: FNR lever must align with neutral position in quadrant when reverser valve is in neutral detent position.

LISTEN: You must hear neutral start switch "click" as FNR lever is moved EQUAL distance from neutral to forward position and from neutral to reverse position.

FEEL: You must feel detent engagement in each position of FNR lever.

OK: Go to next check.

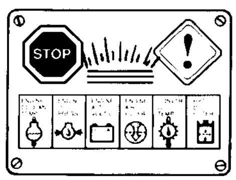
NOT OK: If no "click", inspect neutral start fuse.

NOT OK: See Start Circuit Diagnostic Procedures , Group 9015-15.

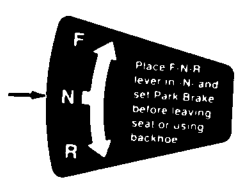
– – –1/1

❷ **Neutral Start Switch Check**	Put FNR lever in neutral. Move FNR lever to forward (F) position and turn key switch to start position. Move FNR lever to reverse (R) position and turn key switch to start position. *LISTEN: Starting motor must NOT operate.*	**OK:** Go to next check. **NOT OK:** See Start Circuit Diagnostic Procedures , Group 9015-15.

– – –1/1

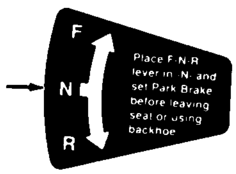
❸ **Start Circuit Check**	 T7394BH –UN–10DEC90 Move FNR lever to neutral (N) position and turn key switch to START position. Observe and listen to monitor as engine is cranking. *LISTEN: Starting motor must operate.* *LISTEN: Alarm must sound.* *LOOK: During engine cranking, all six indicator lights must be on, CAUTION must light and STOP must flash.*	**OK:** Go to next check. **NOT OK:** If engine turns but does not start, check fuel shut-off/start aid/reverse alarm fuse **NOT OK:** If starting motor does not operate check start fuse. **NOT OK:** See Start Circuit Diagnostic Procedures , Group 9015-15.

– – –1/1

❹ **Reverse Warning Alarm Check (S.N. —794639)**	 T7447AH –UN–04JAN91 Operate engine at slow idle. Put FNR lever in neutral (N). Turn park brake switch to OFF position. Move FNR lever to reverse (R) position. *LISTEN: Reverse warning alarm must sound.*	**OK:** Go to next check. **NOT OK:** Increase engine speed to fast idle. If alarm now sounds, low reverser clutch pressure is indicated. Go to Group 9020-10 , Reverser System Check. **NOT OK:** Check wiring connector at alarm. Go to Group 9015-15 , Reverse Alarm Circuit.

– – –1/1

❺ Reverse Warning Alarm Check (S.N.794640—)



T7447AH –UN–04JAN91

Key switch ON.

Move FNR lever to reverse (R) position.

LISTEN: Reverse warning alarm must sound.

OK: Go to next check.

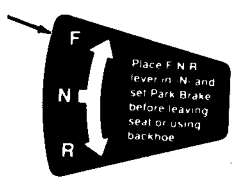
NOT OK: See Reverse Alarm Circuit. Go to Group 9015-15.

– – –1/1

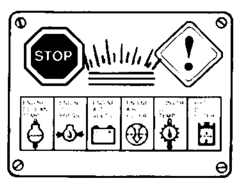
Park Brake, Charge Indicator Light, Tachometer/Hour Meter Circuit And Engine Speed Control Linkage Checks

– – –1/1

❶ Park Brake Indicator Check



T7447AG –UN–04JAN91



T7394BH –UN–10DEC90

IMPORTANT: If engine oil pressure indicator light stays ON, STOP ENGINE IMMEDIATELY, check oil level.

Engage park brake.

Put FNR lever in neutral (N) and start the engine.

Put FNR lever in forward (F) position.

LOOK: STOP indicator must stay ON and flashing. Alarm must "beep". Park brake light must be ON. All other lights must go out.

OK: Go to next check.

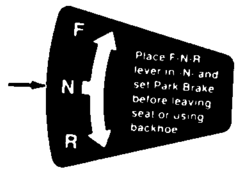
NOT OK: If engine low oil pressure indicator light stays ON, STOP ENGINE IMMEDIATELY and check oil level. Go to Group 9010-15 , Engine Low Oil Pressure.

NOT OK: If alternator indicator light is on, increase engine speed to 1200 rpm and alternator light MUST go out. Go to Group 9015-15 , Charge Circuit Checks.

NOT OK: If no park brake light, inspect wiring connector at switch on park brake linkage. Go to Group 9015-15 , Park Brake Circuit.

– – –1/1

❷ Tachometer/Hourmeter Circuit Check



T7447AH –UN–04JAN91

IMPORTANT: If engine low oil pressure indicator light stays ON, STOP ENGINE IMMEDIATELY and check oil level.

Engage park brake.

Put FNR lever in neutral and start the engine.

Put FNR lever in forward (F) position.

LOOK: STOP indicator must stay ON and flashing. Alarm must "beep". Park brake light must be ON. All other lights must go out.

LOOK: Hourmeter indicator must be rotating.

LOOK: Tachometer (if equipped) must indicate rpm.

Release park brake.

Park brake indicator light and STOP light must go out. Alarm must stop "beeping".

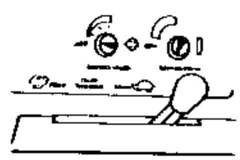
OK: Go to next check.

NOT OK: If park brake indicator light stays ON, adjust park brake switch on park brake linkage until light goes out. Go to Group 9015-15 , Park Brake Circuit.

NOT OK: If no hour meter or tachometer movement, go to Group 9015-15 , Gauge and Hour Meter Circuit.

– – –1/1

❸ Engine Speed Control Lever Linkage Check



T7989AP –UN–19APR93

Engage park brake.

Put FNR lever in neutral (N) position.

Note rpm on tachometer (if equipped).

Move speed control lever to fast idle position.

LOOK: Tachometer must read 850 ± 50 rpm (slow idle) or 2375 ± 50 rpm (fast idle).

LOOK: Speed control lever must remain at selected position.

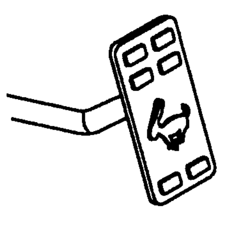
OK: Go to next check.

NOT OK: Tighten friction lock. Go to Group 9010-20.

NOT OK: Check engine speed. Go to Group 9010-20.

– – –1/1

❹ Engine Speed Control Pedal Linkage Check



T7394BF –UN–06JAN92

Depress speed control pedal

LISTEN: Engine speed must be the same as with speed control lever in fast idle position.

OK: Go to next check.

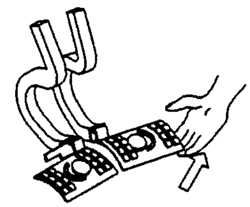
NOT OK: Adjust Speed Control Linkage Override. Go to Group 9010-20.

– – –1/1

Brake System Checks

– – –1/1

❶ Pedal Stop Check



T7394BG –UN–17JAN92

Lift left and right brake pedals.

LOOK: Brake pedals must be against pedal stop screws.

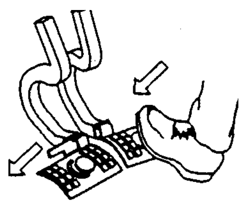
NOTE: This ensures that brake check valves are opened and brakes released.

OK: Go to next check.

NOT OK: Adjust brake pedal stops. Go to Group 9020-20.

– – –1/1

❷ Brake System Leakage Check



T7367AM –UN–17JAN92

Depress and hold left brake pedal, then right brake pedal using approximately 267 N (60 lb force).

Specification

Left Brake Pedal—
Approximate Force .... 267 N (60 lb force)
Right Brake Pedal—
Approximate Force .... 267 N (60 lb force)

LOOK: Brake pedal must NOT feel spongy (caused by air in system) or settle more than 25 mm (1.0 in.) per minute.

Specification

Brake Pedal—Maximum
Settle... 25 mm (1.0 in.) per minute

LOOK: Rear brake light must come ON when either pedal is depressed with key switch in ON position.

OK: Go to next check.

NOT OK: Bleed brake system. Go to Group 9020-20.

NOT OK: Check light fuse.

OK: Check wiring. Go to Group 9015-15 , Lighting Circuit Checks.

– – –1/1

❸ Park Brake Capacity Check

Engage park brake.

Put stabilizers in up position.

Put backhoe in transport position.

Use loader functions to pull machine forward or push machine backward.

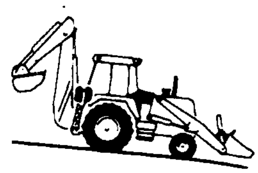
LOOK: Rear wheels should not turn. If loader can pull or push machine, rear tires should drag.

LOOK: Park brake switch light will be ON.

OK: Go to next check.

NOT OK: Adjust park brake linkage. Go to Group 9020-20.

– – –1/1

❹ **Brake Drag Check**	 T6171AL –UN–09DEC88 Position machine on a gradual grade with front of machine downhill. Lift bucket so it clears ground. Shift FNR lever to neutral, differential lock pedal up, disengage park brake and release service brakes. *LOOK: Machine must move or coast.* *NOTE: If machine does not move freely on slope, drive the machine for five minutes. Feel axle housing area to locate which brake is dragging.*	**OK:** Go to next check. **NOT OK:** Brakes dragging. Go to Group 9020-10, Brake Drag Check.

– – –1/1

Steering System Checks

– – –1/1

❶ **Steering System Checks**	Operate engine at approximately 1000 rpm. Turn steering wheel from full left to full right several times. *LOOK: Front wheels must move smoothly in both directions.* *LOOK: When steering wheel is stopped, the front wheels must stop moving.* *NOTE: Internal leakage or a sticking steering valve spool can cause wheels to continue to move after steering wheel is stopped.*	**OK:** Go to next check. **NOT OK:** Go to Group 9025-15, Steering Valve Does Not Return to Neutral.

– – –1/1

❷ **Steering System Leakage Check**	*NOTE: Hydraulic oil must be at operating temperature.* Run engine at slow idle. Turn steering wheel until wheels are in maximum right turn position. Continue turning steering wheel, using approximately 11.3 N•m (100 lb-in.) force while counting steering wheel rpm. Repeat leakage check turning steering wheel to the left. *LOOK: Steering wheel must not turn more than 5 rpm to the left or right. Use good judgement, excessive steering wheel rpm does not mean steering will be affected.*	**OK:** Go to next check. **NOT OK:** If steering wheel turns more than 5 rpm, verify whether valve or cylinder is leaking. Go to Group 9025-25 , Steering System Leakage Test.

– – –1/1

❸ **Steering Priority Valve Check**	Operate engine at slow idle. Turn steering wheel to stop left and right. Note effort required to turn wheel. Turn wheel to stop and apply constant pressure. *LOOK/FEEL: Wheels must stop at both axle stops and require normal steering wheel effort.* *LOOK/LISTEN: Tachometer (if equipped) must decrease 25—50 rpm or hear decrease in engine rpm when steering wheel is held against stop.*	**OK:** Go to next check. **NOT OK:** Steers hard and no decrease in engine rpm. Go to Group 9025-25, Steering Priority Valve Test.

– – –1/1

Reverser Clutch Disconnect Solenoid Check

– – –1/1

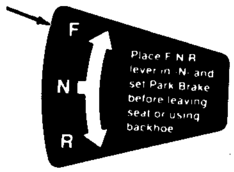
❶ **Clutch Disconnect Circuit Check**	**CAUTION: Machine should try to move forward as FNR lever is moved.** Start engine, set idle speed at approximately 1500 rpm. Put transaxle in fourth gear. Release park brake. Shift FNR lever to forward (F) position. Actuate clutch disconnect on gear shift lever or loader control lever individually and note sound of engine. *LISTEN: When FNR lever is shifted to forward (F) position, a noticeable drop in engine speed should be heard.* *LISTEN: Engine rpm must increase when the reverser clutch disconnect solenoid switches are activated.*	**OK:** Go to next check. **NOT OK:** Check fuse. **OK:** Go to Group 9015-15 , Park Brake/Clutch Disconnect Circuit.

– – –1/1

Driving Checks

– – –1/1

❶ Transaxle Shift Linkage Synchronizer And Noise Check



T7447AG –UN–04JAN91

IMPORTANT: Use clutch disconnect when shifting gears.

Run engine at approximately 1500 rpm with FNR lever in forward (F) position.

Shift transaxle into each gear and drive for a short distance.

LISTEN: 300D—Some gear noise can be expected when shifting into first or second gear. There must NOT be any gear noise when shifting into third or fourth gear. Third and fourth gears are synchronized.

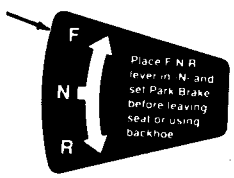
LISTEN: 310D,315D—Excessive gear or FNR lever noise must NOT be heard in any gear. All gears are synchronized.

OK: Go to next check.

NOT OK: Go to Group 9020-15 , Excessive Gear Noise When Shifting Gears.

– – –1/1

❷ Differential Lock And Linkage Check



T7447AG –UN–04JAN91

Shift transaxle to first gear.

Move FNR lever to forward (F) position and operate engine at approximately 1500 rpm.

Depress differential lock pedal.

Turn steering wheel slightly right or left.

Release differential lock pedal.

LOOK: Machine must try to go straight forward and pedal must return to UP position when traction is equal.

OK: Go to next check.

NOT OK: Go to Group 9020-15, No Differential Lock Operation.

– – –1/1

❸ Differential Gear And Pinion Check

NOTE: Hold the wheel which is being braked stationary during this test or brake chatter could be confused with differential gear noise.

Shift transaxle to first gear and operate engine at approximately 1500 rpm.

Move FNR lever to forward (F) position.

Steer machine in a maximum left turn and depress left brake pedal to stop the left wheel.

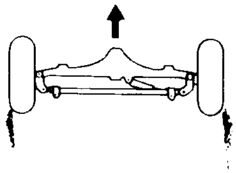
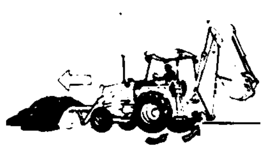
Steer machine in a maximum right turn and depress right brake pedal to stop the right wheel.

LISTEN: NO excessive gear noise must be heard in the differential or pinion gear area.

OK: Go to next check.

NOT OK: Go to Group 9020-10, Differential and Pinion Gear Check.

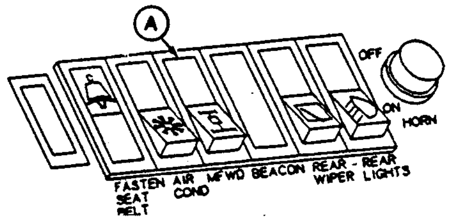
– – –1/1

❹ **Front Wheel Alignment (Toe-In) Check**	 T6264AI –UN–22OCT91	Drive machine in fourth gear forward on a surface with loose material. *LOOK: Material behind front wheels must not be thrown excessively inward or outward.*	**OK:** Go to next check. **NOT OK:** If material is thrown, excessive tire wear will result. Go to Group 9020-20, Adjust Toe-In. – – –1/1
❺ **Engine And Torque Converter Check**	 T6171AM –UN–09DEC88	Position machine with loader bucket at ground level against dirt bank or immovable object. Shift transaxle into first gear. Move FNR lever to forward (F) position. Engage differential lock. Increase engine speed to fast idle. *LOOK: Rear wheels must NOT stall.* *NOTE: This test will give a general indication of engine reverser and torque converter performance.*	**OK:** Go to next check. **NOT OK:** If the wheels can be easily stalled, go to Group 9020-15, Power Train—Machine Lacks Power or Moves Slow. – – –1/1

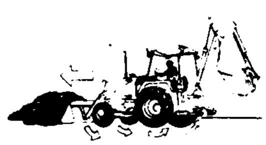
❻ **Reverser Hydraulic System Check**	Run engine at approximately 1500 rpm. Shift transaxle into third gear. Move FNR lever to forward (F) position. Make several shifts from third forward to third reverse. Start counting the number of seconds when FNR lever is moved to opposite direction. *LOOK: A normal shift from forward to reverse or reverse to forward must be completed in three seconds. The machine must be up to speed in four seconds.* *NOTE: Excessive internal leakage is indicated if reverse warning alarm (if equipped) does not sound at slow idle, but sounds when rpm is increased.*	**OK:** Go to next check. **NOT OK:** If shifts are slow, go to Group 9020-25 , Reverser Element Leakage Using Four-Gauge Method. – – –1/1

Mechanical Front Wheel Drive (MFWD) Driving Check

– – –1/1

❶ **MFWD Switch Check**	 T7860AA9 –UN–13NOV92 Drive machine at transport speed. Push switch (A) and engage MFWD. *LOOK: Light in MFWD switch must be ON, and all four wheels must be engaged.* Push switch (A) and disengage MFWD. *LOOK: Light in MFWD switch must be OFF, with MFWD disengaged.* *NOTE: Indicator light in MFWD switch will remain ON while MFWD is engaged. If MFWD is turned OFF while operating, light could remain on for several seconds until load on drive train is released.*	**OK:** Go to next check. **NOT OK:** Check electrical circuit. Go Group 9015-15, MFWD circuit – – –1/1

❷ **MFWD Limited-Slip Differential And Control Linkage Check**	Shift transaxle to first reverse. Engage MFWD and drive machine. Run engine at approximately 1200 rpm. Turn steering wheel for a full left or right turn and observe how the front tires attempt to slide sideways (side load) and the amount of tire scuffing. Disengage MFWD. *LOOK: Tire side loading and scuffing must stop when MFWD is disengaged.* *NOTE: If tires attempt to slide sideways and tire scuffing is seen with MFWD engaged, limited-slip differential is working and power is being transmitted to MFWD.*	**OK:** Go to next check. **NOT OK:** Move MFWD control linkage to feel engagement detents. No detents, inspect linkage to transfer case. **OK:** Go to Group 9020-15, No Power to MFWD. – – –1/1

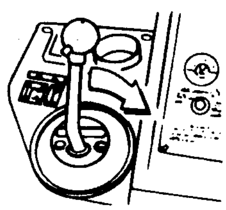
❸ **Engine And Torque Converter Check**	 T6171AN –UN–09DEC88 With loader bucket level and cutting edge at the centerline of front wheels, put machine against a dirt bank or immovable object. Engage MFWD and differential lock. Shift transaxle to first forward. Increase engine speed to fast idle *LOOK: All four wheels must turn.*	**OK:** Go to next check. **NOT OK:** If all wheels stop, a torque converter problem is indicated. If the front wheels stop, MFWD problem is indicated. Go to Group 9020-15 , Machine Lacks Power or Moves Slow. – – –1/1

❹ **MFWD Gear And Pinion Check**	Drive machine at transport speed with MFWD engaged, then disengaged. *LISTEN: MFWD must NOT whine.*	**OK:** Go to next check. **NOT OK:** If MFWD whines, check oil levels and fill to correct levels. **OK:** Check backlash. Go to repair manual.

– – –1/1

Hydraulic System Checks

– – –1/1



T7374CG –UN–04OCT90

❶ **Main Hydraulic Pump Performance Check**	*NOTE: If hydraulic oil is not at operating temperature, heat hydraulic oil until loader and backhoe cylinders feel warm to touch.* Put loader bucket flat on ground. Run engine at slow idle. Measure cycle time of loader raise to maximum height (including bucket leveling). *LOOK: The maximum cycle time is 15 seconds.* *NOTE: Take the average cycle time for at least three complete cycles. This time will give a general indication of hydraulic pump performance.*	**OK:** Go to next check. **NOT OK:** If cycle time slow, go to 9025-15, Slow Hydraulic Functions.

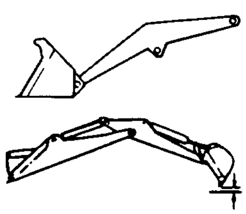
– – –1/1

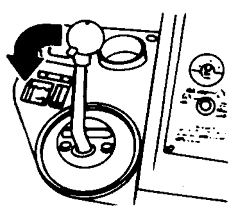
❷ **Auxiliary Hydraulic Pump Performance Check**	*NOTE: Hydraulic oil should be at operating temperature.* Put backhoe in transport position. Run engine at fast idle with hand speed control lever. While holding loader boom raise over relief, extend backhoe dipperstick and measure cycle time. *LOOK: 300D—The maximum cycle time is 15 seconds.* *LOOK: 310D,315D—The maximum cycle time is 19 seconds.*	**OK:** Go to next check. **NOT OK:** If cycle time is slow, go to 9025-15, Slow Hydraulic Functions.

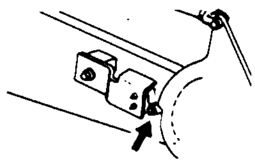
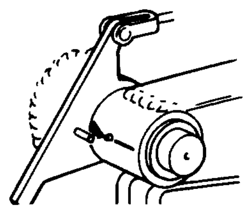
– – –1/1

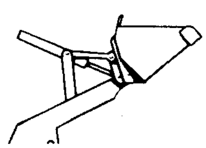
❸ **Cylinder Cushion Check**	Run engine at approximately 1000 rpm. Activate backhoe swing left and right and boom raise. Note sound and speed as cylinders near end of their stroke. *LOOK: Speed of cylinder rod must decrease near the end of its stroke.* *LISTEN: Must hear oil flowing through orifice as cylinder rod nears the end of its stroke.*	**OK:** Go to next check. **NOT OK:** Remove and repair cylinder cushion. Go to repair manual. – – –1/1

❹ **Stabilizer Cylinder And Valve Check**	Operate machine at approximately 1500 rpm. Position loader bucket above ground. Extend each stabilizer cylinder. *LOOK/FEEL: Cylinder must extend smoothly and hold machine up.* Retract each stabilizer cylinder. *LOOK/FEEL: Cylinders must retract smoothly and remain up.*	**OK:** Go to next check. **NOT OK:** Cylinders drift up or down. Inspect lock outs.Go to repair manual. **NOT OK:** Cylinders drift down rapidly. Go to Group 9025-25, Cylinder Leakage Test. – – –1/1

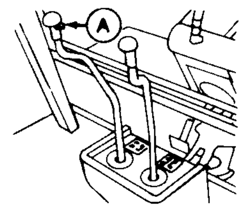
❺ **Backhoe And Loader Function Drift Check**	 T7374CI –UN–04OCT90 *NOTE: Feel backhoe cylinders. Cylinder must be warm to touch (38—52°C [100—125°F]). If cylinders are not warm, heat oil to specifications.* 315D—Switch side shift lock switch to OFF position. With backhoe fully extended, put backhoe bucket at a 45° angle to ground. Lower boom until bucket cutting edge is 50 mm (2.0 in.) off the ground. Position loader bucket same distance off ground as backhoe bucket. Run engine at slow idle and observe bucket cutting edge. *LOOK: Cutting edges must NOT touch ground within one minute.*	**OK:** Go to next check. **NOT OK:** Verify which function is drifting. Go to Group 9025-25, Drift Test. – – –1/1

❻ **Hydraulic Control Valve Lift Check Test**	*NOTE: Gresen valve lift checks must be checked in both directions because the section has a separate lift check for each work port. Husco valves have one lift check for both work ports, and therefore only need to be checked in one direction.* Raise loader bucket 1 m (3.0 ft) off the ground with the bucket level. Position backhoe at maximum reach with bottom of bucket level with ground, 1 m (3.0 ft) off the ground. Stop the engine. Activate each function one at a time. • Loader boom raise • Loader bucket rollback • Backhoe boom up • Dipperstick extend • Backhoe bucket curl Start engine, raise front of machine with bucket tipped 45° down. 300D Only—Activate each function one at a time. • Loader boom lower • Loader bucket dump • Backhoe boom down • Dipperstick retracted • Backhoe bucket dump *LOOK: These functions must not move when the control lever is activated.*	**OK:** Go to next check. **NOT OK:** Inspect control valve lift check. Go to repair manual. **OK:** Go to Group 9025-25, Cylinder Leakage Test. – – –1/1
❼ **Loader Boom Float Check**	 T7390AA –UN–12OCT90 Put loader bucket at maximum height position with bucket dumped. Run engine at approximately 1500 rpm. Move the loader control lever forward into boom float detent position, and at the same time into bucket rollback detent position. Remove hand from control lever. *LOOK: Loader control lever must remain in the boom float detent position.*	**OK:** Go to next check. **NOT OK:** If it jumps out of detent, check detent spring and detent balls. Go to repair manual. – – –1/1

❽ **Loader Return-To-Dig Check (If Equipped)**	  T6171AT –UN–09DEC88 T7374CH –UN–04OCT90 Put loader bucket at maximum height position with bucket dumped. Run engine at approximately 2000 rpm. Move the loader control lever forward into boom float detent position, and at the same time into bucket rollback detent position. Remove hand from control lever. *LOOK: Loader control lever must disengage from the bucket rollback detent when the bucket is level.* *LOOK/LISTEN: Notch on cam must allow switch to "click".* *LOOK: When the bucket is at ground level, bucket must be level and the bucket indicator pointer must be aligned with mark on the boom pivot.* *NOTE: When return-to-dig is used with loader boom in full up position, the bucket leveling linkage will move the bucket control valve out of return-to-dig position before bucket is actually level.*	**OK:** Go to next check. **NOT OK:** Adjust switch till it is activated in cam. Go to Group 9025-20, Loader Bucket Level Indicator and Return-to-Dig. **NOT OK:** Adjust linkage as necessary. Go to Group 9025-20, Adjust Loader Bucket Level Indicator and Return-to-Dig. – – –1/1

❾ **Bucket Leveling Mechanism Check**	 T7374CJ –UN–05OCT90 *NOTE: The loader bucket leveling feature functions during the boom raise cycle only. When bucket is lowered, the operator must level the bucket unless machine is equipped with optional return-to-dig.* Put loader bucket in the rollback position with the boom near ground level. Raise the loader and at the same time hold the control lever in the bucket rollback position. Observe bucket and loader control lever as the loader raises. *LOOK/FEEL: Loader control lever must move into the bucket dump position and the bucket dump function must slowly activate. When the loader control lever moves to activate the bucket dump function, the bucket position must remain stationary the remainder of the loader boom raise cycle.* *LOOK: The bucket side cutting edge must be level through the loader raise cycle.*	**OK:** Go to next check. **NOT OK:** Adjust loader control valve linkage. Go to Group 9025-20. – – –1/1

❿ Side Shift Frame Lock Check—315D



T7394BE –19–17OCT90

Operate engine at slow idle.

Lock backhoe in transport position.

Depress side shift lock switch mounted on backhoe boom control lever.

LOOK: Side shift frame must drop slightly as locking pistons retract.

Release switch to ON position.

Hold boom-up function over relief.

LOOK: Side shift frame must raise slightly when backhoe valve is held over relief.

Return boom lever to neutral position.

LOOK: Side shift frame must remain locked in position for one minute minimum.

NOTE: It is normal for sliding frame to settle if no backhoe functions are operated for a few minutes.

OK: Go to next check.

NOT OK: Side shift frame lock does not release. Check fuse.

OK: Inspect wiring from switch to valve solenoid. Go to Group 9015-15.

OK: If power to solenoid, replace solenoid valve. Go to repair manual.

NOT OK: Side shift frame will not lock. Remove and inspect check valve and solenoid seals. Go to repair manual.

NOT OK: Side shift frame does not remain locked. Test leakage of side shift valve. Go to Group 9025-25.

– – –1/1

Check Operation Of Accessories (Engine Stopped)

– – –1/1

❶ Front Light Switch Check

Turn key switch to ON position.

Push front light rocker switch to middle position.

LOOK: Two front lights, two red tail lights and gauge lights must come on.

Push front light rocker switch in completely.

LOOK: All four front lights, two red tail lights and gauge lights must come on.

OK: Go to next check.

NOT OK: Check fuse and bulbs.

OK: Check wiring. Go to Group 9015-10, Light Circuit Checks.

– – –1/1

❷ **Rear Light Switch Check**	Turn key switch to ON position. Push side console rear light rocker switch in. *LOOK: Rear light (s) must come on.*	**OK:** Go to next check. **NOT OK:** Check fuse and bulbs. **OK:** Check wiring. Go to Group 9015-10, Light Circuit Checks. – – –1/1

❸ **Turn Signal Check**	Turn key switch to ON position. Push right side of turn signal rocker switch down. *LOOK: Right front and rear amber lights must flash. Right indicator light on top of steering column must flash.* Push left side of turn signal rocker switch down. *LOOK: Left front and rear amber lights must flash. Left indicator light on top of steering column must flash.*	**OK:** Go to next check. **NOT OK:** Check fuses and wiring. Go to Group 9015-15, Lighting Circuit Checks. – – –1/1

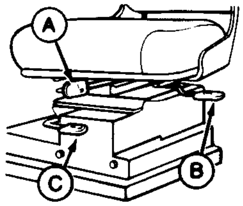
❹ **Warning Light Check**	Key switch ON. Push bottom of warning light rocker switch in. *LOOK: Both front and rear amber lights must come one. Both turn signal indicators and light in warning light rocker switch must flash.*	**OK:** Go to next check . **NOT OK:** Check fuses and wiring. Go to Group 9015-15, Lighting Circuit Checks. – – –1/1

❺ **Horn Check**	Turn key switch to ON position. Push horn button *LISTEN: Horn must sound.*	**OK:** Go to next check. **NOT OK:** Check fuses and wiring. Go to Group 9015-15, Accessory Checks. – – –1/1

Cab Component Checks

– – –1/1

❶ Seat Linkage Check



T7394BD –UN–29NOV90

Move lever (A) to the right.

Move seat forward and rearward and release lever.

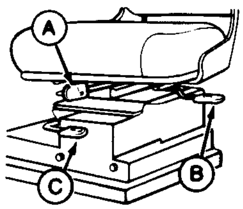
LOOK: Lever must move freely and lock seat in desired position.

OK: Go to next check .

NOT OK: Repair linkage. Go to repair manual.

– – –1/1

❷ Height Adjustable Seat Check (If Equipped)



T7394BD –UN–29NOV90

Pull lever (C) up and at the same time remove your weight from the seat.

Raise seat several positions and engage latch.

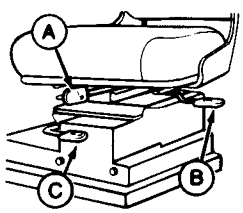
LOOK: Seat must raise upward and must remain in desired latched position.

OK: Go to next check.

NOT OK: Lubricate seat pedestal. Go to repair manual.

– – –1/1

❸ Seat Swivel Linkage Check



T7394BD –UN–29NOV90

Pull lever (B) up.

Move seat from loader to backhoe position and engage latch.

LOOK: Seat latch must move freely and hold seat at the desired position.

FEEL: Lever must move freely and hold seat in loader and backhoe positions.

OK: Go to next check.

NOT OK: Lubricate or repair linkage. Go to repair manual.

– – –1/1

❹ Left Cab Door Latch And Opener Check

Unlatch door.

Observe door as it opens.

Pull door closed and latch it.

FEEL: Cab door latch must work freely.

LOOK: Door cylinder must push door open.

LOOK: Cab door must contact door stop bumper before door cylinder bottoms.

OK: Go to next check.

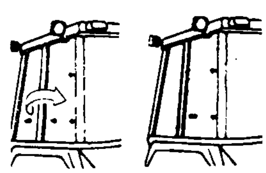
NOT OK: Adjust cab door. Go to repair manual.

– – –1/1

❺ **Right Door Latch And Opener Check**	Unlatch door and pull door open. Close and latch door. *FEEL: Cab door latch must work freely.*	**OK:** Go to next check. **NOT OK:** Adjust door. Go repair manual. – – –1/1

❻ **Rear Window Latch And Opener Checks**	Squeeze latches on both sides of middle rear window. Lower window to rubber bumpers. Push latch releases on upper rear window. Observe window as it opens. Push window up and into window catches and note fit. Observe cylinders while closing window. Raise middle window and push into latches. *LOOK: Window latches and hinges must move freely.* *LOOK: The gas-filled cylinders must slowly assist raising the window to open position. Cylinders must not be at end of travel when closing window.* *LOOK: The window catches must hold and not bow the window in the up position.*	**OK:** Go to next check. **NOT OK:** Check for obstructions. Go to repair manual. – – –1/1

❼ Side Window Checks



T6171DF –UN–09DEC88

Open left and right rear side window.

Fasten rear window against front window.

LOOK: Sleeve on rear window must align with knob on front window.

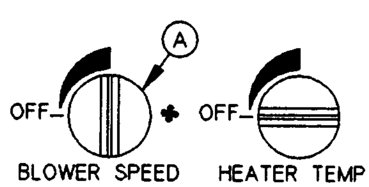
LOOK/FEEL: Hinges must move freely. Locking latches must be equally loaded when closed.

OK: Go to next check.

NOT OK: Adjust windows. Go to repair manual.

– – –1/1

❽ Blower



T7840AX –UN–06OCT92

Turn blower switch (A) to low, medium and high speeds.

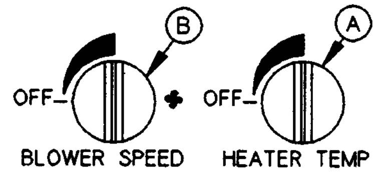
FEEL/LISTEN: Blower must have three speeds and OFF.

OK: Go to next check.

NOT OK: Go to Sub-System Diagnostics, Group 9015-15.

– – –1/1

❾ Heater



T7840AY –UN–06OCT92

Start engine and run at fast idle.

Wait two minutes.

Turn heater temperature switch (A) to maximum heat. Turn blower switch (B) to high speed.

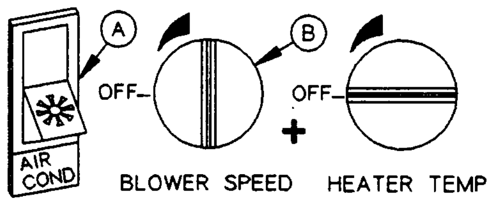
FEEL: Air from ducts must be warm.

OK: Go to next check.

NOT OK: Go to Sub-System Diagnostics, Group 9015-15.

– – –1/1

❿ Air Conditioner (If Equipped)



T7835AX –19–30SEP92

Start engine and run at fast idle.

Turn air conditioner switch (A) to ON position.

Turn blower switch (B) to high speed.

Wait for any warm air in duct system to dissipate.

FEEL: Air from ducts must be cool.

OK: Go to next check.

NOT OK: Go to Heating and Air Conditioning, Group 9031-10.

– – –1/1

⓫ Rear Windshield Wiper Check

Turn key to ON position.

Push rear wiper rocker switch to first detent, middle position.

Push rear wiper rocker switch all the way in.

LOOK: Rear wiper must operate and have two speeds.

LOOK: Wipers must return to park position.

OK: Go to next check.

NOT OK: Check fuse.

OK: Check rear wiper. Go to Group 9015-15, Wiper/Washer Circuit.

– – –1/1

12 Front Windshield Wiper Check	Turn key switch to ON position. Push front wiper rocker switch to first detent, middle position. Push front wiper switch all the way in. *LOOK: Both front wipers must operate and have two speeds.* *LOOK: Wipers must return to park position.*	**OK:** Go to next check. **NOT OK:** Check fuse. **OK:** Check front wiper. Go to Group 9015-15, Wiper/Washer Circuit. – – –1/1

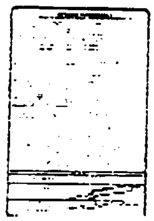
13 Front Windshield Washer Check	Turn key switch to ON position. Push windshield washer rocker switch in. *LOOK: Fluid must spray on both front windows. Rocker switch must return to OFF position.*	**OK:** Go to next check. **NOT OK:** Check fluid level, and fluid lines for blockage. **NOT OK:** Check wiring. Go to Group 9015-15, Wiper/Washer Circuit. – – –1/1

14 Cab Dome Light And Swivel Light Check	Turn key switch to ON position. Push dome light switch to ON position. Push swivel light switch to ON position. *LOOK: Lights must come ON.*	**OK:** Go to next check. **NOT OK:** Check fuse and bulbs. **NOT OK:** Check wiring. Go to Group 9015-15, Dome Light Circuit. – – –1/1

Miscellaneous Checks

– – –1/1

1 Vandal Protection Check	Lock engine access door, reservoir door and cab doors using ignition key. *FEEL: All locks must operate freely and key must not stick in locks.*	**OK:** Go to next check. **NOT OK:** Lubricate or repair lock. Go to repair manual. – – –1/1

❷ **Check Periodic Maintenance Decal**	 T6171DG –UN–09DEC88 Check periodic maintenance decal on inside of reservoir access door. *LOOK: Periodic maintenance decal must be legible.*	**OK:** Go to next check. **NOT OK:** Replace decal. Go to John Deere Dealer for part. – – –1/1
❸ **Backhoe Transport Pin Check**	 T8181AD –UN–20FEB94 Raise boom into transport position and lower boom lock pin (A). Remove swing lock pin (B) from holder in cab and install through top and bottom holes of swing frame and through main frame. *LOOK: Boom lock pin (A) must stay in boom lock mechanism and support weight of boom.* *LOOK: Swing lock pin (B) must install freely.*	**OK:** Operational Checkout completed. **NOT OK:** Adjust boom lock. Go to 9025-20. **NOT OK:** Repair or replace swing lock pin. **NOT OK:** Check pin bore for burrs or obstruction. – – –1/1

Section 9010
Engine

Contents

4039 John Deere Engine—Use CTM8

For additional engine information, the component technical manual (CTM) is also required.

Use the CTM in conjunction with this machine manual.

M44215 –UN–07SEP88

TX,9010,YY507 –19–05MAR93–1/1

General Engine Description

Model 3029, 4039, 4045, 6059, and 6068 engines are vertical, in-line, valve-in-head, 4-cycle (stroke) diesel engines.

Direct fuel injection is provided by a distributor-type injection pump and 9.5 mm injection nozzles mounted in cylinder head. The gear driven injection pump is timed to the crankshaft by the timing gear train.

Some engines are equipped with a turbocharger. The turbocharger uses energy from exhaust gases to compress intake air and force it into the combustion chamber.

The cylinder block is a one-piece casting. The block is available in structural and non-structural configurations.

The camshaft is timed to the crankshaft through the timing gear train. The camshaft rotates in honed bores in the cylinder block. Camshaft gear-driven auxiliary drive engines and all 3029 engines use a bushing in No. 1 camshaft bore. The camshaft lobes determine the duration and lift of each valve, and operate the fuel transfer pump.

Intake and exhaust valves are operated by camshaft followers, push rods and rocker arm assembly. Valve seat inserts in cylinder head are used for intake and exhaust valves.

The crankshaft is a one-piece, heat treated, steel or nodular-iron forging which operates in replaceable two-piece main bearings. Steel crankshafts may have either ground-fillets, or undercut and rolled fillets. All nodular-iron crankshafts are machined with undercut and rolled fillets.

Two different types of main thrust bearing inserts are used to control end-play, depending on the producing factory. Normally, a two-piece thrust bearing insert is used on Dubuque engines, and a 5/6-piece bearing insert is used on Saran engines. The 5/6-piece bearing has high thrust load capability, and may be retro-fitted to Dubuque engines[1] at service repair if so desired.

IMPORTANT: Service thrust bearing kits are now supplied with a six-piece thrust bearing assembly. It is acceptable to use a six-piece bearing where five-piece was previously used. Follow instructions provided.

If a crankshaft has excessive end play, thrust washer sets are available in standard size or 0.007 in. oversize.

Cylinder liners are "wet" (surrounded by coolant) and are individually replaceable. O-rings seals are used at the lower connection between cylinder block and liners.

Pistons are made of high-grade cast aluminum alloy with internal ribbing. The skirt is cam ground to allow for expansion during operation. The piston crown has a cut-out combustion bowl with a truncated cone center. All piston rings are located above the piston pin. Two compression rings and one oil control ring are used. The top compression ring is a keystone shaped ring located close to the top of the piston for improved engine performance.

The hardened, fully-floating piston pins are held in place by snap rings. Spray jets (piston cooling orifices) in cylinder block spray pressurized oil on the underside of the piston to lubricate piston pins and cool pistons.

The forged steel connecting rods have replaceable pin bushing and bearing inserts. 3029 connecting rods have a tapered pin-end.

[1]Main (thrust) bearing web undercut in block and or bearing cap MUST be 113.8 mm (4.48 in.) in order to accept five piece thrust bearings.

Continued on next page

CTM8,GR01,11 –19–18FEB95–1/2

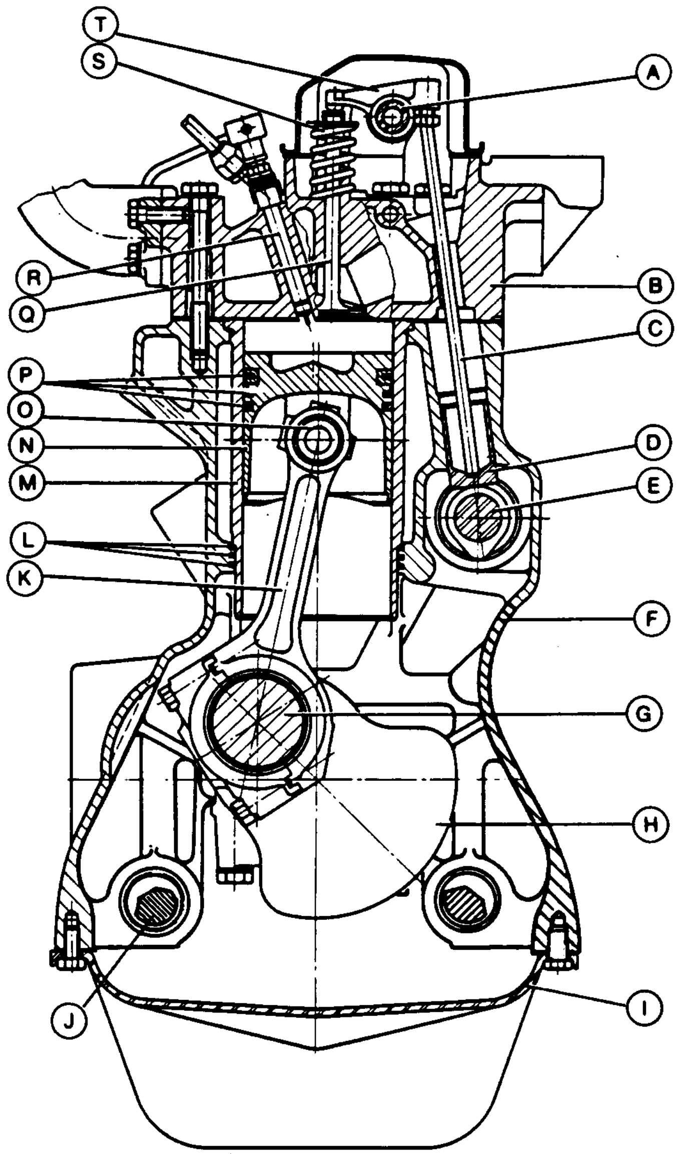
The engine is equipped with a gear driven oil pump and full-flow oil filter. The oil filter has an internal bypass valve which opens if the filter element becomes restricted. Most engines are equipped with an oil cooler mounted externally on the cylinder block. The engine is equipped with a pressure regulator valve to relieve excessive pressure build-up in the main oil gallery, and a bypass valve to prevent oil starvation if the oil cooler and filter become plugged.

Balancer shafts are used on some four-cylinder engines to reduce vibration. The two shafts rotate on bushings in cylinder block and are counter-rotating at twice engine speed.

The engine has a pressurized cooling system, consisting of radiator, water pump, multi-blade fan, and one or two thermostats.

CTM8,GR01,11 –19–18FEB95–2/2

Engine—Sectional View



RG7248 –UN–11JUL95

A—Rocker Arm Shaft
B—Cylinder Head
C—Push Rod
D—Cam Follower
E—Camshaft

F—Cylinder Block
G—Crankshaft
H—Crankshaft Counterweight
I—Oil Pan
J—Balancer Shafts

K—Connecting Rod
L—Liner Packing Rings
M—Cylinder Liner
N—Piston
O—Piston Pin

P—Piston Rings
Q—Valve
R—Fuel Injection Nozzle
S—Valve Spring
T—Rocker Arm

S11,2000,EH –19–11JUL95–1/1

System Operational Checks

This procedure is designed so the mechanic can make a quick check of the engine using a minimum amount of diagnostic equipment. If you need additional information, read Theory of Operation, Group 9010-05.

A location will be required which is level and has adequate space to complete the driving checks.

The engine and all other major components must be at operating temperature for some checks.

Locate system check needed in the left column and read completely, follow this sequence from left to right. Read each check completely before performing.

At the end of each check, if no problem is found (OK:), you will be instructed to GO TO NEXT CHECK. If problem is indicated (NOT OK:), you will be given repair required and Group location or CTM number. If verification is needed, you will be given next best source of information after GO TO:

Group 10 (System Operational Checks)

Group 15 (System Diagnostic Checks)

Group 20 (Adjustments)

Group 25 (Tests)

CTM (Component Technical Manual)

T59,9010,J1 –19–05MAR93–1/1

4039 John Deere Engine—Use CTM8

For additional engine information, the component technical manual (CTM) is also required.

Use the CTM in conjunction with this machine manual.

M44215 –UN–07SEP88

TX,9010,YY507 –19–05MAR93–1/1

Cooling System Checks

– – –1/1

❶ 2 Coolant Condition Checks

CAUTION: DO NOT remove radiator cap unless engine is cool. Then turn cap slowly to the stop. Release all pressure before you remove cap.

Open radiator cap.

LISTEN: If radiator is warmer than air temperature, a "whoosh" must be heard when radiator cap is opened to first stop position.

FEEL: The radiator cap must have a stop position and must be pushed down to turn to remove.

Inspect coolant level, coolant condition.

LOOK: The radiator cap must have a good seal and gasket. The seal must move freely and the spring must not be corroded.

LOOK: The vacuum release valve (center of cap rubber seal) must move freely and holes must not be plugged.

LOOK: The coolant must not be oily, foamy, or rusty.

OK: Check completed.

NOT OK: If vacuum release valve is plugged or spring corroded, replace radiator cap.

NOT OK: If coolant is oily or foamy. Go to Group 9010-15 Oil In Coolant Or Coolant In Oil.

NOT OK: If rust in coolant, drain, flush and replace coolant. Go to Operator’s Manual.

– – –1/1

❷ Hose And Water Pump Check

Inspect all radiator and heater hoses and water pump for cracks or leaks.

LOOK: Radiator hoses must not be brittle or show signs of leaks.

Check all hose clamps.

LOOK: All hose clamps must be tight.

Squeeze lower radiator hose.

FEEL: Lower hose must have wire insert.

LOOK: Water pump must not show any signs of leaks.

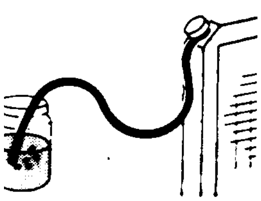
OK: Check completed.

NOT OK: Replace defective hoses, tighten clamps as necessary.

NOT OK: Repair water pump. See Remove Water Pump in CTM8.

– – –1/1

❸ Radiator Bubble Check



T6171AR –UN–25MAY89

a. Radiator to proper level.

b. Install radiator cap and tighten.

c. Start engine. Run engine until at normal operating temperature.

d. Place overflow tube in jar of water.

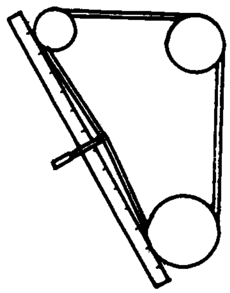
LOOK: Amount of bubbles in glass jar.

OK: Check complete.

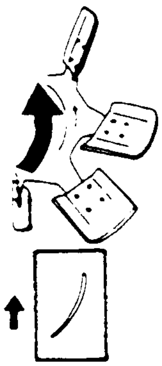
NOT OK: If constant flow of bubbles is seen, a loose cylinder head or a damaged head gasket could be the cause. See Head Gasket Inspection and Repair Sequence in CTM8.

– – –1/1

❹ Fan And Fan Shroud Check



T6171CA –UN–25MAY89



T6171CB –UN–25MAY89

Inspect fan and shroud clearance.

Inspect fan blades for damages.

Check fan belts for tightness.

LOOK/FEEL: Fan belt deflection should be about 7/16 in. with 25 lbs of push.

LOOK: Fan blades must not have any nicks or bends.

LOOK: Make sure there is no oil or grease on fan belt or pulleys.

LOOK: Inside surface of fan belt must not have any cracks or contact bottom of pulley groove.

NOTE: If the fan blade has been installed backwards about 50% of its capacity is lost.

LOOK: Cupped portion of fan blades must be away from radiator.

OK: Check complete.

NOT OK: Adjust belt tension. Go to Group 9010-20.

NOT OK: If fan blades have any bends, replace fan. If fan has nicks, locate interference and repair. Go to repair manual.

NOT OK: Replace fan belt. Go to repair manual.

NOT OK: If fan is on backwards, remove and install. Go to repair manual.

– – –1/1

Air System Checks

– – –1/1

❶ Air Filter Restriction Indicator Switch Check

Run engine at slow idle.

Slowly cover air intake tube

LOOK: Engine air filter restriction monitor light must come on.

OK: Check complete.

NOT OK: Check engine air filter restriction light and switch. Go to Group 9015-15.

– – –1/1

Lubrication System Checks

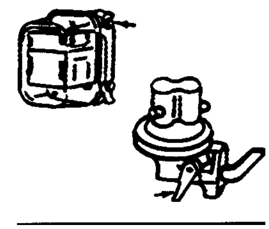
– – –1/1

❶ **Oil Level Check**	a. Pull out oil level dipstick and check level. b. Clean off oil from dipstick with finger or thumb. c. Smell the oil. *LOOK: Oil level must be between add and full marks and must NOT look "milky".* *SMELL: Oil must NOT smell burnt or smell like fuel oil.*	**OK:** Check complete. **NOT OK:** If oil level is high, smell the oil for fuel oil. Replace fuel transfer pump spindle seal. Go to Remove Fuel Supply Pump CTM8. **NOT OK:** Drain small quantity of oil and check for antifreeze. If coolant in oil. See Diagnosing Head Gasket Joint Failures in CTM8. Check for leak in liner wall or packing. **NOT OK:** If oil level is low, check for oil leaks. – – –1/1

Fuel System Checks

– – –1/1

❶ **Engine Fuel System Inspection Checks**	Engine off, engine speed control lever at fast idle position. Inspect water drain, cap, strainer and inside fuel tank (flashlight). Operate pump primer by hand. Inspect all fuel lines, line clamps, and speed control linkage stop. *LOOK: Water drain must NOT contain an excessive amount of water.* *LOOK: Inside of fuel tank must NOT contain any foreign matter.* *LOOK: No fuel leakage must be noted at any of the fuel line connections. The injection line rubber clamps must be in position and NO wiring banded to the injection lines.*	**OK:** Check complete. **NOT OK:** If excessive amount of water is found in fuel tank, change fuel filter. **NOT OK:** If air "hisses" from tank or enters tank when cap is removed, replace fuel cap. **NOT OK:** If excessive debris is found in the bottom of the fuel tank, remove fuel line and observe flow. If flow is restricted, clean tank. – – –1/1

❷ **Fuel Pump Check**	 T6488GR –UN–19OCT88 "Crack" open bleed screw on fuel filter and operate hand primer on fuel pump. Tighten bleed screw of fuel filter and again operate hand primer on fuel pump. *LOOK: Fuel must come out of bleed screw when hand primer is operated.* *FEEL: Resistance must be felt when fuel is being pumped and no resistance will be felt after system is pumped up.*	**OK:** Check complete. **NOT OK:** Be certain fuel filter is clean. If not, replace filter and recheck fuel pump. – – –1/1

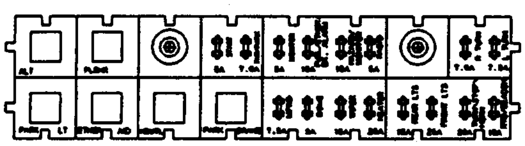
❸ **Fuel System Check**	Engine OFF. Disconnect fuel return hose from leak-off line. Connect a hose to leak-off line to route excess fuel into a container. Start engine and run at fast idle. Put engine under load by operating a hydraulic function over relief. Observe fuel flow from leak-off line. *LOOK: Fuel must flow from leak-off line with engine at full load.* *NOTE: Fuel that flows from leak-off line is excess fuel not required by the engine.*	**OK:** Check completed. **NOT OK:** Check for plugged fuel filters, plugged fuel tank cap vent, restricted lines, stuck injection pump overflow valve, or a bad fuel pump. Repair or replace as necessary. – – –1/1

Engine Speed And Performance Checks

– – –1/1

❶ **Engine Speed Check (Tachometer Installed)**	 T6008AE1 –UN–09DEC88 Start engine, run at slow idle, and record rpm. Increase engine speed to fast idle with speed control pedal and record rpm. *LOOK: Slow idle must be 850 ± 50 rpm.* *LOOK: Fast idle must be 2375 ± 50 rpm.* *NOTE: Override adjustment 6 mm (.250 in.)*	**OK:** Check complete. **NOT OK:** Check spring loaded injection pump lever override. Go to Group 9010-20, Adjustments—Engine Speed Control Linkage. **NOT OK:** If idle speeds are out of specifications, adjust. Go to Group 9010-20, Adjustments—Slow and Fast Idle. – – –1/1
❷ **Engine Power Check**	*NOTE: Engine rpm pull down is valid for No. 2 fuel. If No. 1 fuel is used, engine may pull down more.* Operate engine at fast idle. a. With loader boom fully raised, activate boom raise and backhoe stabilizer to create full hydraulic stall. b. Observe exhaust smoke as load is applied to engine. *LOOK: Exhaust smoke should not be evident at approximately 2200 rpm (rated speed).* *LOOK: Exhaust smoke should not be obvious with engine at full hydraulic stall.*	**OK:** Check complete. **NOT OK:** If exhaust smoke is excessive, go to Group 9010-15 —Engine Emits Excessive Black Smoke or Gray Exhaust Smoke. **NOT OK:** If engine speed decreases to less than 1520 rpm, low power of misadjusted or malfunctioning system relief valve is indicated. Go to Group 9010-15 —Engine Does Not Develop Full Power. – – –1/1

❸ Low Compression Check



T7367AD –UN–17SEP90

Remove fuel shut off fuse.

Crank engine for 10 seconds.

LISTEN: Air must not be heard leaking past valves.

LISTEN: Starting motor must run at a constant speed.

OK: Check Complete.

NOT OK: If starting motor runs at an uneven speed, low compression is indicated on one or two cylinders. Perform Test Engine Compression Pressure in CTM8.

– – –1/1

❹ Engine Blow-By Check

Run engine at fast idle and check the blow-by tube.

LOOK: Fumes should be barely visible at the blow-by tube at fast idle no load.

NOTE: Excessive blow-by indicates that piston rings and cylinder liners do not seal off the combustion chamber. This is a comparative check test that requires some experience to determine excessive blow-by.

OK: Check complete.

NOT OK: If blow-by is excessive, perform Test Engine Compression Pressure in CTM8.

– – –1/1

❺ Loose Or Worn Engine Parts Check

a. Run engine at slow idle.

b. With loader boom fully raised, activate boom raise and run loader valve hydraulics over relief to load engine to minimum rpm.

LISTEN: Knock or rattling noise must NOT be heard from engine.

OK: Check complete.

NOT OK: Go to Group 9010-15, Abnormal Engine Noise.

NOT OK: Go to next check.

– – –1/1

❻ Operator's Complaint Was Not Identified

If you completed the Operational Checkout and did not isolate a malfunction, the problem may be intermittent.

Try to duplicate the condition of the malfunction identified by operator.

OK: Go to Group 9010-15, Diagnose Engine Malfunctions.

– – –1/1

4039 John Deere Engine—Use CTM8

For additional engine information, the component technical manual (CTM) is also required.

Use the CTM in conjunction with this machine manual.

M44215 –UN–07SEP88

TX,9010,YY507 –19–05MAR93–1/1

Make Visual Inspection Of Engine And Supporting Systems

1. Inspect for coolant leaks at:

   - Radiator
   - Water pump
   - Hoses
   - Coolant manifold
   - Thermostat cover

   Check for proper coolant level in radiator. Look at coolant for evidence of oil and/or debris.

2. Inspect for oil leaks around the oil pan, drain plug, oil filter, and clutch housing at drain hole.

3. Inspect hoses to see if they are hard, cracked, soft, or swelled. Replace as necessary.

4. Inspect radiator for bent fins, kinks, dents, cracked side frames, seams and tubes. Check radiator mounts for loose hardware.

5. Check fan to ensure it has been installed correctly. See Cooling System Inspection, in this section.

6. Inspect fan blades. They must be straight and not striking the radiator core or shroud. Bent blades reduce the efficiency of the fan and make the fan out of balance. An out of balance condition can add additional load to the water pump bearings. Check water pump bearings by moving fan and note looseness of bearings.

7. Inspect fan belts. They must not be too tight, too loose, or cracked. Check to see if belt pulleys are worn excessively (if belts run against bore of groove) and that the pulleys are in proper alignment.

   A belt which is too tight puts extra load on the bearings and shortens the life of the bearings as well as the belts. A belt which is too loose allows slippage and reduces fan and alternator speed, causes excess belt wear. Belt slippage can lead to overheating of the cooling and/or hydraulic system, and undercharged batteries.

   The condition of the belts and their tension must be checked periodically. Adjust belt tension, see Adjust Fan Belt Tension, Group 0510.

8. Inspect fuel tank:

   a. Inspect the tank mounting hardware to ensure they are in position and tight.

   b. Inspect fuel tank for cracks and leakage.

   c. Inspect fuel tank outlet strainer and water trap for accumulated debris by shining a flashlight through the filler neck toward bottom right corner of fuel tank.

9. Inspect fuel transfer pump. See if there is fuel leaking from inlet and outlet connections.

10. Inspect fuel filter for water in base of filter. Look for fuel leaking from inlet and outlet connections.

    Check for debris and air in filters. Drain or bleed filters if necessary. Replace filters as required.

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. DO NOT use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

11. Inspect injection pump and nozzles.

Continued on next page

TX,9010,YY509 –19–02JUN93–1/2

Check fuel inlet and outlet connections and injection line connections. If any of the lines are twisted, kinked, or broken, repair or replace as necessary. Check injection line clamps to ensure they are in position and tight.

12. Inspect speed control linkage.

    Check for free movement. Be sure the injection pump lever contacts the fast idle stop on the injection pump.

13. Inspect air cleaner elements for debris, filter condition and air restriction indicator to ensure indicator isn't in red.

    Check all air intake system connections to be sure they are tight. Clean or replace filters when indicator shows red or when there is excessive smoke or loss of power.

14. Check muffler for any signs of leakage or areas that have rusted through. Exhaust leaks can result in a fire in the engine compartment.

15. Check for debris on exhaust manifold.

TX,9010,YY509 –19–02JUN93–2/2

Diagnose Engine Malfunctions

NOTE: Diagnostic charts are arranged from most probable and simplest to verify, to least likely and more difficult to verify. Remember the following steps when diagnosing a problem:

Step 1. Operational Checkout Procedure (See Group 9005-10) .

Step 2. Engine Operational Checkout Procedure (See Group 9010-10) . Step 3. Adjustments and/or Tests (See Group 9010-20 and/or 9010-25).

Symptom	Problem	Solution
Engine Will Not Start Or Starts Hard	Fuel tank empty	Check fuel quantity
	Fuel tank vent plugged	Remove cap and listen for sound of air entering tank. Replace cap.
	No electrical power to injection pump solenoid	Turn key switch to "On". Must hear click at injection pump. Replace fuse. Repair wiring.
	Water in fuel or water frozen in fuel line.	Drain water from fuel tank. Inspect fuel filter for water. Change filter.
	Debris in fuel or wrong grade of fuel	Check fuel tank outlet strainer for type of fuel debris. Check bottom of fuel tank for debris.
	Air leak on suction side of fuel system	Check for bubbles in fuel filter and tighten connections. Inspect fuel lines for damage.
	Fuel transfer pump diaphragm leaking	Check engine oil for fuel dilution. Replace fuel pump.
	Slow cranking speed	Check battery and connections. Incorrect engine oil (Cold weather).
	Restricted air filter	Check air filter restriction indicator and air filters. Clean.

Continued on next page

TX,901015,QQ815 –19–24JUN94–1/12

Symptom	Problem	Solution
	Stuck injection pump metering valve.	Tap injection pump housing (lightly) if engine now starts. Replace metering valve. See your authorized injection pump service center.
	Faulty electric shut-off	Test shut-off solenoid. See 9015-15. Inspect solenoid wiring and linkage.
	Improper injection pump timing	Check timing. See Injection Pump Timing in Group 9010-25.
	Injection pump	Remove and test pump. See Remove Injection Pump in CTM8.
	Injection nozzle(s)	Remove and test nozzles. See Test Fuel Injection Nozzles in CTM8.
	Worn compression rings or low compression	Check compression. Repair. Perform Test Engine Compression Pressure in CTM8.
	Blown head gasket	Remove. Route radiator overflow into container of fluid and check for bubbles. Bubbles indicate head gasket linkage. See Head Gasket Inspection and Repair Sequence in CTM8.
Engine Surges Or Stalls Frequently	Air in fuel	Inspect filter for evidence of air in fuel. Tighten connections and bleed fuel system.
	Fuel tank vent plugged	Remove cap and listen for sound of air entering tank. Replace cap.
	Debris in fuel or wrong grade of fuel	Check fuel tank outlet strainer for debris. Check bottom of fuel tank for debris. Check grade of fuel.
	Water in fuel	Drain fuel tank and inspect filter element for water. Replace filters.
	Fuel filter plugged	Replace filter.

Continued on next page

TX,901015,QQ815 –19–24JUN94–2/12

Symptom	Problem	Solution
	Return line from injection pump to tank restricted	Route return line at the pump into a separate container. If engine now operates normally, check return line to tank for restriction. Replace.
	Fuel injection pump out of time	Time injection pump. See Injection Pump Timing in Group 9010-25.
	Check return oil fitting on top of injection pump control cover plugged.	Remove, inspect and clean. Determine source of debris. See Remove Injection Pump in CTM8. See your authorized injection pump service center.
	Injection pump metering valve sticking	Remove pump top cover and inspect. Replace metering valve. See Remove Injection Pump in CTM8. See your authorized injection pump service center.
	Engine overheating	Test cooling system. See Check and Service Cooling System in CTM8.
	Fuel transfer pump	Test transfer pump pressure. See Measure Fuel Supply Pump Pressure in CTM8.
	Fuel injection pump	Remove fuel injection pump. See Remove Injection Pump in CTM8. Test pump. See your authorized injection pump service center.
	Injection nozzles(s)	Remove and test nozzle(s). See Test Fuel Injection Nozzles in CTM8.
	Improper valve clearance	Check and adjust valve clearance. See Check and Adjust Valve Clearance in CTM8.
	Valve sticking or burned	Do compression pressure test. Perform Test Engine Compression Pressure in CTM8.

Continued on next page

TX,901015,QQ815 –19–24JUN94–3/12

Symptom	Problem	Solution
	Worn or broken compression rings or cylinder head gasket leaking	Route radiator overflow hose into a container of fluid and check. Check for bubbles. Bubbles indicate head gasket leakage. See Head Gasket Inspection and Repair Sequence in CTM8. Do compression pressure test. Perform Test Engine Compression Pressure in CTM8.
Engine Misses	Air in fuel	Check for evidence of air in filter. Tighten connections and bleed fuel system.
	Debris in fuel or wrong grade of fuel	Check fuel tank for water. Check fuel tank strainer and fuel filter for debris. Clean. Check grade of fuel.
	Idle speeds out of adjustment (too low)	Test slow idle speeds. See Engine Speed Control Linkage .
	Fuel injection pump out of time	Time injection pump. See Injection Pump Timing in Group 9010-25.
	Fuel transfer pump	Test fuel system pressure. See Measure Fuel Supply Pump Pressure in CTM8.
	Injection pump governor faulty or metering valve sticking	Inspect. Repair. See Remove Injection Pump in CTM8. See your authorized injection pump service center.
	Engine overheating	Verify engine temperature. Test thermostat. Replace. See Remove, Test, and Install Thermostats in CTM8.
	Incorrect valve clearance	Check and adjust valve clearance. See Check and Adjust Valve Clearance in CTM8.
	Bent push rods	Inspect. Replace.

Continued on next page

Symptom	Problem	Solution
	Cylinder head gasket leaking	Route radiator overflow hose into container of fluid and check for bubbles. Bubbles indicate head gasket leakage. See Diagnosing Head Gasket Joint Failures in CTM8.
	Valve sticking or burned	Do compression pressure test. Perform Test Engine Compression Pressure in CTM8.
	Worn or broken compression rings	Do compression pressure test. Perform Test Engine Compression Pressure in CTM8.
	Fuel injection pump	Remove and test fuel injection pump. See Remove Injection Pump in CTM8.
	Injection nozzles(s) plugged	Remove and test nozzles. See Test Fuel Injection Nozzles in CTM8.
Engine Does Not Develop Power	Fuel tank outlet strainer plugged	Check fuel tank for water or debris. Remove and clean.
	Fuel filter plugged	Replace fuel filter.
	Wrong grade of fuel	Drain and add correct fuel.
	Air system restricted	Check air filter restriction and air filters. Clean.
	Incorrect high idle speed (too low) or linkage out adjustment.	Adjust linkage. Check high idle speed. See Engine Speed Control Linkage .
	Incorrect engine or injection pump timing	Check. Adjust timing. See Injection Pump Timing in Group 9010-25.
	Incorrect valve clearance	Adjust valve clearance. See Check and Adjust Valve Clearance in CTM8.
	Injection pump return fuel tube or fittings are restricted	Route return line at the pump into a separate container. If engine now operates normal, check return line for restriction. Replace.

Continued on next page

Symptom	Problem	Solution
	Fuel transfer pump malfunction	Test fuel transfer pump pressure. See Measure Fuel Supply Pump Pressure in CTM8.
	Fuel line restricted	Route an external fuel source to fuel transfer pump. If engine operation is normal clean fuel line.
	Excess drag in brake system	Check axle and park brake drag. See Operational Checkout, Procedure 9005-10.
	Excess drag in transaxle	Test drag. See Operational Checkout Procedure 9005-10.
	Muffler restricted	Operate without muffler. If engine operation is now normal, replace muffler.
	Injection pump delivery or governor faulty	Remove pump and test. See Remove Injection Pump in CTM8. See your authorized injection pump service center.
	Injection nozzle(s)	Remove and test nozzle(s). See Test Fuel Injection Nozzles in CTM8.
	Low compression	Do compression pressure test. Perform Test Engine Compression Pressure in CTM8.
	Worn camshaft	Do valve lift check. Replace. See Measure Valve Lift in CTM8.
Engine Emits Excessive Black or Gray Exhaust Smoke	Restricted air filter	Check air filter restriction and air filters. Clean or replace.
	Incorrect grade of fuel	Drain and add correct fuel.
	Incorrect injection pump timing	Time injection pump. See Injection Pump Timing in Group 9010-25.
	Excessive fuel delivery	Remove fuel injection pump. See Remove Injection Pump in CTM8. See your authorized injection pump service center.

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TX,901015,QQ815 –19–24JUN94–6/12

Symptom	Problem	Solution
	Injection nozzle(s)	Remove and test nozzle(s). See Test Fuel Injection Nozzles in CTM8.
Engine Emits Excessive Blue or White Smoke	Cranking speed too slow	Check batteries and connections.
	Incorrect grade of fuel	Drain and add correct fuel.
	Engine running too cold	Check thermostat operation. Replace.
	Injection pump out of time	Time injection pump. See Injection Pump Timing in Group 9010-25.
	Injection nozzle(s)	Remove and test nozzle(s). See Test Fuel Injection Nozzles in CTM8.
	Low compression	Do compression test. Perform Test Engine Compression Pressure in CTM8.
	Excessive wear in liners and/or piston rings stuck	Disassemble, inspect, repair.
Slow Acceleration	Wrong grade of fuel	Drain and add correct fuel.
	Injection nozzle(s)	Remove and test nozzle(s). See Test Fuel Injection Nozzles in CTM8.
	Fuel injection pump	Remove and test fuel injection. See Remove Injection Pump in CTM8.
Detonation (Excess Engine Knock)	Stuck cold weather starting aid	Repair.
	Incorrect injection pump timing.	Time injection pump. See Injection Pump Timing in Group 9010-25.
Abnormal Engine Noise	Low or incorrect engine oil (too thin).	Add correct oil to proper level.
	Loose or worn hydraulic pump drive coupling	Inspect. Repair.
	Engine oil diluted with fuel	Inspect engine oil. Determine cause of fuel dilution.

Continued on next page
TX,901015,QQ815 –19–24JUN94–7/12

Symptom	Problem	Solution
	Incorrect fuel injection pump timing	Time injection pump. See Injection Pump Timing in Group 9010-25.
	Excessive valve clearance	Adjust valve clearance. See Check and Adjust Valve Clearance in CTM8.
	Bent push rods	Inspect. Replace.
	Worn rocker arm shafts	Replace.
	Loose connecting rod caps	Inspect, tighten connecting rod cap screws. See Torque-Turn Connecting Rod Cap Screws in CTM8.
	Loose main bearing caps	Inspect, tighten main bearing cap screws. See procedure under Install Crankshaft in CTM8.
	Worn main bearings	Replace bearings. See Remove Crankshaft Main Bearings in CTM8.
	Worn connecting rod bearings	Replace bearings. See Inspect and Measure Connecting Rod Bearings in CTM8.
	Incorrect cam timing	Check engine timing. Repair. See procedure under Install and Time Camshaft in CTM8.
	Scored piston	Inspect. Replace.
	Worn piston pin bushings and pins	Inspect. Replace pins and bushings. See Inspect Piston Pins and Bushings in CTM8.
Low Oil Pressure (Oil Pressure Light on—Red "Stop" Flashing)	Low oil level	Add oil to proper lever. Inspect engine oil.
	Wrong viscosity oil/oil diluted with diesel fuel	Change oil. Check injection pump shaft seals and transfer pump diaphragm. See Remove Injection Pump in CTM8.

Continued on next page
TX,901015,QQ815 –19–24JUN94–8/12

Symptom	Problem	Solution
	Oil pressure switch or indicator	Check engine oil pressure. Test switch and indicator. See 9015-15.
	Oil pressure regulating valve	Test or replace. See CTM8.
	Plugged or broken oil pump intake screen	Inspect. Clean.
	Loose oil pump drive gear	Inspect. Repair.
	Worn oil pump gear or housing	Remove, inspect and repair.
	Excessive main bearing, connecting rod or balance shaft clearance	See CTM8.
	Cracked cylinder block	Replace cylinder block. See Complete Disassembly of Cylinder Block in CTM8. Inspect piston cooling jets.
	Leakage at internal oil passage.	Check all possible internal leakage paths. Repair.
Engine Overheats (Engine Coolant Indicator Light On and Red "Stop" Flashing)	Low coolant level	Fill cooling system and check for leaks. See Check and Service Cooling System in CTM8.
	Low engine oil level	Add oil.
	Loose or broken fan belt.	Adjust belt tension or replace belt. See Adjust Fan Belt Tension in CTM8.
	Engine overloaded, operating in wrong gear	Reduce load.
	Fan on backwards	Check for correct fan installation. See Check and Service Cooling System in CTM8.
	Radiator dirty or plugged	Check air flow. Clean radiator. See Check and Service Cooling System in CTM8.
	Radiator shroud missing, damaged or baffles missing	Inspect. Repair or replace.

Continued on next page

TX,901015,QQ815 –19–24JUN94–9/12

Symptom	Problem	Solution
	Improper fuel	Drain and add correct fuel.
	Radiator cap	Replace cap.
	Faulty temperature sender	Test, repair or replace.See 9015-15.
	Incorrect injection pump timing	Time injection pump. See Injection Pump Timing in Group 9010-25.
	Excessive transaxle drag	Check transaxle drag. See Operational Checkout Procedure 9005-10.
	Excessive brake drag	Check Brake drag. See Operational Checkout Procedure 9005-10.
	Faulty thermostat (Struck closed)	Inspect thermostat. Replace.
	Thermostat missing, cooling system coated with lime deposits	Replace thermostats Flush cooling system. See Check and Service Cooling System in CTM8.
	Water pump	Remove. Inspect. Repair.
	Excessive fuel delivery	Remove. Check for proper fuel delivery, adjust. See Remove Injection Pump in CTM8.
	Scored piston	Replace piston. See Engine Disassembly Sequence in CTM8.
Engine Runs Cold	Thermostat (stuck open)	Replace. See Remove, Test, and Install Thermostats in CTM8.
Oil in Coolant Or Coolant in Oil	Leaking cylinder head gasket	Replace gasket. See Head Gasket Inspection and Repair Sequence in CTM8.
	Leaking cylinder liner packing	Replace packings. See Engine Disassembly Sequence in CTM8.
	Cracked cylinder liner	Replace liner. See Engine Disassembly Sequence in CTM8.

Continued on next page
TX,901015,QQ815 –19–24JUN94–10/12

Symptom	Problem	Solution
	Cracked cylinder block	Replace block. See Complete Disassembly of Cylinder Block in CTM8.
Excessive Fuel Consumption	Air system restricted	Check filter restriction indicator and air filters. Replace
	Leakage in fuel system	Inspect. Repair.
	Incorrect grade of fuel	Refill with correct fuel.
	Operator holding hydraulics over relief.	Return control levers to neutral position.
	High system relief valve setting	Test system relief valve pressure. See 9025-25.
	Incorrect injection pump timing	Time injection pump. See Injection Pump Timing in Group 9010-25.
	Faulty injection nozzle(s)	Test nozzle(s). Repair. See Test Fuel Injection Nozzles in CTM8.
Turbocharger Excessively Noisy or Vibrates	Bearings not lubricated	Insufficient oil pressure. Check for restricted turbocharger oil line.
	Worn bearings	Replace. See Turbocharger Failure Analysis in CTM8.
	Air leak in engine, intake or exhaust manifold	Inspect and repair. See Intake Air Leak Test in CTM8.
	Improper clearance between turbine wheel and turbine housing	Remove exhaust elbow and air inlet hose. Inspect and repair. See Turbocharger Failure Analysis in CTM8.
	Broken blades on turbine	Remove exhaust elbow and air inlet hose. Inspect and repair. See Turbocharger Failure Analysis in CTM8.

Continued on next page

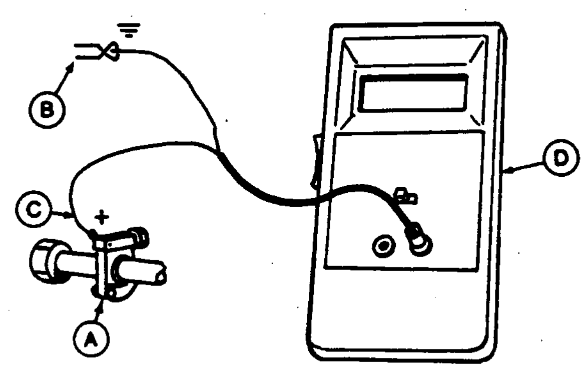
TX,901015,QQ815 –19–24JUN94–11/12

Symptom	Problem	Solution
Oil Dripping From Turbocharger Adapter	Damaged or worn bearings and/or worn seals	Inspect compressor and turbine wheel for damaged blades. Check for proper engine service intervals or dirt entering engine. See Turbocharger Failure Analysis in CTM8.
	Excessive crankcase pressure	Check for plugged oil drain line. Clean.
	Turbocharger oil return line carbon buildup where line passes exhaust manifold.	Remove line. Inspect and clean.
Excessive Drag In Turbocharger Rotating Members	Carbon build-up behind turbine wheel caused by combustion deposits	Inspect and clean. See Turbocharger Failure Analysis in CTM8.
	Dirt build-up behind compressor wheel caused by air intake leaks	Inspect and repair. See Turbocharger Failure Analysis in CTM8.
	Bearing seizure or dirty or worn bearings caused by excessive temperature, unbalanced wheel, dirty oil, oil starvation, or insufficient lubrication	Check for plugged air filters.

TX,901015,QQ815 –19–24JUN94–12/12

JT05801 Clamp-On Electronic Tachometer Installation

SERVICE EQUIPMENT AND TOOLS
Tachometer
A—Clamp-On Transducer
Remove paint with emery cloth and connect to a straight section of injection line within 100 mm (4 in.) of pump. Finger tighten only—DO NOT overtighten.
B—Black Clip (-). Connect to main frame.
C—Red Clip (+). Connect to transducer.
D—Tachometer readout. Install Cable.



T6813AG –UN–28FEB89

10T,9010,K182 –19–10AUG95–1/1

Fan Belt Tension Adjustment

SPECIFICATIONS	
New Belt Deflection	5/16 in. at 25 lb
Used Belt (Cold) Deflection	7/16 in. at 25 lb
Adjusting Strap Cap Screw Torque	27 ± 3 N•m (20 ± 2 lb-ft)

IMPORTANT: The alternator belt is considered used after 1—2 minutes of running.

DO NOT overtighten belts. Overtightening may cause belt cord damage or excessively loud alternator bearings.

NOTE: Belt deflection measured using JDST28 Belt Deflection Gauge.

SERVICE EQUIPMENT AND TOOLS
JDST28 Belt Deflection Gauge

1. Check alternator belt deflection using a belt deflection gauge. A new belt will deflect 5/16 in. at 25 lb force at a point halfway between the pulleys.

Specification
New Belt—Deflection... 5/16 in. at 25 lb Force

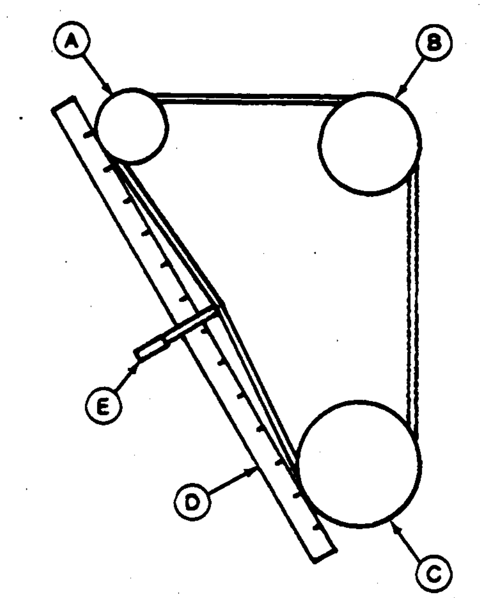
A used belt will deflect 7/16 in. at 25 lb force at a point halfway between the pulleys.

Specification
Used Belt (Cold)—Deflection .... 7/16 in. at 25 lb Force

2. If belt deflection is not within specifications, loosen alternator mounting cap screws. Apply force only to the front of alternator housing (near the belt) and tighten cap screws.

Specification
Adjusting Strap Cap Screw—
Torque .... 27 ± 3 N•m (20 ± 2 lb-ft)

3. Check belt tension. If not correct repeat Step 2 until within specifications.



T6030AT –UN–01JUN89

A—Alternator Pulley
B—Fan Pulley
C—Crankshaft Pulley
D—Straight Edge
E—Belt Deflection Gauge

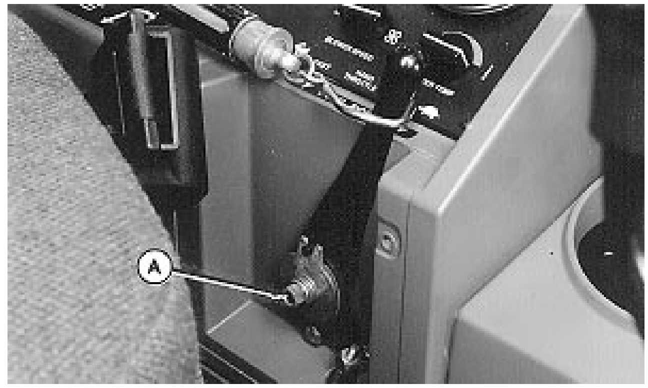
Adjust Speed Control Lever Tension

SPECIFICATIONS	
Tension Adjusting Nut Torque	62—71 N (14—16 lb force) required to move lever using a spring scale

Tighten nut (A) until 62—71 N (14—16 lb force) is required to move lever using a spring scale.

Specification

Tension Adjusting Nut—Torque .... 62—71 N (14—16 lb force) required to move lever using a spring scale



T8219CA –UN–11MAY94

TX,9010,QQ2722 –19–24JUN94–1/1

Engine Speed Control Linkage

SPECIFICATIONS	
Injection Pump Lever Override (Speed Control Lever in Extreme Forward Position)	4—6 mm (1/8—1/4 in.)

1. Move speed control lever to extreme forward position.

2. Measure injection pump lever override. Override must be 4—6 mm (1/8—1/4 in.).

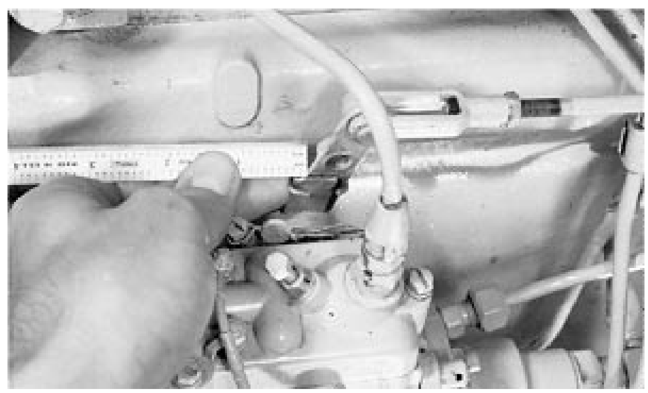
Specification

Injection Pump Lever—Override (Speed Control Lever in Extreme Forward Position) .... 4—6 mm (1/8—1/4 in.)

3. Adjust yoke on speed control rod to provide override.

4. Move speed control lever to rear most position and check override. Override must be at least 1.5 mm minimum.

5. Recheck high idle for a minimum of 2 mm override.



T6030AU –UN–18OCT88

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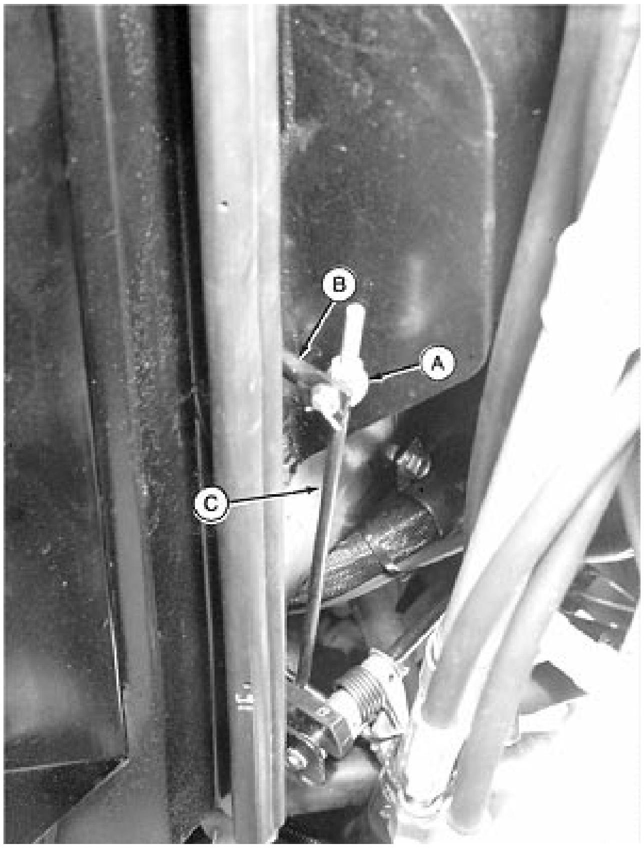
TX,9010,YY511 –19–08JUN94–1/2



T7387AB –UN–16DEC91

6. Remove reservoir cowling to adjust foot control pedal.

7. Disconnect yoke (A) from rod (B). Adjust vertical rod (C) length to allow foot control pedal to stop on floor with hand lever in the extreme forward position.

TX,9010,YY511 –19–08JUN94–2/2

Slow And Fast Idle

SPECIFICATIONS	
Slow Idle RPM	850 ± 50
Fast Idle RPM	2375 ± 50

SERVICE EQUIPMENT AND TOOLS
Tachometer
Sealing Wire Pliers

1. Run engine until it is at normal operating temperature.

2. Install tachometer. See procedure in this group.

CAUTION: Take care to avoid rotating fan blades while making injection pump adjustments.

3. Disconnect speed control rod (B) from fuel injection pump lever.

4. Start engine.

5. Hold injection pump lever forward (toward radiator). Check to make sure slow idle is 850 ± 50 rpm.

Specification

Slow Idle—RPM .... 850 ± 50

6. If slow idle is not correct:

   a. Check air cleaner elements.

   b. Loosen lock nut and turn screw (A) out one or two turns.

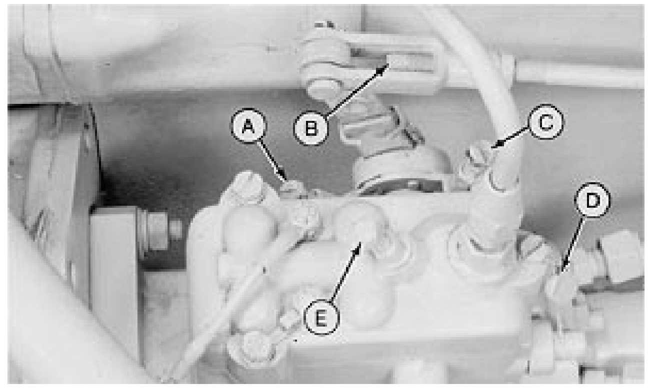
   c. Loosen lock nut and turn screw (E) to adjust slow idle.

   d. Turn screw (A) in until rpm starts to increase then turn screw out one full turn. Tighten lock nuts.

7. Hold injection pump lever rearward (away from radiator). Check to make sure fast idle is 2375 ± 50 rpm.

Specification

Fast Idle—RPM .... 2375 ± 50



T6023AD –UN–18OCT88

A—Lever Stop Screw
B—Speed Control Rod
C—Fast Idle Adjusting Screw
D—Sealing Wire
E—Slow Idle Adjusting Screw

Continued on next page

8. If fast idle is not correct:

   a. Remove sealing wire.

   b. Loosen lock nut and turn screw (C) counterclockwise to increase rpm or clockwise to decrease rpm.

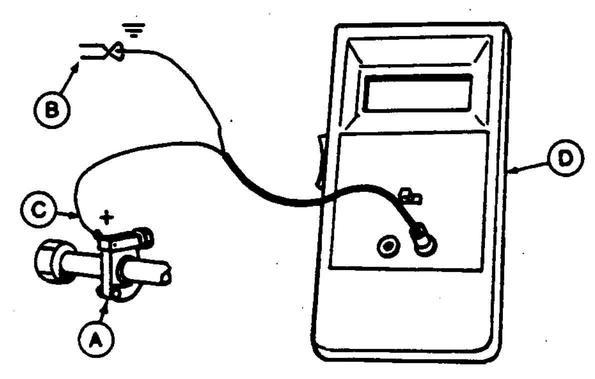
   c. Tighten lock nut and install a new sealing wire using a seal wire pliers.

9. Connect rod (B).

TX,9010,YY513 –19–02JUN93–2/2

JT05801 Clamp-On Electronic Tachometer Installation

SERVICE EQUIPMENT AND TOOLS
Tachometer
A—Clamp-On Transducer
Remove paint with emery cloth and connect to a straight section of injection line within 100 mm (4 in.) of pump. Finger tighten only—DO NOT overtighten.
B—Black Clip (-). Connect to main frame.
C—Red Clip (+). Connect to transducer.
D—Tachometer readout. Install Cable.

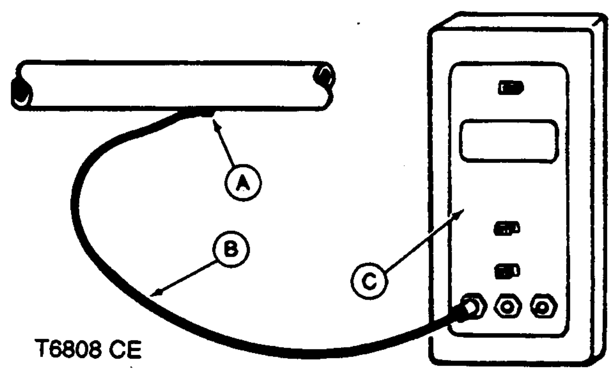


T6813AG –UN–28FEB89

10T,9010,K182 –19–10AUG95–1/1

JT05800 Digital Thermometer Installation

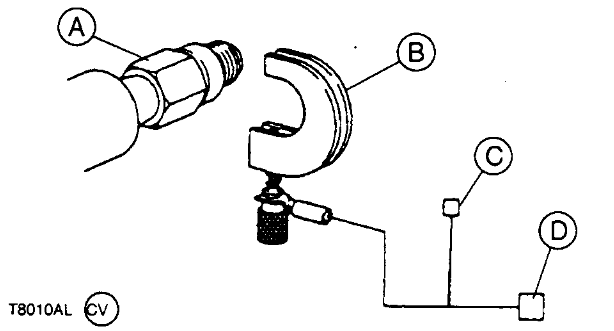
SERVICE EQUIPMENT AND TOOLS
Digital Thermometer
A—Temperature Probe
Fasten to a bare metal line using a tie band. Wrap with shop towel.
B—Cable
C—Digital Thermometer



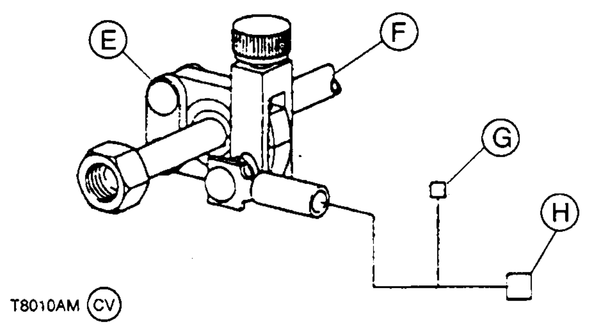
T6808CE –UN–28FEB89

902525,AA4 –19–28FEB95–1/1

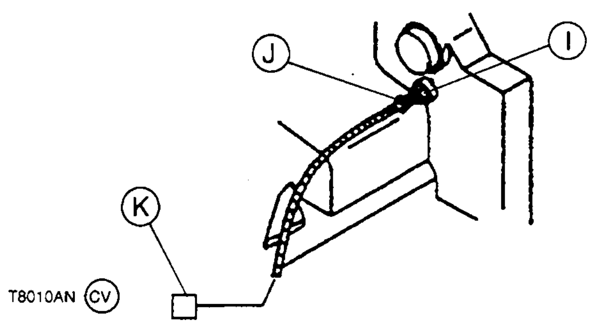
JT07158 TIME TRAC® INSTALLATION



T8010AL —UN—18MAY93



T8010AM —UN—20MAY93



T8010AN —UN—18MAY93

A—SOI Sensor
B—Transducer Clamp
C—Ground
D—Meter Connection
E—Clamp-On Transducer
F—Injection Line
G—Ground
H—Meter Connection
I—Adapter
J—Magnetic Probe
K—Meter Connection

ESSENTIAL TOOLS
JT07158 TIME TRAC® Kit
JT07155 9/16-in. In-Line SOI Sensor (Optional)
JT07173 SOI Clamp Assembly
JT07177 6 mm Clamp-On Transducer (Green)
JDG793 Magnetic Pick-Up Adapter
JT07171 Magnetic Pick-Up

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Continued on next page

TX,TIMETRAC,300 –19–20JUN95–1/2

Remove paint and clean injection line for installation of clamp-on transducer (E).

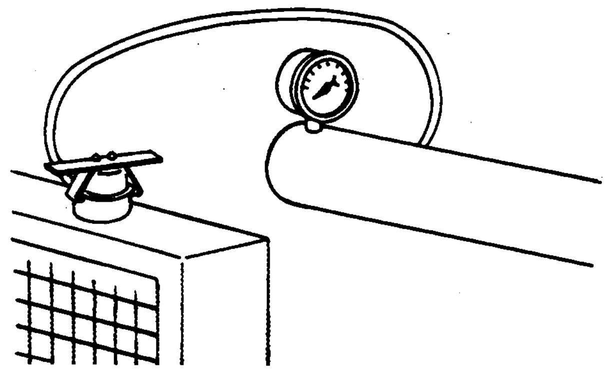
IMPORTANT: Install clamp-on transducer as close as possible to fuel injection nozzle.

TX,TIMETRAC,300 –19–20JUN95–2/2

Cooling System

SPECIFICATIONS	
Cooling System Test Pressure	69 kPa (0.7 bar) (10 psi)
Cooling System Pressure Cap Opening Pressure	43—52 kPa (0.4—0.5 bar) (6.2—7.5 psi)
Vacuum Valve Opening Pressure	0—3.5 kPa (0—0.04 bar) (0—0.5 psi) 0—1.0 in Hg)

SERVICE EQUIPMENT AND TOOLS
Cooling System Pressure Pump


T6487AT –UN–24OCT88


T95940 –UN–25OCT88

1. Check coolant level.
2. Check belt tension. (See procedure in this group).
3. Check radiator fin condition. Make sure fins are not bent or damaged.
4. Check fan tips and shroud for damage. Fan tip shroud should be equal at top and bottom.

NOTE: Sucker fan has six blades with concave sides away from radiator.

5. Check for correct fan installation.
6. Test cooling system for leaks using a cooling system pressure pump (A). Pressurize system to maximum of 69 kPa (0.7 bar) (10 psi).

Specification
Cooling System—Test Pressure .... 69 kPa (0.7 bar) (10 psi)

7. Test radiator cap using a cooling system pressure pump. Pressurize radiator cap valve. Valve must start to open at 43—52 kPa (0.4—0.5 bar) (6.2—7.5 psi).

Specification
Cooling System Pressure Cap—
Opening Pressure .... 43—52 kPa (0.4—0.5 bar) (6.2—7.5 psi)

8. Vacuum valve must open at 0—3.5 kPa (0—0.04 bar) (0—0.5 psi).

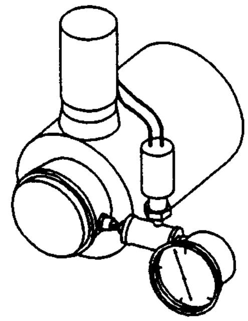
Specification
Vacuum Valve—Opening
Pressure .... 0—3.5 kPa (0—0.04 bar) (0—0.5 psi) 0—1.0 in Hg)

TX,9010,YY514 –19–02JUN93–1/1

Air Filter Restriction Indicator Switch

SPECIFICATIONS	
Restriction Indicator Light Must Come On	5—7.5 kPa (49.8—74.7 mbar) (20—30 in. water) (1.8 ± 0.2 in. Hg) vacuum

SERVICE EQUIPMENT AND TOOLS
0—150 kPa (0—15 bar) (0—60 in. water) Vacuum Gauge
Reducer, 1/4 in. x 1/8 in. Pipe
Barb Fitting, 1/8 in. Pipe (2 Used)
Air Restriction Indicator
Tee Fitting, 1/4 in. Pipe



T7390AR –UN–15OCT90

1. Remove air restriction indicator switch.

2. Install hose nipple, tee fitting and gauge from water vacuum gauge kit into air restriction indicator hole. Install air restriction indicator into tee fitting.

3. Start engine and slowly cover the air cleaner inlet with a piece of paper or cardboard.

4. Yellow warning light and air filter restriction indicator light on monitor panel must come on when gauge is at specified pressure.

Specification

Restriction Indicator Light—Must Come On .... 5—7.5 kPa (49.8—74.7 mbar) (20—30 in. water) (1.8 ± 0.2 in. Hg) vacuum

TX,901025,QQ819 –19–02JUN93–1/1

Air Intake System Leakage Test

SPECIFICATIONS	
Air Intake System Regulated Pressure	13.8—20.7 kPa (0.13—0.21 bar) (2—3 psi)

SERVICE EQUIPMENT AND TOOLS
JDG51 Adapter
Air Regulator With Gauge

IMPORTANT: Anytime the air intake system is opened it must be tested for leaks before the machine is returned to service.

1. Remove air cleaner cover and main filter element.

2. Put a plastic bag over safety element and install main element and cover.

3. Remove plug from air intake tube and install JDG51 adapter (A).

4. Connect air pressure regulator to adapter using hose and fitting (B).

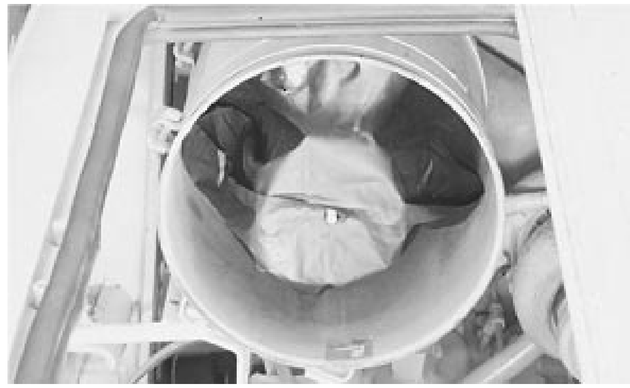
CAUTION: Plastic bag can be sucked into engine if engine is started when trying to close valves.

5. Pressurize air intake system to specifications.

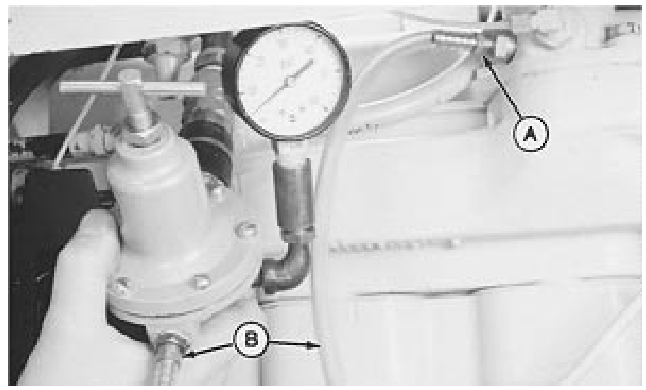
Specification
Air Intake System—Regulated
Pressure .... 13.8—20.7 kPa (0.13—0.21 bar)
(2—3 psi)

If system cannot be pressurized, turn engine slightly to close valves. Check plastic bag.

6. Spray soap solution over all connections from the air cleaner to the turbocharger or air inlet to check for leaks. Repair all leaks.



T92026 –UN–25OCT88



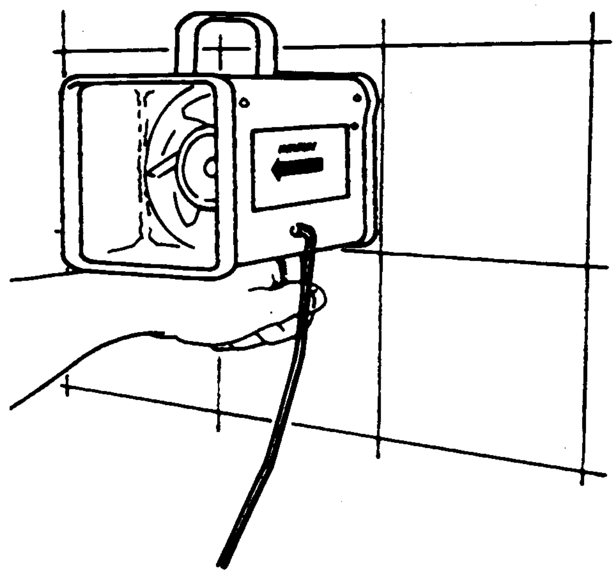
T92027 –UN–25OCT88

TX,901025,QQ816 –19–28NOV90–1/1

Radiator Air Flow Test

SPECIFICATIONS	
410D Engine Speed	1000 ± 10 rpm
510D Engine Speed	1000 ± 10 rpm
410D Suction Fan Actual Voltage Reading	1.49 volts
410D Suction Fan Actual Voltage Reading Minus 20%	1.19 volts
510D Suction Fan Actual Voltage Reading	1.45 volts
510D Suction Fan Actual Voltage Reading Minus 20%	1.16 volts

SERVICE EQUIPMENT AND TOOLS
JT05801 Electronic Tachometer
Air Flow Meter
Heavy Duty Digital Multimeter or Analog/Digital Multimeter



T6080AH –UN–01NOV88

A—JT05529 Air Flow Meter

1. Apply parking brake, put transmission in neutral and lower equipment to the ground. Stop engine.

2. Install tachometer. (See procedure in this group.)

3. Check that all sheet metal is in place. Close side shields.

4. Divide the surface of the grille into 16 equal squares.

5. Start engine and run at 1000 ± 10 rpm.

Specification

410D Engine—Speed.. 1000 ± 10 rpm
510D Engine—Speed.. 1000 ± 10 rpm

6. Connect air flow meter to digital multimeter. Turn switch on multimeter to 20 volts A.C.

7. Place air flow meter in contact with grille. Arrow on meter must point in direction of air flow (toward unit).

8. Record voltage reading for each area.

Continued on next page TX,901025,QQ834 –19–02JUN93–1/2

NOTE: Air flow readings minus 20% is a number used as a guideline to determine when a partially plugged radiator and or cooler core may cause overheating.

9. Combined total of air flow test readings must be greater than specifications.

Specification

410D Suction Fan—Actual Voltage Reading .... 1.49 volts
Actual Voltage Reading Minus 20% .... 1.19 volts
510D Suction Fan—Actual Voltage Reading .... 1.45 volts
Actual Voltage Reading Minus 20% .... 1.16 volts

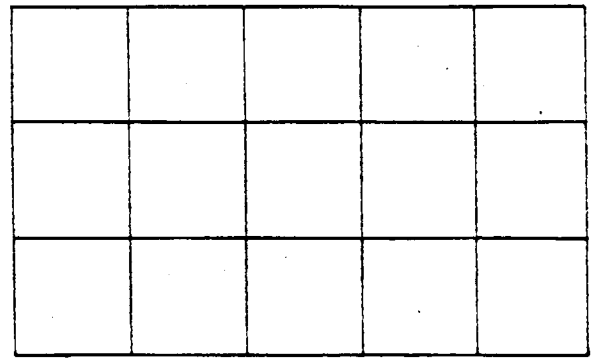
If readings are less than specifications remove oil cooler and clean external surfaces of both oil cooler and radiator. Install oil cooler and repeat test. If reading is still low, check for correct fan installation. Be sure sheet metal is in place.

TX,901025,QQ834 –19–02JUN93–2/2

JT05529 Air Flow Meter Test Record

CUSTOMER NAME AND ADDRESS

DATE: ____________________
MACHINE MODEL NO. ____________________
SERIAL NO. ____________________



T6041AL –UN–20APR89

PRE-TEST INSPECTION					
OK	**SERV REQD**		**OK**	**SERV REQD**	
❒	❒ Coolant Level				
❒	❒ Belt Tension		❒	❒ Correct Fan Installation (Sucker Fan)	
❒	❒ Radiator Fin Condition		❒	❒ Radiator Cap	
❒	❒ Fan Tip & Shroud Condition				

AIR FLOW TEST

1. Park brake ON.

2. Transmission in Neutral and side shields closed.

3. Divide the surface of the grille into 16 equal squares.

4. Start engine.

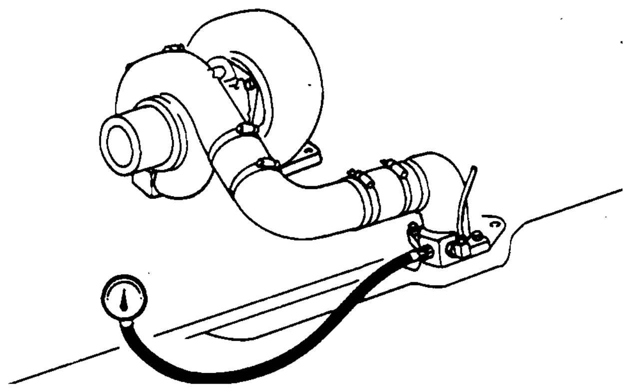
5. Perform air flow test at fast idle. Observe correct air flow direction and place air flow meter in direct contact with grille. (Arrow pointing to grille).

6. Record air flow in each square.

7. Combined total of air flow test readings must be greater than specifications.

TX,9010,YY518 –19–02JUN93–1/1

Turbocharger Boost Pressure-Engine Performance Test—310D, 315D



T6225AS –UN–26MAY89

SPECIFICATIONS	
Engine Normal Operating Temperature	82° ± 10°C (180°C ± 20°F)
Engine Speed	Fast Idle
Turbocharger Boost Pressure (Using No. 2 Fuel)	40—55 kPa (.04—.055 bar) (6—8 psi)

NOTE: Reduce the boost specifications by 7% if using No. 1 fuel.

SERVICE EQUIPMENT AND TOOLS
JDE147 Adapter
030 psi Gauge
JT05801 Electronic Tachometer
JT05800 Digital Thermometer

1. Make test connections.

2. Install tachometer and thermometer. (See procedure in this group.)

3. Apply park brake and put transaxle and reverser in neutral. Run engine until it is at normal operating temperature.

Specification

Engine—Normal Operating Temperature .... 82° ± 10°C (180°C ± 20°F)

4. Adjust engine speed to fast idle.

Specification

Engine—Speed .... Fast Idle

Activate the loader control valve and hold over relief to apply a hydraulic load to engine. The gauge will show a pressure rise and then a pressure drop.

Specification

Turbocharger—Boost Pressure (Using No. 2 Fuel) .... 40—55 kPa (.04—.055 bar) (6—8 psi)

5. If boost pressure DOES NOT drop, use the following procedure to apply additional load to engine.

Continued on next page

T59,9010,J111 –19–05MAR93–1/2

- Lower stabilizers to raise wheels off ground.
- Put machine in first gear with FNR lever in forward or reverse.
- Apply brake pressure until boost pressure begins to drop.

6. Record highest boost pressure and RPM it was obtained at.

7. Repeat test several times.

8. If boost pressure is too high, remove and test fuel injection pump for high fuel delivery.

9. If boost pressure is too low, check for the following:

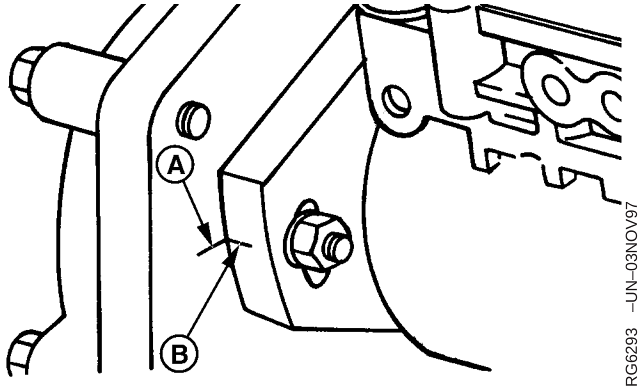
- Restricted air filter elements.
- Restricted fuel filter elements.
- Incorrect fast idle adjustment.
- Incorrect injection pump timing.
- Exhaust manifold leaks.
- Intake manifold leaks.
- Faulty fuel transfer pump.
- Low compression pressure.
- Faulty fuel injection nozzle.
- Carbon build-up in turbocharger.
- Turbocharger compressor or turbine wheel rubbing housing.
- Low fuel injection pump fuel delivery, remove and test fuel injection pump for low fuel delivery.

T59,9010,J111 –19–05MAR93–2/2

Injection Pump Timing

SPECIFICATIONS	
300D, 310D and 315D Engine Models	4039D and 4039T
300D, 310D and 315D Engine Net hp (kW)	67 hp (50 kW)
300D, 310D and 315D Engine Rated RPM	2200
300D, 310D and 315D Injection Pump Dynamic Timing at +0 -1° BTDC	15.5

ESSENTIAL TOOLS
JT07158 TIME TRAC® Kit



A—Front Plate
B—Pump Flange

The JT07158 timing kit electronically indicates start of injection with respect to piston top dead center, and allows setting injection pump timing to provide optimum power, smoke and exhaust emissions.

Timing engines with this tool improves consistency between engines and helps to control cylinder firing pressures which can be a factor in head gasket failures as well as improve overall engine efficiencies.

1. Install JT07158 TIME TRAC. See procedure in this group. (Also found on JT07175 Quick Reference Sheet.)

2. Raise rear of machine off the ground with stabilizers. Put transaxle in fourth forward.

3. Operate machine at WOT.

Specification
300D, 310D and 315D Engine—
Models .... 4039D and 4039T
Net hp (kW) .... 67 hp (50 kW)

Slowly depress service brakes until engine is at 2200 rpm.

Specification
300D, 310D and 315D Engine—
Rated RPM 2200

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4. Record dynamic timing.

Specification

300D, 310D and 315D Injection Pump—Dynamic Timing at +0 -1° BTDC 15.5

5. If timing is not to specification, follow procedure on JT07175 Quick Reference Sheet.

TX,9010,QQ2715 –19–24JUN94–2/2

Injection Pump Static Timing Adjustment

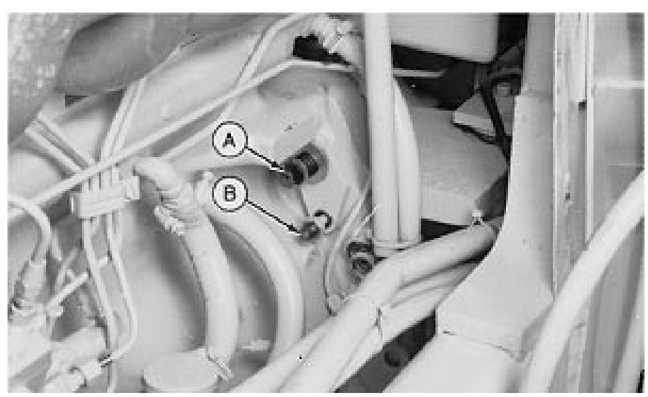
SPECIFICATIONS	
No. 1 Cylinder Position	At TDC on compression stroke
Line on Governor Weight Retainer Alignment	With line on cam ring

ESSENTIAL TOOLS
JDE811 Flywheel Turning Tool
JDE814 Timing Pin

T59,9010,C111 –19–25MAR86–1/3

1. Install flywheel turning tool (A). Rotate flywheel in engine running direction until pin (B) goes into hole in flywheel.

2. Remove timing hole cover from fuel injection pump.



T6024AP –UN–29MAR90

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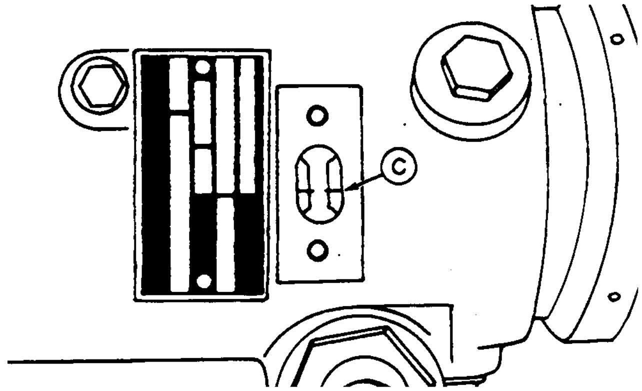
T59,9010,C111 –19–25MAR86–2/3

3. If timing line (C) on weight retainer cannot be seen, turn engine one revolution to get No. 1 cylinder at TDC on compression stroke.

Specification

No. 1 Cylinder—Position	At TDC on compression stroke
Line on Governor Weight Retainer—Alignment	With line on cam ring



T6193AA1 –UN–25MAY89

4. To avoid backlash, always approach the timing lines by turning engine in direction of rotation. The normal backlash of gears is enough to throw the pump timing off several degrees, resulting in poor engine performance.

5. If lines are not aligned, loosen pump mounting flange retaining nuts and rotate pump housing until timing lines are aligned.

T59,9010,C111 –19–25MAR86–3/3

Section 9015
Electrical System

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Continued on next page

9015

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Visually Inspect Electrical System

Make the following visual electrical inspection prior to starting the tractor after receiving customer complaint:

1. Look for bare wires that could ground a component or short across to another component.

2. Look for missing or worn conduit. This could indicate a wire problem.

3. Look for loose or broken connectors and wires.

4. Inspect batteries for:

   - Corroded terminals
   - Loose terminals or battery posts
   - Dirty condition
   - Damp condition
   - Cracked case
   - Proper electrolyte level

5. Check alternator belt tension.

6. After machine has been shut down for five minutes inspect for overheated parts. They will often smell like burned insulation. Put your hand on the alternator. Heat in these parts when the unit has not been operated for some time is a sure clue to charging circuit problems.

7. If your visual inspection does not indicate the possible malfunction, but your inspection does indicate that the machine can be run, turn the key switch to the IGN position. Try out the accessory circuits, indicator lights, gauge lights. How does each of these components work? Look for sparks or smoke which might indicate shorts.

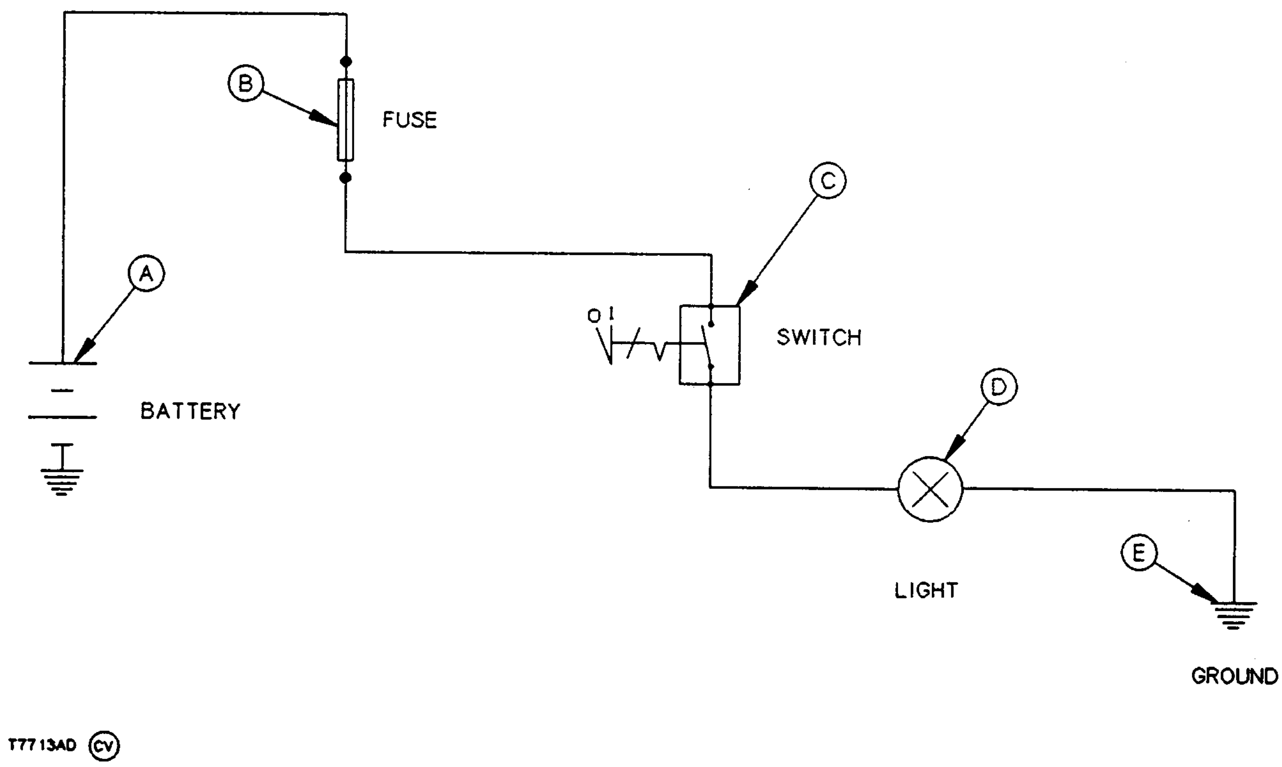
8. Start machine. Check all gauges for good operation and check to see if system is charging or discharging.

9. In general, look for anything unusual.

   Many electrical failures cannot be detected even if the machine is started. Therefore, a systematic and complete inspection of the electrical system is necessary.

TX,901505,QQ369 –19–07FEB96–1/1

Electrical Circuit Malfunctions



A—Battery
B—Fuse
C—Switch
D—Light
E—Ground

There are four common circuit malfunctions.

- High-Resistance Circuit
- Open Circuit
- Grounded Circuit
- Shorted Circuit

Three sections in a simple circuit where these malfunctions can occur;

- Before the controlling switch (C).
- Between the controlling switch and before the component, light (D).
- After the component.

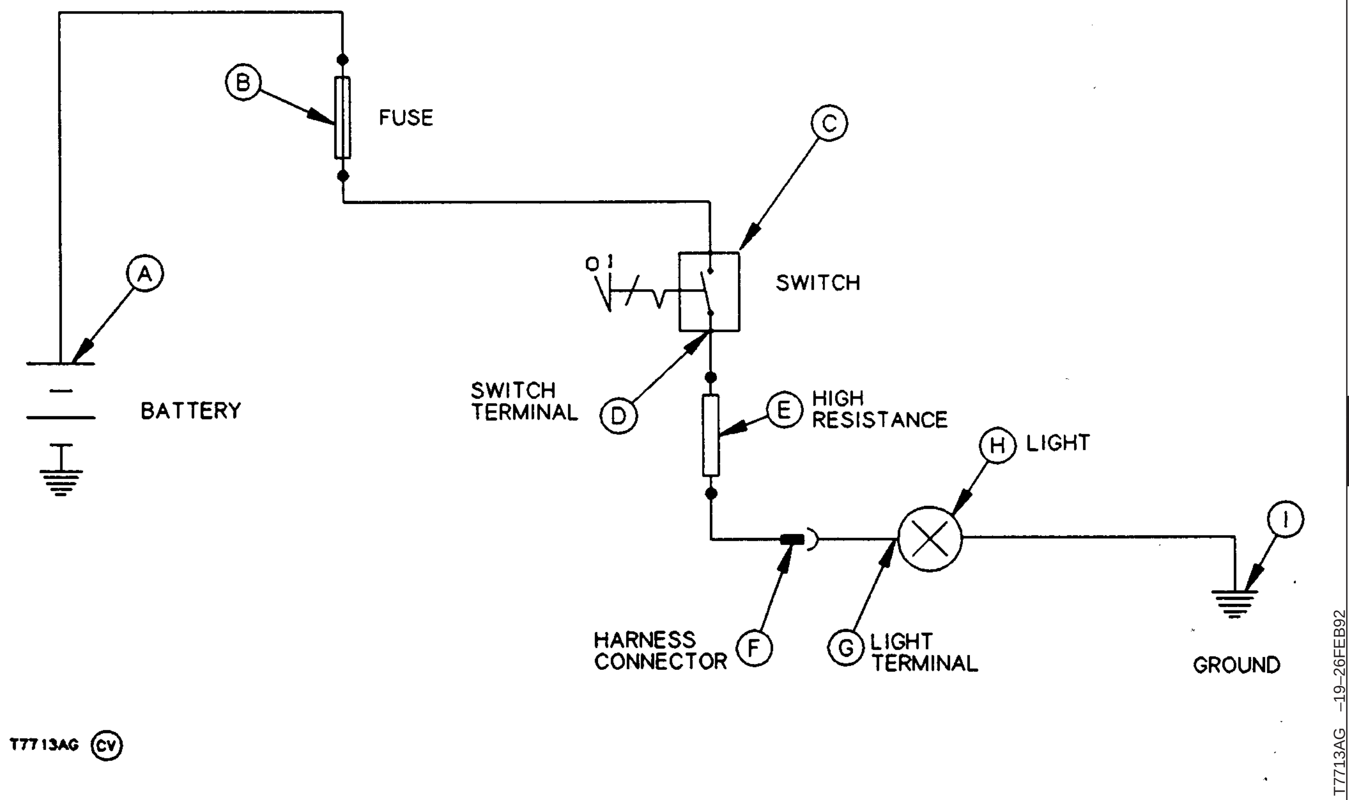
Component malfunctions can easily be confused with circuit malfunctions. Therefore, care must be exercised when isolating the cause of a problem.

Example: Light does not operate or is dim when switch is turned ON, until switch connector is disconnected and reconnected.

Reason: High resistance caused by a dirty switch connector, caused a voltage drop which prevented the proper amount of current from flowing to the light.

TX,9015,DY357 –19–31MAY96–1/1

High Resistance Circuit



A—Battery
B—Fuse
C—Switch
D—Switch Terminal
E—High Resistance
F—Harness Connector
G—Light Terminal
H—Light
I—Ground

A high resistance circuit can result in slow, dim or no component operation.

Examples: Loose, corroded, dirty or oily terminals. Wire size too small strands broken inside the wire. Poor ground connection to frame.

To locate the cause of high resistance:

With switch (C) ON, check for battery voltage between switch and ground (I) at an easily accessible location, like harness connector (F).

If less than battery voltage is measured, check again closer to switch.

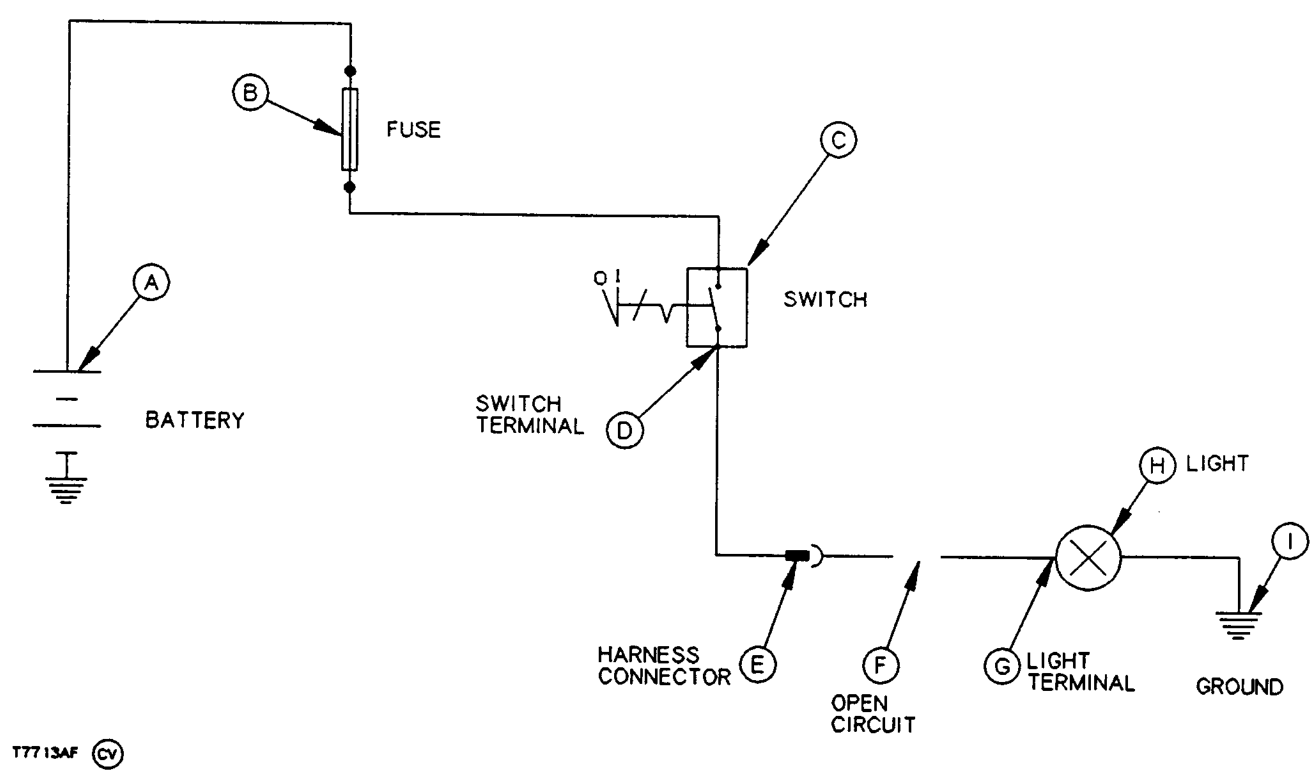
If battery voltage is measured, check closer to ground to locate point of voltage drop. The example shows high resistance (E) between switch and harness connector.

Repair circuit as required. In the example, strands were broken inside the wire, replace that section of wire.

Repeat check-out procedure after repair.

TX,901505,RP968 –19–10AUG95–1/1

Open Circuit



T7713AF –19–27FEB92

A—Battery
B—Fuse
C—Switch
D—Switch Terminal
E—Harness Connector
F—Open Circuit
G—Light Terminal
H—Light
I—Ground

An open circuit will result in no components operating. Fuse may or may not be blown.

Example: Broken wire, disconnected component terminal, pins inside a connector not making contact, blown fuse, open circuit breaker, failed switch or component, or a disconnected ground wire.

To locate an open circuit:

Check fuse. If blown, replace and operate circuit. If fuse blows a second time, continue check.

With switch (C) ON check for battery voltage at switch terminal (D).

If no voltage is measured, check switch, fuse and wiring to battery.

If battery voltage is measured, check for voltage closer to ground at harness connector (E).

If no voltage is measured, wire may be broken between switch and connector.

If battery voltage is measured, inspect connector pins. If pins are OK check for voltage at light terminal (G).

In the example, zero voltage will be measured at light terminal, indicating a broken wire between harness connector and light terminal.

If battery voltage had been measured, the next check for voltage would be at ground connection (I).

Normal measured voltage at a ground connection should be 0.0 to 0.5 volts.

Continued on next page

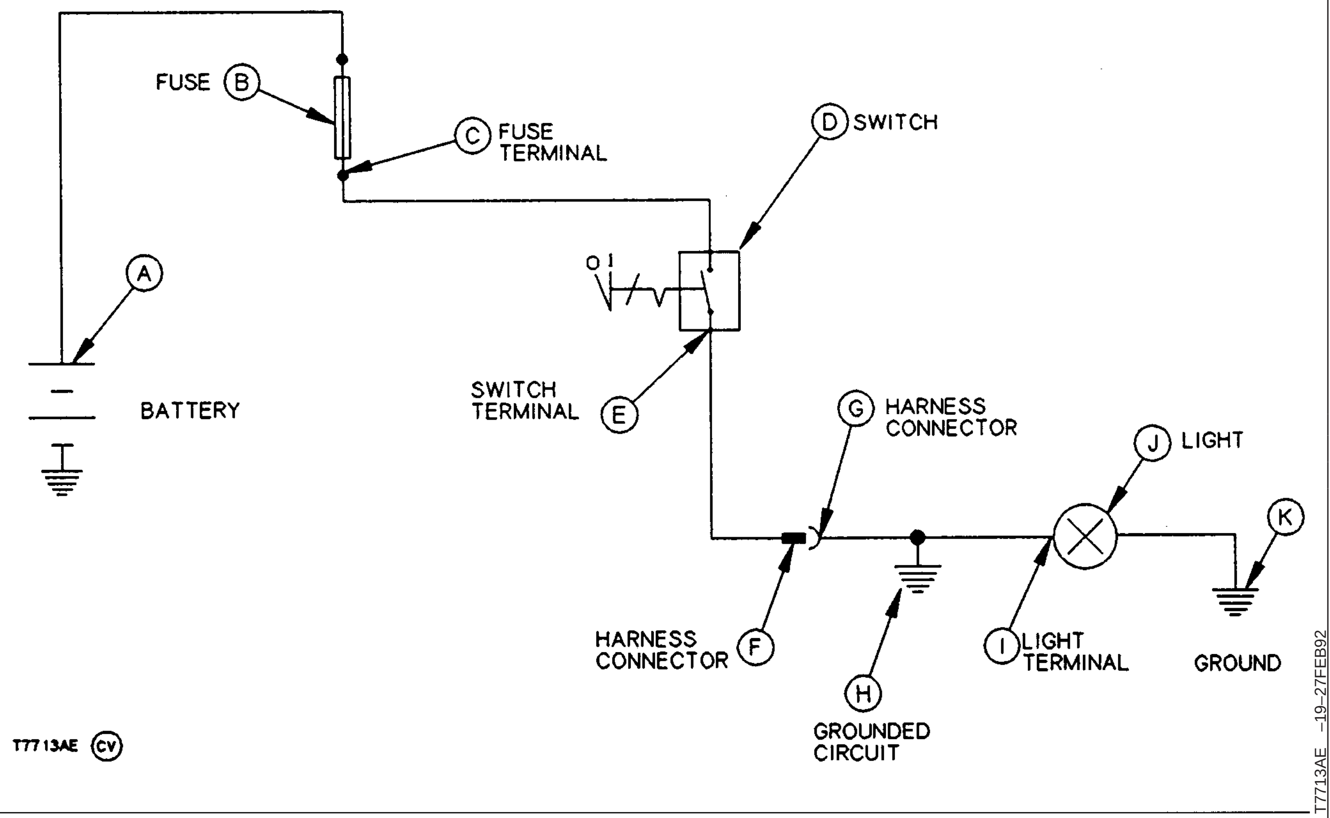
TX,901505,RP964 –19–10AUG95–1/2

If battery voltage is measured, poor connection to frame or broken wire is indicated.

When problem is located, repair as needed then repeat last check.

TX,901505,RP964 –19–10AUG95–2/2

Grounded Circuit



A—Battery
B—Fuse
C—Fuse Terminal
D—Switch
E—Switch Terminal
F—Harness Connector
G—Harness Connector
H—Grounded Circuit
I—Light (Component) Terminal
J—Light
K—Ground

If no component operates, the fuse is blown and replacement fuses blow immediately or the circuit breaker is open and reopens when reset, a grounded circuit exists. (Example: power wire contacting frame or other metal component). A wire may be pinched or insulation may be worn from a wire.

To isolate the location of a grounded circuit: If circuit is grounded between battery and fuse, wire will be burned and circuit will be open, fuse will not be blown.

If fuse is blown, remove fuse from circuit, disconnect circuit near its center, such as harness connector (F), turn switch (D) ON, check for continuity to ground at harness connector (F). This will check harness from harness connector to fuse.

If continuity to ground is measured, there is a pinched or bare wire between fuse (C) and harness connector (F).

If continuity to ground does not exist, disconnect ground (K) from frame. Measure continuity to ground at harness connector (G). This checks harness from harness connector to ground terminal. In the example continuity to ground will exist because circuit is grounded (wire is pinched) at (H).

Continued on next page

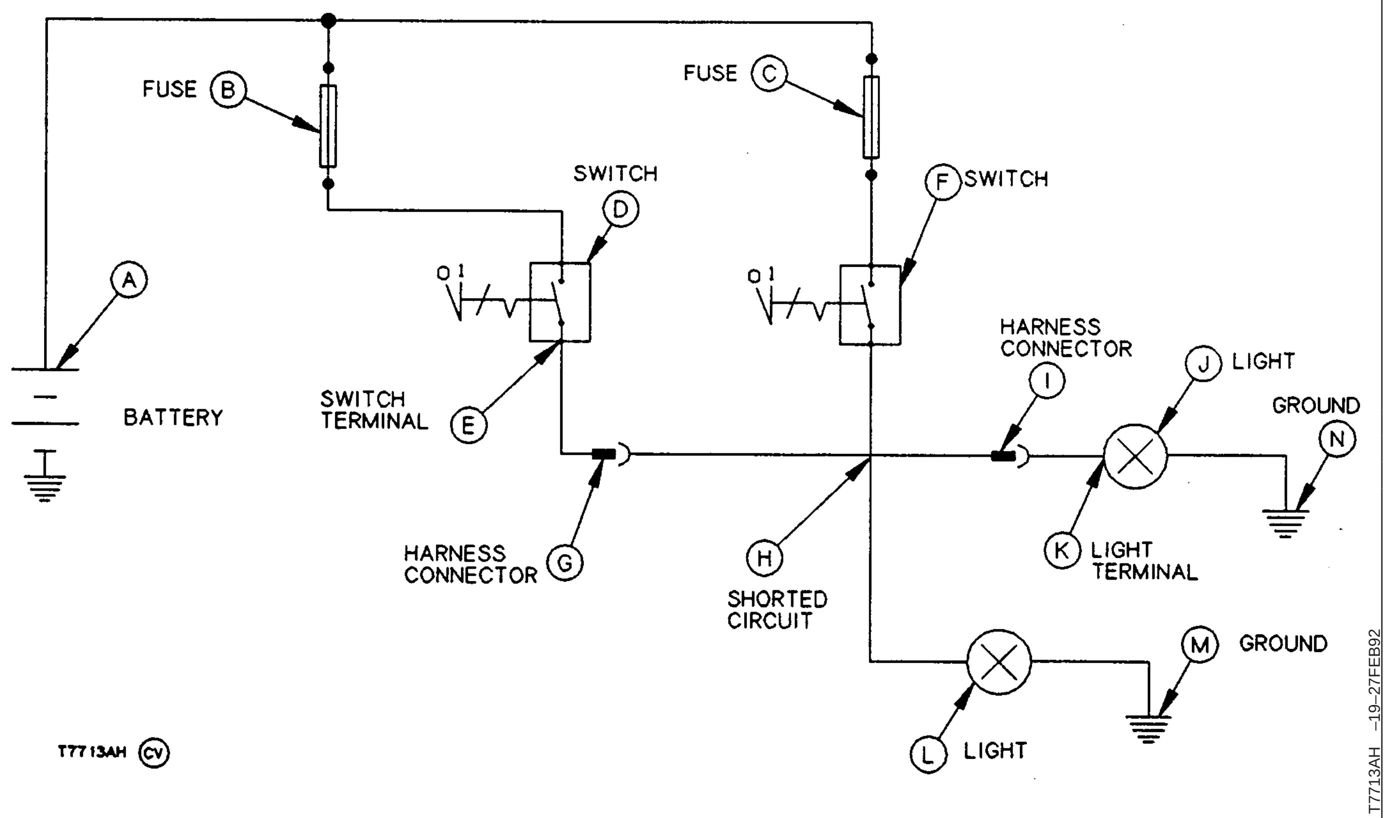
TX,901505,RP969 –19–10AUG95–1/2

If continuity exists, disconnect circuit at light terminal (I) and measure continuity to ground on light terminal. This checks harness from light to ground terminal. In the example continuity will not exist, indicating a grounded circuit between the light and harness connector (G).

Repeat check-out procedure after repair.

TX,901505,RP969 –19–10AUG95–2/2

Shorted Circuit



A—Battery
B—Fuse
C—Fuse
D—Switch
E—Switch Terminal
F—Switch
G—Harness Connector
H—Shorted Circuit
I—Harness Connector
J—Light
K—Light Terminal
L—Light
M—Ground
N—Ground

A shorted circuit causes components in separate circuits to operate when a switch in either circuit is turned ON. (Example: two harnesses rubbing together until insulation is worn through allowing bare wires to touch). Components can also become shorted. However, shorted components will usually blow the fuse.

To locate a shorted circuit:

1. Turn Switch (F) ON then OFF, turn switch (D) ON then OFF, both lights (J and L) will be ON when either switch (D or F) is ON.

2. Turn switch (F) ON. Both lights (J and L) will be ON, only light (L) should be ON.

3. Disconnect wire from switch of component that should not be ON. In the example, disconnect wire from terminal (E) at switch (D). Light (J) remains ON.

4. Disconnect circuit at convenient places like harness connectors (G), (I) and light terminal (K) until light (J) goes OFF.

The short circuit will be between the last two places the circuit was disconnected. In the example, it is between harness connectors (G and I). Light (J) will go OFF when harness connector (I) is disconnected. Inspect harness between connectors (G and I).

Continued on next page

TX,901505,RP970 –19–10AUG95–1/2

Repair or replace wires and harnesses as needed. Install tie bands and clamps on harnesses as required to prevent future failures.

Repeat check-out procedure after repair.

TX,901505,RP970 –19–10AUG95–2/2

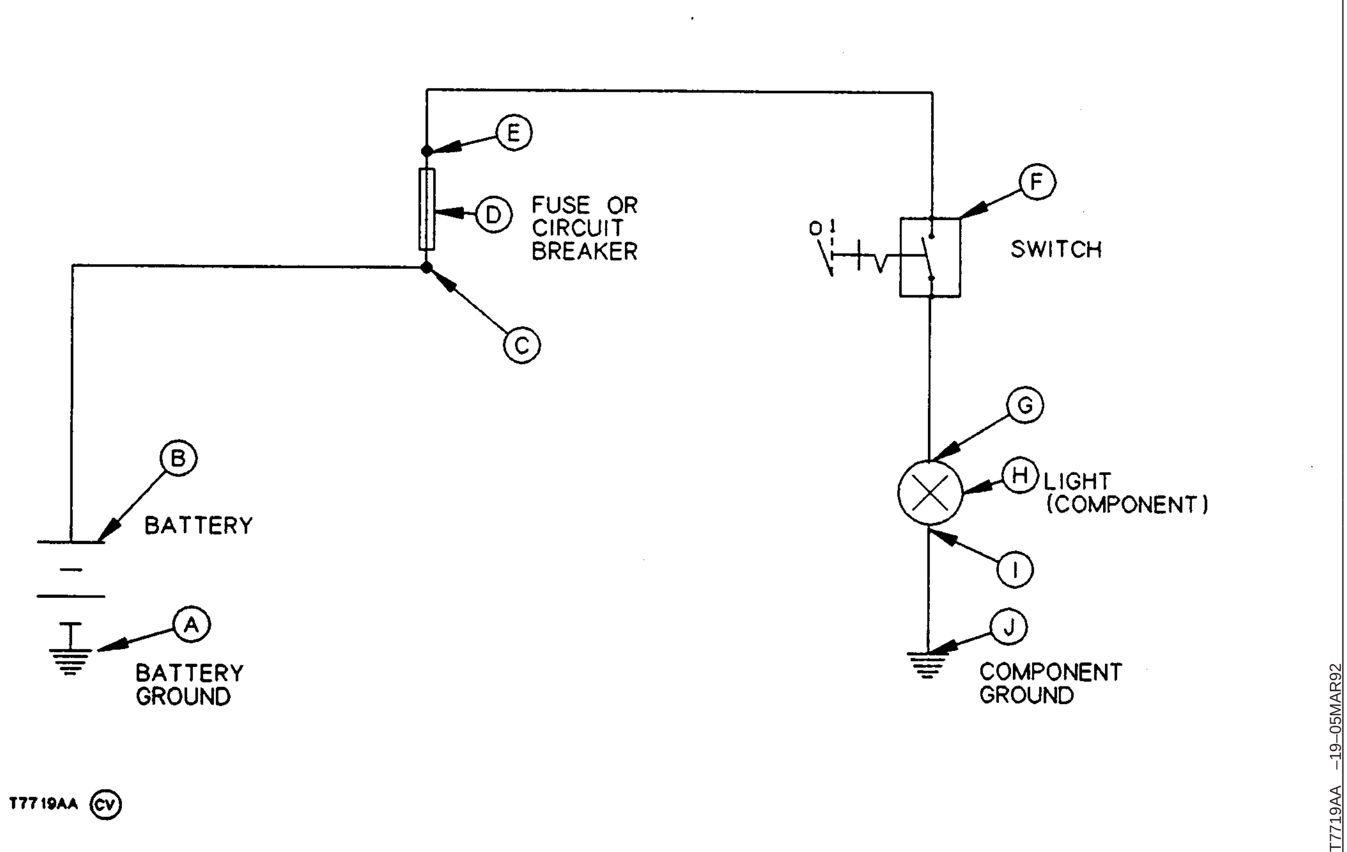
Multimeter

The multimeter is an autoranging digital display that allows very accurate readings to be taken.

T7199AI –19–17JAN90

TX,901505,QQ374 –19–10AUG95–1/1

Seven Step Electrical Test Procedure



A—Battery Ground
B—Battery
C—Battery Side Of Fuse Or Circuit Breaker
D—Fuse Or Circuit Breaker
E—Component Side Of Fuse Or Circuit Breaker
F—Switch
G—Battery Side Of Component Terminal
H—Light (Component)
I—Ground Side Of Component Terminal
J—Component Ground

Continued on next page

TX,9015,QQ1697 –19–10AUG95–1/2

Step 1—Switch ON Check battery side of circuit breaker (C) for battery voltage	Battery voltage normal. Go to Step 2.
	Low voltage, repair high resistance.
	Open circuit from battery.
Step 2—Switch OFF Check component side of circuit breaker for battery voltage	Battery voltage normal. Go to Step 4.
	Low voltage, repair high resistance.
	No voltage. Go to Step 3.
Step 3—Switch OFF Check component side of circuit breaker for continuity to ground	Continuity to ground. Repair grounded circuit at or before switch.
	No continuity to ground, replace circuit breaker.
Step 4—Switch ON Check component side of circuit breaker for battery voltage	Battery voltage normal. Go to Step 6.
	Low voltage, repair high resistance.
	No voltage. Go to Step 5.
Step 5[a]—Disconnect wire at battery side of component (G). Switch ON. Check wire at (G) for battery voltage	Battery voltage, repair component.
	No voltage, repair grounded or open circuit at or after switch.
Step 6—Switch ON Check lead to component at (G) for battery voltage	Battery voltage normal. Go to Step 7.
	Low voltage, repair high resistance in circuit between fuse and component.
	No voltage, repair high resistance or open circuit between fuse and component.
Step 7—Switch ON Check ground wire of component at (I) for voltage	No voltage, good continuity to ground. Repair component.
	Voltage, poor continuity to ground. Repair high resistance or open ground circuit.

[a]A multimeter will not apply a load to the circuit at step 5. The multimeter result is tested as a voltage condition in the result column.

TX,9015,QQ1697 –19–10AUG95–2/2

Wiring Diagram And Schematic Information

System Functional Schematic Diagram

The System Functional Schematic is a schematic diagram of the complete machine. All harnesses are identified by letter/number designation and description (W1 Engine Harness, W2 Dash Harness Etc.). Each wire is identified by number and/or color (G01 BLK, R02 Red, RED/WHT, BLU/GRN Etc.). All components are identified by letter/number designation, description and are represented by a schematic symbol. Component letter/number designation, (K1 Start Relay, S1 Key Switch, B9 Horn, Etc.) will indicate that component throughout the manual. The System Functional Schematic Diagram is divided into Sections. Each section contains one or more electrical circuits. Each section is indicated by a number and circuit (SE1 CHARGING CIRCUIT, SE2 STARTING CIRCUIT Etc).

Wiring Diagram

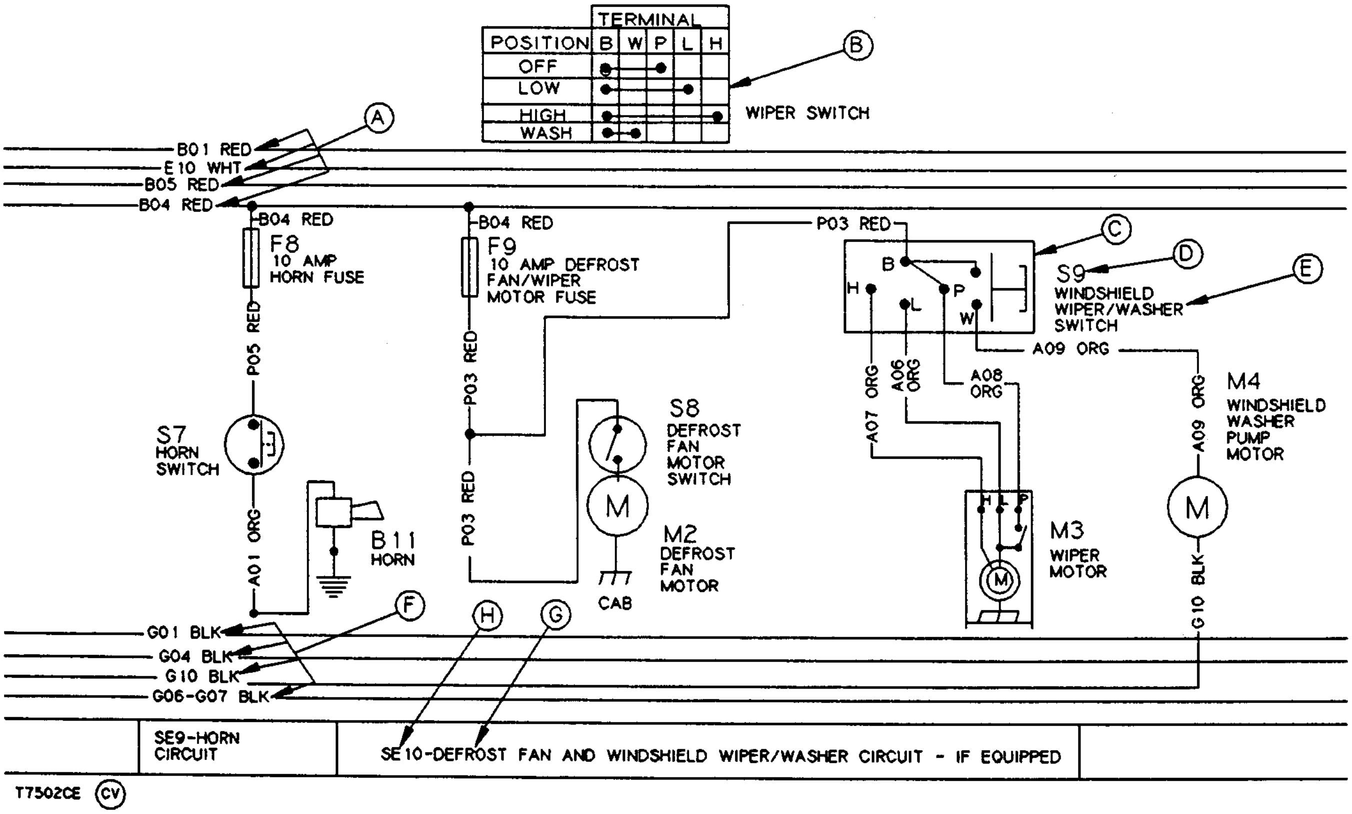
The Wiring Diagram shows each wiring harness, wire color, wire destination, harness connectors and schematic symbols for each electrical component connected to that harness. Harnesses are identified by the same letter/number designation and description used in the System Functional Schematic Diagram (W1 Engine Harness, W2 Dash Harness Etc.). Each component schematic symbol will be identified by the same letter/number designation used in the System Functional Schematic Diagram. Harness connectors will be identified by a letter/number designation and description (X1 CAB HARNESS TO ENGINE HARNESS CONNECTOR, X3 DASH HARNESS TO HEATER BLOWER HARNESS CONNECTOR Etc.).

Component Location Diagram

The Component Location Diagram is a pictorial view by harness showing location of all electrical components, connectors, harness main ground locations and harness band and clamp location. Each component will be identified by the same identification letter/number and description used in the System Functional Schematic Diagram.

TX,9015,DY360 –19– 3JUN96–1/1

Reading A System Functional Schematic



T7502CE –19–29MAY91

A—Power Wires
B—Continuity Chart
C—Component Schematic Symbol
D—Component Identification Code
E—Component Name
F—Ground Wires
G—Circuit Name
H—Section Number

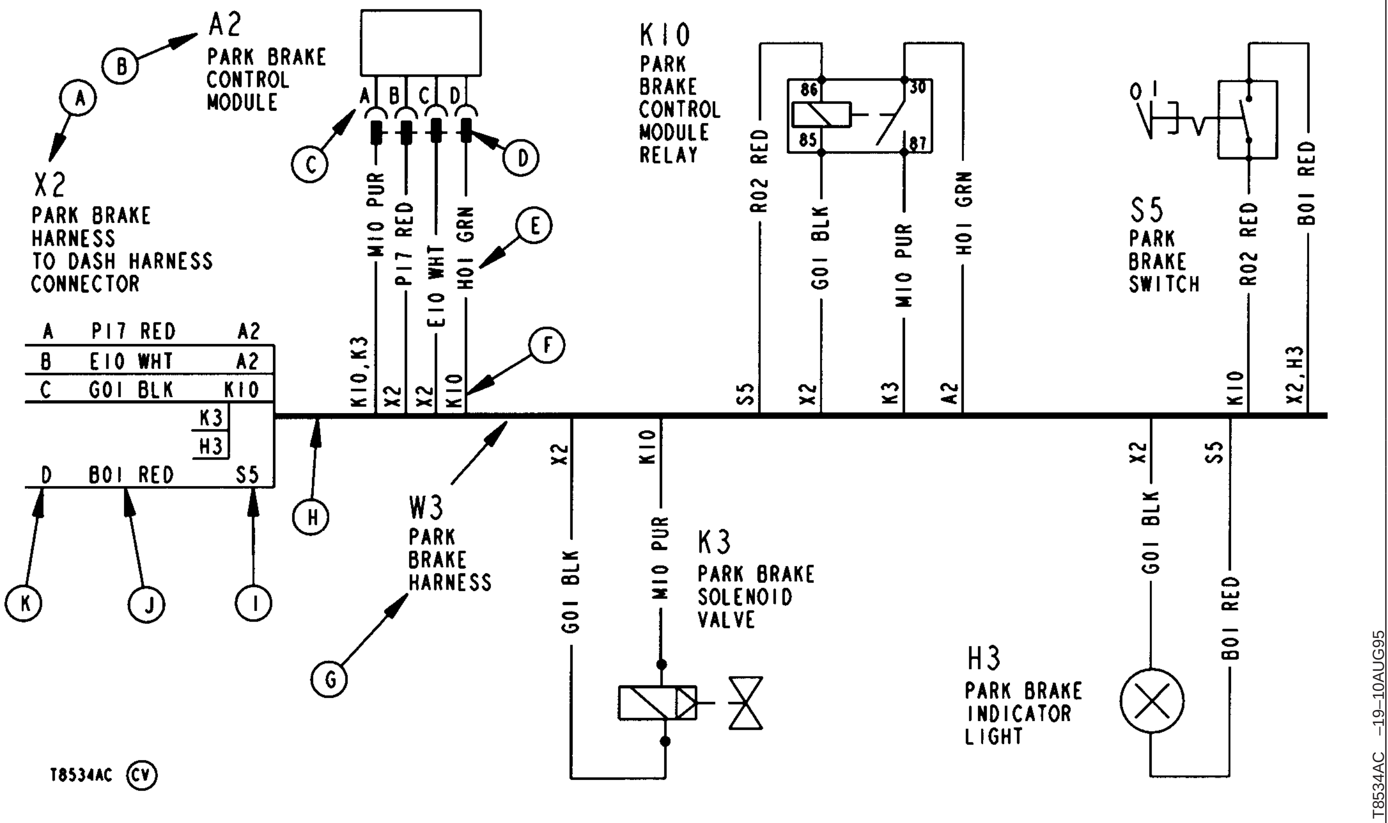
The System Functional Schematic is made up of sections which contain one or more Subsystem Functional Schematic laid out side by side in a logical sequence of related functions. Each Subsystem is a major group of components like starting components or charging components (H). Sections are named to reflect that group of components (G). The System Functional Schematic is formatted with power supply wires (A) shown across the top of the drawing and ground wires (F) across the bottom. The diagram contains no harness or connector information.

Each electrical component is shown by a schematic symbol (C), the component name (E), and a component identification code (D). A continuity chart (B) is included for each multi-terminal switch.

The same names and identification letter codes are used on all machine drawings—the System Functional Schematic, System Wiring and Harness Diagram, and the System Component Location Drawing. Components and connectors can easily be cross-referenced from one drawing to another. See Group -10 for Component Identification Legend.

TX,9015,RP751 –19–12APR94–1/1

Reading A Wiring Diagram



A—Harness Connector Letter/Number Identification
B—Component Letter/Number Identification
C—Component Connector Pin Number or Letter
D—Component Connector
E—Wire Number and/or Color
F—Component(s) Identification Number/Letter Wire is Routed To
G—Harness Identification Letter/Number and Description
H—Wiring Harness
I—Component(s) Identification Number/Letter Wire is Routed To
J—Wire Number and/or Color
K—Harness Connector Pin Number or Letter

Each harness on the machine is drawn showing components, connectors and wires. Harnesses (G) are identified by a letter/number designation and description, (W3 PARK BRAKE HARNESS Etc.).

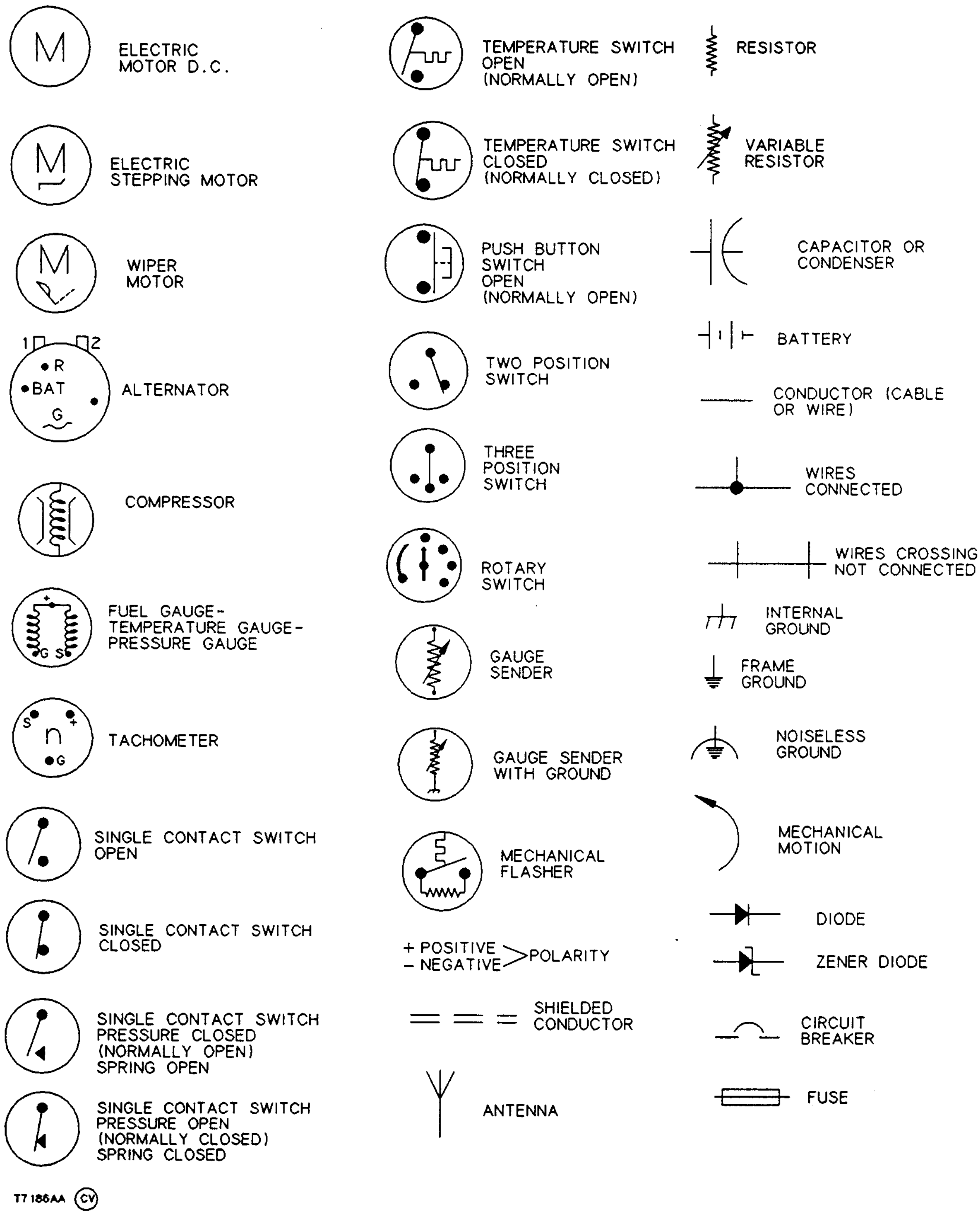
Each component (B) is represented by a schematic symbol and is identified by the same letter/number designation and description used in the System Functional Schematic. Components with integral connectors (D) have pin number/letters indicated (C). Wires from harness to components are identified by letter/number designation (E). Component identification letter/number (F) indicates component wire is routed to.

Main harness connectors (A) are identified by a letter/number designation and description, (X2 PARK BRAKE HARNESS TO DASH HARNESS CONNECTOR Etc.). Harness connector description indicates which harnesses connect together. Connector pin numbers or letters (K) are indicated as they are marked on the connector. Wires attached to each connector pin are identified by number and/or color designation (J). Component identification number/letter (I) indicates destination of each wire.

Harness, harness connector and component identification letter/numbers and description are the same as used on the System Functional Schematic.

TX,9015,RP971 –19–31AUG95–1/1

Electrical Schematic Symbols



T7186AA –19–30OCT90

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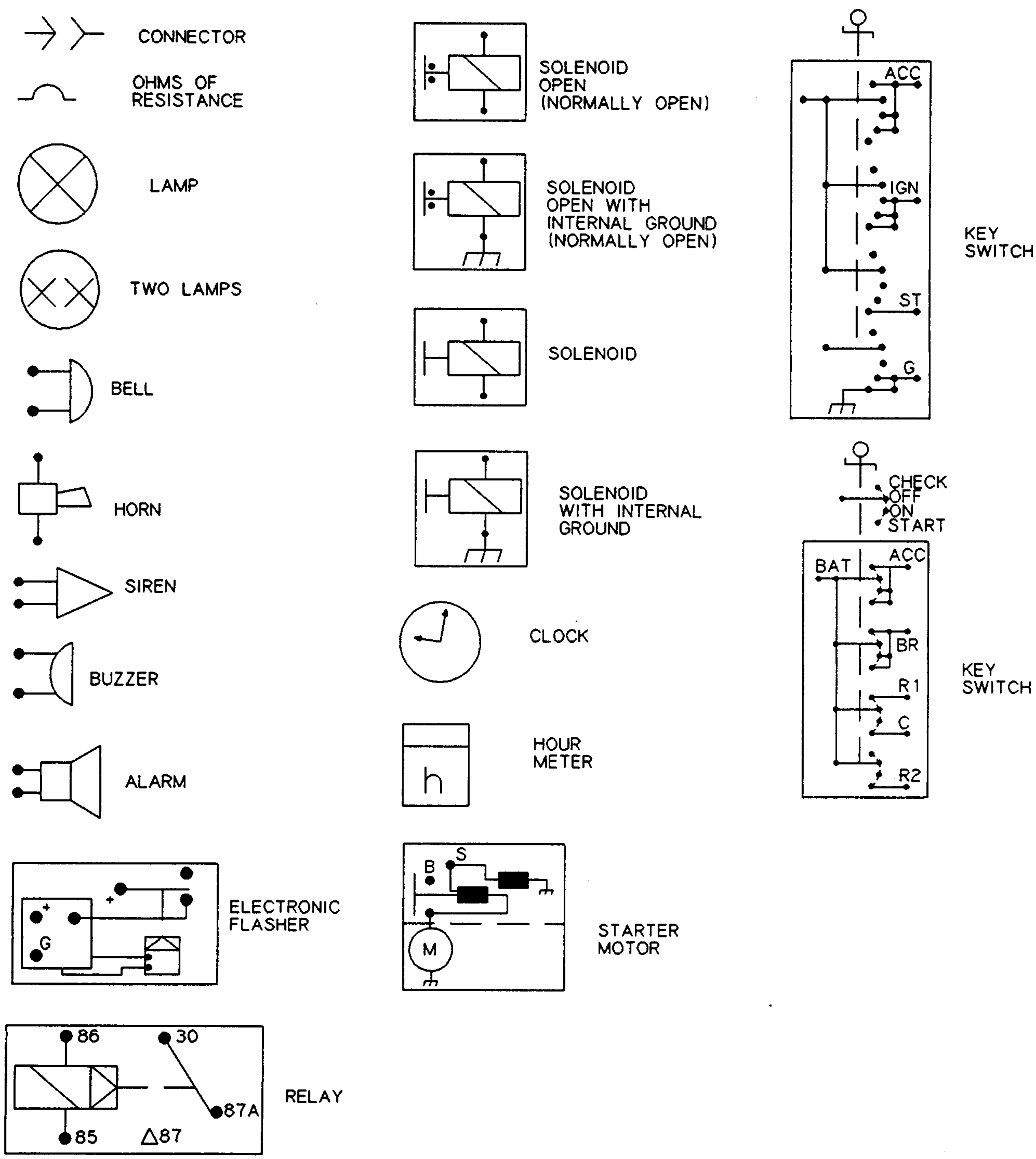
TX,901505,QQ378 –19–10AUG95–1/2



T7186AB (CV)

T7186AB –19–30OCT90

TX,901505,QQ378 –19–10AUG95–2/2

Component Identification Table

Each component (electrical device) and main connector will have and identification letter assigned to it. A number is added to the letter to separate and indicate the total components within that letter group.

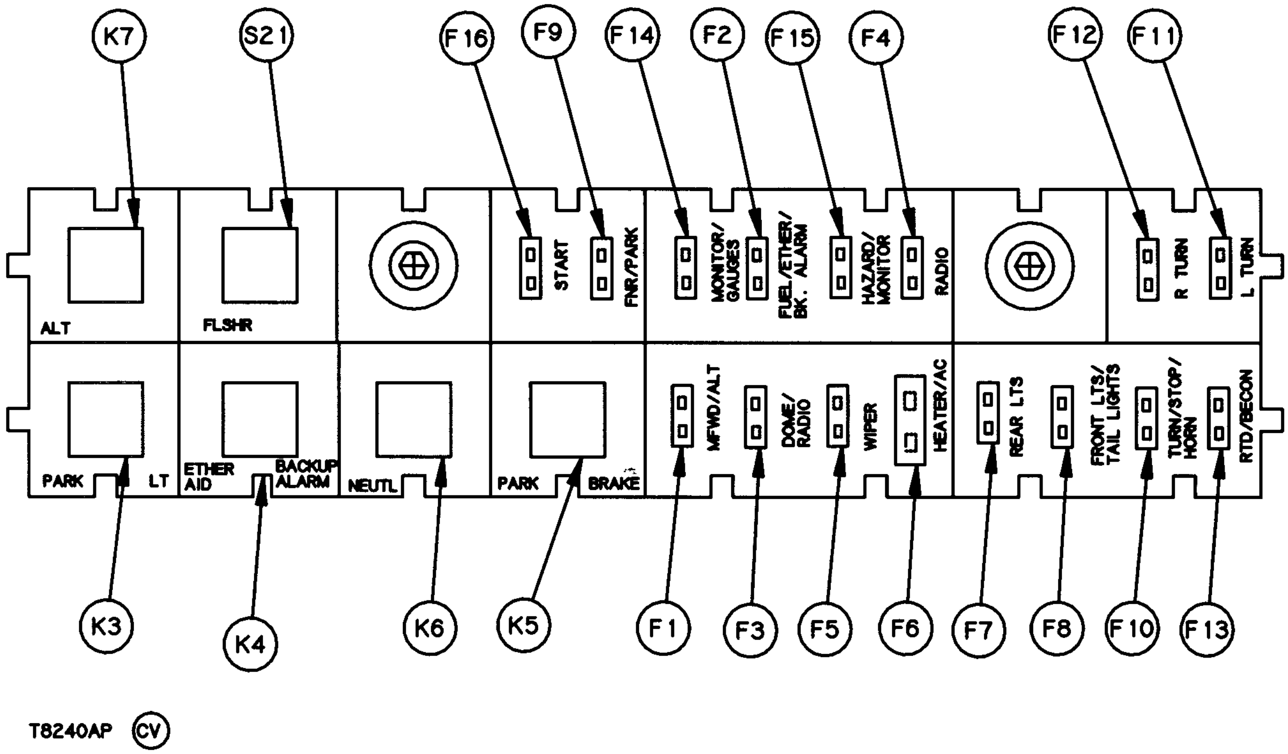
Identification Letter		
Type	**Examples**	
A	System, subassembly, parts group	Control units, trigger boxes, two-way radios, logic module, FNR logic module
B	Transducer for conversion of non-electrical variables to electrical and vice versa	Speed sensors, pressure sensors, pressure switches horns, sensors, pickups, limit-value sensors, pulse generators, loudspeakers, inductive pickups, probes, air-flow sensors, oil-pressure switches, temperature sensors, ignition-voltage pickups
C	Condenser, capacitor	Condensers and capacitors, general
D	Binary device, memory	Digital devices, integrated circuits, pulse counters, magnetic tape recorders
E	Various devices and equipment	Heating devices, air conditioners, light, headlights, spark plugs, ignition distributors
F	Protection device	Release mechanisms, polarity protection devices, fuses, current protection circuits
G	Power supply, generator	Batteries, generators, alternators, charging units
H	Monitor, alarm, signalling device	Audible alarms, indicator lights, turn-signal lights, brake lights, alarms, warning lights, buzzers
K	Relay	Battery relays, turn-signal relays, solenoid switches, starting relays, warning flashers
L	Inductor	Choke coils, coils, windings
M	Motor	Blower motors, fan motors, starter motors
N	Regulator, amplifier	Regulators (electronic or electromechanical), voltage stabilizers
P	Measuring instrument	Ammeter, diagnostic connectors, tachometers, fuel gauge, pressure gauges, measuring points, test points, speedometers

Continued on next page TX,901505,QQ381 –19–16SEP92–1/2

R	Resistor	Flame glow plugs, sheathed-element flame glow plugs, glow plugs, heating resistors, NTC resistors, PTC resistors, potentiometers, regulating resistors
S	Switch	Switches and pushbuttons, general key switch, light switch, horn switch, flasher switch
T	Transformer	Ignition coil, ignition transformer
U	Modulator, converter	DC transformers
V	Semiconductor, electron tubes	Transistors, diodes, electron tubes, rectifiers, semiconductors, thyristors, zener diodes
W	Transmission path, conductor, antenna	Antennas, shielding components, shielded conductors, cable harnesses, conductors, ground conductors
X	Terminal, plug, plug and socket connection	Terminal studs, electrical connections, connectors electrical line couplers, line connectors, sockets, plugs, terminals, plug-and-socket connections
Y	Electrically actuated mechanical device	Permanent magnets, (solenoid-operated) injection valves, electromagnetic clutches and brakes, air valves, fuel pumps, solenoids, switching valves, start valves, locking systems
Z	Electrical filter	Interference suppression filters

TX,901505,QQ381 –19–16SEP92–2/2

Fuse Specifications



T8240AP –19–31MAY94

F1—7.5 Amp MFWD/Alternator/Diff Lock Fuse
F2—15 Amp Fuel/Ether Aid and Reverse Alarm Fuse
F3—5 Amp Dome Light/Radio Fuse
F4—5 Amp Radio Fuse (Unswitched Power)
F5—15 Amp Wiper Fuse
F6—30 Amp Heater/AC Circuit Breaker
F7—15 Amp Rear Light Fuse
F8—25 Amp Front Light/Tail Light Fuse
F9—10 Amp FNR/Park Brake Fuse
F10—20 Amp Turn/Stop and Horn Fuse
F11—7.5 Amp Left Turn Fuse
F12—7.5 Amp Right Turn Fuse
F13—10 Amp RTD/Beacon Fuse
F14—5 Amp Monitor/Gauge Fuse
F15—15 Amp Hazard/Monitor Fuse (Unswitched Power)
F16—10 Amp Start Fuse
K3—Park Light Relay
K4—Ether Aid Relay CAB (S.N. —794216) ROPS (SN—794259) Backup Alarm Relay CAB (S.N.794217—) ROPS (SN794260—)
K5—Park Brake Relay
K6—Neutral Relay
K7—Alternator Sense Relay
S21—Flasher

IMPORTANT: Install fuse with correct amperage rating to prevent electrical system damage from overload.

The fuse block is located on the side console inside an access cover.

TX,9015,QQ2719 –19–31AUG95–1/1

Wiring And Schematic Diagrams Legend

NOTE: A2—Radio (SE3, W12)

- *A2 indicates component identification number.*
- *Radio indicates component name.*
- *SE3 indicates section number of SYSTEM FUNCTIONAL SCHEMATIC where component is located.*
- *W12 indicates HARNESS WIRING DIAGRAM and HARNESS COMPONENT LOCATION drawings where component is located.*

V1—MFWD Solenoid Diode (SE2,W8)

- *V1 indicates component identification number.*
- *MFWD Solenoid Diode indicates component name.*
- *SE1 indicates section number of SYSTEM FUNCTIONAL SCHEMATIC where component is located.*
- *W8 indicates HARNESS WIRING DIAGRAM and HARNESS COMPONENT LOCATION drawings where component is located.*

- A2—Radio (SE3,W12)
- B1—Backup Warning Alarm (SE5,W8)
- B2—Park Brake Sensing Switch (SE9,W8)
- B3—Horn (SE12,W8)
- B4—Fuel Sender (SE15,W8)
- B5—Engine Coolant Temp. Switch (SE17,W8)
- B6—Engine Oil Pressure Switch (SE17,W8)
- B7—Air Filter Restriction Switch (SE17,W8)
- B8—Converter Temperature Switch (SE17,W8)
- B9—Hydraulic Filter Switch (SE17,W8)
- B10—Reverse Alarm Switch (SE9,W8) (SN—794216)
- B11—Brake Light Switches (SE13,W6)
- B12—Reverser Pressure Switch (SN—778668) (SE9,W8)
- B13—Radio Speaker (W12)
- B14—Radio Speaker (W13)
- E1—Dome Light (SE3,W5)
- E2—Swivel Light (SE3,W5)
- E3—Left Front Work Light (SE8,W5)
- E4—Right Front Work Light (SE8,W5)
- E5—Left Rear Work Light (SE8,W5)

Continued on next page
TX,9015,QQ3060 –19–31AUG95–1/6

- E6—Right Rear Work Light (SE8,W5)
- E7—Left Front Drive Light (SE8,W5)
- E8—Right Front Drive Light (SE8,W5)
- E9—Left Tail Light (SE8,W5)
- E10—Right Tail Light (SE8,W5)
- E11—Left Brake Light (SE13,W5)
- E12—Right Brake Light (SE13,W5)
- E13—Beacon Light (SE14,W5)
- E14—Fuel Gauge Light (SE15,W8)
- E15—Seat Belt Light (SE9,W6) (SN789401—)
- F1—MFWD/ALT Fuse (SE2,W6)
- F2—Fuel Shutoff/Start Aid/Reverse Alarm Fuse (SE5,W6)
- F3—Dome Light Fuse (SE3,W6)
- F4—Radio Fuse (Unswitched Power) (SE3,W6)
- F5—Windshield Wiper/Washer Fuse (SE6,W6)
- F6—Heater Circuit Breaker (SE5,W6)
- F7—Rear Work Light Fuse (SE7,W6)
- F8—Front Work Light/Tail Light Fuse (SE8,W6)
- F9—FNR/Park Brake Fuse (SE9,W6)
- F10—Turn/Stop/Horn Fuse (SE12,W6)
- F11—Left Turn Light Fuse (SE13,W6)
- F12—Right Turn Light Fuse (SE13,W6)
- F13—Return-To-Dig/Beacon Fuse (SE14,W6)
- F14—Monitor Fuse (SE15,W6)
- F15—Hazard/Monitor Fuse (Unswitched Power) (SE16,W6)
- F16—Start Fuse (SE11,W6)
- F17—Fuse Block (W6)
- G1—Battery (SE1,W8)
- G2—Alternator (SE1,W8)
- H1—Left Indicator Turn Light (SE13,W7)
- H2—Left Front Turn Light (SE13,W5)
- H3—Left Rear Turn Light (SE13,W5)
- H4—Right Front Turn Light (SE13,W5)
- H5—Right Rear Turn Light (SE13,W5)
- H6—Right Indicator Turn Light (SE13,W7)
- H7—Logic Module (SE16,W6) (SN—XXXXXX)
- H8—Display Module (SE16,W6)
- H9—Red Warning Light (SE17,W6)
- H10—Yellow Warning Light (SE17,W6)
- H11—Alarm (SE17,W6)
- K1—Start Relay (SE1,W8)
- K2—Accessory Relay (SE1,W6)
- K3—Park Light Relay (SE9,W6)
- K4—Ether Aid Relay (SE4,W6) (SN—794216)

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TX,9015,QQ3060 –19–31AUG95–2/6

- K4—Backup Alarm Relay (SE4,W6 (SN794217—)
- K5—Park Brake Latching Relay (SE9,W6)
- K6—Neutral Start Relay (SE9,W6)
- K7—Alternator Relay (SE16,W6)
- K8—Auxiliary Valve Relay (W14)
- M1—Starter Motor (SE1,W8)
- M2—Rear Wiper Motor (SE6,W5)
- M3—Left Hand Door Wiper Motor (SE6,W5)
- M4—Right Hand Door Wiper Motor (SE6,W5)
- M5—Washer Motor (SE6,W8)
- M6—Heater Blower Motor (SE5,W6)
- M7—Heater Blower Motor (SE5,W6)
- P1—Fuel Gauge (SE15,W6)
- P2—Tachometer (SE15,W6)
- P3—Hour Meter (SE15,W6)
- R1—Heater Motor Resistor (SE5,W6)
- S1—Key Switch (SE2,W6)
- S2—MFWD Switch (SE2,W6)
- S3—MFWD Indicator Switch (SE2,W8)
- S4—Start Aid Switch (SE5,W6)
- S5—Front Wiper Switch (SE6,W7)
- S6—Rear Wiper Switch (SE6,W6)
- S7—Windshield Washer Switch (SE6,W6)
- S8—Blower Switch (SE5,W6)
- S9—Front Light Switch (SE8,W7)
- S10—Rear Light Switch (SE7,W6)
- S11—FNR Switch (SE9,W7)
- S12—Park Brake Dash Switch (SE9,W6)
- S13—Loader Lever Switch (SE8,W6)
- S14—Gear Shift Lever Switch (SE8,W6)
- S15—Horn Switch (SE12,W6)
- S16—Turn Signal Switch (SE13,W7)
- S17—4-Way Flasher Switch (SE13,W7)
- S18—Beacon Switch (Optional) (SE14,W6)
- S19—Not Used
- S20—Return-To-Dig Switch (SE14,W8)
- S21—Flasher (SE13,W6)
- S22—Heater Temperature Switch (W6)
- S23—Low Pressure Switch (W11)
- S24—High Pressure Switch (W11)
- S25—A/C Switch (If Equipped) (W6)
- S26—Clutch Cycle Switch (W10)
- S27—Dome Light Switch (SE3,W5)
- S28—Swivel Light Switch (SE3,W5)
- S29—Auxiliary Valve Switch (W14)
- S30—Auxiliary Valve Foot Switch (W14)

Continued on next page

TX,9015,QQ3060 –19–31AUG95–3/6

- V1—MFWD Solenoid Diode (SE2,W8)
- V2—Park Brake Solenoid Diode (SE9,W8)
- V3—Reverse Solenoid Diode (SE9,W8)
- V4—Forward Solenoid Diode (SE9,W8)
- V5—Clutch Disconnect Solenoid Diode (SE9,W8)
- V6—4-Way Flasher Switch Diode (SE13,W7)
- V7—4-Way Flasher Switch Diode (SE13,W7)
- V8—Logic Module/Display Module Diode (SE15,W6)
- V9—Alternator Diode (SE1,W8)
- V10—Auxiliary Valve Diode (W14)
- V11—Park Brake Relay Diode (SE9,W6) (SN—778669)
- W1—Machine Frame/Engine Block Ground (SN—796033) (SE1,W8) Machine Frame To Eng. Ground Strap (SN796034—) (SE1,W8)
- W2—Ground To Cab Frame (SE14,W5)
- W3—Ground At Cab Floor (SE1,W8)
- W4—Engine Ground Strap (W8)
- W5—Cab Roof Harness (W5)
- W6—Cab Floor Harness (W6)
- W6—Cab Side Console Harness (W6)
- W7—Front Console Harness (W7)
- W8—Engine Harness (W8)
- W9—Not Used
- W10—Blower Harness (W10)
- W11—A/C Compressor Harness (W11)
- W12—Radio Harness (W12)
- W13—Radio Antenna (W12)
- W14—Auxiliary Valve Harness (W14)
- W15—Ground to A/C Compressor (W8) (S.N.801200—)
- W16—Alternator Harness (SN—796034)
- X1—Side Console Harness To Roof Harness Connectors (W5,W6)
- X2—Side Console Harness To Roof Harness Connectors (W5,W6)
- X3—Side Console Harness To Roof Harness Connectors (W5,W6)
- X4—Side Console To Floor Harness Connectors (W6) (SN778668—)
- X5—Side Console To Floor Harness Connectors (W6) (SN778668—)
- X6—Blower Switch Connector (W10)
- X7—Display Module Connectors (W6)
- X8—Horn Switch Connector (W6)
- X9—Rear Light Switch Connector (W6)
- X10—Rear Wiper Switch Connector (W6)
- X11—Beacon Switch Connector (W6)

Continued on next page

TX,9015,QQ3060 –19–31AUG95–4/6

- X12—MFWD Switch Connector (W6)
- X13—Park Brake Switch Connector (W6)
- X14—Start Aid Switch Connector (W6)
- X15—Fuel Gauge Connector (W6)
- X16—Key Switch Connector (W6)
- X17—Logic Module 4-Pin Connector (W6) (SN—XXXXXX)
- X18—Logic Module 6-Pin Connector (W6) (SN—XXXXXX)
- X19—Logic Module 4-Pin Connector (W6) (SN—XXXXXX)
- X20—Logic Module 6-Pin Connector (W6) (SN—XXXXXX)
- X21—Floor Harness To Engine Harness (W6,W8) (SN778669—)
- X21—Side Console To Engine Harness (W6,W8) (SN—778668)
- X22—Floor Harness To Engine Harness (W6,W8) (SN778669—)
- X22—Side Console To Engine Harness (W6,W8) (SN—778668)
- X23—Floor Harness To Engine Harness (W6,W8) (SN778669—)
- X23—Side Console To Engine Harness (W6,W8) (SN—778668)
- X24—Not Used
- X25—Floor To Front Console Connectors (W6,W7)(SN—778668)
- X25—Side To Front Console Connectors (W6,W7)(SN778669—)
- X26—FNR Switch Connector (W7)
- X27—Turn Signal Switch Connector (W7)
- X28—Beacon Light Connector (W5)
- X29—Roof Harness to Radio Harness Connector (W5,W12)
- X30—Splice (Inside Harness) (W6)
- X31—Forward/Reverse Solenoid Connector (W8)
- X32—Clutch Disconnect Solenoid Connector (W8)
- X33—Connectors For A/C Switch (W6) (SN—778668)
- X34—Engine Harness To A/C Compressor Harness Connector (W8,W11)
- X35—Side Console Harness To Blower Harness Connectors (W8,W10)
- X36—A/C Clutch Cycle Switch Connectors (W10)
- X37—Seat Belt Light Connector (W6)
- X38—A/C Switch Connector (W6)

Continued on next page

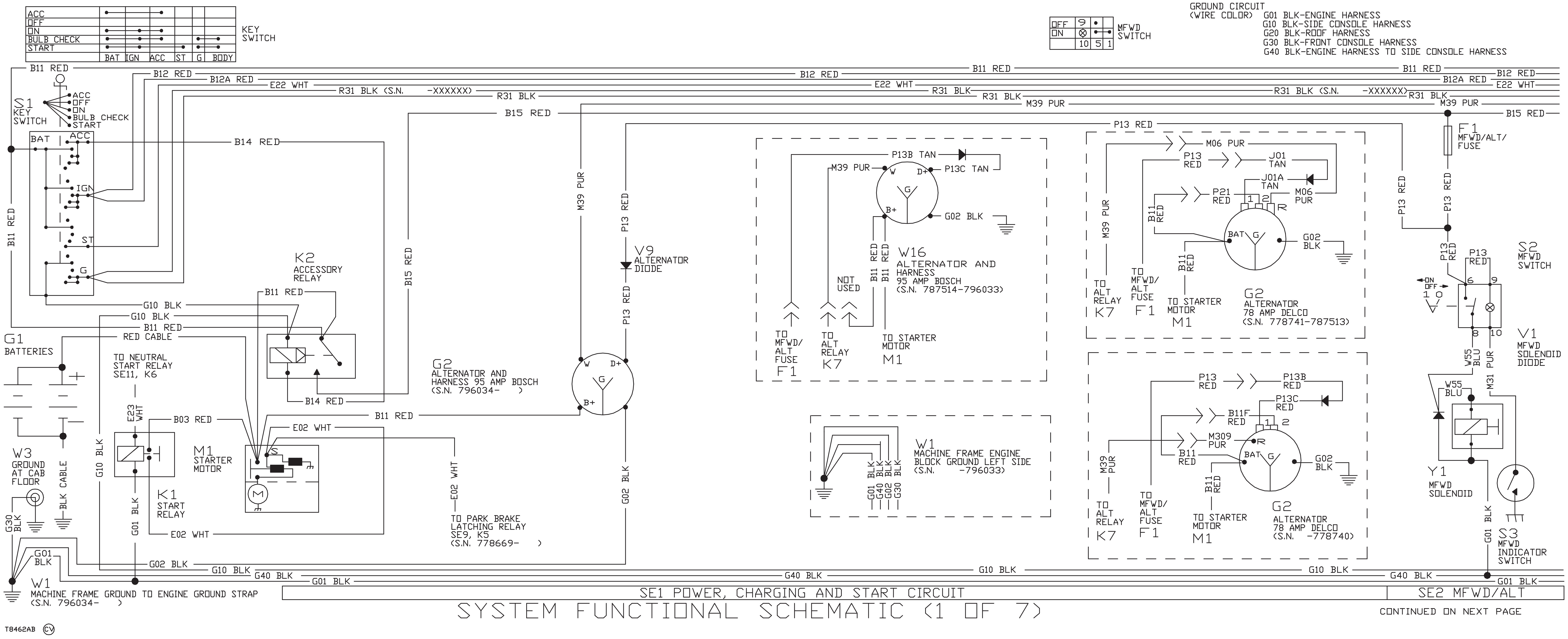
TX,9015,QQ3060 –19–31AUG95–5/6

- X39—Radio Harness To Radio Connector (W12)
- X40—Not Used
- X41—Hourmeter Or Auxiliary Valve Connector (SE13,W6)
- X41A—Auxiliary Valve Harness Connector (W14)
- X42—Auxiliary Valve Harness Connector (W14)
- X43—Not Used
- Y1—MFWD Solenoid (SE2,W8)
- Y2—Start Aid Solenoid (SE5,W8)
- Y3—Fuel Shutoff Solenoid (SE5,W8)
- Y4—Park Brake Solenoid (SE9,W8)
- Y5—Reverse/Solenoid (SE9,W8)
- Y6—Forward/Solenoid (SE9,W8)
- Y7—Clutch Disconnect Solenoid (SE9,W8)
- Y8—Not Used
- Y9—Return-To-Dig Solenoid (SE14,W8)
- Y10—A/C Compressor (W11)
- Y11—Auxiliary Valve Solenoid (W14)

TX,9015,QQ3060 –19–31AUG95–6/6

System Functional Schematic

T8462AB –19–06JAN99



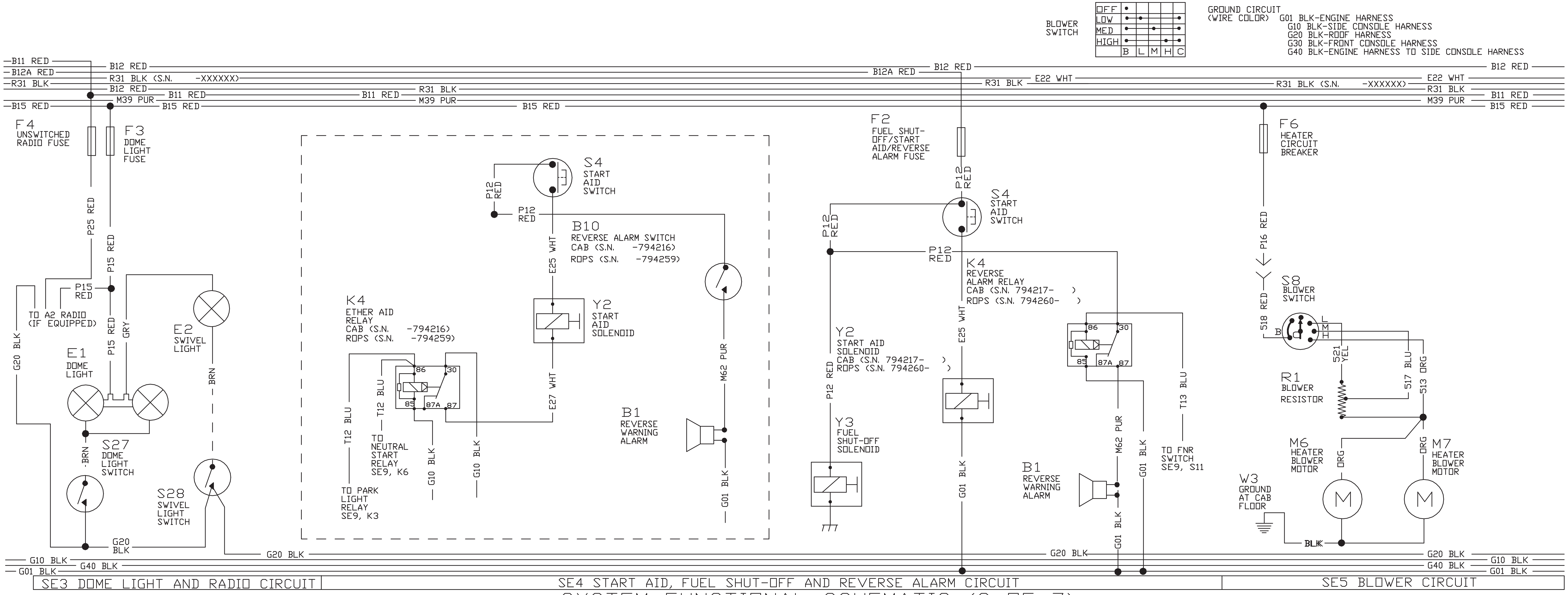
SE1—Battery/Ignition, Power, Charging and Start Circuit—(12 Volt System)
SE2—MFWD/Alternator Circuit
SE3—Dome Light and Radio Circuit
SE4—Start Aid, Fuel Shut Off and Reverse Alarm Circuit
SE5—Blower Circuit
SE6—Wiper and Washer Circuit
SE7—Rear Work Light Circuit
SE8—Front Work and Drive Light Circuit
SE9—Park Brake/Clutch Disconnect Circuit
SE10—Horn Circuit
SE11—Turn Signal, Flasher and Brake Light Circuit
SE12—Beacon and Return-To-Dig Circuit
SE13—Gauge, Side Shift and Hour Meter Circuit
SE14—Display Module and Logic Module Circuit
SE15—Indicator Circuit

NOTE: SE1—Battery/Ignition, Power, Charging and Start Circuit (12 Volt System)

- *SE1 indicates section number of system functional schematic where circuit is located.*
- *Battery/Ignition, Power, Charging and Start Circuit (12 Volt System) indicates circuit name.*

Continued on next page TX,9015,DY375 –19–26AUG02–2/8

T8462AC –19–06JAN99



SYSTEM FUNCTIONAL SCHEMATIC (2 OF 7)

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T8462AC

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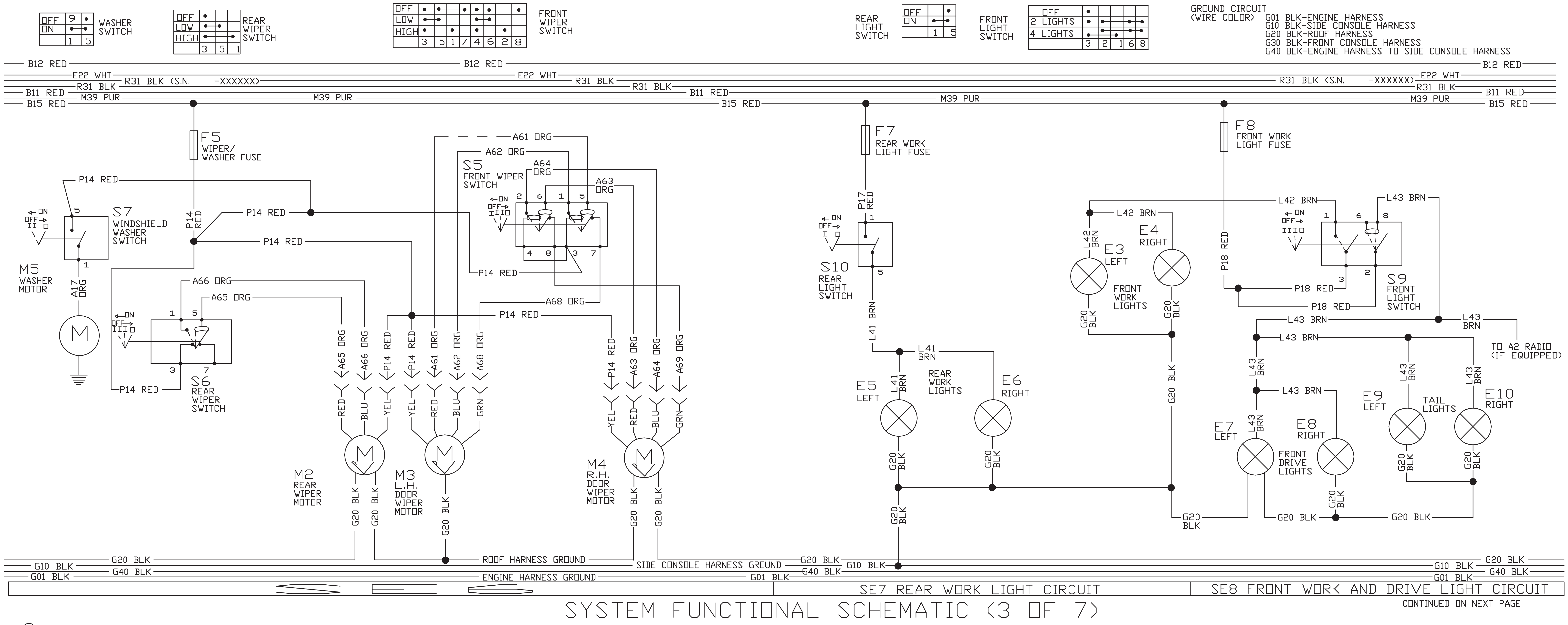
TX,9015,DY375 –19–26AUG02–3/8

T8462AD –19–06JAN99



T8462AD

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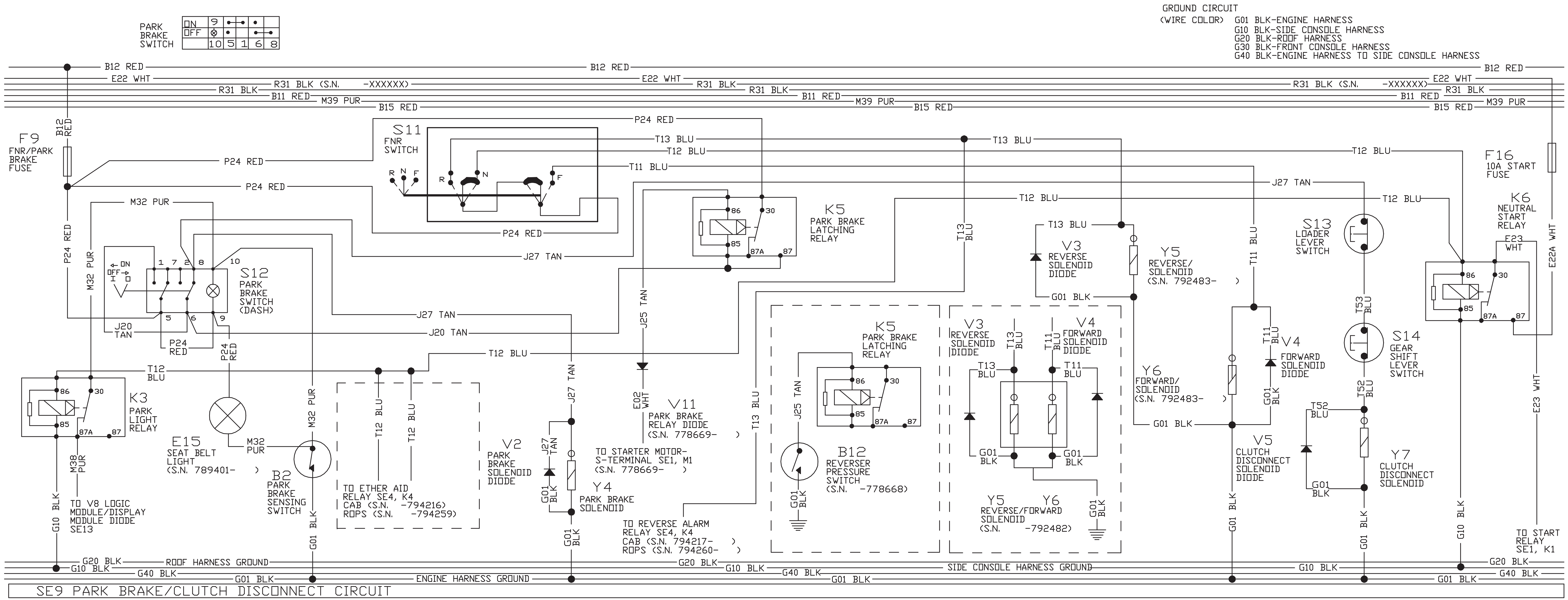
T8462AE –19–06JAN99



SYSTEM FUNCTIONAL SCHEMATIC (4 OF 7)

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T8462AE

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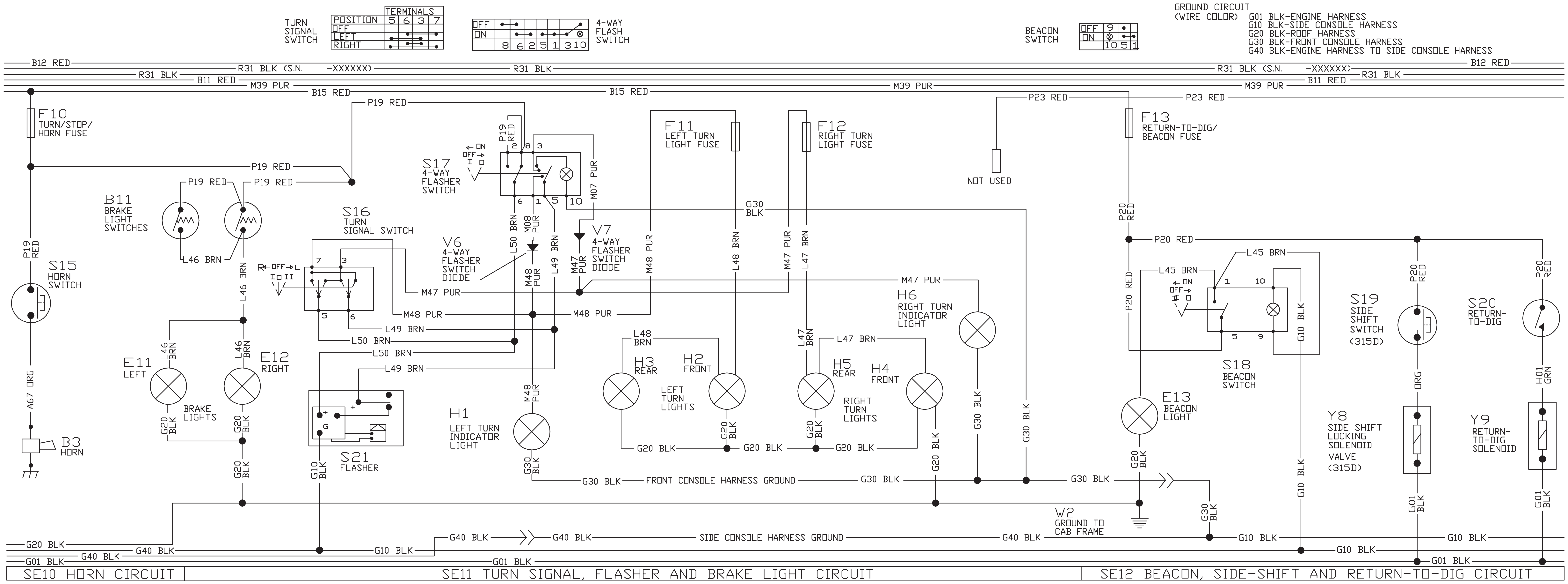
TX,9015,DY375 –19–26AUG02–5/8

T8462AF –19–06JAN99



SYSTEM FUNCTIONAL SCHEMATIC (5 OF 7)

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T8462AF

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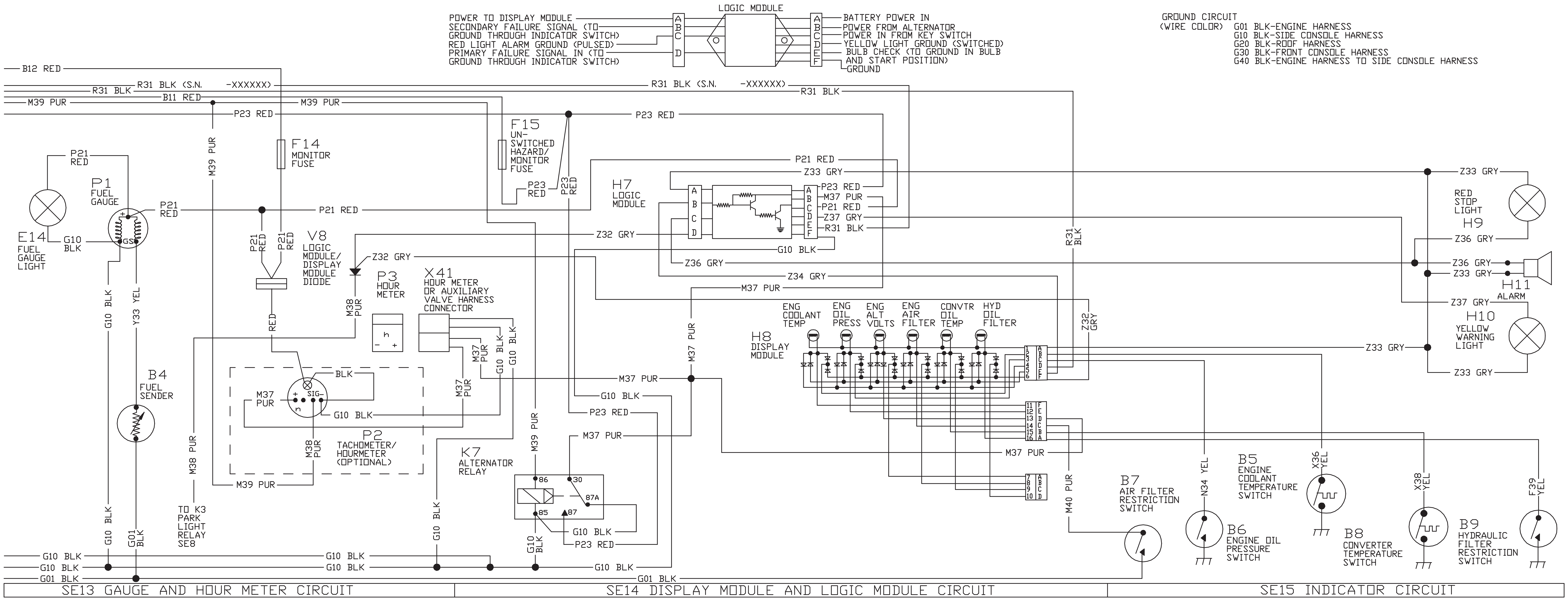
T8462AG –19–06JAN99



SYSTEM FUNCTIONAL SCHEMATIC (S.N. -XXXXXX) WITH LOGIC MODULE (6 OF 7)

T8462AG

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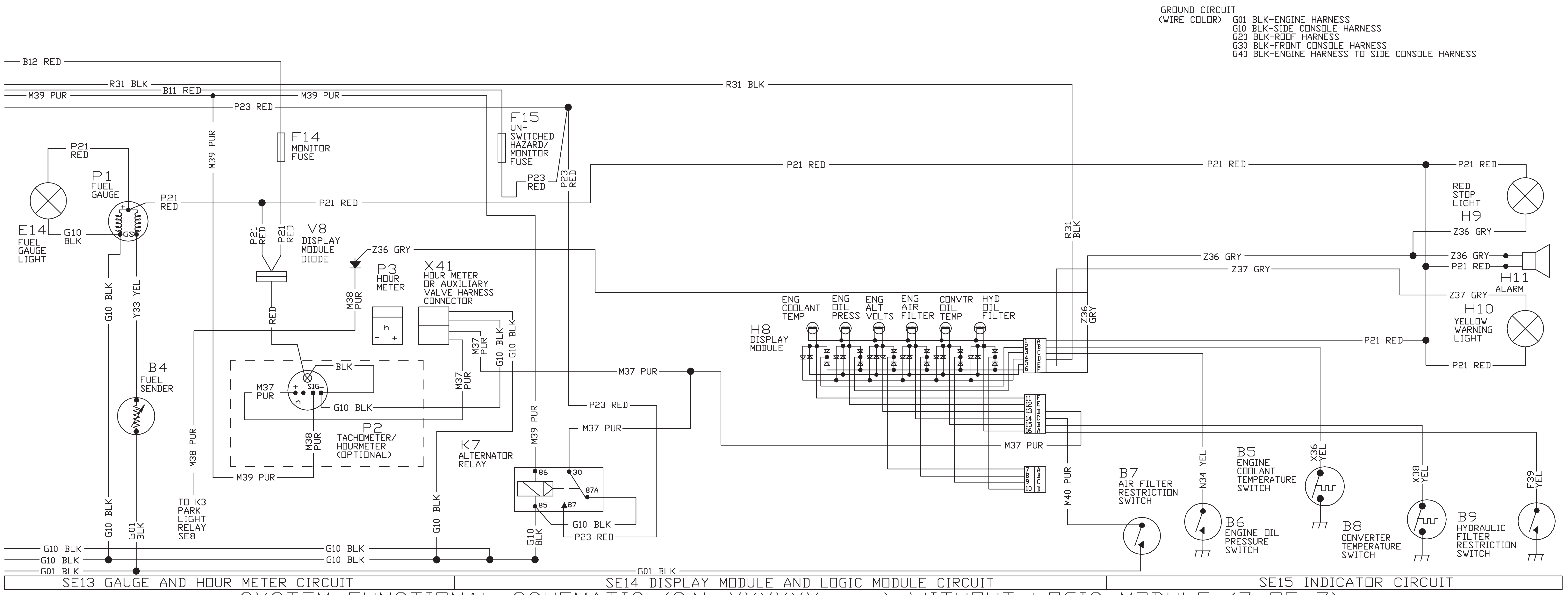
TX,9015,DY375 –19–26AUG02–7/8

T8462AH –19–06JAN99



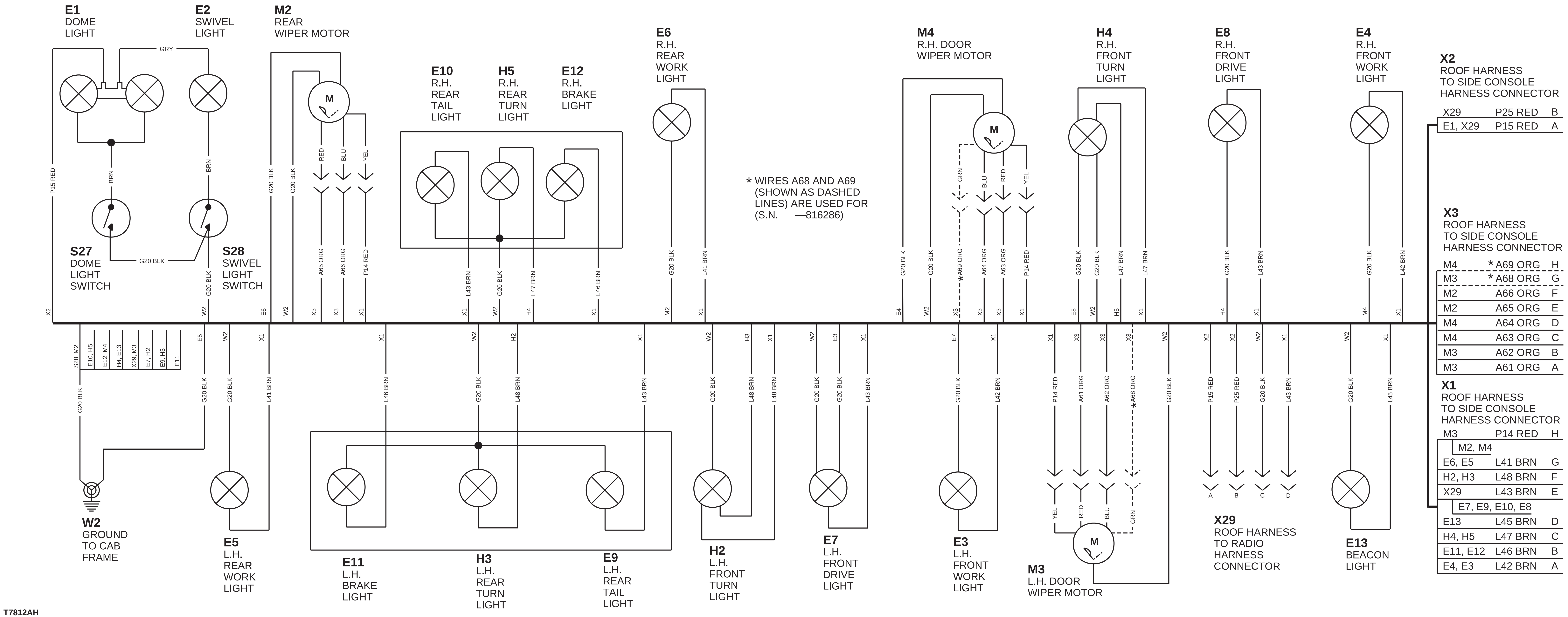
SYSTEM FUNCTIONAL SCHEMATIC (S.N. XXXXXX-) WITHOUT LOGIC MODULE (7 OF 7)

T8462AH

TX,9015,DY375 –19–26AUG02–8/8

Cab Roof Harness (W5) Wiring Diagram

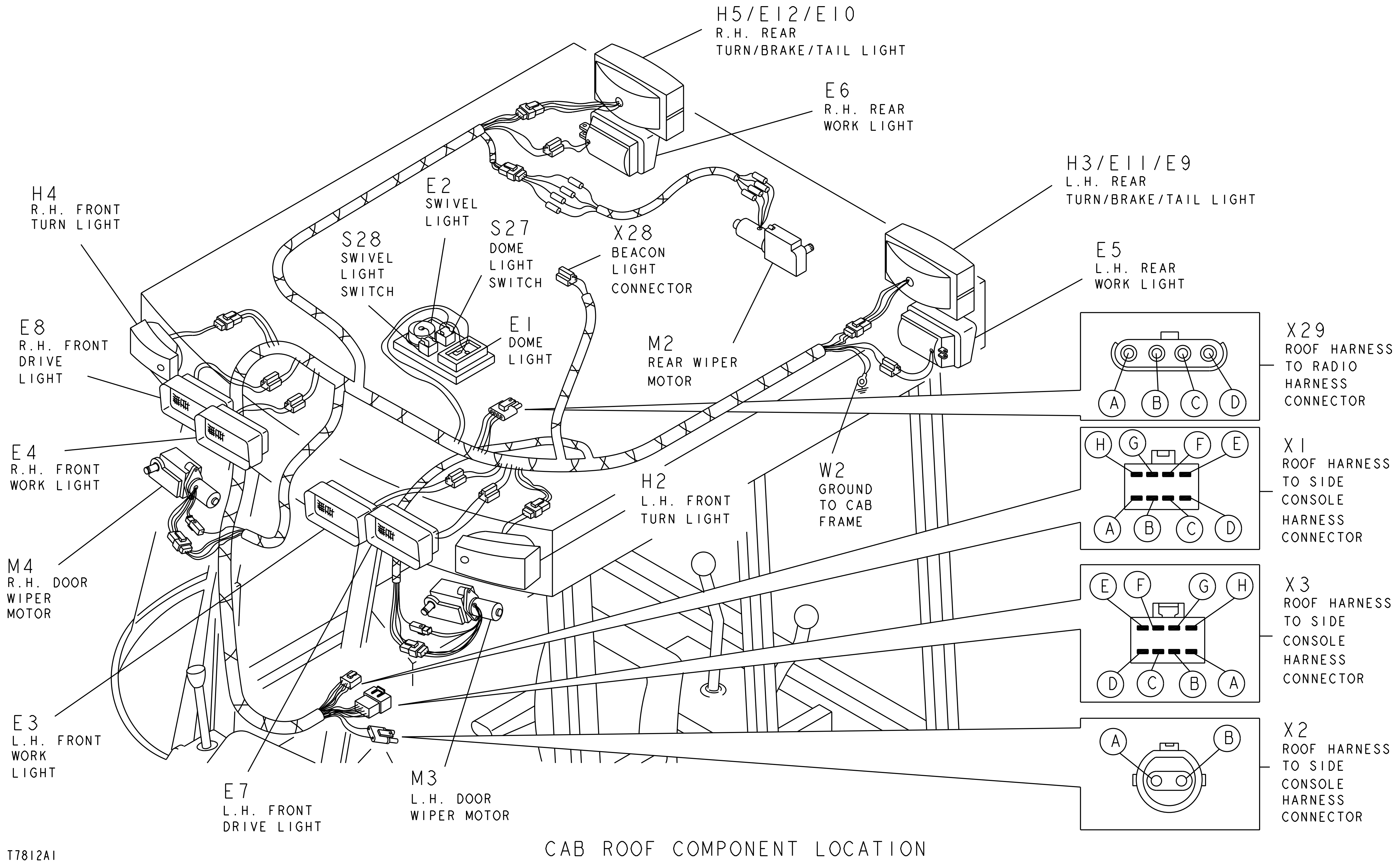
T7812AH –19–23APR97



T7812AH

Cab Roof Harness (W5) Component Location

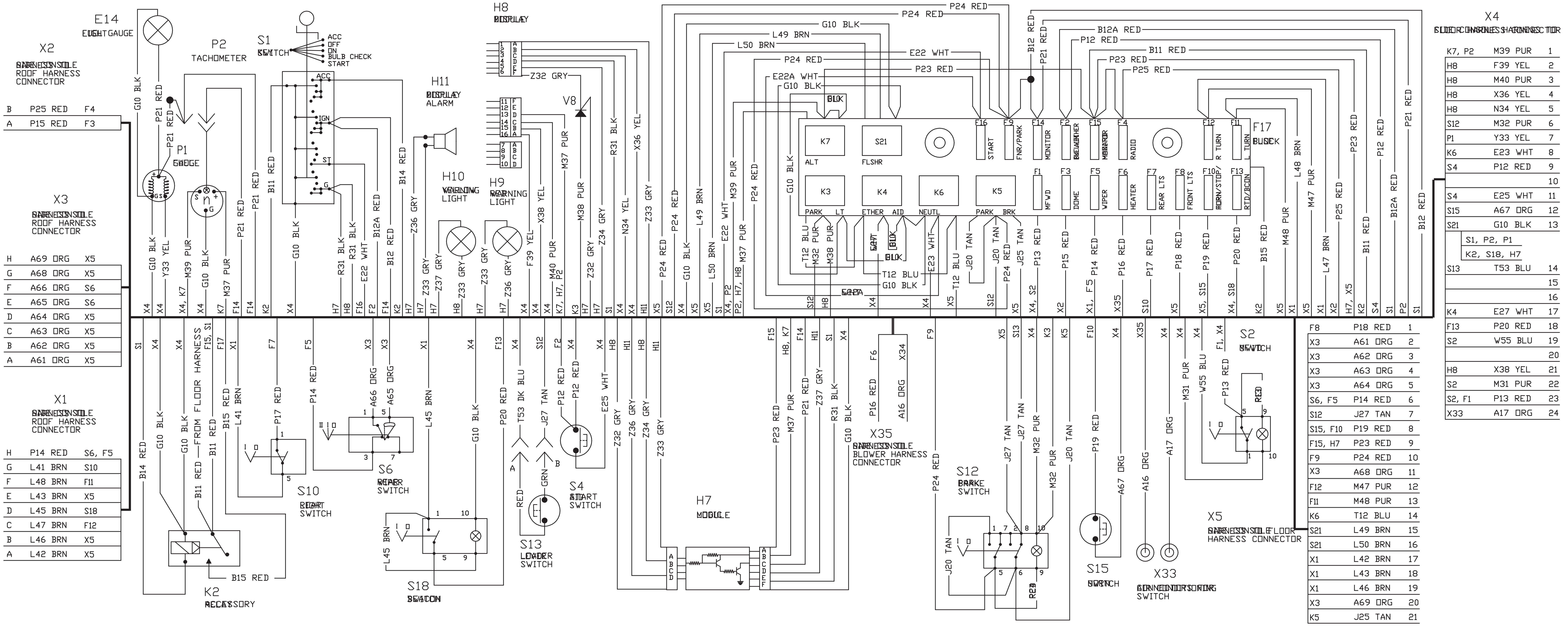
T7812AI –19–25APR97



TX,9015,QQ2665 –19–31AUG95–1/1

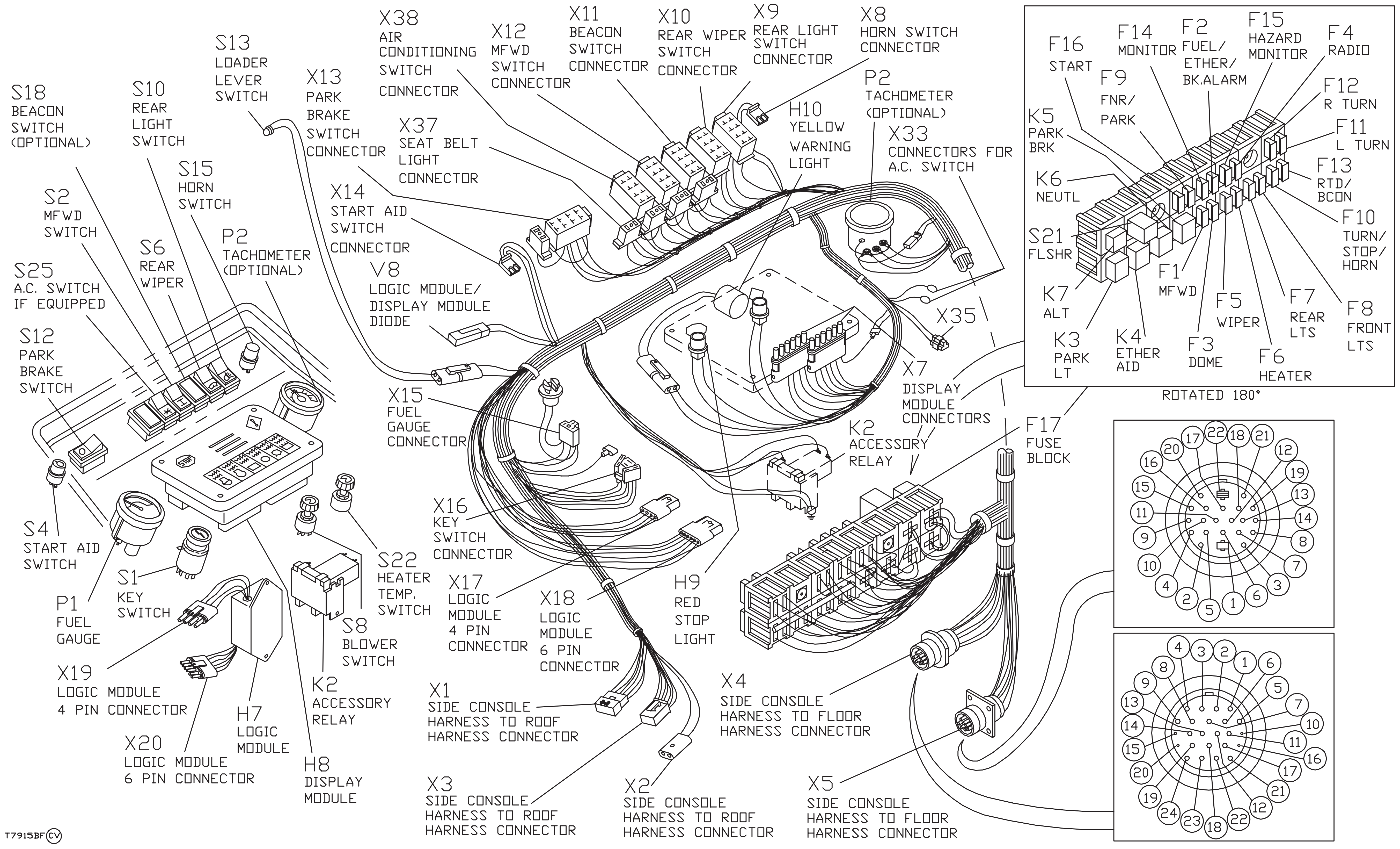
Cab Side Console Harness (W6) Wiring Diagram (S.N. —778668)

T7915BE –19–05MAR99



Cab Side Console Harness (W6) Component Location (S.N. —778668)

T7915BF –19–19FEB99



Cab Floor Harness (W6) Wiring Diagram (S.N. —778668)

T7915BG –19–05MAR99

X23

[illegible]
HARNESS CONNECTOR

1	P12 RED	X4
2	E23 WHT	X4
3	Y33 YEL	X4
4	P13 RED	X4
5	E27 WHT	X4
6	P20 RED	X4
7	J27 TAN	X5
8	M40 PUR	X4

X22

[illegible]
HARNESS CONNECTOR

1	M31 PUR	X4
2	W55 BLU	X4
3	A17 ORG	X4
4	A71 ORG	X25
5	T12 BLU	X5
6	T54 BLU	X4
7	A67 ORG	X4
8	T52 BLU	S14

X21

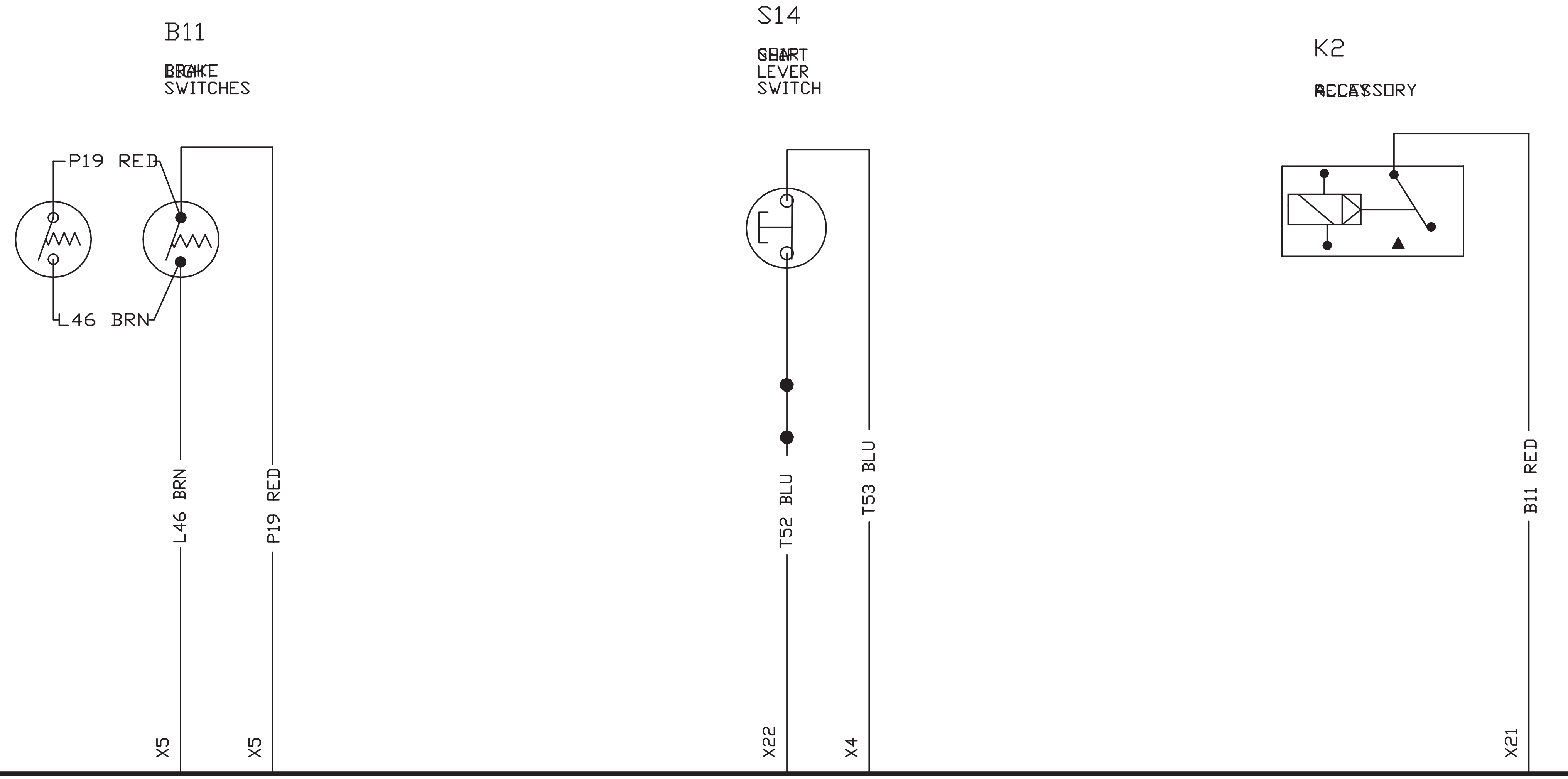
[illegible]
HARNESS CONNECTOR

1	B11 RED	K2
2	G40 BLK	X25, X4
3	T11 BLU	X25
4	J25 TAN	X5
5	T13 BLU	X25
6	F39 YEL	X4
7	E25 WHT	X4
8	X38 YEL	X4
9	M39 PUR	X4
10	N34 YEL	X4
11	M32 PUR	X4
12	P24 RED	X5
13	X36 YEL	X4
14		

X25

[illegible]
HARNESS CONNECTOR

1	A61 ORG	X5
2	A62 ORG	X5
3	A63 ORG	X5
4	A64 ORG	X5
5	A71 ORG	X22
6	P14 RED	X5
7	M47 PUR	X5
8	A69 ORG	X5
9	P23 RED	X5
10	P19 RED	X5, B11
11	L50 BRN	X5
12	L49 BRN	X5
13	M48 PUR	X5
14	G40 BLK	X21, X4
15	T11 BLU	X21
16	T13 BLU	X21
17	P24 RED	X5
18		
19	A68 ORG	X5
20	P18 RED	X5
21	L43 BRN	X5
22	P18 RED	X5
23	L42 BRN	X5
24	T12 BLU	X5



X5

[illegible]
HARNESS CONNECTOR

X25	P18 RED	1
X25	A61 ORG	2
X25	A62 ORG	3
X25	A63 ORG	4
X25	A64 ORG	5
X25	P14 RED	6
X23	J27 TAN	7
B11, X25	P19 RED	8
X25	P23 RED	9
X25	P24 RED	10
X25	A68 ORG	11
X25	M47 PUR	12
X25	M48 PUR	13
X25	T12 BLU	14
X25	L49 BRN	15
X25	L50 BRN	16
X25	L42 BRN	17
X25	L43 BRN	18
B11	L46 BRN	19
X25	A69 ORG	20
X21	J25 TAN	21
		22

X4

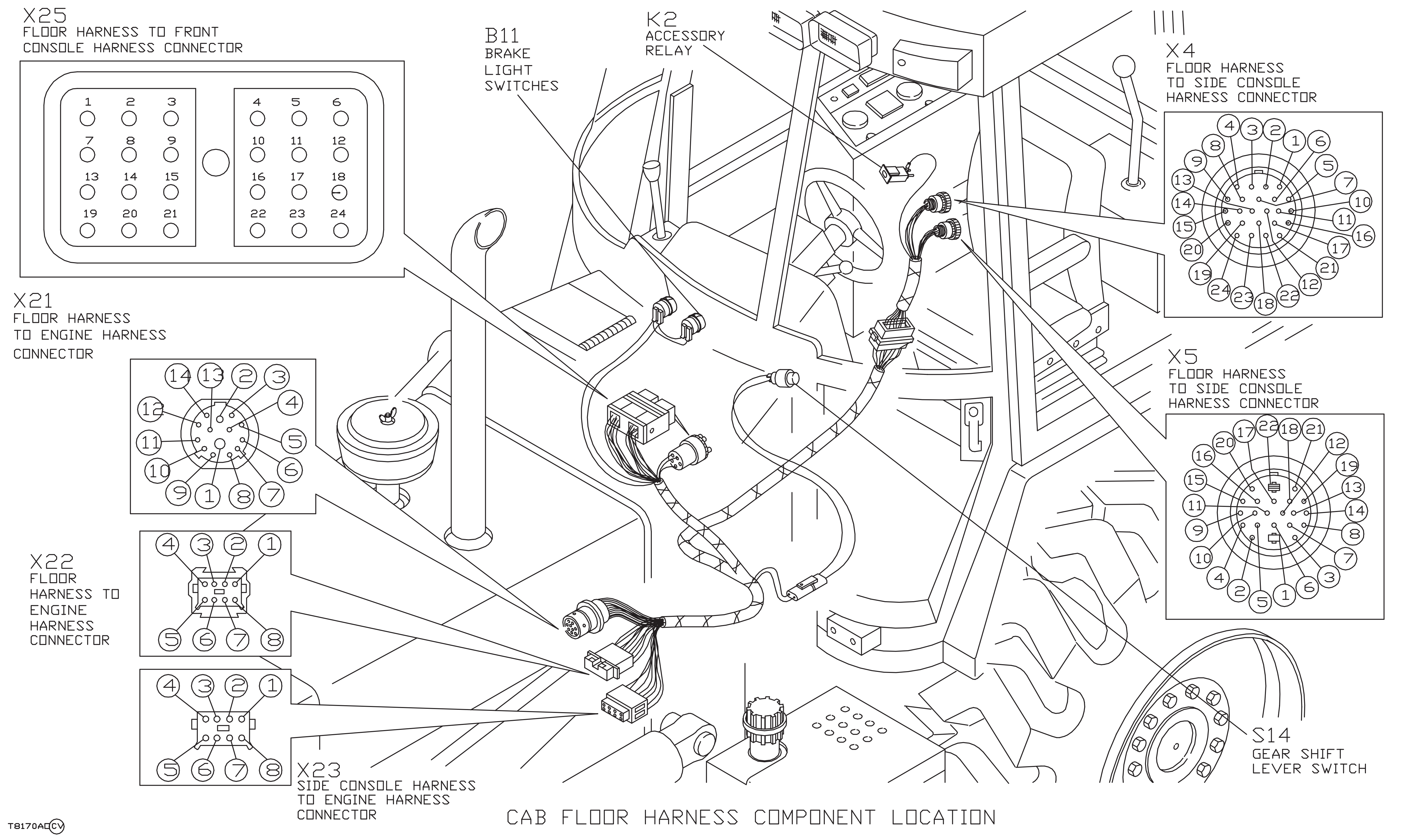
[illegible] TO
HARNESS CONNECTOR

X21	M39 PUR	1
X21	F39 YEL	2
X23	M40 PUR	3
X21	X36 YEL	4
X21	N34 YEL	5
X21	M32 PUR	6
X23	Y33 YEL	7
X23	E23 WHT	8
X23	P12 RED	9
X22	T54 BLU	10
X21	E25 WHT	11
X22	A67 ORG	12
X25, X21	G40 BLK	13
S14	T53 BLU	14
		15
		16
X23	E27 WHT	17
X23	P20 RED	18
X22	W55 BLU	19
		20
X21	X38 YEL	21
X22	M31 PUR	22
X23	P13 RED	23
X22	A17 ORG	24

TX,9015,QQ2668 –19–31AUG95–1/1

Cab Floor Harness (W6) Component Location (S.N. —778668)

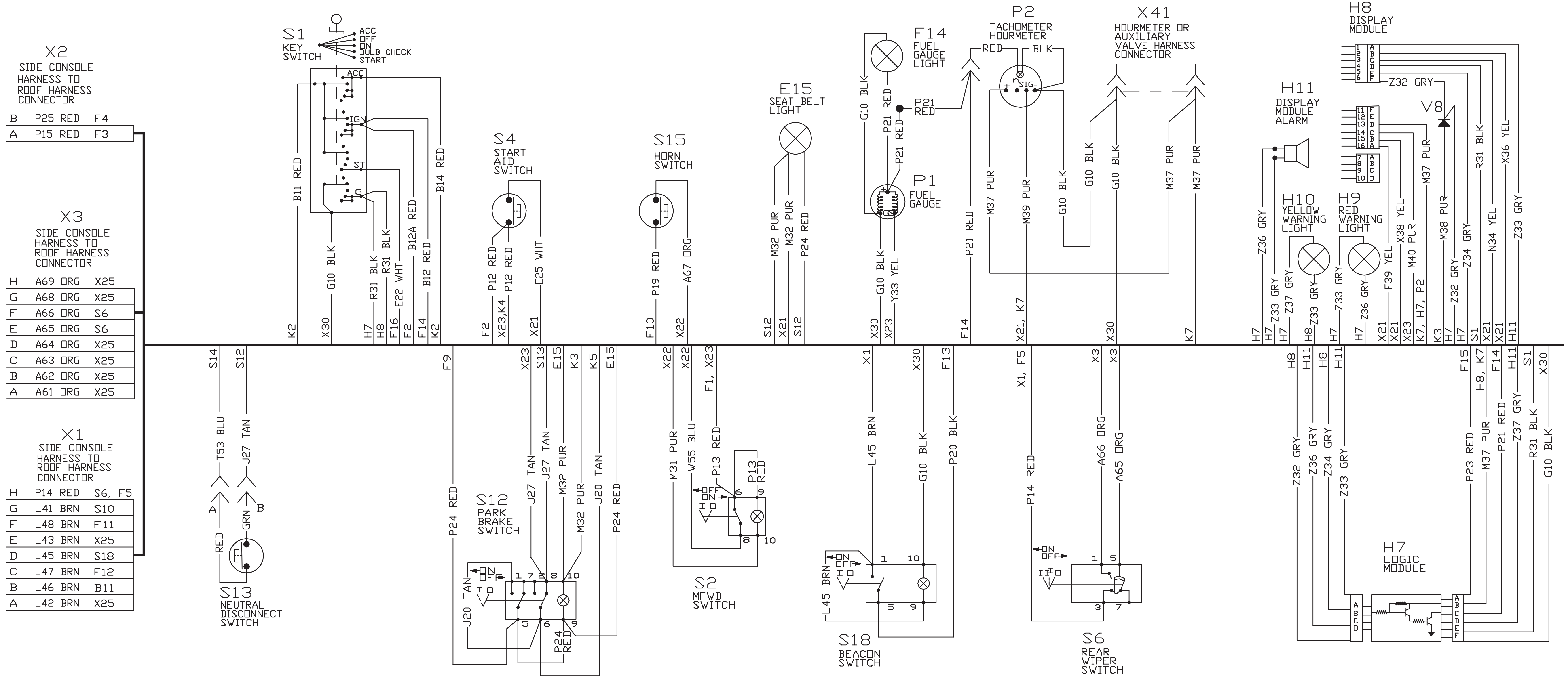
T8170AO –19–18DEC98



TX,9015,QQ2669 –19–31AUG95–1/1

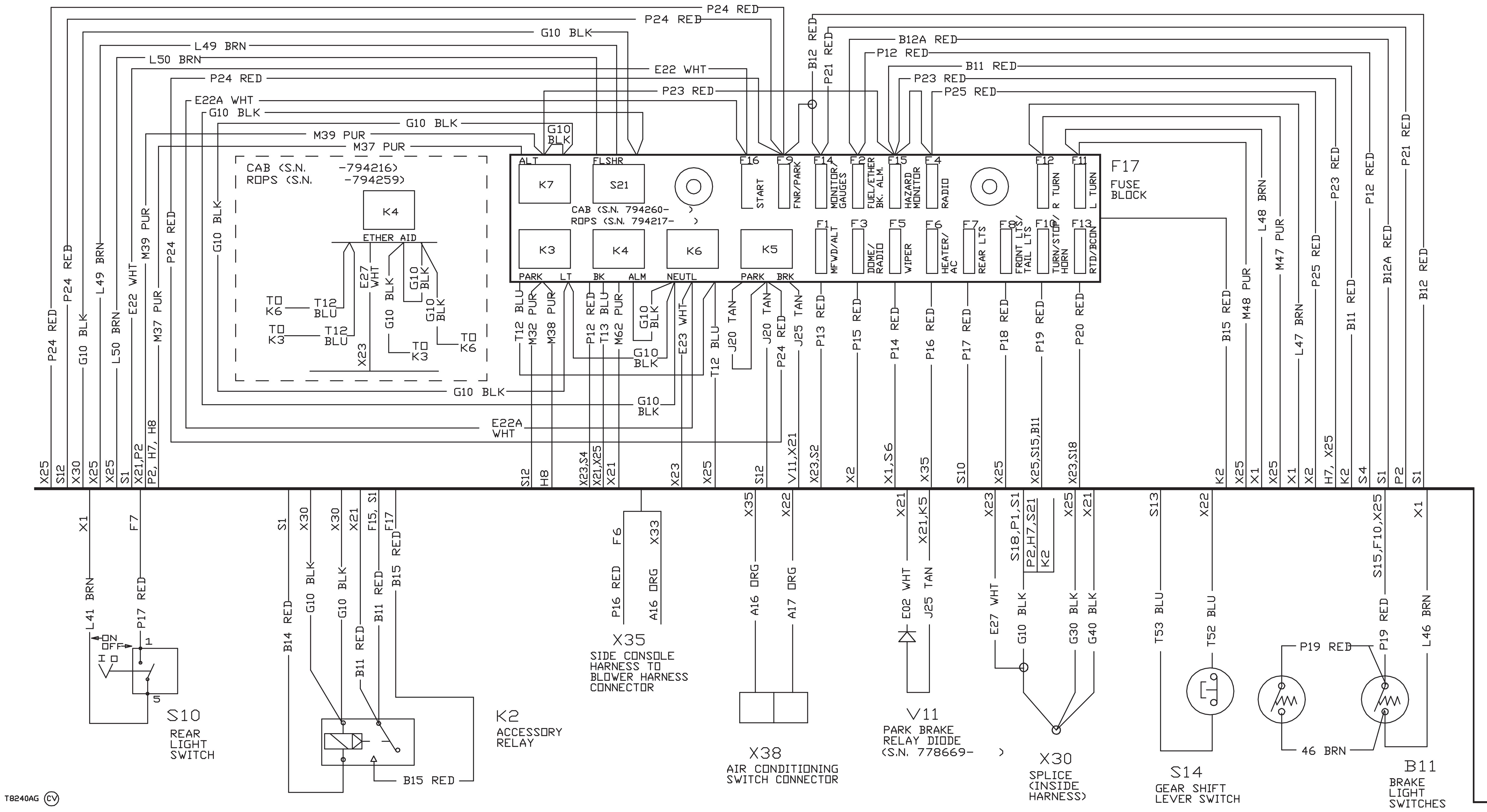
Cab Side Console Harness (W6) Wiring Diagram (S.N. 778669—XXXXXX)

T8240AF –19–18DEC98



T8240AF

T8240AG –19–18DEC98



X23

SIDE CONSOLE HARNESS TO ENGINE HARNESS CONNECTOR

S4	P12 RED	1
K6	E23 WHT	2
P1	Y33 YEL	3
S2,F1	P13 RED	4
X30 CAB (S.N. 794217-) ROPS (S.N. 794260-)	E27 WHT	5
K4 CAB (S.N. -794216) ROPS (S.N. -794259)	E27 WHT	5
F13	P20 RED	6
S12	J27 TAN	7
H8	M40 PUR	8

X22

SIDE CONSOLE HARNESS TO ENGINE HARNESS CONNECTOR

S2	M31 PUR	1
S2	W55 BLU	2
X38	A17 ORG	3
X25	A71 ORG	4
		5
		6
S15	A67 ORG	7
S14	T52 BLU	8

X21

SIDE CONSOLE HARNESS TO ENGINE HARNESS CONNECTOR

K2	B11 RED	1
X30	G40 BLK	2
X25	T11 BLU	3
V11	E02 WHT	4
K5,V11	J25 TAN	4
X25	T13 BLU	5
H8	F39 YEL	6
S4	E25 WHT	7
H8	X38 YEL	8
P2,K7	M39 PUR	9
H8	N34 YEL	10
E15	M32 PUR	11
K4 CAB (S.N. 794217-) ROPS (S.N. 794260-)	M62 PUR	12
H8	X36 YEL	13
		14

X25

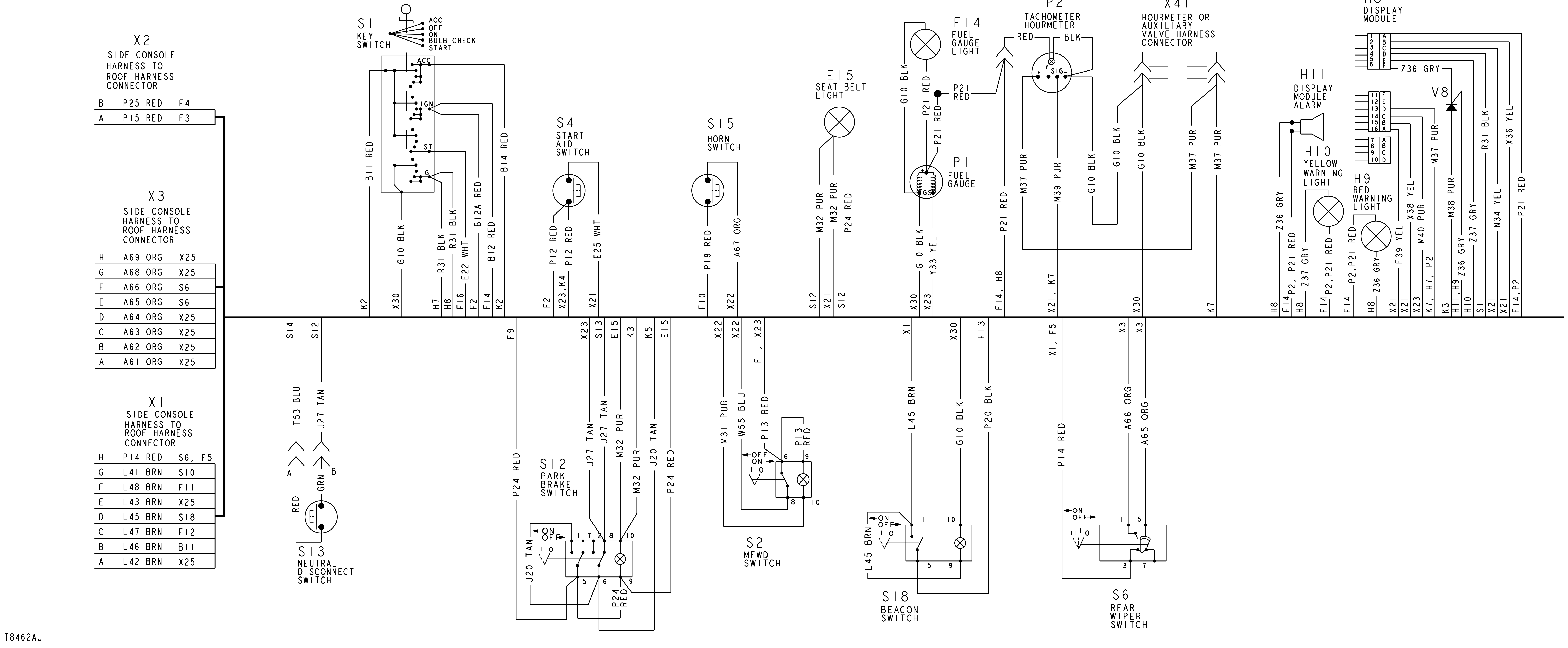
SIDE CONSOLE HARNESS TO FRONT CONSOLE HARNESS CONNECTOR

X3	A61 ORG	1
X3	A62 ORG	2
X3	A63 ORG	3
X3	A64 ORG	4
X22	A71 ORG	5
F5,S6,X1	P14 RED	6
F12	M47 PUR	7
X3	A69 ORG	8
F15,H7	P23 RED	9
B11,F10,S15	P19 RED	10
S21	L50 BRN	11
S21	L49 BRN	12
F11	M48 PUR	13
X30	G30 BLK	14
X21	T11 BLU	15
CAB (S.N. 794217-) ROPS (S.N. 794260-) X23,K4	E27 WHT	16
F9	P24 RED	17
		18
X3	A68 ORG	19
F8	P18 RED	20
X1	L43 BRN	21
F8	P18 RED	22
X1	L42 BRN	23
K6	T12 BLU	24

TX,9015,QQ3226 –19–31AUG95–2/2

Cab Side Console Harness (W6) Wiring Diagram (S.N. XXXXXX—)

T8462AJ –19–25APR97

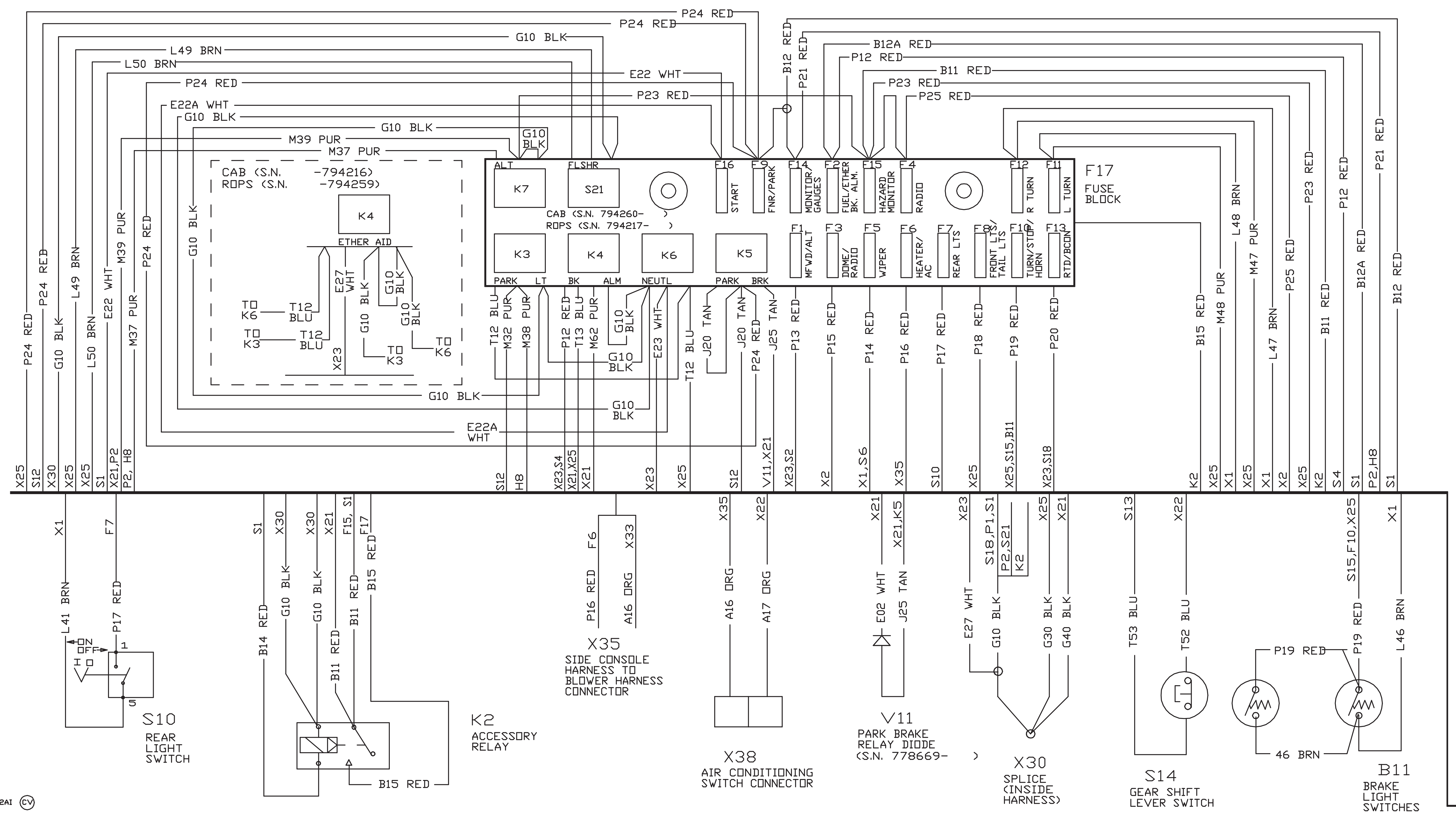


B	P25 RED	F4	
A	P15 RED	F3	

H	A69 ORG	X25	
G	A68 ORG	X25	
F	A66 ORG	S6	
E	A65 ORG	S6	
D	A64 ORG	X25	
C	A63 ORG	X25	
B	A62 ORG	X25	
A	A61 ORG	X25	

H	P14 RED	S6, F5	
G	L41 BRN	S10	
F	L48 BRN	F11	
E	L43 BRN	X25	
D	L45 BRN	S18	
C	L47 BRN	F12	
B	L46 BRN	B11	
A	L42 BRN	X25	

T8462AI –19–06JAN99



T8462AI

X23

SIDE CONSOLE HARNESS TO ENGINE HARNESS CONNECTOR

S4	P12 RED	1
K6	E23 WHT	2
P1	Y33 YEL	3
S2,F1	P13 RED	4
X30 CAB (S.N. 794217-) ROPS (S.N. 794260-)	E27 WHT	5
K4 CAB (S.N. -794216) ROPS (S.N. -794259)	E27 WHT	5
F13	P20 RED	6
S12	J27 TAN	7
H8	M40 PUR	8

X22

SIDE CONSOLE HARNESS TO ENGINE HARNESS CONNECTOR

S2	M31 PUR	1
S2	W55 BLU	2
X38	A17 ORG	3
X25	A71 ORG	4
		5
		6
S15	A67 ORG	7
S14	T52 BLU	8

X21

SIDE CONSOLE HARNESS TO ENGINE HARNESS CONNECTOR

K2	B11 RED	1
X30	G40 BLK	2
X25	T11 BLU	3
V11	E02 WHT	4
K5,V11	J25 TAN	4
X25	T13 BLU	5
H8	F39 YEL	6
S4	E25 WHT	7
H8	X38 YEL	8
P2,K7	M39 PUR	9
H8	N34 YEL	10
E15	M32 PUR	11
K4 CAB (S.N. 794217-) ROPS (S.N. 794260-)	M62 PUR	12
H8	X36 YEL	13
		14

X25

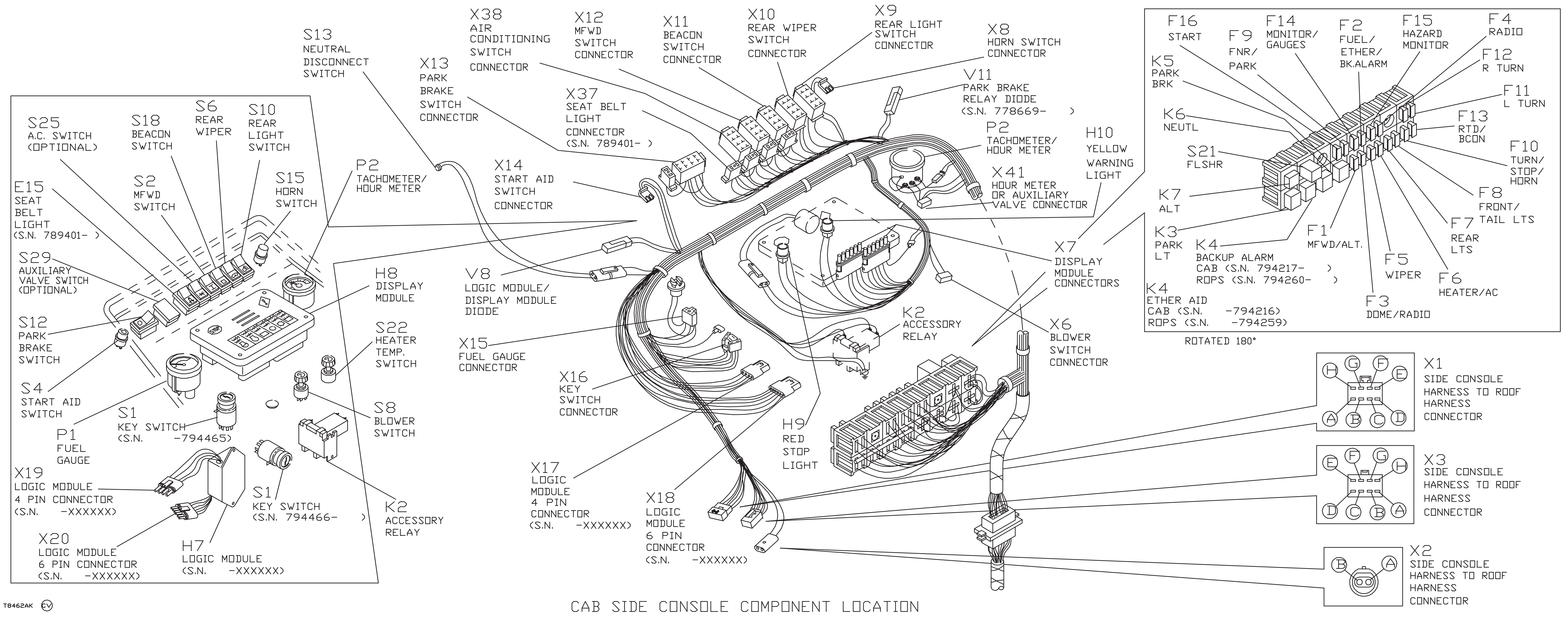
SIDE CONSOLE HARNESS TO FRONT CONSOLE HARNESS CONNECTOR

X3	A61 ORG	1
X3	A62 ORG	2
X3	A63 ORG	3
X3	A64 ORG	4
X22	A71 ORG	5
F5,S6,X1	P14 RED	6
F12	M47 PUR	7
X3	A69 ORG	8
F15	P23 RED	9
B11,F10,S15	P19 RED	10
S21	L50 BRN	11
S21	L49 BRN	12
F11	M48 PUR	13
X30	G30 BLK	14
X21	T11 BLU	15
CAB (S.N. 794217-) ROPS (S.N. 794260-) X23,K4	E27 WHT	16
F9	P24 RED	17
		18
X3	A68 ORG	19
F8	P18 RED	20
X1	L43 BRN	21
F8	P18 RED	22
X1	L42 BRN	23
K6	T12 BLU	24

TX,9015,QQ3228 –19–31AUG95–2/2

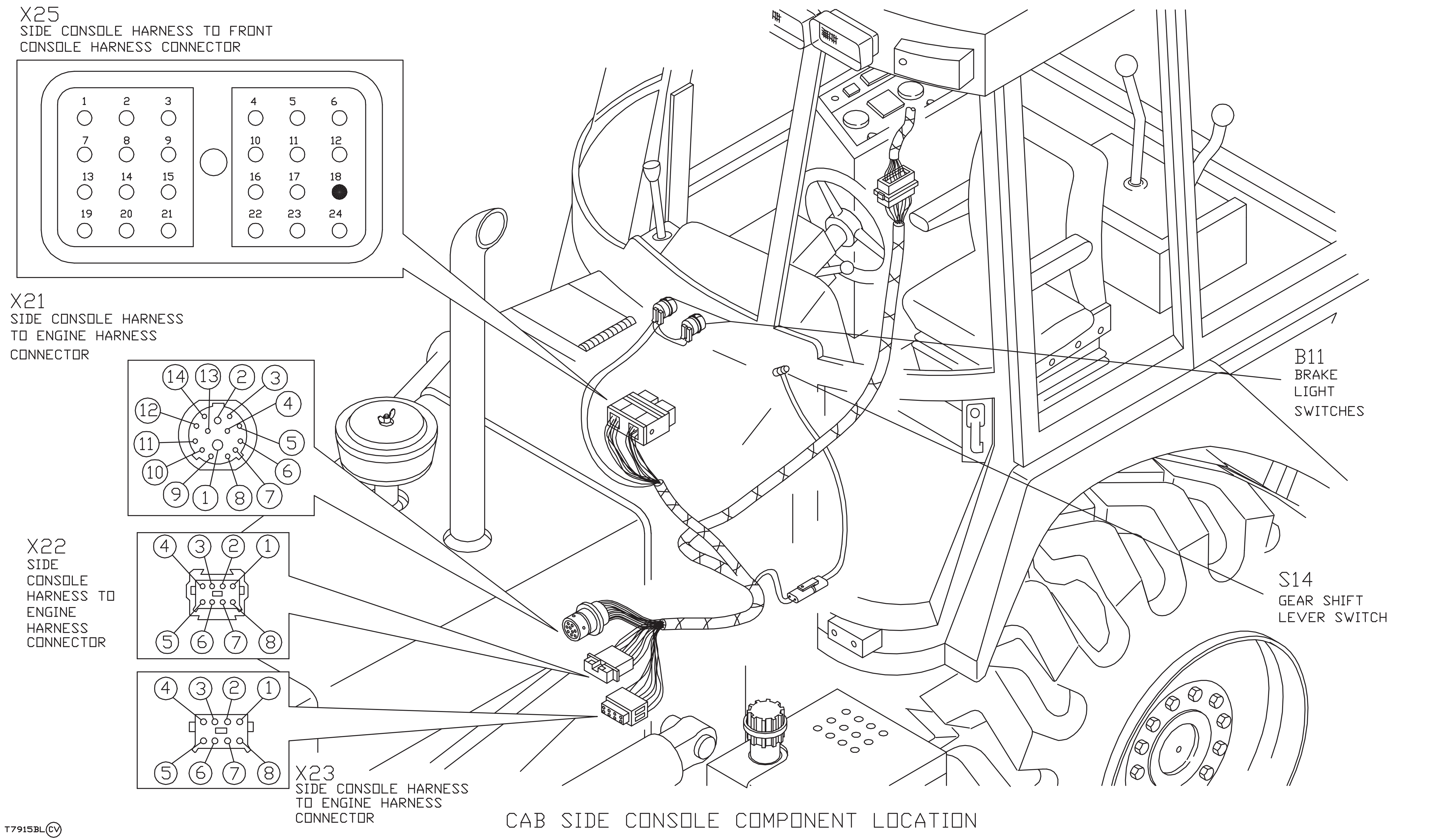
Cab Side Console Harness (W6) Component Location (S.N. 778669—)

T8462AK –19–06JAN99



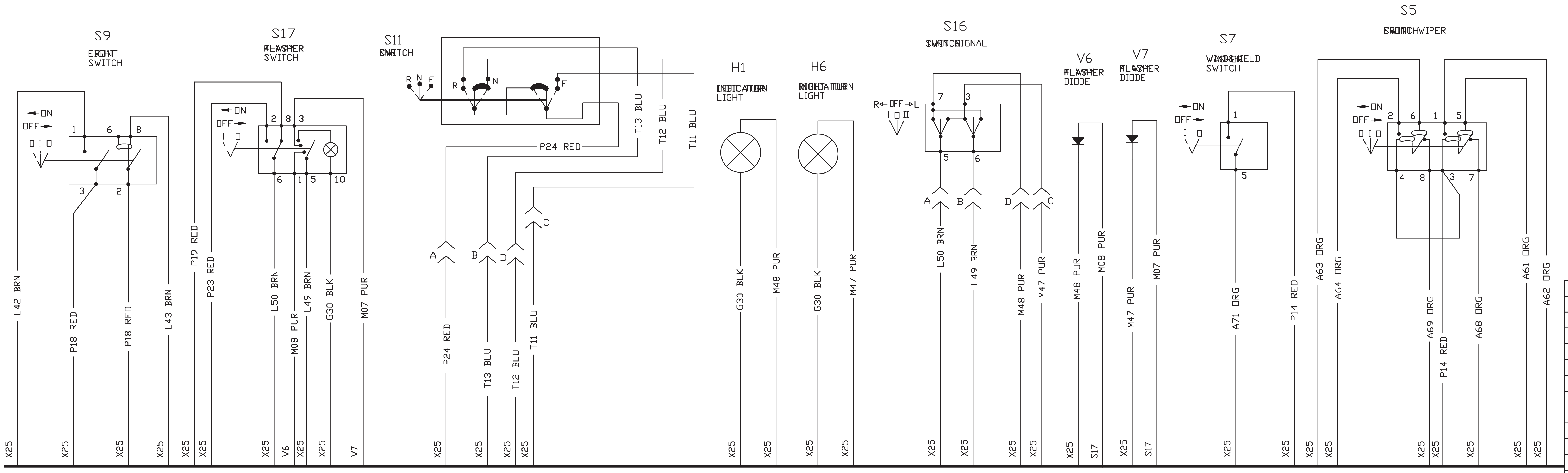
TX,9015,QQ3230 –19–31AUG95–1/2

T7915BL –19–19FEB99



Front Console Harness (W7) Wiring Diagram

T7915BM –19–05MAR99



X25

HARNESS CONNECTOR
(S.N. –778668)

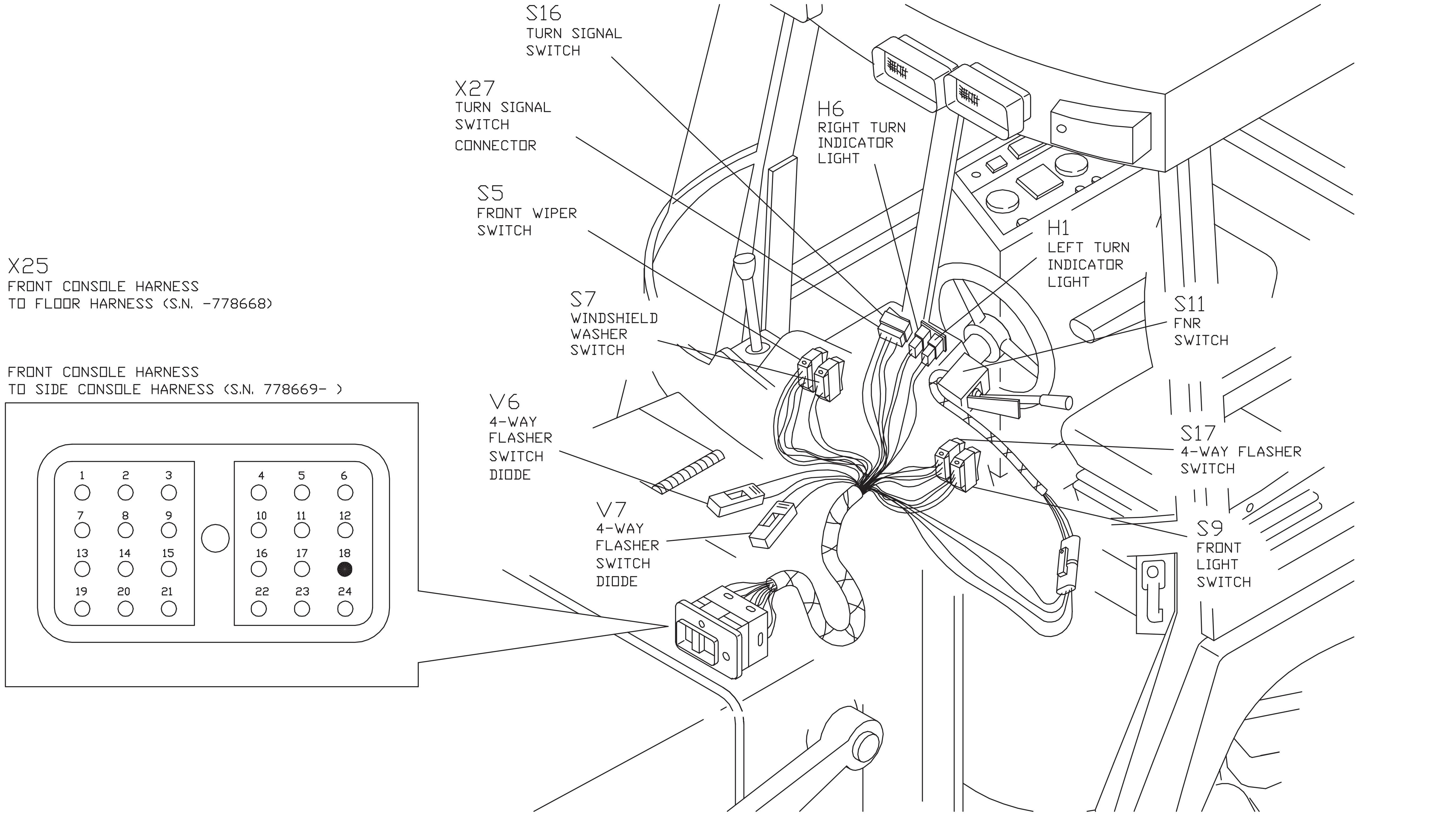
SIDE CONSOLE
HARNESS CONNECTOR
(S.N. 778669–)

S5	A61 ORG	1
S5	A62 ORG	2
S5	A63 ORG	3
S5	A64 ORG	4
S7	A71 ORG	5
S7, S5	P14 RED	6
V7, S16	M47 PUR	7
S5	A69 ORG	8
S17	P23 RED	9
S17	P19 RED	10
S17	L50 BRN	11
S17	L49 BRN	12
V6, S16	M48 PUR	13
H6	G30 BLK	14
H1, S17		
S11	T11 BLU	15
S11	T13 BLU	16
S11	P24 RED	17
		18
S5	A68 ORG	19
S9	P18 RED	20
S9	L43 BRN	21
S9	P18 RED	22
S9	L42 BRN	23
S11	T12 BLU	24

TX,9015,QQ2674 –19–31AUG95–1/1

Front Console Harness (W7) Component Location

T7915BN –19–19FEB99



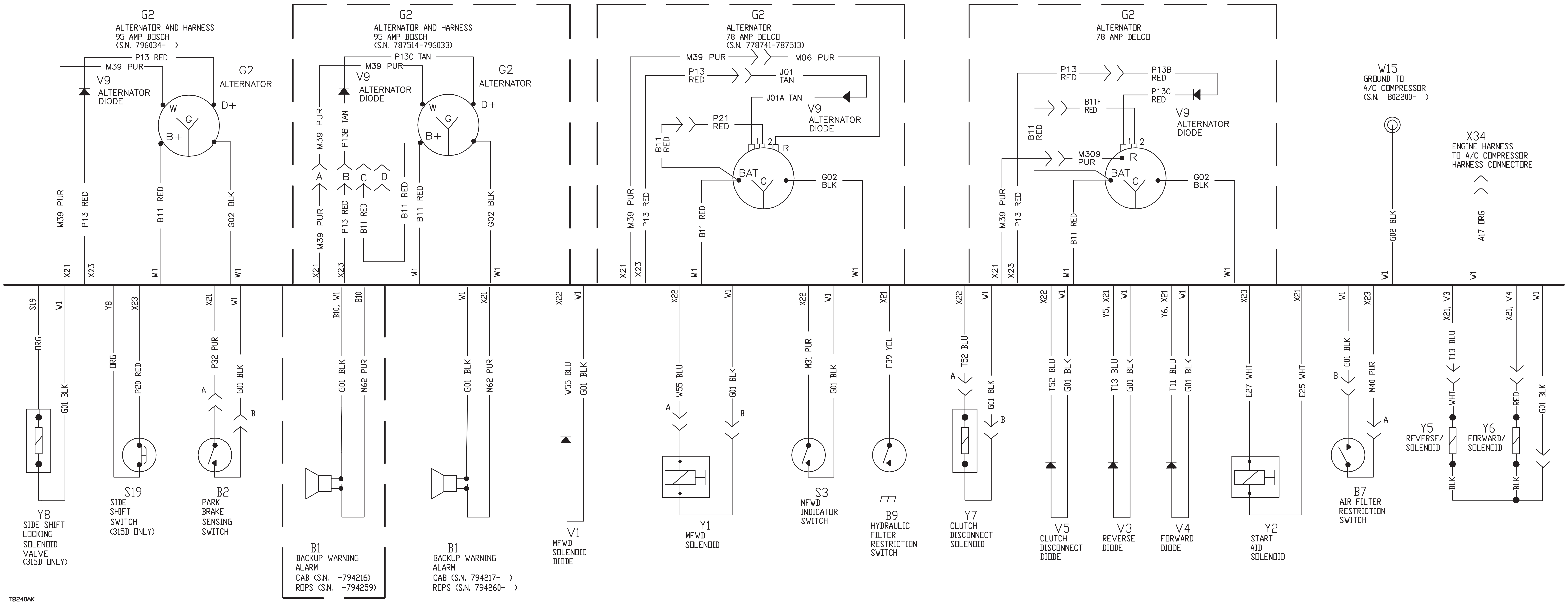
FRONT CONSOLE COMPONENT LOCATION

T7915BN

TX,9015,QQ2675 –19–31AUG95–1/1

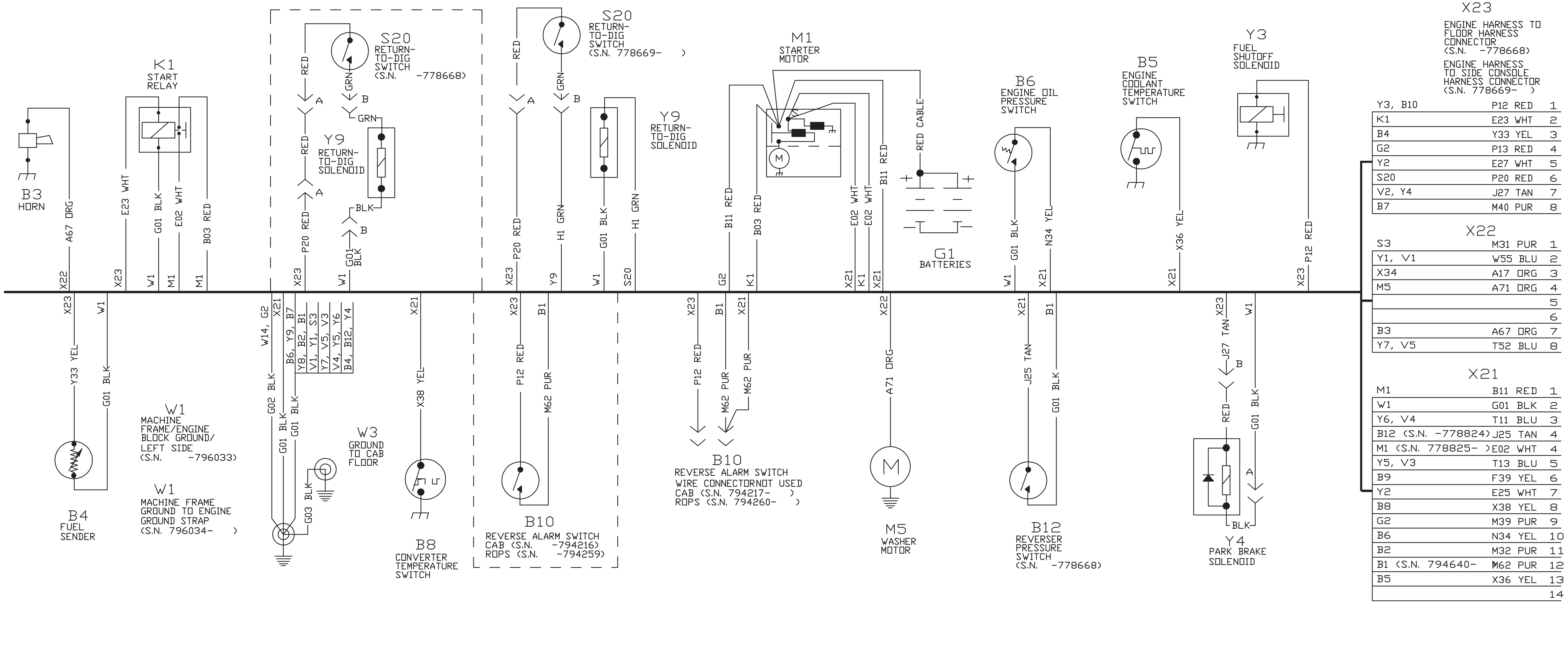
Engine Harness (W8) Wiring Diagram

T8240AK –19–19FEB99



T8240AK

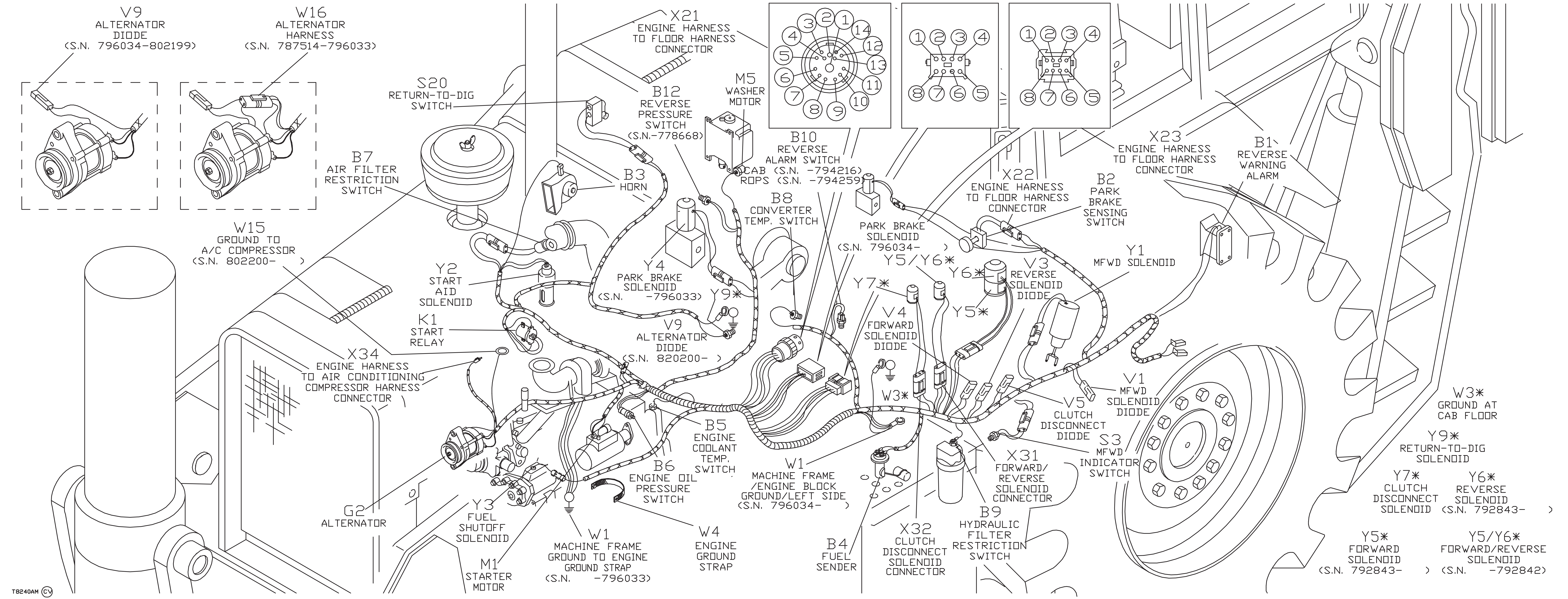
T8240AL –19–18DEC98



T8240AL

Engine Harness (W8) Component Location

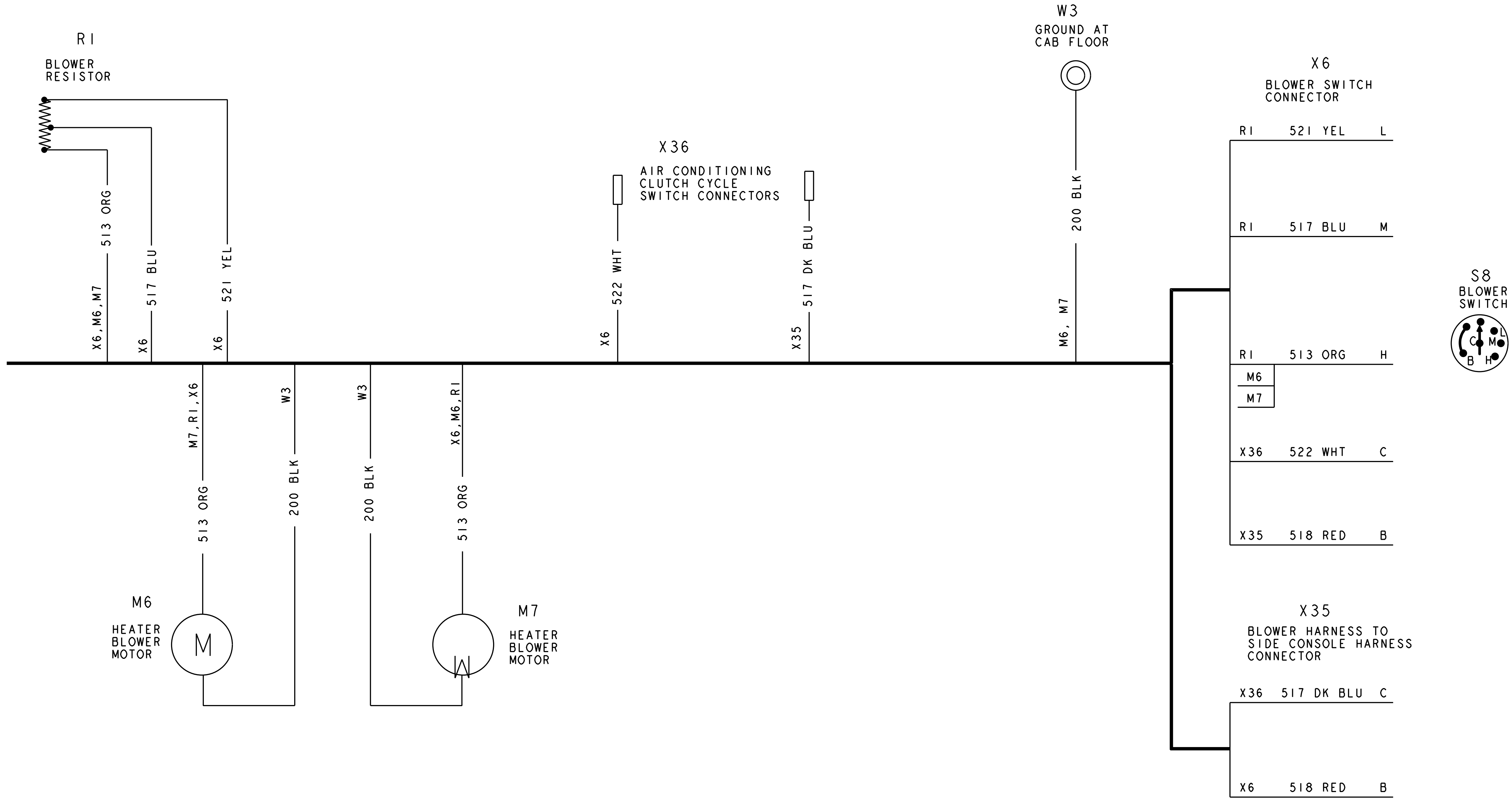
T8240AM –19–06JAN99



TX,9015,QQ2678 –19–31AUG95–1/1

Blower Harness (W10) Wiring Diagram

T7812AT –19–25APR97

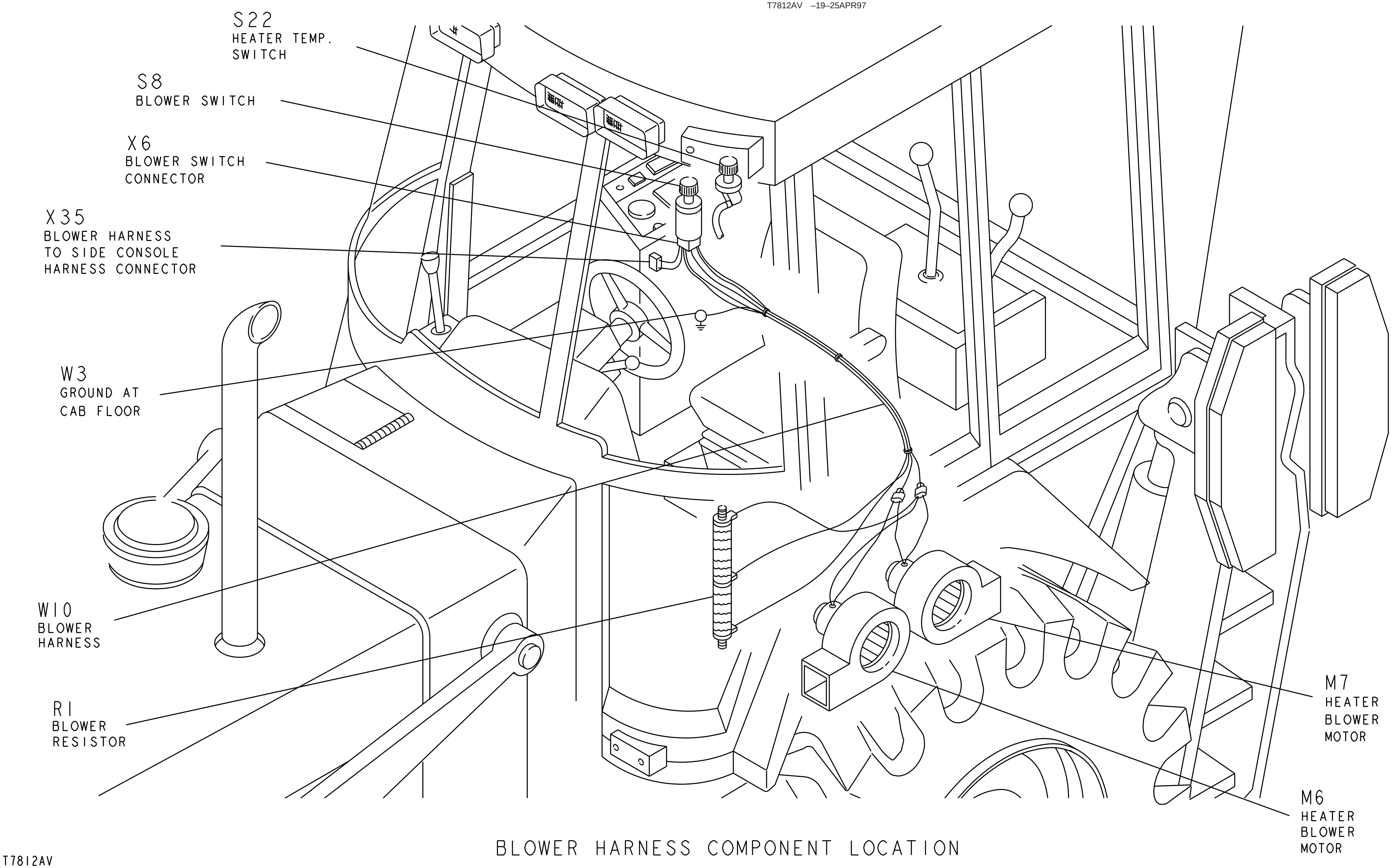


T7812AT

TX,9015,QQ2115 –19–31AUG95–1/1

Blower Harness (W10) Component Location

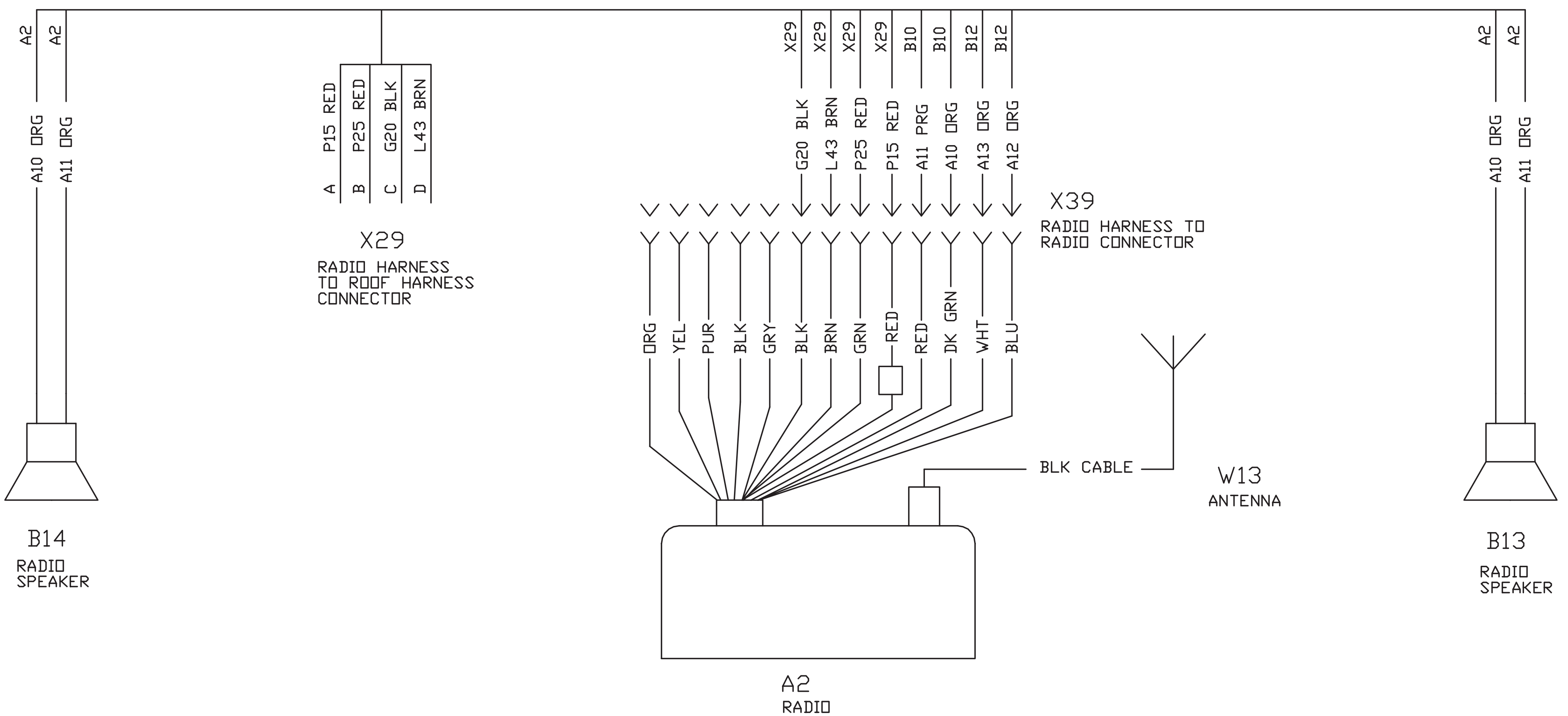
T7812AV –19–25APR97



TX,9015,QQ2116 –19–04MAY93–1/1

Radio Harness (W12) Wiring Diagram

T7931BO –19–19FEB99

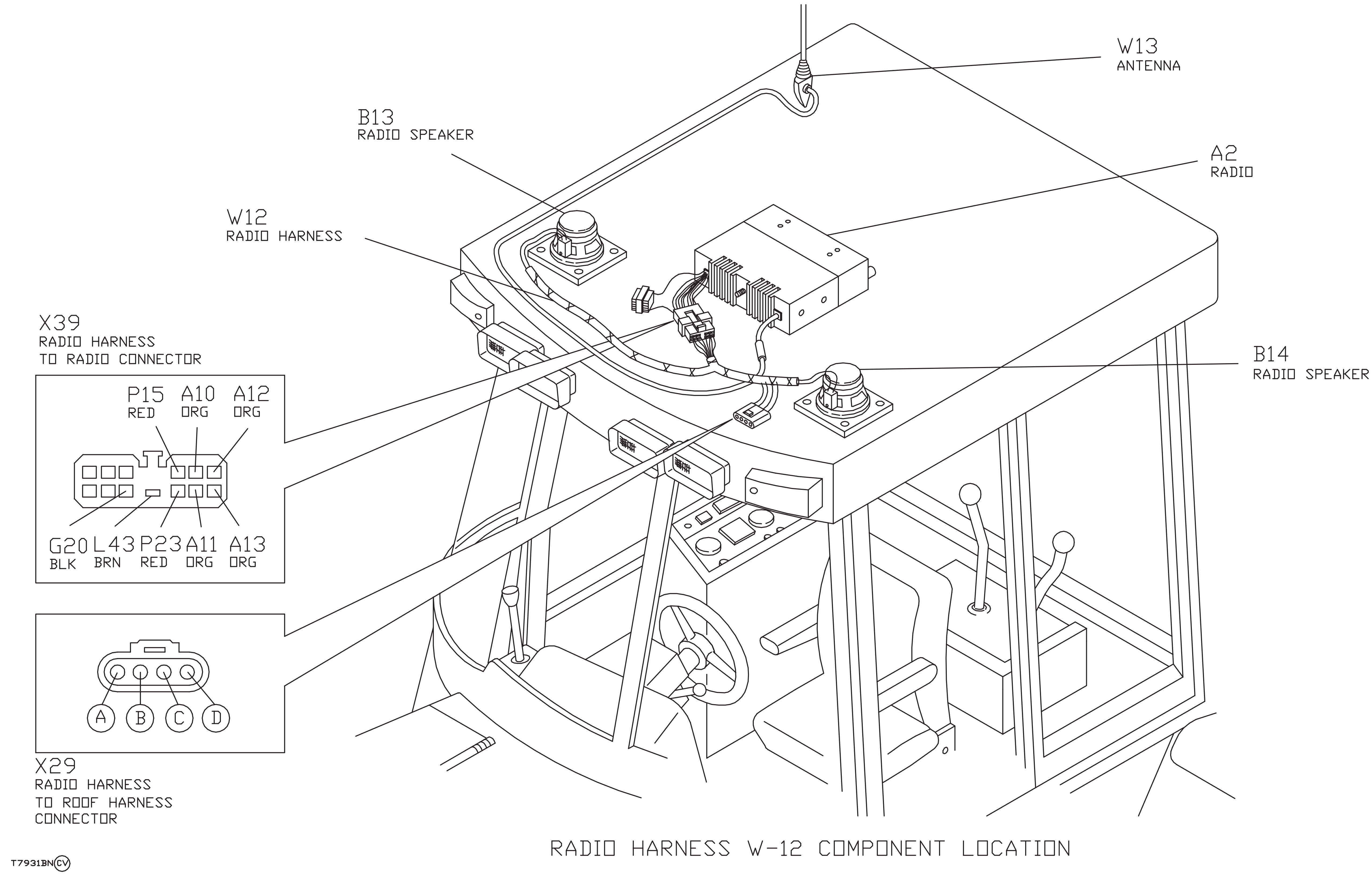


T7931BO

TX,9015,QQ2117 –19–04MAY93–1/1

Radio Harness (W12) Component Location

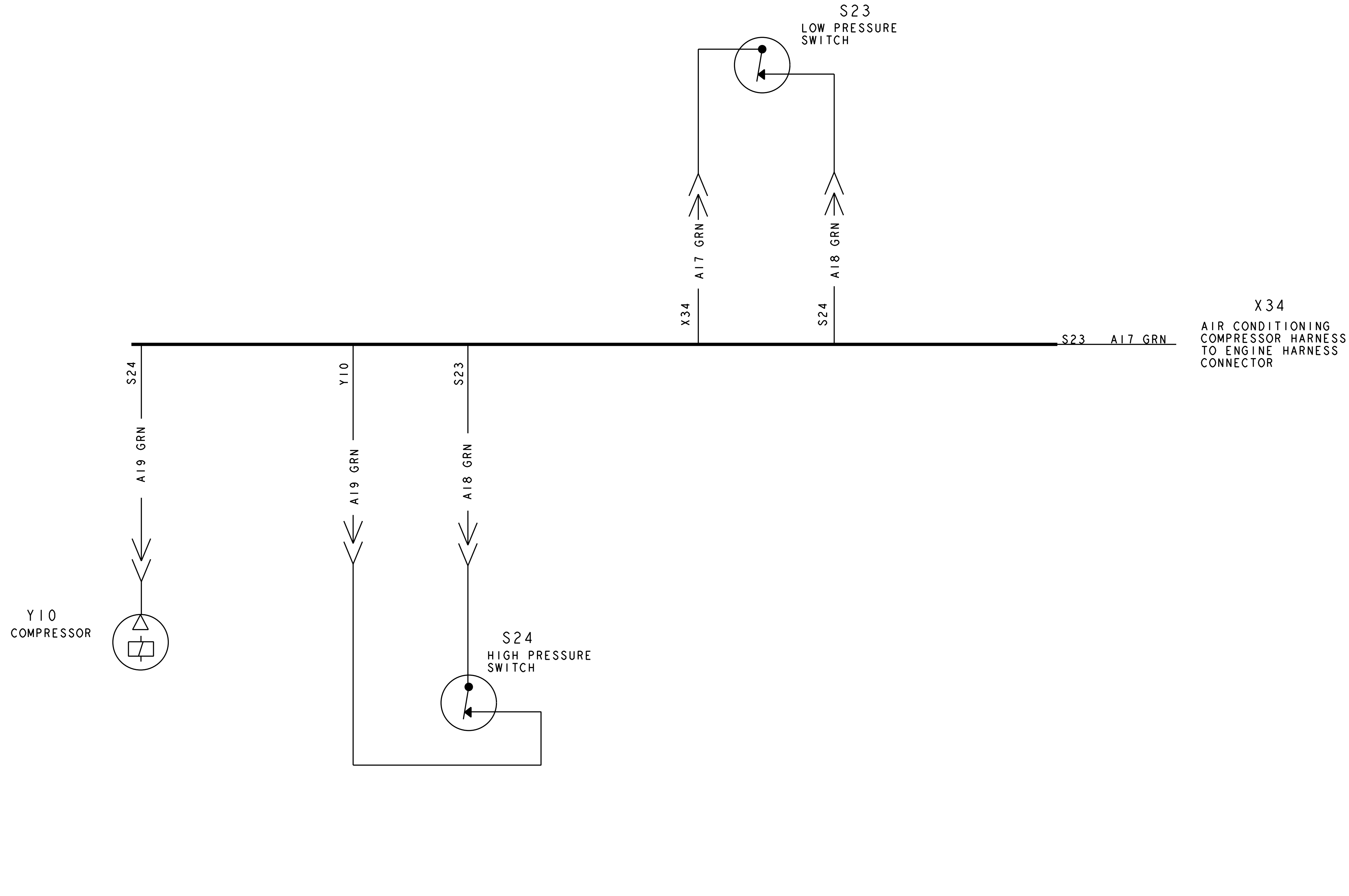
T7931BN –19–19FEB99



TX,9015,QQ2118 –19–04MAY93–1/1

Air Conditioning Compressor Harness (W11) Wiring Diagram

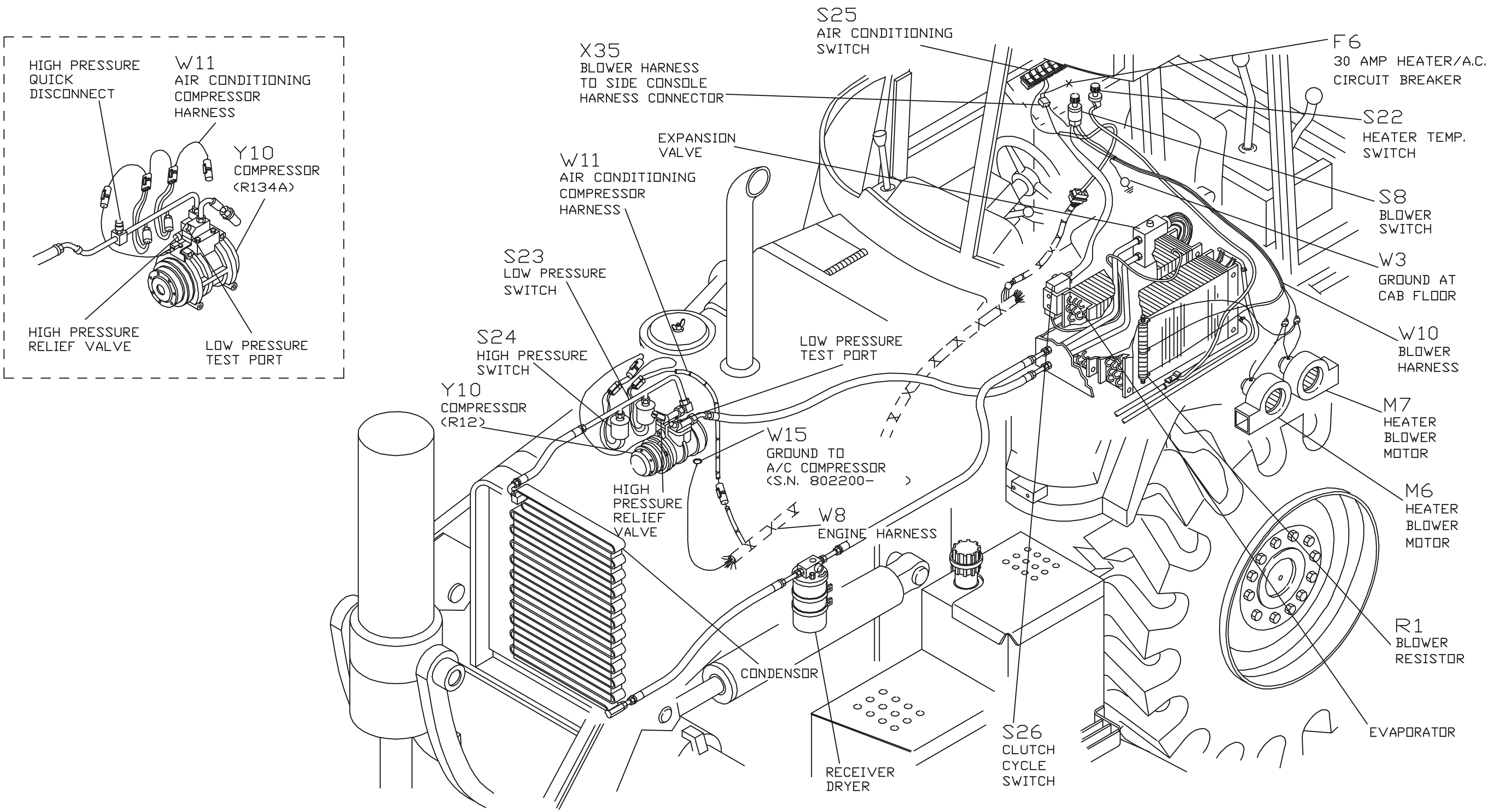
T7812AU –19–25APR97



TX,9015,QQ2119 –19–12APR94–1/1

Air Conditioning Compressor Harness (W11) Component Location

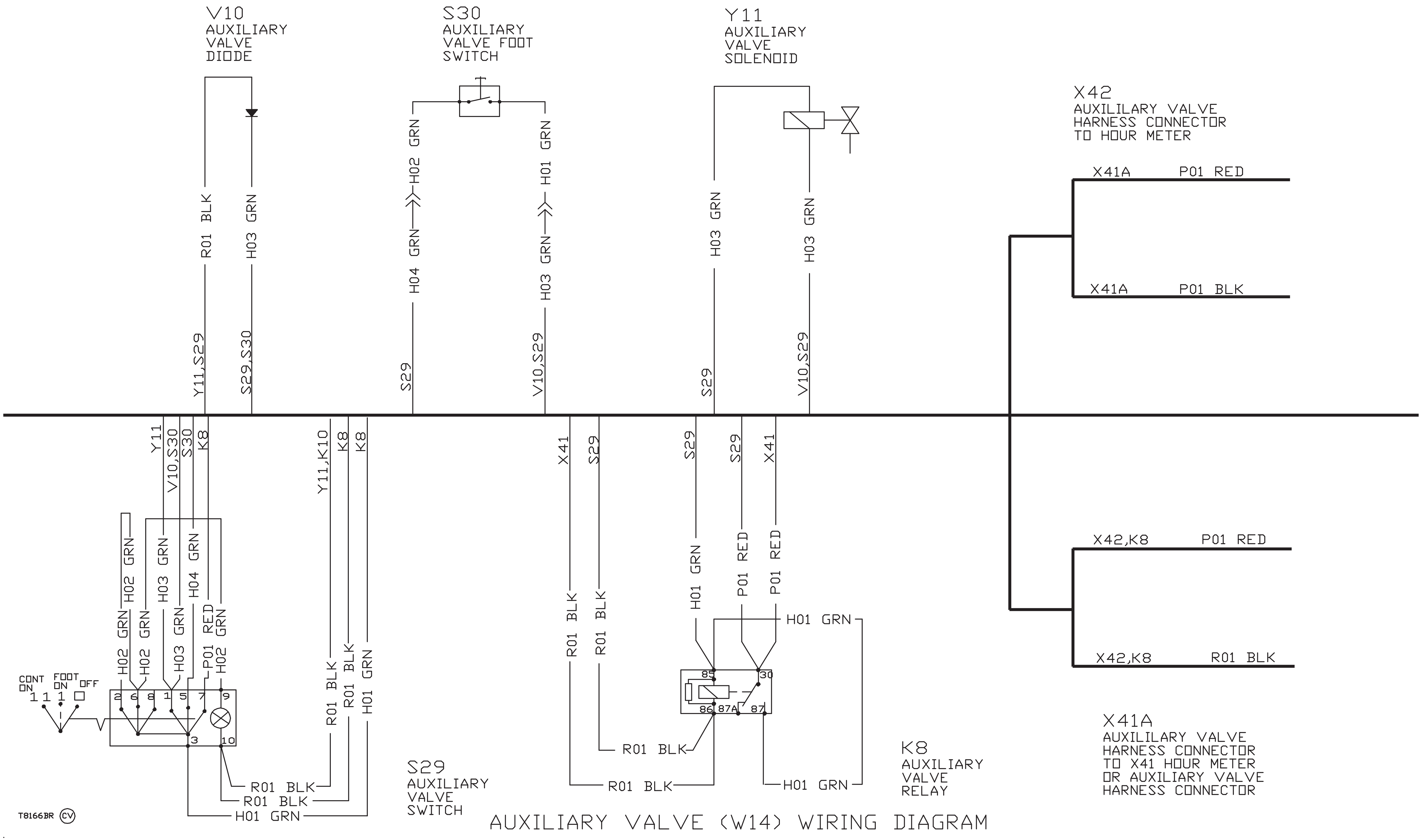
T8240AN –19–06JAN99



T8240AN

Auxiliary Valve Harness (W14) Wiring Diagram

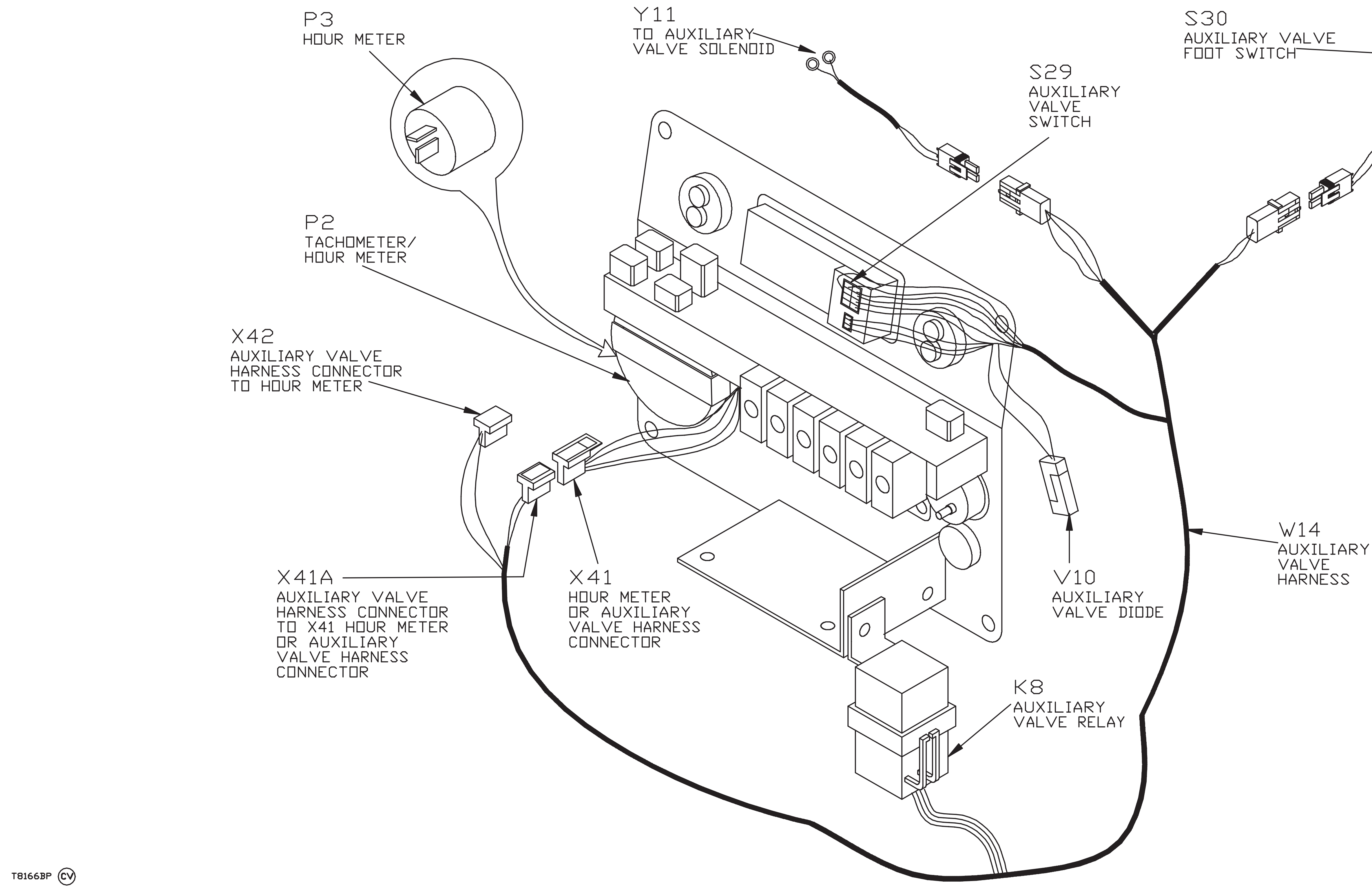
T8166BR –19–18DEC98



TX,9015,QQ2449 –19–12APR94–1/1

Auxiliary Valve Harness (W14) Component Location

T8166BP –19–18DEC98



TX,9015,QQ2451 –19–12APR94–1/1

Power Circuit Operational Information

The following conditions must exist for power circuit to function:

Voltage must be present at these distribution points for other circuits to operate.

- BAT terminal of key switch
- Terminal 30 of accessory relay
- Start relay
- BAT terminal of alternator (S.N. —787513)
- B+ terminal of alternator (S.N.787514—)
- Starter
- Radio fuse
- Hazard/monitor fuse

TX,9015,QQ2150 –19–02JUN93–1/1

Power Circuit Theory Of Operation

The power circuit includes battery and main current paths to primary distribution points.

With key switch OFF, power from battery goes to key switch, accessory relay, start relay, alternator, starter motor, 4-way flasher switch, logic module, alternator sense relay and dome light fuse.

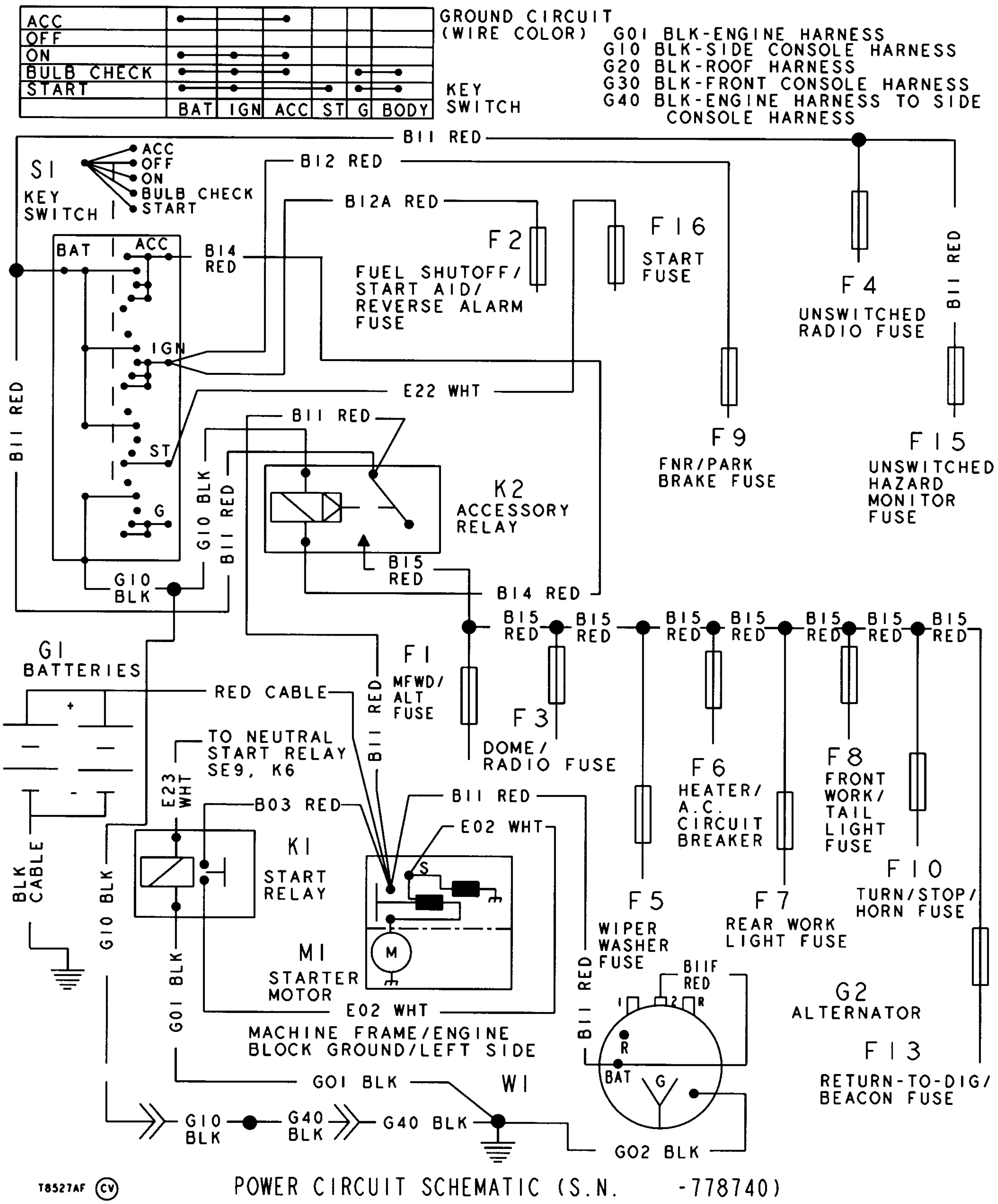
When key switch is moved from OFF position, power continues through IGN and ST terminals to main fuse block. ACC terminal power goes to accessory relay, energizing relay sending power to the main fuse block.

The key switch G terminal is a ground terminal only in "Bulb Check" and "Start" positions.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ2151 –19–02JUN93–1/1

Power Circuit Schematic



T8527AF –19–10AUG95

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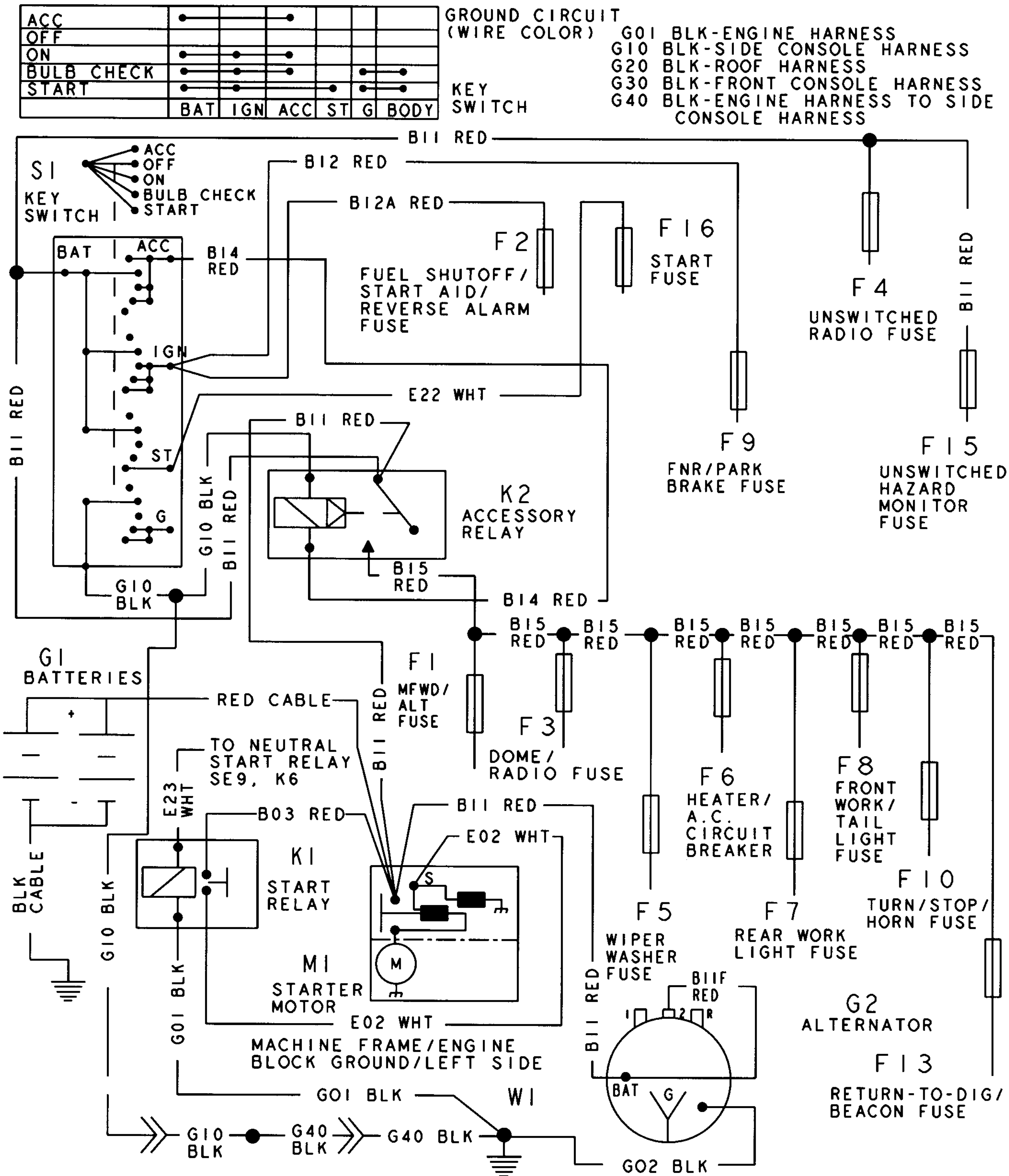
TX,9015,QQ3171 –19–31AUG95–1/3



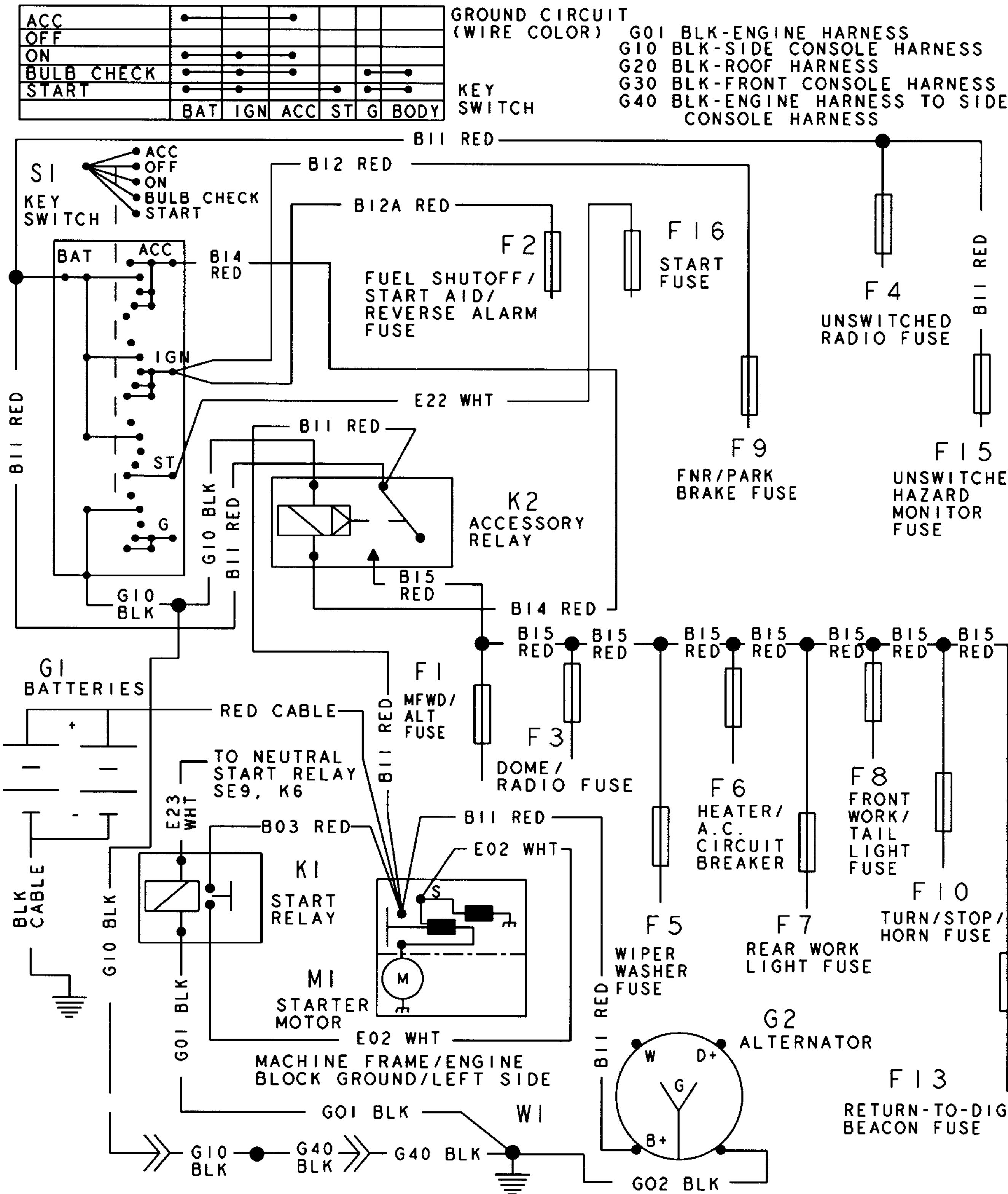
T8527AG (CV) POWER CIRCUIT SCHEMATIC (S.N. 778741-787513)

T8527AG –19–10AUG95

9015
15
3

Continued on next page

TX,9015,QQ3171 –19–31AUG95–2/3



POWER CIRCUIT SCHEMATIC
(S.N. 787514-)

T8527AE –19–10AUG95

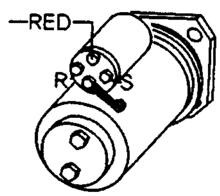
TX,9015,QQ3171 –19–31AUG95–3/3

Power Circuit Diagnostic Procedures

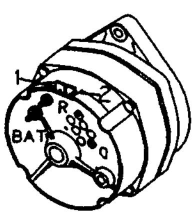
– – –1/1

Battery State Of Charge	**CAUTION: Engine may crank during this check.** Move light switch to ON position. Turn key to START. Do work lights go out or get very dim while cranking engine?	**YES:** Clean battery cable terminals. Repeat test. If lights still get dim, test battery. If battery charge is low, recharge or replace it. **NO:** Battery charge is good. Go to next check.

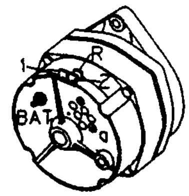
– – –1/1

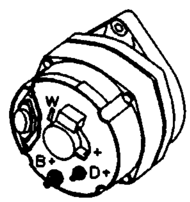
Starter Motor	 T7199BK –19–17SEP90 Key switch OFF. With harness connected, check voltage at terminal of starter with red cable. Are 12 volts measured?	**YES:** Check complete. **NO:** Check wiring harness between battery and starter motor.

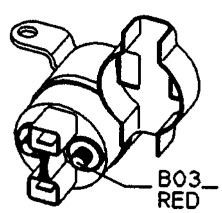
– – –1/1

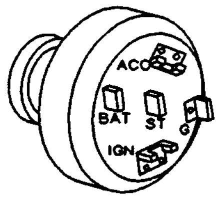
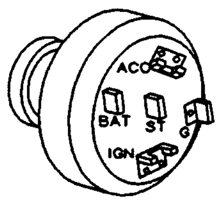
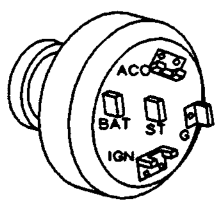
Alternator (S.N. — 778740)	 T7199BL –19–09OCT90 Key switch OFF. With harness connected, check voltage at B+ terminal of alternator. Are 12 volts measured?	**YES:** Go to next check. **NO:** Check wiring harness between battery and alternator.

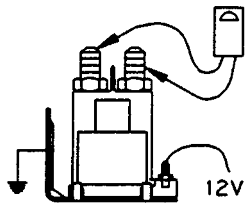
– – –1/1

Alternator (S.N.778741—787513)	 T7934AV –19–15FEB93	Key switch OFF. With harness connected, check voltage at B+ terminal of alternator. Are 12 volts measured?	**YES:** Go to next check. **NO:** Check wiring harness between battery and alternator. – – –1/1

Alternator (S.N.787514—)	 T7828AA –19–23SEP92	Key switch OFF. With harness connected, check voltage at B+ terminal of alternator. Are 12 volts measured?	**YES:** Go to next check . **NO:** Check wiring harness between battery and alternator. – – –1/1

Start Relay	 T7199BM –19–17SEP90	Key switch OFF. With harness connected, check voltage at terminal with BO3 red wire. Are 12 volts measured?	**YES:** Go to next check. **NO:** Check wiring harness between battery and start relay. – – –1/1

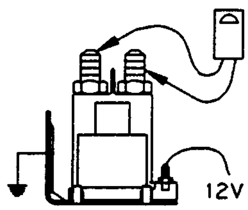
Key Switch Check	 T7199BO –UN–17SEP90	Key switch OFF. With harness connected, check voltage of B11 red wire at BAT terminal of key switch. Are 12 volts measured?	**YES:** Go to next step in this check. **NO:** Check wiring harness between battery and key switch.
	 T7199BO –UN–17SEP90	Remove fuel shut off/start aid/reverse alarm fuse. Remove FNR/park brake fuse. Remove start fuse. Turn key switch to START position. With harness connected, check voltage at IGN and ST terminals. Are 12 volts measured at each terminal?	**YES:** Go to next step in this check. **NO:** Replace key switch
	 T7199BO –UN–17SEP90	Key switch ON. With harness connected, check voltage at ACC terminal of key switch. Are 12 volts measured?	**YES:** Go to next check. **NO:** Replace key switch. – – –1/1

<table>
<tr>
<td rowspan="3">Accessory Relay</td>
<td>

T7199BN –UN–16AUG90</td>
<td>Key switch OFF.

With harness connected, check voltage at large terminal with B11 red wire.

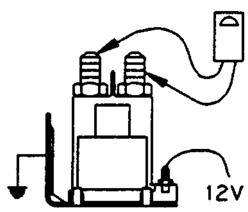
Are 12 volts measured?</td>
<td>YES: Go to next step in this check.

NO: Check wiring harness between battery and accessory relay.</td>
</tr>
<tr>
<td>

T7199BN –UN–16AUG90</td>
<td>Key switch ON.

With harness connected, check voltage at small terminal with B14 red wire.

Are 12 volts measured?</td>
<td>YES: Go to next step in this check.

NO: Check wiring harness between battery and accessory relay.</td>
</tr>
<tr>
<td>

T7199BN –UN–16AUG90</td>
<td>Disconnect harness from relay.

Connect battery voltage to small terminal. Ground mounting bracket.

Does relay click?

Measure continuity between the two large terminals.

Is continuity measured?</td>
<td>YES: Relay is good.

NO: Replace accessory relay.

– – –1/1</td>
</tr>
</table>

Start Circuit Operational Information

The following conditions must exist for start circuit to function:

- FNR lever in neutral
- Key switch in START position

TX,9015,QQ1942 –19–16MAR93–1/1

Start Circuit Theory Of Operation

The start circuit converts the electrical energy from the battery to mechanical energy by the starter. A heavy current draw takes place in the starter.

With key switch OFF, power flows from battery to starter motor terminal, start relay spade terminal, accessory relay, and key switch BAT terminal.

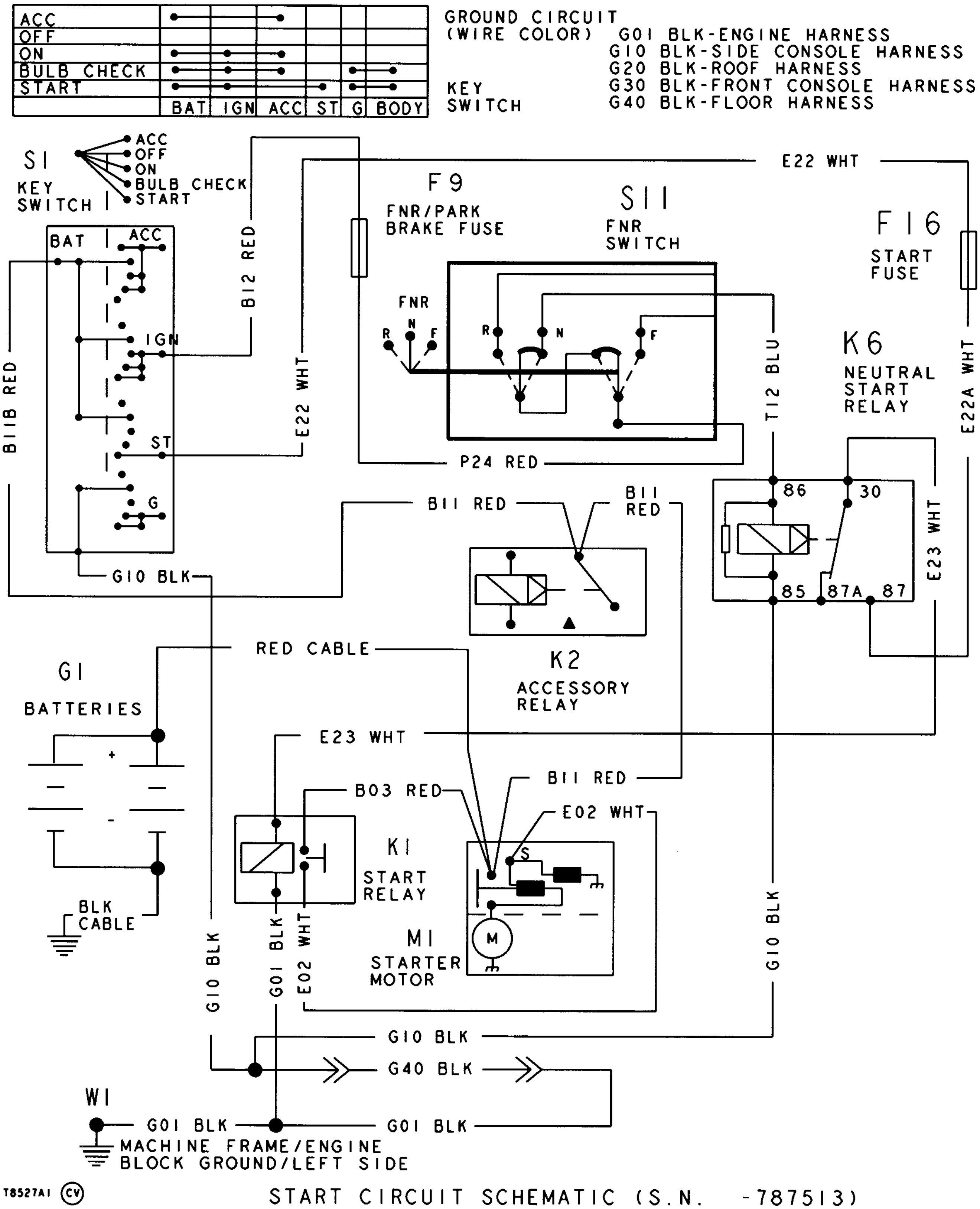
With key in ON or IGN, power flows from IGN terminal through FNR/park brake fuse, to FNR switch. With the FNR in neutral power flows to the neutral start relay terminal 86, energizing relay.

With key switch in START, power flows from ST terminal through start fuse, neutral start relay, to the start relay closing the relay. With relay closed, power flows from starter motor through BO3 red wire to start relay, through E02 white wire to starting motor solenoid "S terminal", closing solenoid contacts. With solenoid contacts closed, power flows from battery to the starter windings.

NOTE: For component identification code description, see Legend For Schematic and Wiring Diagram , Group 9015-10.

TX,9015,QQ1985 –19–16MAR93–1/1

Start Circuit Schematic



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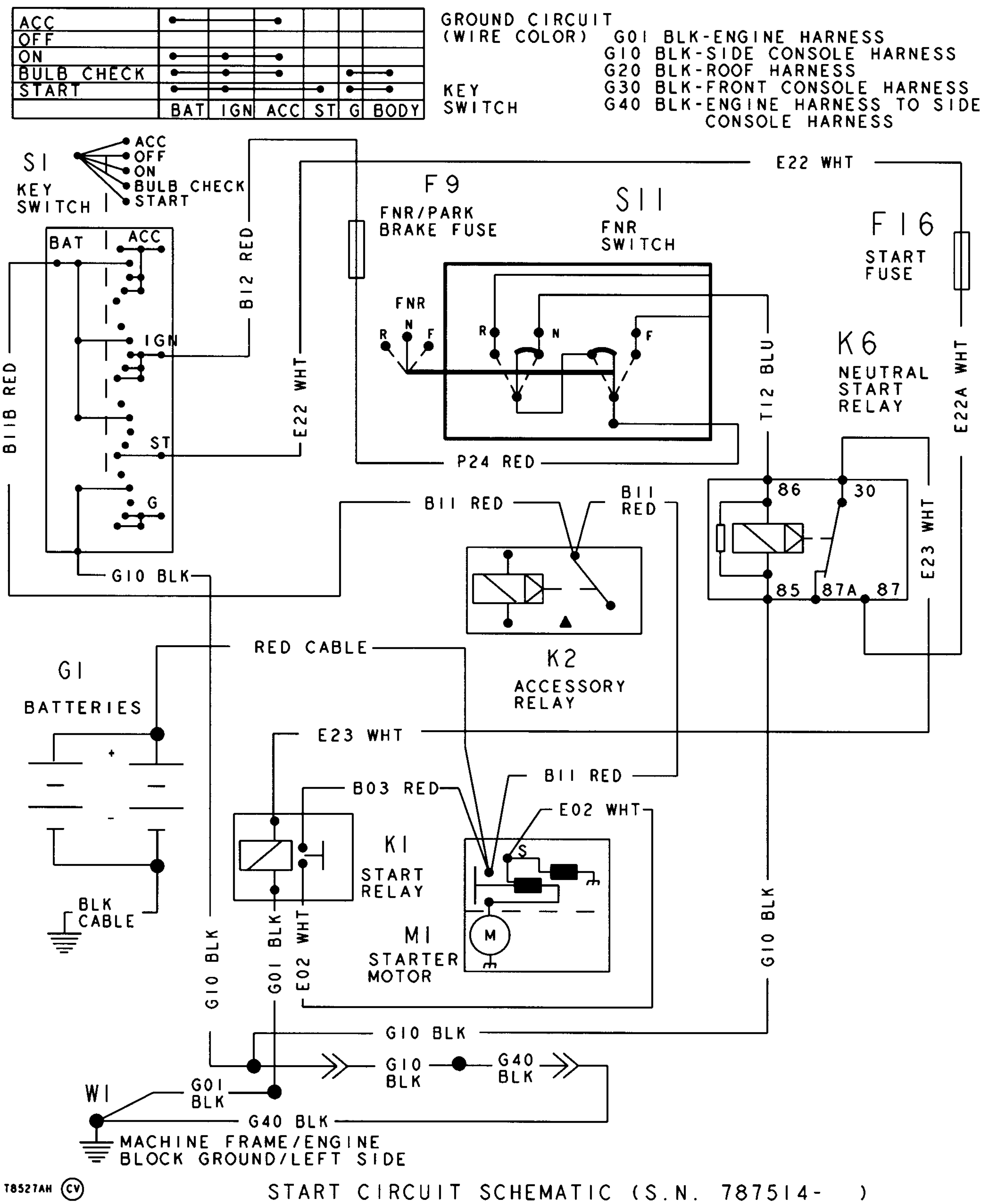
TX,9015,QQ3180 –19–31AUG95–1/2



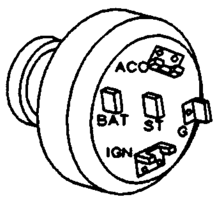
START CIRCUIT SCHEMATIC (S.N. 787514-)

T8527AH –19–10AUG95

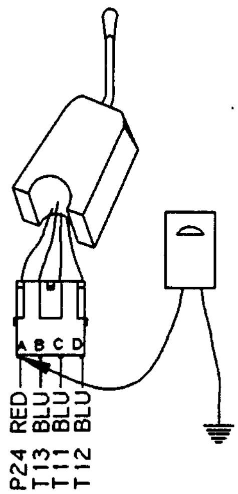
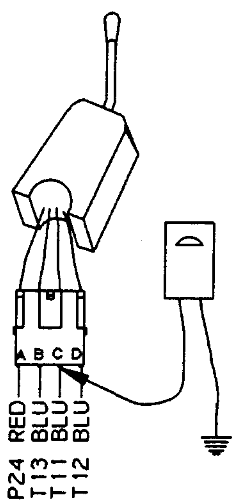
TX,9015,QQ3180 –19–31AUG95–2/2

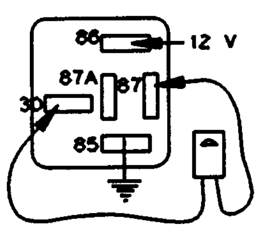
Start Circuit Diagnostic Procedures

– – –1/1

Key Switch Check	 T7199BO –UN–17SEP90 Remove fuel shut off/start aid/reverse alarm fuse. Remove FNR/park brake fuse. Remove start fuse. Turn key switch to START position. With harness connected, check voltage at IGN and ST terminals. Are 12 volts measured at each terminal?	**YES:** Go to next check. **NO:** Replace key switch.

– – –1/1

FNR Lever	T7199BP –19–02OCT90	Key switch ON. FNR lever in neutral With harness connected, check voltage at terminals with P24 red wire and T12 blue wire. Are 12 volts measured at each terminal?	**YES:** Go to next step in this check. **NO:** Check wiring harness.
	T7199BQ –19–02OCT90	Key switch ON. With harness connected, and FNR lever moved to forward, check voltage at terminal with T11 blue wire. Move FNR lever to reverse, check voltage at T13 blue wire. Are 12 volts measured at each terminal?	**YES:** FNR lever is good. Go to next check. **NO:** Replace FNR lever. – – –1/1

Neutral Start Relay	T7287BH –UN–16AUG90	Key switch OFF. Disconnect harness from relay. Connect battery voltage to terminal #86. Ground terminal #85. Does relay click? Measure continuity between terminals #30 and #87. Is continuity measured?	**YES:** Relay is good. Check wiring harness. **NO:** Replace neutral start relay – – –1/1

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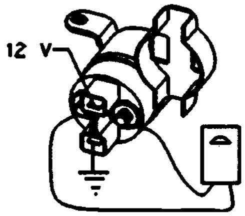
Start Relay



T7287BK –19–16AUG90

Key switch OFF.

Disconnect harness from relay.

Connect battery voltage to one of the small blade terminals and ground the other. Does relay click?

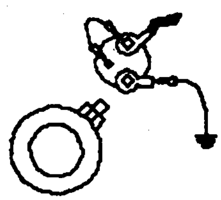
Measure continuity between two large terminals. Is continuity measured?

YES: Relay is good.

NO: Replace start relay.

– – –1/1

Starter Solenoid Check



T6534BI –UN–19OCT88

CAUTION: Starter will crank engine if metal strap is NOT disconnected from starter motor.

Disconnect metal strap from starter motor terminal.

Connect battery voltage to solenoid small terminal.

Ground metal strap from solenoid with heavy gauge wire.

Does solenoid "click"?

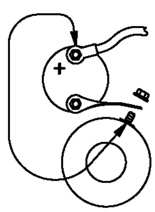
Remove jumper wires.

YES: Solenoid is OK. Check starter motor.

NO: Replace starter solenoid.

– – –1/1

Starter Motor



T6534BJ –UN–07JAN97

CAUTION: Starter will crank engine if metal strap is NOT disconnected from starter motor.

Disconnect metal strap from starter motor large terminal.

Connect a heavy gauge jumper wire from battery positive cable to starter motor terminal.

Does starter motor turn, but NOT crank engine?

YES: Starter motor is good. Check wiring harness.

NO: Repair or replace starter motor.

– – –1/1

Charging Circuit Operational Information

The following conditions must exist for charging circuit to function:

- Key switch in ON position
- Engine running

TX,9015,QQ1827 –19–12MAR93–1/1

Charging Circuit Theory Of Operation

The charging circuit consists of the battery, alternator, alternator relay, key switch, accessory relay, and indicator light in the monitor panel.

78 AMP DELCO ALTERNATOR (S.N. —787513) The alternator BAT terminal is connected to battery voltage at all times. The voltage sensing terminal No. 2 is connected to the BAT terminal of alternator.

The alternator terminal No. 1 gets power from ACC terminal of the key switch. With key switch ON and engine running, power flows from terminal R of alternator to alternator relay, energizing it. Terminals 30 and 87 are connected, and indicator light goes out.

When key is on but engine is not running or if alternator fails, alternator relay de-energizes and terminals 30 and 87A are connected. This grounds the indicator light and light comes on.

95 AMP BOSCH ALTERNATOR (S.N.787514—) The alternator (B+) terminal is connected to battery voltage at all times.

The alternator terminal (D+) gets power from ACC terminal of the key switch by energizing the accessory relay, closing relay contacts and sending power to MFWD/Alternator/Diff. Lock fuse.

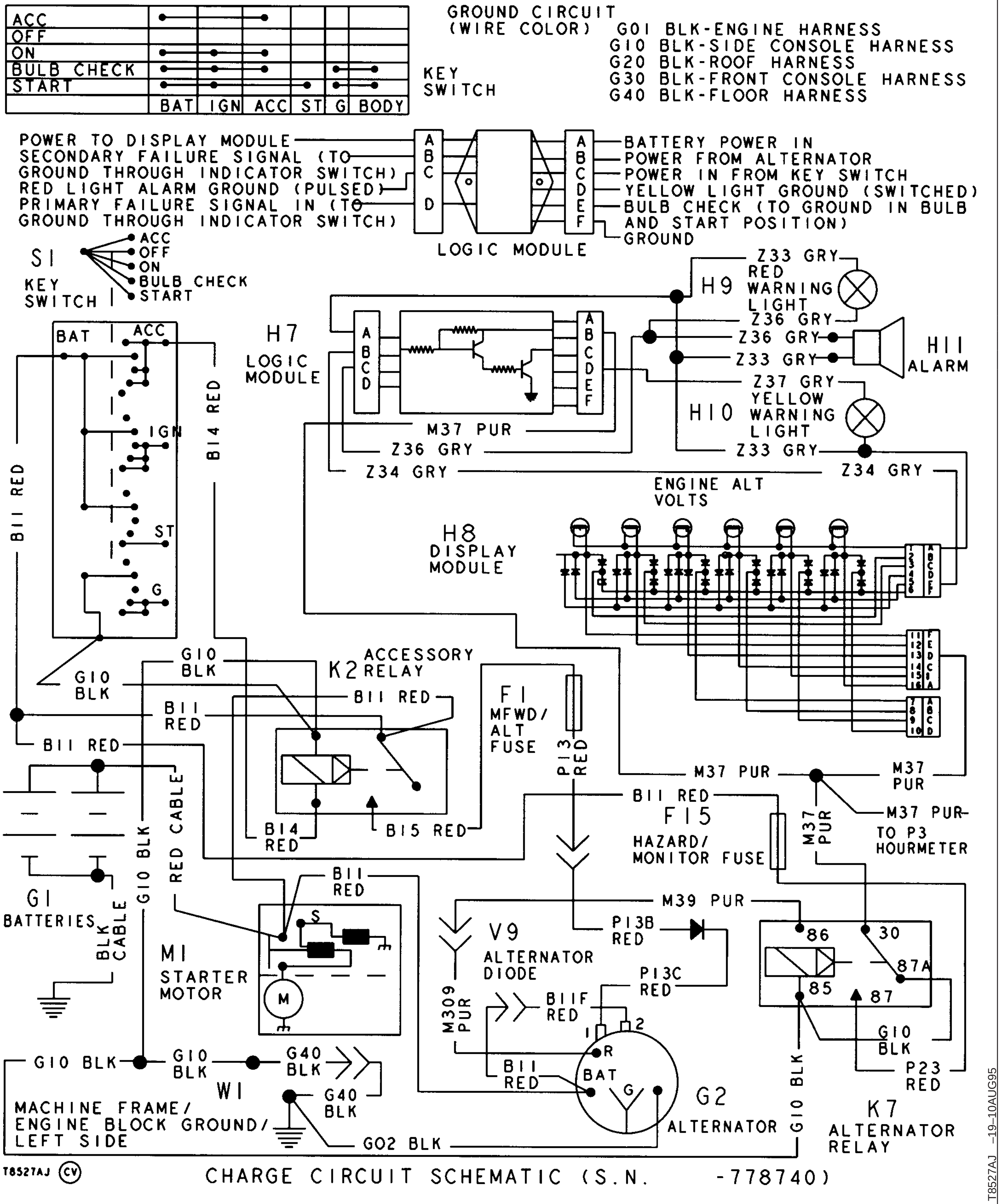
With key switch ON and engine running, power flows from terminal (W) of alternator to alternator relay, energizing it. Terminals 30 and 87 are connected, and indicator light goes out.

When key is on but engine is not running or if alternator fails, alternator relay de-energizes and terminals 30 and 87A are connected. This grounds the indicator light and light comes on.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ2684 –19–31AUG95–1/1

Charge Circuit Schematic



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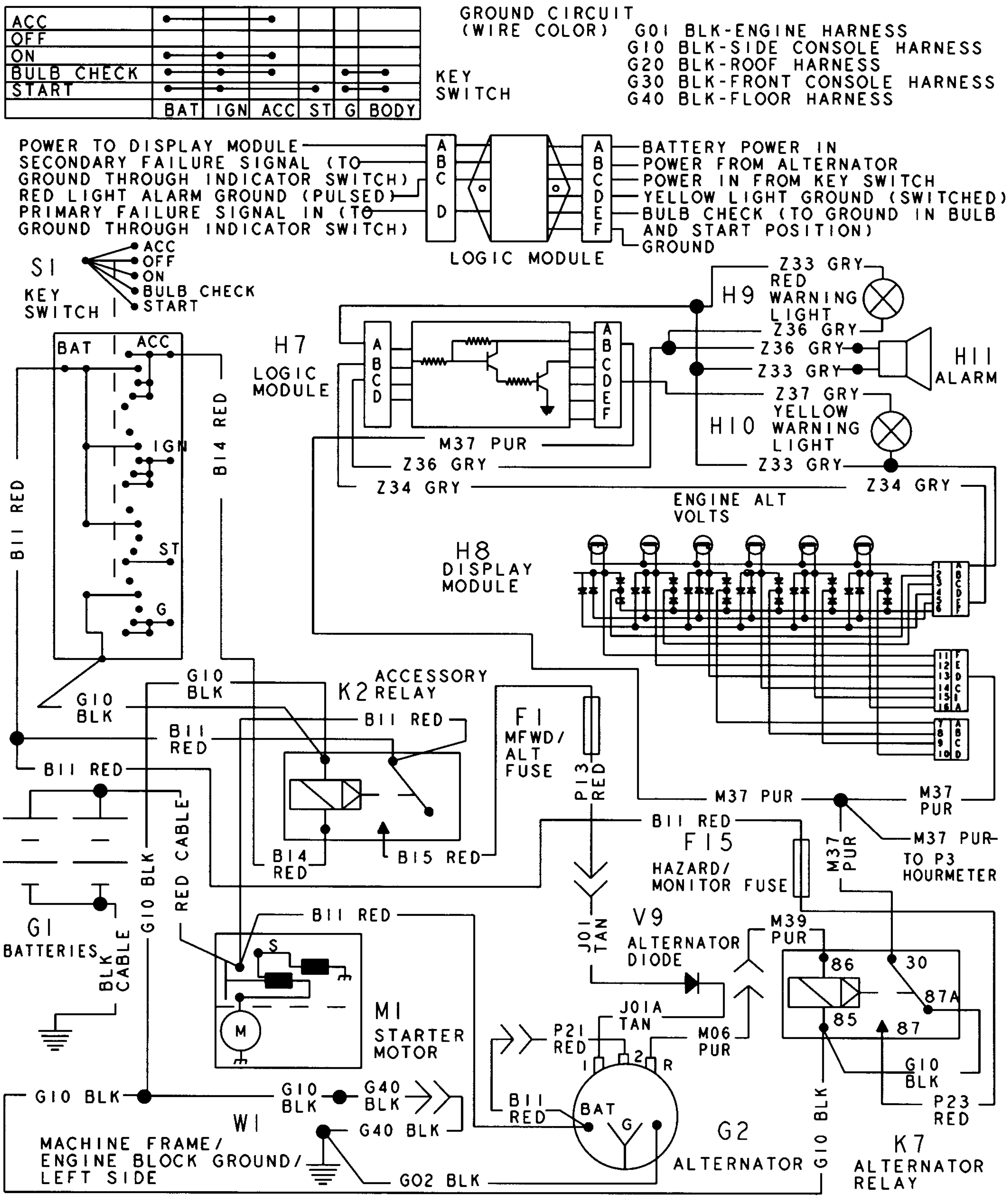
TX,9015,QQ3182 –19–31AUG95–1/5



CHARGE CIRCUIT SCHEMATIC (S.N. 778741-787513)

T8527AK –19–10AUG95

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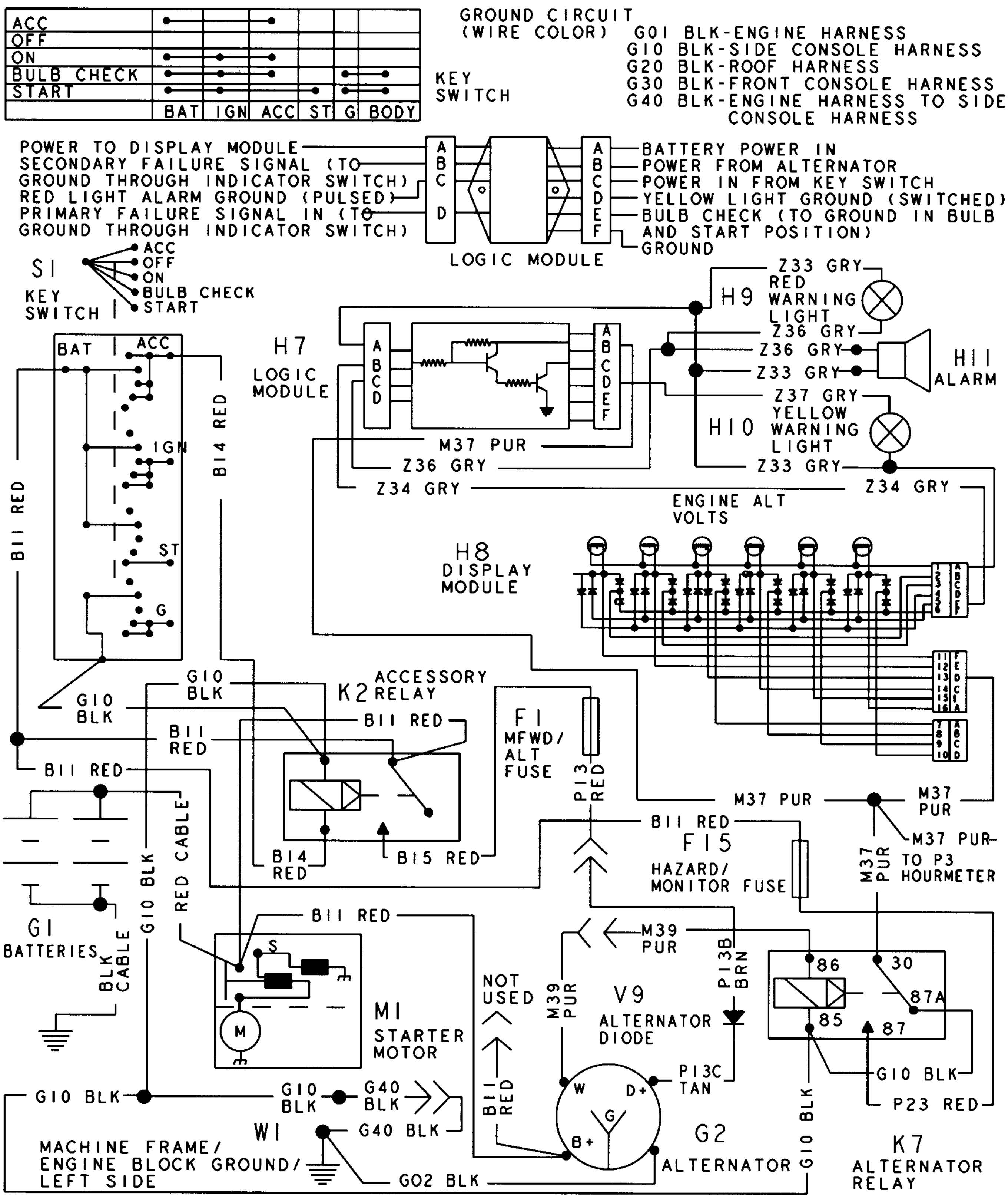
TX,9015,QQ3182 –19–31AUG95–2/5



CHARGE CIRCUIT SCHEMATIC (S.N. 787514-796033)

T8527AL –19–10AUG95

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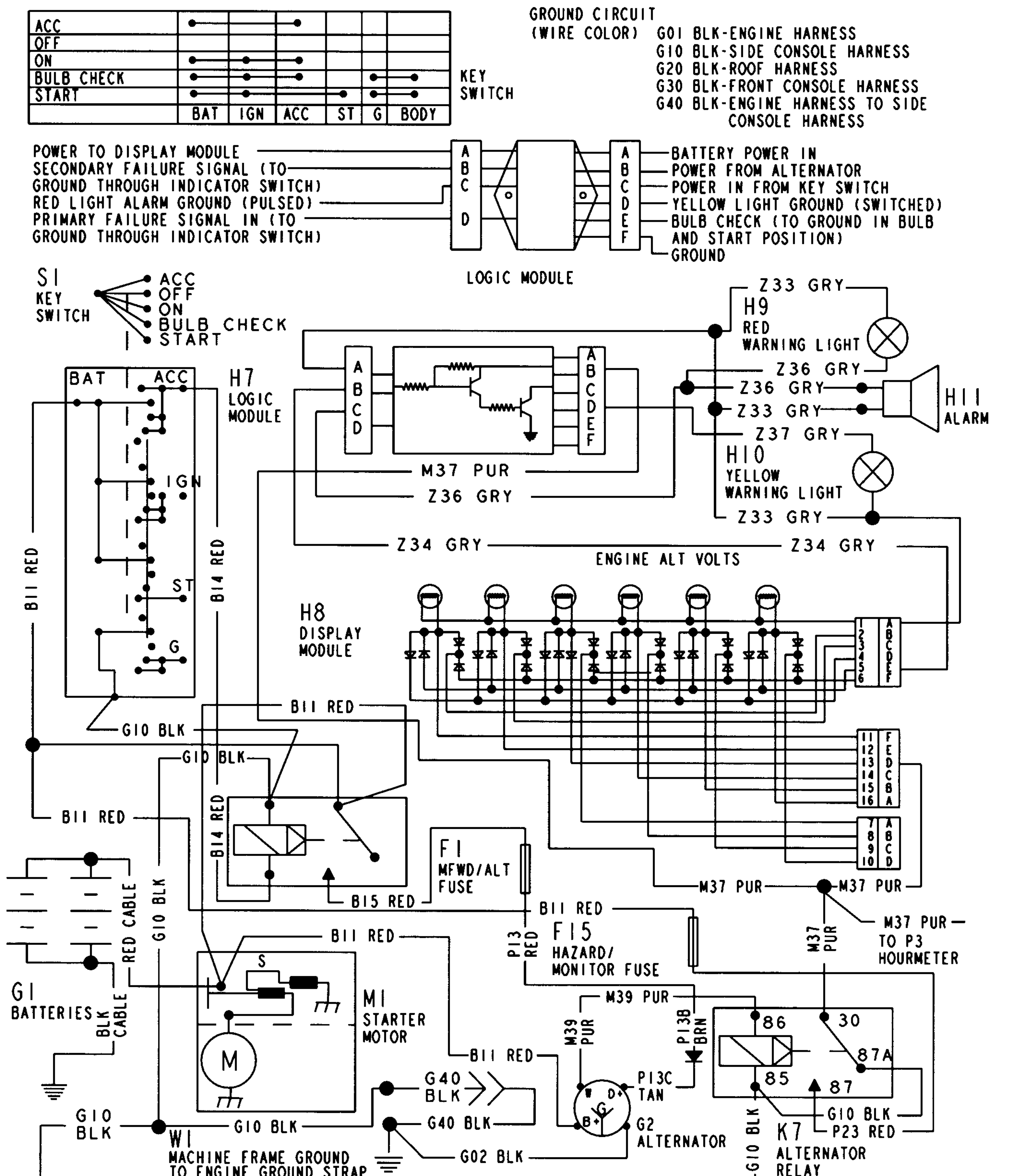
TX,9015,QQ3182 –19–31AUG95–3/5



CHARGE CIRCUIT SCHEMATIC WITH LOGIC MODULE (S.N. 796034-XXXXXX)

T8462AR

T8462AR –19–10AUG95

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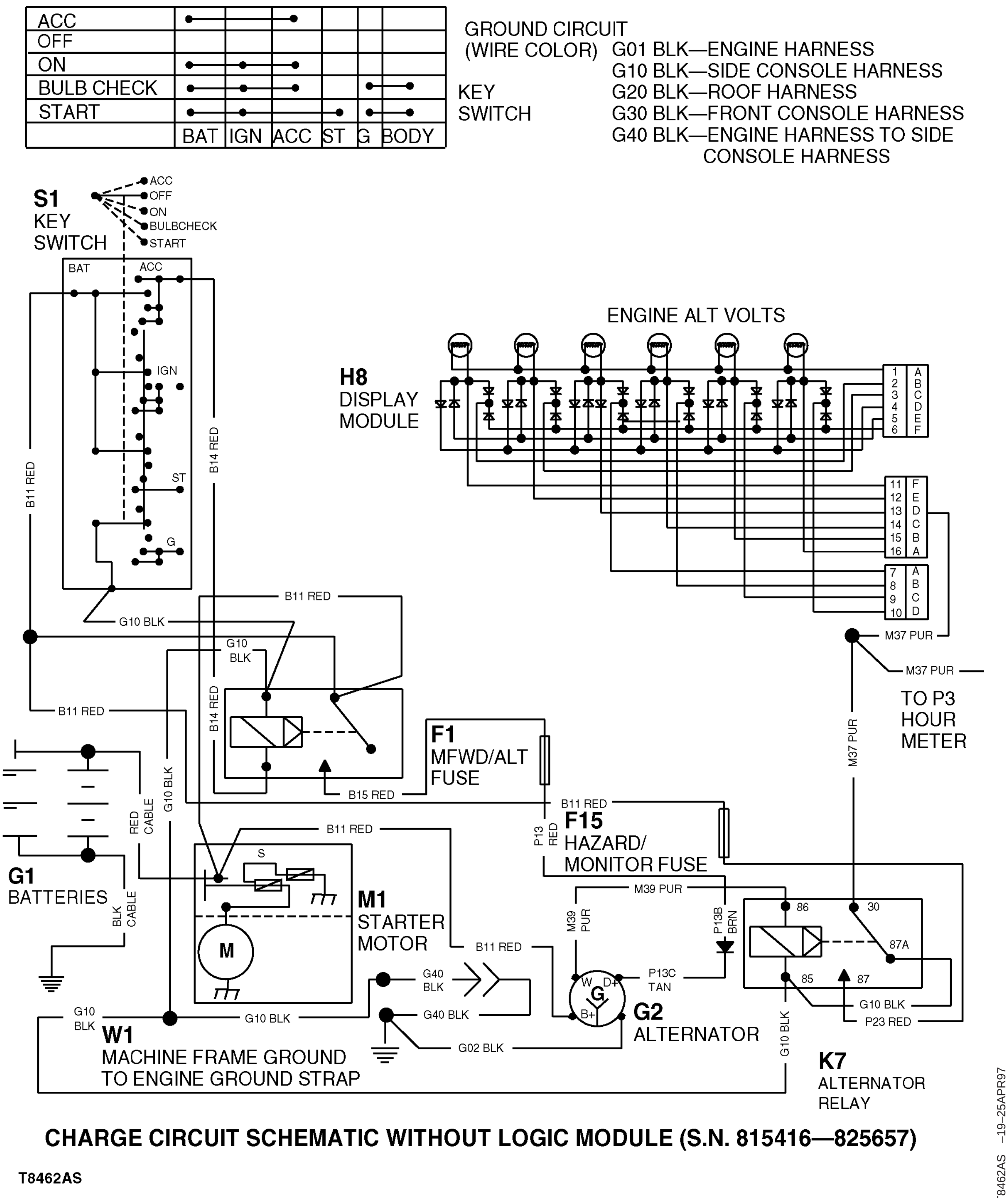
TX,9015,QQ3182 –19–31AUG95–4/5



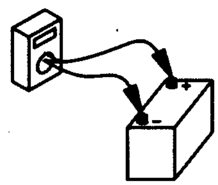
CHARGE CIRCUIT SCHEMATIC WITHOUT LOGIC MODULE (S.N. 815416—825657)

T8462AS

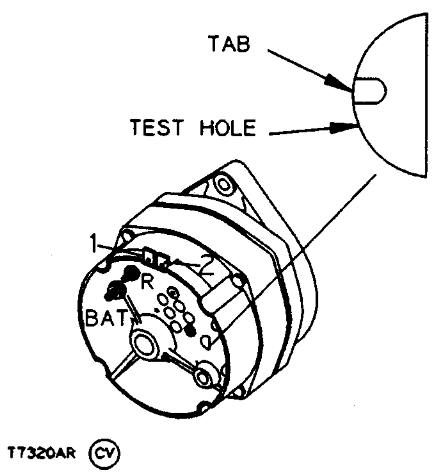
TX,9015,QQ3182 –19–31AUG95–5/5

Charging Circuit Diagnostic Procedures

– – –1/1

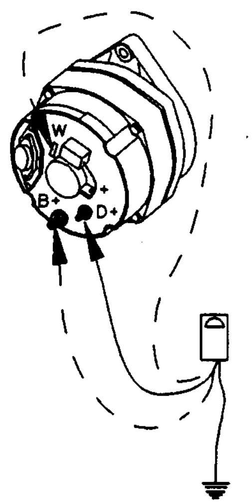
Alternator Output	 T6569AZ –UN–23AUG93 Key switch OFF. Measure and record battery voltage. Start and run engine at 1500 rpm, and check battery voltage. Does battery voltage increase?	**YES:** Alternator is good. Check wiring harness. Check battery. **NO:** Check alternator.

– – –1/1

Alternator And Regulator Check (S.N. —787513)	 T7320AR –19–01AUG90 Using a multimeter, connect to battery voltage at large terminal of starter, and ground other lead. Start and run engine at 1500 rpm. Turn drive lights ON. Insert a small screwdriver in alternator test hole and ground tab to alternator case. Does voltage steadily increase and lights get brighter when tab is grounded?	**YES:** Alternator is good, replace regulator. **NO:** Alternator is failed. Repair or replace.

– – –1/1

Alternator (S.N.787514—)



T7835AT –19–23SEP92

Key switch ON. Engine running. Park brake ON.

Using a multimeter, check for DC voltage at terminals (D+) and (B+).

Is 14 DC volts measured?

Using a multimeter, check for AC voltage at terminal (W).

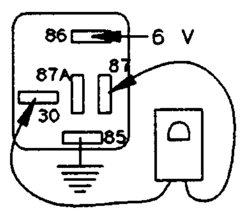
Is 7.63 AC volts measured?

YES: Alternator is good.

NO: Alternator is failed. Repair or replace.

– – –1/1

Alternator Relay



T7596AQ –19–03OCT91

IMPORTANT: Relay is a six volt relay. Do not apply more than 6 volts when testing.

Disconnect harness from relay.

Measure continuity between terminals #30 and #87A. Is continuity measured?

Connect battery voltage to terminal #86. Ground terminal #85. Does relay click?

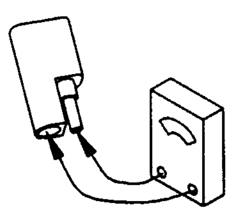
Measure continuity between terminals #30 and #87. Is continuity measured?

YES: Relay is good. Check wiring harness.

NO: Replace relay.

– – –1/1

Alternator Diode



T7961AA –UN–10MAR93

Remove diode from connector.

Connect an ohmmeter to diode terminals.

Is continuity measured?

Reverse ohmmeter probes.

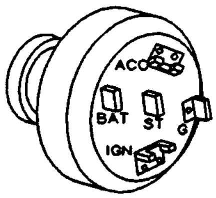
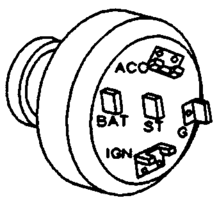
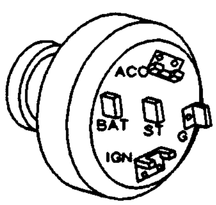
Is continuity measured?

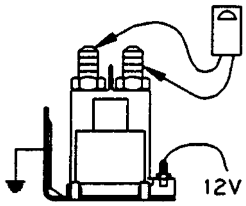
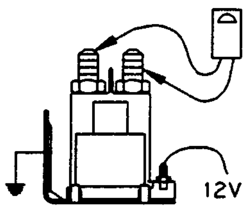
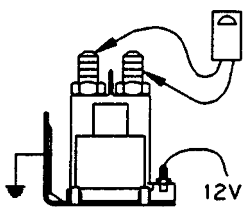
YES: If continuity is measured in both checks, diode has failed in a shorted mode. Replace.

NO: If continuity is NOT measured in either check diode has failed in an open mode. Replace.

NO: If continuity is measured in one check and not the other, diode is OK.

– – –1/1

Key Switch Check	 T7199BO –UN–17SEP90	Key switch OFF. With harness connected, check voltage of B11 red wire at BAT terminal of key switch. Are 12 volts measured?	**YES:** Go to next step in this check. **NO:** Check wiring harness between battery and key switch.
	 T7199BO –UN–17SEP90	Remove fuel shut off/start aid/reverse alarm fuse. Remove FNR/park brake fuse. Remove start fuse. Turn key switch to START position. With harness connected, check voltage at IGN and ST terminals. Are 12 volts measured at each terminal?	**YES:** Go to next step in this check. **NO:** Replace key switch
	 T7199BO –UN–17SEP90	Key switch ON. With harness connected, check voltage at ACC terminal of key switch. Are 12 volts measured?	**YES:** Go to next check. **NO:** Replace key switch. – – –1/1

Accessory Relay	T7199BN –UN–16AUG90	Key switch OFF. With harness connected, check voltage at large terminal with B11 red wire. Are 12 volts measured?	**YES:** Go to next step in this check. **NO:** Check wiring harness between battery and accessory relay.
	T7199BN –UN–16AUG90	Key switch ON. With harness connected, check voltage at small terminal with B14 red wire. Are 12 volts measured?	**YES:** Go to next check. **NO:** Check wiring harness between battery and accessory relay.
	T7199BN –UN–16AUG90	Disconnect harness from relay. Connect battery voltage to small terminal. Ground mounting bracket. Does relay click? Measure continuity between the two large terminals. Is continuity measured?	**YES:** Relay is good. **NO:** Replace accessory relay. – – –1/1

9015
15
24

Display Module And Logic Module Circuit Operational Information (S.N. —XXXXXX) With Logic Module

The following conditions must exist for display module and logic module to function.

The key switch must be in BULB CHECK or START position to "arm" the logic module so failures will be indicated.

TX,9015,QQ3185 –19–31AUG95–1/1

Display Module And Logic Module Circuit Theory Of Operation (S.N. —XXXXXX) With Logic Module

Key Switch OFF

Power is supplied to the logic module through the Hazard/Monitor Unswitched fuse to pin A of logic module (6 pin connector).

Key Switch ON

Power is supplied to the logic module through the Monitor Switched fuse. No power is supplied from the logic module to the display module since the logic module has not been "armed."

Key Switch In BULB CHECK Or START

The key switch connects all indicator lights in the display module to ground when the key switch is in the BULB CHECK or START positions. The key switch also grounds the logic module, signaling the logic module to supply power to all bulbs in the display module, the primary and secondary indicators and the alarm, turning them ON. Turning the key switch to BULB CHECK or START also "arms" the logic module so failures will be indicated.

Engine Started And Key Switch ON

All indicator switches (sensors) are open and the ground circuits to the indicator lights and logic module are broken.

The logic module stops current flow to the display monitor.

Failure Occurs

The indicator switch (sensor) closes, grounding an indicator light and also the logic module. The logic module supplies power to all bulbs in the display module, the secondary failure indicator light, primary indicator light, and alarm. The logic module then connects either the red light and alarm or the yellow light to ground, turning them ON.

Continued on next page

TX,9015,DY361 –19– 3JUN96–1/2

If the key switch is momentarily turned OFF and back ON while the engine is running, power from the alternator indicator terminal will keep the logic module activated.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,DY361 –19– 3JUN96–2/2

Display Module And Logic Module Circuit Operational Information (S.N. XXXXXX—) Without Logic Module

The following conditions must exist for display module to function.

The key switch must be in the "ON" position so failures will be indicated.

TX,9015,QQ3187 –19–31AUG95–1/1

Display Module Circuit Theory Of Operation (S.N. XXXXXX—) Without Logic Module

Power is supplied to the display module through the Monitor Switched fuse.

Elimination of the logic module allows the monitor on the backhoe to be active when the key switch is turned to the ON position. Moving the key switch to the BULB CHECK position to activate the monitor is no longer necessary.

CONDITION: Key ON Engine OFF:

WITH LOGIC MODULE	WITHOUT LOGIC MODULE
No Lights or alarm.	Red warning, yellow warning, engine oil pressure, alternator charging light are ON, and alarm is beeping.

CONDITION: BULB CHECK:

WITH LOGIC MODULE	WITHOUT LOGIC MODULE
Red warning light is flashing, yellow warning is ON, and alarm is beeping.	Red warning light is ON but NOT flashing, yellow warning is ON, and alarm is beeping.

CONDITION: Engine Running And Engine Water Temperature And Alternator Lights Are ON:

WITH LOGIC MODULE	WITHOUT LOGIC MODULE
Red warning light is flashing and alarm is beeping.	Red warning light is on but NOT flashing, yellow warning is ON, and alarm is beeping.

When failure occurs the indicator switch (sensor) closes, grounding an indicator light, the red light and alarm or the yellow light turning them ON.

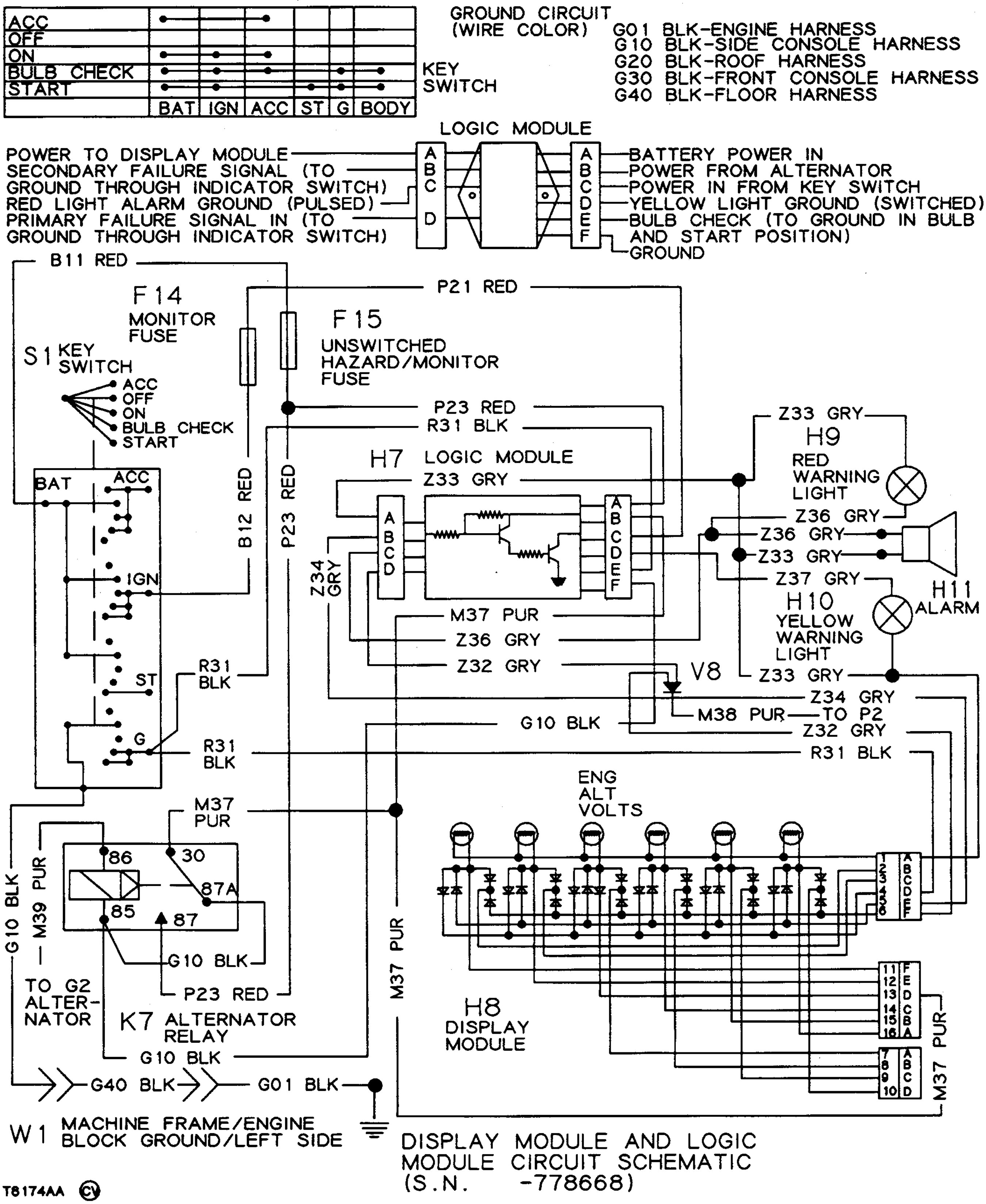
Continued on next page

TX,9015,DY362 –19– 3JUN96–1/2

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,DY362 –19– 3JUN96–2/2

Display Module And Logic Module Circuit Schematic



T8174AA –19–20FEB94

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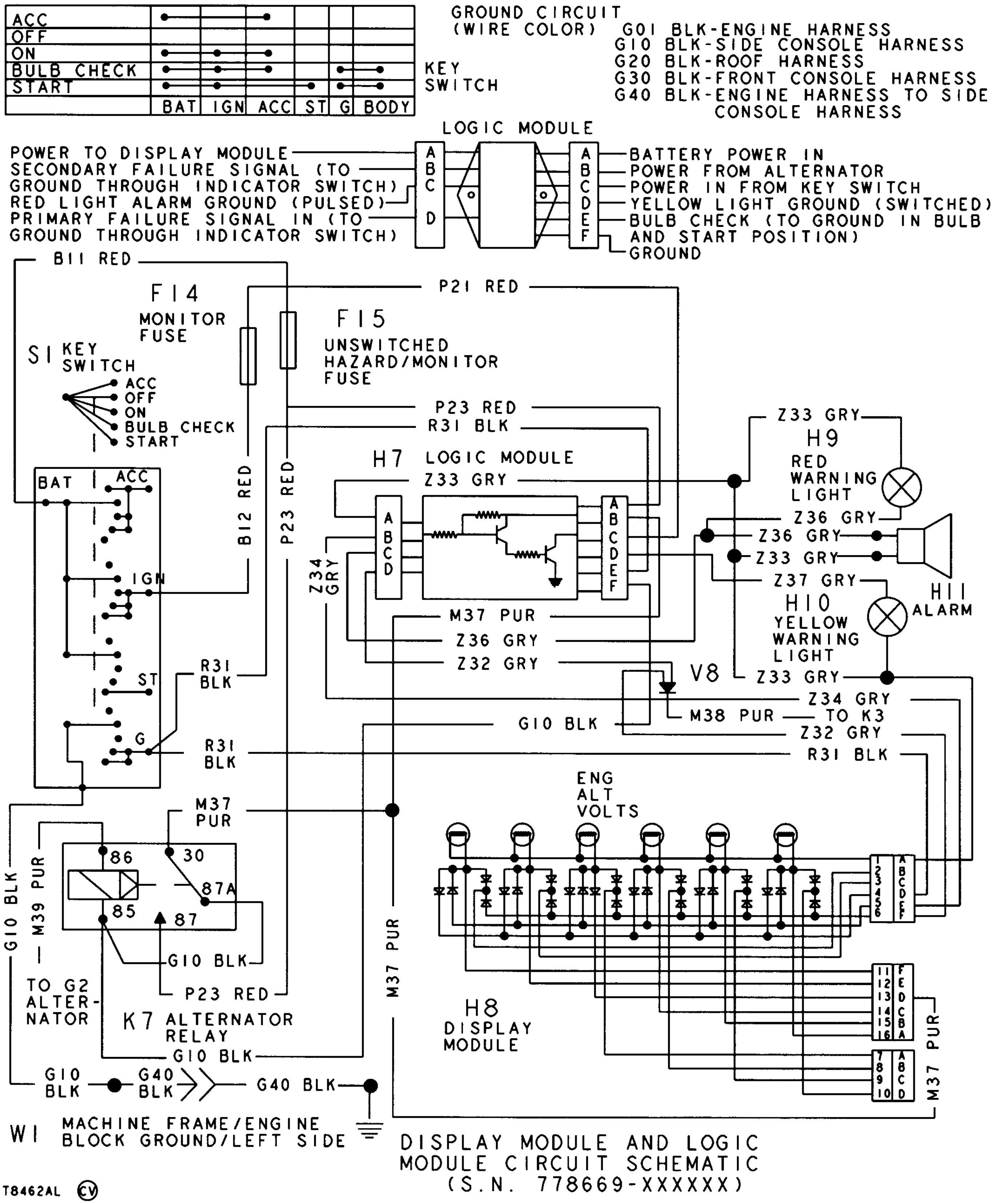
TX,9015,QQ2707 –19–31AUG95–1/3

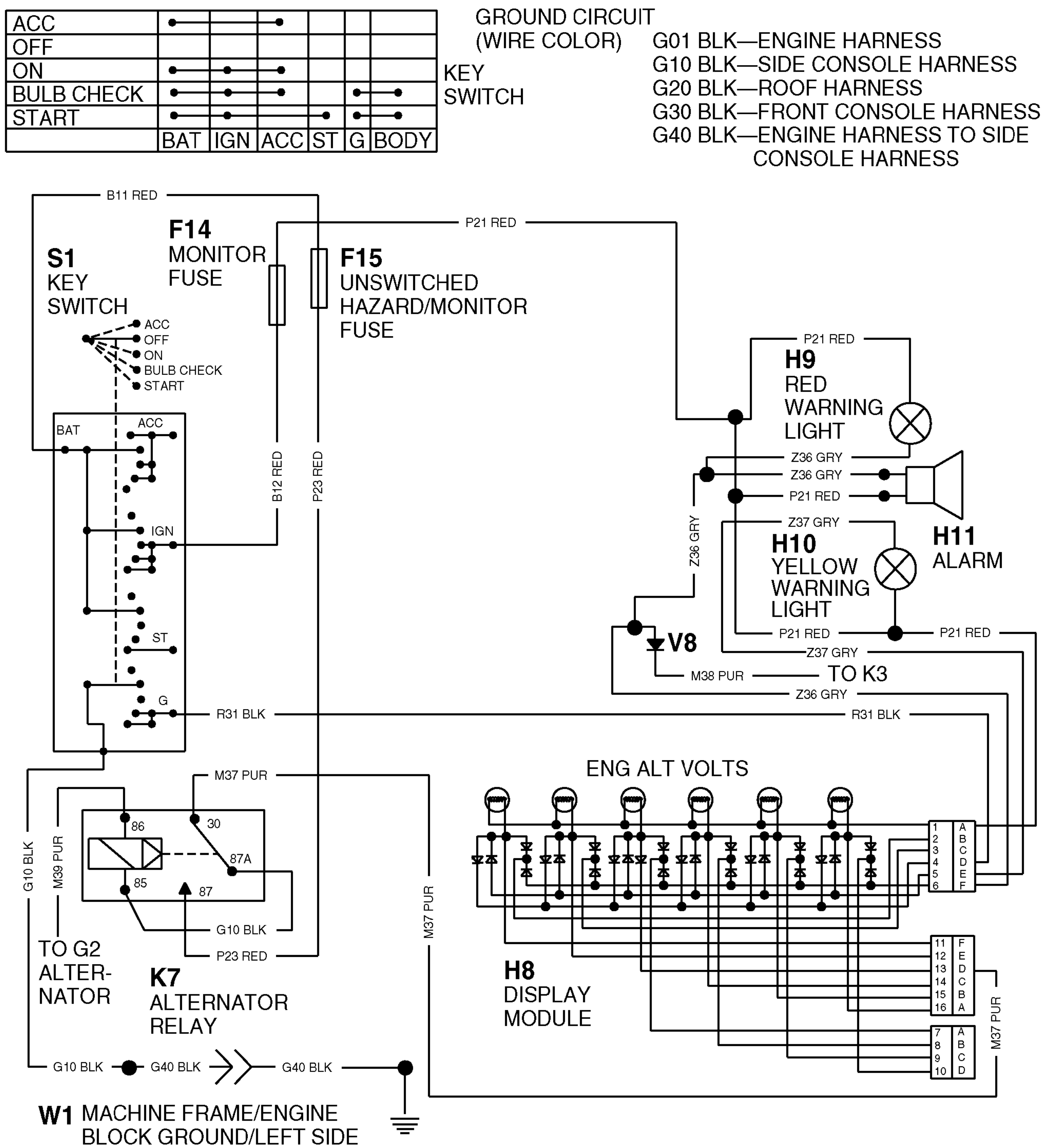


DISPLAY MODULE AND LOGIC MODULE CIRCUIT SCHEMATIC (S.N. 778669-XXXXXX)

T8462AL –19–10AUG95

Continued on next page

TX,9015,QQ2707 –19–31AUG95–2/3



DISPLAY MODULE CIRCUIT SCHEMATIC WITHOUT LOGIC MODULE (S.N. 815416—825657)

T8462AM

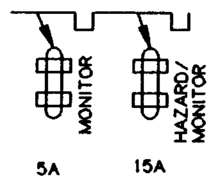
T8462AM –19–25MAR97

TX,9015,QQ2707 –19–31AUG95–3/3

Display Module And Logic Module Circuit Diagnostic Procedures

This circuit is powered by the monitor fuse, and the hazard/monitor unswitched fuse.

– – –1/1

Fuse	 T7199BR –19–16AUG90 Remove fuse cover. Check 5 amp monitor fuse, and 15 amp hazard/monitor fuse. Is fuse blown?	**YES:** Replace fuse. **NO:** Go to next check.

– – –1/1

Logic Module (S.N. —XXXXXX)

See Logic Module Test in Machine and Logic Module Bench Test , in Group 9015-20.

TX,9015,DY377 –19– 5JUN96–1/1

Indicator Circuit Specifications

	Specification
Engine Coolant Temperature Switch (Normally Open)—Closing Temperature	101.7°C (215°F)
Engine Oil Pressure (Normally Closed)—Opening Pressure	37—72 kPa (0.4—0.7 bar) (5.5—10.5 psi)
Air Filter Restriction Switch (Normally Open)—Closes on Increased Vacuum at	4.98—7.48 kPa Vacuum (20—30 in. H_2O)
Converter Oil Temperature Switch (Normally Open)—Closes On Increasing Temperature	114.3°C—121.2°C (238°F—252°F)
Hydraulic Filter Restriction Switch (Normally Open)—Closing Pressure	344 kPa (3.45 bar) (50 psi)

TX,9015,QQ1972 –19–16MAR93–1/1

Indicator Circuit Operational Information

The Indicator Circuit has TWO modes of operation:

- Bulb check mode
- Failure mode

The following conditions must exist for indicator circuit to function in bulb check mode:

Key switch moved to BULB CHECK position

The following conditions must exist for indicator circuit to function in a failure mode:

Engine must be running for a failure to be indicated on a display module light. An indicator switch or alternator relay senses a failure and supplies a ground for an indicator light, warning light and buzzer.

TX,901515,QQ534 –19–07DEC90–1/1

Indicator Circuit Theory Of Operation (S.N. — XXXXXX) With Logic Module

Indicator lights and switches of the display module are:

- Engine Coolant Temperature (Stop)
- Engine Oil Pressure (Stop)
- Engine Alternator Volts (Service Required)
- Engine Air Filter (Service Required)
- Converter Oil Temperature (Stop)
- Hydraulic Oil Filter (Service Required)

STOP Warning Level:

Red STOP light ON, audible alarm ON and function indicator light ON.

SERVICE Warning Level:

Yellow WARNING light and a function indicator light ON.

Bulb Check Mode:

Key switch in BULB CHECK position connects logic module and display module to ground. The ground is supplied to display module by key switch during BULB CHECK. Power then flows through logic module and display module to ground. Logic module is activated and all display module lights and buzzer are checked.

Failure Mode:

During normal operation the indicator lights are turned on when an indicator switch or the alternator relay provides a ground circuit for the light. This ground circuit also signals logic module and turns on red STOP light and alarm or yellow SERVICE REQUIRED light.

NOTE: For component identification code description, see Wiring and Schematic diagrams Legend , Group 9015-10.

TX,9015,DY363 –19– 3JUN96–1/1

Indicator Circuit Theory Of Operation (S.N.XXXXXX—) Without Logic Module

Indicator lights and switches of the display module are:

- Engine Coolant Temperature (Stop)
- Engine Oil Pressure (Stop)
- Engine Alternator Volts (Service Required)
- Engine Air Filter (Service Required)
- Converter Oil Temperature (Stop)
- Hydraulic Oil Filter (Service Required)

STOP Warning Level:

Red STOP light ON, audible alarm ON and function indicator light ON.

SERVICE Warning Level:

Yellow WARNING light and a function indicator light ON.

Bulb Check Mode:

Key switch in BULB CHECK position connects warning lights, buzzer and display module to ground. All display module lights and buzzer are checked.

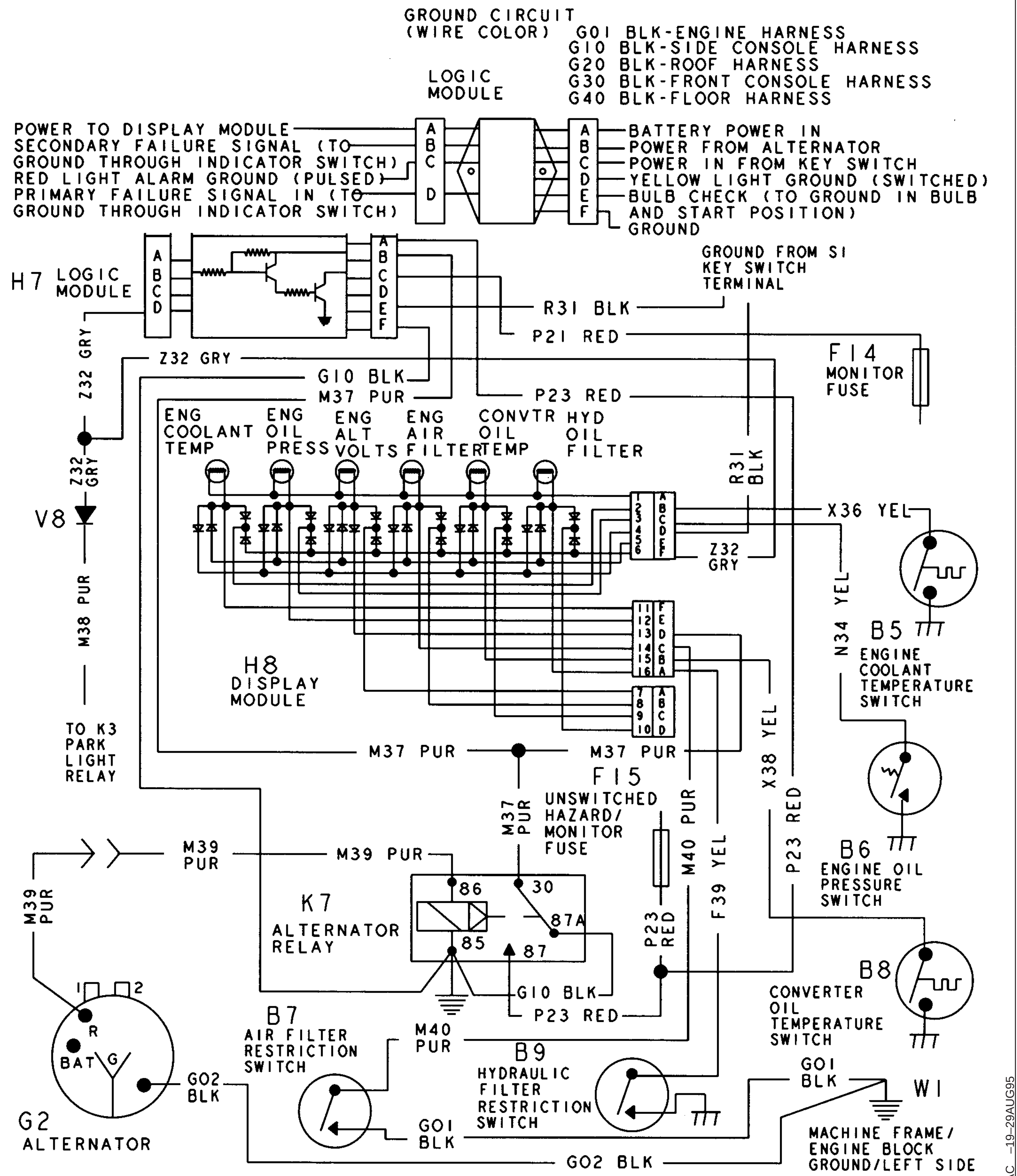
Failure Mode:

During normal operation the indicator lights are turned on when an indicator switch or the alternator relay provides a ground circuit for the light. This ground circuit turns on the red STOP light and alarm or the yellow SERVICE REQUIRED light.

NOTE: For component identification code description, see Wiring and Schematic diagrams Legend , Group 9015-10.

TX,9015,DY369 –19– 3JUN96–1/1

Indicator Circuit Schematic



T8527AC INDICATOR CIRCUIT SCHEMATIC (S.N. -778740)

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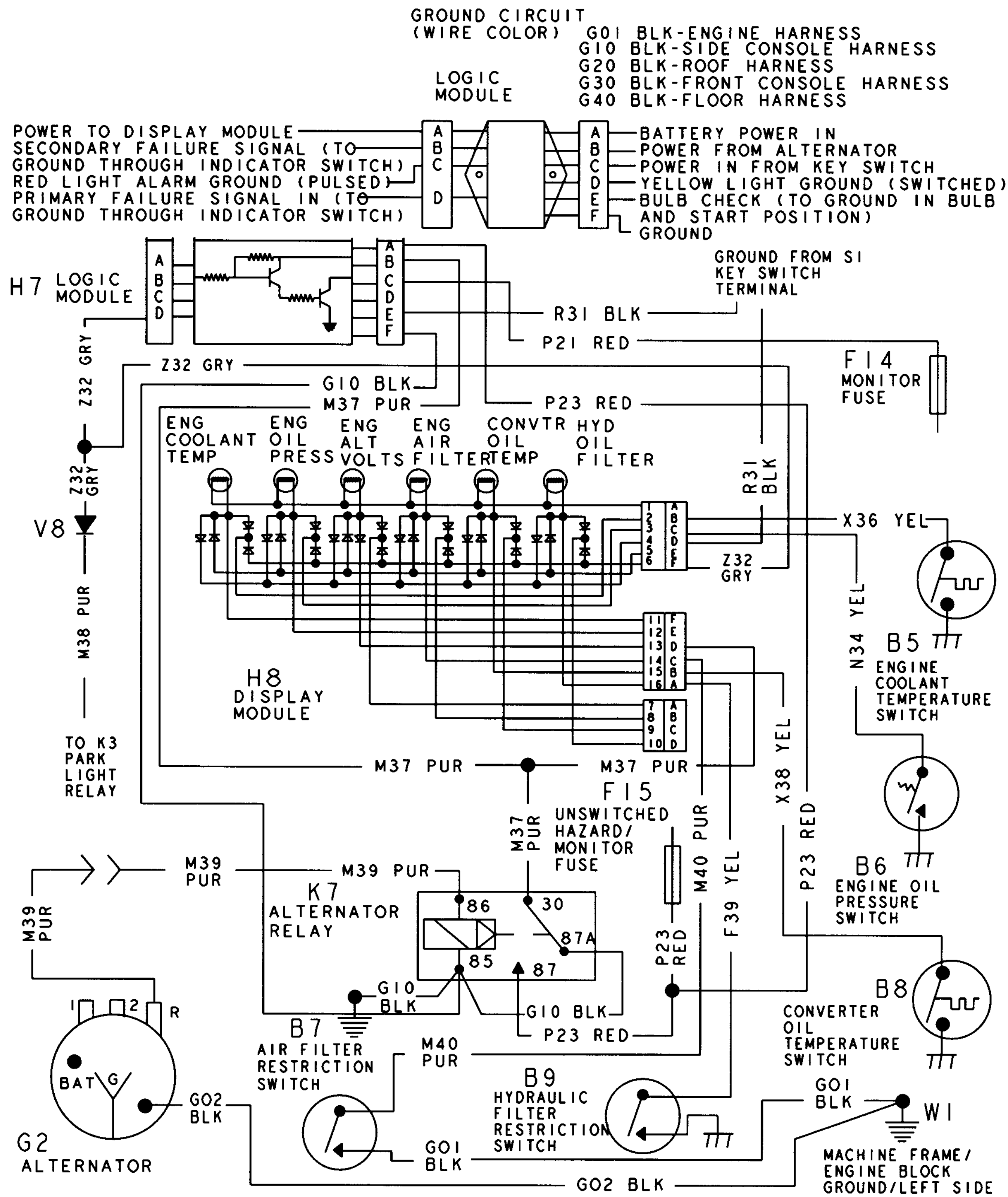
TX,9015,QQ3175 –19–31AUG95–1/4

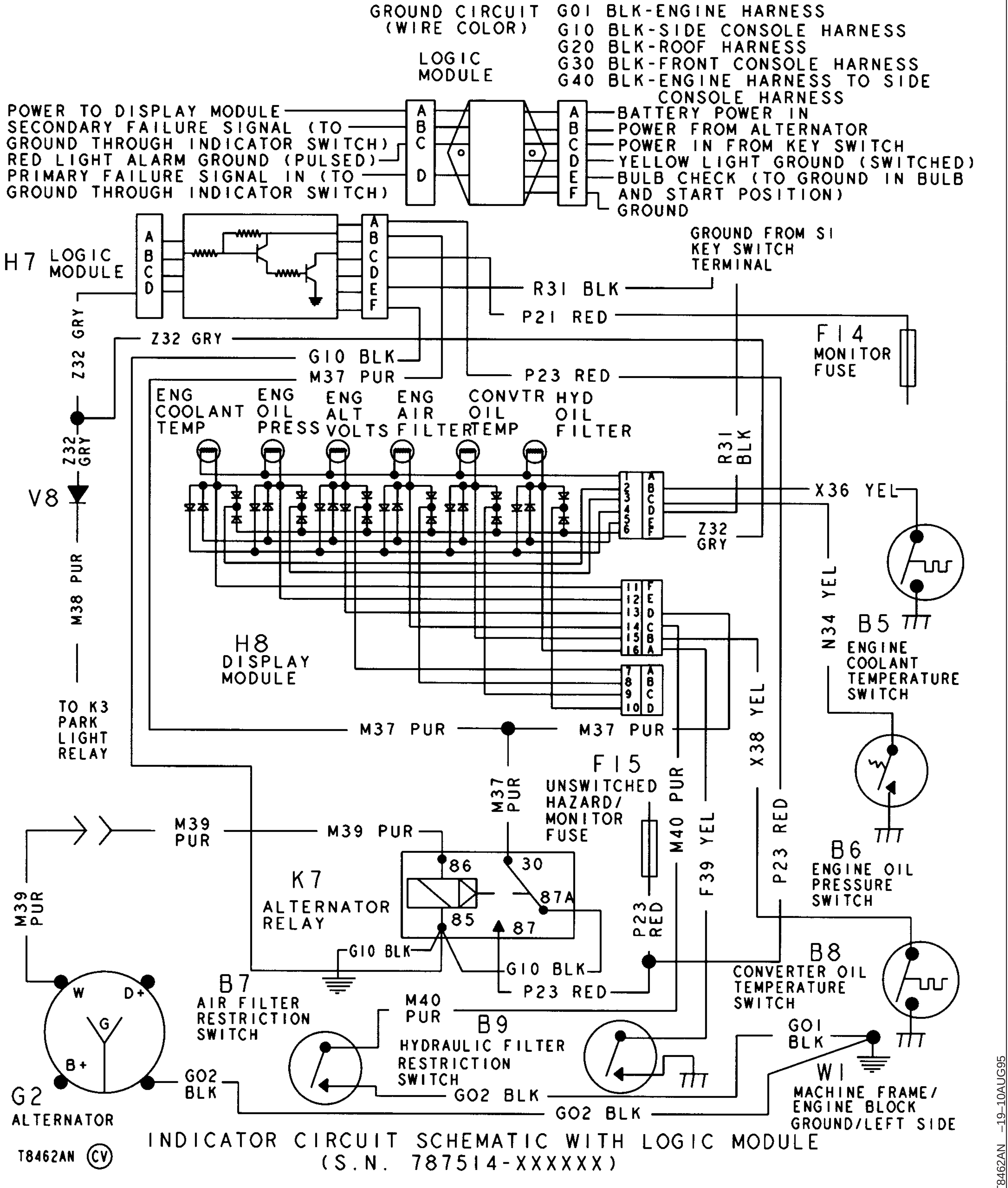


T8527AD INDICATOR CIRCUIT SCHEMATIC (S.N. 778741-787513)

T8527AD –19–10AUG95

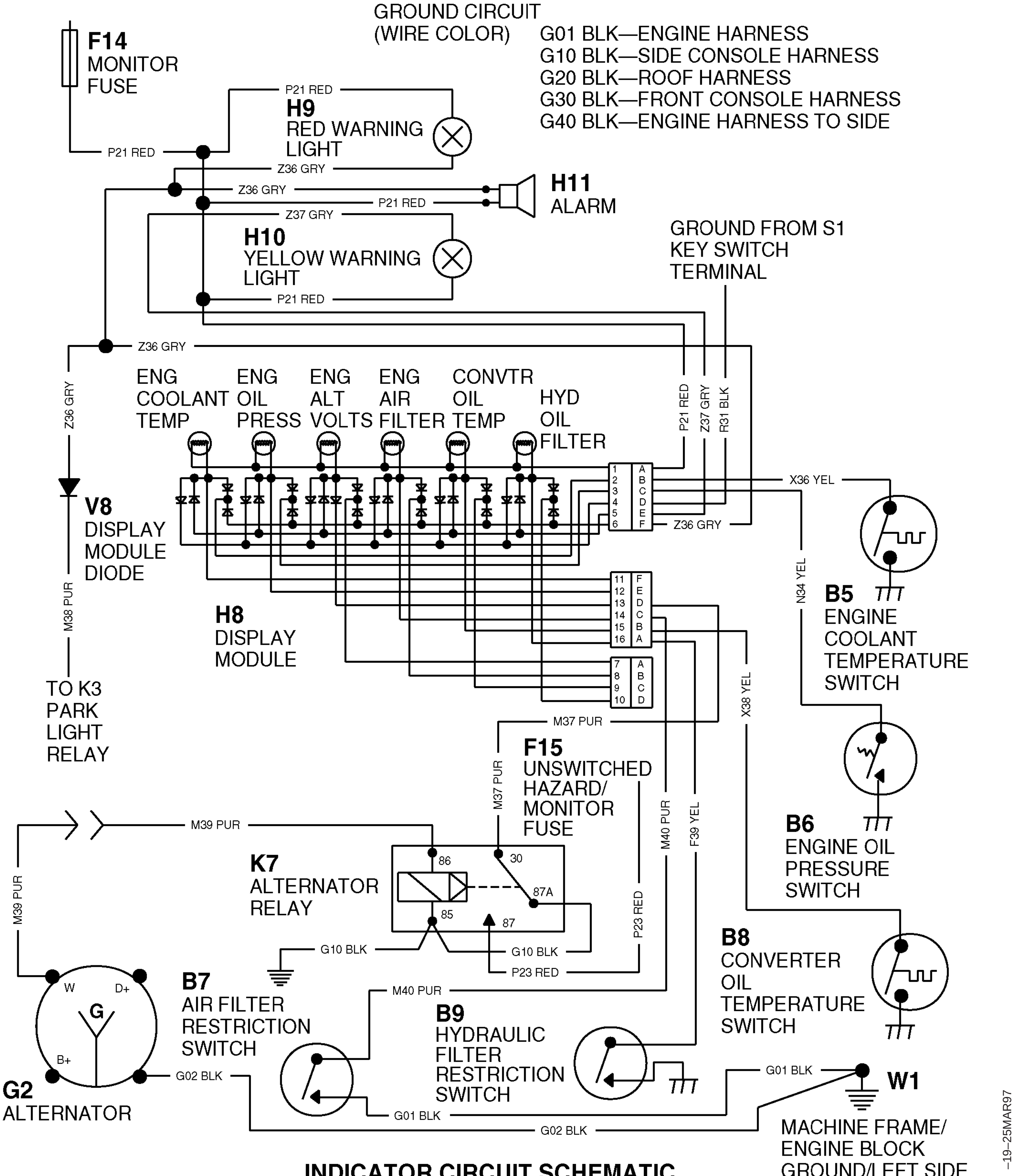
Continued on next page

TX,9015,QQ3175 –19–31AUG95–2/4



INDICATOR CIRCUIT SCHEMATIC WITH LOGIC MODULE
(S.N. 787514-XXXXXX)

Continued on next page



INDICATOR CIRCUIT SCHEMATIC WITHOUT LOGIC MODULE (S.N. 815416—825657)

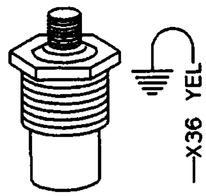
T8462AO

TX,9015,QQ3175 –19–31AUG95–4/4

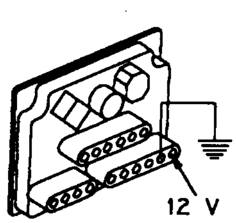
Indicator Circuit Diagnostic Procedures

This circuit is powered by the monitor fuse, and hazard/monitor fuse.

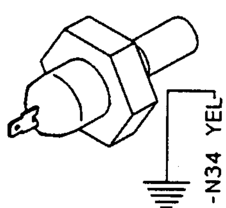
– – –1/1

Engine Coolant Temperature Indicator Switch	 T7199CG –19–16AUG90 Disconnect X36 yellow wire from switch and ground to frame. Without starting engine, turn key switch to BULB CHECK, then release to ON. Is engine coolant indicator light on?	**YES:** Replace switch. **NO:** Switch is good. Go to next check.

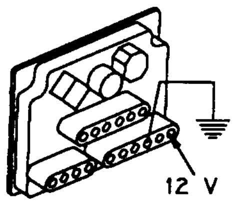
– – –1/1

Engine Coolant Temperature Indicator Light	 T6877AB –UN–18OCT88 Disconnect connector from display module. Connect 12 volts to pin terminal 1 for Z33 gray wire. Ground pin terminal 2 for X36 yellow wire to machine frame. Is engine coolant temperature indicator light on?	**YES:** Indicator light is good. Check wiring harness. **NO:** Check display module. Replace bulb or module.

– – –1/1

Engine Oil Pressure Switch	 T7199DZ –19–26SEP90 Disconnect N34 yellow wire from switch and ground to frame. Without starting engine, turn key switch to BULB CHECK, then release to ON. Is engine oil pressure indicator light on?	**YES:** Replace switch. **NO:** Switch is good. Go to next check.

– – –1/1

Engine Oil Pressure Indicator Light	 T6877AC –UN–18OCT88 Disconnect connector from display module. Connect 12 volts to pin terminal 1 for Z33 gray wire. Ground pin terminal 3 for N34 yellow wire to machine frame. Is engine oil pressure indicator light on?	**YES:** Indicator light is good. Check wiring harness. **NO:** Check display module. Replace bulb or module.

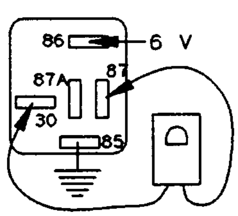
– – –1/1

Engine Alternator Indicator Circuit (S.N. —787513)	Disconnect M39 purple wire from terminal (W) of alternator and apply 6 volts to M39 purple wire. Without starting engine, turn key switch to BULB CHECK, then release to ON. Is alternator indicator light off? Remove voltage from M39 purple wire. Is alternator indicator light on?	**YES:** Circuit is good. Repair or replace alternator. **NO:** Go to next check.

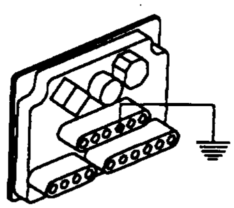
– – –1/1

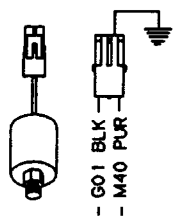
Engine Alternator Indicator Circuit (S.N.787514—)	Disconnect M39 purple wire from terminal (W) of alternator and apply 6 volts to M39 purple wire. Without starting engine, turn key switch to BULB CHECK, then release to ON. Is alternator indicator light off? Remove voltage from M39 purple wire. Is alternator indicator light on?	**YES:** Circuit is good. Repair or replace alternator. **NO:** Go to next check.

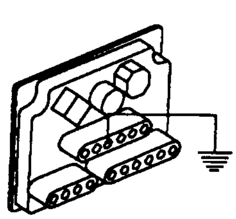
– – –1/1

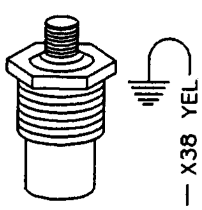
Alternator Relay	 T7596AQ –19–03OCT91 **IMPORTANT: Relay is a six volt relay. Do not apply more than 6 volts when testing.** Disconnect harness from relay. Measure continuity between terminals #30 and #87A. Is continuity measured? Connect battery voltage to terminal #86. Ground terminal #85. Does relay click? Measure continuity between terminals #30 and #87. Is continuity measured?	**YES:** Relay is good. Check wiring harness. **NO:** Replace relay.

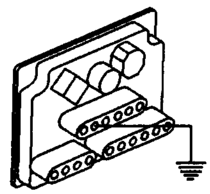
– – –1/1

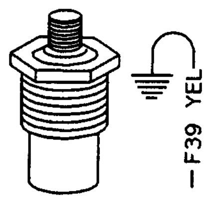
Engine Alternator Indicator Light	 T6877AE –UN–18OCT88 Disconnect middle connector on display module. Ground pin terminal 13 for M37 purple wire to machine frame. Without starting engine, turn key switch to BULB CHECK, then release to ON. Is engine alternator indicator light on?	**YES:** Indicator light is good. Check wiring harness. **NO:** Check display module. Replace bulb or module. – – –1/1

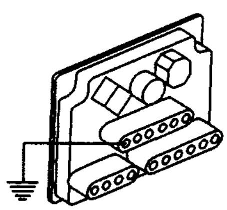
Engine Air Filter Restriction Switch	 T7199CI –19–17SEP90 Disconnect M40 purple wire from switch and ground to frame. Without starting engine, turn key switch to BULB CHECK, then release to ON? Is air filter restriction indicator light on?	**YES:** Replace switch. **NO:** Switch is good. Go to next check. – – –1/1

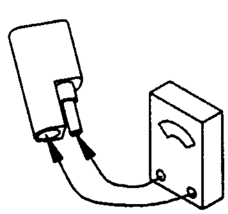
Engine Air Filter Restriction Indicator Light	 T6877AG –UN–18OCT88 Disconnect middle connector of display module. Ground pin terminal 14 for M40 purple wire to machine frame. Without starting engine, turn key switch to BULB CHECK, then release to ON. Is air restriction indicator light on?	**YES:** Indicator light is good. Check wiring harness. **NO:** Check display module. Replace bulb or module. – – –1/1

Converter Oil Temperature Switch	 T7199CJ –19–17SEP90 Disconnect X38 yellow wire from switch and ground to frame. Without starting engine, turn key to BULB CHECK, then release to ON. Is converter oil temperature light on?	**YES:** Replace switch. **NO:** Switch is good. Go to next check. – – –1/1

Converter Oil Temperature Light	 T7199BS –19–16AUG90	Disconnect middle connector from display module. Ground pin terminal 15 for X38 yellow wire from switch and ground to frame. Without starting engine, turn key to BULB CHECK, then release to ON. Is converter oil temperature light on?	**YES:** Indicator light is good. Check wiring harness. **NO:** Check display module. Replace bulb or module. – – –1/1

Hydraulic Filter Restriction Indicator Switch	 T7199CK –19–17SEP90	Disconnect F39 yellow wire from switch and ground to frame. Without starting engine, turn key switch to BULB CHECK, then release to ON. Is hydraulic filter restriction indicator light on?	**YES:** Replace switch. **NO:** Switch is good. Go to next check. – – –1/1

Hydraulic Filter Restriction Indicator Light	 T7199BT –19–16AUG90	Disconnect middle connector on display module. Ground pin terminal 16 for F39 yellow wire to machine frame. Without starting engine, turn key switch to BULB CHECK, then release to ON. Is hydraulic filter restriction indicator light on?	**YES:** Indicator light is good. Check wiring harness. **NO:** Check display module. Replace bulb or module. – – –1/1

Display Module And Logic Module Diode	 T7961AA –UN–10MAR93	Remove diode from connector. Connect an ohmmeter to diode terminals. Is continuity measured? Reverse ohmmeter probes. Is continuity measured?	**YES:** If continuity is measured in both checks, diode has failed in a shorted mode. Replace. **NO:** If continuity is NOT measured in either check diode has failed in an open mode. Replace. **NO:** If continuity is measured in one check and not the other, diode is OK. – – –1/1

MFWD Circuit Operational Information

The following conditions must exist for MFWD circuit to function:

- Key switch ON position
- MFWD Switch ON

TX,901515,QQ811 –19–19NOV90–1/1

MFWD Circuit Theory Of Operation

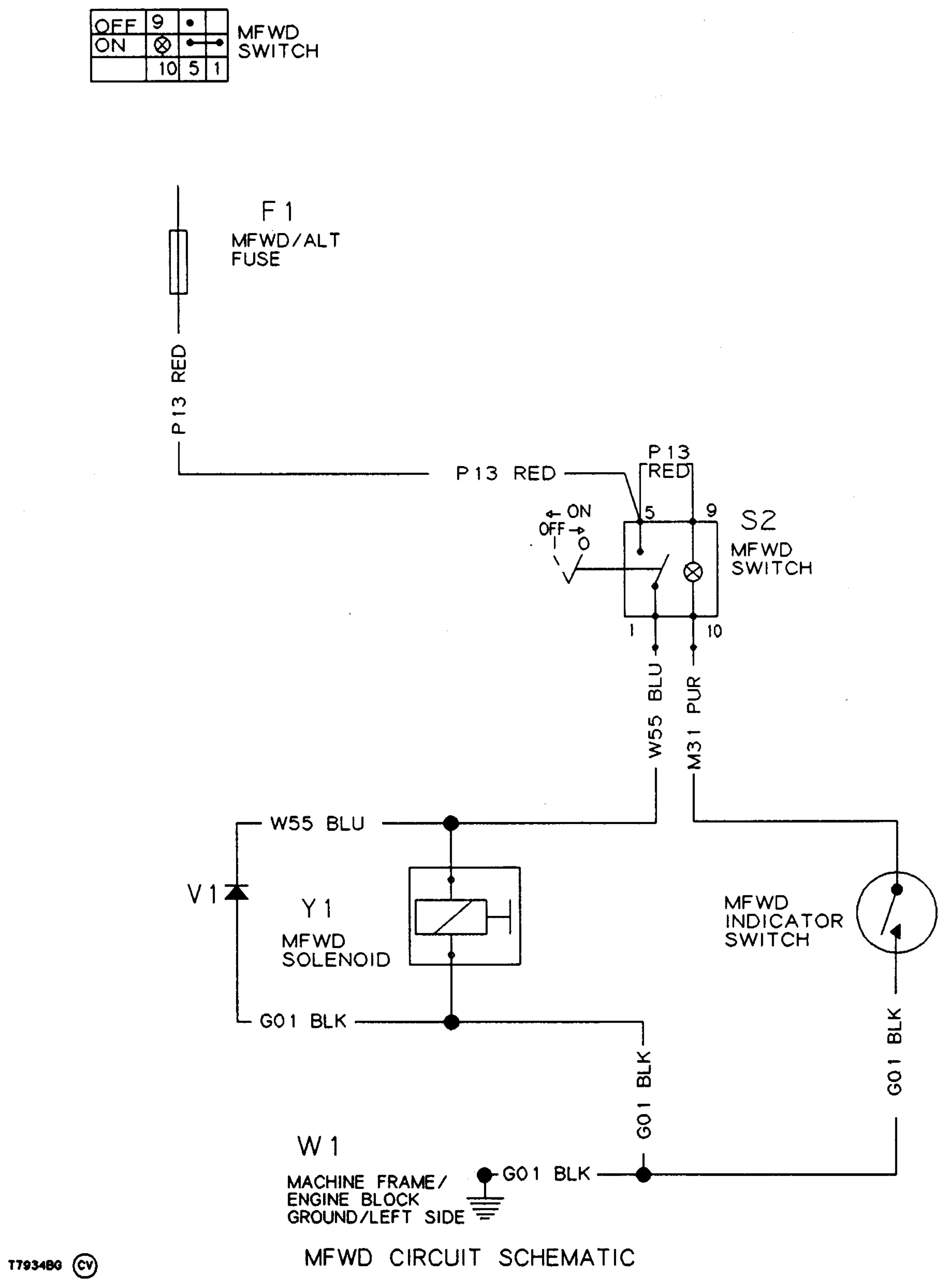
With the key switch ON or ACC position, power flows from MFWD fuse to terminal 5 of MFWD switch. With MFWD switch in ON position, power flows to the MFWD solenoid, energizing and engaging MFWD. MFWD indicator switch closes making light in MFWD switch to come on. With MFWD switch turned to OFF position, the MFWD solenoid is de-energized and disengages MFWD.

NOTE: Indicator light in MFWD switch will remain ON while MFWD is engaged. If MFWD is turned OFF while operating, light could remain on for several seconds until load on drive train is released.

For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ2688 –19–31AUG95–1/1

MFWD Circuit Schematic



T7934BG –19–15FEB93

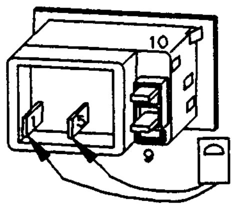
TX,9015,QQ1956 –19–16MAR93–1/1

MFWD Circuit Diagnostic Procedures

This circuit is powered by MFWD fuse.

– – –1/1

MFWD Switch



T7199BU –UN–02OCT90

Disconnect harness from MFWD switch.

With MFWD switch ON, measure continuity between terminals 1 and 5.

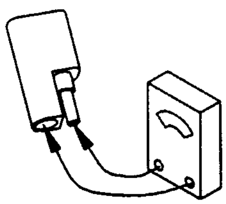
Is continuity measured?

YES: Switch is good. Go to next check.

NO: Replace MFWD switch.

– – –1/1

MFWD Solenoid Diode



T7961AA –UN–10MAR93

Remove diode from connector.

Connect an ohmmeter to diode terminals.

Is continuity measured?

Reverse ohmmeter probes.

Is continuity measured?

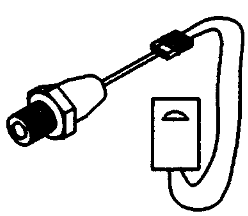
YES: If continuity is measured in both checks, diode has failed in a shorted mode. Replace.

NO: If continuity is NOT measured in either check diode has failed in an open mode. Replace.

NO: If continuity is measured in one check and not the other, diode is OK.

– – –1/1

MFWD Indicator Switch



T7287BJ –UN–16AUG90

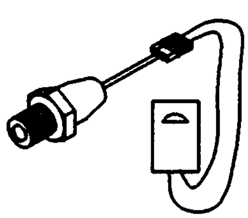
Disconnect harness from switch connector. Remove switch.

Push switch actuator (steel ball). Check continuity.

Is continuity measured?

YES: Go to next step in this check.

NO: Replace MFWD indicator switch.



T7287BJ –UN–16AUG90

Disconnect harness from switch connector. Remove switch.

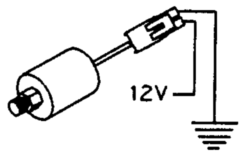
With switch actuator (steel ball) released, check continuity.

Is continuity measured?

YES: Replace MFWD indicator switch.

NO: MFWD indicator switch is good. Go to next check.

– – –1/1

MFWD Solenoid	 T7199BV –UN–16AUG90	Disconnect harness from MFWD solenoid. Connect one lead from connector to ground and the other to battery voltage. Does solenoid click?	**YES:** Solenoid is good. Check wiring harness. **NO:** Replace solenoid.

– – –1/1

Start Aid Circuit Operational Information

The following conditions must exist for start aid circuit to function:

CAB (S.N. —794216) ROPS (S.N. —794259)

- FNR lever in neutral
- Key switch in IGN or ON position
- Start aid switch depressed

CAB (S.N.794217—) ROPS (S.N.794260—)

- Key switch in IGN or ON position
- Start aid switch depressed

TX,9015,QQ2655 –19–31AUG95–1/1

Start Aid Circuit Theory Of Operation

CAB (S.N. —794216) ROPS (S.N. —794259) Power flows from key switch IGN terminal to fuel shut-off/start aid and reverse warning alarm fuse to start aid button. When button is pushed, power is supplied to start aid solenoid.

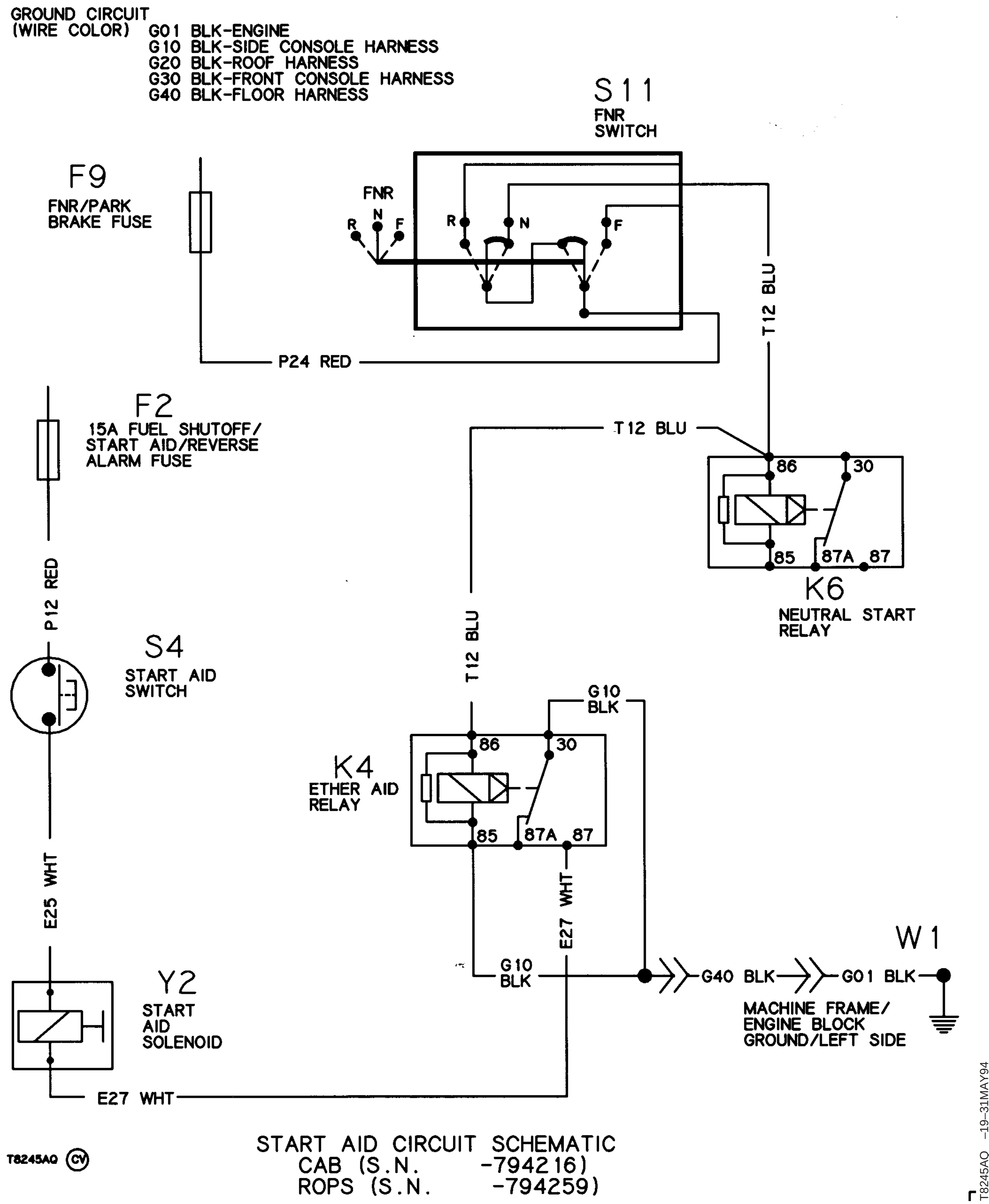
Power flows from key switch IGN terminal to FNR/park brake fuse, FNR lever, neutral start relay and ether aid relay. This energizes ether aid relay, closing terminal 30 and 87 suppling a ground and activating start aid solenoid.

CAB (S.N.794217—) ROPS (S.N.794260—) Power flows from key switch IGN terminal to fuel shut-off/start aid and reverse warning alarm fuse to start aid button. When button is pushed, power is supplied to start aid solenoid. Ground is supplied through GO1 black wire energizing solenoid.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ2656 –19–31AUG95–1/1

Start Aid Circuit Schematic



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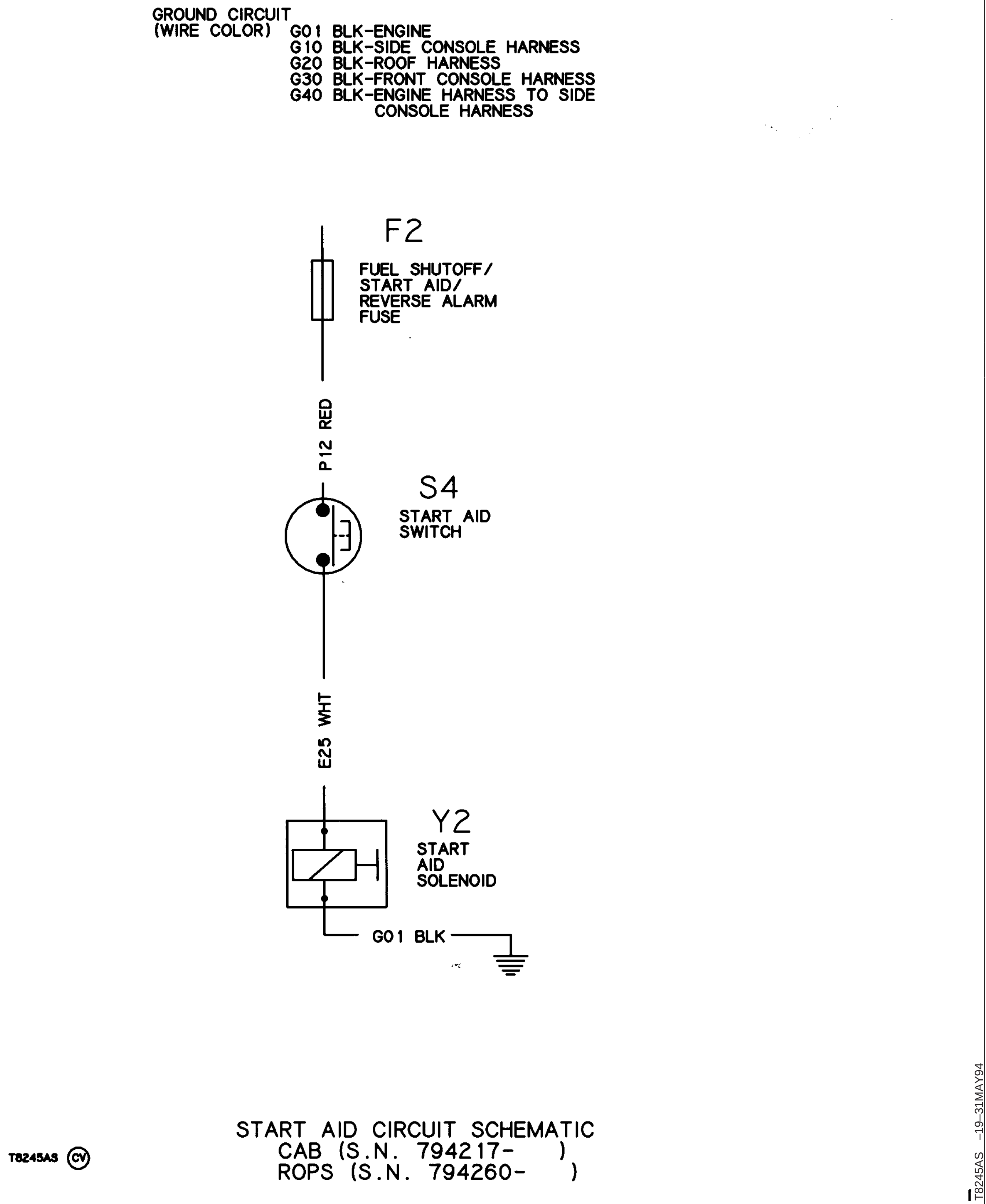
TX,9015,QQ2689 –19–31AUG95–1/2



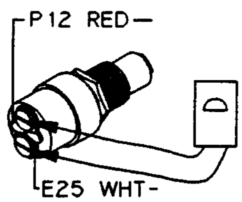
START AID CIRCUIT SCHEMATIC
CAB (S.N. 794217-)
ROPS (S.N. 794260-)

TX,9015,QQ2689 –19–31AUG95–2/2

Start Aid Circuit Diagnostic Procedures

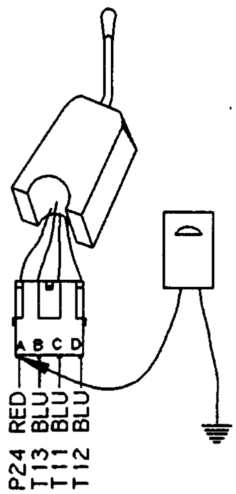
This circuit is powered by the fuel shutoff/start aid/reverse alarm fuse.

– – –1/1

Start Aid Switch	 T7199BW –19–16AUG90 Disconnect harness from start aid switch. With start aid button pushed, check for continuity between terminals with P12 red wire and E25 white wire. Is continuity measured?	**YES:** Start aid switch is good. Go to next check. **NO:** Replace start aid switch.

– – –1/1

FNR Lever
Cab (S.N.—794216)
ROPS (S.N.—794259)



T7199BP –19–02OCT90

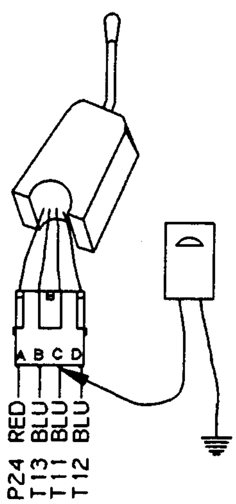
Key switch ON. FNR lever in neutral

With harness connected, check voltage at terminals with P24 red wire and T12 blue wire.

Are 12 volts measured at each terminal?

YES: Go to next step in this check.

NO: Check wiring harness.



T7199BQ –19–02OCT90

Key switch ON.

With harness connected, and FNR lever moved to forward, check voltage at terminal with T11 blue wire.

Move FNR lever to reverse, check voltage at T13 blue wire.

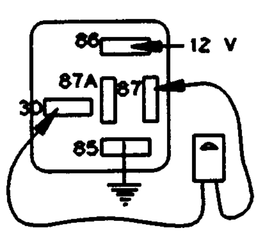
Are 12 volts measured at each terminal?

YES: FNR lever is good. Go to next check.

NO: Replace FNR lever.

– – –1/1

Ether Aid Relay Cab (S.N.—794216) ROPS (S.N.—794259)



T7287BH –UN–16AUG90

Key switch OFF.

Disconnect harness from relay.

Connect battery voltage to terminal #86 with T12 blue wire. Ground terminal #85 with G10 black wire.

Does relay click?

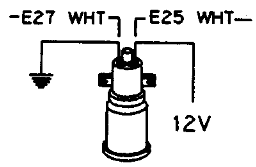
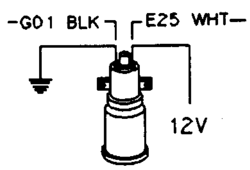
Measure continuity between terminals #30 and #87 with G10 black wire and E27 white wire.

Is continuity measured?

YES: Relay is good. Check wiring harness.

NO: Replace ether aid relay.

– – –1/1

Start Aid Solenoid Cab (S.N.—794216) ROPS (S.N.—794259)	 T7199BX –19–17SEP90	*NOTE: Remove start aid fluid canister from holder to prevent injecting starting fluid into engine.* Key switch OFF. Disconnect harness from solenoid. Connect battery voltage to terminal with E25 white wire. Ground terminal with E27 white wire. Does solenoid "click"?	**YES:** Start aid solenoid is good. Check wiring harness. **NO:** Replace start aid solenoid. – – –1/1
Start Aid Solenoid Cab (S.N.794217—) ROPS (S.N.794260—)	 T7828AK –19–23SEP92	*NOTE: Remove start aid fluid canister from holder to prevent injecting starting fluid into engine.* Key switch OFF. Disconnect harness from solenoid. Connect battery voltage to terminal with E25 white wire. Ground terminal with GO1 black wire. Does solenoid "click"?	**YES:** Start aid solenoid is good. Check wiring harness. **NO:** Replace start aid solenoid. – – –1/1

Fuel Shut-Off Circuit Operational Information

The following conditions must exist for fuel shut-off circuit to function:

Key switch in IGN or ON position

TX,9015,QQ1814 –19–12MAR93–1/1

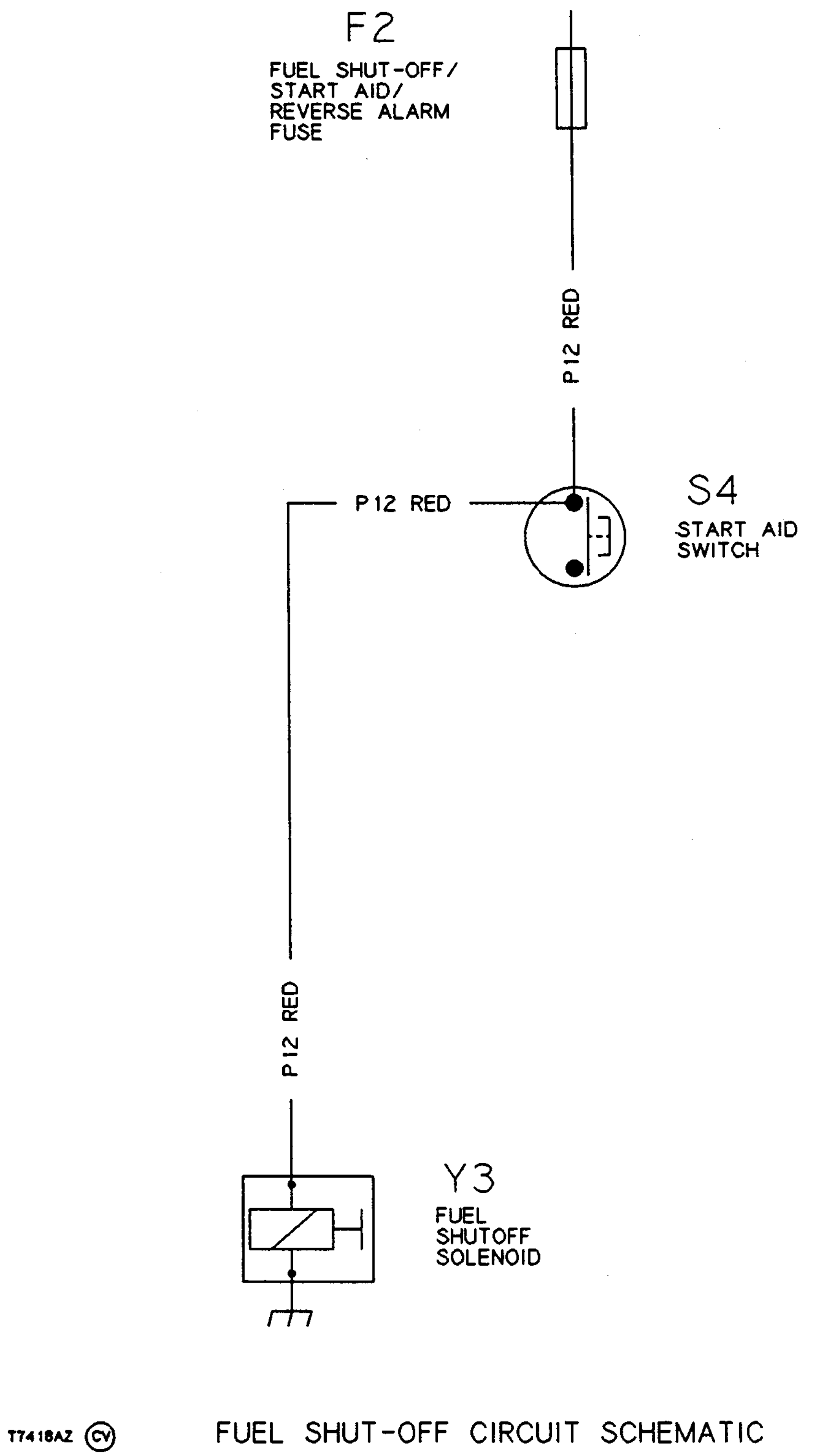
Fuel Shut-Off Circuit Theory Of Operation

Power flows from key switch IGN terminal to fuel shut-off/start aid/reverse alarm fuse, start aid switch and fuel shut-off solenoid. Solenoid is grounded to frame. When the fuel shut-off solenoid is "energized" fuel is allowed into the injection pump.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ1754 –19–12MAR93–1/1

Fuel Shut-Off Circuit Schematic



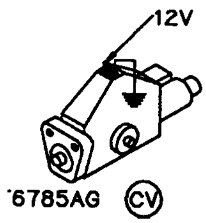
T7418AZ –19–12DEC90

TX,901515,QQ825 –19–12MAR93–1/1

Fuel Shut-Off Circuit Diagnostic Procedures

This circuit is powered by the fuel shutoff/start aid/reverse alarm fuse.

– – –1/1

Injection Pump Fuel Shut-Off Solenoid	 T6785AG –UN–18OCT88	Connect battery voltage to solenoid P12 red wire terminal. Does solenoid "click"? Remove voltage from terminal. Does solenoid "click" again?	**YES:** Solenoid is good. Check wiring harness. **NO:** Replace fuel shut-off solenoid.

– – –1/1

9015
15
56

Reverse Alarm Circuit Specifications Cab (S.N. —794216) ROPS (S.N. —794259)

	Specification
Reverse Alarm Switch (Normally Open)—Closes on Increasing Pressure	296 kPa—599 kPa (3 bar—6 bar) (43 psi—87 psi)

TX,9015,QQ2693 –19–31AUG95–1/1

Reverse Alarm Circuit Operational Information

The following conditions must exist for reverse alarm circuit to function:

- Key switch ON
- FNR lever must be in reverse position

TX,9015,QQ1815 –19–12MAR93–1/1

Reverse Alarm Circuit Theory Of Operation

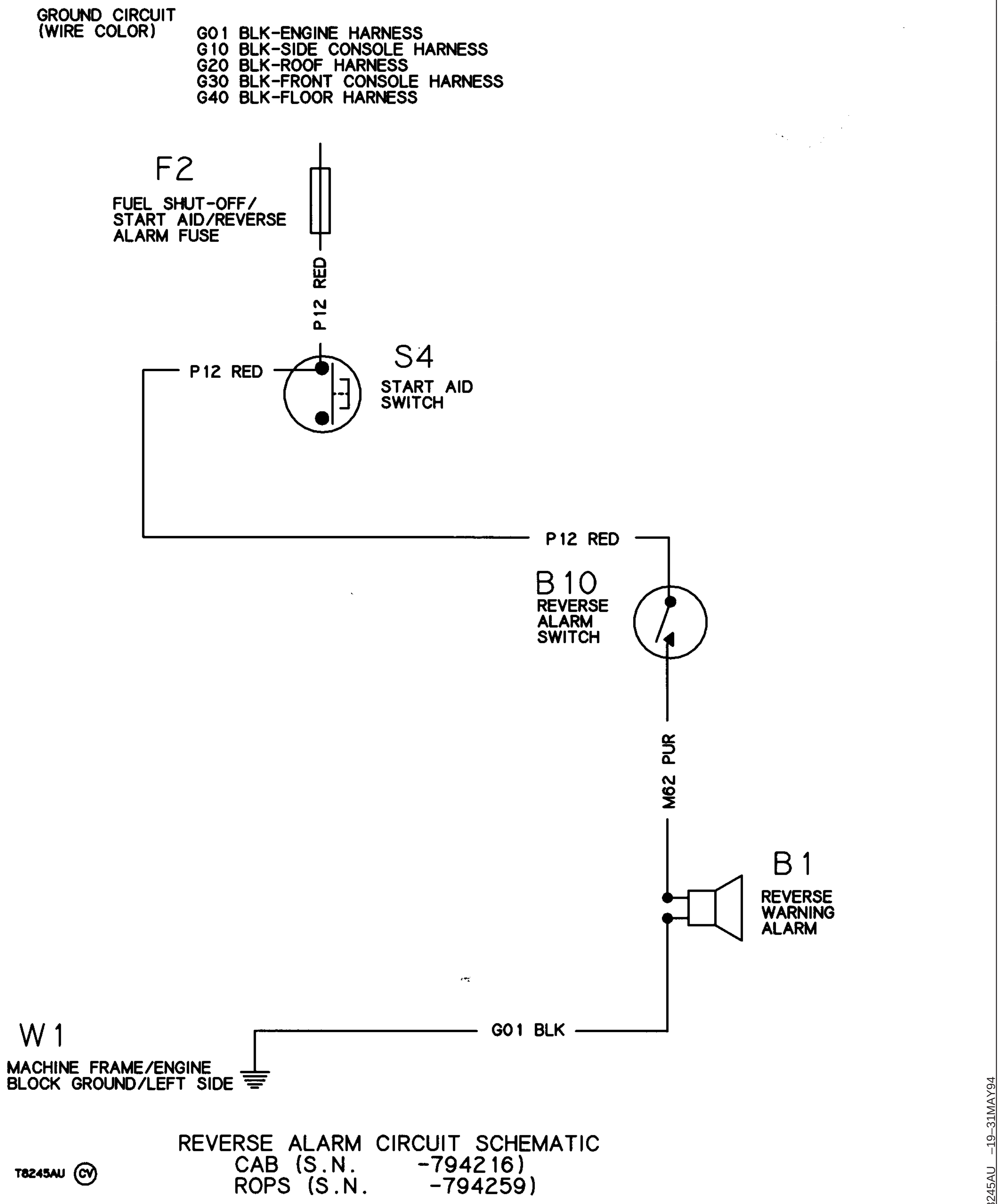
CAB (S.N. —794216) ROPS (S.N. —794259) Power flows from fuel shutoff/start aid/reverse alarm fuse to reverse alarm switch. When FNR lever is moved into reverse the reverse solenoid is activated. Rising pressure closes the reverse alarm switch sending power to activate reverse alarm.

CAB (S.N.794217—) ROPS (S.N.794260—) Power flows from fuel shutoff/start aid/reverse alarm fuse to reverse alarm relay terminal 30. When FNR lever is moved into reverse, power flows through T13 blue wire to terminal 86 of reverse alarm relay , energizing relay. Contacts 30 and 87 are connected sending power to reverse warning alarm. Power is also sent to the reverse solenoid energizing solenoid.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ2698 –19–31AUG95–1/1

Reverse Alarm Circuit Schematic



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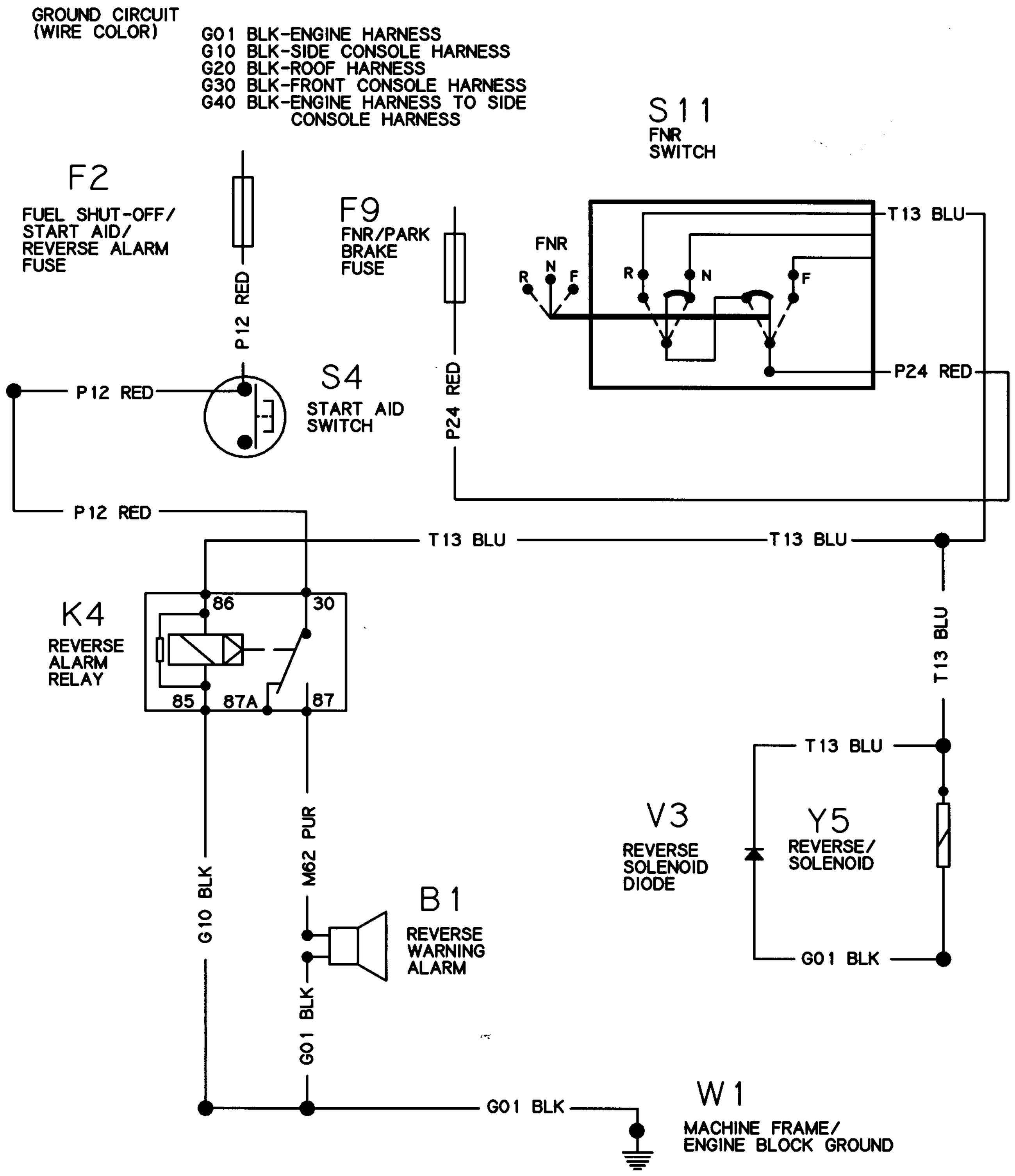
TX,9015,QQ2694 –19–31AUG95–1/2



REVERSE ALARM CIRCUIT SCHEMATIC
CAB (S.N. 794217-)
ROPS (S.N. 794260-)

T8245AV –19–31MAY94

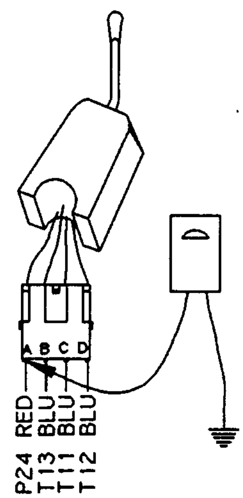
TX,9015,QQ2694 –19–31AUG95–2/2

Reverse Alarm Circuit Diagnostic Procedures

This circuit is powered by the fuel shut-off/start aid/reverse alarm fuse.

– – –1/1

FNR Lever Cab (S.N.794217—)
ROPS(S.N.794260—)



T7199BP –19–02OCT90

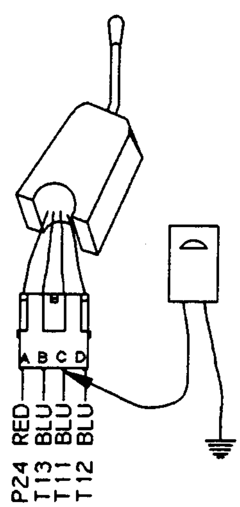
Key switch ON. FNR lever in neutral

With harness connected, check voltage at terminals with P24 red wire and T12 blue wire.

Are 12 volts measured at each terminal?

YES: Go to next step in this check.

NO: Check wiring harness.



T7199BQ –19–02OCT90

Key switch ON.

With harness connected, and FNR lever moved to forward, check voltage at terminal with T11 blue wire.

Move FNR lever to reverse, check voltage at T13 blue wire.

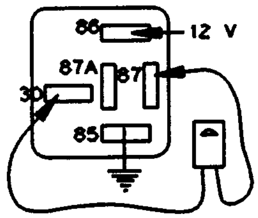
Are 12 volts measured at each terminal?

YES: FNR lever is good. Go to next check.

NO: Replace FNR lever.

– – –1/1

Reverse Alarm Relay Cab (S.N.794217—) ROPS(S.N.794260—)



T7287BH –UN–16AUG90

Key switch OFF.

Disconnect harness from relay.

Connect battery voltage to terminal #86. Ground terminal #85. Does relay click?

Measure continuity between terminals #30 and #87.

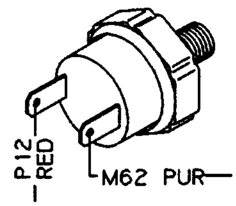
Is continuity measured?

YES: Relay is good. Check wiring harness.

NO: Replace reverse alarm relay.

– – –1/1

Reverse Alarm Switch Cab (S.N.—794216) ROPS(S.N.—794259)



T7199BY –19–16AUG90

Key switch ON.

Remove spade terminals with P12 red wire and M62 purple wire from switch.

Using a jumper wire connect P12 red wire and M62 purple wire.

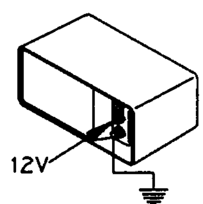
Does reverse alarm sound?

YES: Replace reverse alarm switch.

NO: Reverse alarm switch is good. Go to next check.

– – –1/1

Reverse Alarm



T7199BZ –UN–16AUG90

Disconnect harness from reverse alarm.

Connect battery voltage to reverse warning alarm positive (+) terminal.

Connect jumper wire from reverse warning alarm negative (-) terminal to ground.

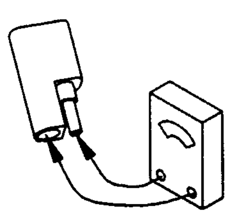
Does reverse alarm sound?

YES: Reverse alarm is good. Check wiring harness.

NO: Replace reverse alarm.

– – –1/1

Reverse Solenoid Diode



T7961AA –UN–10MAR93

Remove diode from connector.

Connect an ohmmeter to diode terminals.

Is continuity measured?

Reverse ohmmeter probes.

Is continuity measured?

YES: If continuity is measured in both checks, diode has failed in a shorted mode. Replace.

NO: If continuity is NOT measured in either check diode has failed in an open mode. Replace.

NO: If continuity is measured in one check and not the other, diode is OK.

– – –1/1

Dome Light Circuit Operational Information

The following conditions must exist for dome light circuit to function:

Key switch in ACC position

TX,9015,QQ1816 –19–12MAR93–1/1

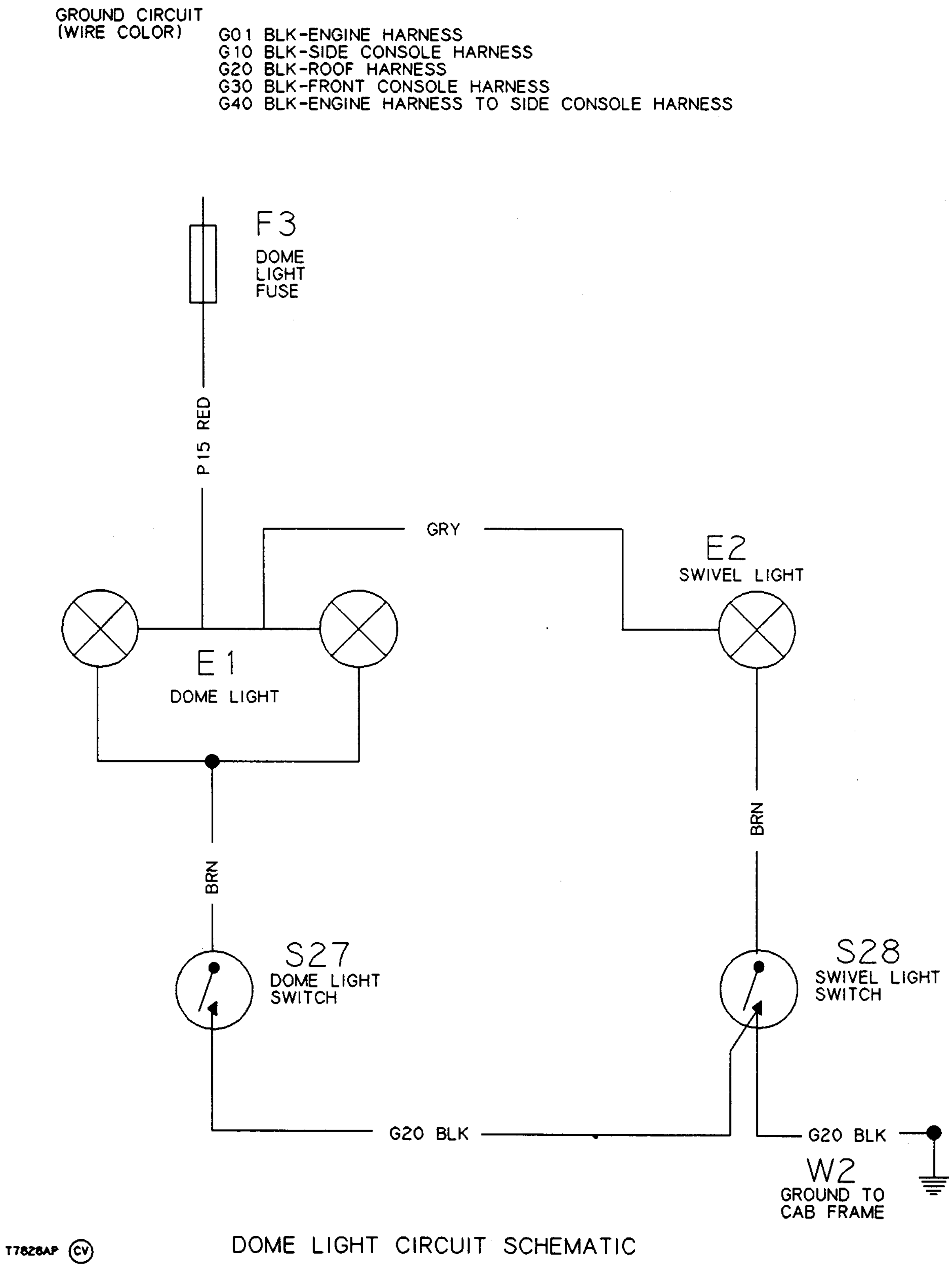
Dome Light Circuit Theory Of Operation

Power from key switch ACC terminal flows through accessory relay, dome light fuse, dome lights, dome light switch, swivel light and swivel light switch. With dome light switch or swivel light switch turned on, contacts close grounding circuit and lights come on.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ1762 –19–12MAR93–1/1

Dome Light Circuit Schematic



DOME LIGHT CIRCUIT SCHEMATIC

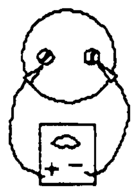
T7828AP –19–23SEP92

TX,9015,QQ1763 –19–12MAR93–1/1

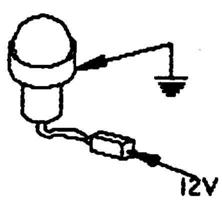
Dome Light Circuit Diagnostic Procedures

This circuit is powered by the dome light fuse

– – –1/1

Dome Light And Swivel Light Switch	 T6622BB –UN–09DEC88 Disconnect harness from switch. Turn dome light/swivel light switch ON. Using a multimeter check continuity at switch terminals for dome and swivel light switch. Does multimeter read continuity?	**YES:** Switch is good. Check wiring harness **NO:** Replace switch.

– – –1/1

Dome And Swivel Light	 T6534DZ –UN–19OCT88 Disconnect harness from light. Connect battery voltage to light terminal. Ground light housing. Does light come on?	**YES:** Light is good. Check wiring harness. **NO:** Replace bulbs or dome/swivel lights.

– – –1/1

Radio Circuit Operational Information

The following condition or conditions must exist for radio circuit to function.

- Key switch in ACC or ON position
- Radio turned ON

TX,9015,QQ1769 –19–12MAR93–1/1

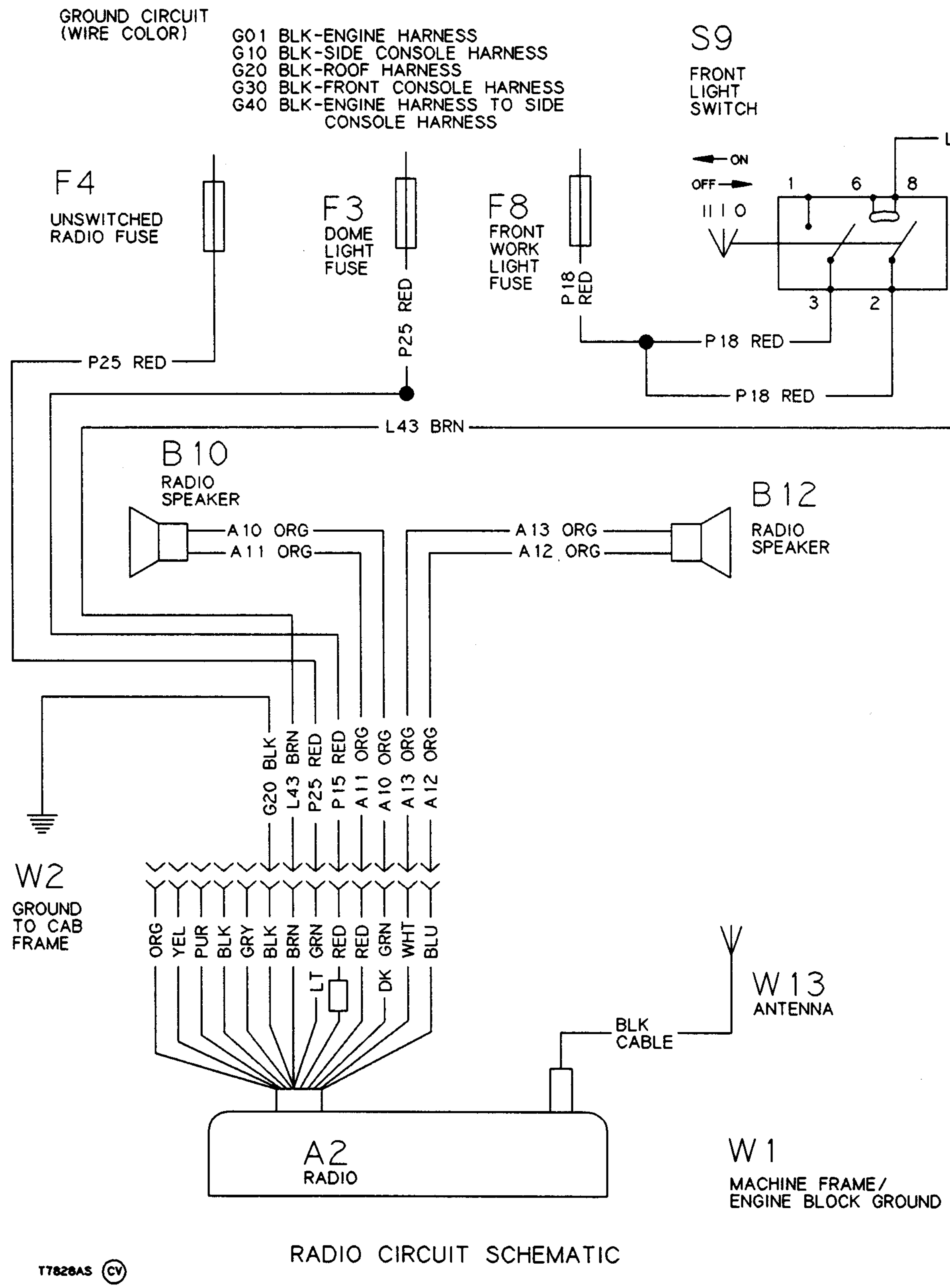
Radio Circuit Theory Of Operation

When key switch is ON or in ACC position of switch, power flows to accessory relay energizing relay. Power is then sent to dome light fuse and front work light fuse. Switched power is sent to radio fuse and radio.

Unswitched power from radio fuse is to maintain station memory. Power from the front work light fuse is for light in radio. Power from the dome light fuse is to power the radio and speakers.

TX,9015,QQ1770 –19–31AUG95–1/1

Radio Circuit Schematic



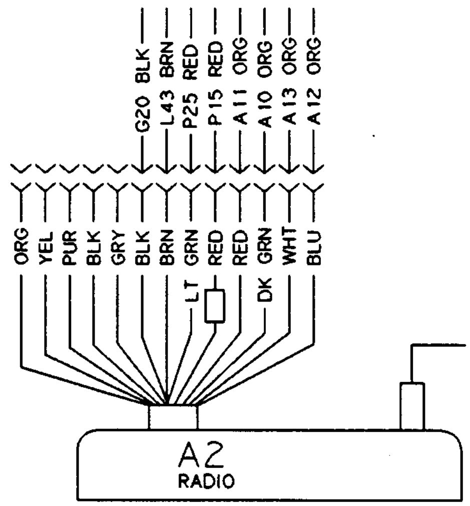
T7828AS –19–23SEP92

TX,9015,QQ1771 –19–12MAR93–1/1

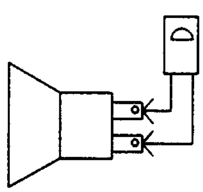
Radio Circuit Diagnostic Procedures

This circuit is powered by the unswitched radio fuse and the dome light fuse.

– – –1/1

Radio	 T7828AT –19–23SEP92 Key switch ON Front work/drive light switch ON Measure 12 volts at wire terminals L43 brown, P25 red and P15 red. Is 12 volts measured at wire terminals?	**YES:** Go to next check. **NO:** Check wiring harness between radio and fuses.

– – –1/1

Radio Speaker	 T7828AU –19–23SEP92 Disconnect harness from radio speaker. Measure resistance between radio speaker terminals. Is 7.3 ohm’s measured?	**YES:** Replace radio. **NO:** Replace speaker

– – –1/1

Wiper/Washer Circuit Operational Information

The following conditions must exist for wiper/washer circuit to function.

- Key switch must be in ON or ACC position.
- Front/rear wiper or washer switch must be turned on.

TX,9015,QQ1817 –19–12MAR93–1/1

Wiper/Washer Circuit Theory Of Operation

Power flows from wiper/washer fuse through wires P14 red to terminal 3 on front wiper switch, terminal 1 of washer switch and terminal 3 of rear wiper switch.

Front wipers on HIGH, power flows through terminal 3 and out terminal 1 to left hand door wiper motor. Power also flows through terminal 4 and out terminal 2 to right hand door wiper motor.

Front wipers on LOW, power flows through terminal 3 and out terminal 5 to left hand door wiper motor. Power also flows through terminal 4 and out terminal 6 to right hand door wiper motor.

Front wiper in PARK position, power flows through P14 red wire to right hand door wiper motor, through A69 orange wire to terminal 8 of front wiper switch, out terminal 6 of front wiper switch through A63 orange wire to right hand door wiper motor and to ground by G20 black wire. Power also flows through P14 red wire to left hand door wiper motor, through A68 orange wire to terminal 7 of front wiper switch, out terminal 5 through A61 orange wire to left hand door wiper motor and to ground by G20 black wire.

Rear wiper in HIGH position, power flows from rear wiper switch terminal 1 through A66 orange wire to rear wiper motor.

Rear wiper in LOW position, power flows from rear wiper switch terminal 5 through A65 orange wire to rear wiper motor.

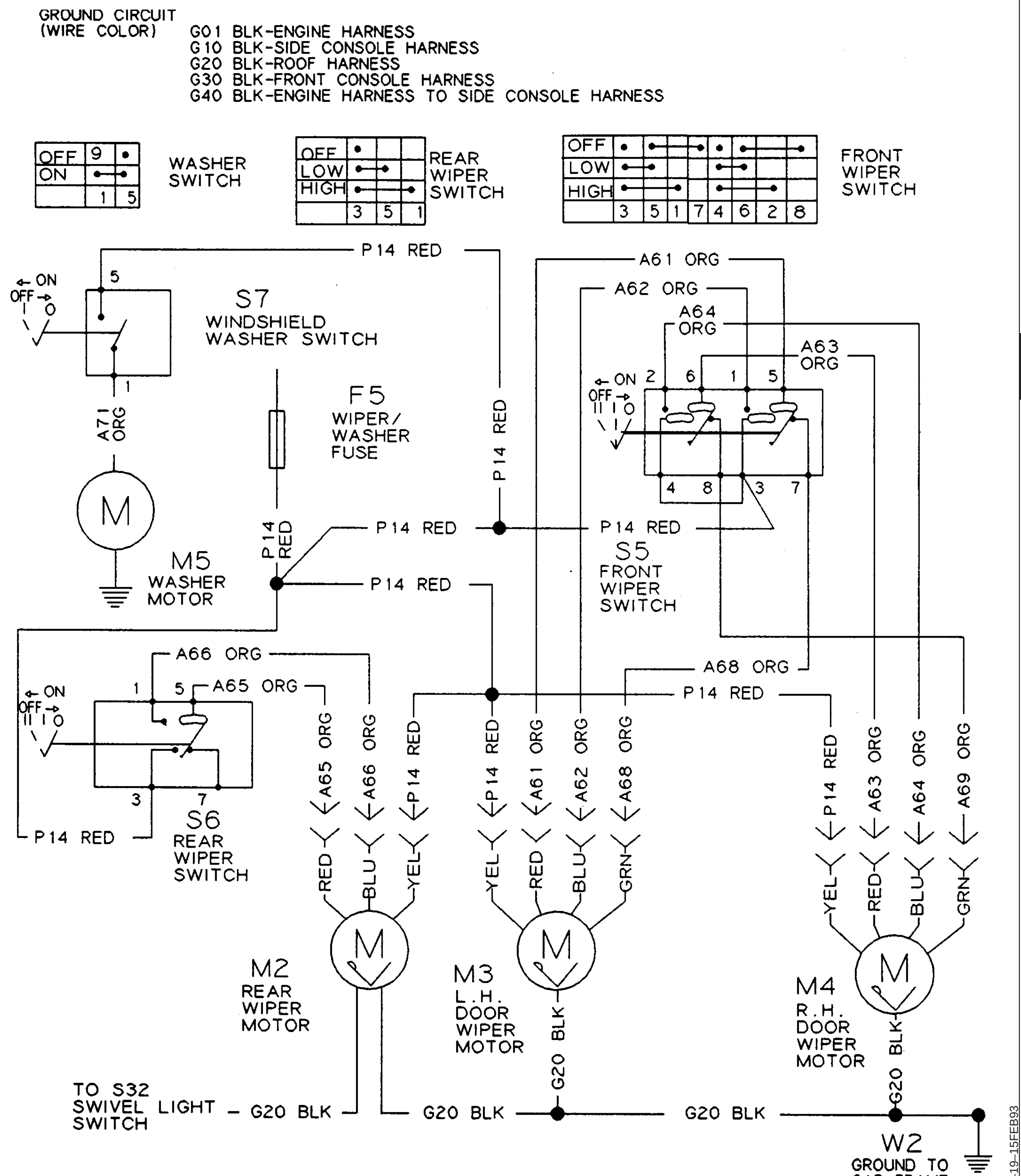
Rear wiper in PARK position, power flows through P14 red to rear wiper motor deactivating a switch in rear wiper motor putting wiper in park position.

Washer: Power flows from 15 amp wiper/washer fuse to terminal 5 of washer switch. With washer switch pushed in power flows from terminal 1 to washer motor, activating pump.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ1764 –19–12MAR93–1/1

Wiper/Washer Circuit Schematic



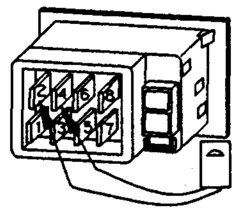
WIPER AND WASHER CIRCUIT SCHEMATIC

TX,9015,QQ1974 –19–16MAR93–1/1

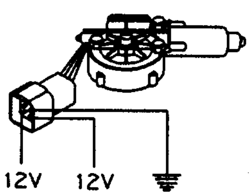
Wiper/Washer Circuit Diagnostic Procedures

This circuit is powered by the wiper/washer fuse.

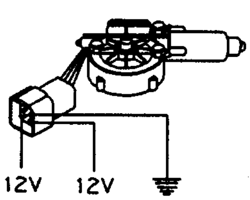
– – –1/1

Front Wiper Switch	 T7199CA –UN–02OCT90 Wiper switch ON. Disconnect harness from front wiper switch. Measure for continuity between terminals 2 and 4, 6 and 8, 1 and 3, and 5 and 7. Is continuity measured?	**YES:** Front wiper switch is good. Go to next check. **NO:** Replace front wiper switch.

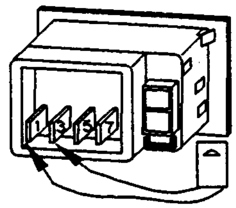
– – –1/1

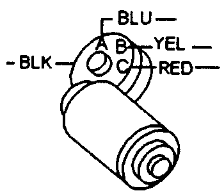
Wiper Motor LH Door And RH Door—Low Speed	 T7199CB –UN–17SEP90 Disconnect harness from wiper motor. Connect battery voltage to terminal with red wire and yellow wire. Ground terminal with black wire. Does motor run in LOW speed? Remove voltage from terminal with red wire, and connect red and green wire together using a jumper wire. Does motor run until blade reaches PARK position?	**YES:** Go to next check. **NO:** Replace wiper motor.

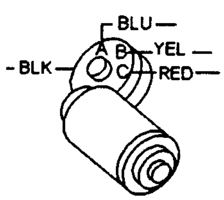
– – –1/1

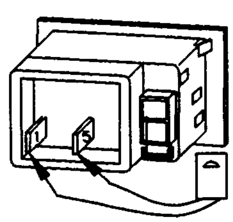
Wiper Motor LH Door And RH Door—High Speed	 T7199CB –UN–17SEP90 Disconnect harness from wiper motor. Connect battery voltage to terminal with blue wire and yellow wire. Ground terminal with black wire. Does motor run in HIGH speed? Remove voltage from terminal with blue wire, and connect blue and green wires together using a jumper wire. Does motor run until blade reaches PARK position?	**YES:** Wiper motor is good. Check wiring harness. **NO:** Replace wiper motor.

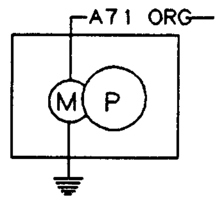
– – –1/1

Rear Wiper Switch	 T7199CC –UN–02OCT90	Wiper switch ON. Disconnect harness from rear wiper switch. Using a multimeter measure for continuity between terminals 1 and 3, and 5 and 7. Is continuity measured?	**YES:** Rear wiper switch is good. Go to next check. **NO:** Replace rear wiper switch. – – –1/1

Rear Wiper Motor—Low Speed	 T7199CD –19–16AUG90	Disconnect harness from wiper motor. Connect battery voltage to terminal with red wire and yellow wire. Ground terminal with black wire. Does motor run in LOW speed? Remove voltage from terminal with red wire. Does motor run until blade reaches PARK position?	**YES:** Go to next check. **NO:** Replace wiper motor. – – –1/1

Rear Wiper Motor—High Speed	 T7199CD –19–16AUG90	Disconnect harness from wiper motor. Connect battery voltage to terminal with blue wire and yellow wire. Ground terminal with black wire. Does motor run in HIGH speed? Remove voltage from terminal with blue wire. Does motor run until blade reaches PARK position?	**YES:** Wiper motor is good. Check wiring harness. **NO:** Replace wiper motor. – – –1/1

Washer Switch	 T7199CE –UN–02OCT90	Washer switch ON. Disconnect harness from washer switch. Using a multimeter measure continuity between terminals 1 and 5. Is continuity measured?	**YES:** Washer switch is good. Go to next check. **NO:** Replace washer switch. – – –1/1

Windshield Washer Motor	 T7199CF –19–16AUG90	Disconnect harness from washer motor. Connect battery voltage to terminal with S71 orange wire. Ground motor. Does motor run and operate the pump?	**YES:** Washer motor is good. Check wiring harness. **NO:** Replace washer motor.

– – –1/1

Blower Circuit Operational Information

9015
15
72

The following conditions must exist for blower circuit to function:

- Key switch in ON or ACC position
- Blower switch turned ON

TX,9015,QQ1818 –19–17JUN94–1/1

Blower Circuit Theory Of Operation

Power from heater circuit breaker goes to blower switch. With blower switch in low position power is sent to blower resistor. Voltage goes through complete resistor and is reduced to 3.0—3.5 volts, blower motor runs in low speed.

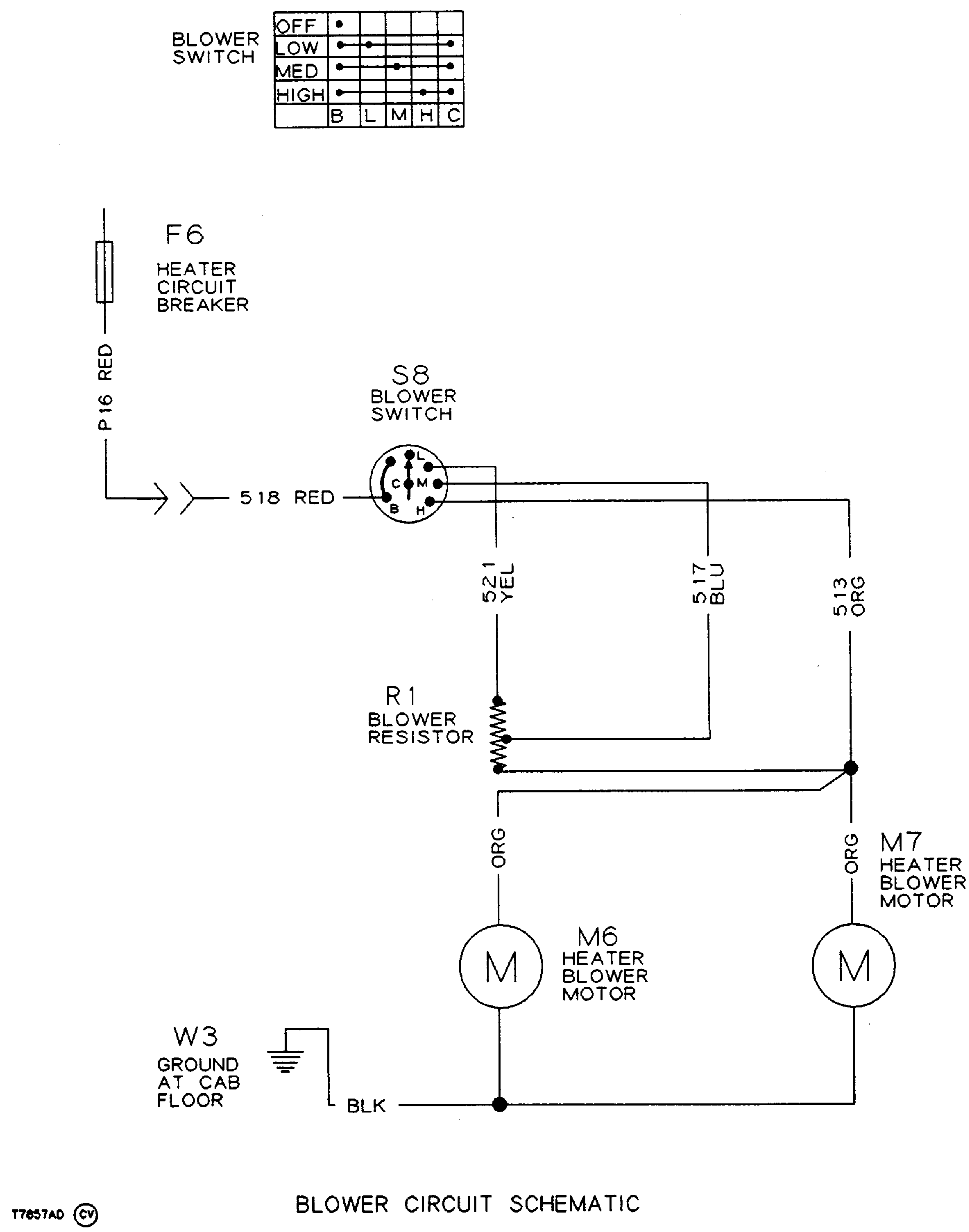
With blower switch in medium position power is sent through half the blower resistor and is reduced to 6.0—6.5 volts, blower motor runs in medium speed.

With blower switch in high position power by-passes resistor and 12 volts is applied to blower motor, causing it to run at high speed.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ1766 –19–17JUN94–1/1

Blower Circuit Schematic



BLOWER CIRCUIT SCHEMATIC

T7857AD –19–30SEP92

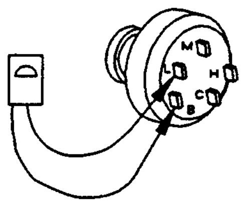
TX,901515,QQ809 –19–17JUN94–1/1

Blower Circuit Diagnostic Procedures

This circuit is powered by the heater circuit breaker.

– – –1/1

Blower Switch



T7199CL –UN–17SEP90

Disconnect harness from blower switch.

Use a multimeter and check for continuity.

Move blower switch to LOW, MEDIUM and HIGH checking terminals B and L, B and M, and B and H.

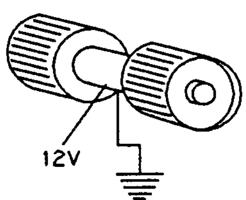
Is continuity measured?

YES: Blower switch is good.

NO: Replace blower switch.

– – –1/1

Heater Blower Motor



T7199CM –UN–16AUG90

Disconnect harness from heater blower motor.

Connect 12 volts to heater blower motor, and ground motor.

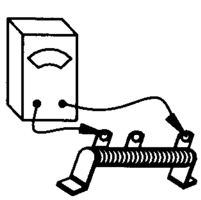
Does heater blower motor operate?

YES: Heater blower motor is good. Check wiring harness.

NO: Replace heater blower motor.

– – –1/1

Blower Resistor Check



T8134AK –UN–03DEC93

Disconnect harness from resistor.

Connect ohmmeter to outer terminals of resistor.

Does ohmmeter read continuity?

YES: Resistor is OK. Check harness and blower motor.

NO: Blower resistor has failed. Replace.

– – –1/1

Drive And Work Light Circuit Operational Information

The following conditions must exist for drive and work lights to function:

- Key switch in ON or ACC
- Front light switch and/or rear light switch in ON position

TX,9015,QQ1820 –19–12MAR93–1/1

Drive And Work Light Circuit Theory Of Operation

Power flows from front work light fuse to terminal 3 and terminal 2 of front light switch.

With front light switch in the first position, power flows from terminal 8 of front light switch to make the front drive lights, and tail lights come on.

With front light switch in the second position, power flows from terminal 8 and terminal 1 of front light switch to make the front drive lights, tail lights, and front work lights come on.

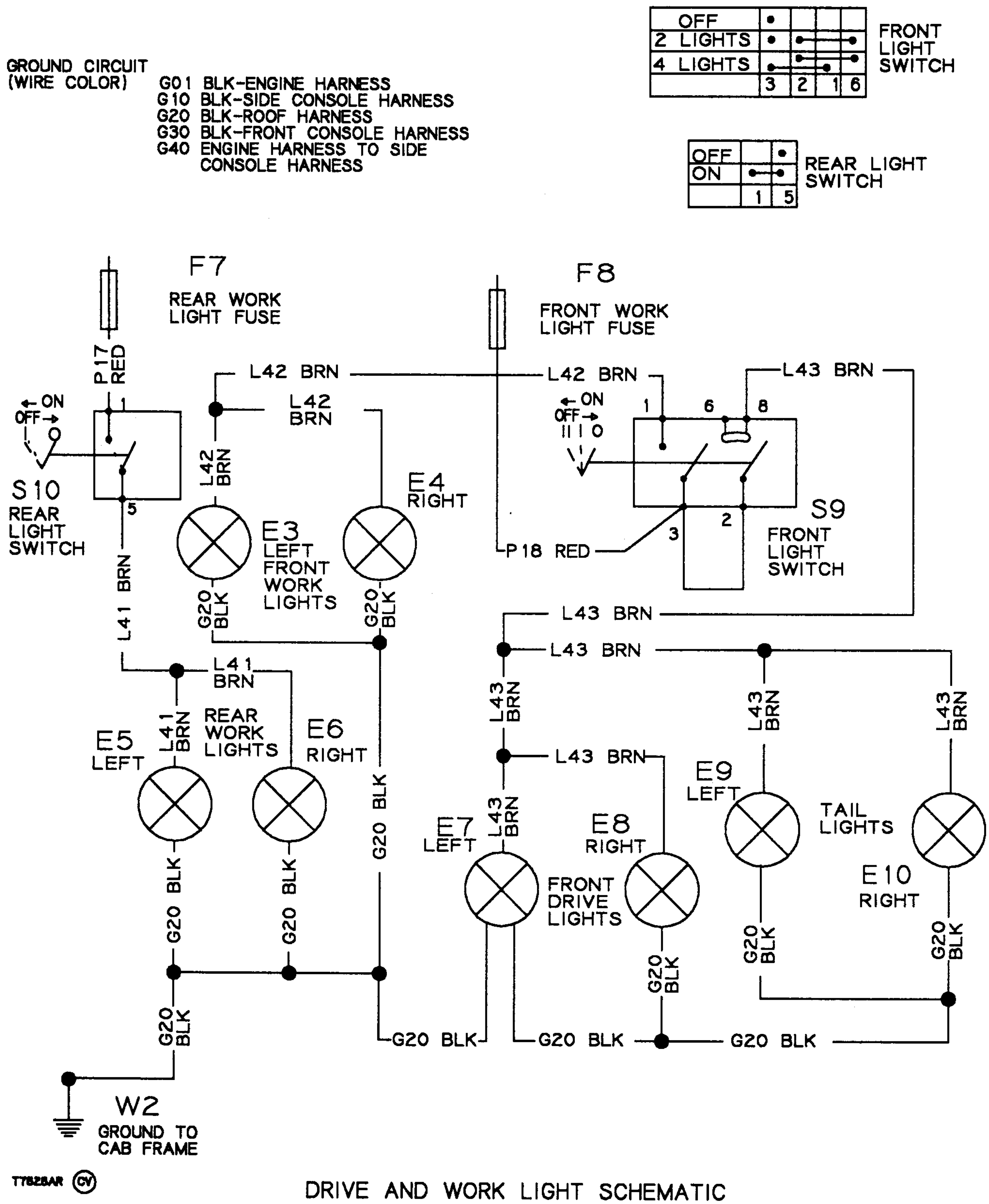
Rear work lights, power flows from rear work light fuse to terminal 1 of rear light switch.

With rear light switch in the first position, power flows from terminal 5 of rear light switch to make rear work lights come on.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ1767 –19–12MAR93–1/1

Drive And Work Light Circuit Schematic



T7828AR –19–23SEP92

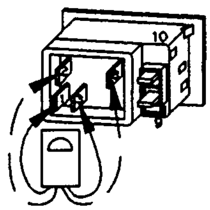
TX,9015,QQ1768 –19–12MAR93–1/1

Drive And Work Light Circuit Diagnostic Procedures

This circuit is powered by the front work and drive light fuse, and the rear work light fuse.

– – –1/1

Front Light Switch



T7199CN –UN–16AUG90

Disconnect harness from front light switch.

Light switch ON.

Measure for continuity between terminals 3 and 1, and 2 and 8.

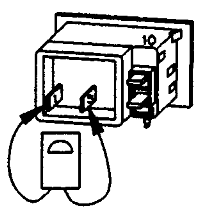
Is continuity measured?

YES: Front light switch is good. Check wiring harness.

NO: Replace switch.

– – –1/1

Rear Light Switch



T7199CO –UN–16AUG90

Disconnect harness from rear light switch.

Light switch ON.

Measure for continuity between terminals 1 and 5.

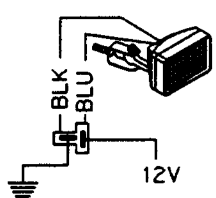
Is continuity measured?

YES: Rear light switch is good. Check wiring harness.

NO: Replace switch.

– – –1/1

Work/Drive Light



T7199CP –UN–17SEP90

Disconnect harness from work/drive light.

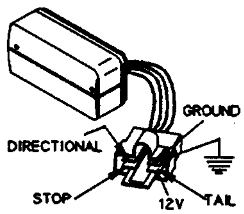
Connect 12 volts to blue wire and ground black wire.

Does light come ON?

YES: Work light is good. Check wiring harness.

NO: Replace bulb. If bulb is good replace light.

– – –1/1

Tail Light	 T7199CQ –19–02OCT90 Disconnect harness from turn/tail/brake light. Connect 12 volts to terminal marked TAIL, and ground terminal marked GROUND. Does tail light come on?	**YES:** Tail light is good. Check wiring harness. **NO:** Replace bulb. If bulb is good replace light.

– – –1/1

Park Brake/Clutch Disconnect Circuit Specifications

	Specification
Reverser Switch (S.N. —778668) (Normally Open)—Closes on Increasing Pressure	345—621 kPa (3.45—6.21 bar) (50—90 psi)
Opening Pressure	103—345 kPa (1.03—3.45 bar) (15—50 psi)

TX,9015,QQ2746 –19–31AUG95–1/1

Park Brake/Clutch Disconnect Circuit Operational Information

The following condition or conditions must exist for park brake/clutch disconnect circuit to function:

- Key switch OFF
- Park brake dash switch in ON position with machine running
- Machine Mechanically Shut Down
- Reverser pressure

TX,901515,QQ575 –19–07DEC90–1/1

Park Brake/Clutch Disconnect Circuit Theory Of Operation

The Park Brake/Clutch Disconnect Circuit consists of FNR/park brake fuse, park brake dash switch, park brake latching relay, FNR switch, loader lever switch, gear shift lever switch, park brake solenoid, clutch disconnect solenoid, reverser pressure switch, park light relay and park brake sensing switch.

NOTE: The park brake applies automatically when machine is mechanically shut down or when key switch is turned off. Park brake dash switch must be cycled first to applied position (ON), then to released position (OFF) before park brake can be released when engine is running.

Key OFF:

Park brake cannot be hydraulically released if there is a blown fuse or key switch is OFF.

Key ON: Park Brake Dash Switch in ON Position. FNR Lever in Neutral:

Power flows from terminal 1 to terminal 6 of park brake dash switch and then to park brake latching relay terminal 85, energizing relay K5 causing it to latch terminals 30 and 87. Ground is supplied to the park brake latching relay through the reverser pressure switch. Power is disconnected from park brake solenoid, and clutch disconnect solenoid de-energizing solenoids. This applies the park brake and puts the reverser in neutral. When the park brake is applied the park brake sensing switch closes providing a ground for the park brake dash switch light.

NOTE: For (S.N. —778824)—ground is supplied to the park brake latching relay through the reverser switch.

For (S.N.778669—)—ground is supplied to the park brake latching relay from the "S" terminal of the starter motor.

Key ON: Park Brake Dash Switch in ON position. FNR Lever Shifted Out of Neutral:

With the park brake dash switch ON, and the FNR lever shifted out of neutral the park light relay K3 is de-energized connecting terminals 30 and 87A causing red light and alarm to come ON.

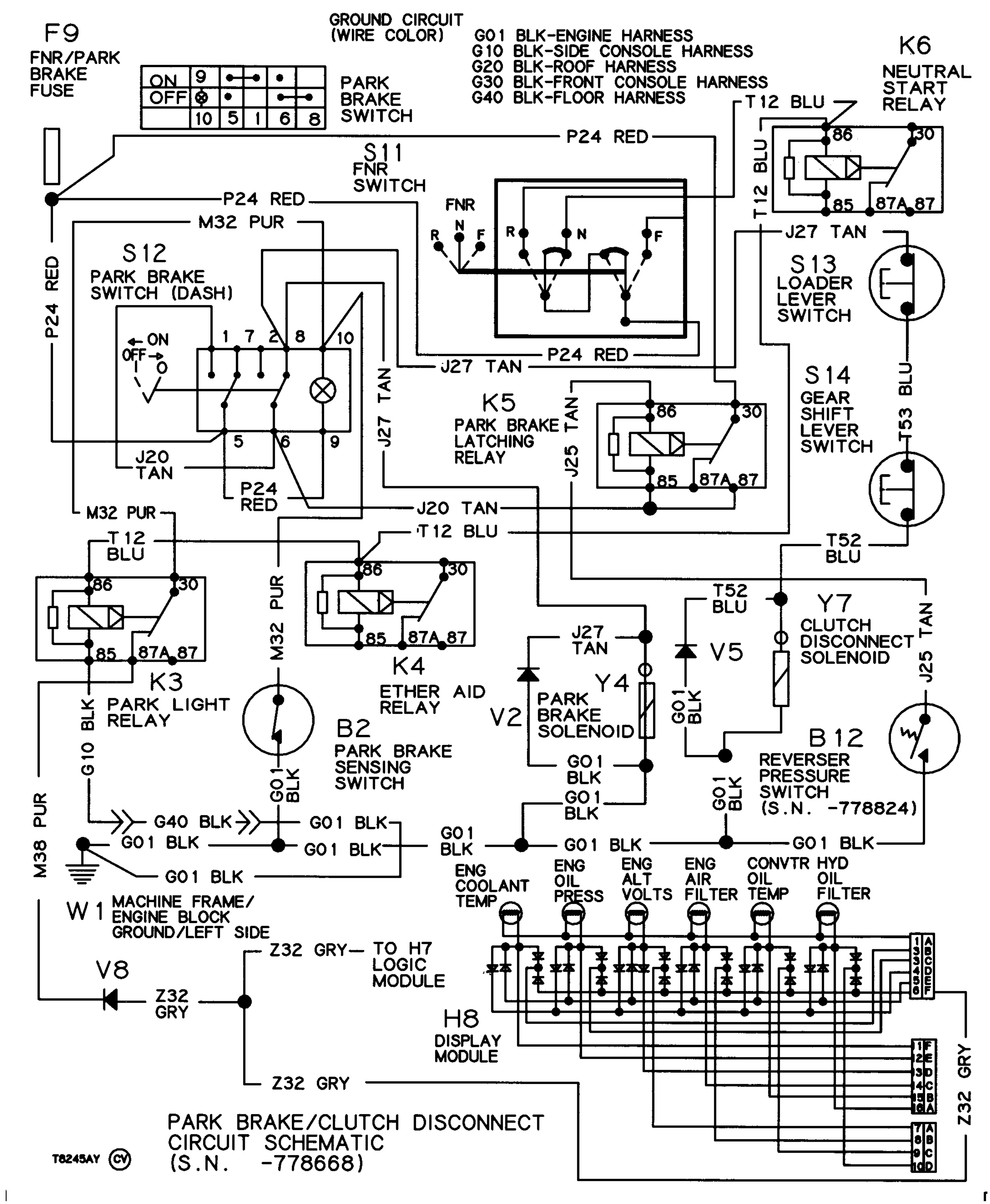
Key ON: Engine running.

With machine mechanically shut down the reverser pressure switch opens a contact removing ground for park brake latching relay, de-energizing park brake latching relay connecting terminals 30 and 87A. Power is then removed from terminals 6 and 8 of park brake dash switch, de-energizing park brake solenoid and clutch disconnect solenoid. Park brake is applied.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

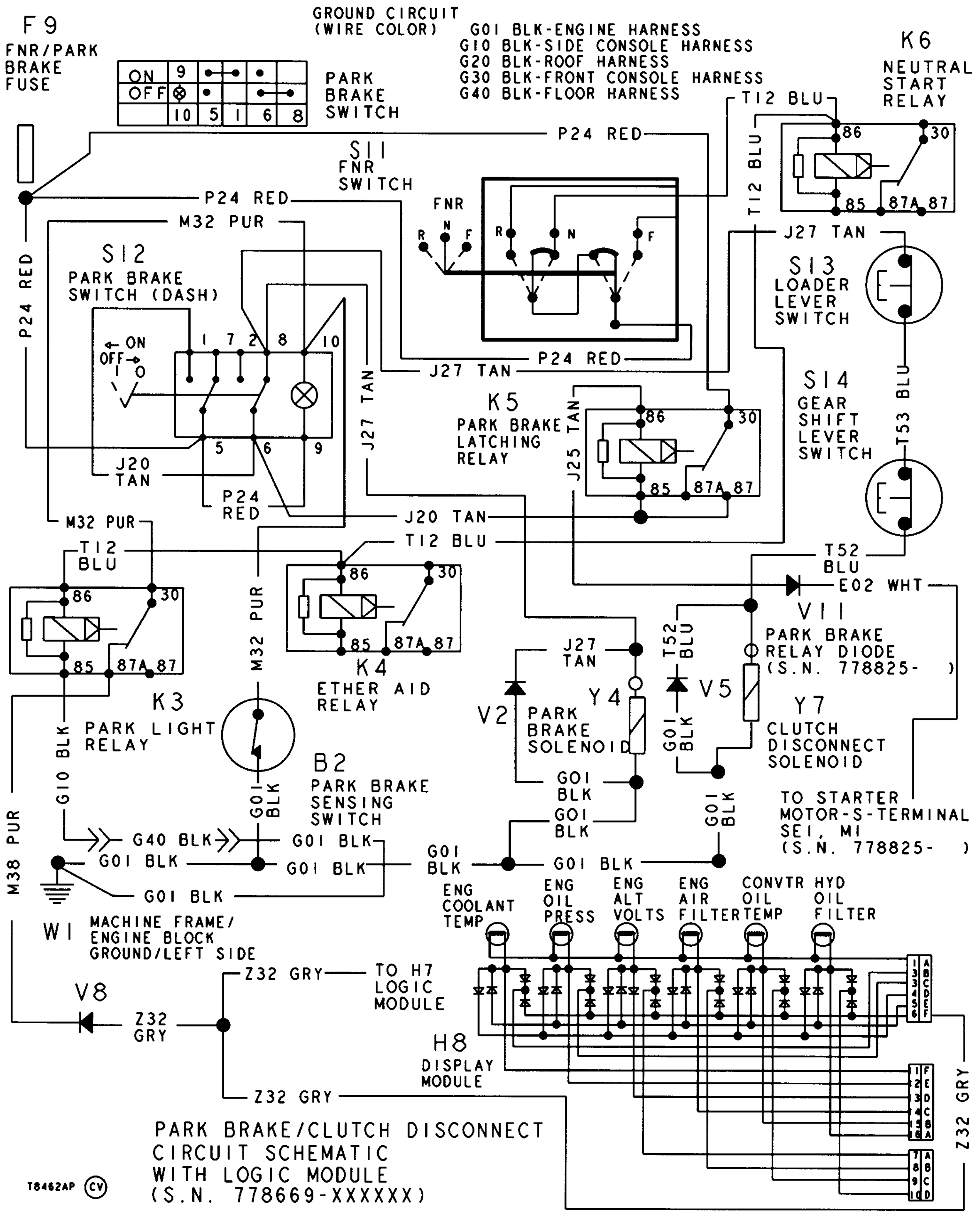
TX,9015,QQ2705 –19–31AUG95–1/1

Park Brake/Clutch Disconnect Circuit Schematic



Continued on next page

TX,9015,QQ2701 –19–31AUG95–1/3

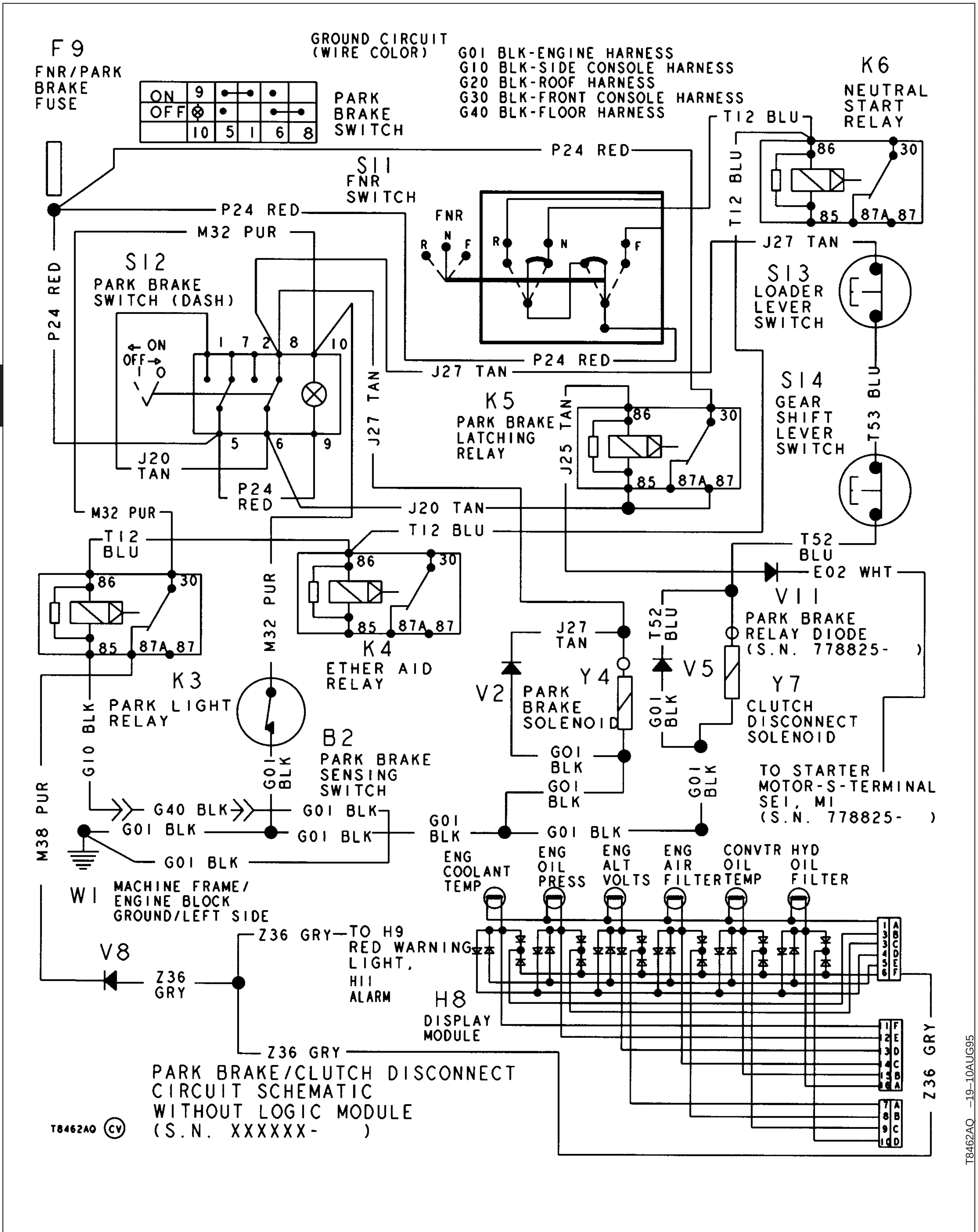


PARK BRAKE/CLUTCH DISCONNECT CIRCUIT SCHEMATIC WITH LOGIC MODULE (S.N. 778669-XXXXXX)

T8462AP –19–10AUG95

Continued on next page

TX,9015,QQ2701 –19–31AUG95–2/3



PARK BRAKE/CLUTCH DISCONNECT CIRCUIT SCHEMATIC WITHOUT LOGIC MODULE (S.N. XXXXXX-)

T8462AQ –19–10AUG95

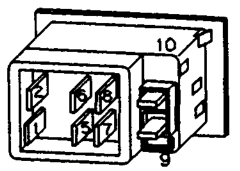
TX,9015,QQ2701 –19–31AUG95–3/3

Park Brake/Neutral Disconnect Circuit Diagnostic Procedures

This circuit is powered by FNR/park brake fuse.

– – –1/1

Park Brake Switch—Dash



T7199CS –UN–16AUG90

Disconnect harness from park brake switch.

Park brake switch OFF.

Check for continuity between terminals 5 and 7, and 6 and 8.

Is continuity measured?

Park brake switch ON.

Check for continuity between terminals 5 and 1, and 6 and 2.

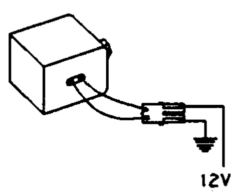
Is continuity measured?

YES: Park brake switch is good. Check wiring harness.

NO: Replace park brake switch.

– – –1/1

Park Brake Solenoid



T7199CT –UN–16AUG90

CAUTION: Solenoid may be damaged if voltage is applied to connector terminal A with black wire.

Key switch OFF.

Disconnect harness from park brake solenoid.

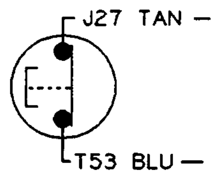
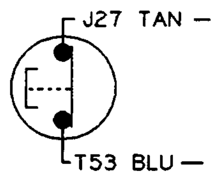
Connect battery voltage to solenoid connector terminal B with red wire and ground connector terminal A with black wire.

Does solenoid click?

YES: Solenoid is good. Check wiring harness.

NO: Replace solenoid.

– – –1/1

Loader Lever Switch	 T7199CU –19–02OCT90	Disconnect harness from loader lever switch Check for continuity between terminals with J27 tan wire and T53 blue wire. Is continuity measured?	**YES:** Go to next step in this check **NO:** Replace loader lever switch.
	 T7199CU –19–02OCT90	Disconnect harness from loader lever switch Depress loader lever switch and check for continuity between terminals with J27 tan wire and T53 blue wire. Is continuity measured?	**YES:** Replace loader lever switch. **NO:** Loader lever switch is good. Check wiring harness. – – –1/1

9015
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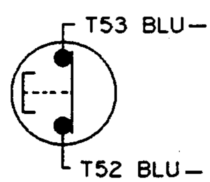
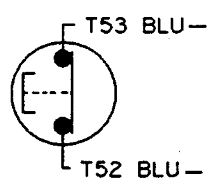
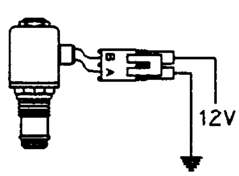
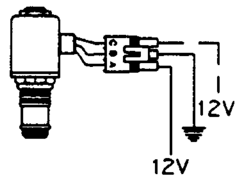
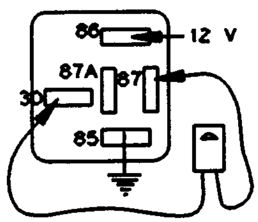
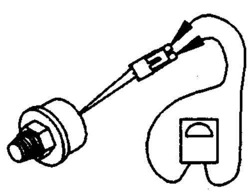
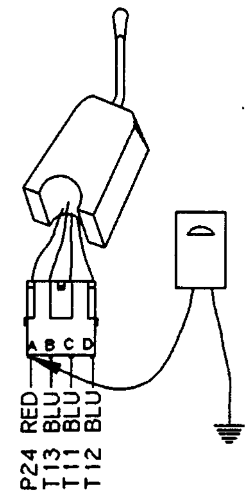
84

Gear Shift Lever Switch	 T7199CV –19–02OCT90	Disconnect harness from gear shift lever switch. Check for continuity between terminals with T53 blue wire and T52 blue wire. Is continuity measured?	**YES:** Go to next step in this check. **NO:** Replace gear shift lever switch.
	 T7199CV –19–02OCT90	Disconnect harness from gear shift lever switch. Depress gear shift lever switch and check for continuity between terminals with T53 blue wire and T52 blue wire. Is continuity measured?	**YES:** Replace gear shift lever switch. **NO:** Gear shift lever switch is good. Check wiring harness. – – –1/1

Clutch Disconnect Solenoid	 T7938AL –UN–24FEB93	Key switch OFF. Disconnect harness from clutch disconnect solenoid. Connect battery voltage to solenoid terminal B, and ground terminal A. Does solenoid click?	**YES:** Solenoid is good. Check wiring harness. **NO:** Replace solenoid. – – –1/1

Forward/Reverse Solenoid	 T7938AK –UN–24FEB93	Key switch OFF. Disconnect harness from forward/reverse solenoid. Connect battery voltage to solenoid terminal A, and ground terminal B. Does solenoid click? Connect battery voltage to solenoid terminal C, and ground terminal B. Does solenoid click?	**YES:** Solenoid is good. Check wiring harness. **NO:** Replace solenoid. – – –1/1
Park Brake Latching Relay	 T7287BH –UN–16AUG90	Key switch OFF. Disconnect harness from relay. Connect battery voltage to terminal #86. Ground terminal #85. Does relay click? Measure continuity between terminals #30 and #87. Is continuity measured?	**YES:** Relay is good. Check wiring harness. **NO:** Replace relay. – – –1/1
Reverser Pressure Switch (S.N. —778668)	 T7199EE –UN–02OCT90	Disconnect harness from switch. Measure continuity between terminals A and B on connector end of switch. Is continuity measured?	**YES:** Replace switch. **NO:** Switch is good. Check wiring harness. – – –1/1

FNR Lever



T7199BP –19–02OCT90

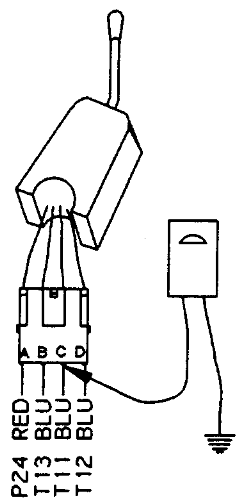
Key switch ON. FNR lever in neutral

With harness connected, check voltage at terminals with P24 red wire and T12 blue wire.

Are 12 volts measured at each terminal?

YES: Go to next step in this check.

NO: Check wiring harness.



T7199BQ –19–02OCT90

Key switch ON.

With harness connected, and FNR lever moved to forward, check voltage at terminal with T11 blue wire.

Move FNR lever to reverse, check voltage at T13 blue wire.

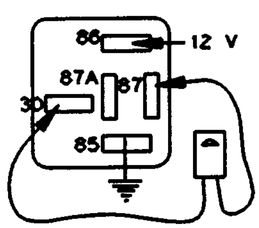
Are 12 volts measured at each terminal?

YES: FNR lever is good. Go to next check.

NO: Replace FNR lever.

– – –1/1

Park Light Relay



T7287BH –UN–16AUG90

Key switch OFF.

Disconnect harness from relay.

Connect battery voltage to terminal #86. Ground terminal #85.

Does relay click?

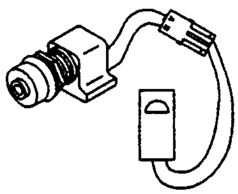
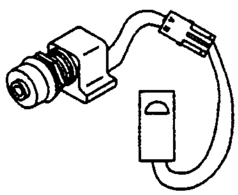
Measure continuity between terminals #30 and #87.

Is continuity measured?

YES: Relay is good. Check wiring harness.

NO: Replace relay.

– – –1/1

Park Brake Sensing Switch	 T7199CX –UN–16AUG90	Key switch OFF. Disconnect harness from switch connector. Measure for continuity. Is continuity measured?	**YES:** Go to next step in this check. **NO:** Replace park brake sensing switch.
	 T7199CX –UN–16AUG90	Key switch OFF. Disconnect harness from switch connector. Depress switch actuator (spring pin). Measure for continuity. Is continuity measured?	**YES:** Replace park brake sensing switch. **NO:** Park brake sensing switch is good. Check wiring harness. – – –1/1

9015
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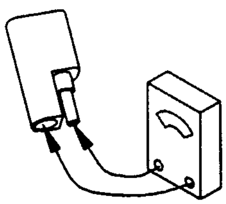
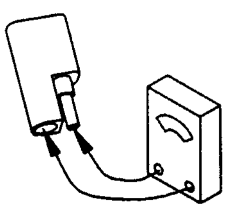
87

Park Brake Relay Diode	 T7961AA –UN–10MAR93	Remove diode from connector. Connect an ohmmeter to diode terminals. Is continuity measured? Reverse ohmmeter probes. Is continuity measured?	**YES:** If continuity is measured in both checks, diode has failed in a shorted mode. Replace. **NO:** If continuity is NOT measured in either check diode has failed in an open mode. Replace. **NO:** If continuity is measured in one check and not the other, diode is OK. – – –1/1

Clutch Disconnect Solenoid	 T7961AA –UN–10MAR93	Remove diode from connector. Connect an ohmmeter to diode terminals. Is continuity measured? Reverse ohmmeter probes. Is continuity measured?	**YES:** If continuity is measured in both checks, diode has failed in a shorted mode. Replace. **NO:** If continuity is NOT measured in either check diode has failed in an open mode. Replace. **NO:** If continuity is measured in one check and not the other, diode is OK. – – –1/1

Horn Circuit Operational Information

The following conditions must exist for horn circuit to function:

- Key switch must be in ON or ACC position
- Horn switch must be depressed

TX,9015,QQ1821 –19–12MAR93–1/1

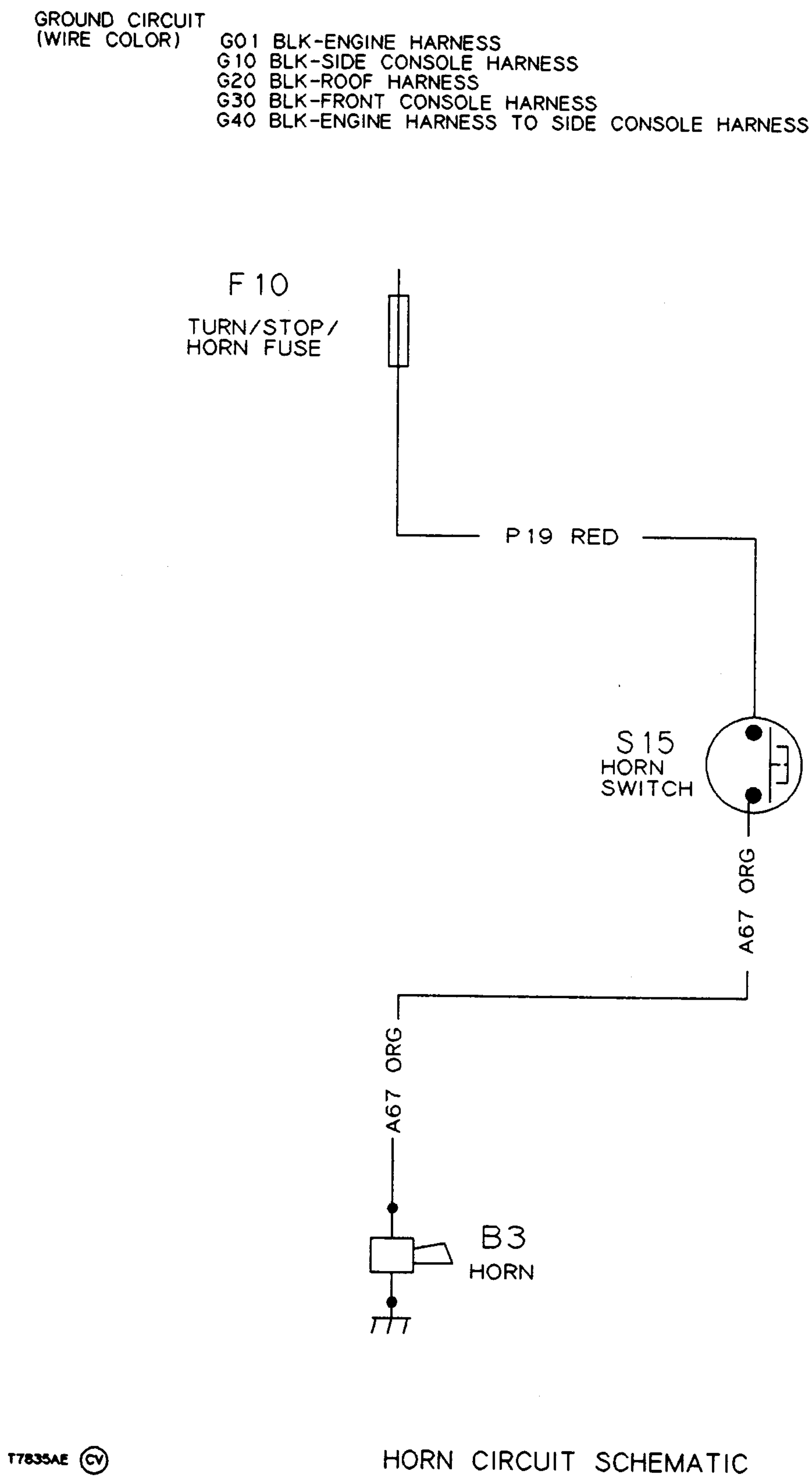
Horn Circuit Theory Of Operation

Power flows from turn/stop/horn fuse to horn switch. When horn button is pushed, switch closes and power flows to activate horn.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ1786 –19–12MAR93–1/1

Horn Circuit Schematic



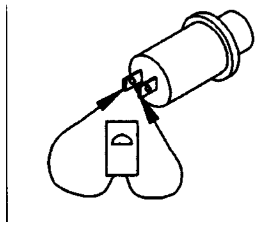
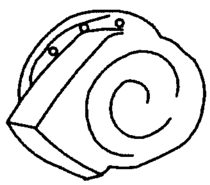
T7835AE –19–23SEP92

TX,9015,QQ1787 –19–12MAR93–1/1

Horn Circuit Diagnostic Procedures

This circuit is powered by the turn/stop/horn fuse.

– – –1/1

Horn Switch	 T7199CY –UN–16AUG90	Disconnect harness from horn switch. Push horn switch and measure for continuity. Is continuity measured?	**YES:** Horn switch is good. **NO:** Replace horn switch. – – –1/1
Horn	 T6573AO –UN–23AUG93	Key switch OFF. Disconnect harness from horn. Connect battery voltage to horn (+) positive terminal. Ground horn body. Does horn sound?	**YES:** Horn is good. Check wiring harness. **NO:** Replace horn. – – –1/1

Turn Signal, Flasher And Brake Light Circuit Operational Information

The following conditions must exist for turn signal, flasher and brake light circuit to function:

Key switch in ON position

TX,9015,QQ1822 –19–12MAR93–1/1

Turn Signal, Flasher And Brake Light Circuit Theory Of Operation

Power flows from turn/stop/horn fuse, to terminal 8 of 4-way flasher switch. With 4-way flasher switch in OFF position power flows from terminal 6 to terminal 5 of turn signal switch. Power also flows from unswitched hazard/monitor fuse to terminal 2 of 4-way flasher switch. Power flows from terminal 6 of 4-way flasher switch to flasher energizing flasher.

Turn Signal:

With power on terminal 5 of turn signal switch and turn signal switch turned left, pulsing power is sent from flasher through L49 brown wires to terminal 6 of turn signal switch and out terminal 7 to left turn lights and left turn indicator light making them flash. Power is also sent out terminal 3 of turn signal switch lighting up right turn lights and right turn indicator light.

With power on terminal 5 of turn signal switch and turn signal switch turned right, pulsing power is sent from flasher through L49 brown wires to terminal 6 of turn signal switch and out terminal 3 to right turn lights and right turn indicator light making them flash. Power is also sent out terminal 7 of turn signal switch lighting up left turn lights and left turn indicator light.

4-Way Flasher:

With 4-way flasher in the ON position and power on terminal 2, power flows out terminal 6 of 4-way flasher switch to flasher, energizing flasher. Pulsing power is sent from flasher through L49 brown wire to terminal 5 of 4-way flasher switch and out terminals 1 and 3. Pulsing power is sent to left and right turn lights and indicator lights, making them flash.

Continued on next page

TX,9015,DY370 –19– 3JUN96–1/2

NOTE: P23 red wire when installed into terminal number (2) of flasher and P19 red wire removed, the flasher will work with key switch OFF.

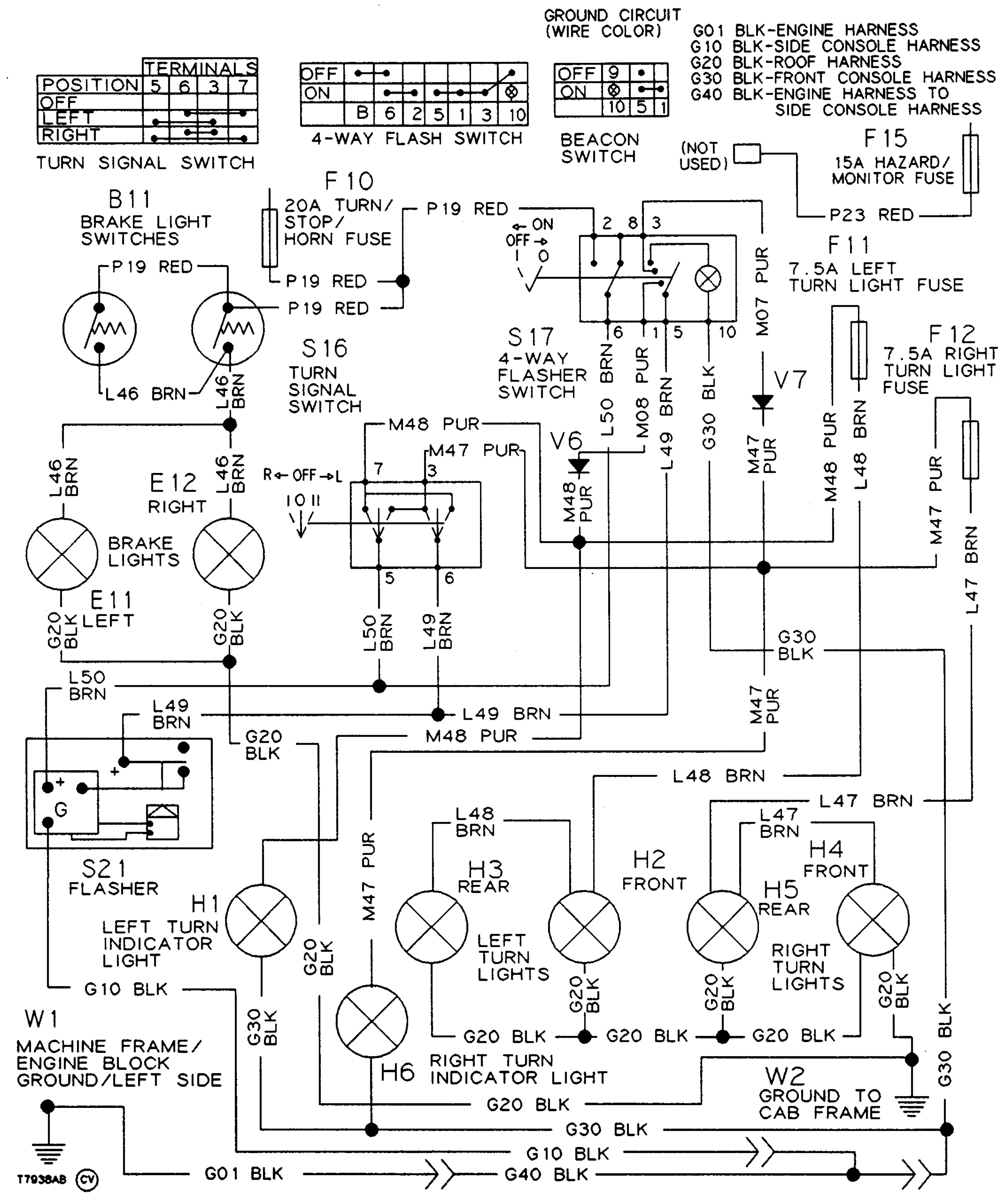
Brake Light:

Power flows from turn/stop/horn fuse to brake light switches. When brakes are applied the brake light switches close and power is routed to brake lights. Lights are grounded through G20 black wire.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,DY370 –19– 3JUN96–2/2

Turn Signal, Flasher And Brake Light Circuit Schematic



TURN SIGNAL, FLASHER AND BRAKE LIGHT CIRCUIT SCHEMATIC

T7938AB –19–15FEB93

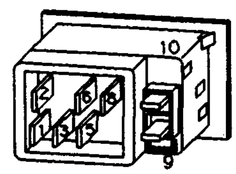
TX,9015,QQ1999 –19–16MAR93–1/1

Turn Signal, Flasher And Brake Light Circuit Diagnostic Procedures

This circuit is powered by the turn/stop/horn fuse, left turn fuse and right turn fuse.

– – –1/1

4-Way Flasher Switch



T7199CZ –UN–16AUG90

Disconnect harness from 4-way flasher switch.

With 4-way flasher switch OFF, check for continuity between terminals 6 and 8.

Is continuity measured?

Flasher switch ON.

Check for continuity between terminals 6 and 2, 5 and 3, 5 and 10, and 5 and 1.

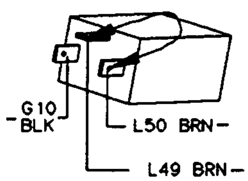
Is continuity measured?

YES: 4-way flasher switch is good. Check wiring harness.

NO: Replace 4-way flasher switch.

– – –1/1

Flasher



T7199DA –19–17SEP90

Key switch ON.

4-way flasher switch ON.

Connect jumper wire from terminal with L49 brown wire to terminal with L50 brown wire.

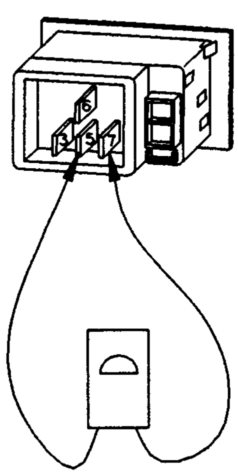
Do all turn lights function?

YES: Replace flasher.

NO: Check bulbs. Check wiring harness.

– – –1/1

Turn Signal Switch



T7199DB –UN–01OCT90

Disconnect harness from turn signal switch.

With turn signal switch turned right, check for continuity between connector terminals 5 and 7, and 6 and 3.

Is continuity measured?

With turn signal switch turned left, check for continuity between connector terminals 5 and 3, and 6 and 7.

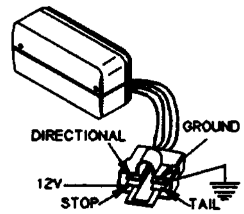
Is continuity measured?

YES: Turn signal switch is good. Go to next check.

NO: Replace turn signal switch.

– – –1/1

Brake Light



T7199DS –19–02OCT90

Disconnect harness from turn/tail/brake light.

Connect 12 volts to terminal marked STOP, and ground terminal marked GROUND.

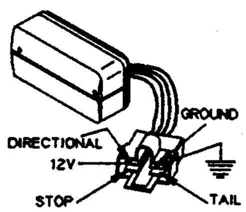
Does brake light function?

YES: Brake light is good. Check wiring harness.

NO: Replace bulb. If bulb is good replace light.

– – –1/1

Turn Signal Light



T7199DT –19–02OCT90

Disconnect harness from turn/tail/brake light.

Connect 12 volts to terminal marked DIRECTIONAL, and ground terminal marked GROUND.

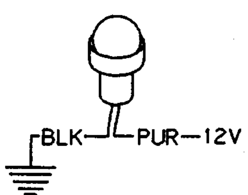
Does turn signal light function?

YES: Turn signal light is good. Check wiring harness.

NO: Replace bulb. If bulb is good replace light.

– – –1/1

Left/Right Indicator Light



T7199DC –19–16AUG90

Disconnect harness from indicator light.

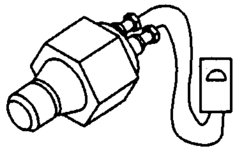
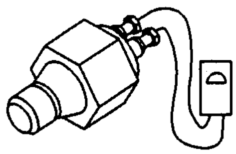
Connect battery voltage to purple wire and ground black wire.

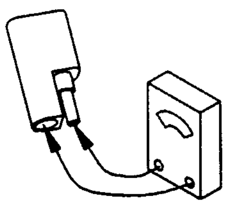
Does indicator light function?

YES: Indicator light is good. Check wiring harness.

NO: Check bulb, if good replace indicator light.

– – –1/1

Brake Light Switch	 T7199DD –UN–16AUG90	Disconnect harness from brake light switch. Check for continuity between the two terminals. Is continuity measured?	**YES:** Replace switch. **NO:** Go next step in this check.
	 T7199DD –UN–16AUG90	Disconnect harness from brake light switch. With brake light switch pushed (closed), check for continuity between the two terminals. Is continuity measured?	**YES:** Brake light switch is good. Check wiring harness. **NO:** Replace switch. – – –1/1

4-Way Flasher Switch Diode	 T7961AA –UN–10MAR93	Remove diode from connector. Connect an ohmmeter to diode terminals. Is continuity measured? Reverse ohmmeter probes. Is continuity measured?	**YES:** If continuity is measured in both checks, diode has failed in a shorted mode. Replace. **NO:** If continuity is NOT measured in either check diode has failed in an open mode. Replace. **NO:** If continuity is measured in one check and not the other, diode is OK. – – –1/1

Beacon Circuit Operational Information

The following conditions must exist for beacon circuit to function:

- Key switch to ACC or ON position
- Beacon switch to ON position

TX,9015,QQ1823 –19–12MAR93–1/1

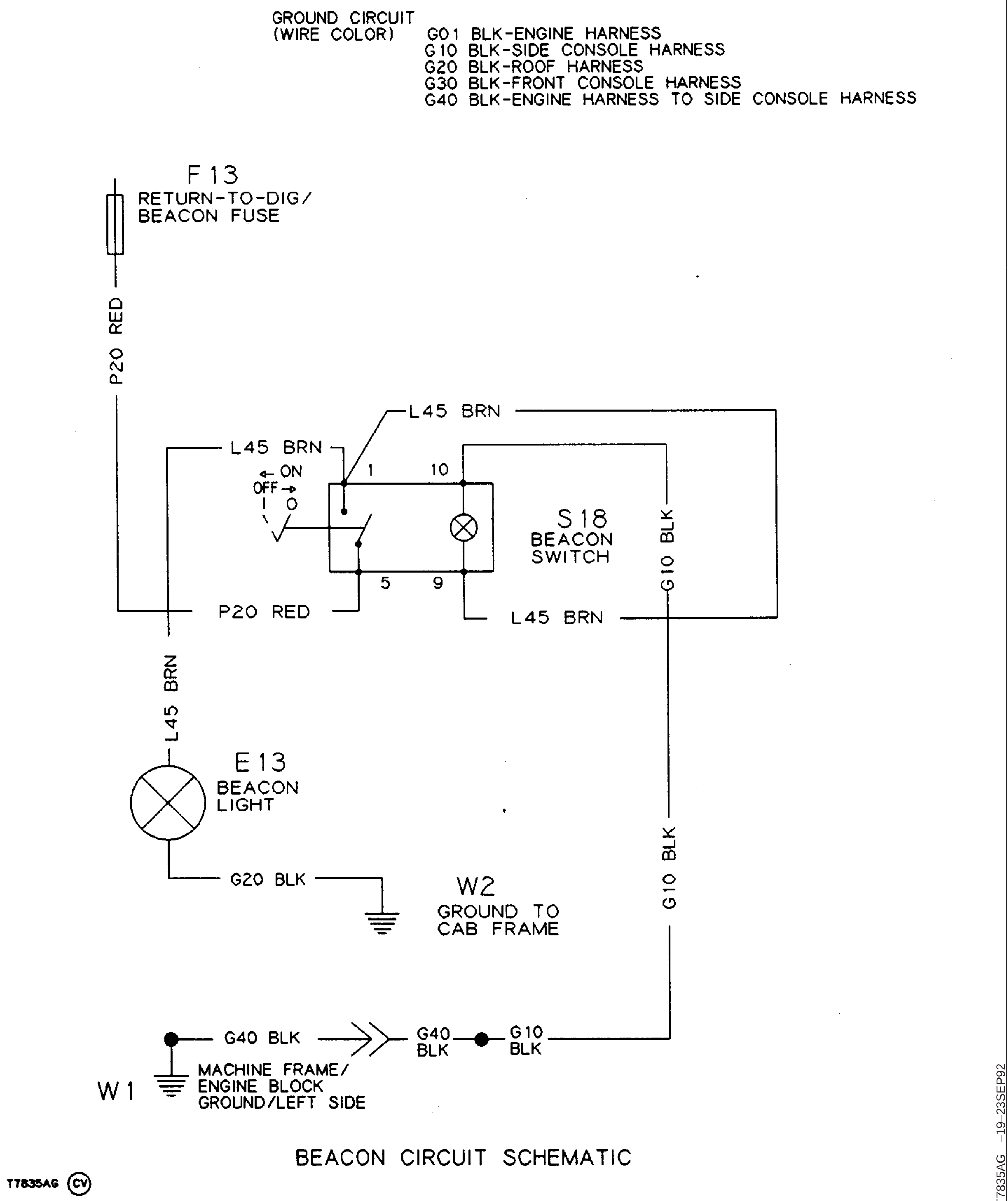
Beacon Circuit Theory Of Operation

Power flows from return-to dig/beacon fuse to beacon switch. With beacon switch ON, power flows to the beacon. Ground for beacon is provided through G20 black wire.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend, Group 9015-10.

TX,9015,QQ1791 –19–12MAR93–1/1

Beacon Circuit Schematic

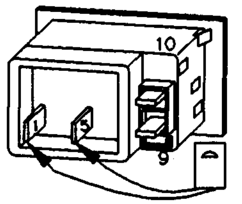


TX,9015,QQ1792 –19–12MAR93–1/1

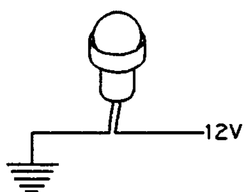
Beacon Circuit Diagnostic Procedures

This circuit is powered by the return-to-dig/beacon fuse.

– – –1/1

Beacon Switch	T7199DE –UN–02OCT90	Disconnect harness from beacon switch. Beacon switch ON. Check for continuity between terminals 1 and 5. Is continuity measured?	**YES:** Beacon switch is good. Go to next check. **NO:** Replace beacon switch.

– – –1/1

Beacon	T7199DF –UN–16AUG90	Disconnect harness from beacon. Connect 12 volts to beacon terminal (white wire), and ground beacon (black wire). Does beacon function?	**YES:** Beacon is good. Check wiring harness. **NO:** Check bulb, if good replace beacon.

– – –1/1

Return-To-Dig Circuit Operational Information

The following conditions must exist for return-to-dig circuit to function:

- Key switch ON
- Engine running

TX,9015,QQ1824 –19–12MAR93–1/1

Return-To-Dig Circuit Theory Of Operation

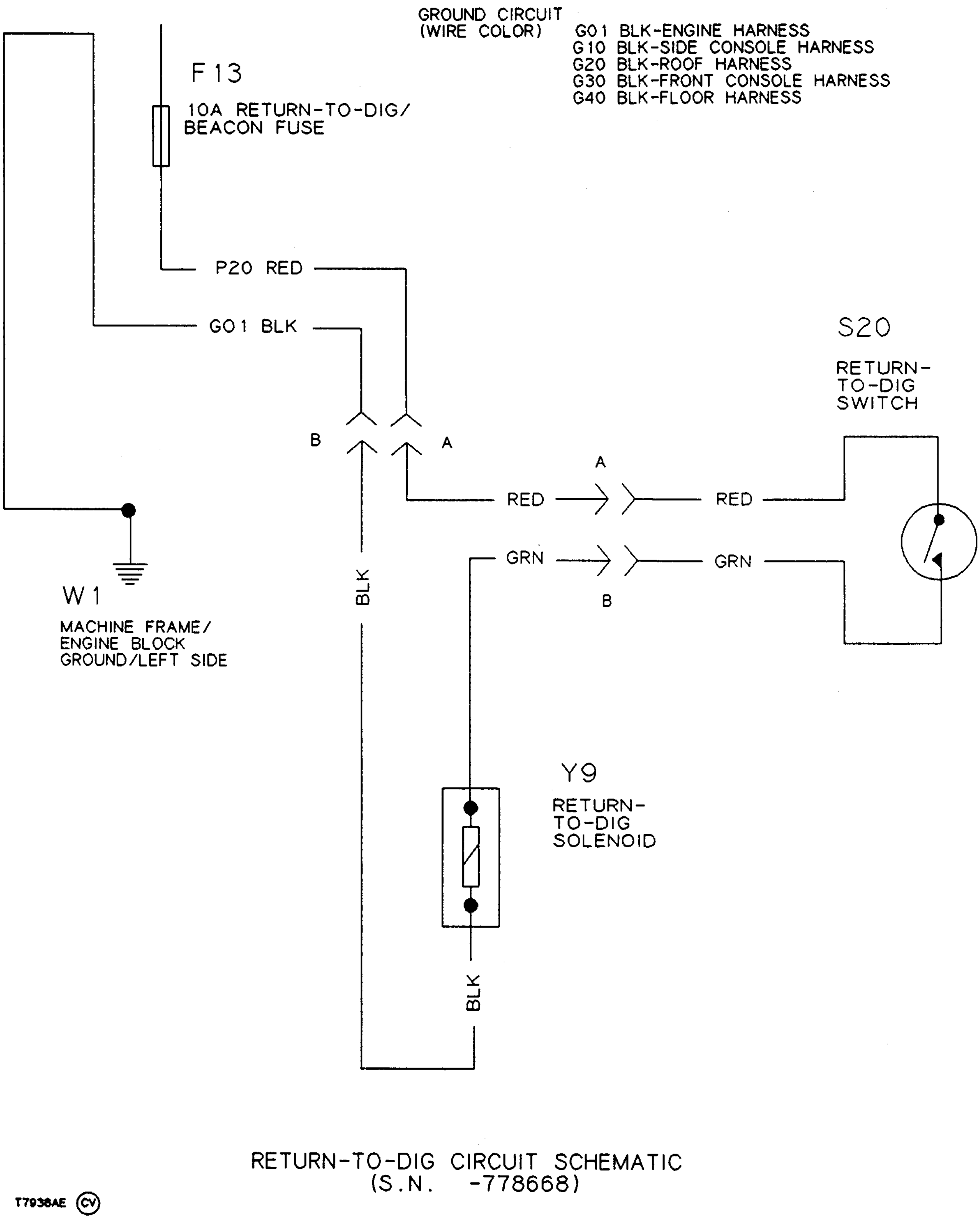
Return-to-dig circuit consists of return-to-dig/beacon fuse, return-to-dig-switch and return-to-dig solenoid.

Power flows from return-to-dig/beacon fuse to return-to-dig switch. When the bucket is not in the "LEVEL" position, the return-to-dig switch is closed which routes battery power to the return-to-dig solenoid. The return-to-dig solenoid is grounded through ground wire GO1 black.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ1793 –19–12MAR93–1/1

Return-To-Dig Circuit Schematic



T7938AE –19–15FEB93

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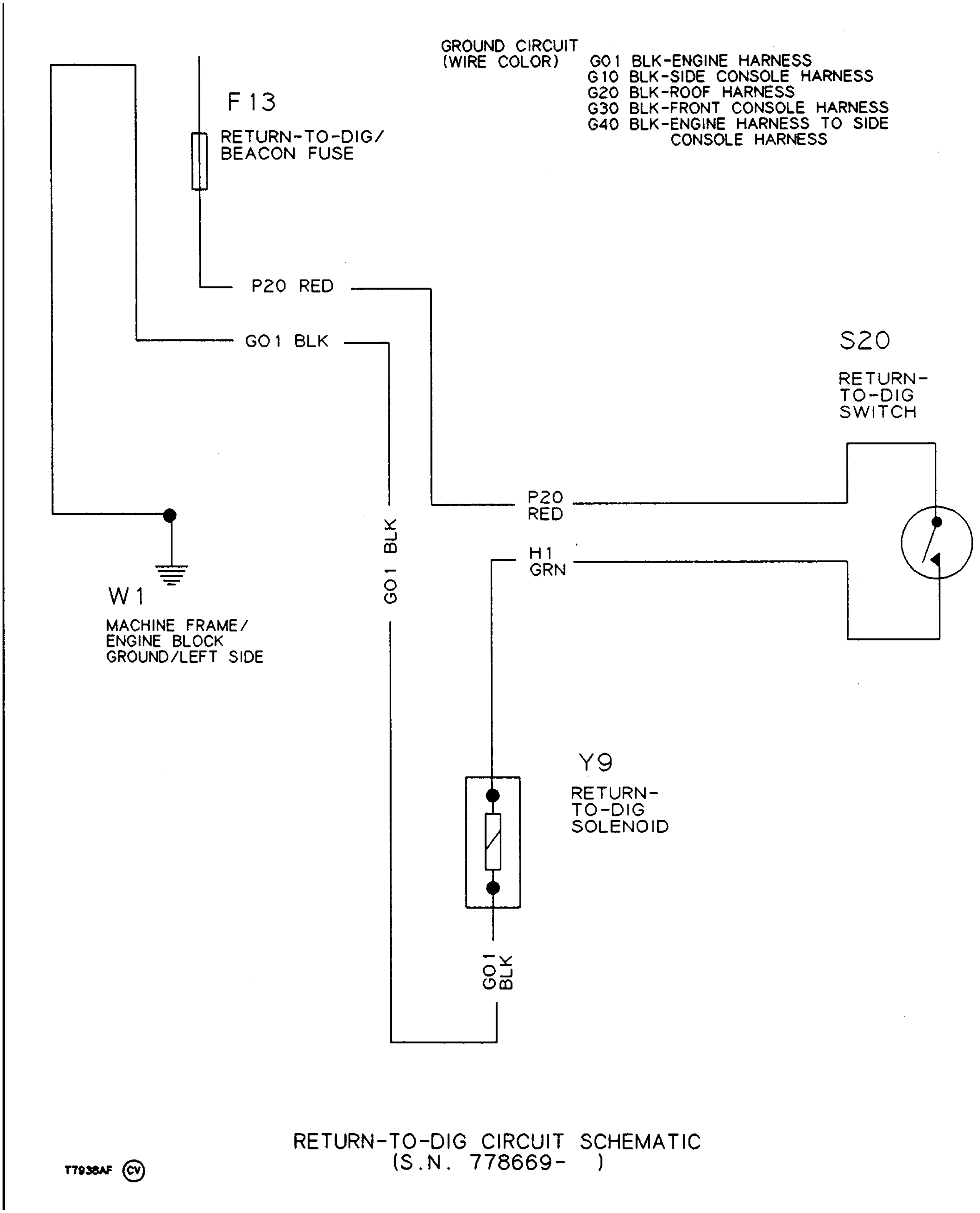
TX,9015,QQ1983 –19–16MAR93–1/2



RETURN-TO-DIG CIRCUIT SCHEMATIC
(S.N. 778669-)

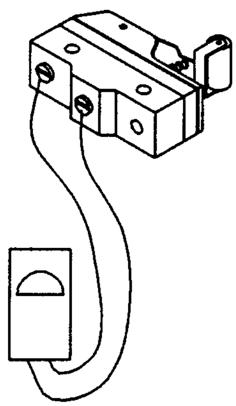
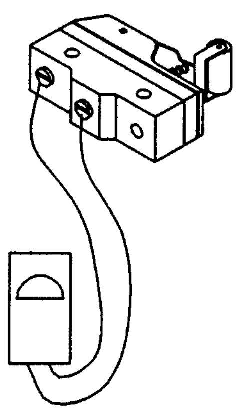
T7938AF –19–15FEB93

TX,9015,QQ1983 –19–16MAR93–2/2

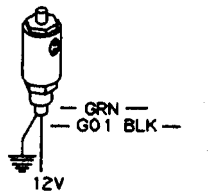
Return-To-Dig Circuit Diagnostic Procedures

This circuit is powered by the return-to-dig/beacon fuse.

– – –1/1

Return-To-Dig Switch	 T7199DG –UN–17SEP90	Disconnect harness from return-to-dig switch. Check for continuity between common terminal and open terminal. Is continuity measured?	**YES:** Replace return-to-dig switch. **NO:** Go to next step in this check.
	 T7199DG –UN–17SEP90	Disconnect harness from return-to-dig switch. Actuate return-to-dig switch. Check for continuity between common terminal and open terminal. Is continuity measured?	**YES:** Return-to-dig switch is good. Go to next check. **NO:** Replace return-to-dig switch.

– – –1/1

Return-To-Dig Solenoid	 T7199DH –19–17SEP90 Disconnect harness from return-to-dig solenoid. Apply battery voltage to solenoid, and ground solenoid. Move control lever to return-to-dig detent position. Remove voltage from solenoid. Does control lever stay in return-to-dig detent position until voltage is removed, and then return to neutral?	**YES:** Return-to-dig solenoid is good. **NO:** Replace return-to-dig solenoid.

– – –1/1

Fuel Gauge And Hour Meter Circuit Specifications

	Specification
Fuel Gauge Level Sender—	
Resistance of Empty Tank	10 ohms
Resistance of Full Tank	180 ohms

TX,9015,QQ1825 –19–31AUG95–1/1

Fuel Gauge And Hour Meter Circuit Operational Information

The following conditions must exist for fuel gauge circuit to function:

Key switch in ON position

The following conditions must exist for tachometer/hour meter circuit to function:

- Key switch in ON position
- Engine running

TX,901515,QQ600 –19–31AUG95–1/1

Fuel Gauge And Hour Meter Circuit Theory Of Operation

Fuel Gauge:

The circuit consists of monitor fuse, fuel gauge/light and fuel sender. Power flows from monitor fuse to (+) terminal of fuel gauge, out S terminal of fuel gauge to fuel sender. Fuel sender is grounded through G10 black wire. Power also flows from (+) terminal of fuel gauge to fuel gauge light. Fuel gauge light is grounded through G10 black wire.

Tachometer/Hour Meter:

Power flows from W terminal of alternator through M39 purple wire to S terminal on tachometer/hour meter.

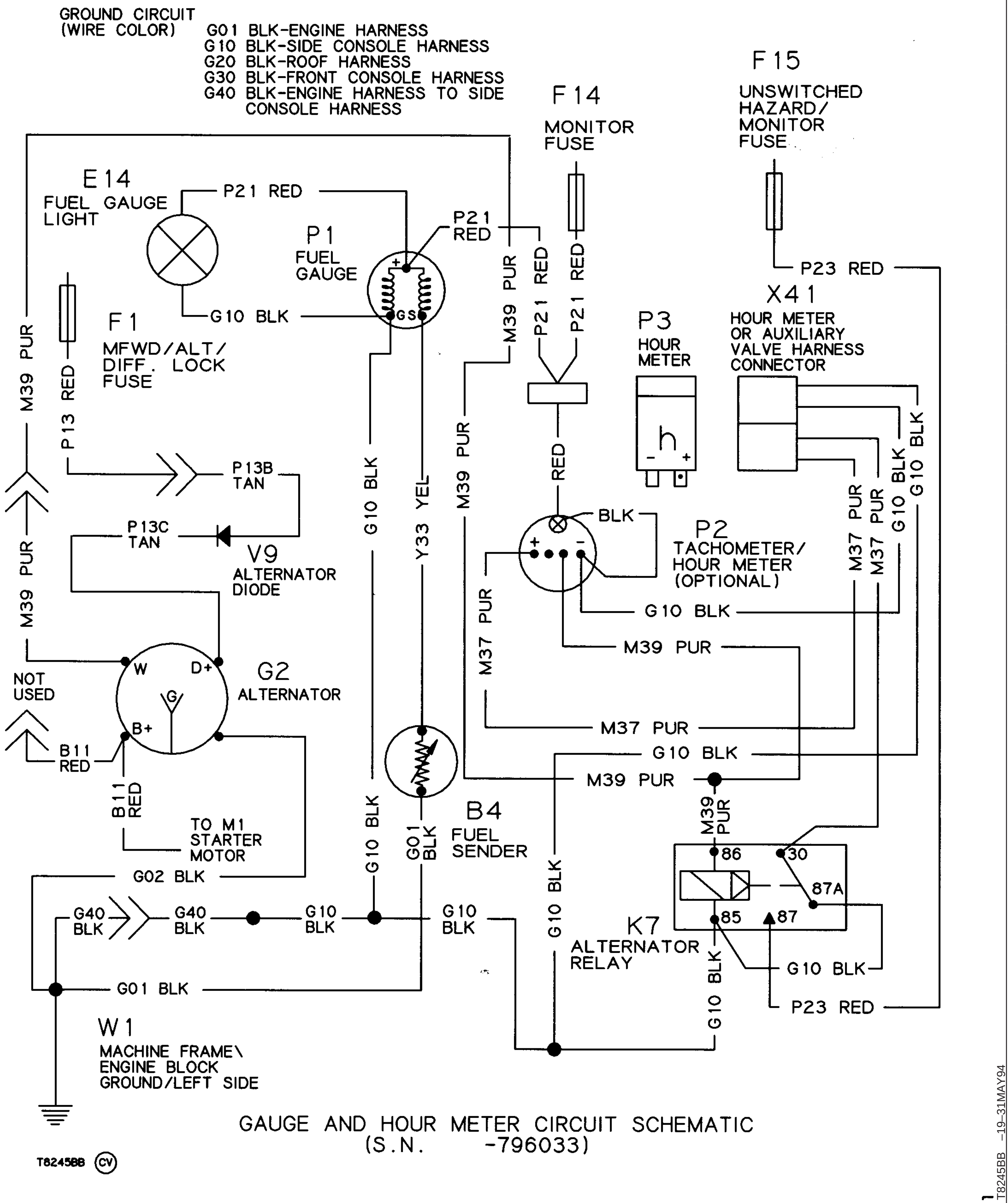
Tachometer light gets power from P21 red wire and is grounded through G10 black wire.

With key switch ON and engine running, hour meter gets power from W terminal of alternator through M39 purple wires to alternator relay, energizing the relay and connecting terminals 30 and 87 suppling power for hour meter, causing the hour meter to run. With engine OFF key switch ON alternator relay is de-energized connecting terminals 30 and 87A removing power for hour meter and suppling ground for alternator indicator light in display module, causing the alternator indicator light to come on.

NOTE: For component identification code description,see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,DY371 –19– 3JUN96–1/1

Fuel Gauge And Hour Meter Circuit Schematic



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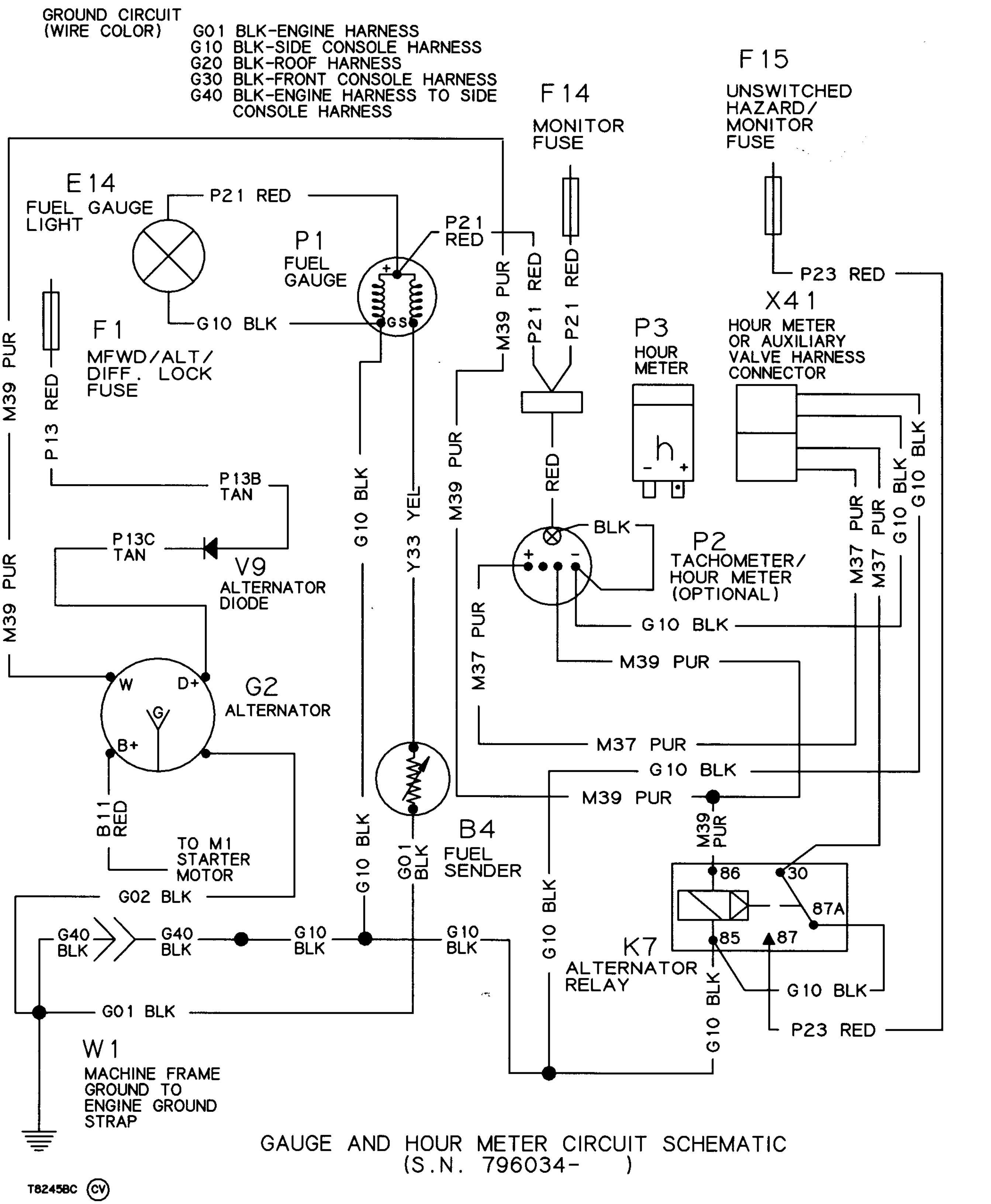
TX,9015,QQ2703 –19–31AUG95–1/2



GAUGE AND HOUR METER CIRCUIT SCHEMATIC
(S.N. 796034-)

T8245BC –19–31MAY94

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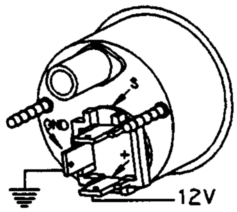
TX,9015,QQ2703 –19–31AUG95–2/2

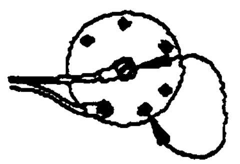
Fuel Gauge And Hour Meter Circuit Diagnostic Procedures

This circuit is powered by the monitor fuse and hazard/monitor fuse

– – –1/1

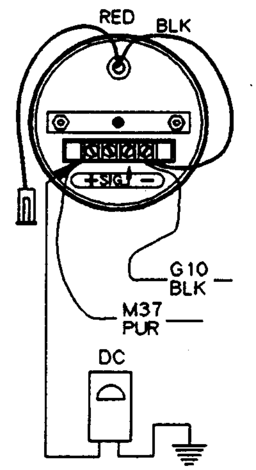
Fuel Gauge	 T7199DI –UN–02OCT90 *NOTE: Be sure some fuel is in tank.* Key switch ON. Engine OFF. Disconnect harness from fuel gauge. Does gauge read EMPTY? Connect battery voltage to (+) terminal and ground GND terminal. Does gauge read FULL?	**YES:** Fuel gauge is good. Go to next check. **NO:** Replace fuel gauge.

– – –1/1

Fuel Gauge Sender	 T6431AJ –UN–19OCT88 Key switch ON. Engine OFF. Disconnect wire Y33 yellow from center of sender. Does gauge read EMPTY? Reconnect wire Y33 yellow to center of sender. Attach a jumper wire from center screw to ground. Does gauge read FULL?	**YES:** Replace sender. **NO:** Fuel gauge sender is good. Check wiring harness to sender.

– – –1/1

Tachometer/Hour Meter



T7199DJ –19–02OCT90

Machine running.

Lower all equipment to ground.

FNR lever in neutral.

Park brake ON.

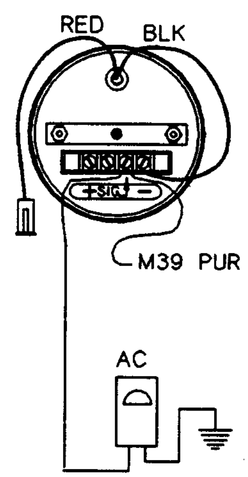
Check ground (-) terminal for good connection.

Using a voltmeter check voltage on (+) terminal with M37 purple wire.

Are 12—14 volts (DC) measured?

YES: Hour meter is bad, replace tachometer/hour meter.

NO: Check wiring harness.



T7199DK –19–17SEP90

Using a voltmeter, check voltage on terminal (SIG) M39 purple wire.

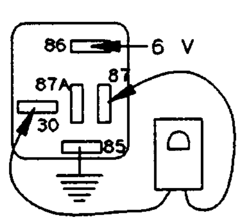
Are 7.63 volts (AC) measured?

YES: Tachometer is bad, replace tachometer/hour meter.

NO: Check wiring harness.

– – –1/1

Alternator Relay



T7596AQ –19–03OCT91

IMPORTANT: Relay is a six volt relay. Do not apply more than 6 volts when testing.

Disconnect harness from relay.

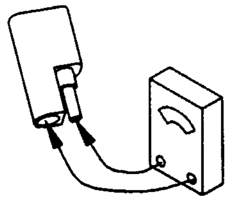
Connect battery voltage to terminal #86. Ground terminal #85. Does relay click?

Measure continuity between terminals #30 and #87. Is continuity measured?

YES: Relay is good. Check wiring harness.

NO: Replace relay.

– – –1/1

Alternator Diode	 T7961AA –UN–10MAR93	Remove diode from connector. Connect an ohmmeter to diode terminals. Is continuity measured? Reverse ohmmeter probes. Is continuity measured?	**YES:** If continuity is measured in both checks, diode has failed in a shorted mode. Replace. **NO:** If continuity is NOT measured in either check diode has failed in an open mode. Replace. **NO:** If continuity is measured in one check and not the other, diode is OK. – – –1/1

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Side Shift Locking Valve Circuit Operational Information—315D

The following conditions must exist for side shift valve circuit to function:

- Key switch in ON position
- Side shift valve switch ON
- Engine running

TX,901515,QQ605 –19–16MAR93–1/1

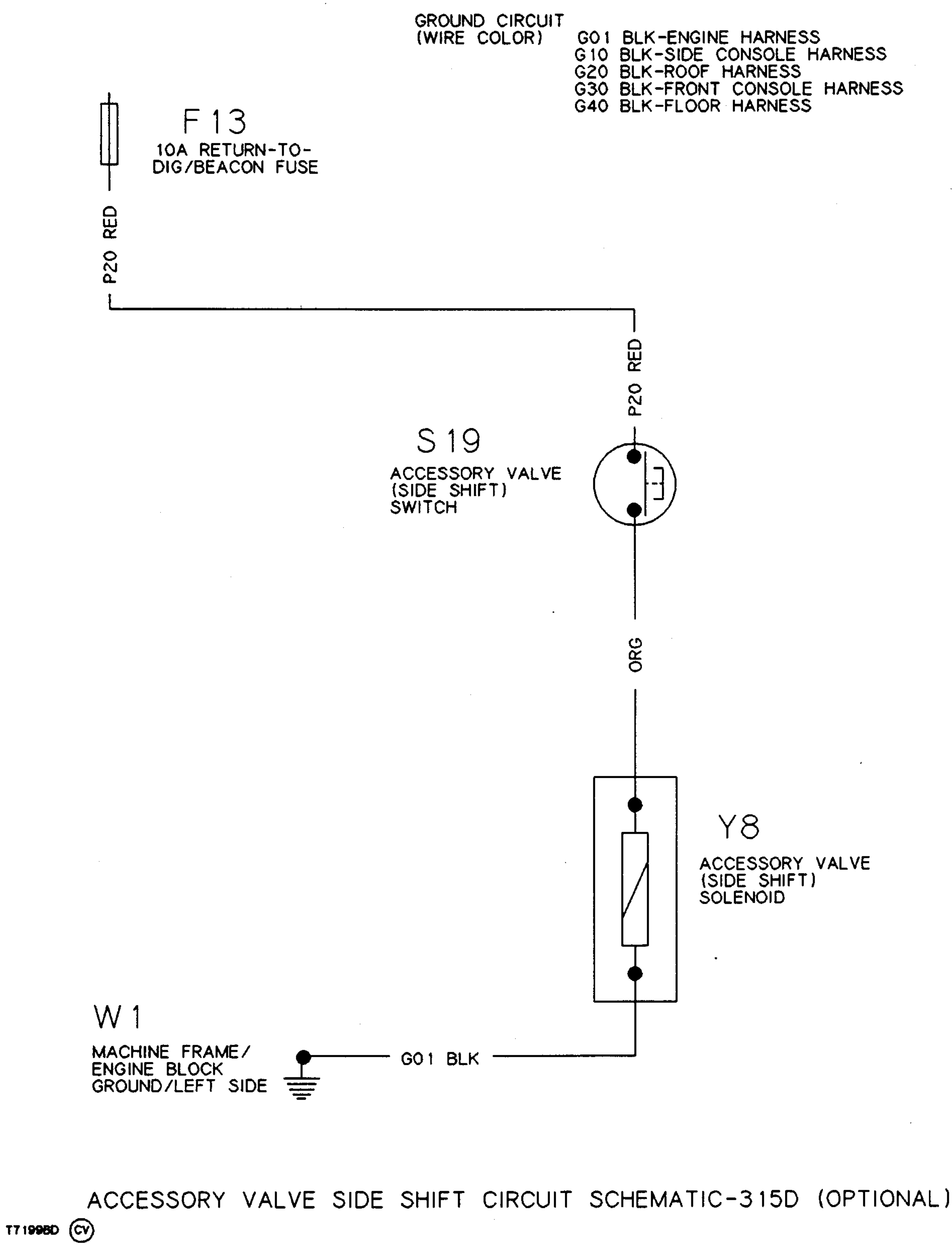
Side Shift Locking Valve Circuit Theory Of Operation—315D

Power flows from return-to-dig/beacon fuse through P20 red wires to side shift switch. With side shift switch pushed ON, power flows to solenoid through orange wire energizing side shift solenoid. With solenoid energized hydraulic pressure is released. With solenoid de-energized hydraulic pressure is applied.

NOTE: For component identification code description, see Legend For Schematic and Wiring Diagram , Group 9015-10.

TX,901515,QQ606 –19–16MAR93–1/1

Side Shift Locking Valve Circuit Schematic—315D



T7199BD –19–27SEP90

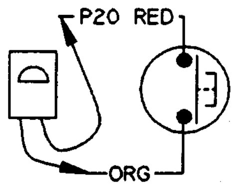
TX,901515,QQ607 –19–16MAR93–1/1

Side Shift Locking Valve Circuit Diagnostic Procedures—315D

This circuit is powered by the Return-To-Dig/Beacon fuse.

– – –1/1

Side Shift Locking Valve Switch



T7199DM –19–17SEP90

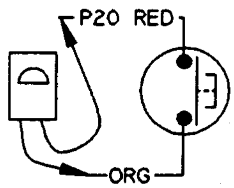
Disconnect harness from side shift valve switch.

Check continuity between P20 red wire and orange wire.

Is continuity measured?

YES: Replace side shift valve switch.

NO: Go to next step in this check.



T7199DM –19–17SEP90

Disconnect harness from side shift valve switch.

Push valve switch and measure continuity between P20 red wire and orange wire.

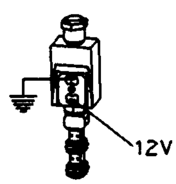
Is continuity measured?

YES: Switch is good. Go to next check.

NO: Replace side shift valve switch.

– – –1/1

Side Shift Locking Valve Solenoid



T7199DL –UN–16AUG90

Disconnect harness from side shift solenoid.

Connect battery voltage to terminal with orange wire and ground terminal with GO1 black wire.

Does solenoid click?

YES: Solenoid is good. Check wiring harness.

NO: Replace solenoid.

– – –1/1

Auxiliary Valve Circuit Operational Information

The following conditions must exist for auxiliary valve circuit to function:

- Key switch ON position
- Machine running
- Auxiliary valve switch in FOOT ON or CONTINUOUS ON position

TX,9015,QQ2581 –19–12APR94–1/1

Auxiliary Valve Circuit Theory Of Operation

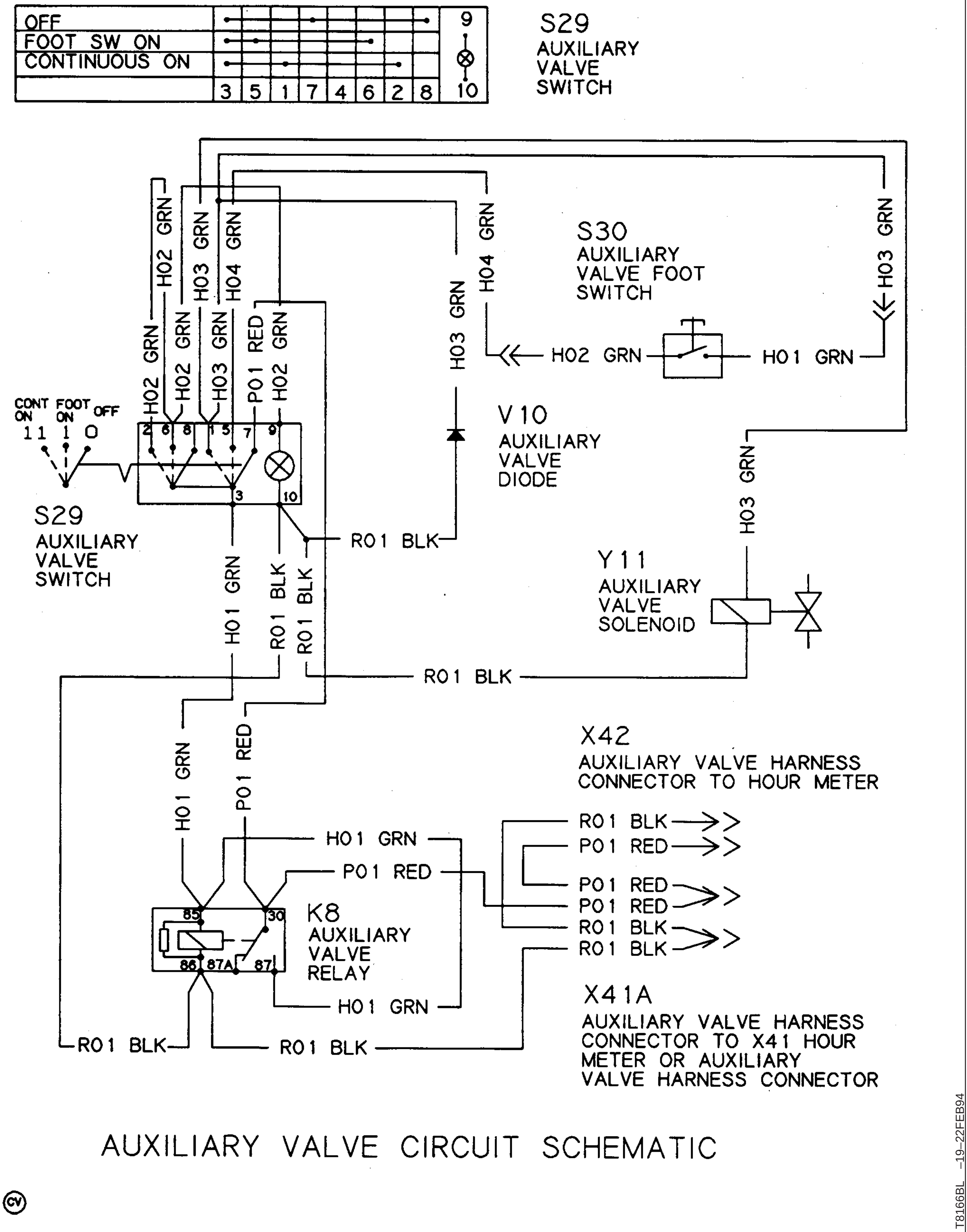
The circuit consists of auxiliary valve relay, auxiliary valve switch, auxiliary valve diode, auxiliary valve foot switch and auxiliary valve solenoid. Components are grounded by the RO1 black wire through cab side console harness. With key switch on, power is routed through PO1 red wire to auxiliary valve relay terminal 30 and to auxiliary valve switch terminal 7. With auxiliary valve switch in OFF position power is routed out terminal 3 of auxiliary valve switch to terminals 85 and 87 of auxiliary valve relay. The relay is energized latching terminals 30 and 87 of auxiliary valve relay.

When auxiliary valve switch is moved to FOOT ON position, power is routed out terminals 5 and 6. Power from terminal 6 is sent to terminal 9 for light in switch. Power from terminal 5 is sent to auxiliary valve foot switch. When foot switch is depressed power is sent to auxiliary valve solenoid energizing solenoid.

When auxiliary valve switch is moved to CONTINUOUS ON position, power is routed out terminal 1 and 2. Power from terminal 2 is sent to terminal 9 for light in switch. Power from terminal 1 is sent to auxiliary valve solenoid energizing solenoid, keeping continuous power on solenoid.

TX,9015,QQ2582 –19–12APR94–1/1

Auxiliary Valve Circuit Schematic



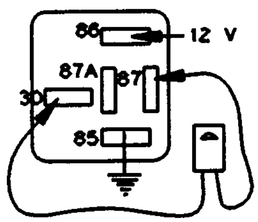
TX,9015,QQ2583 –19–12APR94–1/1

Auxiliary Valve Diagnostic Procedures

This circuit is powered by monitor fuse.

– – –1/1

Auxiliary Valve Relay



T7287BH –UN–16AUG90

Key switch OFF.

Disconnect harness from relay.

Connect battery voltage to terminal #86. Ground terminal #85. Does relay click?

Measure continuity between terminals #30 and #87.

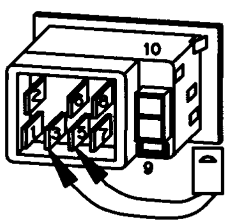
Is continuity measured?

YES: Relay is good. Check wiring harness.

NO: Replace auxiliary valve relay.

– – –1/1

Auxiliary Valve Switch



T8173BN –UN–20FEB94

Disconnect harness from auxiliary valve switch.

Move auxiliary valve switch to FOOT ON.

Measure for continuity between terminals 3 and 5, 3 and 6.

Is continuity measured?

Measure for continuity between terminals 3 and 1, 3 and 2.

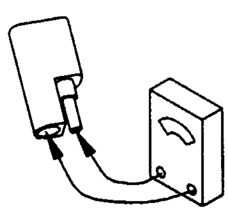
Is continuity measured?

YES: Auxiliary valve switch is good. Check wiring harness.

NO: Replace auxiliary valve switch.

– – –1/1

Auxiliary Valve Diode Check



T7961AA –UN–10MAR93

Remove diode from connector.

Connect an ohmmeter to diode terminals.

Is continuity measured?

Reverse ohmmeter probes.

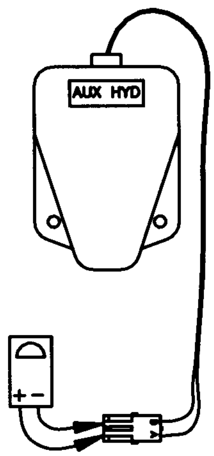
Is continuity measured?

YES: If continuity is measured in both checks, diode has failed in a shorted mode. Replace.

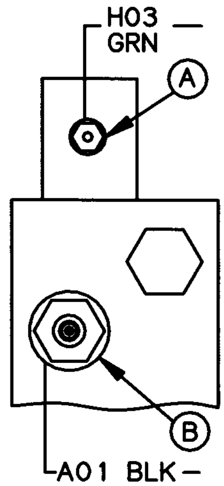
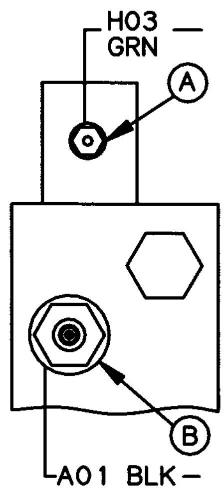
NO: If continuity is NOT measured in either check diode has failed in an open mode. Replace.

NO: If continuity is measured in one check and not the other, diode is OK.

– – –1/1

Auxiliary Valve Foot Switch	 T8173BP –UN–20FEB94	Disconnect harness from auxiliary valve foot switch. Foot switch pressed. Measure for continuity between terminals A and B of connector end. Is continuity measured?	**YES:** Auxiliary valve foot switch is good. Check wiring harness. **NO:** Replace auxiliary valve foot switch. – – –1/1

9015
15
,116

Auxiliary Valve Solenoid	 T8176AF –UN–20FEB94	Key switch ON. Auxiliary valve switch to CONTINUOUS ON. Harness wires connected. Check battery voltage at (A). Is battery voltage measured? Check continuity at (B). Is continuity measured?	**YES:** Continue on. **NO:** Check ground connection at (B). Check wiring harness.
	 T8176AF –UN–20FEB94	Disconnect harness wires from valve. Check continuity at (A). Is continuity measured?	**YES:** Solenoid is good. **NO:** Replace solenoid. – – –1/1

Alternators And Starting Motors—Use CTM77

For additional information, the component technical manual (CTM) is also required.

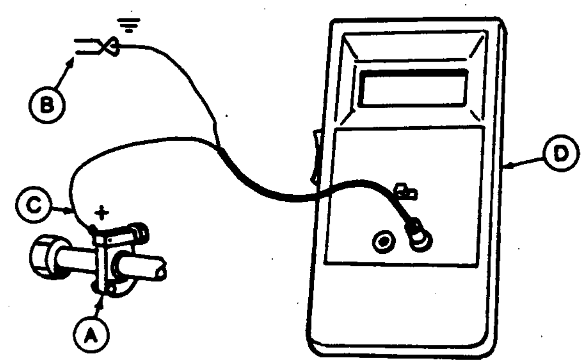
Use the CTM in conjunction with this machine manual.

TS225 –UN–17JAN89

TX,9010,SS2208 –19–01SEP94–1/1

JT05801 Clamp-On Electronic Tachometer Installation

SERVICE EQUIPMENT AND TOOLS
Tachometer
A—Clamp-on Transducer. Remove paint with emery cloth and connect to a straight section of injection line within 100 mm (4 in.) of pump. Finger tighten only. DO NOT overtighten.
B—Black Clip (-). Connect to main frame.
C—Red Clip (+). Connect to transducer.
D—Tachometer Readout. Install cable.



T6813AG –UN–28FEB89

10T,9010,K182 –19–10AUG95–1/1

Battery Operation

A battery is a device for converting chemical energy to electrical energy. It is not a storage tank for electricity, but stores electrical energy in chemical form.

Because of the constant chemical to electrical change (self-discharge, discharge, or charge), the battery has a limited life. Proper care (cleaning, adding water, charging) will extend the life of the battery.

The battery is made up of positive plates, negative plates, separators, plate straps, and chemical solution (electrolyte). The electrolyte is a solution of sulfuric acid and water. Sulfuric acid is not lost during overcharging; therefore, if the liquid solution is low, only water should be added.

In a fully charged battery, the positive plate is lead peroxide (PBQ2), the negative plate is "spongy" lead (Pb), and the electrolyte solution is about 1.270 times heavier than water. The amount that the solution is heavier than water is called specific gravity.

All batteries will self discharge at a rate of .001 specific gravity point per 24 hour period at a constant 85 °F.

Specification

Battery—Discharge Rate	.001 Specific Gravity Point per 24 Hour Period at a Constant 85 °F

The discharge rate increases as temperature increases and decreases as temperature decreases. If the machine is not used for a period of time, the batteries must be maintained or stored in a cool place.

Wipe batteries with a damp cloth. If terminals are corroded, use a stiff brush and wash with an ammonia solution. After washing, flush battery and compartment with clear water. Keep caps in place when cleaning and charging.

Batteries should be maintained at an open circuit voltage of 12.50 volts or greater. To determine open circuit voltage do the following:

1. Turn master disconnect switch to ON position.

2. For machines that have not been run during the past ten hours, go to Step 4.

3. For machines that have been run in the past ten hours, remove surface charge. Turn key switch to START, turn on 3 or 4 work lights and leave them on for 3 to 5 minutes. Turn key switch OFF, then wait two minutes. (If machine does not have lights, turn key switch to START position for at least 5 minutes, then turn off.)

4. Measure voltage at alternator by placing the negative lead of a multimeter to case of alternator and the positive lead to the sense terminal of the alternator.

Specification

Stabilized Open Circuit 12.5 Volts or More—Percent Charged	100%
Stabilized Open Circuit 12.4 Volts or More—Percent Charged	75%
Stabilized Open Circuit 12.2 Volts or More—Percent Charged	50%
Stabilized Open Circuit 12.0 Volts or More—Percent Charged	25%
Stabilized Open Circuit 11.7 Volts or Less—Percent Charged	0%

TX,9015,MM1631 –19–10AUG95–1/1

Battery Specifications

Specification	
Battery—Voltage	12 volts
Cold Cranking Power	625 amps—18°C (0°F)
Reserve Capacity	160 minutes at 25 amps
BCI Group Size	31
Fully Charged Electrolyte Specific Gravity	1.265—1.280

TX,901505,QQ368 –19–10AUG95–1/1

Diagnose Battery Malfunctions

Symptom	Problem	Solution
Battery Using Too Much Water	Shorted battery cell	Check battery state of charge. (See Procedure for Testing Batteries.)
	High ambient temperature	Add distilled water.
	Cracked battery case	Check battery hold down clamps. Replace battery.
	Regulator	Do Alternator Output Check. (See Charging Circuit Operational Checks.)
Cracked Battery Case	Battery hold down clamp too tight, too loose or missing	Install new battery. Install hold down clamps correctly.
	Frozen battery	Keep electrolyte at correct level and battery fully charged during cold weather.
Low Battery Output	Low water level	See Battery Using Too Much Water and Cracked Battery Case symptoms.
	Dirty or wet battery top, causing discharge	Clean battery top. Recharge battery.
	Corroded or loose battery cable ends	Clean and tighten cable end clamps. Recharge battery.
	Broken or loose battery posts	Wiggle posts by hand. If posts are loose or will turn, replace battery.
	Loose fan/alternator belt or worn pulleys	Inspect belt or pulley. Adjust or replace as necessary.

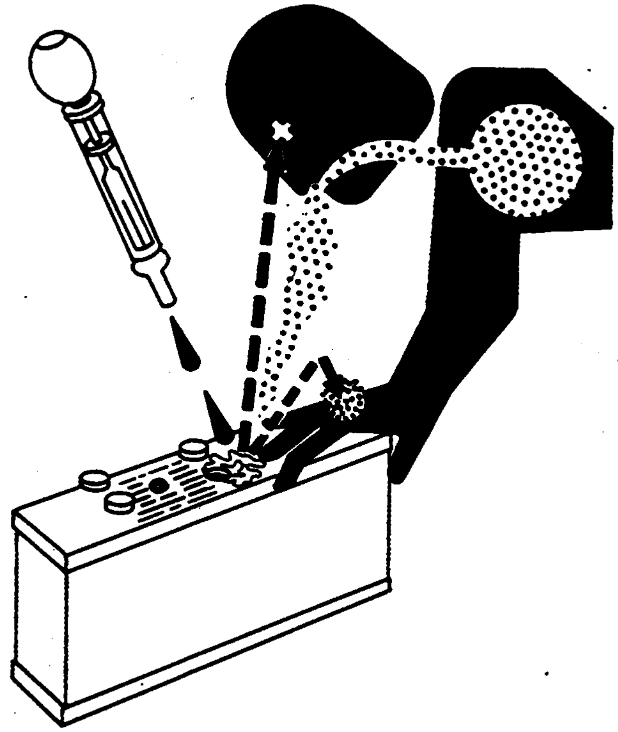
TX,901505,QQ365 –19–10AUG95–1/1

Check Battery Electrolyte Level And Terminals

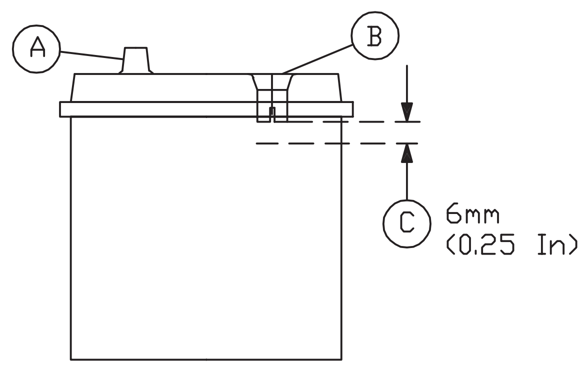
1. Remove hold-down clamps.

2. Remove battery covers.

A—Battery Post
B—Fill Tube
C—Electrolyte Level Range

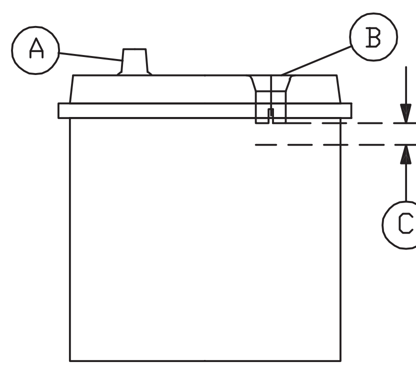


TS203 –UN–23AUG88



T6996DB –UN–09SEP03

Single Level Fill Tube Application



T6996DA –UN–09SEP03

Dual Level Fill Tube Application

Continued on next page

TX,9015,QQ1696 –19–01SEP95–1/2

CAUTION: Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

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

Always remove grounded (-) battery clamp first and replace it last.

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 10—15 minutes. Get medical attention immediately.**

If acid is swallowed:

1. **Drink large amounts of water or milk.**
2. **Then drink milk of magnesia, beaten eggs, or vegetable oil.**
3. **Get medical attention immediately.**

IMPORTANT: During freezing weather, batteries must be charged after water is added to prevent battery freezing. Charge battery using a battery charger or by running the engine.

3. Fill each cell to within specified range with distilled water. DO NOT overfill.

TX,9015,QQ1696 –19–01SEP95–2/2

Procedure For Testing Batteries

VISUAL CHECK

1. Check for damage such as cracked or broken case and electrolyte leakage.

   If damage is seen, replace battery.

2. Check electrolyte level. (See procedure in this group)

   If low, add distilled water to specified level and charge battery.

3. Check terminals for corrosion.

   If corroded, clean using a wire brush or battery post cleaner such as JT05838 Battery Post/Clamp Cleaner.

4. Check posts for looseness.

   If posts are loose, replace battery.

HYDROMETER TEST

Check specific gravity with a hydrometer or battery tester such as JT05460 Coolant/Battery Tester.

Record specific gravity reading for each cell.

If high and low readings vary LESS than 0.050 and average specific gravity is between 1.225 and 1.280, battery is fully charged, go to LOAD TEST.

If high and low readings vary LESS than 0.050 and average specific gravity is LESS than 1.225, charge battery and repeat test. If average specific gravity is still LESS than 1.225, replace both batteries.

If high and low readings vary MORE than 0.050, charge battery and repeat test. If high and low readings still vary MORE than 0.050, replace both batteries.

Continued on next page TX,9015,DY374 –19– 4JUN96–1/2

LOAD TEST

Check battery capacity with a load tester such as JT05832 Battery Load Tester. Follow tester manufacturer’s instructions for proper load test procedures.

If one battery fails load test, replace both batteries.

TX,9015,DY374 –19– 4JUN96–2/2

Using Booster Batteries—12 Volt System

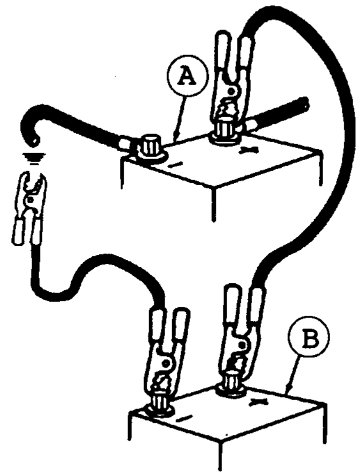
Before boost starting, machine must be properly shut down and secured to prevent unexpected machine movement when engine starts.

CAUTION: An explosive gas is produced while batteries are in use or being charged. Keep flames or sparks away from the battery area. Make sure the batteries are charged in a well ventilated area.

IMPORTANT: The machine electrical system is a 12 volt negative (-) ground. Use only 12 volt booster batteries.

Connect booster batteries as shown for your battery application. Make last connection to frame.

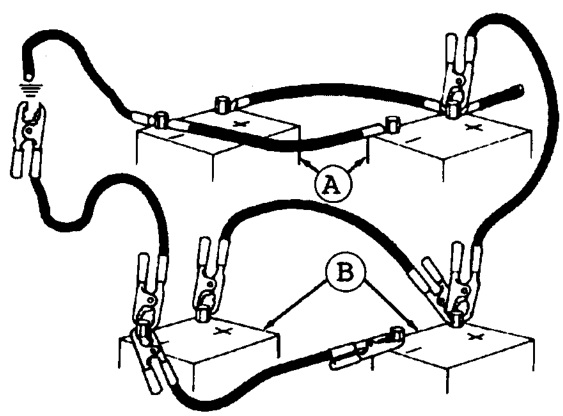
A—Machine Batteries
B—Booster Batteries



T6508AE1 CV

T6508AE1 –UN–24OCT91

Single Battery Application



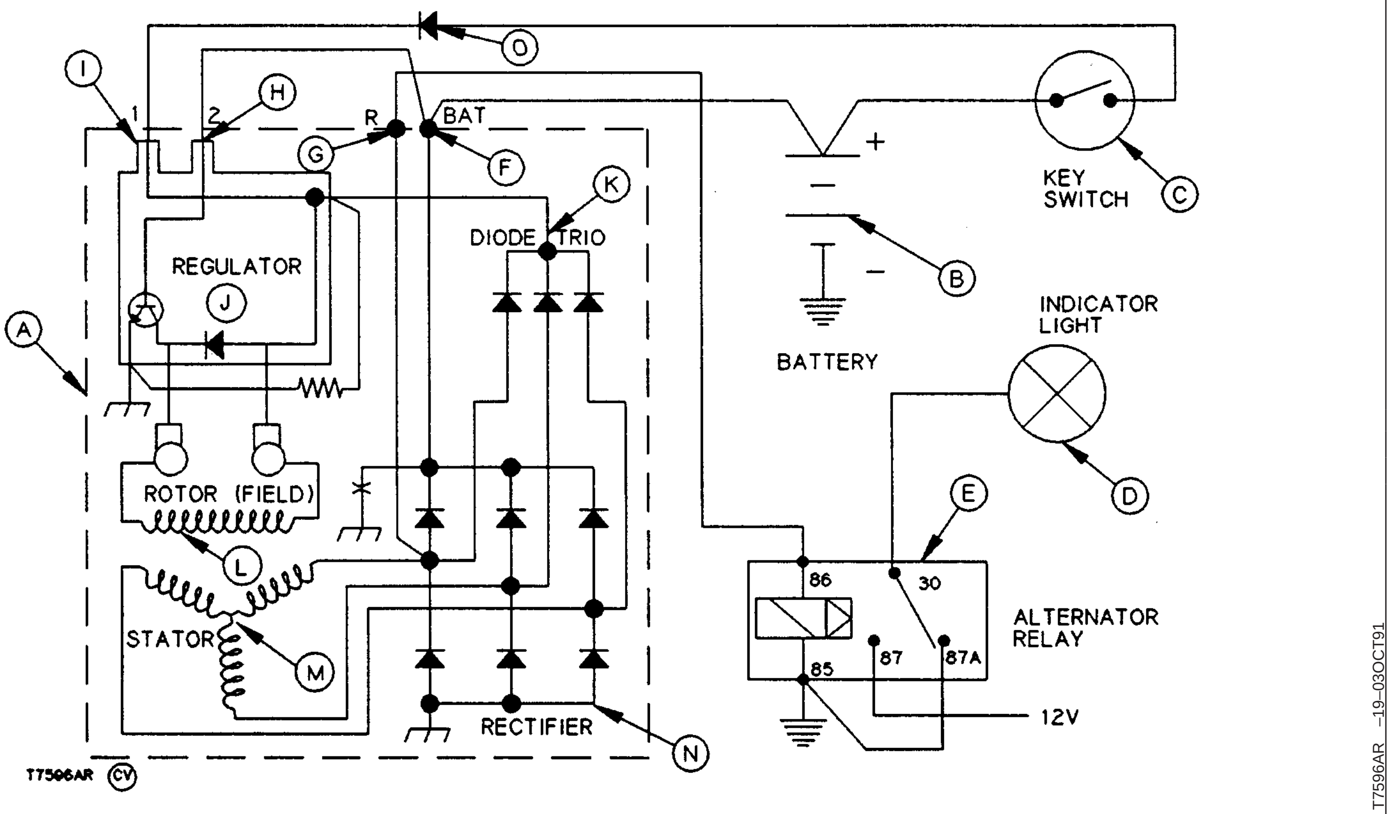
T6713AI1 CV

T6713AI1 –UN–24OCT91

Two Battery Application

TX,901505,QQ364 –19–01SEP95–1/1

Alternator Operation—78 Amp Delco Remy (Serial No.—787513)



A—Alternator
B—Battery
C—Key Switch
D—Indicator Light
E—Alternator Relay
F—BAT terminal
G—R Terminal
H—Terminal 2
I—Terminal 1
J—Regulator
K—Diode Trio
L—Rotor (Field)
M—Stator
N—Rectifier
O—Diode

The alternator is a 12 volt system. The operating principles are as follows:

When key switch (C) is turned ON, voltage is applied to terminal 1 (I) of the alternator. The regulator (J) switches the rotor (L) ON or OFF.

Once the engine reaches alternator cut in RPM, alternating output current is produced in the stator (M) windings. This alternating current is changed to direct current by the rectifier (N) diodes. Voltage is available at BAT (F) terminal. The current is used to charge the battery (B) and supply electrical current to the machine electrical system. Once alternator is charging, field current is supplied by the diode trio. Diode (O) protects the diode trio from external loads.

The regulator (J) acts like a switch for the rotor (L). A wire runs from BAT terminal (F) to terminal 2 (H). If the regulator (J) senses a low battery voltage, rotor is switched on. Field current increases and alternator output increases.

When high battery voltage is sensed by the regulator the rotor is switched off, reducing current output from stator. This on and off occurs many times a second. The voltage regulator is temperature compensated to provide a slightly higher voltage at low temperature to charge the battery.

When the alternator is operating, the R terminal voltage is approximately 7.8 volts AC.

Continued on next page

TX,9015,QQ1926 –19–10AUG95–1/2

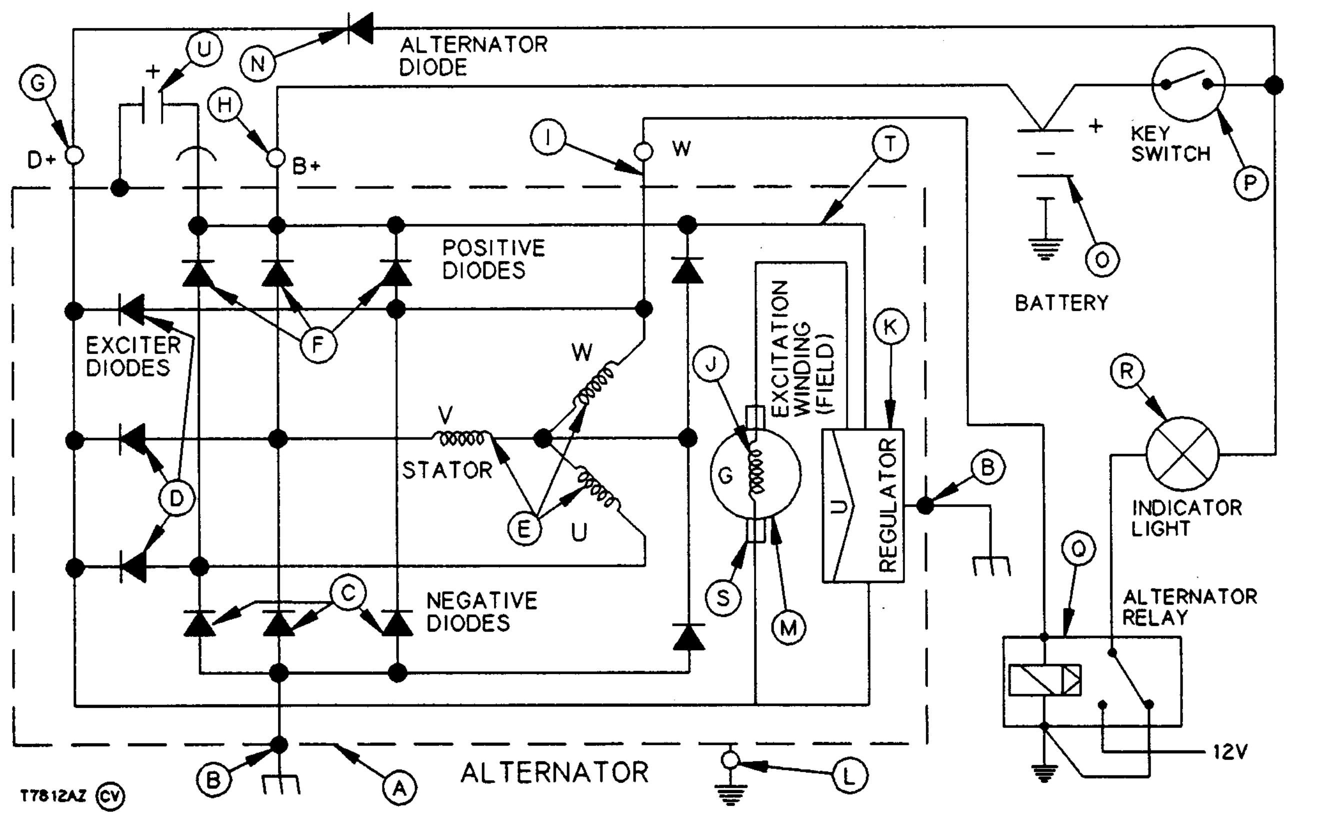
Specification

R Terminal—Approximate Voltage (when Alternator is Operating) .... 7.8 volts AC

This voltage is supplied to the alternator relay, energizing the relay and removing the ground for the alternator indicator light (D) in the display module, turning off the alternator indicator light.

TX,9015,QQ1926 –19–10AUG95–2/2

Alternator Operation—95 Amp Bosch (Serial No. 787514—)



T7812AZ –19–23SEP92

A—Alternator
B—Internal Ground
C—Negative Diodes
D—Exciter Diodes
E—Stator Windings
F—Positive Diodes
G—D+ Terminal
H—B+ Terminal
I—W Terminal
J—Excitation Winding
K—Regulator
L—External Ground Terminal
M—Rotor
N—Alternator Diode
O—Battery
P—Key Switch
Q—Alternator Relay
R—Indicator Light
S—Brushes
T—Sense Circuit
U—Noise Filter

TX,9015,QQ1927 –19–10AUG95–1/1

Alternator Operation—95 Amp Bosch

The 95 AMP Bosch alternator has three basic stages for proper operation. The operating principles are as follows.

PRE-EXCITATION STAGE:

When key switch (P) is turned to ON position, battery power flows to (G) terminal D+ on alternator, excitation winding (J), through regulator (K) and to internal ground (B).

EXCITATION STAGE:

During alternator start (as the engine speeds up from 0 to idle) current supplied by the external alternator diode to the field coil of the rotor produces a magnetic field which induces current in the three-phase winding of the stator (E). The alternator reaches cut-in RPM when the induced current is large enough to produce voltage equal to the battery voltage plus 1.0 volt. At this time, some current from the stator is rectified by the exciter diodes (D) (producing battery voltage at the D+ terminal (G)) and is supplied to the carbon brushes and slip rings of the excitation winding (J), strengthening the magnetic field in the excitation winding. This in turn will increase the stator voltage. This will occur continuously until the alternator (A) is fully excited and the alternator regulated voltage is reached.

Continued on next page TX,9015,DY373 –19– 3JUN96–1/2

NORMAL OPERATION:

The alternating current induced in the stator winding (J) is rectified by the positive and negative diodes (C and F) and delivered to the battery and current consuming accessories. The currents in the stator winding (E) are constantly changing magnitude and direction. However, current flowing to the battery and accessories always maintains the same direction. This is because no matter what position the rotor (M) is in, all the diodes are simultaneously involved in the process of rectification. The regulator (K) measures the B+ voltage (H) and compares it to an internal reference. When the B+ voltage (H) starts to rise above the reference voltage the regulator (K) switches off the field current. When the B+ voltage (H) starts to fall below the reference voltage the regulator (K) switches on the field current. The regulator (K) switches the field ON and OFF several thousand times a second in response to the current load placed on the alternator output and the engine RPM.

When the alternator is operating, the W terminal voltage is (7 to 8) volts (AC). This voltage is supplied to the alternator relay, energizing the relay and removing the ground for the alternator indicator light (Q) in the display module, turning off the alternator indicator light.

Current available from the alternator is dependent on engine RPM. Depending on pulley ratios, little or no current is available below abut 700 RPM. Full rated current is not available below about 1500 RPM.

TX,9015,DY373 –19– 3JUN96–2/2

Monitor Test In Machine

1. Turn key switch to "bulb Check" position. All indicator and warning lights and the buzzer must come on. If none of the lights come on, check the "monitor" fuse. If one or two lights fail to light, replace the bulb.

2. Return key switch to "on" position from "bulb check". Hold just momentarily in "bulb check". If held too long, the logic modules with time delay will have no delay. With machines that have time delay logic modules, after 2-3 seconds the engine oil pressure and engine alternator volts indicator lights and the red warning light and buzzer should come on. With no time delay the lights and buzzer will come on immediately. On some machines additional indicator lights may come on, depending on sending unit switches being closed and sending a ground signal to the monitor.

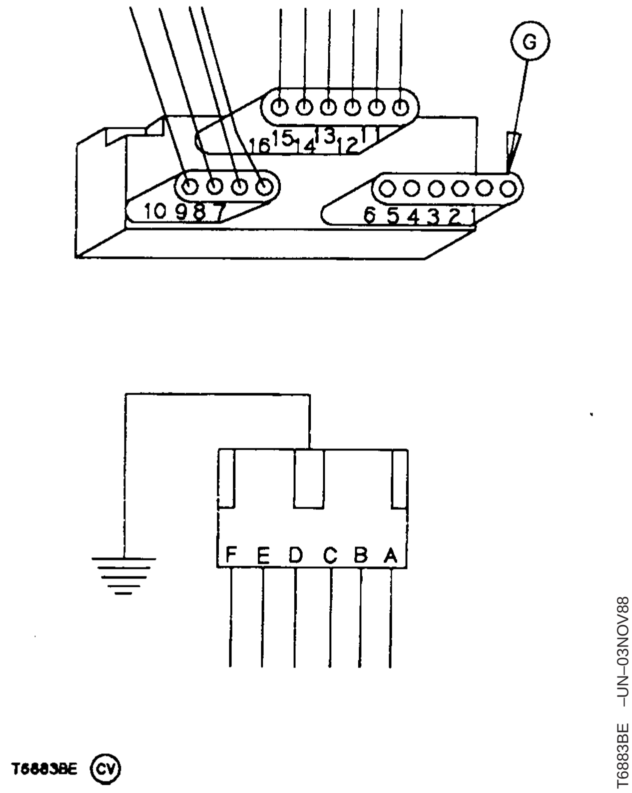
3. Turn key switch to "off" position. Disconnect lead from engine oil pressure switch and all other sending unit switches that are closed and sending a ground signal for a primary (red light) failure indication.

4. Turn key switch to "bulb check" momentarily and back to "on". After 2-3 seconds, the alternator indicator light and the yellow warning light should come on. There may be additional indicator lights on, depending on which secondary (yellow light) failure sending unit switches are closed.

5. If the warning lights do not come on, with (S.N — XXXXXX) the next step is to isolate the logic module from the display module and the machine wiring and sending units. See Logic Module Test In Machine, and Logic Module Bench Test in this group.

TX,9015,QQ3203 –19–31AUG95–1/1

Logic Module Test In Machine (S.N. — XXXXXX)



1. Disconnect 6 wire connector (G) from left side of display. Turn key switch ON. Ground pins "D" "E" and "F" one at a time.

2. Pin "D" must be grounded first to "arm" logic module.

3. With pin "D" grounded, yellow service required light, red STOP light and alarm must come on.

4. With pin "E" grounded, yellow service required light must come on.

5. With pin "F" grounded, red STOP light and alarm must come on.

   If logic module does not work when grounding pins "D", "E" and "F", check logic module wiring by continuing with step 6. If wiring is OK, replace logic module.

6. To check wiring, reconnect wiring at display module.

Continued on next page

TX,9015,QQ3201 –19–31AUG95–1/2

7. Disconnect harness connectors from logic module.

NOTE: Some of the continuity checks are made on circuits that contain warning lights or diodes in the display module. A test light will not work on these circuits, an ohmmeter must be used. If a digital ohmmeter is used, it must be set on the Diode Test position.

8. Make the following voltage and continuity checks at the logic module connectors in the wiring harness.

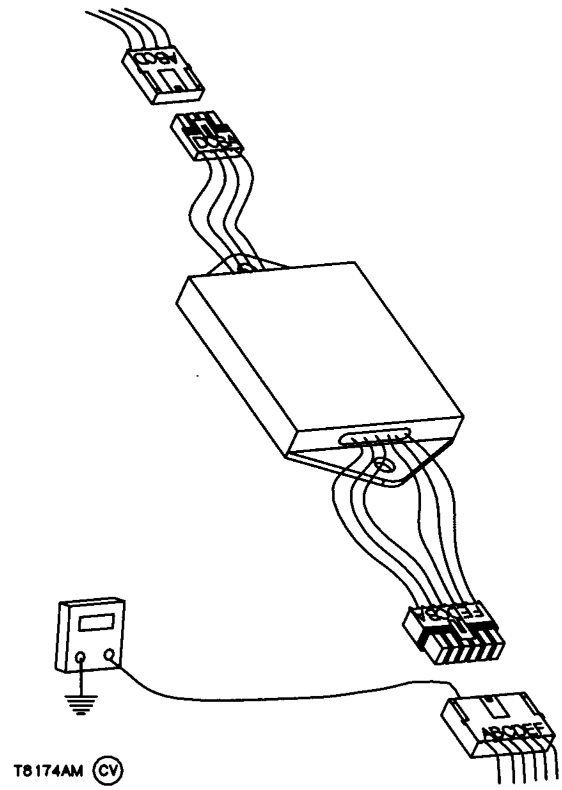
   Voltage Checks—Engine OFF, Key Switch ON:

   - A—12 Volts
   - C—12 Volts

   Continuity Checks—Key Switch OFF

   - A of 4-Pin to C of 4-Pin
   - A of 4-Pin to D of 6-Pin
   - B of 4-Pin to Ground
   - D of 4-Pin to Ground
   - B of 6-Pin to Alternator Relay NO Terminal
   - E of 6-Pin to Ground (With key in BULB CHECK position only)
   - F of 6-Pin to Ground

   If voltage or continuity is not correct, see the schematic and wiring diagram to trace the circuit.



T8174AM —UN–09FEB94

TX,9015,QQ3201 –19–31AUG95–2/2

Logic Module Bench Test (S.N. —XXXXXX)

IMPORTANT: DO NOT allow wires to touch one another after being connected to logic module.

1. Connect wires (A and B) from positive (+) battery post to pins A and C in large connector.

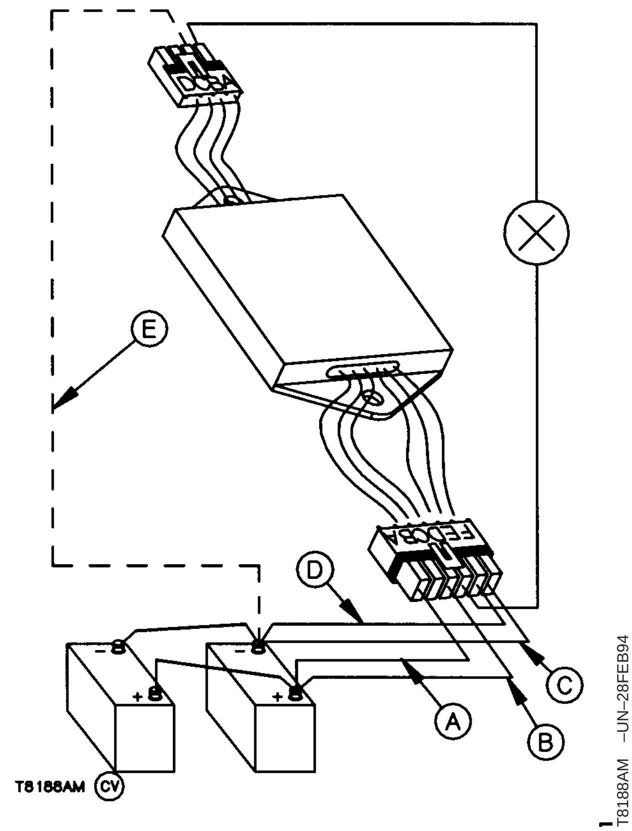
2. Connect wire (C) from negative battery post to pin F in large connector.

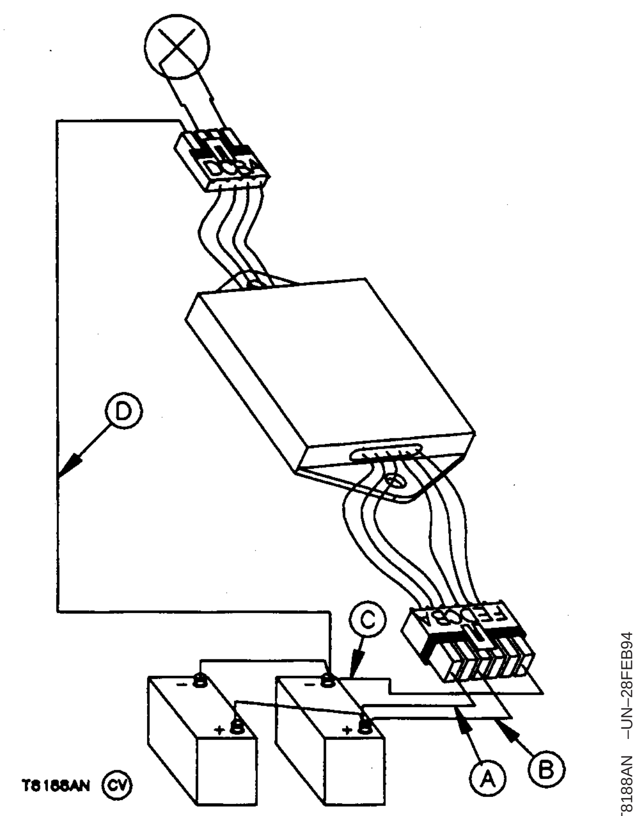
3. Using a 12V indicator light with two wire leads, connect one lead to pin D in large connector, and one lead to pin A in small connector.

4. Connect wire (D) to pin E in large connector, and negative battery post. Light must come on. If it does, remove wire from pin E and go to next step. If light does not come on, replace module.

5. Connect wire (E) to pin B in small connector. Light must come on. If it does, remove wire (E) from pin B and go to next step. If light does not come on, replace module.

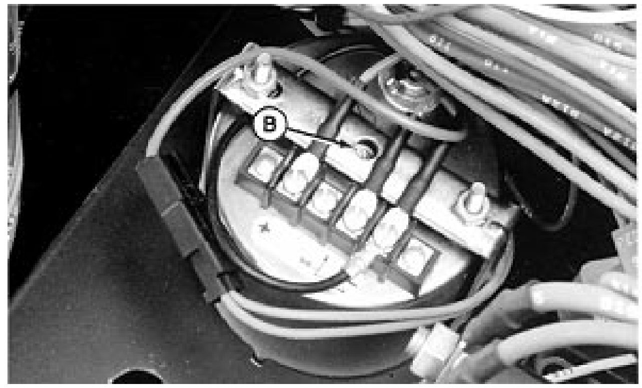
6. Remove the indicator light lead from pin D in large connector and connect to pin C in small connector. Connect wire (D) to pin D in small connector. Light must pulse on and off. If it does not, replace module.





TX,9015,QQ3202 –19–31AUG95–1/1

Tachometer Calibration



T7545BQ –UN–27JUN91

1. Remove heater control knob, blower speed knob and four side console panel screws to remove panel.

2. Verify engine speed using tachometer. See Tachometer Installation in this group.

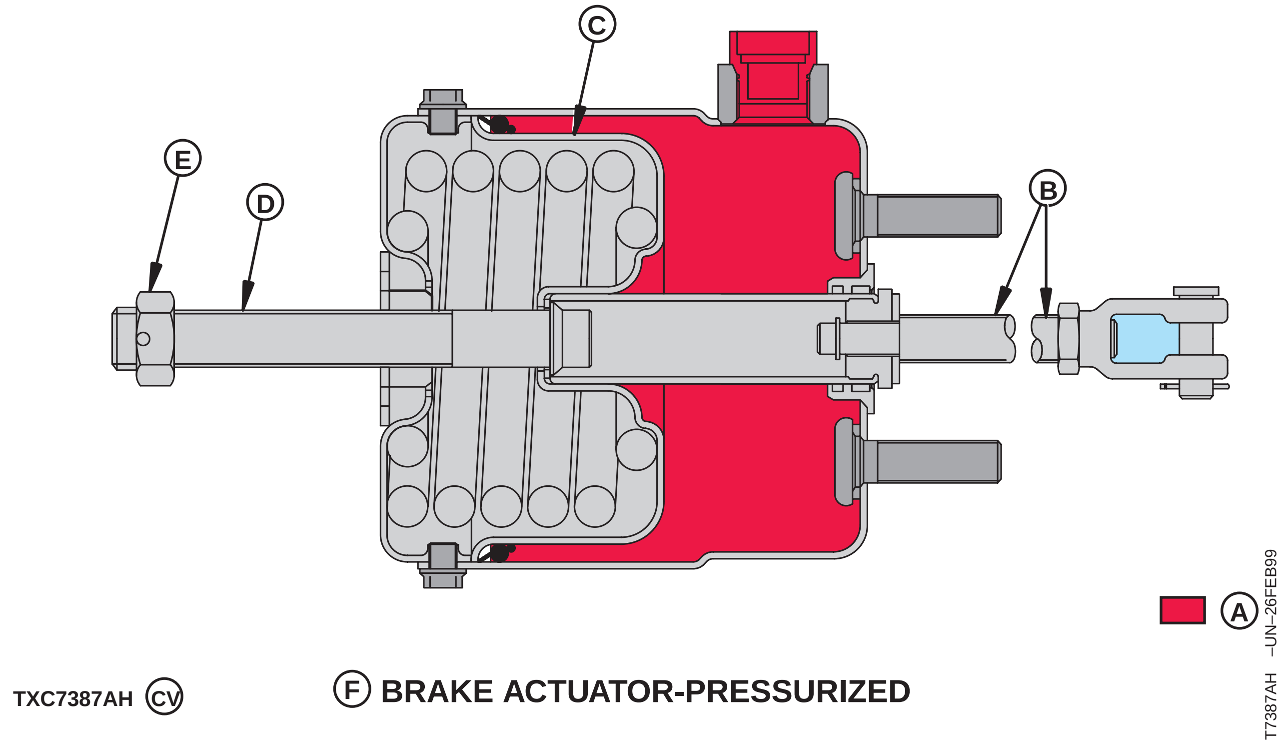
3. Adjust screw (B) to adjust machine tachometer to high idle speed.

TX,9015,QQ1798 –19–31AUG95–1/1

Section 9020
Power Train

Contents

Park Brake Operation



A—Pressure Oil
B—Parking Brake Linkage
C—Facing
D—Release Rod
E—Release Nut
F—Brake Actuator—Pressurized

The parking brake drum is mounted on the differential cover and turns with the ring gear. The brake band that is installed on the brake drum operates in oil and locks the final drive power train to the case when applied.

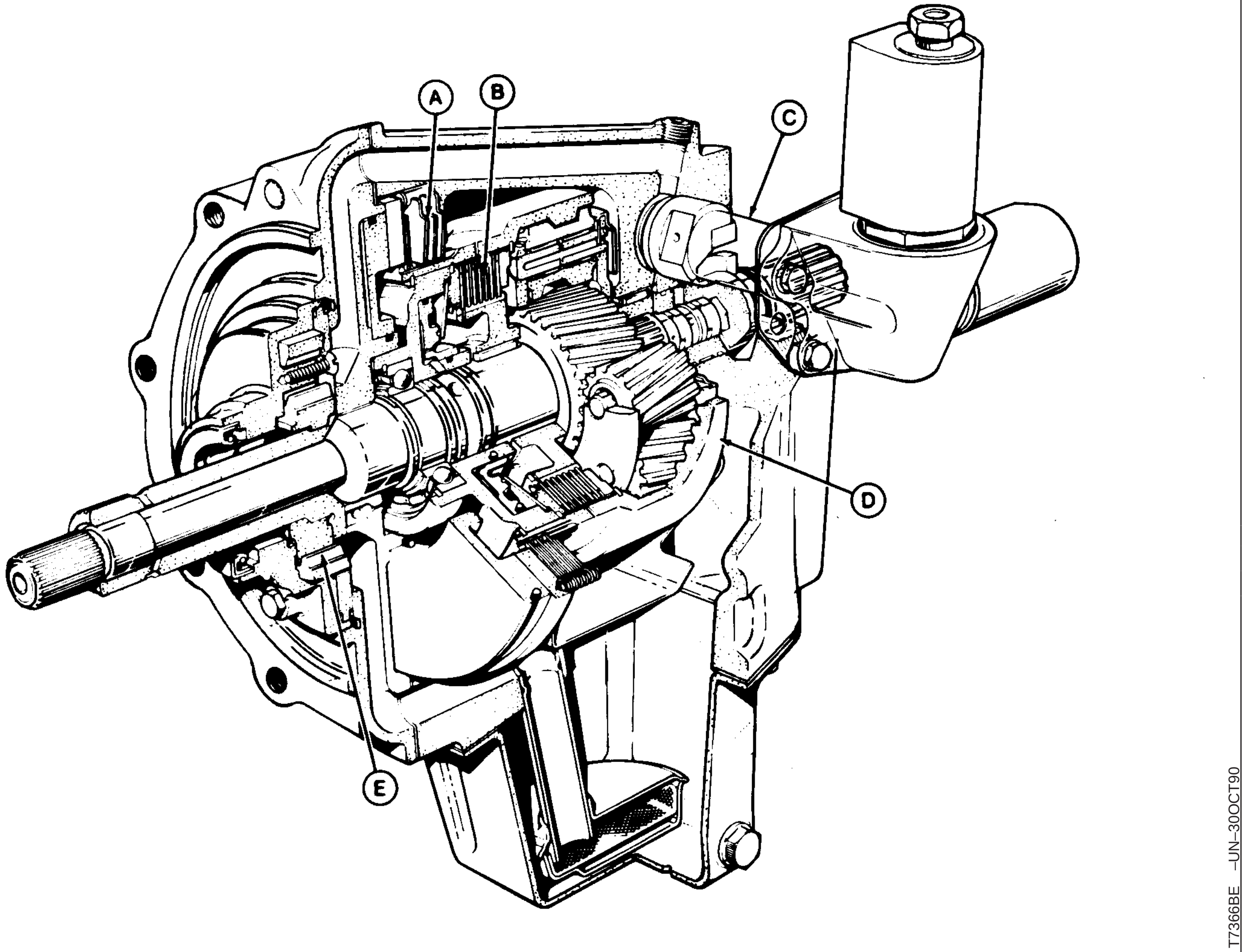
The parking brake is spring applied and hydraulically released during normal machine operation. Pressure oil from the reverser hydraulic system is controlled with a solenoid valve that is actuated by a switch on the console.

Pressure oil from the energized parking brake solenoid is routed to the parking brake actuator facing (C) and brake linkage (B). The pressure oil releases the brake.

Brake can also be manually released for towing by turning nut (E) until rod (D) bottoms.

TX,300D,1973 –19–08MAR93–1/1

Reverser Operation

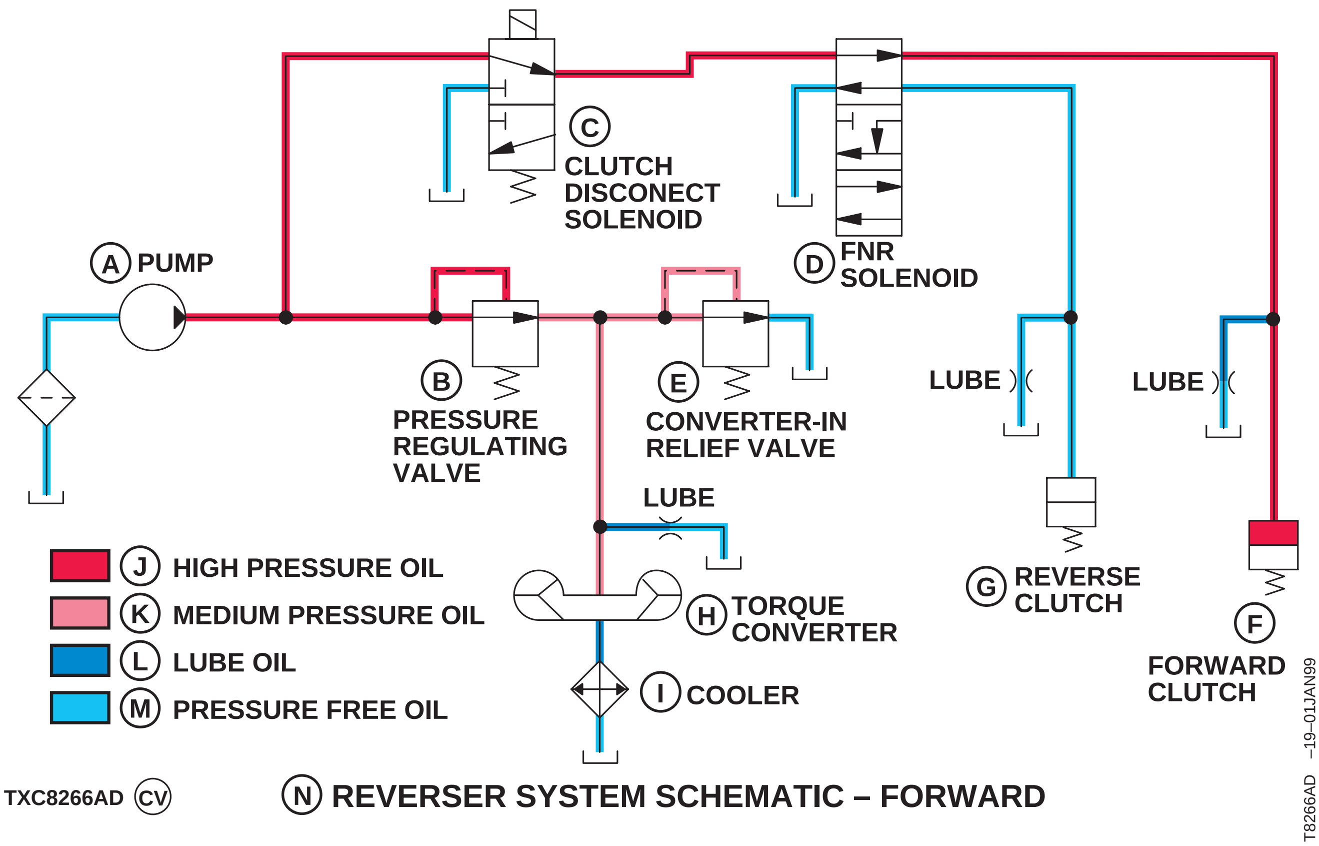


Reverser (S.N. —792482) Shown

A—Reverse Brake
B—Forward Clutch
C—Directional Control Valve
D—Planetary
E—Oil Pump

Continued on next page

T59,9020,340 –19–12JUL94–1/2



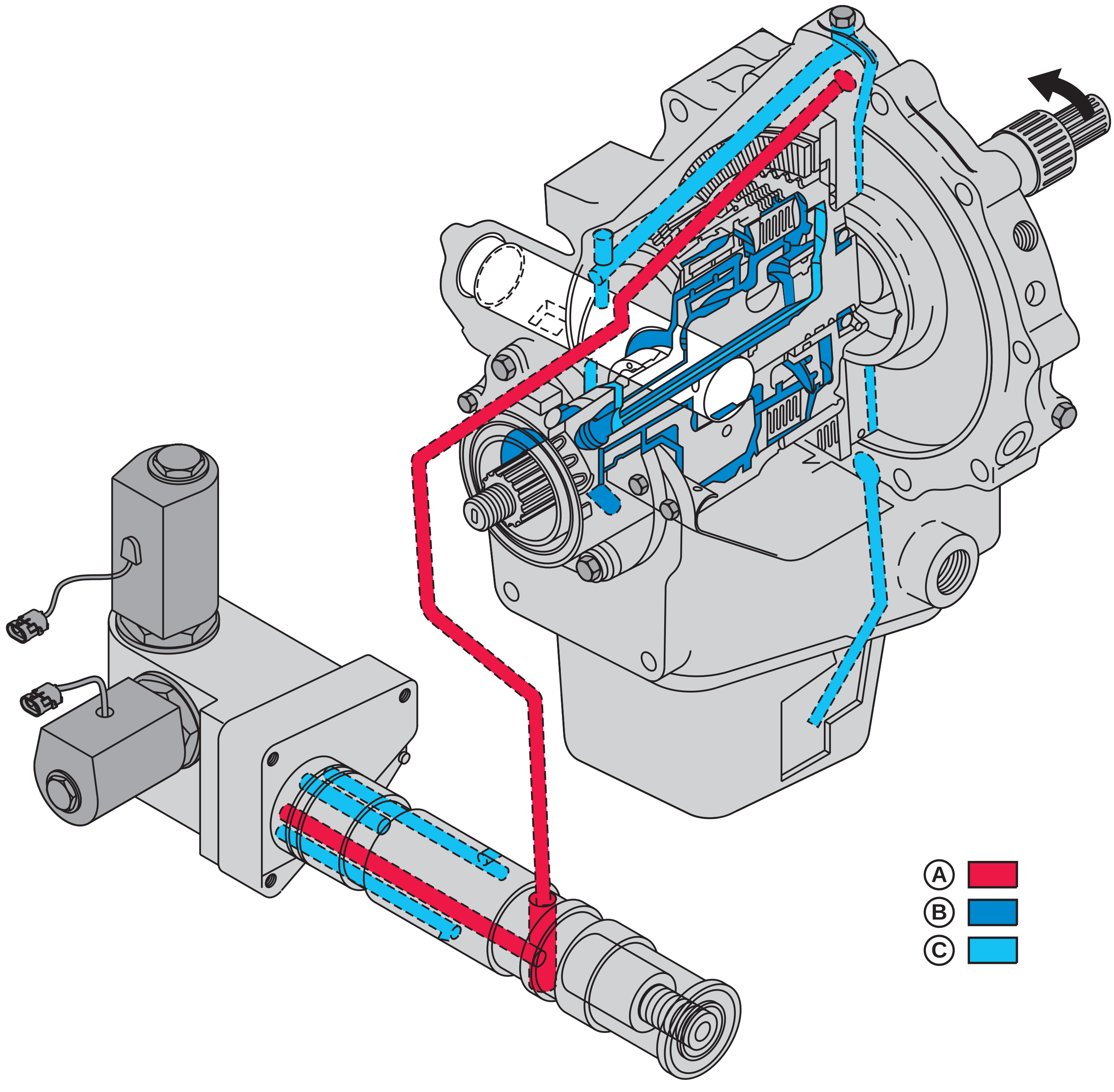
(S.N.792483—) Shown

The reverser is a forward-neutral-reverse gearbox that receives input from torque converter. It contains a forward multi-disk direct drive clutch (B), reverse multidisk brake (A), planetary gear set (D) and a directional control valve (C). Power flow through reverser provides input to transaxle assembly.

Lubrication oil and element engagement pressure oil is supplied by a crescent type oil pump (E). The pump is mounted on the reverser front cover and is driven at engine speed by torque converter drive tangs.

T59,9020,340 –19–12JUL94–2/2

Reverser Operation (SN —792482)



C OIL FLOW IN NEUTRAL

TXC7366BG

T7366BG —UN–26FEB99

Continued on next page

A—High Pressure Oil **B—Lubrication Oil** **C—Return Oil (Pressure Free)** **D—Oil Flow in Neutral**

Oil Flow In Neutral

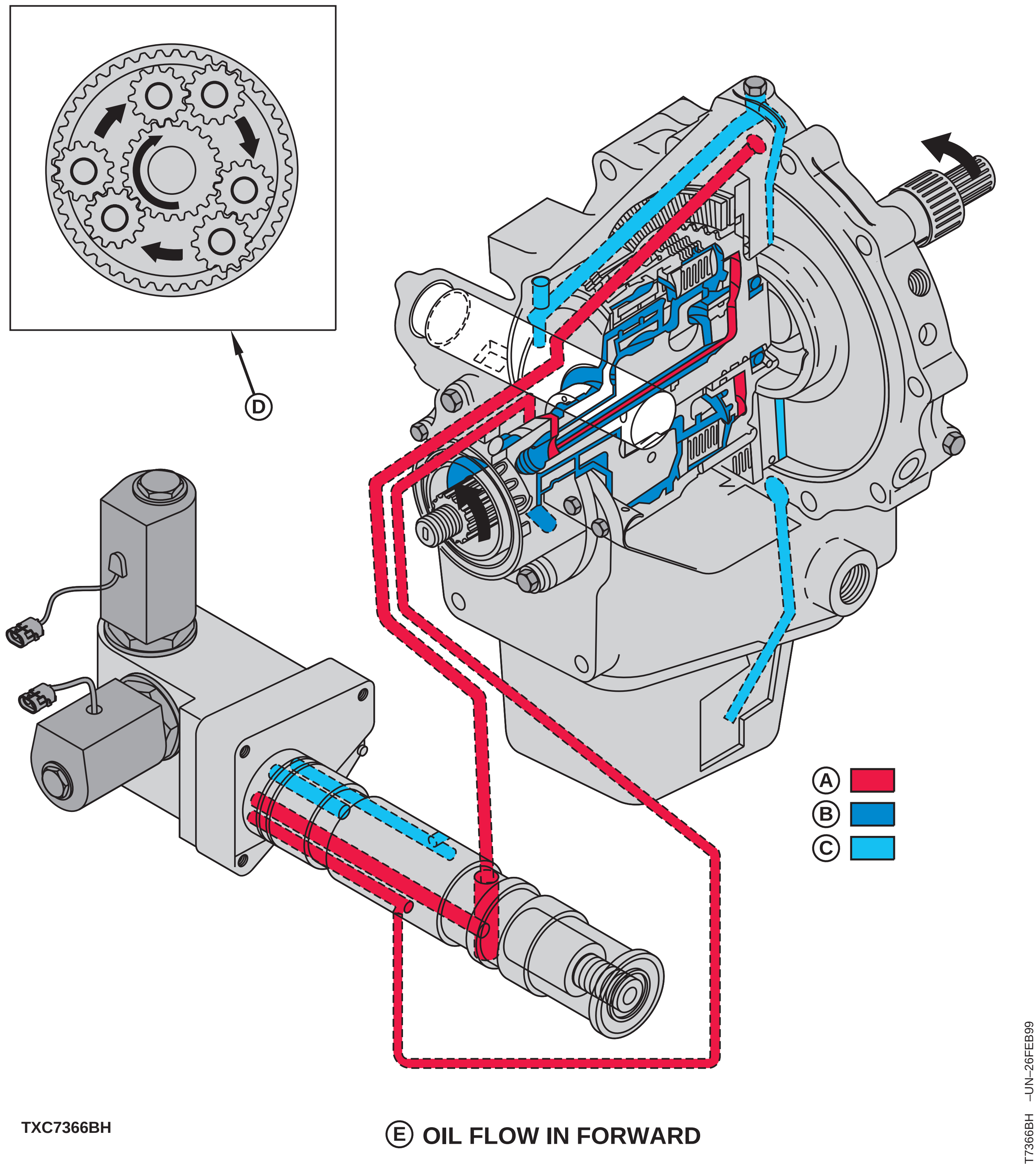
When the directional control lever is moved to the neutral position, pressure oil (A) is blocked from the forward clutch and reverse brake by the directional control solenoid valve. The directional control solenoid valve is de-energized.

Reverser pump and torque converter continue to operate providing lubrication oil and oil to the cooler.

Both the forward clutch and reverse brake pistons dump oil (C) to reservoir which results in a complete interruption of power flow through the reverser.

Continued on next page

TX,210D,1937 –19–12JUL94–2/6



A—Pressure Oil
B—Lubrication Oil
C—Return Oil (Pressure Free)
D—Planetary (Viewed from Front)
E—Oil Flow in Forward

Continued on next page

TX,210D,1937 –19–12JUL94–3/6

Oil Flow In Forward

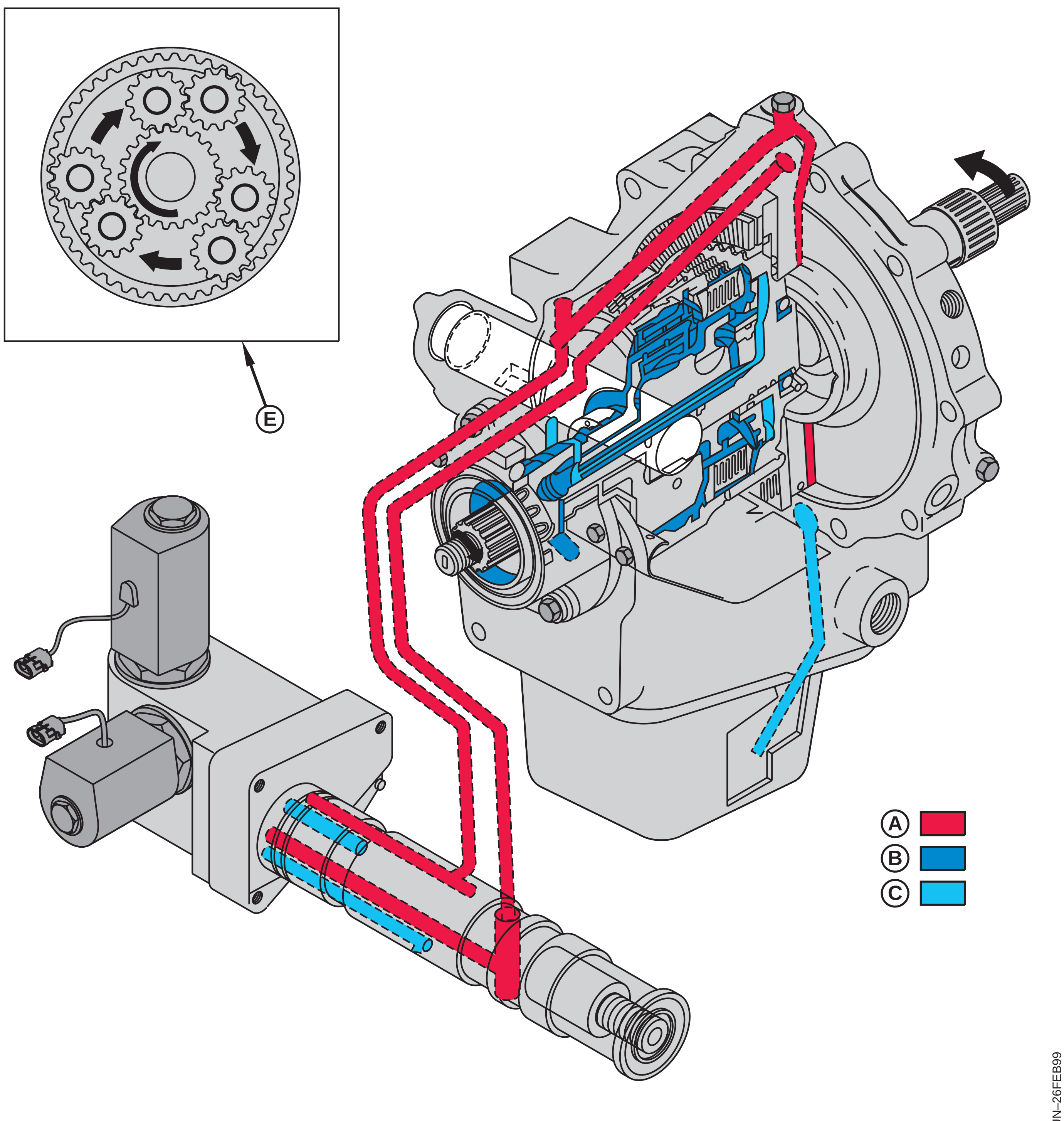
When the FNR lever is shifted to forward position, the directional control solenoid is energized and forces the inner spool IN. This allows high pressure regulated oil (A) from the reverser pump to flow through the valve and internal housing passages to the output shaft. Oil flows through passages in the output shaft to the forward clutch piston.

Pressure oil moves the piston against the disks and plates. With the forward clutch engaged the input shaft, planetary and output shaft rotate as one assembly.

Oil behind the reverse brake piston is routed to return to disengage reverse brake.

Forward clutch lubrication requirements are increased when clutch is engaged causing lower pressure in the forward clutch circuit. This pressure will be slightly lower than system pressure and reverse brake engagement.

Continued on next page TX,210D,1937 –19–12JUL94–4/6



TXC7366BI

D OIL FLOW IN REVERSE

A—High Pressure Oil
B—Lubrication Oil
C—Return Oil
D—Oil Flow in Reverse
E—Planetary (Viewed from Front)

Continued on next page

TX,210D,1937 –19–12JUL94–5/6

Oil Flow In Reverse

When FNR lever is moved to reverse position, the directional control valve solenoid is energized and pulls the inner valve spool OUT and allows high pressure regulated oil (A) from the reverser pump to flow through the valve and internal housing passages to the reverse brake piston. Oil pressure moves the piston against disks, plates, and the reverser housing.

With reverse brake engaged, the ring gear cannot rotate. The input shaft turns inside the planetary assembly.

This rotation causes the pinion gears to rotate against the inside of the ring gear causing planetary and output shaft assembly to rotate in opposite directions of input shaft. This causes a 10 percent speed reduction in reverse gears.

Forward clutch continues to receive lubrication oil (B). Forward clutch piston oil is open to return to disengage forward clutch.

TX,210D,1937 –19–12JUL94–6/6

Reverser Oil Flow (SN 792483—)

Reverser oil flows from the oil pan through suction strainer to the reverser pump (O). The reverser pump is driven at engine speed by the torque converter drive tangs.

High pressure oil (S) flows from the reverser pump through internal passages to the clutch disconnect solenoid. The clutch disconnect solenoid is energized with engine running and allows oil flow to FNR solenoid. Pressure oil is also routed through an external line to the parking brake solenoid valve.

Pressure regulating valve (K) maintains high pressure oil for forward clutch, reverse brake and lubrication oil.

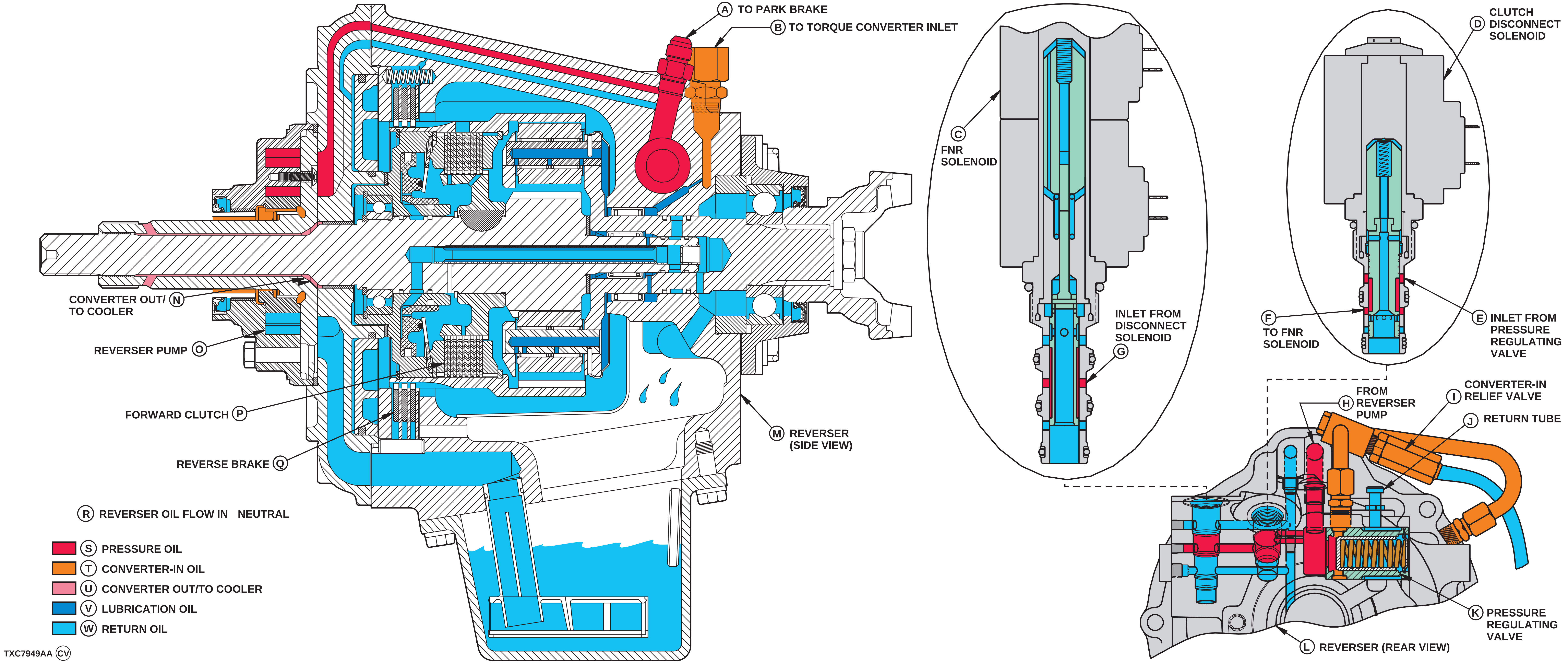
Oil not needed for element engagement or lubrication flows through external line to the torque converter. Torque converter-in (cooler) relief valve (I) protects torque converter and oil cooler components from damage.

Low pressure oil from the torque converter flows to cooler.

Oil from the cooler returns to the oil pan.

Continued on next page TX,9020,YY748 –19–12JUL94–1/5

T7949AA –19–01JAN99



Continued on next page

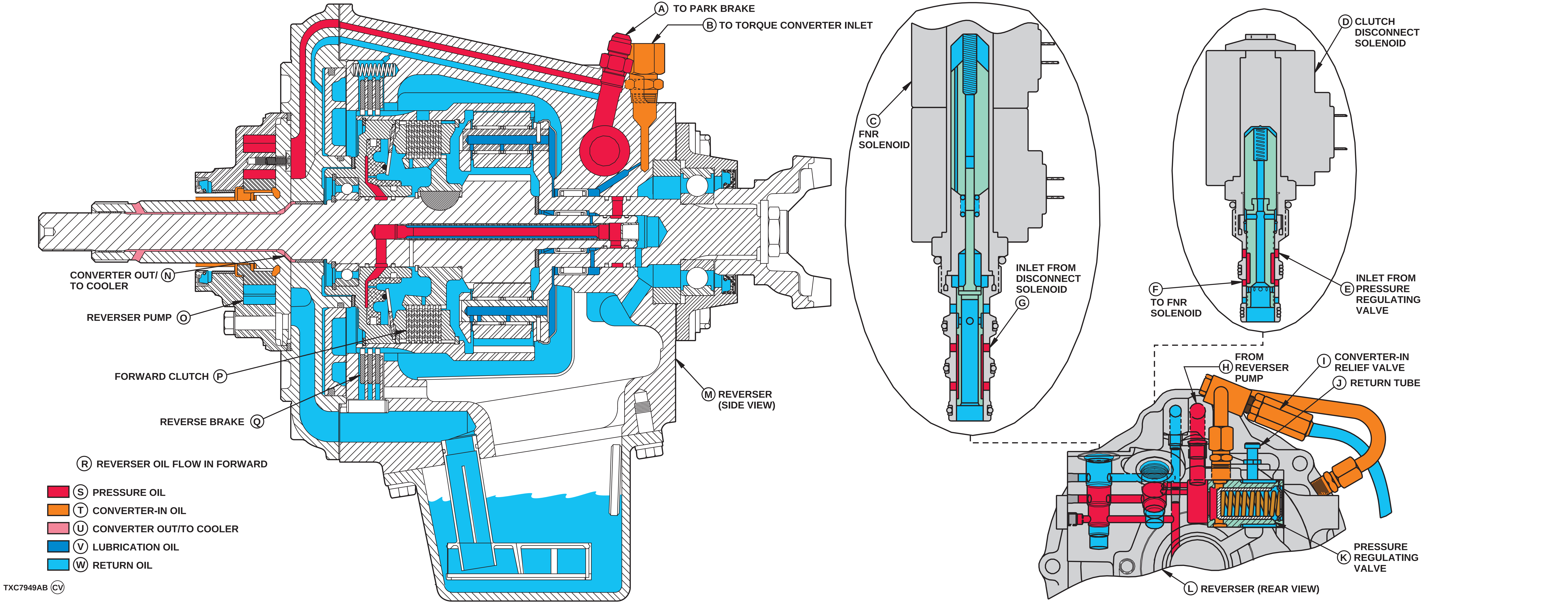
TX,9020,YY748 –19–12JUL94–2/5

A—To Park Brake
B—To Torque Converter Inlet
C—FNR Solenoid
D—Clutch Disconnect Solenoid
E—Inlet from Pressure Regulating Valve
F—To FNR Solenoid
G—Inlet from Disconnect Solenoid
H—From Reverser Pump
I—Converter-in Relief Valve
J—Return Tube
K—Pressure Regulating Valve
L—Reverser (Rear View)
M—Reverser (Side View)
N—Converter Out/To Cooler
O—Reverser Pump
P—Forward Clutch
Q—Reverse Brake
R—Reverse Oil Flow in Neutral
S—Pressure Oil
T—Converter-in Oil
U—Converter Out/To Cooler
V—Lubrication Oil
W—Return Oil

Continued on next page

TX,9020,YY748 –19–12JUL94–3/5

T7949AB –19–01JAN99



TXC7949AB CV

Continued on next page

A—To Park Brake
B—To Torque Converter Inlet
C—FNR Solenoid
D—Clutch Disconnect Solenoid
E—Inlet from Pressure Regulating Valve
F—To FNR Solenoid
G—Inlet from Disconnect Solenoid
H—From Reverser Pump
I—Converter-in Relief Valve
J—Return Tube
K—Pressure Regulating Valve
L—Reverser (Rear View)
M—Reverser (Side View)
N—Converter Out/To Cooler
O—Reverser Pump
P—Forward Clutch
Q—Reverse Brake
R—Reverse Oil Flow in Forward
S—Pressure Oil
T—Converter-In Oil
U—Converter Out/To Cooler
V—Lubrication Oil
W—Return Oil

When the FNR lever is shifted to forward position, the FNR solenoid is energized allowing high pressure regulated oil (S) from the reverser pump to flow through the valve and internal housing passages to the output shaft. Oil flows through passages in the output shaft to the forward clutch piston.

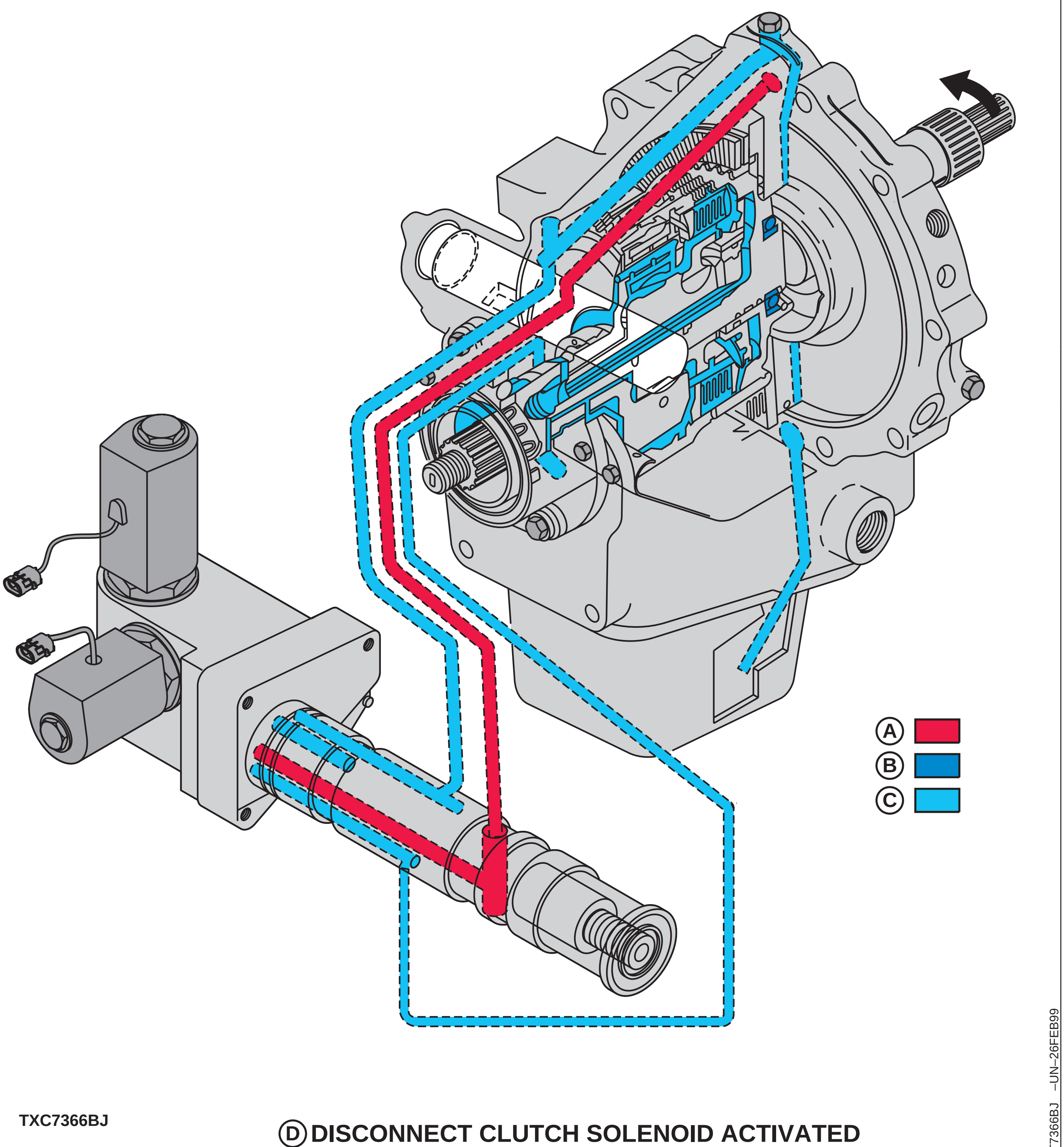
Pressure oil moves the piston against the disks and plates. With the forward clutch engaged the input shaft, planetary and output shaft rotate as one assembly.

Oil behind the reverse brake piston is routed to return to disengage reverse brake.

Forward clutch lubrication requirements are increased when clutch is engaged causing lower pressure in the forward clutch circuit. This pressure will be slightly lower than system pressure and reverse brake engagement.

TX,9020,YY748 –19–12JUL94–5/5

Disconnect Clutch Solenoid Activated (SN —792482)



Continued on next page

TX,300D,1966 –19–12JUL94–1/2

A—High Pressure Oil **B—Lubrication Oil** **C—Return Oil (Pressure Free)** **D—Disconnect Clutch Solenoid**

The disconnect clutch solenoid is used to disengage the forward clutch or reverse brake without moving the FNR lever. This provides maximum engine power to the hydraulic function during loader operation.

The disconnect clutch solenoid can be de-energized by pressing the button on the transmission shift lever or loader control valve lever. When de-energized, spring force moves the inner spool IN which blocks the flow of high pressure oil to the direction control valve solenoid. At the same time, the spool connects the forward clutch and reverse brake passages to sump which disengages power flow by releasing all previous engagement pressure oil.

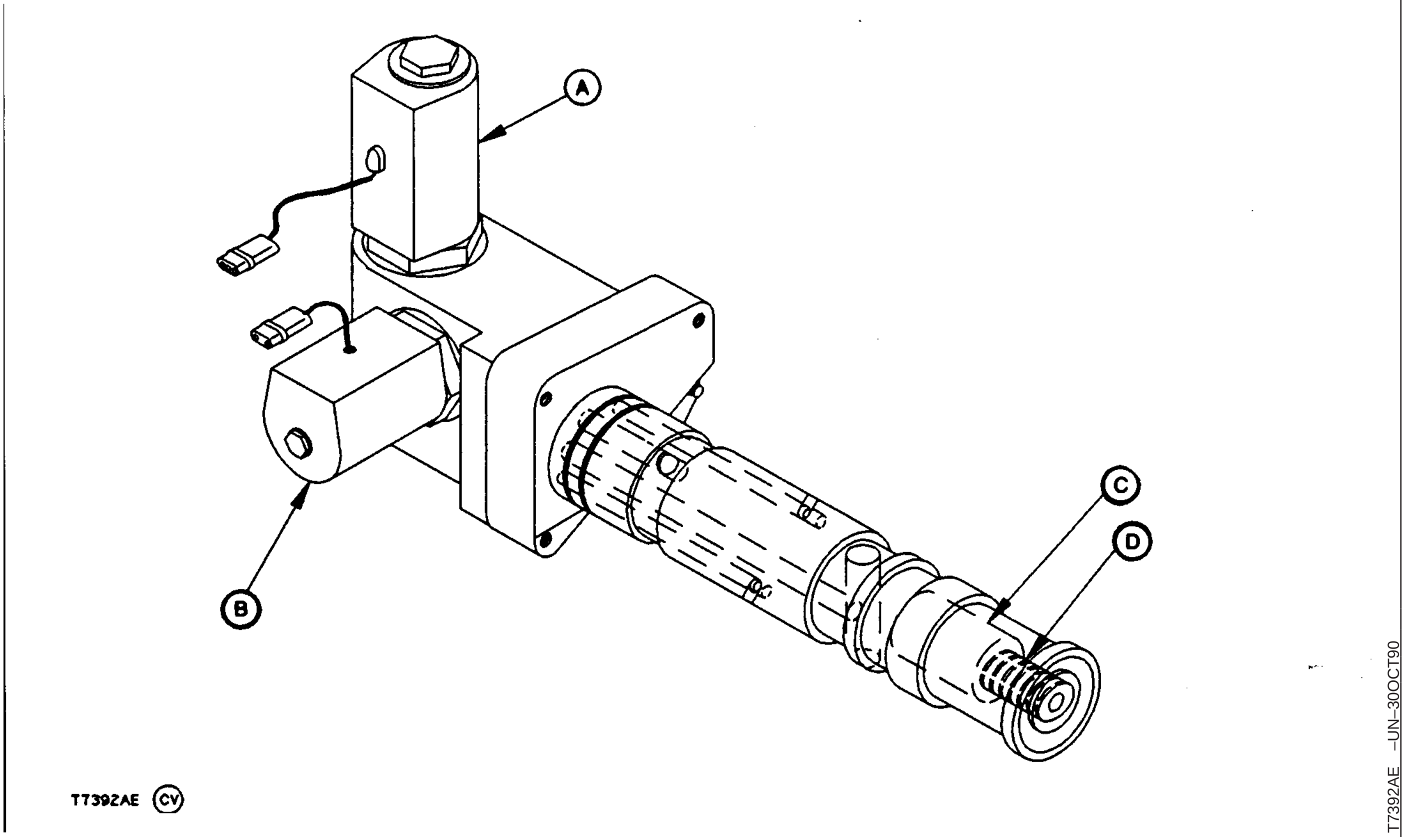
With reverse brake engaged, the ring gear cannot rotate. The input shaft turns inside the planetary assembly.

This rotation causes the pinion gears to rotate against the inside of the ring gear causing planetary and output shaft assembly to rotate in opposite directions of input shaft. This causes a 10% speed reduction in reverse gears.

Forward clutch continues to receive lubrication oil (B). Forward clutch piston oil is open to return to disengage forward clutch.

TX,300D,1966 –19–12JUL94–2/2

Directional Control Valve (SN —792482)



A—Direction Control Solenoid **B—Clutch Cut-off Solenoid** **C—Inner Valve Spool** **D—Centering Spring**

The directional control valve has two electrically actuated solenoids that control oil flow for element engagement.

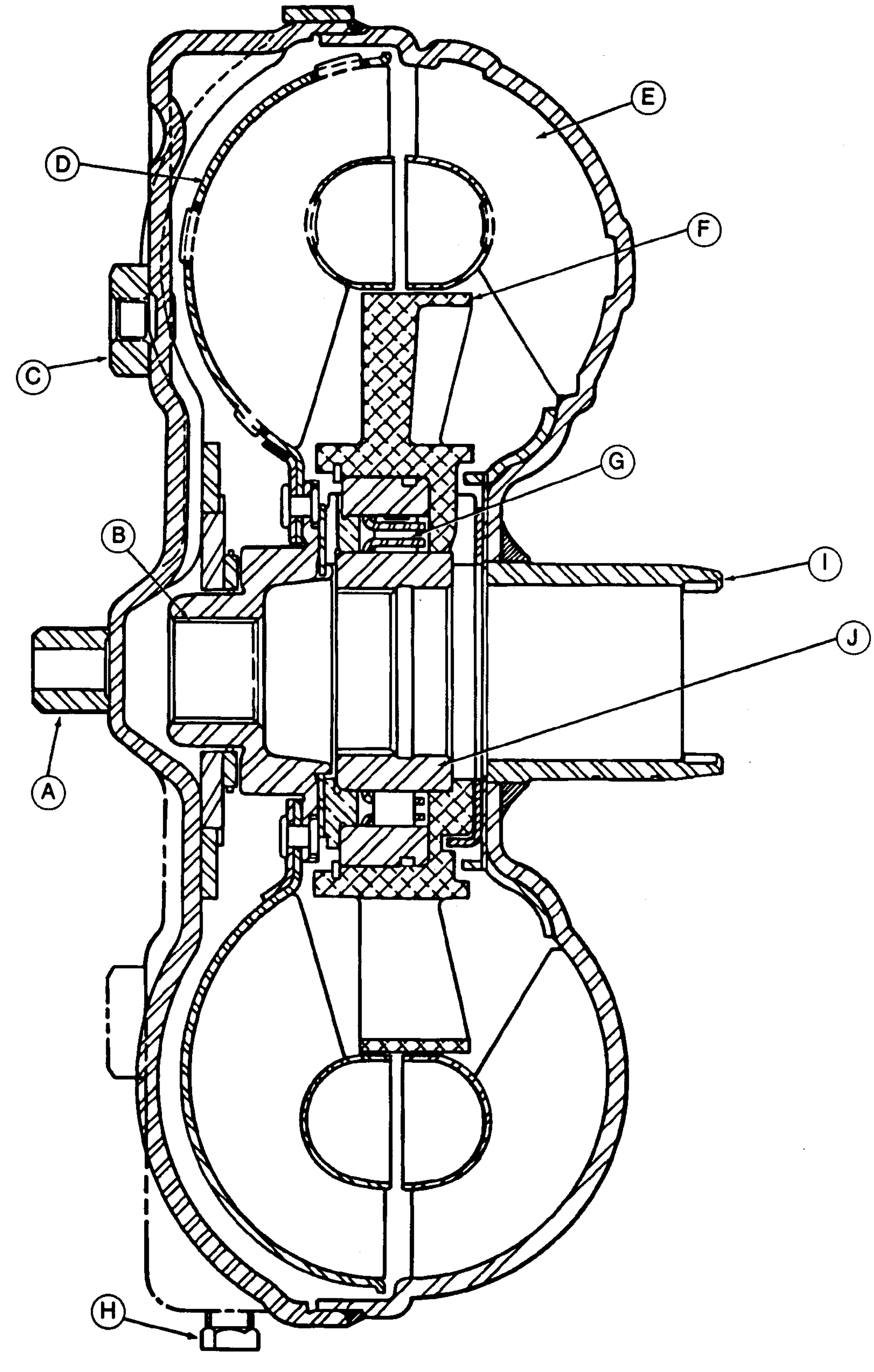
The disconnect clutch cut-off solenoid (B) is a continuous-duty solenoid that actuates and holds inner valve spool against spring during normal machine operation. High pressure oil flow is allowed to pass through the valve and is routed to the directional control solenoid.

When the clutch cut-off solenoid is de-energized, element engagement oil flow is blocked and oil previously used to engage the clutch or brake pack is allowed to return to sump.

The direction control solenoid (A) is a bi-directional solenoid that moves the inner valve spool in or out from a neutral position that is established by the centering spring. Movement of the valve when solenoid is energized directs oil flow to engage either the forward clutch or reverse brake.

TX,210D,1934 –19–12JUL94–1/1

Torque Converter Operation



T7927AQ –UN–22JAN93

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10T,9020,K127 –19–12JUL94–1/2

A—Pilot Shaft
B—Turbine Spline
C—Boss
D—Impeller
E—Turbine
F—Stator
G—Free Wheel Clutch
H—Drain Plug
I—Stator Spline
J—Pump Drive Tang (2 used)

There are three main parts to the torque converter. They are:

- Impeller
- Turbine
- Stator

The impeller is driven by the engine. As it rotates, centrifugal force throws oil out of the impeller against the blades of the turbine. This forces the turbine to rotate in the same direction as the impeller.

The turbine is connected to the turbine shaft which provides input to the reverser.

As the oil leaves the turbine, it is moving in the opposite direction of the impeller. This would tend to slow down the impeller, robbing engine horsepower. The function of the stator is to prevent this.

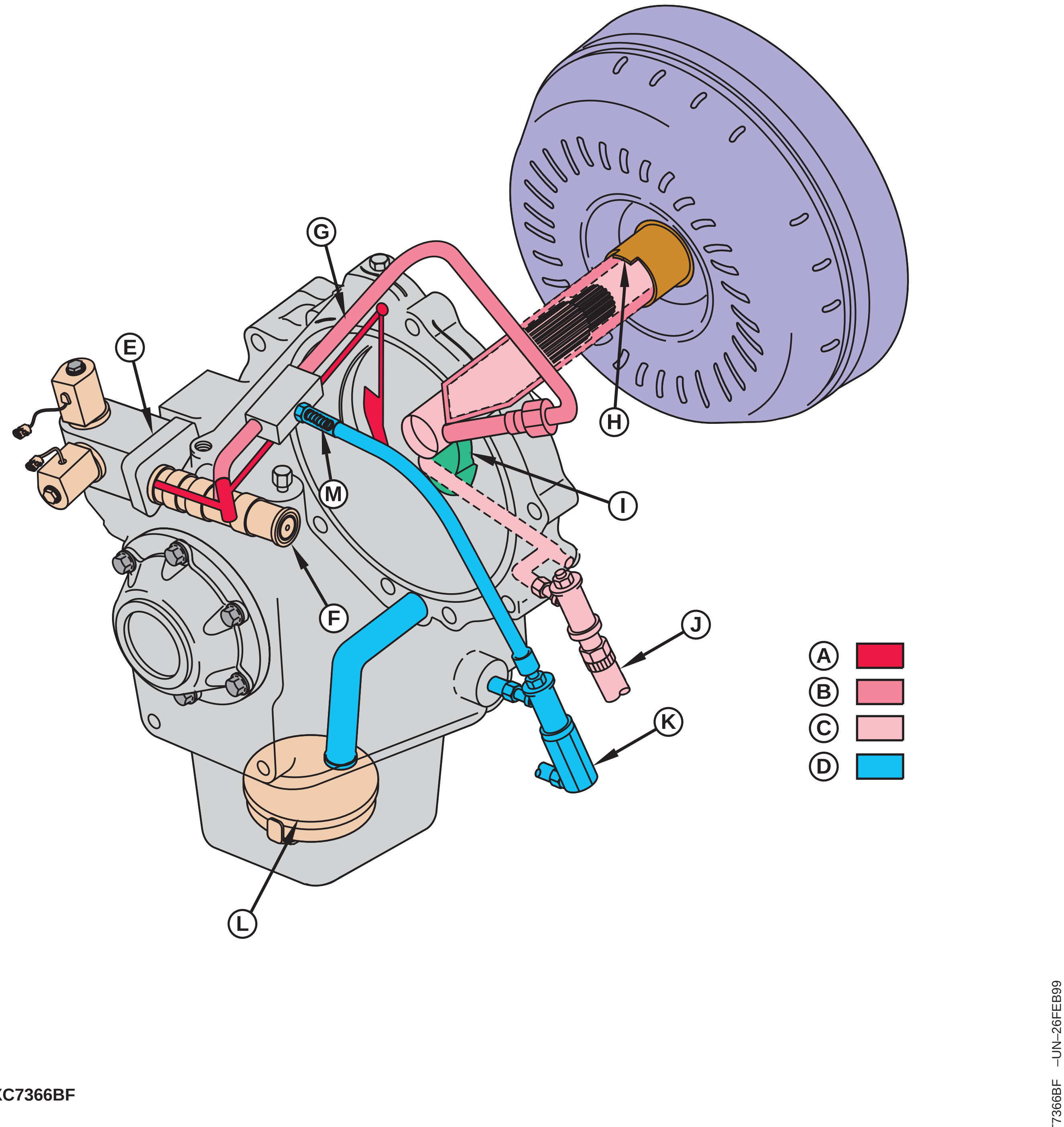
Oil leaving the turbine enters the stationary stator. The stator is curved so that the oil flow changes direction. Oil leaving the stator is moving in the same direction as the impeller. This adds to the force of the oil entering the impeller.

The turbine will be rotating at a slower speed than the impeller, but it will produce a higher torque. It is this increased force developed by the stator that makes a converter able to multiply torque.

Under light load the speed of the turbine will increase until it equals impeller speed. The free wheel clutch will unlock, allowing the stator to freewheel or rotate with the turbine and impeller as a unit. Input speed and torque are equal to output speed and torque when the stator is freewheeling.

10T,9020,K127 –19–12JUL94–2/2

Oil Flow To And From Torque Converter (SN —792482)



TXC7366BF

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TX,210D,1935 –19–12JUL94–1/2

A—High Pressure Oil
B—Medium Pressure Oil
C—Low Pressure Oil
D—Return Oil (Pressure Free)
E—Directional Control Valve
F—Pressure Regulating Piston
G—Control Valve-to-Converter In Line
H—Drive Tangs
I—Reverser Pump
J—Converter Out/Cooler In
K—Cooler Out/Reverser In
L—Suction Screen
M—Cooler Relief Valve

Reverser oil flows from the oil pan through suction strainer (L) to the reverser pump (I). The reverser pump is driven at engine speed by the torque converter drive tangs (H).

High pressure oil (A) flows from the reverser pump through internal passages to the clutch cut-off and directional control solenoid valves. Pressure oil is also routed through an external line to the parking brake solenoid valve.

Pressure regulating piston (F) maintains high pressure oil for forward clutch, reverse brake and lubrication oil.

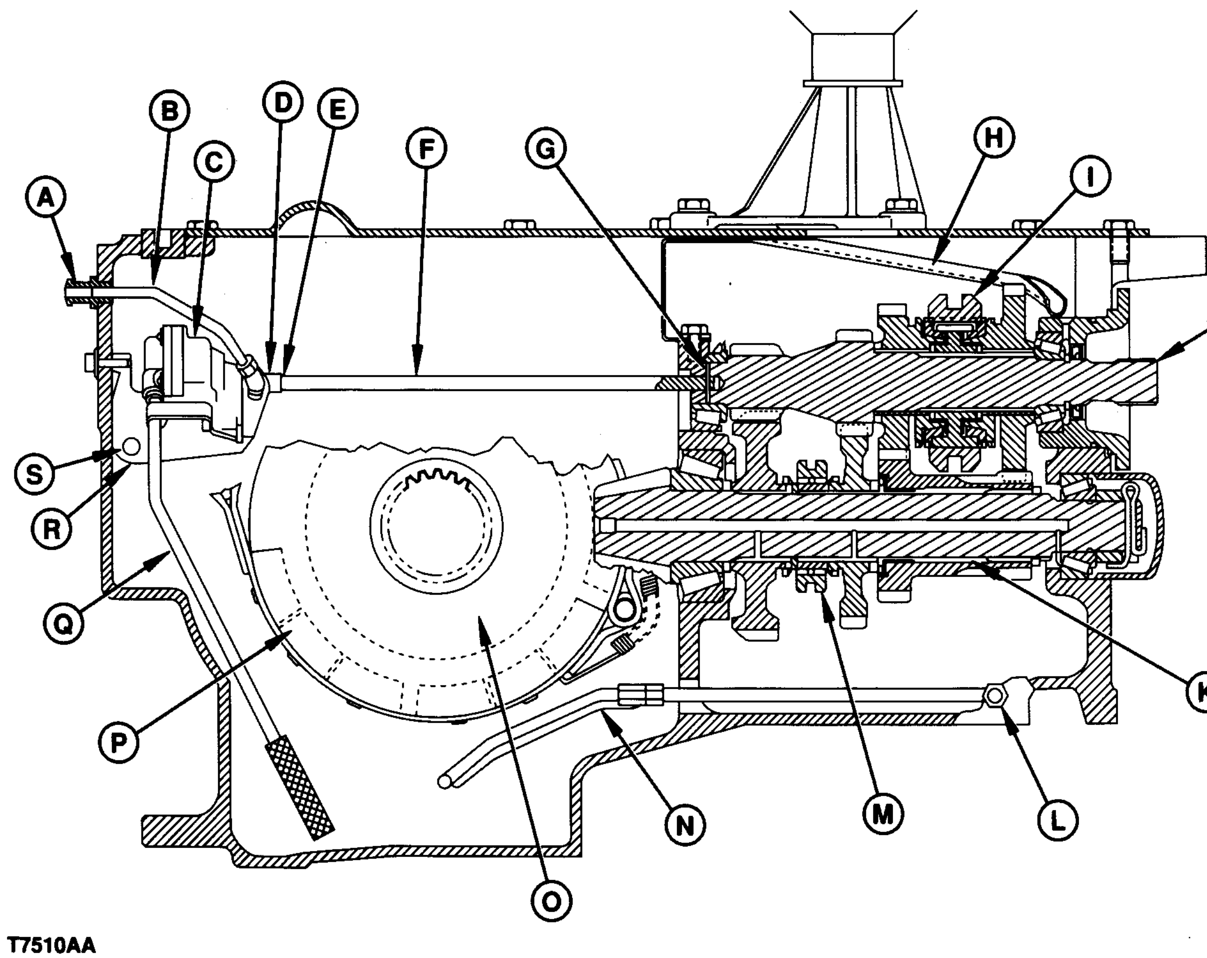
Oil not needed for element engagement or lubrication flows through external lines (G) to reverser front cover. Oil flows through internal passages to the torque converter.

Low pressure oil (C) from the torque converter flows through front cover bearing on input shaft through internal passages to converter out/cooler in hydraulic line (J).

Oil from the cooler (K) returns to the oil pan. Torque converter in (cooler) relief valve (M) protects torque converter and oil cooler components form damage.

TX,210D,1935 –19–12JUL94–2/2

Transaxle—300D



T7510AA –UN–25APR91

A—Pump Outlet to Cooler
B—Pump Outlet Line
C—Lube Pump
D—Clamp
E—Drive Shaft Sleeve
F—Pump Drive Shaft
G—Spring Pin
H—Lube Trough
I—Third and Fourth Gear Synchronizer
J—Transmission Drive Shaft
K—Differential Drive Shaft
L—Case Inlet from Cooler
M—Shift Collar
N—Inlet Line to Brake Cavity
O—Ring Gear
P—Parking Brake Band
Q—Suction Line
R—Pump Support Bracket
S—Pin

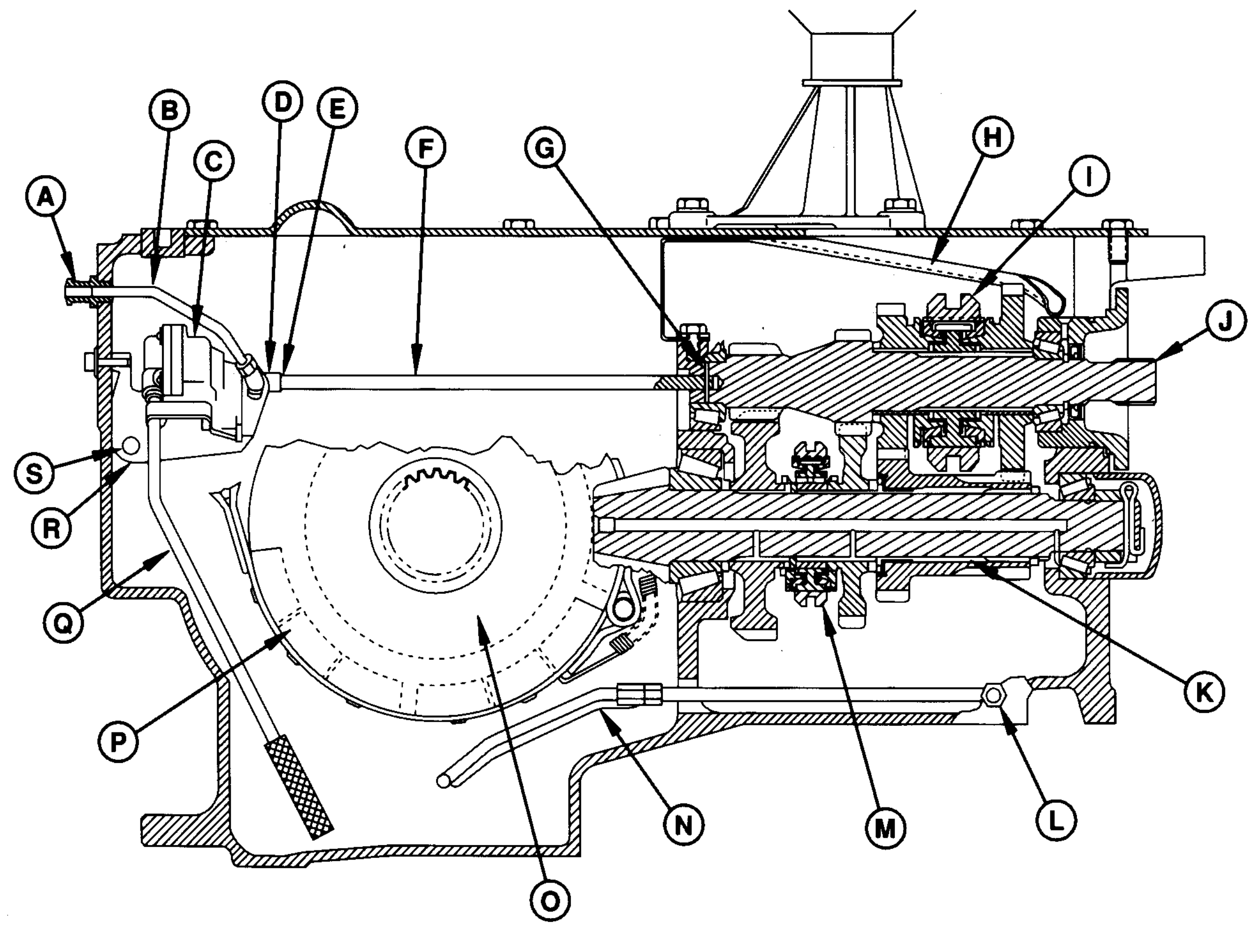
The transaxle case houses the four-speed constant mesh transmission, differential and parking brake assemblies. Output from the reverser drives the transmission drive shaft (J).

Axle housings are mounted to the transaxle case and contain the planetary final drive assemble, brake disks and brake pistons.

Oil in the transaxle case provides a source of splash lubrication for the power train drive components and pressure lube/cooling to the brakes.

TX,D300,YY919 –19–12JUL94–1/1

Transaxle—310D, 315D (SN —796033)

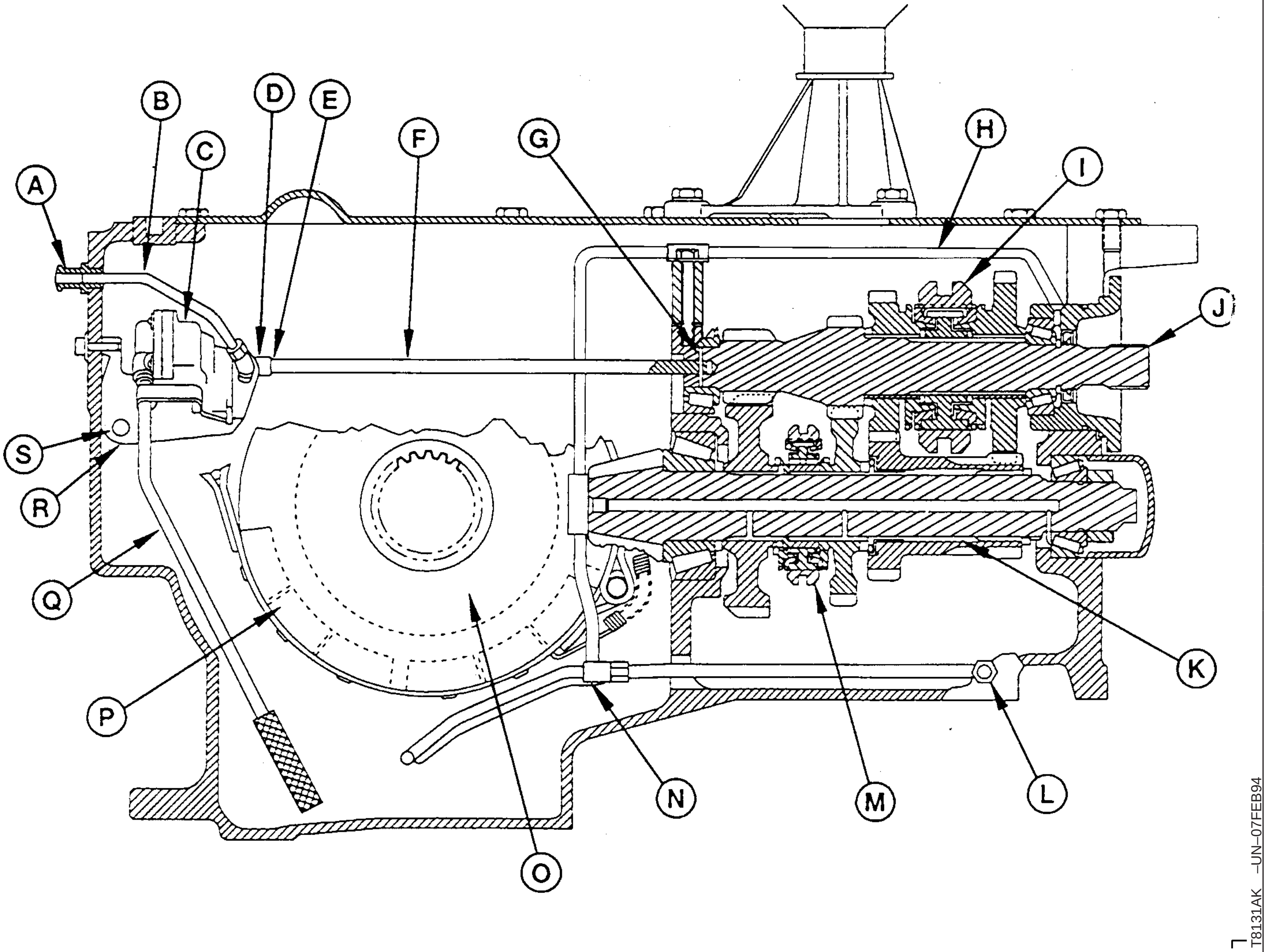


T7511AA –UN–25APR91

A—Pump Outlet to Cooler
B—Pump Outlet Line
C—Lube Pump
D—Clamp
E—Drive Shaft Sleeve
F—Pump Drive Shaft
G—Spring Pin
H—Lube Trough
I—Third and Fourth Gear Synchronizer
J—Transmission Drive Shaft
K—Differential Drive Shaft
L—Case Inlet from Cooler
M—First and Second Gear Synchronizer
N—Inlet Line to Brake Cavity
O—Ring Gear
P—Parking Brake Band
Q—Suction Line
R—Pump Support Bracket
S—Pin

TX,0350,DS3529 –19–12JUL94–1/1

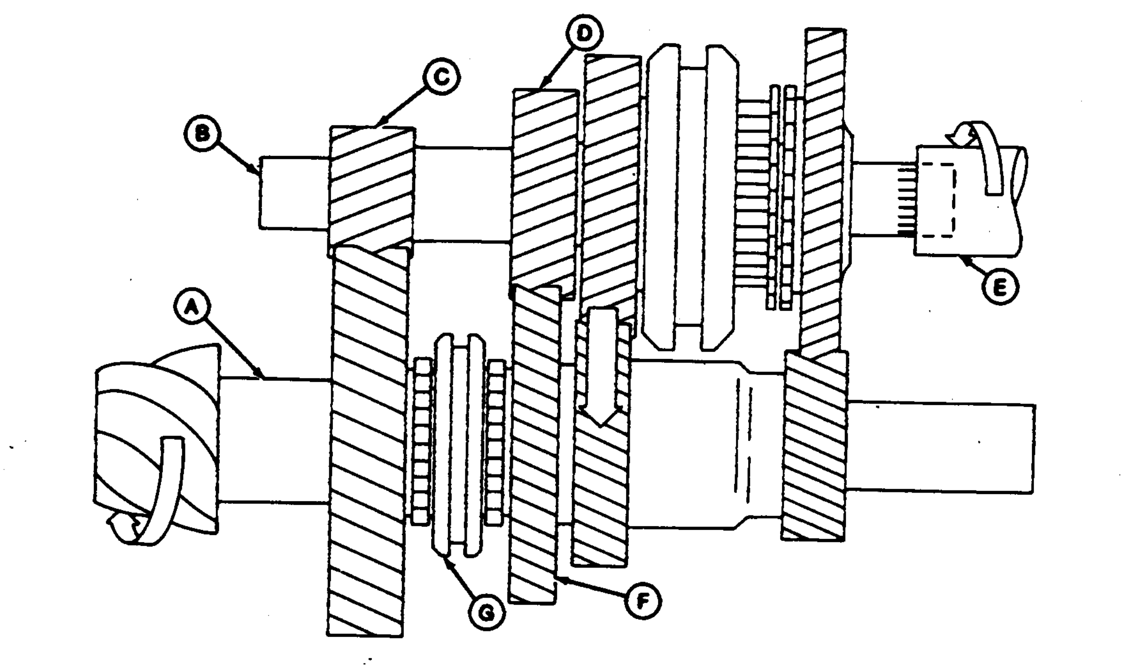
Transaxle—310D, 315D (SN 796034—)



A—Pump Outlet to Cooler
B—Pump Outlet Line
C—Lube Pump
D—Drive Shaft Sleeve
E—Lock Nut
F—Pump Drive Shaft
G—Spring Pin
H—Lube Line
I—Third and Fourth Gear Synchronizer
J—Transmission Drive Shaft
K—Differential Drive Shaft
L—Case Inlet from Cooler
M—First and Second Gear Synchronizer
N—Inlet Line to Brake Cavity
O—Ring Gear
P—Parking Brake Band
Q—Suction Line
R—Pump Support Bracket
S—Pin

TX,0350,BD1323 –19–12JUL94–1/1

Second Speed Operation



T92938 –UN–18APR89

A—Differential Drive Shaft
B—Transmission Drive Shaft
C—First Speed Driving Gear
D—Second Speed Driving Gear
E—Transmission Input Shaft
F—Second Speed Driven Gear
G—Shifter Collar (300D)

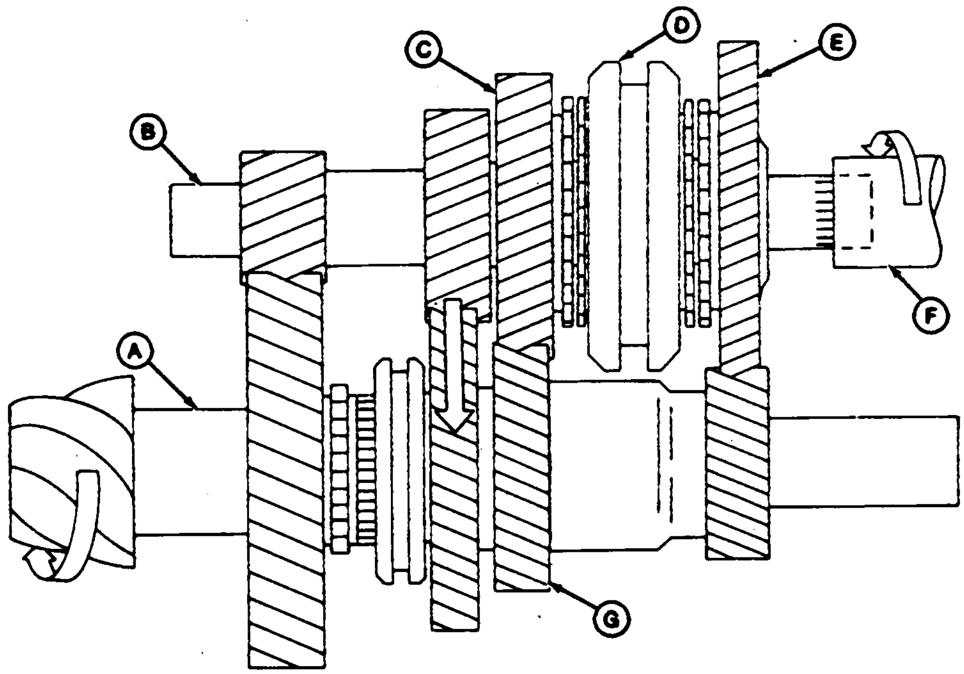
The transmission input shaft (E) is driven by the reverser. It, in turn, drives the transmission drive shaft, and is in constant mesh with the second speed driven gear (F).

When the transmission is in second speed the shifter collar (G) is slid to the right. The second speed driven gear is locked to the differential drive shaft (A). Power is thereby transmitted to the differential assembly.

310D, 315D ONLY—A synchronizer collar is used on differential drive shaft between first and second speed driven gears which provides a fully synchronized transmission.

TX,300D,1970 –19–08MAR93–1/1

Third Speed Operation



T92939 –UN–18APR89

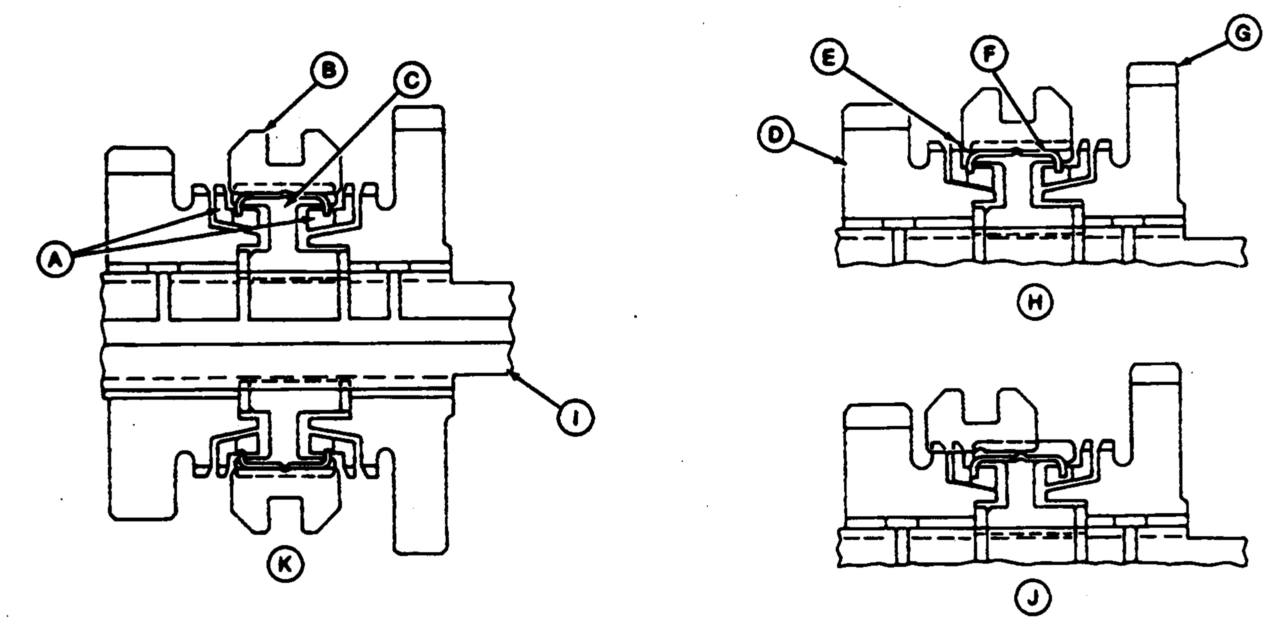
A—Differential Drive Shaft
B—Transmission Drive Shaft
C—Third Speed Driving Gear
D—Synchronizer Collar
E—Fourth Speed Driving Gear
F—Transmission Input Shaft
G—Third Speed Driven Gear

In third speed, the synchronizer collar (D) is moved to the left. The third speed driving gear (C) is then locked to the transmission drive shaft (B). Power is transferred to the third speed driven gear (G). Since the third and fourth speed driven gear is splined to the differential drive shaft (A), there is power flow into the differential assembly.

Notice that the shift collar on the differential drive shaft is in neutral. This allows the first and second speed driven gears to rotate freely on the shaft. Transmission gears and bearing are lubricated by non-pressurized splash oiling system.

TX,300D,1971 –19–08MAR93–1/1

Synchronizer Operation



T92937 –UN–18APR89

A—Blocking Rings
B—Synchronizer Collar
C—Hub
D—Third Speed Drive Gear
E—Blocking Ring
F—Clip
G—Fourth Speed Drive Gear
H—Synchronizing
I—Transmission Drive Shaft
J—Third Gear Engaged
K—Synchronizer

The components of the synchronizer are the hub (C), collar (B), clip (F) and blocking rings (A).

The hub is splined to the transmission drive shaft (I). The synchronizer collar is splined to the hub. Three of the splines in the hub are omitted and a clip is inserted between the hub and the collar. A spring (not shown on the illustration) pushes the clips out against the collar.

The ends of the clips extend into slots in the blocking rings, causing the rings to rotate with the clips. The hub, collar, clips, and blocking rings always rotate as an assembly with the shaft.

With the synchronizer in neutral (K), the blocking rings do not contact either drive gear. Since the gears are not splined to the shaft, they are free to rotate at different speeds.

When a shift to third gear is made, the first step is synchronizing (H) the speed of transmission drive shaft (I) and third speed drive gear (D). As the collar moves across the hub, the clip moves with it. The clip pushes the blocking ring (E) against the tapered portion of the third speed drive gear. The brass blocking ring will accelerate until the speed of the transmission drive shaft matches the speed of the third speed drive gear.

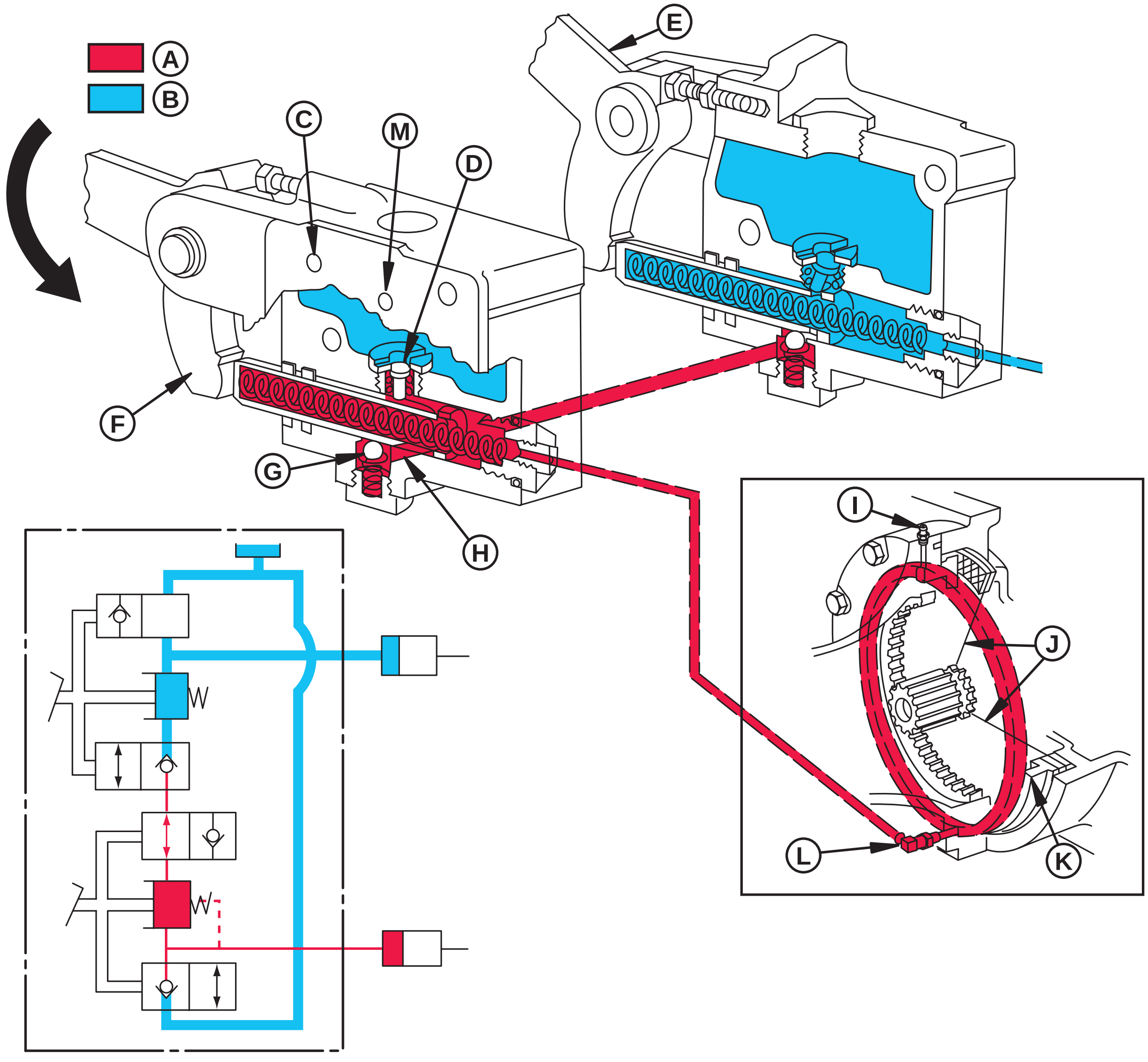
After the gear and the shaft have been synchronized, the collar slides over the teeth of the blocking ring and the gear. Third gear is engaged (J).

The synchronizer operates during up shifts into third and fourth gears and the down shift into third gear on the 300D.

All speeds are synchronized on the 310D and 315D due to an additional synchronizer that is installed between the first and second driven gears.

TX,300D,1972 –19–07DEC90–1/1

Brake Valve Operation



T87128

A—High Pressure Oil
B—Return Oil
C—Return Port
D—Check Valve (2 used)
E—Right Brake Pedal
F—Left Brake Pedal
G—Equalizing Valve (2 used)
H—Piston (2 used)
I—Brake Bleed Screw (2 used)
J—Brake Disk and Facings (2 used)
K—Brake Pressure Plate (2 used)
L—Inlet to Brake Piston
M—Inlet Port

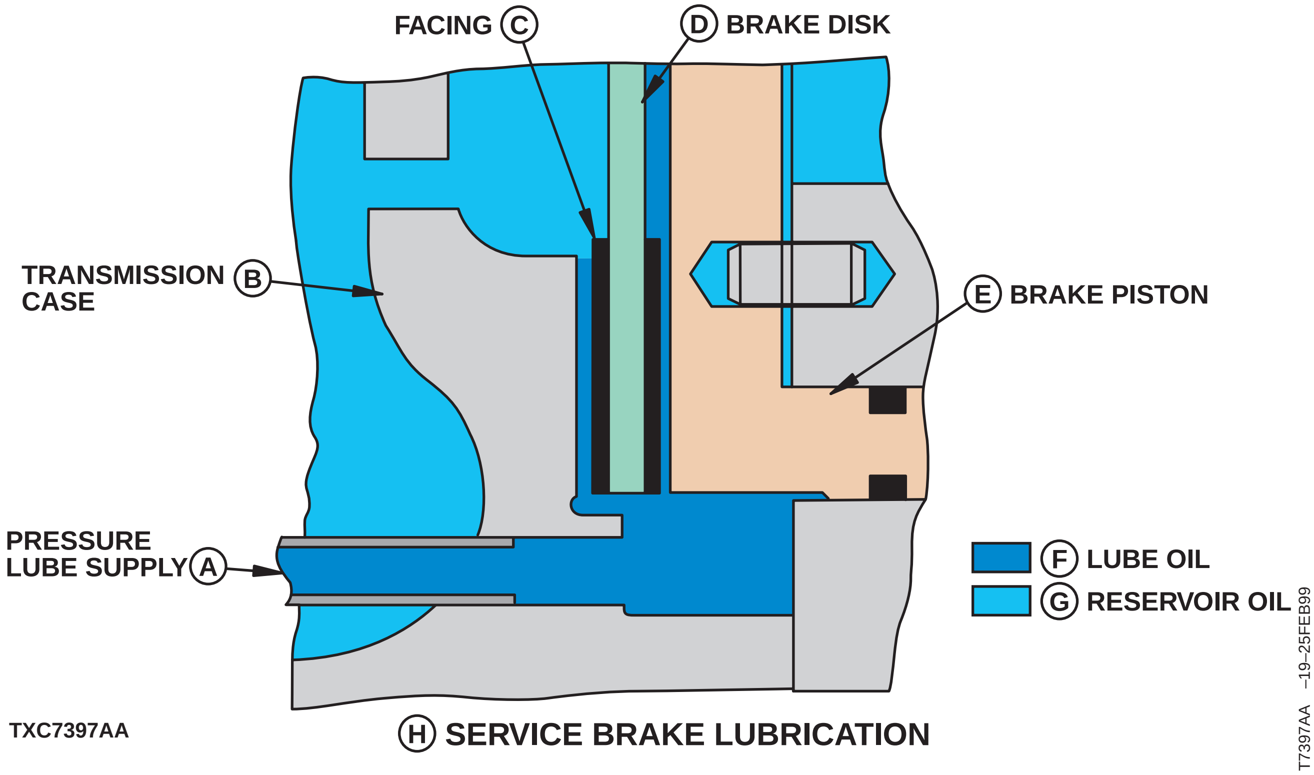
The brake system is hydraulic with no mechanical connection between the brake valve and the brake pressure plates. The brake valve reservoir is filled with return oil from the hydraulic system.

The brake valve is activated by two brake pedals that allow individual or simultaneous operation of brake pressure plates that are located in the final drive housings.

When the brakes are engaged, the brake pressure plate applies force on the brake disk and facings which is connected to the final drive pinion shaft.

TX,300D,1974 –19–08MAR93–1/1

Service Brake Pressure Lubrication (SN —796851)



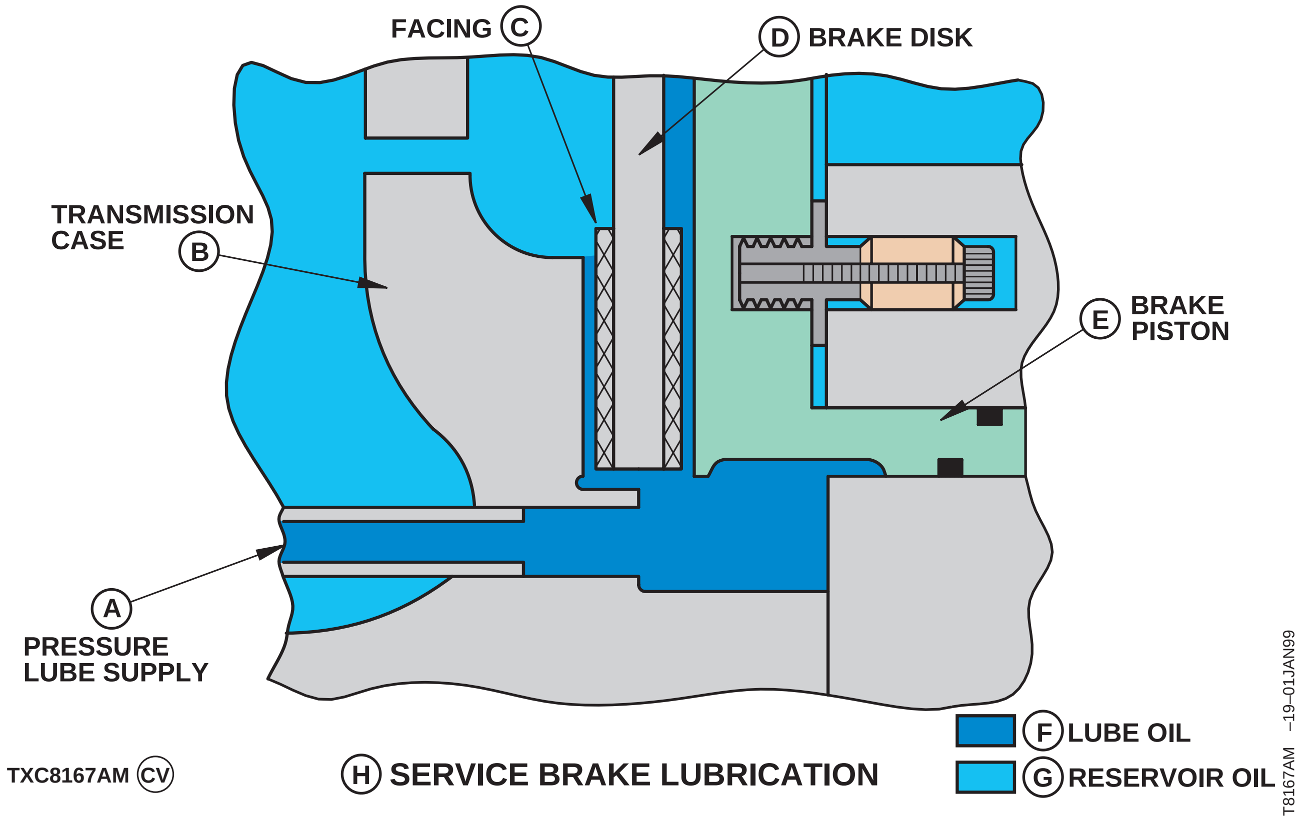
A—Pressure Lube Supply
B—Transmission Case
C—Facing
D—Brake Disk
E—Brake Piston
F—Lube Oil
G—Reservoir Oil
H—Service Brake Lubrication

A constant supply of cooled oil from the main hydraulic oil cooler is routed to the transaxle. Oil from the pressure lube supply (A) is routed to the outside diameter of the brake disk (D). There is a constant flow of oil between the brake facings (C) and the transmission case (B) and brake piston (E).

When the brakes are rotating, centrifugal force draws oil around the entire diameter of the brake disk. This constant flow of cooled oil over the entire facing of the brake disk prevents contact between the facing and the housing when the brakes are not applied. It also provides excellent cooling. Notice the grooves in the brake facings. These grooves provide a path for a constant flow of cool oil across the facings even when the brakes are engaged.

TX,300D,1975 –19–12JUL94–1/1

Service Brake Pressure Lubrication (SN 796852—)



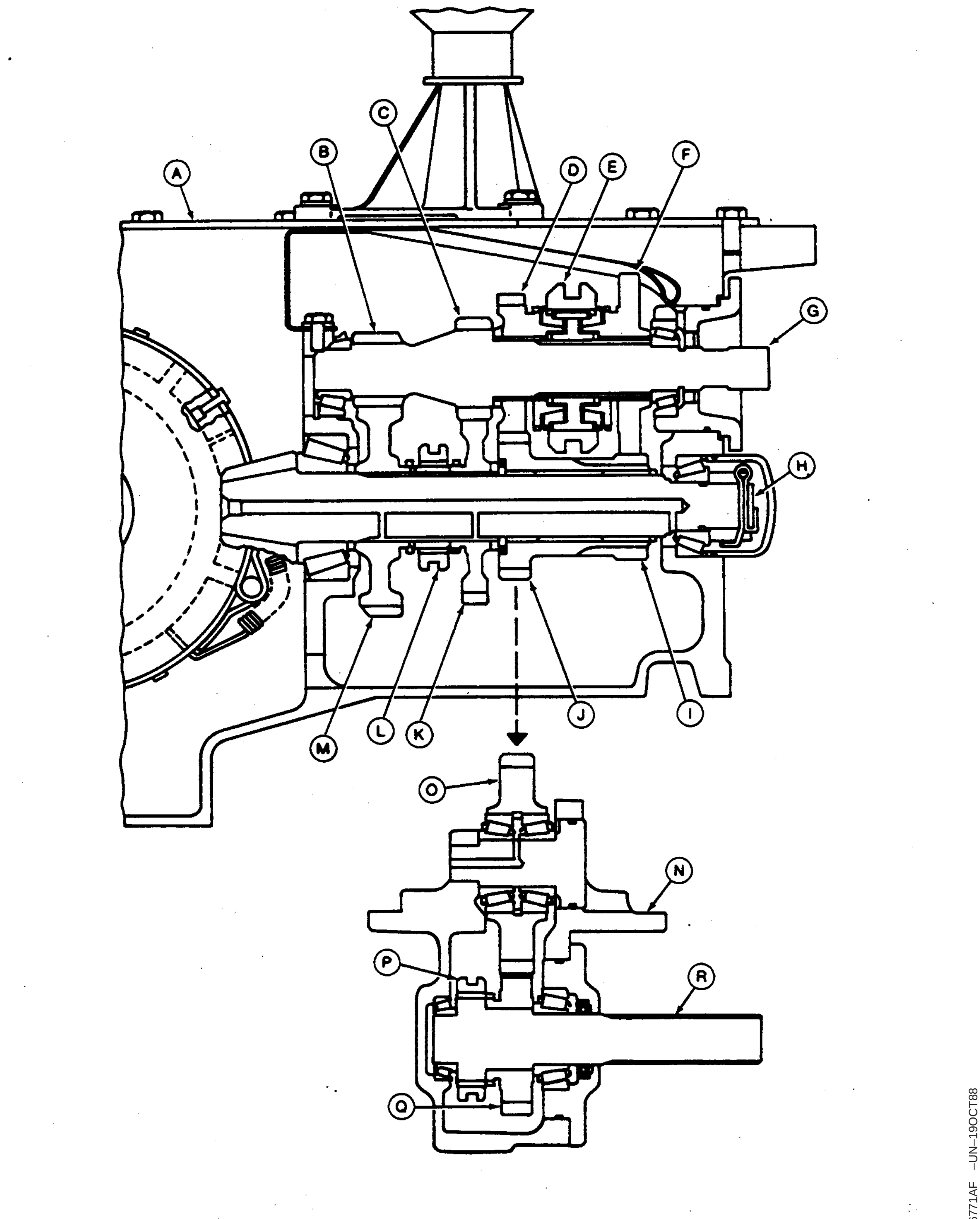
A—Pressure Lube Supply
B—Transmission Case
C—Facing
D—Brake Disk
E—Brake Piston
F—Lube Oil
G—Reservoir Oil
H—Service Brake Lubrication

A constant supply of cooled oil from the main hydraulic oil cooler is routed to the transaxle. Oil from the pressure lube supply (A) is routed to the outside diameter of the brake disk (D). There is a constant flow of oil between the brake facings (C) and the transmission case (B) and brake piston (E).

When the brakes are rotating, centrifugal force draws oil around the entire diameter of the brake disk. This constant flow of cooled oil over the entire facing of the brake disk prevents contact between the facing and the housing when the brakes are not applied. It also provides excellent cooling. Notice the grooves in the brake facings. These grooves provide a path for a constant flow of cool oil across the facings even when the brakes are engaged.

TX,9020,YY922 –19–12JUL94–1/1

MFWD System Operation



Continued on next page

TX,300D,1977 –19–07DEC90–1/2

A—Transaxle Case
B—First Speed Driven Gear
C—Second Speed Driven Gear
D—Third Speed Driven Gear
E—Synchronizer Collar
F—Fourth Speed Driven Gear
G—Transmission Drive Shaft
H—Differential Drive Shaft
I—Fourth Speed Driven Gear
J—Third Speed Driven Gear
K—Second Speed Driven Gear
L—Shift Collar
M—First Speed Driven Gear
N—Transfer Case
O—Idler Gear
P—Shift Collar
Q—Output Gear
R—Output Drive

The MFWD transfer case is located on the left side of the transaxle case.

The differential drive shaft (H) supplies power to the MFWD idler gear (O) and output gear (Q). Output gear (Q) spins freely around the MFWD output drive shaft (R) when the MFWD is not engaged.

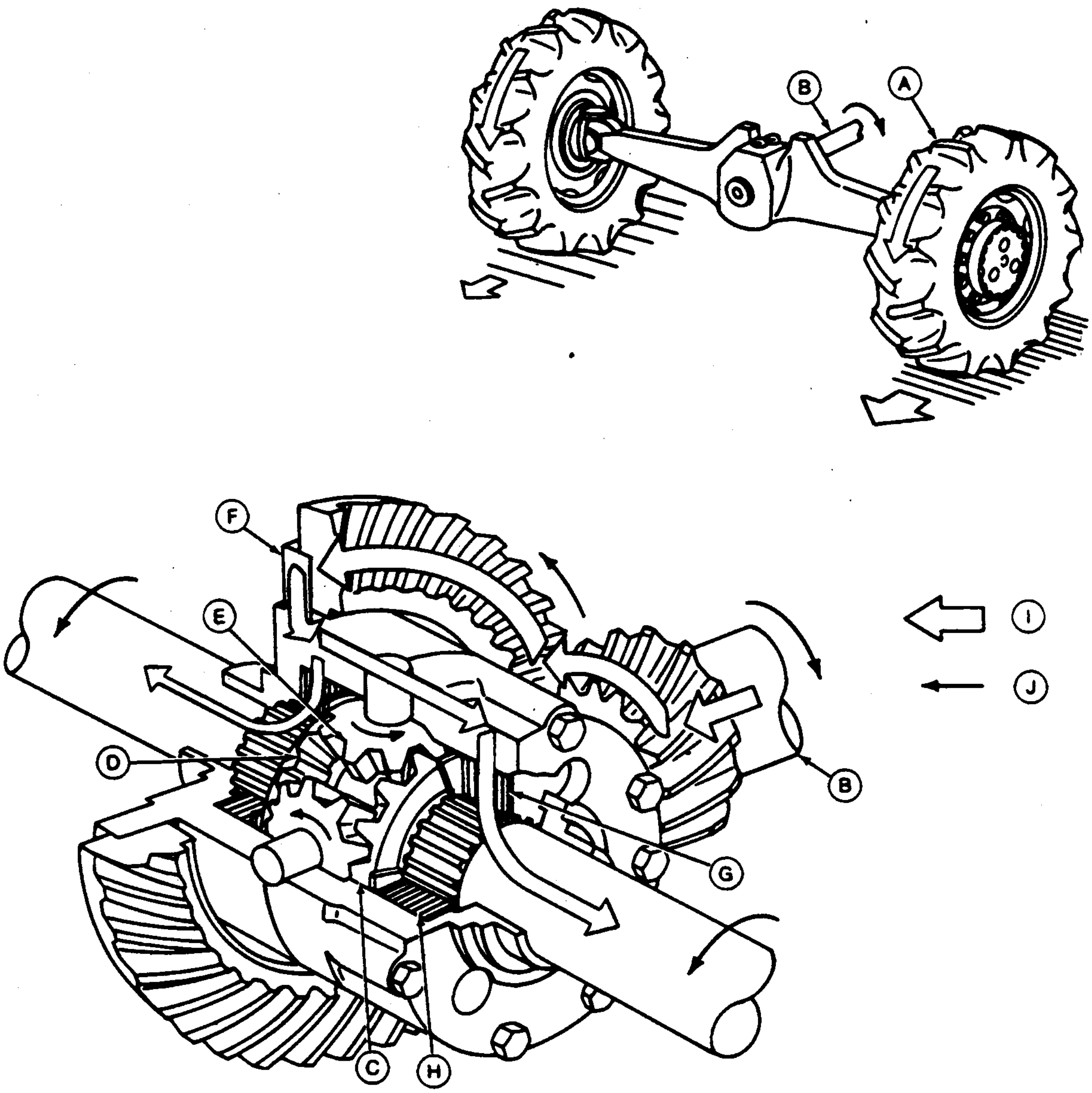
Engagement of the MFWD is controlled by an electric solenoid that moves shift collar (P) forward when energized by a switch on the console. The shift collar engages the driven output gear (Q) to the output drive shaft (R).

When the MFWD shift collar is in the engaged position, power flows forward through the U-jointed drive shaft to the front axle differential drive shaft. The differential drive shaft meshes with the ring gear to drive a limited slip differential. See MFWD Differential Operation in this group for operation.

The limited slip differential powers a sun gear of wheel hub planetaries on each front wheel. The sun gears drive a fixed planetary system to reduce drive shaft speed and increase torque at the front wheels.

TX,300D,1977 –19–07DEC90–2/2

MFWD Differential Operation—Unequal Traction



T6771AH –UN–19OCT88

A—Tire with Most Traction
B—Drive Shaft
C—RH Drive Gear
D—LH Drive Gear
E—Pinion Gears
F—Differential Housing
G—Clutch Disks
H—Clutch Plate
I—Power Flow
J—Rotation Direction

As available traction changes, tire with better traction (A) can use more power. Self-limiting differential action begins to occur.

When one wheel begins to slip more than the other, wheel with better traction holds its drive shaft (B) and drive gear (C) from rotating. Wheel with less traction provides less resistance against its drive gear (D).

Continued on next page

TX,300D,1980 –19–07DEC90–1/2

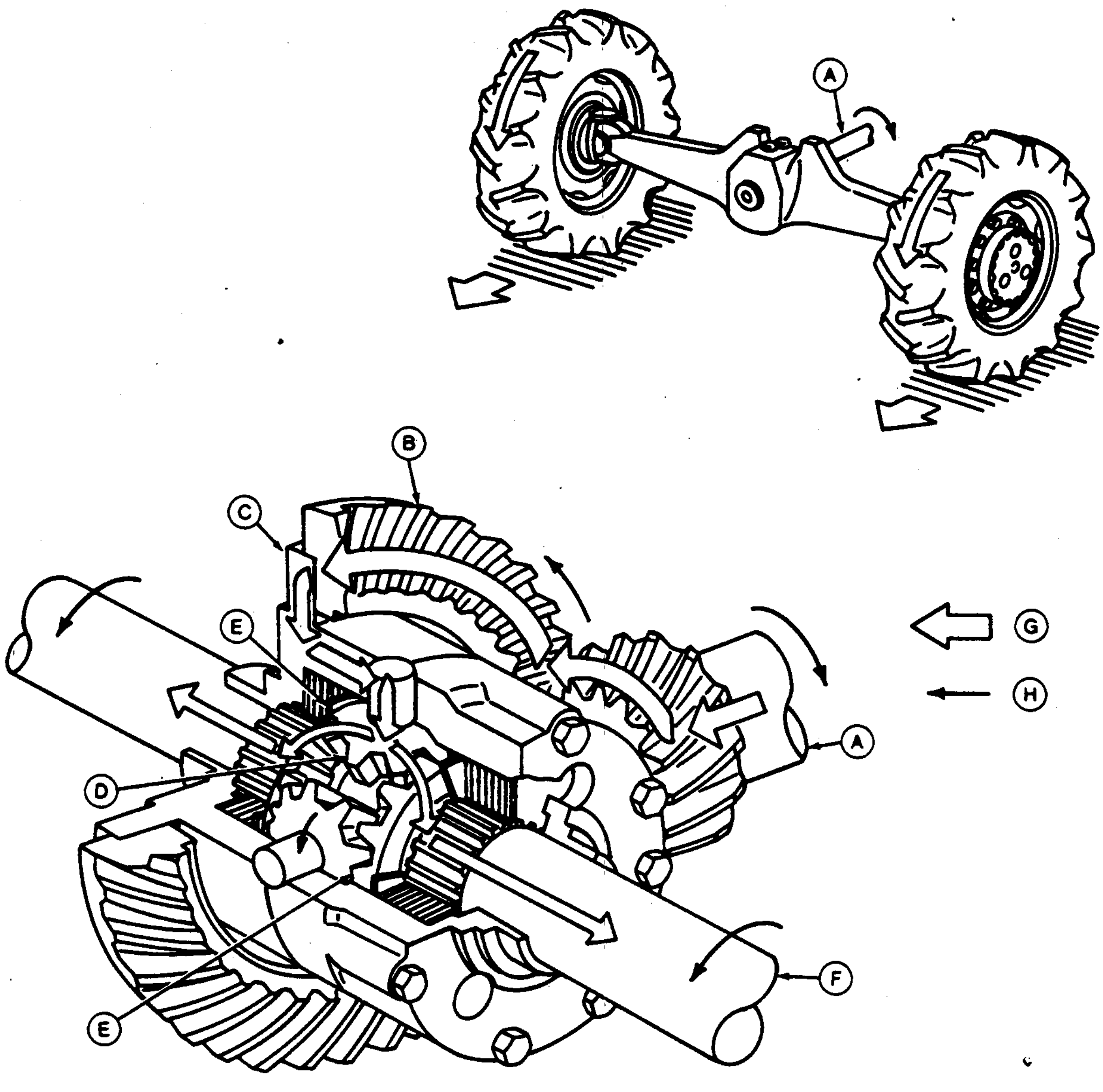
Pinion gears (E) continue to be driven by rotating differential housing (F). These pinion gears push against bevel drive gears as before. Angle of gear teeth tries to force meshed gears apart. On the side with more traction, pinion gears begin to "walk" around drive gear and push against restraining force transmitted from tire. Drive gear is wedged outward and compresses a clutch pack with disks (G) splined to axle and plates (H) tanged to housing. Disks begin to slip less against plates as compressing force increases. As the pack slippage decreases driveshaft begins to receive driving force through the differential housing.

Since the tire with less traction is exerting less force trying to keep its axle from turning, the bevel gear does not force is being transmitted to this drive shaft. As long as the difference in traction between tires remains the same, the clutch pack on the side with less traction will continue to slip more than the clutch pack for the other side.

With MFWD engaged, differential works to automatically balance driving power to available traction.

TX,300D,1980 –19–07DEC90–2/2

MFWD Differential Operation—Equal Traction



A—Differential Driveshaft
B—Ring Gear
C—Differential Housing
D—Pinions
E—Bevel Drive Gears
F—Drive Shafts
G—Power Flow
H—Rotation Direction

Differential unit has self-applied, limited slip feature. When engaged under slippery field conditions, this system automatically applies correct amount of torque to match traction available to each wheel.

With MFWD engaged, when tractor is moving in a straight line and each wheel has equal traction, equal power is supplied to left and right axle. No differential action occurs.

Continued on next page

Power flows into axle housing through differential drive shaft (A), turning ring gear (B) and attached differential housing (C). When both wheels have equal traction, pinions (D) remain stationary within rotating housing. Pinions turn bevel drive gears (E) and drive shafts (F) splined to drive gears.

TX,300D,1979 –19–07DEC90–2/2

System Operational Procedure

The procedure is designed so that mechanic can make a quick check of the power train using a minimum amount of diagnostic equipment. If you need additional information, read the Theory of Operation in Group 9020-05.

A location will be required which is level and has adequate space to operate machine.

The engine and all major components must be at operating temperature for some checks.

Locate system check in the left column and read completely. Follow this sequence from left to right. Read each check completely before performing.

At the end of each check, if no problem is found (OK:), you will be instructed to GO TO NEXT CHECK. If problem is indicated (NOT OK:), you will be given repair required and Group location or CTM number. If verification is needed, you will be given next best source of information after GO TO:

Group 10 (System Operational Checks)

Group 15 (System Diagnostic Checks)

Group 20 (Adjustments)

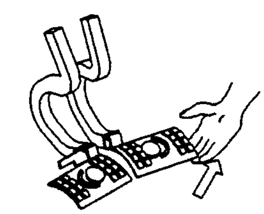
Group 25 (Test)

CTM (Component Technical Manual)

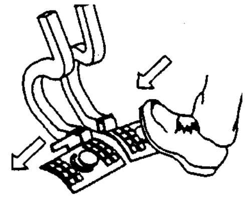
TX,300D,1960 –19–08MAR93–1/1

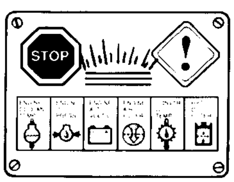
Brake System Checks

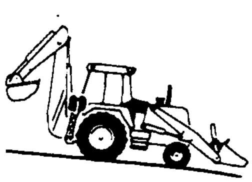
– – –1/1

Pedal Stop Check	 T7394BG –UN–17JAN92	Lift the left and right brake pedals. *LOOK: Brake pedals must be against the pedal stop screws.*	**OK:** Check complete. **NOT OK:** Adjust brake pedal stops. Go to Group 9020-20 **NOT OK:** Inspect and repair brake valve as necessary. Go to repair manual.

– – –1/1

Brake System Leakage Check	 T7367AM –UN–17JAN92	Depress and hold left brake pedal, then right brake pedal using approximately 267 N (60 lb force). *LOOK: Brake pedal must NOT feel spongy (caused by air in system) or settle more than 25 mm (1.0 in.) per minute.* *LOOK: Rear brake light must come on when either pedal is depressed with key switch in ON position.*	**OK:** Check complete. **NOT OK:** Adjust brake pedals. Do Brake Valve Adjustment. Go to Group 9020-20. **NOT OK:** Bleed brake system. Go to Group 9020-20. **NOT OK:** Check light fuse. **OK:** Check wiring. Go to Group 9015-15, Lighting Circuit Checks. **NOT OK:** Do Brake Valve Leakage Test. Go to Group 9020-25. – – –1/1

Park Brake Capacity Check	 T7394BH –UN–10DEC90	Engage park brake. Put stabilizers in transport position. Put backhoe in transport position. Use loader functions to pull machine forward or push machine backward. *LOOK: Rear wheels should not turn. If loader can pull or push machine, rear tires should drag.* *LOOK: Park brake switch light will be ON.*	**OK:** Check complete. **NOT OK:** Adjust park brake linkage. Go to Group 9020-20. – – –1/1

Brake Drag Check	 T6171AL –UN–09DEC88	Position machine on a gradual grade with front of machine downhill. Lift bucket so it clears ground. Shift FNR lever to neutral, differential lock pedal up, disengage park brake and release service brakes. *LOOK: Machine must move or coast.* *NOTE: If machine does not move freely on slope, drive machine for five minutes. Feel axle housing area to locate which brake is dragging.*	**OK:** Check complete. **NOT OK:** Brakes dragging. Go to Group 9020-15, Unit Will Not Move. – – –1/1

Reverser Checks

– – –1/1

Clutch Disconnect Circuit Check

CAUTION: Machine should try to move forward as FNR lever is moved.

Park brake OFF.

Service brake applied.

Put transaxle in fourth gear.

Start engine, set idle speed at approximately 1500 rpm.

Move FNR lever to forward (F) position.

Actuate clutch disconnect on FNR lever or loader control lever individually and note sound of engine.

LISTEN: When FNR lever is shifted to forward (F) position, a noticeable drop in engine speed should be heard.

LISTEN: Engine rpm must increase when the reverser clutch disconnect solenoid switch is activated.

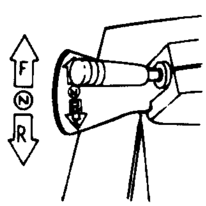
OK: Check complete.

NOT OK: Check fuse.

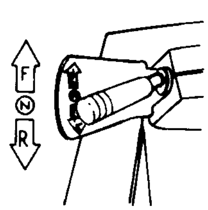
NOT OK: Go to group 9015-15, Park Brake/Clutch Disconnect Circuit Check.

– – –1/1

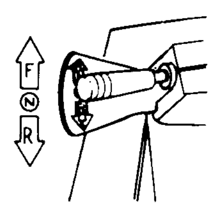
FNR Switch Check



T7367AN –UN–17SEP90



T7394BI –19–17OCT90



T7394BJ –19–17OCT90

Engine off.

Put FNR lever in neutral.

Turn key switch to ON position.

Move FNR lever to forward (F), reverse (R), then neutral (N) position.

Observe and feel forward, neutral and reverse detents.

LOOK: FNR lever must align with neutral position in quadrant when reverser valve is in neutral detent position.

LISTEN: You must hear neutral start switch "click" as FNR lever is moved EQUAL distance from neutral to forward position and from neutral to reverse position.

FEEL: You must feel detent engagement in each position of FNR lever.

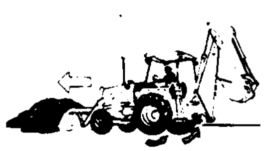
OK: Check complete.

NOT OK: If no "click", inspect neutral start fuse.

NOT OK: Go to Group 9015-15 , Neutral Start Switch Check.

– – –1/1

Reverser Hydraulic System Check	Run engine at approximately 1500 rpm. Put transaxle into third gear. Move FNR lever to forward (F) position. Make several shifts from third forward to third reverse. Start counting the number of seconds when FNR lever is moved to opposite direction. *LOOK: A normal shift from forward to reverse or reverse to forward must be completed in three seconds. The machine must be up to speed in four seconds.* *NOTE: Excessive internal leakage is indicated if reverse warning alarm (if equipped) does not sound at slow idle, but sounds when rpm is increased.*	**OK:** Check complete. **NOT OK:** If shifts are slow, go to Group 9020-25 , Reverser Element Leakage Using Four-Gauge Method. – – –1/1

Engine And Torque Converter Check	 T6171AM –UN–09DEC88 Position machine with loader bucket at ground level against dirt bank or immovable object. Put transaxle into first gear. Move FNR lever to forward (F) position. Engage differential lock. Increase engine speed to fast idle. *LOOK: Rear wheels must NOT stall.* *NOTE: This test will give a general indication of engine reverser and torque converter performance.*	**OK:** Check complete. **NOT OK:** If the wheels can be easily stalled, go to Group 9020-15 , Machine Lacks Power or Moves Slow. – – –1/1

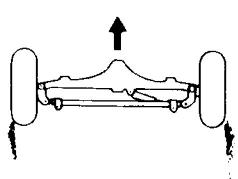
Transaxle Checks

– – –1/1

Transaxle Shift Linkage Synchronizer And Noise Check	Run engine at approximately 1500 rpm with FNR lever in forward (F) position. Put transaxle in each gear and drive machine for a short distance. *LISTEN: 300D—Some gear noise can be expected when shifting into first or second gear. There must NOT be any gear noise when shifting into third or fourth gear. Third and fourth gears are synchronized.* *LISTEN: 310D,315D—Excessive gear or FNR lever noise must NOT be heard in any gear. All gears are synchronized.*	**OK:** Check complete. **NOT OK:** Go to Group 9020-15 , Excessive Gear Noise When Shifting Gears. – – –1/1

Differential Lock And Linkage Check	Put transaxle in first gear. Move FNR lever to forward (F) position and operate engine at approximately 1500 rpm. Depress differential lock pedal. Turn steering wheel slightly right or left. Release differential lock pedal. *LOOK: Machine must try to go straight forward and pedal must return to UP position when traction is equal.*	**OK:** Check complete. **NOT OK:** Go to Group 9020-15 , No Differential Lock Operation. – – –1/1

Differential Gear And Pinion Check	*NOTE: Hold the wheel which is being braked stationary during this test or brake chatter could be confused with differential gear noise.* Put transaxle in first gear and operation engine at approximately 1500 rpm. Move FNR lever to forward (F) position. Steer machine in a maximum left turn and depress left brake pedal to stop the left wheel. Steer machine in a maximum left turn and depress left brake pedal to stop the left wheel. Steer machine in a maximum right turn and depress right brake pedal to stop right wheel. *LISTEN: NO excessive gear noise must be heard in the differential or pinion gear area.*	**OK:** Check complete. **NOT OK:** Go to Group 9020-15 , Unit Makes Excessive Noise. – – –1/1

Front Wheel Alignment (Toe-In) Check	 T6264AI –UN–22OCT91 Drive machine in fourth gear forward on a surface with loose material. *LOOK: Material behind front wheels must not be thrown excessively inward or outward.*	**OK:** Check complete. **NOT OK:** If material is thrown, excessive tire wear will result. Go to Group 9020-20 , Adjust Toe-In. – – –1/1

Mechanical Front Wheel Drive (MFWD) Driving Checks

– – –1/1

MFWD Limited Slip Differential And Control Linkage Check	Shift transaxle to first reverse. Engage MFWD and drive machine. Run engine at approximately 1200 rpm. Turn steering wheel for a full left or right turn and observe how the front tires attempt to slide sideways (side load) and the amount of tire scuffing. Disengage MFWD. *LOOK: Tire side loading and scuffing must stop when MFWD is disengaged.* *NOTE: If tires attempt to slide sideways and tire scuffing is seen with MFWD engaged, limited-slip differential is working and power is being transmitted to MFWD.*	**OK:** Check complete. **NOT OK:** Move MFWD control linkage to feel engagement detents. No detents, inspect linkage to transfer case. **NOT OK:** Go to Group 9020-15 , No Power to MFWD. – – –1/1
MFWD Engine And Torque Converter ChecK	 T6171AN –UN–09DEC88 With loader bucket lever and cutting edge at the centerline of front wheels, put machine against a dirt bank or immovable object. Engage MFWD and differential lock. Shaft transaxle to first forward. Increase engine speed to fast idle. *LOOK: All four wheels must turn.*	**OK:** Check complete. **NOT OK:** If all wheels stop, a torque converter problem is indicated. If the front wheels stop, MFWD problem is indicated. Go to Group 9020-15 , Machine Lacks Power or Moves Slow. – – –1/1
MFWD Gear And Pinion Check	Drive machine at transport speed with MFWD engaged, then disengaged. *LISTEN: MFWD must NOT whine.*	**OK:** System Operational Checkout Completed. **NOT OK:** If MFWD whines, check oil levels and fill to correct levels. **NOT OK:** Check backlash. Go to repair manual. – – –1/1

Reverser Oil Passage Identification

A—Torque Converter Oil Out
B—Torque Converter Oil In

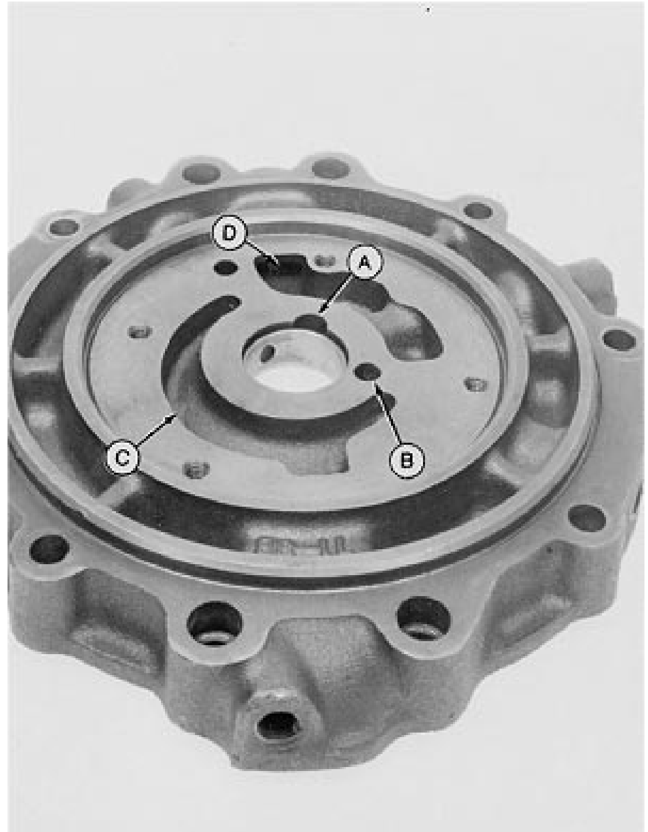
T5982AK1 –UN–02NOV88

Torque Converter Support

Continued on next page TX,300D,1946 –19–08MAR93–1/5

Torque converter oil out (A) lubes the bushing. Torque converter oil in (B) lubes the front bearing.

A—Torque Converter Oil Out
B—Torque Converter Oil In
C—Inlet Oil Passage for Reverser Pump
D—Pressure Oil Passage for Reverser Pump



T5988BB1 –UN–02NOV88

Reverser Front Cover Assembly

Continued on next page TX,300D,1946 –19–08MAR93–2/5

From the directional control valve, forward clutch engagement oil flows into center of the planetary output shaft (A) to the input shaft.

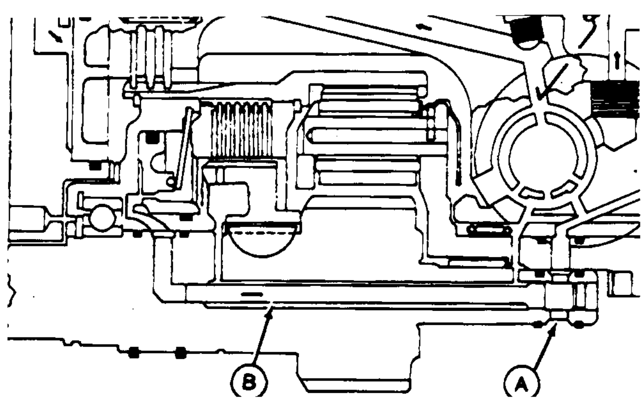
T5988AK –UN–02NOV88

TX,300D,1946 –19–08MAR93–3/5

From the planetary output shaft, forward clutch engagement oil flows into the center of a non-serviceable tube (B) in the shaft (A) through the center of the tube to the forward clutch.

Lubrication oil flows on the outside of the tube in the input shaft to lube forward clutch.

T5984AA1 –UN–02NOV88

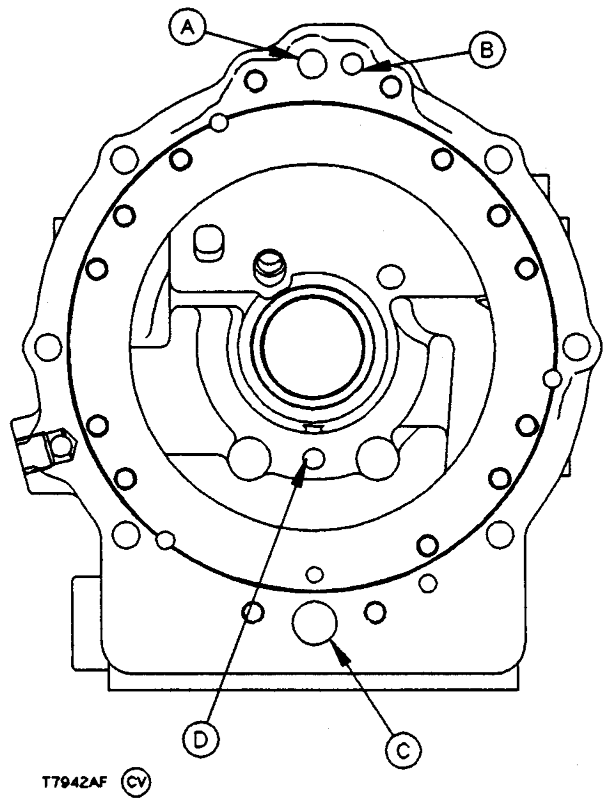


T6218AS –UN–26MAY89

Continued on next page

TX,300D,1946 –19–08MAR93–4/5

A—(S.N. —792482) Reverser Pump Pressure Oil to Directional Control Valve (S.N.792483—) Reverser Pump Pressure Oil to FNR Solenoid
B—(S.N. —792482) From Directional Control Valve to Reverse Brake (S.N.792483—) From FNR Solenoid to Reverse Brake
C—From Suction Screen to Reverser Pump
D—Reverse Brake Lubrication Orifice



T7942AF –UN–02MAR93

Reverser Housing

TX,300D,1946 –19–08MAR93–5/5

Diagnose Power Train Malfunctions

Symptom	Problem	Solution
Park Brake Will Not Hold	Park brake actuator	Inspect and replace. See repair manual.
	Glazed park brake lining	Burnish brake. See repair manual.
Park Brake Will Not Release	Park brake circuit not operating correctly	See Group 9015-15, Park Brake Circuit Checks.
	Internal linkage binding	Inspect and repair. See repair manual.

Continued on next page

TX,300D,2091 –19–08MAR93–1/18

Symptom	Problem	Solution
Machine Will Not Move in Forward or Reverse	Low oil level	Add oil to correct level. See Hydraulic And Reverser Oil in Group 9000-04.
	Brakes dragging	Check brake valve and repair. See repair manual.
	Disconnect clutch not disengaging properly	Check to hear "click" when switch is depressed. See Group 9015-15.
	Directional control valve solenoid spring stuck or broken	Remove, inspect, clean and repair. See repair manual.
	Reverser clutch disk slipping	Do Four Gauge Leakage Test , Group 9020-25.
	Loss of system pressure	Check oil level. Do Four Gauge Leakage Test , Group 9020-25.
	Mechanical failure in reverser	Repair or replace parts as required. See repair manual.
	Converter drive tangs sheared or not engaged in pump	Replace converter. See repair manual.
	Pump gears seized and converter tangs sheared	Replace pump assembly and converter. See repair manual.
	Mechanical failure in transaxle	Inspect transaxle and repair. See repair manual.
	Transaxle shifter forks and/or shafts broken	Repair or replace parts as necessary. See repair manual.
	Transaxle shaft or gear failure	Repair or replace parts as necessary. See repair manual .
	Transaxle shifter collars broken	Replace. See repair manual.
	Planetary assembly out of time or improperly assembled	Repair and time correctly. See repair manual.
	Differential ring gear teeth sheared	Replace ring gear and pinion. See repair manual.
	Final drive axle shaft broken	Replace. See repair manual.

Continued on next page

Symptom	Problem	Solution
	Final drive shaft and sun pinion broken	Replace parts as necessary. See repair manual.
Transaxle Will Not Pull in Forward Only	Disconnect clutch solenoid loose on reverser	Inspect and tighten. See repair manual.
Reverser Will Not Disconnect (Drags)	Disconnect clutch not disengaging properly	Check to hear "click" when switch is depressed. See Reverser Disconnect Clutch Solenoid (SN —792482) or see Reverser Disconnect Clutch Solenoid Test (SN 792483—) .
	Directional control valve solenoid spring stuck or broken	Remove, inspect, clean and repair spring. See repair manual.
	Warped or dragging clutch pack.	Inspect and repair. See repair manual.
	Worn or broken sealing rings in forward clutch of reverser	Do Four Gauge Leakage Test , Group 9020-25. Disassemble and inspect clutch assembly. Replace parts as necessary. See repair manual.
	Clutch plates worn or broken in forward clutch assembly of reverser	Disassemble and inspect clutch assembly. Replace parts as necessary. See repair manual.

Continued on next page

TX,300D,2091 –19–08MAR93–3/18

Symptom	Problem	Solution
Machine Lacks Power or Moves Slow	Operating in too high a gear	Operate in next lower gear.
	Low oil level in reverser	Add oil to correct level. See Group 9000-04.
	Brakes dragging	Check for excessive heat in brake area of axle housings after operating unit. See Remove And Inspect Brake Disk And Pressure Plate (SN —796851) or Remove And Inspect Brake Disk And Pressure Plate (SN 796852—) in repair manual.
	Low "P" port pressure	Do Four Gauge Leakage Test , Group 9020-25.
	Restricted suction screen in reverser	Clean screen. See repair manual.
	Reverser leaks	Do Four Gauge Leakage Test , Group 9020-25.
	Low engine output	See Group 9010-15.
	Incorrect torque converter installed	Check converter part number through inspection hole in bottom of reverser housing.
	Failed torque converter	Drain oil sample from converter and inspect for contamination.
	Mechanical failure in transaxle	Inspect transaxle. See Remove Transaxle in repair manual.

Continued on next page

TX,300D,2091 –19–08MAR93–4/18

Symptom	Problem	Solution
Reverser Shifts Slow	Low oil level	Add oil to correct level. See Hydraulic And Reverser Oil in Group 9000-04.
	Disconnect clutch not disengaging properly	Check to hear "click" when switch is depressed. See Reverser Disconnect Clutch Solenoid (SN —792482) or see Reverser Disconnect Clutch Solenoid Test (SN 792483—) .
	Restricted suction screen	Remove and clean. See repair manual.
	Converter-in (cooler) relief valve stuck open	Remove, inspect and repair. See repair manual.
	Pressure regulating valve sticking	Remove, inspect and clean. See repair manual.
	Leakage in reverser	Do Four Gauge Leakage Test . See Group 9020-25.
	Worn reverser pump	Do Reverser Pump Flow Test. See Group 9020-25.

Continued on next page

TX,300D,2091 –19–08MAR93–5/18

Symptom	Problem	Solution
Reverser Will Not Shift	FNR switch failure.	Do FNR Switch Check, Group 9015-15.
	Disconnect clutch not disengaging properly	Check to hear "click" when switch is depressed. See Reverser Disconnect Clutch Solenoid (SN —792482) or see Reverser Disconnect Clutch Solenoid Test (SN 792483—) .
	Directional control valve not operating properly	Remove, inspect and repair. See repair manual.
	Reverser clutch disk slipping	See Reverser Repair Information in repair manual.
	Loss of system pressure in reverser	Check oil level. Do Four Gauge Leakage Test , Group 9020-25.
	Mechanical failure in reverser	Repair or replace parts. See repair manual.
	Worn or broken sealing rings on reverse brake piston. Broken or worn reverse brake plates.	Disassemble and replace parts as necessary. See repair manual.
Foaming Oil in Reverser	Oil level too low or too high	Check oil level and correct. See Group 9000-04.
	Incorrect type of oil.	Drain and replace oil. See Group 9000-04.
	Restricted suction screen in reverser	Clean suction screen. See repair manual.
	Air leak on suction side of oil pump	Inspect gaskets and housings. See repair manual.

Continued on next page

TX,300D,2091 –19–08MAR93–6/18

Symptom	Problem	Solution
Reverser Oil Overheats	Oil level too high or too low.	Check oil level and correct. See Group 9000-04.
	Converter stalled excessively	Use disconnect clutch switch in these operations to reduce stalls. See Reverser Disconnect Clutch Solenoid (SN —792482) or see Reverser Disconnect Clutch Solenoid Test (SN 792483—) .
	Operating in too high a gear	Operate one gear lower.
	Oil cooler air flow restricted	Inspect and clean exterior of reverser cooler. Do Air Flow Test, Group 9010-25.
	Missing baffles, damaged fan shrouds or loose fan belts	Inspect and check belt tension. See Group 9010-20. Check baffles and repair. See repair manual.
	Converter-in (cooler) relief valve stuck open or broken spring	Remove valve, inspect and repair. See repair manual.
	Low pump oil flow	Do Reverser Pump Flow Test. See Group 9020-25.
	Restricted suction screen in reverser	Remove and clean. See repair manual.
	Leakage in reverser	Do Four Gauge Leakage Test , Group 9020-25.
	Excessive drag in reverser	Do Converter Stall Test, Group 9020-25. Repair as needed. See repair manual.
	Engine over-fueled	Remove fuel injection pump. See authorized injection pump service center.

Continued on next page

TX,300D,2091 –19–08MAR93–7/18

Symptom	Problem	Solution
Low System Pressure in Reverser	Low oil level	Add oil to correct level.
	Wrong oil	Drain and replace oil. See Group 9000-04.
	Restricted suction screen in reverser	Remove and clean. See repair manual.
	Converter-in (cooler) relief valve stuck open or broken	Remove, inspect, clean and repair. See repair manual.
	Directional control valve solenoid spring stuck or broken	Inspect and repair spring. See repair manual. Do Reverser System Pressure Test. See Group 9020-25.
	Leakage in reverser	Do Four Gauge Leakage Test , Group 9020-25.
	Worn reverser oil pump	Do Reverser Pump Flow Test. See Group 9020-25.
Low Forward Pressure in Reverser	Low oil level	Add oil to correct level.
	Wrong oil	Drain and replace oil. See Group 9000-04.
	Restricted suction screen in reverser	Remove and clean. See repair manual.
	Converter-in (cooler) relief valve stuck open or broken	Remove, inspect, clean and repair. See repair manual.
	Directional control valve solenoid spring stuck or broken	Inspect and repair spring. See repair manual. Do Reverser System Pressure Test, Group 9020-25.
	Leakage in forward clutch	Do stall test. Do Four Gauge Leakage Test , Group 9020-25.
	Worn reverser oil pump	Do Reverser Pump Flow Test, Group 9020-25.

Continued on next page

Symptom	Problem	Solution
Low Reverse Pressure in Reverser	Low oil level	Add oil to correct level.
	Wrong oil	Drain and replace oil. See Group 9000-04.
	Restricted suction screen in reverser	Remove and clean. See repair manual.
	Converter-in (cooler) relief valve stuck open or broken spring	Remove, inspect, clean and repair. See repair manual.
	Directional control valve solenoid spring stuck or broken	Inspect, clean and replace spring. See repair manual . Do Reverser System Pressure Test, Group 9020-25.
	Leakage in reverse brake	Do Four Gauge Leakage Test , Group 9020-25.
	Worn reverser oil pump	Do Reverser Pump Flow Test, Group 9020-25.
Low Lube Pressure in Reverser	Low oil level	Add oil to correct level. See Group 9000-04.
	Wrong oil	Drain and replace. See Group 9000-04.
	Restricted suction screen in reverser	Remove and clean. See repair manual.
	Converter-in (cooler) relief valve stuck open or broken	Remove, inspect, clean and repair. See repair manual.
	Directional control valve solenoid spring stuck or broken	Inspect and repair spring. See repair manual. Do Reverser System Pressure Test. See Group 9020-25.
	Leakage in reverser	Do Four Gauge Leakage Test , Group 9020-25.
	Worn reverser oil pump	Do Reverser Pump Flow Test. See Group 9020-25.

Continued on next page

TX,300D,2091 –19–08MAR93–9/18

Symptom	Problem	Solution
High Lube Pressure in Reverser	Converter-in relief valve stuck in closed position	Do Converter-in (cooler) Relief Valve Test, Group 9020-25.
	Lube passage to reverser sump restricted	Do Reverser Cooler Pressure Drop Test and inspect lines, Group 9020-25.
Converter Stall Speed Too Low	Wrong oil in machine	Drain and refill. See Group 9000-04.
	Incorrect torque converter	Check converter part number through inspection hole in bottom of reverser housing.
	Failed free wheel clutch in torque converter	Replace torque converter. See repair manual.
Converter Stall Speed Too High	Low oil level.	Add oil to correct level. See Group 9000-04.
	Incorrect torque converter	Check converter part number through inspection hole in bottom of reverser housing.
	Failed torque converter	Drain oil sample from converter and inspect for contamination. See repair manual.
	Engine over-fueled	Remove fuel injection pump. See authorized injection pump service center.

Continued on next page

TX,300D,2091 –19–08MAR93–10/18

Symptom	Problem	Solution
Valve Buzz or Noise In Reverser	Air in hydraulic system	Running machine will remove air.
	Low oil level	Add oil to correct level. See Group 9000-04.
	Air leak on suction side of pump	Inspect gasket and housing. See repair manual.
	Restrictions in oil passages	Inspect and remove restrictions. See repair manual.
	Restricted suction screen	Remove and clean. See repair manual.
	Sticky pressure regulating	Remove and clean valve. See repair manual. Inspect oil for contamination. Do Converter-in Relief Valve Test. See Group 9020-25.
Reverser Noisy In Forward and Reverse	Worn universal joints	Inspect and service as necessary. See repair manual.
	Misalignment of converter with engine	Align converter assembly. See repair manual.
	Misalignment of reverser and transaxle	Inspect reverser mounts for wear or damage. See repair manual.
Noisy In Neutral Only	Oil level low	Fill to correct oil level. See Group 9000-04.
	Worn bushings in pump assembly	Inspect pump assemble and replace if necessary. See repair manual.
	Worn sprag or sprag races in converter assemble	Replace converter assemble. See repair manual.

Continued on next page

TX,300D,2091 –19–08MAR93–11/18

Symptom	Problem	Solution
Excessive Gear Clash When Shifting	Attempting to shift too fast	See Operator's Manual for instructions.
	Not using disconnect clutch on reverser	Depress disconnect switch on transaxle or loader levers when shifting.
	Shifters worn or broken	Inspect and replace as necessary. See repair manual.
	Gears rotate with disconnect clutch switch depressed	Check for solenoid "click" when disconnect switch is depressed. See Reverser Disconnect Clutch Solenoid (SN —792482) or see Reverser Disconnect Clutch Solenoid Test (SN 792483—) .
Transaxle Overheating	Oil level high	Lower to correct level. See Group 9000-04.
	Brake dragging	Do System Operational Check, Brake Drag Check, Group 9020-10.
Loss of Lubricant in Transaxle	Worn or broken oil seal	Replace. See repair manual.
	Housing gasket broken	Replace. See repair manual.
Excessive Transaxle Noise	Transaxle low on oil	Fill to correct level. See Group 9000-04.
	Worn bearings	Replace bearings and make all necessary adjustments. See repair manual.
	Damaged or worn gears	Repair or replace parts as needed. See Transaxle—300D , Transaxle—310D, 315D (SN —796033) , or Transaxle—310D, 315D (SN 796034—) in repair manual.
	Parts worn or damaged	Repair or replace as needed. See repair manual.

Continued on next page

Symptom	Problem	Solution
Excessive Transaxle Noise (Under Load)	Worn bearings	Replace bearings and make all necessary adjustments. See repair manual.
	Bearing preload out of adjustment	Adjust to specifications. See repair manual.
	Ring gear backlash out of adjustment	Adjust to specifications. See repair manual.

Continued on next page

TX,300D,2091 –19–08MAR93–13/18

Symptom	Problem	Solution
Machine Makes Excessive Noise When Moving	Transaxle oil level low	Add oil to correct level. See Group 9000-04.
	Flywheel loose on crankshaft	Replace cap screws and tighten to specifications. See repair manual.
	Transaxle parts worn or damaged	Repair or replace parts as needed. See repair manual.
	Shifter forks on shafts worn	Replace. See repair manual.
	Reverser parts worn or damaged	Repair or replace parts as needed. See repair manual.
	Cone point out of adjustment	Adjust to specifications. See repair manual.
	Incorrect backlash adjustment	Adjust to specifications. See repair manual.
	Differential gears damaged or worn	Repair or replace part as needed. See repair manual.
	Differential ring gear loose	Repair or replace ring gear and pinion. See repair manual.
	Worn bearings	Replace bearings and make all necessary adjustments. See repair manual.
	Axle shaft improperly adjusted	Adjust to specifications. See repair manual.
	Final drive planetary pinions or bearings damaged	Repair or replace planetary pinions or bearings. See repair manual.
	Sun pinion damaged	Repair or replace. See repair manual.
	Worn final drive shaft and sun pinion	Replace. See repair manual.
	Damaged final drive gear	Replace. See repair manual.
	Worn planet pinion bearing rollers	Replace and adjust to specifications. See repair manual.

Continued on next page

TX,300D,2091 –19–08MAR93–14/18

Symptom	Problem	Solution
	Axle bearings damaged	Replace and adjust to specifications. See repair manual.
No Differential Lock Operation	Lock collar splines worn or damaged	Replace. See repair manual.
	Differential lock shaft sticking in housing	Repair or replace. See repair manual.
Excessive Machine Vibration	Engine idle too low	Adjust rpm to specifications. See Group 9010-20.
	Reverser mounting hardware loose	Inspect and tight to specifications. See repair manual.
	Loose or failed hydraulic pump drive	Inspect and repair. See repair manual.
	Flywheel loose on crankshaft	Replace cap screws and tighten to specifications. See repair manual.
	Transaxle shafts bent or damaged	Replace parts as needed. See repair manual.
	Transaxle bearings improperly adjusted	Adjust to specifications. See repair manual.
	Differential ring gear loose	Repair or replace ring gear. See repair manual.
	Cone point out of adjustment	Adjust to specifications. See repair manual.
	Incorrect backlash adjustment	Adjust to specifications. See repair manual.
	Axle shaft bent or damaged	Adjust to specifications. See repair manual.
	Engine over-fueled	Remove fuel injection pump. See your authorized fuel injection service center.

Continued on next page

TX,300D,2091 –19–08MAR93–15/18

Symptom	Problem	Solution
Axles Will Not Turn	Brakes dragging	Check brake valve and repair. See Group 9020-25.
	Broken rear axle	Replace. See repair manual.
	Broken planetary gears or shafts.	Replace. See repair manual.
Poor or No Brakes (Steering OK)	Air in system	Bleed brakes. See Group 9020-20, Bleed Brakes.
	Internal brake valve leakage	Do Brake Valve Leakage Test, Group 9020-25.
	Internal restriction in circuit	Remove lines and components and inspect
Brakes Will Not Release	Brake pedal not returning to full up position	Inspect brake pedal linkage. Do Brake Valve Stop and Equalizer Valve Adjustment, Group 9020-20.
	Plunger return orifice plugged	Remove, inspect, and clean. See Disassemble And Assemble Brake Valve in repair manual.
Brakes Chatter or Noisy	Air in brake system	Bleed brakes, see Group 9020-20.
	Wrong oil in transaxle	Drain and refill with correct oil. See Group 9000-04.
	Loose brake pads	Disassemble, inspect and repair. See Remove And Inspect Brake Disk And Pressure Plate (SN —796851) or Remove And Inspect Brake Disk And Pressure Plate (SN 796852—) in repair manual.

Continued on next page

TX,300D,2091 –19–08MAR93–16/18

Symptom	Problem	Solution
No Power to MFWD	Solenoid not actuated	See Group 9015-15.
	Drive shaft failure	Inspect and repair. See repair manual.
	Failed spline transaxle output shaft	Inspect and repair. See Disassemble And Assemble MFWD Transfer Case in repair manual.
	Failed axle shaft in MFWD	Inspect and repair. See Disassemble Axle Shaft And Constant Velocity Joint—APL-735 (SN —796033) or Disassemble Axle Shaft And Constant Velocity Joint—APL-2025 Axle (SN 796034—) in repair manual.
	Failed ring gear or pinion in transaxle	Inspect and repair. See repair manual.
	Failed gear in MFWD drop box in transaxle	Inspect and repair. See repair manual.
No Power to One Wheel	Wheel U-Joint failure	Inspect and repair. See repair manual.
	Failed outboard planetary	Inspect and repair. See Disassemble Knuckle Housing And Wheel Hub With Planetary Drive—APL-735 (SN —796033) or Disassemble Knuckle Housing And Wheel Hub With Planetary Drive—APL-2025 (SN 796034—) in repair manual.
	Failed axle shaft in MFWD	Inspect and repair. See repair manual.
	Failed limited-slip in MFWD differential	Inspect and repair. See Disassemble Differential in repair manual.
No Power to One Wheel (Under Load)	Failed limited-slip in MFWD differential	Inspect and repair. See Disassemble Differential in repair manual.

Continued on next page

TX,300D,2091 –19–08MAR93–17/18

Symptom	Problem	Solution
MFWD Jumps Out of Gear	Worn U-Joints in drive shaft	Inspect and repair. See repair manual.
	Incorrect differential backlash	Adjust backlash. See repair manual.

TX,300D,2091 –19–08MAR93–18/18

Adjust Brake Pedals And Equalizing Valves

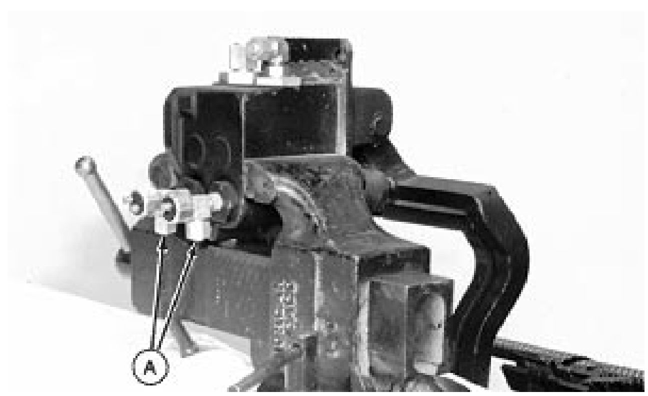
SPECIFICATIONS	
Brake Pedal Minimum Applied Force	44.5 N (10 lb)
Brake Pedal Travel	19 mm (0.75 in.)

1. Remove brake valve from machine. (See repair manual.)

2. Clamp brake valve level in bench vise.

TX,D300,DS2080 –19–12JUL94–1/5

3. Install caps (A). Fill brake valve reservoir with oil.

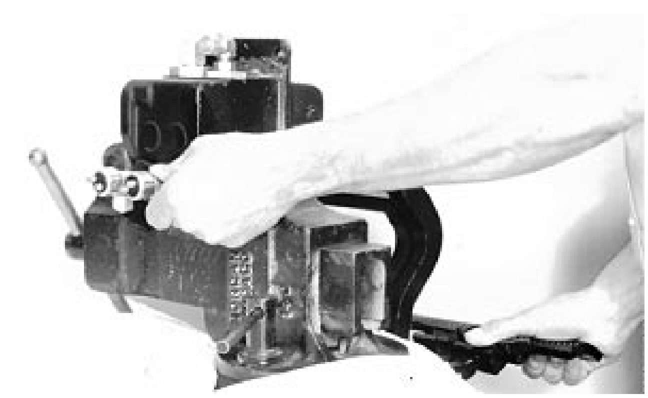


T7407AU –UN–30OCT90

TX,D300,DS2080 –19–12JUL94–2/5

IMPORTANT: DO NOT allow pedal to return abruptly before the stop screws are adjusted. Check valves could be damaged if stop screws are not properly adjusted.

4. Remove left cap and hold finger over end to stop oil flow. Slowly pump left pedal until air is purged. Install cap and repeat procedure on other side. Refill reservoir.



T7407AT –UN–30OCT90

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TX,D300,DS2080 –19–12JUL94–3/5

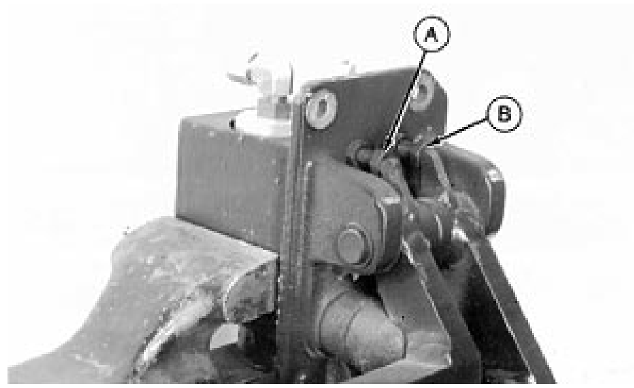
5. Adjust right-hand brake pedal cap screw (B) so brake piston is fully extended from the housing and brake pedal arm is tight against the piston.

6. Apply a minimum of 44.5 N (10 lb) force to the left-hand brake pedal.

Specification

Brake Pedal—Minimum Applied Force .... 44.5 N (10 lb)

If the pedal starts to settle, turn right-hand cap screw (B) out (counterclockwise) until the settling stops. Turn the right-hand cap screw (B) and additional 1/3 turn (two wrench flats) out (counterclockwise).



T7407AS –UN–30OCT90

7. Adjust left-hand brake pedal cap screw (A) so brake piston is fully extended from the housing and brake pedal arm is tight against the piston.

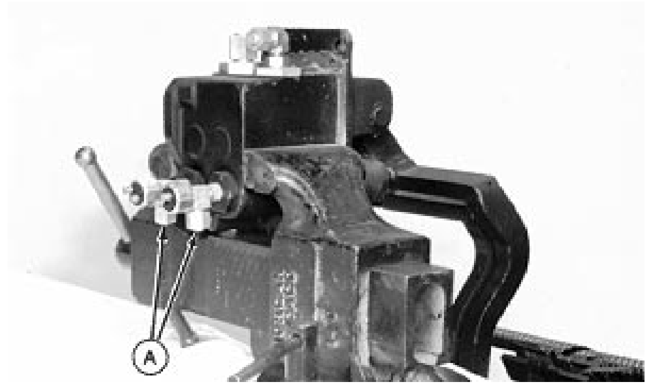
8. Apply a minimum of 44.5 N (10 lb) force to right-hand brake pedal. If pedal starts to settle, turn the left-hand cap screw (A) out (counterclockwise) until settling stops. Turn the left-hand cap screw (A) an additional 1/3 turn (two wrench flats) out (counterclockwise).

9. After both pedals have been adjusted, align pedals by turning cap screws for the highest pedal, a maximum of 1/6 turn (one wrench flat) out (counterclockwise). Lock both stop screws.

Continued on next page

TX,D300,DS2080 –19–12JUL94–4/5

10. Remove cap (A). A steady stream of oil must flow to indicate that check valve is in "open" position with pedals up. Depress pedal up to 13 mm (0.5 in.) and flow must stop which indicates that check valve is in "closed" position and sealing. Slowly release pedal; pedal must return to stop screw by return spring force alone. Install cap. Repeat for other side. Fill reservoir.



T7407AU –UN–30OCT90

NOTE: If oil does not flow, readjust valve stop screws. If flow does not stop with pedal depressed, inspect or replace check valve.

11. Depress one brake pedal. Brake pedal must be solid within first 19 mm (0.75 in.) of pedal travel.

Specification

Brake Pedal—Travel .... 19 mm (0.75 in.)

Repeat for other pedal.

NOTE: Excessive pedal travel indicates air in brake valve; repeat step 4.

TX,D300,DS2080 –19–12JUL94–5/5

Adjust Park Brake

1. Park machine on level surface and lower all equipment to ground.

Continued on next page

TX,55,DH1673 –19–12JUL94–1/6

2. Move FNR lever (B) to neutral "N".

3. Move transaxle gear shift lever (A) to neutral.

4. Stop engine.

CAUTION: Prevent possible injury from unexpected machine movement. Block wheels to prevent movement of machine during adjustment.

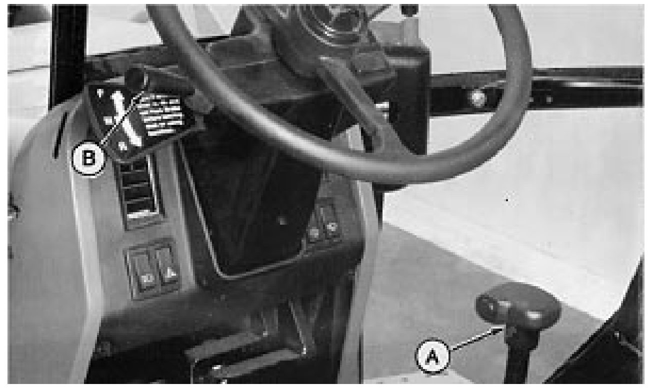
5. Block wheels to prevent movement.

NOTE: Park brake must be disengaged while adjusting.

6. Move park brake switch to OFF position.

7. Remove front and rear floor plates.

8. Start engine. Disengage park brake.



T7446AF –UN–07JAN91

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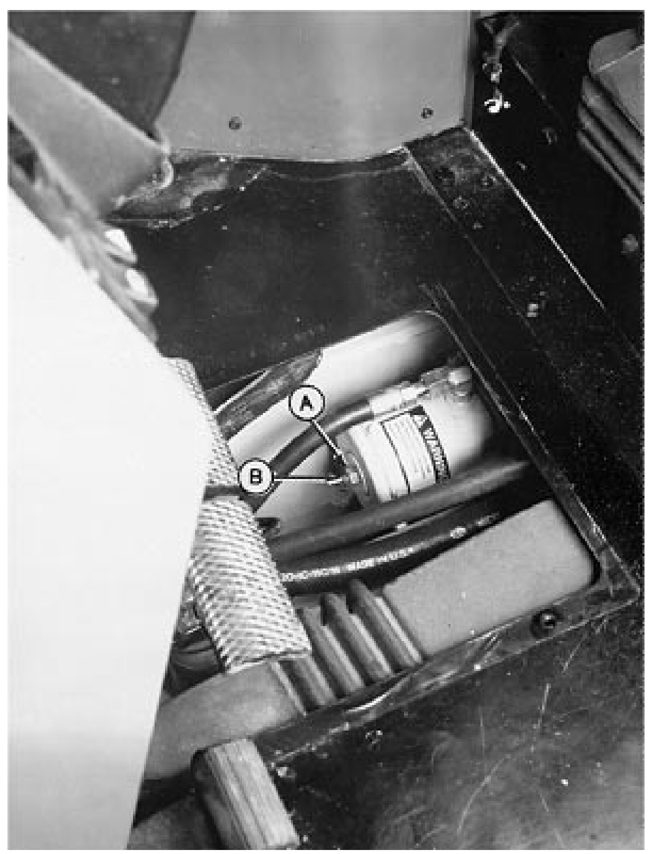
TX,55,DH1673 –19–12JUL94–2/6

CAUTION: Prevent possible personal injury from flying hardware. Actuator contains spring under load. DO NOT disassemble or remove from mounting bracket.

NOTE: Nut (A) is pinned to shaft (B). DO NOT remove pin.

9. Turn shaft assembly counterclockwise until it reaches the end of the canister. Assembly will back out approximately 2.0 in. (51 mm).

10. Stop engine.



T7351AR –UN–15NOV90

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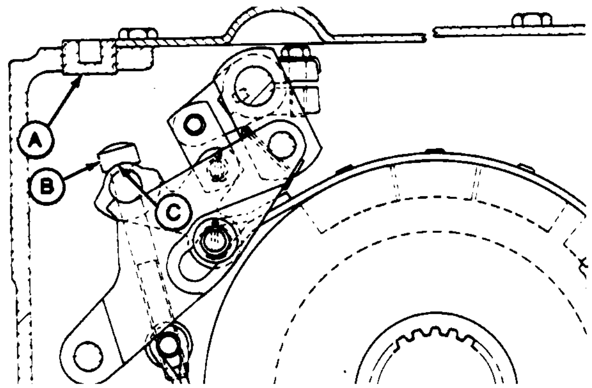
TX,55,DH1673 –19–12JUL94–3/6

11. Remove plug (A) from top rear of transaxle.

NOTE: Screw is adjusted at 1/2 turn increments.

12. Use a screwdriver and turn set screw (B) clockwise until it cannot be tightened another 1/2 turn.

13. Loosen screw approximately one turn making certain concave surface (C) on bottom screw head mates with convex surface of pivot pin. It will feel like a detented position.



T6148AD –UN–18OCT88

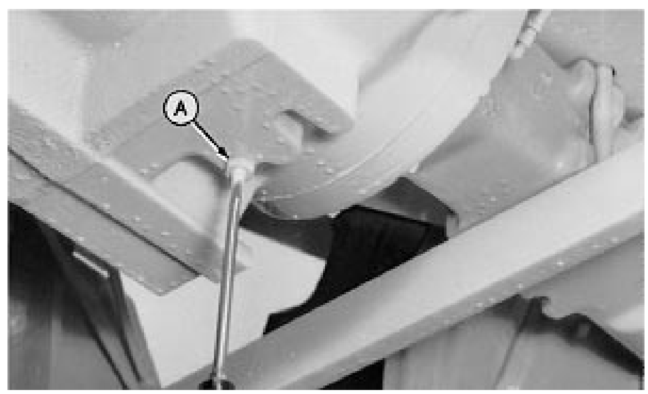
TX,55,DH1673 –19–12JUL94–4/6

14. Loosen lock nut (A).

15. Turn brake band stop screw clockwise until it contacts brake band.

16. Loosen stop screw one full turn.

17. Hold screw and tighten lock nut.



T6001AP –UN–02NOV88

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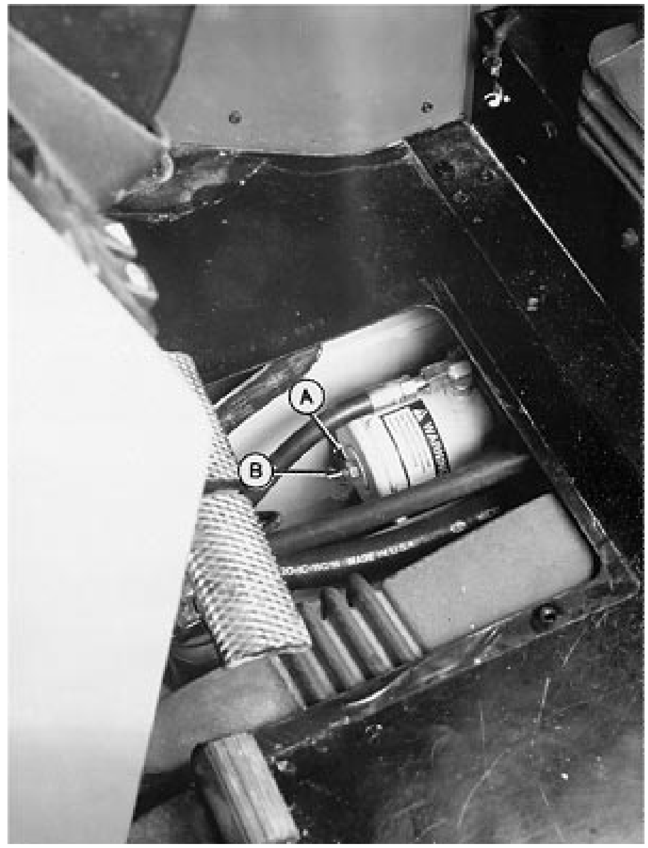
TX,55,DH1673 –19–12JUL94–5/6

18. Turn shaft assembly (B) clockwise until nut (A) contacts end of canister.

19. Install floor plates.



T7351AR –UN–15NOV90

TX,55,DH1673 –19–12JUL94–6/6

Bleeding Brakes

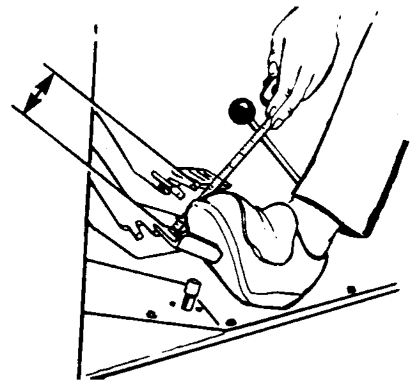
SPECIFICATIONS	
Brake Pedal Travel at 267 N (60 lb)	115 mm (4.5 in.) after a 10 second wait cycle

Continued on next page

TX,D300,DS2087 –19–12JUL94–1/2

NOTE: Air will "gravity bleed" from brake system through brake valve without use of bleed screws. Brake lines must be inclined toward brake valve.

Low ambient temperature or aeration of oil will slow bleed process.



T6838AE –UN–26OCT88

1. Engage park brake. Lock brake pedals together to bleed both brakes.

2. Run engine at low idle. Put bucket in dump position and raise front of machine. Steer to axle stop and hold over relief for 30 seconds to fill brake reservoir.

3. While holding steering over relief, pump the brake pedal slowly 12 times.

4. Release brake pedal completely and wait a minimum of 10 seconds.

CAUTION: Do not operate machine if pedal travel exceeds 115 mm (4.5 in.) while applying 267 N (60 lb) force. Operating machine with excessive brake travel could cause brakes not to stop machine on first application.

5. Repeat step 3 and 4 until a firm pedal is obtained within 115 mm (4.5 in.) of pedal travel after a 10 second wait cycle.

Specification

Brake Pedal—Travel at 267 N (60 lb) .... 115 mm (4.5 in.) after a 10 second wait cycle

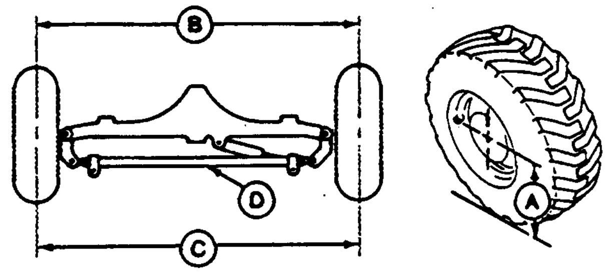
Brakes will continue to self-bleed as you machine and pedal firmness should improve.

6. If unable to obtain firm brake pedal, inspect lines and connections for leakage. If not external leaks, test axle. See repair manual.

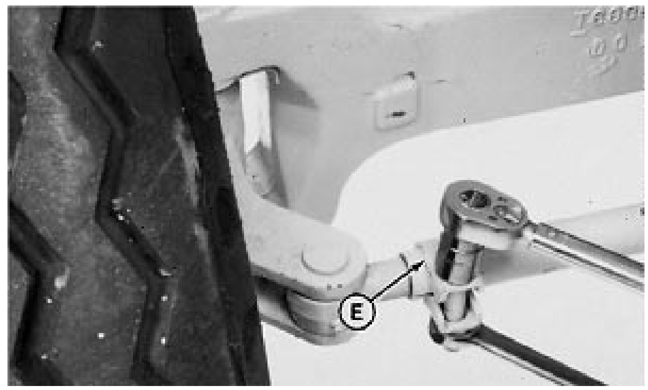
TX,D300,DS2087 –19–12JUL94–2/2

Check And Adjust Toe-In

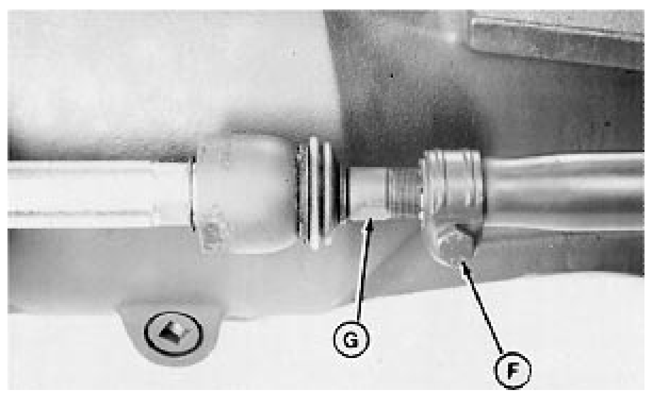
SPECIFICATIONS	
Machine Toe-In	Front marks must be 12 ± 6 mm (0.5 ± 0.25 in.) closer than rear marks
Tie Rod Clamp Cap Screws Torque	95 ± 14 N•m (70 ± 10 lb-ft)



T6382JW –UN–02NOV88



T6162AT –UN–02NOV88



T7417BA –UN–12NOV90

A—Center of Hub
B—Front of Tire
C—Rear of Tire
D—Tie Rod Tube
E—Tie Rod Clamp
F—Nut
G—Tie Rod

1. Measure distance from ground to hub center (A). At this height, mark front (B) and rear (C) in center of tread of each front tire.

2. Measure distance between front marks (B) and rear marks (C).

   MACHINES WITHOUT MFWD

3. Front marks must 12 ± 6 mm (0.5 ± 0.25 in.) closer than rear marks.

Specification

Machine—Toe-In .... Front marks must be 12 ± 6 mm (0.5 ± 0.25 in.) closer than rear marks

9020
20
8

To adjust toe-in, loosen both tie rod clamps (E) and turn tie rod tube (D). After adjustment, tip cap screws 45° down toward rear of machine.

Tighten clamp cap screws to 95 ± 14 N•m (70 ± 10 lb-ft).

Specification

Tie Rod Clamp Cap Screws—
Torque .... 95 ± 14 N•m (70 ± 10 lb-ft)

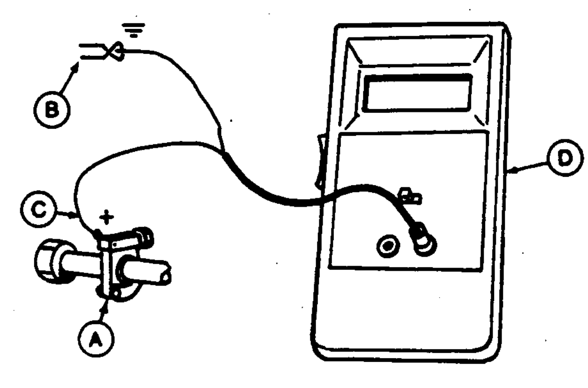
MACHINES WITH MFWD

4. Front marks must 12 ± 6 mm (0.5 ± 0.25 in.) closer than rear marks.

5. Loosen nut (F) on each side of axle. Turn each tie rod (G) equally to adjust. Tighten nuts.

TX,D300,DS2088 –19–12JUL94–1/1

JT05801 Clamp-On Electronic Tachometer Installation

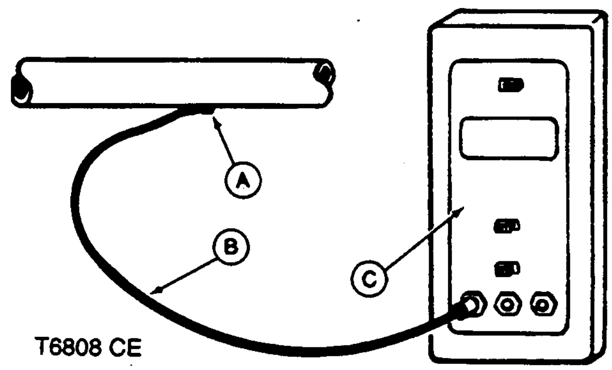


T6813AG –UN–28FEB89

SERVICE EQUIPMENT AND TOOLS
Tachometer
A—Clamp-On Transducer
Remove paint with emery cloth and connect to a straight section of injection line within 100 mm (4 in.) of pump. Finger tighten only. DO NOT over tighten.
B—Black Clip (-). Connect to main frame.
C—Red Clip (+). Connect to transducer.
D—Tachometer Readout. Install cable.

10T,9010,K182 –19–10AUG95–1/1

JT05800 Digital Thermometer Installation



T6808CE –UN–28FEB89

SERVICE EQUIPMENT AND TOOLS
Digital Thermometer
A—Temperature Probe
Fasten to a bare metal line using a tie band. Wrap with shop towel.
B—Cable
C—Digital Thermometer

902525,AA4 –19–28FEB95–1/1

Transaxle Oil Warm-Up Procedure

SPECIFICATIONS	
Engine Speed	Fast idle (2375 ± 25 rpm)

1. Raise machine off ground using loader and stabilizers.

Continued on next page TX,9020,YY914 –19–21APR94–1/2

2. Put transaxle in second gear (A).

3. Operate engine at fast idle (2375 ± 25 rpm).

Specification

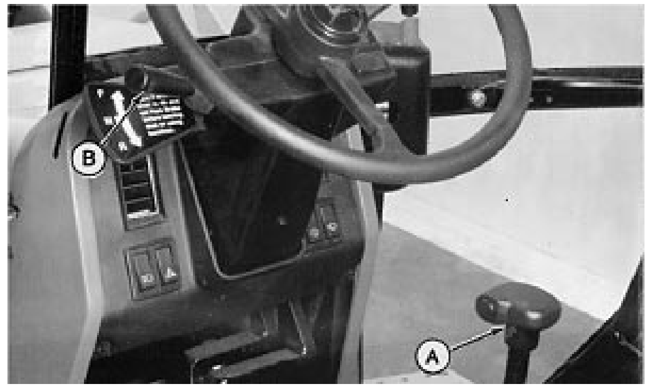
Engine—Speed .... Fast idle (2375 ± 25 rpm)

IMPORTANT: Do not hold brakes for longer than 20 seconds or brake system damage could result.

4. Put FNR lever (B) in forward position and apply moderate pressure to brake pedals for 20 seconds. DO NOT stall wheels while applying brakes.

5. Shift FNR lever to neutral position for 10 seconds to circulate oil.

6. Repeat steps 4 and 5 until transaxle oil reaches necessary test temperature.



T7446AF –UN–07JAN91

9020
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2

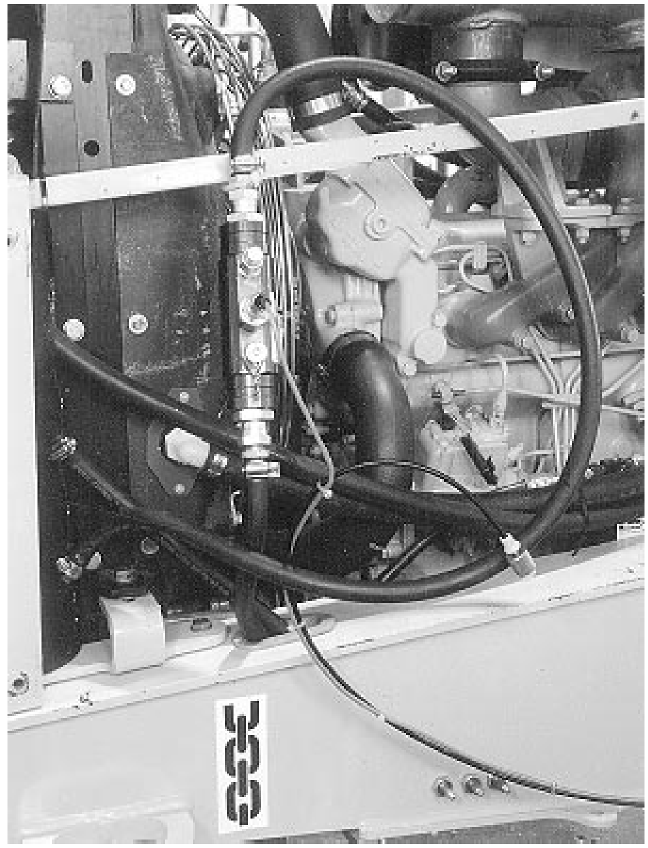
TX,9020,YY914 –19–21APR94–2/2

Transaxle Pump Flow Test

SPECIFICATIONS	
Oil Temperature	40 ± 4°C (104 ± 7°F)
Engine Speed	1500 ± 25 rpm
Oil Minimum Flow	11.3 L/m (3 gpm)

ESSENTIAL TOOLS
(1/2 Male NPT x 1/2 Male) (Parker No. 30182-8-8) Push-Lok Connector (2 used)

SERVICE EQUIPMENT AND TOOLS
Flowmeter
Digital Thermometer
Electronic Tachometer


T8274AB –UN–23JUN94

1. Make test connections.

IMPORTANT: Open flowmeter loading valve before starting unit to prevent damage to system.

2. Open flowmeter loading valve.

3. Raise machine off ground using loader and stabilizers.

4. Heat oil to specifications.

Specification
Oil—Temperature .... 40 ± 4°C (104 ± 7°F)
Engine—Speed .... 1500 ± 25 rpm

(See procedure in this group.)

5. Put transaxle in neutral and FNR lever in forward. Adjust engine speed to specification. Record flow rate.

Specification
Oil—Minimum Flow .... 11.3 L/m (3 gpm)

If flow rate is low, remove and repair or replace pump.

TX,9020,YY925 –19–12JUL94–1/1

9020
25
3

Reverser Oil Warm-Up Procedure

SPECIFICATIONS	
Engine Speed	Fast idle (2375 ± 25 rpm)

1. Hold service brakes on.

TX,300D,YY923 –19–12JUL94–1/2

2. Put transaxle in fourth gear (A).

3. Operate engine at fast idle (2375 ± 25 rpm).

Specification

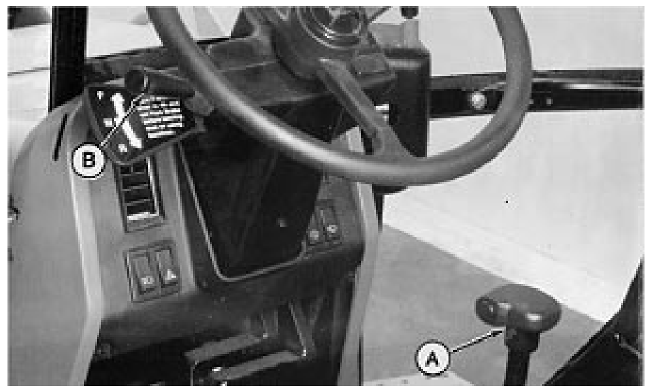
Engine—Speed .... Fast idle (2375 ± 25 rpm)

IMPORTANT: Do not stall converter for longer than 20 seconds or serious converter damage could result.

4. Put FNR lever (B) in forward position and stall for 20 seconds.

5. Shift FNR lever to neutral position for 10 seconds to circulate oil before doing next converter stall.

6. Repeat steps 4 and 5 until reverser oil reaches necessary test temperature.



T7446AF –UN–07JAN91

TX,300D,YY923 –19–12JUL94–2/2

Torque Converter Speed Test

SPECIFICATIONS	
Fast Idle Speed	2375 ± 25 rpm
Oil Temperature	65 ± 5°C (150 ± 10°F)
300D Minimum Engine Speed	2000 rpm
310D and 315D Minimum Engine Speed	2150 rpm
300D Maximum Engine Speed	2200 rpm
310D and 315D Maximum Engine Speed	2360 rpm

SERVICE EQUIPMENT AND TOOLS
Digital Thermometer
Electronic Tachometer

1. Install electronic tachometer and digital thermometer. (See procedure in this group.)

IMPORTANT: Converter should NOT be stalled longer than 20 seconds or serious converter damage may result. Return FNR lever to neutral position for 10 seconds before doing next stall test.

2. Put transaxle in fourth gear.

3. Apply and hold service brakes throughout test.

4. Move FNR lever to forward position.

5. Run engine at fast idle with speed control pedal.

Specification

Fast Idle—Speed .... 2375 ± 25 rpm

IMPORTANT: Minimum engine speed listed is for an engine that is broken-in and using No. 2 fuel.

6. When reverser oil temperature is at test specification, record engine speed.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)
300D—Minimum Engine Speed .... 2000 rpm
310D and 315D—Minimum
Engine Speed .... 2150 rpm
300D—Maximum Engine
Speed.. 2200 rpm
310D and 315D—Maximum
Engine Speed .... 2360 rpm

7. If converter stall speed is low, check for:

- Low engine output. See Group 9010-25.
- Incorrect torque converter (check part number through inspection hole in bottom of reverser housing).
- Failed freewheel clutch in torque converter.

8. If converter stall speed is too high, check for:

- Incorrect oil temperature.
- Low oil level.
- Incorrect oil in machine.
- Restricted suction screen. See repair manual.
- Incorrect torque converter (check part number through inspection hole in bottom of reverser housing).
- Engine over fueled. See Turbocharger Boost Pressure-Engine Performance Test—310D, 315D in Group 9010-25.
- Converter failed.
- Failed reverser clutch disk.
- Low system (pump) pressure in reverser.

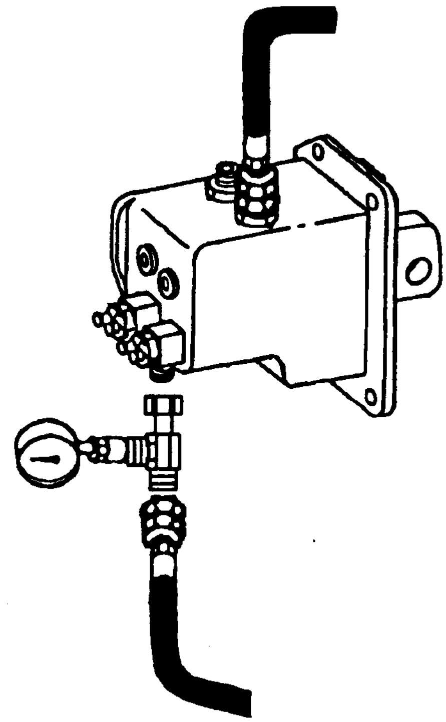
TX,300D,1952 –19–12JUL94–1/1

Brake Valve Leakage Test

SPECIFICATIONS	
Oil Temperature	40 ± 5 °C (104 ± 10°F)

ESSENTIAL TOOLS
38H1352 (-4 ORFS) Nut (2 used)
38H1138 (-4 ORFS) Plug (2 used)
JT03455 (7/16 JIC M x -4 ORFS F) Fitting
38H1029 Tee

SERVICE EQUIPMENT AND TOOLS
Gauge 0—6895 kPa (0—69 bar) (0—1000 psi)



T7668AL CV

T7668AL –UN–14DEC91

1. Heat oil to specifications.

Specification

Oil—Temperature .... 40 ± 5 °C (104 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

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2. Stop engine.

3. Push left and right brake pedal individually. If either pedal settles, leakage is indicated in final drive brake piston or brake valve reservoir.

4. Disconnect brake line and tee gauge at brake valve line of pedal that settled.

5. Push brake pedal down and block in place to set gauge at 500 psi starting point.

6. Monitor gauge. If pressure drops more than 100 psi in 30 seconds, excessive leakage is indicated.

7. To isolate leakage, disconnect and cap line at gauge.

8. If leakage continues, replace check valve.

9. No pressure drop indicates leakage at piston seals in axle housing.

300D,DS4660 –19–12JUL94–1/1

Park Brake Release Pressure Test

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	1500 ± 25
Park Brake Release Pressure	931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)

ESSENTIAL TOOLS
10R6LOS Tee
JT03458 (7/16-20 M JIC) Adapter

SERVICE EQUIPMENT AND TOOLS
Electronic Tachometer
Digital Thermometer
Gauge 0—2000 kPa (0—20 bar) (0—300 psi)

1. Install tachometer and thermometer. (See procedure in this group.)

Continued on next page TX,9020,YY924 –19–12JUL94–1/2

2. Disconnect park brake actuator hose (E) at park brake solenoid valve (A). Install tee (B), adapter (C) and gauge (D). Connect hose to tee.

3. Heat oil to specifications.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

(See procedure in this group.)

4. Increase rpm to specification and record pressure reading.

Specification

Engine—Speed .... 1500 ± 25
Park Brake—Release Pressure .... 931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)

5. If park brake pressure is not to specification, do Reverser Leakage Test—Four-Gauge Method. (See procedure in this group.)

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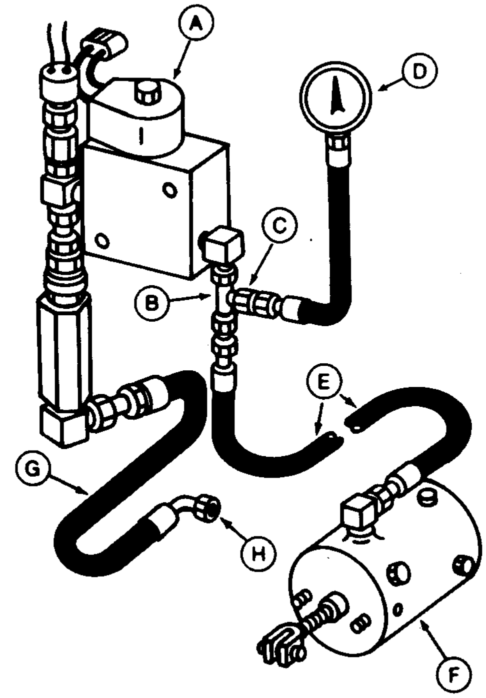
8

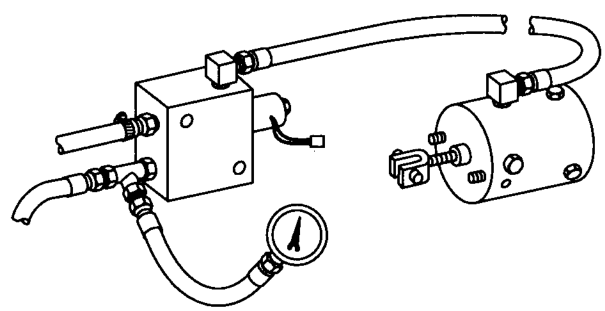
A—Park Brake Solenoid Valve
B—Tee
C—Adapter
D—Gauge
E—To Park Brake Actuator
F—Park Brake Actuator
G—Park Brake Solenoid Valve Hose
H—To Reverser System Pressure Port
I—Reverser System Pressure Port



T7952AB

T7952AB –UN–02MAR93

(S.N. —802199)



T8262BW CV

T8262BW –UN–06JUL94

(S.N. 802200—)

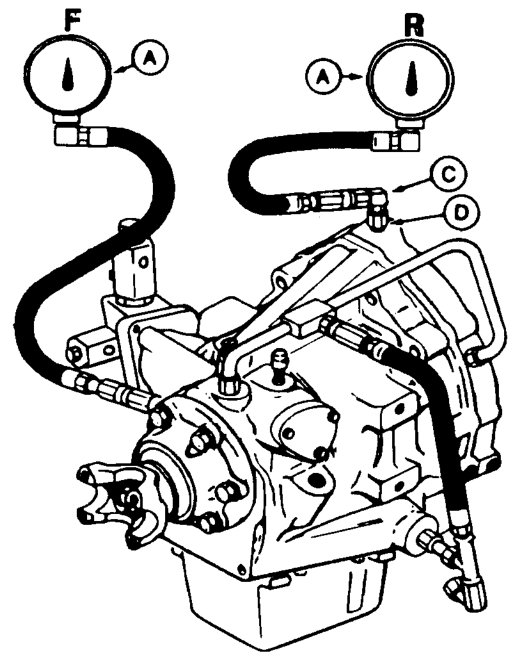
TX,9020,YY924 –19–12JUL94–2/2

Reverser Disconnect Clutch Solenoid (SN —792482)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	1500 ± 25 rpm
Forward and Reverse Pressure with Disconnect Switch Activated	0.0 kPa (0.0 bar) (0.0 psi)
Forward and Reverse Maximum Allowable Pressure Difference with Disconnect Switch not Activated	70 kPa (0.7 bar) (10 psi)

ESSENTIAL TOOLS
B—JT05487 (1/8 M NPT 7/16-20 M 37°) Connector
C—JT05483 (7/16-20 37° x 7/16-20 M 37°) 90° Swivel Elbow
D—JT03104 (3/8 M NPT 7/16-20 M 37°) Connector

SERVICE EQUIPMENT AND TOOLS
Electronic Tachometer
Digital Thermometer
A—Gauge 0—2000 kPa (0—20 bar) (0—300 psi) (2 used)



T7393AG —UN–30OCT90

1. Install tachometer and thermometer. (See procedure in this group.)

2. Make test connections.

3. Heat oil to specifications.

Specification
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

(See Reverser Oil Warm-Up procedure in this group.)

4. Run engine at specifications.

Specification
Engine—Speed .... 1500 ± 25 rpm

Shift FNR lever to forward. Make a record of "F" port pressure gauge reading. Depress disconnect clutch switch. "F" port pressure must decrease to zero pressure.

Specification
Forward and Reverse—Pressure
with Disconnect Switch Activated .... 0.0 kPa (0.0 bar) (0.0 psi)

Continued on next page

Release disconnect clutch switch and watch "F" port pressure gauge return to previous pressure gauge reading.

Repeat procedure in reverse position. "R" port pressure must decrease to zero when disconnect clutch switch is pressed.

Specification

Forward and Reverse—Pressure with Disconnect Switch Activated .... 0.0 kPa (0.0 bar) (0.0 psi)

Reading must be within 70 kPa (0.7 bar) (10 psi) higher than "F" port pressure.

Specification

Forward and Reverse—Maximum Allowable Pressure Difference with Disconnect Switch not Activated.. 70 kPa (0.7 bar) (10 psi)

Pressures out of specifications between "F" and "R" pressure ports indicated leakage in circuit with lowest pressure. Do Four-Gauge Leakage Test in this group.

If pressures do not drop to zero, listen for a "click" sound from reverser disconnect clutch solenoid when switch is depressed. If no "click" is heard, inspect fuse, wiring, or test solenoid. (See Group 9015-25.)

If pressures do not drop to zero, check to make sure that FNR lever is moving to forward and reverse detent positions.

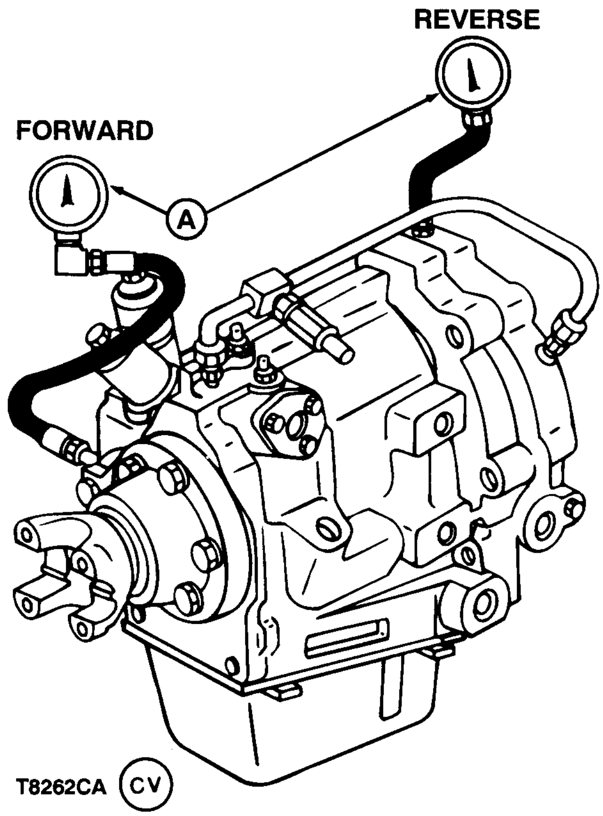
TX,300D,1953 –19–12JUL94–2/2

Reverser Disconnect Clutch Solenoid Test (SN 792483—)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	1500 ± 25 rpm
Forward and Reverse Pressure with Disconnect Switch Activated	0.0 kPa (0.0 bar) (0 psi)
Forward and Reverse Maximum Allowable Pressure Difference with Disconnect Switch not Activated	70 kPa (0.7 bar) (10 psi)

ESSENTIAL TOOLS
JT05487 (1/8 M NPT 7/16-20 M 37°) Connector (2 used)

SERVICE EQUIPMENT AND TOOLS
Digital Thermometer
Electronic Tachometer
A—Gauge 0—2000 kPa (0—20 bar) (0—300 psi) (2 used)



T8262CA –19–06JUL94

1. Install tachometer and thermometer. (See procedure in this group.)

2. Make test connections.

3. Heat oil to specifications.

Specification
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

(See Reverser Oil Warm-Up procedure in this group.)

4. Run engine at specifications.

Specification
Engine—Speed .... 1500 ± 25 rpm

Shift FNR lever to forward. Make a record of forward pressure gauge reading. Depress disconnect clutch switch. Forward pressure must decrease to zero pressure.

Specification
Forward and Reverse—Pressure
with Disconnect Switch Activated .... 0.0 kPa (0.0 bar) (0 psi)

Release disconnect clutch switch. Forward pressure must return to recorded pressure.

Continued on next page

300D,DS4661 –19–12JUL94–1/2

5. Shift FNR lever to reverse. Make a record of reverse pressure gauge reading. Depress disconnect clutch switch. Reverse pressure must decrease to zero pressure and return to recorded pressure when disconnect clutch switch is released.

Specification

Forward and Reverse—Pressure with Disconnect Switch Activated .... 0.0 kPa (0.0 bar) (0 psi)

6. Maximum difference between forward and reverse pressure must not exceed 70 kPa (0.7 bar) (10 psi).

Specification

Forward and Reverse—Maximum Allowable Pressure Difference with Disconnect Switch not Activated .... 70 kPa (0.7 bar) (10 psi)

Pressures out of specifications indicate leakage in circuit with lowest pressure. Do Reverser Element Leakage Test in this group.

7. If pressures do not drop to zero, listen for a "click" from reverser disconnect clutch solenoid when switch is depressed. If no "click" is heard, inspect fuse, wiring or test solenoid. See Reverser Disconnect Clutch Solenoid (SN —792482) or see Reverser Disconnect Clutch Solenoid Test (SN 792483—) .

8. If pressures do not drop to zero, check to make sure that FNR lever is moving to forward and reverse detent positions.

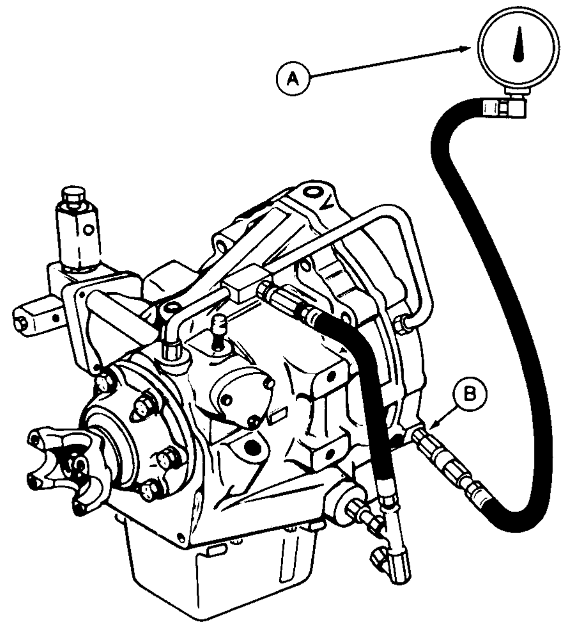
300D,DS4661 –19–12JUL94–2/2

Reverser Cooler Pressure Test (SN —792482)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	1500 ± 25 rpm
Neutral Cooler and Forward or Reverse Cooler Maximum Pressure Difference	35 kPa (0.35 bar) (5 psi)

ESSENTIAL TOOLS
B—JT05487 (1/8 M NPT 7/16-20 M 37°) Connector

SERVICE EQUIPMENT AND TOOLS
Electronic Tachometer
Digital Thermometer
A—Gauge 0—1000 kPa (0—100 bar) (0—150 psi)



T7393AF –UN–30OCT90

1. Install tachometer and thermometer. (See procedure in this group.)

2. Make test connections.

3. Warm reverser oil to specifications.

Specification
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

(See Reverser Oil Warm-Up procedure in this group.)

4. Run engine at specifications and record cooler pressure in forward, neutral, and reverse positions.

Specification
Engine—Speed .... 1500 ± 25 rpm
Neutral Cooler and Forward or
Reverse Cooler—Maximum
Pressure Difference... 35 kPa (0.35 bar) (5 psi)

5. If cooler pressure is high, inspect cooler hoses and cooler for damage. If no damage is found, back flush reverser cooler. See Reverser Oil Cooler Restriction Test in this group.

6. If cooler pressure is lower when forward or reverse is activated, leakage is indicated in that circuit.

Continued on next page

TX,300D,1954 –19–12JUL94–1/2

7. If cooler pressure is low in all positions, directional control valve or reverser pump problems are indicated. Do a Four-Gauge System Leakage Test to analysis results. See procedure in this group.

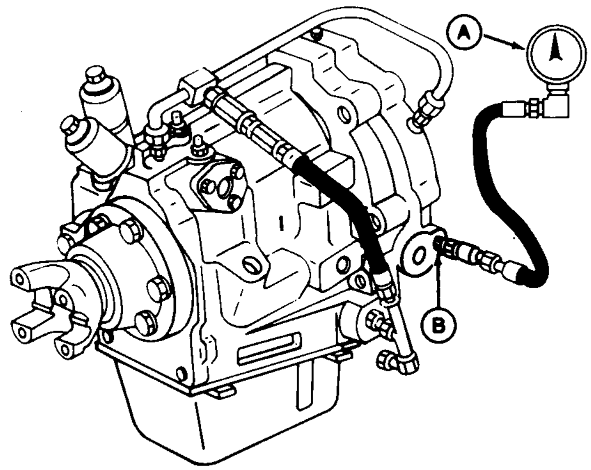
TX,300D,1954 –19–12JUL94–2/2

Reverser Cooler Pressure Test (SN 792483—)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	1500 ± 25 rpm
Neutral Cooler and Forward or Reverse Cooler Maximum Pressure Difference	35 kPa (0.35 bar) (5 psi)

ESSENTIAL TOOLS
B—JT05487 (1/8 M NPT 7/16-20 37°) Connector

SERVICE EQUIPMENT AND TOOLS
Electronic Tachometer
Digital Thermometer
A—Gauge 0—1000 kPa (0—100 bar) (0—150 psi)



T7949AM

T7949AM –UN–02MAR93

1. Install tachometer and thermometer. (See procedure in this group.)

2. Make test connections.

3. Warm reverser oil to specifications.

Specification
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

(See Reverser Oil Warm-Up procedure in this group.)

4. Run engine at specifications and record cooler pressure with FNR lever in forward, neutral and reverse positions.

Specification
Engine—Speed .... 1500 ± 25 rpm
Neutral Cooler and Forward or
Reverse Cooler—Maximum
Pressure Difference... 35 kPa (0.35 bar) (5 psi)

5. If cooler pressure is high, inspect cooler hoses and cooler for damage. If no damage is found, back flush reverser cooler. See Reverser Oil Cooler Restriction Test in this group.

6. If cooler pressure is lower when forward or reverse is activated, leakage is indicated in that circuit.

Continued on next page

7. If cooler pressure is low in all positions, FNR solenoid or reverser pump problems are indicated. Do the Reverser element Leakage Test to analyze results. See procedure in this group.

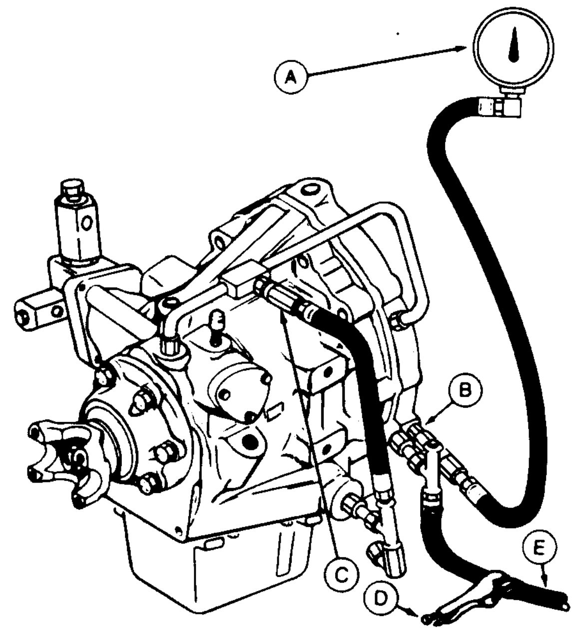
300D,DS4662 –19–12JUL94–2/2

Reverser/Converter-In Relief Valve Test (SN —792482)

SPECIFICATIONS	
Oil Temperature	Warm to touch
Engine Speed	Varying rpm
Converter-in Relief Valve Pressure	550 ± 10 kPa (5.5 ± 1 bar) (80 ± 15 psi)

ESSENTIAL TOOLS
JT05487 (1/8 M NPT 7/16-20 M 37°) Connector

SERVICE EQUIPMENT AND TOOLS
Gauge 0—1000 kPa (0—10 bar) (0—150 psi)
Locking Pliers



A—Gauge
B—Connector
C—Relief Valve
D—Locking Pliers
E—Torque Converter Out-Cooler In

1. Make test connections.

2. Put FNR lever in neutral.

3. Warm reverser oil until cooler lines are warm to touch.

Specification

Oil—Temperature .... Warm to touch

4. Block cooler-in hose with locking pliers (D) to stop cooler flow.

IMPORTANT: DO NOT exceed 700 kPa (7 bar) (100 psi) or converter damage could result.

5. Slowly increase rpm until maximum pressure is reached on gauge.

Specification

Engine—Speed .... Varying rpm
Converter-in Relief Valve—
Pressure .... 550 ± 10 kPa (5.5 ± 1 bar) (80 ± 15 psi)

DO NOT exceed 700 kPa (7 bar) (100 psi) or converter damage could result.

6. If pressure is too high, remove relief valve (C). Disassembly, clean and inspect valve.

7. If pressure is low, check for broken spring, damaged ball or damaged valve seat in relief valve.

Continued on next page

8. Install and check relief valve after repair.

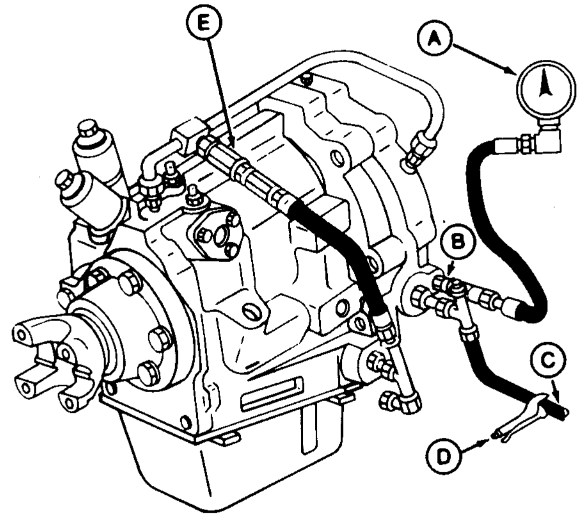
TX,300D,1955 –19–12JUL94–2/2

Reverser/Converter-In Relief Valve Test (SN 792483—)

SPECIFICATIONS	
Oil Temperature	Warm to touch
Engine Speed	Varying rpm
Converter-In Relief Valve Pressure	550 ± 100 kPa (5.5 ± 1 bar) (80 ± 15 psi)

ESSENTIAL TOOLS
JT05487 (1/8 M NPT 7/16-20 M 37°) Connector

SERVICE EQUIPMENT AND TOOLS
Gauge 0—1000 kPa (0—10 bar) (0—150 psi)
Locking Pliers



T7949AL

T7949AL –UN–02MAR93

A—Gauge
B—Connector
C—Torque Converter Out-Cooler In
D—Locking Pliers
E—Relief Valve

1. Make test connections.
2. Put FNR lever in neutral.
3. Warm reverser oil until cooler lines are warm to touch.

Specification
Oil—Temperature .... Warm to touch

4. Block cooler-in hose with locking pliers (D) to stop cooler flow.

IMPORTANT: DO NOT exceed 700 kPa (7 bar) (100 psi) or converter damage could result.

5. Slowly increase rpm until maximum pressure is reached on gauge.

Specification
Engine—Speed .... Varying rpm
Converter-In Relief Valve—
Pressure .... 550 ± 100 kPa (5.5 ± 1 bar) (80 ± 15 psi)

Do not exceed 700 kPa (7 bar) (100 psi) or converter damage could result.

6. If pressure is too high, remove relief valve (E). Disassemble, clean and inspect valve.
7. If pressure is low, check for broken spring, damaged ball or damaged valve seat in relief valve.

Continued on next page

8. Install relief valve. Repeat test.

TX,300D,DS4663 –19–12JUL94–2/2

Reverser Oil Cooler Restriction Test (SN —792482)

SPECIFICATIONS	
Oil Temperature	65 ± 1°C (150 ± 2°F)
Oil Flow	11.4 L/min (3.0 gpm)
Inlet and Outlet Maximum Pressure Difference	140 kPa (1.4 bar) (20 psi)

ESSENTIAL TOOLS
203654 (1/2 M NPT 7/16-20 M 37°) Connector (2 used)
JT03348 (1/2 F NPT) Tee (2 used)
I—JT03212 (1/2 ID 1/2 M NPT) Adapter (6 used)
J—JT03070 (1/2 F NPT 1-1/6-12 37° SW) Adapter (2 used)

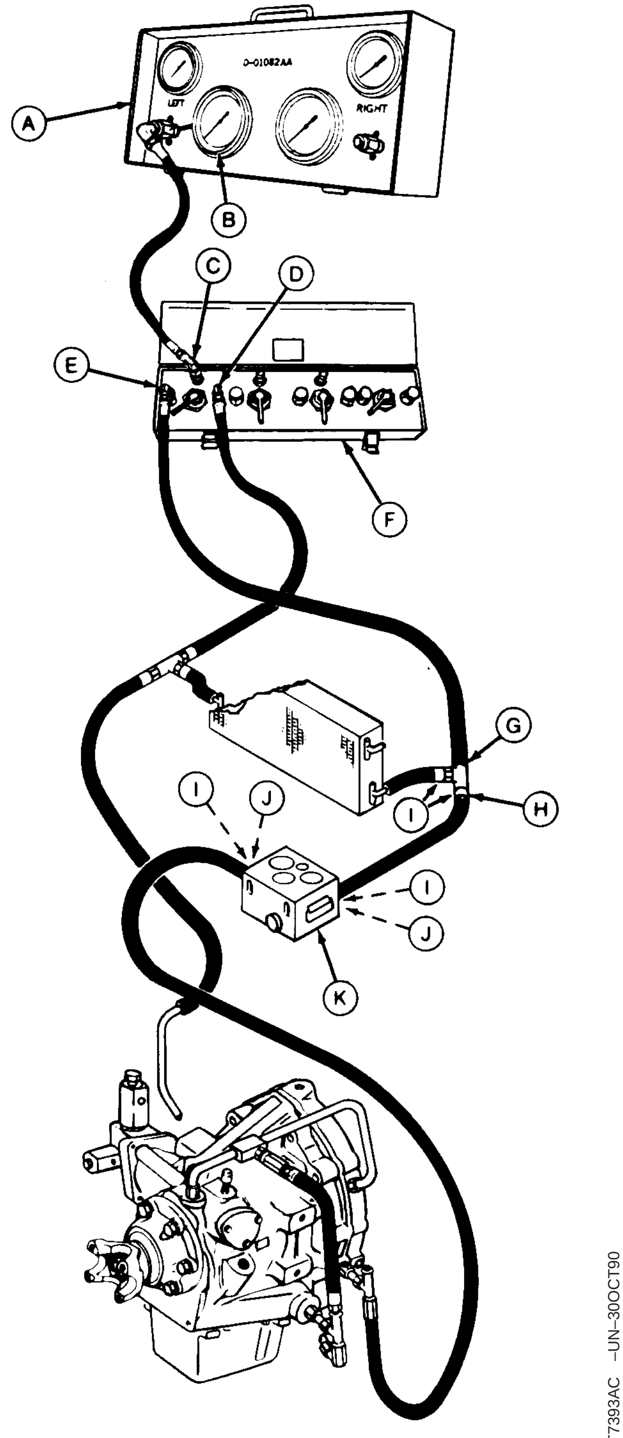
SERVICE EQUIPMENT AND TOOLS
Flowmeter with Temperature Gauge
A—Hydraulic Analyzer or Pressure Gauge
B—Gauge 0—200 kPa (0—2.0 bar) (0—30 psi)
Hydrostatic Switching Unit or Two Similarly Calibrated Gauges

NOTE: If an internally restricted oil cooler is suspected, the oil cooler can be back flushed to check for debris. Steps 1—3 describe how to back flush the cooler and Steps 4—7 describe how to test cooler for an internal restriction.

1. To back flush the cooler, connect reverser pump outlet to cooler outlet. Disconnect cooler inlet line and put end of hose in a five gallon bucket.

2. Start engine and run at slow idle for 20 seconds. DO NOT empty reverser sump.

3. Connect cooler hoses to original position on flowmeter.



A—Hydraulic Analyzer
B—Gauge
C—Gauge Port
D—No. 2 Input
E—No. 1 Input
F—Switch Unit
G—Connector
H—Tee
I—Adapter
J—Adapter
K—Flowmeter

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Continued on next page

TX,300D,1956 –19–12JUL94–1/2

4. Make test connection. Refill reverser, then start engine to fill to proper level before test.

5. Open flowmeter. Heat oil to test specification.

Specification

Oil—Temperature .... 65 ± 1°C (150 ± 2°F)

(See Reverser Oil Warm-Up procedure in this group.)

6. Increase engine speed until flow is at specification.

Specification

Oil—Flow .... 11.4 L/min (3.0 gpm)

7. Read pressure gauges at inlet and outlet of cooler.

Specification

Inlet and Outlet—Maximum
Pressure Difference.. 140 kPa (1.4 bar) (20 psi)

TX,300D,1956 –19–12JUL94–2/2

Reverser Oil Cooler Restriction Test (SN 792483—)

SPECIFICATIONS	
Oil Temperature	65 ± 1°C (150 ± 2°F)
Oil Flow	12.1 L/min (3.2 gpm)
Inlet and Outlet Maximum Pressure Difference	140 kPa (1.4 bar) (20 psi)

ESSENTIAL TOOLS
JT03348 (1/2 F NPT) Tee (2 used)
D—JT03212 (1/2 ID 1/2 M NPT) Adapter (6 used)
E—JT03070 (1/2 F NPT 1-1/16-12 37° SW) Adapter (2 used)

SERVICE EQUIPMENT AND TOOLS
Flowmeter
Gauge 0—200 kPa (0—2.0 bar) (0—30 psi) (2 used)
Digital Thermometer
Electronic Tachometer

NOTE: If an internal restriction in the oil cooler is indicated, the oil cooler can be back flushed to check for debris. (See Steps 1—3.)

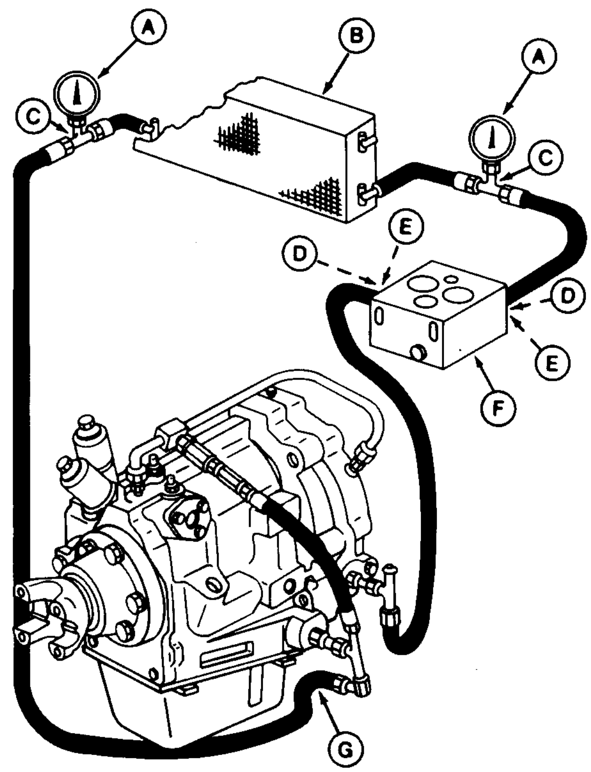
IMPORTANT: Reverser and torque converter capacity is 7.6 L (8 qt).

1. To back flush the cooler, connect reverser pump outlet to cooler outlet. Disconnect cooler inlet line (G) and put end of hose in a five gallon container.

2. Start engine and run at slow idle for 20 seconds. DO NOT empty reverser sump.

3. Connect cooler hoses to original position on flowmeter.

4. Make test connections. Refill reverser, then start engine to fill to proper level before test.



T7949AJ

A—Gauge (2 used)
B—Oil Cooler
C—Tee (2 used)
D—Adapter (2 used)
E—Adapter (2 used)
F—Flowmeter
G—Cooler Inlet

T7949AJ –UN–02MAR93

Continued on next page

TX,300D,DS4664 –19–12JUL94–1/2

9020
25
23

5. Open flowmeter. Heat oil to test specification.

Specification

Oil—Temperature .... 65 ± 1°C (150 ± 2°F)

(See Reverser Oil Warm-Up procedure in this group.)

6. Increase engine speed until flow is at specification.

Specification

Oil—Flow .... 12.1 L/min (3.2 gpm)

7. Read pressure gauges at inlet and outlet of cooler.

Specification

Inlet and Outlet—Maximum
Pressure Difference.. 140 kPa (1.4 bar) (20 psi)

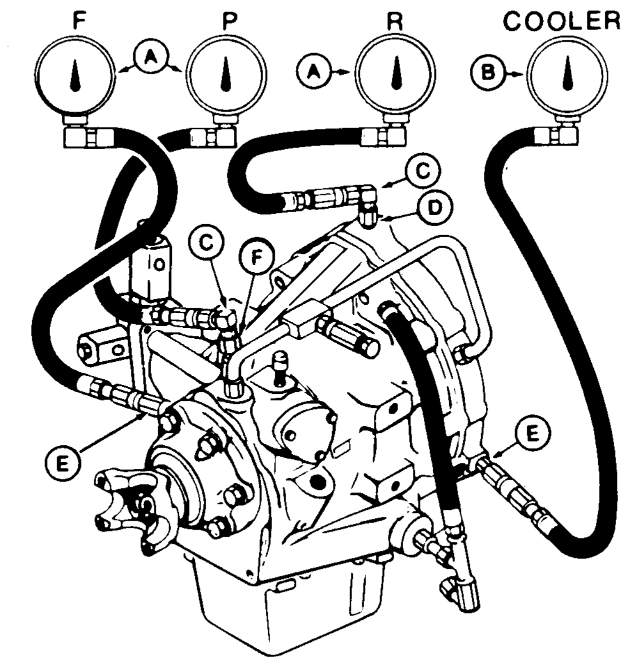
TX,300D,DS4664 –19–12JUL94–2/2

Reverser Leakage Test Using Four-Gauge Method (SN —792482)

SPECIFICATIONS	
Engine Speed	1500 ± 25 rpm
Oil Temperature	65 ± 5°C (150 ± 10°F)
Cooler Pressure	175 ± 35 kPa (1.7 ± 0.3 bar) (25 ± 5 psi)
"P" System Pressure	931 ± 100 kPa (9.3 ± 1 bar) (135 ± 15 psi)
"P" System and "F" Forward Maximum Pressure Difference	70—100 kPa (0.7—1.0 bar) (10—15 psi)
"P" System and "R" Forward Maximum Pressure Difference	35—70 kPa (0.03—0.07 bar) (5—10 psi)

ESSENTIAL TOOLS
C—JT05483 (7/16-20 F JIC x 7/16-20 M) 90° Swivel Elbow (2 used)
D—JT05486 (1/4 M NPT 7/16-20 M 37°) Connector
E—JT05487 (1/8 M NPT 7/16-20 M 37°) Connector (2 used)
F—JT03104 (3/8 M NPT 7/16-20 M 37°) Connector

SERVICE EQUIPMENT AND TOOLS
Electronic Tachometer
Digital Thermometer
A—Gauge 0—2000 kPa (0—20 bar) (0—300 psi) (3 used)
B—Gauge 0—1000 kPa (0—10 bar) (0—150 psi)



T7393AA –UN–30OCT90

1. Pressure higher than specification indicates stuck pressure regulator valve in directional control valve.

Specification
Engine—Speed .... 1500 ± 25 rpm
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)
Cooler—Pressure .... 175 ± 35 kPa (1.7 ± 0.3 bar) (25 ± 5 psi)

Remove, inspect and clean to repair.

2. Low pressure in one circuit indicates leakage in that circuit. Low pressure in all circuits indicates low oil flow caused by plugged filter screen in oil pan or low reverser pump output.

Specification
"P" System—Pressure.......................... 931 ± 100 kPa (9.3 ± 1 bar) (135 ± 15 psi)

Continued on next page
TX,300D,1957 –19–12JUL94–1/2

Specification

"P" System and "F" Forward—
Maximum Pressure Difference .... 70—100 kPa (0.7—1.0 bar)
(10—15 psi)

"P" System and "R" Forward—
Maximum Pressure Difference .... 35—70 kPa (0.03—0.07 bar)
(5—10 psi)

Inspect and clean filter and repeat test. If pressure in all circuits is still low, do complete reverser system check in this group to find problem.

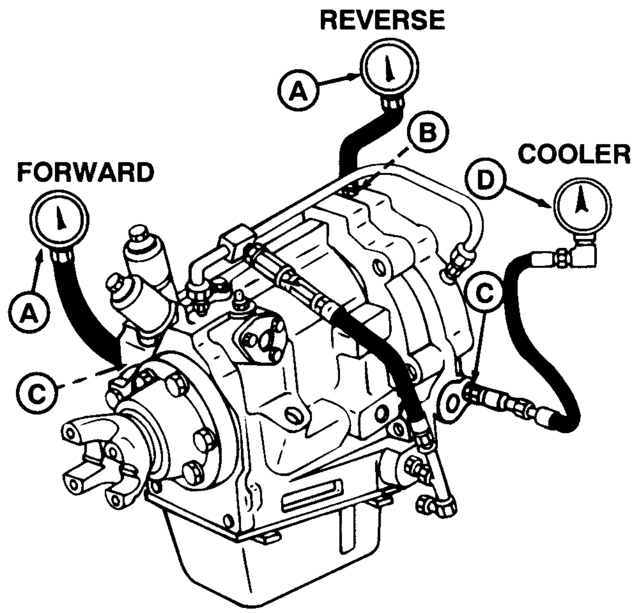
TX,300D,1957 –19–12JUL94–2/2

Reverser Leakage Test Using Four-Gauge Method (SN 792483—)

SPECIFICATIONS	
Engine Speed	1500 ± 25 rpm
Oil Temperature	65 ± 5°C (150 ± 10°F)
Cooler Pressure	175 ± 35 kPa (1.7 ± 0.3 bar) (25 ± 5 psi)
System (Pump) Minimum Pressure	827 kPa (8.2 bar) (120 psi)
System (Pump) and Forward Maximum Pressure Difference	70—100 kPa (0.7—1.0 bar) (10—15 psi)
System (Pump) and Reverse Maximum Pressure Difference	35—70 kPa (0.03—0.07 bar) (5—10 psi)

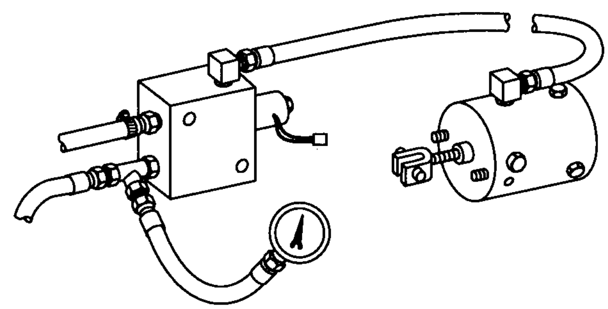
ESSENTIAL TOOLS
B—JT03104 (3/8 M NPT 7/16-20 M 37°) Connector
C—JT05487 (1/8 M NPT 7/16-20 M 37°) Connector (3 used)

SERVICE EQUIPMENT AND TOOLS
B—Gauge 0—2000 kPa (0—20 bar) (0—300 psi) (3 used)
C—Gauge 0—1000 kPa (0—10 bar) (0—150 psi)
Electronic Tachometer
Digital Thermometer



T8262CB CV

T8262CB –19–06JUL94



T8262BW CV

T8262BW –UN–06JUL94

A—Gauge (3 used)
B—Connector
C—Connector (3 used)
D—Gauge

1. Pressure higher than specification indicates stuck pressure regulator valve in reverser.

Specification
Engine—Speed .... 1500 ± 25 rpm
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)
Cooler—Pressure .... 175 ± 35 kPa (1.7 ± 0.3 bar) (25 ± 5 psi)

Remove, inspect and clean to repair.

2. Low pressure in one circuit indicates leakage in that circuit. Low pressure in all circuits indicates low oil flow caused by plugged filter screen in oil pan or low reverser pump output.

Specification
System (Pump)—Minimum
Pressure .... 827 kPa (8.2 bar) (120 psi)
System (Pump) and Forward—
Maximum Pressure Difference....................... 70—100 kPa (0.7—1.0 bar) (10—15 psi)

Continued on next page

TX,300D,DS4665 –19–12JUL94–1/2

Specification

System (Pump) and Reverse—
Maximum Pressure Difference .... 35—70 kPa (0.03—0.07 bar)
(5—10 psi)

Inspect and clean filter and repeat test. If pressure in all circuits is still low, do complete reverser system check in this group to diagnose problem.

TX,300D,DS4665 –19–12JUL94–2/2

Reverser Pump Flow Test (SN —792482)

SPECIFICATIONS	
Engine Speed	1500 ± 5 rpm
Oil Temperature	65 ± 1°C (150 ± 2°F)
New Reverser Pump Flow	11.3 L/min (3.00 gpm)
Used Reverser Pump Flow	7.6 L/min (2.00 gpm)
"P" System Pressure	931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)

ESSENTIAL TOOLS
JT03064 (1-1/16-12 M 37° 1/2 F NPT) Adapter
JT05483 (7/16-20 F 37° x 7/16-20 M) 90° Swivel Elbow (2 used)
JT03104 (3/8 M NPT 7/16-20 M 37°) Connector
JT05487 (1/8 M NPT 7/16-20 M 37°) Fitting
JT03025 (3/4-16 M 37°) Cap
JT03221 (3/4-16 M 37°) Plug

SERVICE EQUIPMENT AND TOOLS
Electronic Tachometer
Digital Thermometer
Flowmeter
E—Gauge 0—2000 kPa (0—20 bar) (0—300 psi)
D—Gauge 0—1000 kPa (0—10 bar) (0—150 psi)

1. Install tachometer and thermometer. (See procedure this group.)

IMPORTANT: Flowmeter loading valve must be open before starting machine to prevent damage to reverser pump.

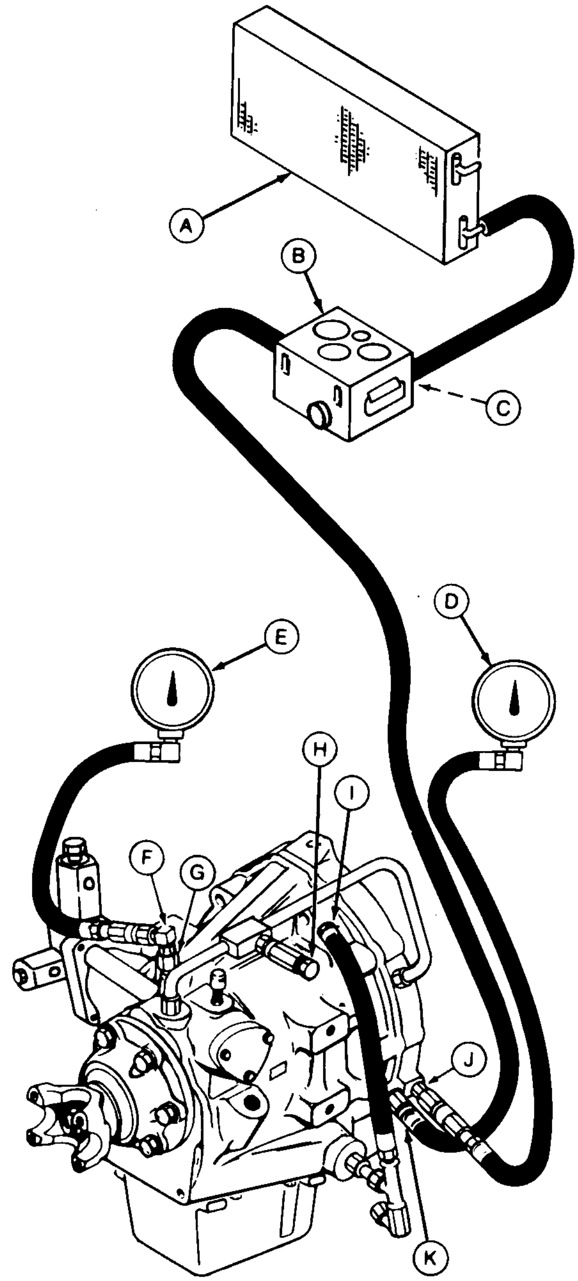
2. Make flowmeter connection and install gauges. Open flowmeter.

3. Disconnect converter-in relief valve hose. Install cap (H) and plug (I).

4. Slowly increase rpm from low idle to test specification.

Specification

Engine—Speed .... 1500 ± 5 rpm



T7393AD –UN–30OCT90

A—Oil Cooler
B—Flowmeter
C—Adapter
D—Gauge
E—Gauge
F—Swivel Elbow
G—Connector
H—Cap
I—Plug
J—Fitting
K—Fitting

Continued on next page

TX,300D,1958 –19–12JUL94–1/2

Watch cooler pressure gauge "D." If it exceeds 275 kPa (2.7 bar) (40 psi), stop test. Locate and repair restriction in cooler circuit before proceeding with flow test. Pressure above 275 kPa (2.9 bar) (40 psi) could damage torque converter or oil cooler.

5. Heat reverser oil to specifications.

Specification

Oil—Temperature	65 ± 1°C (150 ± 2°F)

(See procedure in this group.)

6. Put FNR and transaxle levers in neutral. Record flow and "P" pressure (E).

Specification

New Reverser Pump—Flow	11.3 L/min (3.00 gpm)
Used Reverser Pump—Flow	7.6 L/min (2.00 gpm)
"P" System—Pressure	931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)

7. Connect hose to converter-in relief valve.

8. If pump flow is low, do complete reverser system test to find problem. (See procedure in this group.)

TX,300D,1958 –19–12JUL94–2/2

Reverser Pump Flow (SN 792483—)

SPECIFICATIONS	
Engine Speed	1500 ± 5 rpm
Oil Temperature	65 ± 1°C (150 ± 2°F)
New Reverser Pump Flow	12.1 L/min (3.2 gpm)
Used Reverser Pump Flow	8.5 L/min (2.25 gpm)
System (Pump) Pressure	931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)

ESSENTIAL TOOLS
JT03064 (1-1/16-12 M 37° 1/2 F NPT) Adapter
E—JT05487 (1/8 M NPT 7/16-20 37°) Connector
F—JT03104 (3/8 M NPT 7/16-20 M 37°) Connector (2 used)

SERVICE EQUIPMENT AND TOOLS
Electronic Tachometer
Digital Thermometer
Flowmeter
Gauge 0—2000 kPa (0—20 bar) (0—300 psi)
D—Gauge 0—1000 kPa (0—10 bar) (0—150 psi)

1. Install tachometer and thermometer. (See procedure in this group.)

2. Install flowmeter and gauges.

IMPORTANT: Flowmeter must be open before starting machine to prevent damage to reverser pump.

3. Open flowmeter.

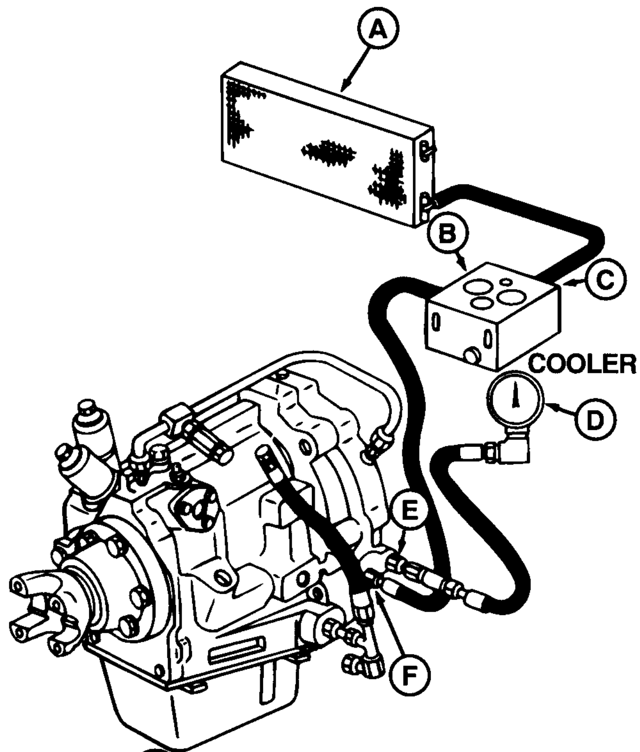
4. Disconnect converter-in relief valve hose. Install cap and plug.

5. Slowly increase rpm from slow idle to test specification.

Specification

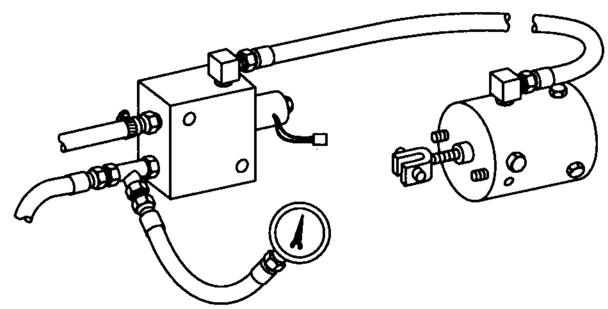
Engine—Speed .... 1500 ± 5 rpm

Watch cooler pressure gauge (D). If it exceeds 275 kPa (2.7 bar) (40 psi), stop test. Locate and repair restriction in cooler circuit before proceeding with test. Pressure above 275 kPa (2.7 bar) (40 psi) could damage torque converter or oil cooler.



T8268AA CV

T8268AA –19–06JUL94



T8262BW CV

T8262BW –UN–06JUL94

A—Oil Cooler
B—Flowmeter
C—Adapter
D—Gauge
E—Connector
F—Connector (2 used)

Continued on next page

TX,300D,DS4666 –19–12JUL94–1/2

6. Heat oil to specification.

Specification	
Oil—Temperature	65 ± 1°C (150 ± 2°F)

(See procedure in this group.)

7. Put FNR and transaxle levers in neutral. Record flow and system (pump) pressure.

Specification	
New Reverser Pump—Flow	12.1 L/min (3.2 gpm)
Used Reverser Pump—Flow	8.5 L/min (2.25 gpm)
System (Pump)—Pressure	931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)

8. Connect hose to converter-in relief valve.

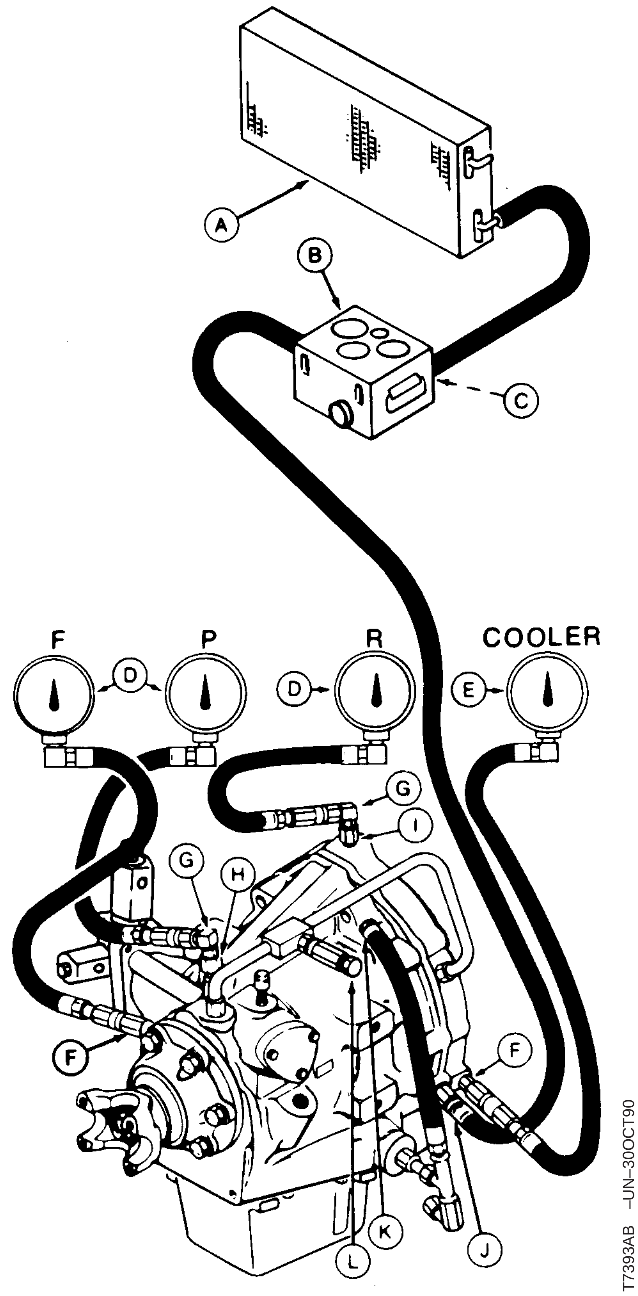
9. If pump flow is low, do complete reverser system test to diagnose problem. (See procedure in this group.)

TX,300D,DS4666 –19–12JUL94–2/2

Complete Reverser Test (SN —792482)

ESSENTIAL TOOLS
JT03064 (1-1/16-12 M 37° 1/2 F NPT) Adapter
F—JT05487 (1/8 M NPT 1/16-20 37°) Connector (2 used)
JT05483 (7/16-20 F 37° x 7/16-20 M) 90° Swivel Elbow (2 used)
H—JT03104 (3/8 M NPT 7/16-20 M 37°) Connector
JT05486 (1/4 M NPT 7/16-20 M 37°) Fitting
J—JT03043 (1/2 M NPT 1-1/16-12 M 37°) Connector
JT03221 (3/4-16 M 37°) Plug

SERVICE EQUIPMENT AND TOOLS
Flowmeter
D—Gauge 0—2000 kPa (0—20 bar) (0—300 psi)
E—Gauge 0—1000 kPa (0—10 bar) (0—150 psi)
Electronic Tachometer
Digital Thermometer



A complete reverser system test consists of test connection, test procedures, test procedure chart, specifications and analysis. The purpose of this test is to check overall performance of reverser hydraulic system. Use a copy of the reverser test procedure chart to record data obtained during test procedure. After the test, use the data and the specifications and analysis to make a diagnosis.

IMPORTANT: DO NOT block converter-in relief valve until Step 7 of test procedure.

Make test connections.

A—Oil Cooler
B—Flowmeter
C—Adapter
D—Gauge (3 used)
E—Gauge
F—Connector
G—Swivel Elbow (2 used)
H—Connector
I—Fitting
J—Connector
K—Plug
L—Cap

9020
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TX,300D,1959 –19–12JUL94–1/1

Complete Reverser System Test (SN 792483—)

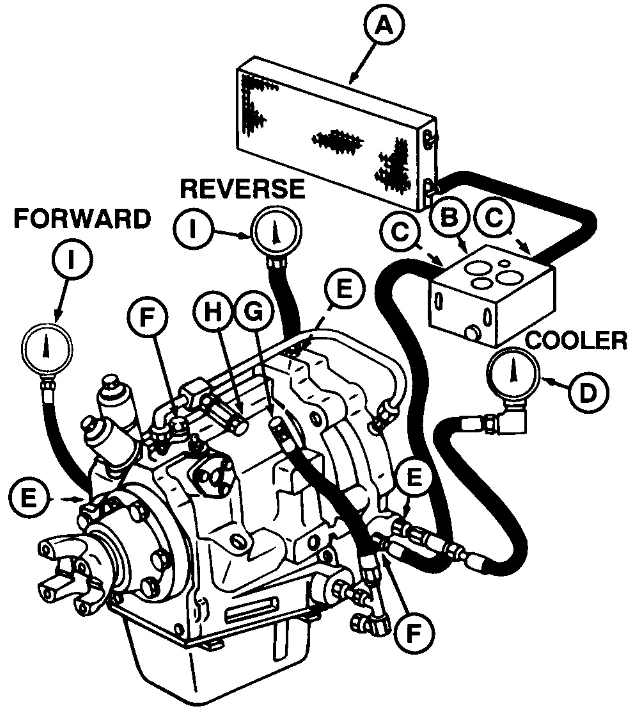
ESSENTIAL TOOLS
JT03064 (1/8 M NPT 1/16-20 37°) Adapter (2 used)
E—JT05487 (1/8 M NPT 1/16-20 37°) Connector (3 used)
F—JT03104 (3/8 M NPT 7/16-20 M 37°) Connector (2 used)

SERVICE EQUIPMENT AND TOOLS
Flowmeter
I—Gauge 0—2000 kPa (0—20 bar) (0—300 psi) (3 used)
D—Gauge 0—1000 kPa (0—10 bar) (0—150 psi)
Electronic Tachometer
Digital Thermometer

A complete reverser system test consists of test connections and procedures, test procedure chart, specifications and analysis. The purpose of this test is to check overall performance of reverser hydraulic system. Use a copy of the reverser test procedure chart to record data obtained during test procedure. After the test, use the data and the specifications and analysis to make a diagnosis.

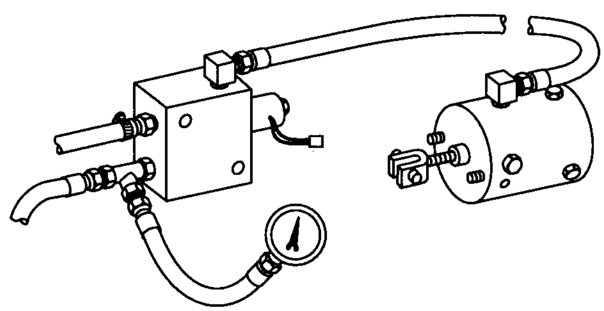
IMPORTANT: DO NOT block converter-in relief valve until step 7 of test procedure.

Make test connections.



T8268AR CV

T8268AR –19–06JUL94



T8262BW CV

T8262BW –UN–06JUL94

A—Oil Cooler
B—Flowmeter
C—Adapter (2 used)
D—Gauge
E—Connector (3 used)
F—Connector (2 used)
G—Plug
H—Cap
I—Gauge

TX,9020,DY387 –19–10JUN96–1/1

Test Procedure

SPECIFICATIONS	
Cooler Maximum Pressure	690 kPa (6.9 bar) (100 psi)
Reverser Pump Flow Test Maximum Cooler Pressure	275 kPa (2.7 bar) (40 psi)

SERVICE EQUIPMENT AND TOOLS
Flowmeter
Locking Pliers

Do the steps below and record data on a copy of the Reverser Test Procedure Chart.

STEP 1—Start engine and run at slow idle. Check reverser oil level.

STEP 2—Heat oil to specification. (See Reverser Oil Warm-Up procedure in this group.) Reverser oil temperature must stay at specifications for accurate data.

STEP 3—Disconnect Clutch Check

Put FNR lever in forward position.

Run engine at 1500 ± 25 rpm.

Depress clutch disconnect switch.

Forward pressure must decrease to zero. Record reading.

STEP 4—Converter-In (Cooler) Relief Valve Pressure Check

IMPORTANT: Cooler pressure MUST NOT exceed 690 kPa (6.9 bar) (100 psi).

Put FNR lever in neutral position.

Close flowmeter.

Slowly increase engine speed until cooler pressure stops increasing. DO NOT exceed 690 kPa (6.9 bar) (100 psi).

Specification
Cooler—Maximum Pressure................... 690 kPa (6.9 bar) (100 psi)

If pressure does reach 690 kPa (6.9 bar) (100 psi), stop test and repair relief valve before continuing test.

Record reading for converter-in (cooler) pressure.

Open flowmeter.

STEP 5—Converter Stall Speed Check

Run engine at approximately 2150 rpm.

Heat oil to 65 ± 1°C (150 ± 2°F). (See Reverser Warm-Up Procedure in the group.)

Do Converter Stall Speed Test (See procedure in this group.)

STEP 6—Reverser Clutch Valve Circuit Check

Put FNR lever in neutral position.

Run engine at 1500 ± 25 rpm.

Record reading for cooler flow, cooler and system (pump) pressure.

Put FNR lever in forward position. Record pressure readings for cooler flow, cooler and forward.

Put FNR lever in reverse. Record pressure readings for cooler flow, cooler and reverse.

STEP 7—Reverser Pump Flow Check

Block converter-in (cooler) relief valve line with locking pliers.

Disconnect converter-in hose and plug. Cap relief valve.

Put FNR lever in neutral.

Continued on next page TX,D300,DS2090 –19–08MAR93–1/2

Slowly increase rpm from slow idle to 1500 ± 25 rpm while watching cooler pressure gauge. Stop test if cooler pressure increases above 275 kPa (2.7 bar) (40 psi) or torque converter could be damaged.

Specification

Reverser Pump Flow Test—
Maximum Cooler Pressure .... 275 kPa (2.7 bar) (40 psi)

Record cooler flow and cooler pressure at 1500 ± 3 rpm.

Connect hose to converter-in relief valve.

Remove locking pliers from converter-in (cooler) relief valve line.

TX,D300,DS2090 –19–08MAR93–2/2

Reverser Test Procedure Chart

Step	RPM	Temperature	Element Tested	Shift Mode	Cooler Flow	Converter In Relief Cooler Pressure	Pressure	Test Port Pressure	Operating Condition
1	Slow Idle			NN					Check oil level
2	Fast Idle	65 ± 5°C (150 ± 10°F)	Converter	4F					Brakes on, 4th gear converter stall
3	1500 ± 25	65 ± 5°C (150 ± 10°F)	Clutch solenoid	NF				Forward	Depress clutch disconnect switch
1500 ± 25	65 ± 5°C (150 ± 10°F)	Clutch solenoid disengaged	NF					Forward	Release clutch disconnect switch
4	Slow Idle to 2000	40 ± 5°C (100 ± 10°F)	Converter-in relief valve	NN					Close flow meter
Increase rpm until pressure stops increasing									
Open flow meter.									
5	Fast Idle Note rpm	65 ± 5°C (150 ± 10°F)	Converter	4F					Brakes on, 4th gear converter stall
6	1500 ± 25	65 ± 5°C (150 ± 10°F)	System pressure	NN				System	
	1500 ± 25	65 ± 5°C (150 ± 10°F)	System pressure	NF				Forward	
	1500 ± 25	65 ± 5°C (150 ± 10°F)	System pressure	NR				Reverse	
7	1500 ± 25	65 ± 5°C (150 ± 10°F)	System pressure	NN					Converter-in relief valve blocked. Slowly increase rpm to specified speed while watching cooler pressure gauge.

T59,9025,375 –19–08MAR93–1/1

Specifications And Analysis

SPECIFICATIONS	
'F' Port Pressure With Clutch Disconnect Switch Depressed	0
'F' Port Pressure With Clutch Disconnect Switch Released	931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)
Torque Converter-In (Cooler) Relief Valve Pressure Setting	550 ± 100 kPa (5.5 ± 1 bar) (80 ±15 psi)
300D Minimum Engine Speed	2000
310D and 315D Minimum Engine Speed	2150
300D Maximum Engine Speed	2200
310D and 315D Maximum Engine Speed	2360
Neutral and Forward or Reverse Maximum Allowable Difference in Flow	2.0 L/min (0.5 gpm)
System (Pump) Pressure	931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)
System (Pump) and Forward Maximum Allowable Pressure Difference	100 kPa (1 bar) (15 psi)
System (Pump) and Reverse Maximum Allowable Pressure Difference	70 kPa (0.7 bar) (10 psi)
Cooler Maximum Allowable Pressure Difference Between Circuits	70 kPa (0.7 bar) (5 psi)
Cooler Maximum Pressure	200 kPa (2.0 bar) (30 psi)
New Reverser Charge Pump Minimum Flow Rate	12.1 L/min (3.2 gpm)
Used Reverser Charge Pump Minimum Flow Rate	8.5 L/min (2.25 gpm)
Neutral and Forward or Reverse Maximum Allowable Flow Difference	2.0 L/min (0.5 gpm)
Reverser Pump Flow Test Maximum Cooler Pressure	275 kPa (2.7 bar) (40 psi)
System (Pump) Pressure	931 ± 100 kPa (9.3 ± 1 bar) (135 ± 15 psi)

Use the following analysis to determine if reverser meets the specifications given and hydraulic system for reverser is acceptable. Information is also given to help identify the cause of possible problems.

STEP 3—Forward pressure must decrease to zero when clutch disconnect switch is depressed. Pressure must return to "F" port specifications 931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi) when clutch disconnect switch is released.

Specification

'F' Port—Pressure With Clutch Disconnect Switch Depressed.......... 0
Pressure With Clutch Disconnect Switch Released.............. 931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)

If specifications are not met, inspect disconnect solenoid wiring. See Group 9015-15.

STEP 4—Torque converter-in (cooler) relief valve setting is 550 ± 100 kPa (5.5 ± 1 bar) (80 ±15 psi).

Specification

Torque Converter-In (Cooler) Relief Valve—Pressure Setting........ 550 ± 100 kPa (5.5 ± 1 bar) (80 ±15 psi)

When the pressure stops increasing is when relief valve opens. If charge pump flow and cooler pressure are to specification (see Step 7) and this pressure is not to specifications, remove and inspect valve for damaged spring, ball, or valve seat. Repair and retest.

STEP 5—Torque converter stall speed:

Specification

300D—Minimum Engine Speed.......... 2000
310D and 315D—Minimum Engine Speed.......... 2150
300D—Maximum Engine Speed.......... 2200
310D and 315D—Maximum Engine Speed.......... 2360

If converter stall speed is low, check for:

- Low engine output. See Group 9010-25.
- Incorrect torque converter (part number through inspection hole in bottom of reverser housing.
- Failed freewheel clutch in torque converter.

Continued on next page

If converter stall speed is high, check for:

- Incorrect oil temperature.
- Low oil level.
- Incorrect oil in machine.
- Restricted suction screen. See repair manual.
- Incorrect torque converter (part number through inspection hole in bottom of reverser housing.
- Engine over-fueled. See Turbocharger Boost Pressure-Engine Performance Test—310D, 315D in Group 9010-25.
- Converter failed.
- Check for failed reverser clutch disk.

STEP 6—The maximum allowable difference of flow between neutral, forward and reverse is 2.0 L/min (0.5 gpm).

Specification

Neutral and Forward or Reverse—Maximum Allowable Difference in Flow .... 2.0 L/min (0.5 gpm)

Difference in flow between pressure circuits indicates leakage in circuit with lowest flow.

System (pump) pressure specifications are 931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi).

Specification

System (Pump)—Pressure .... 931 ± 100 kPa (9.3 ± 1.0 bar) (135 ± 15 psi)

Maximum allowable difference between system (pump) pressure and forward pressure is 100 kPa (1 bar) (15 psi).

Specification

System (Pump) and Forward—Maximum Allowable Pressure Difference .... 100 kPa (1 bar) (15 psi)

Maximum allowable difference between system (pump) pressure and reverse pressure is 70 kPa (0.7 bar) (10 psi).

Specification

System (Pump) and Reverse—Maximum Allowable Pressure Difference .... 70 kPa (0.7 bar) (10 psi)

Pressure below specifications indicated leakage in circuits with low pressure. If all pressures are low and pump flow is low, remove reverser and repair charge pump. If pressures are at zero, drive tangs on torque converter are failed. Replace torque converter. If all pressures are too high or low, pressure regulating valve is sticking. Remove, inspect, clean and install. Repeat test.

The maximum allowable difference in cooler pressure between circuits is 70 kPa (0.7 bar) (10 psi).

Specification

Cooler—Maximum Allowable Pressure Difference Between Circuits .... 70 kPa (0.7 bar) (10 psi)

Circuit with lowest cooler (lube) pressure indicates excessive leakage in that circuit. Maximum cooler pressure is 200 kPa (2.0 bar) (30 psi).

Specification

Cooler—Maximum Pressure .... 200 kPa (2.0 bar) (30 psi)

If pressure is too high and converter-in relief in Step 4 was at specifications, inspect oil cooler circuit for damage. If no damage is found, back flush oil cooler. See Group 9020-25, Reverser Cooler Pressure Test.

If system (pump) pressure was to specifications and lube pressure was low in neutral-neutral, a damaged torque converter is indicated. Replace torque converter. See repair manual.

STEP 7—Minimum acceptable reverser charge pump flow with new pump is 12.1 L/min (3.2 gpm) or a used pump is 8.5 L/min (2.25 gpm) in forward, reverse or neutral.

Specification

New Reverser Charge Pump—Minimum Flow Rate .... 12.1 L/min (3.2 gpm)
Used Reverser Charge Pump—Minimum Flow Rate .... 8.5 L/min (2.25 gpm)

The maximum allowable difference of flow between neutral, forward and reverse is 2.0 L/min (0.5 gpm).

Continued on next page

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Specification

Neutral and Forward or Reverse—Maximum Allowable Flow Difference .... 2.0 L/min (0.5 gpm)

If cooler pressure is above 275 kPa (2.7 bar) (40 psi), inspect cooler circuit for damaged parts or debris in system.

Specification

Reverser Pump Flow Test—Maximum Cooler Pressure .... 275 kPa (2.7 bar) (40 psi)

See Group 9025-25, Reverser Cooler (Lube) Pressure Test.

System (pump) pressure specification is 931 ± 100 kPa (9.3 ± 1 bar) (135 ± 15 psi).

Specification

System (Pump)—Pressure .... 931 ± 100 kPa (9.3 ± 1 bar) (135 ± 15 psi)

If system (pump) pressure is too high or low, disassemble, inspect, clean and repair pressure regulating valve.

TX,D300,DS2078 –19–08MAR93–3/3

Section 9025
Hydraulics

Contents

Continued on next page

9025

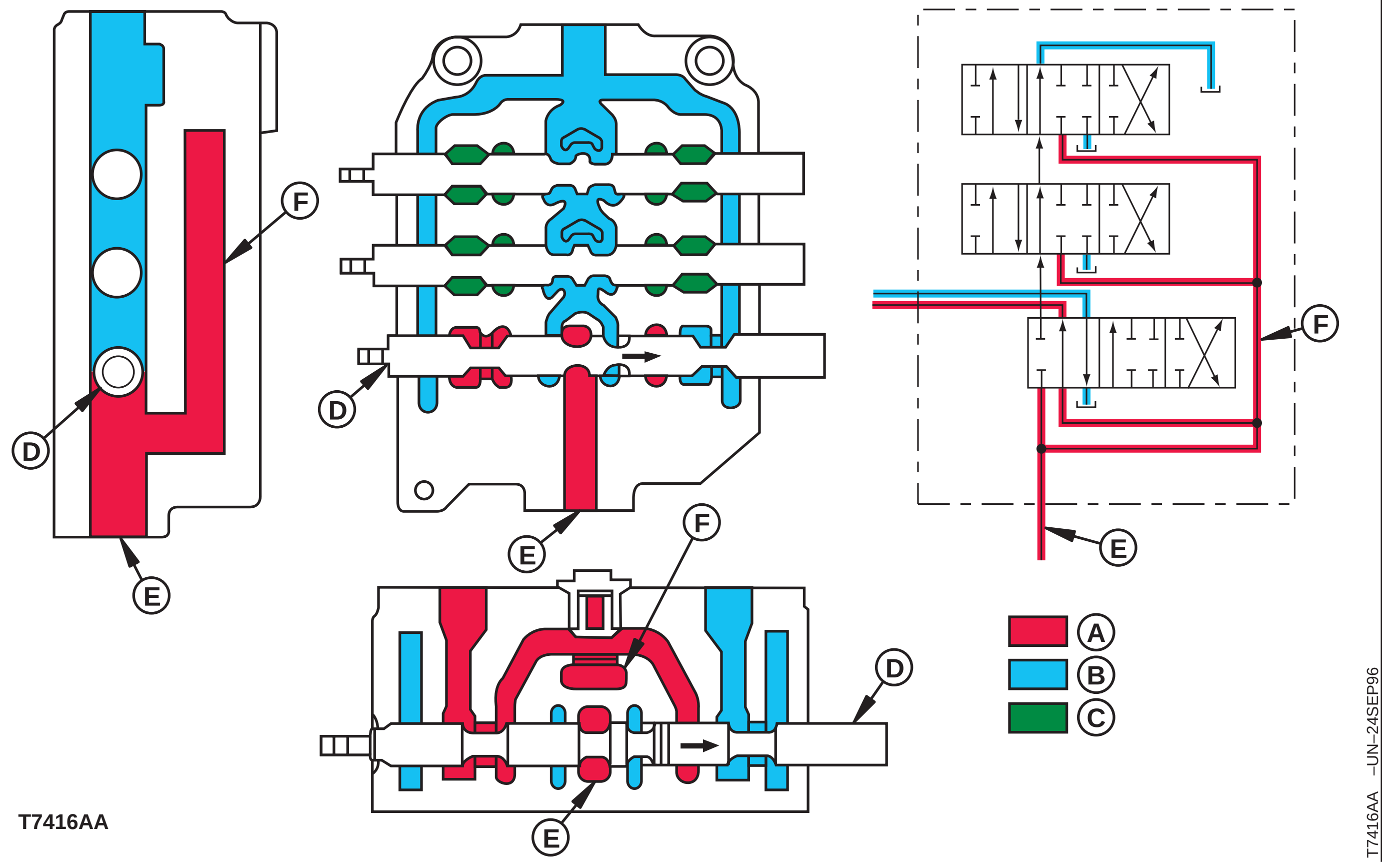
Page

Open-Center Hydraulic System

NOTE: This illustration is for example only. This particular valve is not used on 300D, 310D or 315D Loader Backhoe.

Open-center system requires that the control valve spool be OPEN in the center to allow pump flow to pass through the valve and return to the reservoir. The main hydraulic pump supplies a constant flow of oil. This pressure oil must have a path for return when it is not required to operate a function.

Continued on next page TX,902505,BR40 –19–07JAN93–1/2



A—Pressure Oil (From Main Hydraulic Pump)
B—Return Oil (Pressure Free)
C—Trapped Oil
D—Valve Spool
E—Inlet (From Pump)
F—Power Passage

A power passage (F) in the valve allows pressure oil to flow to all the control valve sections regardless of their spool positions.

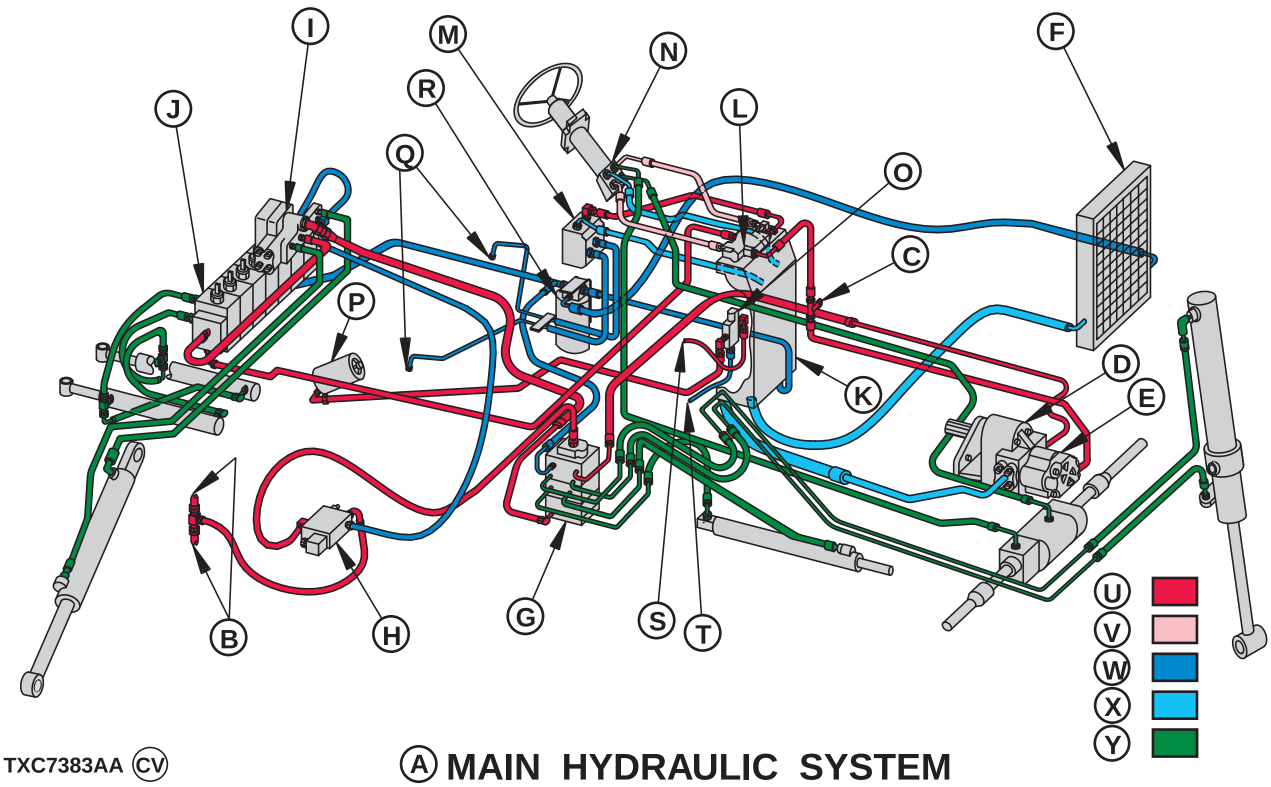
With spool (D) moved to activate a function, pressure oil flows to that function. Without a power passage, no flow would be available to the other valves downstream of the activated function. With a power passage, a parallel connection is made to the other valves downstream.

With the power passage providing a parallel connection, more than one function may be operated at a time.

However, the function requiring the least amount of pressure will move first.

TX,902505,BR40 –19–07JAN93–2/2

Main Hydraulic System



(S.N. —802199) Shown

A—Main Hydraulic System
B—To Side Shift Locks
C—Test Port
D—Main Hydraulic Pump
E—Auxiliary Pump
F—Cooler
G—Loader Control Valve
H—Side Shift Locking Valve (315D)
I—Stabilizer Valve
J—Backhoe Control Valve
K—Reservoir
L—Steering Priority Valve
M—Service Brake Valve
N—Steering Valve
O—Park Brake Solenoid
P—Park Brake Actuator
Q—To Brakes
R—Main Hydraulic Filter
S—Pressure From Reverser
T—Return To Reverser
U—High Pressure Oil
V—Low Pressure Oil
W—Return Oil (Low Pressure)
X—Return Oil (Pressure Free)
Y—Trapped Oil

Hydraulic oil flows from reservoir (K) to the main hydraulic pump (D) and auxiliary pump (E).

Pressure oil (U) from the main hydraulic pump flows to the loader control valve (G). Pressure oil from the auxiliary pump flows to the steering priority valve (S.N. —802199) or directly to the backhoe valve (S.N. —802200).

With the loader control valve in neutral, pressure oil is routed to the stabilizer valve (I). When the steering valve (N) is in neutral, pressure oil from the priority valve is available to the loader valve , stabilizer valve, and backhoe valve.

When the stabilizer valve is in neutral, pressure oil is routed through the stabilizer valve and to the backhoe control valve (J).

With the backhoe control valve in neutral, pressure oil is routed through the valve and into the return circuit. When the control valves are in neutral, oil is trapped in the cylinders and lines preventing movement of components.

Return oil (W) from the backhoe and loader valves combine and flow through the main hydraulic filter (R).

Continued on next page

Return oil is then routed to reservoir (K) and hydraulic oil cooler (F). A surge relief valve (spring and poppet) located in the return line fitting on the bottom of the reservoir creates enough back pressure on returning oil to force a specific amount of oil through the cooler then to reservoir.

Pressure oil from the reverser (S) is sent to a park brake solenoid (O) which directs it to the park brake actuator (P) or returns it to reverser sump (T).

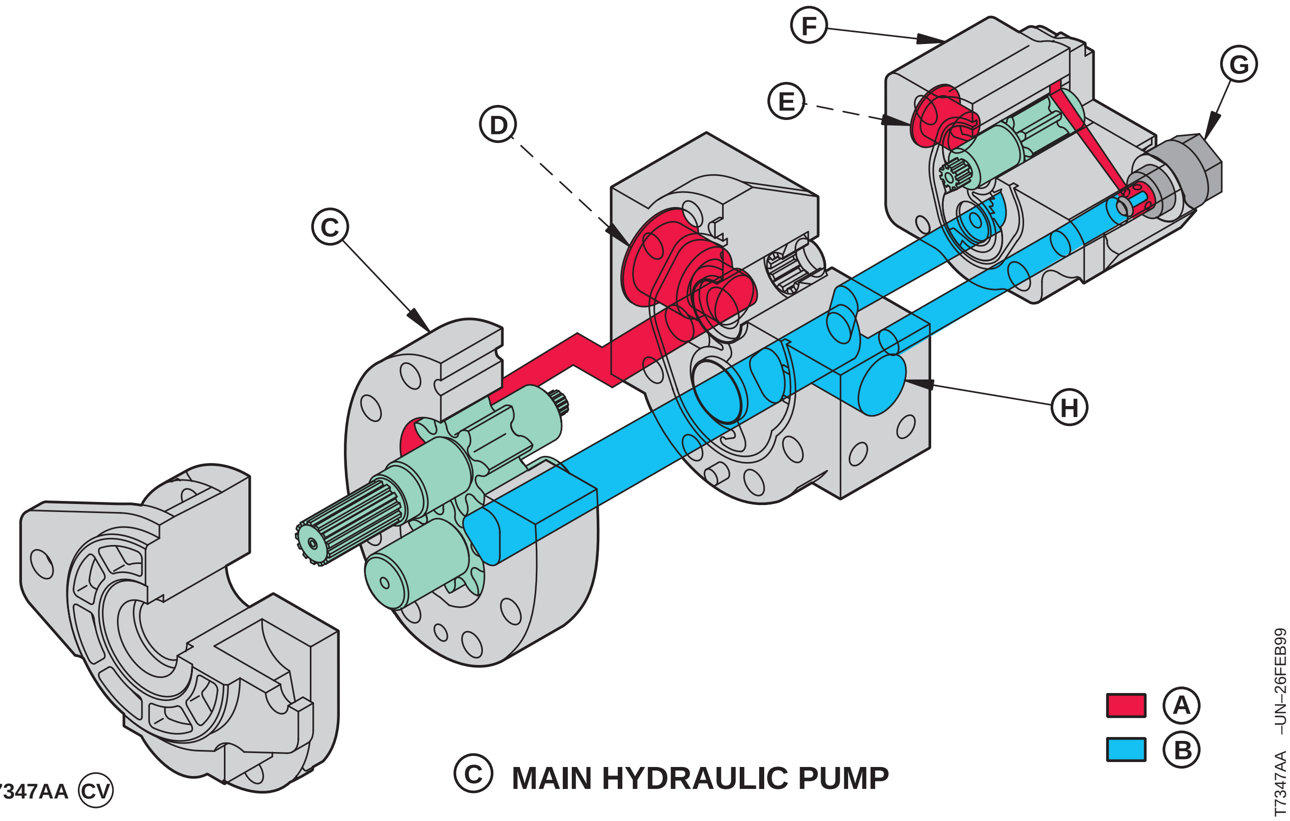
On (S.N. —802199) machines the brake valve is supplied with oil from the priority valve. On (S.N. 802200—) machines the brake valve is supplied oil from the hydraulic cooler return line. Brake pressure oil is routed to the right and left inboard disks in the transaxle through individual lines (Q).

315D Only—The side shift lock valve (H) receives pressure oil from the pressure port on the loader control valve. When the side shift lock valve is applied, pressure oil is directed to locks (B) on the slide frame through hydraulic lines.

A test port (C) is provided for hydraulic diagnosis on (S.N. —802199) machines.

TX,9025,BS384 –19–21JUL94–2/2

Main Hydraulic Pump

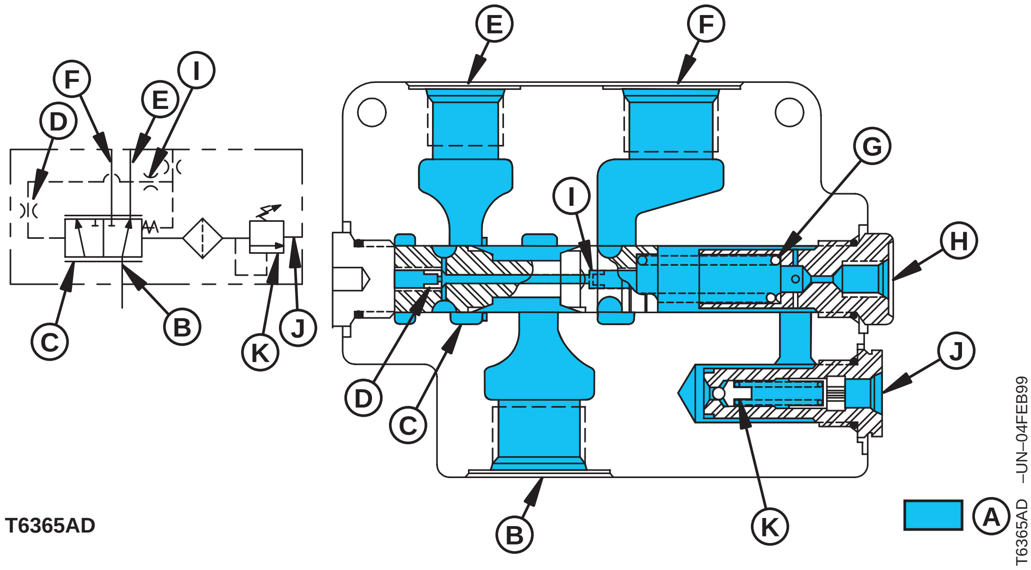


A—Pressure Oil
B—Return Oil
C—Main Hydraulic Pump
D—Main Pump Pressure Port
E—Steering Pump Pressure Port
F—Auxiliary Pump
G—Auxiliary Pump Relief Valve
H—Inlet Port

The main hydraulic pump is a fixed displacement gear-type pump. The auxiliary pump, a smaller fixed displacement pump is mounted in line with the main hydraulic pump. They are mounted ahead of the engine and driven by the engine crankshaft. Oil is drawn from the hydraulic reservoir and delivered to a common inlet port (H) at the pumps. Pressure oil from the main pump is at port (D) and sent to the loader control valve. A system relief valve in the loader control valve regulates main pump pressure. Pressure oil from the auxiliary pump leaves through port (E) and is sent to the steering priority valve on (S.N. —802199) machines. Oil is sent directly to the backhoe valve on (S.N. 802200—) machines. The auxiliary pump has a relief valve (G) built into the pump housing.

TX,9025,BS386 –19–21JUL94–1/1

Priority Valve (300D, 310D S.N. —802199) (315D, All Machines)



T6365AD

Engine Stopped

A—Pressure Free Oil
B—From Steering Pump
C—Spool
D—Orifice
E—To Steering
F—To Backhoe
G—Spring
H—Load Sensing Line
I—Orifice
J—To Return
K—Relief Valve Poppet

The priority valve maintains priority pressure oil to the steering valve. When the engine is stopped, spool (C) is pushed to the left blocking oil to backhoe (F) and opening the passage to steering (E).

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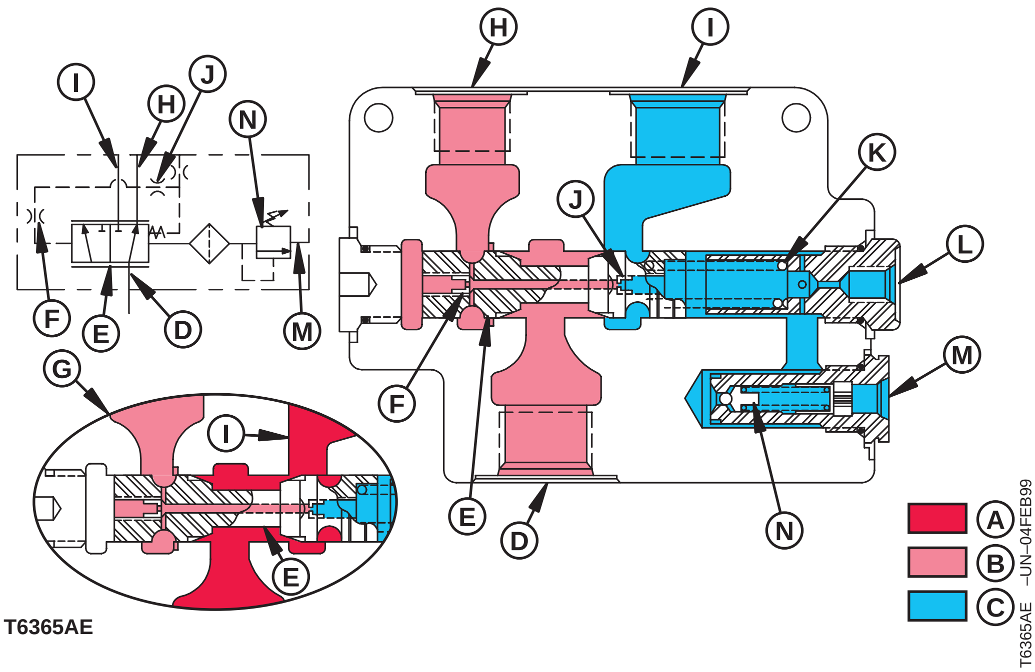

Engine Running—Steering In Neutral

A—High Pressure Oil	**E—Spool**	**I—To Backhoe**	**L—Load Sensing Line**
B—Reduced Pressure Oil	**F—Orifice**	**J—Orifice**	**M—To Return**
C—Return Oil	**G—Backhoe Activated**	**K—Spring**	**N—Relief Valve Poppet**
D—From Steering Pump	**H—To Steering**		

When the machine is first started, all pump flow is routed to the steering valve (H) which blocks the flow. With the flow blocked, the pressure increases. Pressure at the steering valve inlet is sensed at the load sensing line (L) on the priority valve. This causes the spool to shift to the right against the spring and open to backhoe (I). As long as the steering valve is in neutral, just enough pressure is maintained at the steering valve to keep the priority valve spool shifted to the right.

The operating pressure in the backhoe circuit has no effect on operation of the priority valve. With the backhoe activated (G) in relief, the priority valve spool will not shift to the left unless the machine is steered.

Flow from the steering port (H) is routed through orifice (J) in the priority valve spool in the load sensing line (L). It flows through the steering valve, which is in neutral, to return. This provides flow to the steering valve warm-up circuit which prevents binding of the steering valve caused by extreme oil temperature variation.

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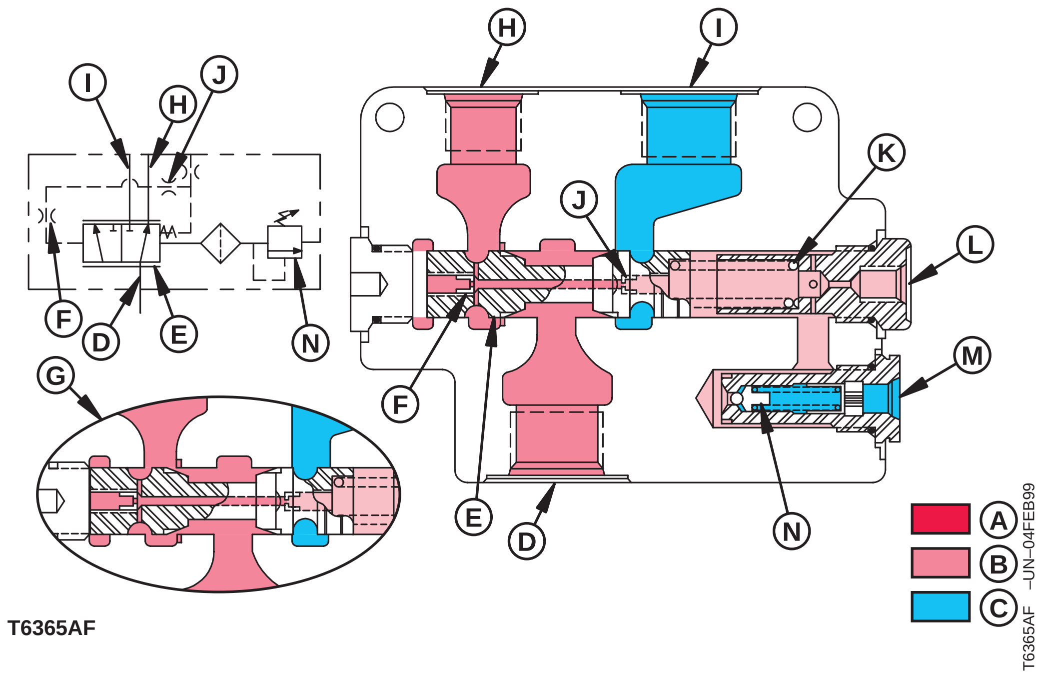
TX,D300,DS2093 –19–21JUL94–2/4



Engine Running—Steering Activated

A—Steering Inlet Pressure
B—Steering Work Port Pressure
C—Return Pressure
D—From Steering Pump
E—Spool
F—Orifice
G—Full Rate Steer
H—To Steering
I—To Backhoe
J—Orifice
K—Spring
L—Load Sensing Line
M—To Return
N—Relief Valve Poppet

When the operator steers the machine, load-sensing pressure oil from the steering valve flows to the load sensing line (L) on the priority valve. Load-sensing pressure plus spring (K) act against pilot pressure to move the spool to the left. This restricts flow through the backhoe port while the steering port (H) is opened to the steering valve.

The load-sensing circuit is a control circuit that routes steering valve outlet pressure to the spring side of the priority valve spool (E). It allows the priority valve to sense the pressure that is required to move the steering cylinders under varying steering conditions.

During normal steering operation, oil is metered into the load sensing circuit (L) through an orifice in the steering valve. When steering at full steer rate (G), the orifice opens to an unrestricted passage. At low engine speed the spool will shift to the full left position directing all flow to the steering valve. At fast idle, the steering system can use about one half of the pump flow. Therefore, the excess oil flows to the backhoe.

The load sensing circuit receives the majority of its flow from the load sensing orifice in the steering valve. Some flow is also supplied from the steering port (H) through orifice (J) in the priority valve spool.

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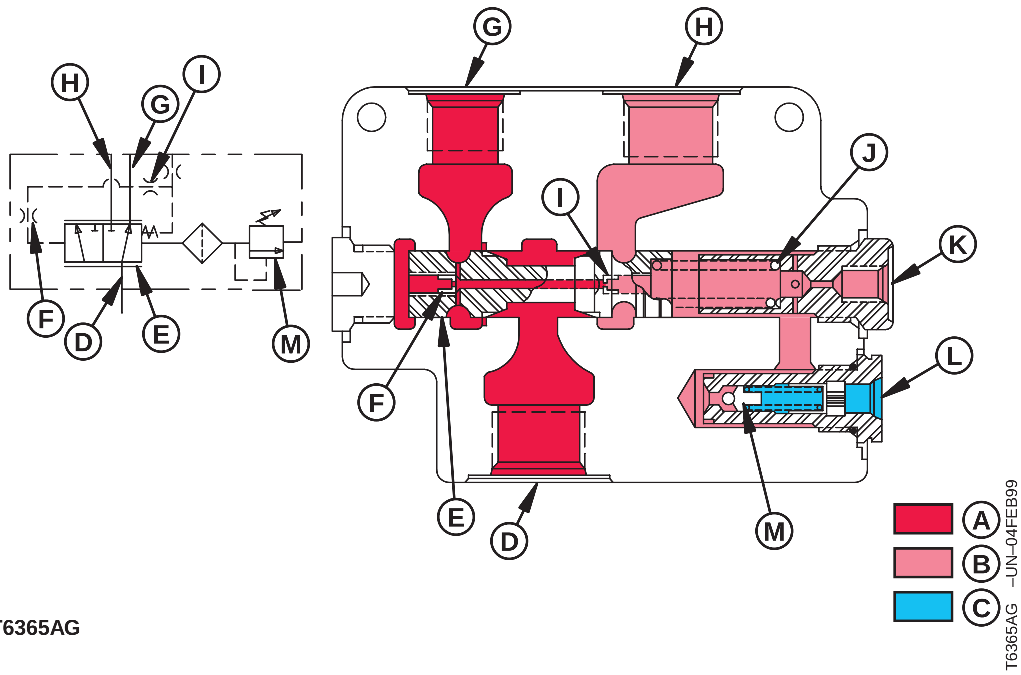

T6365AG

Engine Running—Steering To Stop

A—High Pressure Oil
B—Relief Pressure Oil
C—Return Oil
D—From Steering Pump
E—Spool
F—Orifice
G—To Steering
H—To Backhoe
I—Orifice
J—Spring
K—Load Sensing Line
L—To Reservoir
M—Relief Valve Poppet

When the operator steers the machine for a full turn the cylinder bottoms against the steering stops. To limit steering system pressure a relief system is built into the priority valve assembly.

When the cylinder bottoms, the pressure in the steering cylinder increases. This pressure is sensed at the load sensing port (K). When the pressure in the load sensing port increases enough to push poppet (M) off of its seat, oil in the load sensing circuit flows to return. Load sensing pressure is limited to the pressure setting of the relief valve.

Pressure to the steering valve (pilot pressure), which is sensed at the orifice (F), continues to increase until it can move the spool (E) to the right against the load sensing pressure plus spring (J) force. At this time, all oil flows out the backhoe port (H).

TX,D300,DS2093 –19–21JUL94–4/4

Hydraulic Filter Operation

The hydraulic return filter removes contaminants from the hydraulic system oil. The filter housing contains a bypass valve and a filter restriction switch.

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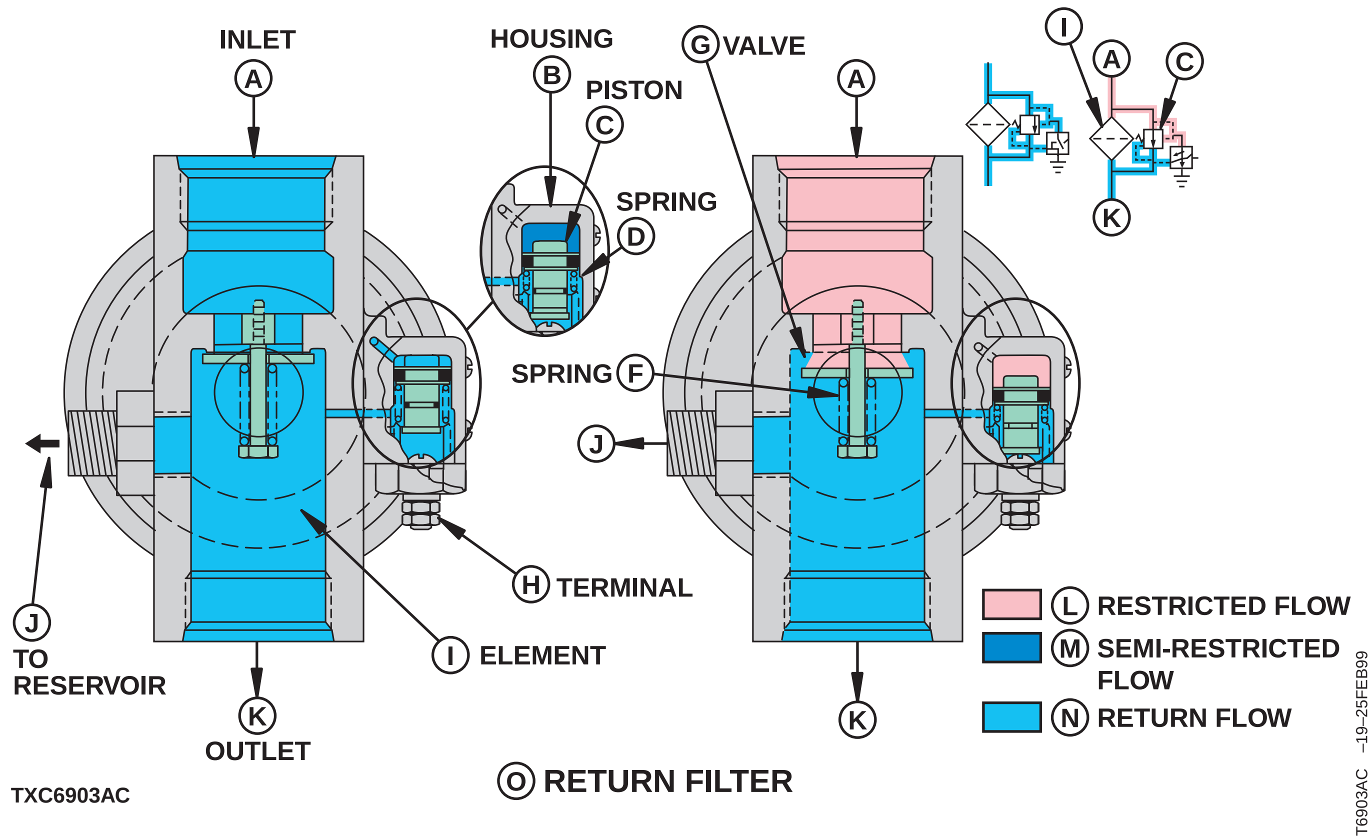
TX,9025,3011 –19–07JAN93–1/2



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A—Inlet Port
B—Filter Housing
C—Piston
D—Spring
F—Spring
G—Valve
H—Terminal
I—Filter Element
J—To Reservoir
K—Outlet Port
L—Restricted Flow
M—Semi-Restricted Flow
N—Return Flow
O—Return Filter

Under normal operation, return flow from the steering, loader and priority valve enters the inlet (A), flows through the filter element (I), through the filter canister and out the outlet (K), or to reservoir (J).

If the pressure differential between the inlet and outlet increases past a set level due to cold oil or a partially restricted filter element, inlet pressure in the housing (B) increases, moving the piston (C) down against spring (D) force and outlet pressure. The piston contacts the terminal (H), completing a circuit which causes the filter restriction indicator light to glow.

As the filter element becomes plugged, the pressure differential between the inlet and outlet increases. Inlet pressure is sensed on one side of the valve (G) which opens against spring (F) force and outlet pressure. The return oil then bypasses the filter while the restriction indicator lights glow.

Under normal operation, the restriction indicator light will glow when operating the hydraulic functions with cold oil. If the restriction indicator light continues to glow after the oil reaches operating temperature, the return filter is being bypassed. Extended operation in the bypass mode will cause damage to the hydraulic system.

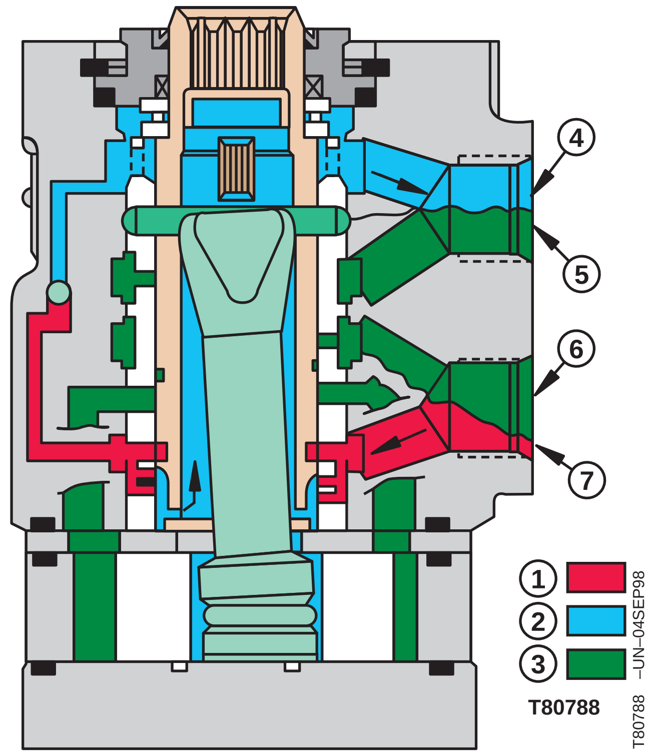
TX,9025,3011 –19–07JAN93–2/2

Steering Valve Operation

The steering valve is essentially a closed-center type valve. The steering valve and priority valve provide a smooth pressure compensated steering system.

When steering valve is in neutral, there is no oil flowing through it except neutral leakage from the priority valve. Neutral leakage is used for lubrication and cooling the steering valve.

1—Pressure Oil
2—Return Oil
3—Trapped Oil
4—Port "T"
5—Port "L"
6—Port "R"
7—Port "P"

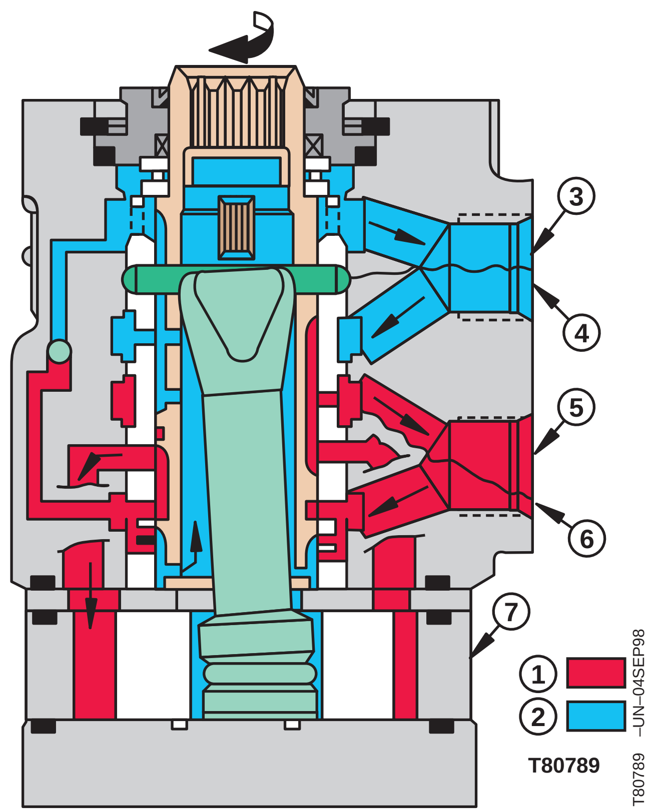


Steering Valve In Neutral

TX,9025,DS3006 –19–09MAR93–1/4

A right turn on the steering wheel activates the gerotor gear assembly (7) to pump metered pressure oil (1) to the rod end of steering cylinder. Return oil (2) from the steering cylinder flows through the steering valve and back to the hydraulic reservoir.

1—Pressure Oil
2—Return Oil
3—Port "T"
4—Port "L"
5—Port "R"
6—Port "P"
7—Gerotor Gear Assembly



Oil Flow For A Right Turn

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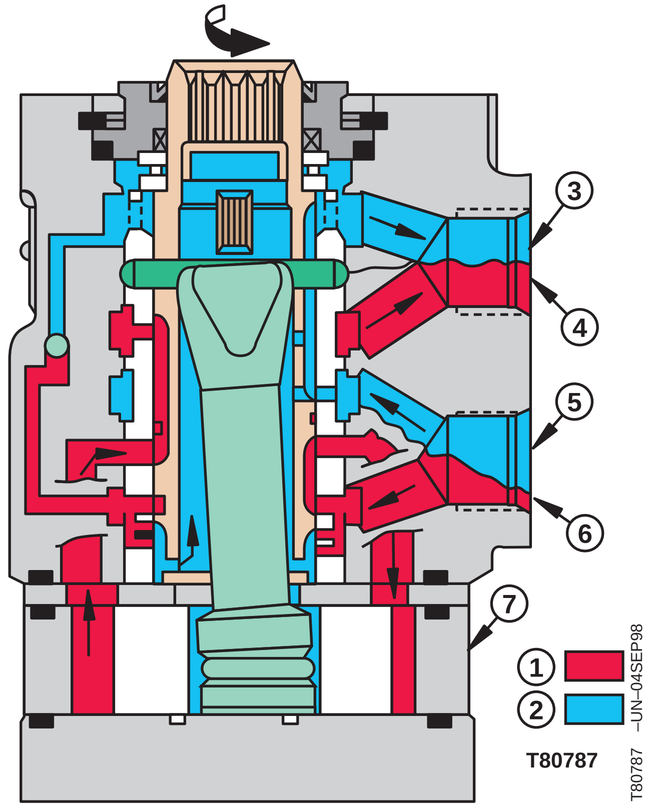
TX,9025,DS3006 –19–09MAR93–2/4

A left turn on the steering wheel actuates the gerotor gear assembly (7) to pump metered pressure oil (1) to the head end of steering cylinder. Return oil (2) from the steering cylinder flows through the steering valve and back to the reservoir.

1—Pressure Oil
2—Return Oil
3—Port "T"
4—Port "L"
5—Port "R"
6—Port "P"
7—Gerotor Gear Assembly



Oil Flow For A Left Turn

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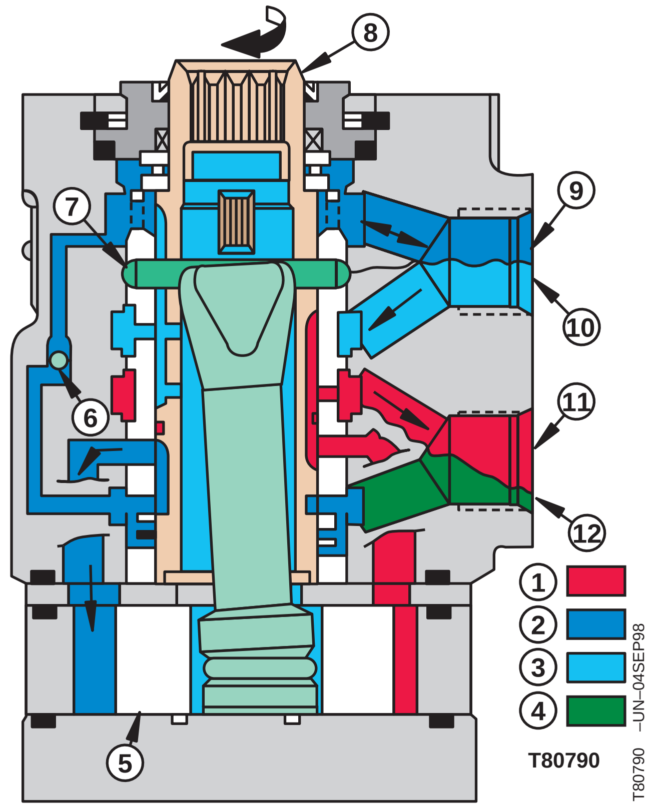
TX,9025,DS3006 –19–09MAR93–3/4

If there is no power to supply pressure oil to the steering valve, the machine can be turned manually. When the steering wheel is turned, the spool will come into contact with the pin (7). The pin then will provide a direct mechanical connection to the gerotor gear assembly (5). As the gerotor is turned, it pumps oil to the steering cylinder. Return oil from the cylinder is drawn through a check valve (6) between port "P" (12) and port "T" (9) to provide oil for the secondary manual steering operation. Make up oil is drawn from the hydraulic reservoir through return line of the steering valve.

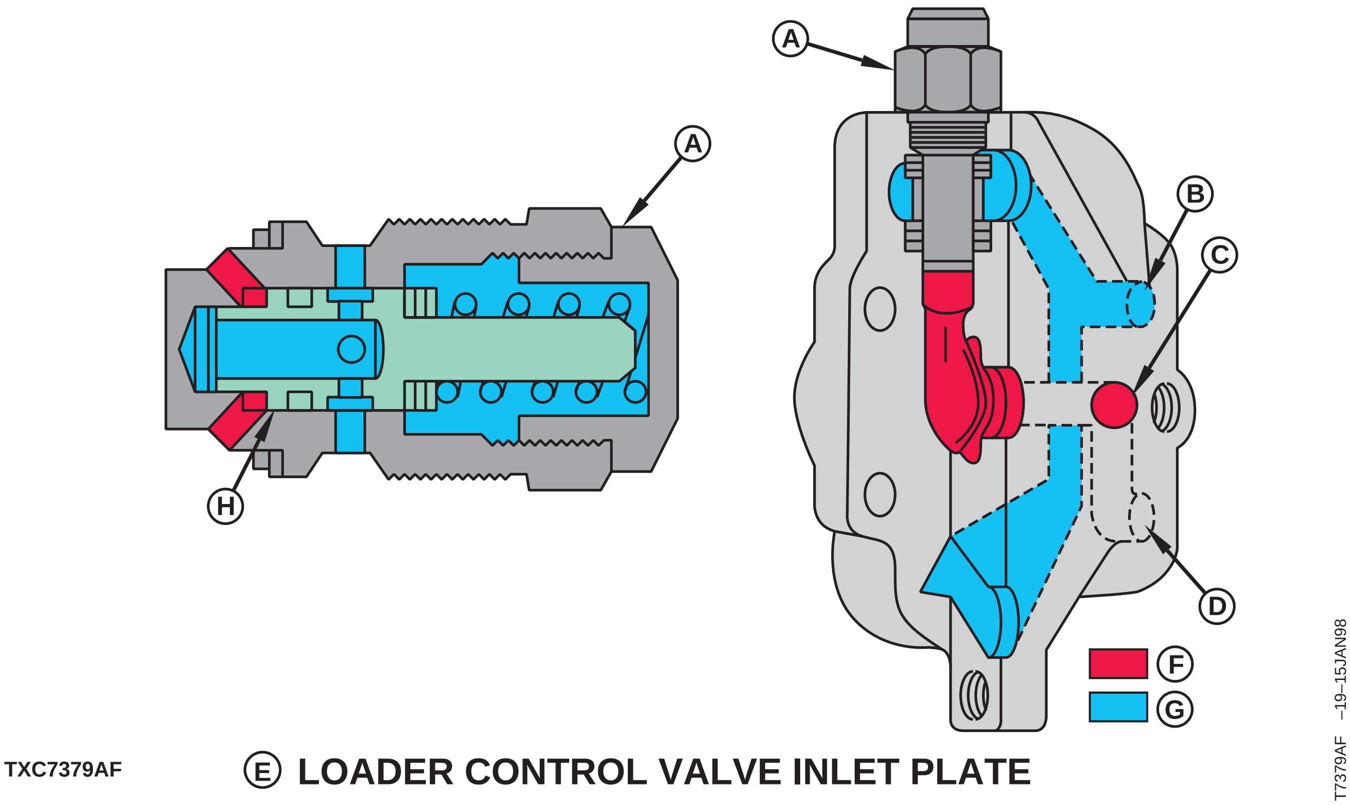


Oil Flow For Secondary Steering

1—Pressure Oil
2—Suction Oil
3—Return Oil
4—Trapped Oil
5—Gerotor Gear Assembly
6—Check Valve
7—Pin
8—Control Spool
9—Port "T"
10—Port "L"
11—Port "R"
12—Port "P"

TX,9025,DS3006 –19–09MAR93–4/4

Loader Control Valve—GRESEN (300D, 310D S.N. —802199) (315D, All Machines)



A—System Relief Valve
B—Return Passage
C—Pressure Passage
D—From Pump
E—Loader Control Valve Inlet Plate
F—Pressure Oil
G—Pressure Free Oil
H—Poppet

Oil enters the inlet plate and pressure is sensed by the system relief valve (A). The system relief valve is a direct acting valve. When oil pressure is less than the setting of the relief valve, spring force holds the poppet (H) closed. When pressure exceeds the setting of the valve, pressure acting on the flanged area of the poppet overcomes spring force to open the poppet. Oil then flows through the radial holes in the valve body, into the end of the poppet and to return (B).

When the control valves are in neutral, pressure oil flows through the center passage and out the outlet plate.

When a valve spool is moved, the center passage is blocked and oil flows to the power passage. From there oil is directed out to the function and is returned back to the end plate where it is routed to the return passage.

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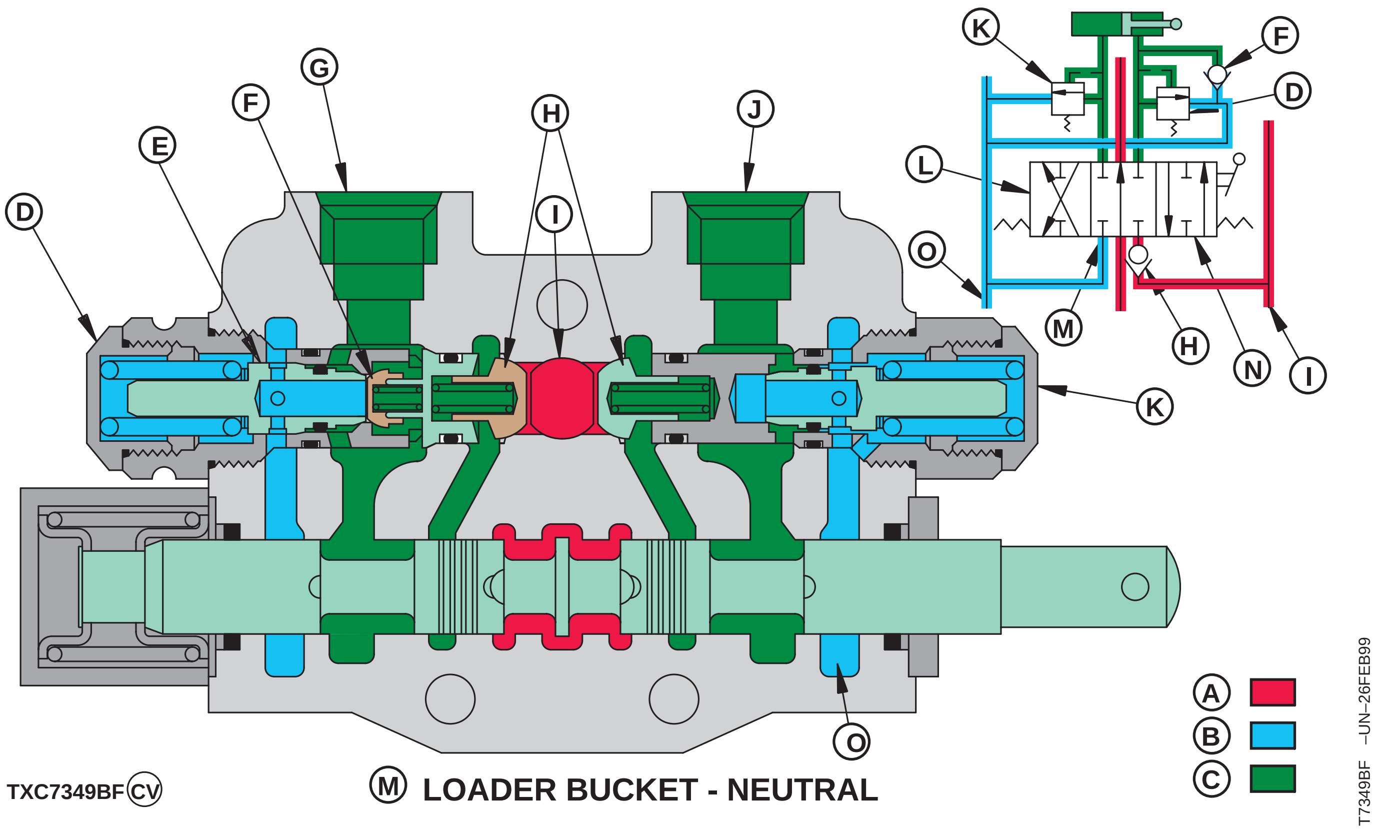

A—Pressure Oil
B—Return Oil
C—Trapped Oil
D—Circuit Relief Valve with Anti-Cavitation and Lift Checks
E—Poppet
F—Anti-Cavitation Valve
G—Cylinder Rod End Work Port
H—Lift Checks
I—Functional Inlet Passage
J—Cylinder Head End Work Port
K—Circuit Relief Valve with Lift Check
L—Bucket Rollback
M—Neutral
N—Bucket Dump
O—Return Passage

The loader bucket section is a three-position, four-way, spool-type valve. The valve contains one circuit relief with lift check (K) and one circuit relief with anti-cavitation with lift check (D). Relief valves with anti-cavitation feature are identified by notches in the hex head. The operation of all circuit relief valves in the loader and backhoe control valves are the same.

During operation, a pressure spike is generated in the bucket rod end circuit (G). When pressure in the rod end circuit exceeds the setting of the relief valve (D), the poppet (E) is moved off its seat allowing pressure oil to move into the return circuit (O). The spring will reseat the poppet when pressure drops below the valve setting. When the valve is in neutral oil is trapped (C) between the spool and bucket cylinder piston.

During anti-cavitation operation, the pressure in the rod end work port is less than pressure in return work port and return oil circuit. The difference in pressure pushes anti-cavitation poppet off its seat allowing oil to flow from return port into work ports to prevent cavitation.

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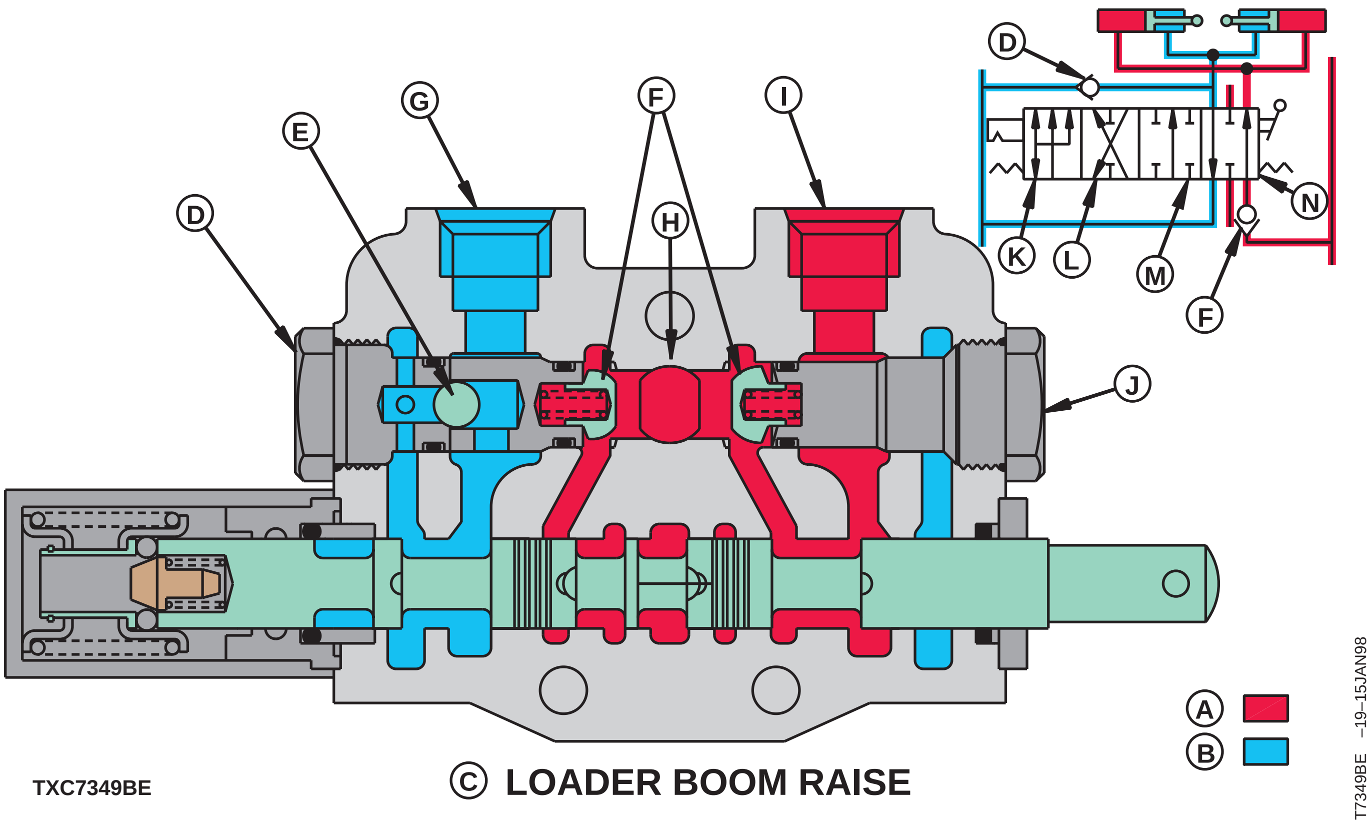

A—Pressure Oil
B—Return Oil
C—Loader Boom Raise
D—Anti-Cavitation Valve with Lift Check
E—Anti-Cavitation Ball
F—Lift Check Valve
G—Cylinder Rod End Work Port
H—Pressure Passage
I—Cylinder Head End Work Port
J—Plug with Lift Check
K—Boom Float
L—Boom Lower
M—Neutral
N—Boom Raise

The loader boom valve section is a four-position, four-way, spool-type valve.

The boom section contains one lift check assembly (J) and one anti-cavitation valve with lift check (D).

The lift check (F) creates a trapped oil circuit when system pressure is below the pressure required to move the function. When a function is activated, system pressure must increase above pressure in the work circuit to open lift check and move the function.

When the spool is moved to raise the boom (N), oil flows from the pressure passage (H), past lift check (F) to cylinder head end port (I) and out work port to cylinders. Return oil from cylinder rod end flows into other work port (G) past spool, into return passage and then out of control valve to return circuit.

During anti-cavitation operation, the pressure in the rod end work port is less than pressure in return work port and return oil circuit. The difference in pressure pushes anti-cavitation poppet off its seat allowing oil to flow from return port into work ports to prevent cavitation.

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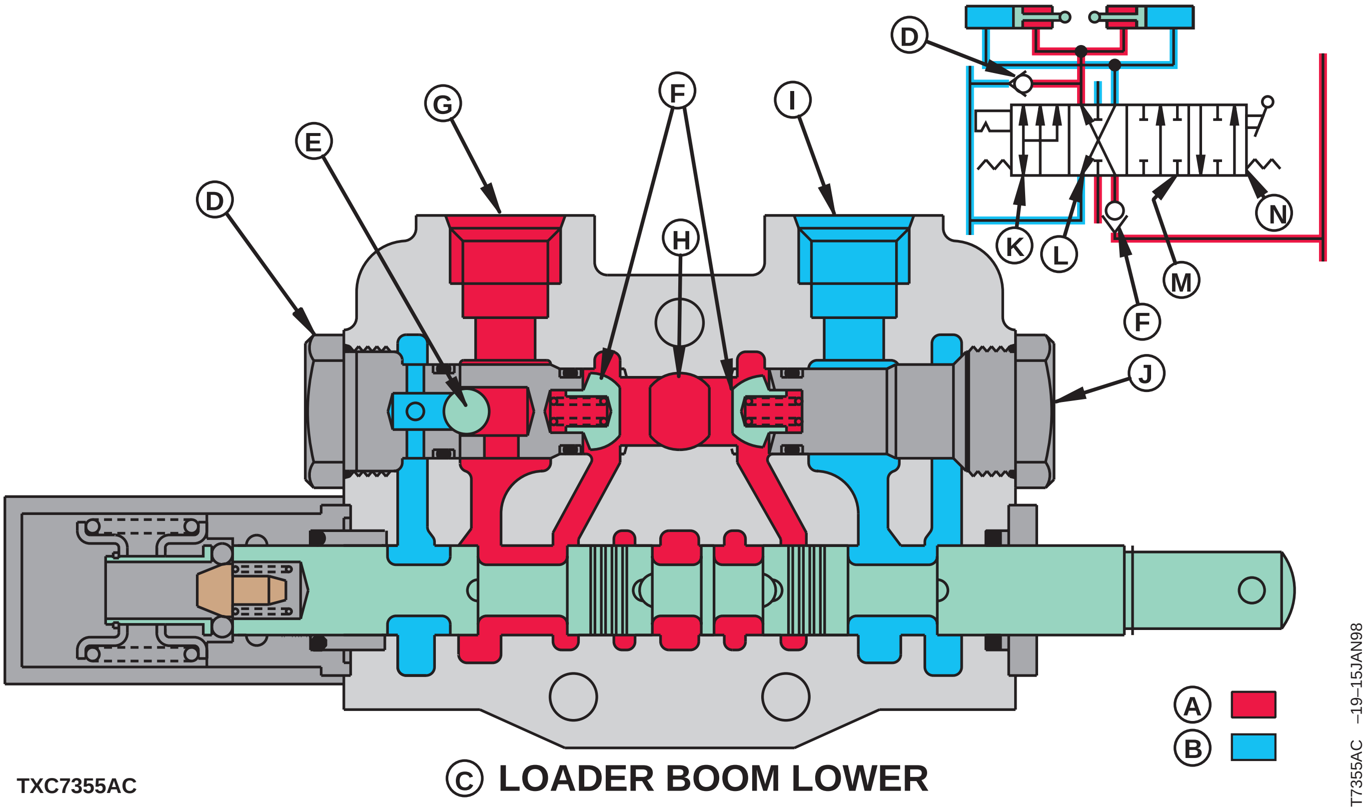
TX,902505,BR41 –19–21JUL94–3/6



A—Pressure Oil
B—Return Oil
C—Loader Boom Lower
D—Anti-Cavitation with Lift Check
E—Anti-Cavitation Ball
F—Lift Check Valve (2 used)
G—Cylinder Rod End Work Port
H—Pressure Passage
I—Cylinder Head End Work Port
J—Lift Check Valve
K—Boom Float
L—Boom Lower
M—Neutral
N—Boom Raise

When the loader control valve spool is moved to lower the boom (L), pressure oil (A) flows from the pressure passage (H) past lift check (F) to cylinder rod end port (G) and out to cylinders. Return oil (B) from cylinder head end flows into other work port (I) past spool, into return passage and then out of control valve to return circuit.

When the loader boom is lowered quickly, the pressure of the oil in work passage (G) can be less than that of oil in the return passage. The higher pressure in return passage will unseat ball (E) and allow return oil into the work passage preventing the cylinders from cavitating.

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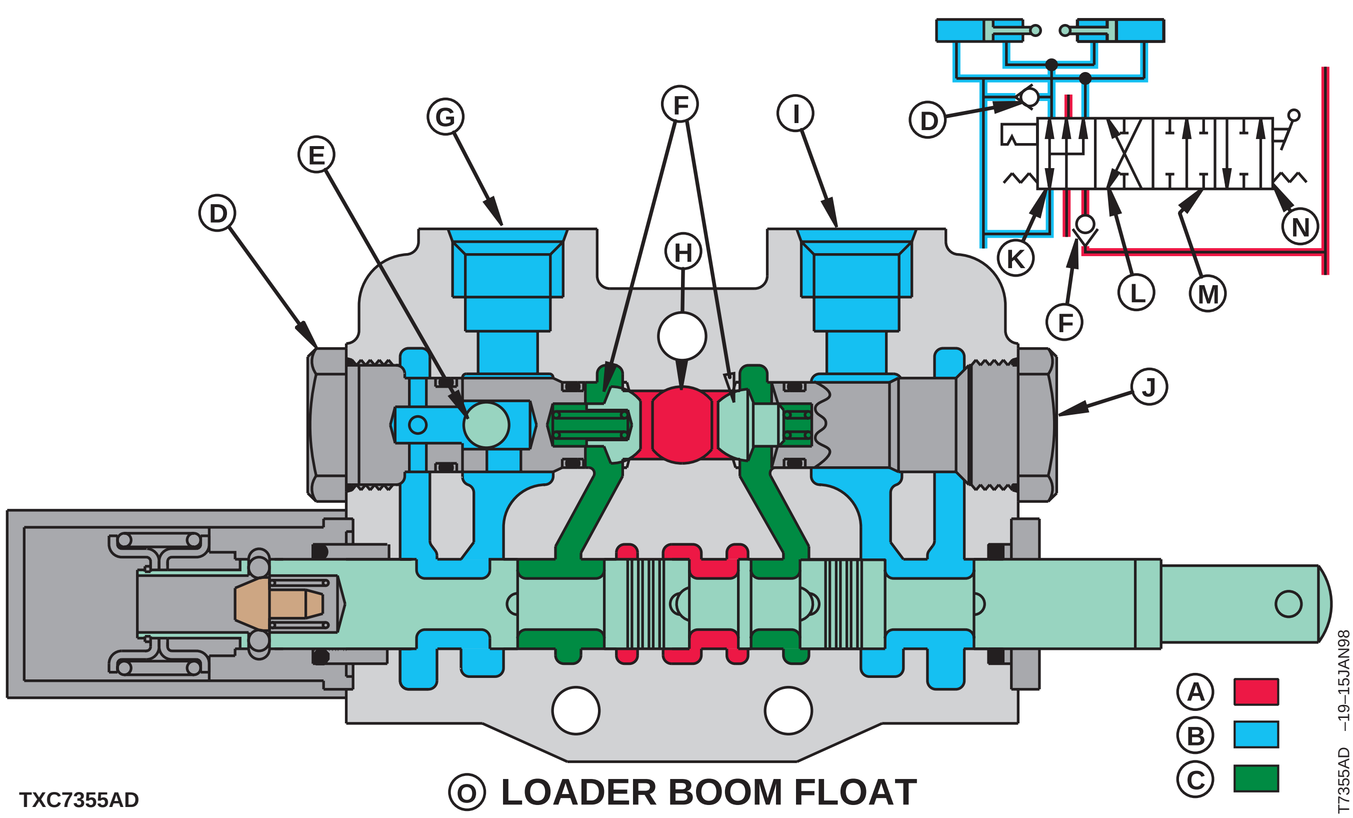

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O LOADER BOOM FLOAT

A—Pressure Oil
B—Return Oil
C—Trapped Oil
D—Anti-Cavitation with Lift Check Valve
E—Anti-Cavitation Ball
F—Lift Check Valve (2 used)
G—Cylinder Rod End Work Port
H—Pressure Passage
I—Cylinder Head End Work Port
J—Lift Check Valve
K—Boom Float
L—Boom Lower
M—Neutral
N—Boom Raise

When the loader control valve spool is moved to the float position (K), it is mechanically held in this position. A spring-loaded ramp and ball mechanism locks the spool in position.

With the spool held in float (K) both work ports (G and I) are open to return allowing oil to flow in and out both ends of cylinder. This allows the boom to raise or lower as it follows the contour of the ground. Pressure oil passes through the valve and both lift checks remain seated.

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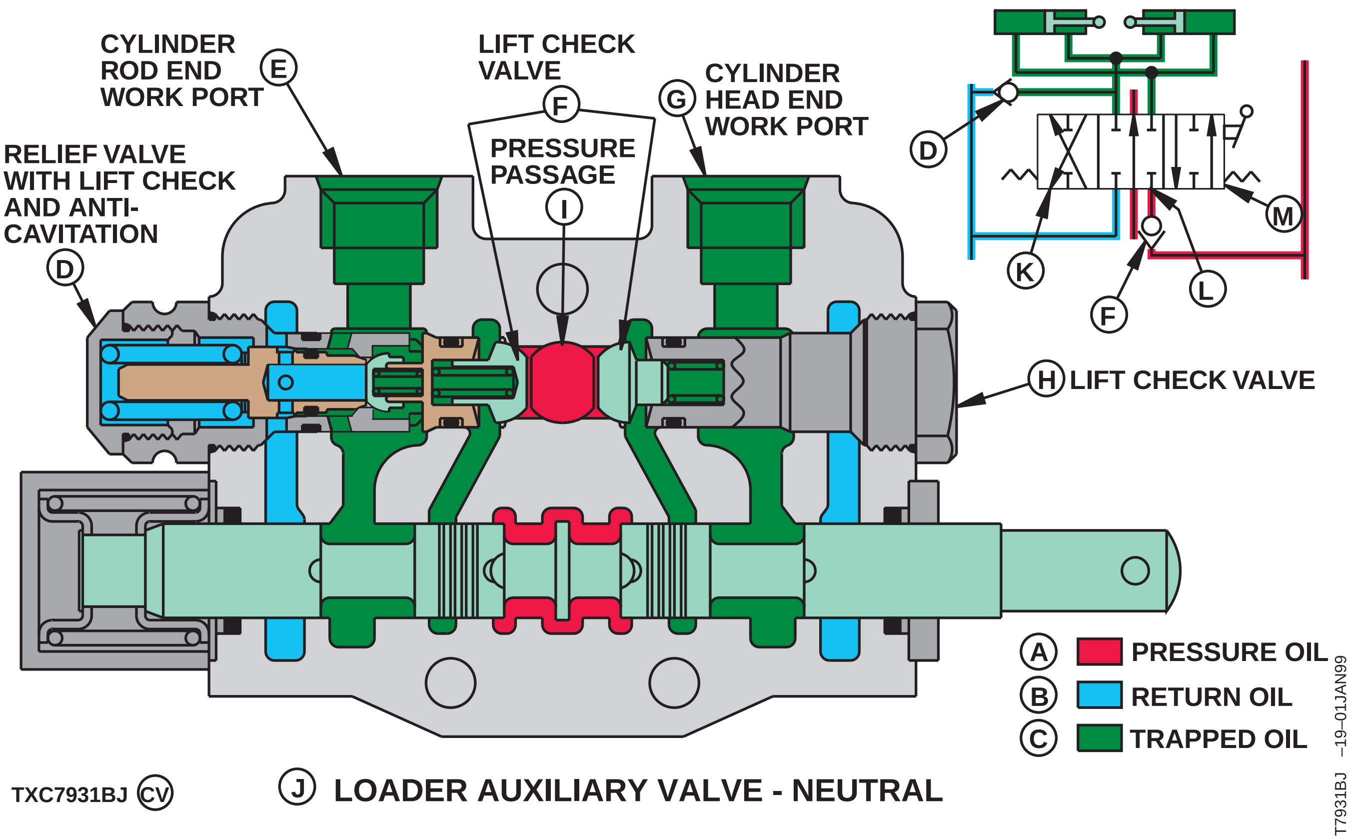
TX,902505,BR41 –19–21JUL94–5/6



A—Pressure Oil
B—Return Oil
C—Trapped Oil
D—Relief Valve with Lift Check and Anti-Cavitation
E—Cylinder Rod End Work Port
F—Lift Check Valve (2 used)
G—Cylinder Head End Work Port
H—Lift Check Valve
I—Pressure Passage
J—Loader Auxiliary Valve-Neutral
K—Retract Cylinders
L—Neutral
M—Extend Cylinders

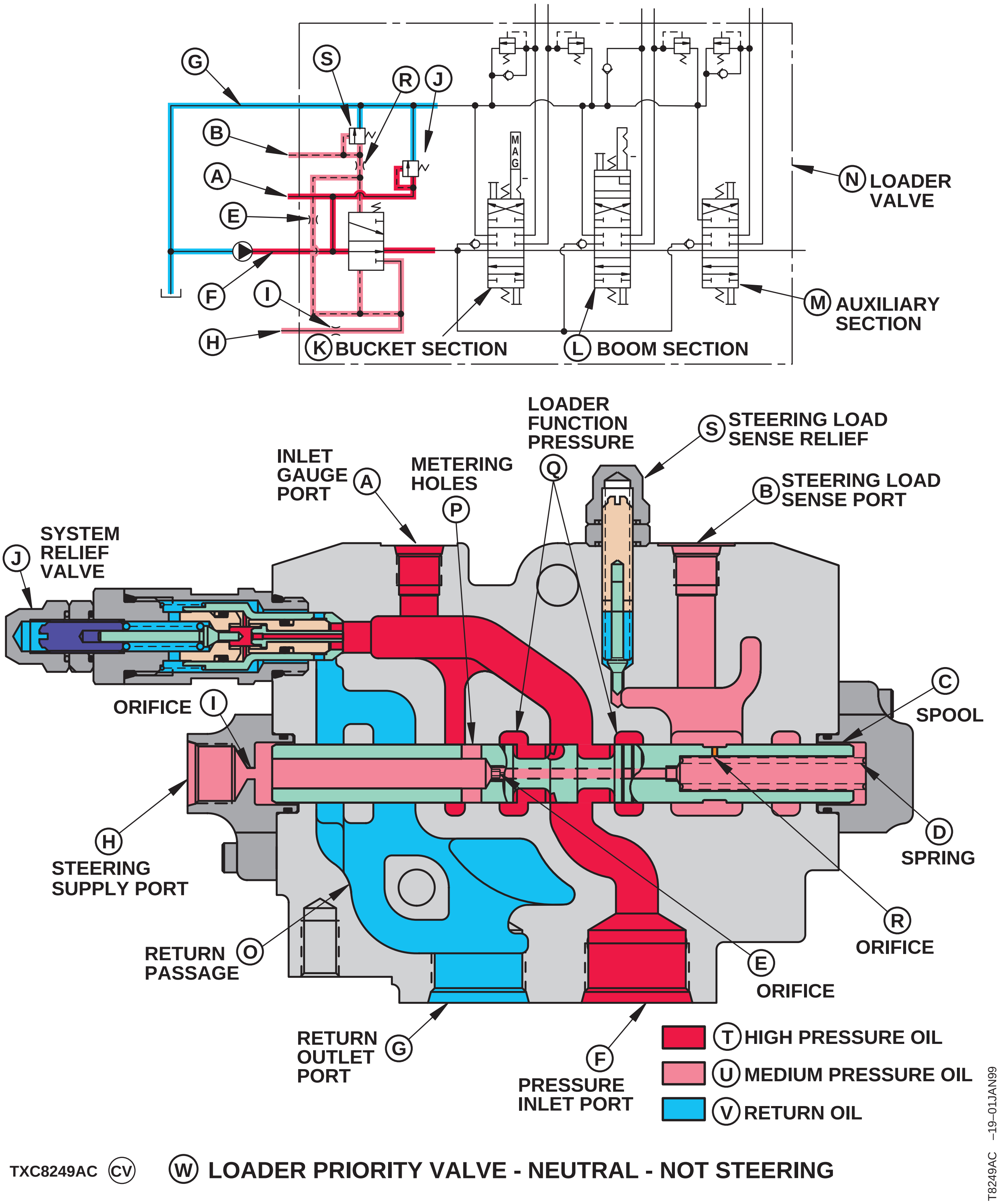
The loader auxiliary section is a three-position, four-way, spool-type valve.

The auxiliary section contains one lift check/relief valve (D) and one anti-cavitation check valve (I). When the valve spool is in neutral, the oil is trapped in the work circuits (E and G). This prevents movement of cylinders and linkage.

Pressure oil flows through the center of the spool and valve section. The lift checks (F) remain seated because the pressure passage (I) remains lower than the pressure in work circuits.

TX,902505,BR41 –19–21JUL94–6/6

Loader Control Valve Operation—HUSCO (300D, 310D S.N. 802200—)



W LOADER PRIORITY VALVE - NEUTRAL - NOT STEERING

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TX,9025,BS387 –19–21JUL94–1/8

A—Gauge Port
B—Steering Load Sense Port
C—Spool
D—Spring
E—Orifice
F—Pressure Inlet Port
G—Return Outlet Port
H—Steering Supply Port
I—Orifice
J—System Relief Valve
K—Bucket Section
L—Boom Section
M—Auxiliary Section
N—Loader Valve
O—Return Passage
P—Metering Holes
Q—Loader Function Pressure
R—Orifice
S—Steering LS Relief Valve
T—High Pressure Oil
U—Medium Pressure Oil
V—Return Oil
W—Loader Priority Valve-Neutral-Not Steering

The priority valve maintains priority oil to the steering valve. When the engine is stopped, spool (C) is pushed to the left by the bias spring (D) restricting the oil to loader (Q) and opening the passage to steering (H).

When the machine is first started, all pump flow is routed to the steering valve thru port (H). The steering valve blocks the flow except for a small amount of flow to sump thru an orifice in the priority valve. With the flow blocked, the pressure increases at port (H). This causes the spool (C) to shift to the right against the bias spring (D) and limit the flow to port (H) by closing the priority metering holes (P). This also opens inlet pump flow (F) to loader (Q) functions. As long as the steering valve is in neutral, just enough flow is allowed to pass through the metering holes (P) to maintain a steer pressure at port (H) that keeps the spool shifted to the right and balanced against the bias spring (D).

If through the use of loader functions the pump is unable to supply adequate flow to maintain steering pressure at port (H) then spool (C) will shift left and restrict flow to loader (Q) until steer supply pressure is satisfied.

Flow from the steering port (H) is also routed through orifice (E) in the priority spool to the load sensing port (B). This flow provides oil to the steering valve warm up circuit which prevents binding of the steering valve caused by extreme oil temperature variation.

The load sensing circuit is a control circuit that routes steering valve outlet pressure to the spring side of the priority valve spool (C). It allows the priority valve to sense the pressure that is required to move the steering cylinders under varying steering conditions. When the operator steers the machine, load sensing pressure oil from the steering valve flows to the load sense port (B) on the priority valve. Load sensing pressure plus spring (D) act against steer pilot pressure to move the spool to the left. This restricts flow to the loader (Q) while the priority metering holes (P) are opened to the priority steering port (H).

To limit steering system pressure a steering load sense relief valve (S) is built into the priority valve. When the operator steers the machine fully the steer cylinder will bottom against the steer stops. Pressure in the load sense circuit will increase. When the pressure in the load sense port (B) increases enough to push the steer relief valve (S) poppet off its seat, oil in the load sense circuit flows to return. Load sensing pressure is limited to the pressure setting of the relief valve.

System relief valve (J) is located in the priority valve section. The relief is pilot operated, screw adjustable, and does not have anti-cavitation operation. The function of the relief is to regulate system (main pump) pressure.

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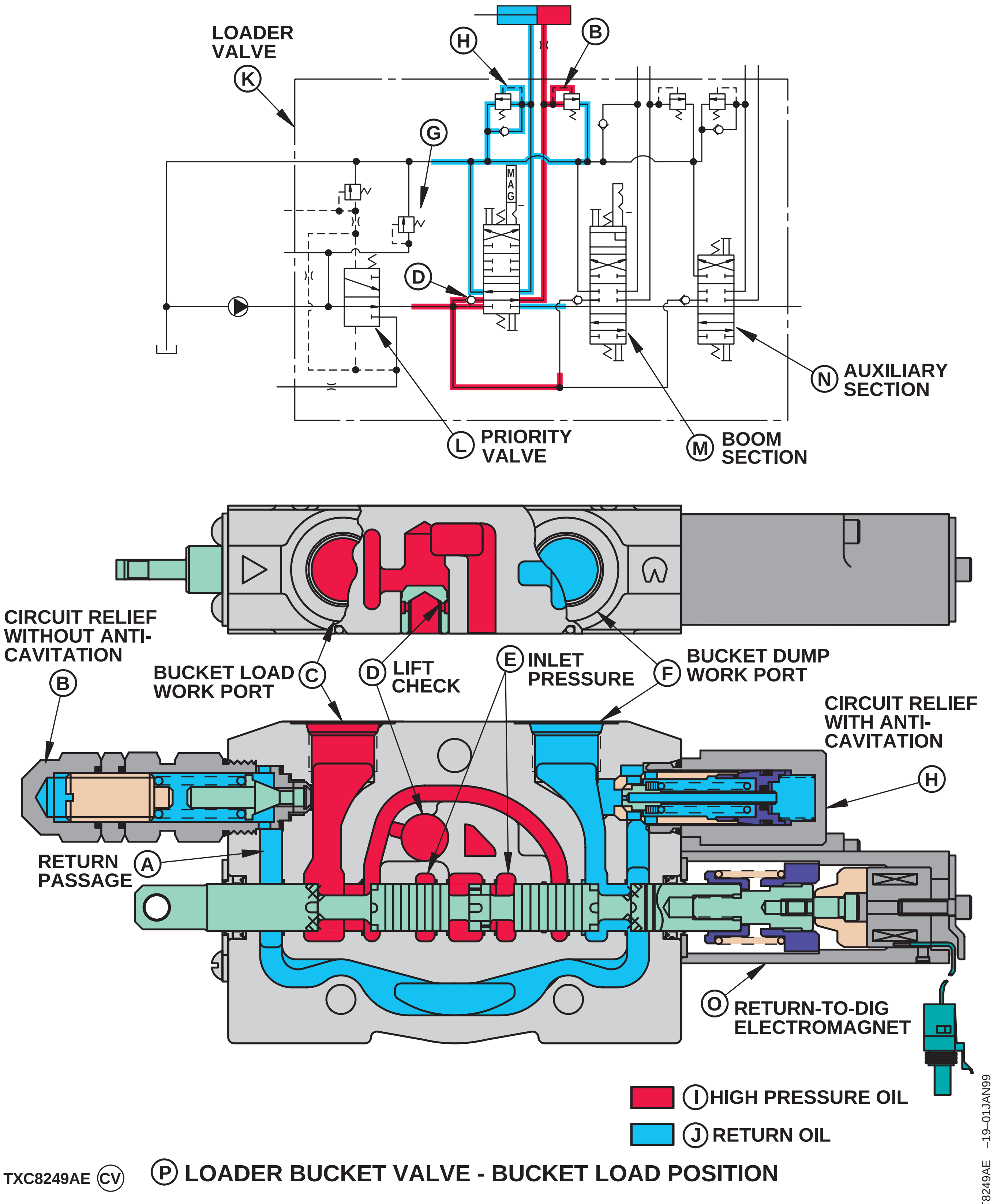
TX,9025,BS387 –19–21JUL94–2/8



TXC8249AE (CV)

P LOADER BUCKET VALVE - BUCKET LOAD POSITION

Continued on next page

TX,9025,BS387 –19–21JUL94–3/8

A—Return Passage
B—Circuit Relief Valve Without Anti-Cavitation
C—Bucket Load Work Port
D—Lift Check
E—Inlet Pressure
F—Bucket Dump Work Port
G—System Relief Valve
H—Circuit Relief Valve With Anti-Cavitation
I—High Pressure Oil
J—Return Pressure Oil
K—Loader Valve
L—Priority Valve Section
M—Boom Valve Section
N—Auxiliary Valve Section
O—Return-To-Dig Electromagnet
P—Loader Bucket Valve-Bucket Load Position

The bucket valve is a three position, four way, spool-type valve. It contains a lift check (D) and two circuit relief valves. Relief valve (H) also contains an anti-cavitation valve for the bucket dump circuit.

In the bucket load position oil flows from the inlet pressure passage (E) past lift check (D) and spool, out the bucket load workport to the cylinder. Return oil from the cylinder flows into the return passage (A) and out of the control valve to the return circuit.

When bucket dump function is activated and pressure in circuit is less than return pressure, oil flows from return passage (A) past anti-cavitation valve (H) to the bucket dump circuit (F).

The valve is equipped with a return-to-dig. When loader control lever is moved to the bucket rollback position, a plate fastened to end of valve spool contacts an electromagnet (O). If the bucket is in dump position, the return-to-dig switch is closed which energizes the electromagnet and holds the spool in the load position. When the bucket rolls back to the dig position, a mechanical linkage opens the return-to-dig switch, which de-energizes the electromagnet (O) letting the spool centering spring move the spool to neutral.

An orifice is located between the bucket valve section pressure port and cylinder head end to reduce function cycle times and protect system components.

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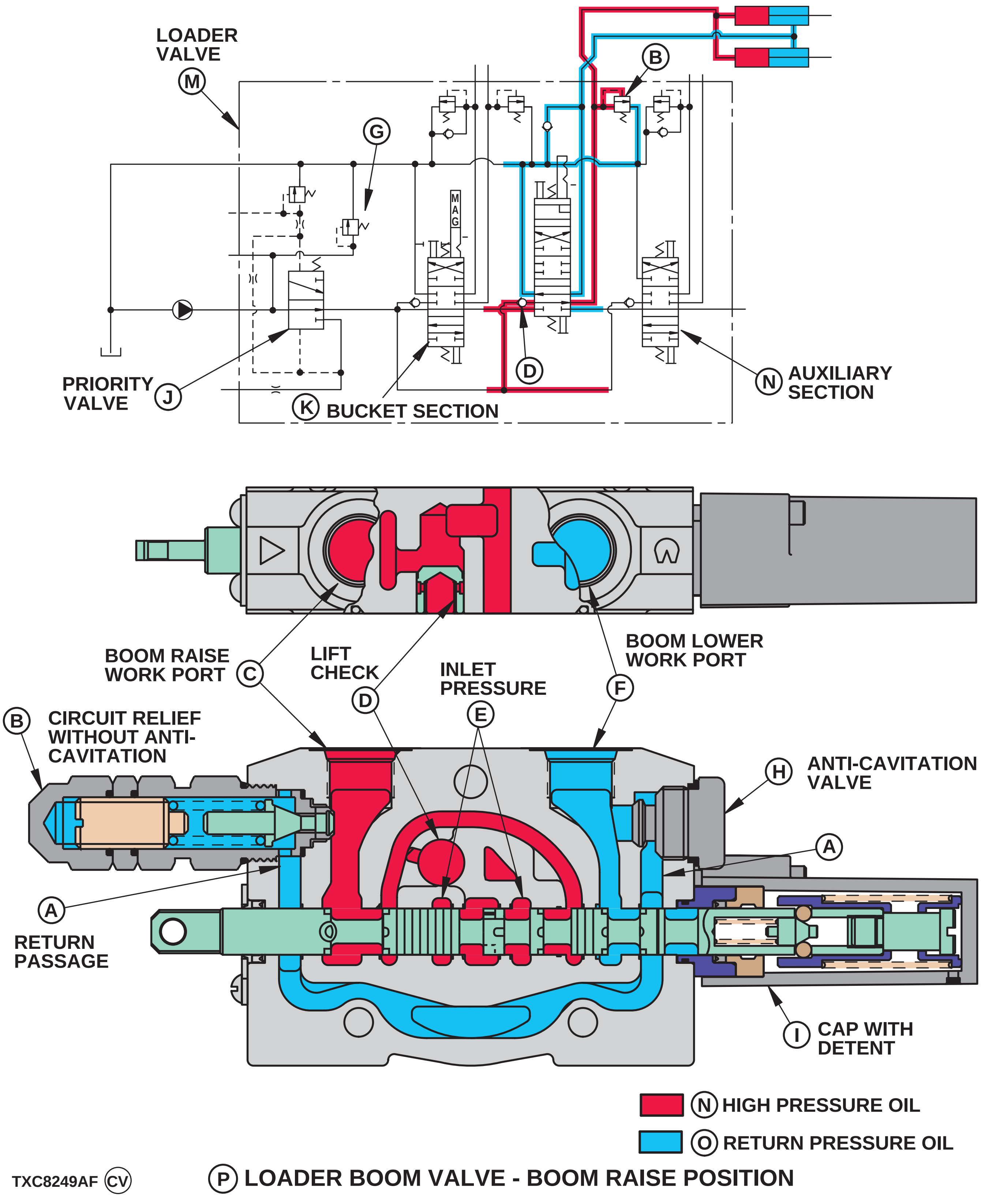
TX,9025,BS387 –19–21JUL94–4/8



TXC8249AF CV

P LOADER BOOM VALVE - BOOM RAISE POSITION

Continued on next page

TX,9025,BS387 –19–21JUL94–5/8

A—Return Passage
B—Circuit Relief Valve Without Anti-Cavitation
C—Boom Raise Work Port
D—Lift Check
E—Inlet Pressure
F—Boom Lower Work Port
G—System Relief Valve
H—Anti-Cavitation Valve
I—Cap With Detent
J—Priority Valve Section
K—Bucket Valve Section
L—Auxiliary Valve Section
M—Loader Valve
N—High Pressure Oil
O—Return Pressure Oil
P—Loader Boom Valve-Boom Raise Position

The spool has grooves in both ends to meter oil through the valve to prevent abrupt starts and stops.

When the spool is moved to activate a function, oil flows from functional inlet passage (E), past lift check (D) and spool, out the work port to the cylinders. Return oil from the cylinders flows into the other work port, past the spool, into the return passage (A), then out of the control valve to the charge circuit.

When the boom lower function is activated and pressure in circuit is less than return pressure, oil flows from return passage (A), past anti-cavitation plug (H) into the boom lower circuit (F).

When spool is moved to the boom float (detent) position, both work ports (C and F) are open to return passage (A) allowing oil to flow in and out both ends of cylinders.

When the machine is equipped with a two function valve the boom section has a power beyond port located on the main frame side of the valve. The section is similar to the loader valve auxiliary section illustrated in this group.

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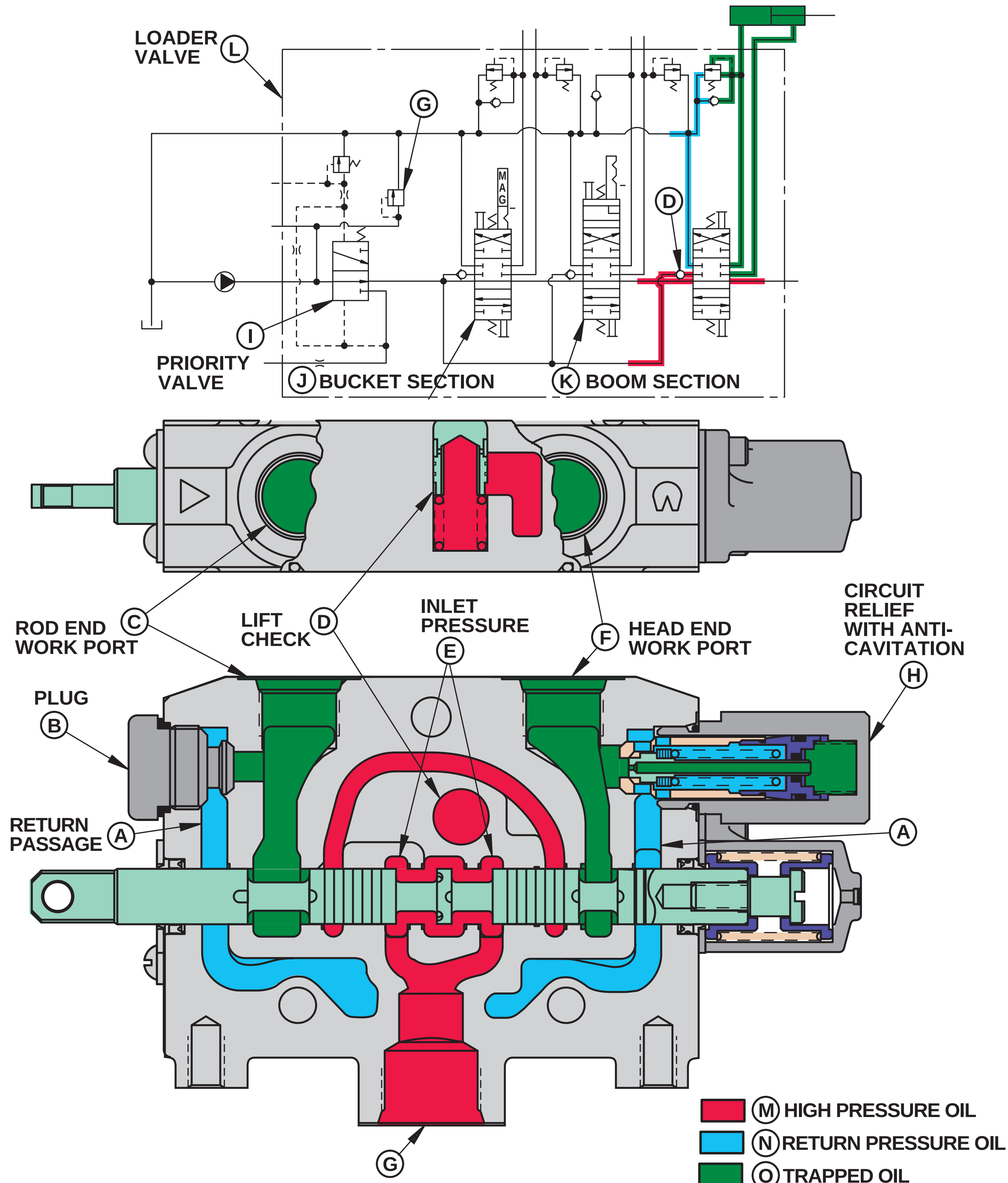
TX,9025,BS387 –19–21JUL94–6/8



TXC8249AD CV

P LOADER AUXILIARY VALVE - NEUTRAL POSITION

Continued on next page

TX,9025,BS387 –19–21JUL94–7/8

A—Return Passage
B—Plug
C—Rod End Work Port
D—Lift Check
E—Inlet Pressure
F—Head End Work Port
G—System Relief Valve
H—Circuit Relief With Anti-Cavitation
I—Priority Valve Section
J—Bucket Valve Section
K—Boom Valve Section
L—Loader Valve
M—High Pressure Oil
N—Return Pressure Oil
O—Trapped Oil
P—Loader Auxiliary Valve-Neutral Position

The loader auxiliary valve is a three position, four way, spool type valve. It contains a lift check (D), relief valve with anti-cavitation (H), and a plug (B). The valve spool is returned to neutral by a centering spring in the spool end cap.

The auxiliary valve is normally used to control clam buckets or other front-mounted hydraulic functions. If an auxiliary valve is field installed both the boom and auxiliary sections must be replaced. The boom section of a two function loader valve has a power beyond port which is not compatible with the installation of a third function auxiliary valve.

When the auxiliary valve is moved to the extend position, oil flows from pressure passage (E) by lift check (D) and spool, out head end work port (F) to cylinder head end. Oil from rod end of cylinder flows back to valve through rod end work port (C) to return passage (A). Oil in the return passage is sent to main hydraulic filter where it combines with other return pressure oil and becomes available to main pump.

TX,9025,BS387 –19–21JUL94–8/8

Loader Circuit Relief Valve With Anti-Cavitation—HUSCO (300D, 310D, S.N. 802200—)

The relief is direct acting and has anti-cavitation operation.

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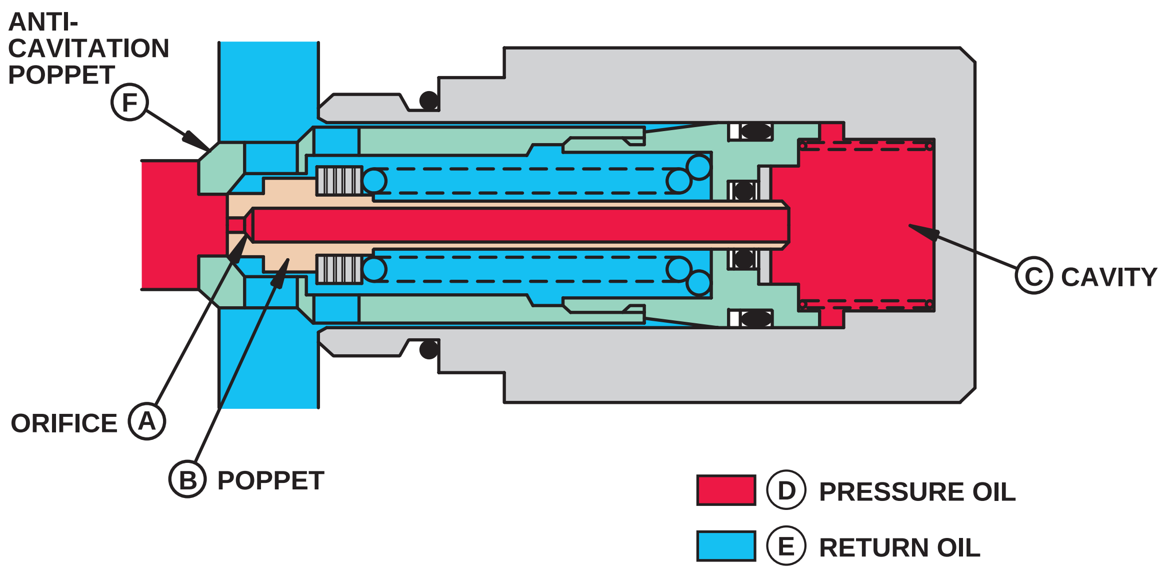
TX,9025,BS395 –19–21JUL94–1/2



9025
05
28

A—Orifice
B—Relief Poppet
C—Cavity
D—Pressure Oil
E—Return Oil
F—Anti-Cavitation Poppet

In normal operation, pressure oil less than relief valve setting flows through orifice (A) into cavity (C) behind relief valve poppet. Pressure oil and spring in cavity hold the anti-cavitation poppet closed because effective area on this side is greater than on work port side.

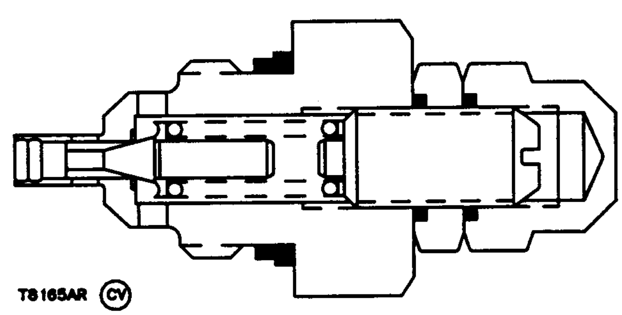
In relief operation, pressure oil overcomes relief poppet (B) pressure setting and opens a path to return.

During anti-cavitation operation, the pressure in the work port is less than pressure in the return port. The pressure difference pushes the anti-cavitation poppet (F) off its seat allowing oil to flow from return port to work port to prevent cavitation.

TX,9025,BS395 –19–21JUL94–2/2

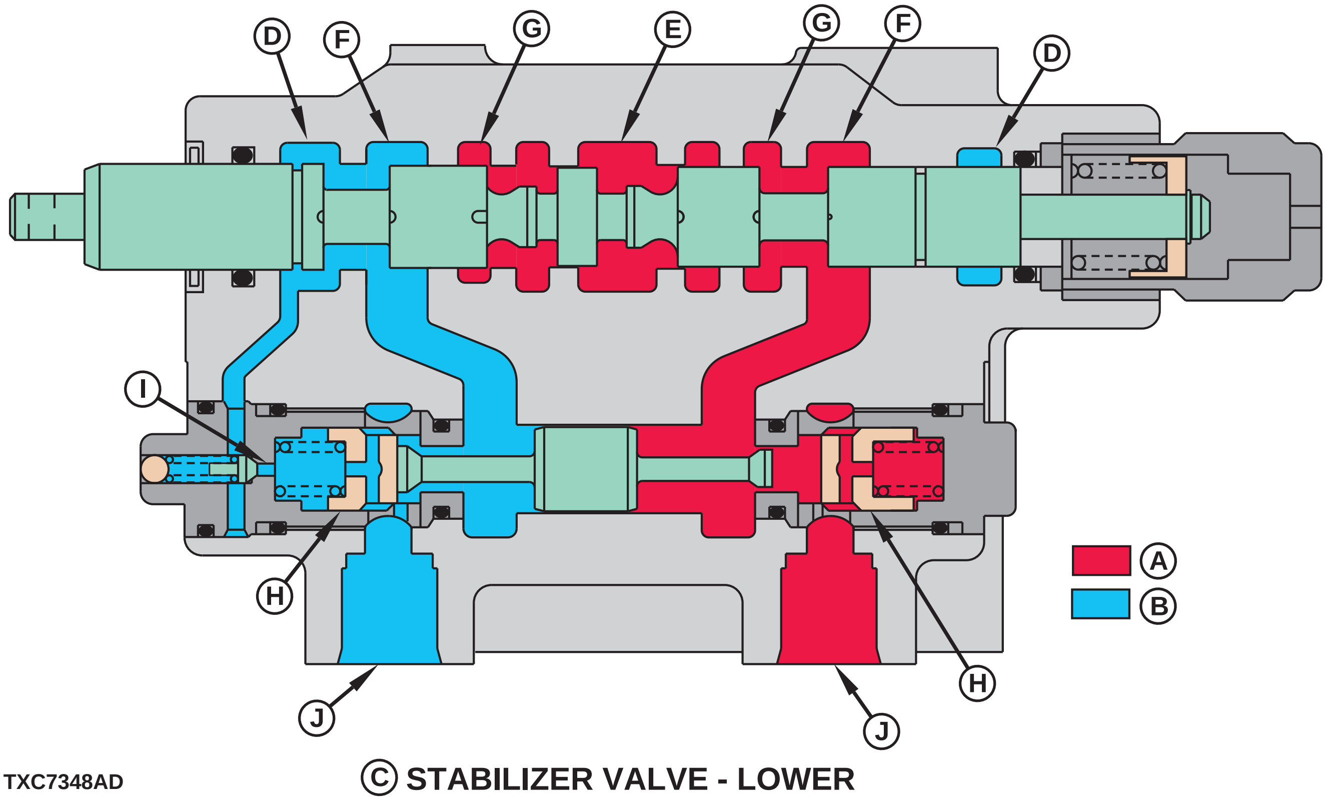
Loader Circuit Relief Valve Without Anti-Cavitation— HUSCO (300D, 310D, S.N. 802200—)

This circuit relief valve is direct acting, screw adjustable and does not have anti-cavitation operation.



TX,9025,BS396 –19–21JUL94–1/1

Stabilizer Valve Operation



A—Pressure Oil
B—Return Oil
C—Stabilizer Valve—Lower
D—Return Passage
E—Pressure Passage
F—Connecting Passage
G—Power Passage
H—Poppet
I—Thermal Relief Valve
J—Work Port

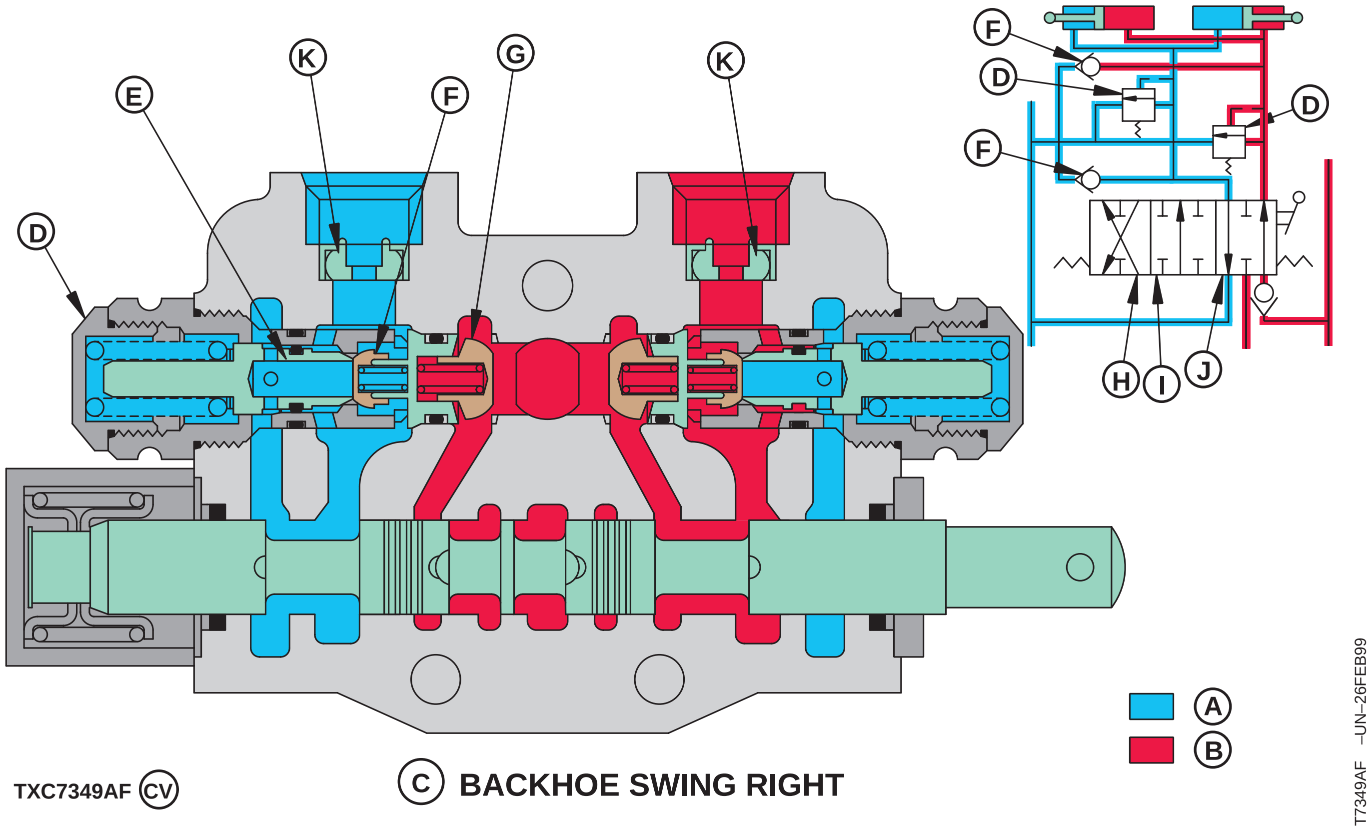
The stabilizer valve is a two-spool valve containing two lockout poppets for each spool. When the spool is in neutral, oil from the hydraulic pump flows through the pressure passage (E) to the backhoe control valve.

When the spool is moved to lower the stabilizer (as shown), the spool is pulled out. This directs oil into connecting passage (F), pushing the shuttle valve against left hand poppet (H). As pressure increases, the left poppet opens allowing that work port to be connected to return passage (D). As pressure increases, the right-hand poppet (H) is pushed off its seat filling the cylinder head end circuit (J) and pushing the stabilizer arm down.

When the spool is returned to neutral, pressure oil is cut off from the shuttle valve and poppets. The poppets are seated by pressure oil in cylinder work port and held by trapped oil. The thermal relief valve (I) opens when there is an expansion of oil in the trapped circuit due to external heat.

TX,902505,BR65 –19–07JAN93–1/1

Backhoe Control Valve Operation—GRESEN (300D, S.N. —802199)

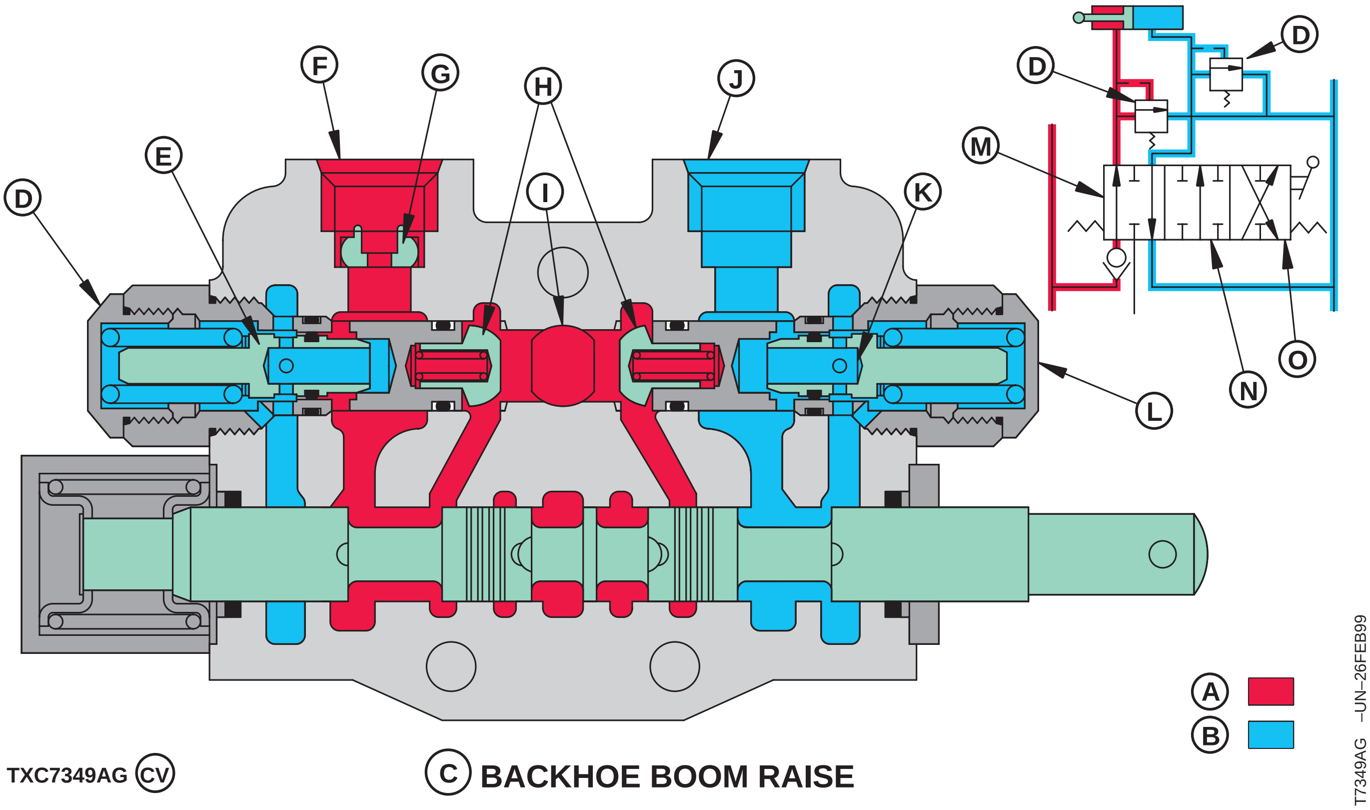


A—Return Oil
B—Pressure Oil
C—Backhoe Swing—Right
D—Circuit Relief with Lift Check Valve (2 used)
E—Relief Valve Poppet
F—Anti-Cavitation Poppet
G—Lift Check
H—Swing Left
I—Neutral
J—Swing Right
K—Orifice

The swing section is a three-position, four-way spool-type valve. The valve contains two combination circuit relief valves with lift checks and anti-cavitation valves (D).

During swing operation, oil flows from the pressure passage, past the lift checks (G) and out the work port to rod end of one cylinder and head end of the other cylinder. Return oil flows from the opposite ends of the swing cylinder into the other work port, past spool to the return passage.

Continued on next page TX,9025,BS397 —19—21JUL94—1/5



TXC7349AG CV

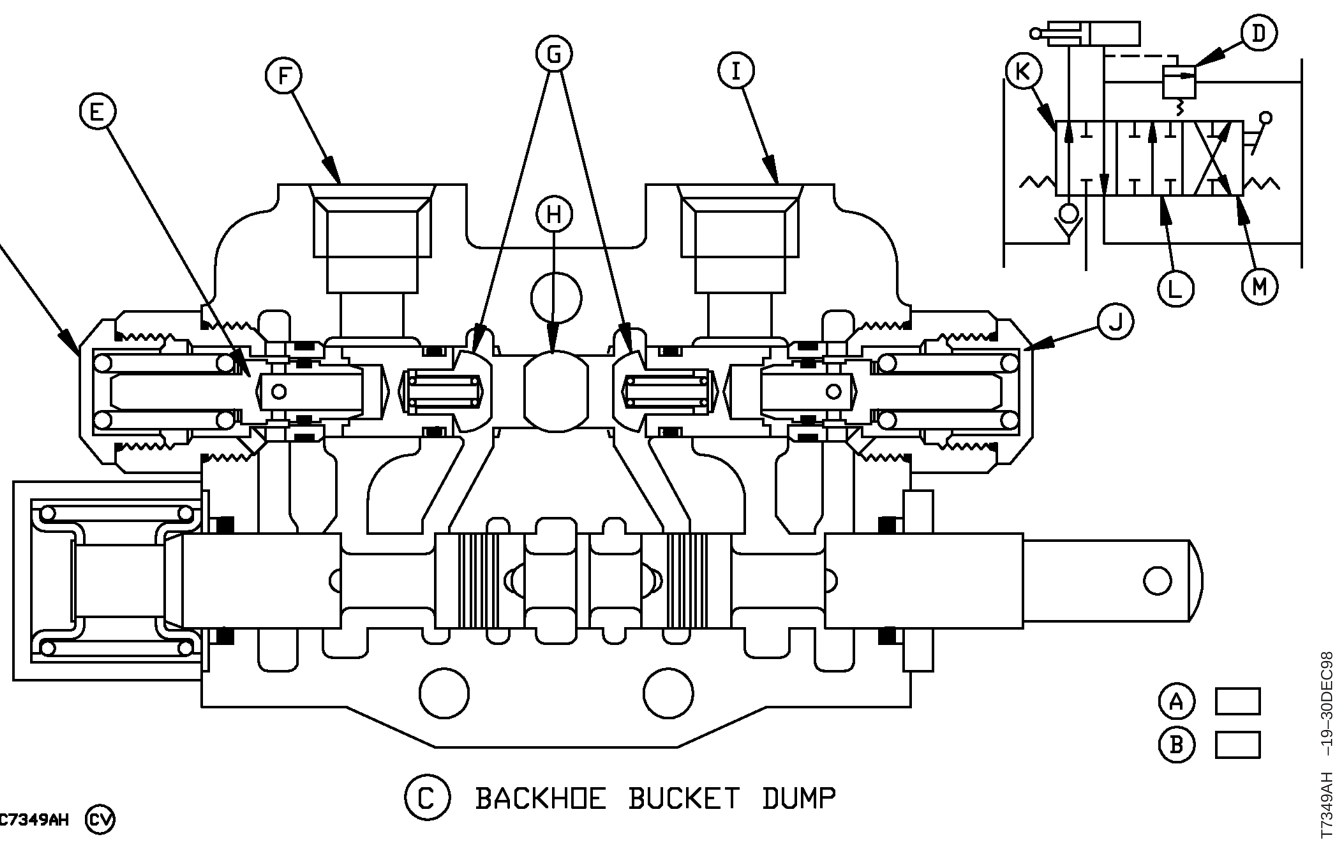
C BACKHOE BOOM RAISE

A—Pressure Oil
B—Return Oil
C—Backhoe Boom Raise
D—Circuit Relief with Lift Check Valve
E—Relief Valve Poppet
F—Cylinder Rod End Work Port
G—Orifice
H—Lift Check (2 used)
I—Pressure Passage
J—Cylinder Head End Work Port
K—Relief Valve Poppet
L—Circuit Relief with Lift Check Valve
M—Boom Raise
N—Neutral
O—Boom Lower

The boom section is a three-position, four-way spool type valve. The valve contains two circuit relief with lift check valves (D and L). During boom raise operation, oil flows from the pressure passage (I) past the lift checks (H) and out to the cylinder rod end port (F). Return oil from the cylinder head end port (J) flows past the spool into return passage.

Continued on next page

TX,9025,BS397 –19–21JUL94–2/5



A—Pressure Oil
B—Return Oil
C—Backhoe Bucket Dump
D—Circuit Relief Valve with Lift Check
E—Relief Valve Poppet
F—Cylinder Rod End Work Port
G—Lift Check (2 used)
H—Pressure Passage
I—Cylinder Head End Work Port
J—Circuit Relief Valve with Lift Check
K—Bucket Dump
L—Neutral
M—Bucket Roll-Back

The bucket section is a three-position, four-way spool type valve. The valve contains two circuit relief with lift check valves (D and J).

During bucket dump operation, oil flows from the pressure passage (H) past the lift check (G) and out the cylinder rod end work port (F). Return oil from the cylinder flows into port (I), past the spool and into the return passage.

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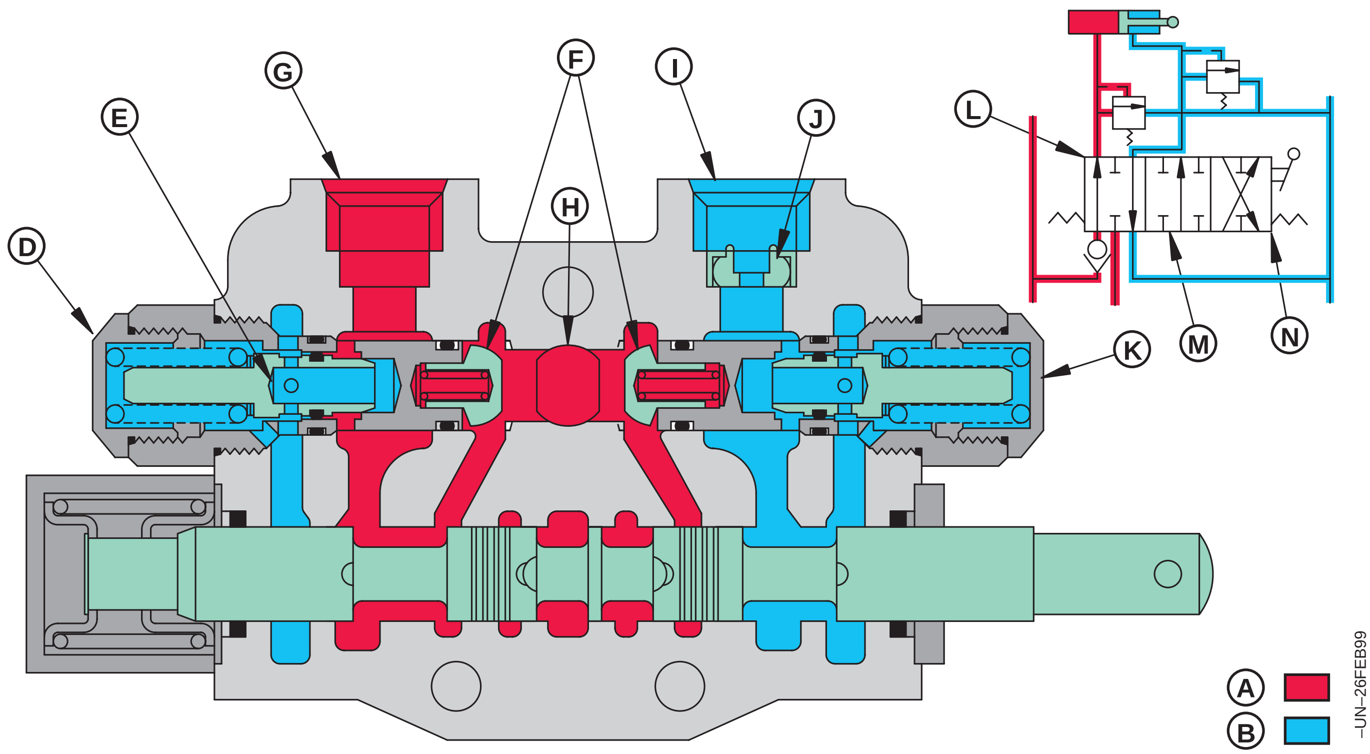
TX,9025,BS397 –19–21JUL94–3/5



TXC7349AI CV

C BACKHOE CROWD-IN

A—Pressure Oil
B—Return Oil
C—Backhoe Crowd-In
D—Circuit Relief Valve with Lift Check
E—Relief Valve Poppet
F—Lift Check (2 used)
G—Cylinder Head End Work Port
H—Pressure Passage
I—Cylinder Rod End Work Port
J—Orifice
K—Circuit Relief with Lift Check Valve
L—Crowd-In
M—Neutral
N—Crowd-Out

The crowd section is a three-position, four-way spool type valve. The valve section contains two circuit relief with lift check valves (D and K).

During crowd-in operation, oil flows from the pressure passage (H) past lift check (F) and out cylinder head end work port (G). Return oil flows from port (I), past spool into return passages.

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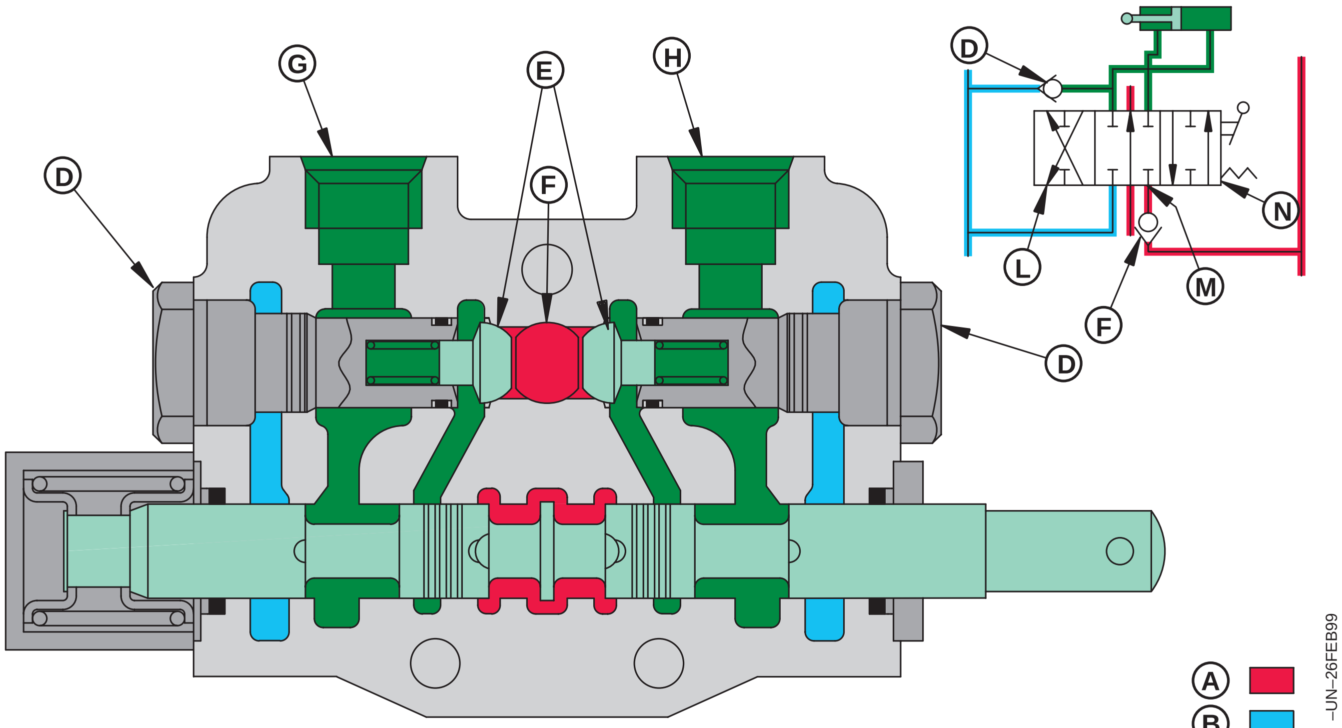
TX,9025,BS397 –19–21JUL94–4/5



TXC7349AJ CV

I BACKHOE AUXILIARY - NEUTRAL

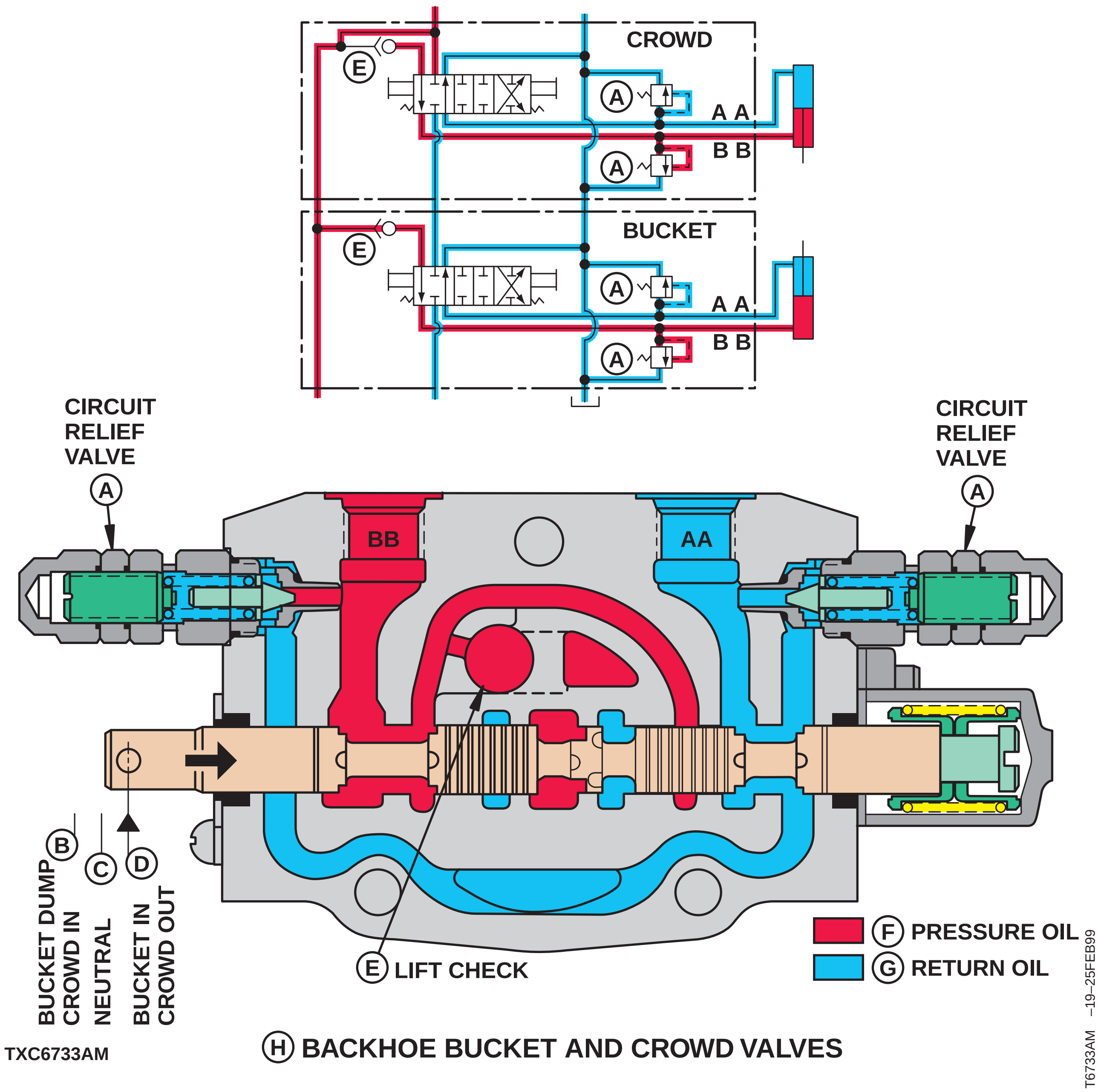
A—Pressure Oil
B—Return Oil
C—Trapped Oil
D—Plug with Lift Check (2 used)
E—Lift Check
F—Pressure Passage
G—Cylinder Rod End Work Port
H—Cylinder Head End Work Port
I—Backhoe Auxiliary—Neutral
L—Extend
M—Neutral
N—Retract

The auxiliary section is a three-position, four-way spool type valve. The valve contains two plugs with lift checks and no relief valve.

When the valve is in neutral, pressure oil flows through the valve section. The spool traps oil in the work circuits preventing movement of cylinder and linkage.

TX,9025,BS397 –19–21JUL94–5/5

Backhoe Control Valve Operation—HUSCO (310D, 315D, All Machines) (300D, S.N. 802200—)



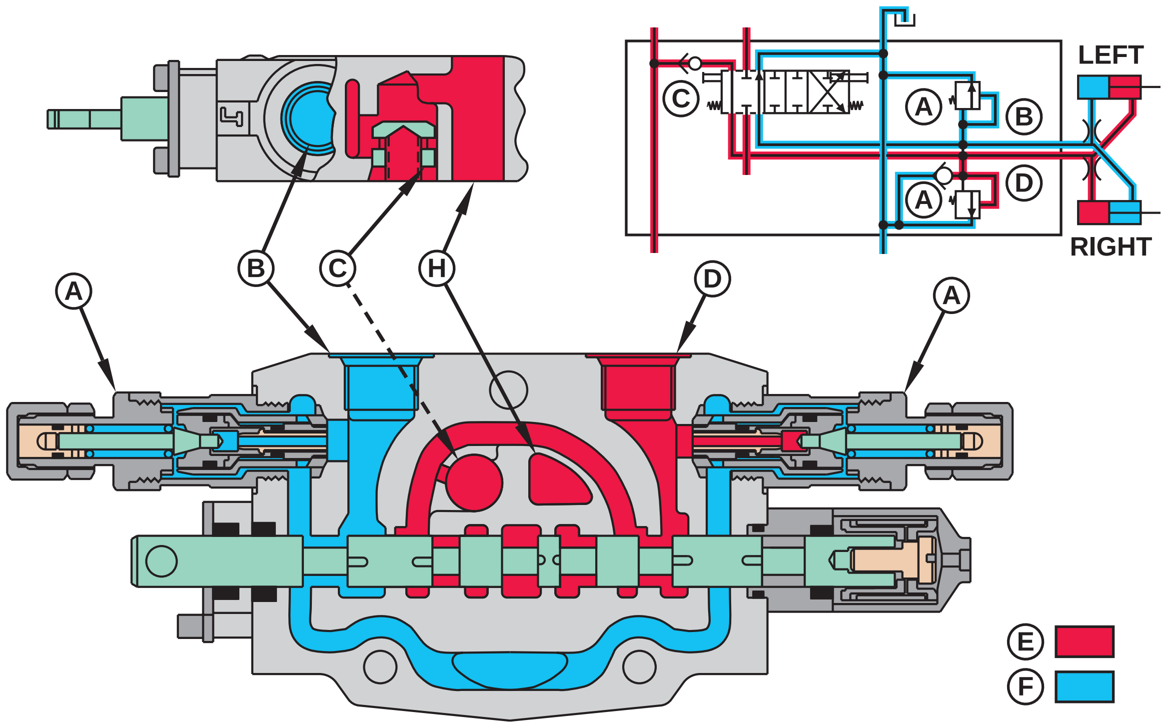
A—Circuit Relief Valve (2 used)
B—Bucket Dump/Crowd In
C—Neutral
D—Bucket In/Crowd Out
E—Lift Check
F—Pressure Oil
G—Return Oil
H—Backhoe Bucket and Crowd Valves

The crowd and bucket valves are three-position, four-way, spool-type valves. Each valve section contains two circuit relief valves and a lift check valve.

Continued on next page

When the valve spool is moved to activate the function, oil flows past the left check (E) to work port (BB). Return oil flows from port (AA) past spool into the return passage.

TX,9025,BS398 –19–21JUL94–2/7



TXC7371BC

G BACKHOE SWING VALVE - LEFT

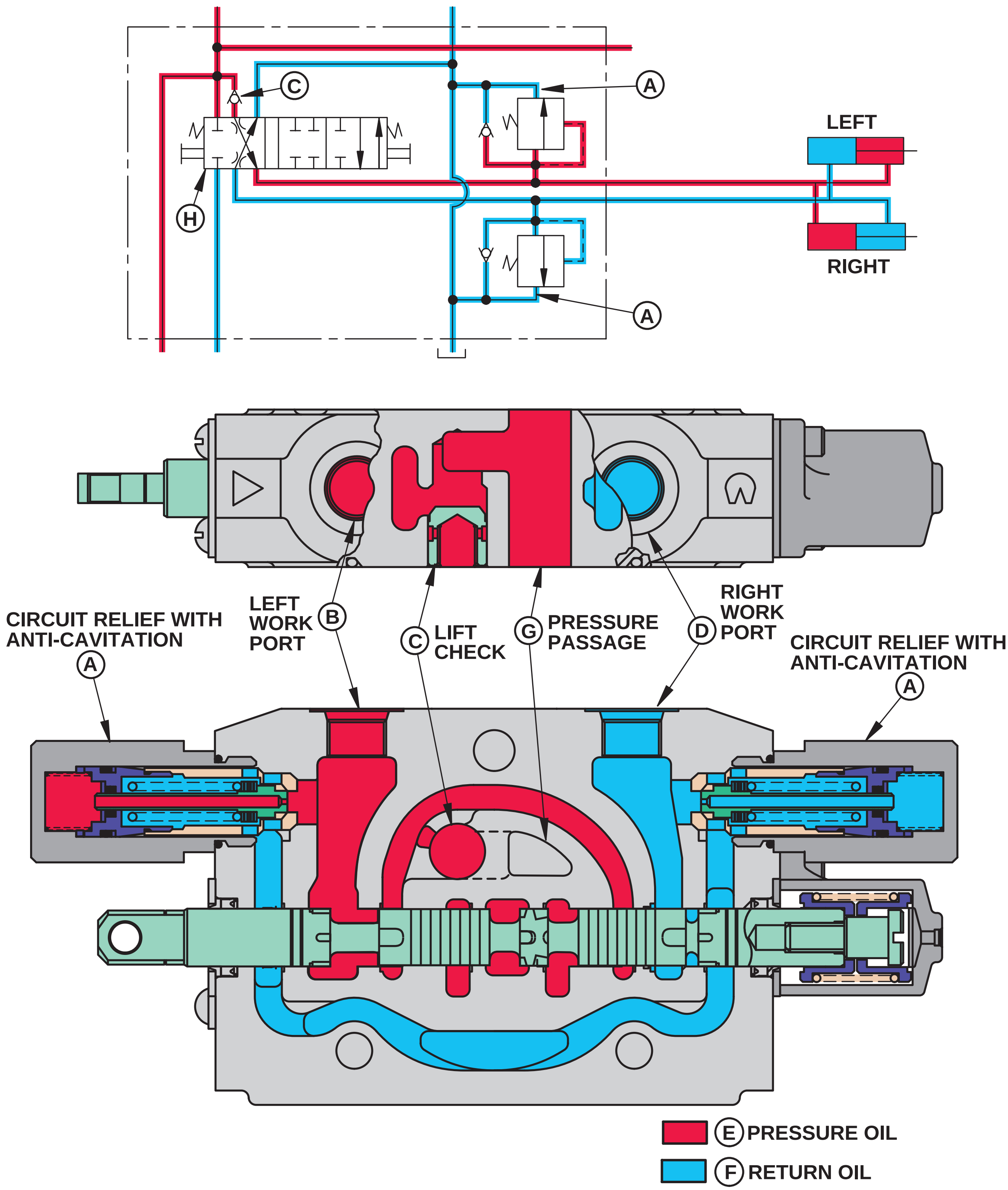
(Swing Section S.N. —802199)

A—Circuit Relief Valve with Anti-Cavitation
B—Right Work Port
C—Lift Check
D—Left Work Port
E—Pressure Oil
F—Return Oil
G—Backhoe Swing Valve—Left
H—Pressure Passage

The swing section is a three-position, four-way, open-center, spool-type valve. The valve contains two combination circuit relief and anti-cavitation valves.

During a left swing, oil flows to the lift check (C), into pressure passage, past the spool and out work port (D). Return oil from the cylinder flows into work port (B), past the spool, into the return passage.

Continued on next page TX,9025,BS398 –19–21JUL94–3/7



TXC8249AB CV

H **BACKHOE SWING VALVE - SWING LEFT**

(Swing Section S.N. 802200—)

Continued on next page

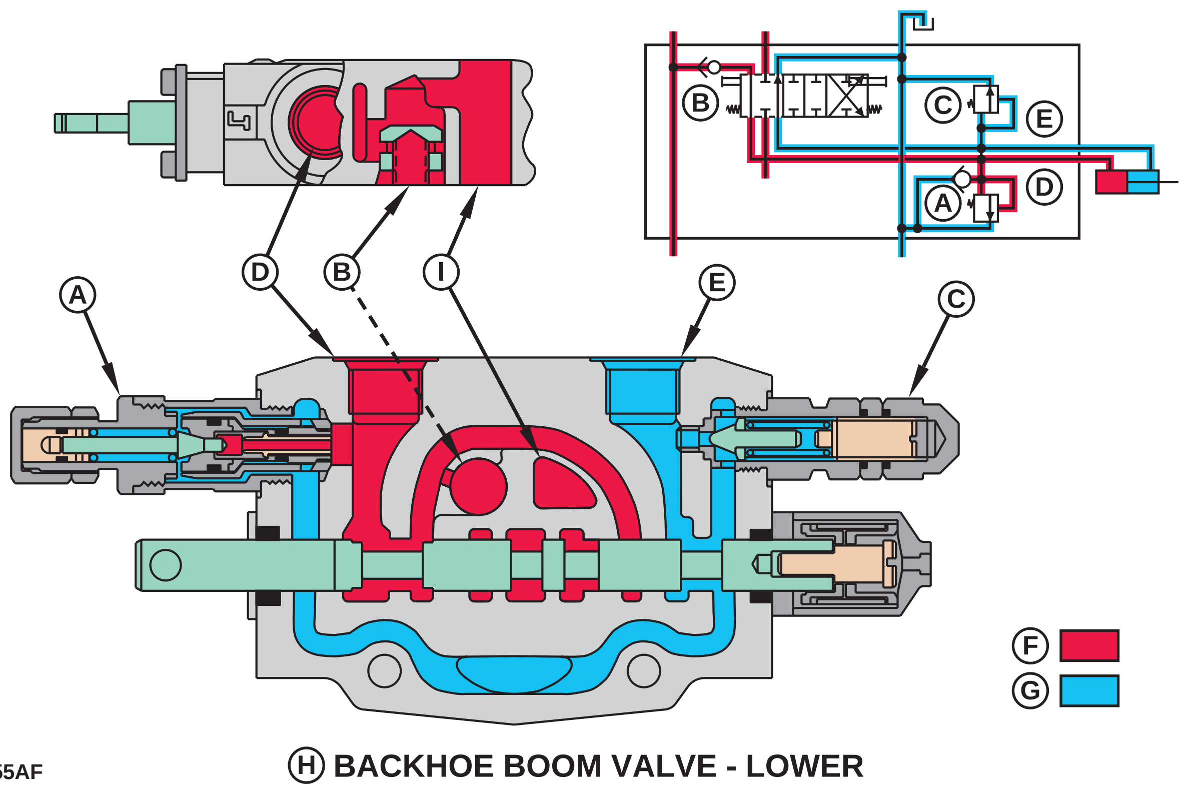
A—Circuit Relief Valve with Anti-Cavitation
B—Left Work Port
C—Lift Check
D—Right Work Port
E—Pressure Oil
F—Return Oil
G—Pressure Passage
H—Backhoe Swing Valve—Left

The swing section is a three-position, four-way, open-center, spool-type valve. The valve contains two combination circuit relief and anti-cavitation valves.

During a left swing, oil flows to the lift check (C), into pressure passage, past the spool and out work port (B). Return oil from the cylinder flows into work port (D), past the spool, into the return passage.

The 300D has a one way orifice fitting located in outlet ports (B) and (D) to regulate swing cycle time and protect system components.

TX,9025,BS398 –19–21JUL94–5/7



T7355AF –UN–26FEB99

A—Circuit Relief Valve with Anti-Cavitation
B—Lift Check
C—Circuit Relief
D—Work Port
E—Work Port
F—Pressure Oil
G—Return Oil
H—Backhoe Boom Valve—Lower
I—Functional Inlet

The boom section is a three-position, four-way, open-center, spool-type valve. The valve contains a circuit relief (C) and a pilot operated circuit relief with anti-cavitation valve (A).

NOTE: On later machines boom lower relief (A) is direct acting with anti-cavitation.

During boom lower operation, oil flows to the lift check (B), to the work port (D). Return oil from the cylinder flows into work port (E) past the spool, into the return passage.

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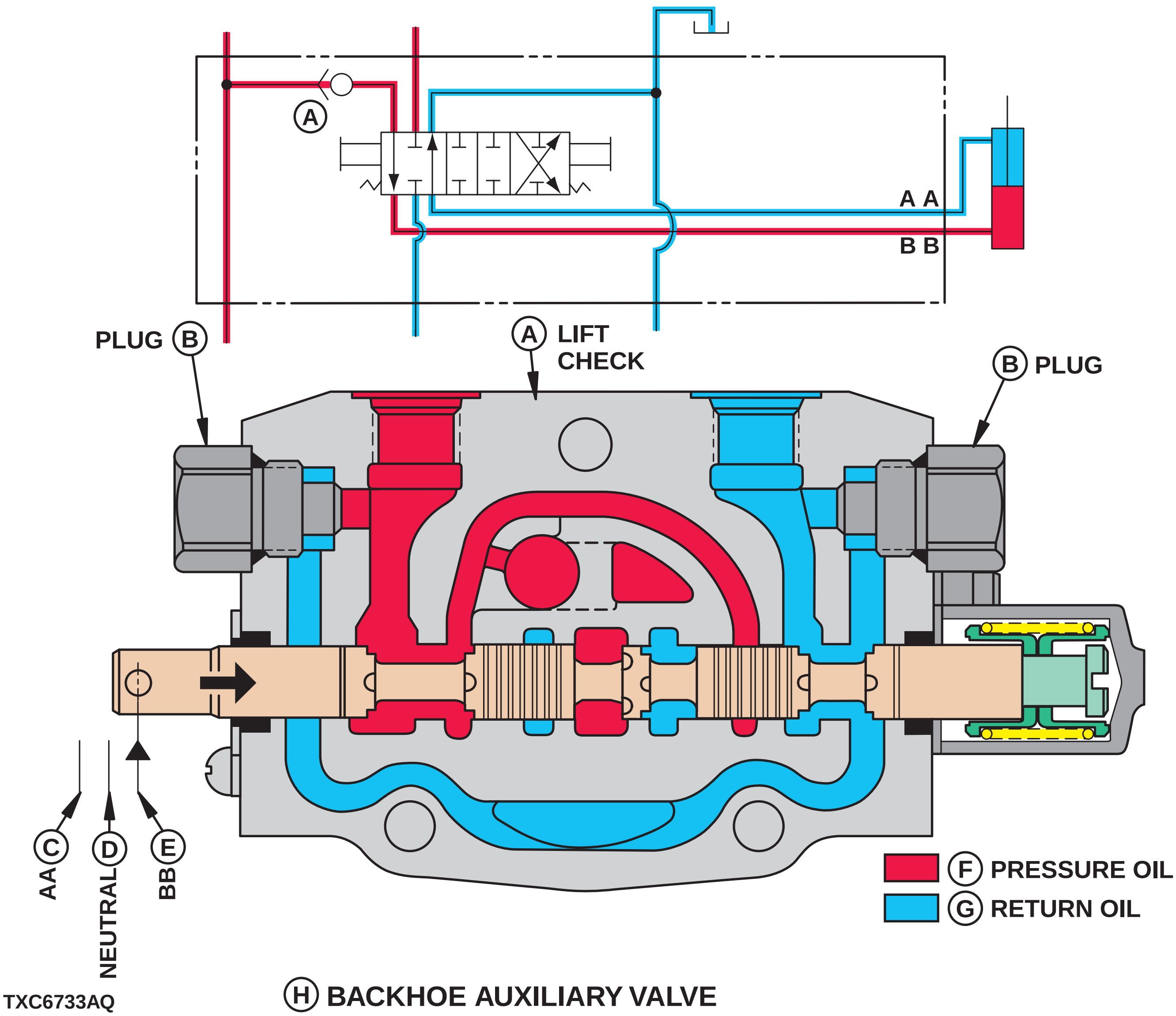
TX,9025,BS398 –19–21JUL94–6/7



T6733AQ –19–25FEB99

A—Lift Check	**C—"AA"**	**E—"BB"**	**G—Return Oil**
B—Plug (2 used)	**D—Neutral**	**F—Pressure Oil**	**H—Backhoe Auxiliary Valve**

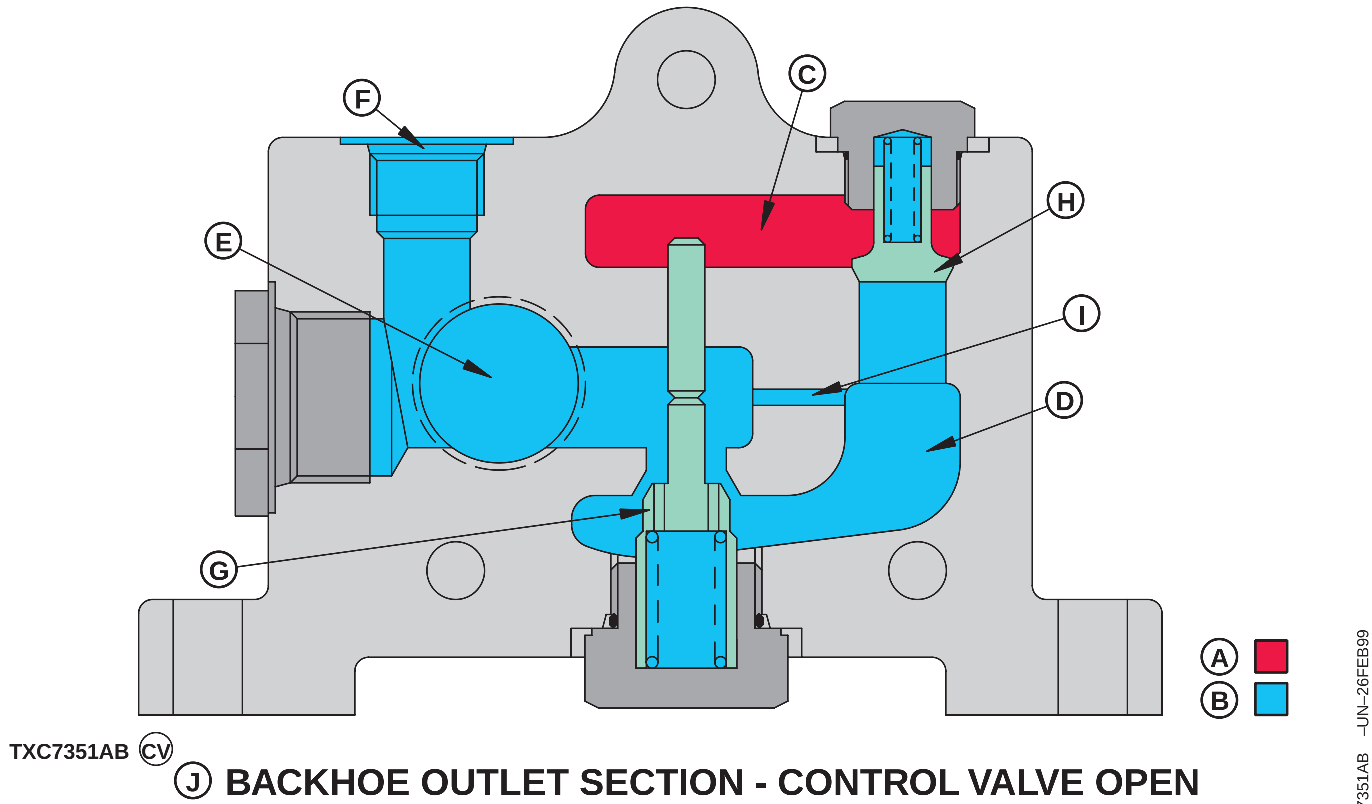
The backhoe auxiliary section is a three-position, four-way, spool-type valve. This valve is commonly used for an extendable dipperstick.

The auxiliary valve contains only a lift check (A). When the spool is moved to activate the functions, oil flows past the lift check (A), into the pressure passage to work port (BB).

Return oil from the cylinder flows into work port (AA) past the spool into return passage.

TX,9025,BS398 –19–21JUL94–7/7

Regenerative Outlet—HUSCO



A—Pressure Oil
B—Return Oil
C—Pressure Passage
D—Return from Cylinder
E—Return to Filter
F—Return from Stabilizer Valve
G—Control Valve Poppet
H—Anti-Cavitation Poppet
I—Orifice
J—Outlet Section—Control Valve Open

When one or more backhoe spools are moved from the neutral position, oil in pressure passage (C) increases to the pressure required to move the functions. This pressure acts to unseat poppet (G), allowing unrestricted flow of oil through cylinder return passage (D) to outlet (E).

When the operator is metering pump flow, and the parallel passage pressure is not enough to unseat the high flow poppet, the cylinder return oil pressure acts upon the area differential of the high flow poppet body diameter and seat diameter. When the pressure on this area exceeds the poppet spring force, the poppet opens allowing flow of cylinder return oil to outlet, while regulating cylinder return passage pressure.

When a valve spool is moved from neutral and external load on the cylinder causes the return pressure to exceed the pressure passage, the anti-cavitation valve opens, allowing pressure regulated cylinder return oil to supplement pump oil to the cylinder. The regenerative system is used to supplement oil flow to the backhoe cylinders to prevent cavitation when cylinder travel outruns pump delivery.

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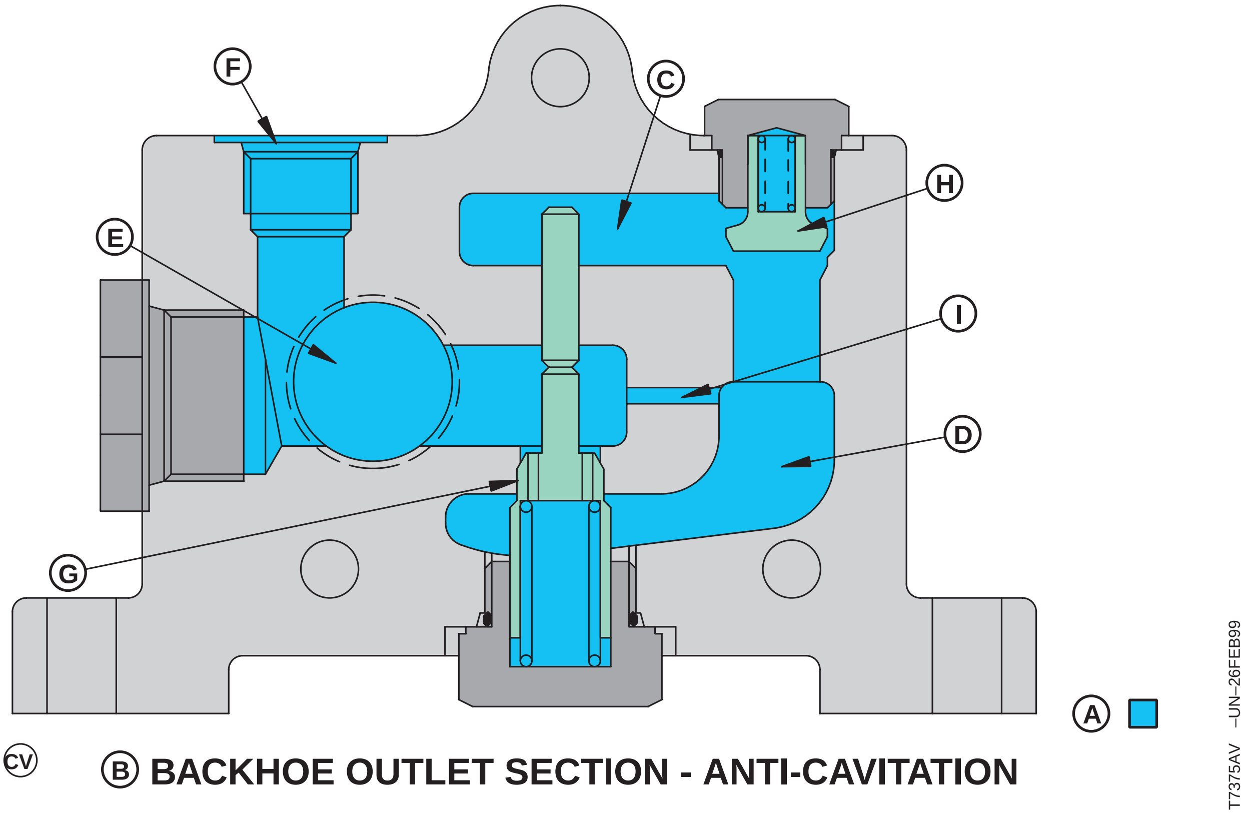


TXC7375AV CV

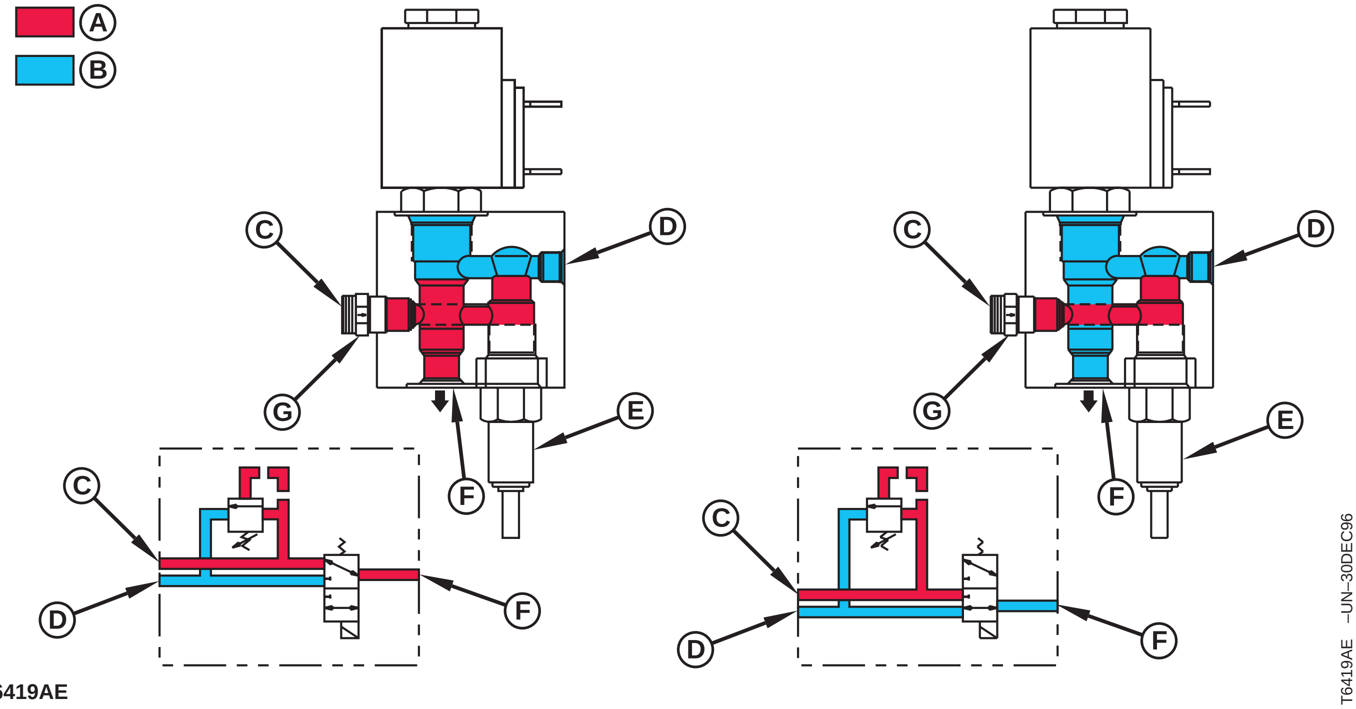
B BACKHOE OUTLET SECTION - ANTI-CAVITATION

A—Return Oil
B—Outlet Section—Anti-Cavitation
C—Pressure Passage
D—Return from Cylinders
E—Return to Filter
F—Return from Stabilizer
G—Control Valve Poppet
H—Anti-Cavitation Poppet
I—Orifice

When the backhoe valve spools are all in neutral, oil from the pump flows through the valve stack neutral passage to the outlet and filter. All the regenerative valves remain closed. When machine has all valves in neutral and is being driven over rough terrain, the circuit relief valves may be opening to protect components from pressure spikes. As oil is relieved on one side of the cylinder, oil must be supplied to the other side or the cylinder will cavitate. The orifice (I) allows oil to be pulled from the filter return side to be the make-up oil.

TX,902505,BR64 –19–21JUL94–2/2

Side Shift Locking Valve—315D



T6419AE

A—Pressure Oil
B—Return Oil (Pressure Free)
C—Inlet
D—Return
E—Relief Valve
F—Outlet
G—Check Valve

When the solenoid is not energized, spring pressure pushes the valve spool down, so oil flows to side shift locking pistons. The check valve (G) in the inlet port traps oil to maintain pressure on locking pistons.

When the solenoid is energized, the valve spool is pulled up against spring pressure, blocking inlet oil and releasing pressure on the side shift pistons to the reservoir.

The relief valve (E) is a direct acting relief valve. When pressure increases above the pressure setting, pressure overcomes spring force and seat is pushed away from the poppet. Oil flows through the seat to the reservoir.

T60,9025,C418 –19–07JAN93–1/1

System Operational Procedure

The procedure is designed so the mechanic can make a quick check of the hydraulic system using a minimum amount of diagnostic equipment. If you need additional information read the Theory of Operation in Group 9025-05.

A location will be required which is level, and has adequate space to operate unit.

The engine, and all other major components must be at operating temperature for some checks.

Locate system check needed in the left column and read completely, follow this sequence from left to right. Read each check completely before performing.

At the end of each check, if no problem is found (OK:), you will be instructed where to GO TO ( ) for next check. If problem, (NOT OK:) is indicated, you will be given repair required and Group location or CTM number. If verification is needed you will be given next best source of information after GO TO:

Group 10 (System Operational Checks)

Group 15 (System Diagnostic Checks)

Group 20 (Adjustments)

Group 25 (Tests)

CTM(Component Technical Manual)

T60,9025,C235 –19–09MAR93–1/1

Steering System Checks

– – –1/1

❶ **Steering System Operational Check**	1. Operate engine at approximately 1000 rpm. 2. Turn steering wheel from full left to full right and back several times. *LOOK: Front wheels must move smoothly in both directions.* *LOOK: When steering wheel is stopped the front wheels must stop moving.* *NOTE: Internal leakage or a sticking steering valve spool can cause the wheels to continue to move after the steering wheel has stopped.*	**OK:** Go to next check. **NOT OK:** Check Hydraulic Oil Level. **NOT OK:** Go to next check.

– – –1/1

❷ **Steering System Leakage Check**	*NOTE: Hydraulic oil must be at operating temperature for this test.* 1. Run engine at approximately 1000 rpm. 2. Turn steering wheel until wheels are in the maximum right turn position. 3. Continue turning steering wheel using approximately 11.3 N•m. (100 lb-in) force while counting steering wheel rpm. 4. Repeat leakage check turning steering wheel to the left. *LOOK: Steering wheel must not turn more than 5 rpm, left or right.* *NOTE: Use good judgement, excessive steering wheel rpm does not mean steering will be affected.*	**OK:** Go to next check. **NOT OK:** Cap off steering cylinder lines. Rerun check. **NOT OK:** Repair steering cylinder. **NOT OK:** Repair steering valve. Go to repair manual. – – –1/1

❸ **Backhoe Loader Steering Priority Operational Check**	1. 300D, operate engine at slow idle. 310D and 315D, operate engine at 1500 RPM. 2. Turn steering wheel full left to right and note effort needed to turn wheel. 3. Bottom a backhoe function and then turn steering wheel. Make a note of the time and effort now needed to turn wheel. 4. While holding steering wheel against axle stop, hold backhoe function over relief by bottoming cylinder. *FEEL: Effort to turn steering wheel must NOT decrease when operating steering wheel and backhoe function is bottomed.* *FEEL: It is normal for steering wheel to jerk as backhoe function is bottomed.*	**OK:** Go to next check. **NOT OK:** Steering effort decreases. Go to next check. **NOT OK:** No jerk in steering wheel. Go to group 9025-25, Priority Valve Test. – – –1/1

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2

Hydraulic System Checks

– – –1/1

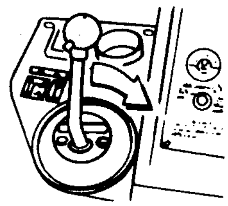
❶ Main Hydraulic Pump Performance Check

NOTE: If hydraulic oil is not at operating temperature, heat hydraulic oil until loader and backhoe cylinders feel warm to touch.

1. Put loader bucket flat on ground.

2. Run engine at approximately 1000 rpm.

3. Measure cycle time of loader raise to maximum height, including bucket leveling.



T7374CG –UN–04OCT90

LOOK: The maximum cycle time is 15 seconds.

NOTE: Take the average cycle time for at least 3 complete cycles. This cycle time will give a general indication of main hydraulic pump performance.

OK: Go to next check.

NOT OK: Go to group 9025-15, Slow Hydraulic Functions.

– – –1/1

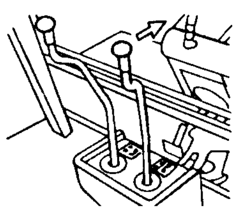
❷ Auxiliary Pump Performance Check

NOTE: Hydraulic oil should be at operating temperature.

Put backhoe in transport position.

Run engine at fast idle.

While holding loader boom raise function over relief, extend dipperstick from retracted position to fully extended and measure cycle time.



T7374CK –UN–04OCT90

NOTE: Take the average cycle time for at least 3 complete cycles. This cycle time will give a general indication of auxiliary pump performance.

Specification

300D—Cycle Time	15 sec.
310D/315D—Cycle Time	19 sec.

OK: Go to next check.

NOT OK: Go to next check.

NOT OK: Go to group 9025-25, Single Gauge Hydraulic System Relief Check.

– – –1/1

9025
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3

❸ Hydraulic Filter Check

If cycle times are slow remove and inspect hydraulic filter for aluminum or brass particles. If metal particles are present, remove and inspect pump.

LOOK: Inspect hydraulic filter bypass valve when filter canister is off.

NOTE: If bypass valve is held open by trapped foreign material, the filter restriction indicator switch will not close since pressure differential is not great enough between inlet and outlet of the filter.

OK: Go to group 9025-25, Main Pump Flow Test.

NOT OK: Remove and inspect pumps. Go to Repair manual.

– – –1/1

❹ Hydraulic Cylinder Cushion Check

1. Run engine at approximately 1000 rpm.
2. Activate the following functions and note sound and speed as cylinders near end of stroke.

   Backhoe swing left and right. Boom raise.

LISTEN: Must hear oil flowing through orifice as cylinder rod nears the end of stroke.

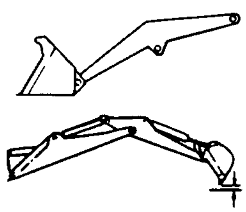
LOOK: Speed of cylinder rod must decrease near the end of stroke.

OK: Go to next check.

NOT OK: Remove cylinder and inspect cushion. Go to repair manual.

– – –1/1

❺ Backhoe And Loader Function Drift Checks



T7374CI –UN–04OCT90

1. Cylinder must be warm to touch.
2. Put backhoe bucket at a 45° angle to ground. Lower boom until bucket cutting edge is 50 mm (2 in.) off ground.
3. Position loader bucket same distance off ground as backhoe bucket.
4. Run engine at slow idle and observe buckets cutting edges.

LOOK: If bucket cutting edges touch the ground within 1 minute, excessive leakage is indicated in the bucket or boom cylinders or control valve.

OK: Go to next check.

NOT OK: Go to group 9025-25, Do Cylinder Drift Test.

– – –1/1

❻ **Hydraulic Control Valve Lift Check Test**	*NOTE: Gresen valve sections must be tested in both directions because each work port has its own lift check. Husco valve sections have one lift check for both work ports, and therefore only need to be checked in one direction.* 1. Raise loader until bucket is 1 m (3 ft) off the ground with the bucket level. 2. Position backhoe at maximum reach with bottom of bucket level with ground, 1 m (3 ft) off the ground. 3. Stop the engine. 4. Activate each function one at a time. a. loader boom raise b. loader bucket rollback c. backhoe boom up d. dipperstick extend e. backhoe bucket curl 5. Start engine, raise front of unit with bucket tipped 45° down. Put backhoe so each function is loaded opposite to Step B trying to raise rear of unit. Stop engine. 6. Activate each function one at a time. a. loader boom lower b. loader bucket dump c. backhoe boom down d. dipperstick retracted e. backhoe bucket dump *LOOK: These functions must not move when the control lever is activated.* *FEEL: It is normal for first function operated to "jerk" because of stored hydraulic pressure in system but must not continue to move.*	**OK:** Go to next check. **NOT OK:** Remove and inspect relief valves checks. Go to repair manual.

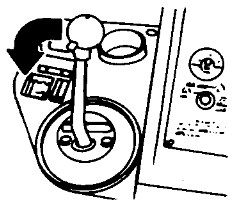
– – –1/1

Loader Control Valve Checks

– – –1/1

❶ Loader Boom Float Check

1. Put loader at maximum height position with bucket dumped.
2. Run engine at approximately 1500 rpm.
3. Move the loader control lever forward into boom float detent position, and at the same time into bucket rollback detent position. Remove hand from control lever.



LOOK: Loader control lever must remain in the boom float detent position.

T7390AA –UN–12OCT90

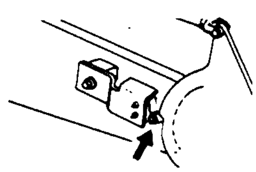
OK: Go to next check.

NOT OK: If it jumps out of detent, inspect detent spring and balls, repair as necessary. Go to repair manual.

– – –1/1

❷ Return-To-Dig Check (If Equipped)

LOOK: Loader control lever must disengage from the bucket roll-back detent when the bucket is level.



LOOK: The notch on cam must allow switch to "click" deactivating the circuit when bucket is in dig position.

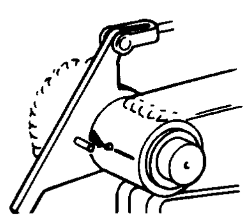
T6171AT –UN–09DEC88

OK: Go to next step in this check.

NOT OK: If bucket rollback does not stay in detent. With bucket to full dump position, compress switch roller. If a click is heard, adjust switch till it is activated on cam.

NOT OK: Inspect fuse and wiring. Go to group 9015-10, Return-To-Dig Solenoid Check.

NOT OK: If bucket rollback releases before bucket is level, adjust linkage. Go to Repair manual, Adjust Loader Bucket Level Indicator And Return-To-Dig.



LOOK: When the bucket is at ground level, bucket must be level and the bucket indicator pointer must be aligned with mark on the boom pivot.

NOTE: When return-to-dig is used with loader boom in full up position, the bucket leveling linkage will move the bucket control valve out of return-to-dig position before bucket is actually level.

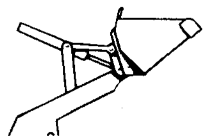
T7374CH –UN–04OCT90

OK: Go to next check.

NOT OK: Adjust linkage as necessary. Go to Repair manual.

– – –1/1

❸ Bucket Leveling Mechanism Check



T7374CJ –UN–05OCT90

1. Put bucket in the rollback position with the boom near ground level.
2. Raise the loader and at the same time hold the control lever in the bucket rollback position.
3. Observe bucket and loader control lever as the loader raises.

LOOK/FEEL: Loader control lever must move into the bucket dump position and the bucket dump function must slowly activate. When the loader control lever moves to activate the bucket dump function, the bucket position must remain stationary the remainder of the loader boom raise cycle.

LOOK: The bucket side cutting edge must be level through the loader raise cycle.

NOTE: The loader bucket leveling feature functions during the boom raise cycle only. When bucket is lowered, the operator must level the bucket unless unit is equipped with optional return-to-dig.

OK: System Operational Checkout Complete.

NOT OK: Adjust linkage on the Loader Control Valve. Go to Repair manual.

NOT OK: Operators complaint was not identified. Go to next check.

– – –1/1

❹ Operator Complaint Was Not Identified

If you completed the Operational Checkout and did not isolate a malfunction, the problem may be intermittent.

Try to duplicate the condition of the malfunction identified by operator.

NOT OK: Go to group 9025-15, Diagnose Hydraulic System Malfunctions.

– – –1/1

Use These Seven Basic Steps To Diagnose And Test The Hydraulic System

1. KNOW THE SYSTEM. Study the information on the system and component operation given in the front part of Section 9025. Learn the basic principles of hydraulics by reading the Fundamentals of Service manual on hydraulics.

2. ASK THE OPERATOR. The operator can tell you how the machine performed when it started to fail; what was unusual about it. Try to find out if any do-it-yourself service has been performed. Ask about how the machine was operated and when it was serviced.

3. OPERATE THE MACHINE. Are the gauge indications normal? How is the performance? Do the controls feel normal? Do you smell or hear anything unusual.

4. INSPECT THE MACHINE. Use your eyes, ears, and nose to find signs of trouble. Check the level and condition of the hydraulic oil. Is the oil dirty; are the filters plugged? Are the hydraulic oil lines hotter than normal; covered with dirt; paint peeled off from heat; dented or collapsed; show signs of leakage?

5. LIST THE POSSIBLE CAUSES. What unusual conditions did you find when the machine was inspected? What are the possible causes? Are there other possibilities? Remember, one failure often leads to another.

NOTE: You can use the Hydraulic System Pretest Check Sheet to list the possible causes.

6. REACH A CONCLUSION. Decide which possible causes are the most likely and the easiest to verify. Use the Diagnose Malfunctions section of Group 9025 to help you.

7. TEST YOUR CONCLUSION. Do individual component tests to verify your conclusion before you repair or replace any components.

9025
15
1

T60,9025,1013 –19–07JAN93–1/1

Make A Pretest Inspection And An Operation Check Of The Machine

1. Write the pretest inspection and operation check information on the Hydraulic System Pretest Check Sheet (Form M-5107 is available from Deere and Company, Distribution Service Center).

2. Go to Diagnose Malfunctions to determine the cause of the customer complaint. If necessary, do tests of individual component to verify the malfunction.

3. Repair or replace the faulty component.

T60,9025,725 –19–21JUL94–1/1

Hydraulic System Pretest

1. Clean machine as needed.

2. Perform all inspections.

3. Correct any problems.

4. Perform Operational Check.

- Hydraulic Oil
  - Correct Oil
  - Correct Level
  - Bubbles In Oil
  - Other
- Control Valve(s)
  - Bent Linkage
  - Proper Linkage Adjustment
- Filters: Hydraulic, Reverser
  - Ruptured
  - Plugged
  - Metal Particles
  - Packing Particles
  - New Filter Installed
- Oil Cooler
  - Clean Of Dirt And Debris
  - Fan Or Shroud Damaged
  - Belt Tension And Condition
  - Leaking Lines Or Cooler
- Hydraulic System
  - Bent Or Damaged Lines
  - External Oil Lines
  - Cylinder Rod(s) Bent
  - Frequently Blown Seals And Fittings

T60,9025,J236 –19–21JUL94–1/1

Diagnose Hydraulic System Malfunction

Symptom	Problem	Solution
Reservoir Drains When Changing Hydraulic Filter	Return tube vent hole in reservoir may be plugged.	Remove, inspect and repair. See repair manual.
No Loader Or Steering Hydraulics	Low oil level	Add oil to correct level.
	Failed pump drive shaft	Replace. See repair manual.
	Reservoir suction screen plugged. (300D, 310D, S.N. —802199) (315D, All Machines)	Remove and clean screen in hydraulic reservoir.
	Pump failed	Remove hydraulic filter and inspect. If filter contains excessive amounts of brass or aluminum, remove, and inspect pump. See repair manual.
	Obstruction in oil lines or valves.	Inspect for pinched lines or stuck valve spools. See repair manual.
No Loader Hydraulics (Steering OK)	Failed system relief valve	Remove and repair. Do Main Hydraulics System Relief Test. See Group 9025-25.
	Main pump failure	Remove hydraulic filter and inspect. If filter contains excessive amounts of brass or aluminum, remove, and inspect pump. See repair manual.
No Steering Hydraulics (Loader Hydraulics OK)	Malfunction of priority valve	Do Priority Valve Test. See Group 9025-25.
	Failed steering pressure regulating valve	Test Steering Pump Relief pressure. See Group 9025-25.

Continued on next page

TX,902515,BR89 –19–21JUL94–1/8

Symptom	Problem	Solution
Slow Hydraulic Functions	Low oil level	Add oil to correct level.
	Engine rpm too low	Increase rpm or check engine speed. See Group 9010-20.
	Reservoir suction screen restricted (300D, 310D, S.N. —802199) (315D, All Machines)	Remove and clean screen in hydraulic reservoir.
	Hydraulic oil aerated.	Incorrect oil, drain and refill. Suction hose has air leak. Inspect and tighten. See Hydraulic And Reverser Oil .
	Hose or line leakage	Inspect and tighten fittings.
	System relief valve stuck or leaking	Remove, clean and test. See repair manual. Also see Group 9025-25.
	Low pump flow	Do System Operational Checkout 9025-10 to determine which pump has low flow. Test pump flow. See Group 9025-25.
Slow Steering Hydraulics	Malfunction of priority valve	Test operation of priority valve.
	Steering valve leakage	Test Steering System for leakage. See Group 9025-25.
	Low auxiliary pump flow	Test Auxiliary Pump flow. See Group 9025-25.
	Steering cylinder leakage	Do Steering Cylinder Leakage Test. See Group 9025-25.

Continued on next page TX,902515,BR89 –19–21JUL94–2/8

Symptom	Problem	Solution
Loader Or Backhoe Operates Slowly In One Function	Control lever and linkage out of adjustment.	Inspect lever and linkage. Adjust to get equal valve spool travel in each direction. See Group 9025-20.
	Relief valve or plug leakage in control valve.	Remove, inspect and repair sealing rings on relief valve or plug. See repair manual.
	Hydraulic cylinder leakage	Do Cylinder Leakage Test. See Group 9025-25.
	Bent or restricted line	Inspect and repair.
	Hydraulic control valve not operating properly	Do Valve Leakage Test. See Group 9025-25. Remove, inspect and repair. See repair manual.
No Loader Or Backhoe Power In One Function	Control lever and linkage out of adjustment	Inspect lever and linkage. Adjust to get equal valve spool travel in each direction.
	Relief valve or plug leakage in control valve	Remove inspect and repair sealing rings on relief valve or plug. See Disassemble And Assemble Loader Control Valve (SN —802199) or Disassemble And Assemble Loader Control Valve (SN 802200—) in repair manual.
	Bent or restricted line	Inspect and repair.
	Hydraulic control valve not operating properly	Do Valve Leakage Test. See Group 9025-25. Remove, inspect and repair. See repair manual.

Continued on next page

TX,902515,BR89 –19–21JUL94–3/8

Symptom	Problem	Solution
Slow Loader And Backhoe Hydraulics (Low Pump Output)	Hydraulic oil aerated	Incorrect oil, drain and refill. Suction hose has air leak. Inspect and tighten. Hydraulic And Reverser Oil
	Incorrect system relief valve setting	Test System Relief Pressure at loader valve. See Group 9025-25. Replace or repair. See repair manual.
	Hydraulic pump suction screen restricted (300D, 310D, S.N. —802199) (315D, All Machines)	Remove and clean screen in hydraulic reservoir.
	Worn main pump	Do System Operational Checkout 9025-10 to check pump flow. Remove hydraulic filter and inspect. If filter contains excessive amounts of brass or aluminum, remove and inspect pump. In no metal particles, Test Main Pump Flow. See Group 9025-25. Also see repair manual.
Low Hydraulic Power (Low Hydraulic Pressure)	Low oil level (aeration of oil)	Add oil to correct level.
	Hydraulic oil aerated	Incorrect oil, drain and refill. Suction hose has air leak. Inspect and tighten. Hydraulic And Reverser Oil
	Hydraulic pump suction screen restricted (300D, 310D, S.N. —802199) (315D, All Machines)	Remove and clean screen in hydraulic reservoir.
	Incorrect system relief valve setting	Test System Relief Valve Pressure. See Group 9025-25. Repair or replace. Also see repair manual.
	Leakage within work circuit	Feel components for heat. Do Cylinder Drift Test. See Group 9025-25.
	Excessive leakage in hydraulic system	Do Leakage Test. See Group 9025-25.

Continued on next page

Symptom	Problem	Solution
Hydraulic Function Makes "Chattering" Noise	Low oil level	Add oil to correct level.
	Hydraulic oil aerated	Incorrect oil, drain and refill. Suction hose has air leak. Inspect and tighten. Hydraulic And Reverser Oil
	Hydraulic pump suction screen restricted (300D, 310D, S.N. —802199) (315D, All Machines)	Remove and clean screen in hydraulic reservoir
	Malfunctioning or wrong circuit relief valve installed in backhoe valve.	Inspect, remove and repair. See repair manual.
Functions Drift	Oil leaking past cylinders or control valve.	Do System Operational Checkout drift test to pinpoint cylinder or valve leakage. See Group 9025-10 .
Control Valve Sticks Or Works Hard	Control valve lever linkage binding	Inspect and adjust linkage. See Group 9025-20. Inspect valve spools. See repair manual.
	Hydraulic system overheating	Test component leakage. See Group 9025-25.
	Broken return spring	Remove and replace. See repair manual.
	Contamination in control valve	Remove and clean. See repair manual. Locate source of contamination. Repair and clean oil in system.
	Scored valve bore or bent spool	See repair manual.

Continued on next page
TX,902515,BR89 –19–21JUL94–5/8

Symptom	Problem	Solution
Hydraulic Oil Overheats	Excessive load	Reduce load.
	Operator holding hydraulic system over relief	Return levers to neutral when not in use.
	Using low viscosity oil in hot weather	Use recommended oil. See Operator's Manual.
	Incorrect system relief valve pressure	Test System Relief Valve. See Group 9025-25.
	Excessive leakage in the hydraulic system	Do Leakage Test. See Group 9025-25.
Foaming Oil	Oil level too low or too high	Check oil level. Adjust to full mark on dipstick.
	Incorrect type of oil	Drain and replace. See repair manual.
	Pump suction screen restricted (aeration of inlet oil) (300D, 310D, S.N. —802199) (315D, All Machines)	Inspect and clean screen in hydraulic reservoir.
	Air leak on suction side of pump	Locate and repair leak. See repair manual.
Hydraulic Pump Leaking	Cap screws that hold pump sections together are loose	Tighten to specification. See repair manual.
	Worn shaft seal	Replace seal. See repair manual.
	Broken diaphragm "V" seal or backup gasket	Replace seal or gasket. See repair manual.
	Hydraulic oil overheating	Determine cause of overheating, see above.

Continued on next page

TX,902515,BR89 –19–21JUL94–6/8

Symptom	Problem	Solution
Excessive Pump Noise	Low oil level	Add oil to correct level.
	Hydraulic filter by-pass valve chattering	Replace filter. Inspect, clean, and repair. See repair manual.
	Loose pump drive coupling	Inspect and tighten coupling. See repair manual.
	Pump suction screen restricted (aeration of inlet oil) (300D, 310D, S.N. —802199) (315D, All Machines)	Inspect and clean screen in hydraulic reservoir.
	Oil lines in contact with operators station (Failed rubber cab or canopy isolators)	Inspect, repair or replace.
	Pump attaching hardware loose	Retighten to specification. See repair manual.
	Leakage in hydraulic circuit	Do Leakage Tests. See Group 9025-25.
	Misalignment between pump and pump support	Align correctly. See repair manual.
Steering Valve Does Not Return To Neutral	Broken centering springs	Inspect steering valve. See repair manual.
	Damaged steering valve spool	Inspect steering valve. See repair manual.

Continued on next page

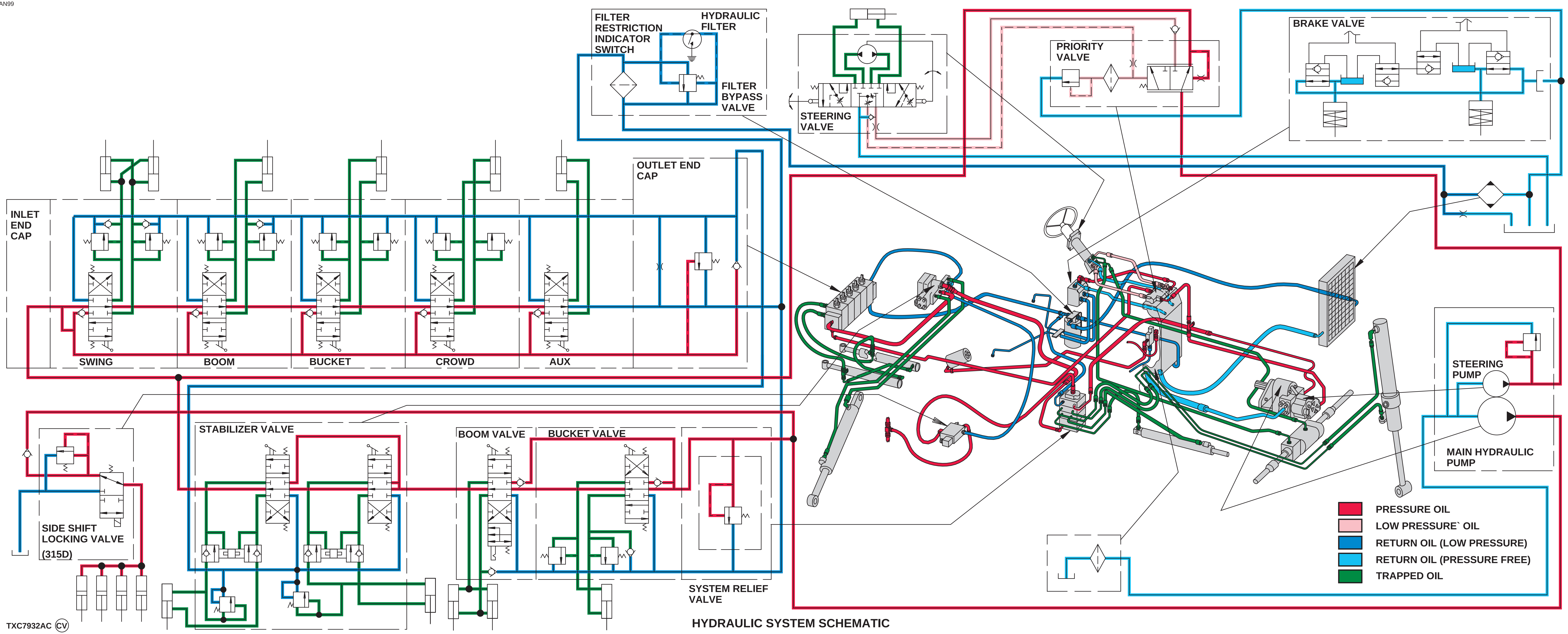
TX,902515,BR89 –19–21JUL94–7/8

Symptom	Problem	Solution
No Response When Steering Wheel Is Turned	Low oil level	Check reservoir oil level.
	External leakage	Check for leakage. Repair as necessary.
	Malfunctioning of priority valve	Do Priority Valve Test. See Group 9025-25.
	Steering valve leakage	Do Steering System Leakage Test. See Group 9025-25.
	Steering cylinder leakage	Test steering valve or cylinder for leakage. See Group 9025-25.
	Worn steering pump	Do System Operational Check, Steering Pump Performance. See 9025-10.
Unit Turns In Opposite Direction	Steering cylinder lines not connected properly	Connect steering cylinder lines to opposite ports.
Violent Oscillation Of Steering Wheel	Misalignment of steering valve geroter	Put steering valve geroter in alignment. See repair manual.
Unit Turns When Steering Valve Is In Neutral	Steering valve leakage	Do Steering System Leakage Test. See Group 9025-25.
Steering Wheel Kickback	Check valve leakage	Inspect check valve in "P" port of steering valve. See repair manual.

TX,902515,BR89 –19–21JUL94–8/8

Hydraulic System Component Location And System Schematic (300D, 310D, S.N. —802199) (315D, All Machines)

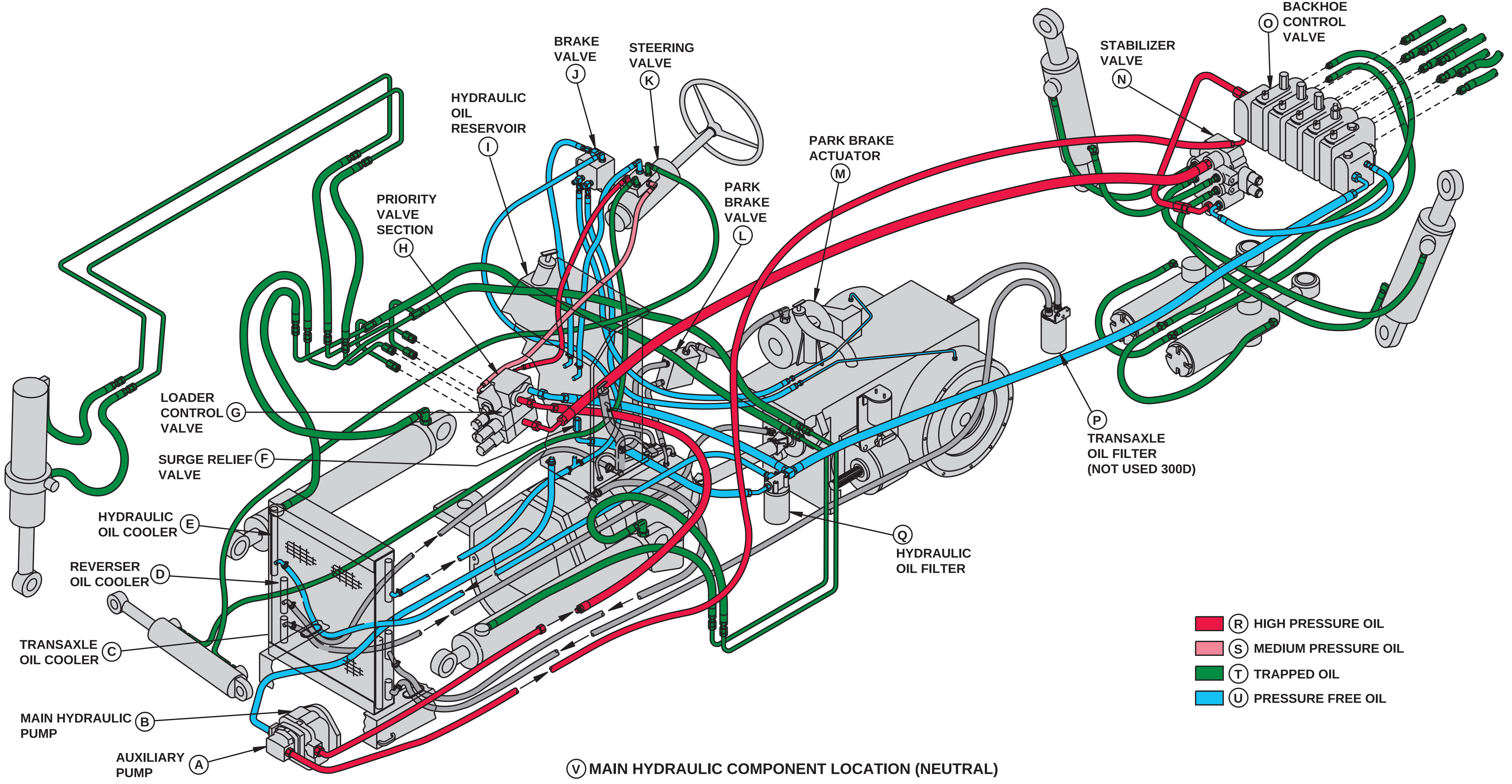
T7932AC –19–01JAN99



HYDRAULIC SYSTEM SCHEMATIC

Hydraulic System Component Location (300D, 310D, S.N. 802200—)

T8246AB –19–01JAN99



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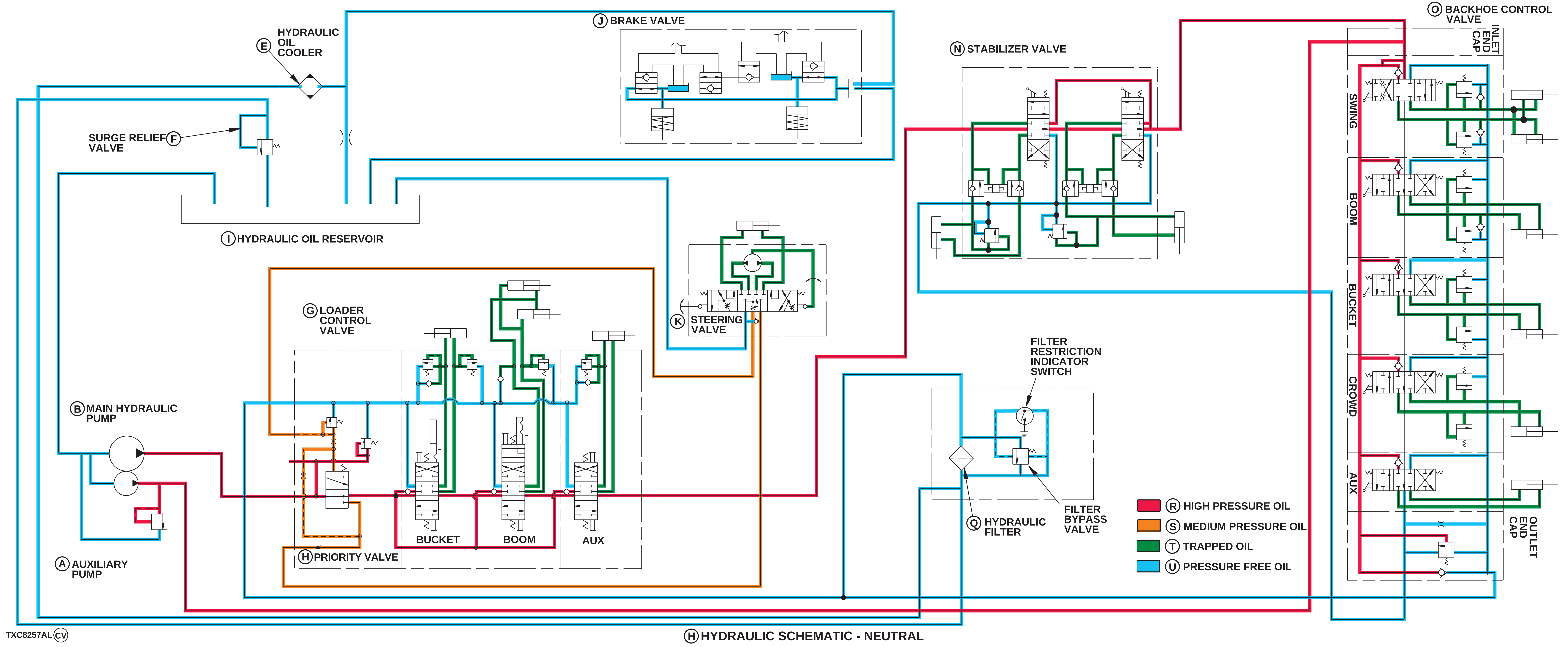
TX,9025,BS403 –19–21JUL94–1/1

Hydraulic System Schematic (300D, 310D, S.N. 802200—)

T8257AL –19–01JAN99



H HYDRAULIC SCHEMATIC - NEUTRAL

TX,9025,BS402 –19–21JUL94–1/1

Loader Bucket Level Indicator And Return-To-Dig Switch Adjustment

SPECIFICATIONS	
Guard and Stop-to-Bell Crank Gap	1 mm (0.04 in.)
Top of Bell Crank Pin-to-Bottom of Actuator Tang Gap	130 mm (5.1 in.)

NOTE: Later machines have new design guard/stop (B). Adjustment is the same for all machines.

1. Position bucket flat on ground. Turn engine off.

2. Hold bucket lever in roll-back position.

Continued on next page TX,9025,BS404 –19–21JUL94–1/3

3. Measure gap (A) between guard and stop (B) and bell crank (C). Gap should be 1 mm (0.04 in.).

Specification

Guard and Stop-to-Bell Crank—
Gap .... 1 mm (0.04 in.)

4. If gap is not to specification, adjust rod jam nut and yoke (D) to obtain correct gap. Allow bucket lever to return to neutral position.

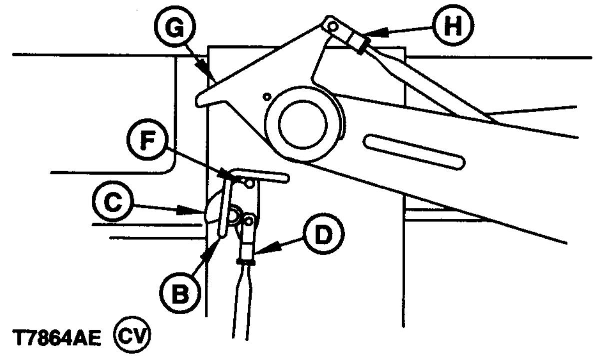
5. Measure gap (E) between top of bell crank pin (F) and bottom of actuator tang (G). Gap should be 130 mm (5.1 in.).

Specification

Top of Bell Crank Pin-to-Bottom
of Actuator Tang—Gap .... 130 mm (5.1 in.)

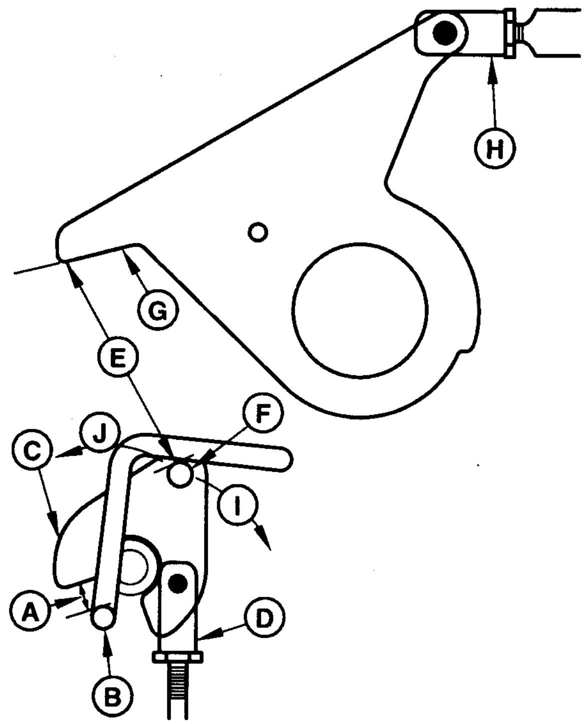
6. If gap is not to specification, adjust sensor tube jam nut and yoke (H) to correct length.

A—1 mm (0.04 in.) gap
B—Guard/Stop
C—Bell Crank-Neutral Position
D—Rod Jam Nut and Yoke
E—130 mm (5.1 in.) gap
F—Bell Crank Pin
G—Actuator Tang
H—Sensor Tube Jam Nut and Yoke
I—Bucket Dump
J—Bucket Rollback



T7864AE CV

T7864AE –19–15OCT92



T7864AD CV

T7864AD –19–15OCT92

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TX,9025,BS404 –19–21JUL94–2/3

7. Loosen cap screw (A) and move return-to-dig switch so roller (B) is touching area (C) on the cam.

NOTE: On later machines switch will have a plastic roller on actuator arm. Omit steps 8 and 9 on these machines. Older machines have a metal roller on actuator arm.

8. Move switch toward cam until a "click" is heard.

9. Move switch away from cam until a "click" is heard.

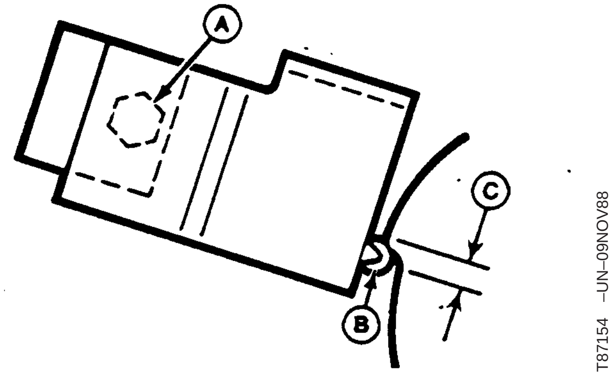
10. Tighten cap screw without moving switch.

11. Remove pin from sensor tube yoke.

12. While watching clearance between cam and switch, turn command pointer back and forth to be sure cam does not hit switch bracket.

NOTE: Be sure that switch arm and roller does not bottom on switch housing.

13. If cam touches bracket or switch arm, and roller bottoms on switch housing, reposition switch. (See steps 7—10.)



A—Cap Screw
B—Roller
C—Area on Cam

9025
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3

TX,9025,BS404 –19–21JUL94–3/3

Loader Control Valve Linkage Adjustment

SPECIFICATIONS	
Right Side of Knob-to-Tape Distance	250 mm (10 in.)
Front of Loader Knob-to-Tape Distance	130 mm (5.25 in.)

NOTE: Levers must be positioned correctly to allow full travel and proper operation of loader valves. Cab and other components have been removed in some photographs for clarity.

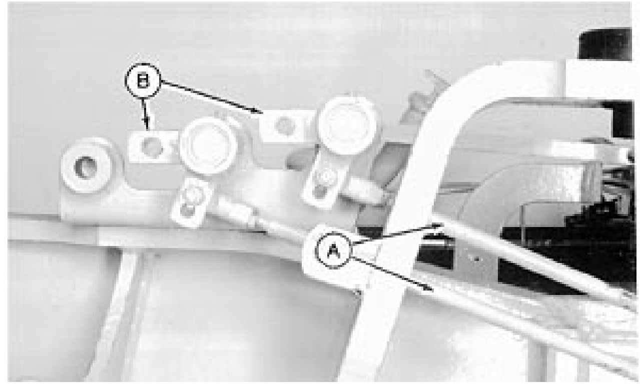
1. Put loader control valve spools in neutral position.

Continued on next page

TX,9025,BS405 –19–21JUL94–1/5

2. Adjust rods (A) so tabs (B) on bell crank are horizontal.

3. Put a piece of masking tape from right front to right rear ROPS posts on inside surface at loader knob height.



T7407AN –UN–30OCT90

(S.N. —802199) Shown

TX,9025,BS405 –19–21JUL94–2/5

4. Distance (C) from right side of knob to tape should be 250 mm (10 in.).

Specification

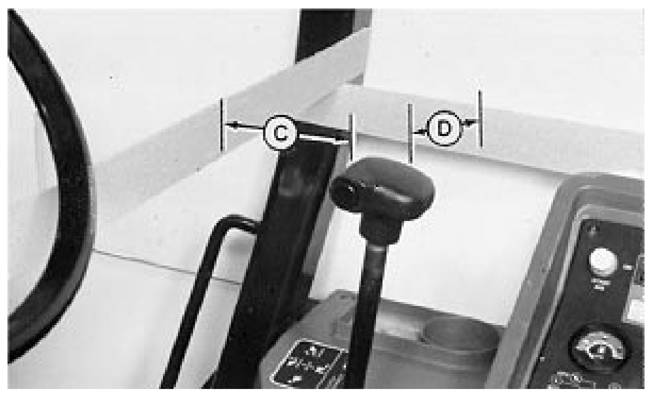
Right Side of Knob-to-Tape—
Distance.. 250 mm (10 in.)

5. Put a piece of masking tape from left front to right front ROPS posts on inside surface at loader knob height.

6. Distance (D) from front of loader knob to tape should be 130 mm (5.25 in.).

Specification

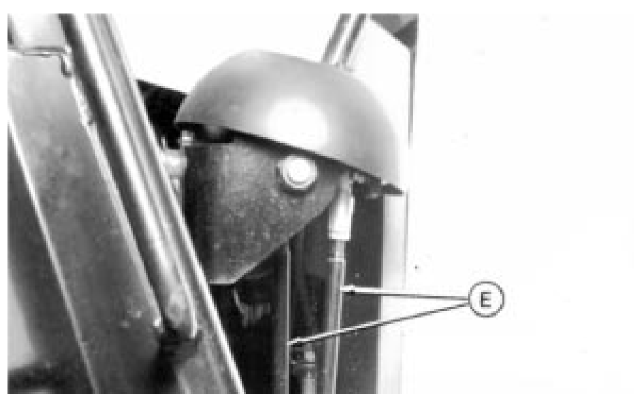
Front of Loader Knob-to-Tape—
Distance... 130 mm (5.25 in.)



T7407AO –UN–14NOV90

TX,9025,BS405 –19–21JUL94–3/5

7. The distances in steps 4 and 6 can be obtained by adjusting rods (E).



T7407AP –UN–30OCT90

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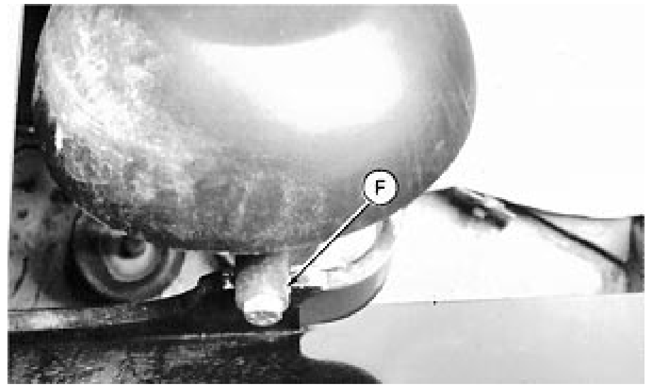
TX,9025,BS405 –19–21JUL94–4/5

NOTE: Pivot (F) must remain in slot when holding the loader lever in the roll-back position.



TX,9025,BS405 –19–21JUL94–5/5

Backhoe Valve Linkage Adjustment

SPECIFICATIONS	
300D, 310D (S.N. —801199) Center of Clevis Pin Hole-to-Center of Ball Joint Rod Length	292 mm (11.4 in.)
300D, 310D (S.N. 802200—) Center of Clevis Pin Hole-to-Center of Ball Joint Rod Length	338 mm (13.3 in.)
315D Center of Clevis Pin Hole-to-Center of Ball Joint Rod Length	193 mm (7.6 in.)
300D, 310D, (S.N. —802199) Center of Clevis Pin Hole-to-Center of Ball Joint Rod Length (With Extendible Dipperstick)	208 mm (8.2 in.)
300D, 310D, (S.N. 802200—) Center of Clevis Pin Hole-to-Center of Ball Joint Rod Length (With Extendible Dipperstick)	248 mm (9.75 in.)
315D Center of Clevis Pin Hole-to-Center of Ball Joint Rod Length (With Extendible Dipperstick)	105 mm (4.1 in.)
Edge of Knobs-to-Tape Distance	140 mm (5.5 in.)
Knob-to-Knob Distance	250 mm (10.25 in.)

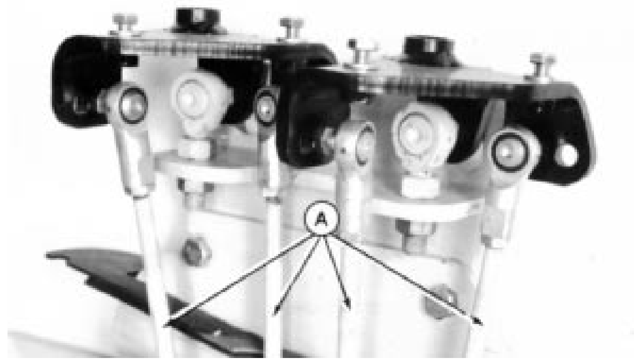
NOTE: Levers must be positioned correctly to allow full travel and proper operation of backhoe valves. Cab and other components have been removed in some photographs for clarity.

1. Put backhoe valve spools in neutral position.

Continued on next page

TX,9025,BS406 –19–21JUL94–1/3

2. Measure rods (A) from center of clevis pin hole to center of ball joint.



T7407AI –UN–30OCT90

Specification

300D, 310D (S.N. —801199) Center of Clevis Pin Hole-to-Center of Ball Joint—Rod Length........ 292 mm (11.4 in.)
300D, 310D (S.N. 802200—) Center of Clevis Pin Hole-to-Center of Ball Joint—Rod Length........ 338 mm (13.3 in.)
315D Center of Clevis Pin Hole-to-Center of Ball Joint—Rod Length........ 193 mm (7.6 in.)

3. On machines with extendable dipperstick, auxiliary valve linkage adjustment is also required. Measure rod from center of clevis pin hole to center of ball joint.

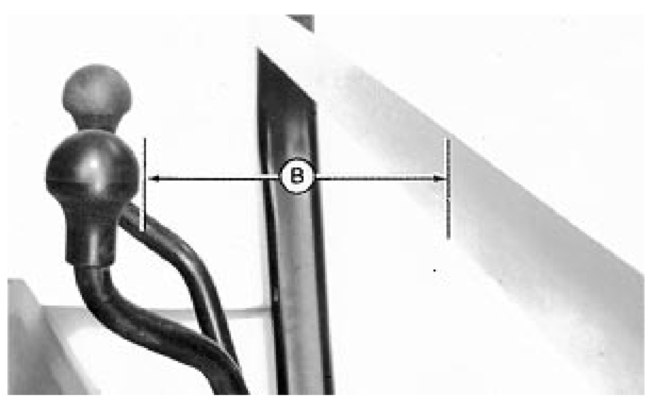
Specification

300D, 310D, (S.N. —802199) Center of Clevis Pin Hole-to-Center of Ball Joint—Rod Length (With Extendible Dipperstick)........ 208 mm (8.2 in.)
300D, 310D, (S.N. 802200—) Center of Clevis Pin Hole-to-Center of Ball Joint—Rod Length (With Extendible Dipperstick)........ 248 mm (9.75 in.)
315D Center of Clevis Pin Hole-to-Center of Ball Joint—Rod Length (With Extendible Dipperstick)........ 105 mm (4.1 in.)

4. Put a piece of masking tape across the rear ROPS posts on inside surface at backhoe lever knob height.

TX,9025,BS406 –19–21JUL94–2/3

5. Measure from edge of knobs to tape. Distance (B) should be 140 mm (5.5 in.).



T7407AJ –UN–30OCT90

Specification

Edge of Knobs-to-Tape—Distance........ 140 mm (5.5 in.)

Knobs should be 250 mm (10.25 in.) apart.

Specification

Knob-to-Knob—Distance........ 250 mm (10.25 in.)

TX,9025,BS406 –19–21JUL94–3/3

Stabilizer Valve Linkage Adjustment

SPECIFICATIONS	
Edge of Right Stabilizer Knob-to-Tape Distance	260 mm (10.25 in.)
Edge of Left Stabilizer Knob-to-Tape Distance	295 mm (11.6 in.)

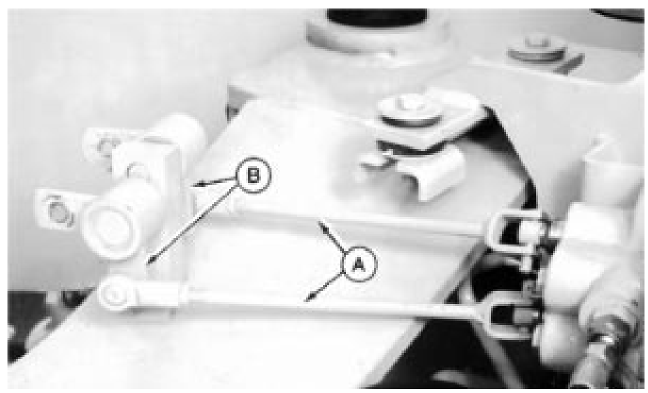
NOTE: Levers must be positioned correctly to allow full travel and proper operation of stabilizer valves. Cab and other components have been removed in some photographs for clarity.

1. Put stabilizer valve spools in neutral position.

TX,9025,BS407 –19–21JUL94–1/3

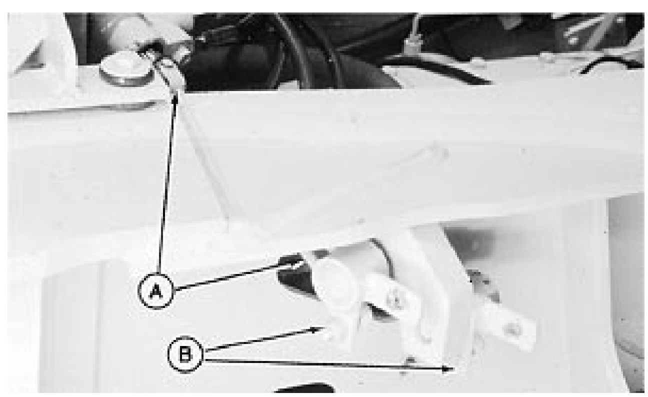
2. Adjust linkage rods (A) so that tabs (B) are vertical.

3. Put masking tape across left and right rear ROPS posts on inside surface at stabilizer knob height.



T7407AK –UN–30OCT90

(S.N. —802199)



T8187AL –UN–20FEB94

(S.N. 802200—)

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TX,9025,BS407 –19–21JUL94–2/3

9025
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7

4. Measure the distance (C) from edge of right stabilizer knob to tape. It should be 260 mm (10.25 in.).

Specification

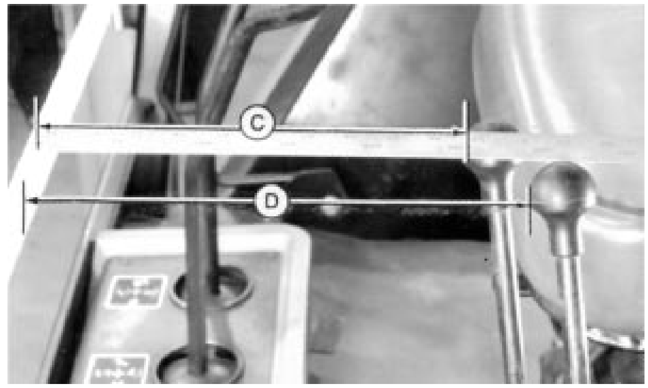
Edge of Right Stabilizer
Knob-to-Tape—Distance .... 260 mm (10.25 in.)

Measure the distance (D) from edge of left stabilizer knob to tape. It should be 295 mm (11.6 in.).

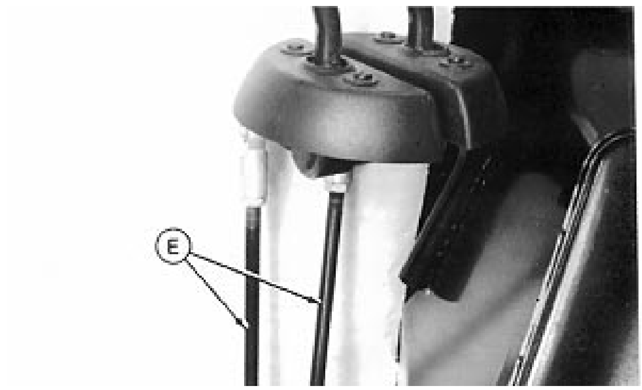
Specification

Edge of Left Stabilizer
Knob-to-Tape—Distance .... 295 mm (11.6 in.)

Adjust rods (E) as necessary.



T7407AL –UN–30OCT90

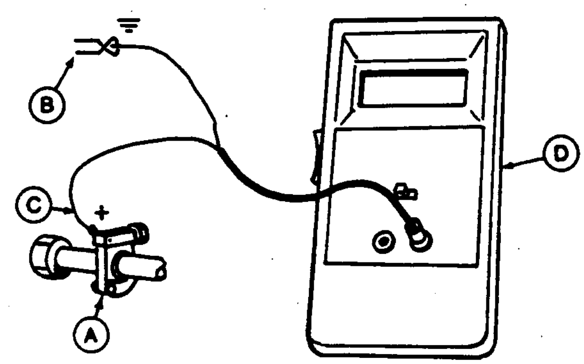


T7407AM –UN–30OCT90

TX,9025,BS407 –19–21JUL94–3/3

JT05801 Clamp-On Electronic Tachometer Installation

SERVICE EQUIPMENT AND TOOLS
Tachometer
A—Clamp-on Transducer. Remove paint with emery cloth and connect to a straight section of injection line within 100 mm (4 in.) of pump. Finger tighten only. DO NOT overtighten.
B—Black Clip (-). Connect to main frame.
C—Red Clip (+). Connect to transducer.
D—Tachometer Readout. Install cable.

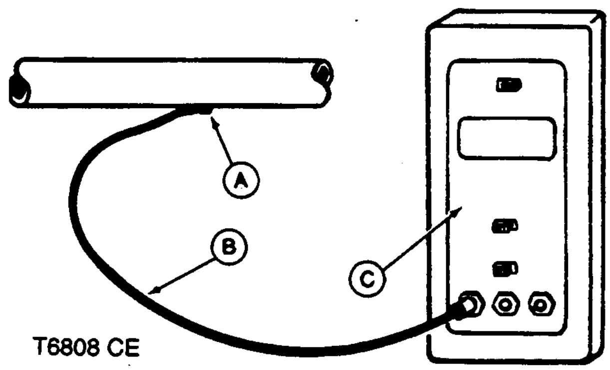


T6813AG –UN–28FEB89

10T,9010,K182 –19–10AUG95–1/1

JT05800 Digital Thermometer Installation

SERVICE EQUIPMENT AND TOOLS
Digital Thermometer
A—Temperature Probe Fasten to a bare metal line using a tie band. Wrap with shop towel.
B—Cable
C—Digital Thermometer



T6808CE –UN–28FEB89

902525,AA4 –19–28FEB95–1/1

Hydraulic Oil Warm-Up Procedure

1. Put FNR lever in neutral and engage park brake.

2. Run engine at fast idle.

3. Raise loader boom to full height, then hold lever and stall hydraulics. This forces the hydraulic oil over the loader relief valve causing oil to heat up. Hold the lever over relief for one minute, then cycle function to reduce localized over-heating in control valve and to equalize temperature in circuits being tested. Repeat cycle until oil, after cycling, is at test specifications.

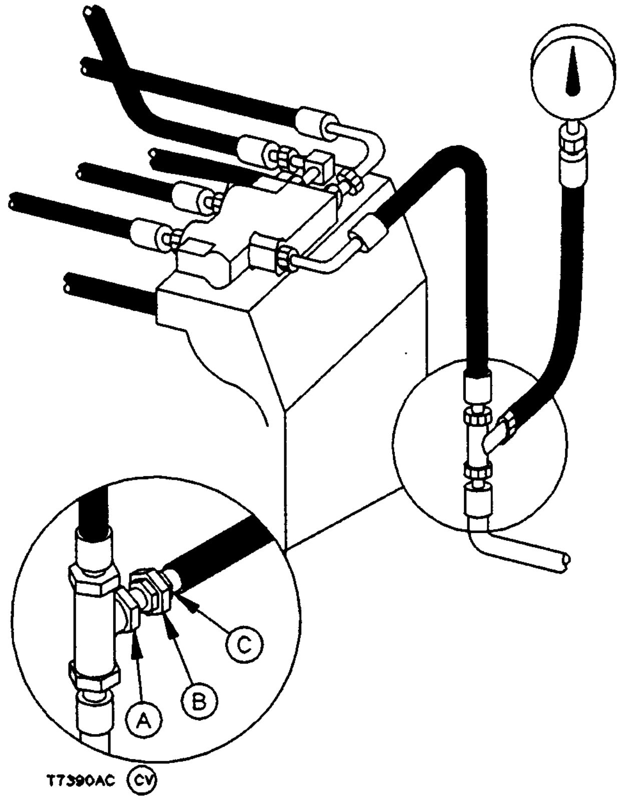
T60,9025,1061 –19–09MAR93–1/1

System Relief Test (300D, 310D S.N. —802199) (315D, All Machines)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F) (cylinder hot to touch)
Engine Speed	Fast idle
Priority Valve Relief Valve Pressure Setting	16 890—18 250 kPa (169—182 bar) (2450—2650 psi)
Main Hydraulic System Relief Valve Pressure Setting	17 925—19 650 kPa (179—197 bar) (2600—2850 psi)
Steering Pump Relief Valve Pressure Setting	20 500—23 800 kPa (205—238 bar) (2975—3450 psi)
Steering Pump Relief Valve Pressure Setting	20 500—23 800 kPa (205—238 bar) (2975—3450 psi)

ESSENTIAL TOOLS
A—T05688 (1-1/10 12 M x -8F ORFS) Adapter
B—T03103 (7/16-20 M x 1-1/16-12F 37°) Adapter
T01608 (2-1/16-20F x 1/8) Nipple Quick Coupler

SERVICE EQUIPMENT AND TOOLS
Gauge 0—35 000 kPa (0—350 bar) (0—5000 psi)
Digital Thermometer



T7390AC –19–17OCT90

9025
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2

1. Operate all hydraulic control valves to relieve pressure in the hydraulic system.

2. Remove left engine side shield. Make test connection at tee provided in steering pump to priority valve line.

3. Warm oil to specifications.

Specification
Oil—Temperature .... 65 ± 5°C (150 ± 10°F) (cylinder hot to touch)

See Hydraulic Oil Warm-up in Group 9025-25.

4. Run engine at high idle.

Specification
Engine—Speed .... Fast idle

Turn steering wheel to full turn against steering stop and hold against stop. Make record of priority valve pressure on gauge.

Continued on next page

TX,9025,BS409 –19–21JUL94–1/2

Specification

Priority Valve—Relief Valve Pressure Setting .... 16 890—18 250 kPa (169—182 bar) (2450—2650 psi)

(See Priority Valve Test in this section if adjustment is required.)

5. Activate and hold backhoe boom raise over relief. Make a record of main hydraulic system relief setting on gauge.

Specification

Main Hydraulic System—Relief Valve Pressure Setting .... 17 925—19 650 kPa (179—197 bar) (2600—2850 psi)

(See System Relief Test (300D, 310D S.N. —802199) (315D, All Machines) and System Relief Test (300D, 310D S.N. 802200—) in this group if adjustment is required.)

6. Test steering pump relief setting.

- 310D, 315D
  – Activate and hold backhoe boom raise and loader boom raise over relief. Record steering pump relief setting on gauge.

Specification

Steering Pump—Relief Valve Pressure Setting .... 20 500—23 800 kPa (205—238 bar) (2975—3450 psi)

- 300D
  – Remove steering pump inlet line to priority valve. Cap valve and connect gauge to line. Run machine at fast idle and observe steering pump relief setting on gauge.

Specification

Steering Pump—Relief Valve Pressure Setting .... 20 500—23 800 kPa (205—238 bar) (2975—3450 psi)

  – Steering relief cartridge is not adjustable. Replace if necessary.

System Relief Test (300D, 310D S.N. 802200—)

SPECIFICATIONS	
Engine Speed	Fast idle
Oil Temperature	65 ± 5°C (150 ± 10°F) (cylinder hot to touch)
System Relief Valve Setting Pressure	17 925—19 650 kPa (179—197 bar) (2600—2850 psi)

ESSENTIAL TOOLS
JT03111 (9/16 -18 M ORB x 7/16 -20 M JIC) Connector

SERVICE EQUIPMENT AND TOOLS
D—Gauge 0—35 000 kPa (0—350 bar) (0—5000 psi)
Digital Thermometer

1. Operate all hydraulic control valves to relieve pressure in the hydraulic system.

Continued on next page

TX,9025,BS410 –19–21JUL94–1/2

2. Make test connection at priority valve gauge port (A).

3. Install temperature probe in reservoir. Warm oil to specifications.

Specification

Engine—Speed	Fast idle
Oil—Temperature	65 ± 5°C (150 ± 10°F) (cylinder hot to touch)

See Hydraulic Oil Warm-up in Group 9025-25.

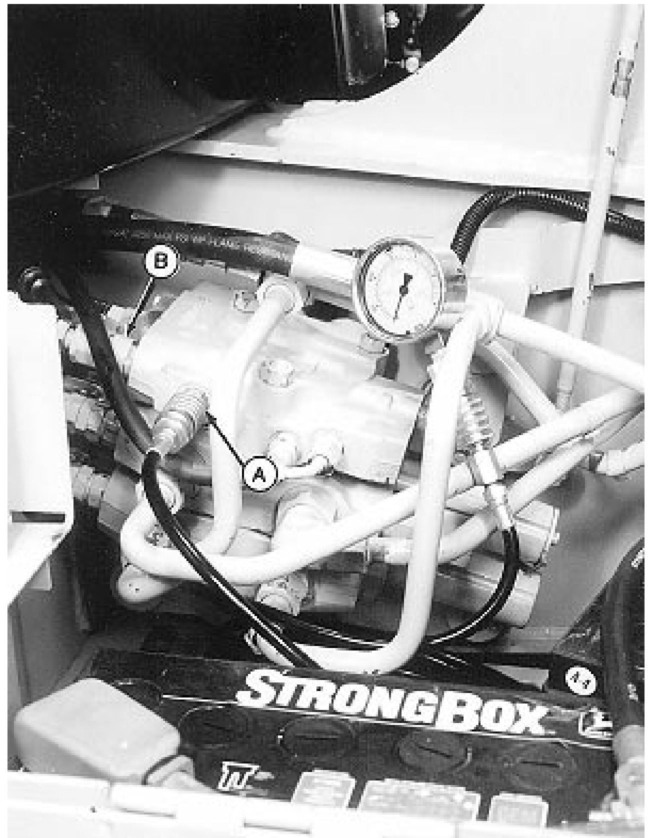
4. Activate and hold loader boom raise over relief. Record main hydraulic system relief setting from gauge.

Specification

System Relief Valve Setting—Pressure	17 925—19 650 kPa (179—197 bar) (2600—2850 psi)

NOTE: System relief is screw adjustable. Remove relief end cap and adjust to specification. Turn clockwise to increase pressure.

5. Adjust or replace system relief (B) as required.



T8258AD –UN–02JUN94

TX,9025,BS410 –19–21JUL94–2/2

Main Pump Flow Test

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	2000 ± 10 rpm
Oil Pressure	13 700 ± 70 kPa (137 ± 0.7 bar) (2000 ± 10 psi)
300D New Main Pump Minimum Flow	64 L/min (17 gpm)
300D Used Main Pump Minimum Flow	55 L/min (14.5 gpm)
315D New Main Pump Minimum Flow	91 L/min (24 gpm)
315D Used Main Pump Minimum Flow	76 L/min (20 gpm)
310D (S.N. —802199) New Main Pump Minimum Flow	91 L/min (24 gpm)
310D (S.N. —802199) Used Main Pump Minimum Flow	76 L/min (20 gpm)
310D (S.N. 802200—) New Main Pump Minimum Flow	87 L/min (23 gpm)
310D (S.N. 802200—) Used Main Pump Minimum Flow	72 L/min (19 gpm)

ESSENTIAL TOOLS
(Parker HLO-S) 16 M x 16 M ORFS[a]
JT05691 (1-5/16-12 M37° x -16 F ORFS) Adapter[a] (2 used)
[a]These ORFS fittings should be ordered through normal service parts channels.

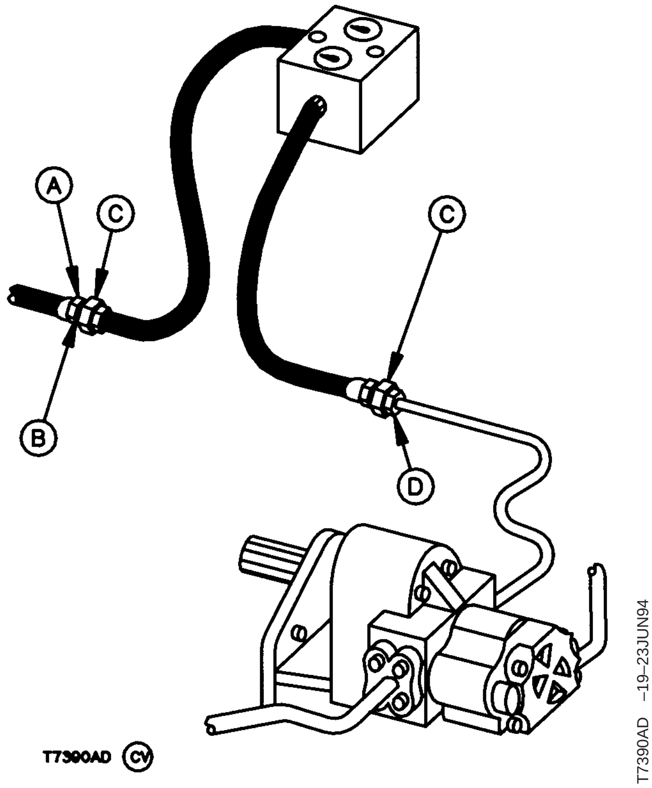
SERVICE EQUIPMENT AND TOOLS
Flowmeter
Electronic Tachometer
Digital Thermometer

1. Make test connections. Install electronic tachometer, and digital thermometer probe in reservoir.(See procedure in this group.)

IMPORTANT: Flowmeter must be open to prevent damage to hydraulic pump.

2. Open flowmeter.

3. Put FNR lever in neutral and engage park brake.



A—16 F ORFS (on hose)
B—HLO-S (Parker), 16 M x 16 M ORFS
C—Adapter (2 used)
D—16 M ORFS (on pipe)

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Continued on next page
TX,9025,BS411 –19–22JUL94–1/2

4. Heat hydraulic oil to test specifications.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

5. Adjust engine speed to test specifications.

Specification

Engine—Speed .... 2000 ± 10 rpm

Slowly close loading valve to read test pressure on flowmeter.

6. Record the flow rate.

Specification

Oil—Pressure .... 13 700 ± 70 kPa (137 ± 0.7 bar)
(2000 ± 10 psi)
300D New Main Pump—Minimum
Flow .... 64 L/min (17 gpm)
300D Used Main Pump—
Minimum Flow .... 55 L/min (14.5 gpm)
315D New Main Pump—Minimum
Flow .... 91 L/min (24 gpm)
315D Used Main Pump—
Minimum Flow .... 76 L/min (20 gpm)
310D (S.N. —802199) New Main
Pump—Minimum Flow .... 91 L/min (24 gpm)
310D (S.N. —802199) Used Main
Pump—Minimum Flow .... 76 L/min (20 gpm)
310D (S.N. 802200—) New Main
Pump—Minimum Flow .... 87 L/min (23 gpm)
310D (S.N. 802200—) Used
Main Pump—Minimum Flow .... 72 L/min (19 gpm)

TX,9025,BS411 –19–22JUL94–2/2

Priority Relief Valve Pressure Test (300D, 310D S.N. —802199) (315D, All Machines)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	Fast idle
Relief Setting Pressure	16 890—18 250 kPa (169—182 bar) (2450—2650 psi)

ESSENTIAL TOOLS
A—JT05688 (1-1/16 M 37° x -8F ORFS) Adapter
B—JT03103 (7/16-20 M 37° x 1-1/16 F 37°) Adapter
JT01608 (7/16-20 F 37° x 1/8) Nipple Quick Coupler

SERVICE EQUIPMENT AND TOOLS
Gauge 0—20 000 kPa (0—200 bar) (0—3000 psi)
Digital Thermometer

1. Remove left engine side shield. Make test connection at tee fitting provided in steering pump to priority valve line. Install digital thermometer temperature probe in reservoir.

2. Put FNR lever in neutral and engage park brake.

3. Warm oil to specifications.

Specification
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

4. Run engine at specified speed, turn steering wheel to stop and hold against stop.

Specification
Engine—Speed .... Fast idle

Record pressure on gauge.

Specification
Relief Setting—Pressure .... 16 890—18 250 kPa (169—182 bar) (2450—2650 psi)

Continued on next page

TX,9025,BS412 –19–21JUL94–1/2

5. Adjust or replace relief valve (D) in priority valve as necessary.

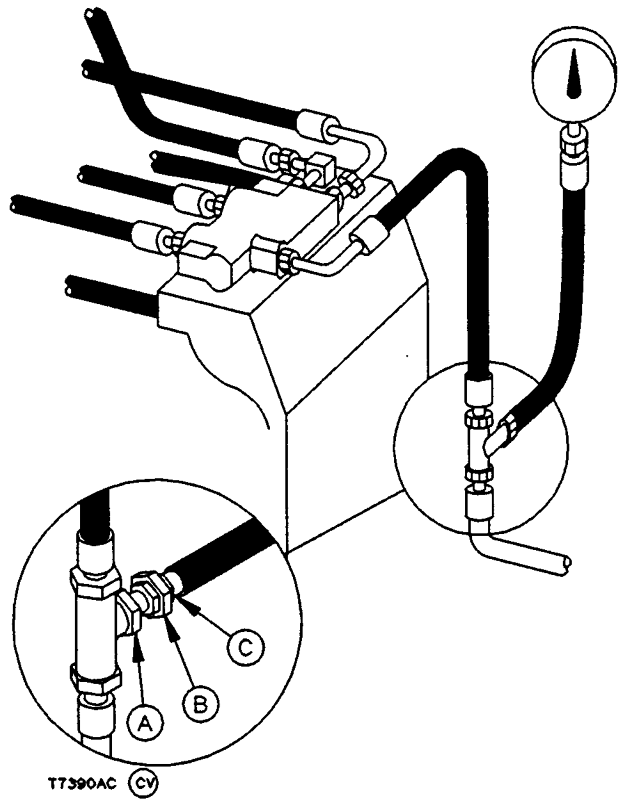
6. Adjustment procedure:

- Stop engine.
- Lower all equipment to ground and operate steering valve to release pressure in the hydraulic system.
- Disconnect tube from connector (F).
- Remove connector (F).

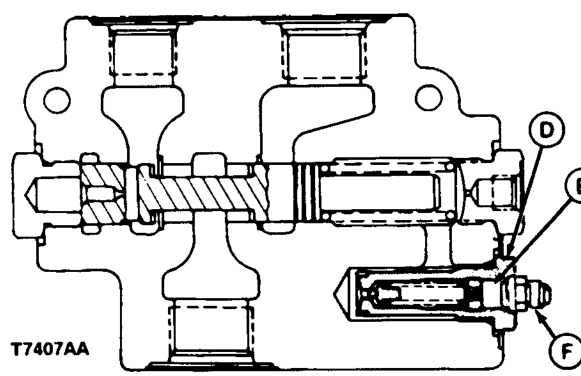
IMPORTANT: The steering system priority relief valve pressure adjustment is very sensitive. Turn adjustment screw (E) a maximum of 1/8 turn. Test again and adjust if necessary.

7. Turn adjustment screw (E) 1/8 turn clockwise to increase the pressure setting or 1/8 turn counterclockwise to decrease pressure setting. Install connector (H) and connect tube. Recheck pressure setting using steps 3, 4 and 5 as necessary.

8. If relief valve (D) cannot be adjusted, replace. See repair manual.



T7390AC –19–17OCT90



T7407AA –UN–30OCT90

A—Adapter
B—Adapter
C—Nipple
D—Relief Valve
E—Adjustment Screw
F—Connector

TX,9025,BS412 –19–21JUL94–2/2

Priority Relief Valve Pressure Test (300D, 310D S.N. 802200—)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	Fast idle
Priority Relief Valve Relief Pressure Setting	15 500—16 900 kPa (155—169 bar) (2250—2450 psi)
1/8 Turn of Adjustment Screw Changes Pressure	50-75 psi

ESSENTIAL TOOLS
38H1031 (-8 ORFS) Swivel Run Tee

SERVICE EQUIPMENT AND TOOLS
Gauge 0—20 000 kPa (0—200 bar) (0—3000 psi)
Digital Thermometer

Continued on next page

TX,9025,BS413 –19–21JUL94–1/3

1. Install test tee and gauge (A) at pressure inlet to steering valve.

2. Install digital thermometer temperature probe in reservoir.

3. Put FNR lever in neutral and engage park brake.

4. Warm oil to specifications.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

5. Run engine at specified speed, turn steering wheel to stop and hold against stop.

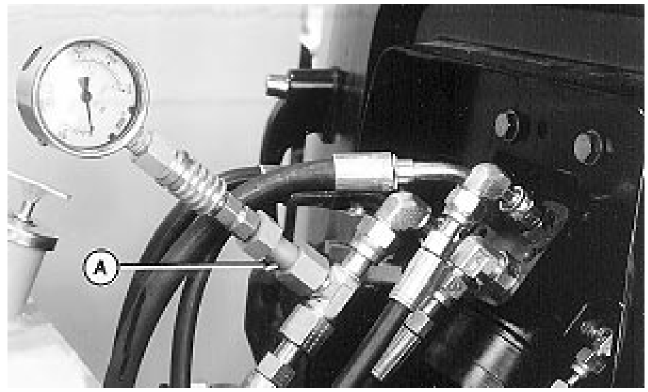
Specification

Engine—Speed .... Fast idle

Record pressure on gauge.

Specification

Priority Relief Valve—Relief Pressure Setting..................................... 15 500—16 900 kPa (155—169 bar) (2250—2450 psi)



T8256AB –UN–02JUN94

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TX,9025,BS413 –19–21JUL94–2/3

6. Adjust or replace relief valve (B) in priority valve as necessary.

7. Adjustment procedure:

- Stop engine.
- Lower all equipment to ground and operate steering valve to release pressure in the hydraulic system.
- Remove cap from steering relief valve (C).

IMPORTANT: The steering system priority relief valve pressure adjustment is very sensitive. Turn adjustment screw a maximum of 1/8 turn. (1/8 turn is equal to 50-75 psi.)

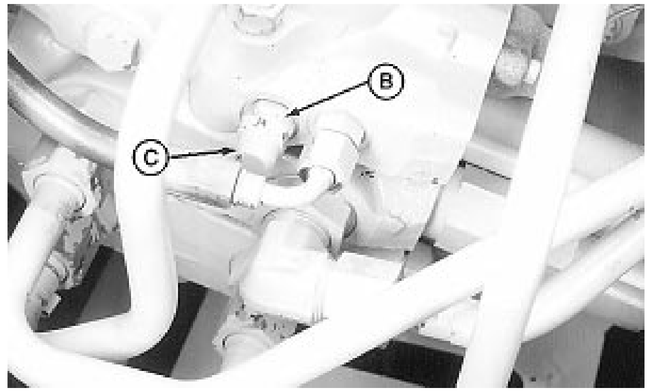
8. Turn adjustment screw 1/8 turn clockwise to increase the pressure setting or 1/8 turn counterclockwise to decrease pressure setting.

Specification

1/8 Turn of Adjustment Screw
Changes—Pressure .... 50-75 psi

Check pressure again to verify it is to specification.

9. If relief valve (B) cannot be adjusted, replace. See repair manual.



T8256AA –UN–02JUN94

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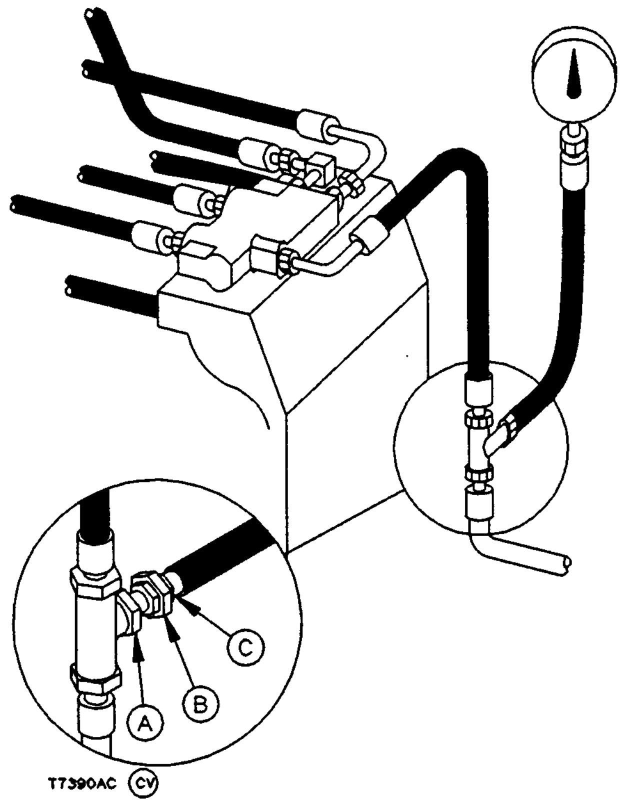
TX,9025,BS413 –19–21JUL94–3/3

Steering Pump Relief Pressure Test (300D, 310D S.N. —802199) (315D, All Machines)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	Fast idle
Steering Pump Relief Pressure Setting	20 500—23 800 kPa (205—238 bar) (2975—3450 psi)

ESSENTIAL TOOLS
A—JT05688 (1-1/16 12 M -8 F ORFS) Adapter
B—JT03103 (7/16-20 M 37° x 1-1/16-12 F 37°) Adapter
JT01608 (7/16-20 F 37° x 1/8) Nipple Quick Coupler

SERVICE EQUIPMENT AND TOOLS
Digital Thermometer
Gauge 0—35 000 kPa (0—350 bar) (0—5000 psi)



T7390AC –19–17OCT90

1. Put FNR lever in neutral and engage park brake.

2. Stop engine, operate hydraulic control levers to release pressure in system, and install digital thermometer probe in reservoir.

3. Test steering pump relief setting.

    - 310D, 315D
        – Remove left engine side shield. Make test connection at tee provided in line from steering pump to priority valve. Warm oil to specifications.

Specification
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

Run engine at fast idle.

Specification
Engine—Speed .... Fast idle

Activate and hold loader raise and backhoe boom raise over relief. Record pressure on gauge.

Specification
Steering Pump—Relief Pressure
Setting... 20 500—23 800 kPa (205—238 bar) (2975—3450 psi)

Continued on next page

TX,9025,BS414 –19–21JUL94–1/2

- 300D
  – Remove steering pump inlet line to priority valve. Cap valve and connect gauge to line. Warm oil to specifications. Run machine at fast idle and observe gauge reading.

IMPORTANT: Steering pump relief valve must be set higher than main hydraulic system relief valve to prevent damage to steering pump relief. See Main Hydraulic Relief Pressure Test in this group.

4. Relief cartridge is not adjustable. Replace if necessary.

TX,9025,BS414 –19–21JUL94–2/2

Auxiliary Pump Relief Pressure Test (300D, 310D S.N. 802200—)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	Fast idle
Auxiliary Pump Relief Pressure Setting	20 500—23 800 kPa (205—238 bar) (2975—3450 psi)

ESSENTIAL TOOLS
38H1279 (-8 ORFS) Union
38H1415 (-8 ORFS) Cap

SERVICE EQUIPMENT AND TOOLS
Gauge 0—35 000 kPa (0—350 bar) (0—5000 psi)
Digital Thermometer

1. Put FNR lever in neutral and engage park brake.

2. Stop engine.

Continued on next page

TX,9025,BS415 –19–21JUL94–1/2

3. Operate all hydraulic control valves to release pressure in the hydraulic system. Remove auxiliary pump inlet line to backhoe valve. Cap valve (A) and connect gauge (B) to inlet line (C).

4. Install digital thermometer probe in reservoir. Warm oil to specifications.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

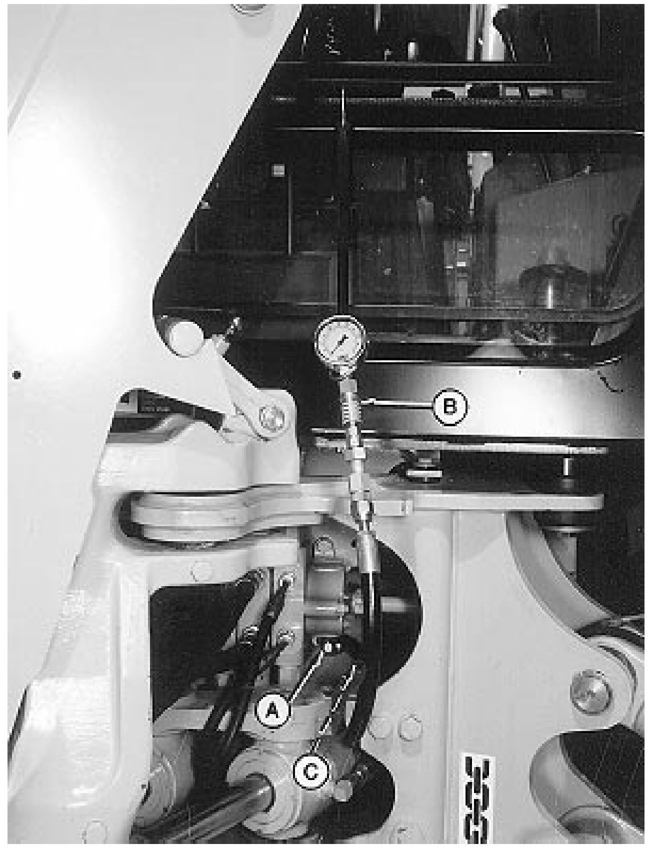
5. Run engine at specified speed and record pressure on gauge.

Specification

Engine—Speed .... Fast idle
Auxiliary Pump—Relief Pressure
Setting... 20 500—23 800 kPa (205—238 bar) (2975—3450 psi)

IMPORTANT: Steering pump relief valve must be set higher than main hydraulic system relief valve to prevent damage to steering pump relief. See Main Hydraulic Relief Pressure Test in this group.

6. Relief cartridge is not adjustable. Replace if necessary.



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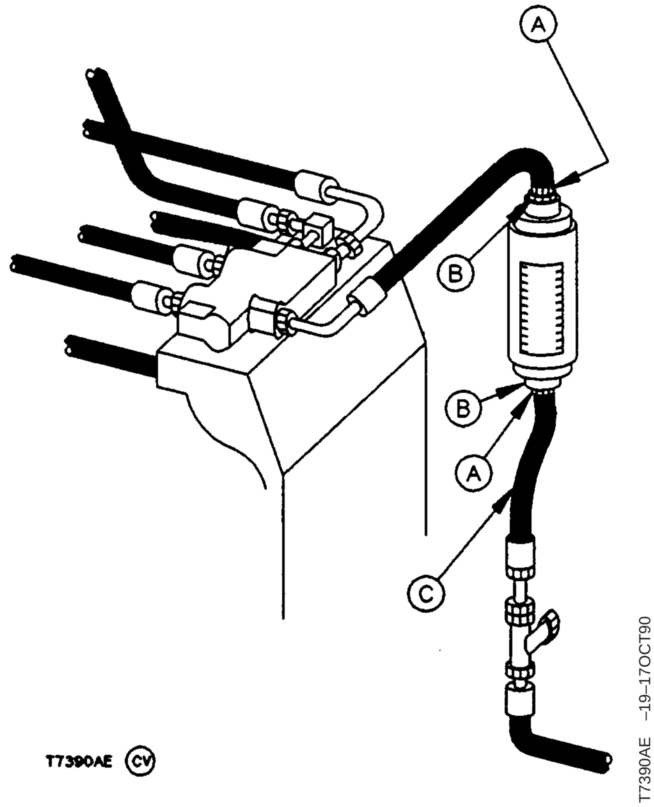
TX,9025,BS415 –19–21JUL94–2/2

Steering Pump Flow Test (300D, 310D S.N. — 802199) (315D, All Machines)



SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	2000 ± 10 rpm
Oil Pressure	13,700 ± 70 kPa (137 ± 0.7 bar) (2000 ± 10 psi)
New Steering Pump Minimum Flow	24 L/min (6.4 gpm)
Used Steering Pump Minimum Flow	18 L/min (4.8 gpm)

ESSENTIAL TOOLS
A—JT05688 (1-1/16-12 M 37° x -8 F ORFS) Adapter (2 used)
B—38H1279 (-8 M x -8 M ORFS) Union[a]
[a]These ORFS fittings should be ordered through normal service parts channels.

SERVICE EQUIPMENT AND TOOLS
Flowmeter
Electronic Tachometer
Digital Thermometer

NOTE: An in-line flowmeter is shown in the illustration. Any flowmeter capable of measuring the specified flow is suitable.

9025
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16

1. Make test connections. Install electronic tachometer, and digital thermometer probe in reservoir. (See procedure in this group.)

2. Open flowmeter.

3. Put FNR lever in neutral and engage park brake.

4. Heat hydraulic oil to test specifications.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

Continued on next page

TX,9025,BS416 –19–21JUL94–1/2

5. Adjust engine speed to test specification.

Specification

Engine—Speed .... 2000 ± 10 rpm

Slowly close loading valve to get test pressure reading on flowmeter gauge.

Specification

Oil—Pressure .... 13,700 ± 70 kPa (137 ± 0.7 bar) (2000 ± 10 psi)

6. Record the flow rate.

Specification

New Steering Pump—Minimum Flow .... 24 L/min (6.4 gpm)
Used Steering Pump—Minimum Flow .... 18 L/min (4.8 gpm)

TX,9025,BS416 –19–21JUL94–2/2

Auxiliary Pump Flow Test (300D, 310D S.N. 802200—)

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	2000 ± 10 rpm
Oil Pressure	13 700 ± 70 kPa (137 ± 0.7 bar) (2000 ± 10 psi)
New Auxiliary Pump Minimum Flow	28 L/min (7.3 gpm)
Used Auxiliary Pump Minimum Flow	23 L/min (6.1 gpm)

ESSENTIAL TOOLS
JT05688 (1-1/16-12 M 37° x -8 F ORFS) Adapter (2 used)
38H1279 (-8 M x -8 M ORFS) Union

SERVICE EQUIPMENT AND TOOLS
Flowmeter
Electronic Tachometer
Digital Thermometer

1. Make test connections. Install electronic tachometer, and digital thermometer probe in reservoir. Heat oil to specification.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

(See procedure in this group.)

Continued on next page TX,9025,BS417 –19–21JUL94–1/2

2. Connect flowmeter at auxiliary pump inlet to backhoe valve (A).

3. Open flowmeter.

4. Put FNR lever in neutral and engage park brake.

5. Heat hydraulic oil to test specifications. See Hydraulic Oil Warm-up in Group 9025-25.

6. Adjust engine speed to test specification.

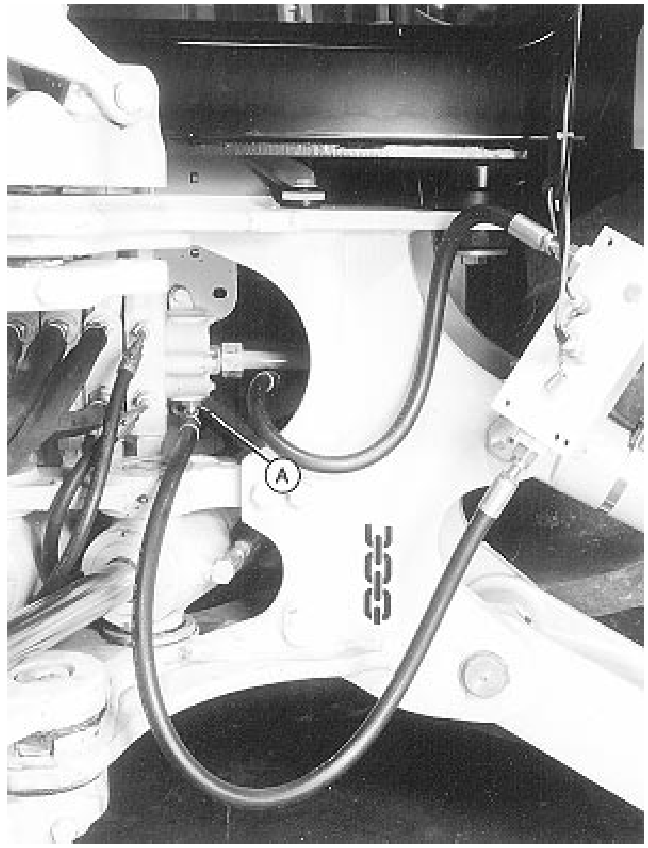
Specification
Engine—Speed .... 2000 ± 10 rpm

Slowly close loading valve to get test pressure reading on flowmeter gauge.

Specification
Oil—Pressure .... 13 700 ± 70 kPa (137 ± 0.7 bar)
(2000 ± 10 psi)

7. Record the flow rate.

Specification
New Auxiliary Pump—Minimum
Flow .... 28 L/min (7.3 gpm)
Used Auxiliary Pump—Minimum
Flow .... 23 L/min (6.1 gpm)



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TX,9025,BS417 –19–21JUL94–2/2

Hydraulic Oil Cooler Restriction Test

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Hydraulic Oil Cooler Flow	26.5 L/min. (7 gpm)
Hydraulic Oil Cooler Maximum Pressure Differential	200 kPa (2 bar) (30 psi)

ESSENTIAL TOOLS
G—(3/4 M NPT x 5/8 barb) Barb Fitting
H—JT03012 (1-1/16 F 37° SW x 3/4 F NPT) Adapter
I—JT03048 (1-1/16 M ORB x 1-1/16 M 37°) Adapter
J—JT03348 (1/2 F NPT) Tee (2 used)
K—JT03213 (5/8 I.D. Hose x 1/2 M NPT) Adapter (6 used)

SERVICE EQUIPMENT AND TOOLS
A—Hydraulic Analyzer or Pressure Gauge
B—Gauge 0—200 kPa (0—2.0 bar) (0—30 psi)
F—Hydrostatic Switching Unit
Flowmeter with Temperature Gauge

NOTE: Two gauges can be used in place of analyzer and switch box.

1. Make test connection.

2. Open flowmeter. Heat oil to test specification.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

3. Increase engine speed until flow is at specification.

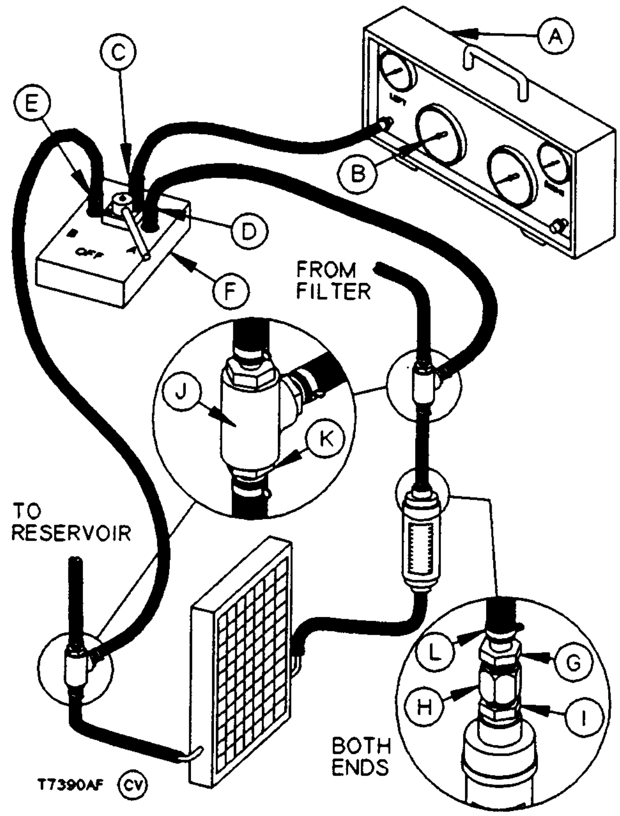
Specification

Hydraulic Oil Cooler—Flow .... 26.5 L/min. (7 gpm)

4. Read pressure gauges at inlet and outlet of cooler. Difference in gauge reading is pressure drop in cooler.

Specification

Hydraulic Oil Cooler—Maximum
Pressure Differential .... 200 kPa (2 bar) (30 psi)



T7390AF –19–17OCT90

A—Hydraulic Analyzer
B—Gauge
C—Gauge Port
D—No. 2 Input
E—No. 1 Input
F—Switch Unit
G—Fitting
H—Adapter
I—Adapter
J—Tee
K—Barb Fitting
L—Clamp
M—Flow Rater

TX,9025,BS418 –19–21JUL94–1/1

Circuit Relief Valve Test—With Remote Pump

SPECIFICATIONS	
Oil Temperature	40 ±6°C (104 ±10°F)
Pressure Set Tolerance	+1380 -0 kPa (+13.8 -0 bar) (+200 -0 psi)
388D, 310D, 315D Gresen/Husco Loader Circuit Pressure (Auxiliary Extend (S.N. 802200—))	19 200 kPa (192 bar) (3000 psi)
388D, 310D, 315D Gresen/Husco Loader Circuit Pressure (Bucket Curl)	22 060 kPa (220 bar) (3200 psi)
388D, 310D, 315D Gresen/Husco Loader Circuit Pressure (Bucket Dump)	22 060 kPa (220 bar) (3200 psi)
388D, 310D, 315D Gresen/Husco Loader Circuit Pressure (Boom Up (S.N.802200—))	26 200 kPa (262 bar) (3800 psi)
(300D, S.N. —802199) Gresen Backhoe Circuit Pressure (Crowd Out)	22,000 kPa (220 bar) (3200 psi)
(300D, S.N. —802199) Gresen Backhoe Circuit Pressure (Bucket Curl)	18,600 kPa (186 bar) (2700 psi)
(300D, S.N. —802199) Gresen Backhoe Circuit Pressure (Boom Down)	13,700 kPa (138 bar) (2000 psi)
(300D, S.N. —802199) Gresen Backhoe Circuit Pressure (Swing Left)	18,100 kPa (181 bar) (2625 psi)
(300D, S.N. —802199) Gresen Backhoe Circuit Pressure (Swing Right)	18,100 kPa (181 bar) (2625 psi)
(300D, S.N. —802199) Gresen Backhoe Circuit Pressure (Boom Raise)	22,000 kPa (220 bar) (3200 psi)
(300D, S.N. —802199) Gresen Backhoe Circuit Pressure (Bucket Dump)	22,064 kPa (220 bar) (3200 psi)
(300D, S.N. —802199) Gresen Backhoe Circuit Pressure (Crowd In)	17,235 kPa (172 bar) (2500 psi)
(300D, S.N.802200—) Husco Backhoe Circuit Pressure (Crowd Out)	22,000 kPa (220 bar) (3200 psi)
(300D, S.N.802200—) Husco Backhoe Circuit Pressure (Bucket Curl)	22,000 kPa (220 bar) (2750 psi)

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TX,9025,BS419 –19–22JUL94–1/5

SPECIFICATIONS	
(300D, S.N.802200—) Husco Backhoe Circuit Pressure (Boom Down)	12,900 kPa (129 bar) (1875 psi)
(300D, S.N.802200—) Husco Backhoe Circuit Pressure (Swing Left)	19 000 kPa (190 bar) (2750 psi)
(300D, S.N.802200—) Husco Backhoe Circuit Pressure (Swing Right)	19 000 kPa (190 bar) (2750 psi)
(300D, S.N.802200—) Husco Backhoe Circuit Pressure (Boom Raise)	22,000 kPa (220 bar) (3200 psi)
(300D, S.N.802200—) Husco Backhoe Circuit Pressure (Bucket Dump)	22,000 kPa (220 bar) (3200 psi)
(300D, S.N.802200—) Husco Backhoe Circuit Pressure (Crowd In)	19 000 kPa (190 bar) (2750 psi)
310D, 315D Husco Backhoe Circuit Pressure (Crowd Out)	24 100 kPa (241 bar) (3500 psi)
310D, 315D Husco Backhoe Circuit Pressure (Bucket Curl)	24 100 kPa (241 bar) (3500 psi)
310D, 315D Husco Backhoe Circuit Pressure (Boom Down)	12,900 kPa (129 bar) (1875 psi)
310D, 315D Husco Backhoe Circuit Pressure (Swing Left)	19 000 kPa (190 bar) (2750 psi)
310D, 315D Husco Backhoe Circuit Pressure (Crowd In)	19 000 kPa (190 bar) (2750 psi)
310D, 315D Husco Backhoe Circuit Pressure (Bucket Dump)	24 100 kPa (241 bar) (3500 psi)
310D, 315D Husco Backhoe Circuit Pressure (Boom Raise)	26 200 kPa (262 bar) (3800 psi)
310D, 315D Husco Backhoe Circuit Pressure (Swing Right)	19 000 kPa (190 bar) (2750 psi)

ESSENTIAL TOOLS
JT07192 Electric/Hydraulic Pump
38H1355 (-10 ORFS) Nut
38H1470 (-10 -6 ORFS) Reducer
38H1356 (-12 ORFS) Nut
38H1473 (-12 -6 ORFS) Reducer
38H1358 (-16 ORFS) Nut
38H1475 (-16 -8 ORFS) Reducer
38H1481 (-8 -6 ORFS) Reducer

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TX,9025,BS419 –19–22JUL94–2/5

SERVICE EQUIPMENT AND TOOLS
Digital Thermometer
0—35 000 kPa (0—350 bar) (0—5000 psi) Gauge

IMPORTANT: Relief valve is flow sensitive. A flow rate greater than 7.5 L/min 2 gpm will flood the valve causing an inaccurate pressure reading. A hydraulic source must be used that will provide a continuous flow to get an accurate reading.

NOTE: Relief valves may also be tested with an amplification cylinder using machine hydraulics. (See Relief Valve Test Using Amplification Cylinder in this section.)

1. Operate hydraulic functions to relieve pressure.

Specification

Oil—Temperature .... 40 ±6°C (104 ±10°F)

Continued on next page

TX,9025,BS419 –19–22JUL94–3/5

CAUTION: To avoid injury from escaping fluid under pressure, stop engine and relieve the pressure in the system before disconnecting or connecting hydraulic or other lines. Tighten all connections before applying pressure.

2. Disconnect pressure line (A) at inlet port of relief valve to be tested. Cap line.

3. Connect test pump pressure hose (B) to inlet port using adapters. Install gauge.

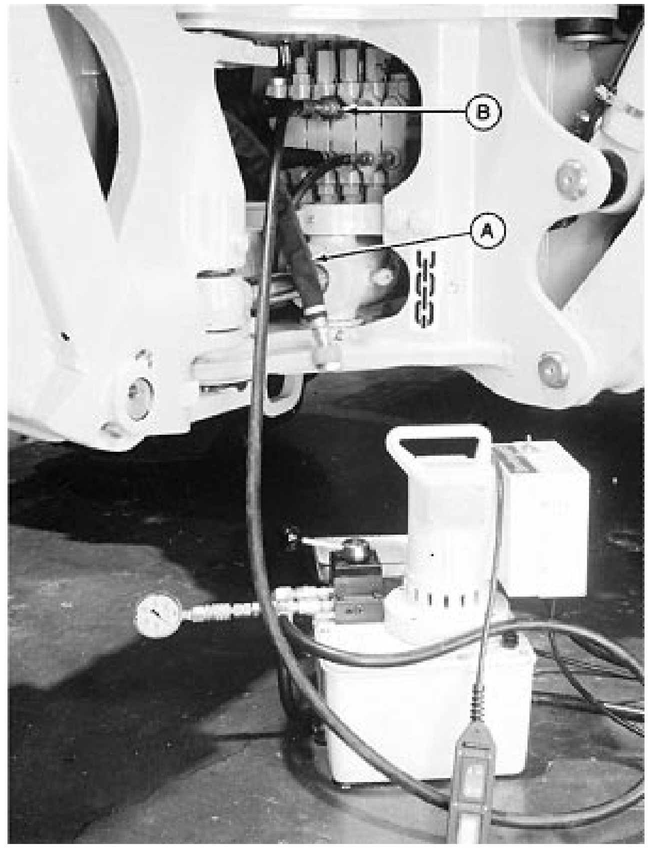
4. Start pump to pressurize valve inlet.

NOTE: Take reading when pressure on gauge starts to decrease. The point at which pressure decreases is the opening pressure of the relief valve.

5. Adjust or replace as required.

Specification

Pressure—Set Tolerance	+1380 -0 kPa (+13.8 -0 bar) (+200 -0 psi)
388D, 310D, 315D Gresen/Husco Loader Circuit—Pressure (Auxiliary Extend (S.N. 802200—))	19 200 kPa (192 bar) (3000 psi)
Pressure (Bucket Curl)	22 060 kPa (220 bar) (3200 psi)
Pressure (Bucket Dump)	22 060 kPa (220 bar) (3200 psi)
Pressure (Boom Up (S.N.802200—))	26 200 kPa (262 bar) (3800 psi)
(300D, S.N. —802199) Gresen Backhoe Circuit—Pressure (Crowd Out)	22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Curl)	18,600 kPa (186 bar) (2700 psi)
Pressure (Boom Down)	13,700 kPa (138 bar) (2000 psi)
Pressure (Swing Left)	18,100 kPa (181 bar) (2625 psi)
Pressure (Swing Right)	18,100 kPa (181 bar) (2625 psi)
Pressure (Boom Raise)	22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Dump)	22,064 kPa (220 bar) (3200 psi)
Pressure (Crowd In)	17,235 kPa (172 bar) (2500 psi)
(300D, S.N.802200—) Husco Backhoe Circuit—Pressure (Crowd Out)	22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Curl)	22,000 kPa (220 bar) (2750 psi)
Pressure (Boom Down)	12,900 kPa (129 bar) (1875 psi)
Pressure (Swing Left)	19 000 kPa (190 bar) (2750 psi)
Pressure (Swing Right)	19 000 kPa (190 bar) (2750 psi)
Pressure (Boom Raise)	22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Dump)	22,000 kPa (220 bar) (3200 psi)
Pressure (Crowd In)	19 000 kPa (190 bar) (2750 psi)



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TX,9025,BS419 –19–22JUL94–4/5

Specification

310D, 315D Husco Backhoe	
Circuit—Pressure (Crowd Out)	24 100 kPa (241 bar) (3500 psi)
Pressure (Bucket Curl)	24 100 kPa (241 bar) (3500 psi)
Pressure (Boom Down)	12,900 kPa (129 bar) (1875 psi)
Pressure (Swing Left)	19 000 kPa (190 bar) (2750 psi)
Pressure (Crowd In)	19 000 kPa (190 bar) (2750 psi)
Pressure (Bucket Dump)	24 100 kPa (241 bar) (3500 psi)
Pressure (Boom Raise)	26 200 kPa (262 bar) (3800 psi)
Pressure (Swing Right)	19 000 kPa (190 bar) (2750 psi)

TX,9025,BS419 –19–22JUL94–5/5

Circuit Relief Valve Test—300D, With Amplification Cylinder

SPECIFICATIONS	
Test Cylinder Rod End Flow	3.78 L/min (1 gpm)
Oil Temperature	40 ± 6°C (104 ± 10°F)
Engine Speed	Approximately 1000 rpm
Test Cylinder Rod Extend Cycle Time	1.5 sec.
Relief Valve Oil Pressure Tolerance	+1380 -0 kPa (+13.8 -0 bar) (+200 -0 psi)
(S.N. —802199) Gresen Backhoe Circuits Pressure (Crowd Out)	22 000 kPa (220 bar) (3200 psi)
(S.N. —802199) Gresen Backhoe Circuits Pressure (Bucket Curl)	18 600 kPa (186 bar) (2700 psi)
(S.N. —802199) Gresen Backhoe Circuits Pressure (Swing Left)	18,100 kPa (181 bar) (2625 psi)
(S.N. —802199) Gresen Backhoe Circuits Pressure (Swing Right)	18,100 kPa (181 bar) (2625 psi)
(S.N. —802199) Gresen Backhoe Circuits Pressure (Boom Raise)	22,000 kPa (220 bar) (3200 psi)
(S.N. —802199) Gresen Backhoe Circuits Pressure (Bucket Dump)	22,064 kPa (220 bar) (3200 psi)
(S.N. —802199) Gresen Backhoe Circuits Pressure (Crowd In)	17,235 kPa (172 bar) (2500 psi)
(S.N.802200—) Husco Backhoe Circuits Pressure (Crowd Out)	22,000 kPa (220 bar) (3200 psi)
(S.N.802200—) Husco Backhoe Circuits Pressure (Bucket Curl)	19 000 kPa (190 bar) (2750 psi)
(S.N.802200—) Husco Backhoe Circuits Pressure (Boom Lower)	12 900 kPa (129 bar) (1875 psi)
(S.N.802200—) Husco Backhoe Circuits Pressure (Swing Left)	19 000 kPa (190 bar) (2750 psi)
(S.N.802200—) Husco Backhoe Circuits Pressure (Swing Right)	19 000 kPa (190 bar) (2750 psi)
(S.N.802200—) Husco Backhoe Circuits Pressure (Boom Raise)	22,000 kPa (220 bar) (3200 psi)
(S.N.802200—) Husco Backhoe Circuits Pressure (Bucket Dump)	22 000 kPa (220 bar) (3200 psi)
(S.N.802200—) Husco Backhoe Circuits Pressure (Crowd In)	19 000 kPa (190 bar) (2750 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Crowd Out)	22,000 kPa (220 bar) (3200 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Bucket Curl)	22,000 kPa (220 bar) (2750 psi)

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TX,902525,BR78 –19–21JUL94–1/8

SPECIFICATIONS	
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Boom Down)	12,900 kPa (129 bar) (1875 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Swing Left)	19 000 kPa (190 bar) (2750 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Swing Right)	19 000 kPa (190 bar) (2750 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Boom Raise)	22,000 kPa (220 bar) (3200 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Bucket Dump)	22,000 kPa (220 bar) (3200 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Crowd In)	19 000 kPa (190 bar) (2750 psi)
Gresen/Husco Loader Circuits Pressure (Bucket Head End)	22,000 kPa (220 bar) (3200 psi)
Gresen/Husco Loader Circuits Pressure (Bucket Rod End)	22,000 kPa (220 bar) (3200 psi)
Gresen/Husco Loader Circuits Pressure (Boom Head End (S.N.802200—))	26 200 kPa (262 bar) (3800 psi)
Gresen/Husco Loader Circuits Pressure (Auxiliary Head End (S.N.802200—))	20 700 kPa (207 bar) (3000 psi)

Continued on next page TX,902525,BR78 –19–21JUL94–2/8

ESSENTIAL TOOLS
D—AH120121 Test Cylinder[a] (Cancelled)
D—AH93323 Test Cylinder[a] (Replaces AH120121)
B—38H1030 (-6 ORFS) Tee[a]
B—38H1031 (-8 ORFS) Tee[a]
B—38H1032 (-10 ORFS) Tee[a]
G—38H1415 (-6 ORFS) Cap[a] (2 used)
I—(-6 M ORFS x 3/8 M NPT) Adapter
K—(3/8 M NPT x 3/8 F NPT) 90° Elbow
L—(9/16-18 M ORB x 3/8 F NPT) Adapter
M—AT81867 Check Valve[a]
N—(1/4 M NPT x 9/16 -18 F 37°) Adapter
O—N/A Quick-Coupler
P—(1/8 M NPT x 1/4 F NPT) Nipple
Q—(1/4 M NPT x 1/4 F NPT) 90° Elbow
R—(1/4 M NPT x 1/4 F NPT x 1/4 F NPT) Tee
S—(9/16 M ORB x 1/4 F NPT) Adapter
38H1146 (-6 ORFS) Plug[a]
38H1147 (-8 ORFS) Plug[a]
38H1148 (-10 ORFS) Plug[a]
J—JT03408 Hydraulic Flow Regulator
[a]These ORFS fittings and parts should be ordered through normal service parts channels.

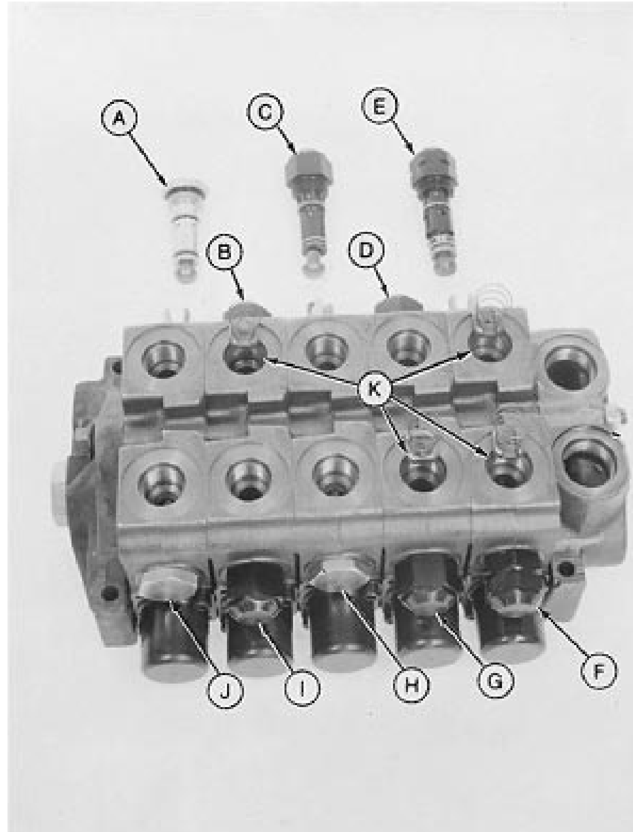
SERVICE EQUIPMENT AND TOOLS
A—Rod End Hose To Tee
Gauge 35,000 kPa (350 bar) (5000 psi)

This test uses a test cylinder to amplify system pressure 2.25 times so reliefs can be opened and tested. Flow regulator is used to restrict flow to relief to 3.8 L/min (1 gpm) to duplicate factory calibration specifications. Install test tee at most accessible part of circuit being tested.

Continued on next page

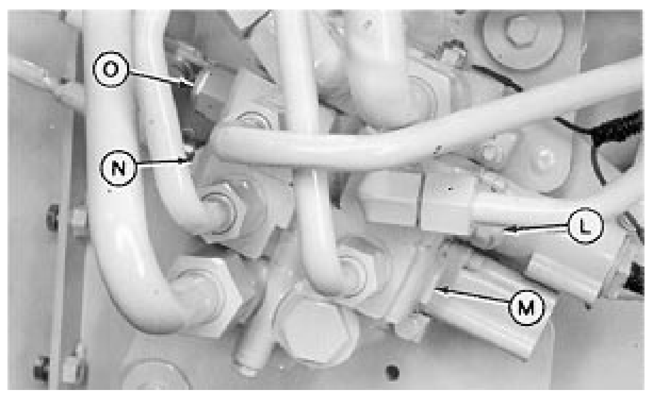
TX,902525,BR78 –19–21JUL94–3/8

A—Extendible Dipperstick Head End Lift Check Plug
B—Crowd Rod End Relief Valve And Lift Check
C—Bucket Head End Relief Valve And Lift Check
D—Boom Head End Relief Valve And Lift Check
E—Swing Left Combination Relief/Lift Check/Anti-Cavitation Valve
F—Swing Right Combination Relief/Lift Check/Anti-Cavitation Valve
G—Boom Rod End Relief Valve And Lift Check
H—Bucket Rod End And Relief Valve End Lift
I—Crowd Head End Relief Valve And Lift Check
J—Extendible Dipperstick Rod End Lift Check Plug
K—Orifice Plate With Springs (4 Used) Orifices Used In Boom Rod End Port (Lower Port) Both Swing Ports, And Crowd Rod End Port
L—Loader Bucket Rod End Combination Relief/Lift Check/Anti- Cavitation Valve
M—Loader Boom Rod End Lift Check/Anti-Cavitation Plug
N—Loader Boom Head End Lift Check Plug
O—Loader Bucket Head End Relief Valve And Lift Check



T6157AL –UN–03NOV88

(S.N. —802199) Shown

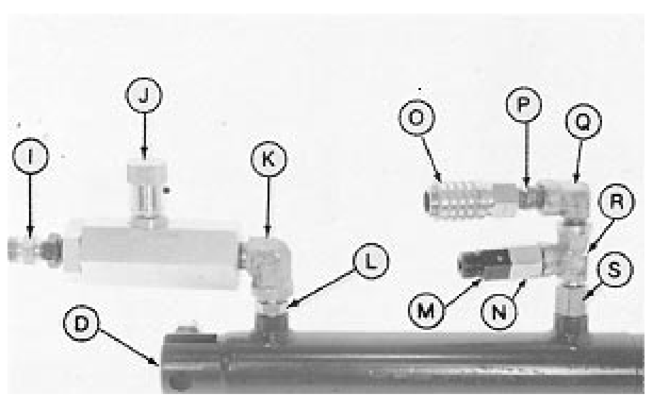


T7401AF –UN–25OCT90

(S.N. —802199) Shown

TX,902525,BR78 –19–21JUL94–4/8

1. Lower stabilizers to ground and stop engine.



T6725AB –UN–26OCT88

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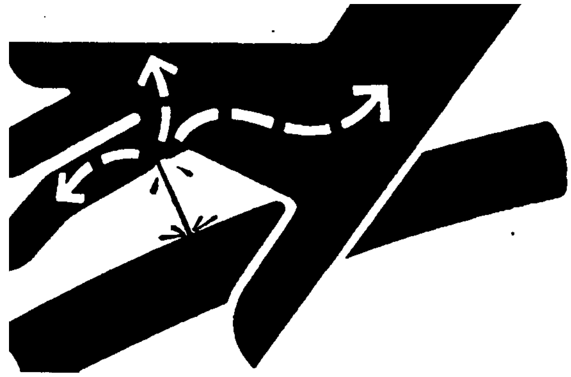
TX,902525,BR78 –19–21JUL94–5/8

CAUTION: Stabilizer control valve contains lock-outs, which prevent releasing of hydraulic pressure when engine is off. Slowly loosen stabilizer hoses to bleed off stored pressure to prevent being sprayed with high pressure oil.

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.



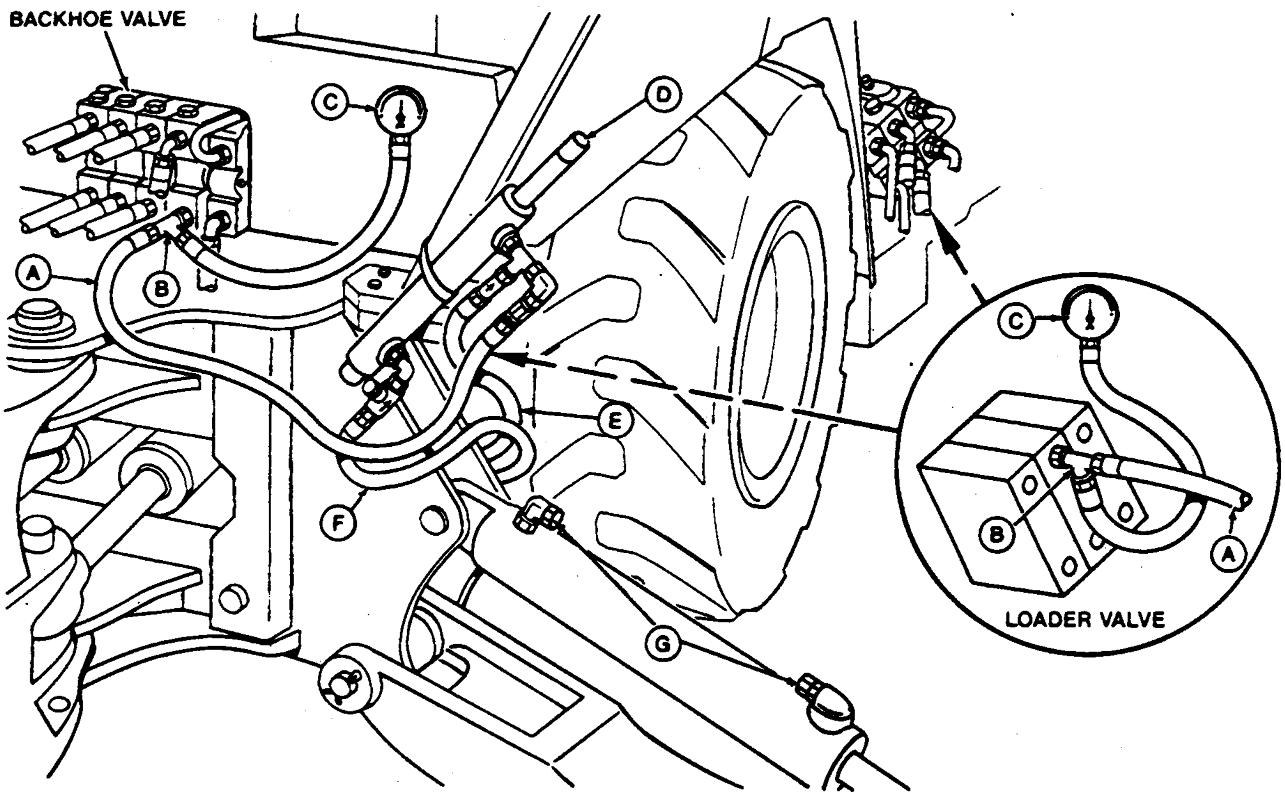
X9811 –UN–23AUG88

2. Operate hydraulic controls to relieve pressure in hydraulic system.

3. Install stabilizer hoses on test cylinder.

9025
25
30

Continued on next page TX,902525,BR78 –19–21JUL94–6/8



A—Rod End Hose To Tee
B—Tee
C—Gauge
D—Cylinder
E—Stabilizer Hose (Rod End)
F—Stabilizer Hose (Head End)
G—38H1415 Cap (2 Used)

4. Install adapter in relief valve port to be tested. Tee in test gauge (C) and rod end hose (A) from test cylinder.

Specification
Test Cylinder—Rod End Flow .... 3.78 L/min (1 gpm)

5. Start engine, use stabilizer lever to cycle test cylinder until temperature is to test specifications.

Specification
Oil—Temperature .... 40 ± 6°C (104 ± 10°F)
Engine—Speed... Approximately 1000 rpm

6. Adjust JT03408 hydraulic flow regulator on head end of test cylinder, until rod extends in 1.5 seconds.

Specification
Test Cylinder—Rod Extend
Cycle Time... 1.5 sec.

Lock flow regulator at this setting.

7. Activate stabilizer to extend test cylinder and record pressure reading on gauge (C).

8. Retract cylinder rod for next test cycle. Repeat steps 7 and 8 if required.

9. Move tee (B) to next relief valve port to be tested. Repeat steps 7 and 8.

IMPORTANT: To prevent structural damage of machine, do not adjust relief valves above specifications.

10. Adjust or replace reliefs as required.

Specification
Relief Valve Oil—Pressure
Tolerance .... +1380 -0 kPa (+13.8 -0 bar)
(+200 -0 psi)

Continued on next page

TX,902525,BR78 –19–21JUL94–7/8

Specification

(S.N. —802199) Gresen Backhoe Circuits—Pressure (Crowd Out) .... 22 000 kPa (220 bar) (3200 psi)
Pressure (Bucket Curl) .... 18 600 kPa (186 bar) (2700 psi)
Pressure (Swing Left) .... 18,100 kPa (181 bar) (2625 psi)
Pressure (Swing Right) .... 18,100 kPa (181 bar) (2625 psi)
Pressure (Boom Raise) .... 22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Dump) .... 22,064 kPa (220 bar) (3200 psi)
Pressure (Crowd In) .... 17,235 kPa (172 bar) (2500 psi)

(S.N.802200—) Husco Backhoe Circuits—Pressure (Crowd Out) .... 22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Curl) .... 19 000 kPa (190 bar) (2750 psi)
Pressure (Boom Lower) .... 12 900 kPa (129 bar) (1875 psi)
Pressure (Swing Left) .... 19 000 kPa (190 bar) (2750 psi)
Pressure (Swing Right) .... 19 000 kPa (190 bar) (2750 psi)
Pressure (Boom Raise) .... 22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Dump) .... 22 000 kPa (220 bar) (3200 psi)
Pressure (Crowd In) .... 19 000 kPa (190 bar) (2750 psi)

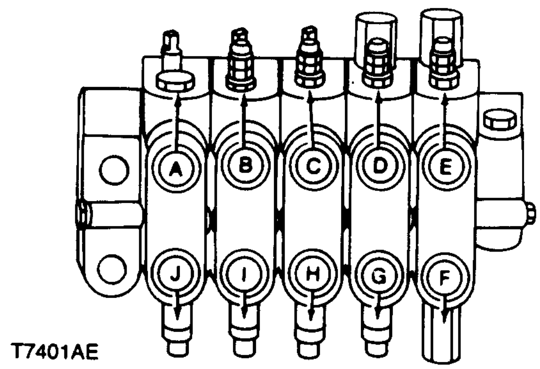
(300D, S.N.802200—) Husco Backhoe Circuits—Pressure (Crowd Out) .... 22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Curl) .... 22,000 kPa (220 bar) (2750 psi)
Pressure (Boom Down) .... 12,900 kPa (129 bar) (1875 psi)
Pressure (Swing Left) .... 19 000 kPa (190 bar) (2750 psi)
Pressure (Swing Right) .... 19 000 kPa (190 bar) (2750 psi)
Pressure (Boom Raise) .... 22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Dump) .... 22,000 kPa (220 bar) (3200 psi)
Pressure (Crowd In) .... 19 000 kPa (190 bar) (2750 psi)

Gresen/Husco Loader Circuits—Pressure (Bucket Head End) .... 22,000 kPa (220 bar) (3200 psi)
Pressure (Bucket Rod End) .... 22,000 kPa (220 bar) (3200 psi)
Pressure (Boom Head End (S.N.802200—)) .... 26 200 kPa (262 bar) (3800 psi)
Pressure (Auxiliary Head End (S.N.802200—)) .... 20 700 kPa (207 bar) (3000 psi)

TX,902525,BR78 –19–21JUL94–8/8

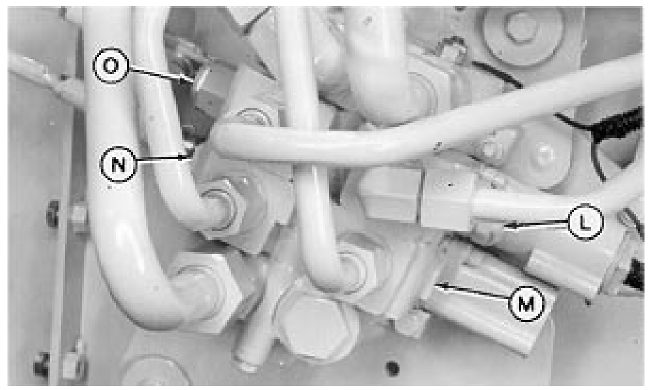
Circuit Relief Valve Test—310D, 315D, With Amplification Cylinder

SPECIFICATIONS	
Oil Temperature	40 ± 6°C (104 ± 10°F)
Engine Speed	Approximately 1000 rpm
Test Cylinder Rod Extend Cycle Time	1.5 sec.
Test Cylinder Rod End Flow	3.78 L/min (1 gpm)
Relief Valve Oil Pressure Tolerance	+1380 -0 kPa (+13.8 -0 bar) (+200 -0 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Crowd Out)	24,100 kPa (241 bar) (3500 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Bucket Curl)	24,100 kPa (241 bar) (3500 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Boom Lower)	12,900 kPa (129 bar) (1875 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Swing Left)	19 000 kPa (190 bar) (2750 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Swing Right)	19 000 kPa (190 bar) (2750 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Boom Raise)	26,200 kPa (262 bar) (3800 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Bucket Dump)	24,100 kPa (241 bar) (3500 psi)
(300D, S.N.802200—) Husco Backhoe Circuits Pressure (Crowd In)	19 000 kPa (190 bar) (2750 psi)
Gresen/Husco Loader Circuits Pressure (Bucket Head End)	22,064 kPa (220 bar) (3200 psi)
Gresen/Husco Loader Circuits Pressure (Bucket Rod End)	22,060 kPa (220 bar) (3200 psi)
Gresen/Husco Loader Circuits Pressure (Boom Head End (S.N.802200—))	26 200 kPa (262 bar) (3800 psi)
Gresen/Husco Loader Circuits Pressure (Auxiliary Head End (S.N.802200—))	20 700 kPa (207 bar) (3000 psi)



T7401AE –UN–01NOV90

(S.N. —802199) Shown



T7401AF –UN–25OCT90

(S.N. —802199) Shown

A—Extendible Dipperstick Head End Plug
B—Crowd Rod End Relief Valve
C—Bucket Head End Relief Valve
D—Boom Head End Relief Valve
E—Swing Right Relief/Orifice
F—Swing Left Relief/Orifice
G—Boom Rod End Relief Valve
H—Bucket Rod End Relief
I—Crowd Head End Relief Valve
J—Extendible Dipperstick Rod End Plug
K—(Not Used)
L—Loader Bucket Rod End Combination Relief/Lift Check/Anti-Cavitation Valve
M—Loader Boom Rod End Lift Check/Anti-Cavitation Plug
N—Loader Boom Head End Lift Check Plug
O—Loader Bucket Head End Relief Valve And Lift Check

Continued on next page

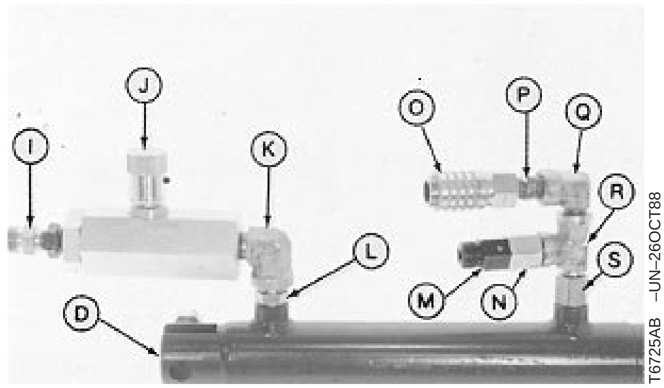
TX,9025,BS422 –19–22JUL94–1/6

ESSENTIAL TOOLS
D—AH120121 Test Cylinder[a] (Cancelled)
D—AH93323 Test Cylinder[a] (Replaces AH120121)
B—38H1030 (-6 ORFS) Tee[a]
B—38H1031 (-8 ORFS) Tee[a]
B—38H1032 (-10 ORFS) Tee[a]
G—38H1415 Cap[a] (2 used)
I—(-6 M ORFS x 3/8 M NPT) Adapter
K—(3/8 M NPT x 3/8 F NPT) 90° Elbow
L—(9/16-18 M ORB x 3/8 F NPT) Adapter
M—AT81867 Check Valve[a]
N—(1/4 M NPT x 9/16 -18 F 37°) Adapter
O—N/A Quick-Coupler
P—(1/8 M NPT x 1/4 F NPT) Nipple
Q—(1/4 M NPT x 1/4 F NPT) 90° Elbow
R—(1/4 M NPT x 1/4 F NPT x 1/4 F NPT) Tee
S—(9/16 M ORB x 1/4 F NPT) Adapter
38H1146 (-6 ORFS) Plug[a]
38H1147 (-8 ORFS) Plug[a]
38H1148 (-10 ORFS) Plug[a]
J—JT03408 Hydraulic Flow Regulator
[a]These ORFS fittings and parts should be ordered through normal service parts channels.

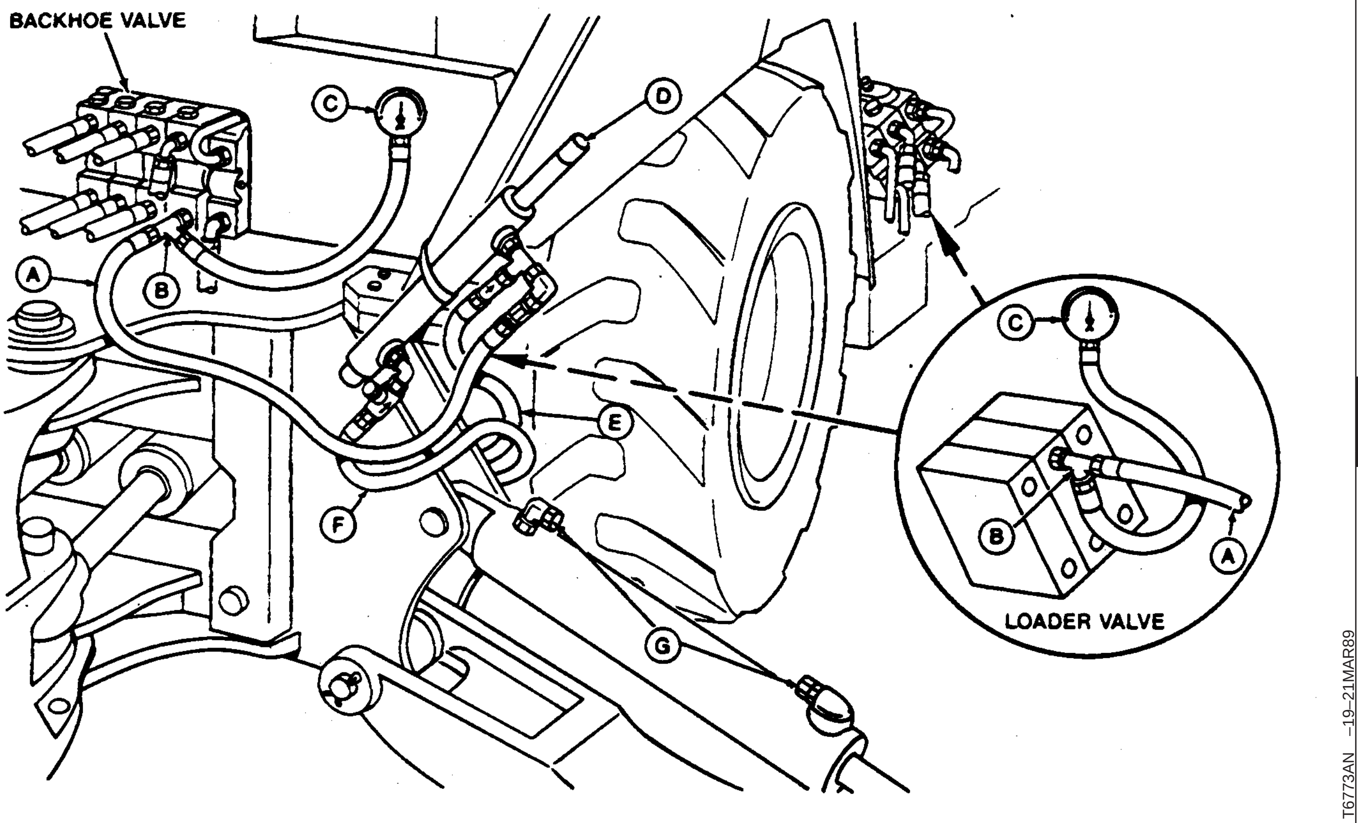
SERVICE EQUIPMENT AND TOOLS
A—Rod End Hose To Tee
B—Gauge 35,000 kPa (350 bar) (5000 psi)

This test uses a test cylinder to amplify system pressure 2.25 times so reliefs can be opened and tested. Flow regulator is used to restrict flow to relief to 3.8 L/min (1 gpm) to duplicate factory calibration specifications. Install test tee at most accessible part of circuit being tested.

Continued on next page TX,9025,BS422 –19–22JUL94–2/6



TX,9025,BS422 –19–22JUL94–3/6



A—Rod End Hose To Tee
B—Tee
C—Gauge
D—Cylinder
E—Stabilizer Hose (Rod End)
F—Stabilizer Hose (Head End)
G—38H1415 Cap (2 Used)

1. Lower stabilizers to ground and stop engine.

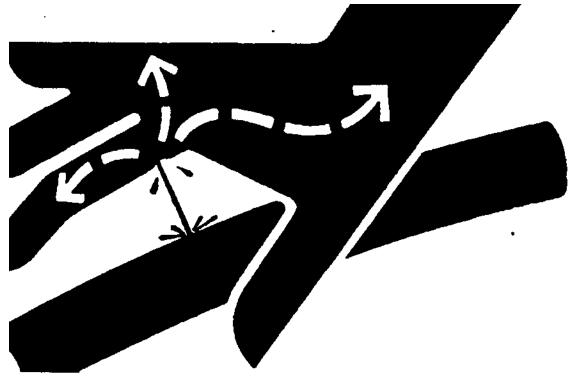
Continued on next page

TX,9025,BS422 –19–22JUL94–4/6

CAUTION: Stabilizer control valve contains lock-outs, which prevent releasing of hydraulic pressure when engine is off. Slowly loosen stabilizer hoses to bleed off stored pressure to prevent being sprayed with high pressure oil.

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

2. Operate hydraulic controls to relieve pressure in the hydraulic system.

3. Slowly loosen stabilizer hoses to bleed off stored pressure. Install stabilizer hoses on test cylinder.

4. Install adapter in relief valve port to be tested. Tee in test gauge (C) and rod end hose (A) from test cylinder.

5. Start engine, use stabilizer lever to cycle test cylinder until temperature is to test specifications.

Specification

Oil—Temperature	40 ± 6°C (104 ± 10°F)
Engine—Speed	Approximately 1000 rpm

6. Adjust JT03408 hydraulic flow regulator on head end of test cylinder, until rod extends in 1.5 seconds.

Specification

Test Cylinder—Rod Extend Cycle Time	1.5 sec.
Test Cylinder—Rod End Flow	3.78 L/min (1 gpm)

Lock flow regulator at this setting.

Continued on next page

7. Activate stabilizer to extend test cylinder and record pressure reading on gauge (C).

8. Retract cylinder rod for next test cycle. Repeat steps 7 and 8 if required.

9. Move tee (B) to next relief valve port to be tested. Repeat steps 7 and 8.

IMPORTANT: To prevent structural damage of machine, do not adjust relief valves above specifications.

10. Adjust or replace reliefs as required.

Specification	
Relief Valve Oil—Pressure Tolerance	+1380 -0 kPa (+13.8 -0 bar) (+200 -0 psi)
(300D, S.N.802200—) Husco Backhoe Circuits—Pressure (Crowd Out)	24,100 kPa (241 bar) (3500 psi)
Pressure (Bucket Curl)	24,100 kPa (241 bar) (3500 psi)
Pressure (Boom Lower)	12,900 kPa (129 bar) (1875 psi)
Pressure (Swing Left)	19 000 kPa (190 bar) (2750 psi)
Pressure (Swing Right)	19 000 kPa (190 bar) (2750 psi)
Pressure (Boom Raise)	26,200 kPa (262 bar) (3800 psi)
Pressure (Bucket Dump)	24,100 kPa (241 bar) (3500 psi)
Pressure (Crowd In)	19 000 kPa (190 bar) (2750 psi)
Gresen/Husco Loader Circuits—Pressure (Bucket Head End)	22,064 kPa (220 bar) (3200 psi)
Pressure (Bucket Rod End)	22,060 kPa (220 bar) (3200 psi)
Pressure (Boom Head End (S.N.802200—))	26 200 kPa (262 bar) (3800 psi)
Pressure (Auxiliary Head End (S.N.802200—))	20 700 kPa (207 bar) (3000 psi)

TX,9025,BS422 –19–22JUL94–6/6

Steering System Leakage Test

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	Low idle
Steering Wheel Torque	11.3 N•m (100 lb-in.)
Steering System Maximum Leakage	5 rpm

ESSENTIAL TOOLS
38H1145 (-4 ORFS) Plug[a] (2 used)
38H1352 (-4 ORFS) Nut[a] (2 used)
38H1138 (-4 ORFS) Plug[a] (2 used)
[a]These ORFS fittings should be ordered through normal service parts channels.

SERVICE EQUIPMENT AND TOOLS
Digital Thermometer

Continued on next page
TX,902525,BS221 –19–21JUL94–1/4


T93024 –UN–26OCT88

1. Install digital thermometer probe in reservoir.

2. Heat hydraulic oil to specifications.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

(See procedure in this group.)

3. Put FNR lever in neutral and engage park brake.

4. Run the engine at low idle.

Specification

Engine—Speed .... Low idle

5. Remove steering wheel emblem.

6. Bend locking tab away from steering wheel nut.

7. Turn the steering wheel clockwise at a constant torque of 11.3 N•m (100 lb-in.) with wheels in the maximum right position.

Specification

Steering Wheel—Torque.. 11.3 N•m (100 lb-in.)

Count the rpm.

8. Turn the steering wheel counterclockwise at a constant torque of 11.3 N•m (100 lb in.) with wheels in the maximum left turn position. Count the rpm.

9. If the steering wheel can be turned faster than 5 rpm in either direction, excessive leakage is indicated.

Specification

Steering System—Maximum
Leakage.. 5 rpm

Go to steps 12-16 to isolate steering valve or cylinder leakage.

10. If the steering wheel cannot be turned faster than 5 rpm in both directions, the steering valve and cylinder are good. Stop the test here.

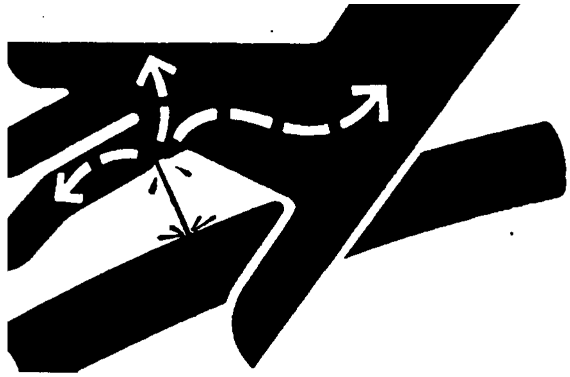
11. Stop the engine.

Continued on next page

TX,902525,BS221 –19–21JUL94–2/4

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

12. Operate all hydraulic control valves to release pressure in system.

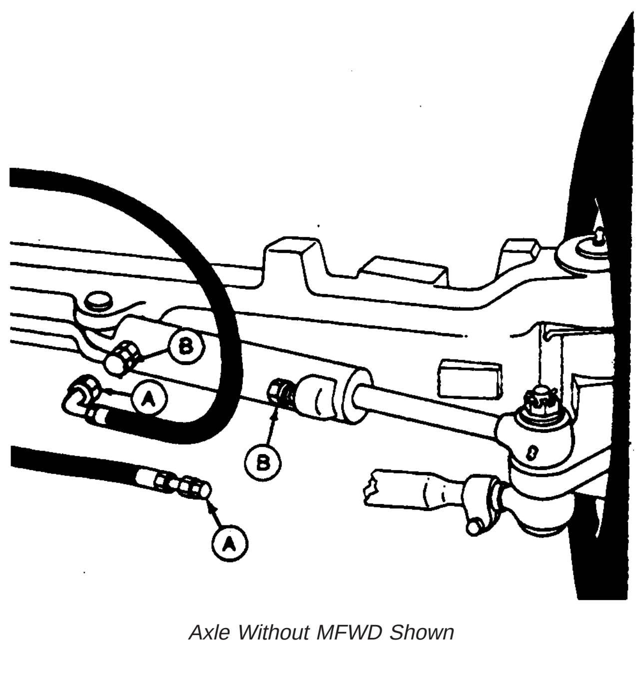
TX,902525,BS221 –19–21JUL94–3/4

13. Disconnect hydraulic lines from steering cylinder and install caps (B) and plugs (A).

14. Start the engine and run at low idle.

15. Turn steering wheel counterclockwise and then clockwise at a constant torque of 11.3 N•m (100 lb-in.). Count the rpm.

16. If steering wheel can be turned faster than 5 rpm in either direction, steering valve is leaking excessively.



T6076AM –UN–25MAY89

Axle Without MFWD Shown

TX,902525,BS221 –19–21JUL94–4/4

Steering Cylinder Leakage Test

SPECIFICATIONS	
Engine Speed	Low idle
Oil Temperature	65 ± 5°C (150 ± 10°F)
Steering Cylinder Leakage	5 ml/min (1/6 oz/min)

ESSENTIAL TOOLS
38H1145 (-4 ORFS) Plug[a]
[a]These ORFS fittings should be ordered through normal service parts channels.

SERVICE EQUIPMENT AND TOOLS
Digital Thermometer

1. Install digital thermometer probe in reservoir.

2. Put FNR lever in neutral and engage park brake.

3. Start engine. Turn the steering wheel to left turn stop to extend cylinder rod. Stop engine. Move steering wheel back and forth to relieve hydraulic pressure.

Continued on next page

T60,9025,1065 –19–21JUL94–1/2

4. Remove rod end hose and plug (A). Put beaker under cylinder port after oil stops dripping.

5. Start engine and hold steering wheel in full left turn with constant pressure for one minute.

Specification

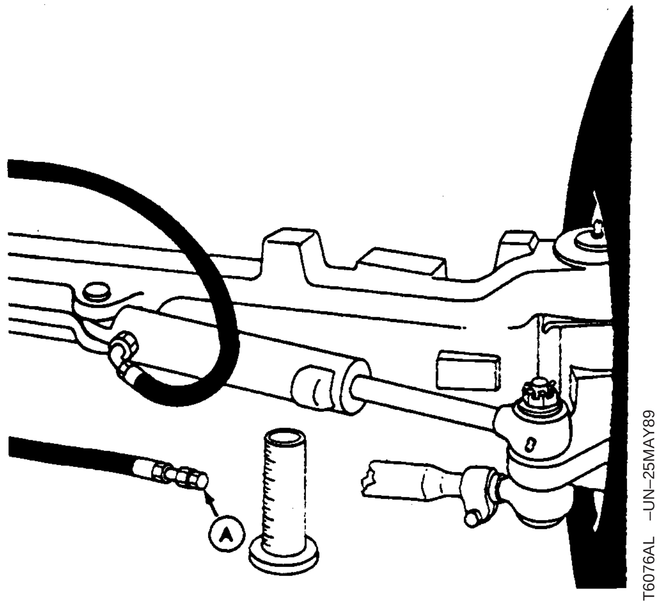
Engine—Speed .... Low idle
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

Stop engine.

6. Measure oil collected and connect hose.

Specification

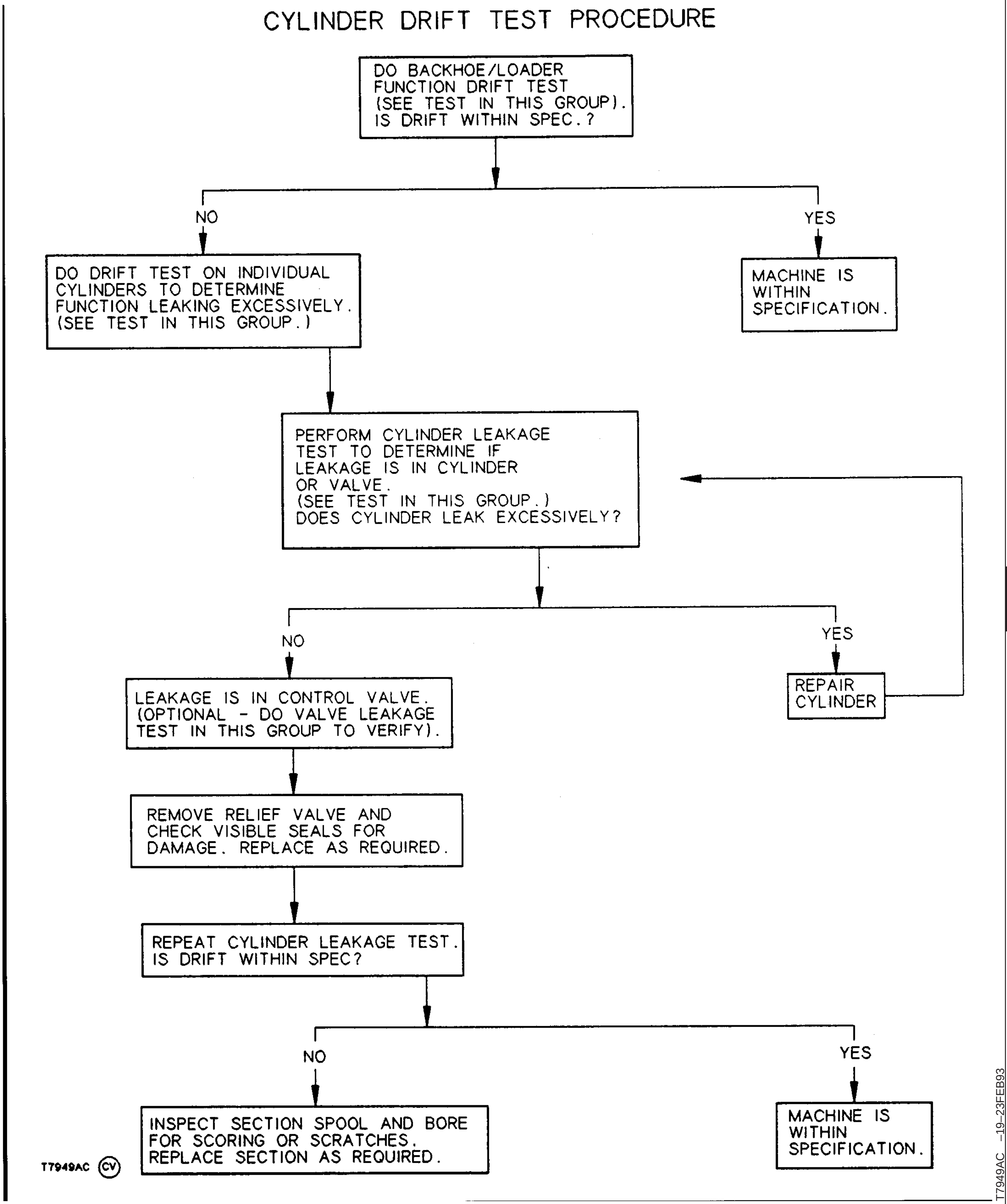
Steering Cylinder—Leakage........................ 5 ml/min (1/6 oz/min)



Axle Without MFWD Shown

T60,9025,1065 –19–21JUL94–2/2

Hydraulic Cylinder Drift Test Procedure



TX,902525,BS230 –19–09MAR93–1/1

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43

Function Drift Test

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	Low idle
Function Max Allowable Drift	50 mm/min (2.00 in/min)
BH Boom, Crowd Cylinder Max Allowable Drift (Std. Dipper)	5 mm/min (0.20 in/min)
BH Boom, Crowd Cylinder Max Allowable Drift (Ext. Dipper)	6 mm/min (0.25 in/min)
BH Bucket Cylinder Max Allowable Drift	3 mm/min (0.12 in/min)
Swing Cylinder Max Allowable Drift	150 mm/min (6.00 in/min)
Loader Boom and Bucket Cylinder Maximum Allowable Drift	3 mm/min (0.12 in/min)
John Deere Ext. Dipper Cylinder Maximum Allowable Drift	6 mm/min (0.25 in/min)

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer

NOTE: The following tests are used to check leakage past the cylinder piston seals and through the main control valve spool and reliefs. Weighting the machine is not required to perform these tests. On extendable dipperstick machines fully retract dipperstick for all testing.

1. Install digital thermometer probe in reservoir. Warm hydraulic oil to specifications.

Specification
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

2. Put FNR lever in neutral and engage park brake.

Function Drift

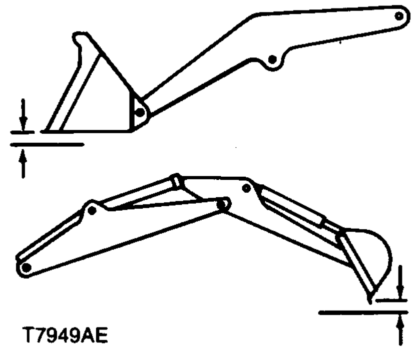
3. Position backhoe bucket side cutters at 45° angle to ground and lower boom until bucket cutting edge is 50 mm (2.00 in.) off ground.

Continued on next page

4. Position level loader bucket cutting edge same distance off ground as backhoe bucket.

NOTE: If bucket cutting edges touch the ground within one minute, excessive leakage is indicated in the cylinders or control valve. Position machine as shown, with the bucket pivot pin one meter (36 in.) off ground.

5. Run engine at slow idle and observe bucket cutting edges for one minute.



T7949AE

T7949AE –UN–25FEB93

Specification

Engine—Speed	Low idle
Function—Max Allowable Drift	50 mm/min (2.00 in/min)

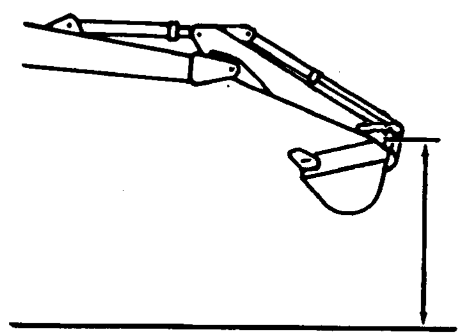
Backhoe Cylinder Drift

TX,902525,BS231 –19–21JUL94–2/7

6. Position the crowd cylinder with rod 20—50 mm (0.75—2.00 in.) extended from the fully retracted position.

7. Position the bucket cylinder with rod 20—50 mm (0.75—2.00 in) retracted from the fully extended position.

8. Measure movement of boom, crowd, and bucket cylinders for five minutes.



T7949AF –UN–26MAR93

Specification

BH Boom, Crowd Cylinder—Max	
Allowable Drift (Std. Dipper)	5 mm/min (0.20 in/min)
Max Allowable Drift (Ext. Dipper)	6 mm/min (0.25 in/min)
BH Bucket Cylinder—Max	
Allowable Drift	3 mm/min (0.12 in/min)

Divide measured rod drift by five to determine drift per minute.

Continued on next page

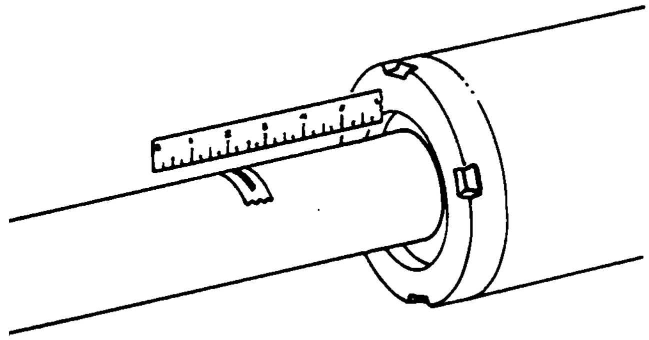
TX,902525,BS231 –19–21JUL94–3/7

9. To measure swing drift tilt machine by fully extending RH stabilizer. Fully extend dipperstick and bucket, so bucket is approximately 300 mm (12 in.) off ground. Boom should be parallel to ground. Position LH stabilizer 75 mm (3 in.) off ground.

10. Measure swing drift from side of bucket, to vertical rod placed in ground next to bucket, for five minutes. Divide measured drift by five to determine drift per minute.

Specification

Swing Cylinder—Max Allowable Drift .... 150 mm/min (6.00 in/min)

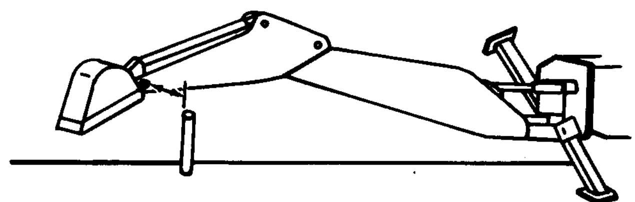


T6222AM —UN—26MAY89

TX,902525,BS231 –19–21JUL94–4/7

11. Measure swing drift in opposite direction by reversing stabilizer positions and vertical rod.

Loader Cylinder Drift



T7949AG —UN—25FEB93

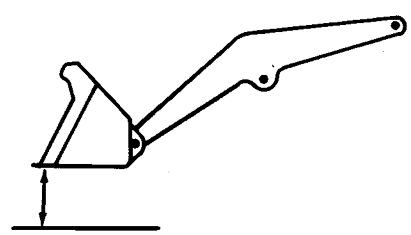
TX,902525,BS231 –19–21JUL94–5/7

12. Position the machine as shown with the loader bucket pivot pin one meter (36 in.) above ground, with bucket level.

13. Measure movement of boom and bucket cylinders for five minutes. Divide measured rod drift by five to determine drift per minute.

Specification

Loader Boom and Bucket Cylinder—Maximum Allowable Drift .... 3 mm/min (0.12 in/min)



T7949AH —UN—25FEB93

Extendable Dipperstick Cylinder Drift

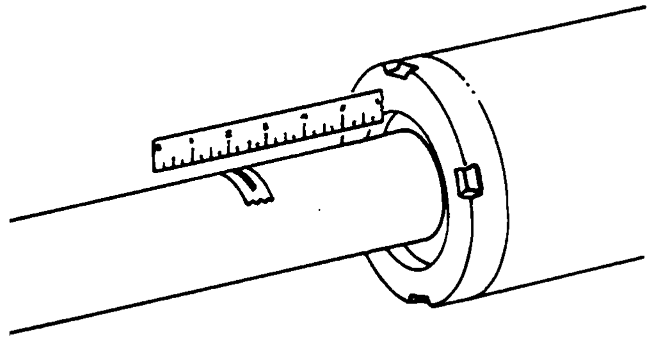
Continued on next page

TX,902525,BS231 –19–21JUL94–6/7

14. Machine in transport position. Mark or tape end of exposed internal dipperstick tube. Measure drift from end of external dipperstick housing for five minutes. Divide measured drift by five to determine drift per minute.

Specification

John Deere Ext. Dipper
Cylinder—Maximum Allowable
Drift .... 6 mm/min (0.25 in/min)



T6222AM –UN–26MAY89

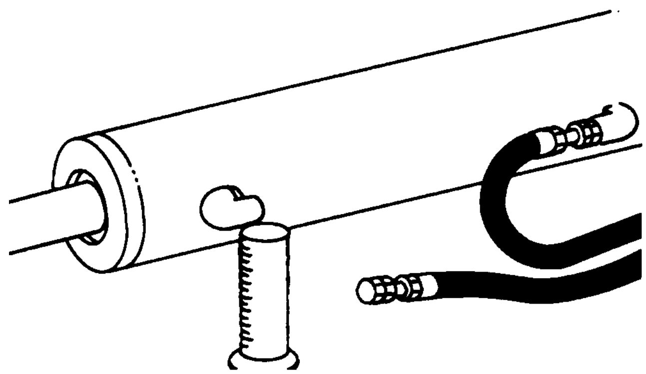
TX,902525,BS231 –19–21JUL94–7/7

Cylinder Leakage Test

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	Low idle
Cylinder Leakage	5 ml/min (1/6 oz/min)

ESSENTIAL TOOLS
38H1353 (-6 ORFS) Nut[a]
38H1139 (-6 ORFS) Plug[a]
38H1354 (-8 ORFS) Nut[a]
38H1140 (-8 ORFS) Plug[a]
38H1146 (-6 ORFS) Plug[a]
38H1147 (-8 ORFS) Plug[a]
[a]These ORFS fittings should be ordered through normal service parts channels.

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer



1. Install digital thermometer probe in reservoir.

Specification
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

9025
25
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2. Put FNR lever in neutral and engage park brake.

3. Start engine. Fully extend cylinder rod. Stop engine. Activate a hydraulic function to relieve pressure in the system.

4. Remove rod end hose and plug hose. Use a measuring beaker, after oil stops dripping, to catch oil. This can also be done at control valve, which would require capping control valve port and putting hose end into measuring beaker after oil stops dripping.

5. Start engine and actuate cylinder extend function for one minute.

Specification
Engine—Speed .... Low idle

Continued on next page

6. Stop engine. Measure oil collected and connect hose.

Specification

Cylinder—Leakage .... 5 ml/min (1/6 oz/min)

7. Repair as necessary. (See repair manual.)

8. Repeat procedure to test each cylinder.

T60,9025,1068 –19–21JUL94–2/2

Backhoe Or Loader Valve Leakage Test

SPECIFICATIONS	
Oil Temperature	65 ± 5°C (150 ± 10°F)
Engine Speed	Low idle
Oil Pressure	6900 ± 690 kPa (69 ± 6.9 bar) (1000 ± 100 psi)
300D, 310D Maximum Cylinder Rod Travel	7 mm/min (0.280 in/min)
315D Maximum Cylinder Rod Travel	15 mm/min (0.600 in/min)

ESSENTIAL TOOLS
38H1030 (-6 ORFS) Swivel Run Tee[a]
38H1338 (1-1/16-12 Male ORB x -6 ORFS Male) Adapter[a]
38H1172 (7/8-14 Male ORB x -6 ORFS Male) Adapter[a]
(Parker No. 1JS4366) Female Hose Ends Test Hose
(Parker No. 4316) 96 in. Cut Length Test Hose
38H1146 (-6 ORFS) Plug[a]
38H1147 (-8 ORFS) Plug[a]
[a]These ORFS fittings should be ordered through normal service parts channels.

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer
Gauge 0—35 000 kPa (0—350 bar) (0—5000 psi)
Dial Indicator

1. Put FNR lever in neutral and engage park brake.

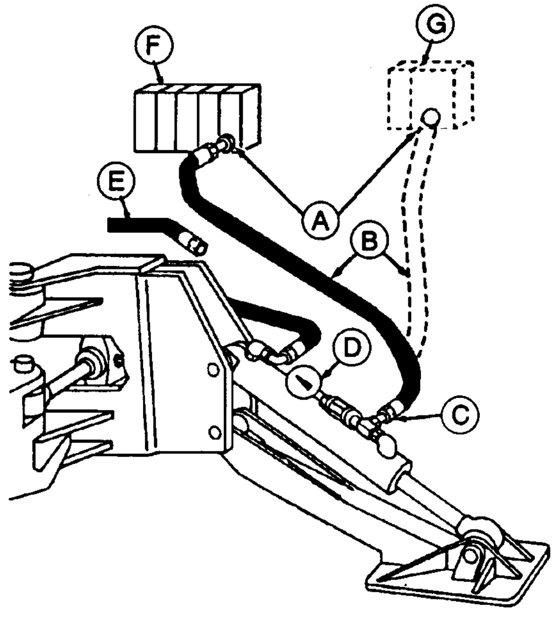
2. Install digital thermometer probe in reservoir. Heat oil to test specification.

Specification

Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

3. Lower stabilizers to ground and stop engine.



T7949AD CV

T7949AD –UN–25FEB93

A—Adapter
B—Test Hose
C—Tee
D—Gauge
E—Plug
F—Backhoe Valve
G—Loader Valve

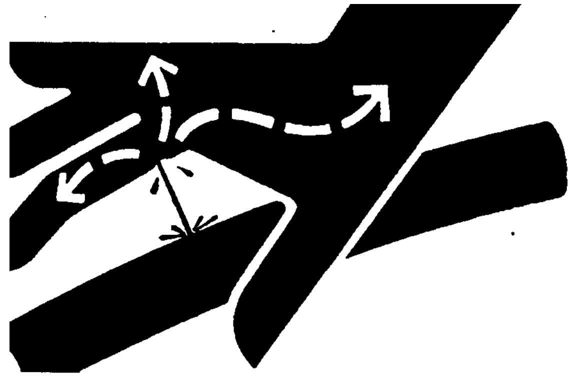
Continued on next page

TX,902525,BS225 –19–21JUL94–1/3

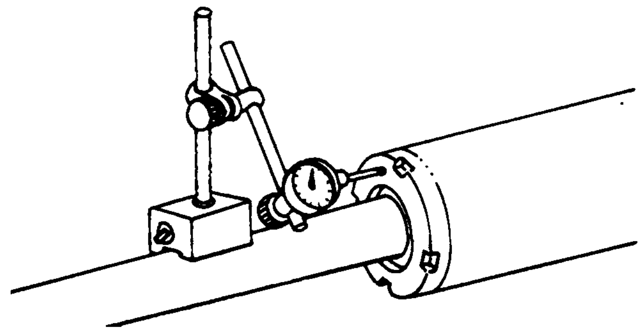
CAUTION: Stabilizer control valve contains lock-outs, which prevent releasing of hydraulic pressure when engine is off. Slowly loosen stabilizer hoses to bleed off stored pressure to prevent being sprayed with high pressure.

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



T6222AN –UN–26OCT88

4. Operate hydraulic controls to relieve pressure in the hydraulic system.

5. Do stabilizer cylinder leakage test to verify it is within allowable leakage specification. (See procedure in this group.)

6. Make test connections.

7. The stabilizer and circuit being tested must be activated together in order to retract stabilizer cylinder to start test cycle.

8. Install dial indicator to measure rod movement.

9. Start engine. Slowly meter stabilizer cylinder lever (down) until 7000 kPa (70 bar) (1000 psi) reading is obtained on gauge.

Specification

Engine—Speed	Low idle
Oil—Pressure	6900 ± 690 kPa (69 ± 6.9 bar) (1000 ± 100 psi)

Continued on next page

TX,902525,BS225 –19–21JUL94–2/3

Maintain this pressure and record cylinder rod travel on dial indicator for one minute.

Specification

300D, 310D—Maximum Cylinder Rod Travel:	7 mm/min (0.280 in/min)
315D—Maximum Cylinder Rod Travel	15 mm/min (0.600 in/min)

10. Stop engine and lower stabilizer to relieve pressure. Move test hose to next valve port to be tested. Reinstall previously tested lines. Plug hose of function being tested. Repeat Steps 4 thru 9 (as required).

NOTE: If leakage is high on both ports of a valve section, valve spool is worn and section should be replaced.

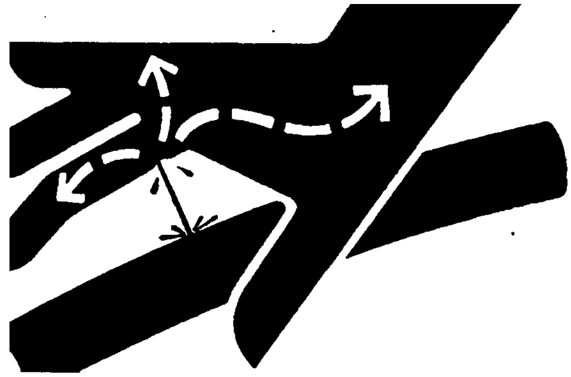
If one port of a section is above specification remove the relief for that section and inspect seals, replace if required. If seals are good, replace relief.

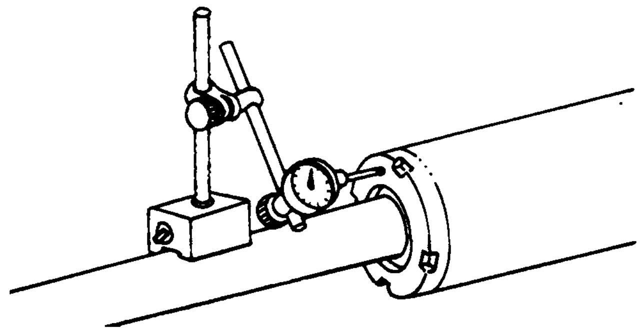
TX,902525,BS225 –19–21JUL94–3/3

Stabilizer Valve Lockout Leakage Test

SPECIFICATIONS	
Engine Speed	Low idle
Oil Temperature	65 ± 5°C (150 ± 10°F)
300D, 310D Max. Rod Travel	0.15 mm/min (0.006 in/min)
315D Max. Rod Travel	0.25 mm/min (0.010 in/min)

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer
Dial Indicator


X9811 –UN–23AUG88


T6222AN –UN–26OCT88

1. Install digital thermometer probe in reservoir. Heat hydraulic oil to test specifications.

Specification

Engine—Speed .... Low idle
Oil—Temperature .... 65 ± 5°C (150 ± 10°F)

See Hydraulic Oil Warm-up in Group 9025-25.

2. Lower stabilizers to lift machine off ground. Check for cylinder rod movement with dial indicator.

Specification

300D, 310D—Max. Rod Travel...................... 0.15 mm/min (0.006 in/min)
315D—Max. Rod Travel................................ 0.25 mm/min (0.010 in/min)

NOTE: The stabilizer valve has lockouts to prevent cylinder drift up or down. If cylinder rod drift is above specification, remove the lockout and check for scratches on the seat and poppet. Replace if required. Check that the lockout plunger which slides between the two lockouts is not sticking. Also check for contamination in the thermal relief poppet seat and cylinder packings.

TX,902525,BS227 –19–21JUL94–1/1

Side Shift Valve Leakage Test—315D

SPECIFICATIONS	
Engine Speed	Low idle
Oil Temperature	40 ± 6°C (104 ± 10°F) (warm to touch)
Oil Maximum Leakage	125 mL (4.2 oz)

SERVICE EQUIPMENT AND TOOLS
Measuring Beaker

1. Install digital thermometer probe in reservoir. Heat hydraulic oil to test specification.

Specification

Engine—Speed .... Low idle
Oil—Temperature .... 40 ± 6°C (104 ± 10°F) (warm to touch)

See Hydraulic Oil Warm-up in Group 9025-25.

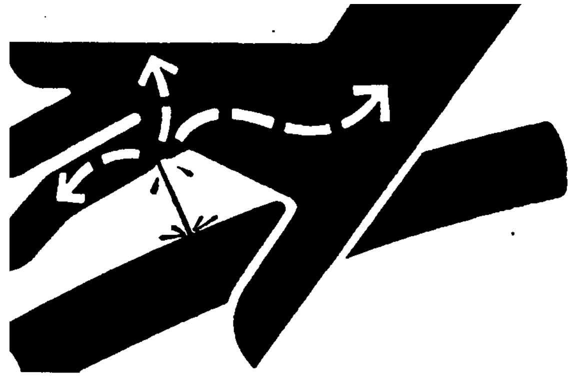
2. Put FNR lever in neutral and engage park brake. Install boom lock pin.

Continued on next page

T60,9025,C420 –19–21JUL94–1/2

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

3. Operate controls to relieve pressure in hydraulic system.

4. Hold side shift switch in ON position.

5. Remove return line and plug. Put beaker under fitting.

6. Start unit and hold boom raise function for one minute. Measure oil.

Specification

Oil—Maximum Leakage .... 125 mL (4.2 oz)

If leakage is excessive, replace O-ring or replace valve as necessary. See repair manual.

T60,9025,C420 –19–21JUL94–2/2

Cycle Time Specifications

Item	Measurement	Specification
Oil	Temperature	65 ± 5°C (150 ± 10°F)
Engine	Speed	Fast idle
300D Backhoe Loader		
Loader Boom Raise (Bucket Flat on Ground to Full Height) (Includes Bucket Self-Leveling)	Maximum Cycle Time	5.4 sec.
Loader Boom Lower (Power Down) (Full Up to Ground)	Maximum Cycle Time	3.0 sec.
Loader Boom Lower (Float Down) (Full Up to Ground)	Maximum Cycle Time	3.3 sec.
Loader Bucket Dump (Bucket Just Clears Ground)	Maximum Cycle Time	2.5 sec.
Loader Bucket Rollback (Bucket Just Clears Ground)	Maximum Cycle Time	2.4 sec.
Backhoe Boom Raise (Backhoe at Max. Reach With Bucket Teeth on Ground up to Cylinder Cushion)	Maximum Cycle Time	2.2 sec.
Backhoe Boom Lower (Backhoe at Max. Reach. Transport Position to Bucket Teeth on Ground)	Maximum Cycle Time	2.3 sec.
Crowd In (Boom in Transport Position)	Maximum Cycle Time	3.5 sec.
Crowd Out	Maximum Cycle Time	2.8 sec.
Backhoe Bucket Dump	Maximum Cycle Time	2.3 sec.
Backhoe Bucket Curl	Maximum Cycle Time	2.8 sec.
Backhoe Swing (Boom Raised to Cushion, Bucket Curled, Dipperstick Parallel to Ground. Time Cycle to Cylinder Cushion)	Maximum Cycle Time	4.0 sec.

Continued on next page

Item	Measurement	Specification
Stabilizer Up (Ground Level to Full Up)	Maximum Cycle Time	3.5 sec.
Stabilizer Down (Full Up to Ground Level)	Maximum Cycle Time	3.3 sec.
Extendible Dipperstick Extend and Retract	Maximum Cycle Time	3.0 sec.
Steering Right to Left	Maximum Cycle Time	3.2 turns
Steering Left to Right	Maximum Cycle Time	2.4 turns
Steering Right to Left (MFWD)	Maximum Cycle Time	3.5 turns
Steering Left to Right (MFWD)	Maximum Cycle Time	3.5 turns
Main Hydraulic Pump (Bucket Flag on Ground to Max. Height) (Includes Bucket Self-Leveling)	Maximum Cycle Time at 1000 ± 25 rpm Engine Speed	15 sec.
(S.N. —802199) Steering Pump (Full Crowd Out Cycle of Dipperstick, While Loader Boom at Max. Height and Held Over Relief)	Maximum Cycle Time at Fast Idle	15 sec.
(S.N. 802200—) Steering Pump (Full Crowd Out Cycle of Dipperstick, While Loader Boom at Max. Height and Held Over Relief)	Maximum Cycle Time	12 sec.
310D/315D Backhoe Loader		
Loader Boom Raise (Bucket Flat on Ground to Full Height) (Includes Bucket Self-Leveling)	Maximum Cycle Time	3.8 sec.
Loader Boom Lower (Power Down) (Full Up to Ground)	Maximum Cycle Time	2.6 sec.
Loader Boom Lower (Float Down) (Full Up to Ground)	Maximum Cycle Time	4.2 sec.
Loader Bucket Dump (Bucket Just Clears Ground)	Maximum Cycle Time	2.5 sec.

Continued on next page

TX,9025,BS423 –19–21JUL94–2/4

Item	Measurement	Specification
Loader Bucket Rollback (Bucket Just Clears Ground)	Maximum Cycle Time	2.4 sec.
Backhoe Boom Raise (Backhoe at Max. Reach With Bucket Teeth on Ground up to Cylinder Cushion)	Maximum Cycle Time	2.4 sec.
Backhoe Boom Lower (Backhoe at Max. Reach. Transport Position to Bucket Teeth on Ground)	Maximum Cycle Time	2.5 sec.
Crowd In (Boom in Transport Position)	Maximum Cycle Time	3.6 sec.
Crowd Out	Maximum Cycle Time	3.1 sec.
Backhoe Bucket Dump	Maximum Cycle Time	2.7 sec.
Backhoe Bucket Curl	Maximum Cycle Time	3.1 sec.
Backhoe Swing (Boom Raised to Cushion, Bucket Curled, Dipperstick Parallel to Ground. Time Cycle to Cylinder Cushion)	Maximum Cycle Time	4.5 sec.
Stabilizer Up (Ground Level to Full Up)	Maximum Cycle Time	3.5 sec.
Stabilizer Down (Full Up to Ground Level)	Maximum Cycle Time	3.3 sec.
Extendible Dipperstick Extend and Retract	Maximum Cycle Time	3.0 sec.
Steering Right to Left	Maximum Cycle Time	3.2 turns
Steering Left to Right	Maximum Cycle Time	2.4 turns
Steering Right to Left (MFWD)	Maximum Cycle Time	3.5 turns
Steering Left to Right (MFWD)	Maximum Cycle Time	3.5 turns
Main Hydraulic Pump (Bucket Flag on Ground to Max. Height) (Includes Bucket Self-Leveling)	Maximum Cycle Time at 1000 ± 25 rpm Engine Speed	15 sec.

Continued on next page

TX,9025,BS423 –19–21JUL94–3/4

Item	Measurement	Specification
315D Steering Pump (Full Crowd Out Cycle of Dipperstick, While Loader Boom at Max. Height and Held Over Relief)	Maximum Cycle Time	22 sec.
(310D, S.N. —802199) Steering Pump (Full Crowd Out Cycle of Dipperstick, While Loader Boom at Max. Height and Held Over Relief)	Maximum Cycle Time at Fast Idle	22 sec.
(310D, S.N. 802200—) Steering Pump (Full Crowd Out Cycle of Dipperstick, While Loader Boom at Max. Height and Held Over Relief)	Maximum Cycle Time	18 sec.

TX,9025,BS423 –19–21JUL94–4/4

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Section 9031
Heating And Air Conditioning

Contents

Proper Refrigerant Handling

The U.S. Environmental Protection Agency prohibits discharge of any refrigerant into the atmosphere, and requires that refrigerant be recovered using the approved recovery equipment.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT use refrigerant, hoses, fittings, components or refrigerant oils intended for use with R12 refrigerant.

Recovery, recycling and charging stations for R12 and R134a refrigerants MUST NOT be interchanged. Systems containing R12 refrigerant use a different oil than systems using R134a. Certain seals are not compatible with both types of refrigerants.

TX,9031,QQ2009 –19–19AUG94–1/1

R12 And R134A Refrigerant Cautions

CAUTION: DO NOT allow liquid refrigerant to contact eyes or skin. Liquid refrigerant will freeze eyes or skin on contact. Wear goggles, gloves and protective clothing.

If liquid refrigerant contacts eyes or skin, DO NOT rub the area. Splash large amounts of COOL water on affected area. Go to a physician or hospital immediately for treatment.

DO NOT allow refrigerant to contact open flames or very hot surfaces such as electric welding arc, electric heating element and lighted smoking materials.

DO NOT heat refrigerant over 52°C (125°F) in a closed container. Heated refrigerant will develop high pressure which can burst the container.

Keep refrigerant containers away from heat sources. Store refrigerant in a cool place.

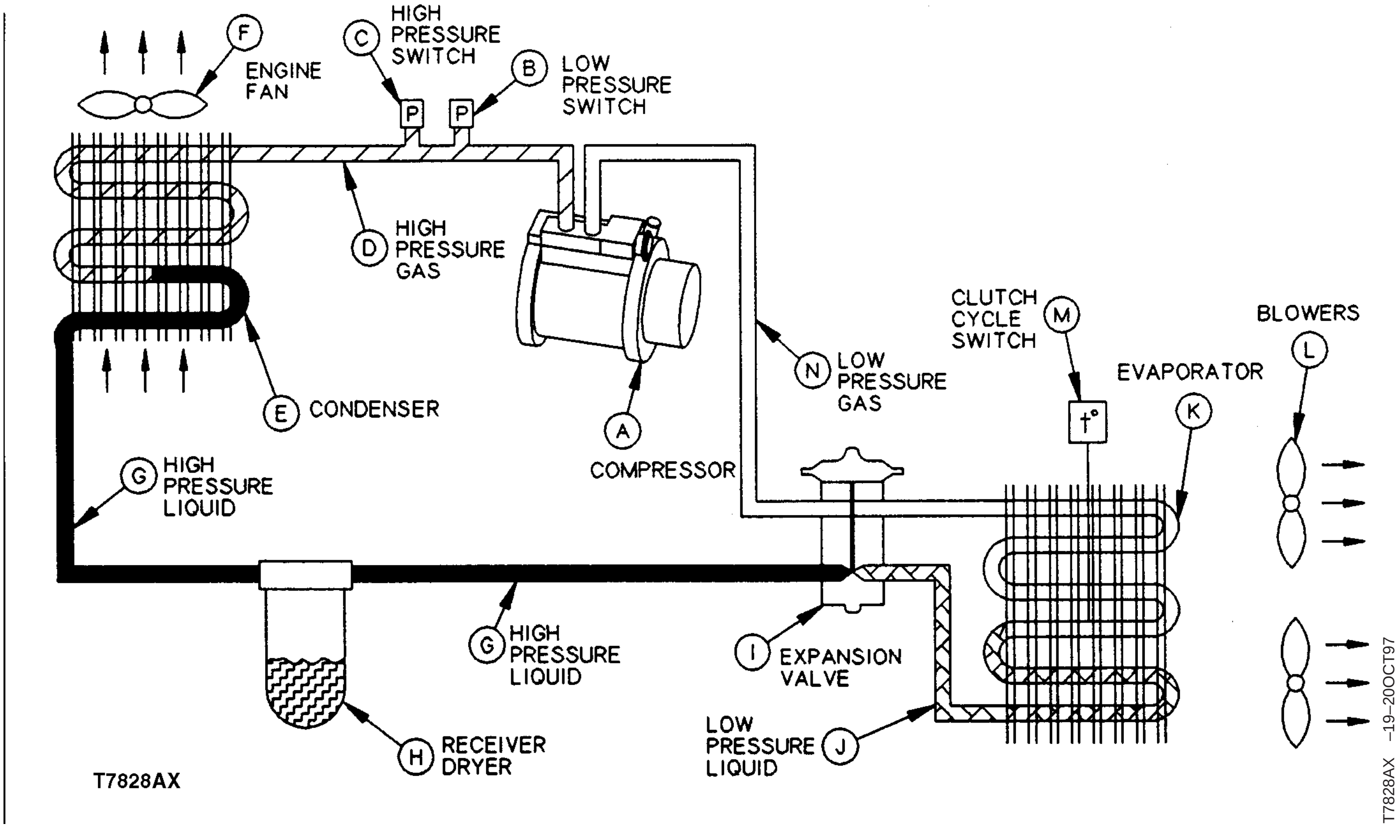
DO NOT handle damp refrigerant container with your bare hands. Skin may freeze to container. Wear gloves.

If skin freezes to container, pour COOL water over container to free the skin. Go to a physician or hospital immediately for treatment.

(R12 ONLY) Refrigerant exposed to high temperature forms phosgene gas. Inhaling toxic phosgene gas may result in serious illness or death. Phosgene gas has an odor like new mown hay or green corn. If you inhale phosgene gas, go to a physician or hospital immediately for treatment.

TX,9031,QQ2010 –19–17JUN94–1/1

Refrigerant Theory Of Operation



A—Compressor
B—Low Pressure Switch
C—High Pressure Switch
D—High Pressure Gas
E—Condenser
F—Engine Fan
G—High Pressure Liquid
H—Receiver Dryer
I—Expansion Valve
J—Low Pressure Liquid
K—Evaporator
L—Blowers
M—Clutch Cycle Switch
N—Low Pressure Gas

The compressor (A) draws low pressure gas (N) from the evaporator (K) and compresses it into high pressure gas (D). Increasing the pressure of the refrigerant causes its boiling point to rise to a temperature higher than the outside air temperature.

High pressure gas (D) leaves the compressor (A) and passes through two switches (B and C). These switches monitor refrigerant pressure. Should the pressure become too great or too small, either the high or low pressure switch will open and stop the compressor, interrupting the cycle.

As the high pressure gas flows through the condenser (E), the engine fan (F) draws air through the condenser core which cools the refrigerant. Cooling the refrigerant causes it to condense and it leaves the condenser (E) as a high pressure liquid (G). The high pressure liquid flows into the receiver-dryer (H) where moisture and contaminants are removed.

The refrigerant flows from the receiver-dryer (H) to the expansion valve (I). The expansion valve (I) is a variable orifice used to cause a pressure and temperature drop in the refrigerant causing refrigerant to vaporize. The expansion valve (I) is one of the dividing lines between the high side and low side of the air conditioning system. At this point in the system, the high pressure/high temperature liquid is sprayed into the evaporator (K) where it changes and becomes a gas.

Continued on next page

TX,9031,QQ2011 –19–17JUN94–1/2

The expansion valve diaphragm is activated by sensing temperature and pressure within the valve body. The internal bulb senses the evaporator outlet or discharge temperature and pressure of refrigerant as it passes through the valve back to the low pressure or suction side of the compressor. (See Expansion Valve Operation in this group for additional information on theory of operation.)

If too much refrigerant is flowing into evaporator, the liquid refrigerant will still be evaporating as it leaves the evaporator, causing a low temperature at the evaporator outlet. The low temperature causes the expansion valve variable orifice to decrease in size, restricting refrigerant flow. If the evaporator outlet temperature is too warm, the orifice will increase in size, allowing more refrigerant into evaporator.

If evaporator (K) temperature becomes too low, the clutch cycle switch (M) will interrupt current flow to the compressor clutch coil, stopping system operation until the temperature becomes normal, between 31° and 40°.

TX,9031,QQ2011 –19–17JUN94–2/2

Air Conditioning Circuit Operational Information

The following conditions must exist for air conditioning circuit to function:

- Key switch ON
- Machine running
- Air conditioning switch turned
- ON Blower switch turned to low, medium or high.

TX,9031,QQ1840 –19–17JUN94–1/1

Air Conditioning Circuit Theory Of Operation

Power from 30 amp heater fuse flows through P16 red and 518 red wires to blower switch. With blower switch turned to low, medium or high position, power flows to blower resistor and then to heater blower motors.

Power also flows from C terminal of blower switch, through 522 white wire to clutch cycle switch, through 517 dark blue wire to air conditioning switch.

With air conditioning switch turned ON, power flows through A17 orange wire to the low pressure switch. With low pressure switch closed, power flows through A18 green wire to high pressure switch. With high pressure switch closed power flows through A19 green wire to the coil terminal of the compressor coil to energize the compressor clutch.

Low Pressure Switch

The low pressure switch will open if the air conditioning system loses its refrigerant charge. The switch opens to stop current flow to the compressor which prevents compressor engagement. The low pressure switch is located near the compressor in high pressure line.

High Pressure Switch

The high pressure switch protects the system from high pressure. If a malfunction or line restriction causes the high pressure to increase above the setting of the switch, the switch will open to stop current flow to the compressor clutch. The high pressure switch is located near the compressor in the high pressure line.

Clutch Cycle Switch

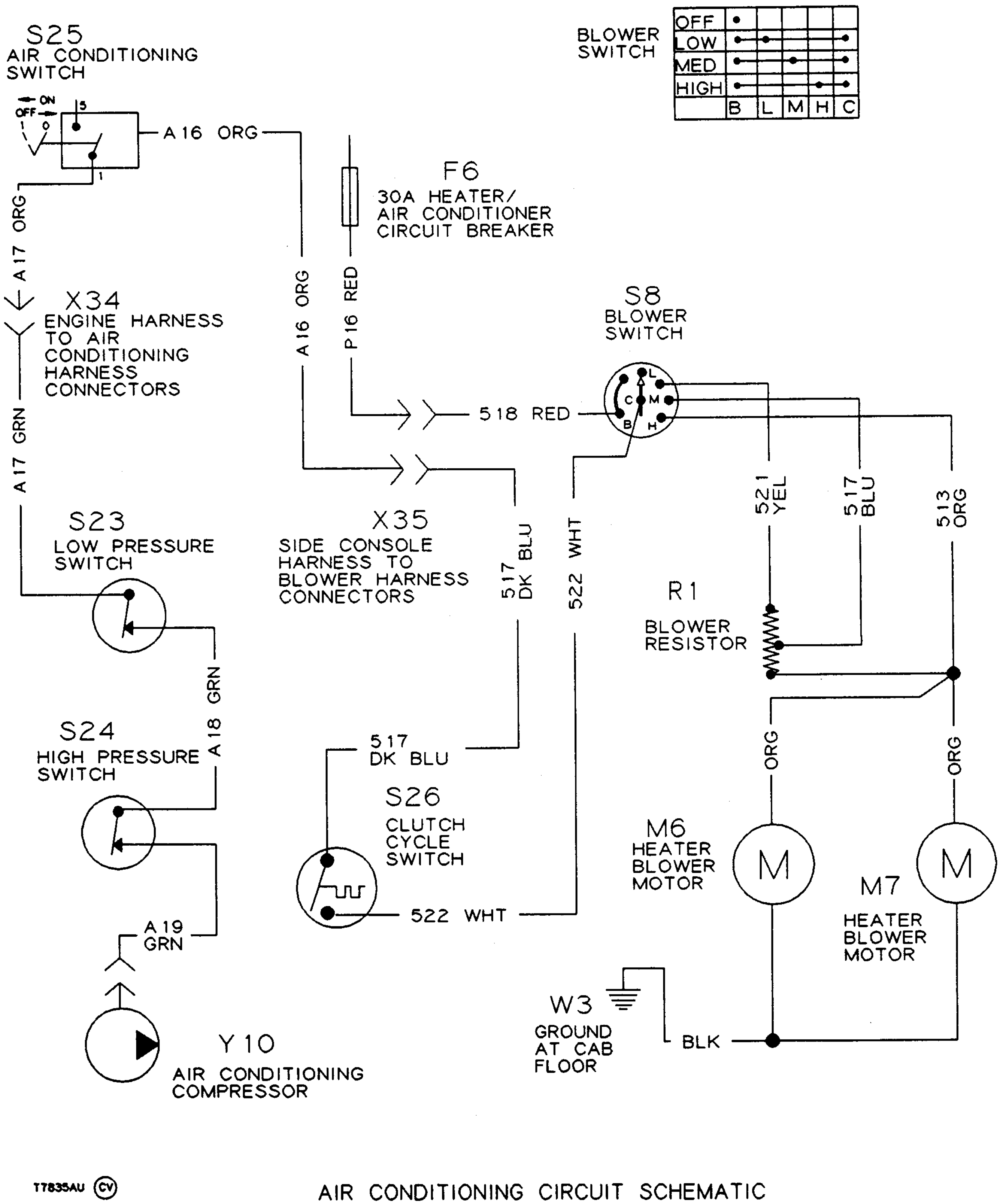
The clutch cycle switch is used to sense the temperature in the evaporator core. When the temperature drops, the clutch cycle switch opens, shutting the compressor off. When the temperature in the evaporator core raises, the clutch cycle switch closes sending voltage to the compressor.

The clutch cycle switch receives power from the blower switch when blower switch is turned to low, medium or high position.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9031,DY357 –19–30MAY96–1/1

Air Conditioning Circuit Schematic



TX,90310,QQ1842 –19–17JUN94–1/1

Blower Circuit Operational Information

The following conditions must exist for blower circuit to function:

- Key switch in ON or ACC position
- Blower switch turned ON

TX,9015,QQ1818 –19–17JUN94–1/1

Blower Circuit Theory Of Operation

Power from heater circuit breaker goes to blower switch. With blower switch in low position power is sent to blower resistor. Voltage goes through complete resistor and is reduced to 3.0—3.5 volts, blower motor runs in low speed.

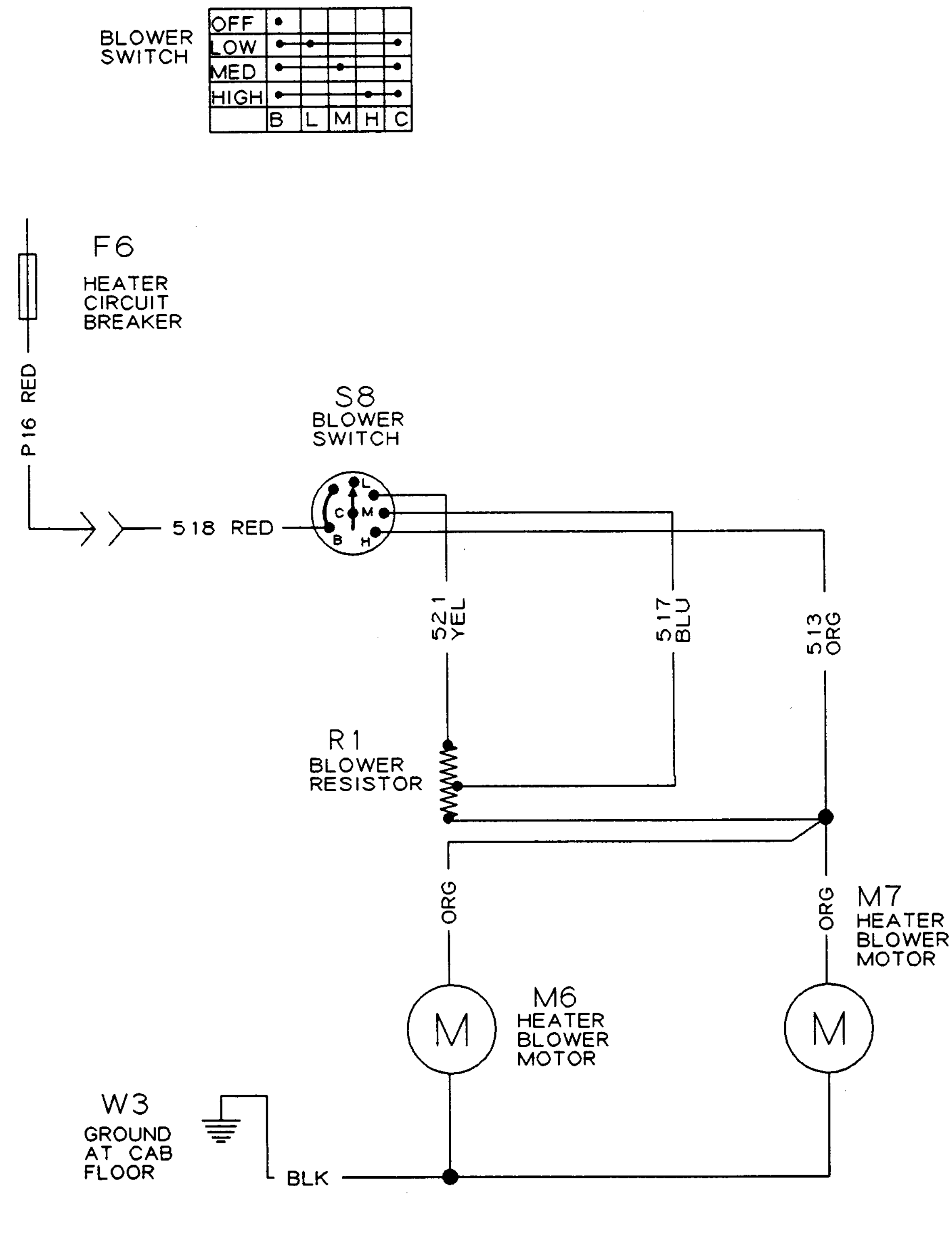
With blower switch in medium position power is sent through half the blower resistor and is reduced to 6.0—6.5 volts, blower motor runs in medium speed.

With blower switch in high position power by-passes resistor and 12 volts is applied to blower motor, causing it to run at high speed.

NOTE: For component identification code description, see Wiring and Schematic Diagrams Legend , Group 9015-10.

TX,9015,QQ1766 –19–17JUN94–1/1

Blower Circuit Schematic



T7857AD

BLOWER CIRCUIT SCHEMATIC

T7857AD –19–30SEP92

TX,901515,QQ809 –19–17JUN94–1/1

Receiver/Dryer Operation

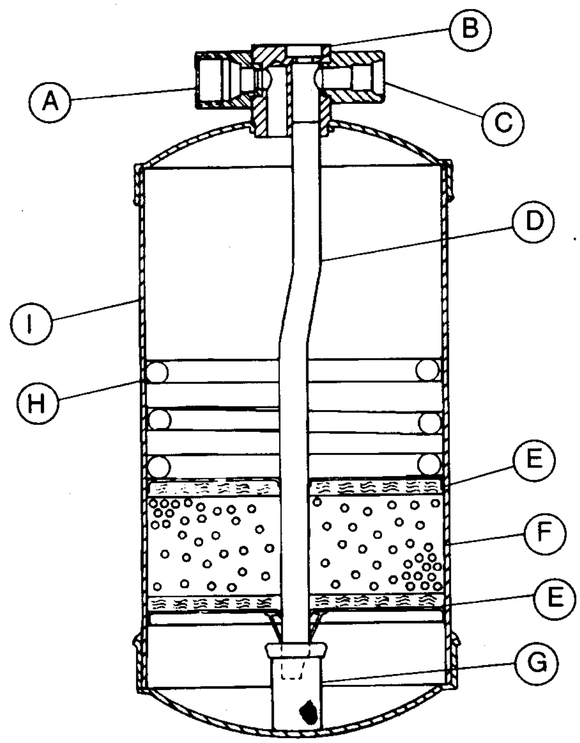
The receiver/dryer is a reservoir to store excess liquid refrigerant in the system. Excess refrigerant is required for two reasons:

Outside air temperature and humidity have an effect on the minimum quantity of refrigerant required in the system for the air conditioner to operate at maximum efficiency. The higher the temperature and humidity, the more refrigerant required in the system. More refrigerant is required due to the expansion valve opening farther allowing more refrigerant into the low pressure side of the system.

Refrigerant hoses allow a small amount of refrigerant to migrate through their walls. Extra refrigerant stored in the system allows for a longer period of time before additional refrigerant is needed.

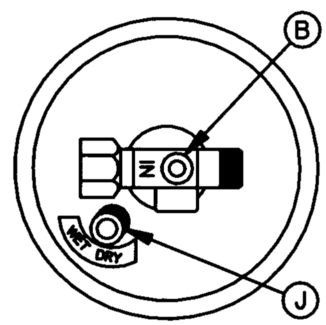
The receiver/dryer also contains two filters (E) and desiccant (F) between the filters. The filters remove solid materials which could be generated by a compressor failure, debris left in the system due to improper service procedures, or particles caused by corrosion of metal parts due to moisture and acids in the system (also caused by improper service procedures).

Desiccant is used to absorb moisture. If too much moisture gets into the system, the desiccant may not be able to absorb it all. When moisture is combined with refrigerant oil, a sludge is formed. This sludge does not permit moving parts to be adequately lubricated. When moisture is combined with refrigerant, hydrofluoric and hydrochloric acids are formed. These acids are very corrosive to metal surfaces and leakage will eventually develop. If the air conditioning system is left open for a period of time or if the plugs are removed from the receiver/dryer, the desiccant will also absorb moisture from the air. The receiver/dryer contains a color moisture indicator. (Blue) indicates dryer is dry. (Pink) indicates moisture in the desiccant. Evacuating the system will not remove moisture from the desiccant. You must replace the receiver/dryer.



T8104AE CV

T8104AE –UN–19OCT93



T8104AF CV

T8104AF –UN–10JAN94

A—Inlet Port
B—Sight Glass
C—Outlet Port
D—Pickup Tube
E—Filter
F—Desiccant
G—Strainer
H—Spring
I—Receiver/Dryer
J—Wet/Dry Indicator

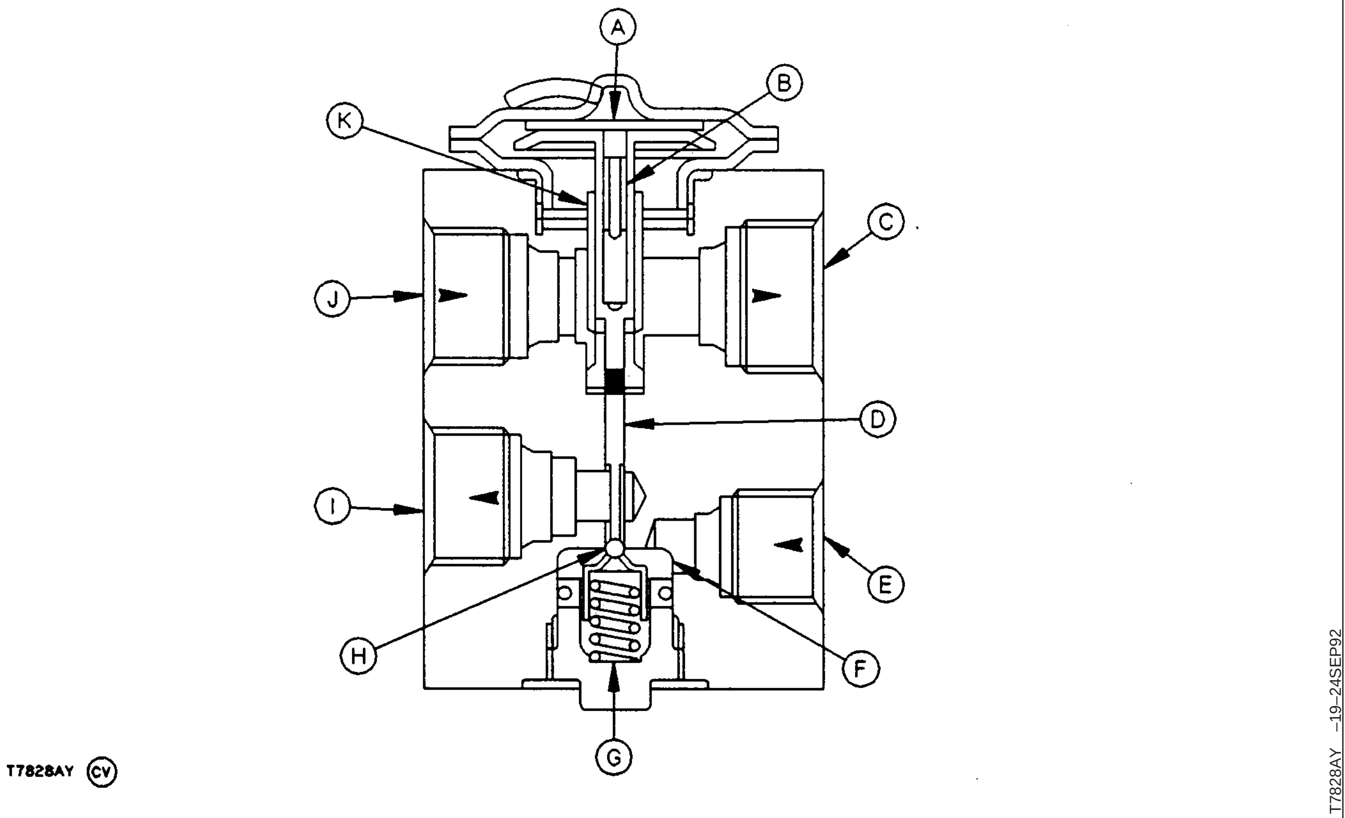
Continued on next page

TX,9031,QQ2341 –19–17JUN94–1/2

A sight glass is installed in the receiver/dryer outlet port. If the refrigerant level is low, a steady stream of gas bubbles will be present in the liquid flowing from the receiver/dryer. These gas bubbles can be seen in the sight glass and are an indication that the system needs charging. However, bubbles may be present when the compressor clutch first engages but must disappear after a few seconds. If the sight glass is clear, the system either has a sufficient charge or is completely discharged.

TX,9031,QQ2341 –19–17JUN94–2/2

Expansion Valve Operation



A—Valve Diaphragm
B—Sealed Sensing Bulb
C—Outlet to Compressor
D—Operating Pin
E—Inlet Flow
F—Metering Orifice
G—Valve Spring
H—Ball Seat
I—Outlet to Evaporator
J—Discharge from Evaporator
K—Internal Equalization Passage

The expansion valve is used to regulate the amount of refrigerant flowing into the evaporator. At this point in the system, the high pressure/high temperature liquid is sprayed into the evaporator where it changes state and becomes a gas.

The valve diaphragm (A) is activated by sensing temperature and pressure within the valve body. The sealed sensing bulb (B) senses the evaporator outlet (I) or discharge temperature and pressure of the refrigerant as it passes through the valve back to the low pressure or suction side of the compressor.

The metering orifice (F) and ball seat area (H) in the expansion valve is relatively small. The rapidly expanding refrigerant passing through this area can cause any moisture in the system to freeze at this point and block refrigerant flow. Other contaminants in the system can also cause a valve to malfunction. If expansion valve malfunctions, it must be replaced. Expansion valve is not repairable.

TX,9031,QQ2012 –19–17JUN94–1/1

Compressor Relief Valve Operation

The compressor relief valve is a direct acting pressure limiting valve. If a malfunction in the system occurs that would cause high pressure, such as a restricted line, the valve will open near 4137 kPa (41.4 bar) (600 psi) and remain open until pressure drops to below the valve setting.

If the relief valve opens, a loud popping noise will be heard. Some oil may also be lost from the system. Correct any condition that would cause the valve to open.

TX,9031,QQ1879 –19–17JUN94–1/1

Temperature Control

Temperature control is adjusted by the position of the heater temperature switch in the cab. This switch is mechanically connected to the water valve at the base of the heater core. Turning the heater temperature switch towards maximum and/or towards off opens and closes the water valve controlling engine coolant flow through the heater core, thus controlling the temperature inside the cab.

In certain conditions when the air conditioning switch is turned on and the blower switch is in low position, the cab temperature may still be too cool. It may be necessary to blend heat with cooling to get a comfortable cab temperature.

TX,903105,QQ775 –19–17JUN94–1/1

Air Conditioning Operational Checks

This procedure is designed so the mechanic can make a quick check of the system using a minimum amount of diagnostic equipment. If you need additional information, read Theory of Operation (Group 9031-05).

The engine or other major components must be at operating temperature for some checks.

Locate system check in the left column and read completely, following this sequence from left to right. Read each check completely before performing.

At the end of each check, if no problem is found, that check is complete. When a problem is indicated, additional checks or repair information will be given.T.M. Group or CTM number required for repair will be given. If verification is needed, you will be given next best source of information:

Group: 10 (System Operational Checks)

Group: 15 (Diagnostic Information)

Group: 20 (Adjustments)

Group: 25 (Tests)

CTM (Component Technical Manual)

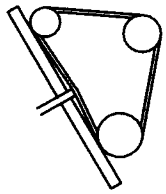
TX,9031,QQ1862 –19–17JUN94–1/1

❶ Visual Inspection Of Components

– – –1/1

All Lines And Hoses	Engine OFF. Inspect all lines and hoses. Are lines and hoses straight, NOT kinked or worn from rubbing on other machine parts or ’weather checked’? Are hose and line connections clean NOT showing signs of leakage, such as oil or dust accumulation at fittings? All hose and line clamps must be in place and tight. Clamps must have rubber inserts or cushions in place to prevent clamps from crushing or wearing into hoses or lines?	**YES:** Check Complete. **NO:** Reposition hoses or lines and tighten or replace clamps. Tighten fittings or replace O-rings in fittings. Replace hoses or lines as required.

– – –1/1

Air Conditioner Compressor Check	 T6488GD –UN–02SEP93 Inspect compressor. Is compressor drive belt tight? Is belt in good condition, NOT frayed, worn or glazed? Is compressor belt pulley in good condition, NOT worn or grooved? Are compressor mounting brackets in good condition, and bracket cap screws tight? Are electrical connections to compressor clutch clean and tight? Is wiring to compressor in good condition?	**YES:** Check complete. **NO:** Repair or replace components as required. – – –1/1
Condenser Check	Engine OFF. Inspect condenser cores. Is condenser core free of dirt or debris? Does condenser show signs of leakage, dust accumulation or oily areas? Are condenser fins straight, not bent or damaged? Inspect engine fan. Are fan blades in good condition, not worn, bent, broken or missing?	**YES:** Check complete. **NO:** Clean, repair or replace condenser core. Replace engine fan. – – –1/1
Evaporator Core Check	Engine OFF. Inspect core. Are fins straight? Is evaporator core free of dirt and debris?	**YES:** Check complete. **NO:** Repair, replace or clean evaporator. – – –1/1

Clutch Cycle Switch Sensing Tube Check	Engine OFF. Inspect clutch cycle switch sensing tube. Is sensing tube straight, NOT kinked or broken? Is sensing tube inserted into evaporator core and secured in place?	**YES:** Check complete. **NO:** If sensing tube is kinked, replace clutch cycle switch . **NO:** If tube is positioned in evaporator incorrectly, re-route.

– – –1/1

Air Conditioner Compressor Check	Engine OFF. Inspect compressor. Is compressor drive belt tight? Is belt in good condition? Is belt tightening strap straight? Is compressor belt pulley in good condition (NOT grooved)? Are compressor to bracket and bracket to engine mounting cap screws tight? Is compressor pulley aligned with engine pulley? Are electrical connections to compressor clutch clean and tight? Is wiring to compressor in good condition?	**YES:** Go to next check. **NO:** Repair or replace components as required.

– – –1/1

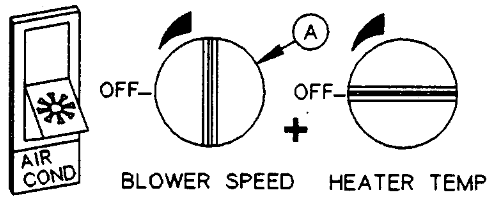
Cab Door And Window Seals Check	Open and close door and windows. Inspect seals. Do door and windows contact seals evenly? Are seals in position and in good condition?	**YES:** Check complete. **NO:** Adjust door and windows to close against seals properly. Replace seals as necessary.

– – –1/1

❷ System Operating Checks

– – –1/1

Blower Motor Check



T7828AW –19–30SEP92

Engine OFF. Key switch ON.

Turn blower switch (A) to LOW, MEDIUM and HIGH.

Does fan have three speeds?

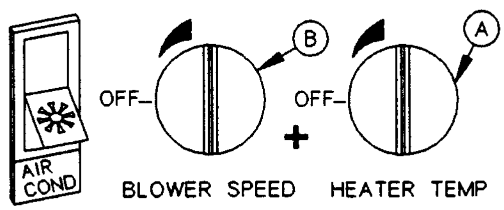
Does air exit from ducts?

YES: Check complete.

NO: See Circuit Checks in Group 9031-10. Check wiring harness.

– – –1/1

Heater



T7835AW –19–30SEP92

Start engine and allow to warm several minutes.

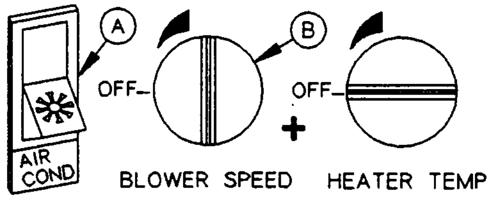
Turn heater temperature switch (A) to maximum heat. Turn blower switch (B) to high speed.

Does warm air exit from ducts?

YES: Check complete.

NO: See Circuit Checks in Group 9031-10. Check wiring harness.

– – –1/1

Air Conditioner (If Equipped)	 T7835AX –19–30SEP92 Start engine and run at fast idle. Turn air conditioner switch (A) to ON position. Turn blower switch (B) to high speed. Wait for any warm air in duct system to dissipate. Is air from ducts cool?	**YES:** Check complete. **NO:** See Blower/Air Conditioning Circuit Checks in Group 9031-10. See Charging the system in Group 9031-20. – – –1/1

Compressor Clutch Check	Engine OFF. Key switch ON. Blower switch on LOW. Air conditioner switch ON. Does compressor clutch ’click’ as switch is pushed?	**YES:** Check complete. **NO:** Replace compressor clutch. – – –1/1

❸ System Performance Checks

– – –1/1

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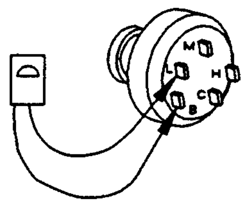
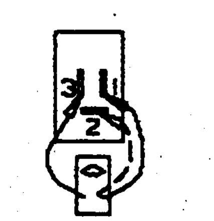
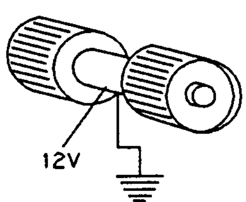
Expansion Valve Check	Is expansion valve outlet line free of frost? Is insulating tape wound tightly around outlet line and is tape in good condition?	**YES:** Check complete. **NO:** Go to Expansion Valve Operation in Group 9031-05. – – –1/1

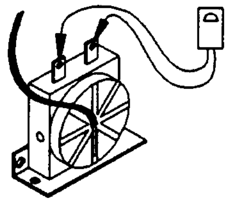
Evaporator Check	Remove seat and heater/blower cover. Is ice forming on evaporator core? Is fan motor failing or fan blades damaged? Is clutch cycle sensing tube properly positioned? Is heater temperature balance control misadjusted or damaged? Is evaporator drain tubes plugged?	**YES:** Check complete. **NO:** Go to Clutch Cycle Switch Bench Test in Group 9031-25 – – –1/1

❹ Blower/Air Conditioning Circuit Checks

– – –1/1

Blower Switch	 T7199CL –UN–17SEP90	Disconnect harness from blower switch. Using a multimeter check for continuity. Move blower switch to LOW, MEDIUM and HIGH checking terminals B to L and C, B to M and C and B to H and C. Is continuity measured?	**YES:** Blower switch is good. Go to next check. **NO:** Replace blower switch. – – –1/1
Blower Resister	 T6534CR –UN–19OCT88	Measure ohms between terminals 3 and 1. Does ohmmeter read 1.0 ohms? Measure ohms between terminals 3 and 2. Does ohmmeter read 0.5 ohms?	**YES:** Resistor is good. Check wiring harness. **NO:** Replace resistor – – –1/1
Heater/Blower Motor Check	 T7199CM –UN–16AUG90	Disconnect harness from heater blower motor. Connect 12 volts to heater blower motor, and ground motor. Does heater blower motor operate?	**YES:** Heater blower motor is good. Check wiring harness. **NO:** Replace heater blower motor. – – –1/1

Clutch Cycle Switch



T7835AV –19–24SEP92

With clutch cycle switch at room temperature.

Disconnect harness from switch.

Measure continuity across switch terminals.

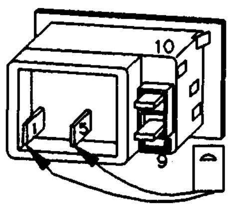
Is continuity measured?

YES: Do Clutch Cycle Switch Test. See Group 9031-25. If Switch is OK. Check wiring harness.

NO: Switch has failed. Replace switch.

– – –1/1

Air Conditioning Switch



T7199DE –UN–02OCT90

Disconnect harness from air conditioning switch.

Turn switch ON, and measure for continuity between terminals 1 and 5.

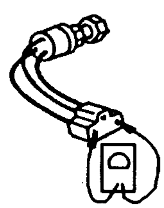
Is continuity measured?

YES: A/C switch is good. Check wiring harness.

NO: Replace A/C switch.

– – –1/1

Air Conditioner Low Pressure Switch Check



T8093AB –UN–05OCT93

Disconnect harness from switch.

Check for continuity between outer terminals. Is continuity measured?

YES: Replace switch.

NO: Continue with this check.

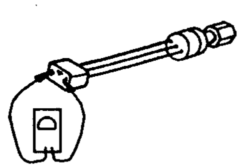
Remove switch from system. (The line that attaches the low pressure switch has a valve to prevent discharging the air conditioning system when switch is removed.)

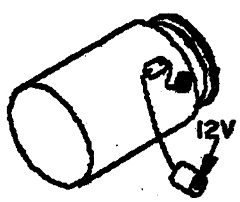
Does ohmmeter read open?

YES: Switch is good. Check wiring harness.

NO: Go to Low Pressure Switch Test, Group 9031-25.

– – –1/1

Air Conditioner High Pressure Switch Check	 T8093AD –UN–05OCT93 Disconnect harness from switch. Measure continuity across outer switch terminals. Does ohmmeter read continuity?	**YES:** Continue with this check. **NO:** Replace switch.
	Remove switch from system. (The line that attaches the high pressure switch has a valve to prevent discharging the air conditioning system when switch is removed.) Measure continuity across switch terminals. Does ohmmeter read continuity?	**YES:** Switch is good. Check wiring harness. **NO:** System pressure is too high. Go to Air Conditioning Pressure Diagnostic Chart, Group 9031-25. – – –1/1

Air Conditioning Compressor Clutch Coil	 T6534CV –UN–19OCT88 Disconnect harness from clutch. Connect battery voltage to clutch terminal that has orange wire. Ground black wire terminal. Does Clutch ’click’?	**YES:** A/C compressor clutch coil is good. Check wiring harness. **NO:** Replace clutch coil. – – –1/1

Diagnose Air Conditioning Electrical Malfunctions

NOTE: Diagnostic charts are arranged from most probable and simplest to verify, to least likely more difficult to verify. Remember the following steps when diagnosing a problem:

- *Step 1. Operational Check Out Procedure*
- *Step 2. Diagnostic Charts*
- *Step 3. Adjustments and/or Tests*

Symptom	Problem	Solution
Air Conditioning System Does Not Operate	Circuit Breaker	Replace circuit breaker.
	Blower switch	See Blower/Air Conditioning Circuit Checks, Group 9031-10.
	Blower resistor	See Blower/Air Conditioning Circuit Checks, Group 9031-10.
	Heater/blower motor	See Blower/Air Conditioning Circuit Checks, Group 9031-10.
	Clutch cycle switch	See Blower/Air Conditioning Circuit Checks, Group 9031-10.
	Air conditioning switch	See Blower/Air Conditioning Circuit Checks, Group 9031-10.
	Low pressure switch	See Blower/Air Conditioning Circuit Checks, Group 9031-10.
	High pressure switch	See Blower/Air Conditioning Circuit Checks, Group 9031-10.
	Compressor clutch coil	See Blower/Air Conditioning Circuit Checks, Group 9031-10.
	Wiring harness	Check wiring harness. (See Group 9015-10.)

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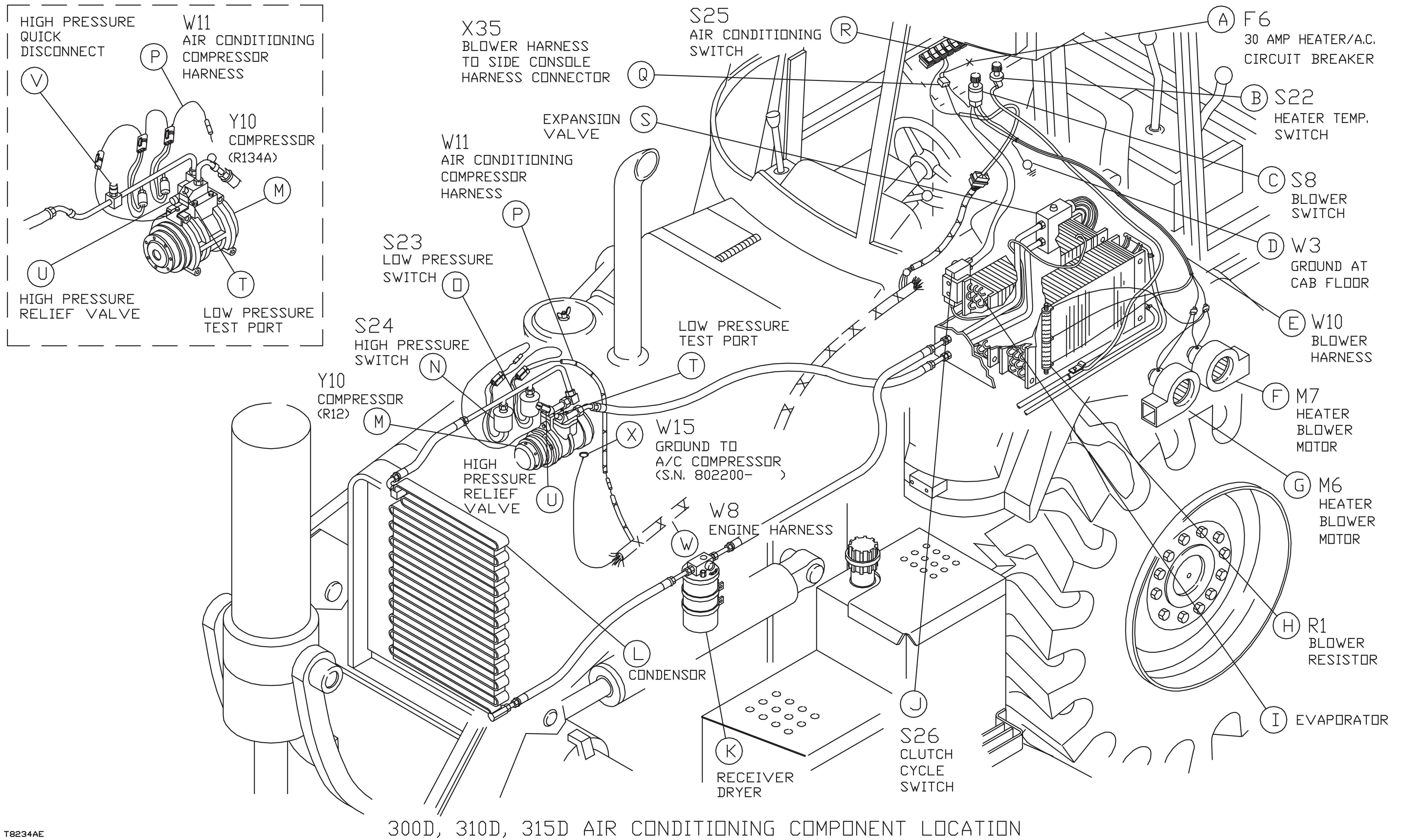
TX,9031,QQ2003 –19–17JUN94–1/1

Air Conditioning Component Location

T8234AE –19–20FEB99



300D, 310D, 315D AIR CONDITIONING COMPONENT LOCATION

TX,9031,QQ2606 –19–17JUN94–1/2

A—30 AMP Heater/A.C. Circuit Breaker
B—Heater Temperature Switch (S22)
C—Blower Switch (S8)
D—Ground at Cab Floor
E—Blower Harness (W10)
F—Heater Blower Motor (M7)
G—Heater Blower Motor (M6)
H—Blower Resistor (R1)
I—Evaporator
J—Clutch cycle switch (S26)
K—Receiver Dryer
L—Condenser
M—Compressor R12/R134a (Y10)
N—High Pressure Switch (S24)
O—Low Pressure Switch (S23)
P—Air Conditioning Compressor Harness (W11)
Q—Blower Harness to Side console Harness Connector (X35)
R—Air Conditioning Switch (S25)
S—Expansion Valve
T—Low Pressure Test Port
U—High Pressure Relief Valve
V—High Pressure Quick Disconnect

NOTE: For electrical call-outs in parenthesis, see Wiring and Schematic Diagrams Legend in Group 9015-10.

TX,9031,QQ2606 –19–17JUN94–2/2

Proper Refrigerant Handling

The U.S. Environmental Protection Agency prohibits discharge of any refrigerant into the atmosphere, and requires that refrigerant be recovered using the approved recovery equipment.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT use refrigerant, hoses, fittings, components or refrigerant oils intended for use with R12 refrigerant.

Recovery, recycling and charging stations for R12 and R134a refrigerants MUST NOT be interchanged. Systems containing R12 refrigerant use a different oil than systems using R134a. Certain seals are not compatible with both types of refrigerants.

TX,9031,QQ2009 –19–19AUG94–1/1

R12 And R134A Refrigerant Cautions

CAUTION: DO NOT allow liquid refrigerant to contact eyes or skin. Liquid refrigerant will freeze eyes or skin on contact. Wear goggles, gloves and protective clothing.

If liquid refrigerant contacts eyes or skin, DO NOT rub the area. Splash large amounts of COOL water on affected area. Go to a physician or hospital immediately for treatment.

DO NOT allow refrigerant to contact open flames or very hot surfaces such as electric welding arc, electric heating element and lighted smoking materials.

DO NOT heat refrigerant over 52°C (125°F) in a closed container. Heated refrigerant will develop high pressure which can burst the container.

Keep refrigerant containers away from heat sources. Store refrigerant in a cool place.

DO NOT handle damp refrigerant container with your bare hands. Skin may freeze to container. Wear gloves.

If skin freezes to container, pour COOL water over container to free the skin. Go to a physician or hospital immediately for treatment.

(R12 ONLY) Refrigerant exposed to high temperature forms phosgene gas. Inhaling toxic phosgene gas may result in serious illness or death. Phosgene gas has an odor like new mown hay or green corn. If you inhale phosgene gas, go to a physician or hospital immediately for treatment.

TX,9031,QQ2010 –19–17JUN94–1/1

R12 Component Air Charge

IMPORTANT: The compressor takes a special 525 viscosity oil R49856 that has 'special additives' which give better compressor life.

If complete system was flushed to remove contamination, the full charge of oil 326 mL (11 fl oz) must be added to the system.

NOTE: Dispose oil drained from compressor in accordance with Federal, State and Local regulations. Do not reuse oil drained from the system. Always add NEW oil to the system.

1. Remove compressor. Drain the oil from the suction port and record amount of oil.

2. If 90—240 mL (3—8 fl oz) was drained from the original compressor, add 180 mL (6 fl oz) of new oil back into the compressor.

3. If more than 240 mL (8 fl oz) was drained from the original compressor, add 180 mL (6 fl oz) of new oil back into the compressor. Replace receiver/dryer to remove excess oil from the system.

4. If less than 90 mL (3 fl oz) was drained from the original compressor, flush all components of the system. Replace the receiver/dryer and add 330 mL (11 fl oz) of new oil back into the system.

5. When installing a compressor that has been disassembled and reassembled with no oil charge, add an extra 30 mL (1 fl oz) to the amounts specified in steps 2, 3 or 4.

6. When installing a new or remanufactured compressor, drain the oil. Replace with new oil per steps 2, 3 or 4.

7. If components of the system were drained and flushed, add 330 mL (11 fl oz) to the compressor.

8. After adding proper amount of oil, rotate the compressor shaft four or five times to insure proper lubrication of the compressor seal.

IMPORTANT: DO NOT add any more oil than necessary or maximum cooling will be reduced.

9. When servicing individual components, determine the oil charge needed using following chart:

Component	Oil Charge
Condenser	59 mL (2 fl oz)
Evaporator	118 mL (4 fl oz)
Receiver/Dryer	15 mL (0.4 fl oz)

TX,9031,QQ2081 –19–12SEP95–1/1

R12 Refrigerant Recovery, Recycling Station Installation Procedure

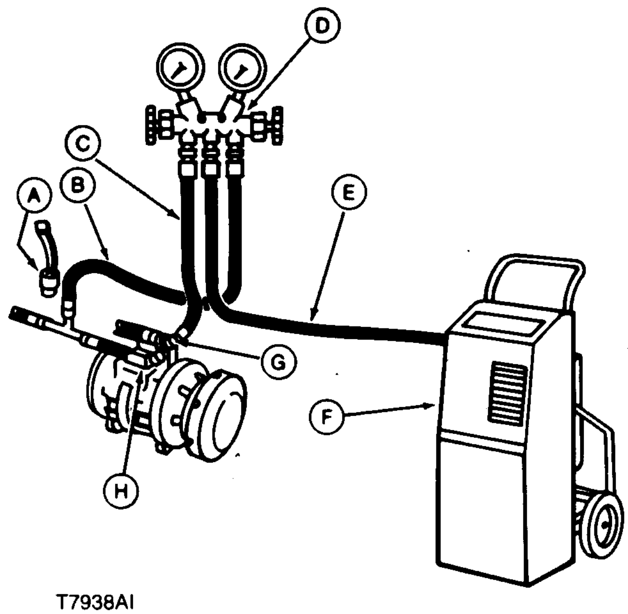
ESSENTIAL TOOLS
JT02020 R12 Refrigerant Recovery and Recycling Station[a]
[a]JT02021 recovery/recycling station can be substituted for the JT02020 station.

NOTE: JT02021 recovery/recycling station can be substituted for the JT02020 station.

CAUTION: Do not remove high pressure relief valve (H). Air conditioning system will discharge rapidly causing possible injury.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

1. Close both high and low pressure valves on gauge assembly (D).
2. Remove cap from low pressure test port (G).
3. Connect (C) low pressure hose blue from refrigerant recovery, recycling station (F) to low pressure test port (G) on compressor.
4. Remove high pressure switch (A) and connect high pressure red hose (B) from refrigerant recovery, recycling station.
5. Follow the manufactures instructions when using the refrigerant recovery, recycling station.



T7938AI –UN–25FEB93

A—High Pressure Switch
B—Red Hose (High Pressure)
C—Blue Hose (Low Pressure)
D—Gauge Assembly
E—Yellow Hose
F—Recovery/Recycling Station
G—Low Pressure Test Port
H—High Pressure Relief Valve

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TX,9031,QQ2013 –19–17JUN94–1/1

R12 Refrigerant Evacuation And Charging Station Installation Procedure

ESSENTIAL TOOLS
JT02023 R12 Refrigerant Charging and Evacuation Station

CAUTION: Do not remove high pressure relief valve (H). Air conditioning system will discharge rapidly causing possible injury.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

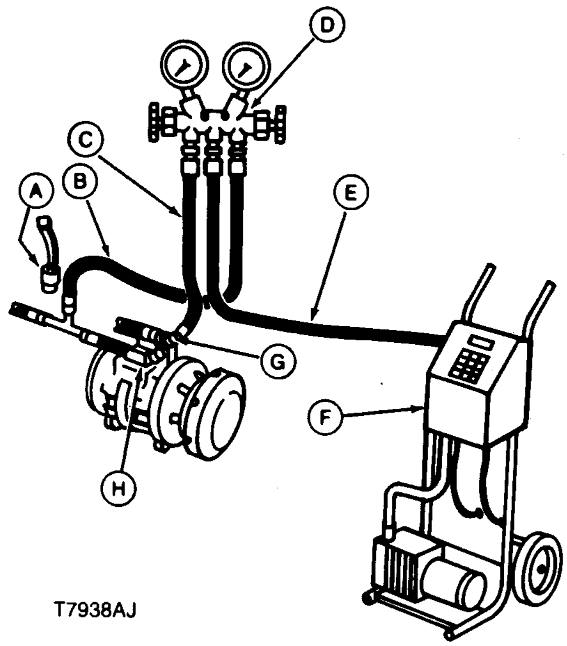
1. Close both high and low pressure valves on gauge assembly (D).

2. Remove cap from low pressure test port (G).

3. Connect (C) low pressure hose blue from refrigerant recovery, recycling station (F) to low pressure test port (G) on compressor.

4. Remove high pressure switch (A) and connect high pressure red hose (B) from refrigerant charging and evacuation station.

5. Follow the manufactures instructions when using the refrigerant evacuation and charging station.



T7938AJ –UN–25FEB93

A—High Pressure Switch
B—Red Hose (High Pressure)
C—Blue Hose (Low Pressure)
D—Gauge Assembly
E—Yellow Hose
F—Recovery/Recycling Station
G—Low Pressure Test Port
H—High Pressure Relief Valve

TX,9031,QQ2014 –19–17JUN94–1/1

Recover R12 System

ESSENTIAL TOOLS
JT02020 R12 Refrigerant Recovery and Recycling Station

NOTE: JT02020 recovery and recycling station can be substituted for the JT02021 station.

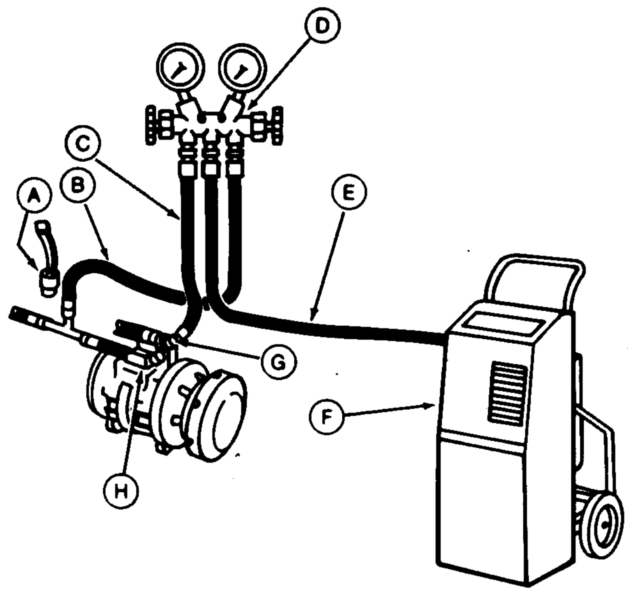
CAUTION: Do not remove high pressure relief valve (H). Air conditioning system will discharge rapidly causing possible injury.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

NOTE: Run the air conditioning system for three minutes to help in the recovery process. Turn air conditioning system off before proceeding with recovery steps.

1. Connect refrigerant recovery and recycling station. (See installation procedure in this group.)

2. Follow the manufactures instructions when using the refrigerant recovery and recycling station.



T7938AI

T7938AI –UN–25FEB93

A—High Pressure Switch
B—Red Hose (High Pressure)
C—Blue Hose (Low Pressure)
D—Gauge Assembly
E—Yellow Hose
F—Recovery/Recycling Station
G—Low Pressure Test Port
H—High Pressure Relief Valve

TX,9031,QQ2016 –19–17JUN94–1/1

Evacuate R12 System

SPECIFICATIONS	
Vacuum Pressure	98 kPa (980 mbar) (29 in. Hg) minus 3.4 kPa (34 mbar) (1 in. Hg) for each 300 m (1000 ft) elevation above sea level

ESSENTIAL TOOLS
JT02023 R12 Refrigerant Charging and Evacuation Station

CAUTION: Do not remove high pressure relief valve (H). Air conditioning system will discharge rapidly causing possible injury.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

Do not run compressor while evacuating.

1. Connect refrigerant charging and evacuation station. (See installation procedure in this group.)

2. Open low and high pressure valves on refrigerant charging and evacuation station.

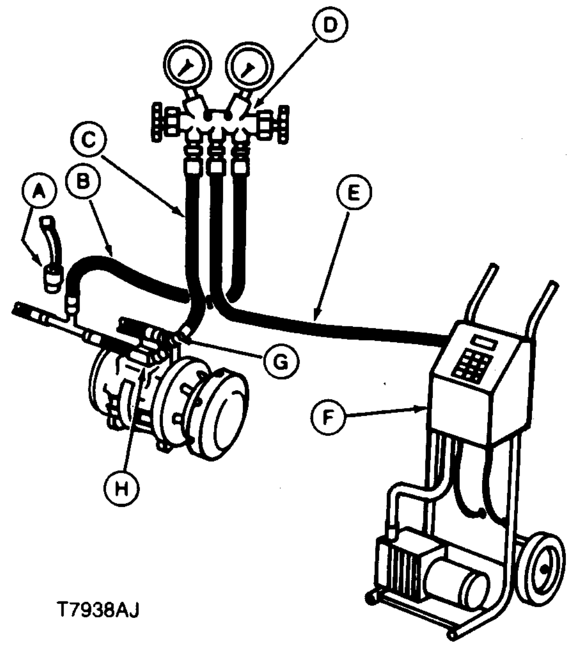
3. Follow the manufactures instructions and evacuate the system.

4. Evacuate system until low pressure gauge registers 98 kPa (980 mbar) (29 in. Hg) vacuum.

Specification

Vacuum—Pressure.................................... 98 kPa (980 mbar) (29 in. Hg) minus 3.4 kPa (34 mbar) (1 in. Hg) for each 300 m (1000 ft) elevation above sea level

If 98 kPa (980 mbar) (29 in. Hg) vacuum cannot be obtained in 15 minutes, test the system for leaks. (See Leak Testing, 9031-25). Correct any leaks.



T7938AJ –UN–25FEB93

A—High Pressure Switch
B—Red Hose (High Pressure)
C—Blue Hose (Low Pressure)
D—Gauge Assembly
E—Yellow Hose
F—Recovery/Recycling Station
G—Low Pressure Test Port
H—High Pressure Relief Valve

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Continued on next page

TX,9031,QQ2017 –19–17JUN94–1/2

NOTE: The vacuum specifications listed are for sea level conditions. Subtract 3.4 kPa (34 mbar) (1 in. Hg) from 98 kPa (980 mbar) (29 in. Hg) for each 300 m (1000 ft) elevation above sea level.

5. When vacuum is 98 kPa (980 mbar) (29 in. Hg), close low and high pressure valves. Turn vacuum pump off.

6. If the vacuum decreases more than 3.4 kPa (34 mbar) (1 in. Hg) in 5 minutes, there is a leak in the system.

7. Repair leak.

8. Start to evacuate.

9. Open low and high pressure valves.

10. Evacuate system for 30 minutes after 98 kPa (980 mbar) (29 in. Hg) vacuum is reached.

11. Close low and high pressure valves. Stop evacuation.

12. Charge the system. (See procedure in this group.)

TX,9031,QQ2017 –19–17JUN94–2/2

Charge R12 System

SPECIFICATIONS	
Air Conditioning System Refrigerant Charge	2.3 Kg (5 lbs)

ESSENTIAL TOOLS
JT02023 R12 Refrigerant Charging and Evacuation Station

CAUTION: Do not remove high pressure relief valve (H). Air conditioning system will discharge rapidly causing possible injury.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

1. Connect refrigerant charging and evacuation station. (See installation procedure in this group.)

2. Evacuate the system. (See Evacuate Air Conditioning System, this group.)

NOTE: Before beginning to charge air conditioning system, the following conditions must exist: Engine STOPPED, the pump must be capable of pulling at least 28.6 in. Hg vacuum (sea level). Subtract 3.4 kPa (34 mbar) (1 in. Hg) from 98 kPa (980 mbar) (29 in. Hg) for each 300 m (1000 ft) elevation above sea level.

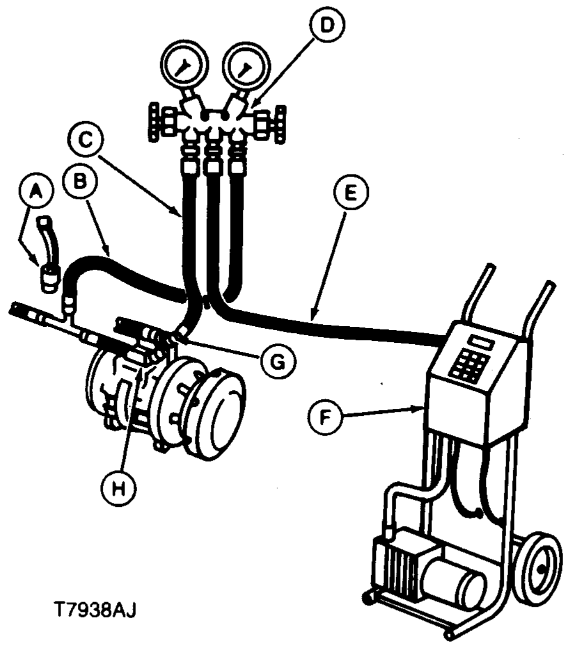
3. Follow the manufacturers instructions and charge the system.

4. Add refrigerant until system is charged with 2.3 Kg (5 lbs).

Specification

Air Conditioning System—
Refrigerant Charge .... 2.3 Kg (5 lbs)

5. Do air conditioner checks and tests in Groups 9031-10 and 9031-25.



T7938AJ –UN–25FEB93

A—High Pressure Switch
B—Red Hose (High Pressure)
C—Blue Hose (Low Pressure)
D—Gauge Assembly
E—Yellow Hose
F—Recovery/Recycling Station
G—Low Pressure Test Port
H—High Pressure Relief Valve

R134A Compressor Oil Charge Check

OTHER MATERIAL
TY16134 U.S. Air Conditioning Flushing Solvent
TY22025 U.S. Refrigerant Oil

Remove compressor if R134a leakage was detected and repaired. See Remove and install Compressor in Repair Manual.

Drain oil from the compressor and record the amount. See Compressor Oil Removal procedure in this group.

NOTE: Drain oil and save if this is a new compressor.

If the oil drained from a compressor removed from operation is very black or the amount of oil is less than 6 mL (0.2 fl oz), perform the following:

1. Remove and discard the receiver-dryer.
2. Remove, clean, but do not disassemble the valve.
3. Flush the complete system with TY16134 air conditioning flushing solvent.
4. If the compressor is serviceable, pour flushing solvent in the manifold ports and internally wash out the old oil.
5. Install a new receiver-dryer.
6. Install required amount of TY22025 refrigerant oil in the compressor. (See R134a Component Oil Charge in this group.)
7. Connect all components, evacuate and charge the system.

TX,9031,QQ2366 –19–07MAR95–1/1

R134A Compressor Oil Removal

1. Remove compressor from machine. See Remove and Install Compressor in Repair Manual.
2. Remove inlet/outlet manifold from compressor, and clutch dust cover.
3. Drain oil into graduated container while rotating compressor shaft.
4. Record measured oil and discard oil properly.
5. Install new oil. See R134a Component Oil Charge in this Group.
6. Install compressor. See Remove and Install Compressor in Repair Manual.

TX,9015,QQ2299 –19–17JUN94–1/1

R134A Component Oil Charge

CAUTION: All new compressors are charged with a mixture of nitrogen, R134a refrigerant and TY22025 (R134a) refrigerant oil. Wear safety goggles and discharge the compressor slowly to avoid possible injury.

Compressors can be divided into three categories when determining the correct oil charge for the system.

- New compressor from parts depot
- Used compressor removed from operation
- Compressor internally washed with flushing solvent

Determining the amount of system oil charge prior to installation of compressor on a machine.

1. When the complete system, lines, and components were flushed add the correct amount of oil as described.

   • New compressor from parts depot contains the amount of new oil of 230 ± 20 mL (7.7 ± .7 fl oz). System requires an additional amount of new oil of 100 mL (3.4 fl oz) of new oil.

   • Used compressor removed from operation, oil drained, and flushed requires 330 ± 20 mL (11.1 ± .7 fl oz) of new oil.

2. When the complete system was not flushed add the correct amount of oil for the compressor plus amount of oil for each component that was serviced.

   • New compressor from parts depot, drain and return 45 mL (1.5 fl oz) of oil to the compressor. (See Compressor Oil Removal procedure in this group)

   • Used compressor removed from operation and oil drained, (See Compressor Oil Removal procedure in this group.) Add 45 mL (1.5 fl oz) of new oil.

   • Used compressor removed from operation, oil drained, and flushed add 60 mL (2.0 fl oz) of new oil.

NOTE: Components listed below which have been removed, drained or flushed, require the removal of the compressor to determine the correct oil charge. Use the following chart as a guide for adding oil to components:

Evaporator	130 mL (4.4 fl oz)
Condenser	65 mL (2.2 fl oz)
Receiver-Dryer	30 mL (1.0 fl oz)
Hoses	60 mL (2.0 fl oz)

NOTE: Hoses = 3 mL per 30 cm (0.1 fl oz per ft). Approximate total length equals 600 cm (20 ft).

If any section of hose is removed and flushed or replaced, measure the length of hose and use the formula to determine the correct amount of oil to be added.

CAUTION: DO NOT leave the system or R134a compressor oil containers open. This oil easily absorbs moisture. DO NOT spill R134a compressor oil on acrylic or ABS plastic. This oil will deteriorate these materials rapidly. Identify R134a oil containers and measures to eliminate accidental mixing of different oils.

TX,9015,QQ2300 –19–17JUN94–1/1

R134A Refrigerant Recovery, Recycling And Charging Station Installation Procedure

ESSENTIAL TOOLS
JT02047 R134a Refrigerant Recovery/Recycling and Charging Station

NOTE: JT02046 and JT02050 recovery and charging stations can be substituted for the JT02047 station.

CAUTION: Do not remove high pressure relief valve (B). Air conditioning system will discharge rapidly causing possible injury.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

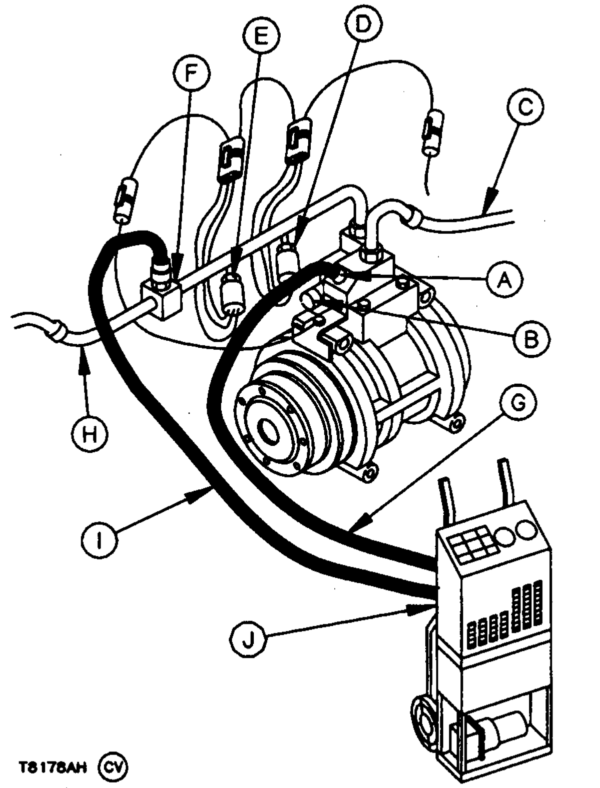
1. Close both high and low pressure valves on refrigerant recovery, recycling and charging station (J).

2. Remove cap from low pressure test port (A).

3. Connect low pressure blue hose (I) from refrigerant recovery, recycling and charging station (J) to low pressure test port (A) on compressor.

4. Connect high pressure red hose (G) to high pressure quick disconnect (F).

5. Follow the manufactures instructions when using the refrigerant recovery, recycling and charging station.



T8178AH –UN–01MAR94

A—Low Pressure Test Port
B—High Pressure Relief Valve
C—Low Pressure Hose
D—Low Pressure Switch
E—High Pressure Switch
F—High Pressure Quick-Disconnect
G—Red Hose
H—High Pressure Hose
I—Blue Hose
J—Refrigerant Recovery/Recycling and Charging Station

TX,9031,QQ2607 –19–17JUN94–1/1

Recover R134A System

ESSENTIAL TOOLS
JT02045 R134a Refrigerant Recovery/Recycling and Charging Station

NOTE: JT02046 and JT02050 recovery and charging stations can be substituted for the JT02045 station.

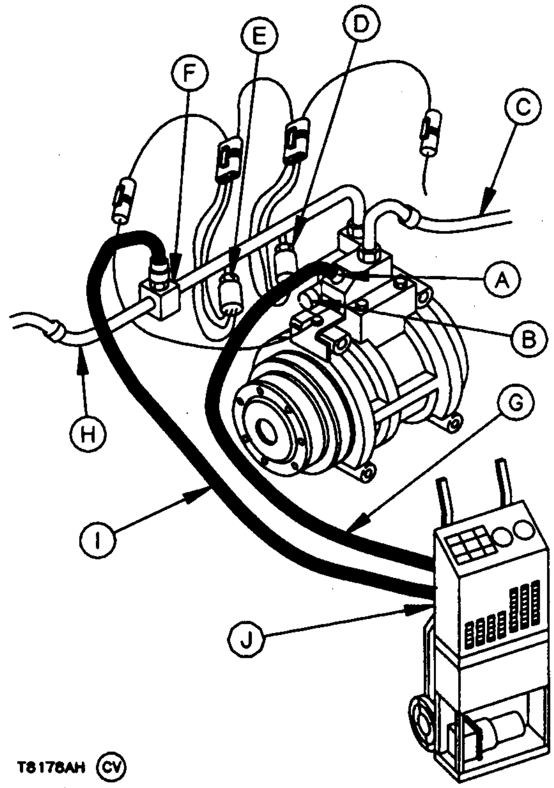
CAUTION: Do not remove high pressure relief valve (B). Air conditioning system will discharge rapidly causing possible injury.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

NOTE: Run the air conditioning system for three minutes to help in the recovery process. Turn air conditioning system off before proceeding with recovery steps.

1. Connect refrigerant recovery, recycling and charging station. (See installation procedure in this group.)

2. Follow the manufactures instructions when using the refrigerant recovery, recycling and charging station.



T8178AH –UN–01MAR94

A—Low Pressure Test Port
B—High Pressure Relief Valve
C—Low Pressure Hose
D—Low Pressure Switch
E—High Pressure Switch
F—High Pressure Quick-Disconnect
G—Red Hose
H—High Pressure Hose
I—Blue Hose
J—Refrigerant Recovery/Recycling and Charging Station

TX,9031,QQ2608 –19–25OCT95–1/1

Evacuate R134A System

ESSENTIAL TOOLS
JT02045 R134a Refrigerant Recovery/Recycling and Charging Station

NOTE: JT02046 and JT02050 recovery and charging stations can be substituted for the JT02045 station.

CAUTION: Do not remove high pressure relief valve (B). Air conditioning system will discharge rapidly causing possible injury.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

Do not run compressor while evacuating.

1. Connect refrigerant recovery, recycling and charging station. (See installation procedure in this group.)

2. Open low and high pressure valves on refrigerant recovery, recycling and charging station.

3. Follow the manufactures instructions and evacuate the system.

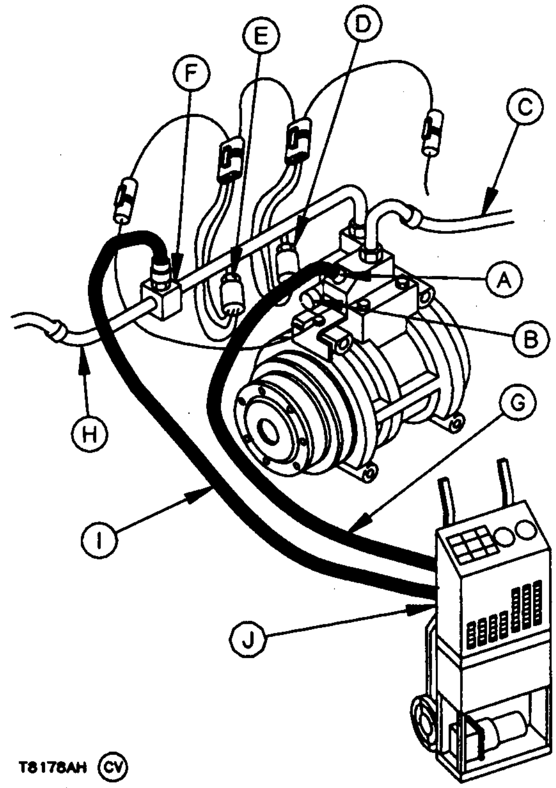
4. Evacuate system until low pressure gauge registers 98 kPa (980 mbar) (29 in. Hg) vacuum.

   If 98 kPa (980 mbar) (29 in. Hg) vacuum cannot be obtained in 15 minutes, test the system for leaks. (See Leak Testing , 9031-25.) Correct any leaks.

NOTE: The vacuum specifications listed are for sea level conditions. Subtract 3.4 kPa (34 mbar) (1 in. Hg) from 98 kPa (980 mbar) (29 in. Hg) for each 300 m (1000 ft) elevation above sea level.

5. When vacuum is 98 kPa (980 mbar) (29 in. Hg), close low-side and high-side valves. Turn vacuum pump off.

6. If the vacuum decreases more than 3.4 kPa (34 mbar) (1 in. Hg) in 5 minutes, there is a leak in the system.



T8178AH –UN–01MAR94

A—Low Pressure Test Port
B—High Pressure Relief Valve
C—Low Pressure Hose
D—Low Pressure Switch
E—High Pressure Switch
F—High Pressure Quick-Disconnect
G—Red Hose
H—High Pressure Hose
I—Blue Hose
J—Refrigerant Recovery/Recycling and Charging station

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Continued on next page

TX,9031,QQ2609 –19–25OCT95–1/2

7. Repair leak.

8. Start to evacuate.

9. Open low-side and high-side valves.

10. Evacuate system for 30 minutes after 98 kPa (980 mbar) (29 in. Hg) vacuum is reached.

11. Close low-side and high-side valves. Stop evacuation.

12. Charge the system. (See procedure in this group.)

TX,9031,QQ2609 –19–25OCT95–2/2

Charge R134A System

SPECIFICATIONS	
System Refrigerant Charge	2.3 Kg (5 lbs)

ESSENTIAL TOOLS
JT02047 R134a Refrigerant Recovery/Recycling and Charging Station

NOTE: JT02046 and JT02050 recovery and charging stations can be substituted for the JT02045 station.

CAUTION: Do not remove high pressure relief valve (B). Air conditioning system will discharge rapidly causing possible injury.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

1. Connect JT02047 R134a refrigerant recovery, recycling and charging station. (See installation procedure in this group.)

2. Evacuate the system. (See Evacuate Air Conditioning System , this group.)

NOTE: Before beginning to charge air conditioning system, the following conditions must exist: Engine STOPPED, the pump must be capable of pulling at least 28.6 in. Hg vacuum (sea level). Subtract 3.4 kPa (34 mbar) (1 in. Hg) from 98 kPa (980 mbar) (29 in. Hg) for each 300 m (1000 ft) elevation above sea level.

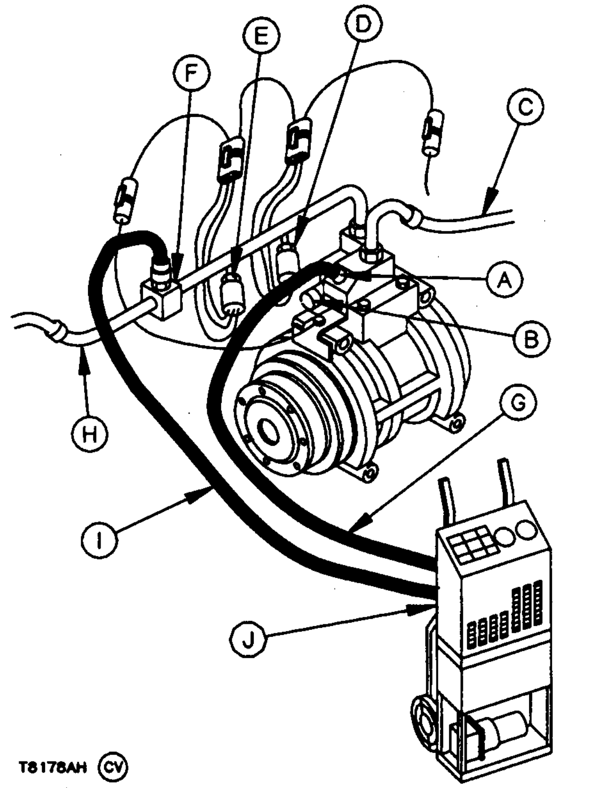
3. Follow the manufacturers instructions and charge the system.

4. Add refrigerant until system is charged with 2.3 Kg (5 lbs).

Specification

System—Refrigerant Charge .... 2.3 Kg (5 lbs)

5. Do air conditioner checks and tests in Groups 9031-10 and 9031-25.



T8178AH –UN–01MAR94

A—Low Pressure Test Port
B—High Pressure Relief Valve
C—Low Pressure Hose
D—Low Pressure Switch
E—High Pressure Switch
F—High Pressure Quick-Disconnect
G—Red Hose
H—High Pressure Hose
I—Blue Hose
J—Refrigerant Recovery/Recycling and Charging Station

TX,9031,QQ2610 –19–25OCT95–1/1

Check And Adjust Compressor Belt Tension

SPECIFICATIONS	
Belt Deflection	19 mm (0.75 in.) at 400 N (90 lb force)

SERVICE EQUIPMENT AND TOOLS
Belt Tension Gauge

IMPORTANT: Never over tighten belt. Over tightening may cause belt cord damage and excessive load on bearings.

1. Run engine for five minutes. Stop the engine, then immediately check tension using a belt tension gauge. Measure strand tension or deflection at a point halfway between pulleys.

2. Belt must deflect 19 mm (0.75 in.) at 400 N (90 lb force).

Specification

Belt—Deflection .... 19 mm (0.75 in.) at 400 N (90 lb force)

If not, allow belt to cool for 8—10 minutes.

IMPORTANT: Force to adjust belt must be applied to front of compressor housing only to prevent damage to compressor.

3. Loosen compressor mounting cap screws. Apply force to front of compressor housing to tighten belt. Tighten cap screws.

4. Repeat Steps 1 and 2 to check belts.

TX,9031,QQ2082 –19–17JUN94–1/1

Proper Refrigerant Handling

The U.S. Environmental Protection Agency prohibits discharge of any refrigerant into the atmosphere, and requires that refrigerant be recovered using the approved recovery equipment.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT use refrigerant, hoses, fittings, components or refrigerant oils intended for use with R12 refrigerant.

Recovery, recycling and charging stations for R12 and R134a refrigerants MUST NOT be interchanged. Systems containing R12 refrigerant use a different oil than systems using R134a. Certain seals are not compatible with both types of refrigerants.

TX,9031,QQ2009 –19–19AUG94–1/1

R12 And R134A Refrigerant Cautions

CAUTION: DO NOT allow liquid refrigerant to contact eyes or skin. Liquid refrigerant will freeze eyes or skin on contact. Wear goggles, gloves and protective clothing.

If liquid refrigerant contacts eyes or skin, DO NOT rub the area. Splash large amounts of COOL water on affected area. Go to a physician or hospital immediately for treatment.

DO NOT allow refrigerant to contact open flames or very hot surfaces such as electric welding arc, electric heating element and lighted smoking materials.

DO NOT heat refrigerant over 52°C (125°F) in a closed container. Heated refrigerant will develop high pressure which can burst the container.

Keep refrigerant containers away from heat sources. Store refrigerant in a cool place.

DO NOT handle damp refrigerant container with your bare hands. Skin may freeze to container. Wear gloves.

If skin freezes to container, pour COOL water over container to free the skin. Go to a physician or hospital immediately for treatment.

(R12 ONLY) Refrigerant exposed to high temperature forms phosgene gas. Inhaling toxic phosgene gas may result in serious illness or death. Phosgene gas has an odor like new mown hay or green corn. If you inhale phosgene gas, go to a physician or hospital immediately for treatment.

TX,9031,QQ2010 –19–17JUN94–1/1

R134A Air Conditioning System Test

SPECIFICATIONS	
Engine Speed	2200 rpm
Air Conditioning Cooling	Maximum
Blower Speed	High
Ambient Temperature	16°C (60°F)
Ambient Temperature	21°C (70°F)
Ambient Temperature	27°C (80°F)
Ambient Temperature	32°C (90°F)
Ambient Temperature	38°C (100°F)
Ambient Temperature	43°C (110°F)
Air Duct Temperature	13°C (55°F)
Air Duct Temperature	16°C (60°F)
Air Duct Temperature	18°C (65°F)
Air Duct Temperature	21°C (70°F)
Air Duct Temperature	27°C (80°F)
Air Duct Temperature	29°C (85°F)
Low Pressure Gauge Pressure	7—165 kPa (0.07—1.6 bar) (1—24 psi)
Low Pressure Gauge Pressure	7—180 kPa (0.07—1.8 bar) (1—26 psi)
Low Pressure Gauge Pressure	7—205 kPa (0.07—2.1 bar) (1—30 psi)
Low Pressure Gauge Pressure	7—240 kPa (0.07—2.4 bar) (1—35 psi)
Low Pressure Gauge Pressure	7—280 kPa (0.07—2.7 bar) (1—40 psi)
Low Pressure Gauge Pressure	7—330 kPa (0.07—3.3 bar) (1—48 psi)
High Pressure Gauge Pressure	630—1095 kPa (6—11 bar) (90—160 psi)
High Pressure Gauge Pressure	785—1225 kPa (7.6—12 bar) (110—175 psi)
High Pressure Gauge Pressure	955—1410 kPa (9.6—14.1 bar) (140—205 psi)
High Pressure Gauge Pressure	1145—1645 kPa (11.4—16.5 bar) (165—240 psi)
High Pressure Gauge Pressure	1355—1935 kPa (13.4—19.3 bar) (195—280 psi)
High Pressure Gauge Pressure	1580—2275 kPa (15.8—22.7 bar) (230—330 psi)

Continued on next page

ESSENTIAL TOOLS
JT02047 R134a Refrigerant Recovery/Recycling and Charging Station

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT use refrigerant, hoses, fittings, components or refrigerant oils intended for R12 refrigerant.

1. Connect refrigerant recovery, recycling and charging station.(See installation procedure in this group.)

2. Close both low and high pressure valves on refrigerant recovery, recycling and charging station.

3. Open cab doors and windows.

Continued on next page TX,9031,QQ2358 –19–19AUG94–2/4

4. Connect low pressure blue hose (I) from refrigerant recovery, recycling and charging station (J) to low pressure test port (A) on compressor.

5. Connect high pressure red hose (G) to high Pressure Quick-Disconnect (F) on compressor.

6. Follow the manufactures instructions when using the refrigerant recovery, recycling and charging station.

7. Start engine and run at rated engine speed.

Specification

Engine—Speed .... 2200 rpm

8. Turn temperature control switch to the maximum cooling position.

Specification

Air Conditioning—Cooling .... Maximum

9. Turn blower switch to high speed.

Specification

Blower—Speed .... High

10. Check sight glass in receiver-dryer.

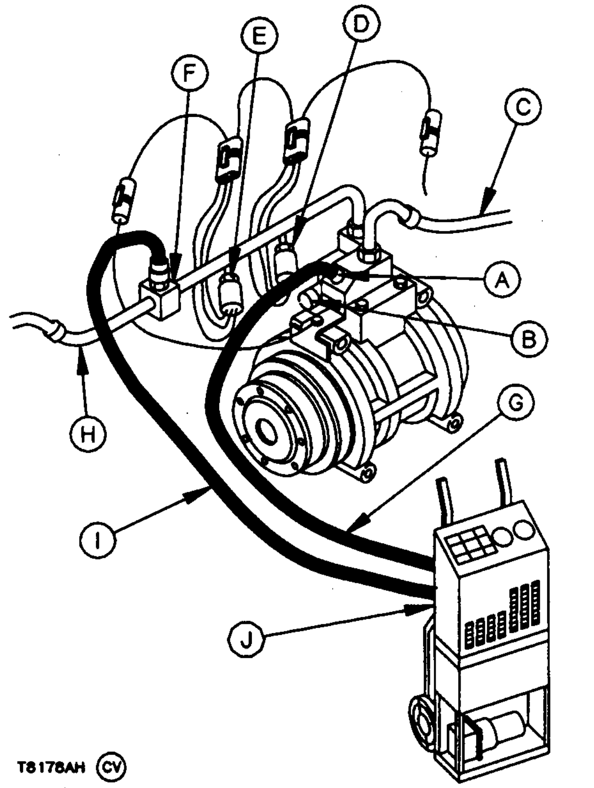
11. Run unit for at least 5 minutes.

12. Measure air temperature at condenser air inlet and at air ducts in air conditioning unit.

13. Compare air duct temperature reading to the temperatures shown in the specifications.

Specification

Ambient—Temperature	16°C (60°F)
Temperature	21°C (70°F)
Temperature	27°C (80°F)
Temperature	32°C (90°F)
Temperature	38°C (100°F)
Temperature	43°C (110°F)
Air Duct—Temperature	13°C (55°F)
Temperature	16°C (60°F)
Temperature	18°C (65°F)
Temperature	21°C (70°F)
Temperature	27°C (80°F)
Temperature	29°C (85°F)



T8178AH –UN–01MAR94

A—Low Pressure Test Port
B—High Pressure Relief Valve
C—Low Pressure Hose
D—Low Pressure Switch
E—High Pressure Switch
F—High Pressure Quick-Disconnect
G—Red Hose
H—High Pressure Hose
I—Blue Hose
J—Refrigerant Recovery/Recycling and Charging Station

Continued on next page

TX,9031,QQ2358 –19–19AUG94–3/4

14. Observe low and high pressure gauges on refrigerant recovery, recycling and charging station.

15. Compare pressure readings to the pressure shown in specifications.

Specification

Low Pressure Gauge—Pressure	7—165 kPa (0.07—1.6 bar) (1—24 psi)
Pressure	7—180 kPa (0.07—1.8 bar) (1—26 psi)
Pressure	7—205 kPa (0.07—2.1 bar) (1—30 psi)
Pressure	7—240 kPa (0.07—2.4 bar) (1—35 psi)
Pressure	7—280 kPa (0.07—2.7 bar) (1—40 psi)
Pressure	7—330 kPa (0.07—3.3 bar) (1—48 psi)
High Pressure Gauge—Pressure	630—1095 kPa (6—11 bar) (90—160 psi)
Pressure	785—1225 kPa (7.6—12 bar) (110—175 psi)
Pressure	955—1410 kPa (9.6—14.1 bar) (140—205 psi)
Pressure	1145—1645 kPa (11.4—16.5 bar) (165—240 psi)
Pressure	1355—1935 kPa (13.4—19.3 bar) (195—280 psi)
Pressure	1580—2275 kPa (15.8—22.7 bar) (230—330 psi)

Use the Operating Pressure Diagnostic Chart in this group to diagnose the malfunction.

TX,9031,QQ2358 –19–19AUG94–4/4

Pressure Diagnostic Chart

Condition	Low Side-kPa (bar;psi)	High Side-kPa (bar;psi)	Sight Glass	Suction Line	Receiver-Drier	Liquid Line	Discharge Line	Discharge Air
Lack of Refrigerant	Very low	Very low	Clear	Slightly cool	Slightly warm	Slightly warm	Slightly warm	Warm
Loss of Refrigerant	Low	Low	Bubbles	Cool	Warm to hot	Warm	Warm to hot	Slightly cool
Lack of Refrigerant and Air in System	Normal (won't drop)	Normal	Occasion-al bubbles	Warm to hot	Warm	Warm	Warm	Slightly cool
Compressor Failure	High	Low	Clear	Cool	Warm	Warm	Warm	Slightly cool
Condenser Malfunction	High	High	Clear to occasion-bubbles	Slightly cool to warm	Hot	Hot	Hot	Warm
Moisture in System	Normal (may drop)	Normal (may drop)	Clear	Cool	Warm	Warm	Hot	Cool to warm
Refrigerant Contam-inated and Air in System	High	High	Bubbles	Warm to hot	Warm	Warm	Hot	Warm
Expansion Valve Open	High	High	Clear	Cold-sweating or frosting heavily	Warm	Warm	Hot	Slightly cool
Expansion Valve Closed	Low	Low	Clear	Cold-sweating or frosting heavily at valve outlet	Warm	Warm	Hot	Slightly cool
High Side Restriction	Low	Low	Clear	Cool	Cool or sweating or frosting	Cool or sweating or frosting	Hot to point of restriction	Slightly cool
Normal	Normal 7-500 kPa (0.07-5 bar 1-35 psi	Normal 700-2100 kPa 7-21 bar 100-300 psi	Clear	Cool-possible light sweat	Warm	Warm	Hot	Cool-11° to 17°C (20°F to 30°F) below ambient

T6609AB –19–28FEB89

TX,9031,QQ2145 –19–25FEB94–1/1

Low Pressure Switch Test

SPECIFICATIONS	
Low Pressure Switch (Normally Open) Closes on Increasing Pressure	276 ± 20 kPa (2.76 ± 0.2 bar) (40 ± 3 psi)
Low Pressure Switch (Normally Open) Opens on Decreasing Pressure	220 ± 20 kPa (2.2 ± 0.2 bar) (32 ± 3 psi)

SERVICE EQUIPMENT AND TOOLS
Regulated Air Supply or Hydraulic Hand Pump
Volt-Ohm-Amp Meter

NOTE: Low pressure switch is normally open when removed from machine. When installed the switch becomes closed because of normal system pressure.

1. Turn key switch ON but DO NOT start engine. Turn blower switch ON. Turn temperature control switch to the maximum cooling position.

2. Disconnect and connect low pressure switch at harness connector. Compressor clutch must engage and disengage (click).

NOTE: The line that attaches the low pressure switch has a valve to prevent discharging the air conditioning system when switch is removed.

3. Disconnect harness from switch and remove switch from line. Connect low pressure switch to harness.

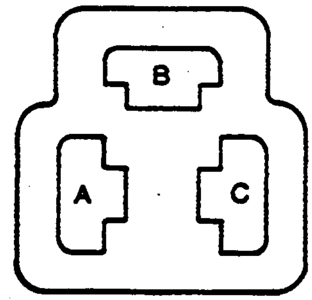
   Compressor clutch must not engage (click).

4. The actual pressure setting of switch can be checked by connecting it to a pressure source such as a regulated air supply or hydraulic hand pump.

5. Switch must not have continuity between terminals (A and C) until pressure increases to switch closing pressure specification.

Specification

Low Pressure Switch (Normally Open)—Closes on Increasing Pressure .... 276 ± 20 kPa (2.76 ± 0.2 bar) (40 ± 3 psi)



T88001 –UN–08NOV88

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TX,903125,QQ731 –19–17JUN94–1/2

Slowly release pressure. Switch must have continuity until pressure decreases to switch opening pressure specification.

Specification

Low Pressure Switch (Normally Open)—Opens on Decreasing Pressure .... 220 ± 20 kPa (2.2 ± 0.2 bar) (32 ± 3 psi)

TX,903125,QQ731 –19–17JUN94–2/2

High Pressure Switch Test

SPECIFICATIONS	
High Pressure Switch (Normally Closed) Opens on Increasing Pressure	2410 ± 100 kPa (24.1 ± 1 bar) (350 ± 15 psi)
Low Pressure Switch (Normally Closed) Closes on Decreasing Pressure	1516 ± 100 kPa (13.91 ± 1 bar) (220 ± 15 psi)

SERVICE EQUIPMENT AND TOOLS
Hydraulic Hand Pump
Volt-Ohm-Amp Meter
Air Conditioning Gauge Set

Continued on next page

TX,903125,QQ774 –19–26JAN95–1/2

NOTE: The high pressure switch has a valve under it to prevent discharging the air conditioning system when switch is removed.

1. Remove high pressure switch.

2. Connect a portable pressure source, such as a hydraulic hand pump, to high pressure switch.

3. Switch must have continuity between terminals (A and C) until pressure increases to switch opening pressure specification.

Specification

High Pressure Switch (Normally Closed)—Opens on Increasing Pressure .... 2410 ± 100 kPa (24.1 ± 1 bar) (350 ± 15 psi)

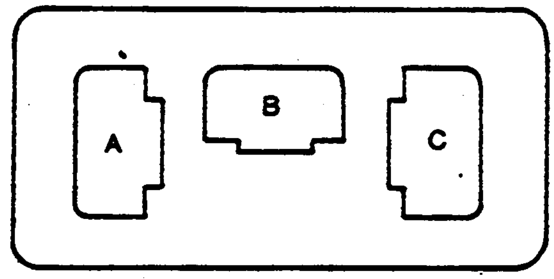
4. Slowly release pressure. Switch must not have continuity until pressure decreases to switch closing pressure specification.

Specification

Low Pressure Switch (Normally Closed)—Closes on Decreasing Pressure .... 1516 ± 100 kPa (13.91 ± 1 bar) (220 ± 15 psi)

5. The switch can also be checked when installed in air conditioning system, however, pressure is slow to increase to test specification.

   Connect an air conditioning gauge set to service fittings at compressor. Cover condenser with paper or plastic to stop air flow. Operate air conditioner on maximum cooling. Note high-side pressure when high pressure switch opens and then closes.



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Clutch Cycle Switch

SPECIFICATIONS	
Freezer Maximum Test Temperature	-0.5°C (31°F)
Clutch Cycle Switch (Normally Closed) Opens as Temperature Drops	-0.5°C (31°F)
Clutch Cycle Switch (Normally Closed) Closes as Temperature Rises	4°C (39°F)

SERVICE EQUIPMENT AND TOOLS
Multimeter

1. Remove clutch cycle switch from evaporator.

2. Connect ohmmeter to switch terminals. Switch must be closed at room temperature.

3. Put switch into a freezer (assure freezer temperature is below -0.5°C (31°F).

Specification
Freezer—Maximum Test Temperature .... -0.5°C (31°F)

Switch must open, and continuity must not be read.

Specification
Clutch Cycle Switch (Normally Closed)—Opens as Temperature Drops .... -0.5°C (31°F)

4. Remove switch from freezer. Put sensing tube into a glass of warm water. Switch must close, and continuity must be read.

Specification
Clutch Cycle Switch (Normally Closed)—Closes as Temperature Rises .... 4°C (39°F)

5. If switch does not open and close during testing, install new switch.

Leak Testing

1. Inspect all lines, fittings, and components for oily or dusty spots. When refrigerant leaks from the system, a small amount of oil is carried out with it.

2. A soap and water solution can be sprayed on the components in the system to form bubbles at the source of the leak.

3. If a leak detector is used, move the leak detector probe under the hoses and around the connections at a rate of 25 mm (1 in.) per second.

4. Some refrigerant manufacturers add dye to refrigerant to aid in leak detection.

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Refrigerant Hoses And Tubing Inspection

When a component is disconnected from the system, special care should be given to inspecting hoses and tubing for moisture, grease, dirt, rust, or other foreign material. If such contamination is present in hoses, tubing, or fittings and cannot be removed by cleaning, then replace parts.

Fittings that have grease or dirt on them should be wiped clean with a cloth dampened with alcohol. Chlorinated solvents (such as trichloroethylene) are contaminants, and must not be used for cleaning.

To assist in making leak-proof joints, use a small amount of clean correct viscosity refrigerant oil on all hose and tube connections. Dip O-rings in correct viscosity oil before assembling.

IMPORTANT: Hose used for air conditioning systems contains special barriers in its walls to prevent migration of refrigerant gas.

DO NOT use hydraulic hoses as replacement hoses in the air conditioning system. Use ONLY certified hose meeting SAE J51B requirements.

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