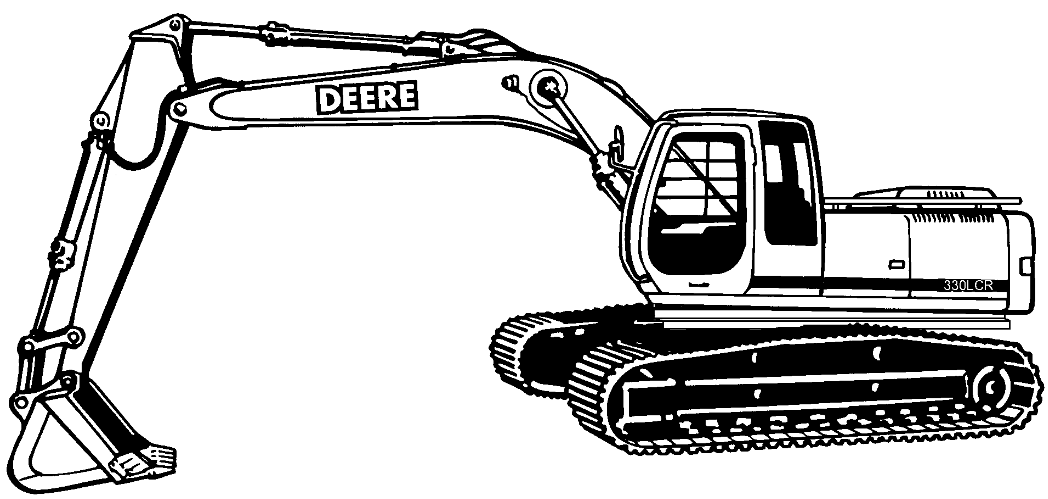
TECHNICAL MANUAL

UNIT, DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE MANUAL

HYDRAULIC EXCAVATOR
JOHN DEERE
MODEL 330LCR
NSN 3805-01-463-0805



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HEADQUARTERS, DEPARTMENT OF THE ARMY

15 FEBRUARY 2000

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Dates of issue for original and updated pages are:

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Technical Manual
No. 5-3805-281-24-1

**HEADQUARTERS,
DEPARTMENT OF THE ARMY
Washington, DC, *15 February 2000***

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

HYDRAULIC EXCAVATOR JOHN DEERE MODEL 330LCR NSN 3805-01-463-0805

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028-2 (Recommended Changes to Equipment Technical Publications), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is http://aeps.ria.army.mil. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or email your letter, DA Form 2028, or DA Form 2028-2 direct to: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-LC-CI, Rock Island, IL 61299-7630. The email address is AMSTA-LC-CI@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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WARRANTY

1. **General.** This section explains the contractor's warranty for the Hydraulic Excavator (HYEX), including all of its components and subassemblies. It also contains information, instructions, methods and forms required to obtain services and/or supplies and for processing claims for items covered under warranty for the HYEX. If additional warranty information is required for the HYEX, contact your local Warranty Control Office/Officer (WARCO) or TACOM-WRN Logistics Assistance Representative (LAR). If your WARCO or TACOM LAR is not available, contact TACOM-WRN. The numbers at TACOM to call are DSN 786-7215/(810) 574-7215, DSN 786-7420/(810) 574-7420, or DSN 786-8297/(810) 574-8297. The caller should be prepared to provide: (1) name, (2) telephone number and/or electronic address, (3) complete unit designation, (4) identification of the vehicle to include serial number(s) and (5) a brief description of the problem.

2. **Coverage Specific.** The information and data contained in this Technical Manual applies to the U.S. Army's Hydraulic Excavator (HYEX), model number 330LCR, NSN 3805-01-463-0805. The HYEX is manufactured by Deere & Company, Moline, IL under contract number DAAE07-98-D-S009.

3. **Claim Procedures.** DA Form 2407, along with information and instructions provided by the contractor at time of delivery of the HYEX, shall be used to process warranty claims.

4. **Claim Denial/Disputes.** All denials or disputes will be handled by TACOM. The contact point for warranty claim denials or disputes is:

   Commander
   U.S. Army Tank-Automotive and Armaments Command
   ATTN: AMSTA-LC-CJBB
   Warren, MI 48397-5000

   Telephone: DSN 786-5314
   Commercial: (810) 574-5314

5. **Local WARCO.** Upon completion of warranty actions by the contractor, the WARCO shall complete and provide a copy of DA Form 2407 to TACOM for information and warranty tracking purposes only. **NOTE**: The DA Form 2407 shall be stamped or otherwise clearly marked **"FOR INFORMATION ONLY"**. Send the completed DA Form 2407 to:

   Commander
   U.S. Army Tank-Automotive and Armaments Command
   ATTN: AMSTA-LC-CJCB
   Warren, MI 48397-5000

   Telephone: DSN 786-7215
   Commercial: (810) 574-7215

   Forms may also be faxed to TACOM. Fax the forms to: DSN 786-5605, Commercial - (810) 574-5605. Include ATTN: AMSTA-LC-CJCB on all related materials being faxed to TACOM.

INTRODUCTION

READ THIS MANUAL carefully to learn how to operate and service your machine correctly. Failure to do so could result in personal injury or equipment damage. This manual and safety signs on your machine may also be available in other languages. (See your John Deere dealer to order.)

THIS MANUAL SHOULD BE CONSIDERED a permanent part of your machine and should remain with the machine when you sell it.

MEASUREMENTS in this manual are given in both metric and customary U.S. unit equivalents. Use only correct replacement parts and fasteners. Metric and inch fasteners may require a specific metric or inch wrench.

RIGHT-HAND AND LEFT-HAND sides are determined by facing in the direction of forward travel.

SECTION NUMBERS (e.g., 01, 02, 16) of the Repair Chapters 9 through 22 refer to the John Deere Functional Group Coding system.

WARRANTY is provided as part of John Deere's support program for customers who operate and maintain their equipment as described in this manual. The warranty is explained on the warranty certificate, which you should have received from your dealer.

This warranty provides you the assurance that John Deere will back its products where defects appear within the warranty period. In some circumstances, John Deere also provides field improvements, often without charge to the customer, even if the product is out of warranty. Should the equipment be abused, or modified to change its performance beyond the original factory specifications, the warranty will become void and field improvements may be denied. Setting fuel delivery above specifications or otherwise overpowering machines will result in such action.

CALIFORNIA PROPOSITION 65 WARNING
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

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CHAPTER 1

SECTION 9000

GENERAL INFORMATION

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Group 01
Safety

FOLLOW SAFE PROCEDURES

Unsafe work practices are dangerous. Understand service procedure before doing work; do not attempt shortcuts.

TS231 –19–07OCT88

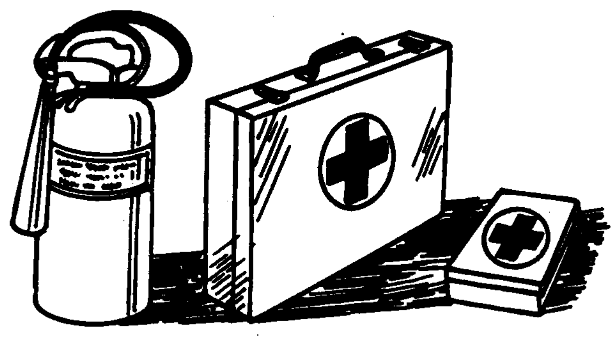
TX,05,FF1611 –19–14JUN90–1/1

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

HANDLE FLUIDS SAFELY—AVOID FIRES

Handle fuel with care; it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks. Always stop engine before refueling machine. Fill fuel tank outdoors.

TS202 –UN–23AUG88

TX,05,FF1622 –19–14JUN90–1/2

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

TX,05,FF1622 –19–14JUN90–2/2

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PREVENT BATTERY EXPLOSIONS

TS204 –UN–23AUG88

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).

DX,SPARKS –19–03MAR93–1/1

HANDLE CHEMICAL PRODUCTS SAFELY

TS1132 –UN–26NOV90

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

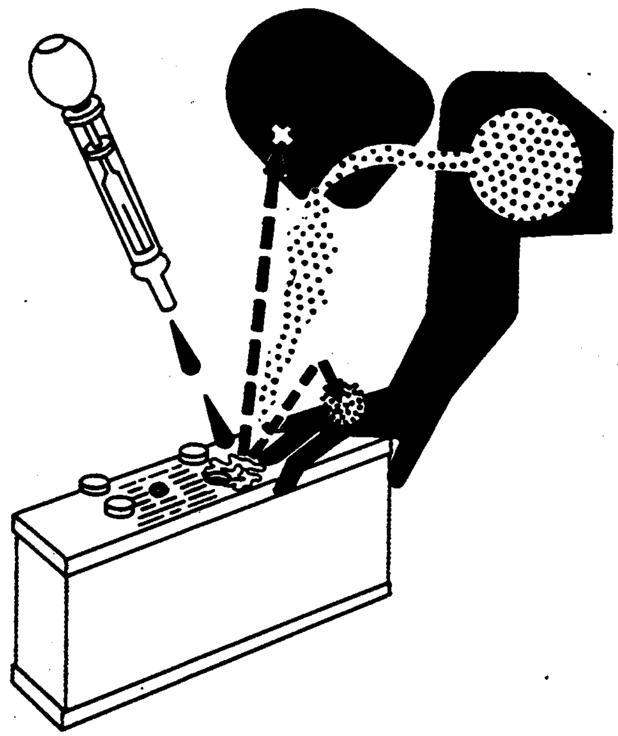
A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

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 authorized dealer for MSDS's on chemical products used with your machine.

TX,05,DH2500 –19–02OCT92–1/1

PREVENT ACID BURNS



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

Avoid the hazard by:

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

If you spill acid on yourself:

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

If acid is swallowed:

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

DX,POISON –19–21APR93–1/1

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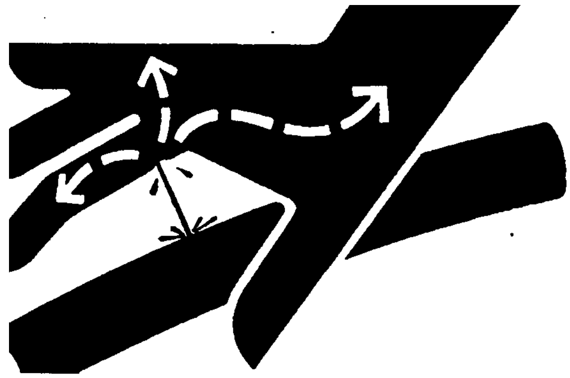
AVOID HIGH-PRESSURE FLUIDS

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

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

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

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



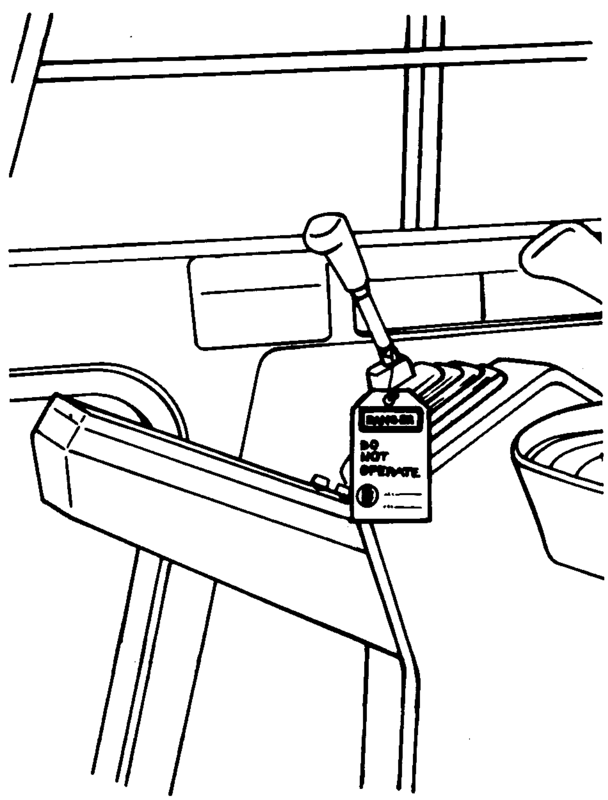
X9811 –UN–23AUG88

DX,FLUID –19–03MAR93–1/1

WARN OTHERS OF SERVICE WORK

Unexpected machine movement can cause serious injury.

Before performing any work on the machine, attach a “Do Not Operate” tag on the right control lever.



T7273AP –UN–08JUN90

TX,05,RR,566 –19–23JUL91–1/1

PARK MACHINE SAFELY

Before working on the machine:

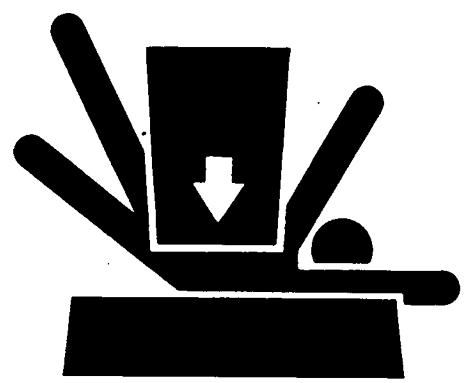
- Park machine on a level surface.
- Lower bucket to the ground.
- Turn auto-idle switch off.
- Run engine with engine RPM dial at 1/3 position for 2 minutes.
- Move engine RPM dial to slow idle position.
- Turn key switch to OFF. Remove key from switch.
- Pull pilot control shut-off lever to locked position.
- Allow engine to cool.

TX,05,DH5002 –19–28MAY96–1/1

SUPPORT MACHINE PROPERLY

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

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



TS229 –UN–23AUG88

DX,LOWER –19–04JUN90–1/1

OPERATE ONLY FROM OPERATOR'S SEAT

Avoid possible injury or machine damage. Do not start engine by shorting across starter terminals.

NEVER start engine while standing on ground. Start engine only from operator's seat.

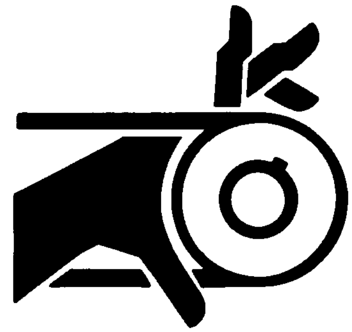
T6607AO –UN–18OCT88

TX,05,FF1615 –19–14JUN90–1/1

STAY CLEAR OF MOVING PARTS

Entanglements in moving parts can cause serious injury.

To prevent accidents, use care when working around rotating parts.



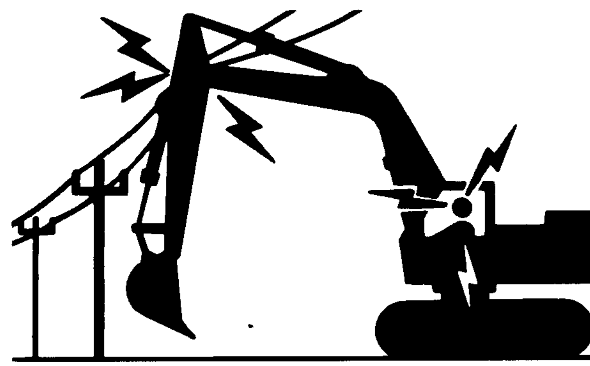
T7273AS –UN–08JUN90

TX,05,RR,572 –19–12JUN90–1/1

AVOID POWER LINES

Serious injury or death can result from contact with electric lines.

Never move any part of the machine or load closer to electric line than 3 m (10 ft) plus twice the line insulator length.



T7273AD –UN–08JUN90

TX,05,RR,594 –19–12JUN90–1/1

USE HANDHOLDS AND STEPS

Falling is one of the major causes of personal injury.

When you get on and off the machine, always maintain a three point contact with the steps and handrails and face the machine. Do not use any controls as handholds.

Never jump on or off the machine. Never mount or dismount a moving machine.

Be careful of slippery conditions on platforms, steps, and handrails when leaving the machine.

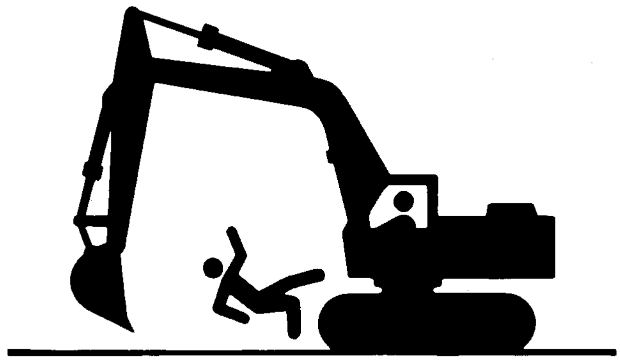
T6981AN –UN–15JUN89

TX,05,DH832 –19–16MAR92–1/1

KEEP RIDERS OFF MACHINE

Only allow the operator on the machine. Keep riders off.

Riders on machine are subject to injury such as being struck by foreign objects and being thrown off the machine. Riders also obstruct the operator's view resulting in the machine being operated in an unsafe manner.



T7273AH —UN–08JUN90

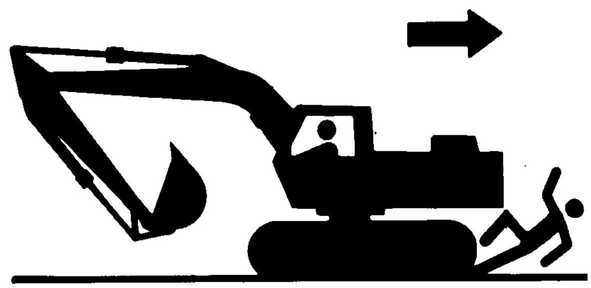
TX,05,RR,560 –19–05OCT90–1/1

MOVE AND OPERATE MACHINE SAFELY

Bystanders can be run over. Know the location of bystanders before moving, swinging, or operating the machine.

Always keep the travel alarm in working condition. It warns people when the machine starts to move.

Use a signal person when moving, swinging, or operating the machine in congested areas. Coordinate hand signals before starting the machine.



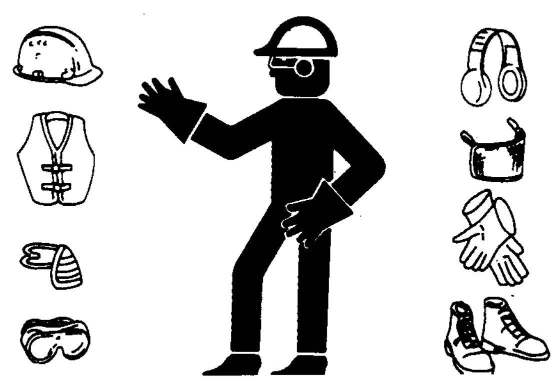
T7273AL —UN–08JUN90

TX,05,FF1806 –19–05OCT90–1/1

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.

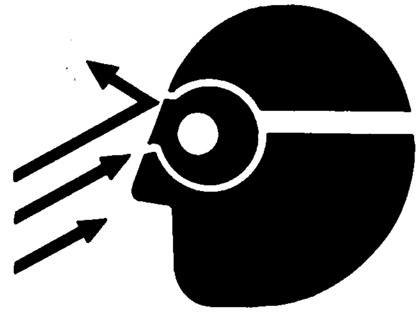


TS206 —UN–23AUG88

DX,WEAR2 –19–03MAR93–1/1

PROTECT AGAINST FLYING DEBRIS

Guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.



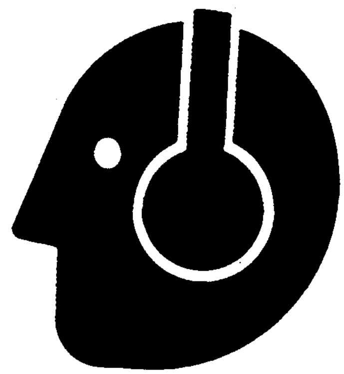
T6642DK –UN–18OCT88

TX,05,FF1613 –19–14JUN90–1/1

PROTECT AGAINST NOISE

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

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

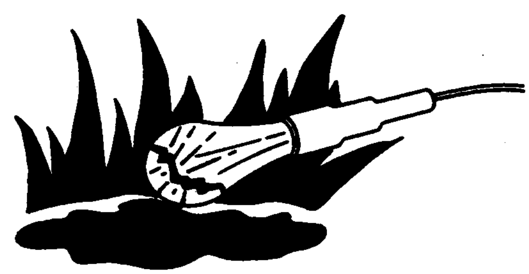


TS207 –UN–23AUG88

DX,NOISE –19–03MAR93–1/1

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.



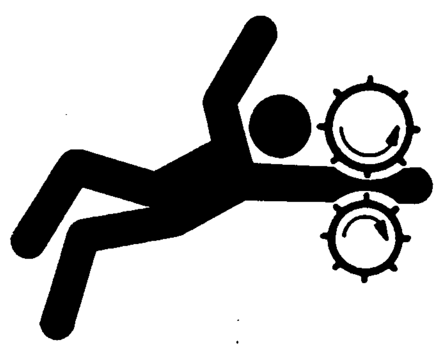
TS223 –UN–23AUG88

TX,05,FF1623 –19–09JUL90–1/1

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.

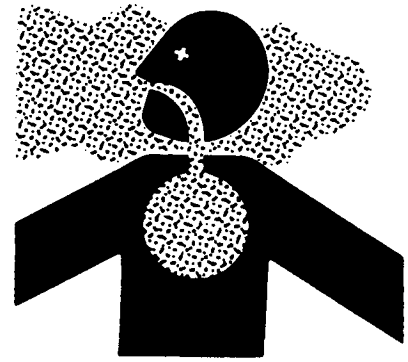
Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



TS228 –UN–23AUG88

DX,LOOSE –19–04JUN90–1/1

REMOVE PAINT BEFORE WELDING OR HEATING



TS220 –UN–23AUG88

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.

DX,PAINT –19–03MAR93–1/1

AVOID HEATING NEAR PRESSURIZED FLUID LINES

TS953 –UN–15MAY90

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.

DX,TORCH –19–03MAR93–1/1

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BEWARE OF EXHAUST FUMES

Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.

If you must operate in a building, be positive there is adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.

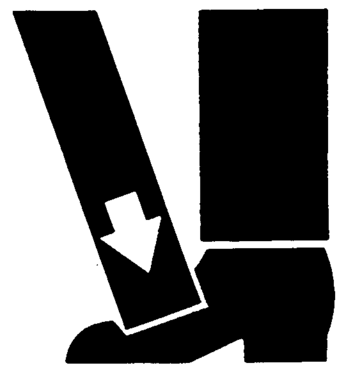
T6458AO –UN–18OCT88

02T,05,J9 –19–07JAN91–1/1

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

SERVICE COOLING SYSTEM SAFELY

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

TS281 –UN–23AUG88

DX,RCAP –19–04JUN90–1/1

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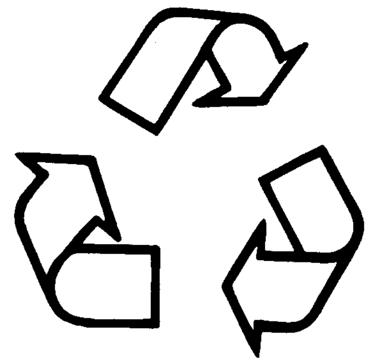
DISPOSE OF WASTE PROPERLY



TS1133 –UN–26NOV90

Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with your machine 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 authorized dealer.

TX,05,DH2502 –19–26AUG92–1/1

WORK IN A CLEAN AREA

Before starting a job, clean the work area. Remove objects that may be a safety hazard to the mechanic or bystanders.

TX,05,FF1624 –19–14JUN90–1/1

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USE TOOLS PROPERLY

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

Use power tools only to loosen threaded tools 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 recommended replacement parts. (See Parts Catalog.)

TS779 –UN–08NOV89

TX,05,FF1614 –19–14JUN90–1/1

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

LIVE WITH SAFETY

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

TS231 –19–07OCT88

DX,LIVE –19–25SEP92–1/1

BATTERY TERMINALS, LIFTING EQUIPMENT, DRY CLEANING SOLVENT AND COMPRESSED AIR

WARNING: Avoid possible injury. Disconnect the negative terminal first and reconnect the negative terminal last when disconnecting/reconnecting battery terminals.

WARNING: When lifting equipment, ensure that the lifting device is capable of supporting the desired weights and the inspection date stamped on the lifting device has not expired.

WARNING: Dry cleaning solvent PD-680 Type III is toxic and flammable. Wear protective goggles and gloves and use only in a well ventilated area. Avoid contact with skin, eyes, and clothes and don’t breathe vapors. Do not use near open flames or excessive heat. The flash point is 200°F (93°C). If you become dizzy while using solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.

WARNING: Compressed air used for cleaning purposes shall not exceed 30 psi. Use only with effective chip guarding and personnel protective equipment (goggles/shield/gloves, etc.).

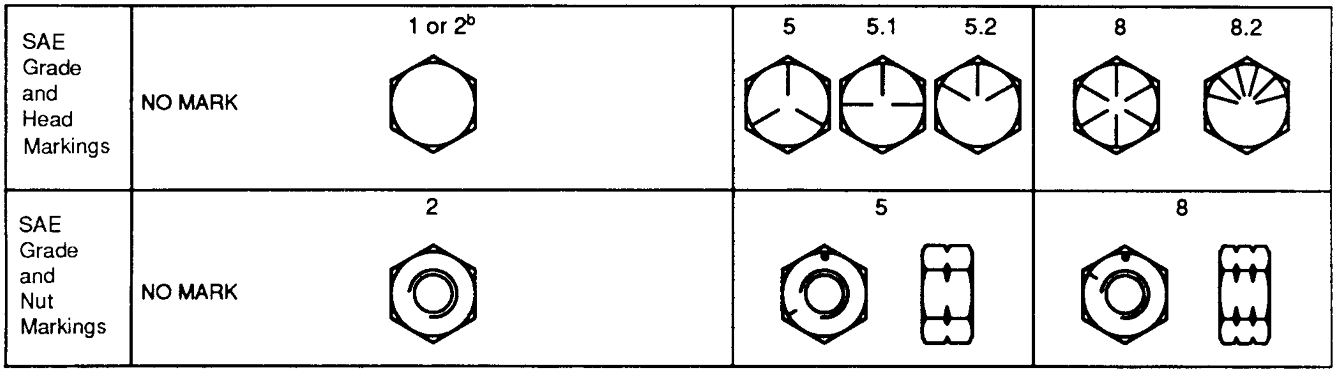
CED,OUOE042,40 –19–18OCT99–1/1

Group 02
General Specifications

Refer to TM 5-3805-281-10 for General Specifications.

Group 03
Torque Values

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.

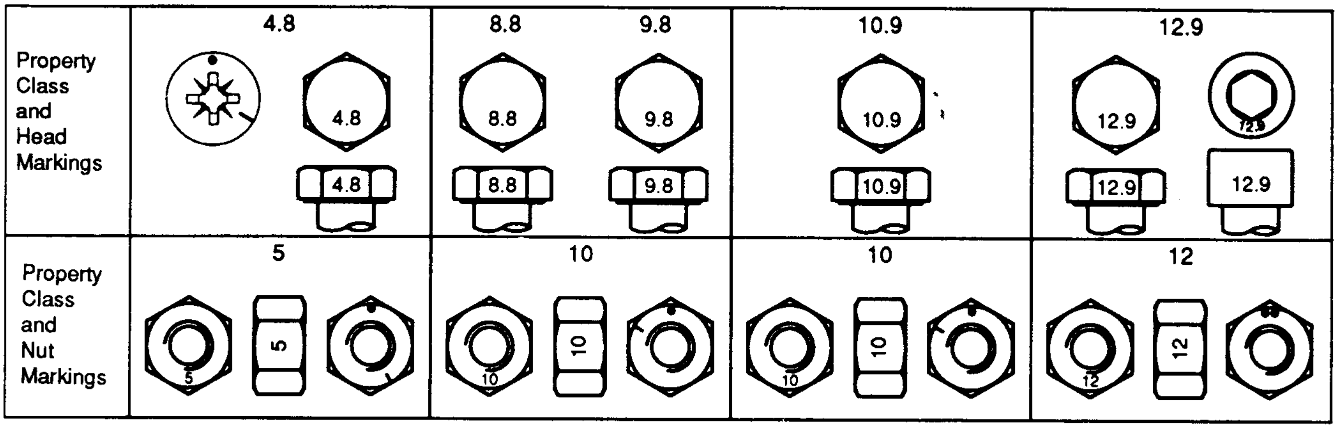
Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

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

METRIC BOLT AND CAP SCREW TORQUE VALUES



Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	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
M6	4.8	3.5	6	4.5	9	6.5	11	8.5	13	9.5	17	12	15	11.5	19	14.5
M8	12	8.5	15	11	22	16	28	20	32	24	40	30	37	28	47	35
M10	23	17	29	21	43	32	55	40	63	47	80	60	75	55	95	70
M12	40	29	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	47	80	60	120	88	150	110	175	130	225	165	205	150	260	190
M16	100	73	125	92	190	140	240	175	275	200	350	255	320	240	400	300
M18	135	100	175	125	260	195	330	250	375	275	475	350	440	325	560	410
M20	190	140	240	180	375	275	475	350	530	400	675	500	625	460	800	580
M22	260	190	330	250	510	375	650	475	725	540	925	675	850	625	1075	800
M24	330	250	425	310	650	475	825	600	925	675	1150	850	1075	800	1350	1000
M27	490	360	625	450	950	700	1200	875	1350	1000	1700	1250	1600	1150	2000	1500
M30	675	490	850	625	1300	950	1650	1200	1850	1350	2300	1700	2150	1600	2700	2000
M33	900	675	1150	850	1750	1300	2200	1650	2500	1850	3150	2350	2900	2150	3700	2750
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2750	4750	3500

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 property class.

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

[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.*

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.

TS1657 –19–02APR97

DX,TORQ2 –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.

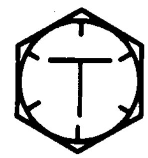
fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

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.

METRIC CAP SCREW TORQUE VALUES [a]						
	T-Bolt		H-Bolt		M-Bolt	
Nominal Dia	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%.



T6873AA

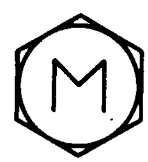
T6873AA –UN–18OCT88

T-Bolt

T6873AB

T6873AB –UN–18OCT88

H-Bolt



T6873AC

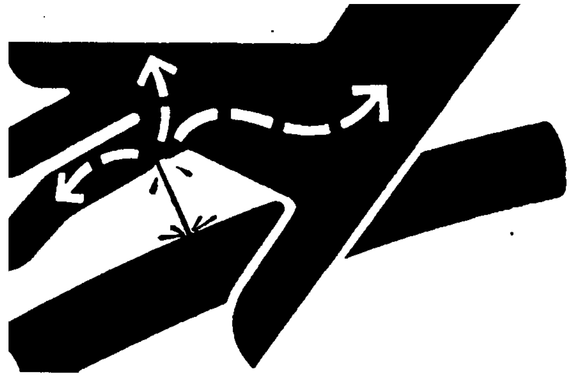
T6873AC –UN–18OCT88

M-Bolt

CHECK OIL LINES AND FITTINGS

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

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



X9811 –UN–23AUG88

T85401 –UN–24JAN89

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 machine parts which are moving.

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

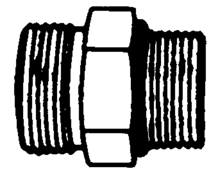
IMPORTANT: Tighten fittings as specified in torque chart.

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

T82,FLMA,AI –19–14MAR90–1/1

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,90,DY340 –19–15MAY96–1/2

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6

STRAIGHT FITTING

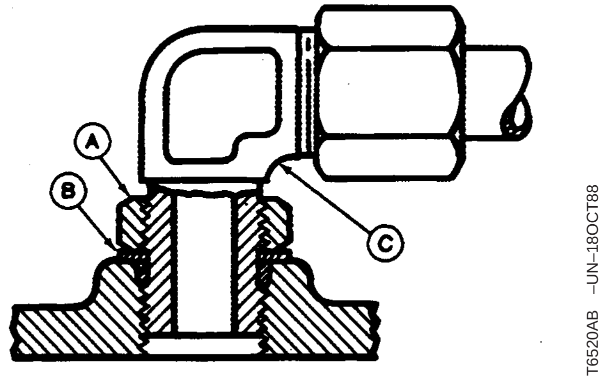
1. Back-off lock nut (A) and back-up washer (B) completely to head-end (C) of fitting.

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.



A—Lock Nut
B—Back-Up Washer
C—Head-End of Fitting

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,90,DY340 –19–15MAY96–2/2

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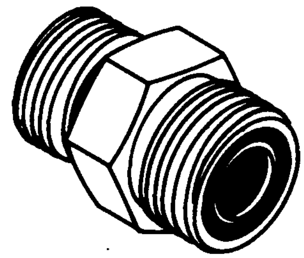
SERVICE RECOMMENDATIONS FOR FLAT FACE O-RING SEAL FITTINGS



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 [a]

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

[a]Torque tolerance is +15 -20%.

04T,90,K67 –19–01AUG94–1/1

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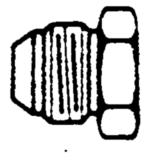
SERVICE RECOMMENDATIONS FOR 37° FLARE AND 30° CONE SEAT CONNECTORS



T6234AC –UN–18OCT88

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 [a]			
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
[a]Torque tolerance is ± 10%.			

04T,90,C96 –19–21JAN92–1/1

SERVICE RECOMMENDATIONS FOR FLARED CONNECTIONS—STRAIGHT OR TAPERED THREADS

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

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

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

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

5. Index angle fittings and tighten by hand.

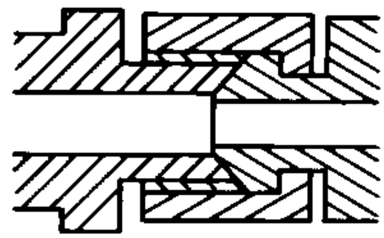
6. Tighten fitting or nut to torque value shown on the chart. Do not allow hoses to twist when tightening fittings.

TORQUE CHART [a]				
	Straight Thread [b]		Tapered Thread	
Thread Size	N•m	lb-ft	N•m	lb-ft
1/8	15	11		
1/4	20	15	45	33
3/8	29	21	69	51
1/2	49	36	93	69
3/4	69	51	176	130
1	157	116	343	253
1-1/2	196	145	539	398
2	255	188	588	434

[a]Torque tolerance is ±10%.

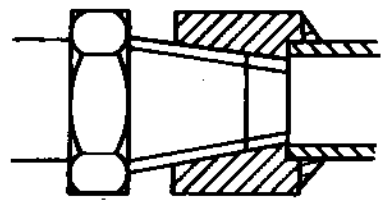
[b]With seat face.

NOTE: If female thread is cast iron (control valves, brake valves motors, etc.), torque must be reduced approximately 10%.



Straight Thread Fitting

T6873AE –UN–18OCT88

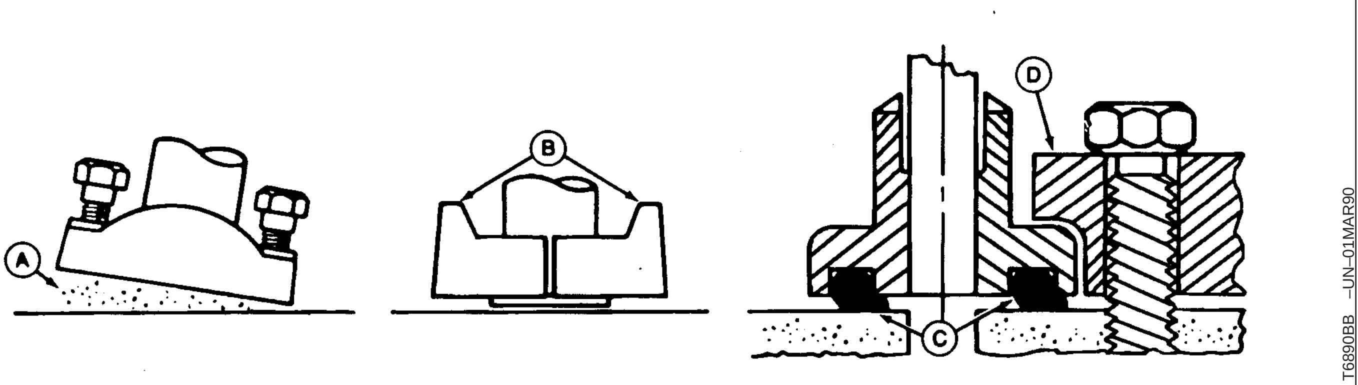


Tapered Thread Fitting

T6873AD –UN–18OCT88

04T,90,M171 –19–01DEC97–1/1

SERVICE RECOMMENDATIONS FOR INCH 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 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.

Continued on next page 04T,90,K174 –19–01AUG94–1/2

Torque Values

TORQUE CHART [a]						
			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

[a]Tolerance ± 10%. The torques given are enough for the given size connection with the recommended working pressure. Torques can be increased to the maximum shown for each cap screw size if desired. Increasing cap screw torque beyond this maximum will result in flange and cap screw bending and connection failures.

04T,90,K174 –19–01AUG94–2/2

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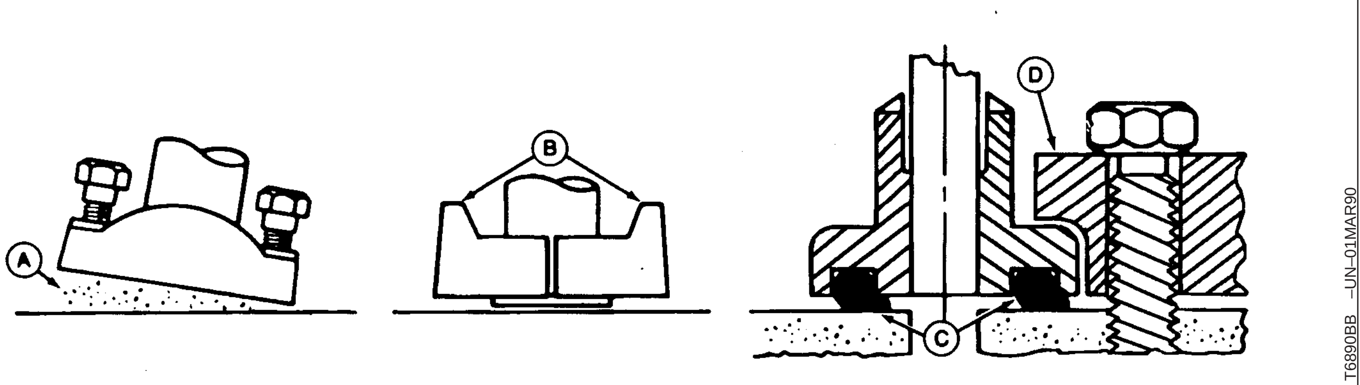
SERVICE RECOMMENDATIONS FOR METRIC SERIES FOUR BOLT FLANGE FITTING



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

Group 04
Fuels and Lubricants

DIESEL FUEL

Consult your local fuel distributor for properties of the diesel fuel available in your area.

In general, diesel fuels are blended to satisfy the low temperature requirements of the geographical area in which they are marketed.

Diesel fuels specified to A-A-52557, EN 590 or ASTM D975 are recommended.

In all cases, the fuel shall meet the following properties:

- **Cetane Number 40** minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).
- **Cold Filter Plugging Point** (CFPP) below the expected low temperature OR **Cloud Point** at least 5°C (9°F) below the expected low temperature.
- **Fuel Lubricity** should pass a minimum of 3100 gram load level as measured by the SL BOCLE scuffing test.
- **Sulfur content:**
  - Sulfur content should not exceed 0.5%. Sulfur content less than 0.05% is preferred.
  - If diesel fuel with sulfur content greater than 0.5% sulfur content is used, reduce the service interval for engine oil and filter by 50%.
  - DO NOT use diesel fuel with sulfur content greater than 1.0%.

Bio-diesel fuels with properties and meeting DIN 51606 or equivalent specifications may be used.

Aviation fuel Grade JP-8 may be used.

DO NOT mix used engine oil or any other type of lubricant with diesel fuel.

CED,OUOE020,26 –19–10MAR99–1/1

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LUBRICITY OF DIESEL FUELS

Diesel fuel must have adequate lubricity to ensure proper operation and durability of fuel injection system components.

Diesel fuels for highway use in the United States and Canada now require sulfur content less than 0.05%. Diesel fuel in the European Union will require sulfur content less than 0.05% by 1 October 1996.

Experience shows that some low sulfur diesel fuels may have inadequate lubricity and their use may reduce performance in fuel injection systems due to inadequate lubrication of injection pump components. The lower concentration of aromatic compounds in these fuels also adversely affects injection pump seals and may result in leaks.

Use of low lubricity diesel fuels may also cause accelerated wear, injection nozzle erosion or corrosion, engine speed instability, hard starting, low power, and engine smoke.

Fuel lubricity should pass a minimum of 3100 gram load level as measured by the SL BOCLE scuffing test.

A-A-52557, ASTM D975 and EN 590 specifications do not require fuels to pass a fuel lubricity test.

If fuel of low or unknown lubricity is used, add John Deere Premium Diesel Fuel Conditioner or Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (MIL-PRF-25017) at the recommended concentration. John Deere Premium Diesel Fuel Conditioner is available in winter and summer formulas. Consult your John Deere engine distributor or servicing dealer for more information.

CED,OUOE003,7684 –19–28OCT99–1/1

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 only low sulfur fuel is available, Inhibitor, Corrosion/Lubricity Improver, Fuel Soluble (MIL-PRF-25017) should be added at the recommended concentration. 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.

CED,OUOE003,7685 –19–28OCT99–1/1

DIESEL FUEL STORAGE

Proper fuel storage is critically important. Use clean storage and transfer tanks. Periodically drain water and sediment from bottom of tank. Store fuel in a convenient place away from buildings.

IMPORTANT: DO NOT store diesel fuel in galvanized containers. Diesel fuel stored in galvanized containers reacts with zinc coating on container to form zinc flakes. If fuel contains water, a zinc gel will also form. The gel and flakes will quickly plug fuel filters, damage injection nozzles and injection pump.

DO NOT use brass-coated containers for fuel storage. Brass is an alloy of copper and zinc.

Store diesel fuel in plastic, aluminum, and steel containers specially coated for diesel fuel storage.

Avoid storing fuel over long periods of time. If fuel is stored for more than a month prior to use, or there is a slow turnover in fuel tank or supply tank, add a fuel conditioner such as John Deere Premium Diesel Fuel Conditioner or fuel conditioner meeting MIL-S-53021 to stabilize the fuel and prevent microbial growth in the fuel. John Deere Premium Diesel Fuel Conditioner is available in winter and summer formulas. Fuel conditioner also reduces fuel gelling and controls wax separation during cold weather.

Consult your John Deere engine distributor or servicing dealer for recommendations and local availability. Always follow manufacturer's directions on label.

CED,OUOE003,7686 –19–28OCT99–1/1

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. Capacity is 560 L (148 gal).

CED,TX14740,6018 –19–28JAN98–1/1

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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.

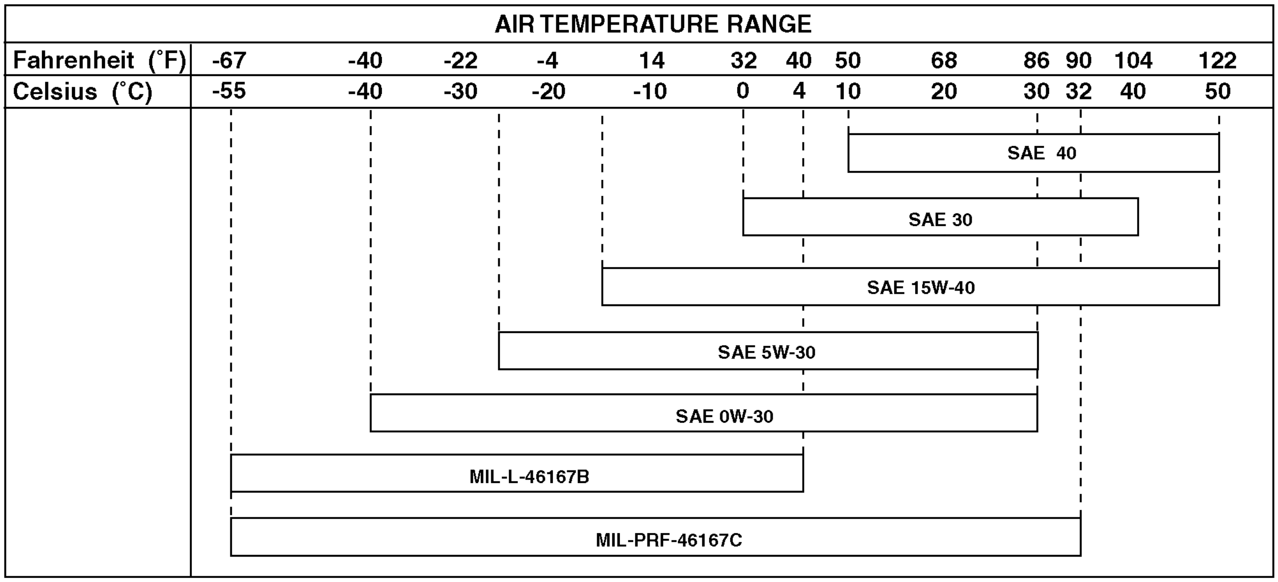
Store fuel in:

- 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

DIESEL ENGINE AND PUMP GEARBOX OILS



T125427

T125427 –19–28OCT99

Use oil viscosity based on the expected air temperature range during the period between oil changes.

Other oils may be used if they meet one or more of the following:

- MIL-PRF-2104G
- MIL-L-46167B
- MIL-PRF-46167C
- API CG-4
- API CF-4

Multi-viscosity diesel engine oils are preferred.

If diesel fuel with sulfur content greater than 0.5% is used, reduce the service interval by 50%.

CED,OUOE020,3 –19–12FEB99–1/1

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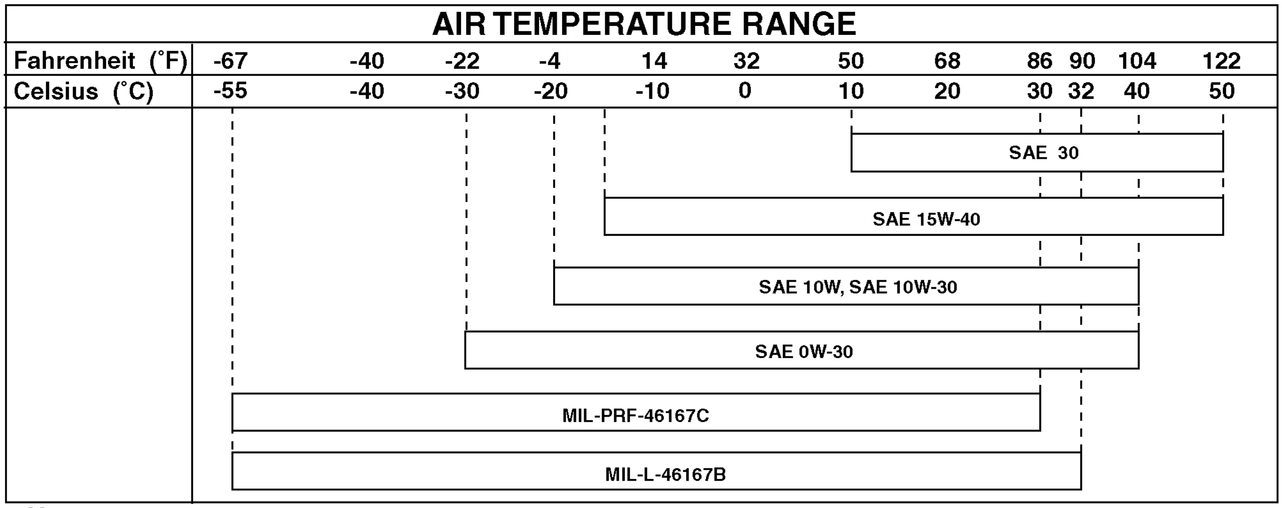
HYDRAULIC OIL



T125428

T125428 –19–12NOV99

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

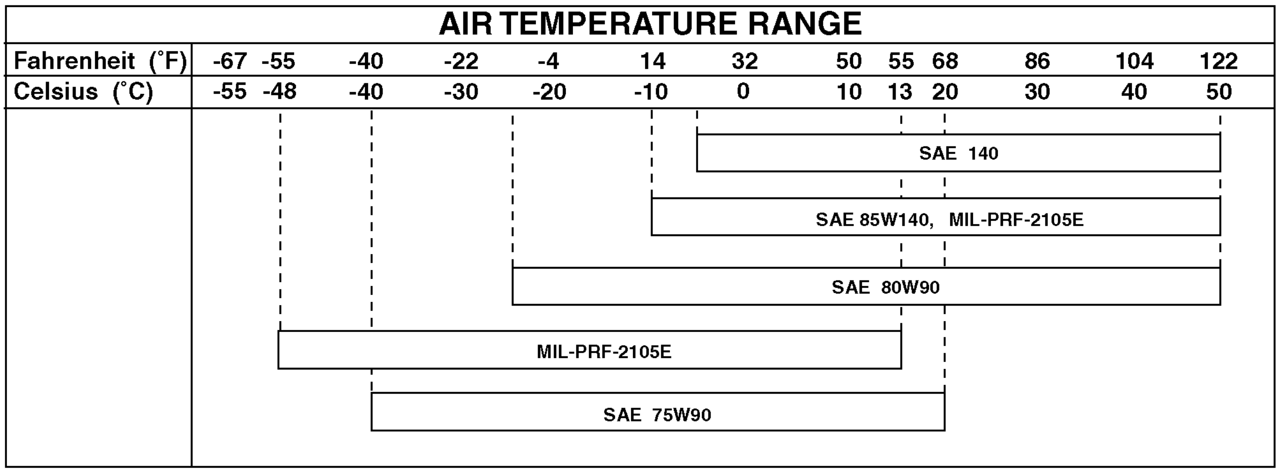
Use oils meeting one or more of the following:

- MIL-PRF-2104G[1]
- MIL-L-46167B
- MIL-PRF-46167C
- API CG-4[1]
- API CF-4[1]

[1]*Must contain a minimun zinc additive of 0.09 percent.*

CED,OUOE020,4 –19–12FEB99–1/1

SWING GEARBOX AND PROPEL GEARBOX OILS



T125429

T125429 –19–12NOV99

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

The following oils are recommended:

- Oils meeting MIL-PRF-2105. MIL-PRF-2105E is updated.
- Oils meeting API Service GL-5 (MIL-L-2105E).

CED,OUOE020,5 –19–12FEB99–1/1

TRACK ROLLER, FRONT IDLER, AND CARRIER ROLLER OIL

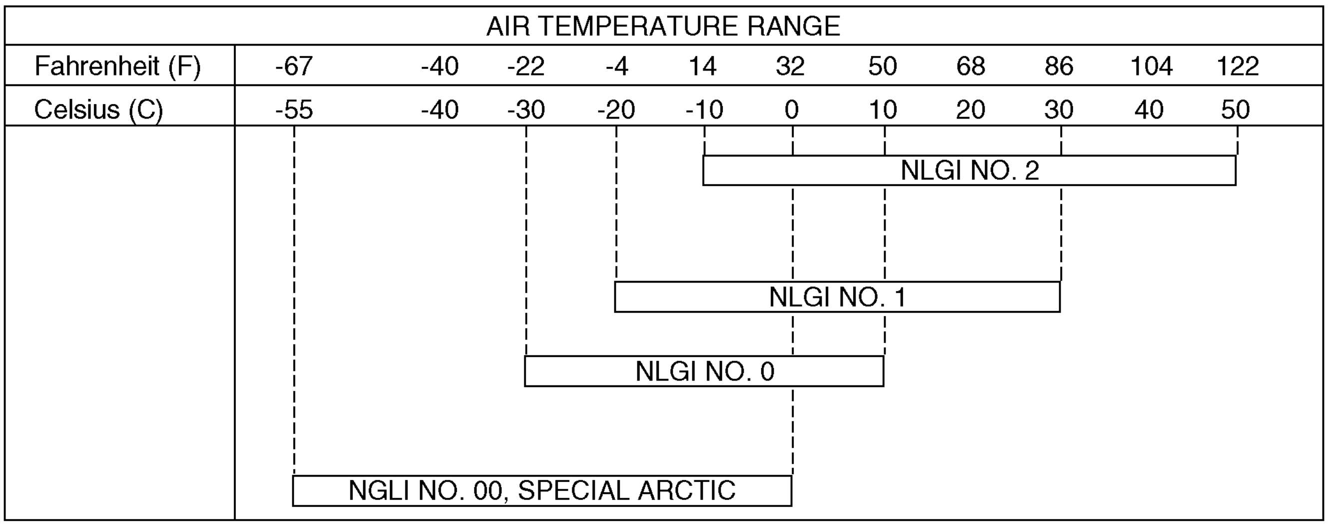
Use oil viscosity based on the expected air temperature range during the period between oil changes.

The following oils are recommended:

- MIL-PRF-2105E (80W90)
- API Service Classification GL-5 gear oil (SAE 80W90)
- Arctic oil such as MIL-PRF-2105E (75W) should be used at temperatures below -30°C (-11°F).

CED,OUOE020,6 –19–12FEB99–1/1

TRACK ADJUSTER, WORKING TOOL PIVOT, SWING BEARING, AND SWING BEARING GEAR GREASE



T120320

T120320 –19–25MAR99

Use grease based on NLGI consistency numbers and the expected air temperature range during the service interval.

Use greases meeting MIL-PRF-10924G.

Lithium complex grease containing high temperature, extreme pressure properties with 3-5 percent molybdenum disulfide is preferred, although those without the molybdenum disulfide are acceptable.

CED,OUOE020,7 –19–12FEB99–1/1

OIL FILTERS

Filtration of oils is critical to proper operation and lubrication. Always change filters regularly as specified in this manual.

Use filters meeting John Deere performance specifications.

DX,FILT –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

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

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MIXING OF LUBRICANTS

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

Mixing different types of 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

CHAPTER 2

SECTION 9005

OPERATIONAL CHECKOUT PROCEDURE

BLANK

Group 10
Operational Checkout Procedure

OPERATIONAL CHECKOUT

Use this procedure to check all systems and functions on the machine. It is designed so you can make a quick check of machine operation while doing a walk around inspection and performing specific checks from the operator's seat.

Should you experience a problem with your machine, you will find helpful diagnostic information in this checkout that will pinpoint the cause. This information may allow you to perform a simple adjustment yourself which will reduce the down time of the machine. Use the table of contents or index to help find adjustment procedures.

The information you provide after completing the operational checkout will allow you or your authorized dealer to pinpoint a specific test or repair needed to restore the machine to design specifications.

A location will be required which is level and has adequate space to complete the checks. No tools or equipment are needed to perform the checkout.

Complete the necessary visual checks (oil levels, oil condition, external leaks, loose hardware, linkage, wiring, etc.) prior to doing the checkout. The machine must be at operating temperature for many of the checks.

Start at the top of the left column and read completely down column before performing check. Follow this sequence from left to right. In the far right column, if no problem is found, you will be instructed to go to next check. If a problem is indicated, you will be referred to either a section in this manual or to your authorized dealer for repair.

CED,OUOE003,7682 –19–19OCT99–1/1

Operational Checkout Procedure

❶ OPERATOR STATION CHECKS—KEY SWITCH ON, ENGINE OFF

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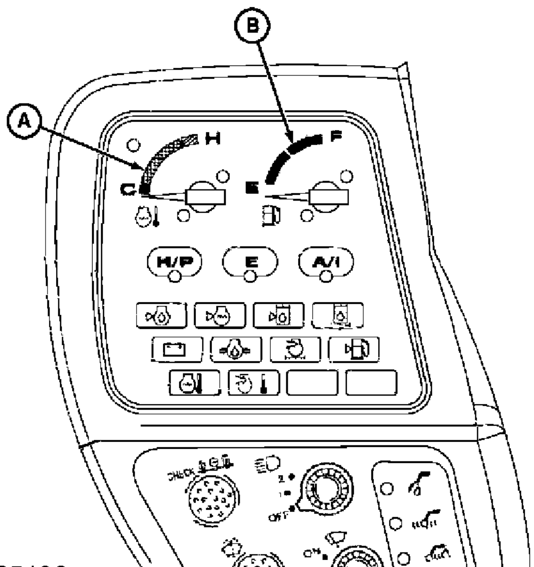
GAUGES, MONITOR, AND BATTERY DISCONNECT RELAY CHECKS



T125196

T125196 –UN–29OCT99

A—Coolant Temperature Gauge
B—Fuel Gauge

NOTE: Monitor buzzer is not checked during this procedure.

If engine coolant temperature is below 30°C (86°F) engine temperature gauge needle may not move to the right. Run engine a few minutes to warm coolant before check.

Engine OFF.

Key switch ON.

Does battery relay click?

Do engine coolant temperature gauge (A) and fuel gauge (B) needles move to the right?

Do all 10 monitor lights come on and after 2—3 seconds only the alternator indicator and engine oil pressure indicator remain on?

YES: Go to next check.

NO: Check monitor fuse.

NO: Check and replace bulb if any bulb fails to come on. Go to Group 9015-15.

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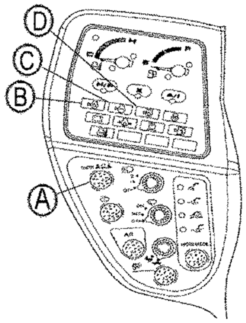
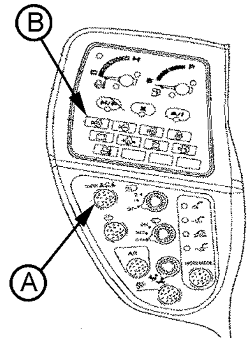
Operational Checkout Procedure

FLUID LEVEL (COOLANT, HYDRAULIC OIL, AND ENGINE OIL) INDICATOR CIRCUIT CHECKS	 T102097 –UN–26JUL96 **A—Level Check Switch** **B—Engine Oil Level Indicator** **C—Engine Coolant Level Indicator** **D—Hydraulic Oil Level Indicator** Engine OFF. Key switch ON. Push and hold level check switch (A). Are the engine coolant level (C), engine oil level (B), and hydraulic oil level (D) indicator lights ON?	**YES:** Go to next check. **NO:** Check monitor fuse. If OK, check fluid levels in radiator, recovery tank, hydraulic oil tank, or engine. If OK, check fluid level switch or wiring. Go to Group 9015-15. – – –1/1

Operational Checkout Procedure

ENGINE OIL LEVEL AND CONDITION CHECK

T6488GH –19–23FEB89



T103525 –UN–10SEP96

A—Pre-Operation Level Check Switch
B—Engine Oil Level Indicator

Engine OFF.

Remove dipstick and check oil level and condition.

Is oil above “full” mark or below “add” mark on dipstick.

Does the oil look milky or grainy?

If oil level is high, check for fuel or anti-freeze. Drain a small amount of engine oil into a clear container. Watch oil in container to see if anti-freeze or water accumulates at the bottom. If oil is milky, moisture or anti-freeze may be present.

If oil is grainy, carbon may be present. Carbon in oil may result when engine runs at slow idle too long.

If oil level is low, check for oil leaks or oil seal problems in engine.

Adjust oil level to between “add” and “full” marks on dipstick.

Key switch ON.

Push pre-operation level check switch (A).

Is green light for engine oil level indicator (B) ON?

YES: Add oil if low.

Change oil and filter if too high, milky or grainy. Go to Group 9000-04. Check oil level after a few hours operation to determine if a problem exists. Go to Diagnose Engine Malfunctions Group 9010-15.

NO: If engine oil level indicator does not come ON, go to Monitor Diagnostic Information in Group 9015-15.

If oil level is OK, go to next check.

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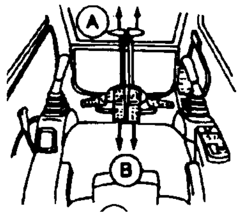
Operational Checkout Procedure

PROPEL LEVER AND PEDAL CUSHION CYLINDER CHECKS



T7531AO –UN–07JUN91

A—Propel Lever and Pedal Forward
B—Propel Lever and Pedal Rearward

Engine OFF.

Push each propel lever and pedal forward (A), then release.

Pull each propel lever and pedal rearward (B), then release.

Does each lever and pedal have equal effort to operate forward and reverse?

Does each lever and pedal return to neutral at the same time when released?

YES: Go to next check.

NO: Repair or repair cushion cylinders. Go to Group 3360.

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OPERATOR STATION CHECKS—ENGINE ON

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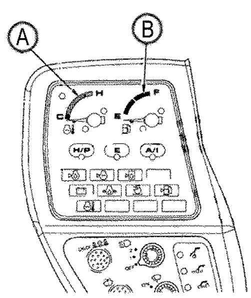
MONITOR CIRCUIT AND GAUGE CHECKS



T102096 –UN–26JUL96

A—Coolant Temperature Gauge
B—Fuel Gauge

Start engine.

IMPORTANT: Stop the engine if alternator or engine oil pressure indicators do not go OFF or a monitor indicator comes ON after engine starts.

Does alternator and engine oil pressure indicators go OFF after engine starts?

Do all monitor indicators remain OFF after engine starts?

The buzzer will sound if engine oil pressure is low.

Is coolant temperature gauge needle (A) in normal operating zone after a few minutes?

Does fuel gauge (B) indicate fuel level?

Stop engine.

YES: Go to next check.

NO: Check engine lubrication system if engine oil pressure indicator is on after engine starts. Go to Group 9010-15.

Check alternator belt if alternator indicator is on after engine starts. Go to Group 0510. If OK, check fuses and alternator. Go to Group 9015-15.

Check switches sensors, and gauges. Go to Group 9015-15.

Check fluid levels.

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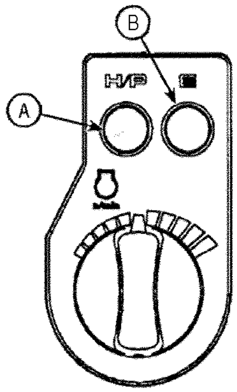
Operational Checkout Procedure

POWER MODE INDICATORS CIRCUIT CHECKS



T102098 –UN–26JUL96

A—HP (High Power) Mode Switch
B—E (Economy) Mode Switch

Start engine.

Auto-idle switch OFF.

Pilot shut-off lever in LOCKED position.

Push HP (high power) mode (A) and E (economy) mode (B) switches one at a time.

Do corresponding indicator lights come on as each switch is pushed?

YES: Go to next check.

NO: Check controller fuse. Go to Group 9015-15.

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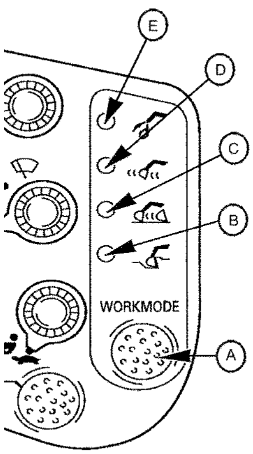
WORK MODE CIRCUIT CHECKS



T102099 –UN–26JUL96

A—Work Mode Switch
B—Dig Mode Indicator
C—Grading Mode Indicator
D—Precision Mode Indicator
E—Attachment Mode Indicator

Start engine.

Turn engine rpm dial to fast idle.

Auto-idle switch OFF.

Pilot shut-off lever in LOCKED position.

Push work mode select switch (A) to select desired work mode.

Do corresponding indicator lights (B—E) come on as each switch is pushed?

Does engine speed decrease when precision mode is selected?

YES: Go to next check.

NO: Check fuse. If OK, check monitor and wiring harness. Go to Group 9015-15.

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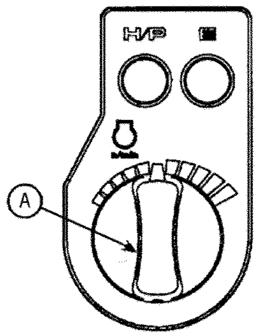
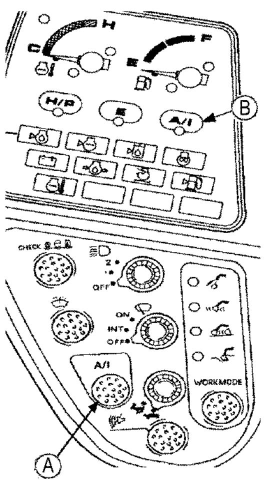
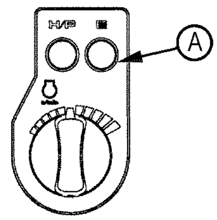
Operational Checkout Procedure

ENGINE RPM DIAL CHECKS	 T102100 –UN–26JUL96	**A—Engine RPM Dial** Start engine. Auto-idle switch OFF. Pilot shut-off lever in LOCKED position. Turn engine rpm dial (A) clockwise. Does engine speed increase? Turn engine rpm dial counterclockwise. Does engine speed decrease?	**YES:** Go to next check. **NO:** Check dial and wiring harness. Go to Group 9015-15. If OK, check for control signal to EC motor. Go to harness test in Group 9025-25. Check that cable from EC motor to injection pump lever moves freely. Go to Group 0515. – – –1/1

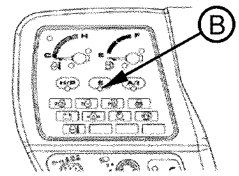
AUTO-IDLE CIRCUIT CHECK	 T102101 –UN–26JUL96	**A—Auto-Idle Switch** **B—Auto-Idle Indicator** Engine at fast idle. HP (High Power) and E (Economy) mode switches OFF. Auto-idle switch OFF. Pilot shut-off lever in UNLOCKED position. Push auto-idle switch (A) to ON. Does auto-idle indicator (B) come on? Does engine speed decrease after 4—6 seconds? Slowly actuate any dig function control lever. Does engine speed return to fast idle?	**YES:** Go to next check. **NO:** Check fuse. Check switches and wiring harness. Go to Group 9015-15. – – –1/1

Operational Checkout Procedure

E (ECONOMY) MODE CHECK



T103545 –UN–09SEP96



T103546 –UN–09SEP96

A—E (Economy) Mode Switch
B—E (Economy) Mode Indicator

Start the engine.

Auto-idle switch OFF.

Turn engine rpm dial clockwise to fast idle.

Push E (Economy) mode switch (A) on.

Does engine speed decrease?

Does E mode indicator (B) come on?

Push E mode switch again to turn it OFF.

Does E mode indicator go out and engine speed increase to fast idle?

YES: Go to next check.

NO: Check switch, indicator, and harness. Go to Group 9015-15.

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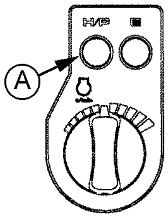
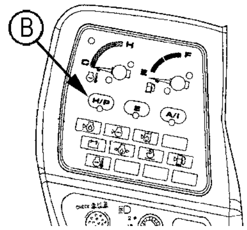
Operational Checkout Procedure

HP (HIGH POWER) MODE CHECK	 T111983 –UN–27OCT97  T112183 –UN–13NOV97 **A—HP (High Power) Mode Switch** **B—HP (High Power) Mode Indicator** Start the engine. Auto-idle switch OFF. Turn engine rpm dial clockwise to fast idle. Push HP (High Power) mode switch (A) on. Does HP (High Power) mode indicator (B) come on? Operate the arm in function over relief (arm cylinder fully extended). Does engine speed increase? Push HP mode switch again to turn it OFF. Does HP mode indicator go out?	**YES:** Go to next check. **NO:** Check switch, indicator, arm in sensor, pump pressure sensor, and harness. Go to Group 9015-15. Check linkage and fast idle speed stop at the injection pump. Go to Group 9010-20. – – –1/1

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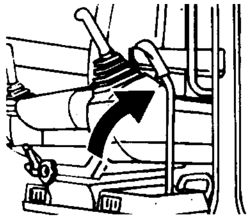
Operational Checkout Procedure

PILOT SHUT-OFF VALVE CHECKS



T7351CC –UN–22AUG90

CAUTION: Machine may move during this check. Make sure area is clear and large enough to operate all machine functions.

Run engine at slow idle.

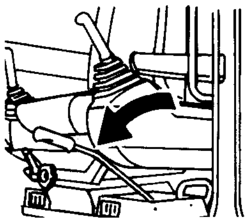
Pilot shut-off lever in LOCKED (rearward) position.

Actuate controls for dig and propel functions.

Do any dig or propel functions operate?

YES: Check adjustment. Go to Group 9025-20. Repair or replace pilot shut-off valve. Go to Group 3360.

NO: Continue check.



T7351CB –UN–22AUG90

Push pilot shut-off lever to UNLOCKED position (forward).

Actuate controls for dig and propel functions.

Do all functions operate?

YES: Go to next check.

NO: Check adjustment. Go to Group 9025-20. Repair or replace pilot shut-off valve. Go to Group 3360.

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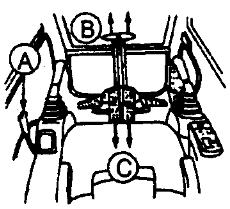
TRAVEL ALARM CHECK



T7850AF –UN–22OCT92

A—Pilot Shut-Off Lever
B—Propel Pedals Or Levers Forward
C—Propel Pedals Or Levers Rearward

CAUTION: Machine will move during this check. Make sure area is clear and large enough to operate the machine.

Engine running.

Pilot shut-off lever (A) in UNLOCKED position (forward).

Push propel pedals or levers forward (B) for forward travel.

Does travel alarm sound?

Push propel pedals or pull levers rearward (C) for reverse travel.

Does travel alarm sound?

YES: Go to next check.

NO: Check travel (motion) alarm fuse. Check motion alarm and wiring harness. Go to Group 9015-15.

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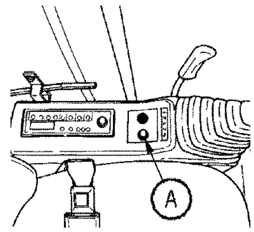
Operational Checkout Procedure

TRAVEL ALARM STOP CIRCUIT CHECK



T102919 –UN–08AUG96

A—Travel Alarm Cancel Switch

CAUTION: Machine will move during this check. Make sure area is clear, and large enough to operate the machine.

NOTE: Travel alarm must operate for this check.

Push propel pedals or levers and allow travel alarm to operate for a minimum of 12 seconds.

While continuing travel, push travel alarm cancel switch (A).

Does travel alarm stop sounding?

YES: Go to next check.

NO: Check switch and wiring harness. Go to Group 9015-15.

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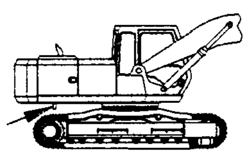
ENGINE BLOW-BY CHECK



T7700AC –UN–10FEB92

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

Are fumes barely visible at the blow-by tube at fast idle, with 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 that requires some experience to determine excessive blow-by.

YES: Go to next check.

NO: If blow-by is excessive. Go to Compression Pressure Test in Group 9010-25.

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ENGINE PARTS LOOSE OR WORN CHECK

Run engine at slow idle.

Move hydraulic control lever to operate a hydraulic function over relief to put engine under load.

Does engine run smooth, no knocking or rattling noise?

YES: Go to next check.

NO: Go to Abnormal Engine Noise, in Group 9010-15.

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Operational Checkout Procedure

9005
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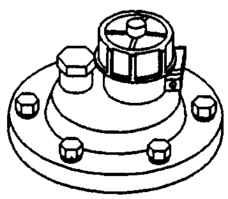
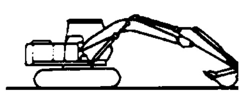
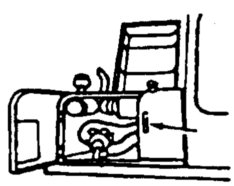
HYDRAULIC SYSTEM CHECKS

– – –1/1

HYDRAULIC OIL TANK PRESSURIZATION CHECK	 T7884AG –UN–12NOV92 Raise boom to full height, then lower boom to ground. *NOTE: Ensure that engine is properly shut down.* Slowly loosen vent plug on hydraulic oil tank. Is air heard escaping from vent plug? *NOTE: The pressurized hydraulic oil tank creates pressure at the inlet to the hydraulic pumps. If filler cap does not seal, hydraulic pumps could cavitate and be damaged.*	**YES:** Go to next check. **NO:** Replace cap.

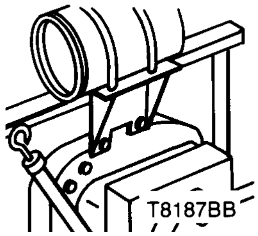
– – –1/1

HYDRAULIC OIL LEVEL CHECK	 T6477AQ –UN–19OCT88  T7387AD –UN–03OCT90 Park machine on a level surface. Extend bucket cylinder. Retract arm cylinder. Lower boom so bucket is on the ground. Check the hydraulic oil level. Is oil level between the marks on hydraulic oil level window?	**YES:** Go to next check. **NO:** Add hydraulic oil so level is between marks on window. Go to Group 9000-04.

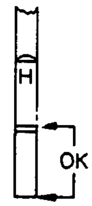
– – –1/1

Operational Checkout Procedure

PUMP GEARBOX OIL LEVEL CHECK



T8187BB –UN–08MAR94



T7884AH –UN–12NOV92

NOTE: Ensure that engine is properly shut down.

Pull dipstick from tube, check oil level.

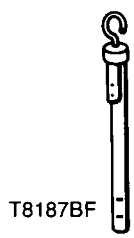
Is oil level between end of dipstick and “H” mark?

YES: Go to next check.

NO: Add oil if low.

– – –1/1

SWING GEARBOX OIL LEVEL CHECK



T8187BF –UN–08MAR94

NOTE: Ensure that engine is properly shut down.

Pull dipstick from tube, check oil level.

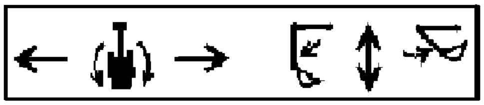
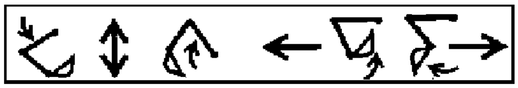
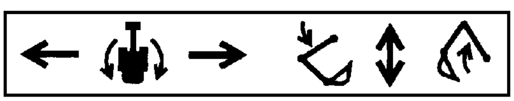
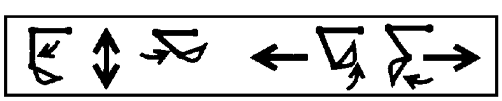
Is oil between marks?

YES: Go to next check.

NO: Add oil if low.

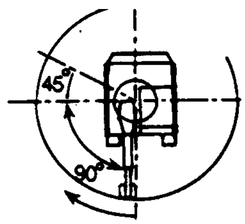
– – –1/1

Operational Checkout Procedure

PILOT CONTROLLER PATTERN CHECK—SAE PATTERN	 T102070 –UN–16JUL96 *Left Control Lever Decal*  T102071 –UN–16JUL96 *Right Control Lever Decal* Run engine at slow idle. Operate machine in clear area. Push pilot shut-off lever to UNLOCKED position. Slowly move control levers to all positions on decals. Do bucket, boom, arm, and swing move as decals show?	**YES:** Go to next check. **NO:** Install correct decals for control pattern. To change control pattern, go to Control Lever Pattern Conversion in Group 9025-15. – – –1/1
PILOT CONTROLLER PATTERN CHECK—JOHN DEERE PATTERN	 T102197 –UN–19JUL96 *Left Control Lever Decal*  T102198 –UN–19JUL96 *Right Control Lever Decal* Run engine at slow idle. Operate machine in clear area. Push pilot shut-off lever to UNLOCKED position. Slowly move hydraulic levers to all positions on decals. Do bucket, boom, arm, and swing move as decals show?	**YES:** Go to next check. **NO:** Install correct decals for control pattern. To change control pattern, go to Control Lever Pattern Conversion in Group 9025-15. – – –1/1

Operational Checkout Procedure

SWING DYNAMIC BRAKE CHECK



T6479AY –UN–19OCT88

CAUTION: Make sure area is clear and large enough to swing extended arm and bucket. Machine must be on level ground.

Position upperstructure with boom in front.

Put arm and bucket in fully extended position with bucket 900 mm (3 ft) above ground level.

Operate engine at fast idle.

Actuate swing control valve to full stroke. Swing around 90 degrees and release lever.

Does upperstructure stop within 45 degrees (1/8 turn) after releasing lever?

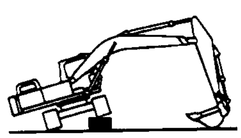
Repeat procedure in opposite direction.

YES: Go to next check.

NO: Check swing motor leakage. Check swing motor crossover relief valve. Go to Group 9025-25. Check swing valve spool. Go to Group 3360.

– – –1/1

SWING CIRCUIT LEAKAGE CHECK



T6479AZ –UN–19OCT88

Run engine at slow idle.

Position machine on a side hill or raise one side of machine 300 mm (1 ft) with the boom and put blocks under track.

Position bucket 300 mm (1 ft) off the ground at maximum reach.

Actuate bucket curl function over relief.

NOTE: Actuating the bucket function releases the mechanical swing park brake.

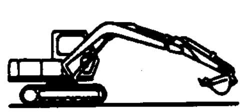
Does upperstructure move only slightly?

YES: Go to next check.

NO: Check swing circuit leakage. Go to Group 9025-25.

– – –1/1

DIG FUNCTION DRIFT CHECK



T6290AF –UN–19OCT88

Run engine at slow idle.

Fill bucket with dirt. Position bucket at maximum reach with bucket 2 in. (50 mm) above ground.

Observe bucket for 1 minute.

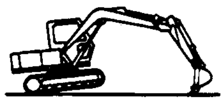
Does bucket drift down to ground within 1 minute?

YES: Check cylinder drift. Go to 9025-25. Inspect reduced leakage valves for boom down and arm in functions. Go to Group 3360.

NO: Go to next check.

– – –1/1

Operational Checkout Procedure

CONTROL VALVE LIFT CHECK TEST	 T6292AZ –UN–19OCT88 Run engine at slow idle. Position machine as illustrated. Slowly actuate pilot controller to lower boom, extend arm (retract cylinder), and dump bucket (retract cylinder). Do functions move in opposite direction as control levers are moved, then change direction as levers are moved further?	**YES:** If functions move in opposite direction first, a leak at the lift check valve is indicated. Inspect lift check valves. Go to Group 3360. **NO:** Go to next check. – – –1/1
BOOM UP, ARM IN, AND BUCKET COMBINED OPERATION CHECK	Engine at fast idle. Work mode selector in dig mode. Actuate the boom up function, arm in function and then the bucket function. Does boom continue to move at approximately the same speed after bucket function is actuated?	**YES:** Go to next check. **NO:** Inspect bucket flow control valve in control valve if boom speed slows excessively. Go to Group 3360. – – –1/1
ARM REGENERATIVE VALVE OPERATION CHECK	Engine at fast idle Work mode selector in dig mode. Extend the arm to full extension and then lower boom so bucket is on the ground. Actuate the boom up and arm in functions in combined operation. Does the arm move smoothly through the complete cycle and not hesitate when it goes through the vertical position?	**YES:** Go to next check. **NO:** Check the rear pump pressure sensor, arm in pressure sensor, boom up pressure switch, and arm regenerative solenoid valve. Go to Group 9015-15. **IF OK:** Check the arm regenerative valve in the control valve. Go to Group 3360. – – –1/1

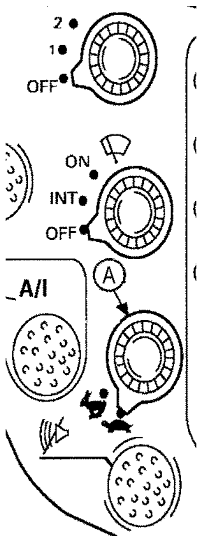
Operational Checkout Procedure

PROPEL SYSTEM TRACKING CHECKS WHILE PROPELLING	Engine at fast idle. Work mode selector in dig mode. Propel speed switch in fast speed (rabbit). Propel machine at full speed forward on a flat and level area. Repeat procedure in reverse. Do both tracks move and machine does not mistrack excessively in forward or reverse?	**YES:** Go to next check. **NO:** Note which track does not move or if machine mistracks and the mistrack pattern. Go to Propel System Tracking Test in Group 9025-25. – – –1/1

PROPEL SYSTEM TRACKING CHECKS WHILE OPERATING A DIG FUNCTION	Engine at fast idle. Propel speed switch in fast speed (rabbit). Propel machine at full speed forward on a flat and level area. After machine is moving, actuate the arm function to full actuation to extend the arm and then to retract the arm. Then actuate boom control lever to full actuation to raise and lower the boom. Does machine mistrack excessively when the arm is extended or boom is raised? *NOTE: Machine will slow down during this test.*	**YES:** Inspect flow combiner valve in the control valve if machine mistracks during arm out operation. Inspect propel flow control valve in the control valve if machine mistracks during boom up operation. Go to Group 3360. **NO:** Go to next check. – – –1/1

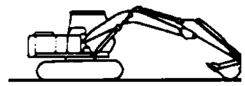
PROPEL SYSTEM MANEUVERABILITY CHECK	Engine at fast idle. Propel speed switch in fast speed (rabbit). Propel machine at full speed forward down a slope. Turn in each direction. Repeat the procedure in reverse. Does each track slow down in response to pedal or lever movement in order to turn?	**YES:** Go to next check. **NO:** Inspect counterbalance valve. Go to Group 0260. – – –1/1

Operational Checkout Procedure

PROPEL SPEED SELECTION CHECK	 T102104 –UN–26JUL96	**A—Propel Speed Switch** Engine at fast idle. Turn propel speed switch (A) to slow speed (turtle). Actuate propel function to full speed. Turn propel speed switch to fast speed (rabbit). Does machine travel speed increase? Actuate a dig function and then return to neutral. Does machine travel speed decrease and then increase? Turn propel speed switch to slow speed (turtle). Does machine travel speed decrease?	**YES:** Go to next check. **NO:** Check pressure switches and sensors. Go to Group 9015-15. Go to Propel Speed Change Circuit Operation in Group 9025-05. – – –1/1

CYCLE TIMES CHECK	**CAUTION: Make sure area is clear and large enough to operate all functions of machine.** *NOTE: Hydraulic oil must be at operating temperature for this check to obtain reliable results.* Warm hydraulic oil to operating temperature for this check. Engine at fast idle in standard mode. Work mode selector in dig mode. E mode switch OFF. HP mode switch OFF. Auto-idle switch OFF.	– – –1/2

Operational Checkout Procedure



T6477AQ –UN–19OCT88

Boom Position

T7884AE –UN–10NOV92

Arm, Bucket, Swing, Propel Position

Move machine to position shown for each test. Record cycle time for each function. Does machine perform within specifications?

Boom Up—Specification

Cycle Time .... 3.1 ± 0.3 sec

Boom Down—Specification

Cycle Time .... 2.8 ± 0.3 sec

Arm In—Specification

Cycle Time .... 3.9 ± 0.3 sec

Arm Out—Specification

Cycle Time .... 3.3 ± 0.3 sec

Bucket Load—Specification

Cycle Time .... 4.6 ± 0.3 sec

Bucket Dump—Specification

Cycle Time .... 2.7 ± 0.3 sec

Swing 3 Revolutions From a Running Start—Check Time Left and Right—Specification

Cycle Time .... 16.5 ± 1.0 sec

Fast Speed Propel 20 m (65 ft) From a Running Start—Check Time Forward and Reverse—Specification

Cycle Time .... 13.1 ± 1.0 sec

Slow Speed Propel 20 m (65 ft) From a Running Start—Check Forward and Reverse—Specification

Cycle Time .... 20.0 ± 2.0 sec

Slow Speed Propel With Track Raised Three Revolutions From A Running Start—Check Forward and Reverse—Specification

Cycle Time .... 33.0 ± 2.0 sec

YES: Go to next check.

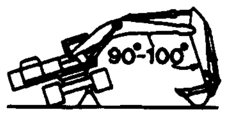
NO: Check engine speed. Check hydraulic pump flow. Go to Group 9010-20 and 9025-25.

– – –2/2

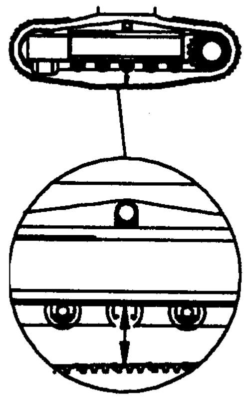
❹ UNDERCARRIAGE CHECKS

– – –1/1

TRACK SAG, ROLLER AND IDLER LEAKAGE CHECKS



T6915AN –UN–07APR89



T7850AI –UN–22OCT92

Swing upperstructure to side and raise track off ground.

Slowly turn track forward for two revolution then in reverse for two revolution. Stop track while turning in reverse so all track sag is at the bottom.

Stop engine.

Measure distance between top of track shoe to center of lower surface of track frame.

Track (330LCR)—Specification

Sag .... 340—380 mm (13-3/8—15 in.)

Check rollers and idlers for oil leaks.

Is oil leaking from rollers or idlers?

Raise other side of machine and repeat checks.

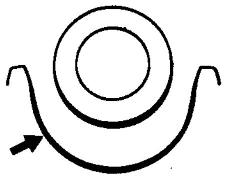
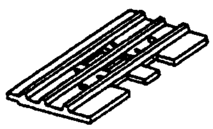
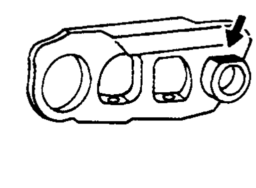
NOTE: If track sag is more or less than specified, track chain wear will be accelerated. If track sag is more or less than specified on one side only, the machine may mistrack.

YES: Repair or replace idles or rollers that are leaking. Go to Group 0130.

NO: Go to next check.

– – –1/1

Operational Checkout Procedure

SPROCKET WEAR CHECK	 T6981AC –UN–13MAR89	Inspect drive sprocket. Is tooth wear excessive? *NOTE: Do not evaluate sprocket by condition of tooth tip. Tooth tip wear does not affect sprocket operation if it does not extend into the bushing contact area. Reverse drive side wear is generally more than forward drive side wear.*	**YES:** Replace sprocket. Go to Group 0130. **NO:** Go to next check. – – –1/1
GROUSER WEAR, BENT TRACK SHOE, AND LOOSE HARDWARE CHECKS	 T7322AF –UN–21JUN90	Inspect for worn grousers, bent track shoes, and loose shoe hardware. Are grouser bars worn excessively? Are track shoes bent? Is track shoe width appropriate for ground condition? Is track shoe hardware tight? *NOTE: Excessive grouser wear weakens track shoes and may result in track shoes bending.*	**YES:** If shoe hardware is loose, remove shoe and clean joint before tightening. Go to Group 0130. **NO:** Go to next check. – – –1/1
TRACK LINK, ROLLER, AND FRONT IDLER WEAR CHECKS	 T6484AZ –UN–19OCT88	Inspect track links for pin boss wear. Do link pin boss areas indicate contact with roller flanges or track guides? *NOTE: Some contact or wear is normal. Excessive contact or wear indicates excessive rail wear.* Inspect front idler flanges. Do idler flanges contact bushings? *NOTE: Idler contact with bushings indicates excessive chain rail wear and idler tread surface wear.*	**YES:** Go to Undercarriage Appraisal Manual for more in information and specifications. **NO:** Go to next check. – – –1/1

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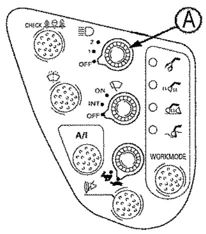
Operational Checkout Procedure

5 ACCESSORIES CHECKS

– – –1/1

LIGHT CIRCUIT CHECKS



T102105 –UN–26JUL96

A—Light Switch

NOTE: All accessories are powered from the fuse block. If any accessories do not function, check fuses in fuse block.

Turn key switch ON.

Turn light switch (A) to 1st position.

Are monitor panel back lights and front driving lights on?

Turn light switch to 2nd position.

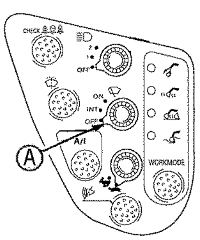
Do work lights on boom come on also?

YES: Go to next check.

NO: Check fuses, monitor panel back light bulbs, switches, and wiring. Go to Group 9015-15.

– – –1/1

WINDSHIELD WIPER CIRCUIT CHECK



T102106 –UN–26JUL96

A—Windshield Wiper Switch

Key switch ON.

Turn wiper switch (A) to INT position.

Does wiper operate intermittently?

Turn wiper switch to ON position.

Does wiper operate continuously?

Move wiper switch to OFF position.

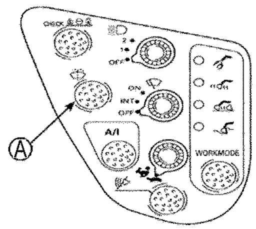
Does wiper arm stop in park position?

YES: Go to next check.

NO: Check that upper right window lock pin engages hole in cab frame and is turned to engage the lock to close windshield wiper enable switch. Check fuse, switch, and wiper harness. Go to Group 9015-15.

– – –1/1

WINDSHIELD WASHER CIRCUIT CHECK



T102107 –UN–26JUL96

A—Windshield Washer Switch

IMPORTANT: Washer motor may be damaged if washer switch is held for more than 20 seconds, or continually operated with no fluid in the windshield washer tank.

Key switch ON

Push washer switch (A)

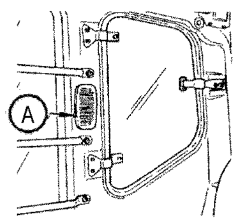
Does washer fluid squirt on windshield?

YES: Go to next check.

NO: Check washer fluid level. Check wiper fuse and wiring harness. Go to Group 9015-15.

– – –1/1

CAB DOME LIGHT CIRCUIT CHECK



T102183 –UN–26JUL96

A—Cap Dome Light Switch

Key switch ON.

Move cab dome light switch (A) to on position.

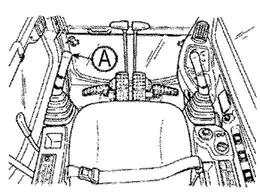
Does cab dome light come on?

YES: Go to next check.

NO: Check fuse and wiring harness. Go to Group 9015-15.

– – –1/1

HORN CIRCUIT CHECK



T102195 –UN–26JUL96

A—Horn Button

Key switch ON.

Push horn button (A) on top of left control lever.

Does horn sound?

YES: Go to next check.

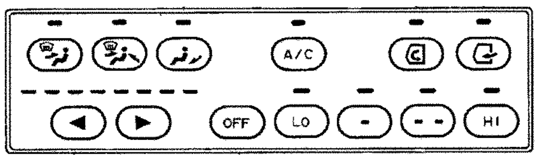
NO: Check fuse and wiring harness. Go to Group 9015-15.

– – –1/1

Operational Checkout Procedure

AIR CONDITIONING CHECKS

– – –1/1

AIR CONDITIONING CHECKS	 T103130 T103130 –19–29AUG96 Start engine and run at fast idle. Push “A/C” switch to turn air conditioner on. Push “HI” blower switch to run blower at high speed. Wait for any warm air in duct system to dissipate. Is air from ducts cool after a few minutes?	**YES:** Go to next check. **NO:** See Blower and Air Conditioning Circuit Checks in Group 9031-10. See Charging the System in Group 9031-20.

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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:** Go to next check. **NO:** Position hoses or lines and tighten or replace clamps. Tighten fittings or replace O-rings in fittings. Replace hoses or lines as required.

– – –1/1

Operational Checkout Procedure

EVAPORATOR CORE CHECK	Engine ON. Blower switch on high Is air from ducts cool and air flow good? Is water dripping from evaporator drain hose?	**YES:** Go to next check. **NO:** Repair, replace, or clean evaporator.

– – –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:** Go to next check. **NO:** Clean, repair, or replace condenser core. Replace engine fan.

– – –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:** Go to next check. **NO:** Replace compressor clutch. Go to Group 1830.

– – –1/1

❼ SEAT, DOORS, WINDOWS, LATCHES, AND LOCKS CHECKS

– – –1/1

Operational Checkout Procedure

9005
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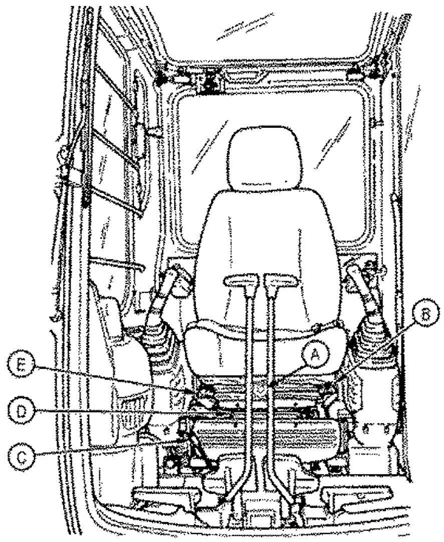
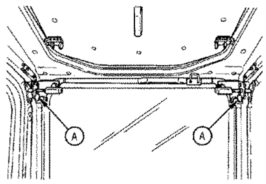
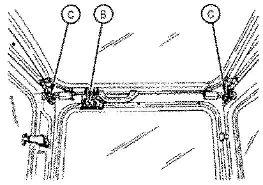
SEAT CONTROL CHECKS	 T102507 –UN–29JUL96 **A—Weight Adjustment Knob** **B—Seat Height And Angle Adjustment Lever** **C—Console And Seat Fore-Aft Adjustment Lever** **D—Seat Fore-Aft Adjustment Lever** **E—Backrest Adjustment Lever** Push seat height and angle adjustment lever (B) down. Raise and lower seat. Does seat raise and lower easily? Push seat height and angle adjustment lever (B) down. Adjust angle of seat. Does seat angle change easily? Push console and seat fore-aft adjustment lever (C) down. Move seat and both side consoles forward and rearward. Release lever to lock seat and side consoles in position. Does lever unlock easily and then lock to hold seat and consoles in position? Pull seat fore-aft adjustment lever (D) up. Move seat forward and rearward. Release lever to lock seat in any position. Does lever move easily to unlock seat support? Does seat move forward and rearward easily? Does lever lock seat support in position when released? Pull backrest adjustment lever (E) up. Tilt seat back forward and rearward. Release lever to lock seat back in any position. Does seat back tilt forward and rearward easily? Does lever unlock and lock easily to hold seat back in position?	**YES:** Go to next check. **NO:** Inspect and repair or replace any parts that do not operate properly. Go to Group 1821. – – –1/1

Operational Checkout Procedure

UPPER FRONT WINDOW CHECK	 T102109 –UN–26JUL96  T102110 –UN–26JUL96 **A—Lock Pins** **B—Rear Latch** **C—Cab Frame Rear Holes** *NOTE: The upper right window lock pin is also used to close the windshield wiper enable switch so windshield wiper can operate. When window is closed, check that lock pins engage holes in cab frame and are turned to engage lock.* Turn lock pins (A) and pull towards center of window. Pull window up and back until it catches in rear latch (B) for convenient storage overhead. Slide the two lock pins into the cab frame rear holes (C) and turn to lock. Do pins move smoothly to lock and unlock window? Does rear latch operate freely? Do pins engage cab frame boss holes and lock window securely in full open position?	**YES:** Go to next check. **NO:** Inspect. Repair. Go to Group 1810. – – –1/1

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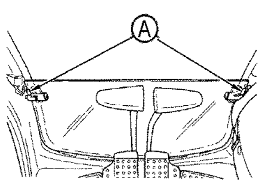
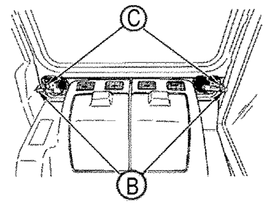
LOWER FRONT WINDOW STORAGE CHECK



T102111 –UN–26JUL96



T102112 –UN–26JUL96

A—Lock Pins
B—Brackets
C—Holes

NOTE: Upper front window must be raised before lower window can be removed from window frame.

Pull in on lock pins (A) to unlock window.

Lift the lower front window from the frame.

Store window behind rear console. Slide lock pins into hole (C) in brackets (B).

Do the springs push the lock pins out?

Does window lock securely into bracket?

YES: Go to next check.

NO: Inspect. Repair. Go to Group 1810.

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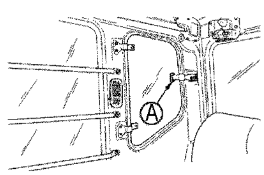
RIGHT REAR SIDE AND LEFT SIDE WINDOW CHECKS



T102113 –UN–26JUL96

A—Latch

Right rear side window: Pull on latch handle (A) to unlock it. Push on latch handle to push window open.

Does latch operate smoothly?

Does window remain opened when latched open?

Left side cab window: Slide both windowpanes open and closed.

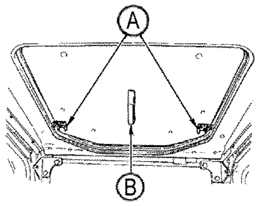
Do both windowpanes slide freely to left and right?

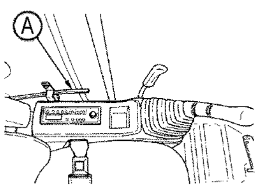
YES: Go to next check.

NO: Inspect. Repair. Go to Group 1810.

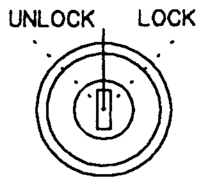
– – –1/1

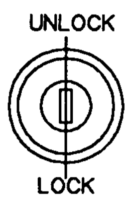
Operational Checkout Procedure

ROOF EXIT COVER CHECK	 T102205 –UN–26JUL96 **A—Lock Pins** **B—Handle** Move lock pins (A) toward center of roof exit cover. Push on handle (B) until cover is held in open position by air cylinders. Pull on handle to pull cover down until lock pins “click” into position and hold cover closed. Does cover open and close freely? Does air cylinders hold cover in the open position? Does lock pins “click” into position and hold cover closed.	**YES:** Go to next check. **NO:** Inspect. Repair. Go to Group 1810. – – –1/1

CAB DOOR LATCH CHECK	 T102114 –UN–26JUL96 **A—Lever** Open cab door. Lock cab door in open position. Push down on lever (A) to release door from locked open position. Close door. Does door unlatch easily, lock in open position securely, unlock from open position easily, and latch closed securely?	**YES:** YES Go to next check. **NO:** Inspect. Repair. Go to Group 1810. – – –1/1

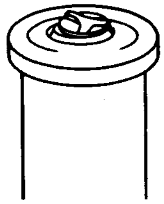
Operational Checkout Procedure

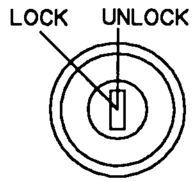
CAB DOOR LOCK CHECK	 T7425AH –UN–10DEC90	From outside cab, close cab door. Insert ignition key into door lock, turn clockwise 1/4 turn to lock. Allow key to return to vertical. Try to open door. Turn key 1/4 turn counterclockwise to unlock. Allow key to return to vertical. Remove key from lock. Does lock turn easily? Does lock prevent door from opening when locked?	**YES:** Go to next check. **NO:** Inspect. Repair. – – –1/1

LEFT AND RIGHT ACCESS DOORS LOCK CHECK	 T7425AG –UN–28NOV90	Insert ignition key into lock and turn 180° clockwise to lock. Turn key 180° counterclockwise to unlock. Does lock turn easily and lock door and cap in position? Are all parts free of any visible damage?	**YES:** Go to next check. **NO:** Inspect. Repair. – – –1/1

Operational Checkout Procedure

FUEL CAP LOCK CHECK





T7351AH –UN–22AUG90 T7425AF –UN–04DEC90

Turn lock cover to expose lock.

Insert ignition key into fuel cap lock.

Turn key 45° counterclockwise to lock fuel cap.

Does lock prevent cap from being removed?

Turn key 45° clockwise to unlock fuel cap.

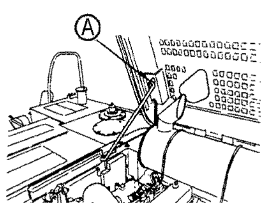
Does lock turn easily to lock and unlock?

YES: Go to next check.

NO: Replace fuel cap.

– – –1/1

HOOD CHECK



T102128 –UN–26JUL96

A—Hood Hold-Open Rod

Unlock hood latch with ignition key.

Release latches.

Open hood.

Engage hold-open rod (A).

Does rod hold hood open?

Close hood and engage latches.

Do latches operate easily?

Do latches hold hood closed?

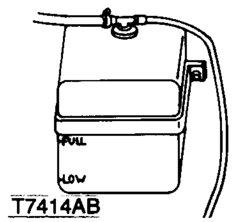
YES: Go to next check.

NO: Inspect. Repair.

– – –1/1

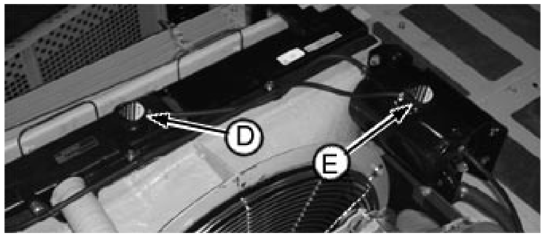
ENGINE COOLING SYSTEM CHECKS

– – –1/1

COOLANT LEVEL AND CONDITION IN RECOVERY TANK CHECKS	 T7414AB –19–13DEC90	Engine OFF and cool. Open radiator access door. Inspect coolant level and coolant condition in recovery tank. Is coolant level between FULL and LOW marks on recovery tank? Is coolant clear, not oily, foamy, or rust colored?	**YES:** Go to next check. **NO:** Add coolant if low. Drain and flush overflow tank and radiator, replace coolant if dirty or rusty. If coolant is oily check for hydraulic or engine oil leaks into cooling system. Go to Group 0510.

– – –1/1

SURGE TANK CAP CHECKS



T115432C –UN–08JUN98

D—Radiator Cap
E—Surge Tank Cap

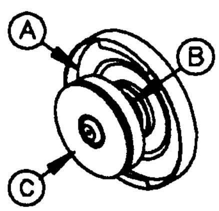
CAUTION: Prevent possible injury. DO NOT remove surge tank cap unless engine is cool. When engine is hot and cap is removed, hot coolant or steam will spray out causing serious burns.

Engine off and cool.

Remove surge tank cap (E).

If coolant is warmer than surrounding air temperature, is a “whoosh” sound heard when cap is loosened?

Does cap have a stop position that requires it to be pushed down to remove?



T7690AB –UN–23JAN92

A—Gasket
B—Spring
C—Seal

Does cap have a good seal (C) and gasket (A)?
Is spring (B) in good condition?

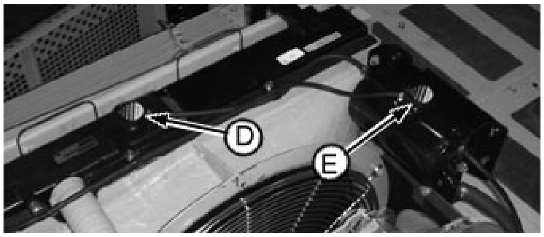
YES: Go to next check.

NO: Replace surge tank cap.

– – –1/1

Operational Checkout Procedure

COOLANT LEVEL AND CONDITION IN SURGE TANK CHECKS



T115432C –UN–08JUN98

D—Radiator Cap
E—Surge Tank Cap

CAUTION: Prevent possible injury. DO NOT remove surge tank cap unless engine is cool. When engine is hot and cap is removed, hot coolant or steam will spray out causing serious burns.

Engine OFF and cool.

Remove surge tank cap.

Inspect coolant level.

Inspect coolant condition.

Is coolant level at bottom of fill neck on surge tank?

Is coolant clear, not oily, foamy or rust colored?

YES: Go to next check.

NO: Add coolant if low. Check hose to coolant recovery tank. Flush surge tank, radiator, and engine if coolant is dirty or rusty. Add clean coolant. If coolant is oily check for hydraulic or engine oil leaks into cooling system. Go to Engine Repair chapter.

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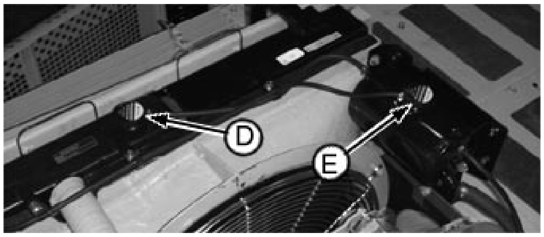
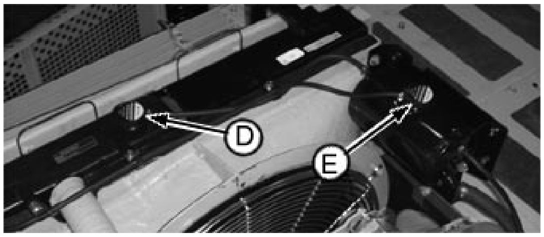
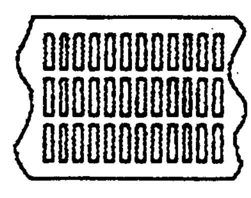
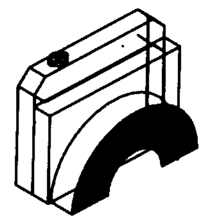
RADIATOR CAP CHECK	 T115432C –UN–08JUN98 **D—Radiator Cap** **E—Surge Tank Cap** **CAUTION: Prevent possible injury. DO NOT remove radiator cap unless engine is cool. When engine is hot and cap is removed, hot coolant or steam will spray out causing serious burns.** Engine OFF and cool. Remove surge tank cap (E) Remove radiator cap. (D) If coolant is warmer than surrounding air temperature, is a “whoosh” sound heard when cap is loosened? Does cap have a stop position that requires it to be pushed down to remove? Does cap have a good seal and gasket?	**YES:** Go to next check. **NO:** Replace radiator cap. – – –1/1

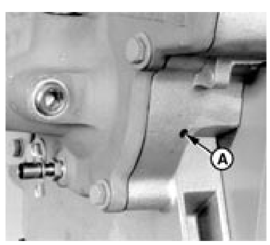
Operational Checkout Procedure

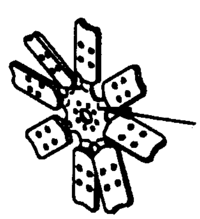
COOLANT LEVEL AND CONDITION IN RADIATOR CHECKS	 T115432C –UN–08JUN98 **D—Radiator Cap** **E—Surge Tank Cap** **CAUTION: Prevent possible injury. DO NOT remove radiator cap unless engine is cool. When engine is hot and cap is removed, hot coolant or steam will spray out causing serious burns.** Engine OFF and cool. Remove surge tank cap (E). Remove radiator cap (D). Inspect coolant level. Inspect coolant condition. Is coolant level at bottom of fill neck on radiator? Is coolant clear, not oily, foamy or rust colored?	**YES:** Go to next check. **NO:** Add coolant if low. Check hose to surge tank. Flush radiator and engine if coolant is dirty or rusty. Add clean coolant. If coolant is oily check for hydraulic or engine oil leaks into cooling system. Go to Engine Repair chapter. – – –1/1
RADIATOR INTERNAL CORE CHECK	 T6488FZ –UN–19OCT88 **CAUTION: Prevent personal injury, DO NOT remove radiator cap unless engine is cool. When engine is hot and cap is removed, hot coolant or steam will spray out causing serious burns.** Raise engine access door. Remove radiator cap. Drain coolant into a clean container until core tubes are visible. Is radiator core free of rust, lime, or corrosion? Are passages in core clean, not plugged?	**YES:** Go to next check. **NO:** Remove and clean or replace radiator. Fill cooling system with clean coolant. – – –1/1

Operational Checkout Procedure

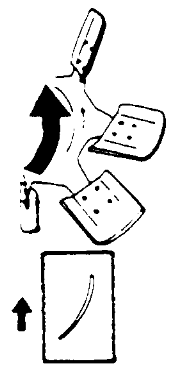
COOLANT HOSES AND CLAMPS CHECKS	Are radiator and heater hoses free of twists, kinks, cracks, leaks, or wear from rubbing on adjacent parts? Are hose clamps tight and installed correctly?	**YES:** Go to next check. **NO:** Replace hoses as required. Install and tighten hose clamps. – – –1/1

FAN SHROUD AND FAN GUARD CHECKS	 T6488GC –UN–23AUG93 Check fan to fan shroud clearance. Is fan centered in shroud? Is guard free of damage? Are all mounting brackets and hardware tight?	**YES:** Go to next check. **NO:** Adjust fan shroud to center fan. Repair or replace guard. Tighten loose hardware. Replace fan shroud if needed. Go to Group 0510. – – –1/1

WATER PUMP CHECK	 T115004 –UN–22APR98 **A—Weep Hole** Engine stopped. Is coolant leaking from weep hole (A)?	**YES:** Seal has failed. Replace seal or water pump. Go to Engine Repair chapter. **NO:** Go to next check. – – –1/1

FAN BLADES CHECK	 T7694AH –UN–03FEB92 Are fan blades bent or twisted? Are fan blades cracked or nicked?	**YES:** Replace fan. **NO:** Go to next check. – – –1/1

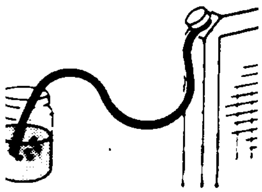
Operational Checkout Procedure

FAN DIRECTION CHECK	 T6171CB –UN–25MAY89 Is fan installed correctly with concave (cupped) side (arrow) of fan blade towards engine? *NOTE: If fan is installed backwards, about 50% of its capacity is lost.*	**YES:** Check complete. **NO:** Install fan correctly. – – –1/1

RADIATOR OUTSIDE AIR FLOW CHECK	Inspect radiator screen for mud and debris. Inspect radiator fins for mud and debris. Inspect radiator for bent or damaged fins. Are radiator fins free of mud, leaves, grass, and other debris? Are fins straight, not broken or cracked?	**YES:** Go to next check. **NO:** Clean screen. Clean outside of radiator. Straighten fins. Replace radiator if severely damaged. – – –1/1

FAN BELT CHECK	Is fan belt free of oil or grease? Is inside surface of belt free of cracks or frayed edges? Is belt aligned with pulleys? *NOTE: Fan belt is self-adjusting.* Is fan belt tightener operating to keep belt tight?	**YES:** Check complete. **NO:** Replace belt if oily, greasy, cracked, or otherwise damaged. – – –1/1

Operational Checkout Procedure

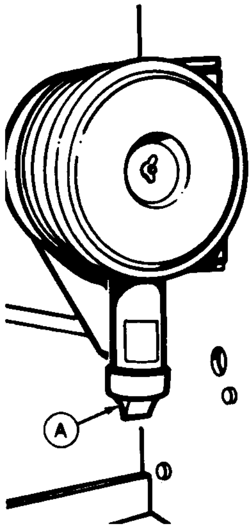
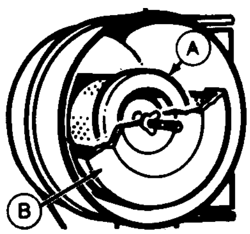
ENGINE HEAD GASKET SEAL CHECK	 T6171AR –UN–25MAY89 Engine at normal temperature. Radiator full. Install radiator cap and tighten. Place end of radiator overflow hose into a container of clear water. Operate engine at fast idle. Load engine by holding a hydraulic function over relief. Look for bubbles coming from overflow tube. Do bubbles flow from tube intermittently?	**YES:** Head gasket is OK. Go to next Check. **NO:** If there is a constant flow of bubbles from tube, loose or damaged cylinder head or a leaking head gasket may be indicated. Go to Engine Repair chapter. – – –1/1

9 AIR INTAKE SYSTEM CHECKS

– – –1/1

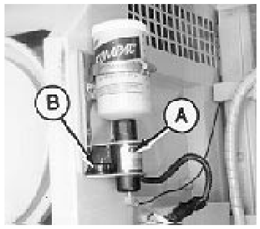
AIR FILTER RESTRICTION INDICATOR AND SWITCH CHECK	Run engine at slow idle. Slowly cover air intake tube. Does air filter restriction indicator light in cab come ON?	**YES:** Go to next check. **NO:** Check monitor circuit fuse, air filter restriction indicator light and switch. Go to Section 9015-15. – – –1/1

Operational Checkout Procedure

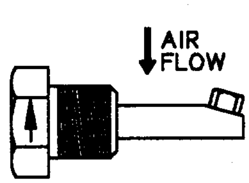
AIR CLEANER UNLOADER VALVE CHECK	T7531BF –UN–07JUN91	**A—Air Cleaner Unloader Valve** Open left front access door. Inspect air cleaner unloader valve (A). Is unloader valve slightly open when the engine is not running? Is rubber flexible and showing no sign of becoming hard or brittle? Engine running. Turn auto-idle switch off and turn engine rpm dial to fast idle. Does unloader valve close?	**YES:** Go to next check. **NO:** Replace unloader valve. – – –1/1
AIR CLEANER ELEMENTS CHECK	T7531BG –UN–07JUN91	**A—Secondary Element** **B—Primary Element** Remove air cleaner cover. Inspect primary element (B). Is element clean and in good condition? Remove wing nut to remove primary element. Inspect secondary element (A). Is element clean and in good condition?	**YES:** Go to next check. **NO:** Clean or replace primary element. Replace secondary element if primary element is damaged. Do not clean secondary element. Replace if dirty. – – –1/1

Operational Checkout Procedure

COLD WEATHER STARTING AID CHECKS



T103516 –UN–04SEP96



T7699AL –UN–03FEB92

A—Starting Aid Solenoid
B—Dust Cover

Raise engine access door.

Open left rear service door.

Check that starting fluid can is installed in starting aid solenoid (A).

If starting fluid can is NOT installed, check that dust cover (B) is installed.

Is starting fluid line from starting aid solenoid to air intake manifold straight—NOT kinked or broken?

Is arrow on starting aid nozzle pointing AGAINST air flow of air intake manifold?

NOTE: It may be necessary to scrape paint from nozzle to see arrow.

YES: Go to next check.

NO: Install a starting fluid can or the dust cover. Replace plastic line. Tighten nozzle until arrow is in correct position—pointing AGAINST incoming air flow.

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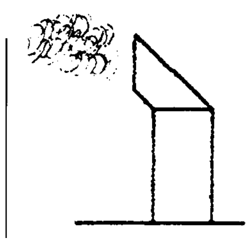
EXHAUST SMOKE CHECK


T6488GF –UN–19OCT88

Operate engine until coolant temperature gauge needle is in the “GREEN” zone before doing this check.

Run engine at fast idle.

Counter rotate tracks to put load to engine.

Observe exhaust smoke.

Is exhaust smoke dark black or blue? Is exhaust smoke gray or white?

NOTE: Dark black smoke can be caused by dirty air filter or poor fuel delivery. Blue smoke can be caused by worn or damaged piston rings or cylinder liners. Gray or white smoke can be caused by a cold engine, dirty injection nozzles, or both.

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

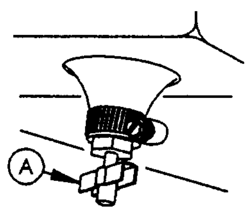
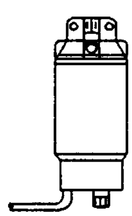
NO: Go to next check.

– – –1/1

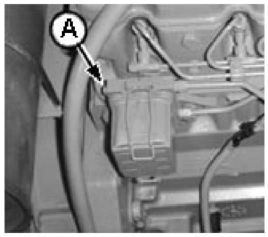
Operational Checkout Procedure

⑩ FUEL SYSTEM CHECKS

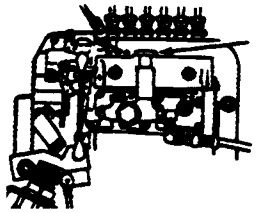
– – –1/1

FUEL TANK INTERIOR CHECK	**IMPORTANT: Be careful not to damage fuel gauge sender float or low fuel level sending unit.** Remove fuel cap. Use a flashlight to inspect bottom of fuel tank by shining light through the fuel. Is dirt, debris, or contamination seen in tank?	**YES:** Drain fuel, dispose of contaminated fuel properly. Remove debris, clean bottom of tank. Replace fuel filters. Check water separator. **NO:** Go to next check. – – –1/1
FUEL TANK SUMP CHECK	 T7700AA –UN–18FEB92 **A—Fuel Tank Drain Valve** Hold a clean container under fuel tank drain valve (A). Remove recessed hex plug. Open drain valve for a few seconds and catch fuel in container. Check condition of fuel in container. Is water present or is fuel cloudy?	**YES:** Drain until clear fuel flows or drain all fuel from tank, dispose of contaminated fuel properly. Replace final fuel filter, check primary fuel filter (water separator). **NO:** Go to next check. – – –1/1
PRIMARY FUEL FILTER (WATER SEPARATOR) CHECK	 T7700AB –UN–25FEB92 Inspect fuel in water separator. Is water or other contamination present?	**YES:** Replace water separator filter element. **NO:** Go to next check. – – –1/1

FUEL TRANSFER PUMP CHECK



T115148F –UN–04MAY98



T6493AA –UN–19OCT88

A—Bleed Screw

Open bleed screw (A) on fuel filter.

Operate hand primer on fuel transfer pump.

Does fuel come out of bleed screw when hand primer is operated?

Tighten bleed screw and again operate hand primer.

Is resistance felt when hand primer is operated and increase as system pressure increases?

YES: Go to next check.

NO: Be certain fuel filter is clean. If not, replace filter. Check fuel transfer pump.

– – –1/1

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.

Does fuel 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 and flows back to the fuel tank.

YES: Go to next check.

NO: Fuel supply is restricted, check for plugged fuel filters, plugged fuel tank cap vent, restricted lines, stuck injection pump overflow valve, or a malfunctioning fuel transfer pump. Repair or replace as necessary.

– – –1/1

Operational Checkout Procedure

11 VISUAL INSPECTION

– – –1/1

9005
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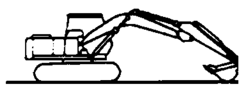
44

VISUAL INSPECTION			
	 T6477AQ –UN–19OCT88	Park machine on a level surface. Extend the bucket cylinder. Retract bucket cylinder. Lower the boom so bucket is on the ground. Stop the engine. Inspect oil lines and hydraulic components for leaks or damage. Are lines or components damaged or leaking?	**YES:** Replace damaged O-rings or gaskets. Tighten fittings or cap screws. Repair or replace bent or damaged lines. Repair or replace damaged components. **NO:** Operational checkout is complete.

– – –1/1

CHAPTER 3

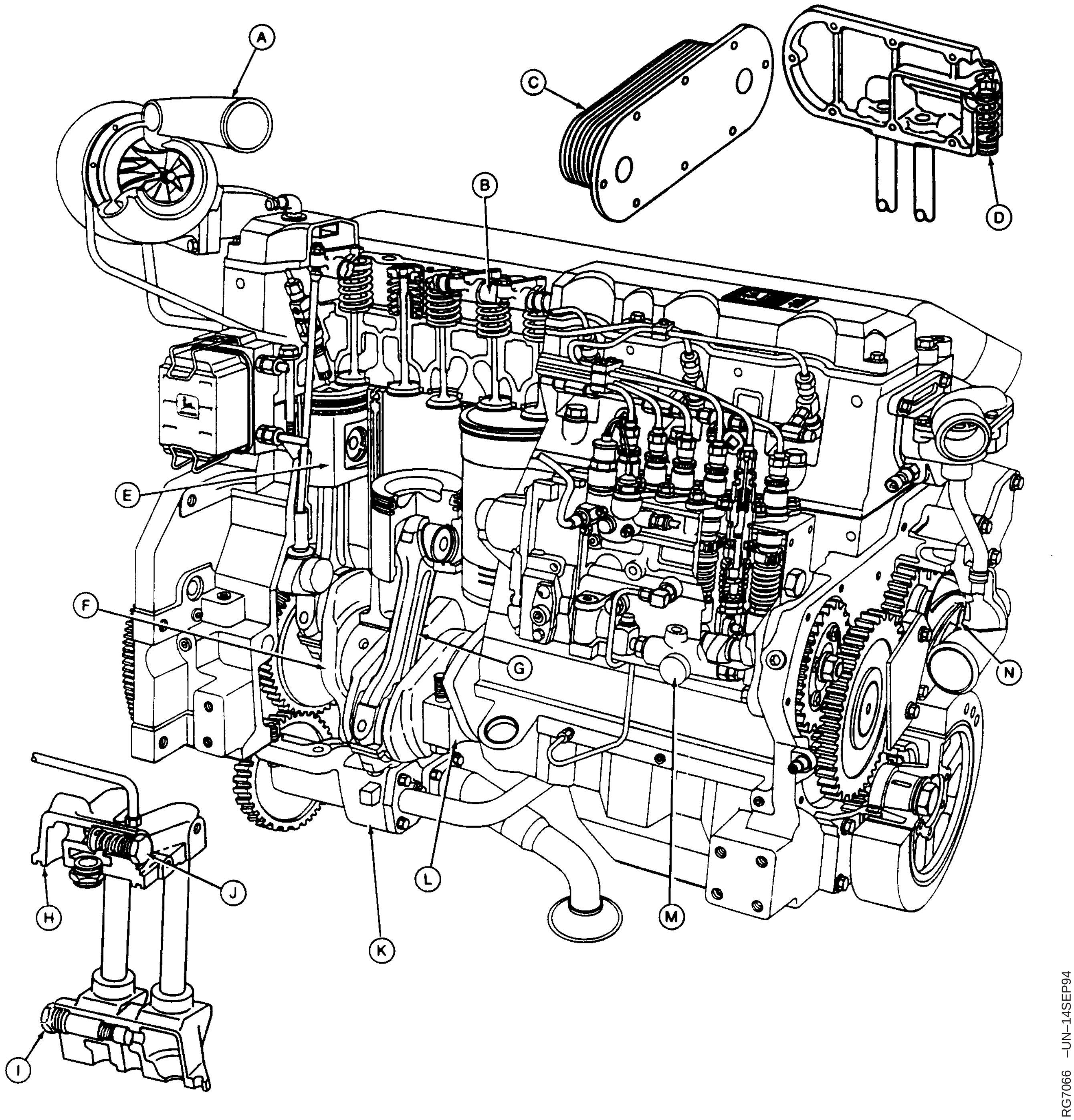
SECTION 9010

ENGINE

BLANK

Group 05
Theory of Operation

ENGINE—SECTIONAL VIEW



A—Turbocharger
B—Rocker Arm Shaft
C—Oil Cooler
D—Oil Cooler Relief Valve
E—Piston
F—Crankshaft
G—Connecting Rod
H—Oil Filter Base
I—Oil Pressure Regulating Valve
J—Oil Filter Relief Valve
K—Oil Pump Assembly
L—Main Bearing Cap
M—Fuel Injection Pump
N—Water Pump

CED,TX14795,4361 –19–21APR98–1/1

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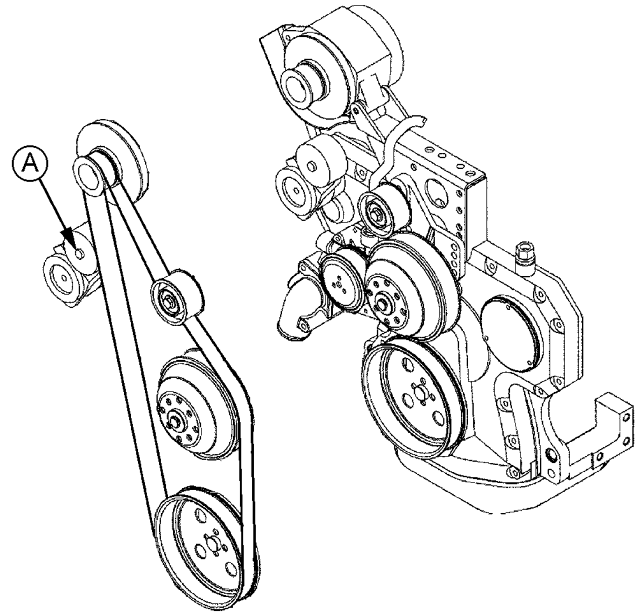
FAN DRIVE OPERATION

The fan drive , driven by one fan belt from the engine crankshaft, is self adjustable. The fan belt tension adjuster (A) automatically adjusts the belt to correct tension.



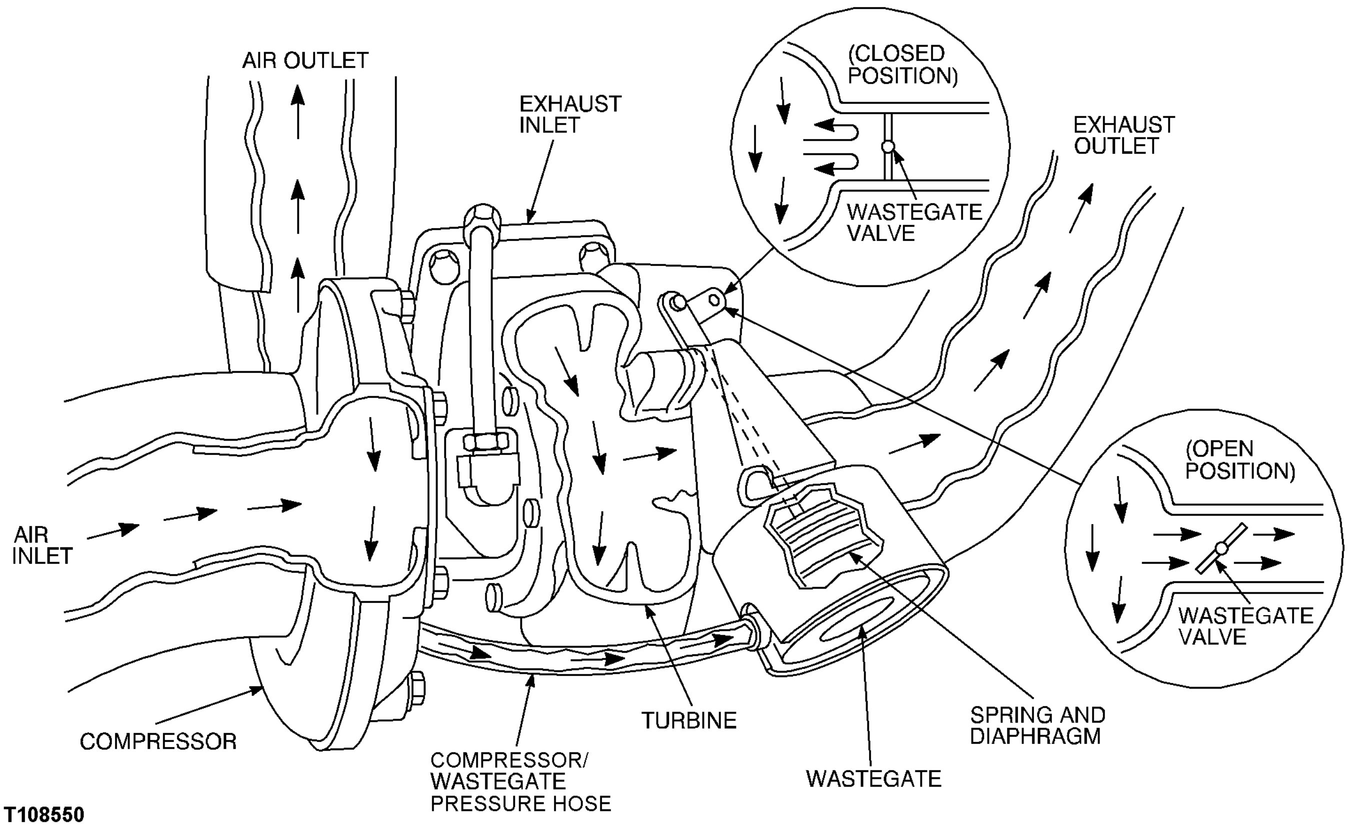
T114980

T114980 –UN–21APR98

A—Tension Adjuster

TX,9010,UU3275 –19–06SEP96–1/1

WASTEGATED TURBOCHARGERS OPERATION



T108550

T108550 –19–15JUN98

The wastegate is a spring-loaded diaphragm controlled by boost pressure. It is designed to protect the engine and turbocharger by limiting turbocharger boost pressure and prevent turbocharger overspeeding at high engine rpm (high load).

As engine speed increases, the boost or manifold pressure acts to maintain desired turbocharger speed by opening or closing the wastegate valve to pass excess exhaust gas around, rather than through the turbine thus maintaining the desired boost pressure and turbocharger speed.

TX,9010,DU2100 –19–21MAR97–1/1

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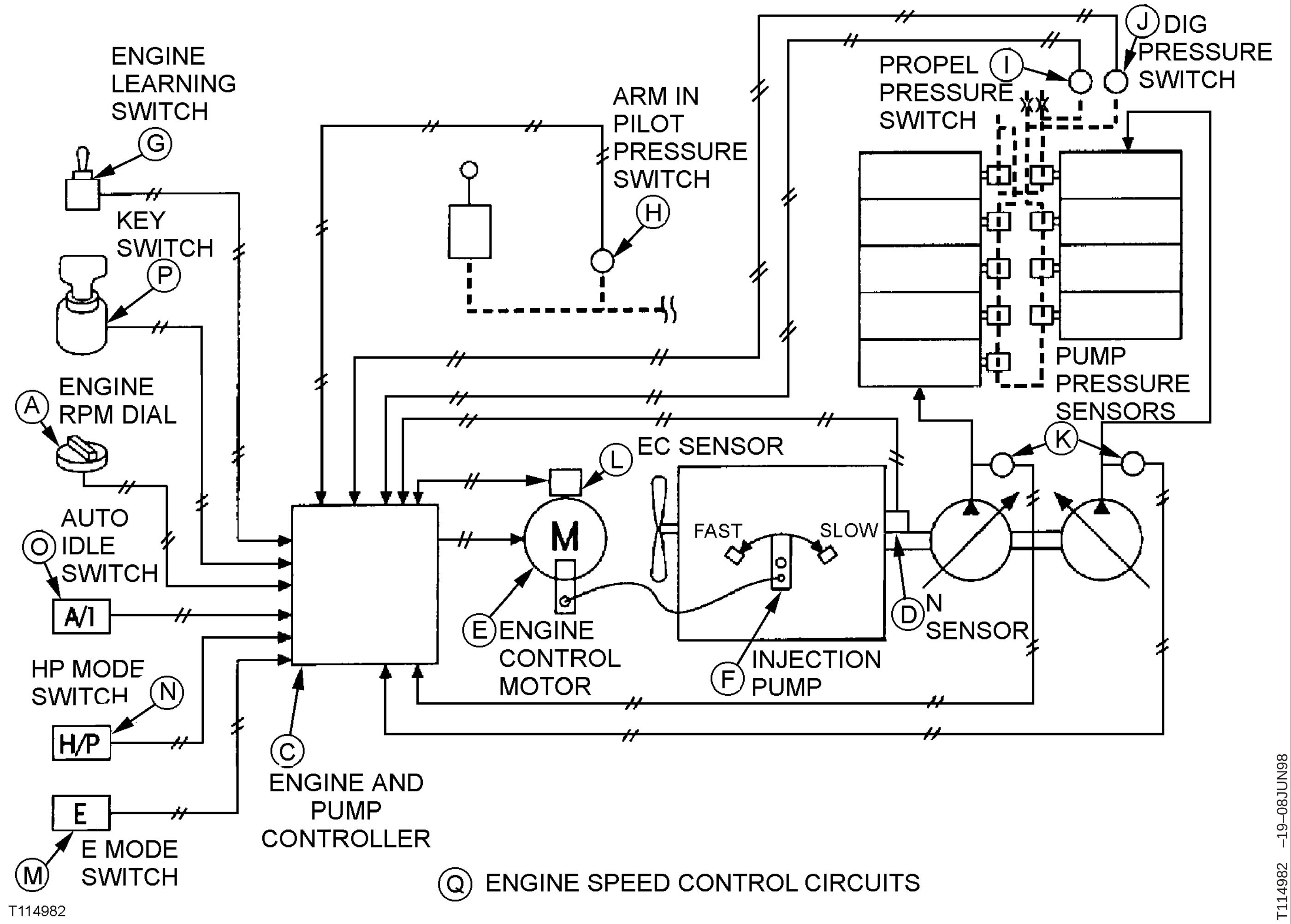
4

ENGINE SPEED CONTROL SYSTEM OPERATION



Q ENGINE SPEED CONTROL CIRCUITS

The engine speed control circuits (Q) have the following control functions:

- Slow to fast idle in standard mode
- HP (high power) mode control
- E (economy) mode control
- AI (Auto-idle) mode
- Engine learning control

Continued on next page CED,TX08227,3178 –19–06JUN98–1/2

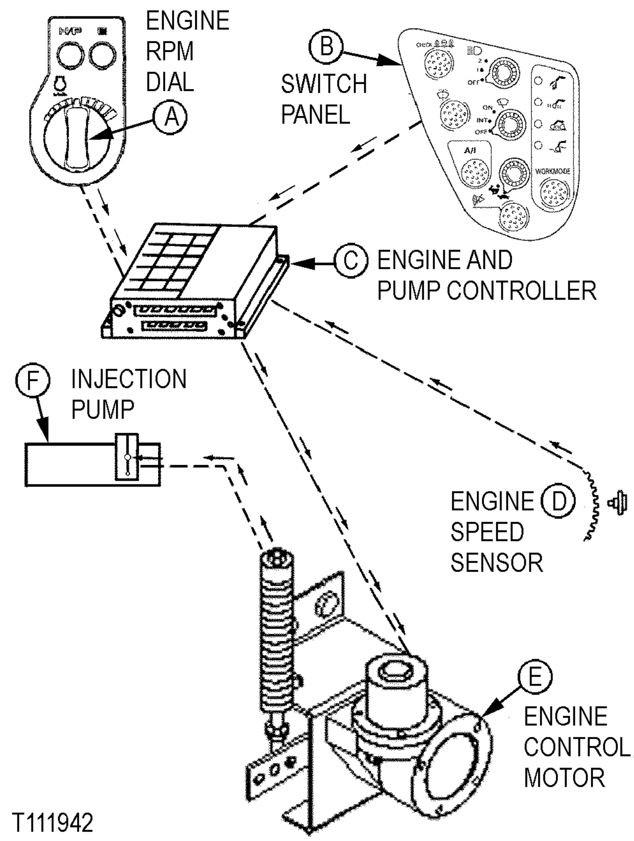
The engine speed control components allows the operator to choose engine speeds to match operating conditions and to operate the engine as efficiently as possible.

Engine speeds from slow idle to fast idle in standard mode are selected by the engine rpm dial (A) located in the right console panel in cab. The E (economy) mode and HP (high power) mode are selected by switches located in the right console panel just above the engine rpm dial. The auto idle mode is selected by a switch located in the switch panel (B). Indicators in the monitor panel are lit to indicate when the E mode, HP mode, and auto-idle mode switches are pushed to activate the function.

- AI=Auto Idle Mode Switch
- E=Economy Mode Switch
- HP=High Power Mode Switch

Turning the engine rpm dial or pushing the AI, E, or HP mode switches sends an electrical signal to the controller. The engine and pump controller (C) senses the signal and sends an electrical signal to the engine control motor (E). The engine control motor regulates engine speed through a push-pull cable attached to the fuel injection pump (F) lever. The engine and pump controller is located under the console cover behind the seat. The engine control motor is located in the hydraulic pump compartment.

The engine speed sensor (D) (located in the pump drive gearbox adjacent to the front pump) counts the pump drive gear teeth as the gears rotate. This senses actual engine speed. The sensing signal is sent to the engine and pump controller which calculates engine speed.



T111942 –19–28OCT97

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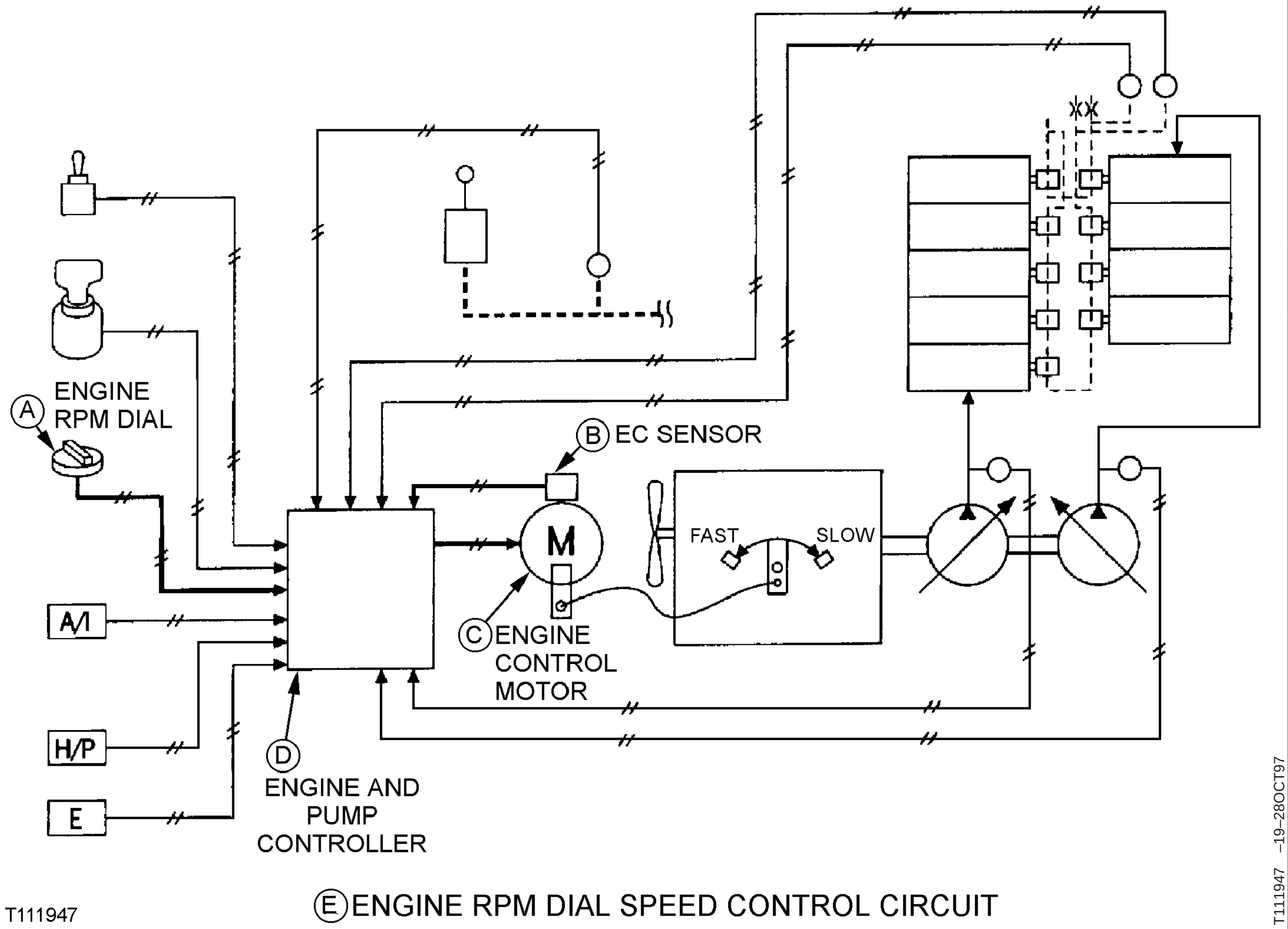
CED,TX08227,3178 –19–06JUN98–2/2

ENGINE RPM DIAL SPEED CONTROL CIRCUIT OPERATION



T111947

E ENGINE RPM DIAL SPEED CONTROL CIRCUIT

The function of the engine rpm dial speed control circuit (E) is to control engine speed from slow to fast idle in standard mode in response to the position of engine rpm dial (A).

As the engine rpm dial is turned to increase or decrease engine speed, the electrical signal sent from the dial to the engine and pump controller (D) changes. Then, from data stored in the controller, the controller sends an electrical signal to actuate the engine control motor (C). The control motor moves the injection pump lever by a push-pull cable to change engine speed in response to the position of the engine rpm dial. The EC (engine control) sensor (B) sends an electrical feedback signal to the controller indicating the motor's position.

The engine speed for slow idle is limited by the external slow idle stop. The data for slow idle position is stored in the engine and pump controller and is used to calculate the positions for, AI (auto-idle), E (economy), and HP (high power) modes. (See Engine Learning Control Circuit Operation in this group. For adjustment, see Injection Pump Fast and Slow Idle Stops Adjustment in Group 9010-20.)

The engine speed for fast idle in standard mode is controlled by data stored in the engine and pump controller. The parameter for fast idle in standard mode can be change from the factory setting within a specified range. (See Excavator Diagnostic Software Special Function—Engine Speed in Group 9025-25.)

Continued on next page CED,TX08227,3179 –19–06JUN98–1/2

Theory of Operation

The fast idle stop on the injection pump limits the maximum engine speed for HP mode. (For adjustment, see Injection Pump Fast and Slow Idle Stops Adjustment in Group 9010-20.).

CED,TX08227,3179 –19–06JUN98–2/2

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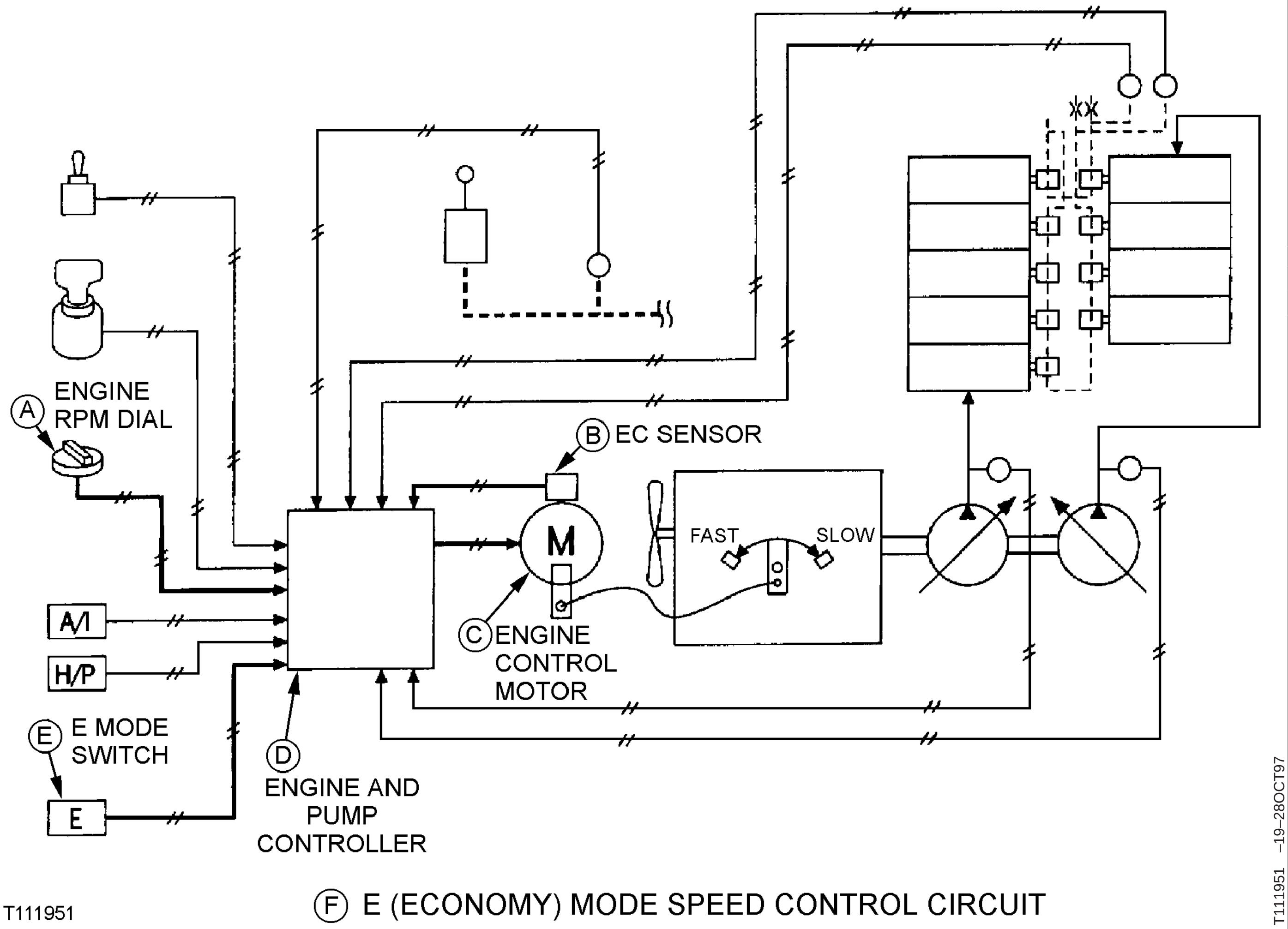
E (ECONOMY) MODE SPEED CONTROL CIRCUIT OPERATION



(F) E (ECONOMY) MODE SPEED CONTROL CIRCUIT

The function of E (economy) mode speed control circuit (F) is to operate the engine at a lower speed range when full engine power is not needed. The engine power is somewhat less but digging power is the same as in standard mode. Operating in E mode also improves fuel efficiency and reduces the noise level. The E mode function is available when dig mode is selected as the work mode. The E mode indicator is ON when the E mode switch (E) is push down to show that E mode is actuated.

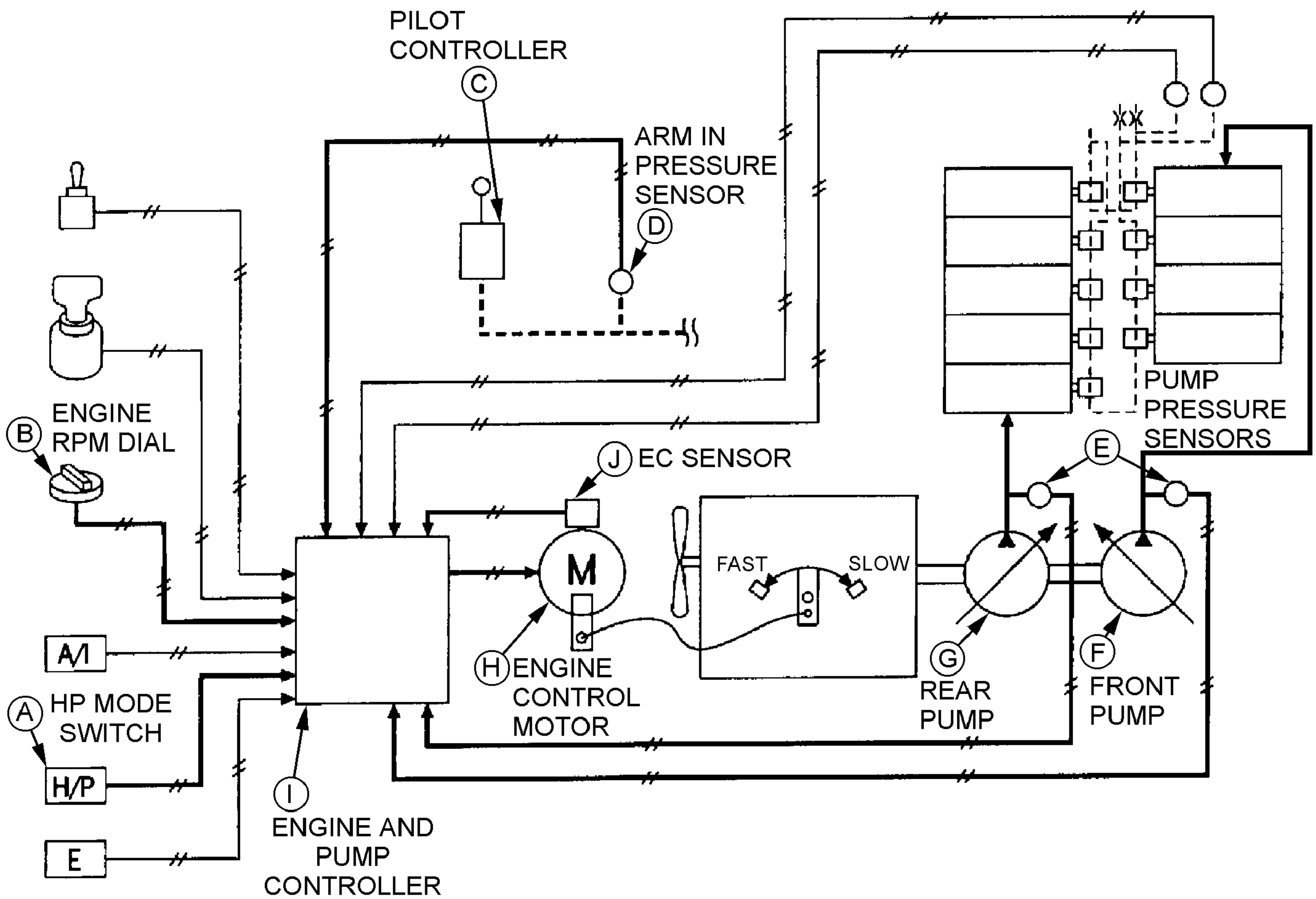
NOTE: Standard mode is when the E mode and HP mode switches are OFF.

When E mode is actuated, the engine and pump controller (D) sends electrical signals to the engine control motor (C) to run the engine in a speed range lower than standard mode. The adjustable range for engine speed is from the specified speed for E mode down to slow idle and is in proportion to the engine rpm dial position. The electrical signals to the motor are calculated from data stored in the engine and pump controller (D). The EC (engine control) sensor (B) sends an electrical feedback signal to the controller indicating the motor's position.

The parameter for engine speed in E (economy) mode can be change from the factory setting within a specified range. (See Excavator Diagnostic Software Special Function—Engine Speed in Group 9025-25.)

TX,9010,GG2869 –19–17DEC97–1/1

HP (HIGH POWER) MODE SPEED CONTROL CIRCUIT OPERATION



T111974 K HP (HIGH POWER) MODE SPEED CONTROL CIRCUIT

T111974 –19–28OCT97

The function of the HP (high power) mode speed control circuit (K) is to increase engine speed when a little more hydraulic power is needed for arm in operation. The HP mode is available when in the dig work mode. HP mode is used in the standard and E (economy) modes.

The HP mode is actuated with the following conditions:

- HP mode switch (A) is pushed down. The HP indicator is ON.
- Engine speed is approximately 1600 rpm or faster. The electrical signal from the engine rpm dial (B) to the engine and pump controller (I) indicates the engine speed.
- Arm in function is actuated. The arm in pressure sensor (D) sends an electrical signal to the engine and pump controller (I).
- The pump delivery pressure is approximately 23 440 kPa (234 bar) (3400 psi) or higher. The pump pressure sensors (E) send an electrical signal to the engine and pump controller.

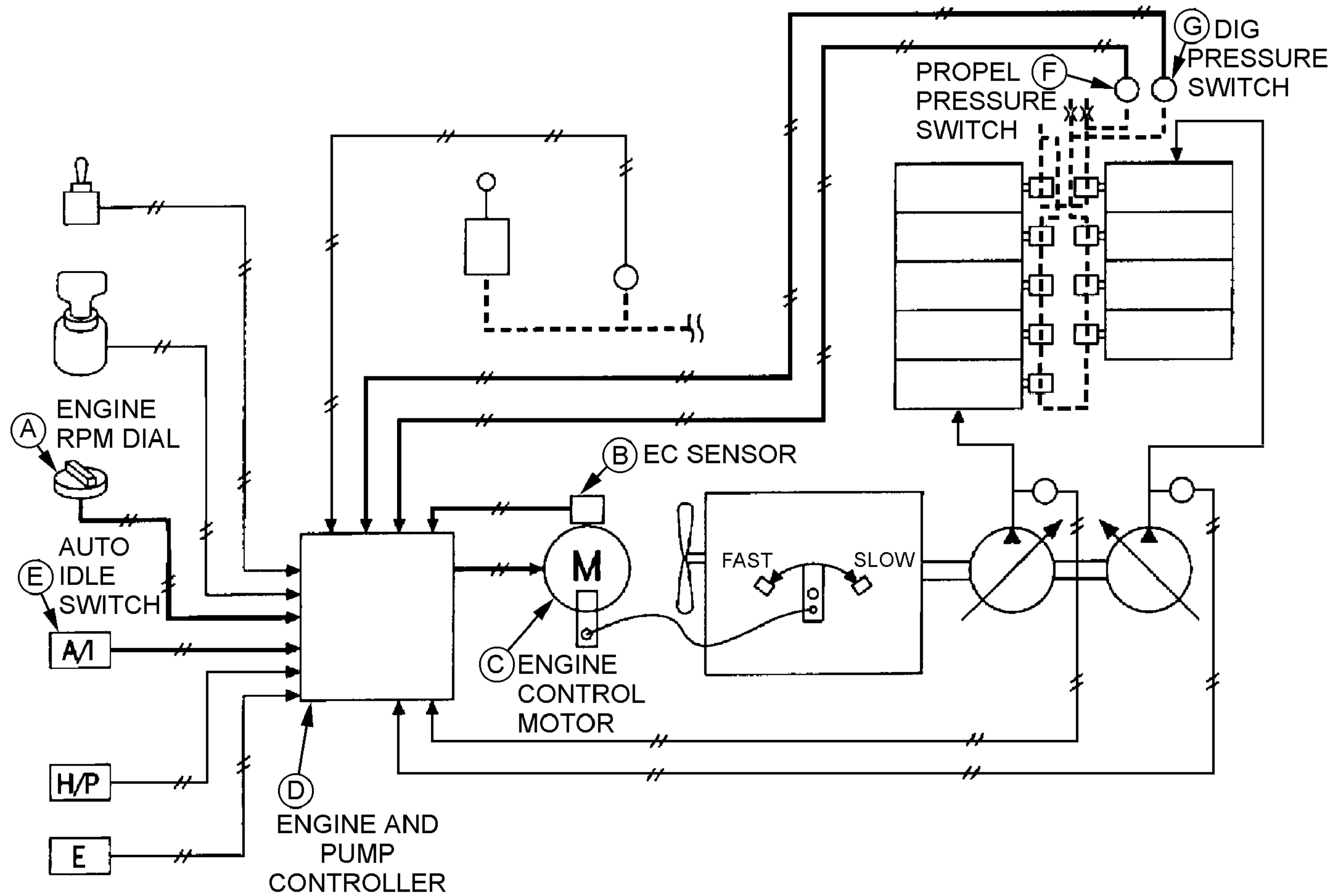
Continued on next page CED,TX08227,3180 –19–06JUN98–1/2

Theory of Operation

When all conditions are meet, the engine and pump controller sends an electrical signal to the engine control motor to increase the engine speed. The amount of engine speed increase is somewhat controlled by the pump regulators adjustment and the load on the engine. The maximum engine speed for HP mode is limited by the fast idle stop on the injection pump. (For adjustment, see Injection Pump Fast and Slow Idle Stops Adjustment in Group 9010-20.).

CED,TX08227,3180 –19–06JUN98–2/2

AI (AUTO-IDLE) MODE SPEED CONTROL CIRCUIT OPERATION



H AUTO-IDLE MODE SPEED CONTROL CIRCUIT

T111952 –19–28OCT97

The function of the auto-idle mode speed control circuit (H) is to automatically reduce engine speed when all dig and propel function are in neutral to reduce fuel consumption and the noise level. The AI indicator is ON when the auto-idle switch (E) is pushed to show that the auto-idle function is actuated. Pushing the switch again turns the auto-idle function off.

When auto-idle function is actuated and no electrical signal is received from the propel or dig pressure switches (F and G) for more than four seconds, the engine and pump controller (D) sends an electrical signal to the engine control motor (C). The control motor reduces the engine speed to the specified auto-idle speed. The electrical signal sent to the motor is calculated from data stored in the engine and pump controller. The EC (engine control) sensor (B) sends an electrical feedback signal to the controller indicating the motor's position.

Actuating the propel or a dig function causes an electrical signal to be sent from the propel or dig pressure switch to the controller. The controller then sends an electrical signal to the engine control motor to increase engine speed back to the setting of engine rpm dial.

The parameter for auto-idle engine speed can be change from the factory setting within a specified range. (See Excavator Diagnostic Software Special Function—Engine Speed in Group 9025-25.)

TX,9010,GG2870 –19–23OCT97–1/1

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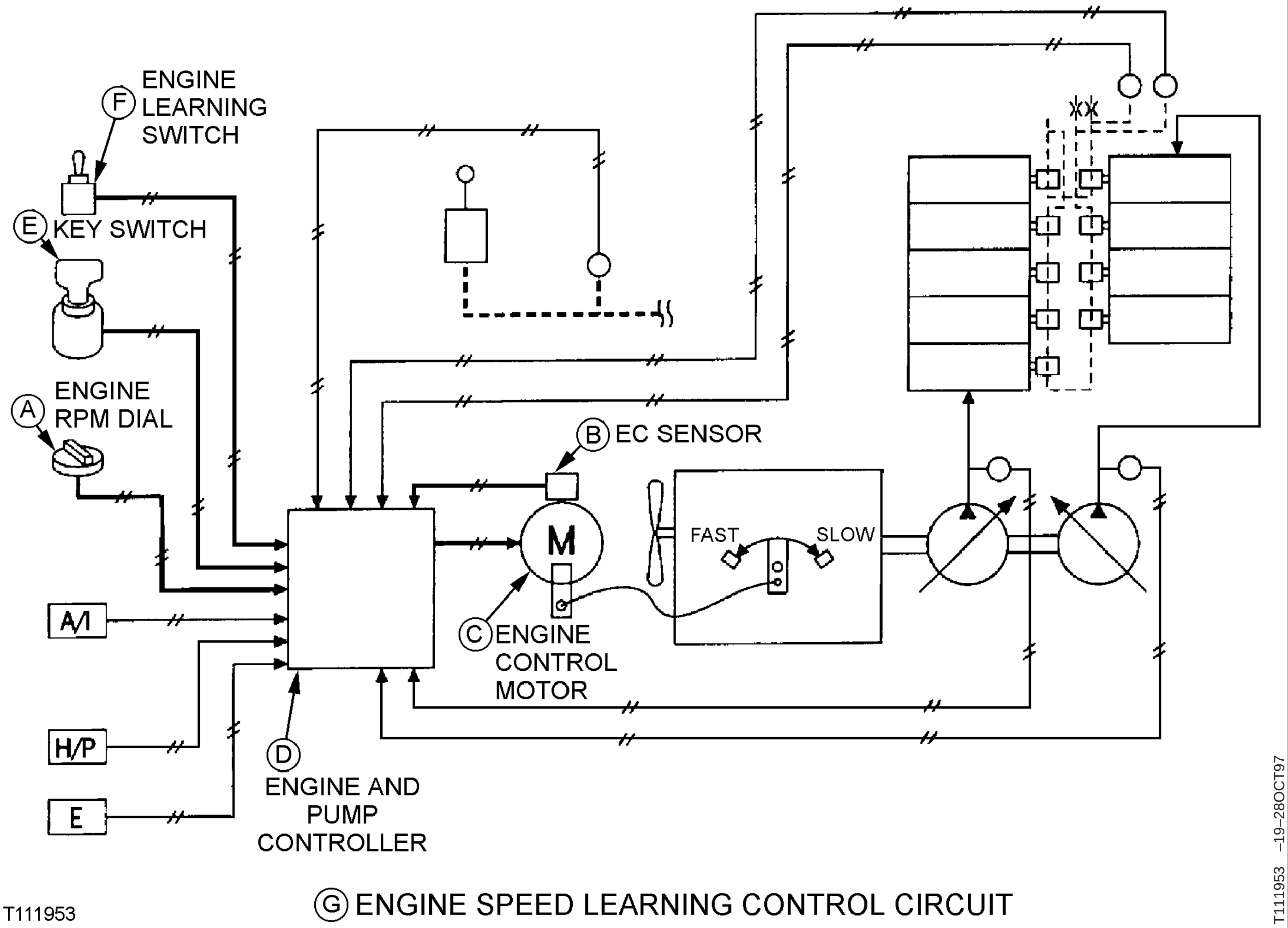
ENGINE SPEED LEARNING CONTROL CIRCUIT OPERATION



T111953

G ENGINE SPEED LEARNING CONTROL CIRCUIT

The function of the engine speed learning control circuit (G) is to learn the slow idle position as determine by the slow idle stop bracket on the injection pump and to store that data in the engine and pump controller (D).

When the engine learning switch (F) is push up to the learning position and the key switch (E) is turned on, the engine control motor (C) is driven by an electrical signal from the engine and pump controller (D). The control motor moves the injection pump lever to the slow idle position (the end of slot in slow idle stop bracket). An electrical feedback signal corresponding to the slow idle position is sent back to the engine and pump controller by the EC (engine control) sensor (B).

The slow idle position data is stored in the engine and pump controller.

The position of the engine control motor for auto-idle mode, E (economy) mode, and fast idle in standard mode is based on the slow idle position data stored in the engine and pump controller.

When the following components are repaired or replaced, or when engine speeds deviate from specification, the engine control motor adjustment and engine learning control procedure must be performed.

- Engine.
- Engine speed control cable.

Continued on next page CED,TX08227,3181 –19–06JUN98–1/2

- External slow idle stop in bracket at injection pump.
- Fast idle stop on injection pump.
- Engine control motor and sensor.
- Engine and pump controller.

(See Engine Control Motor and Sensor Adjustment and Engine Speed Learning Procedure in Group 9010-20.)

The procedure is not necessary after the replacement of batteries.

CED,TX08227,3181 –19–06JUN98–2/2

Group 10
System Operational Checks

ENGINE 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. A tachometer is required.

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

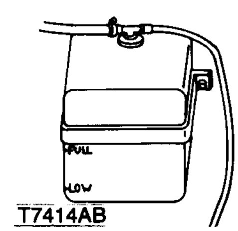
At the end of each check, if no problem is found, that check is complete or an additional check is needed. If problem is indicated, you will be given repair required and group location. If verification is needed, you will be given the next best source of information:

- Group 10—System Operational Checks
- Group 15—Diagnostic Information
- Group 20—Adjustments
- Group 25—Tests

CED,OUOE003,7683 –19–19OCT99–1/1

❶ COOLING SYSTEM CHECKS

– – –1/1

COOLANT LEVEL AND CONDITION IN COOLANT RECOVERY TANK CHECK	 T7414AB –19–13DEC90	Engine stopped, radiator cool. Inspect coolant level and condition in coolant recovery tank. Is coolant level between FULL and LOW marks on coolant recovery tank? Is coolant free of oil, foam, or rust?	**YES:** Go to next check. **NO:** Add coolant if low. Drain and flush overflow tank and radiator, replace coolant if dirty or rusty. If coolant is oily check for hydraulic or engine oil leaks into cooling system. Go to Group 0510 or General Information section.

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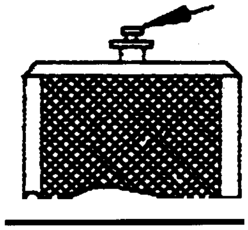
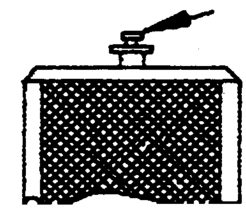
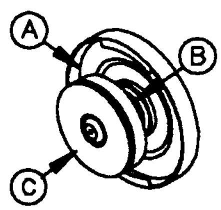
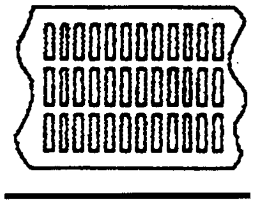
System Operational Checks

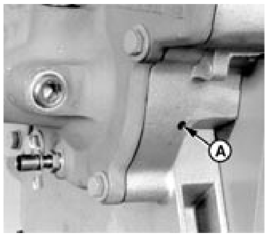
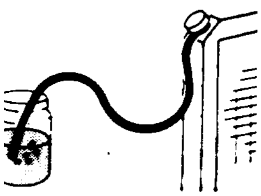
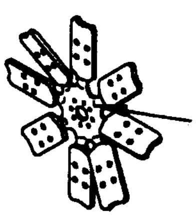
COOLANT LEVEL AND CONDITION IN RADIATOR CHECKS	 T6488FY –UN–19OCT88 **CAUTION: Prevent personal injury, DO NOT remove radiator cap unless engine is cool. When engine is hot and cap is removed, hot coolant or steam will spray out causing serious burns.** Engine OFF. Engine cold. Remove radiator cap. With engine cold, is coolant level just below filler neck in radiator? Is coolant free of oil, foam or rust?	**YES:** Go to next check. **NO:** Add coolant if low. Flush radiator and engine if coolant is dirty or rusty. Add clean coolant. Go to Section 9000, Group 04. If coolant is oily check for hydraulic or engine oil leaks into cooling system. Go to Engine Repair chapter. – – –1/1
RADIATOR CAP CHECK	 T6488FY –UN–19OCT88  A B C T7690AB –UN–23JAN92 **A—Gasket** **B—Spring** **C—Seal** **CAUTION: Prevent personal injury, DO NOT remove radiator cap unless engine is cool. When engine is hot and cap is removed, hot coolant or steam will spray out causing serious burns.** Engine stopped and cool. Remove radiator cap. If coolant is warmer than surrounding air temperature, is a "whoosh" sound heard when cap is loosened? Does cap have a stop position that requires it to be pushed down to remove? Does cap have a good seal (C) and gasket (A)? Is spring (B) in good condition?	**YES:** Go to next check. **NO:** Replace radiator cap. – – –1/1

System Operational Checks

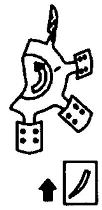
RADIATOR INTERNAL CORE CHECK	 T6488FZ –UN–19OCT88 **CAUTION: Prevent personal injury, DO NOT remove radiator cap unless engine is cool. When engine is hot and cap is removed, hot coolant or steam will spray out causing serious burns.** Raise engine access door. Remove radiator cap. Drain coolant into a clean container until core tubes are visible. Is radiator core free of rust, lime, or corrosion? Are passages in core clean, not plugged?	**YES:** Go to next check. **NO:** Remove and clean or replace radiator. Fill cooling system with clean coolant. Go to General Information section. – – –1/1

RADIATOR OUTSIDE AIR FLOW CHECK	Open engine hood. Open left rear access door. Inspect radiator screen for mud and debris. Are radiator fins free of mud, leaves, grass, and other debris? Is radiator damaged?	**YES:** Clean outside of radiator and straighten fins if bent. Replace radiator if severely damaged. **NO:** Go to next check. – – –1/1

COOLANT HOSES AND CLAMPS CHECK	Are radiator and heater hoses free of twists, kinks, cracks, leaks or wear from rubbing on adjacent parts? Are hose clamps tight and installed correctly?	**YES:** Go to next check. **NO:** Replace or untwist hoses as required. Tighten or reinstall hose clamps. – – –1/1

WATER PUMP CHECK	T115004 –UN–22APR98	**A—Weep Hole** Engine stopped. Is coolant leaking from weep hole (A)?	**YES:** Seal has failed. Replace seal or water pump. Go to Engine Repair chapter. **NO:** Go to next check. – – –1/1
ENGINE HEAD GASKET SEAL CHECK	T6171AR –UN–25MAY89	Engine at normal temperature. Radiator full. Install radiator cap and tighten. Place end of radiator overflow hose into a container of clear water. Operate engine at fast idle. Load engine by holding a hydraulic function over relief. Look for bubbles coming from overflow tube. Do bubbles flow from tube intermittently?	**YES:** Head gasket is OK. Go to next Check. **NO:** If there is a constant flow of bubbles from tube, loose or damaged cylinder head or a leaking head gasket may be indicated. Go to Engine Repair chapter. – – –1/1
FAN BLADES CHECK	T7694AH –UN–03FEB92	Are fan blades bent or twisted? Are fan blades cracked or nicked?	**YES:** Replace fan. **NO:** Go to next check. – – –1/1

System Operational Checks

FAN DIRECTION CHECK	 T6488GB –UN–23AUG93	Is fan installed correctly with cupped portion side (Arrow) of fan away from radiator? *NOTE: If fan is installed backwards, about 50% of its capacity is lost.*	**YES:** Go to next check. **NO:** Install fan correctly. – – –1/1

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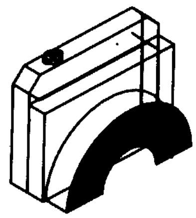
FAN SHROUD AND FAN GUARD CHECK	 T6488GC –UN–23AUG93	Check clearance between fan and fan shroud. Is fan centered in shroud? Is guard free of damage? Are all mounting brackets and hardware tight?	**YES:** Go to next check. **NO:** Adjust fan shroud if fan is not centered. Repair or replace guard. Tighten loose hardware. Replace fan shroud if needed. – – –1/1

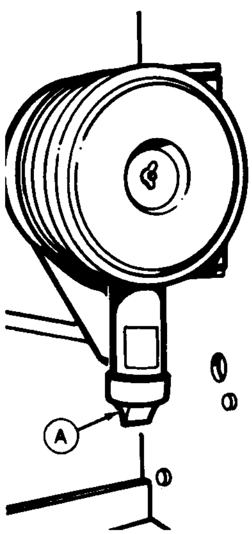
FAN BELT CHECK	Is fan belt free of oil or grease? Is inside surface of belt free of cracks or frayed edges? Is belt aligned with pulleys? *NOTE: Fan belt is self-adjusting.* Is fan belt tightener operating to keep belt tight?	**YES:** Go to next check. **NO:** Replace fan belt if oily, greasy, cracked or otherwise damaged. Repair or replace tightener if belt is loose. – – –1/1

❷ AIR INTAKE SYSTEM CHECKS

– – –1/1

AIR FILTER RESTRICTION INDICATOR AND SWITCH CHECK	Run engine at slow idle. Slowly cover air intake tube. Does air filter restriction indicator light in cab come ON?	**YES:** Go to next check. **NO:** Check monitor circuit fuse, air filter restriction indicator light and switch. Go to Section 9015-15.

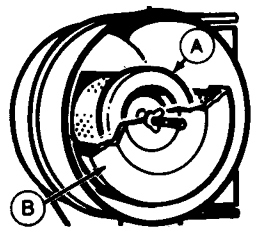
– – –1/1

AIR CLEANER UNLOADER VALVE CHECK	T7531BF –UN–07JUN91 **A—Air Cleaner Unloader Valve** Open left front access door. Inspect air cleaner unloader valve (A). Is unloader valve slightly open when the engine is not running? Is rubber flexible and showing no sign of becoming hard or brittle? Engine running. Turn auto-idle switch off and turn engine rpm dial to fast idle. Does unloader valve close?	**YES:** Go to next check. **NO:** Replace unloader valve.

– – –1/1

System Operational Checks

AIR CLEANER ELEMENTS CHECK



T7531BG –UN–07JUN91

A—Secondary Element
B—Primary Element

Remove air cleaner cover.

Inspect primary element (B).

Is element clean and in good condition?

Remove wing nut to remove primary element.

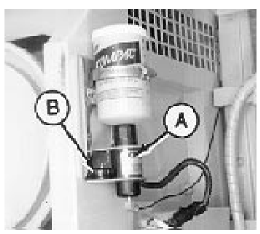
Inspect secondary element (A). Is element clean and in good condition?

YES: Go to next check.

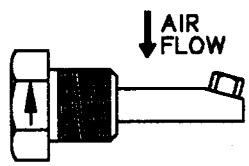
NO: Clean or replace primary element. Replace secondary element if primary element is damaged. Do not clean secondary element. Replace if dirty.

– – –1/1

COLD WEATHER STARTING AID CHECKS



T103516 –UN–04SEP96



T7699AL –UN–03FEB92

A—Starting Aid Solenoid
B—Dust Cover

Raise engine access door.

Open left rear service door.

Check that starting fluid can is installed in starting aid solenoid (A).

If starting fluid can is NOT installed, check that dust cover (B) is installed.

Is starting fluid line from starting aid solenoid to air intake manifold straight—NOT kinked or broken?

Is arrow on starting aid nozzle pointing AGAINST air flow of air intake manifold?

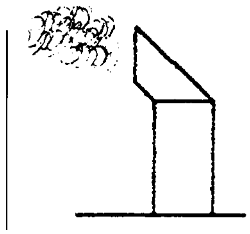
NOTE: It may be necessary to scrape paint from nozzle to see arrow.

YES: Check complete.

NO: Install a starting fluid can or the dust cover. Replace plastic line. Tighten nozzle until arrow is in correct position—pointing AGAINST incoming air flow.

– – –1/1

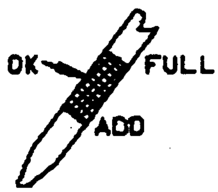
System Operational Checks

EXHAUST SMOKE CHECK	 T6488GF –UN–19OCT88	Operate engine until coolant temperature gauge needle is in the “GREEN” zone before doing this check. Run engine at fast idle. Counter rotate tracks to put load to engine. Observe exhaust smoke. Is exhaust smoke dark black or blue smoke? Is exhaust smoke gray or white? *NOTE: Dark black smoke can be caused by dirty air filter or poor fuel delivery. Blue smoke can be caused by worn or damaged piston rings or cylinder liners. Gray or white smoke can be caused by a cold engine, dirty injection nozzles, or both.*	**YES:** Go to Diagnose Engine Malfunctions, Group 9010-15. **NO:** Go to next check. – – –1/1

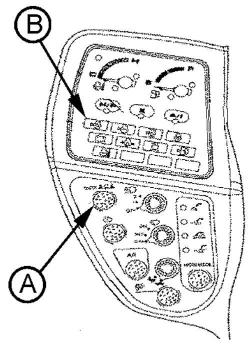
LUBRICATION SYSTEM CHECKS

– – –1/1

OIL LEVEL CHECK



T6488GH –19–23FEB89



T103525 –UN–10SEP96

A—Pre-Operation Level Check Switch
B—Engine Oil Level Indicator

Engine OFF.

Remove dipstick and check oil level.

Is oil above “full” mark or below “add” mark on dipstick?

If oil level is high, check for fuel or anti-freeze. Drain a small amount of engine oil into a clear container. Watch oil in container to see if anti-freeze or water accumulates at the bottom.

If oil level is low, check for oil leaks or oil seal problems in engine.

Adjust oil level to between “add” and “full” marks on dipstick.

Key switch ON.

Push pre-operation level check switch (A).

Is green light for engine oil level indicator (B) ON?

YES: Add oil if low. Change oil and filter if too high. Go to Group 9000-04. Check oil level after a few hours operation to determine if a problem exists. Go to Diagnose Engine Malfunctions Group 9010-15.

NO: If engine oil level indicator does not come ON, go to Monitor Diagnostic Information in Section 9015-15. If oil level is OK, go to next check.

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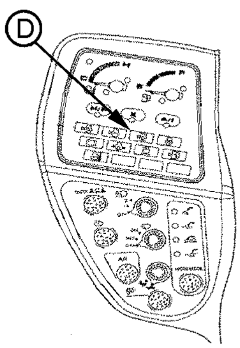
ENGINE OIL CONDITION CHECK	Remove dipstick and check oil condition. Is oil milky or grainy? If oil is milky, moisture or anti-freeze may be present. If oil is grainy, carbon may be present. Carbon in oil may result when engine runs at slow idle too long.	**YES:** Change oil and filter. Check condition of oil after a few hours operation to determine if a problem exists. Go to Section 9000 Group 04 or Diagnose Engine Malfunctions Section 9010-15. **NO:** Go to next check. – – –1/1

ENGINE OIL PRESSURE SWITCH AND INDICATOR CHECK	 T103526 –UN–09SEP96 **D—Engine Oil Pressure Indicator** Turn key switch from OFF to ON and observe engine oil pressure indicator (D). Does indicator come ON and stay ON? Start engine and observe engine oil pressure indicator. Does indicator go OFF a few seconds after engine starts?	**YES:** Go to next check. **NO:** Stop engine if engine oil pressure indicator remains ON after engine starts. Go to Section 9010-15, Diagnose Engine Malfunctions or Engine Repair chapter. If engine oil pressure indicator does not come ON, go to Section 9015-10 Monitor Circuit Diagnostic Procedures. – – –1/1

❹ FUEL SYSTEM CHECKS

– – –1/1

FUEL TANK INTERIOR CHECK	**IMPORTANT: Be careful not to damage fuel gauge sender float or low fuel level sending unit.** Remove fuel cap. Use a flashlight to inspect bottom of fuel tank by shining light through the fuel. Is dirt, debris, or contamination seen in tank?	**YES:** Drain fuel, dispose of contaminated fuel properly. Remove debris, clean bottom of tank. Replace fuel filters. Check water separator. **NO:** Go to next check.

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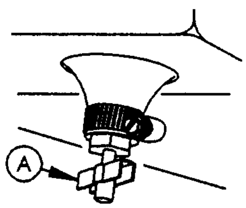
FUEL TANK SUMP CHECK	 T7700AA –UN–18FEB92 **A—Fuel Tank Drain Valve** Hold a clean container under fuel tank drain valve (A). Remove recessed hex plug. Open drain valve for a few seconds and catch fuel in container. Check condition of fuel in container. Is water present or is fuel cloudy?	**YES:** Drain until clear fuel flows or drain all fuel from tank, dispose of contaminated fuel properly. Replace fuel filters, check water separator. **NO:** Go to next check.

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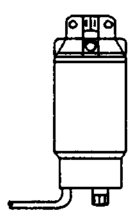
WATER SEPARATOR CHECK	 T7700AB –UN–25FEB92 Inspect fuel in water separator. Is water or other contamination present?	**YES:** Replace water separator filter element. **NO:** Go to next check.

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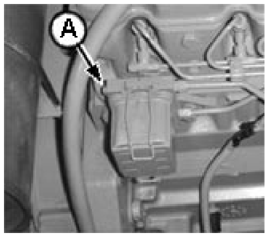
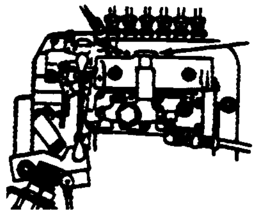
System Operational Checks

FUEL TRANSFER PUMP CHECK



T115148F –UN–04MAY98



T6493AA –UN–19OCT88

Open bleed screw (A) on fuel filter and operate hand primer on fuel transfer pump.

Does fuel come out of bleed screw when hand primer is operated?

Tighten bleed screw and again operate hand primer.

Is resistance felt when hand primer is initially operated and increase as system pressure increases?

YES: Go to next check.

NO: Be certain fuel filter is clean. If not, replace filter and recheck fuel supply pump.

– – –1/1

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.

Does fuel 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 and flows back to the fuel tank.

YES: Go to next check.

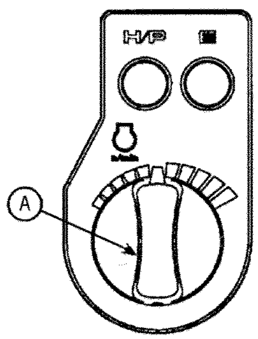
NO: Fuel supply is restricted, check for plugged fuel filters, plugged fuel tank cap vent, restricted lines, stuck injection pump overflow valve, or a malfunctioning fuel transfer pump. Repair or replace as necessary.

– – –1/1

❺ ENGINE SPEED AND PERFORMANCE CHECKS

– – –1/1

ENGINE RPM DIAL CHECK



T102100 –UN–26JUL96

A—Engine RPM Dial

Start the engine.

Turn engine rpm dial (A) to the right to fast idle position.

Did engine speed increase to fast idle in standard mode?

Turn engine rpm dial to the left to slow idle position.

Did engine speed decrease to slow idle?

NOTE: To check and verify engine speeds, see procedure in Group 9010-20.

YES: Go to next check.

NO: Check engine rpm dial and harness. Go to Group 9015-15.

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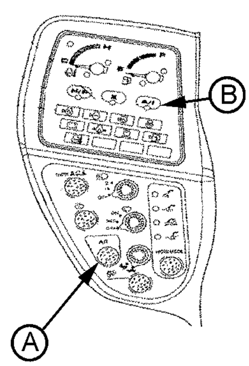
AUTO-IDLE SPEED CHECK



T103536 –UN–09SEP96

A—Auto-Idle Switch
B—Auto-Idle Indicator

Start engine.

Run engine at half speed.

Push auto-idle switch (A) on.

Does the auto-idle indicator (B) come on?

Does the engine speed decrease to auto-idle speed after about 4 seconds?

Actuate the bucket function momentarily. Does the engine speed increase immediately to the engine rpm dial setting?

Does the engine speed return to auto-idle after 4 seconds?

Push auto-idle switch (A) again to turn it off.

Does the engine speed increase immediately to the engine rpm dial setting and the indicator go out?

YES: Go to next check.

NO: See Auto-Idle Circuit Diagnostic Procedures in Group 9015-15.

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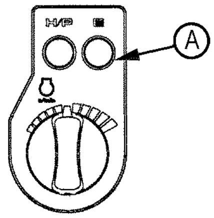
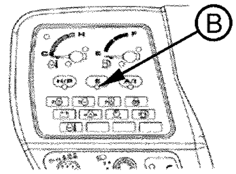
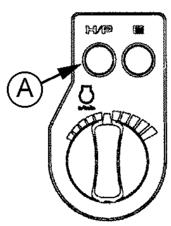
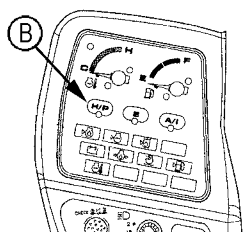
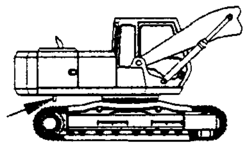
E (ECONOMY) MODE CHECK	 T103545 –UN–09SEP96  T103546 –UN–09SEP96 **A—E (Economy) Mode Switch** **B—E (Economy) Mode Indicator** Start engine. Turn engine rpm dial clockwise to fast idle. Push E (economy) mode switch (A) on. Did you hear a decrease in engine speed? Did the E (economy) mode indicator (B) come on? Push the E mode switch again to turn it off. Did E mode indicator go out and engine speed increase to fast idle?	**YES:** Go to next check. **NO:** Check switch, indicator, and harness. Go to Group 9015-15. – – –1/1

HP (HIGH POWER) MODE CHECK	 T111983 –UN–27OCT97  T112183 –UN–13NOV97 **A—HP (High Power) Mode Switch** **B—HP (High Power) Mode Indicator** Start engine. Run engine at fast idle. Push HP (high power) mode switch (A) on. Did HP (high power) mode indicator (B) come on? Operate the arm in function over relief (arm cylinder fully extended). Does the engine speed increase? Push HP mode switch again to turn it off. Does HP mode indicator go out?	**YES:** Go to next check. **NO:** Check switch, indicator, and harness. Go to Group 9015-15. – – –1/1

System Operational Checks

ENGINE BLOW-BY CHECK	 T7700AC –UN–10FEB92	Run engine at fast idle and check engine blow-by tube. Are fumes barely visible at the blow-by tube at fast idle, with 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 that requires some experience to determine excessive blow-by.*	**YES:** Go to next check. **NO:** If blow-by is excessive. Go to Compression Pressure Test in Group 9010-25. – – –1/1

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LOOSE OR WORN ENGINE PARTS	Run engine at slow idle. Move hydraulic control lever to operate a hydraulic function over relief to put engine under load. Does engine run smooth, no knocking or rattling noise?	**YES:** Operational Checkout complete. **NO:** Go to Abnormal Engine Noise, in Group 9010-15. – – –1/1

Group 15
Diagnostic Information

DIAGNOSE ENGINE MALFUNCTIONS

NOTE: Diagnostic charts are arranged from most probable and simplest to verify, to least likely and more difficult to verify.

Symptom	Problem	Solution
Engine Cranks But Will Not Start Or Hard To Start	No fuel	Add fuel. Bleed air.
	Wrong fuel	Use correct fuel.
	Water in fuel or water frozen in fuel line	Drain water from fuel tank trap. Inspect fuel filter for water. Change filter.
	Fuel filter plugged	Replace fuel filter. Clean fuel tank strainer. Bleed air.
	Debris in fuel	Drain fuel tank. Clean tank strainer. Add clean fuel.
	Air in fuel system	Check for bubbles in fuel filter and tighten connections. Bleed air.
	Fuel pump	Check fuel pump pressure. See Engine Repair chapter.
	Low battery power	Charge or install new batteries.
	Slow cranking speed—poor electrical connection	Clean and tighten battery and starter connections.
	Wrong engine oil	Use correct oil for cold weather.
	Air filter plugged	Check air filter restriction indicator and air filter elements. Clean or replace elements.
	Standby fuse or relay	Replace fuse, relay or wiring. See Section 9015.

Continued on next page

Diagnostic Information

Symptom	Problem	Solution
	Injection pump metering valve sticking	Lightly tap injection pump housing. If engine now starts, repair metering valve. See Local Fuel Injection Pump Service Center.
	Electric shut-off solenoid	Check shut-off solenoid. See Group 9015-10. Inspect solenoid wiring and linkage. See your Local Fuel Injection Pump Service Center.
	Injection pump	Remove and test pump. See your Local Fuel Injection Pump Service Center.
	Injection nozzle(s)	Remove and test nozzles. See Engine Repair chapter.
	Starter	Replace starter.
	Worn compression rings or low compression	Check compression. Repair. See Engine Repair chapter.
	Start aid fluid used excessively	Remove nozzles and add small amount of oil to each cylinder. See Engine Repair chapter.
	Blown cylinder head gasket	Place end of radiator overflow hose (between radiator and coolant recovery tank) into a container of clear water. Operate engine at fast idle under a load. A constant flow of bubbles indicates cylinder head gasket leakage. Replace gasket. See Engine Repair chapter.
Engine Knocks, Runs Irregularly or Stops	Air in fuel	Inspect filter for evidence of air in fuel. Tighten connections and bleed fuel system.
	Debris in fuel	Drain fuel tank. Clean tank strainer. Add clean fuel.
	Wrong fuel	Use correct fuel.

Continued on next page

Diagnostic Information

Symptom	Problem	Solution
	Water in fuel	Drain tank water trap, inspect filter element for water. Replace filters.
	Fuel filter plugged	Replace filter.
	Fuel injection pump out of time	Time injection pump. See Engine Repair chapter.
	Slow idle speeds adjustment too low	Adjust slow idle speed. See Group 9010-20.
	Engine overheating	Test cooling system. See Group 9010-25.
	Fuel transfer pump	Test pump pressure. See Engine Repair chapter.
	Fuel injection pump	Remove and test fuel injection pump. See your Local Fuel Injection Pump Service Center.
	Injection nozzle(s)	Remove and test nozzle(s). See Engine Repair chapter.
	Improper valve clearance	Check and adjust valve clearance. See Engine Repair chapter.
	Valve sticking or burned	Do compression pressure test. See Engine Repair chapter.
	Bent push rods	Inspect. Replace. See Engine Repair chapter.
	Worn or broken compression rings or cylinder head gasket leaking	Place end of radiator overflow hose (between radiator and coolant recovery tank) into a container of clear water. Operate engine at fast idle under a load. A constant flow of bubbles indicates head gasket leakage. Replace gasket. See Engine Repair chapter.
		Do compression pressure test. See Engine Repair chapter.

Continued on next page

Diagnostic Information

Symptom	Problem	Solution
Engine Not Developing Full Power	Fuel filter plugged	Change filter. Bleed air.
	Air filter plugged	Clean or replace air cleaner elements.
	Debris in fuel	Drain fuel tank. Clean Tank strainer.
	Wrong fuel	Use correct fuel.
	Fuel tank outlet fitting plugged	Clean.
	Fast idle speed incorrect	Do Engine Speed Learning Procedure. See Group 9010-20.
	Hydraulic system leakage	Do Hydraulic System Checks. See Group 9025-25.
	Fuel line to pump or pump return to tank restricted	Check, repair.
	Fuel pump	Do Fuel Pump Pressure Test. See Engine Repair chapter.
	Timing incorrect	Check injection pump timing. See Engine Repair chapter.
	Injection nozzles	Remove and test injection nozzles. See Engine Repair chapter.
	Low compression	Do Compression Pressure Test. See Engine Repair chapter.
	Injection pump delivery or governor	Repair pump. See your Local Fuel Injection Pump Service Center.
	Turbocharger	Do turbocharger inspection. See Engine Repair chapter.
	Valves burned, warped	Repair valves. See Engine Repair chapter.
	Cam shaft worn	Do Valve Lift Test. See Engine Repair chapter.

Continued on next page

Diagnostic Information

Symptom	Problem	Solution
Engine Overheats	Coolant level low	Fill cooling system and check for leaks.
	Thermostat stuck closed or missing	Test. Install thermostat. See Group 0400 and Engine Repair chapter.
	Radiator screen plugged	Remove and clean screen.
	Radiator, oil cooler cores plugged with dirt or fins bent	Check air flow. See Group 9010-25. Clean radiator. Straighten fins.
	Air filter plugged	Clean or replace elements.
	Gauge or sender	Check gauge and sender. See Group 9015-15.
	Fan belt soaked with oil. Belt or pulleys worn excessively	Inspect, replace. See Operator's Manual or Group 0510.
	Shroud or baffles (foam rubber) missing	Inspect. Repair or replace.
	Fan blade on backward	Install correctly. See Group 0510.
	Fan belt tension adjuster	Replace.
	Radiator cap	Test, replace cap.
	Water used in radiator	Replace with correct coolant mixture.
	Hydraulic system overheating	Verify, repair. See Group 9025-25.
	Cooling system passages dirty	Flush cooling system.
	Water pump	Repair. See Engine Repair chapter.
	Fuel injection pump timing	Check injection pump static timing. See Engine Repair chapter.
	Fuel delivery excessive	Remove and adjust fuel injection pump. See your Local Fuel Injection Pump Service Center.
Engine Stalls Easily Under Load	Water separator filter plugged	Change water separator filter.

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Diagnostic Information

Symptom	Problem	Solution
	Engine and pump controller	Check engine and pump controller. See Group 9015-15.
	Wiring harness	Check wiring harness. See Group 9015-15.
Engine Speed Does Not Change When Engine RPM Dial is Turned	Engine rpm dial and harness	Check engine rpm dial and harness. See Group 9015-15.
	Engine control motor	Check engine control motor. See Group 9015-15.
	Engine and pump controller	Check engine and pump controller. See Group 9015-15.
	Wiring harness	Check wiring harness. See Group 9015-15.
Engine Speeds Are Too Fast Or Slow	Engine speed learning	Do Engine Speed Learning Procedure. See Group 9010-20.
	Linkage not adjusted	Adjust Linkage. See Group 9010-20.
	Engine and pump controller	Check engine and pump controller. See Group 9015-15.
	Engine control motor	Check engine control motor. See Group 9015-15.
	Wiring harness	Check wiring harness. See Group 9015-15.
	Fuel injection pump	Remove and test fuel injection pump. See your Local Fuel Injection Pump Service Center.
Auto-Idle Does Not Work	Auto-idle switch	Check auto-idle switch. See Group 9015-15.
	Dig and propel pressure switches	Check dig and propel pressure switches. See Group 9015-15.
	Engine control motor.	Check engine control motor. See Group 9015-15.

Continued on next page CED,TX14795,4357 –19–17APR98–6/12

Diagnostic Information

Symptom	Problem	Solution
	Engine and pump controller	Check controller. See Group 9015-15.
	Wiring harness	Check wiring harness. See Group 9015-15.
Coolant Temperature Too Low	Thermostat stuck open	Replace thermostat. See Engine Repair chapter.
	Temperature gauge	Install new gauge or sending unit.
Oil In Coolant Or Coolant In Crankcase	Oil cooler leaking	Test, repair. See Engine Repair chapter.
	Blown cylinder head gasket	Place end of radiator overflow hose (between radiator and coolant recovery tank) into a container of clear water. Operate engine at fast idle under a load. A constant flow of bubbles indicates cylinder head gasket leakage. Replace gasket. See Engine Repair chapter.
	Cylinder head cracked	Check, replace. See Engine Repair chapter.
	Liner packing leaking and/or cracked cylinder block	Remove pan, inspect bottom end, repair, verify and replace if necessary. See Engine Repair chapter.
Low Engine Oil Pressure	Oil level low	Fill to proper level.
	Oil filter plugged	Install new oil filter and oil.
	Oil pump intake screen plugged or loose	Clean or replace. See Engine Repair chapter.
	Wrong grade of oil or fuel dilution	Use correct grade of oil. See Engine Repair chapter.
	Engine oil pressure regulating valve	Repair valve. See Engine Repair chapter.

Continued on next page

Diagnostic Information

Symptom	Problem	Solution
	Internal oil passages leak and/or spray cooling jet missing	Check, repair. See Engine Repair chapter.
	Pressure pipe from oil pump leaking	Check. See Engine Repair chapter.
	Oil pump drive gear loose	Check, repair drive gear. See Engine Repair chapter.
	Oil pump gear and/or housing worn	Repair. See Engine Repair chapter.
	Excessive main or connecting rod bearing clearance	Replace main bearings or connecting rod bearings. See Engine Repair chapter.
High Engine Oil Pressure	Oil viscosity wrong (too thick)	Drain and refill with correct oil. See Group 9000-04.
	Pressure regulating valve stuck or misadjusted	Verify, repair. See Engine Repair chapter.
	Piston cooling spray orifices plugged	Verify, clean. See Engine Repair chapter.
	Anti-freeze in engine oil	Verify, repair, change oil.
Engine Uses Too Much Oil	Wrong oil	Use correct oil. See Group 9000-04.
	Oil level too high	Correct. Check to see if some other fluid is leaking into oil.
	Oil leaks	Check engine oil drain plug.
	Air cleaner plugged	Clean air cleaner elements or install new elements
	Crankcase breather restricted	Remove, clean. See Engine Repair chapter.
	Engine operating too hot or oil cooler water passage plugged	Test cooling system. See Group 9010-25. Test thermostat. See Engine Repair chapter.

Continued on next page

Diagnostic Information

Symptom	Problem	Solution
	Main or connecting rod bearing clearance excessive	Replace main bearings or connecting rod bearings. See Engine Repair chapter.
	Pistons or liners scored	Check, repair pistons or liners. See Engine Repair chapter.
	Piston rings worn, broken or stuck	Do Compression Pressure Test. See Engine Repair chapter.
	Oil return slots in piston clogged	Clean. See Engine Repair chapter.
	Crankshaft thrust bearing worn (misaligned piston and rod)	Check piston and rod assembly. See Engine Repair chapter.
	Valve guides or valve stems worn	Check, repair. See Engine Repair chapter.
Engine Uses Too Much Fuel	Fuel system leakage	Tighten connections. See Engine Repair chapter.
	Plugged or dirty air intake	Clean air intake system.
	Wrong fuel	Use correct fuel.
	Injection pump static timing	Check, injection pump static timing. See Engine Repair chapter.
	Injection nozzles	Test, repair nozzles. See Engine Repair chapter.
Excessive Black Smoke	Wrong fuel	Use correct fuel.
	Plugged or dirty air intake or exhaust system.	Clean air intake and exhaust system.
	Injection pump static timing	Check injection pump timing. See Engine Repair chapter.
	Over-fueling	Remove and adjust fuel injection pump. See your Local Fuel Injection Pump Service Center.

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Diagnostic Information

Symptom	Problem	Solution
	Injection nozzle orifice plugged	Check and repair. See Engine Repair chapter.
Excessive Blue or White Smoke	Cranking speed too slow	Check batteries and connections. See Group 9015-15
	Injection pump static timing	Check injection pump timing. See Engine Repair chapter.
	Engine running too “cold”	Check thermostat. See Group 0400 and Engine Repair chapter.
	Wrong fuel	Use correct fuel.
	Liners have wear and/or piston ring stuck	Do Compression Pressure Test. See Engine Repair chapter.
Detonation	Fuel injection pump static timing incorrect and/or injection pump advance faulty	Check injection pump static timing. See Engine Repair chapter.
	Cold weather starting aid solenoid stuck	Check and repair.
Abnormal Noise	Oil level low	Check and add oil.
	Wrong engine oil	Use correct oil.
	Engine oil diluted with fuel	Inspect engine oil. Inspect fuel pump spindle, seal and housing.
	Valve clearance excessive	Check, adjust valve. See Engine Repair chapter.
	Engine static timing incorrect	Check, adjust. See Engine Repair chapter.
	Push rods bent	Inspect, replace push rods. See Engine Repair chapter.
	Main and/or connecting rod bearing caps loose or worn	Inspect main bearing cap screws and connecting rod cap screws. See Engine Repair chapter.

Continued on next page CED,TX14795,4357 –19–17APR98–10/12

Diagnostic Information

Symptom	Problem	Solution
	Piston scored	Replace piston. See Engine Repair chapter.
	Piston pin bushings worn	Replace pins and bushings. See Engine Repair chapter.
	Rocker arm shafts worn	Check. See Engine Repair chapter.
	Crankshaft end play excessive	Check, repair. See Engine Repair chapter.
Turbocharger Excessively Noisy or Vibrates	Bearings not lubricated	Insufficient oil pressure. Check for restricted turbocharger oil line.
	Worn bearings	Replace. See Engine Repair chapter.
	Air leak in engine, intake or exhaust manifold	Inspect and repair. See Engine Repair chapter.
	Improper clearance between turbine wheel and turbine housing	Remove exhaust elbow and air inlet hose. Inspect and repair. See Engine Repair chapter.
	Broken blades on turbine	Remove exhaust elbow and air inlet hose. Inspect and repair. See Engine Repair chapter.
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 Engine Repair chapter.
	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 Engine Repair chapter.

Continued on next page

Diagnostic Information

Symptom	Problem	Solution
	Dirt build-up behind compressor wheel caused by air intake leaks	Inspect and repair. See Engine Repair chapter.
	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. See Engine Repair chapter.

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JT05801 CLAMP-ON ELECTRONIC TACHOMETER INSTALLATION

SERVICE EQUIPMENT AND TOOLS
JT05801 Clamp-On Electronic Tachometer

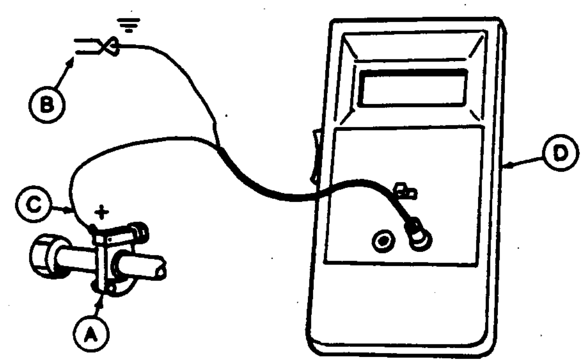
1. Before installing clamp-on electronic tachometer, remove the paint from a straight section of injection line within 100 mm (4 in.) of No. 1 injection nozzle. Use emery cloth to remove the paint.

2. Install the clamp-on transducer (A). Tighten finger tight only—DO NOT overtighten.

3. Connect the red clip (+) (C) to the clamp-on transducer.

4. Connect the black clip (-) (B) to a ground connection such as the head of a cap screw or other metal part on engine.

5. Start the engine. Check for a reading on the digital readout unit (D).



A—Clamp-On Transducer
B—Black Clip (-)
C—Red Clip (+)
D—Digital Readout Unit

CED,TX08227,2879 –19–11NOV97–1/1

FUEL SHUT-OFF SOLENOID LINKAGE CHECK AND ADJUSTMENT

SPECIFICATIONS	
Fuel Shut-Off Solenoid Ball Joint Hole-to-Fuel Shut-Off Lever Hole Distance	3—6 mm (1/8—1/4 in.) short of alignment.
Fuel Shut-Off Solenoid Plunger-to-Ball Joint Nut Torque	8 N•m (70 lb-in.)
Fuel Shut-Off Lever-to-Stop Position Stop Distance	within 3 mm (0.125 in.) of stop position stop

Continued on next page

TX,05,GG2305 –19–08JUN98–1/3

1. Disconnect ball joint (C) from fuel shut-off lever (D).

2. Turn key switch to ON. It is not necessary to start engine for this procedure.

3. Push plunger (F) into solenoid housing until the plunger bottoms. With key switch ON, solenoid hold coil is energized and will hold plunger in the run position

4. Manually pull fuel shut-off lever (D) up against the run position stop (upper stop) (H).

5. Check that hole in ball joint (C) is 3—6 mm (1/8—1/4 in.) short of aligning with hole in fuel shut-off lever.

Fuel Shut-Off Solenoid Ball Joint Hole-to-Fuel Shut-Off Lever Hole—Specification

Distance .... 3—6 mm (1/8—1/4 in.) short of alignment.

The 3—6 mm (1/8—1/4 in.) is the amount of overtravel needed to compress the spring in the plunger to hold the shut-off lever against the run position stop when plunger is bottomed in the solenoid housing.

Adjust ball joint as necessary.

6. Manually pull fuel shut-off lever up against the run position stop (upper stop).

   Adjust ball joint so hole is aligned with hole in shut-off lever and then turn ball joint to shorten linkage by three turns.

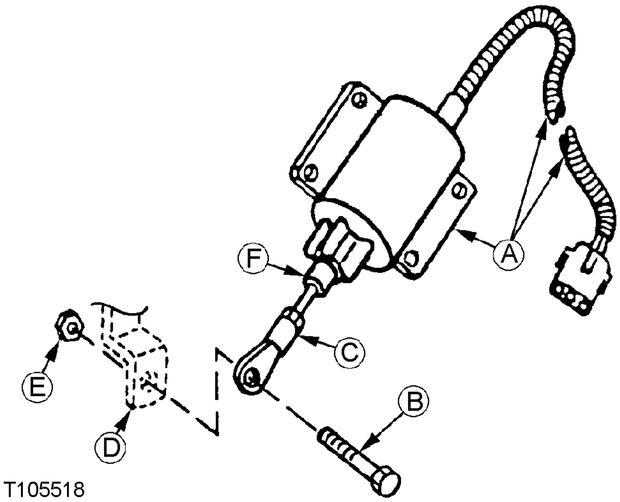
   Hold ball joint and tighten nut.

Fuel Shut-Off Solenoid Plunger-to-Ball Joint Nut—Specification

Torque .... 8 N•m (70 lb-in.)

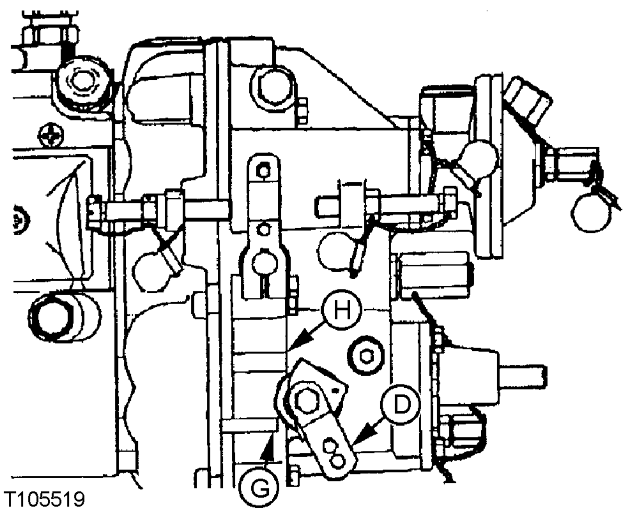
7. Turn key switch to OFF.

8. Connect ball joint to fuel shut-off lever using cap screw (B) and nut (E).



T105518

T105518 –UN–04DEC96



T105519

T105519 –UN–04DEC96

A—Shut-Off Solenoid
B—Cap Screw
C—Ball Joint
D—Fuel Shut-Off Lever
E—Lock Nut
F—Plunger
G—Stop Position Stop (Lower Stop)
H—Run Position Stop (Upper Stop)

Continued on next page

IMPORTANT: Failure to have the shut-off lever tight against run position stop (upper stop) can result in low engine horsepower.

9. Turn the key switch to ON.

   Push plunger into solenoid housing so hold coil holds the plunger in the run position.

   Check that shut-off lever is tight against run position stop using a 0.025 mm (0.001 in.) feeler gauge. If feeler gauge passes between shut-off lever and stop, shorten the linkage two more turns.

10. Turn key switch to OFF.

    The spring inside the solenoid housing boot will extend the plunger to push the shut-off lever down to the stop position stop (lower stop) (G).

    Check that shut-off lever is within the specified distance of stop position stop.

Fuel Shut-Off Lever-to-Stop Position Stop—Specification

Distance.. within 3 mm (0.125 in.) of stop position stop

TX,05,GG2305 –19–08JUN98–3/3

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ENGINE SPEED CHECK

SPECIFICATIONS	
Engine Fast Idle in Standard Mode Speed	2050 ± 75 rpm
Engine Slow Idle Speed	1050 + 100 - 0 rpm

SERVICE EQUIPMENT AND TOOLS
JT05801 Clamp-On Electronic Tachometer
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable

1. Connect the tachometer or the laptop computer with excavator diagnostics program. Select “14 Actual engine speed” from Monitor Data Items. (See JT05801 Clamp-On Electronic Tachometer Installation in this group or for laptop computer installation, see procedure in Group 9025-25.)

2. Warm engine to normal operating temperature.

3. Turn engine rpm dial to the right to check fast idle in standard mode.

Engine Fast Idle in Standard Mode—Specification

Speed... 2050 ± 75 rpm

4. Turn engine rpm dial to the left to check slow idle.

Engine Slow Idle—Specification

Speed.. 1050 + 100 - 0 rpm

5. If not to specifications, do the Engine Speed Learning Procedure (See procedure in this group.)

   If engine speeds are still not to specification, do the Injection Pump Fast and Slow Idle Stops Adjustment (See procedure in this group.)

CED,TX14795,4356 –19–17APR98–1/1

INJECTION PUMP FAST AND SLOW IDLE STOPS ADJUSTMENT

SPECIFICATIONS	
Engine Fast Idle Speed	2050 ± 75 rpm
Engine Slow Idle Speed	1050 + 100 - 0 rpm

SERVICE EQUIPMENT AND TOOLS
JT05801 Clamp-On Electronic Tachometer
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable

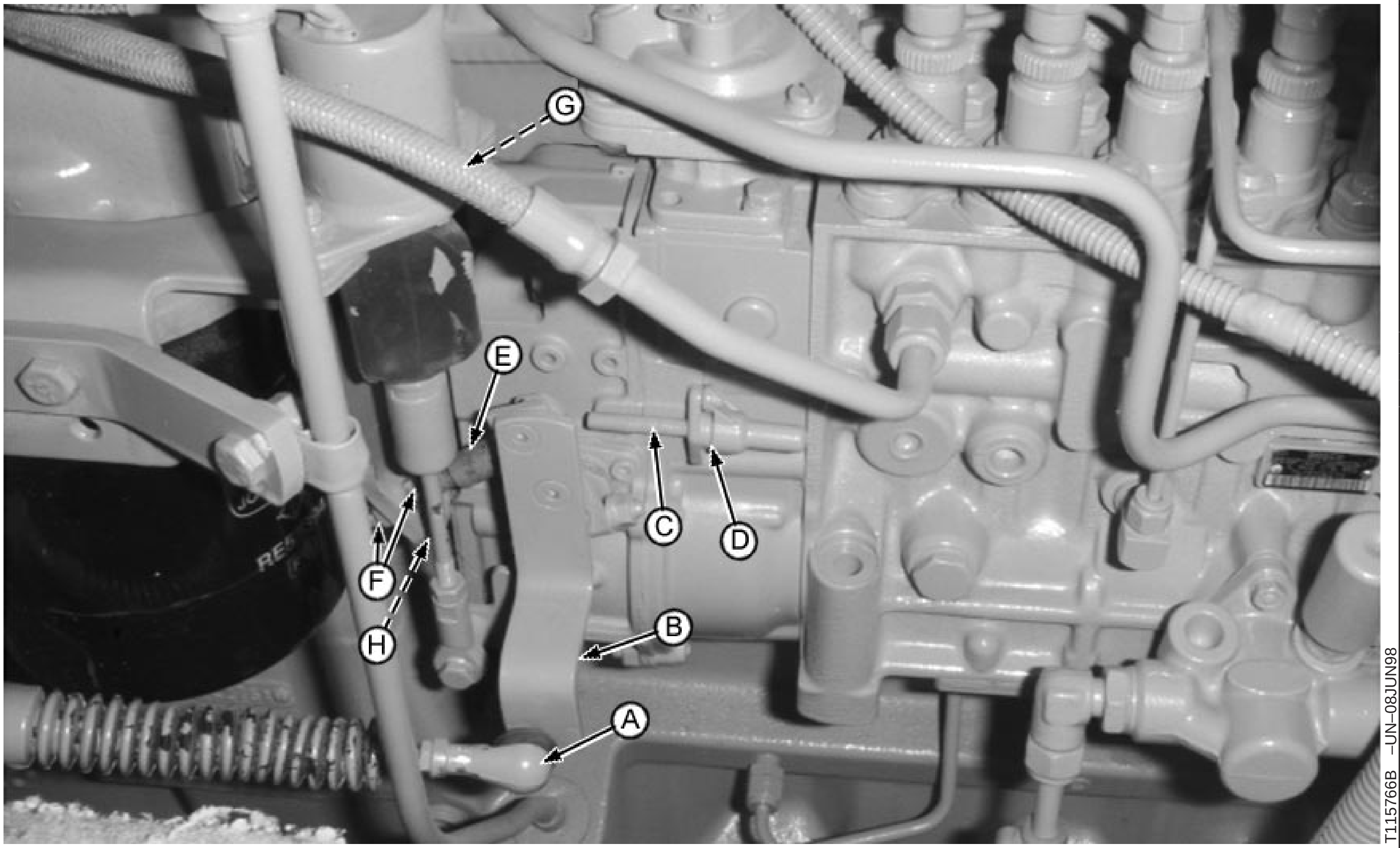
1. Connect the tachometer or the laptop computer with excavator diagnostics program. Select “14 Actual engine speed” from Monitor Data Items. (See JT05801 Clamp-On Electronic Tachometer Installation in this group or for laptop computer installation, see procedure in Group 9025-25.)

2. Start the engine.

3. Warm engine to its normal operating temperature.

4. Stop the engine.

Continued on next page CED,TX08227,3182 –19–06JUN98–1/4



A—Speed Control Cable
B—Injection Pump Lever
C—Fast Idle Stop
D—Nut
E—External Slow Idle Stop
F—Nut (2 used)
G—Internal Slow Idle Stop
H—Supplementary Idle Screw

5. Disconnect the speed control cable (A) from injection pump lever (B).

6. Check that injection pump lever moves freely from external slow idle stop (E) to the fast idle stop (C) and back.

7. Start the engine.

8. Push injection pump lever against fast idle stop (C).

   Record the engine fast idle speed.

NOTE: The fast idle stop on the injection pump serves as the stop when the HP (high power) mode is actuated.

9. Push injection pump lever against the external slow idle stop (F).

   Record the engine slow idle speed.

10. Adjust the fast and external slow idle stops as needed.

Engine Fast Idle—Specification

Speed... 2050 ± 75 rpm

Engine Slow Idle—Specification

Speed.. 1050 + 100 - 0 rpm

11. Loosen nut (D) on the fast idle stop (C).

12. Hold injection pump lever against the fast idle stop.

Continued on next page

Turn fast idle stop in to decrease engine fast idle speed; turn stop out to increase engine fast idle speed.

Hold fast idle stop and tighten nut.

IMPORTANT: The slow idle speed must be adjusted to specification so the injection pump lever only contacts the external slow idle stop (E) and not the internal slow idle stop (G). The internal slow idle stop is adjusted at the factory so it is not contacted when slow idle speed is adjusted to specification. Seals on the injection pump lever shaft may be damage if internal slow idle stop is used as the stop when injection pump lever is connected to the engine control motor. The engine slow idle speed specification given is with the engine installed in the machine and the pumps, alternator, and fan installed.

13. Loosen nuts (F) on the external slow idle stop (E).

14. Hold injection pump lever against the external slow idle stop.

    Turn external slow idle stop in to increase engine slow idle speed; turn stop out to decrease engine slow idle speed.

    Hold external slow idle stop and tighten nuts.

Continued on next page

CED,TX08227,3182 –19–06JUN98–3/4

15. Pull injection pump lever rapidly to fast idle and then decelerate to slow idle. Slow idle must be to specification.

NOTE: Injection pump shown removed for clarity of photograph.

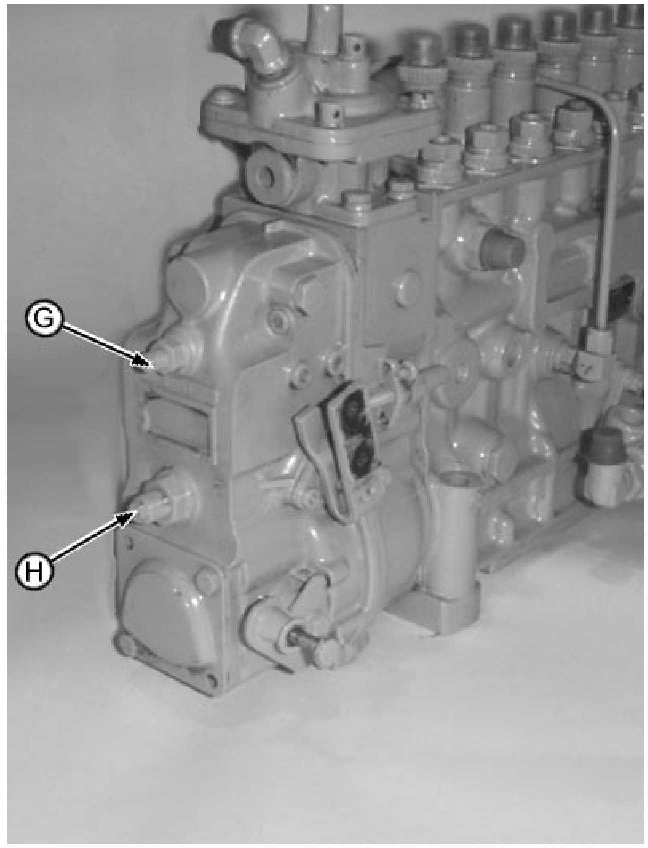
Turning the supplementary idle screw (H) in no more than 1/4 of a turn may help to reduce surging or hunting. If surging or hunting continues, repair injection pump.

16. Stop the engine.

17. Connect the cable to lever.

Check that the threaded portion of cable in centered in bulkhead bracket. Loosen and tighten the nuts to centered threaded portion of cable in bulkhead bracket. Cable can be adjusted in the bulkhead bracket if more cable travel is need in one direction.

18. Do Engine Control Motor Adjustment and then the Engine Speed Learning Procedure. (See procedures in this group.)



T115579B –UN–08JUN98

G—Internal Slow Idle Stop
H—Supplementary Idle Screw

CED,TX08227,3182 –19–06JUN98–4/4

ENGINE CONTROL MOTOR AND SENSOR ADJUSTMENT

SPECIFICATIONS	
Arm-to-Engine Control Motor Shaft Cap Screw Torque	13 N•m (115 lb-in.)

When the following components are repaired or replaced, or when engine speeds deviate from specification, the engine control motor and sensor adjustment and engine learning control procedure must be performed.

- Engine
- Engine speed control cable
- Engine control motor and sensor
- Engine and pump controller
- Fast and slow idle stop brackets

NOTE: The engine control sensor is located inside the engine control motor housing. Sensor is serviced as an assembly with the engine control motor.

1. Check that fast and external slow idle stops on the injection pump are adjusted to specification. (See Injection Pump Fast and Slow Idle Stops Adjustment in this group.)

2. Turn key switch to ON.

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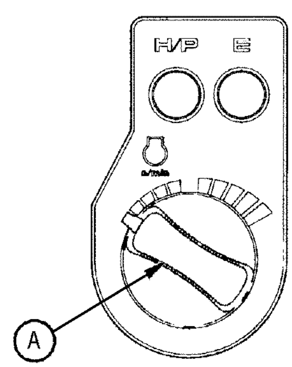
CED,TX08227,3183 –19–06JUN98–1/3

3. Turn the engine rpm dial (A) to slow idle.



T101749 –UN–27JUN96

A—Engine RPM Dial

Continued on next page

CED,TX08227,3183 –19–06JUN98–2/3

4. Check that engine speed control cable is connected to the outer hole of engine control motor arm (B).

5. Loosen cap screw (A) in arm (B).

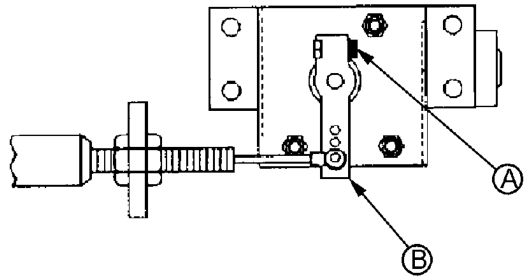
6. Adjust the arm on the shaft so injection pump lever just contacts the external slow idle stop.

7. Tighten cap screw (A).

Arm-to-Engine Control Motor Shaft Cap Screw—Specification

Torque .... 13 N•m (115 lb-in.)

8. Do the Engine Speed Learning Procedure. (See procedure in this group.)



A—Cap Screw
B—Arm

CED,TX08227,3183 –19–06JUN98–3/3

ENGINE SPEED LEARNING PROCEDURE

SPECIFICATIONS	
Engine Slow Idle Speed	1050 + 100 - 0 rpm
Engine Auto-Idle Speed	1200 ± 100 rpm
Engine E (Economy) Mode Speed	1900 ± 100 rpm
Engine Fast Idle in Standard Mode Speed	2050 ± 75 rpm

When the following components are repaired or replaced, or when engine speeds deviate from specification, the engine control motor adjustment and engine learning control procedure must be performed.

- Engine
- Engine speed control cable
- Engine control motor and sensor
- Engine and pump controller
- Fast and slow idle stop brackets

1. Stop the engine.

2. Disconnect the laptop computer from the diagnostic test port.

3. Wait for 5 seconds.

Continued on next page

CED,TX08227,3184 –19–06JUN98–1/2

4. Push engine learning switch (C) up to top position. The switch is a three position switch. Make sure it is in the top position.

5. Turn key switch ON. Wait 5 seconds.

6. Turn key switch OFF. Wait 5 seconds.

7. Push engine learning switch to middle position.

8. Check engine speeds.

Engine Slow Idle—Specification

Speed .... 1050 + 100 - 0 rpm

Engine Auto-Idle—Specification

Speed .... 1200 ± 100 rpm

Engine E (Economy) Mode—Specification

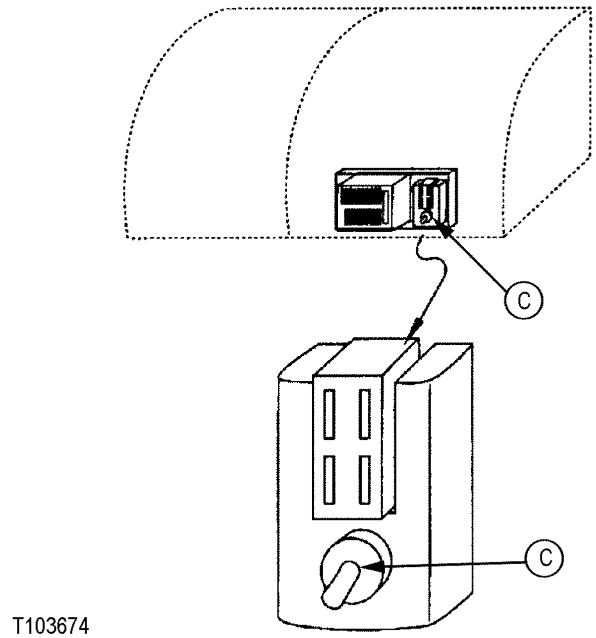
Speed .... 1900 ± 100 rpm

Engine Fast Idle in Standard Mode—Specification

Speed .... 2050 ± 75 rpm

If slow idle speed is still not to specification, check the engine control sensor. (See Engine Control (EC) Sensor Harness Test in Group 9025-25.)

NOTE: The laptop computer with excavator diagnostic software can be used to change the default speeds for slow idle, auto-idle, economy mode, and fast idle in standard mode. See Excavator Diagnostic Software Special Function—Engine Speed in Group 9025-25.



T103674 –UN–11SEP96

C—Engine Learning Switch

CED,TX08227,3184 –19–06JUN98–2/2

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12

COOLING SYSTEM FILL AND DEARERATION

SPECIFICATIONS	
Cooling System Capacity	30 L (32 qt)

FREEZING TEMPERATURES

IMPORTANT: Use only permanent-type low silicate ethylene glycol base antifreeze in coolant solution. Other types of antifreeze may damage cylinder seals.

Fill cooling system with permanent-type, low silicate, ethylene glycol antifreeze (without stop-leak additive) and clean, soft water.

FILL

1. Fill the radiator to the bottom of the fill neck. Install the cap.

2. Fill the surge tank to the bottom of the fill neck. Install the cap.

3. Fill the coolant recovery tank to the FULL mark. Install the cap.

Cooling System—Specification

Capacity .... 30 L (32 qt)

DEAERATION

IMPORTANT: The cooling system requires several warm-up and cool down cycles to deaerate. It will NOT deaerate during normal operation. Only during warm-up and cool down cycles will the system deaerate.

1. Start engine. Run engine until coolant reaches a warm temperature.

2. Stop engine. Allow coolant to cool.

3. Check coolant level at recovery tank.

4. If necessary, fill recovery tank to FULL mark. Install the cap.

5. Repeat Steps 1—4 until recovery tank coolant level is repeatedly at the same level (stabilized).

NOTE: The level of the coolant in the cooling system MUST BE repeatedly checked after all drain and refill procedures to ensure that all air is out of the system which allows the coolant level to stabilize. Check coolant level only when the engine is cold.

CED,TX08227,3185 –19–06JUN98–1/1

JT05801 CLAMP-ON ELECTRONIC TACHOMETER INSTALLATION

SERVICE EQUIPMENT AND TOOLS
JT05801 Clamp-On Electronic Tachometer

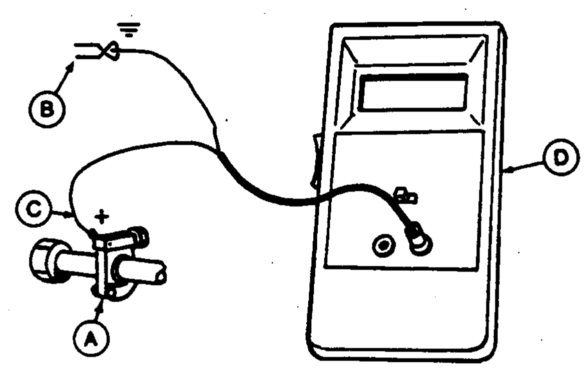
1. Before installing clamp-on electronic tachometer, remove the paint from a straight section of injection line within 100 mm (4 in.) of No. 1 injection nozzle. Use emery cloth to remove the paint.

2. Install the clamp-on transducer (A). Tighten finger tight only—DO NOT overtighten.

3. Connect the red clip (+) (C) to the clamp-on transducer.

4. Connect the black clip (-) (B) to a ground connection such as the head of a cap screw or other metal part on engine.

5. Start the engine. Check for a reading on the digital readout unit (D).



T6813AG –UN–28FEB89

A—Clamp-On Transducer
B—Black Clip (-)
C—Red Clip (+)
D—Digital Readout Unit

CED,TX08227,2879 –19–11NOV97–1/1

FUEL LINE LEAKAGE TEST

SPECIFICATIONS	
Fuel Line Leakage Test Pressure	69 kPa (0.7 bar) (10 psi)
To Prevent Fuel System Component Damage Never Exceed Maximum Pressure	103 kPa (1 bar) (15 psi)

Connections may allow air to enter the fuel system without allowing fuel to leak out. Use the following procedure to find air leaks in the system.

1. Disconnect fuel supply and fuel return lines at fuel tank.

2. Drain all fuel from system, including fuel transfer pump, fuel injection pump, and fuel filter(s).

3. Close end of fuel return line using a plug, cap, or a short length of hose, plug, and clamps.

IMPORTANT: Never exceed 103 kPa (1 bar) (15 psi) to prevent damage to fuel system components.

4. Pressurize the system to specification at the fuel supply line using a regulated pressure air source.

Fuel Line Leakage Test—Specification

Pressure .... 69 kPa (0.7 bar) (10 psi)

To Prevent Fuel System Component Damage Never Exceed Maximum—Specification

Pressure .... 103 kPa (1 bar) (15 psi)

5. Apply liquid soap and water solution to all joints and connections in the fuel system and inspect for leaks.

6. Repair any leaks.

7. Connect supply and return lines and prime system.

8. Start machine and let run for approximately 10 minutes.

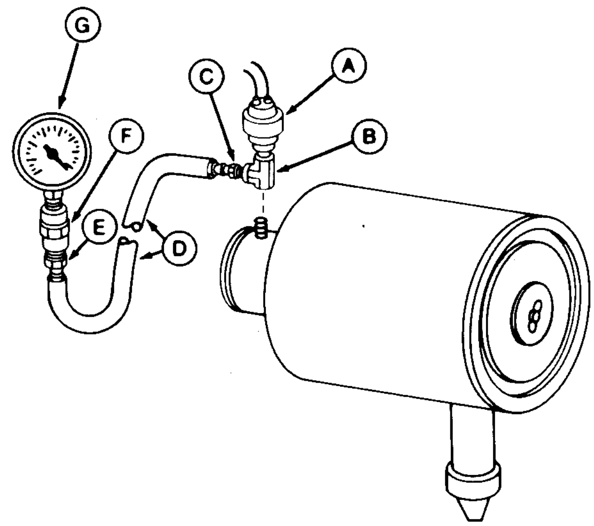
CED,TX08227,3000 –19–25NOV97–1/1

AIR FILTER RESTRICTION INDICATOR SWITCH TEST

SPECIFICATIONS	
Air Filter Restriction Indicator Must Come On At Vacuum	6.2 kPa (62 mbar) (25 in. water)

ESSENTIAL TOOLS
JT05652 (1/8 F NPT x 1/8 F NPT x 1/8 M NPT) Tee
JT03246 (1/4 F NPT x 1/4 F NPT) (Parker No. 0202-4-4) Coupler

SERVICE EQUIPMENT AND TOOLS
1/8 in. Barbed Fitting
1/4 in. Barb Fitting
0—15 kPa (0—150 mbar) (0—60 in. water) Vacuum Gauge



T7350EP

T7350EP –UN–17DEC90

A—Air Filter Restriction Indicator Switch
B—Tee
C—Barbed Fitting
D—Tube
E—Barbed Fitting
F—Coupler
G—Gauge

1. Remove air filter restriction indicator switch (A).
2. Install parts as shown.
3. Start engine.
4. Slowly cover the air cleaner inlet using a piece of heavy cardboard or a board.
5. Check reading on gauge when air filter restriction indicator comes on.

Air Filter Restriction Indicator Must Come On At—Specification

Vacuum .... 6.2 kPa (62 mbar) (25 in. water)

If reading is not within specifications, install a new indicator switch.

TX,9010,UU3269 –19–25OCT97–1/1

AIR INTAKE SYSTEM LEAKAGE TEST

SPECIFICATIONS	
Air Intake System Leakage Test Pressure	14—21 kPa (0.14—0.21 bar) (2—3 psi)

1. Remove air cleaner cover and primary element.

2. Put large plastic bag into and over end of primary element as shown. Install primary element and cover.

T5906AP –UN–23FEB89

CED,TX08227,2881 –19–12NOV97–1/2

3. Remove plug (A) from air intake tube between turbocharger and intake manifold.

4. Connect air pressure regulator to tube using hose and fitting from manifold pressure tester.

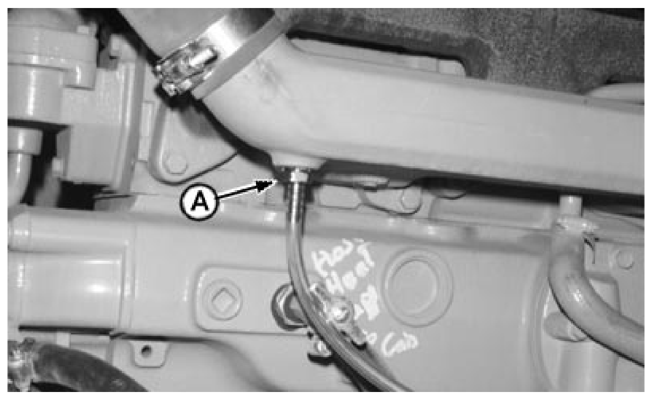
5. Pressurize air intake system to specification. If intake system cannot be pressurized, turn engine slightly to close valves.

Air Intake System Leakage Test—Specification

Pressure .... 14—21 kPa (0.14—0.21 bar) (2—3 psi)

6. Spray soap solution over all connections from the air cleaner to turbocharger and air intake manifold. Check for leaks. Correct all leaks.

7. Apply thread lock and sealer (medium strength) to plug. Install plug into air intake tube and tighten.



T114427B –UN–19MAR98

A—Plug

CED,TX08227,2881 –19–12NOV97–2/2

RADIATOR AIR FLOW TEST

SPECIFICATIONS	
Total Reading Equal To Or Greater Than Voltage	6.00 volts typical new
Engine Speed	Fast Idle

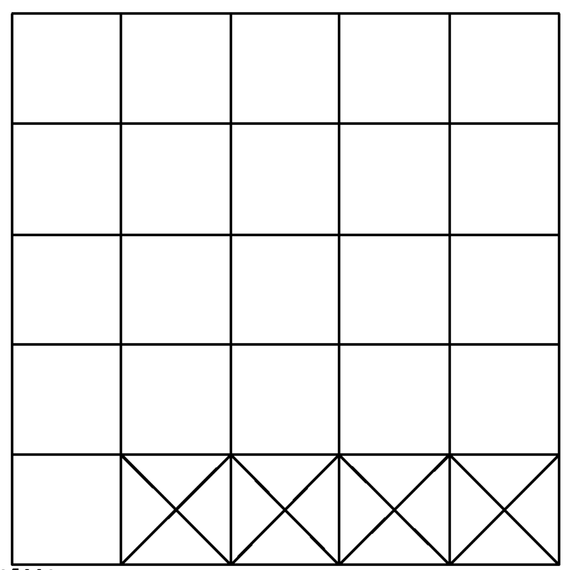
ESSENTIAL TOOLS
JT05529 Air Flow Meter

SERVICE EQUIPMENT AND TOOLS
JT07306 Analog/Digital Multimeter

1. Lower all equipment to the ground.
2. Position all levers and pedals in neutral.
3. Stop the engine.
4. Straighten any bent fins in radiator or oil cooler.

CED,TX14795,4353 –19–17APR98–1/4

5. Divide the surface of trash screen into 25 equal squares starting at the top.
6. Connect air flow meter to analog/digital multimeter. Set multimeter to AC volts.
7. Start engine and run it at fast idle.



T115001

T115001 –UN–22APR98

Continued on next page CED,TX14795,4353 –19–17APR98–2/4

8. Put air flow meter against the trash screen so it is centered in a square and air flow is through meter in the direction of air flow arrow.

9. Record voltage reading for each square that is not marked out with an “X”.

NOTE: Make a copy of the JT05529 Air Flow Meter Test Record shown on the following page. Use to make a record of the voltage readings and machine information.

10. Add the voltage readings. The total of readings must be equal to or greater than the specification.

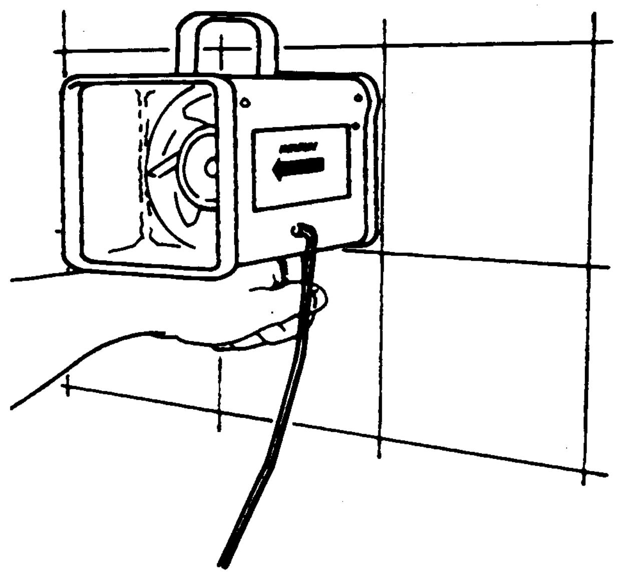
Total Reading Equal To Or Greater Than—Specification

Voltage.. 6.00 volts typical new

Engine—Specification

Speed .... Fast Idle

11. If readings are less than specification, clean the trash screen and external surfaces of oil cooler and radiator. Repeat test.



T6080AH –UN–01NOV88

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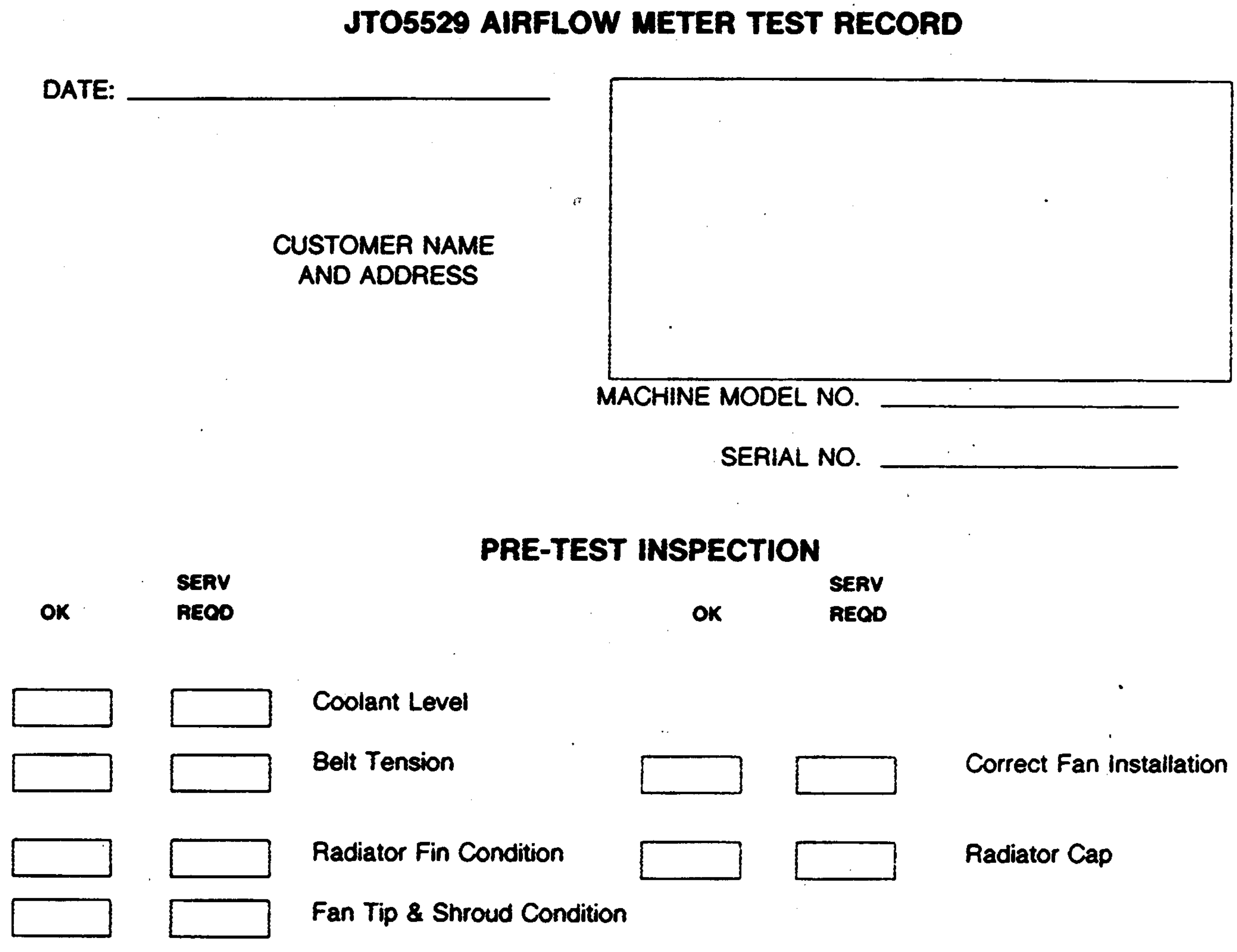


JTO5529 AIRFLOW METER TEST RECORD

DATE: ____________________

CUSTOMER NAME
AND ADDRESS

MACHINE MODEL NO. ____________

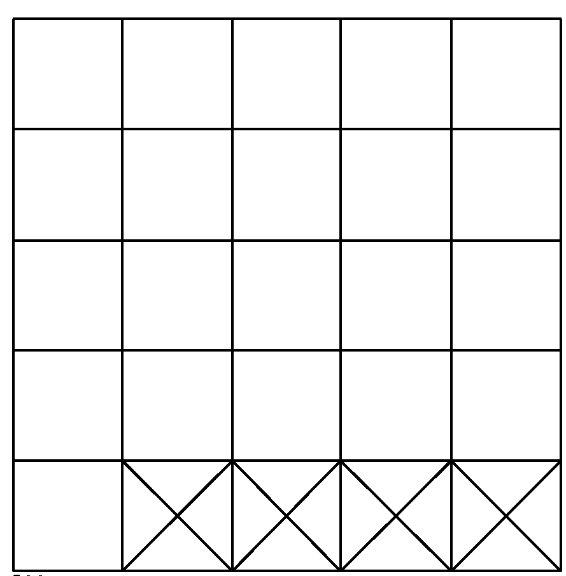
SERIAL NO. ____________

PRE-TEST INSPECTION

OK	SERV REQD		OK	SERV REQD	
☐	☐	Coolant Level			
☐	☐	Belt Tension	☐	☐	Correct Fan Installation
☐	☐	Radiator Fin Condition	☐	☐	Radiator Cap
☐	☐	Fan Tip & Shroud Condition			

T6500AK –19–21MAR89

1. Divide surface of trash screen into 25 equal squares starting at the top.
2. Start engine and run it at fast idle.
3. Put air flow meter against the trash screen so it is centered in a square and air flow is through meter in the direction of air flow arrow.
4. Record voltage reading for each square not marked out with an “X”.
5. The combined total of voltage readings must be equal to or greater than specification.



T115001

T115001 –UN–22APR98

CED,TX14795,4353 –19–17APR98–4/4

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ENGINE POWER TEST USING TURBOCHARGER BOOST PRESSURE

SPECIFICATIONS	
Turbocharger Boost Pressure	172—193 kPa (1.72—1.93 bar) (25—28 psi) using No. 2 fuel and no muffler
Turbocharger Boost[a] Pressure	152—172 kPa (1.52—1.72 bar) (22—25 psi) using No. 1 fuel and no muffler
Rated Engine Speed	1940 rpm
[a]Turbocharger boost pressure is reduced by 7% if using No. 1 fuel.	

SERVICE EQUIPMENT AND TOOLS
JT05801 Clamp-On Electronic Tachometer
JT07248 Turbo Boost Test Kit

This procedure must only be used as a guide to determine engine condition.

1. Connect tachometer. (See JT05801 Clamp-On Electronic Tachometer Installation in this group.)

Continued on next page CED,TX14795,4358 –19–17APR98–1/3

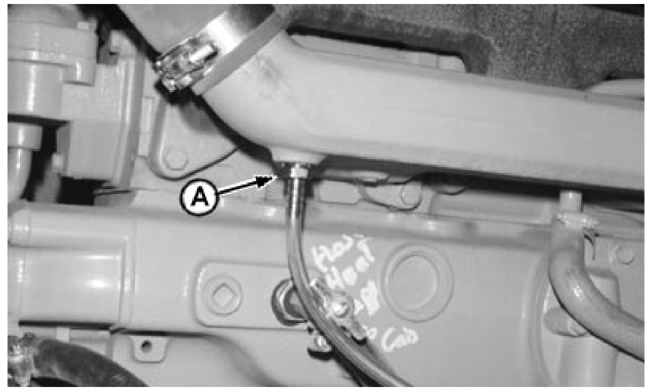
2. Remove plug (A) from tube between turbocharger and intake manifold and install hose and pressure gauge.

3. Warm engine to normal operating temperature.

4. Set engine speed at normal fast idle.

5. Propel machine in rabbit mode at approximately half speed and slowly actuate arm in until power boost mode actuates.

6. Load engine for a pull down of approximately 1940 rpm.



T114427B –UN–19MAR98

IMPORTANT: Pressure gauge accuracy is very critical for this test. DO NOT make adjustments to injection pump fuel delivery on the machine to raise or lower boost pressure.

NOTE: New engines will not develop specified boost pressure. Check after 50 hours of operation.

If using a John Deere Boost Pressure Kit the boost pressure gauge used in the test will lock the reading at the highest boost pressure encountered and will not drop off if boost pressure drops in the course of actuating the arm in function.

7. Watch engine speed as you slowly actuate arm in function over relief to load engine to pull it down below rated engine speed. Repeat this step at least six times.

   Record highest pressure reading at rated engine speed. The gauge will show a pressure increase as engine nears rated engine speed and then drop off.

Turbocharger Boost—Specification

Pressure .... 172—193 kPa (1.72—1.93 bar) (25—28 psi) using No. 2 fuel and no muffler

Continued on next page

Turbocharger Boost[1]—Specification

Pressure .... 152—172 kPa (1.52—1.72 bar) (22—25 psi) using No. 1 fuel and no muffler

Rated Engine—Specification

Speed .... 1940 rpm

8. If boost pressure is low, check the following:

- Wrong fuel
- Restricted air filter elements.
- Restricted fuel filter elements.
- Incorrect injection pump timing.
- Incorrect fast idle adjustment.
- Exhaust manifold leaks.
- Intake manifold leaks.
- Faulty fuel pump.
- Low compression pressure.
- Cam lobe wear (valve clearance).
- Faulty fuel injection nozzles.
- Carbon build-up in turbocharger.
- Turbocharger compressor or turbine wheel rubbing housing.

9. Remove gauge.

   Apply thread lock and sealer (medium strength) to plug.

   Tighten plug.

[1]*Turbocharger boost pressure is reduced by 7% if using No. 1 fuel.*

CED,TX14795,4358 –19–17APR98–3/3

CHAPTER 4

SECTION 9015

ELECTRICAL SYSTEM

BLANK

Group 05
System Information

VISUALLY INSPECT ELECTRICAL SYSTEM

Make the following visual electrical inspection prior to starting the machine 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.

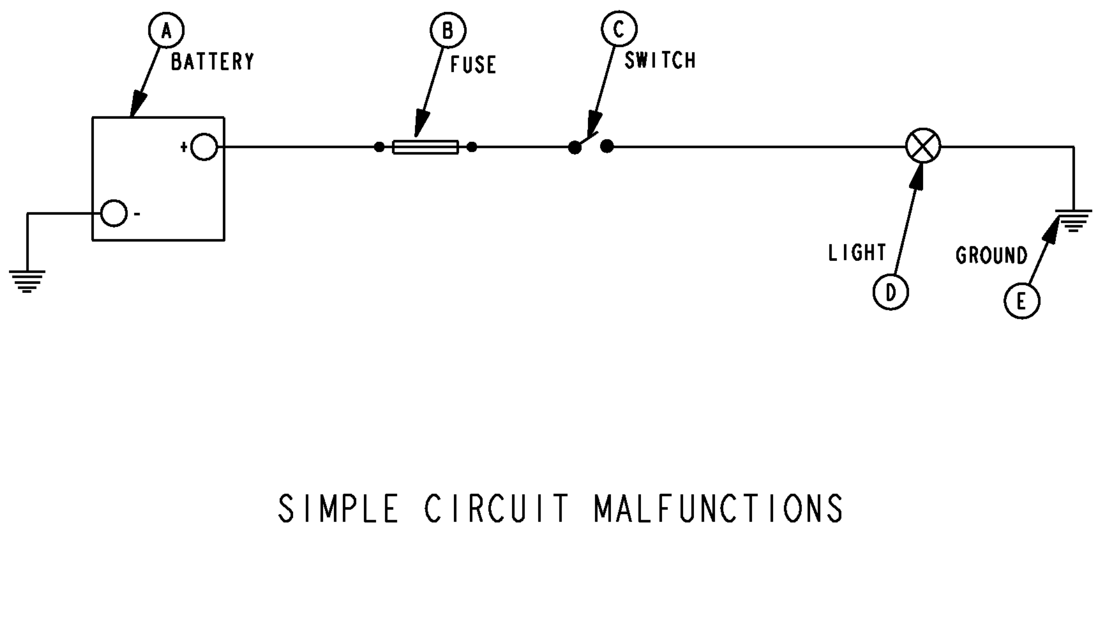
7. If your visual inspection does not indicate the possible malfunction, but your inspection does indicate that the machine can be run, turn the key switch to the IGN position. Try out the accessory circuits, indicator lights, gauge lights. How does each of these components work? Look for sparks or smoke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

CIRCUIT MALFUNCTIONS



T112479 –19–19DEC97

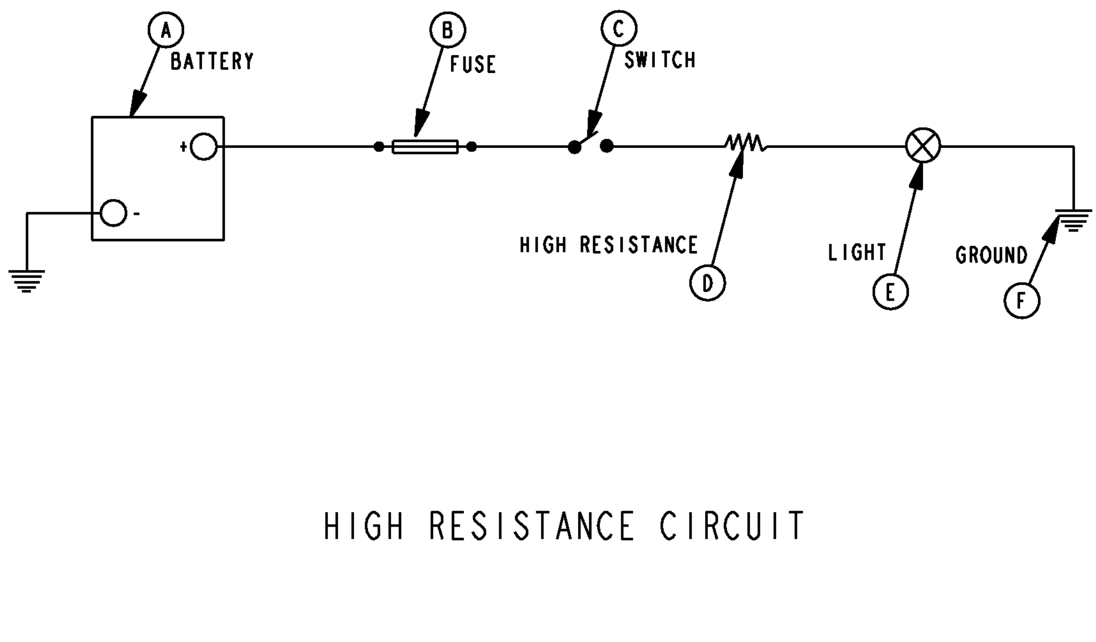
A—Battery
B—Fuse
C—Switch
D—Light
E—Ground

There are four common circuit malfunctions:

1. High-Resistance Circuit
2. Open Circuit
3. Grounded Circuit
4. Shorted Circuit

AG,TX13067,2 –19–03FEB99–1/1

DEFINITION OF CIRCUIT MALFUNCTIONS

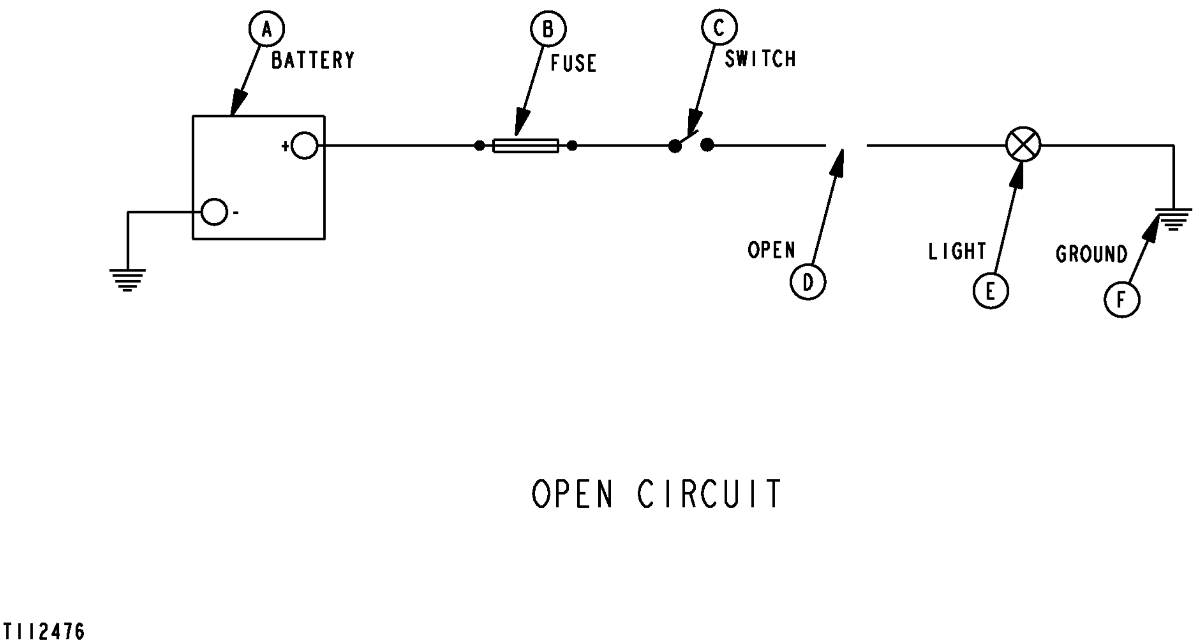


T112473 –19–17DEC97

A—Battery
B—Fuse
C—Switch
D—High Resistance
E—Light
F—Ground

A high resistance circuit has high resistance (D). An example would be a loose or corroded connection that causes a voltage drop and reduces current flow.

Continued on next page AG,TX13067,4 –19–03FEB99–1/5



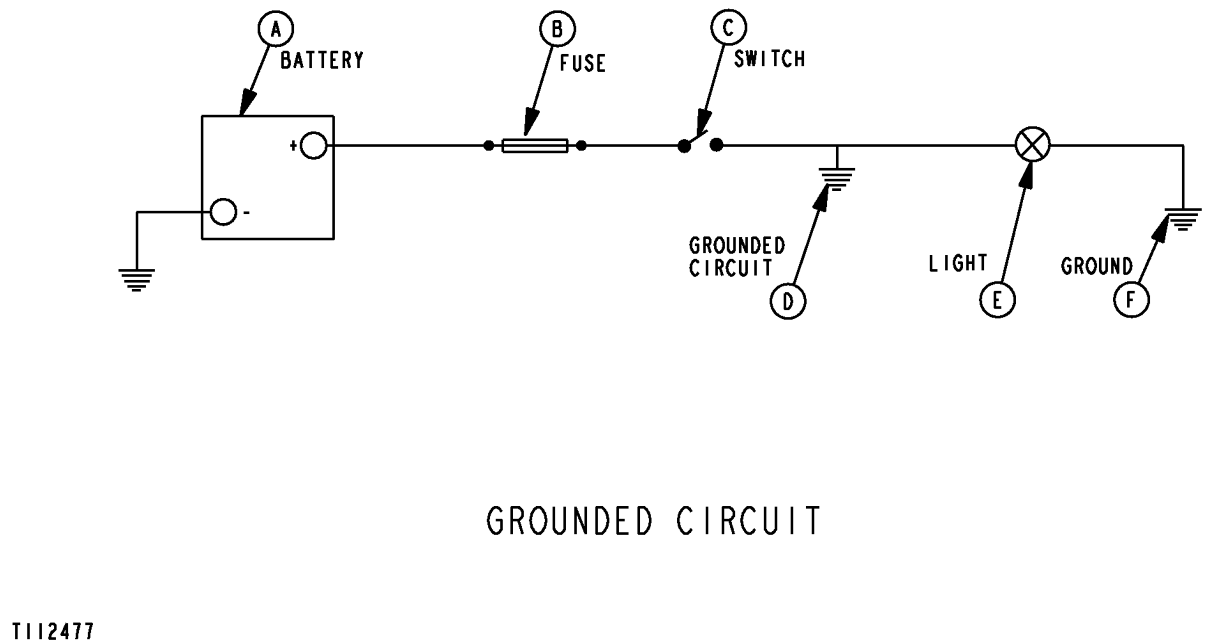
T112476 –19–17DEC97

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

An open circuit has an open (D), such as a broken wire, that prevents current from flowing in the circuit.

Continued on next page

AG,TX13067,4 –19–03FEB99–2/5



T112477 –19–17DEC97

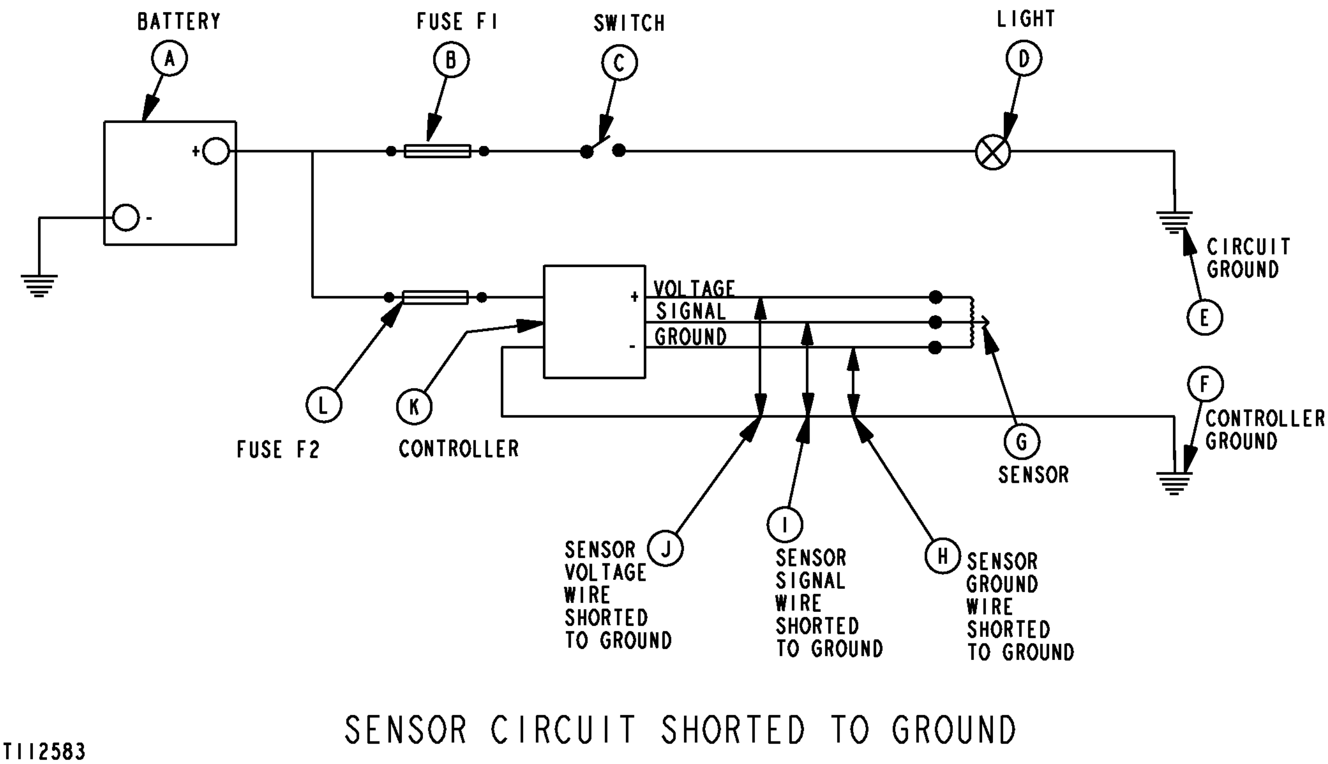
A—Battery
B—Fuse
C—Switch
D—Grounded Circuit
E—Light
F—Ground

A grounded circuit (shorted circuit) has a power wire with its insulation rubbed through contacting the machine frame causing a grounded circuit (D). This provides continuity to the battery ground terminal (shorted to ground).

Continued on next page

AG,TX13067,4 –19–03FEB99–3/5

System Information



T112583 –19–22DEC97

A—Battery
B—Fuse F1
C—Switch
D—Light
E—Circuit Ground
F—Controller Ground
G—Sensor
H—Sensor Ground Wire Shorted To Ground
I—Sensor Signal Wire Shorted To Ground
J—Sensor Voltage Wire Shorted To Ground
K—Controller
L—Fuse F2

A sensor circuit shorted to ground has one or more sensor wires, voltage wire (J), signal wire (I) or ground wire (H) shorted to machine ground or a grounded wire.

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AG,TX13067,4 –19–03FEB99–4/5

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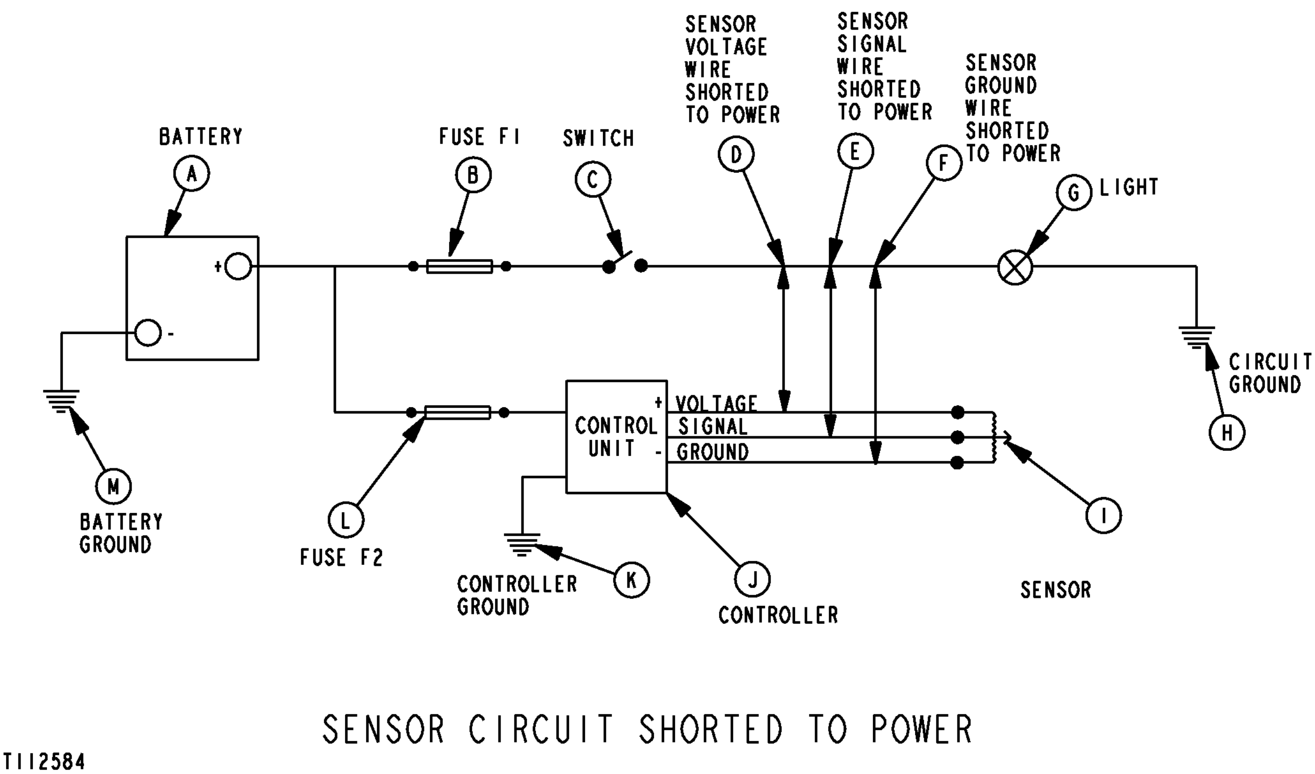


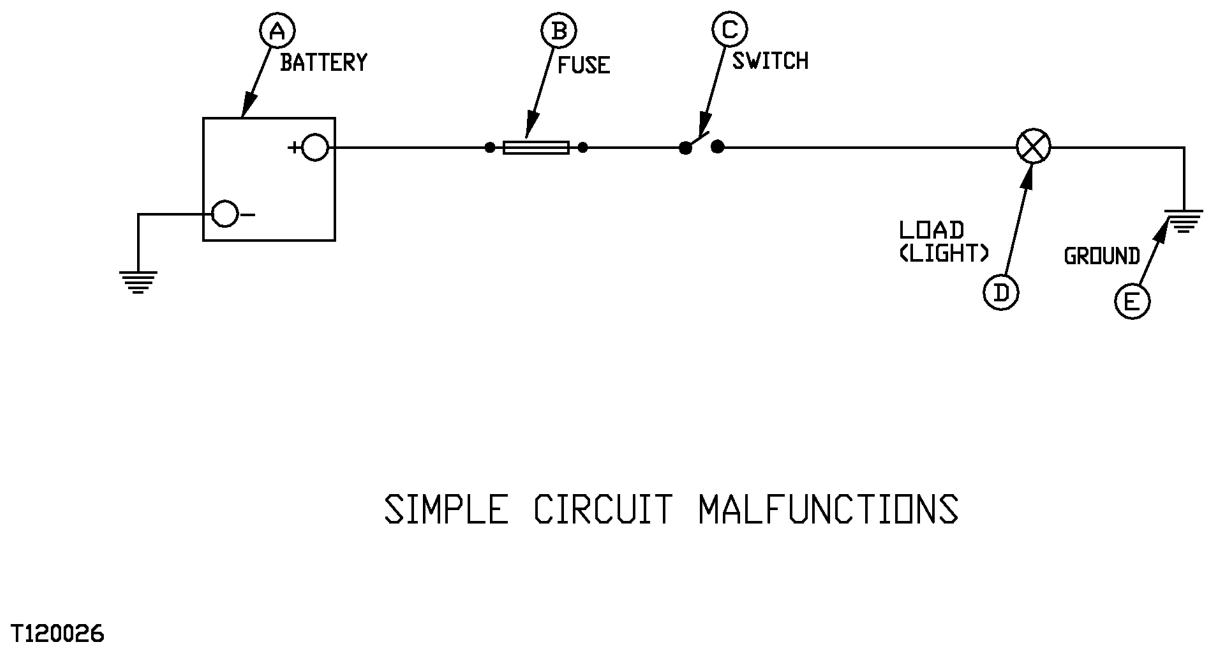
T112584 –19–22DEC97

A—Battery
B—Fuse F1
C—Switch
D—Sensor Voltage Wire Shorted to Power
E—Sensor Signal Wire Shorted to Power
F—Sensor Ground Wire Shorted to Power
G—Light
H—Circuit Ground
I—Sensor
J—Controller
K—Controller Ground
L—Fuse F2
M—Battery Ground

A sensor circuit shorted to power has one or more sensor wires, voltage wire (D), signal wire (E) or ground wire (F) shorted to a power source.

AG,TX13067,4 –19–03FEB99–5/5

LOCATION OF CIRCUIT MALFUNCTIONS



T120026 –19–03FEB99

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A—Battery
B—Fuse
C—Switch
D—Load (Light)
E—Ground

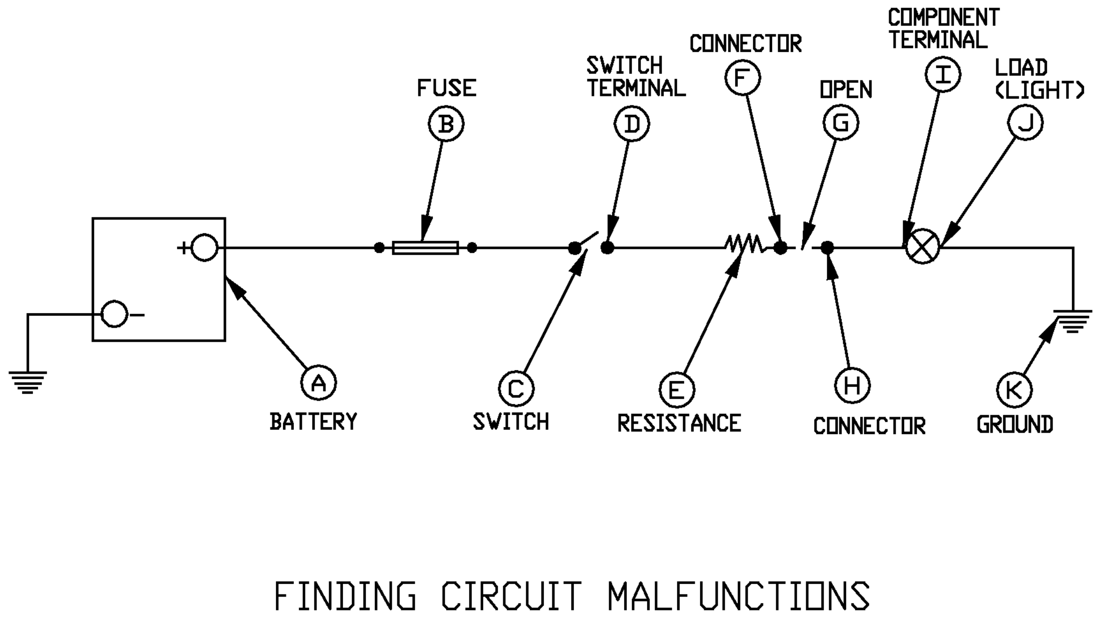
In a simple electrical circuit malfunctions only occur at three locations:

1. Before the controlling switch (C).
2. Between controlling switch (C) and load (D).
3. After the load (D).

Failed components can be diagnosed as circuit malfunctions. Isolate malfunctions to determine the cause of failure.

CED,TX13067,1 –19–03FEB99–1/1

TROUBLESHOOTING CIRCUIT MALFUNCTIONS



T120025

T120025 –19–03FEB99

A—Battery	**D—Switch Terminal**	**G—Open**	**J—Load (Light)**
B—Fuse	**E—Resistance**	**H—Connector**	**K—Ground**
C—Switch	**F—Connector**	**I—Component Terminal**	

High-Resistance Circuit:

1. A high resistance circuit results in slow, dim or no component operation. High resistance can be caused by loose, corroded or oily connector terminals.
2. High resistance can be caused by wire that is too small or has broken strands internally.
3. Troubleshoot a high resistance circuit by measuring voltage between the switch and load with the switch ON.
4. If voltage is low, the malfunction is between the point of measurement and the battery. Continue measuring voltage toward battery until normal voltage is found. Malfunction is between last two points of measurement.
5. If voltage is normal, the malfunction is between point of measurement and circuit ground. Continue measuring voltage toward circuit ground until low voltage is found. Malfunction is between last two points of measurement.

Open Circuit:

1. An open circuit results in no component operation. An open circuit can be caused broken wires, disconnected connector, blown fuse or tripped circuit breaker.
2. Troubleshoot an open circuit by replacing the fuse or resetting the circuit breaker, then measure voltage between the switch and load with the switch ON.

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CED,TX13067,2 –19–03FEB99–1/6

3. If voltage is zero, the malfunction is between the point of measurement and the battery. Continue measuring voltage toward the battery until normal voltage is found. Malfunction is between last two points of measurement.

4. If voltage is normal, the malfunction is between point of measurement and circuit ground. Continue measuring voltage toward circuit ground until zero voltage is found. Malfunction is between last two points of measurement.

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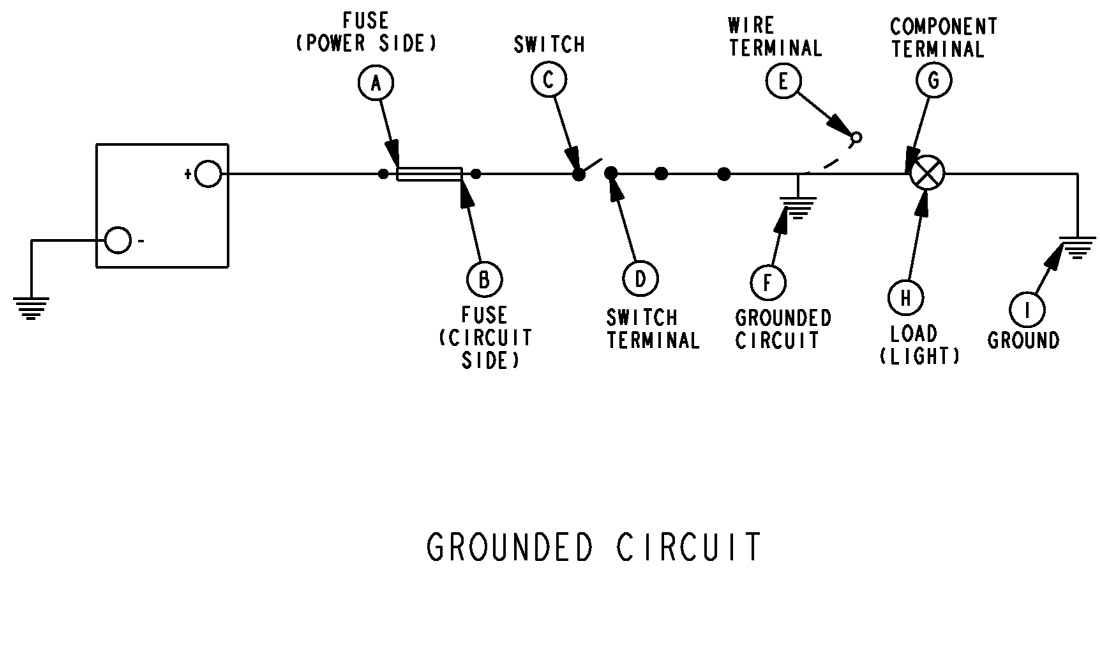
CED,TX13067,2 –19–03FEB99–2/6



T112481 –19–17DEC97

A—Fuse (Power Side)
B—Fuse (Circuit Side)
C—Switch
D—Switch Terminal
E—Wire Terminal
F—Grounded Circuit
G—Component Terminal
H—Load (Light)
I—Ground

Grounded Circuit:

1. A grounded circuit results in no component operation and the fuse blown or circuit breaker open.
2. Troubleshoot a grounded circuit by turning the switch OFF, and checking continuity to frame ground between the fuse circuit side (B) and switch (C).
3. If continuity is measured, the malfunction is between fuse and switch. Inspect wire harness for burned areas or insulation rubbed off a wire.
4. If continuity is not measured, measure continuity to frame ground, between switch terminal (D) and component terminal (G).
5. If continuity is measured, the malfunction is between switch and component. Inspect wire harness for burned areas or insulation rubbed off a wire.

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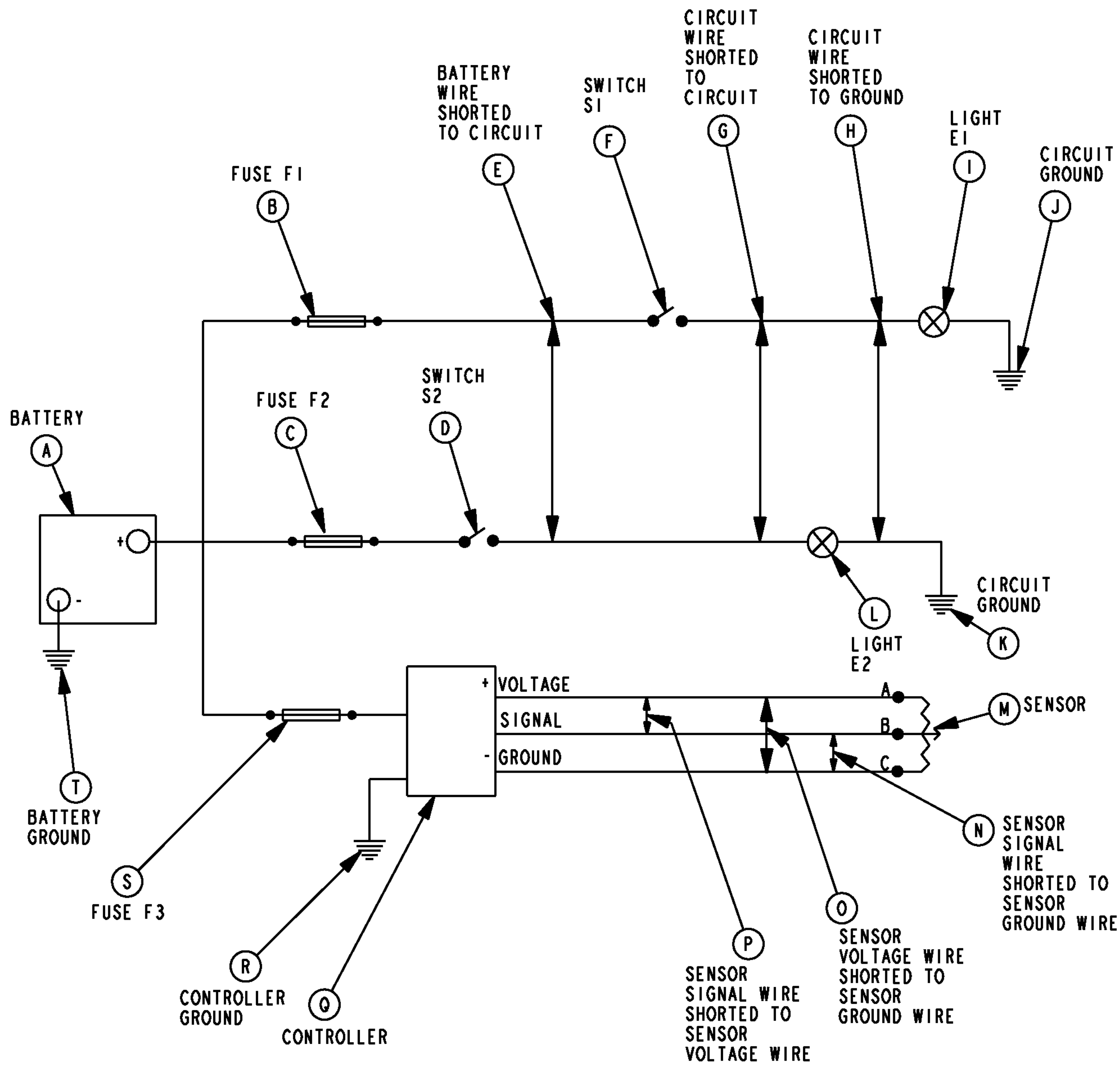

CIRCUIT SHORTED TO POWER
AND
SENSOR CIRCUIT SHORTED TO ITSELF

T112482

T112482 –19–19DEC97

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CED,TX13067,2 –19–03FEB99–4/6

A—Battery
B—Fuse F1
C—Fuse F2
D—Switch S2
E—Battery Wire Shorted To Circuit
F—Switch S1
G—Circuit Wire Shorted To Circuit
H—Circuit Wire Shorted To Ground
I—Light E1
J—Circuit Ground
K—Circuit Ground
L—Light E2
M—Sensor
N—Sensor Signal Wire Shorted To Sensor Ground Wire
O—Sensor Voltage Wire Shorted To Sensor Ground Wire
P—Sensor Signal Wire Shorted To Sensor Voltage Wire
Q—Controller
R—Controller Ground
S—Fuse F3
T—Battery Ground

Circuit Shorted to Power:

1. Complex circuits can fail in numerous ways. Circuits can short to other circuits causing components to operate when unrelated switches are turned ON. In the example if switch S1 (F) is ON and wires are shorted at (G) light E1 (I) and E2 (L) will be ON.
2. Components can operate even when all switches are OFF. In the example if wires are shorted at (E), light E2 will be ON all the time.
3. Components can operate strangely. In the example if wires are shorted at (H), fuse F1 (B) will blow when switch S1 is turned ON. If switch S2 (D) is turned ON, light E2 will operate normally and light E1 may be very dim, or light E1 and E2 may be dim, even if fuse F1 is blown.

Sensor Circuit Shorted to Itself:

1. Sensors are part of a controller circuit. Controllers are used to operate components like engines, transmissions or hydraulic systems. Sensors send information such as speed, pressure or temperature from the component to the controller to monitor operation of the component. If a malfunction occurs in the component, or the sensor circuit the controller no longer receives a “normal” signal. “Abnormal” signals received by a controller mean part of the circuit has a malfunction.
2. Sensor circuits can fail in numerous ways. Service Codes will be generated when sensor circuits fail. Controllers may allow the component to operate normally, may allow operation in a reduced capacity such as a “limp home mode”, or the controller may prevent any component operation.
3. If a sensor circuit signal wire (N) shorts to a ground wire, a “Short to Ground” Service Code may be generated
4. If a sensor circuit voltage wire (O) shorts to ground, a Service Code may or may not be generated, but other sensors connected to the controller will cease to work, because their supply voltage will also be shorted to ground. Erratic operation of the monitor may result.
5. If a sensor circuit voltage wire (P) shorts to the sensor signal wire a Service Code may or may not be generated. The controller may receive a signal indicating the sensor is reading its maximum upper or lower limit.

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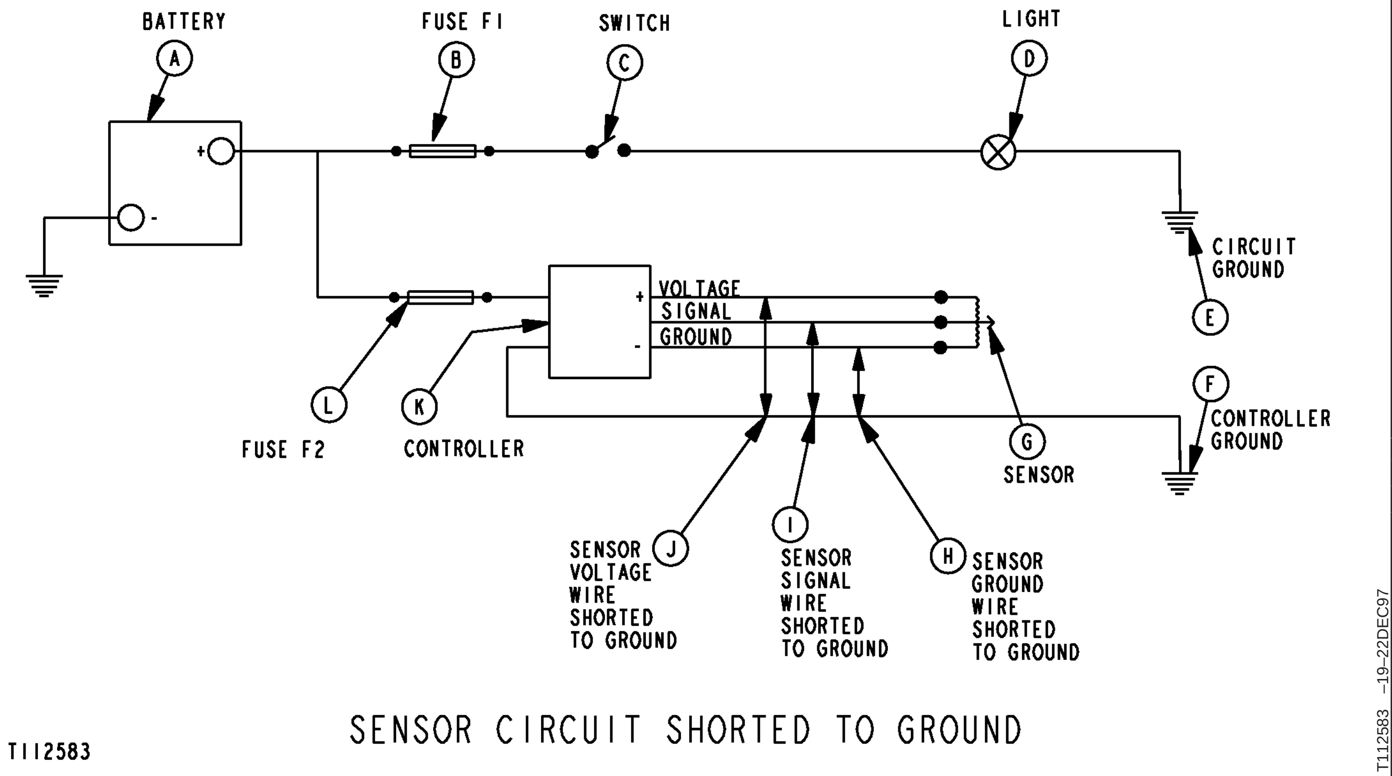
CED,TX13067,2 –19–03FEB99–5/6



A—Battery
B—Fuse F1
C—Switch
D—Light
E—Circuit Ground
F—Controller Ground
G—Sensor
H—Sensor Ground Wire Shorted To Ground
I—Sensor Signal Wire Shorted To Ground
J—Sensor Voltage Wire Shorted To Ground
K—Controller
L—Fuse F2

Sensor Circuit Shorted to Ground:

1. If a sensor circuit ground wire shorts to a machine ground wire (H), a service code probably won’t be generated. Sensor operation may be normal.
2. If a sensor signal wire shorts to a machine ground wire (I), a Short to Ground service code may be generated.
3. If a sensor voltage wire shorts to a machine ground wire (J), a Service Code may be generated. The monitor indicator for the sensor may illuminate.

CED,TX13067,2 –19–03FEB99–6/6

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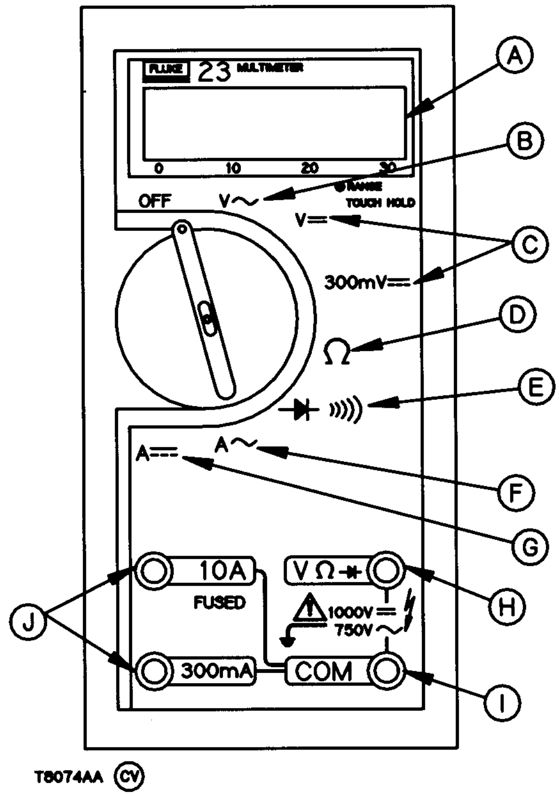
MULTIMETER

The multimeter is an auto-ranging digital display that allows very accurate readings to be taken.

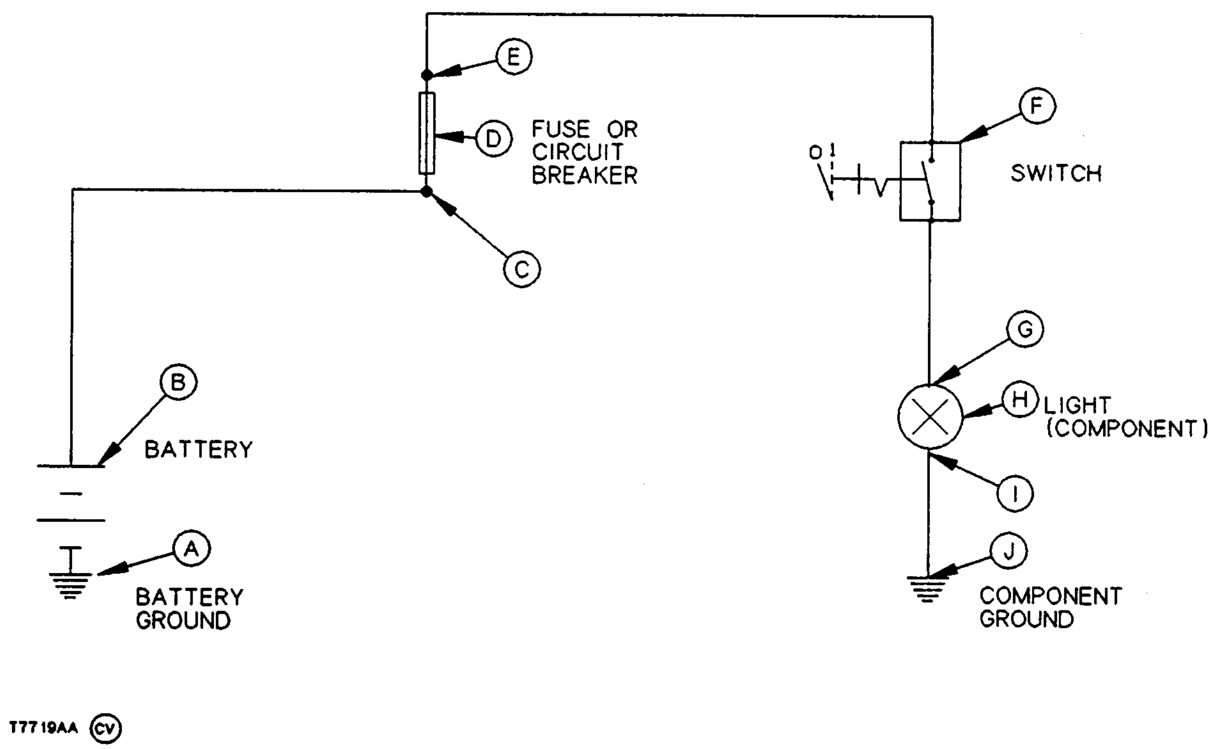


T8074AA –19–03SEP93

A—Display
B—Voltage AC (Alternating Current)
C—Voltage DC (Direct Current)
D—Resistance
E—Diode Test/Continuity
F—Current AC (Alternating Current)
G—Current DC (Direct Current)
H—Voltage, Resistance, Diode/Continuity (Red Lead Input)
I—Ground (Black Lead Input)
J—Current/Amps (Red Lead Input)

TX,9015,MM2916A –19–20MAR96–1/1

SEVEN STEP ELECTRICAL TEST PROCEDURE



T7719AA –19–05MAR92

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

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.

Continued on next page TX,9015,MM2917B –19–01MAY95–1/2

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	
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.

TX,9015,MM2917B –19–01MAY95–2/2

WIRING DIAGRAM, SCHEMATIC, AND COMPONENT LOCATION 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—IF PROVIDED

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.).

T85958 –UN–27FEB90

Continued on next page CED,OUTX466,1361 –19–03FEB99–1/2

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.

NOTE: All System Functional Schematics, Circuit Schematics, and Wiring Diagrams are shown with key switch in the off position.

CONNECTOR END VIEW DIAGRAM—IF PROVIDED

The connector end view diagram is a pictorial end view of the component connectors showing the number of pins in the connector and the wire color and identifier of the wire in every connector. Each component will be identified by the same identification letter/number and description used in the System Functional Schematic Diagram.

CED,OUTX466,1361 –19–03FEB99–2/2

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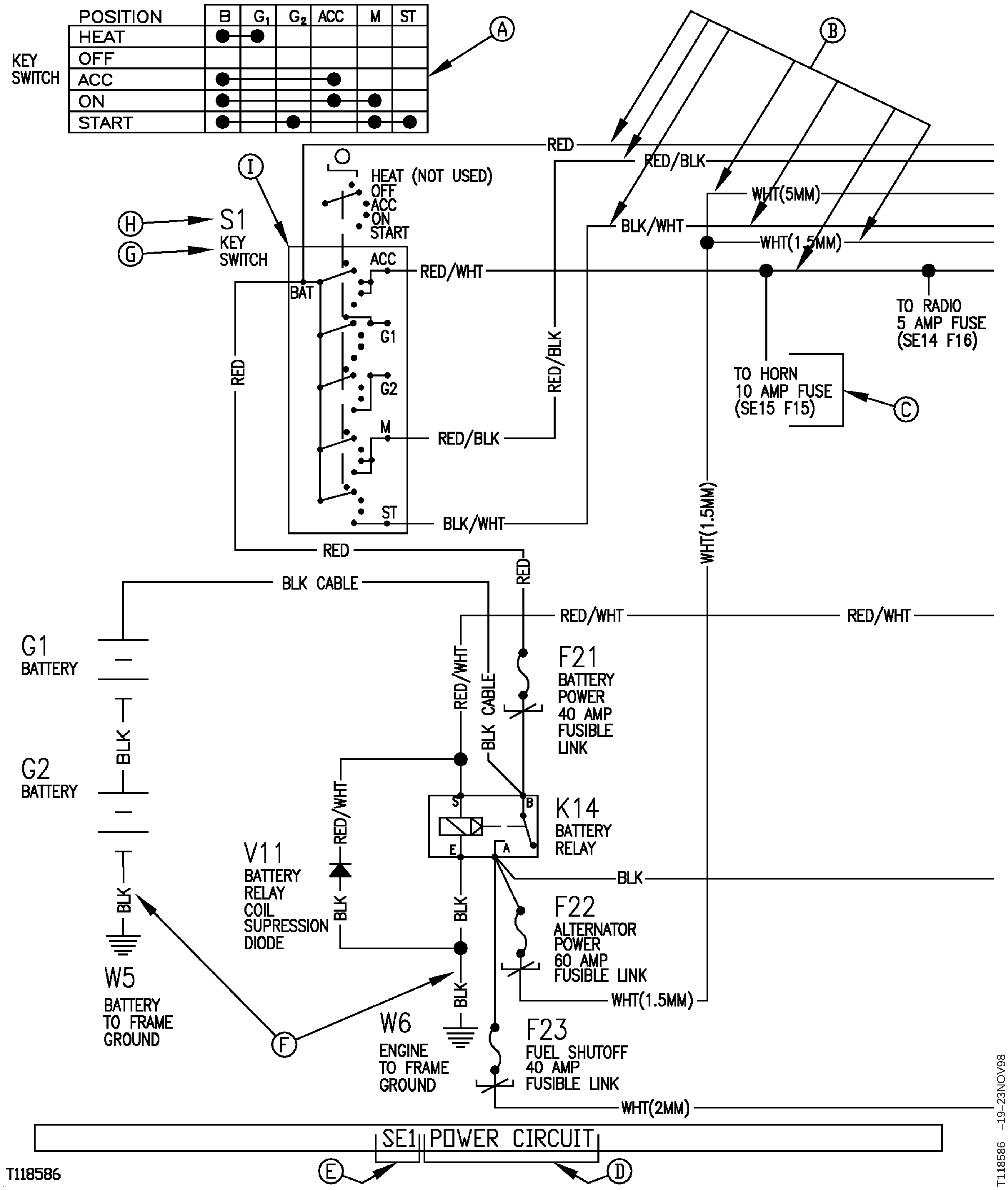
READING A SYSTEM FUNCTIONAL SCHEMATIC DIAGRAM



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CED,OUTX782,7 –19–19NOV98–1/2

System Information

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

The System Functional Schematic Diagram is made up of sections which contain one or more Subsystem Functional Schematics 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. Each Section of the System Functional Schematic is assigned a number (E) and a name (D) that reflects that group of components. The System Functional Schematic is formatted with power supply wires (B) shown across the top of the drawing and ground wires (F) across the bottom. The schematic contains no harness or connector information.

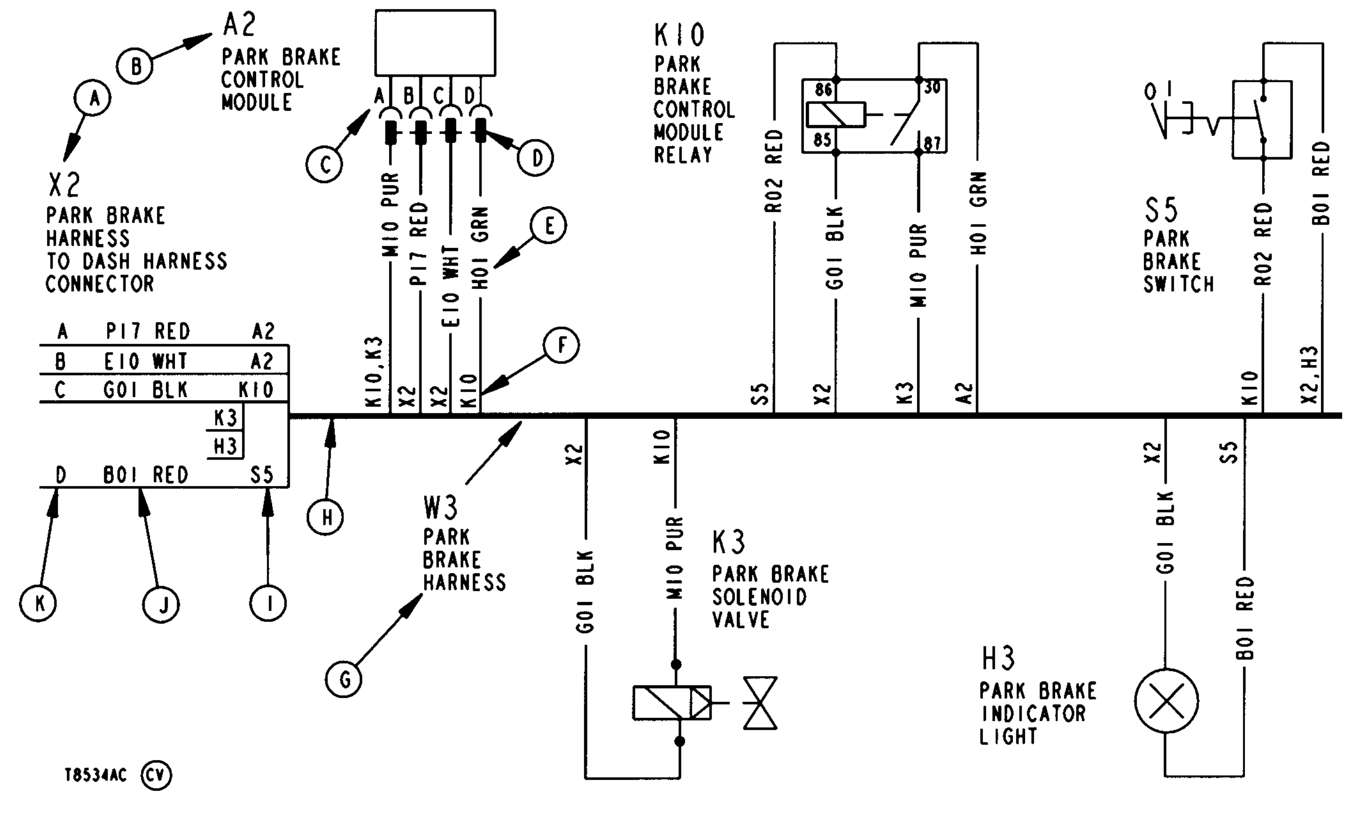
Each electrical component is shown by a schematic symbol (I), the component name (G), and a component identification code (H). A continuity chart (A) is included for the key switch.

Other routing location information (C) is included for reference. In the example shown the Red/Wht wire also is connected to the Horn 10 Amp Fuse which is located on Section 15 of the System Functional Schematic; and the fuse identification number is F10.

The same names and identification codes are used on all machine drawings, the System Functional Schematic, the Harness Component Location Drawing and the Harness Connectors, Wires and Pin Location drawings. Components and connectors can easily be cross-referenced from one drawing to another. See Group 9015-10 for Functional Schematic and Component Location Legend.

CED,OUTX782,7 –19–19NOV98–2/2

READING A WIRING DIAGRAM



T8534AC –19–10AUG95

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.

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Continued on next page

System Information

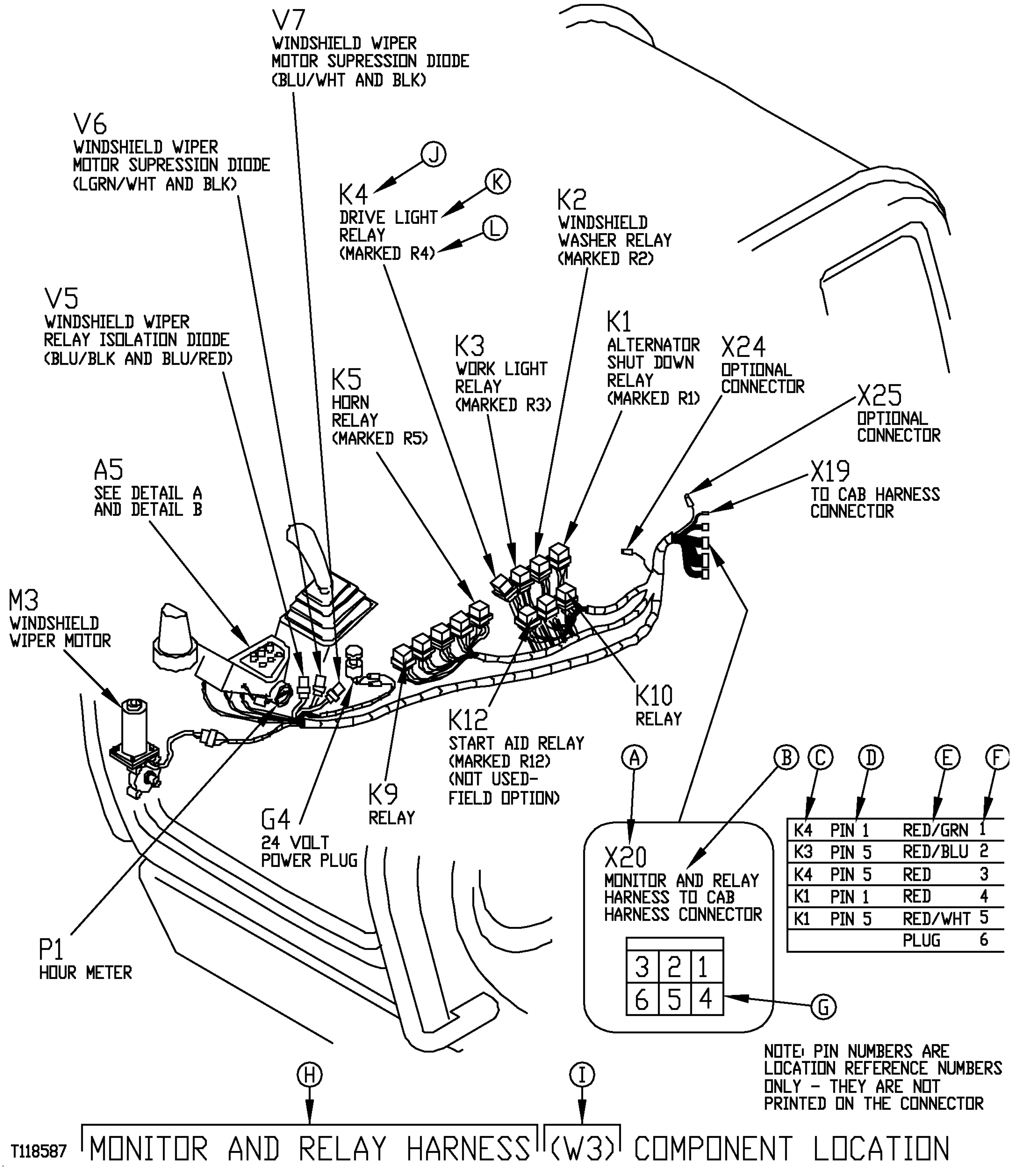
Main harness connectors (A) are identified by a letter/number designation and description (X2 PARK BRAKE HARNESS TO DASH HARNESS CONNECTOR, Etc.). Harness connector description indicates which harnesses connect together. Connector pin numbers or letters (K) are indicated as they are marked on the connector. 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.

CED,OUTX466,1363 –19–15OCT98–2/2

READING A HARNESS COMPONENT LOCATION DIAGRAM

T118587 –19–18MAR99



T118587

TX,9015,MM2920B –19–14DEC98–1/2

A—Mating Harness Connector Identification Number
B—Mating Harness Connector Identification Name
C—Routing Destination of Wire (Shown as Component Identification Number)
D—Pin Number of Harness Connector to Which Wire is Routed
E—Wire Color
F—Pin Number of Harness Connector
G—Front View of Harness Connector
H—Name of Harness
I—Harness Identification Number

NOTE: The same names and identification numbers are used on all machine schematic and harness electrical drawings throughout the Operation and Test Technical Manual so components can easily be cross-referenced from one drawing to another.

The component location by harness drawing is a pictorial representation that shows harness routing, component location and mating harness connector information.

The location of each component that is connected to the harness is shown and identified by its alpha-numeric identification number (J) and component name (K). In the example shown, the component is also identified by an R number (L) that is actually marked on the part.

Each connector that joins one harness to another is identified by an “X” component identification number (A) and a name (B). An end (front) view (G) of the connector is shown. Also, a diagram view of the connector shows connector pin number (F), wire color (E) and destination of each wire (C and D).

In the example shown, X20 Connector connects the Monitor and Relay Harness to the Cab Harness. Pin 1 (F) of the connector contains a Red/Grn wire (E), which is routed to Pin 1 (D) of the connector for K4 (C) Drive Light Relay.

NOTE: Pin numbers are location reference numbers only—they are not printed on the connector.

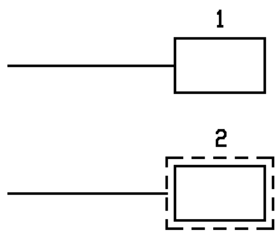
Each wiring harness component location is followed by individual component connector drawings. These drawings show an end (front) view and a diagram view of each connector in the harness that connects to a component.

TX,9015,MM2920B –19–14DEC98–2/2

READING CONNECTOR END VIEW DIAGRAM

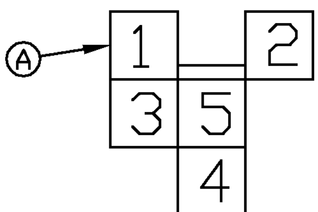
A5
MONITOR CONTROLLER AND DISPLAY (MADE UP OF X10, X11, AND X12)

SEE MONITOR AND RELAY HARNESS (W3) COMPONENT LOCATION DETAIL A



G4
24V POWER PLUG

1	BLK
2	BRN



K1
ALTERNATOR SHUT DOWN RELAY (MARKED R1)

1	RED
2	RED/YEL
3	RED
4	PLUG
5	RED/WHT

K2
WINDSHIELD WASHER RELAY (MARKED R2)

1	BLU/YEL
2	YEL/BLK
3	BLU/YEL
4	PLUG
5	PUR

K3
WORK LIGHT RELAY (MARKED R3)

1	RED/GRN
2	RED/WHT
3	RED/GRN
4	PLUG
5	RED/BLU

B
C
K4
DRIVE LIGHT RELAY (MARKED R4)
E
D

1	RED/GRN
2	RED/BLK
3	RED/GRN
4	PLUG
5	RED

K5
HORN RELAY (MARKED R5)

1	RED/WHT
2	PNK
3	RED/WHT
4	PLUG
5	RED/GRN

K9
WINDSHIELD WIPER RELAY (MOTOR GROUND FOR PARK) (MARKED R9)

1	BLU/YEL
2	GRN/WHT
3	BLK/RED
4	PLUG
5	BLK

K10
PROPEL AUTO IDLE RELAY (MARKED R10)

1	WHT/RED
2	YEL
3	WHT/BLK
4	PLUG
5	BLK

K12
START AID RELAY (MARKED R12)

(NOT USED - FIELD OPTION)

CONNECTORS FOR MONITOR AND RELAY HARNESS (W3)
(HARNESS CONNECTORS - FRONT VIEW SHOWN)

T118588

T118588 –19–18MAR99

Continued on next page

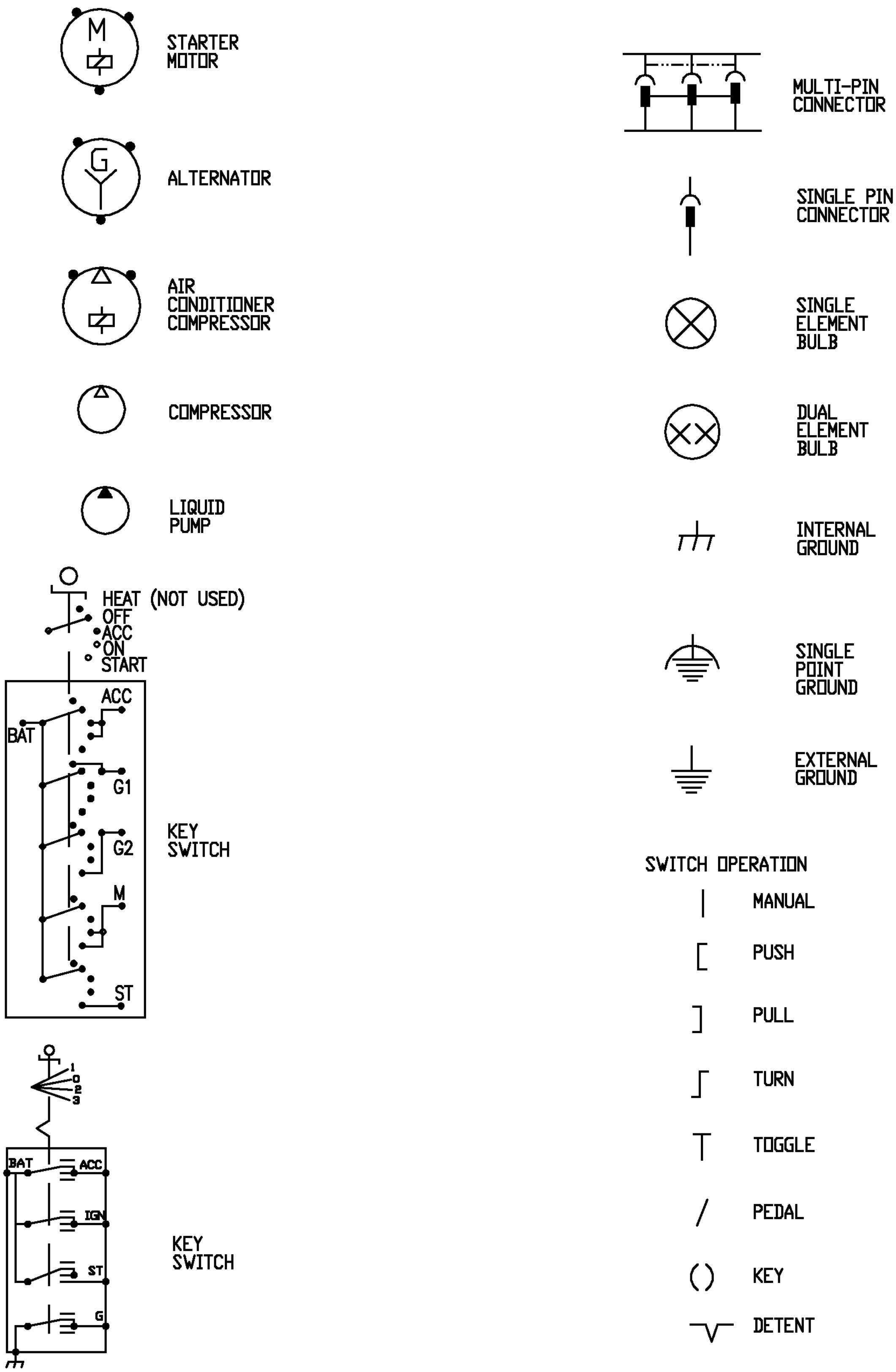
System Information

A—End (Front) View of Connector
B—Component Identification Number
C—Component Name
D—Wire Color
E—Component Marked Number (If Any)

In the preceding example, to see the location of the Red/Grn wire in the harness connector for the K4 Drive Light Relay, refer to the Connector Diagram. This drawing shows the end (front) view of the connector (A), the Component Identification Number (B), the Component Name (C), the Component Marked Number (if any) (E) and the wire color (D).

CED,OUTX782,140 –19–03FEB99–2/2

ELECTRICAL SCHEMATIC SYMBOLS



T120028

T120028 –19–03FEB99

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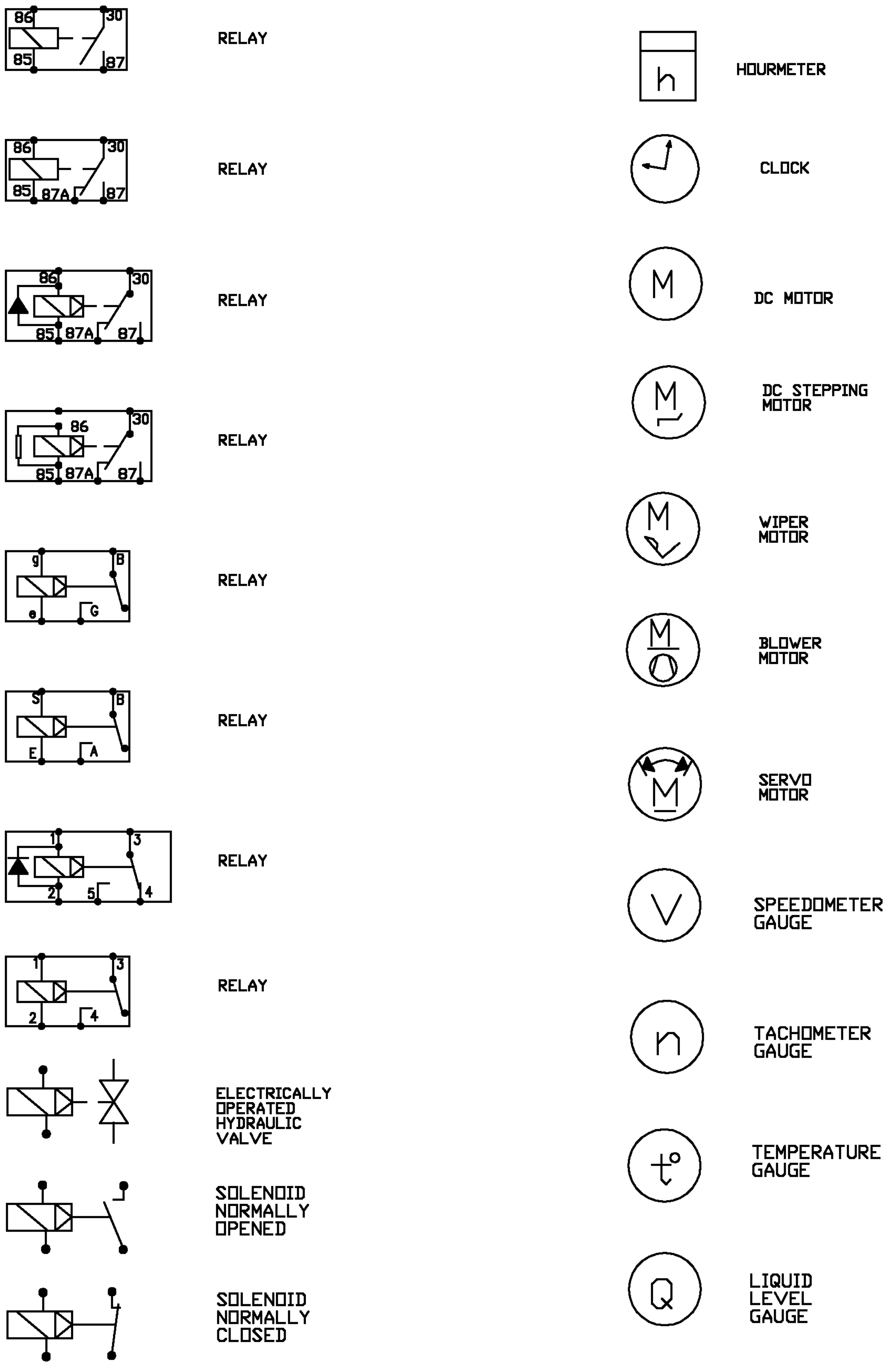

T120029

T120029 –19–03FEB99

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TX,9015,MM2921 –19–26OCT93–2/4

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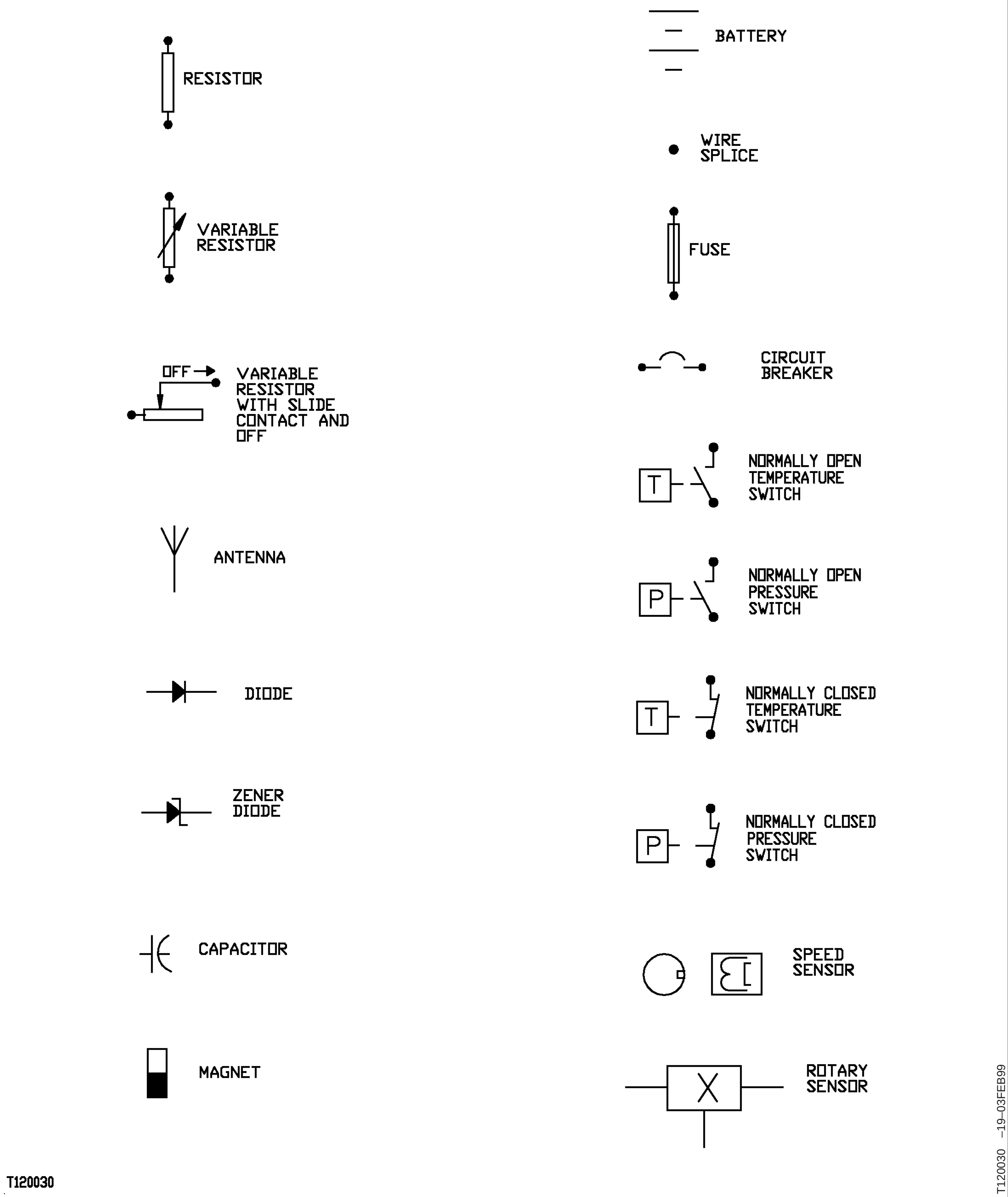

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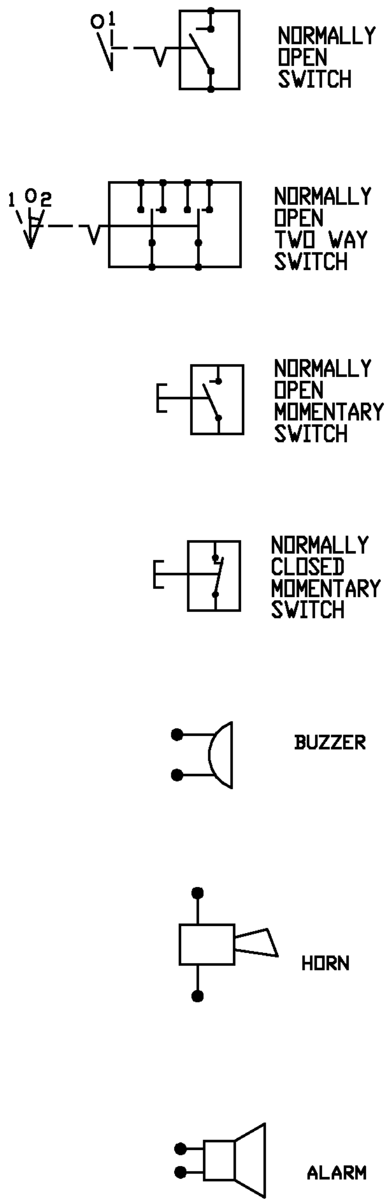


T120031

T120031 –19–22MAR99

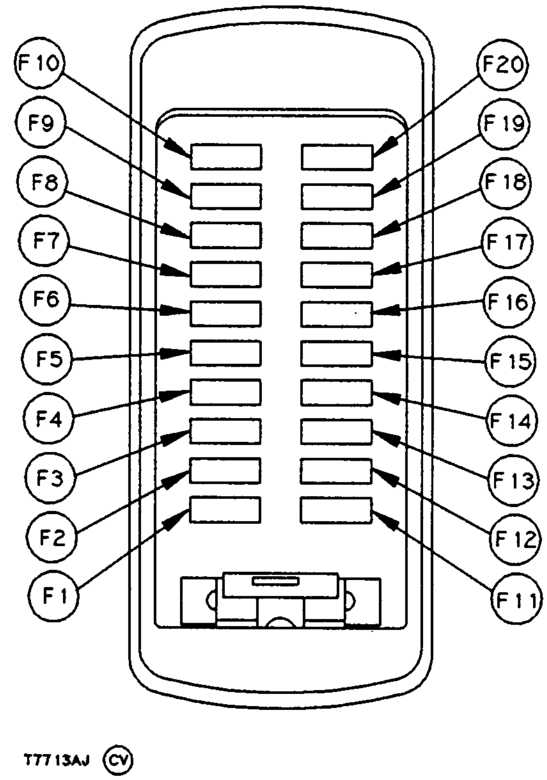
TX,9015,MM2921 –19–26OCT93–4/4

FUSE SPECIFICATIONS

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

NOTE: The "marked" name in parenthesis is the fuse name shown on the fuse block cover.

Fuse block is located behind the operators seat under a fuse block cover.



T7713AJ –UN–06MAR92

F1—Radio and Monitor Controller Backup 5-Amp Fuse (marked Back Up)
F2—Engine and Pump Controller 10-Amp Fuse (marked Controller)
F3—Engine Control (EC) Motor 10-Amp Fuse (marked EC Motor)
F4—Solenoid 5-Amp Fuse (marked Solenoid)
F5—Power On 10-Amp Fuse (marked Pow. On)
F6—Monitor Controller and Display 5-Amp Fuse (marked Sw. Box)
F7—Switched Power 5-Amp Fuse (marked Option 1)
F8—Switched Power 10-Amp Fuse (marked Option 2)
F9—Battery Power 5-Amp Fuse (marked Option 3)
F10—Travel Alarm 5-Amp Fuse (marked Travel)
F11—Work and Drive Lights 20-Amp Fuse (marked Lamp)
F12—Windshield Wiper 10-Amp Fuse (marked Wiper)
F13—Blower Motor 20-Amp Fuse (marked Heater)
F14—Air Conditioner Controller and Relays 5-Amp Fuse (marked Air Con)
F15—Horn 10-Amp Fuse (marked Horn)
F16—Radio 5-Amp Fuse (marked Radio)
F17—Lighter 10-Amp Fuse (marked Lighter)
F18—Dome Light 5-Amp Fuse (marked Room Lamp)
F19—Auxiliary 10-Amp Fuse (marked Auxiliary)
F20—Start Aid 20-Amp Fuse (marked Start Aid) (Not used)

CED,TX02661,227 –19–14DEC98–1/1

FUSE (BLADE-TYPE) COLOR CODES

Amperage Rating	Color
1	Black
3	Violet
4	Pink
5	Tan
7-1/2	Brown
10	Red
15	Light Blue
20	Yellow
25	Natural (White)
30	Light Green

CED,TX14795,4106 –19–22NOV97–1/1

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
R	Resistor	Flame glow plugs, sheathed-element flame glow plugs, glow plugs, heating resistors, NTC resistors, PTC resistors, potentiometers, regulating resistors

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Continued on next page

TX,10,111507 –19–22AUG96–1/2

System Diagrams

Identification Letter	Type	Examples
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,10,111507 –19–22AUG96–2/2

FUNCTIONAL SCHEMATIC AND COMPONENT LOCATION LEGEND

NOTE: A2—Engine and Pump Controller (SE8, W2)

A2 indicates component identification number.

Engine and Pump Controller indicates component name.

SE8 indicates section numbers of SYSTEM FUNCTIONAL SCHEMATIC where component is located.

W2 is the identification number of the COMPONENT LOCATION and HARNESS CONNECTOR (WITH WIRE AND PIN LOCATION) drawings for the component. This would indicate that the Engine and Pump Controller is connected to W2 Cab Harness.

- A1—Radio (SE14, W2)
- A2—Engine and Pump Controller (SE8, W2)
- A3—Air Conditioner Controller (SE17, W9)
- A4—Engine Mode and RPM Control Unit (SE4, W2)
- A5—Monitor Controller and Display (SE5, W3)
- A6—Quick Hitch Control Box (SE19, W2)

- B1—Air Filter Restriction Switch (SE6, W1)
- B2—Fuel Level Switch (SE6, W1)
- B3—Engine Coolant Temperature Switch (SE6, W1)
- B4—Engine Oil Pressure Switch (SE6, W1)
- B5—Hydraulic Oil Level Switch (SE6, W1)
- B6—Engine Coolant Level Switch (SE6, W1)
- B7—Engine Oil Level Switch (SE6, W1)
- B8—Fuel Level Sensor (SE6, W1)
- B9—Engine Coolant Temperature Sensor (SE4, W1)
- B10—Not Used
- B11—Not Used
- B12—Charge Air Temperature Switch (SE6, W1)
- B13—Boom Up Pressure Switch (SE7, W1)
- B14—Dig Pressure Switch (SE7, W1)
- B15—Propel Pressure Switch (SE7, W1)
- B16—Engine Speed (N) Sensor (SE8, W1)
- B17—Engine Control (EC) Sensor (Located Inside Engine Control Motor Housing) (SE7, W1)
- B18—Rear Pump Pressure Sensor (SE7, W1)
- B19—Front Pump Pressure Sensor (SE7, W1)
- B20—Arm In Pressure Sensor (SE7, W1)
- B21—Rear Pump Control Pressure Sensor (SE7, W1)
- B22—Front Pump Control Pressure Sensor (SE7, W1)
- B23—Right Speaker (SE14, W2)
- B24—Left Speaker (SE14, W2)
- B25—High Note Horn (SE15, W1)
- B26—Low Note Horn (SE15, W1)
- B27—Air Conditioner High and Low Pressure Switch (SE17, W9)
- B28—Not Used
- B29—Air Conditioner and Heater Thermistor (SE17, W9)
- B30—Hydraulic Oil Filter Restriction Switch (SE6, W1)
- B31—Not Used
- B32—Overload Alarm Proximity Switch (SE19, W1)
- B33—Overload Alarm Pressure Switch (SE19, W1)
- B34—Auxiliary Hydraulic Control Switch (SE18, W2)

- E1—Left Work Light (SE13, W1)
- E2—Not Used
- E3—Cab Dome Light (SE15, W2)
- E4—Monitor Controller and Display Backlight (SE5, W3)
- E5—Engine RPM Dial Backlight (SE4, W2)
- E6—Right Work Light (SE13, W1)
- E7—Left Cab Drive Light (SE13, W1)
- E8—Right Cab Drive Light (SE13, W1)
- E9—Left Rear Light (SE13, W1)
- E10—Right Rear Light (SE13, W1)

- F1—Radio and Monitor Controller Backup 5 Amp Fuse (marked Back Up) (SE6, W2)
- F2—Engine and Pump Controller 10 Amp Fuse (marked Controller) (SE9, W2)
- F3—Engine Control (EC) Motor 10 Amp Fuse (marked EC Motor) (SE9, W2)
- F4—Solenoid 5 Amp Fuse (marked Solenoid) (SE9, W2)

Continued on next page

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- F5— Power On 10 Amp Fuse (marked Pow. On) (SE3, W2)
- F6—Monitor Controller and Display 5 Amp Fuse (marked Sw. Box) (SE4, W2)
- F7—Switched Power 5 Amp Fuse (marked Option 1) (SE18, W2)
- F8—Switched Power 10 Amp Fuse (marked Option 2) (SE18, W2)
- F9—Battery Power 5 Amp Fuse (marked Option 3) (SE18, W2)
- F10—Travel Alarm 5 Amp Fuse (marked Option 1) (SE18, W2)
- F11—Work and Drive Lights 20 Amp Fuse (marked Lamp) (SE13, W2)
- F12—Windshield Wiper 10 Amp Fuse (marked Wiper) (SE12, W2)
- F13—Blower Motor 20 Amp Fuse (marked Heater) (SE16, W2)
- F14—Air Conditioner Controller and Relays 5 Amp Fuse (marked Heater) (SE17, W2)
- F15—Horn 10 Amp Fuse (marked Horn) (SE15, W2)
- F16—Radio 5 Amp Fuse (marked Radio) (SE14, W2)
- F17—Lighter 10 Amp Fuse (marked Lighter) (SE15, W2)
- F18—Dome Light 5 Amp Fuse (marked Room Lamp) (SE15, W2)
- F19—Auxiliary 10 Amp Fuse (marked Auxiliary) (SE18, W2)
- F20—Start Aid 20 Amp Fuse (marked Start Aid) (SE2, W2)
- F21—Battery Power 40 Amp Fusible Link (SE1, W1)
- F22—Alternator Power 60 Amp Fusible Link (SE1, W1)
- F23—Fuel Shutoff 40 Amp Fusible Link (SE1, W1)
- F24—Quick Hitch 5 Amp Fuse (SE19, W2)

- G1—Battery (SE1, W1)
- G2—Battery (SE1, W1)
- G3—Alternator (SE3, W1)
- G4—24 Volt Power Plug (SE15, W3)
- G5—24 Volt Slave Receptacle (SE1, W1)

- H1—Dig Mode Indicator Light (SE5, W3)
- H2—Grading Mode Indicator Light (SE5, W3)
- H3—Precision Mode Indicator Light (SE5, W3)
- H4—Attachment Mode Indicator Light (SE5, W3)
- H5—High Power Mode Indicator Light (SE4, W3)
- H6—Economy Mode Indicator Light (SE4, W3)
- H7—Auto Idle Mode Indicator Light (SE4, W3)
- H8—Monitor Controller and Display Alarm (SE5, W3)
- H9—Overload Alarm (SE19,W2)
- H10—Travel Alarm (SE10, W1)
- H11—Spare Indicator Light (SE4, W3)
- H12—Hydraulic Oil Level Indicator Light (SE4, W3)
- H13—Fuel Level Indicator Light (SE4, W3)
- H14—Air Filter Restriction Indicator Light (SE4, W3)
- H15—Charge Air Temperature Indicator Light (SE4, W3)
- H16—Engine Coolant Temperature Indicator Light (SE4, W3)
- H17—Engine Oil Pressure Indicator Light (SE4, W3)
- H18—Alternator Voltage Indicator Light (SE4, W3)
- H19—Engine Oil Level Indicator Light (SE4, W3)
- H20—Engine Coolant Level Indicator Light (SE4, W3)
- H21—Hydraulic Oil Filter Restriction Light (SE5, W3)
- H22—Quick Hitch Alarm (SE19, W2)
- H23—Quick Hitch Indicator Light (SE19, W2)

- K1—Alternator Shut Down Relay (Marked R1) (SE3, W3)
- K2—Windshield Washer Relay (Marked R2) (SE11, W3)
- K3—Work Light Relay (Marked R3) (SE13, W3)
- K4—Drive Light Relay (Marked R4) (SE13, W3)
- K5—Horn Relay (Marked R5) (SE15, W3)
- K6—Windshield Wiper Relay (Motor Ground and Intermittent) (Marked R6) (SE11, W3)
- K7—Windshield Wiper Relay (Wiper Run) (Marked R7) (SE12, W3)
- K8—Windshield Wiper Relay (Hold for Park) (Marked R8) (SE12, W3)
- K9—Windshield Wiper Relay (Motor Ground for Park) (Marked R9) (SE2, W3)
- K10—Propel Auto Idle Relay (Marked R10) (SE7, W3)
- K11—Starter Protection Relay (Marked R11) (SE2, W3)

Continued on next page
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- K12—Start Aid Relay (Marked R12)
- K13—Starter Relay (SE2, W1)
- K14—Battery Relay (SE1, W1)
- K15—Fuel Shutoff Relay (SE3, W1)
- K16—Overload Alarm Relay (SE19, W1)
- K17—Not Used
- K18—Not Used
- K19—Not Used
- K20—Not Used
- K21—Not Used
- K22—Not Used
- K23—Not Used
- K24—Air Conditioner Blower Motor and Main Power (Low Speed) Relay (SE17, W9)
- K25—Air Conditioner Compressor Clutch Relay (SE17, W9)
- K26—Air Conditioner Blower Motor (Low Medium Speed) Relay (SE17, W9)
- K27—Air Conditioner Blower Motor (Medium Speed) Relay (SE17, W9)
- K28—Air Conditioner Blower Motor (High Speed) Relay (SE17, W9)

- M1—Starter (SE2, W1)
- M2—Engine Control (EC) Motor (SE8, W1)
- M3—Windshield Wiper Motor (SE11, W3)
- M4—Windshield Washer Motor (SE11, W1)
- M5—Heater Blower Motor (Without Air Conditioner) (SE16, W2)
- M6—Air Conditioner and Heater Blower Motor (SE17, W9)
- M7—Not Used
- M8—Not Used
- M9—Air Conditioner Internal and External Cab Air Servomotor (SE17, W9)
- M10—Air Conditioner Blower Port Change Servomotor (SE17, W9)
- M11—Air Conditioner Air Mixer Servomotor (SE17, W9)

- P1—Hour Meter (SE5, W3)
- P2—Engine Coolant Temperature Gauge (SE4, W3)
- P3—Fuel Gauge (SE4, W3)

- R1—Not Used
- R2—Heater Blower Motor Dropping Resistor Block (Without Air Conditioner) (SE16, W2)
- R3—Not Used
- R4—Engine Coolant Temperature Gauge Resistor (150 ohms) (SE5, W3)
- R5—Fuel Gauge Resistor (220 ohms) (SE5, W3)
- R6—Alternator Excitation Resistor (SE3, W2)
- R7—Not Used
- R8—Not Used
- R9—Not Used
- R10—Engine RPM Dial (SE4, W2)
- R11—Air Conditioner and Heater Blower Motor Dropping Resistor Block (SE17, W9)

- S1—Key Switch (SE1, W2)
- S2—Horn Switch (SE15, W2)
- S3—Dome Light Switch (SE15, W2)
- S4—Heater Blower Motor Switch (Without Air Conditioner) (SE16, W2)
- S5—Fluid Level Check Switch (SE5, W3)
- S6—Buzzer Stop Switch (SE5, W3)
- S7—Work Mode Selection Switch (SE5, W3)
- S8—Propel Speed Change Switch (SE5, W3)
- S9—Wiper Speed Switch (SE5, W3)
- S10—Drive and Work Light Switch (SE5, W3)
- S11—Economy (E) Mode Switch (SE4, W2)
- S12—High Power (HP) Mode Switch (SE4, W2)
- S13—Auto Idle Switch (SE5, W3)
- S14—Windshield Wiper Enable Switch (SE4, W2)
- S15—Windshield Washer Switch (SE5, W3)
- S16—Learning Switch (SE9, W2)
- S17—Travel Alarm Cancel Switch (SE10, W2)
- S18—Start Aid Switch (SE2, W2)
- S19—Power Boost Switch (SE9, W2)
- S20—Rear Lights Switch (SE13, W2)
- S21—Quick Hitch Switch (SE12, W2)

- V1—Start Aid Diode (SE2, W1)
- V2—Alternator Shut Down Relay Isolation Diode (SE3, W2) (Red/Wht and Red/Blk)
- V3—Switched Power Fuse (F8) Suppression Diode (SE18, W2) (Blk and Red)
- V4—Propel Auto Idle Relay (marked R10) Isolation Diode (SE7, W2) (Wht/Blk and Yel)

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- V5—Windshield Wiper Relay (marked R8) Isolation Diode (SE12, W3) (Blu/Blk and Blu/Red)
- V6—Windshield Wiper Motor Suppression Diode (SE11, W3) (Blk and LGrn/Wht)
- V7—Windshield Wiper Motor Suppression Diode (SE11, W3) (Blk and Blu/Wht)
- V8—Fuel Shutoff Solenoid Hold-In Coil Suppression Diode (SE3, W2) (Brn/Blk and Blk)
- V9—Start Relay Coil Suppression Diode (SE2, W2) (Yel/Grn and Blk/Wht)
- V10—Fuel Shutoff Solenoid Pull-In Coil Suppression Diode (SE3, W2) (Red/Blk and Blk)
- V11—Battery Relay Coil Suppression Diode (SE1, W1) (Blk and Red/Wht)

- W1—Engine and Frame Harness
- W2—Cab Harness
- W3—Monitor and Relay Harness
- W4—Radio Antenna (SE14, W2)
- W5—Battery to Frame Ground (W1)
- W6—Engine to Frame Ground (W1)
- W7—Cab to Frame Ground (W2)
- W8—Starter to Frame Ground (SE2, W1)
- W9—Air Conditioner Harness

- X1—Diagnostic Connector (SE9, W2)
- X2—Learning Switch Connector (SE9, W2)
- X3—Attachment Pressure Switch Connector (SE9, W2)
- X4—Accel Connector (SE8, W2)
- X5—Optional Connector (SE18, W2)
- X6—Auxiliary Connector (SE18, W2)
- X7—Optional Right Speaker Connector (SE14, W2)
- X8—Engine and Frame Harness to Cab Harness Connector (W1, W2)
- X9—Engine and Frame Harness to Cab Harness Connector (W1, W2)
- X10—Monitor Controller and Display Connector (20-Pin) (W3)
- X11—Monitor Controller and Display Connector (16-Pin) (W3)
- X12—Monitor Controller and Display Connector (12-Pin) (W3)
- X13—Engine and Pump Controller Connector (26-Pin) (W2)
- X14—Engine and Pump Controller Connector (16-Pin) (W2)
- X15—Engine and Pump Controller Connector (22-Pin) (W2)
- X16—Air Conditioner Harness to Cab Harness Connector (SE17, W2, W9)
- X17—Air Conditioner Controller Connector (16-Pin) (SE17, W9)
- X18—Air Conditioner Controller Connector (12-Pin) (SE17, W9)
- X19—Monitor and Relay Harness to Cab Harness Connector (2-Pin) (W2, W3)
- X20—Monitor and Relay Harness to Cab Harness Connector (6-Pin) (W2, W3)
- X21—Monitor and Relay Harness to Cab Harness Connector (12-Pin) (W2, W3)
- X22—Monitor and Relay Harness to Cab Harness Connector (16-Pin) (W2, W3)
- X23—Monitor and Relay Harness to Cab Harness Connector (8-Pin) (W2, W3)
- X24—Optional Connector (W3)
- X25—Optional Connector (W3)
- X26—Engine and Frame Harness to Cab Harness Connector (W1, W2)
- X27—Auxilary Power Terminal Strip (SE8, W1, W2)
- X28—Rear Light Switch Harness to Rear Light Harness Connector (SE13, W1)

- Y1—Air Conditioner Compressor Clutch (SE17, W1 and W9)
- Y2—Quick Hitch Solenoid (SE19, W1)
- Y3—Not Used
- Y4—Start Aid Solenoid (SE2, W1)
- Y5—Power Boost Proportional Solenoid (SE7, W1)
- Y6—Propel Speed Change Proportional Solenoid (SE8, W1)
- Y7—Fuel Shutoff Solenoid (SE3, W1)
- Y8—Speed Sense Proportional Solenoid (SE7, W1)
- Y9—Arm Regenerative Proportional Solenoid (SE7, W1)

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SYSTEM FUNCTIONAL SCHEMATIC SECTION LEGEND

NOTE: SE1—Power Circuit

SE1 indicates section number of System Functional Schematic where circuit is located.

Power Circuit indicates circuit name.

- SE1—Power Circuit
- SE2—Starting Circuit
- SE3—Charging and Fuel Shut-Off Circuit
- SE4—Monitor Controller and Display Circuit
- SE5—Monitor Controller and Display Circuit
- SE6—Monitor Controller and Display Circuit
- SE7—Engine and Pump Controller Circuit
- SE8—Engine and Pump Controller Circuit
- SE9—Engine and Pump Controller Circuit
- SE10—Travel Alarm Circuit
- SE11—Windshield Wiper and Washer Circuit
- SE12—Windshield Wiper and Washer Circuit
- SE13—Work and Drive Light Circuit
- SE14—Radio Circuit
- SE15—Accessory Circuit
- SE16—Not Used
- SE17—Heater and Air Conditioner Circuit
- SE18—Optional Connector Circuit
- SE19—Overload Alarm And Quick Hitch Circuit

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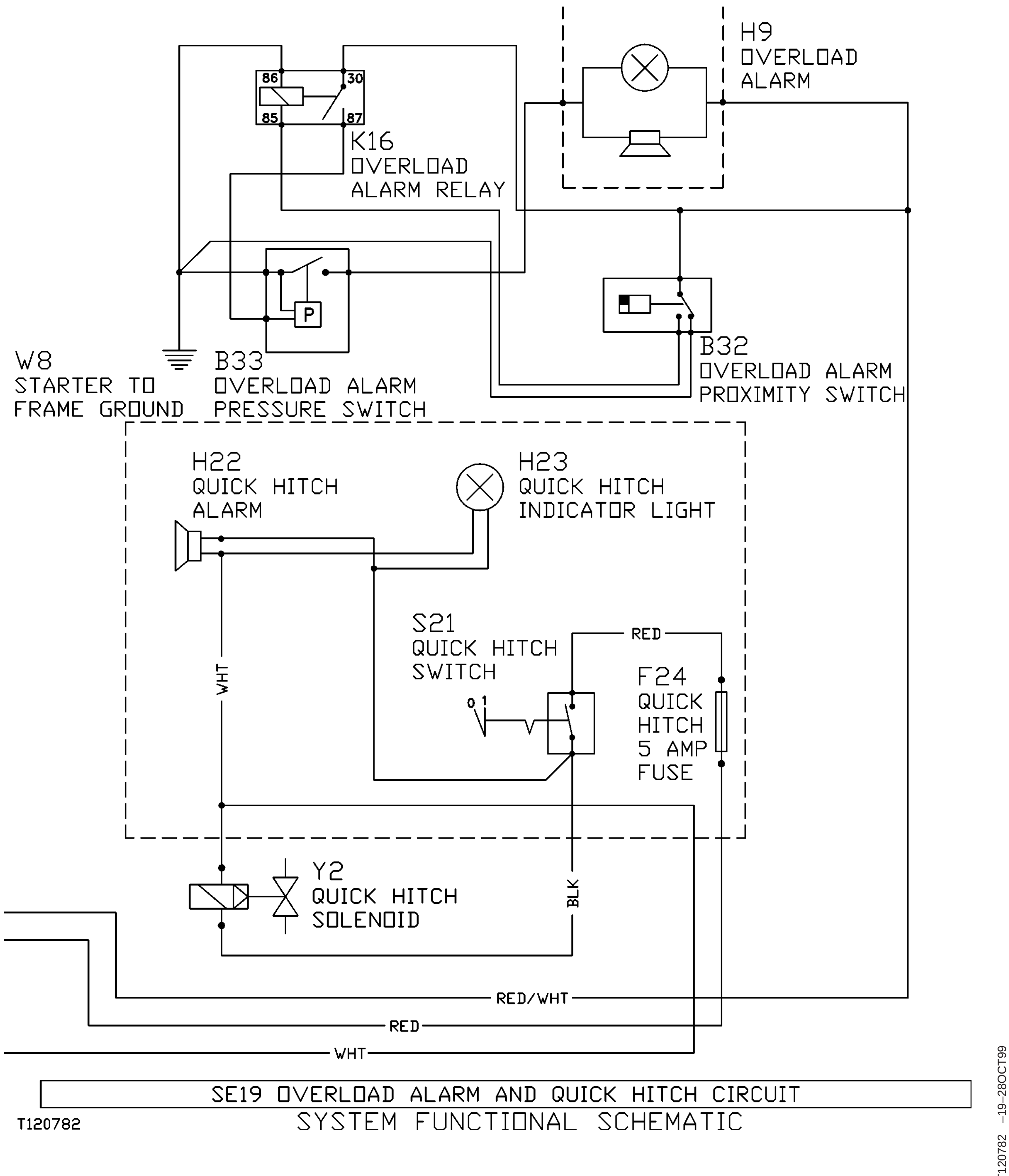
SYSTEM FUNCTIONAL SCHEMATIC (SE19)



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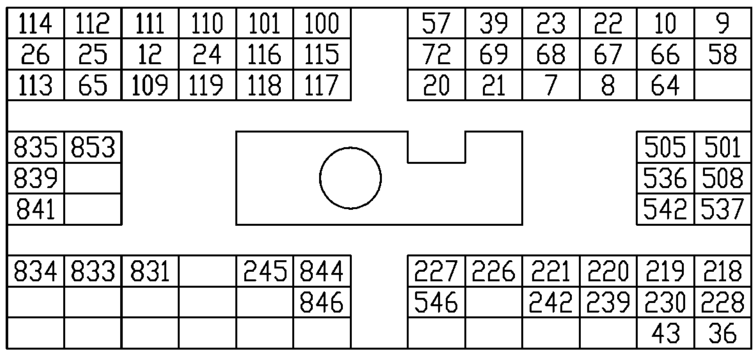
X8
ENGINE AND FRAME
HARNESS TO CAB
HARNESS CONNECTOR
(FRONT VIEW SHOWN)

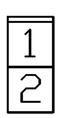


Y5	PIN 1	BLU/RED	7
Y8	PIN 1	RED/WHT	8
Y6	PIN 1	LGRN/BLK	9
Y9	PIN 1	BLU/ORG	10
M2	PIN 3	ORG	12
Y5	PIN 2	BLU/BLK	20
Y8	PIN 2	RED/YEL	21
Y6	PIN 2	LGRN/RED	22
Y9	PIN 2	BLU/WHT	23
M2	PIN 1	BRN/RED	24
M2	PIN 2	RED	25
M2	PIN 4	YEL	26
B16	PIN 1	BLK	36
B21	PIN 1	BLK/YEL	39
B16	PIN 1	WHT	43
B13	PIN 2	BLK/RED	57
B14	PIN 1	BLK/WHT	58
B22	PIN 3	BLU	64
B17	PIN 2	YEL/BLK	65
B19	PIN 2	RED/GRN	66
B18	PIN 2	GRN/BLK	67
B20	PIN 2	RED/BLK	68
B21	PIN 3	BLK/BLU	69

B21	PIN 2	BLK/PNK	72
B14	PIN 2	ORG/BLK	100
B13	PIN 1	ORG/BLU	101
B17	PIN 1	YEL/BLU	109
B19	PIN 1	WHT	110
B18	PIN 1	WHT/RED	111
B20	PIN 3	YEL/RED	112
B17	PIN 3	BRN/BLU	113
B19	PIN 3	RED/YEL	114
B18	PIN 3	RED/BLU	115
B20	PIN 1	BRN/WHT	116
B22	PIN 1	YEL/BLK	117
B22	PIN 2	BRN/BLU	118
B15	PIN 2	ORG	119
B4	PIN 1	WHT/RED	218
B5	PIN 2	GRN	219
B6	PIN 1	BLU	220
B7		WHT/BLK	221
B1	PIN 1	GRN/BLU	226
B2		WHT/YEL	227
B3	PIN 1	RED/BLU	228
G3	(D+)	BLU/YEL	230
B8	PIN 2	BRN	239

B9		RED/GRN	242
B12	PIN 1	BRN/YEL	245
G3	(GND)	BLK	501
K13	(e)	BLK/WHT	505
K14	(S)	RED/WHT	508
E1		RED/BLU	536
E2	(+)	RED	537
B26		RED/GRN	542
M4	PIN L	PUR	546
H10	PIN B	WHT/RED	831
H10	PIN D	WHT/BLK	833
B15	PIN 1	BLK/GRN	834
K13	(g)	YEL/GRN	835
NOT USED		BLK/RED	839
K15	(G)	RED/BLK	841
Y7	PIN 2	BRN/BLK	844
H10	PIN A	WHT	846
Y1		BLK/YEL	853

X9
ENGINE AND FRAME
HARNESS TO CAB
HARNESS POWER
CONNECTOR



K13	PIN B	WHT	1
F21		RED	2

CONNECTORS -
FRONT VIEW SHOWN

NOTE: PIN NUMBERS ARE LOCATION REFERENCE NUMBERS ONLY - THEY ARE NOT PRINTED ON THE CONNECTOR

ENGINE AND FRAME HARNESS (W1) COMPONENT LOCATION

T121284

T121284 –19–28OCT99

9015
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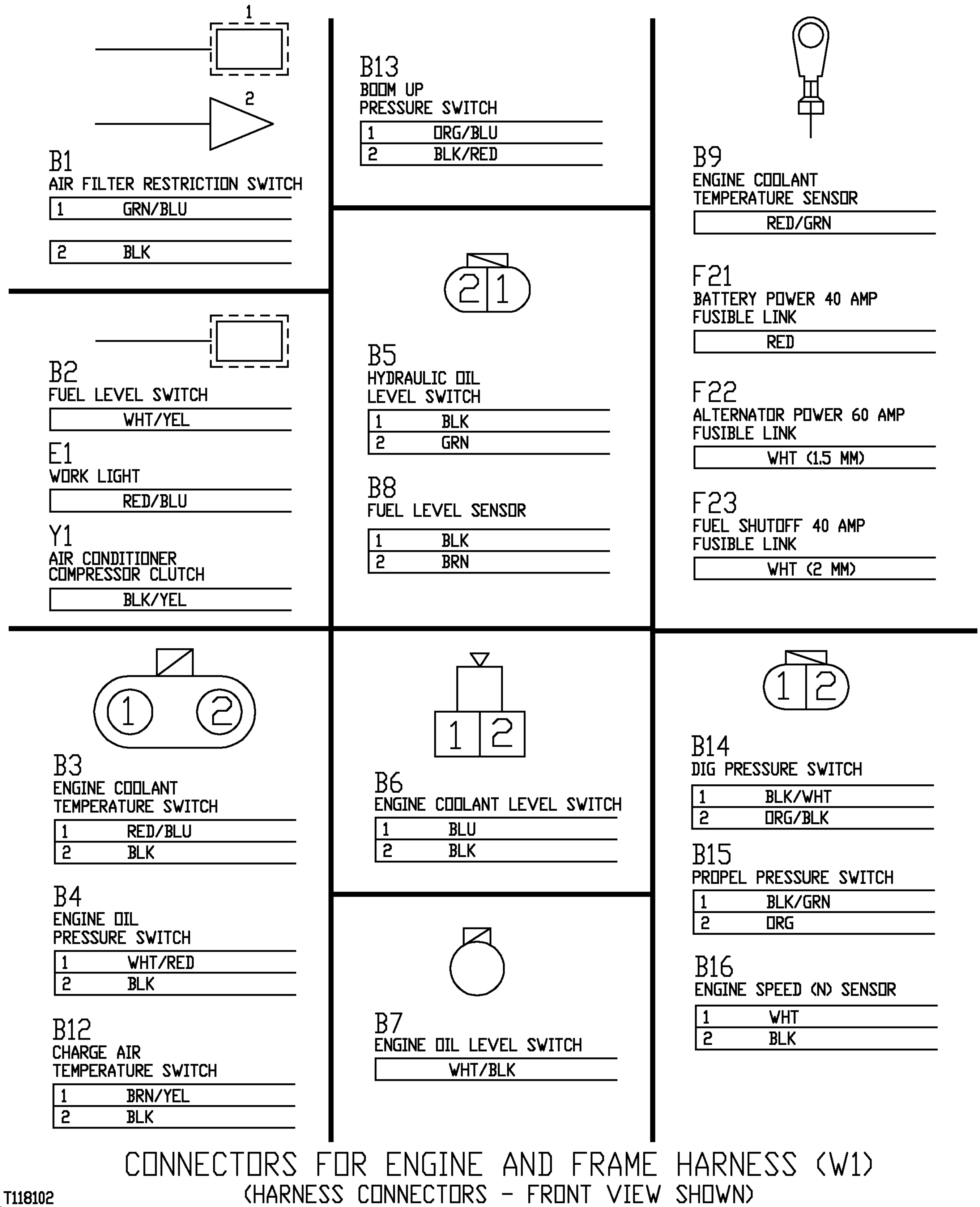
19

CED,OUOE012,202 –19–09JUN99–3/3

ENGINE AND FRAME HARNESS (W1) CONNECTORS, WIRE AND PIN LOCATION



T118102 –19–24NOV98

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CED,OUOE012,203 –19–09JUN99–1/4

9015
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20

9015
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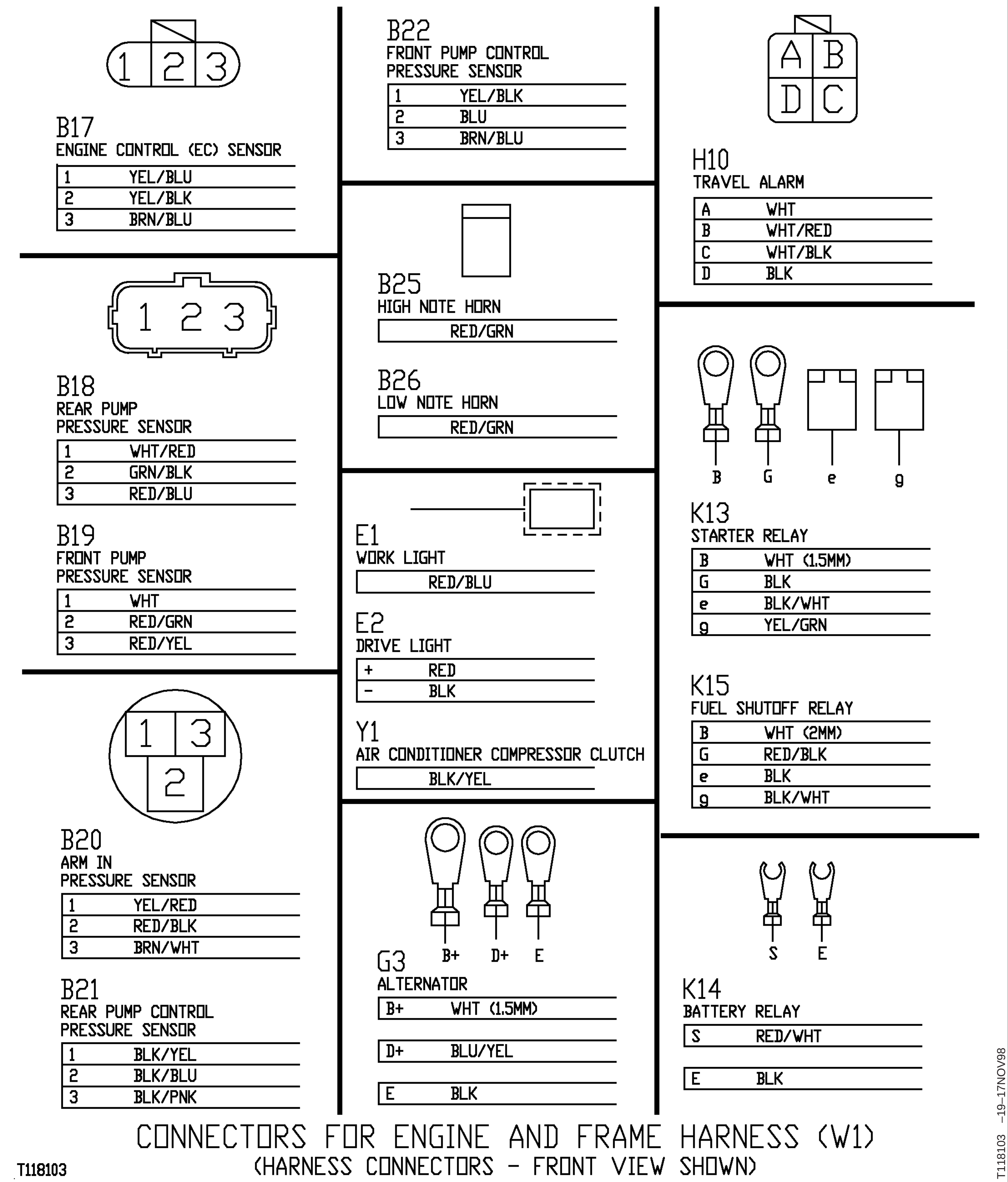
21



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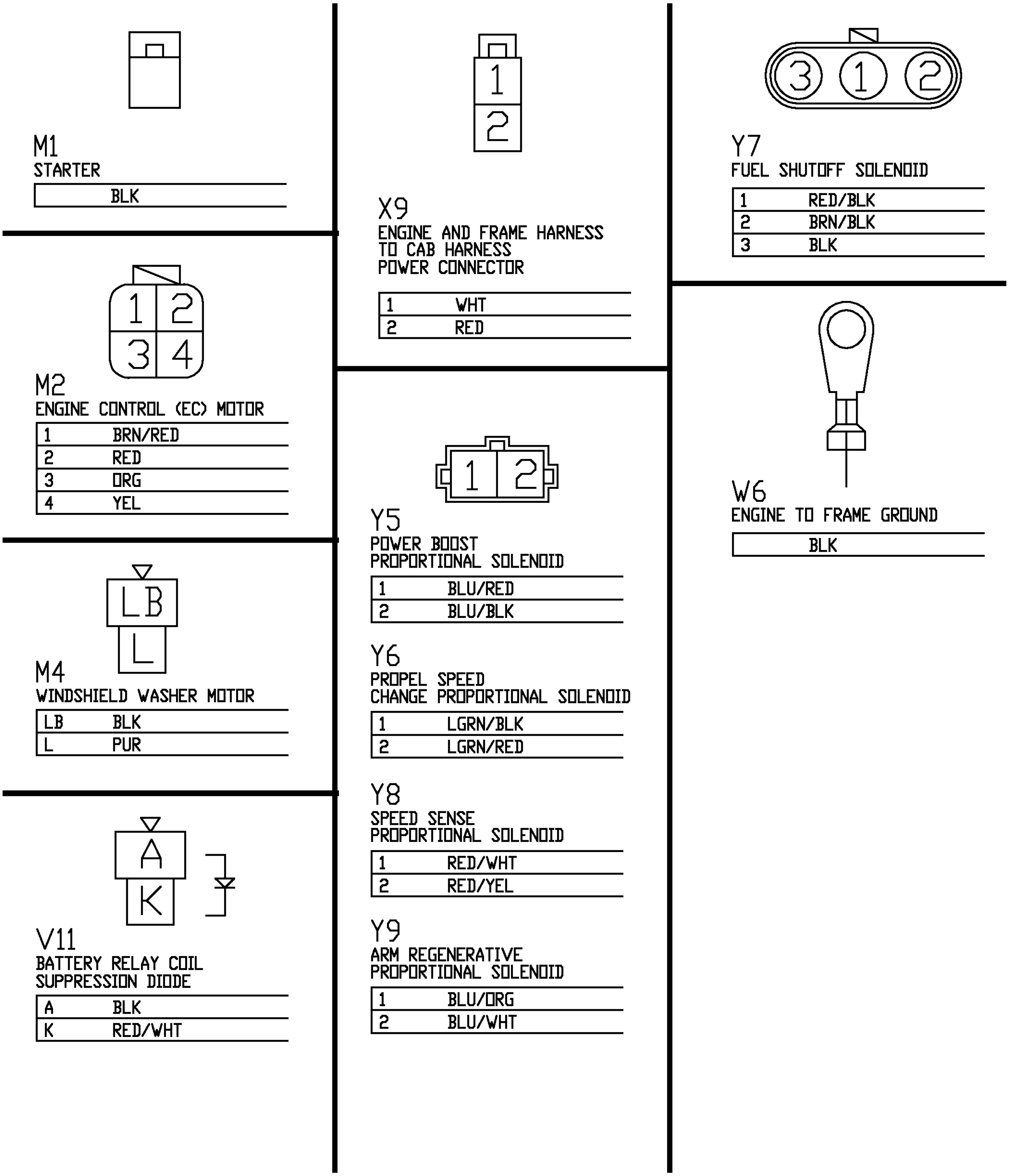
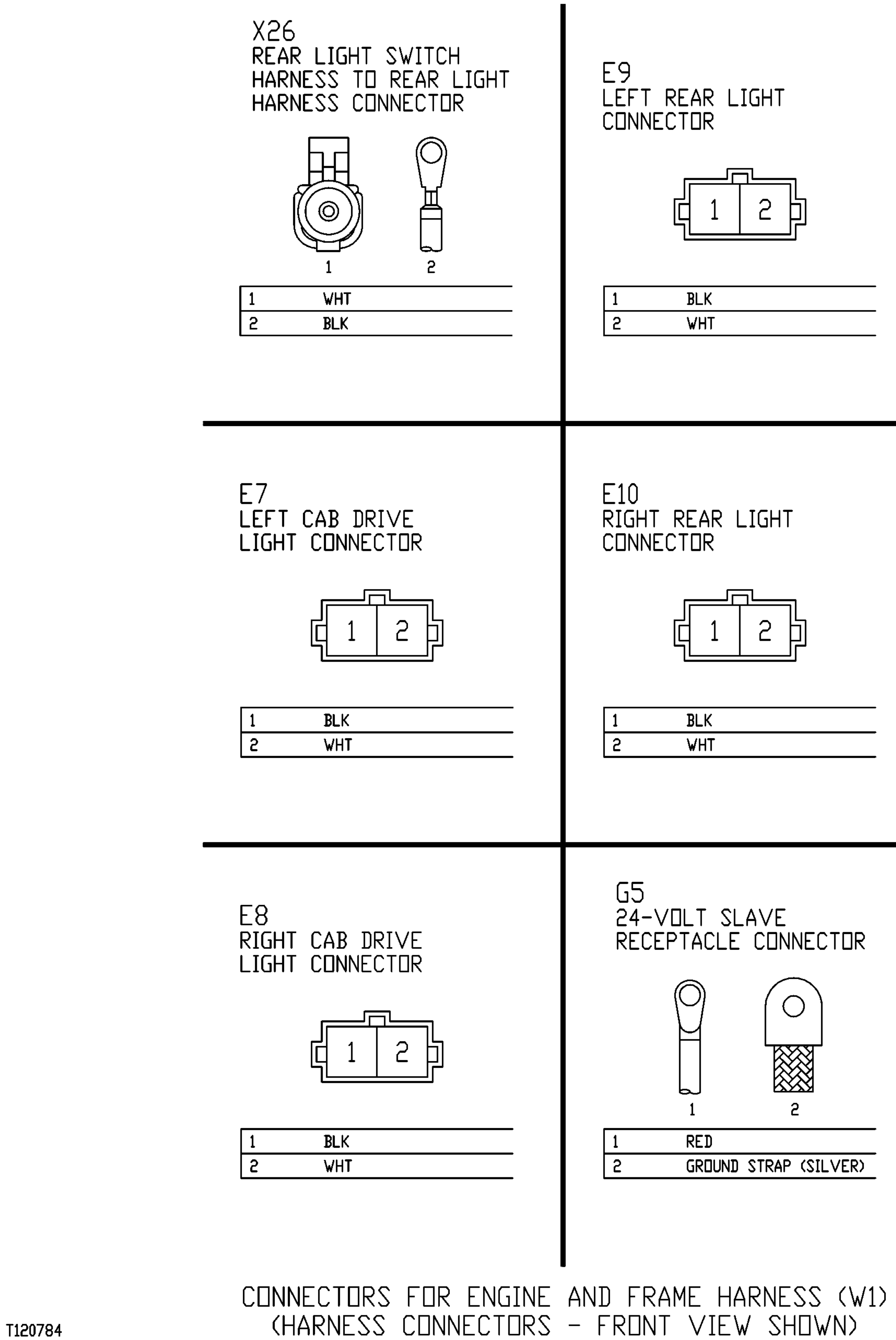


CONNECTORS FOR ENGINE AND FRAME HARNESS (W1)
(HARNESS CONNECTORS - FRONT VIEW SHOWN)

T118104

T118104 –19–17NOV98

Continued on next page



T120784 –19–28OCT99

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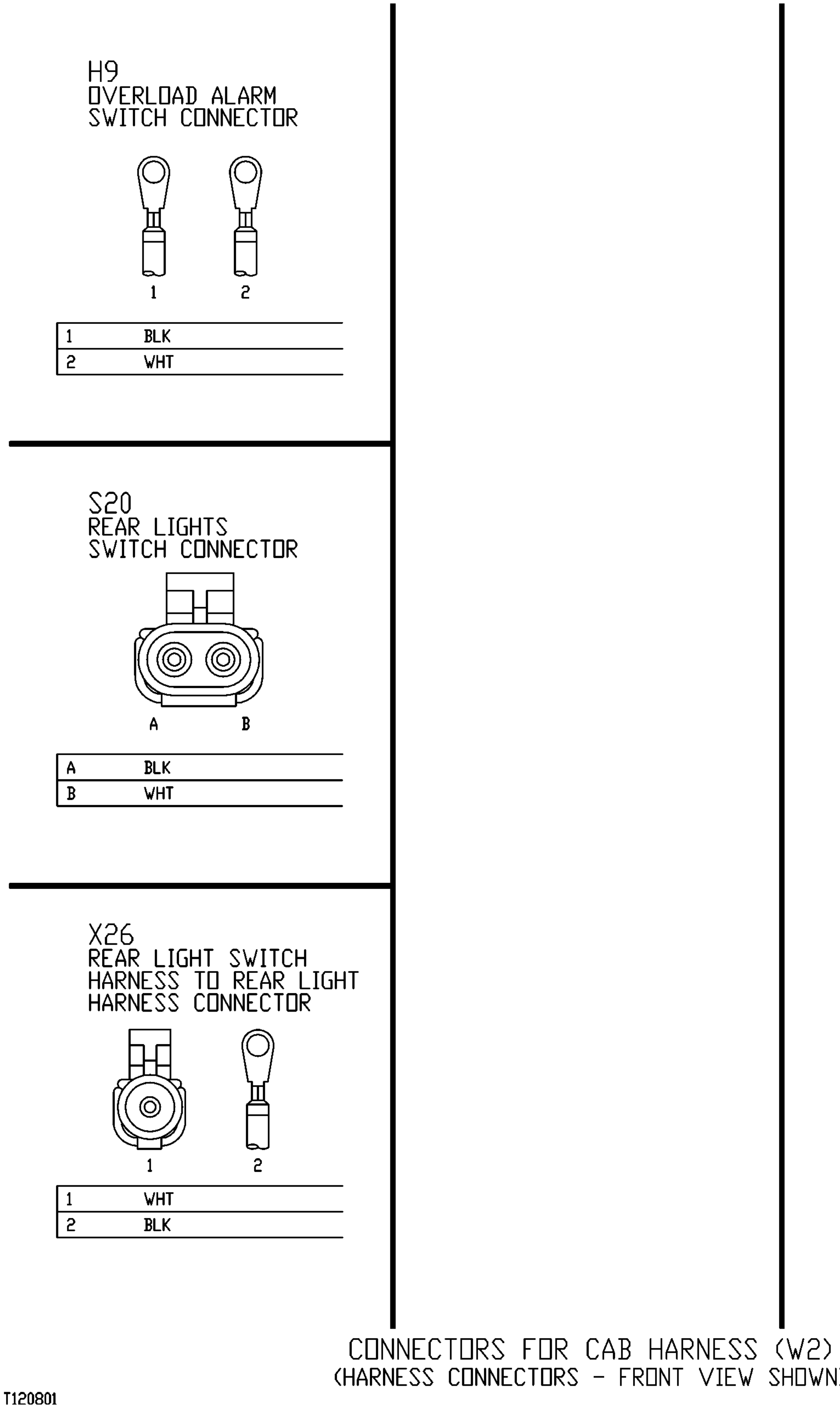
CAB HARNESS (W2) COMPONENT LOCATION—DETAIL A (HARNESS MATING CONNECTORS)

T120801 –19–28OCT99



1	BLK
2	WHT

A	BLK
B	WHT

1	WHT
2	BLK

CED,OUOE012,204 –19–09JUN99–1/1

9015
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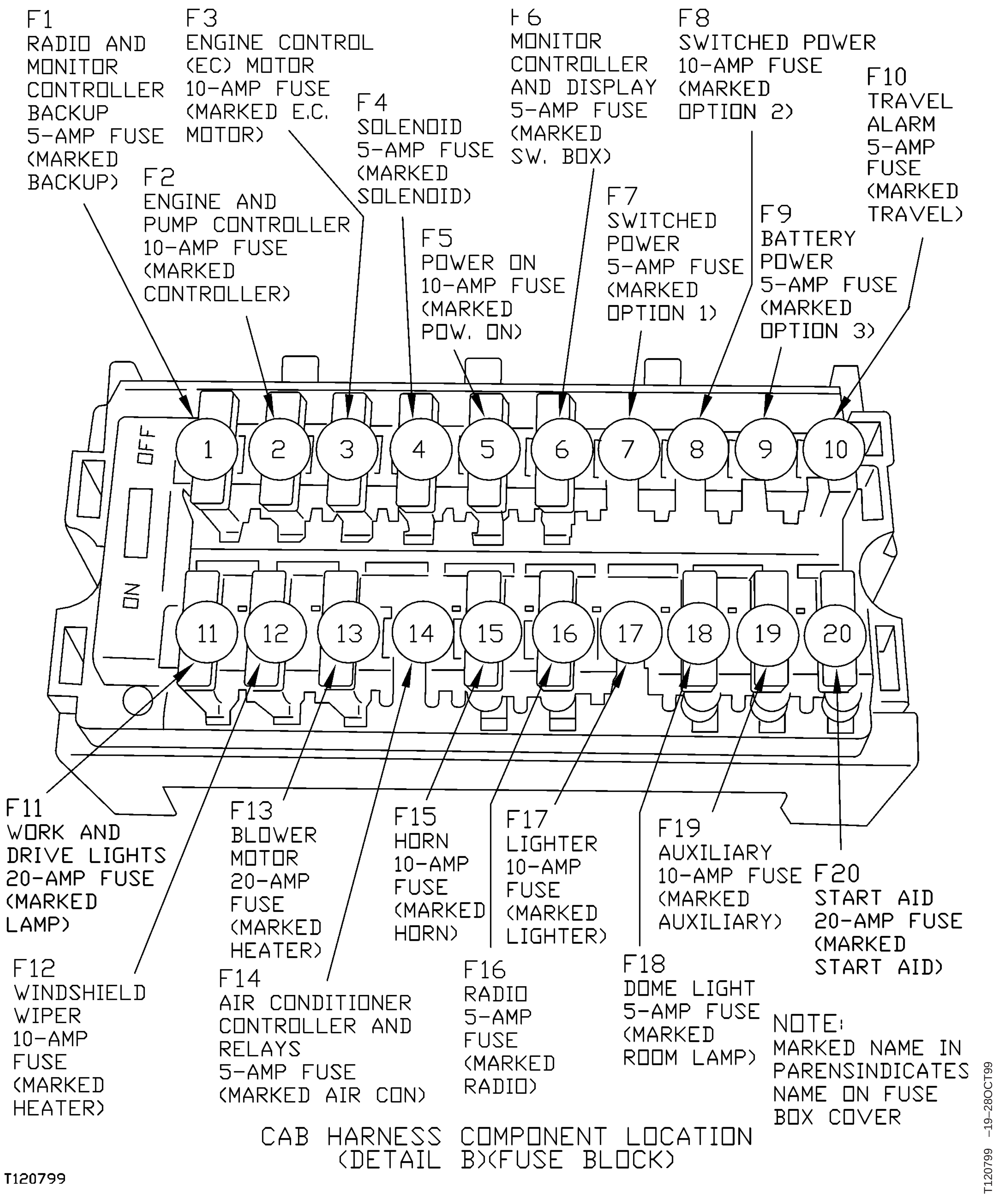
26

CAB HARNESS (W2) COMPONENT LOCATION—DETAIL B (FUSE BLOCK)



CED,OUOE012,205 –19–09JUN99–1/1

CAB HARNESS (W2) CONNECTORS, WIRE AND PIN LOCATION

A1
RADIO
INCLUDES:
B24 LEFT SPEAKER
W4 RADIO ANTENNA

1	2	O	3	4
5	6	7	8	9	10

1	LGRN/YEL
2	RED
3	BRN/RED
4	PLUG
5	LGRN/RED
6	LGRN/BLK
7	PLUG
8	BLK
9	GRN/RED
10	RED

A2
ENGINE PUMP
AND CONTROLLER
INCLUDES:
X13, X14, X15

NOTE: PIN NUMBERS ARE LOCATION REFERENCE NUMBERS ONLY - THEY ARE NOT PRINTED ON THE CONNECTOR

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13
A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26

X13
ENGINE AND PUMP CONTROLLER
CONNECTOR (26-PIN)

A1	BRN	A14	BLK
A2	PLUG	A15	PLUG
A3	PLUG	A16	PLUG
A4	PLUG	A17	PLUG
A5	PLUG	A18	PLUG
A6	PLUG	A19	PLUG
A7	BLU/RED	A20	BLU/BLK
A8	RED/WHT	A21	RED/YEL
A9	LGRN/BLK	A22	LGRN/RED
A10	BLU/ORG	A23	BLU/WHT
A11	BLK	A24	BRN/RED
A12	ORG	A25	RED
A13	BRN/WHT	A26	YEL

B1	B2	B3	B4	B5	B6	B7	B8
B9	B10	B11	B12	B13	B14	B15	B16

X14
ENGINE AND PUMP CONTROLLER
CONNECTOR (16-PIN)

B1	PLUG
B2	GRN
B3	PLUG
B4	WHT/PUR
B5	WHT/GRN
B6	BLK
B7	BRN/BLK
B8	BLK/GRN
B9	BLK/YEL
B10	GRN/RED
B11	ORG/BLU
B12	BLK/RED
B13	WHT
B14	PLUG
B15	RED/BLU
B16	BLK/BLU

D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22

X15
ENGINE AND PUMP CONTROLLER
CONNECTOR (22-PIN)

D1	BRN/YEL	D12	BLK
D2	BRN/YEL	D13	BLK
D3	GRY/BLU	D14	BLU
D4	GRY/RED	D15	YEL/BLK
D5	WHT	D16	RED/GRN
D6	ORG/BLK	D17	GRN/BLK
D7	BLK/RED	D18	RED/BLK
D8	BLK/WHT	D19	BLK/BLU
D9	WHT/BLK	D20	WHT/BLU
D10	YEL/GRN	D21	WHT/RED
D11	PLUG	D22	BLK/PNK

CONNECTORS FOR CAB HARNESS (W2)
(HARNESS CONNECTORS - FRONT VIEW SHOWN)

T118464

T118464 –19–17NOV98

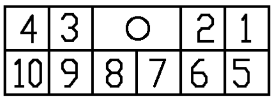
9015
10
27

Continued on next page

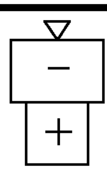
CED,OUOE012,206 –19–09JUN99–1/6

A4

ENGINE MODE AND
RPM CONTROL UNIT
INCLUDES:
E5 ENGINE RPM DIAL BACKLIGHT
R10 ENGINE RPM DIAL
S11 ECONOMY (E) MODE SWITCH
S12 HIGH POWER (HP) MODE SWITCH



1	YEL/BLU
2	YEL/WHT
3	YEL/RED
4	YEL/WHT
5	BLK/YEL
6	WHT/RED
7	BLK/PNK
8	RED
9	BLK
10	PLUG



B23

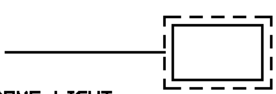
RIGHT SPEAKER
(SAME AS X7)

−	LGRN/BLK
+	LGRN/WHT

B24

LEFT SPEAKER

SEE A1 RADIO



E3

CAB DOME LIGHT
INCLUDES S3 DOME LIGHT SWITCH

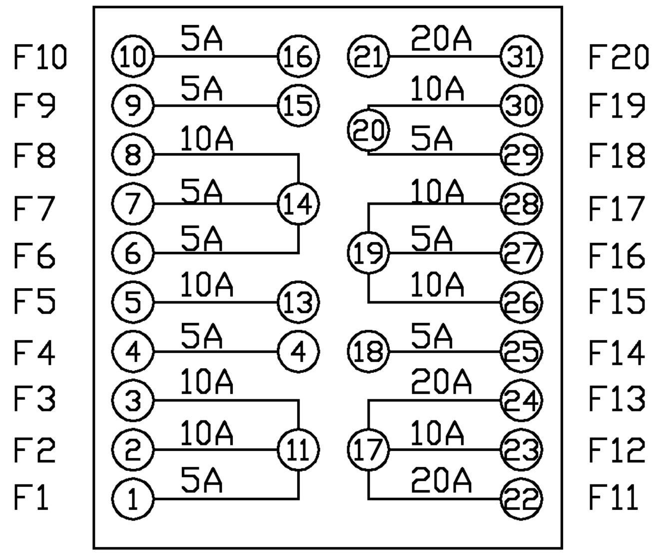
RED/WHT

E5

ENGINE SPEED DIAL BACKLIGHT

SEE A4 ENGINE SPEED CONTROL UNIT

FUSE BLOCK



F1

RADIO AND MONITOR
CONTROLLER
5 AMP
FUSE

1	GRN/RED
11	RED

F2

ENGINE AND
PUMP CONTROLLER
10 AMP
FUSE

2	BRN/YEL
11	RED

F3

ENGINE CONTROL
(EC) MOTOR
10 AMP
FUSE

3	BRN/WHT
11	RED

F4

SOLENOID
5 AMP
FUSE

4	BRN
12	WHT (5 MM)

F5

POWER ON
10 AMP
FUSE

5	BRN/BLK
12	RED/BLK

F6

MONITOR CONTROLLER
AND DISPLAY
5 AMP
FUSE

6	YEL/GRN
14	WHT (5 MM)

F7

SWITCHED POWER
5 AMP
FUSE

7	WHT/RED
14	WHT (5 MM)

F8

SWITCHED POWER
10 AMP
FUSE

8	RED/YEL
14	WHT (5 MM)

T118465

CONNECTORS FOR CAB HARNESS (W2)
(HARNESS CONNECTORS - FRONT VIEW SHOWN)

T118465 –19–14DEC98

Continued on next page

F9
BATTERY POWER
5 AMP
FUSE

9	WHT
15	RED

F10
TRAVEL
ALARM
5 AMP
FUSE

10	WHT/RED
16	WHT (5 MM)

F11
WORK AND
DRIVE LIGHTS
20 AMP
FUSE

22	RED/GRN
17	WHT (5 MM)

F12
WINDSHIELD
WIPER
10 AMP
FUSE

23	BLU/YEL
17	WHT (5 MM)

F13
BLOWER MOTOR
20 AMP
FUSE

24	BRN
17	WHT (5 MM)

F14
AIR CONDITONER
CONTROLLER AND RELAYS
5 AMP
FUSE

25	WHT/YEL
18	WHT (5 MM)

F15
HORN
10 AMP
FUSES

26	RED/WHT
19	RED/WHT

F16
RADIO
5 AMP
FUSE

27	BRN/RED
19	RED/WHT

F17
LIGHTER
10 AMP
FUSE

28	BRN
19	RED/WHT

F18
DOME LIGHT
5 AMP
FUSE

29	RED/WHT
20	RED/WHT

F19
AUXILIARY
10 AMP
FUSE

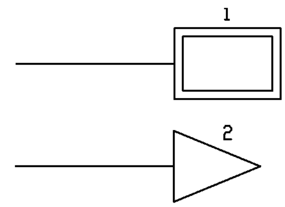
30	RED
20	RED/WHT

F20
START AID
20 AMP
FUSE

31	RED/BLU
21	WHT

M5
HEATER BLOWER MOTOR
(WITHOUT AIR CONDITIONER)
SEE S4 HEATER BLOWER
MOTOR SWITCH

R2
HEATER BLOWER MOTOR
DROPPING RESISTOR BLOCK
WITHOUT AIR CONDITIONER)
SEE S4 HEATER BLOWER
MOTOR SWITCH



R6
ALTERNATOR
EXCITATION RESISTOR

1	RED/WHT
2	BLU/YEL

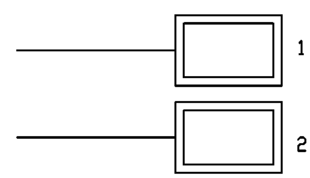
X6
AUXILIARY CONNECTOR

+	RED
-	BLK

4	2	6
5	3	1

S1
KEY SWITCH

1	RED
2	PLUG
3	PLUG
4	RED/WHT
5	RED/BLK
6	BLK/WHT



S2
HORN SWITCH

1	PNK
2	BLK

S19
POWER BOOST SWITCH

S	WHT/GRN
GND	BLK

CONNECTORS FOR CAB HARNESS (W2)
(HARNESS CONNECTORS – FRONT VIEW SHOWN)

T120787

T120787 –19–28OCT99

9015
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CED,OUOE012,206 –19–09JUN99–3/6

9015
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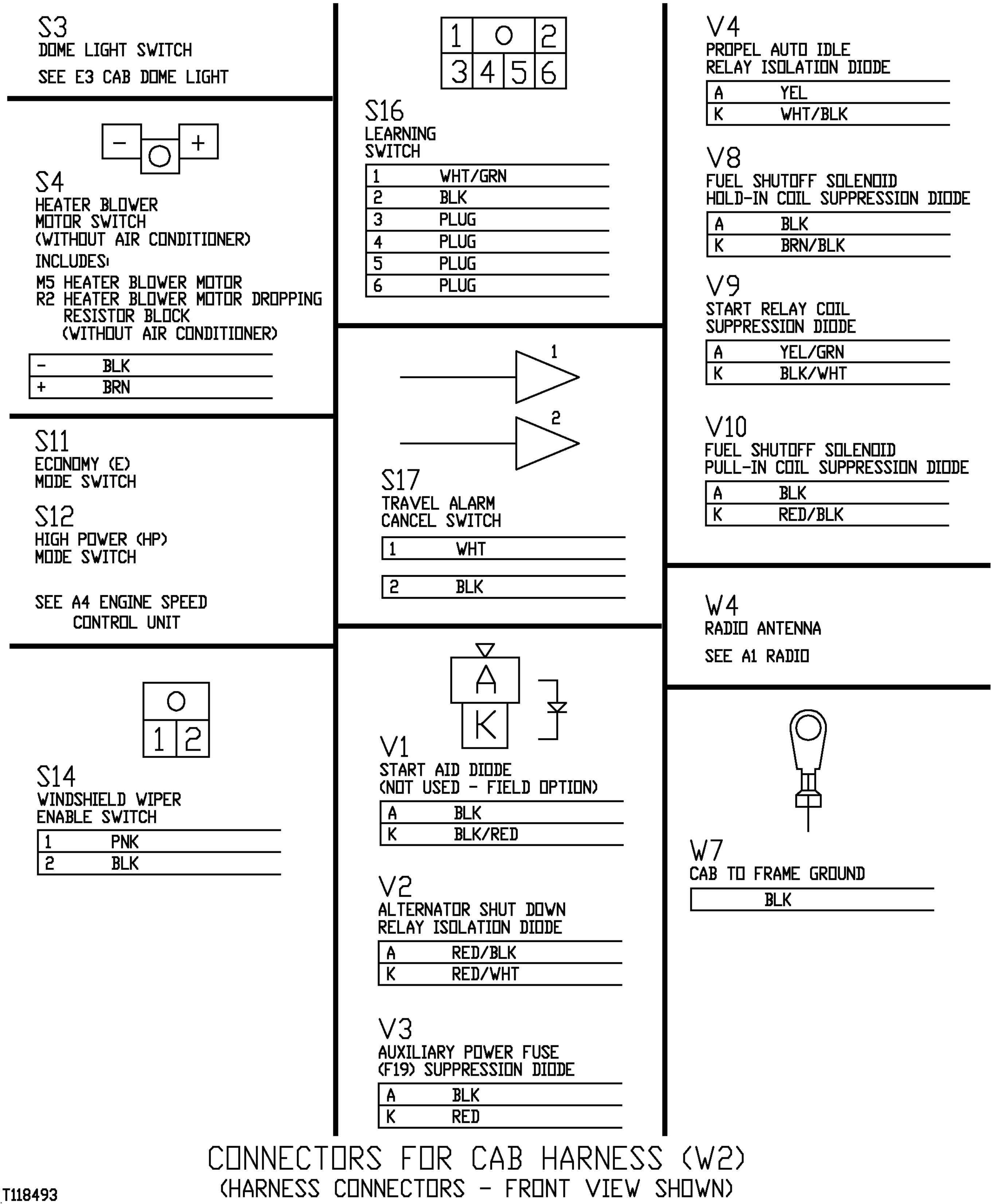
30



T118493 –19–05JAN99

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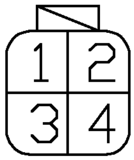
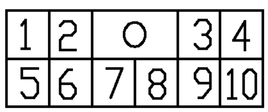
CED,OUOE012,206 –19–09JUN99–4/6



X1
DIAGNOSTIC CONNECTOR

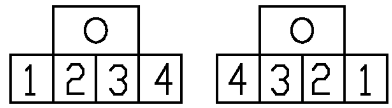
1	BLK/BLU
2	BLK
3	BLK/GRN
4	RED/BLU

X2
LEARNING SWITCH CONNECTOR
SEE S16 LEARNING SWITCH



X3
ATTACHMENT PRESSURE SWITCH CONNECTOR

1	GRN
2	GRN/RED
3	YEL/GRN
4	PLUG
5	PLUG
6	PLUG
7	PLUG
8	PLUG
9	PLUG
10	BLK

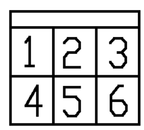


X4
ACCEL CONNECTOR

1	BLK/PNK
2	WHT/BLU
3	YEL/GRN
4	PLUG

X4
ACCEL CONNECTOR
(OTHER HALF)

1	BLK/PNK
2	BLK/PNK
3	PLUG
4	PLUG



X5
OPTIONAL CONNECTOR

1	WHT/RED
2	RED/YEL
3	WHT
4	RED
5	RED/BLU
6	BLK

X7
OPTIONAL RIGHT SPEAKER CONNECTOR

SEE B23 RIGHT SPEAKER CONNECTOR

X13
ENGINE AND PUMP CONTROLLER CONNECTOR
(26-PIN)

X14
ENGINE AND PUMP CONTROLLER CONNECTOR
(16-PIN)

X15
ENGINE AND PUMP CONTROLLER CONNECTOR
(22-PIN)

SEE A2 ENGINE AND PUMP CONTROLLER

CONNECTORS FOR CAB HARNESS (W2)
(HARNESS CONNECTORS - FRONT VIEW SHOWN)

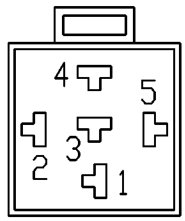
T118494

T118494 –19–17NOV98

Continued on next page

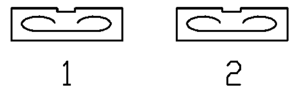
CED,OUOE012,206 –19–09JUN99–5/6

K16
OVERLOAD ALARM
RELAY CONNECTOR



1	RED/BRN
2	BLU
3	NOT USED
4	BRN
5	BLK

B31
HYDRAULIC OIL
TEMPERATURE SWITCH
CONNECTOR

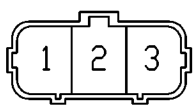


1	YEL
2	RED

B30
HYDRAULIC OIL
FILTER RESTRICTION
SWITCH CONNECTOR

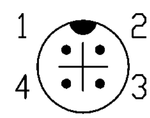
	YEL

B32
OVERLOAD ALARM
PROXIMITY SWITCH
CONNECTOR



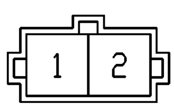
1	BLU
2	BLK
3	BRN

B33
OVERLOAD ALARM
PRESSURE SWITCH
CONNECTOR



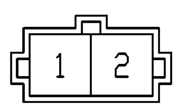
1	BLU
2	NOT USED
3	BRN
4	BLK

E1
LEFT WORK
LIGHT CONNECTOR



1	BLK
2	WHT

E6
RIGHT WORK
LIGHT CONNECTOR



1	BLK
2	WHT

CONNECTORS FOR ENGINE AND FRAME HARNESS (W1)
(HARNESS CONNECTORS – FRONT VIEW SHOWN)

T120783

T120783 –19–28OCT99

CED,OUOE012,206 –19–09JUN99–6/6

FOLDOUT PAGE 4-64 IS AT REAR OF MANUAL

9015
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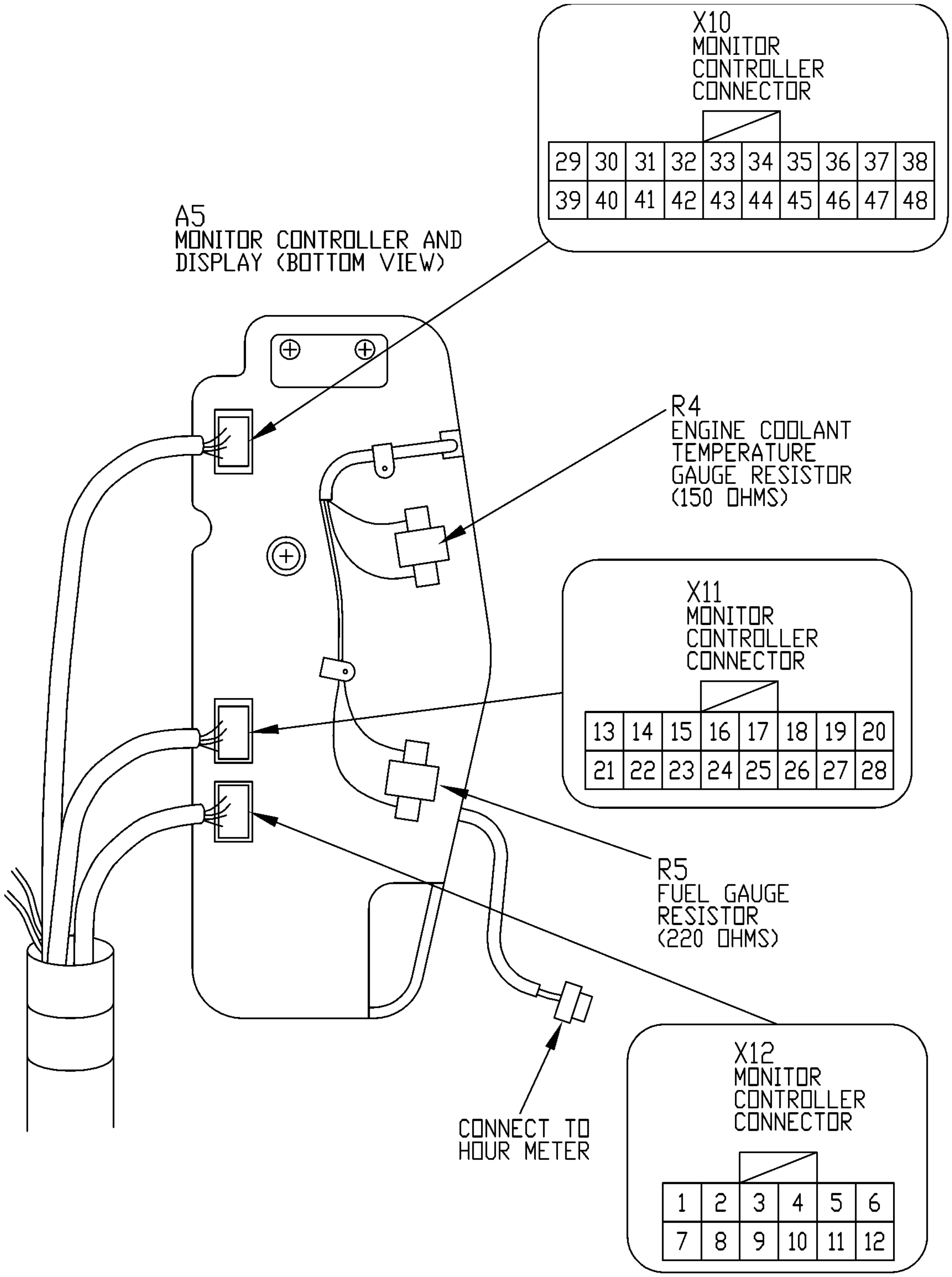
34

MONITOR AND RELAY HARNESS (W3) COMPONENT LOCATION—DETAIL A (MONITOR CONTROLLER CONNECTORS)



YEL/GRN	29
YEL/GRN	30
PLUG	31
PLUG	32
PLUG	33
YEL/BLU	34
YEL/RED	35
PLUG	36
BLK	37
YEL/WHT	38
GRN/RED	39
YEL/GRN	40
RED	41
BLU/YEL	42
YEL/GRY	43
BRN/YEL	44
–	45
BRN	46
RED/GRN	47
GRN/BLK	48

ORG/BLK	13
PLUG	14
WHT	15
PLUG	16
BLK/RED	17
RED/YEL	18
RED/BLK	19
RED/WHT	20
GRY/BLU	21
GRY/RED	22
ORG/BLU	23
GRN/WHT	24
YEL/BLK	25
BLU/GRN	26
BRN/WHT	27
BLU/GRN	28

RED/BLU	1
WHT/YEL	2
GRN/BLU	3
PLUG	4
PLUG	5
PNK	6
WHT/BLK	7
BLU	8
GRN	9
WHT/RED	10
WHT/BLK	11
GRY	12

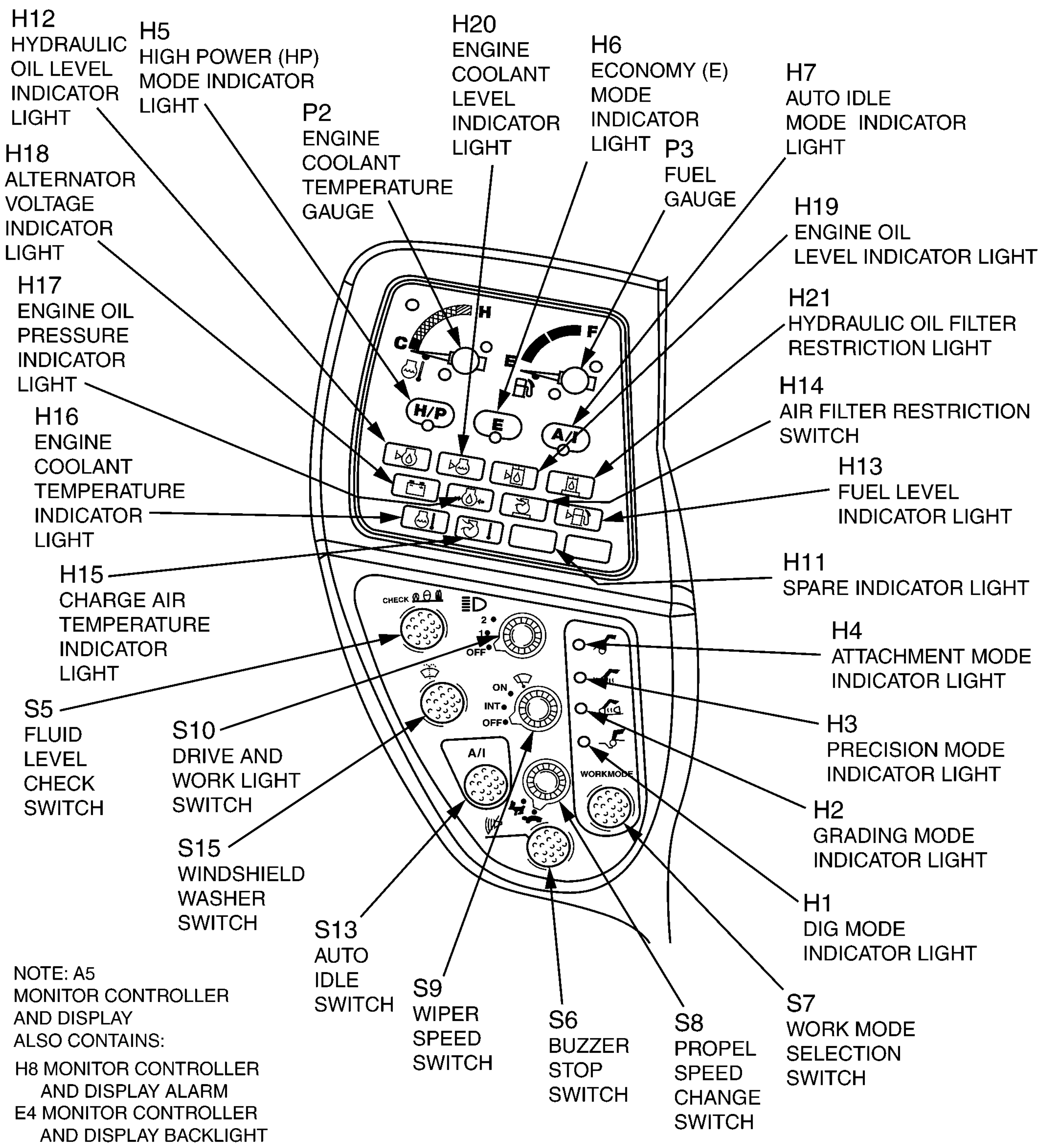
MONITOR AND RELAY HARNESS (W3) COMPONENT LOCATION
(DETAIL A - MONITOR CONTROLLER CONNECTORS)

T120786

T120786 –19–28OCT99

CED,OUOE012,207 –19–09JUN99–1/1

MONITOR AND RELAY HARNESS (W3) COMPONENT LOCATION—DETAIL B (MONITOR CONTROLLER INDICATORS)



MONITOR AND RELAY HARNESS (W3) COMPONENT LOCATION
(DETAIL B - MONITOR CONTROLLER INDICATORS)

T120576

T120576 –19–28OCT99

CED,OUOE012,160 –19–19MAR99–1/1

9015
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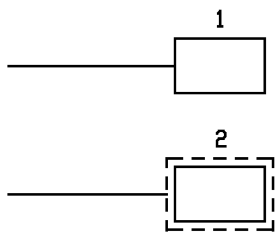
36

MONITOR AND RELAY HARNESS (W3) CONNECTORS, WIRE AND PIN LOCATION

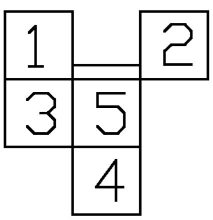
A5
MONITOR CONTROLLER AND DISPLAY (MADE UP OF X10, X11, AND X12)

SEE MONITOR AND RELAY HARNESS (W3) COMPONENT LOCATION DETAIL A



G4
24V POWER PLUG

1	BLK
2	BRN



K1
ALTERNATOR SHUT DOWN RELAY (MARKED R1)

1	RED
2	RED/YEL
3	RED
4	PLUG
5	RED/WHT

K2
WINDSHIELD WASHER RELAY (MARKED R2)

1	BLU/YEL
2	YEL/BLK
3	BLU/YEL
4	PLUG
5	PUR

K3
WORK LIGHT RELAY (MARKED R3)

1	RED/GRN
2	RED/WHT
3	RED/GRN
4	PLUG
5	RED/BLU

K4
DRIVE LIGHT RELAY (MARKED R4)

1	RED/GRN
2	RED/BLK
3	RED/GRN
4	PLUG
5	RED

K5
HORN RELAY (MARKED R5)

1	RED/WHT
2	PNK
3	RED/WHT
4	PLUG
5	RED/GRN

K6
WINDSHIELD WIPER RELAY (MOTOR GROUND AND INTERMITTENT) (MARKED R6)

1	BLU/YEL
2	BLU/GRN
3	LGRN/WHT
4	BLU/BLK
5	BLK

K7
WINDSHIELD WIPER RELAY (WIPER RUN) (MARKED R7)

1	BLU/YEL
2	BRN/WHT
3	BLU/WHT
4	BLK/RED
5	BLU/YEL

K8
WINDSHIELD WIPER RELAY (HOLD FOR PARK) (MARKED R8)

1	BLU/YEL
2	BRN/WHT
3	BLU/RED
4	PLUG
5	BRN/WHT

K9
WINDSHIELD WIPER RELAY (MOTOR GROUND FOR PARK) (MARKED R9)

1	BLU/YEL
2	GRN/WHT
3	BLK/RED
4	PLUG
5	BLK

K10
PROPEL AUTO IDLE RELAY (MARKED R10)

1	WHT/RED
2	YEL
3	WHT/BLK
4	PLUG
5	BLK

K11
STARTER PROTECTION RELAY (MARKED R11)

1	RED
2	RED/YEL
3	YEL/GRN
4	BLK
5	PLUG

K12
START AID RELAY (MARKED R12)

(NOT USED - FIELD OPTION)

CONNECTORS FOR MONITOR AND RELAY HARNESS (W3)
(HARNESS CONNECTORS - FRONT VIEW SHOWN)

T118352

T118352 –19–17NOV98

CED,OUOE012,161 –19–19MAR99–1/1

AIR CONDITIONER HARNESS (W9) COMPONENT LOCATION—SEE GROUP 9031-15

CED,TX02661,249 –19–04NOV98–1/1

AIR CONDITIONER HARNESS (W9) CONNECTORS, WIRE AND PIN LOCATION—SEE GROUP 9031-15

CED,TX02661,250 –19–04NOV98–1/1

POWER CIRCUIT OPERATIONAL INFORMATION

The following conditions must be met for the circuits to function:

With key switch S1 OFF, voltage must be present at the following:

- Battery positive terminals
- Key switch S1 terminal BAT
- Battery relay K14 terminal B
- Radio and monitor controller backup 5-amp fuse F1
- Engine and pump controller 10-amp fuse F2
- Engine control (EC) motor 10-amp fuse F3
- Battery power 5-amp fuse F9
- Battery power 40-amp fusible link F21
- Alternator shut down relay K1 terminals 1 and 3
- Starter protection relay K11 terminal 1

With key switch S1 in ACC position, voltage must be present at the following:

- Key switch S1 terminal ACC
- Horn 10-amp fuse F15
- Radio 5-amp fuse F16
- Lighter 10-amp fuse F17
- Dome light 5-amp fuse F18
- Auxiliary 10-amp fuse F19

With key switch S1 ON, voltage must be present at the following:

- Alternator excitation resistor R6
- Key switch S1 terminal M
- Battery relay K14 terminal S and A
- Alternator power 60-amp fusible link F22
- Starter motor terminal C
- Solenoid 5-amp fuse F4
- Power On 10-amp fuse F5
- Monitor controller and display 5-amp fuse F6
- Switched power 5-amp fuse F7
- Switched power 10-amp fuse F8
- Travel alarm 5-amp fuse F10
- Work and drive lights 20-amp fuse F11
- Windshield wiper 10-amp fuse F12
- Blower motor 20-amp fuse F13
- Air conditioner controller and relays 5-amp fuse F14
- Start Aid 20-amp fuse F20
- Fuel shutoff 40-amp fusible link F23

CED,OUOE012,130 –19–15MAR99–1/1

POWER CIRCUIT THEORY OF OPERATION

The power circuit includes batteries, key switch, battery relay, battery relay fuse, battery relay diode and all other fuses.

With key switch OFF, battery power is available at terminal BAT of key switch S1, terminals 1 and 3 of alternator shut down relay K1, terminal 1 of starter protection relay K11, and through battery power 40-amp fusible link F21 to terminal B of battery relay K14. Battery power is also applied to radio and monitor controller backup 5-amp fuse F1, engine and pump controller 10-amp fuse F2, and engine control (EC) motor 10-amp fuse F3 and battery power 5 amp fuse F9.

With key switch turned to ACC, battery power is available at horn 10-amp fuse F15, lighter 10-amp fuse F17, dome light 5-amp fuse F18, auxiliary 10-amp fuse F19 and radio 5-amp fuse F16.

With key switch turned to ON, battery relay K14 is energized by power from key switch S1 terminal M to battery relay terminal S. Operating power from terminal A of the battery relay is applied to starter motor M1 terminal B, fuel shutoff 40-amp fusible link F23, and through alternator power 60-amp fusible link F22 to fuses F4, F6, F7, F8, F10, F11, F12, F13, F14 and F20. Operating power is also applied from key switch S1 terminal M to alternator excitation resistor R6 and power on 10-amp fuse F5.

Connection to an external battery source is provided by 24-volt slave receptacle G5.

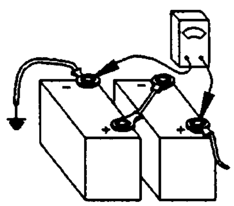
CED,OUOE012,129 –19–15MAR99–1/1

FOLDOUT PAGE 4-71 IS AT REAR OF MANUAL

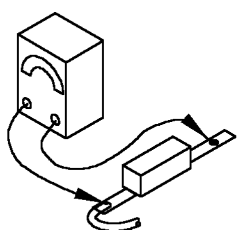
❶ POWER CIRCUIT DIAGNOSTIC PROCEDURES

IMPORTANT: Do not disconnect electrical connectors while the engine is running. Damage to Engine and Pump Controller or other components may result. Disconnect connectors only when instructed during a test or check.

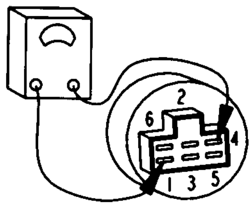
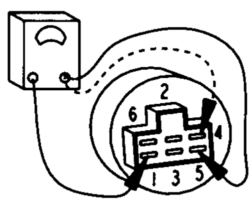
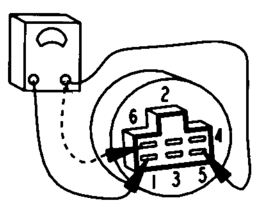
– – –1/1

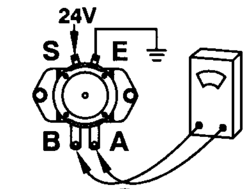
BATTERY (G1, G2) VOLTAGE CHECK	 T7487AF –UN–20MAR91	Measure battery voltage by connecting a voltmeter to (-) negative battery terminal grounded to frame and (+) positive battery terminal connected to machine harness. Is 24 to 28 volts measured?	**YES:** Batteries are OK. Go to next check. **NO:** Batteries are undercharged. Charge batteries.

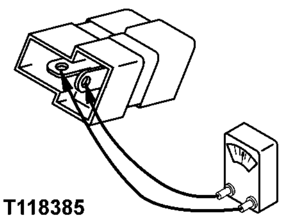
– – –1/1

BATTERY POWER 40 AMP FUSIBLE LINK (F21) CHECK	 T109319 –UN–28APR97	Disconnect fusible link from battery relay. Connect ohmmeter to both ends of fusible link. Is continuity measured?	**YES:** Fusible link is OK. Check wiring harness. **NO:** Fusible link has failed. Replace fusible link.

– – –1/1

KEY SWITCH (S1) CHECK	 T8357AK –UN–09NOV94	**1—B Terminal** **2—G1 Terminal** **3—G2 Terminal** **4—ACC Terminal** **5—M Terminal** **6—ST Terminal** Remove harness from key switch. Turn key switch to ACC. Is continuity measured between key switch terminals 1 and 4?	**YES:** Go to next step. **NO:** Key switch has failed if continuity is not measured or continuity is measured between other terminals. Replace.
	 T8357AL –UN–09NOV94	**1—B Terminal** **2—G1 Terminal** **3—G2 Terminal** **4—ACC Terminal** **5—M Terminal** **6—ST Terminal** Remove harness from key switch. Turn key switch ON. Is continuity measured between key switch terminals 1 and 4, and terminals 1 and 5?	**YES:** Go to next step. **NO:** Key switch has failed if continuity is not measured or continuity is measured between other terminals. Replace.
	 T8357AM –UN–02DEC98	**1—B Terminal** **2—G1 Terminal** **3—G2 Terminal** **4—ACC Terminal** **5—M Terminal** **6—ST Terminal** Remove harness from key switch. Turn key switch to START. Is continuity measured between key switch terminals 1 and 5, and terminals 1 and 6?	**YES:** Key switch is OK. **NO:** Key switch has failed if continuity is not measured or continuity is measured between other terminals. Replace. – – –1/1

BATTERY RELAY (K14) CHECK	 T8182AK –UN–03MAR94 Disconnect harness from relay. Connect 24 volts to small terminal S and ground small terminal E. Does relay click? Connect ohmmeter to large terminals A and B. Is continuity measured?	**YES:** Relay is OK. Check wiring harness. **NO:** Relay has failed. Replace relay. – – –1/1

BATTERY RELAY COIL SUPPRESSION DIODE (V11) CHECK	*NOTE: A diode can fail in two modes, either shorted or open. Continuity will be measured in one direction only in a serviceable diode. Use “diode checking mode” on meter when checking continuity.*  T118385 –UN–21NOV98 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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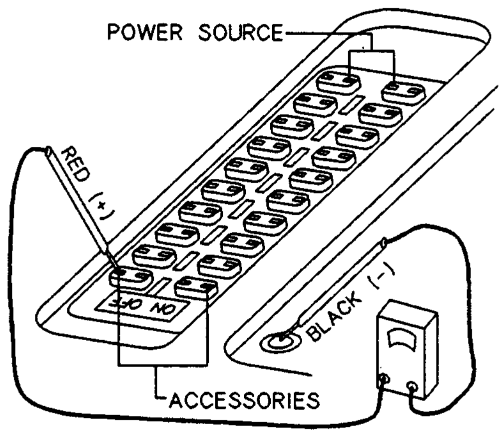
FUSE CHECK	 T7468AF –UN–14MAR91 Remove cover from fuse block. Turn key switch ON. Connect black (-) probe of multimeter to screw head (ground) in console. Set multimeter to measure 24 volts. Connect multimeter red (+) probe to the outside slot in each fuse. Is 24 volts measured on each fuse?	**YES:** Fuse is OK **NO:** Replace fuse. – – –1/1

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7

CHARGING CIRCUIT OPERATIONAL INFORMATION

The following conditions must be met for the circuit to function:

- Key switch ON
- Voltage present at alternator G3 terminals B+ and D+
- Engine running

CED,OUOE012,12 –19–26OCT98–1/1

CHARGING CIRCUIT THEORY OF OPERATION

The charging circuit includes batteries, key switch, alternator shut down relay, alternator excitation resistor, alternator shutdown relay and isolation diode, monitor controller and display.

With key switch S1 ON, battery power is applied through alternator power 60-amp fusible link F22 to terminal B+ of alternator G3. Alternator excitation power is applied from key switch S3 terminal M through alternator shut down relay isolation diode V2 and alternator excitation resistor R6 to alternator terminal D+. The excitation voltage is monitored by controller and display monitor A5 at terminal 42.

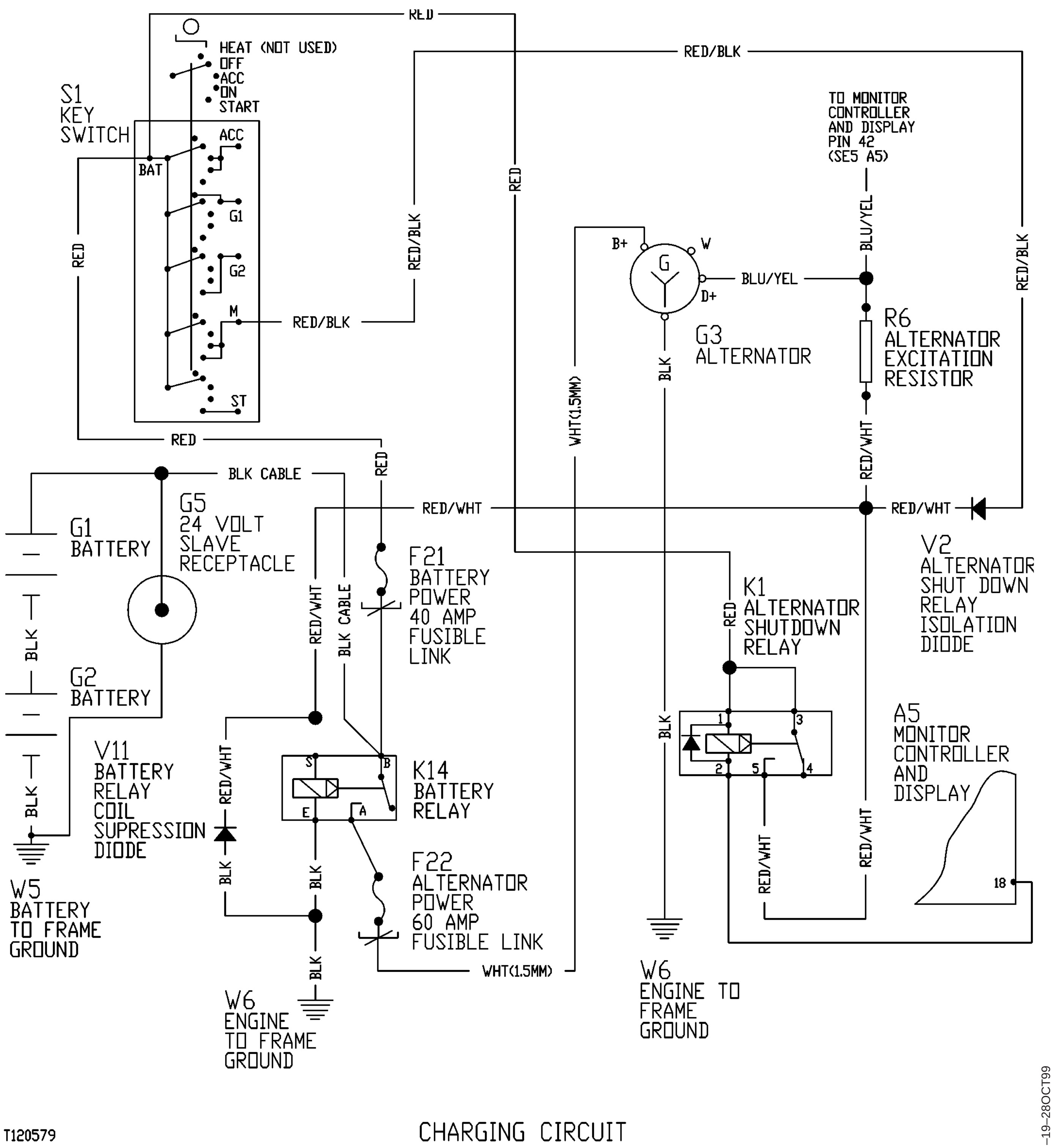
With the engine running and the charging circuit functioning properly, the voltage at alternator terminal D+ is greater than 10 volts, therefore, alternator voltage indicator light H18 and monitor controller and display alarm H8 are off. Output current from alternator terminal B charges the batteries as needed and provides power to the machine circuits. If the voltage at alternator terminal D+ drops below 6 volts, as a result of a charging circuit failure or the engine not running, the monitor controller will turn on the alternator voltage indicator light and sound the display alarm.

Once the monitor controller senses that the engine is running (voltage at alternator terminal D+ is greater than 10 volts), monitor controller and display terminal 18 is grounded. This provides a ground path for alternator shutdown relay K1, energizing the relay. With relay K1 energized, battery power is applied through contacts 3 and 5 to alternator excitation resistor R6. This ensures that power to the alternator excitation circuit (and the alternator voltage output) is maintained as long as the engine is running, even if the key switch is turned to OFF or ACC momentarily.

Isolation diode V2 isolates the battery power at terminal 5 of relay K1 from the key switch ON power circuits.

CED,OUOE012,28 –19–02NOV98–1/1

CHARGING CIRCUIT SCHEMATIC



CED,OUOE012,163 –19–19MAR99–1/1

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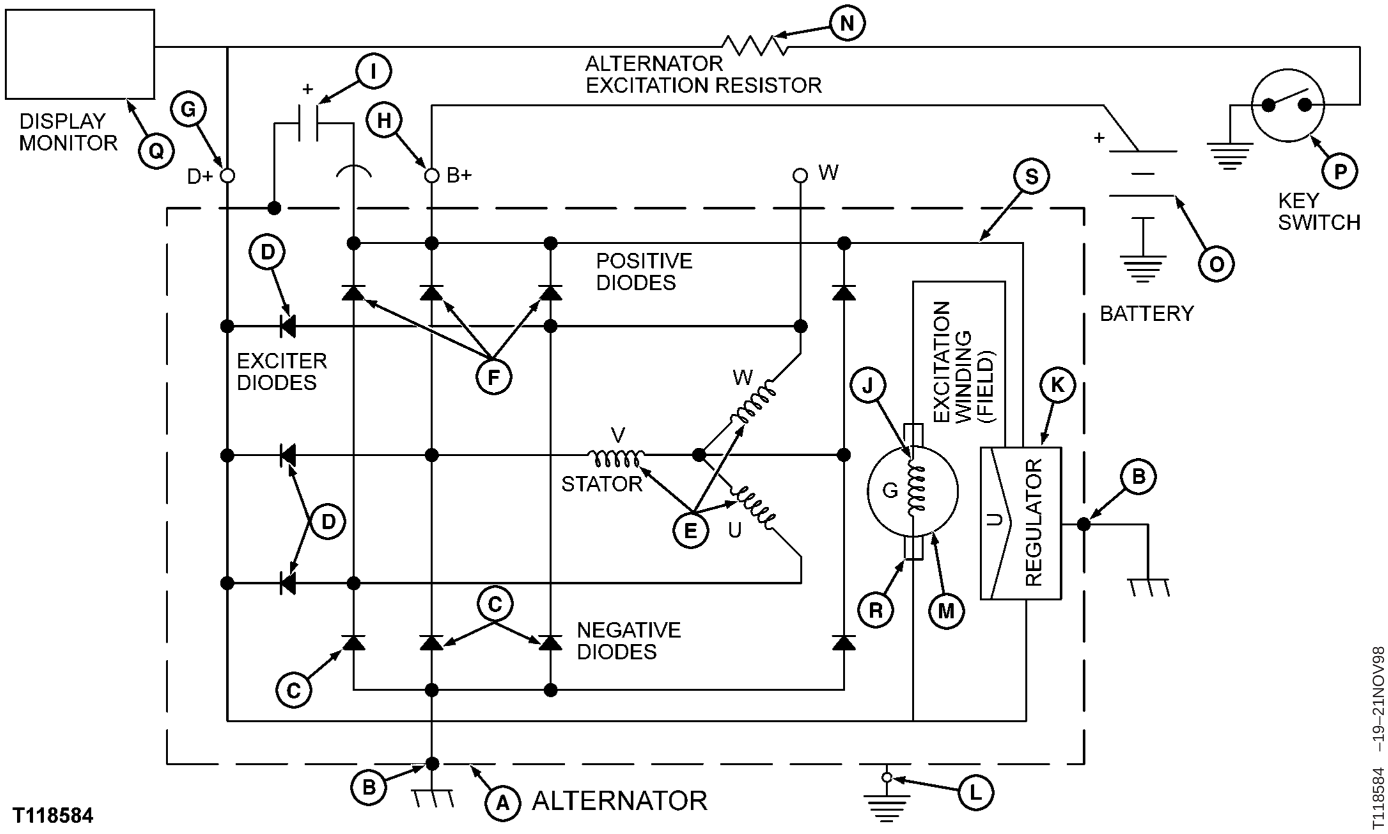
ALTERNATOR THEORY OF OPERATION



T118584

A—Alternator
B—Internal Ground
C—Negative Diodes
D—Exciter Diodes
E—Stator Windings
F—Positive Diodes
G—D+ Terminal
H—B+ Terminal
I—Noise Filter
J—Excitation Winding
K—Regulator
L—External Ground Terminal
M—Rotor
N—Alternator Excitation Resistor
O—Battery
P—Key Switch
Q—Display Monitor
R—Brushes
S—Sense Circuit

The 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, battery power flows through the alternator excitation resistor (N) to terminal D+ (G) 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 alternator excitation resistor 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 B+ terminal (G) and is supplied to the carbon brushes and slip rings of the excitation winding, 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

NORMAL OPERATION

The alternating current induced in the stator winding (E) is rectified by the positive and negative diodes (F and C) 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.

CED,OUOE012,13 –19–27OCT98–2/2

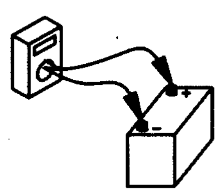
❶ CHARGING CIRCUIT DIAGNOSTIC PROCEDURES

IMPORTANT: Do not disconnect electrical connectors while the engine is running. Damage to Engine and Pump Controller or other components may result. Disconnect connectors only when instructed during a test or check.

NOTE: For a problem that cannot be identified using the diagnostic procedures, check the wiring harnesses and diodes in the circuits for shorts and opens.

– – –1/1

ALTERNATOR (G3) OUTPUT CHECK



T6569AZ –UN–23AUG93

Key switch OFF.

With voltmeter connected from battery (+) terminal to vehicle ground, measure and record battery voltage. 24 - 25.5 volts is normal.

Start and run engine at 1500 rpm, and check battery voltage.

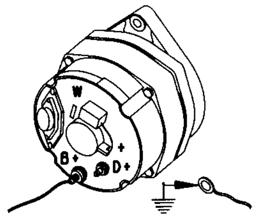
Does battery voltage increase to 27.4 - 28.4 volts?

YES: Alternator is OK.

NO: Repair alternator.

– – –1/1

ALTERNATOR VOLTAGE INDICATOR LIGHT (H18) CHECK



T8322AC –UN–10OCT94

B+—Alternator Output
D+—Alternator Excitation

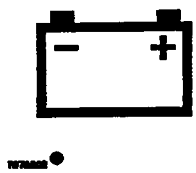
Turn key switch ON.

Engine OFF.

Is alternator voltage indicator light on?

YES: Go to next step.

NO: Go to next check.



T6768CR –UN–18OCT88

Start engine.

Does alternator voltage indicator light go off.

YES: Alternator voltage indicator light and harness are OK.

NO: Check alternator harness for short circuit between alternator and monitor controller. Also check alternator output.

– – –1/1

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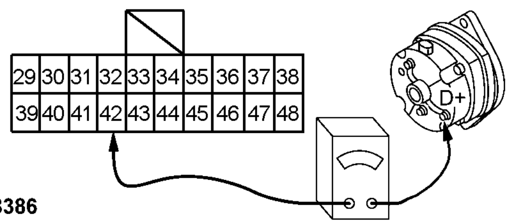
ALTERNATOR VOLTAGE INDICATOR LIGHT HARNESS CHECK



T118386

T118386 –UN–21NOV98

Key switch OFF.

Disconnect 20-pin harness connector from monitor controller and display.

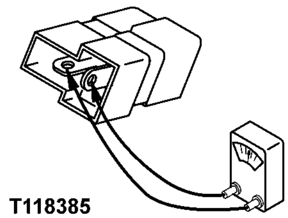
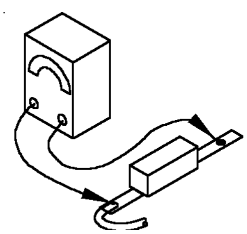
Measure continuity from alternator terminal D+ to pin 42 in harness side of 20-pin monitor controller and display connector.

Is continuity measured?

YES: Check indicator lamp.

NO: Harness has failed. Repair.

– – –1/1

ALTERNATOR SHUT DOWN RELAY ISOLATION DIODE (V2) CHECK	*NOTE: A diode can fail in two modes, either shorted or open. Continuity will be measured in one direction only in a serviceable diode. Use "diode checking mode" on meter when checking continuity.*  T118385 –UN–21NOV98 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
ALTERNATOR POWER 60 AMP FUSIBLE LINK (F22) CHECK	 T109319 –UN–28APR97 Disconnect fusible link from battery relay. Connect ohmmeter to both ends of fusible link. Is continuity measured?	**YES:** Fusible link is OK. Check wiring harness. **NO:** Fusible link has failed. Replace fusible link. – – –1/1

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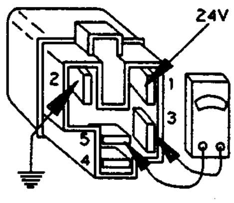
ALTERNATOR SHUT DOWN RELAY (K1) CHECK	 T7447BG –19–14JAN91	**1—24 Volt Terminal** **2—Ground Terminal** **3—Relay Common** **4—Relay Normally Closed** **5—Relay Normal Open** Disconnect harness from relay. Connect 24 volts to relay terminal 1 and ground terminal 2. Does relay click? Connect ohmmeter to terminals 3 and 5. Does ohmmeter read continuity?	**YES:** Relay is OK. **NO:** Relay has failed. Replace. – – –1/1

STARTING AND FUEL SHUTOFF CIRCUIT OPERATIONAL INFORMATION

The following conditions must be met for the circuit to function:

Key switch in START and voltage present at the following:

- Starter relay K13 terminal B
- Fuel shutoff relay K15 terminal B
- Starter M1 terminal C
- Fuel shutoff solenoid Y7 hold-in coil terminal

CED,OUOE012,127 –19–15MAR99–1/1

STARTING AND FUEL SHUTOFF CIRCUIT THEORY OF OPERATION

When key switch S1 is moved to START, power is applied from key switch terminal ST to terminal e of starter relay K13 and terminal g of fuel shutoff relay K15, energizing both relays. (The ground path for the starter relay coil is provided through terminals 3 and 4 of de-energized starter protection relay (K11). Battery power from alternator power fusible link F22 is applied from terminals B and G of energized starter relay K13 to starter M1 solenoid terminal C, energizing the solenoid. This applies battery voltage at starter terminal B (from battery relay K14) to the motor winding, and the starter motor starts cranking the engine.

At the same time, power from fuel shutoff fusible link F23 is applied through terminals B and G of the energized fuel shutoff relay to the pull-in coil of fuel shutoff solenoid Y7, opening the fuel valve. Power from power on 10-amp fuse F5 at the hold-in coil of the fuel shutoff solenoid keeps the fuel valve open after the key switch is returned to ON.

When the engine is running and the alternator is producing output voltage, starter protection relay K11 is energized by ground applied to terminal 2 of the relay from pin 18 of monitor controller and display A5. This prevents the starter motor from being activated if the key switch is moved to START while the engine is running, by removing the ground path for starter relay K13.

When star aid switch S18 is pressed, start aid relay K12 is energized by ground applied to terminal 2. With relay K12 energized, power from start aid fuse F20 is applied to start aid solenoid Y4 through the energized relay contacts, energizing the start aid solenoid. Start aid solenoid diode V1 limits the voltage spikes generated by the solenoid coil when it is de-energized.

Start relay coil suppression diode V9 limits the voltage spikes generated by the starter relay coil when the relay de-energizes.

Fuel shutoff solenoid pull-in and hold-in coil suppression diodes V10 and V8 limit the voltage spikes generated by the solenoid coils when they are de-energized.

CED,OUOE012,126 –19–15MAR99–1/1

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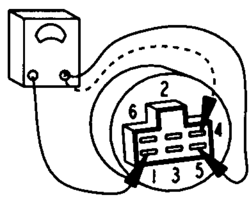
❶ STARTING CIRCUIT DIAGNOSTIC PROCEDURES

IMPORTANT: Do not disconnect electrical connectors while the engine is running. Damage to Engine and Pump Controller or other components may result. Disconnect connectors only when instructed during a test or check.

– – –1/1

KEY SWITCH (S1) CHECK



T8357AL –UN–09NOV94

1—B Terminal
2—G1 Terminal
3—G2 Terminal
4—ACC Terminal
5—M Terminal
6—ST Terminal

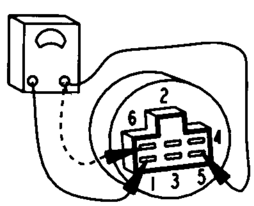
Remove harness from key switch.

Turn key switch to ON.

Is continuity measured between terminals 1 and 4, and 1 and 5?

YES: Go to next step.

NO: Key switch has failed. Replace.



T8357AM –UN–02DEC98

1—B Terminal
2—G1 Terminal
3—G2 Terminal
4—ACC Terminal
5—M Terminal
6—ST Terminal

Remove harness from key switch.

Turn key switch to START.

Is continuity measured between terminals 1 and 5, and 1 and 6?

YES: Key switch is OK.

NO: Key switch has failed. Replace.

– – –1/1

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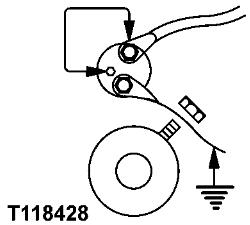
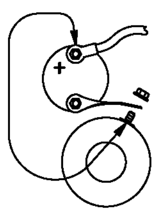
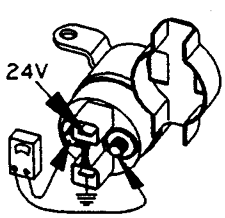
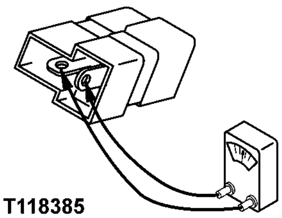
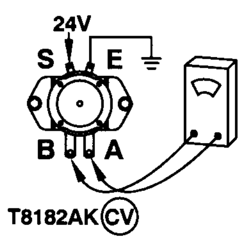
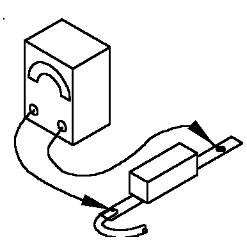
18

STARTER (M1) SOLENOID CHECK	 T118428 –UN–21NOV98 **CAUTION: Starter will crank engine if metal strap is NOT disconnected from motor.** Disconnect metal strap from starter motor large terminal. Connect battery voltage to solenoid small terminal. Ground metal strap from solenoid with heavy gauge wire. Does solenoid click?	**YES:** Solenoid is OK. Check wiring harness. **NO:** Repair or replace starter solenoid. – – –1/1
STARTER (M1) MOTOR CHECK	 T6534BJ –UN–07JAN97 Disconnect metal strap from starter motor large terminal. Connect a heavy gauge wire from battery positive cable to starter motor terminal. Does starter motor turn, but NOT crank engine.	**YES:** Starter motor is OK. Check wiring harness. **NO:** Repair or replace starter. – – –1/1
STARTER RELAY (K13) CHECK	 T7466AD –UN–14MAR91 Disconnect harness from relay. Connect 24 volts to small terminal e and ground small terminal g. Measure continuity between large terminals B and G. Is continuity measured?	**YES:** Relay is OK. Check wiring harness. **NO:** Relay has failed. Replace relay. – – –1/1

START RELAY COIL SUPPRESSION DIODE (V9) CHECK	*NOTE: A diode can fail in two modes, either shorted or open. Continuity will be measured in one direction only in a serviceable diode. Use “diode checking mode” on meter when checking continuity.*  T118385 –UN–21NOV98 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

BATTERY RELAY (K14) CHECK	 T8182AK –UN–03MAR94 **S—Relay Coil +24 Volt Terminal** **E—Relay Coil Ground Terminal** **B—Relay Battery Input Terminal** **A—Relay Battery Output Terminal** Disconnect harness from relay. Connect 24 volts to small terminal S and ground small terminal E. Measure continuity between large terminals A and B. Is continuity measured?	**YES:** Relay is OK. Check wiring harness. **NO:** Relay has failed. Replace relay. – – –1/1

ALTERNATOR POWER 60 AMP FUSIBLE LINK (F22) CHECK	 T109319 –UN–28APR97 Disconnect fusible link from battery relay. Connect ohmmeter to both ends of fusible link. Measure continuity between terminals. Is continuity measured?	**YES:** Fusible link is OK. Check wiring harness. **NO:** Fusible link has failed. Replace fusible link. – – –1/1

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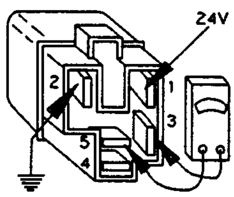
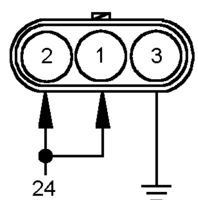
STARTER PROTECTION RELAY (K11) CHECK	 T7447BG –19–14JAN91 **1—24 Volt Terminal** **2—Ground Terminal** **3—Relay Common** **4—Relay Normally Closed** **5—Relay Normally Open** Disconnect harness from starter protection relay. Connect ohmmeter to terminals 3 and 4. Does ohmmeter read continuity? Connect 24 volts to relay terminal 1 and ground terminal 2. Does relay “click”? Connect ohmmeter to terminals 3 and 5. Does ohmmeter read continuity?	**YES:** Relay is OK. **NO:** Relay has failed. Replace. – – –1/1
FUEL SHUTOFF SOLENOID (Y7) CHECK	 **T118387** T118387 –UN–21NOV98 Disconnect harness from fuel shutoff solenoid. Connect 24 volts to solenoid terminals 1 and 2, and ground terminal 3, then remove power from terminal 2. Does solenoid “click” and pull injection pump shutoff lever back, and remain in the energized position after power is removed from terminal 2?	**YES:** Solenoid is OK. **NO:** Solenoid has failed. Replace. – – –1/1

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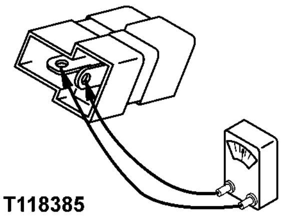
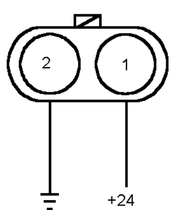
FUEL SHUT-OFF SOLENOID HOLD-IN COIL SUPPRESSION DIODE (V8) AND FUEL SHUT-OFF SOLENOID PULL-IN COIL SUPPRESSION DIODE (V10) CHECK	*NOTE: A diode can fail in two modes, either shorted or open. Continuity will be measured in one direction only in a serviceable diode. Use “diode checking mode” on meter when checking continuity.*  T118385 T118385 –UN–21NOV98 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
START-AID SOLENOID (Y4) CHECK	 T111034 T111034 –UN–21AUG97 **IMPORTANT: DO NOT start engine with start aid can removed from solenoid. Dust can enter the engine, seriously damaging the engine.** Disconnect harness from start-aid solenoid. Remove ether can from start-aid Connect 24 volts to solenoid terminal No. 1 and ground terminal No. 2. Does solenoid click? Reconnect harness. Replace ether can.	**YES:** Solenoid is OK. Go to next check. **NO:** Solenoid has failed. Replace. – – –1/1

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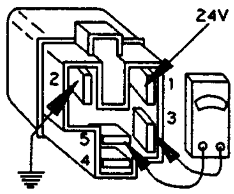
START AID RELAY (K12) CHECK



T7447BG –19–14JAN91

1—24 Volt Terminal
2—Ground Terminal
3—Relay Common
4—Relay Normally Closed
5—Relay Normally Open

Disconnect harness from start aid relay.

Connect ohmmeter to terminals 3 and 5.

Does ohmmeter read open?

Connect 24 volts to relay terminal 1 and ground terminal 2.

Does relay “click”?

Connect ohmmeter to terminals 3 and 5.

Does ohmmeter read continuity?

YES: Relay is OK. Check switch and harness.

NO: Relay has failed. Replace.

– – –1/1

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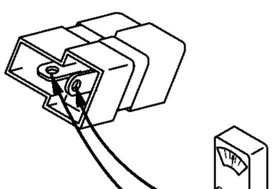
START AID COIL SUPPRESSION DIODE (V1) CHECK

NOTE: A diode can fail in two modes, either shorted or open. Continuity will be measured in one direction only in a serviceable diode. Use “diode checking mode” on meter when checking continuity.



T118385

T118385 –UN–21NOV98

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

WINDSHIELD WIPER AND WASHER CIRCUIT OPERATIONAL INFORMATION

The following conditions must be met for the circuit to function:

- Upper windshield in closed position with latch fully engaged.
- Key switch ON.

CED,OUOE012,8 –19–21OCT98–1/1

WINDSHIELD WIPER AND WASHER CIRCUIT THEORY OF OPERATION

The windshield wiper and washer circuit has four modes of operation: windshield wiper ON (continuous), windshield wiper INT (intermittent), windshield wiper OFF (park), and windshield wash. The operation of the windshield wiper and washer circuit is controlled by signals from the monitor controller and the state of the wiper motor internal position status switch.

WINDSHIELD WIPER CONTINUOUS OPERATION

When wiper speed switch S9 is placed in the ON position, windshield wiper relays K6 (motor ground and intermittent), K7 (wiper run), and K8 (hold for park) are energized by grounds at terminals 26 and 27 of monitor controller and display A5. Windshield wiper relay K9 (motor ground for park) is de-energized by an open at terminal 24 of the monitor controller and display.

Power for windshield wiper motor M3 is supplied from windshield wiper 10-amp fuse F12 through contacts 3 and 5 of energized wiper run relay K7 to terminal L of the wiper motor. Terminal E of the wiper motor is connected to frame ground through contacts 3 and 5 of relay K6, and the wiper motor runs. The wiper motor drives a Pittman arm assembly which moves the wiper blade back and forth across the windshield.

Windshield wiper motor suppression diodes V6 and V7 protect the circuit components from voltage transients generated by the wiper motor.

WINDSHIELD WIPER INTERMITTENT OPERATION

When wiper speed switch S9 is placed in the INT position, monitor controller and display A5 grounds terminals 27 and 28, and windshield wiper motor M3 is started in the same manner as described for continuous operation. After 1 to 2 seconds, the ground at terminal 28 of the monitor controller and display is removed by the controller, causing motor ground and intermittent relay K6 to de-energize. However, ground to wiper motor terminal E is now provided from wiper motor terminal S through contacts 3 and 4 of de-energized relay K6, and the wiper motor continues to run.

When the wiper motor reaches the intermittent stop position (wiper blade at right side of window), terminal S (which is applied to wiper motor terminal E through contacts 3 and 4 of de-energized relay K6) is switched from ground to +24 volts (from motor terminal B) by the wiper motor internal switch. With +24 volts now at both wiper motor terminals, E and L, the motor stops running. After a few seconds, the cycle is repeated by another 1 to 2 second ground pulse from terminal 28 of the monitor controller and display.

WINDSHIELD WIPER PARK OPERATION

When wiper speed switch S9 is turned to the OFF position, monitor controller and display A5 grounds terminal 24, energizing motor ground for park relay K9, and opens terminals 26, 27, and 28. If the wiper motor is running (not in the intermittent stop position), ground from terminal S of the wiper motor (applied through relay K8 contacts 3 and 5) keeps windshield wiper relays K7 (wiper run) and K8 (hold for park) energized. The ground from terminal S is also supplied through the de-energized contacts of motor ground and intermittent relay K6 to wiper motor terminal E, and the wiper motor continues running.

Continued on next page CED,OUOE012,7 –19–21OCT98–1/2

When windshield wiper motor M3 reaches the intermittent stop position, wiper motor terminal S is switched from ground to +24 volts by the wiper motor internal switch. The +24 volts is applied to wiper motor terminal E, and also reverse biases windshield wiper relay isolation diode V5, causing windshield wiper relays K7 (wiper run) and K8 (hold for park) to be de-energized. Ground is now applied through contacts 5 and 3 of energized relay K9 and contacts 3 and 4 of de-energized relay K7 to wiper motor terminal L. With +24 volts on wiper motor terminal E and ground on wiper motor terminal L, the motor runs backwards until a cam in the Pittman arm assembly causes the wiper to be driven off the right side of the windshield into the park position on the windshield frame . When the wiper motor reaches the park position, motor terminal S is grounded by the motor internal switch, and the motor stops.

WINDSHIELD WASHER OPERATION

When windshield washer switch S15 is pressed, windshield washer relay K2 is energized by a ground at terminal 24 of monitor controller and display A5. Power is applied to windshield washer motor M4 from windshield wiper 10–amp fuse F12 through contacts 3 and 5 of energized relay K2. The motor drives the windshield washer pump, to spray fluid from the windshield washer fluid reservoir onto the windshield. When the switch is released, ground is removed from terminal 24 of monitor controller and display A5, and the washer motor stops.

CED,OUOE012,7 –19–21OCT98–2/2

FOLDOUT PAGE 4-94 IS AT REAR OF MANUAL

WINDSHIELD WIPER AND WASHER CIRCUIT DIAGNOSTIC PROCEDURES

IMPORTANT: Do not disconnect electrical connectors while the engine is running. Damage to Monitor Controller or other components may result. Disconnect connectors only when instructed during a test or check.

NOTE: If windshield wiper does not operate, first check the latch on the upper right corner of the windshield. The windshield must be all the way down and the right latch must be secured to contact the windshield wiper enable switch, which allows the wiper to operate.

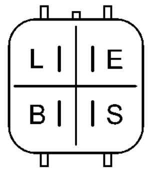
Before troubleshooting the circuits, clean all terminals in the monitor controller and harness connectors using a non-conductive lubricating contact cleaner, then try the circuit operation again before proceeding. TY16324 Contact Cleaner can be used.

– – –1/1

WINDSHIELD WIPER 10 AMP FUSE (F12) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

WINDSHIELD WIPER MOTOR (M3) RUN AND INTERMITTENT STOP CHECK



T118388

T118388 –UN–21NOV98

Disconnect harness from windshield wiper motor.

Connect wiper motor connector terminal E to connector terminal S.

Connect +24 volts to wiper motor connector terminal L.

If the windshield wiper was in the park position, did it operate for one sweep, then stop in the intermittent stop position?

Connect wiper motor connector terminal E to ground (while still connected to S).

Does windshield wiper operate?

Remove ground from terminal E.

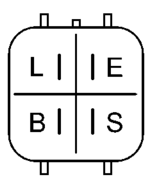
Does windshield wiper continue operating until wiper blade reaches intermittent park position, then stop?

YES: Check harness, wiper relays and monitor controller.

NO: Replace windshield wiper motor.

– – –1/1

WINDSHIELD WIPER MOTOR (M3) PARK CIRCUIT CHECK



T118388

T118388 –UN–21NOV98

With key switch ON, move windshield wiper switch to INT.

When wiper stops in intermittent stop position, turn key switch OFF, then turn windshield wiper switch OFF.

Disconnect harness from windshield wiper motor.

Connect wiper motor connector terminal L to connector terminal B.

Connect +24 volts to wiper motor connector terminal E.

Ground wiper motor connector terminal S.

Does wiper motor operate until wiper blade reaches park position?

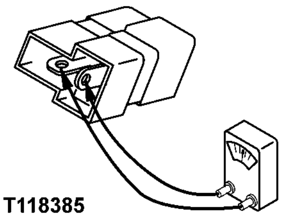
YES: Check harness, wiper relays and monitor controller.

NO: Replace windshield wiper motor.

– – –1/1

WINDSHIELD WIPER MOTOR SUPPRESSION DIODE (V6, V7) CHECK

NOTE: A diode can fail in two modes, either shorted or open. Continuity will be measured in one direction only in a serviceable diode.



T118385

T118385 –UN–21NOV98

The windshield wiper diodes are located inside right console lower cover.

Remove diodes from connectors.

Connect an ohmmeter to diode terminals.

Is continuity measured?

Reverse ohmmeter probes.

Is continuity measured?

Install diodes in connectors.

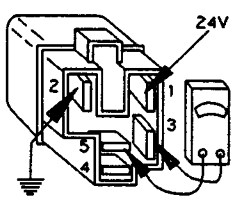
YES: If continuity is measured in both checks, diode has failed in a shorted mode. Replace.

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. Check wiring harness and monitor controller.

– – –1/1

WINDSHIELD WIPER RELAY (MOTOR GROUND AND INTERMITTENT) (K6), WINDSHIELD WIPER RELAY (WIPER RUN) (K7), WINDSHIELD WIPER RELAY (HOLD FOR PARK) (K8) AND WINDSHIELD WIPER RELAY (MOTOR GROUND FOR PARK) (K9) CHECK



T7447BG –19–14JAN91

1—24-Volt Terminal
2—Ground Terminal
3—Relay Common
4—Relay Normal Closed
5—Relay Normal Open

Disconnect relay from harness.

Connect ohmmeter to relay terminals 3 and 4.

Does ohmmeter read continuity?

Connect 24 volts to relay terminal 1 and ground terminal 2.

Does relay “click”?

With 24 volts still connected to terminal 1, connect ohmmeter to terminals 3 and 5.

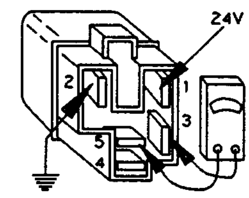
Does ohmmeter read continuity?

YES: Relay is OK.

NO: Relay has failed. Replace.

– – –1/1

WINDSHIELD WASHER RELAY (K2) CHECK



T7447BG –19–14JAN91

1—24-Volt Terminal
2—Ground Terminal
3—Relay Common
4—Relay Normal Closed
5—Relay Normal Open

Disconnect relay from harness.

Connect ohmmeter to relay terminals 3 and 4.

Does ohmmeter read continuity?

Connect 24 volts to relay terminal 1 and ground terminal 2.

Does relay “click”?

With 24 volts still connected to terminal 1 connect ohmmeter to terminals 3 and 5.

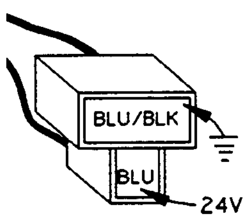
Does ohmmeter read continuity?

YES: Relay is OK.

NO: Relay has failed. Replace.

– – –1/1

WINDSHIELD WASHER MOTOR (M4) CHECK



T7395EG –UN–15OCT90

Disconnect harness from windshield washer motor.

Connect 24 volts to BLUE wire terminal in washer motor connector.

Ground BLUE/BLACK wire terminal in washer motor connector.

Does windshield washer motor operate?

YES: Check wiring harness and monitor controller.

NO: Replace windshield washer motor.

– – –1/1

WINDSHIELD WIPER ENABLE SWITCH (S14) CHECK

Slide upper windshield up.

Remove windshield wiper enable switch retaining plate located in upper right hand corner of cab.

Connect ohmmeter across pins 1 and 2 of the switch and actuate the switch.

Is continuity measured when switch is actuated and no continuity when switch is not actuated?

YES: Windshield wiper enable switch is OK.

NO: Check wiring harness and monitor controller.

– – –1/1

WINDSHIELD WIPER ENABLE SWITCH (S14) HARNESS CHECK	Slide upper windshield up. Remove windshield wiper enable switch retaining plate located in upper right hand corner of cab. Using an ohmmeter, measure resistance of harness wire from enable switch pin 1 to pin 6 of monitor controller 12-pin connector, and from enable switch pin 2 to ground. Is continuity measured in both checks?	**YES:** Windshield wiper enable switch harness is OK. **NO:** Check monitor controller. – – –1/1

WORK AND DRIVE LIGHT CIRCUIT OPERATIONAL INFORMATION

In order for the work and drive light circuits to function, the key switch must be in the ACC or ON position.

CED,OUOE012,134 –19–16MAR99–1/1

WORK AND DRIVE LIGHT CIRCUIT THEORY OF OPERATION

When the key switch is in the ON or ACC position, power is applied from work and drive light 10-amp fuse F11 to terminals 1 and 3 of work and drive light relays K3 and K4.

When drive and work light switch S10 is moved to position 1, drive light relay K4 is energized by ground applied to relay terminal 2 from terminal 19 of monitor and controller display A5. With the drive light relay energized, power is applied through relay terminals 3 and 5 to drive light E2, and cab lights E7 and E8.

Power from the drive light relay is also applied to terminal 41 of monitor controller and display A5, terminal 8 of engine mode and speed control unit A4, and the ILLUM terminal of radio A1 for panel illumination.

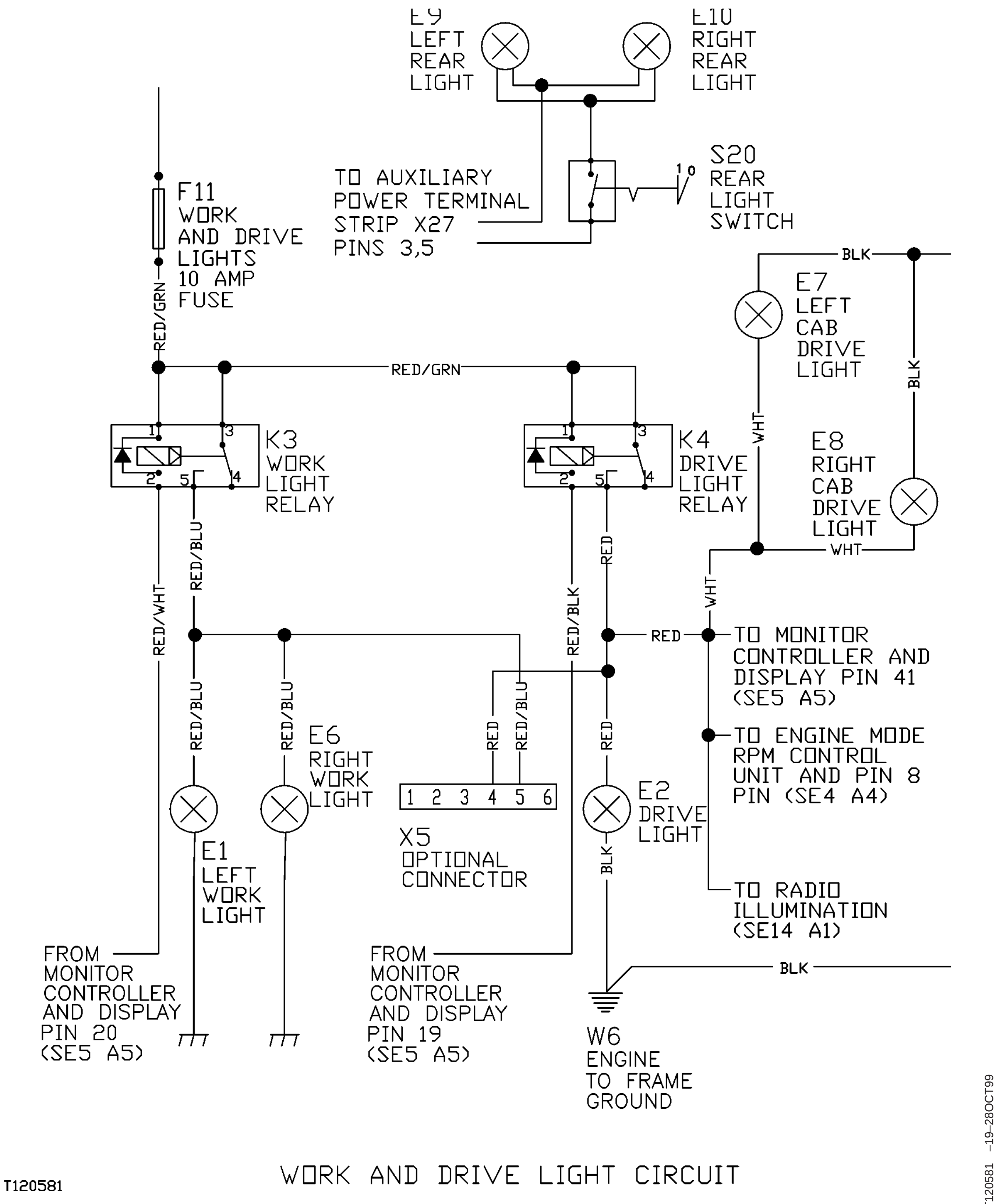
When the light switch is moved to position 2, terminal 20 of the monitor controller and display is also grounded (terminal 19 remains grounded), energizing work light relay K3 as well. With the work light relay energized, power is applied through relay terminals 3 and 5 to work lights E1 and E6.

Relays K3 and K4 also apply power to pins 5 (work light) and 4 (drive light) of optional connector X5 to provide for connection of additional lights.

When the key switch is in the ON or ACC position, power is also applied from auxiliary power fuse F19 through terminal 3 of terminal strip X27, to rear light switch S20. When switch S20 is On, power is applied to left and right rear lights E9 and E10. The ground path for the rear lights is provided through X27 terminal 5 to cab ground.

CED,OUOE012,135 –19–16MAR99–1/1

WORK AND DRIVE LIGHT CIRCUIT SCHEMATIC



Work and Drive Light Circuit

CED,OUOE012,20 –19–31OCT98–1/1

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WORK AND DRIVE LIGHT CIRCUIT DIAGNOSTIC PROCEDURES

IMPORTANT: Do not disconnect electrical connectors while the engine is running. Damage to Engine and Pump Controller or other components may result. Disconnect connectors only when instructed during a test or check.

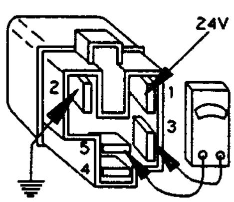
NOTE: Before troubleshooting the circuits, clean all terminals in the monitor controller and harness connectors using a non-conductive lubricating contact cleaner, then try the circuit operation again before proceeding. TY16324 Contact Cleaner can be used.

– – –1/1

WORK AND DRIVE LIGHTS 20 AMP FUSE (F11) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

DRIVE LIGHT RELAY (K4) CHECK



T7447BG –19–14JAN91

1—24 Volt Terminal
2—Ground Terminal
3—Relay Common
4—Relay Normally Closed
5—Relay Normally Open

Disconnect harness from relay.

Connect ohmmeter to terminals 3 and 5.

Does ohmmeter read open?

Connect 24 volts to relay terminal 1 and ground terminal 2.

Does relay “click”?

With 24 volts still connected to terminal 1, connect ohmmeter to terminals 3 and 5.

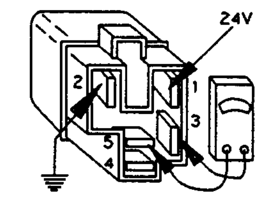
Does ohmmeter read continuity?

YES: Relay is OK.

NO: Relay has failed. Replace.

– – –1/1

WORK LIGHT RELAY (K3) CHECK



T7447BG –19–14JAN91

1—24-Volt Terminal
2—Ground Terminal
3—Relay Common
4—Relay Normally Closed
5—Relay Normally Open

Disconnect harness from relay.

Connect ohmmeter to terminals 3 and 5.

Does ohmmeter read open?

Connect 24 volts to relay terminal 1 and ground terminal 2.

Does relay 'click'?

With 24 volts still connected to terminal 1, connect ohmmeter to terminals 3 and 5.

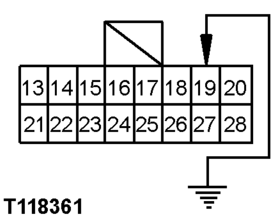
Does ohmmeter read continuity?

YES: Relay is OK.

NO: Relay has failed. Replace.

– – –1/1

DRIVE LIGHTS (E2, E7, E8) CIRCUIT CHECK



T118361

T118361 –UN–21NOV98

Disconnect 16-pin harness connector from monitor controller and display panel.

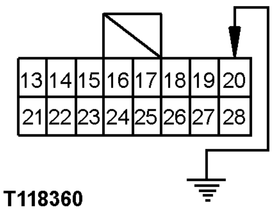
Ground harness connector pin 19.

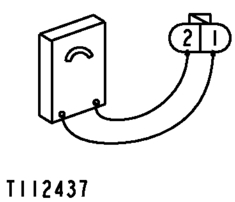
Do drive light E2 and left and right cab lights E7 and E8 operate with key switch in ACC position?

YES: Light switch on monitor controller and display panel has failed. Replace.

NO: Check light bulbs, wire harness and drive light relay.

– – –1/1

WORK LIGHTS (E1) CIRCUIT CHECK	 T118360 –UN–21NOV98 Disconnect 16-pin harness connector from monitor controller and display panel. Ground harness connector pin 20. Do work lights E1 and E6 operate with key switch in ACC position?	**YES:** Light switch on monitor controller and display panel has failed. Replace. **NO:** Check light bulbs, wire harness, and work light relay. – – –1/1

REAR LIGHTS (E9, E10) CIRCUIT CHECK	Remove fuse block cover. Remove fuse F19 from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. Go to next step. **NO:** Replace Fuse. If fuse blows again, check circuit for short.
	 T112437 –UN–05DEC97 Disconnect harness connector from rear lights switch S20. Connect ohmmeter across switch connector pins. Does ohmmeter read open with switch Off, and continuity with switch On?	**YES:** Light switch is OK. Check light bulbs and wire harness **NO:** Switch has failed. Replace. – – –1/1

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ACCESSORY CIRCUITS OPERATIONAL INFORMATION

In order for the circuits to function, the key switch must be in the ACC or ON position.

CED,OUOE012,21 –19–31OCT98–1/1

ACCESSORY CIRCUITS THEORY OF OPERATION

The accessory circuits include the horns (B25, B26), the cab dome light (E3), and the 24-volt power plug (G4).

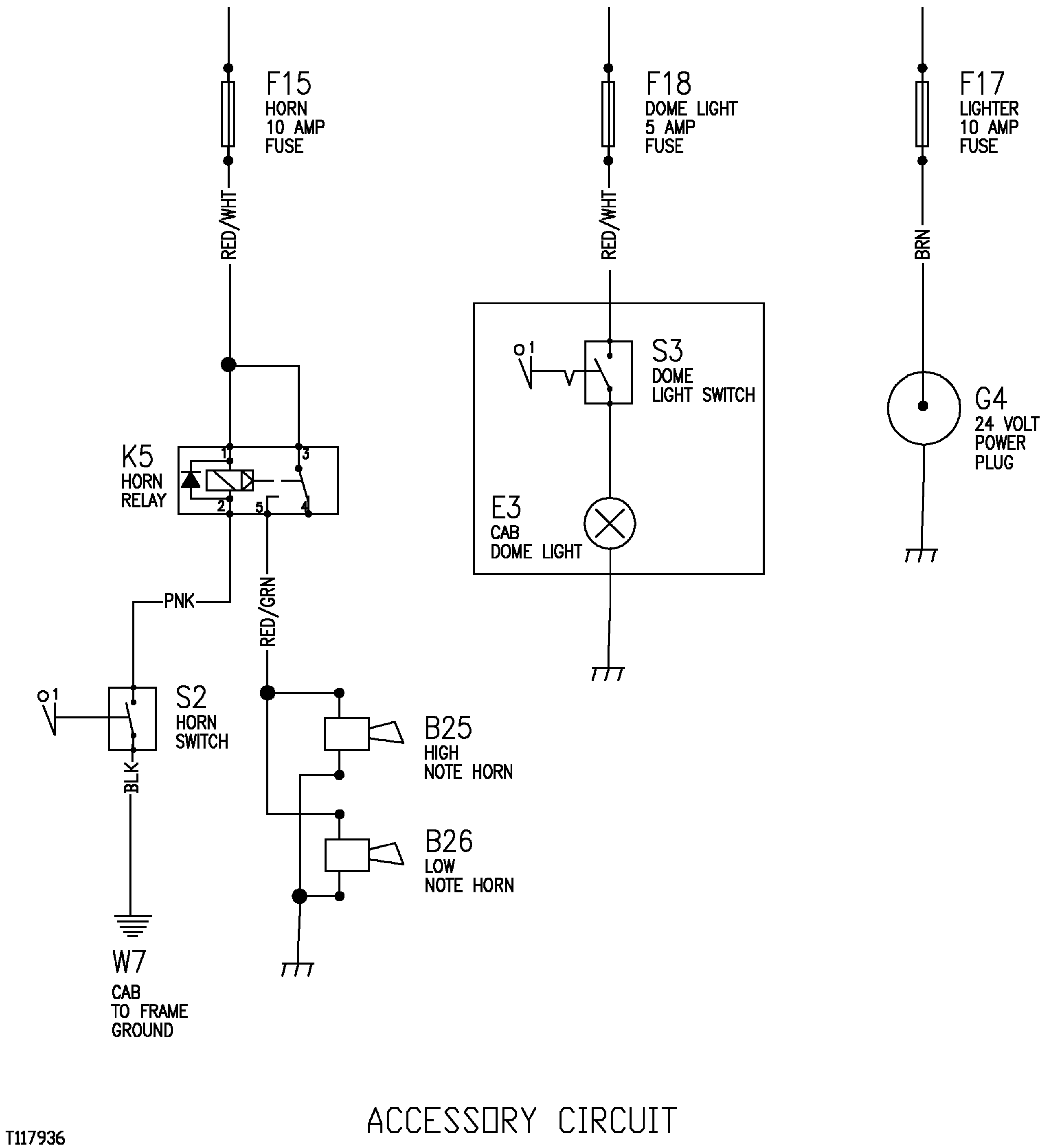
Power from horn 10-amp fuse F15 is applied to terminal 1 and 3 of horn relay K5. When horn switch S2 is pressed, the closed contacts of the switch apply ground to terminal 2 of the horn relay, and the relay is energized. With the relay is energized, power is applied from relay terminal 5 to high and low note horns B25 and B26, sounding the horns.

Power from dome light 5-amp fuse F18 is applied to dome light switch S3. When the switch is turned ON, power is applied to cab dome light E3, turning the light on.

Power from lighter 10-amp fuse F17 is applied to 24-volt power plug G4.

CED,OUOE012,22 –19–31OCT98–1/1

ACCESSORY CIRCUITS SCHEMATIC



T117936 –19–18NOV98

❶ ACCESSORY CIRCUITS DIAGNOSTIC PROCEDURES

IMPORTANT: Do not disconnect electrical connectors while the engine is running. Damage to Engine and Pump Controller or other components may result. Disconnect connectors only when instructed during a test or check.

– – –1/1

HORN 10 AMP FUSE (F15) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

DOME LIGHT 5 AMP FUSE (F18) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace Fuse. If fuse blows again, check for short.

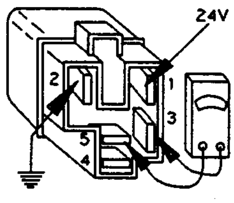
– – –1/1

LIGHTER 10 AMP FUSE (F17) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

Sub-System Diagnostics

HORN RELAY (K5) CHECK



T7447BG –19–14JAN91

1—24-Volt Terminal
2—Ground Terminal
3—Relay Common
4—Relay Normally Closed
5—Relay Normally Open

Disconnect harness from relay.

Connect ohmmeter to terminals 3 and 4.

Does ohmmeter read continuity?

Connect 24 volts to relay terminal 1 and ground terminal 2.

Does relay “click”?

With 24 volts still connected to terminal 1, connect ohmmeter to terminals 3 and 5.

Does ohmmeter read continuity?

YES: Relay is OK.

NO: Relay has failed. Replace.

– – –1/1

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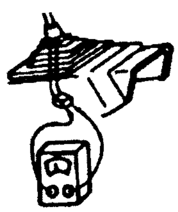
HORN SWITCH (S2) CHECK



T108586 –UN–31MAR97

Remove bottom cover from left arm rest.

Disconnect wire harness from horn switch.

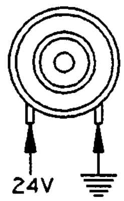
Connect ohmmeter to both wires (pink and black) and push horn button.

Does ohmmeter read continuity?

YES: Horn switch OK. Check wiring harness and horns.

NO: Replace switch.

– – –1/1

HIGH NOTE HORN (B25) AND LOW NOTE HORN (B26) CHECK	 T7469AF –UN–11MAR91	Disconnect wire harness from horns. Connect 24 volts to one terminal of either horn and connect other horn terminal to ground. Does horn sound? Repeat check on other horn.	**YES:** Check wire harness. **NO:** Replace horn.

– – –1/1

QUICK HITCH CIRCUIT OPERATIONAL INFORMATION

In order for the circuit to function, the key switch must be in the ACC or ON position.

CED,OUOE012,131 –19–15MAR99–1/1

QUICK HITCH CIRCUIT THEORY OF OPERATION

With the key switch in the ON or ACC position, power is applied from auxiliary fuse F19 to quick hitch fuse F24 via terminal 2 of auxiliary terminal strip X27. When quick hitch switch S21 is moved to the UNLATCH (closed) position, power from fuse F24 is applied through the switch to solenoid Y2, energizing the solenoid. With the switch in the UNLATCH position, power is also applied from to warning light H23 and audible alarm H22.

CED,OUOE012,132 –19–15MAR99–1/1

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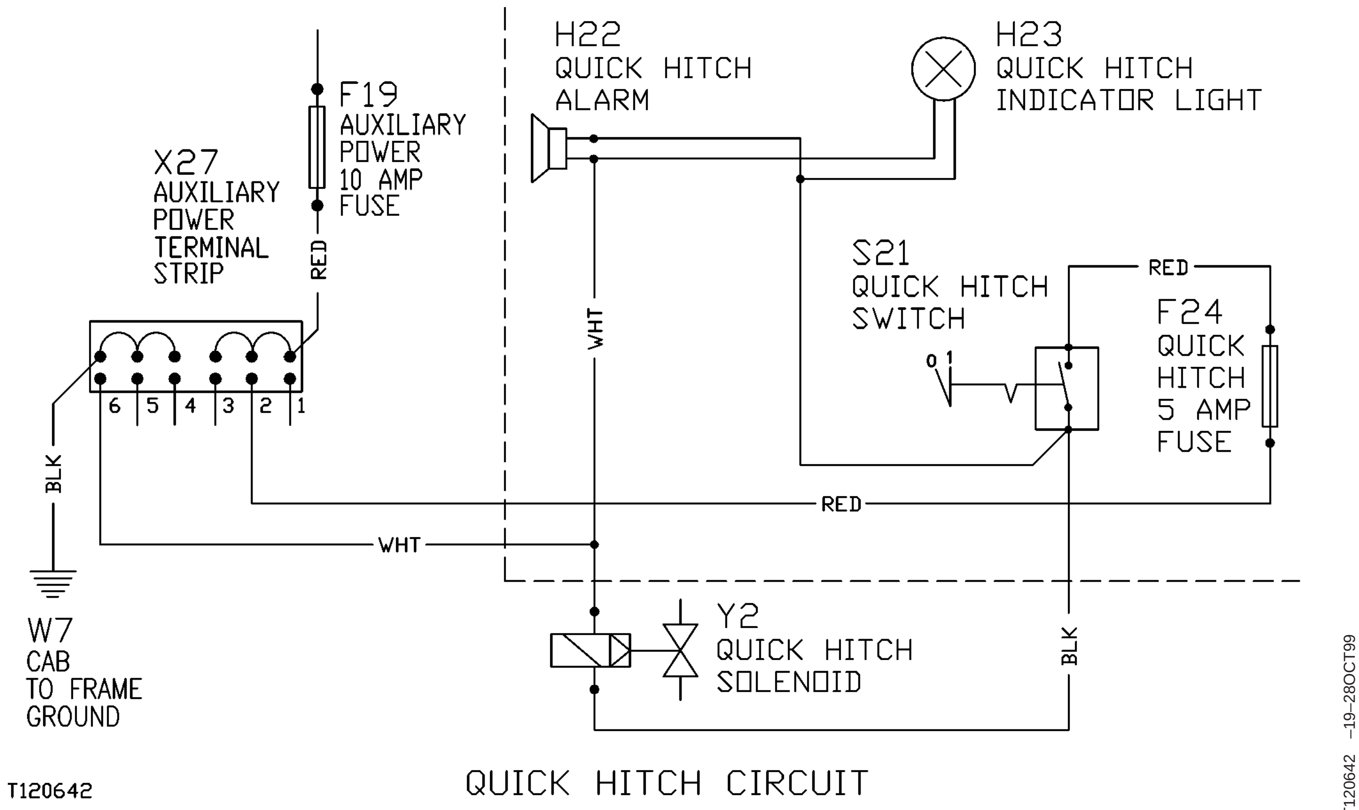
QUICK HITCH CIRCUIT SCHEMATIC



Quick Hitch Circuit

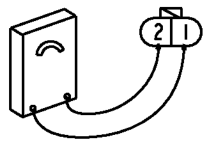
CED,OUOE012,133 –19–15MAR99–1/1

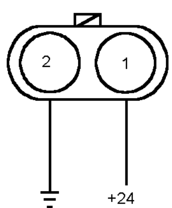
❶ QUICK HITCH CIRCUIT DIAGNOSTIC PROCEDURES

– – –1/1

1a AUXILIARY 10 AMP FUSE (F19) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace fuse. If fuse blows again, check for short.

– – –1/1

1b QUICK HITCH CONTROL BOX (A6) CHECK	 T112437 –UN–05DEC97	Position boom so implement is resting on ground. Turn key Switch OFF Remove harness connector from hitch solenoid. connect voltmeter to pins 1 and 2 of harness connector. Turn key switch ON. **CAUTION: Do not move control box switch to UNLATCH position unless implement or quick hitch is resting on ground.** Move control box switch to UNLATCH position. Does voltmeter read 24 volts? Does hitch indicator light come on? Does hitch warning alarm sound? Move control box switch to LATCH position	**YES:** Control box is OK. Go to next check. **NO:** Repair or replace control box. – – –1/1

1c HITCH SOLENOID (Y2) CHECK	 T111034 –UN–21AUG97	Disconnect harness from hitch solenoid. Connect 24 volts to solenoid terminal No. 1 and ground terminal No. 2. Does solenoid click? Reconnect harness.	**YES:** Solenoid is OK. **NO:** Solenoid has failed. Replace. – – –1/1

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MONITOR CONTROLLER AND DISPLAY CIRCUIT SPECIFICATIONS

Fuel Sending Unit—Specification

Resistance .... 10 +0 -4 Ohms With Fuel Gauge Reading Full

Fuel Sending Unit—Specification

Resistance .... 38 ± 5 Ohms With Fuel Gauge Reading Half

Fuel Sending Unit—Specification

Resistance .... 90 +10 -0 Ohms With Fuel Gauge Reading Empty

Fuel Level Switch Closes At—Specification

Level .... 112 mm (4.4 in.) Fuel In Tank Or Less (30.3—37.9 L) (8—10 gal)

Engine Oil Pressure Switch Opens At—Specification

Pressure... Above 172 kPa (1.72 bar) (24.9 psi)

Engine Oil Pressure Switch Closes At—Specification

Pressure... Below 103 kPa (1.03 bar) (14.9 psi)

Engine Coolant Temperature Switch Closes On—Specification

Increasing Temperature......................... 110°C ± 3°C (230°F ± 37°F) Maximum

Engine Coolant Temperature Switch Opens On—Specification

Decreasing Temperature .... 95°C (203°F) Minimum

Alternator Charge Light Illuminates At Alternator Excitation

Field Output—Specification

Voltage.. 10 ± 1.5 Volts Or Less

Alternator Charge Light Goes Out At Alternator Excitation Field Output—Specification

Voltage.. 13 ± 1.5 Volts Or More

Air Filter Restriction Switch Closes At—Specification

Vacuum.. 6.23 kPa ± 1.25 kPa
Vacuum... 1.84 ± 0.36 in. Hg
Vacuum.. 25 ± 2.3 in.

Coolant Temperature Gauge Needle Position At—Specification

Temperature .... 60°C (140°F) Beginning Of Green Area (Cold)
Temperature .... 104°C (219°F) End Of Green Area (Cold)
Temperature .... 110°C (230°F) Beginning Of Red Area (Hot)
Temperature .... 135°C (275°F) End Of Red Area (Hot)

Engine Coolant Temperature Sensor—Specification

Resistance .... 63 Ohms At 60°C (140°F)
Resistance .... 14 Ohms At 104°C (219°F)
Resistance .... 15 Ohms At 110°C (230°F)
Resistance .... 3 Ohms At 135°C (275°F)

Charge Air Temperature Switch Closes On—Specification

Increasing Temperature.................... at 94°C ± 2.8°C (201°F ± 37°F) maximum

Continued on next page

CED,OUOE012,122 –19–12MAR99–1/2

Charge Air Temperature Switch Opens On—Specification

Decreasing Temperature .... at 84°C ± 2.8°C (183°F ± 37°F) minimum

Hydraulic Oil Filter Differential Pressure Switch Closes At—Specification

Differential Pressure .... 15 psi ± 2.0 psi

CED,OUOE012,122 –19–12MAR99–2/2

MONITOR CONTROLLER AND DISPLAY CIRCUIT OPERATIONAL INFORMATION

The key switch must be ON for the circuit to function.

CED,OUOE012,26 –19–31OCT98–1/1

MONITOR CONTROLLER AND DISPLAY CIRCUIT THEORY OF OPERATION

The monitor controller and display (A5) contains gauges and indicators, sensor inputs, and switches. The gauges and indicators display the status of machine systems and control switches. The sensor inputs are used by the monitor controller to monitor the status of the machine systems, and the switches are used to control or select machine functions by providing control signal outputs to other machine systems. The illumination of the indicators and the status of control signal outputs are controlled by logic circuits and drivers in the monitor controller in response to the sensor inputs and control switch settings.

Operating power to the controller and display is applied from monitor controller and display fuse F6 to pin 40. Cab frame ground is applied to pin 37. Backup power for the controller logic circuits is applied from radio and monitor controller fuse F1 to monitor controller pin 39.

HOURMETER AND GAUGES

Operating power for the hourmeter is applied from fuse F6 to controller pin 29, and the controller monitors the alternator excitation field at pin 42. When the engine is running and the alternator excitation field voltage is greater than 11.5 volts, the hourmeter operates.

The engine coolant temperature and fuel level gauges (P2 and P3) are controlled by coolant temperature and fuel level sensors B9 and B8, which provide a variable resistance to ground for the gauges.

Temperature sensor B9 is applied to controller pin 47, and fuel level sensor B8 is applied to pin 46.

STATUS INDICATORS

When the key switch is turned to ON, the monitor controller and display performs a lamp check by illuminating all the status indicators. After 2—3 seconds the lamp check mode ends, and indicator lamp illumination is controlled by the sensor inputs.

AIR FILTER RESTRICTION INDICATOR LIGHT (H14)

The air filter restriction switch (B1) is a normally open switch that closes to machine ground when a restriction is sensed with the engine running. The machine ground is applied to controller pin 3, causing the indicator to illuminate.

FUEL LEVEL INDICATOR LIGHT (H13)

The fuel level switch (B2) is normally open when fuel is in the tank, and closes to machine ground when the fuel level is below 112 mm (4.4 in.). The machine ground is applied to controller pin 2, causing the indicator to illuminate.

ENGINE COOLANT TEMPERATURE INDICATOR LIGHT (H16)

The engine coolant temperature switch (B3) is a normally open switch that closes to machine ground when the coolant temperature exceeds 105 ± 5°C (221 ± 35°F). The machine ground is applied to controller pin 1, causing the indicator to illuminate.

ENGINE OIL PRESSURE INDICATOR (H17)

The engine oil pressure switch (B4) is normally closed and opens with the engine running. When the oil pressure falls below 39 kPa (.039 bar) (5.7 psi) the switch closes to machine ground. The machine ground is applied to controller pin 10, causing the indicator to illuminate.

HYDRAULIC OIL LEVEL INDICATOR (H12)

Hydraulic oil level switch (B5) is a normally open switch, held closed when the oil level is adequate. When closed, the switch applies machine ground to controller pin 9. The monitor controller only checks the status of pin 9 when the fluid level switch (S5) is pressed. If ground is present when the switch is pressed, the indicator illuminates.

Continued on next page

CED,OUOE012,27 –19–26JAN99–1/3

ENGINE COOLANT LEVEL INDICATOR (H20)

Engine coolant level switch (B6) is a normally open switch, held closed when the coolant level is adequate. When closed, the switch applies machine ground to controller pin 8. The monitor controller only checks the status of pin 8 when the fluid level switch (S5) is pressed. If ground is present when the switch is pressed, the indicator illuminates.

ENGINE OIL LEVEL INDICATOR (H19)

Engine oil level switch (B7) is a normally open switch, held closed with adequate oil level. When closed, the switch applies machine ground to controller pin 7. The monitor controller only checks the status of pin 7 when the fluid level switch (S5) is pressed. If ground is present when the switch is pressed, the indicator illuminates.

ALTERNATOR VOLTAGE INDICATOR (H18)

The alternator voltage indicator is controlled by the alternator excitation field voltage monitored by the controller at pin 42. When the alternator excitation field voltage drops below 10 ± 1.5 volts the indicator illuminates. When the alternator excitation field voltage goes above 13 ± 1.5 volts the indicator goes out.

CHARGE AIR TEMPERATURE INDICATOR (H15)

Charge air temperature switch (B12) is a normally open switch that closes to machine ground when the charge air temperature exceeds 100°C (212°F) . The machine ground is applied to controller pin 44, causing the indicator to illuminate.

HYDRAULIC OIL FILTER RESTRICTION INDICATOR (H21)

The hydraulic oil filter restriction switch (B30) is a normally open switch that closes to machine ground when the differential pressure in the hydraulic oil filter exceeds 15 psi. The machine ground is applied through switch B31 to controller pin 43, causing the indicator to illuminate.

MONITOR CONTROLLER AND DISPLAY ALARM (H8)

The monitor controller and display alarm sounds when the engine oil pressure is low, or the engine coolant overheats. When the buzzer stop switch (S6) is pressed and released, the buzzer stops sounding and the buzzer function is automatically reset for the engine coolant overheat function. The buzzer cannot be turned off when the oil pressure is low.

The buzzer is reset by turning the key switch to OFF. The buzzer will not sound more than once for the same problem unless it has been reset.

CONTROL SWITCHES AND INDICATORS

WIPER SPEED SWITCH (S9)

The wiper speed switch is used to select intermittent or continuous windshield wiper operation. The monitor controller provides ground switched outputs to the windshield wiper circuit from controller pins 24, 26, 27, and 28 based on the setting of the wiper speed switch. If the windshield is open, a ground from windshield wiper enable switch S14 is allied to monitor controller pin 6, disabling the wiper speed switch.

WINDSHIELD WASHER SWITCH (S15)

When the windshield washer switch is pressed, the monitor controller provides a ground switched output to the windshield washer circuit from controller pin 25.

DRIVE AND WORK LIGHT SWITCH (10)

The drive and work light switch provides ground switched outputs to the light circuits. When the switch is moved to position 1, controller pin 19 (drive light) is grounded. When the switch is moved to position 2, controller pins 19 and 20 (work light) are grounded.

Continued on next page CED,OUOE012,27 –19–26JAN99–2/3

WORK MODE SELECTION SWITCH (S7)

The work mode selection switch selects the machine operating modes (dig, grading, precision, or attachment). Each time the switch is pressed the mode selection is stepped to the next mode and the corresponding mode indicator (H1, H2, H3 or H4) is illuminated. The monitor controller provides different combinations of ground switched outputs to the engine and pump controller depending on the mode selected. The outputs are applied from mode 1 and mode 2 monitor controller pins 21 and 22 to engine controller pins D3 and D4.

Mode	Pin 21[a]	Pin 22[a]
Dig	H	H
Grading	L	H
Precision	H	L
Attachment	L	L
[a]H=5 ± 0.5 volts; L=less than 1.0 volt.		

PROPEL SPEED CHANGE SWITCH (S8)

The propel speed change switch selects slow or fast operating speed. When fast speed is selected, the switch applies a ground from monitor controller pin 17 to engine and pump controller pin B12.

AUTO IDLE (A/I) SWITCH (S13)

When the auto idle (A/I) switch is pressed, the A/I indicator illuminates and the monitor controller applies a ground from monitor controller pin 13 to engine motor and pump controller pin D6.

ENGINE MODE AND RPM CONTROL UNIT (A4)

ECONOMY (E) MODE SWITCH (S11)

When the economy (E) mode switch is pressed, a ground is applied from engine mode and RPM control unit pin 2 to monitor controller pin 35, causing the economy mode to be selected. With the economy mode selected, the monitor controller illuminates the economy mode indicator light (H6), and provides a ground from pin 15 to engine and pump controller pin D5. Ground for the mode switch is applied to engine mode and RPM control unit pin 1.

HIGH POWER (HP) MODE SWITCH (S12)

When the high power (HP) mode switch is pressed, a ground is applied from engine mode and RPM control unit pin 4 to monitor controller pin 34, causing the high power mode to be selected. With the high power mode selected, the monitor controller illuminates the high power mode indicator light (H5), and provides a ground from pin 23 to engine and pump controller pin B11. Ground for the mode switch is applied to engine mode and RPM control unit pin 3.

ENGINE RPM DIAL (R10)

The engine RPM dial provides a variable voltage to engine and pump controller pin D21 from engine mode and RPM control unit pin 6 based on the setting of the RPM dial. Power for the RPM dial is applied across engine mode and RPM control unit pins 5 and 7.

CED,OUOE012,27 –19–26JAN99–3/3

FOLDOUT PAGE 4-118 IS AT REAR OF MANUAL

❶ MONITOR CONTROLLER AND DISPLAY CIRCUIT DIAGNOSTIC PROCEDURES

IMPORTANT: Do not disconnect electrical connectors while the engine is running. Damage to Engine and Pump Controller or other components may result. Disconnect connectors only when instructed during a test or check.

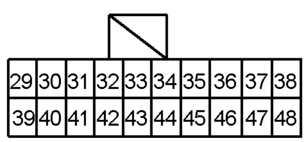
NOTE: Before troubleshooting the circuits, clean all pins in the monitor controller and harness connectors using a non-conductive lubricating contact cleaner, then try the circuit operation again before proceeding. TY16324 Contact Cleaner can be used.

– – –1/1

MONITOR CONTROLLER AND DISPLAY 5 AMP FUSE (F6) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

MONITOR CONTROLLER AND DISPLAY (A5) HARNESS POWER CHECK

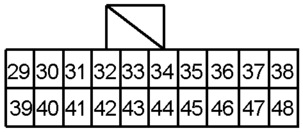


T118378

T118378 –UN–21NOV98

MONITOR CONTROLLER AND DISPLAY (A5) HARNESS POWER CHECK	Turn key switch OFF. Disconnect 20-pin harness connector from monitor controller and display. Measure voltage on pins 30, 39 and 40 of harness connector. Is 24 volts measured?	**YES:** Go to next check. **NO:** Repair harness.

– – –1/1

MONITOR CONTROLLER AND DISPLAY (A5) HARNESS GROUND CHECK	 **T118378** T118378 –UN–21NOV98 Turn key switch OFF. Disconnect 20-pin harness connector from monitor controller and display. Measure continuity from pin 37 of harness connector to cab frame. Is continuity measured?	**YES:** Monitor controller has failed. Replace. **NO:** Repair wiring harness. – – –1/1

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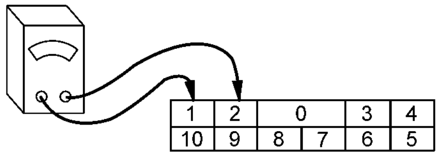
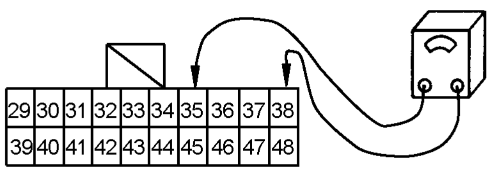
ECONOMY MODE INDICATOR LIGHT (H6) CHECK	With key switch ON and economy mode OFF, push economy (E) mode switch. Does switch stay down and economy mode indicator light come ON? Push economy (E) mode switch again. Does switch return to original position and indicator go OFF?	**YES:** Indicator and switch are OK. **NO:** Go to next check. – – –1/1

ECONOMY (E) MODE SWITCH (S11) CHECK	 T118513 T118513 –UN–21NOV98 Turn key switch OFF. Disconnect engine mode and RPM control unit (A4) connector. Connect ohmmeter between pins 1 and 2 of connector. Measure continuity with economy (E) mode switch in OFF and ON positions. Does ohmmeter read open with switch in OFF position, and continuity with switch in ON position? Reconnect engine mode and RPM control unit connector.	**YES:** Switch is OK. Go to next check. **NO:** Switch has failed. Replace. – – –1/1

ECONOMY (E) MODE SWITCH (S11) HARNESS CHECK	 T118512 T118512 –UN–21NOV98 Turn key switch OFF. Disconnect 20-pin harness connector from monitor controller and display. Connect ohmmeter between pins 35 and 38 of harness connector. Measure continuity with economy (E) mode switch in OFF and ON positions. Does ohmmeter read open with switch in OFF position, and continuity with switch in ON position?	**YES:** Indicator lamp or controller has failed. Replace. **NO:** Harness has failed. Repair. – – –1/1

Sub-System Diagnostics

HIGH POWER MODE INDICATOR LIGHT (H5) CHECK	With key switch ON and high power mode OFF, push high power (HP) mode switch. Does switch stay down and high power mode indicator light come ON? Push high power (HP) mode switch again. Does switch return to original position and indicator go OFF?	**YES:** Indicator and switch are OK. **NO:** Go to next check. – – –1/1

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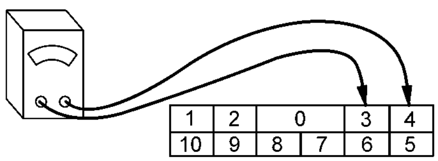
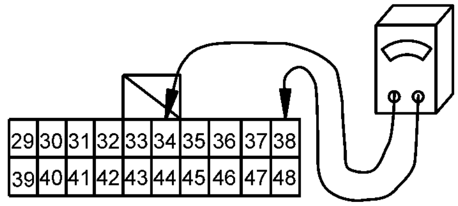
HIGH POWER (HP) MODE SWITCH (S12) CHECK	 **T118515** T118515 –UN–21NOV98 Turn key switch OFF. Disconnect engine mode and RPM control unit (A4) connector. Connect ohmmeter between pins 3 and 4 of connector. Measure continuity with high power (HP) mode switch in OFF and ON positions. Does ohmmeter read open with switch in OFF position, and continuity with switch in ON position? Reconnect engine mode and RPM control unit connector.	**YES:** Switch is OK. Go to next check. **NO:** Switch has failed. Replace. – – –1/1

HIGH POWER (HP) MODE SWITCH (S12) HARNESS CHECK	 T118514 –UN–21NOV98 Turn key switch OFF. Disconnect 20-pin harness connector from monitor controller and display. Connect ohmmeter between pins 34 and 38 of harness connector. Measure continuity with high power (HP) mode switch in OFF and ON positions. Does ohmmeter read open with switch in OFF position, and continuity with switch in ON position?	**YES:** Indicator lamp or controller has failed. Replace. **NO:** Harness has failed. Repair. – – –1/1

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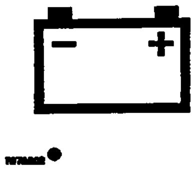
WORK MODE SELECTION SWITCH (S7), DIG MODE INDICATOR LIGHT (H1), GRADING MODE INDICATOR LIGHT (H2), PRECISION MODE INDICATOR LIGHT (H3) AND ATTACHMENT MODE INDICATOR LIGHT (H4) CHECK	Turn key switch ON. Push WORK MODE switch several times to cycle through all work mode selections (dig, grading precision, attachments). Does mode selection change when switch is pressed? Does each mode indicator come ON as mode is selected?	**YES:** Switch and indicators are OK. **NO:** If modes do not change, switch or monitor controller has failed. Repair or replace. Replace indicator lamp that does not come ON. – – –1/1

AUTO IDLE SWITCH (S13) AND AUTO IDLE MODE INDICATOR LIGHT (H7) CHECK	Turn key switch ON. Push auto idle (A/I) switch. Does auto idle (A/I) indicator come ON? Push auto idle (A/I) again. Does auto idle (A/I) indicator go OFF?	**YES:** Switch and indicator are OK. **NO:** Check indicator lamp. If lamp is OK, switch or controller has failed. Replace. – – –1/1

ALTERNATOR VOLTAGE INDICATOR LIGHT (H18) CHECK	 T6768CR –UN–18OCT88 Turn key switch ON. Engine OFF. Is alternator voltage indicator light ON?	**YES:** Go to next step. **NO:** Check indicator lamp. If OK go to next check.
	Start engine. Does alternator voltage indicator light go OFF?	**YES:** Indicator light is OK. **NO:** Go to next check. – – –1/1

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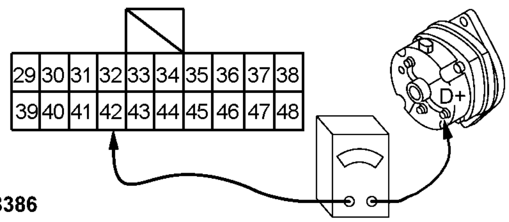
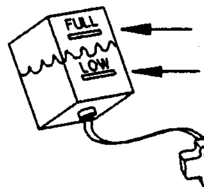
ALTERNATOR VOLTAGE INDICATOR LIGHT HARNESS CHECK	 T118386 T118386 –UN–21NOV98 Turn key switch OFF. Disconnect 20-pin harness connector from monitor controller and display. Check wire from alternator terminal D+ to pin 42 of 20-pin harness connector for continuity and for short to ground. Is continuity measured and no short found?	**YES:** Monitor controller may have failed. **NO:** Harness has failed. Repair. – – –1/1

ENGINE COOLANT LEVEL INDICATOR LIGHT (H20) CHECK



T7469AK –UN–14MAR91

Check coolant level in overflow recovery tank. Be sure level is between FULL and LOW marks.

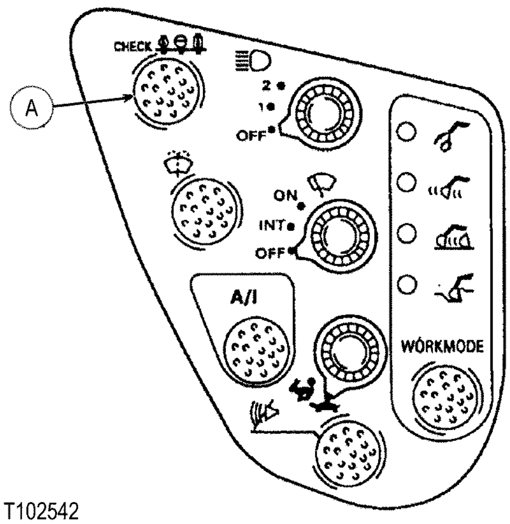
Turn key switch ON.

Observe coolant level indicator.

Does indicator come ON, then go OFF 2—3 seconds later?

YES: Indicator is OK. Go to next step.

NO: Check indicator lamp.



T102542

T102542 –UN–29AUG96

A—Fluid Level Check Switch

Push fluid level check switch.

Does coolant level indicator come ON?

YES: Engine coolant level switch is OK.

NO: Go to next check.

– – –1/1

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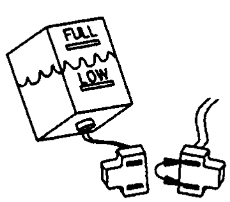
ENGINE COOLANT LEVEL SWITCH (B6) CHECK



T7469AL –UN–14MAR91

Disconnect harness from engine coolant level switch.

Connect a jumper wire between harness connector pins.

Turn key switch ON.

Push fluid level check switch.

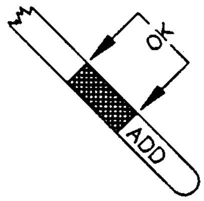
Does coolant level indicator come ON?

YES: Engine coolant level switch has failed. Replace.

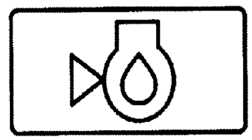
NO: Check wiring harness.

– – –1/1

ENGINE OIL LEVEL INDICATOR LIGHT (H19) CHECK



T7469AM –UN–11MAR91



T101681 –UN–29AUG96

Check oil level in engine pan, be sure level is between FULL and ADD marks on dip stick.

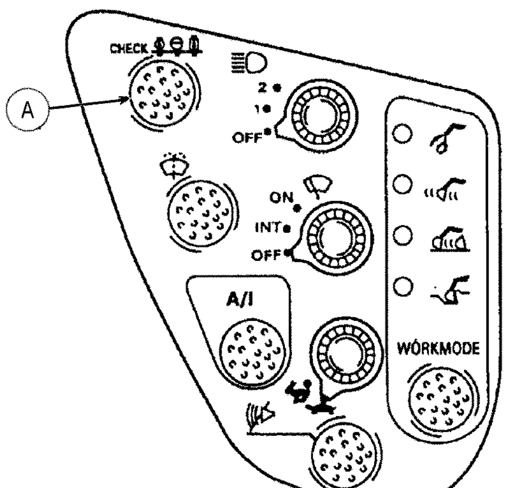
Turn key switch ON.

Observe engine oil level indicator.

Does indicator come ON then go OFF 2—3 seconds later?

YES: Indicator is OK. Go to next step.

NO: Check indicator lamp.



T102542

T102542 –UN–29AUG96

A—Fluid Level Check Switch

Push fluid level check switch.

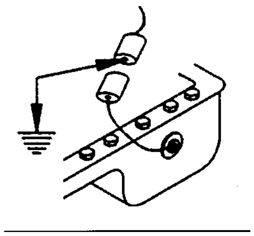
Does engine oil level indicator come ON?

YES: Engine oil level switch is OK.

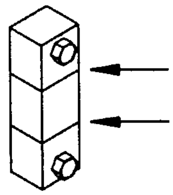
NO: Go to next check.

– – –1/1

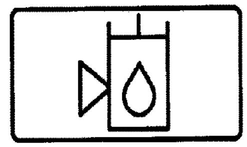
Sub-System Diagnostics

ENGINE OIL LEVEL SWITCH (B7) CHECK	 T7470AH –UN–11MAR91	Disconnect harness from engine oil level switch. Connect a jumper wire from harness connector to ground. Turn key switch ON. Push fluid level check switch. Does engine oil level indicator come ON?	**YES:** Engine oil level switch has failed. Replace. **NO:** Check wiring harness. – – –1/1

HYDRAULIC OIL LEVEL INDICATOR LIGHT (H12) CHECK



T7470AI –UN–11MAR91



T101683 –UN–29AUG96

Check oil level in hydraulic reservoir. Be sure level is between red lines on sight gauge.

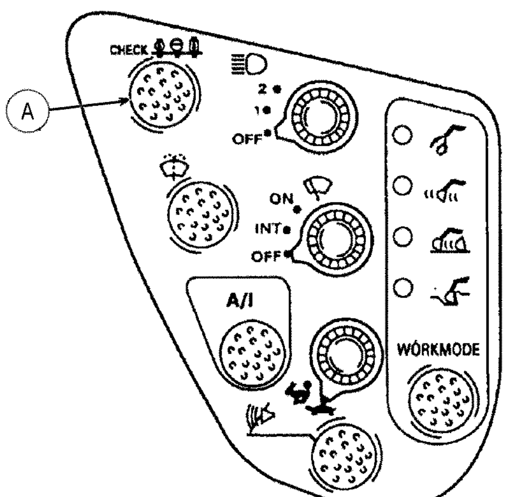
Turn key switch ON.

Observe hydraulic oil level indicator.

Does indicator come ON then go OFF 2—3 seconds later?

YES: Indicator is OK. Go to next step.

NO: Check indicator lamp.



T102542

T102542 –UN–29AUG96

A—Fluid Level Check Switch

Push fluid level check switch.

Does hydraulic oil level indicator come ON?

YES: Hydraulic oil level switch is OK.

NO: Go to next check.

– – –1/1

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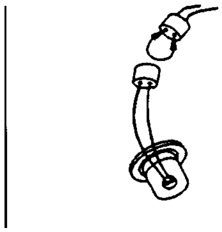
HYDRAULIC OIL LEVEL SWITCH (B5) CHECK	 T7470AJ –UN–05MAR91 Disconnect harness from hydraulic oil level switch. Connect a jumper wire between harness connector pins. Turn key switch ON. Push fluid level check switch. Does hydraulic oil level indicator come ON?	**YES:** Hydraulic oil level switch has failed. Replace. **NO:** Check wiring harness. – – –1/1

HYDRAULIC OIL FILTER RESTRICTION INDICATOR LIGHT (H21) CHECK	Turn key switch ON. Observe hydraulic oil filter restriction indicator. Does indicator come ON when key switch is turned ON, then go OFF 2—3 seconds later?	**YES:** Indicator is OK. Go to next check. **NO:** If indicator does not come ON, check indicator lamp. If indicator does not go OFF, go to next check. – – –1/1

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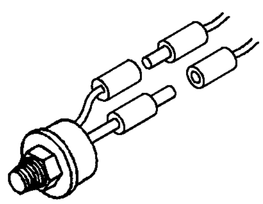
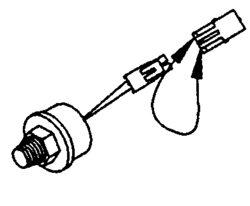
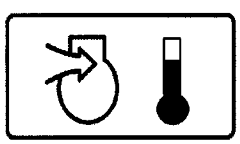
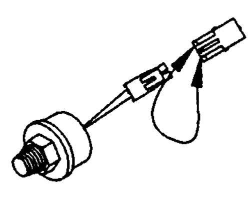
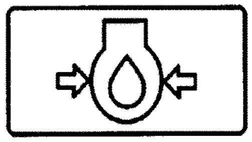
HYDRAULIC OIL FILTER RESTRICTION SWITCH (B30) CHECK	 **T118382** T118382 –UN–21NOV98 Disconnect two harness leads from hydraulic oil filter restriction switch. If indicator was ON, did it go OFF with leads disconnected and key switch ON? If indicator was OFF, connect two harness leads together. Does indicator come ON?	**YES:** Hydraulic oil filter restriction switch has failed. Replace. **NO:** Check harness. – – –1/1

Sub-System Diagnostics

ENGINE COOLANT TEMPERATURE INDICATOR LIGHT (H16) CHECK	 T101686 –UN–29AUG96	With engine cool, turn key switch ON. Observe engine temperature indicator. Does indicator come ON when key switch is turned ON, then go OFF 2—3 seconds later?	**YES:** Indicator is OK. Go to next check. **NO:** If indicator does not come ON, check indicator lamp. If indicator does not go OFF, go to next check. – – –1/1
ENGINE COOLANT TEMPERATURE SWITCH (B3) CHECK	 T7470AM –UN–05MAR91	Disconnect harness from engine coolant temperature switch. If engine coolant temperature indicator was ON, did it go OFF with harness disconnected and key switch ON? If indicator was OFF, connect a jumper wire between harness connector pins. Does indicator come ON when key switch is ON?	**YES:** Engine coolant temperature switch has failed. Replace. **NO:** Check harness. – – –1/1
CHARGE AIR TEMPERATURE INDICATOR LIGHT (H15) CHECK	 T107672 T113692 –UN–24FEB98	Turn key switch ON. Observe charge air temperature indicator. Does indicator come ON when key switch is turned ON, then go OFF 2—3 seconds later?	**YES:** Indicator is OK. Go to next check. **NO:** If indicator does not come ON, check indicator lamp. If indicator does not go OFF, go to next check. – – –1/1
CHARGE AIR TEMPERATURE SWITCH (B12) CHECK	 T7470AM –UN–05MAR91	Disconnect harness from charge air temperature switch. If indicator was ON, did it go OFF with harness disconnected and key switch ON? If indicator was OFF, connect a jumper wire between harness connector pins. Does indicator come ON when key switch is ON?	**YES:** Charge air temperature switch has failed. Replace. **NO:** Check harness. – – –1/1

ENGINE OIL PRESSURE INDICATOR LIGHT (H17) CHECK	 T101684 –UN–29AUG96 Disconnect harness from engine oil pressure switch. Turn key switch ON and observe engine oil pressure indicator. Does indicator come ON when key switch is turned ON, then go OFF 2—3 seconds later?	**YES:** Indicator is OK. Go to next check. **NO:** If indicator does not come ON, check indicator lamp. If indicator does not go OFF, check harness for short.

– – –1/1

ENGINE OIL PRESSURE SWITCH (B4) CHECK	Connect harness to engine oil pressure switch. Does indicator come ON with key switch ON?	**YES:** Go to next step. **NO:** Check harness for open. If harness is OK, replace switch.
	Start engine. Observe engine oil pressure indicator. Does indicator go OFF?	**YES:** Engine oil pressure switch is OK. **NO:** Engine oil pressure switch has failed. Replace.

– – –1/1

AIR FILTER RESTRICTION INDICATOR LIGHT (H14) CHECK	Turn key switch ON. Observe air filter restriction indicator. Does indicator come ON when key switch is turned ON, then go OFF 2—3 seconds later?	**YES:** Indicator is OK. Go to next check. **NO:** If indicator does not come ON, check indicator lamp. If indicator does not go OFF, go to next check.

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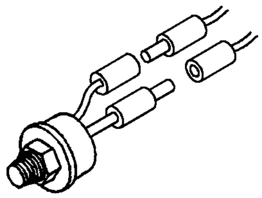
AIR FILTER RESTRICTION SWITCH (B1) CHECK



T118382

T118382 –UN–21NOV98

Disconnect two harness leads from air filter restriction switch.

If indicator was ON, did it go OFF with leads disconnected and key switch ON?

If indicator was OFF, connect two harness leads together.

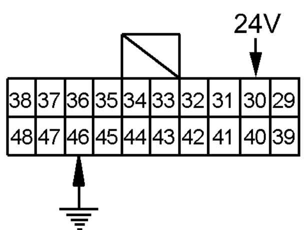
Does indicator come ON when key switch is ON?

YES: Air filter restriction switch has failed. Replace.

NO: Check harness.

– – –1/1

FUEL GAUGE (P3) CHECK



T118389 –UN–30NOV98

Disconnect 20-pin harness connector from monitor display and controller connector.

Connect 24 volts to 20-pin monitor display and controller pin 30.

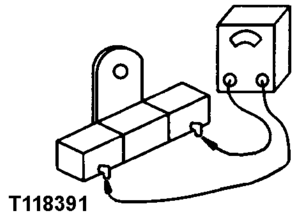
Then ground pin 46.

Does gauge needle point to “E” with 24 volts applied to pin 30, and “F” with pin 46 grounded?

YES: Gauge and gauge resistor are OK. Go to fuel level sensor (B8) check.

NO: Go to next check.

– – –1/1

FUEL GAUGE RESISTOR (R5) CHECK	 T118391 –UN–21NOV98 *NOTE: Check fuel gauge before checking resistor. Resistor is located on bottom of monitor controller panel. Access resistor by removing bottom cover from monitor controller panel.* Connect ohmmeter to resistor terminals. Does ohmmeter read about 220 ohms?	**YES:** Gauge has failed. Replace. **NO:** Resistor has failed. Replace. – – –1/1

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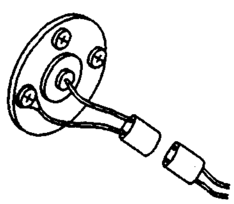
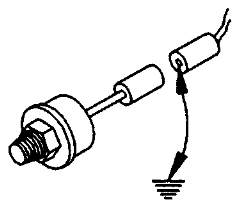
FUEL LEVEL SENSOR (B8) CHECK	 T7472AE –UN–11MAR91 *NOTE: Check fuel gauge before checking sensor.* Disconnect harness from fuel level sensor. Observe fuel gauge. Does gauge needle go to “E”? Connect jumper wire between harness connector pins. Does gauge needle go to “F”?	**YES:** Sensor has failed. Replace. **NO:** Check harness. – – –1/1

FUEL LEVEL INDICATOR LIGHT (H13) CHECK	With adequate fuel in tank, turn key switch ON. Observe fuel level indicator. Does indicator come ON when key switch is turned ON, then go OFF 2—3 seconds later?	**YES:** Indicator is OK. Go to next check. **NO:** If indicator does not come ON, check indicator lamp. If indicator does not go OFF, go to next check. – – –1/1

FUEL LEVEL SWITCH (B2) CHECK



T7472AB –UN–14MAR91

Disconnect harness from fuel level switch.

If indicator was ON, did it go OFF with harness disconnected and key switch ON?

If indicator was OFF, connect a jumper wire from harness connector to ground.

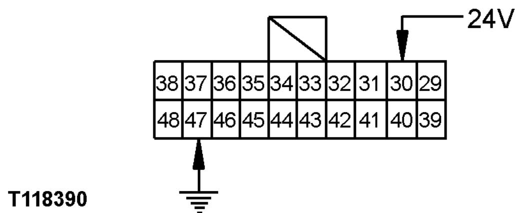
Does indicator come ON when key switch is ON?

YES: Fuel level switch has failed. Replace.

NO: Check harness.

– – –1/1

ENGINE COOLANT TEMPERATURE GAUGE (P2) CHECK



T118390 –UN–21NOV98

Disconnect 20-pin harness connector from monitor display and controller connector.

Connect 24 volts to 20-pin monitor display and controller pin 30.

Then ground pin 47.

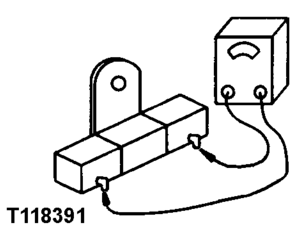
Does gauge needle point to “C” with 24 volts applied to pin 30, and “H” with pin 47 grounded?

YES: Gauge and gauge resistor are OK. Go to engine coolant temperature sensor (B9) check.

NO: Go to next check.

– – –1/1

ENGINE COOLANT TEMPERATURE GAUGE RESISTOR (R4) CHECK



T118391 –UN–21NOV98

NOTE: Check engine coolant temperature gauge before checking resistor. Resistor is located on bottom of the monitor controller panel. Access resistor by removing bottom cover from monitor controller panel.

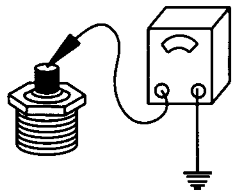
Connect ohmmeter to resistor terminals.

Does ohmmeter read about 220 ohms?

YES: Gauge has failed. Replace.

NO: Gauge resistor has failed. Replace.

– – –1/1

ENGINE COOLANT TEMPERATURE SENSOR (B9) CHECK	 T8359AJ –UN–10NOV94	*NOTE: Check engine coolant temperature gauge before checking resistor.* Disconnect harness from temperature sensor. Connect ohmmeter to sensor and ground. Start engine and observe ohmmeter. Does ohmmeter reading decrease as engine becomes warmer?	**YES:** Sensor is OK. Check harness. **NO:** Sensor has failed. Replace. – – –1/1

ENGINE AND PUMP CONTROLLER CIRCUIT OPERATIONAL INFORMATION

The following conditions must be met for the circuit to function:

Key switch ON and voltage present at the following:

- Engine and pump controller connector pins B7, D1, D2, A1, and A13
- Relay K10 terminal 1

CED,TX14795,4140 –19–22DEC98–1/1

ENGINE AND PUMP CONTROLLER CIRCUIT THEORY OF OPERATION

The engine and pump controller (EPC) A2 monitors and controls engine speed and all digging functions, propel functions, hydraulic pump functions, and pilot functions.

The EPC applies service codes from EPC pins B8, B15, and B16 to diagnostic connector X1 for analysis of hydraulic and electrical systems by the diagnostic computer.

ENGINE CONTROL CIRCUITS

ENGINE SPEED CONTROL

The engine speed control circuits monitor and adjust the engine speed to match the operating modes selected. The engine and pump controller (EPC) monitors the engine speed via signals from the engine speed sensor (B16) applied to EPC pins B6 and B13. The EPC controls the engine speed by sending rotation control signals to the engine control (EC) motor (M2) from pins A12, A24, A25, and A26. The EC motor is mechanically linked to the engine throttle linkage. As the motor rotates, the engine throttle linkage is moved, changing the engine speed. The engine control (EC) sensor (B17) provides a signal to EPC at pin D15 indicating the amount of EC motor rotation.

When the engine is started, the dig hydraulic work mode is selected by logic circuit in the monitor controller. Each time work mode select switch is pushed a different work mode is selected (Dig, Grading, Precision, and Attachment).

Operating mode selection signals from the monitor controller and display are applied to EPC pins B11, D3, D4, D5, and D6. The combination of signals instructs the EPC which mode has been selected.

When an operating mode is changed, the EPC causes the EC motor to rotate, changing the engine speed. When the engine speed matches the requirement for the mode selected, the EC motor stops rotating and the engine speed remains constant. If another mode is selected, the process is repeated until the engine speed has changed to match the new mode speed requirement.

AUTO A/I IDLE MODE

An RPM dial is provided to vary engine speed to any speed between slow idle and fast idle if E or HP modes do not provide a speed adequate to the job. Each time the engine is started, the EPC automatically activates the idle mode to run the engine at the engine RPM dial setting.

When the auto idle mode is activated by the auto idle switch, a signal from the monitor controller is applied to EPC pin D6 informing the EPC that auto idle is selected. With auto idle selected, mode switches E and HP control engine speed during machine operation. However, if a hydraulic function is not used for more than 4 seconds, the EPC automatically reduces the engine speed to auto idle.

LEARNING SWITCH (S16)

If the engine and pump controller or EC sensor is changed, the EPC learning sequence must be activated the next time engine is started. The learning switch activates the EPC learning sequence by applying a ground to EPC pin B5. When the switch is activated, the slow idle engine speed is registered in the EPC memory. After maximum power engine speed is stored in EPC memory, the EPC calculates the economy mode (E) speed as a percentage of the slow idle speed.

Continued on next page

HYDRAULIC CONTROL CIRCUITS

The hydraulic control circuits consist of pressure sensors and switches, proportional control solenoids, and power boost switch. The EPC utilizes input signals from the pressure sensors and switches to monitor the machine hydraulic functions. It then controls the propel speed, relief valve pressure, pump swash, and arm regenerative functions by sending control signals to the propel speed, power boost, speed sense, and arm regenerative proportional solenoids.

These circuits control the hydraulic functions of the machine at the same time the EPC is controlling engine speed to provide maximum machine quickness and productivity for the load conditions and operating mode selected.

CED,OUOE012,33 –19–15DEC98–2/2

FOLDOUT PAGE 4-139 IS AT REAR OF MANUAL

❶ ENGINE AND PUMP CONTROLLER CIRCUIT DIAGNOSTIC PROCEDURES

IMPORTANT: Do not disconnect electrical connectors while the engine is running. Damage to Engine and Pump Controller or other components may result. Disconnect connectors only when instructed during a test or check.

NOTE: Before troubleshooting the circuits, clean all pins in the engine and pump controller, and harness connectors using a non-conductive lubricating contact cleaner, then try the circuit operation again before proceeding. TY16324 Contact Cleaner can be used.

– – –1/1

ENGINE AND PUMP CONTROLLER 10 AMP FUSE (F2) CHECK	Turn key switch OFF. Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. Check wiring harness. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

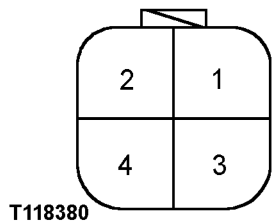
POWER ON 10 AMP FUSE (F5) CHECK	Turn key switch OFF. Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. Check wiring harness. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

ENGINE CONTROL (EC) MOTOR 10 AMP FUSE (F3) CHECK	Turn key switch OFF. Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. Check wire from fuse to monitor controller connector D, pins 1 and 2. If OK, go to next check. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

SOLENOID 5 AMP FUSE (F4) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. Check wiring harness. **NO:** Replace Fuse. If fuse blows again, check for short. – – –1/1

ENGINE CONTROL (EC) MOTOR (M2) CHECK	 T118380 –UN–21NOV98 Disconnect harness from EC motor. Measure resistance between pin 1 and pin 3, and between pin 2 and pin 4. Does ohmmeter read approximately the same resistance for both measurements?	**YES:** EC motor is OK. Go to next check. **NO:** Motor has failed. Replace. – – –1/1

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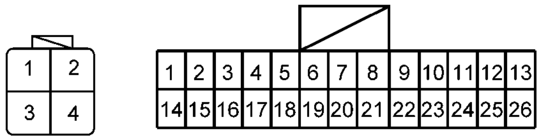
ENGINE CONTROL (EC) MOTOR (M2) HARNESS CHECK



T118393 –UN–30NOV98

Disconnect harness from EC motor.

Disconnect 26-pin connector A from engine and pump controller.

Measure continuity from pin 1 in EC motor connector to pin 24 in connector A.

Measure continuity from pin 2 in EC motor connector to pin 25 in connector A.

Measure continuity from pin 3 in EC motor connector to pin 12 in connector A.

Measure continuity from pin 4 in EC motor connector to pin 26 in connector A.

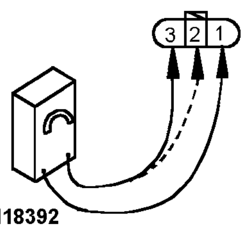
Does ohmmeter read approximately the same resistance in all 4 measurements?

YES: EC motor harness is OK. Go to next check.

NO: Repair open wire.

– – –1/1

ENGINE CONTROL (EC) SENSOR (B17) CHECK



T118392

T118392 –UN–21NOV98

1—Positive Pin
2—Sense Pin
3—Negative Pin

Disconnect harness from EC sensor.

Measure resistance of sensor from connector pin 1 to pin 3, and pin 1 to Pin 2.

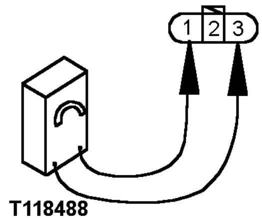
Does ohmmeter read 2000 ± 400 ohms from pin 1 to pin 3 and something less than that from pin 1 to pin 2?

YES: EC Sensor is OK. Go to next check.

NO: Sensor has failed. Replace.

– – –1/1

ENGINE CONTROL (EC) SENSOR (B17) HARNESS CHECK



T118488 –UN–21NOV98

1—Positive Pin
2—Sense Pin
3—Negative Pin

Turn key switch OFF.

Disconnect harness from EC sensor.

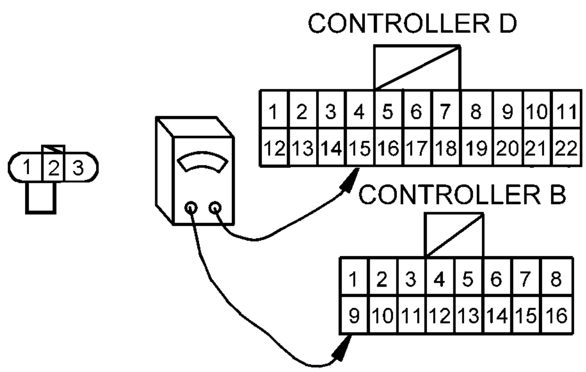
Turn key switch ON.

Measure voltage between pin 1 and pin 3 of EC sensor harness connector.

Is 5 volts measured?

YES: Go to next step.

NO: Harness has failed. Repair.



T118379 –19–30NOV98

1—Positive Pin
2—Sense Pin
3—Negative Pin

Turn key switch OFF.

Disconnect harness from EC sensor.

Connect jumper wire between sensor harness connector pins 1 and 2.

Disconnect 22-pin connector D and 16-pin connector B from engine and pump controller.

Measure continuity between pin 9 of connector B and pin 15 of connector D.

Is continuity measured?

YES: Harness is OK.

NO: Harness has failed. Repair.

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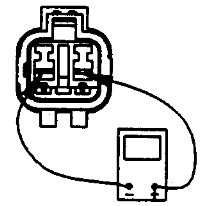
– – –1/1

ENGINE SPEED (N) SENSOR (B16) CHECK



T7502BM –UN–01APR91

Turn key switch OFF.

Disconnect harness from engine speed sensor.

Measure resistance across speed sensor connector pins 1 and 2.

Does ohmmeter read 810 ± 240 ohms?

Start engine.

Measure AC voltage at speed sensor terminals. Increase engine speed.

Does AC voltage increase as engine speed increases?

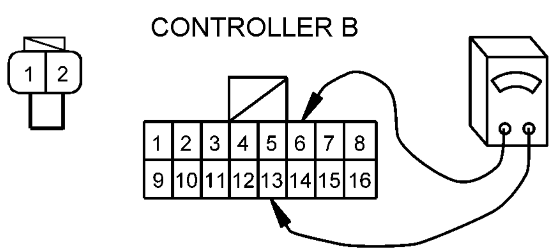
YES: Sensor is OK. Go to next check.

NO: Sensor has failed. Replace.

9015
15
76

– – –1/1

ENGINE SPEED (N) SENSOR (B16) HARNESS CHECK



T118373

T118373 –19–30NOV98

Turn key switch OFF.

Disconnect harness from engine speed sensor.

Disconnect 16-pin connector B from engine and pump controller.

Measure continuity between pins 6 and 13 of connector B.

Does ohmmeter read open?

Connect jumper wire between sensor harness connector pins 1 and 2.

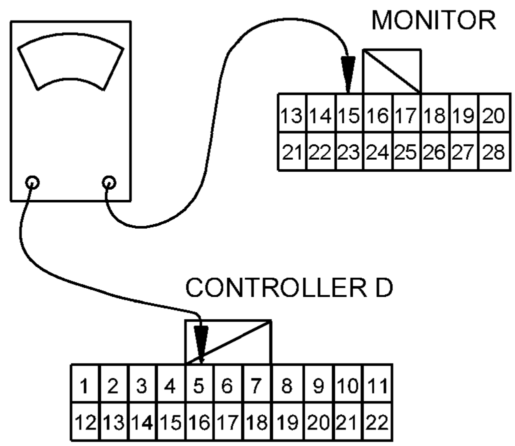
Is continuity measured?

YES: Harness is OK.

NO: Harness has failed. Repair.

– – –1/1

ECONOMY (E) MODE OUTPUT TO ENGINE AND PUMP CONTROLLER HARNESS CHECK



T118394

T118394 –19–30NOV98

Disconnect 16-pin harness connector from monitor controller and display, and 22-pin harness connector D from engine and pump controller.

Measure continuity between pin 15 of monitor controller harness connector and pin 5 of engine and pump controller harness connector D.

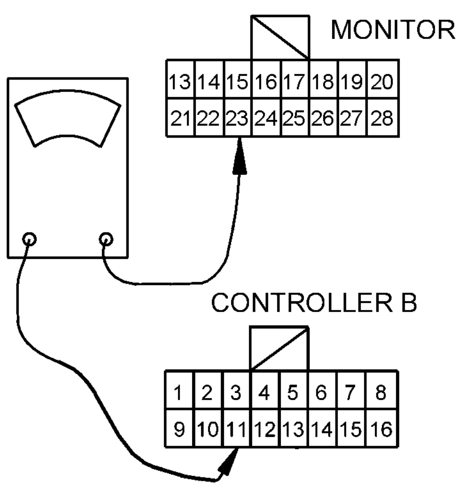
Is continuity measured?

YES: Harness wire is OK.

NO: Harness wire is open. Repair.

– – –1/1

HIGH POWER (HP) MODE OUTPUT TO ENGINE AND PUMP CONTROLLER HARNESS CHECK



T118376

T118376 –19–30NOV98

Disconnect 16-pin harness connector from monitor controller and display, and 16-pin harness connector B from engine and pump controller.

Measure continuity between pin 23 of monitor controller harness connector and pin 11 of engine and pump controller harness connector B.

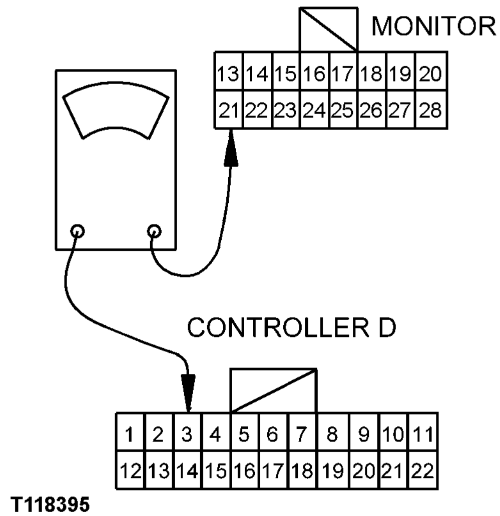
Is continuity measured?

YES: Harness wire is OK.

NO: Harness wire is open. Repair.

– – –1/1

MODE 1 OUTPUT TO ENGINE AND PUMP CONTROLLER HARNESS CHECK



T118395 –19–30NOV98

Disconnect 16-pin harness connector from monitor controller and display, and 22-pin harness connector D from engine and pump controller.

Measure continuity between pin 21 of monitor controller harness connector and pin 3 of engine and pump controller harness connector D.

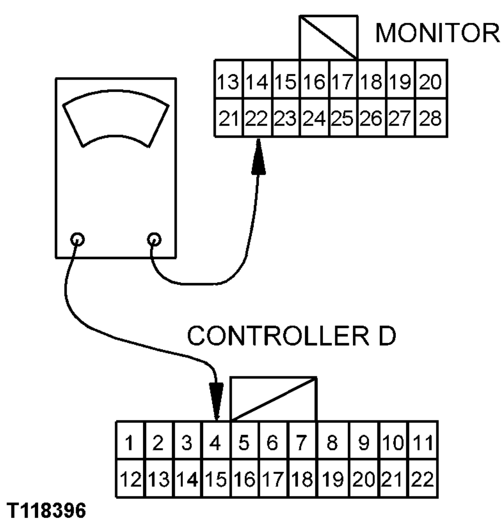
Is continuity measured?

YES: Harness wire is OK. Go to next check.

NO: Harness wire is open. Repair.

– – –1/1

MODE 2 OUTPUT TO ENGINE AND PUMP CONTROLLER HARNESS CHECK



T118396 –19–30NOV98

Disconnect 16-pin harness connector from monitor controller and display, and 22-pin harness connector D from engine and pump controller.

Measure continuity between pin 22 of monitor controller harness connector and pin 4 of engine and pump controller harness connector D.

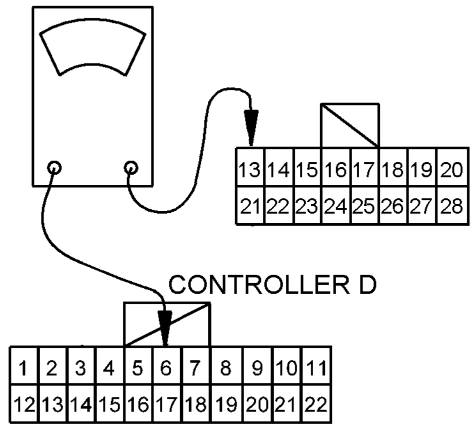
Is continuity measured?

YES: Harness wire is OK.

NO: Harness wire is open. Repair.

– – –1/1

AUTO IDLE TO SYSTEM CONTROLLER HARNESS CHECK



T118381

T118381 –19–21NOV98

Disconnect 16-pin harness connector from monitor controller, and 22-pin harness connector D from engine and pump controller.

Measure continuity between pin 13 of monitor controller harness connector and pin 6 of engine and pump controller harness connector D.

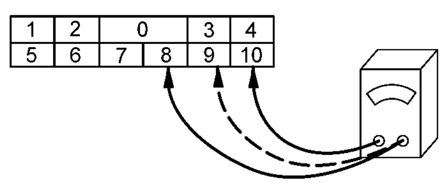
Is continuity measured?

YES: Harness wire is OK.

NO: Harness wire is open. Repair.

– – –1/1

ENGINE RPM DIAL (R10) CHECK



T118383

T118383 –UN–17MAR99

Disconnect harness connector from engine mode and RPM control unit A4.

Measure resistance from engine mode and RPM control unit pin 5 to pin 7, and from pin 5 to pin 6.

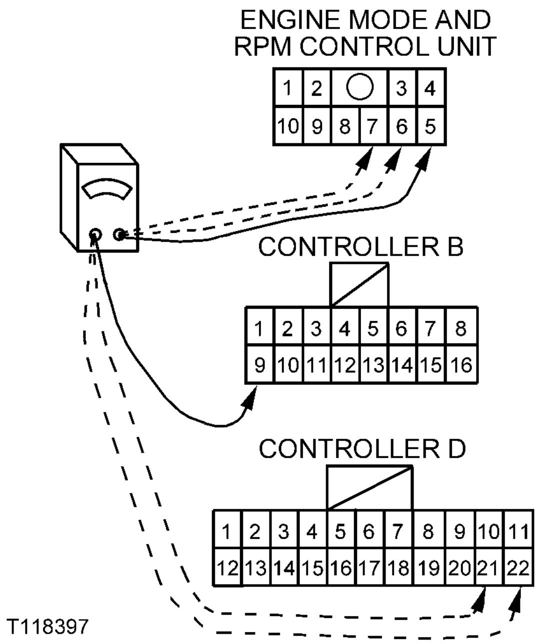
Is 5000 ± 500 ohms measured from pin 5 to pin 7, and less than that from pin 5 to pin 6?

YES: Engine RPM dial is OK. Go to next check.

NO: Engine RPM dial has failed. Replace.

– – –1/1

ENGINE RPM DIAL (R10) HARNESS CHECK



T118397 –19–30NOV98

Disconnect 16-pin harness connector B and 22-pin harness connector D from engine and pump controller.

Disconnect harness connector from engine mode and RPM control unit A4.

Measure continuity from pin 5 of engine mode and RPM control unit harness connector to pin 9 of engine and pump controller harness connector B.

Measure continuity from pin 7 of engine mode and RPM control unit harness connector to pin 22 of engine and pump controller harness connector D.

Measure continuity from pin 6 of engine mode and RPM control unit harness connector to pin 21 of engine and pump controller harness connector D.

Is continuity measured?

YES: Engine RPM dial harness is OK.

NO: Harness has failed. Repair.

– – –1/1

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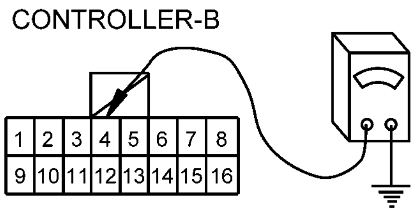
POWER BOOST SWITCH (S19) CHECK



T118538

T118538 –19–21NOV98

Turn key switch OFF.

Disconnect 16-pin harness connector B from engine and pump controller.

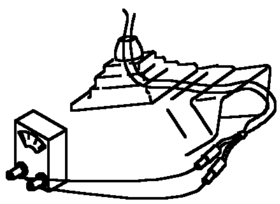
Connect ohmmeter from pin 4 of harness connector B to ground.

Press power boost switch.

Does ohmmeter read continuity when switch is pressed?

YES: Switch and harness are OK.

NO: Go to next step.



T118486

T118486 –UN–21NOV98

Remove right console bottom cover.

NOTE: Do not disconnect wires other than power boost wires.

Disconnect two leads from power boost switch.

Connect ohmmeter to both leads from switch.

Press switch button.

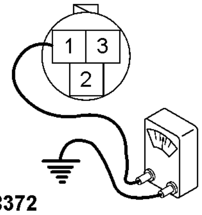
Does ohmmeter read continuity?

YES: Switch is OK. Check harness wiring.

NO: Switch has failed. Replace.

– – –1/1

ARM IN PRESSURE SENSOR (B20) HARNESS CHECK



T118372

T118372 –UN–21NOV98

1—Positive Pin
2—Sense Pin
3—Negative Pin

Turn key switch OFF.

Disconnect harness from arm in pressure sensor.

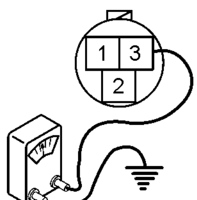
Connect voltmeter to sensor harness connector pin 1 and ground.

Turn key switch ON.

Does voltmeter read 5 volts?

YES: Harness wire is OK. Go to next step.

NO: Wire or engine and pump controller has failed. Repair.



T118371

T118371 –UN–21NOV98

1—Positive Pin
2—Sense Pin
3—Negative Pin

Turn key switch OFF.

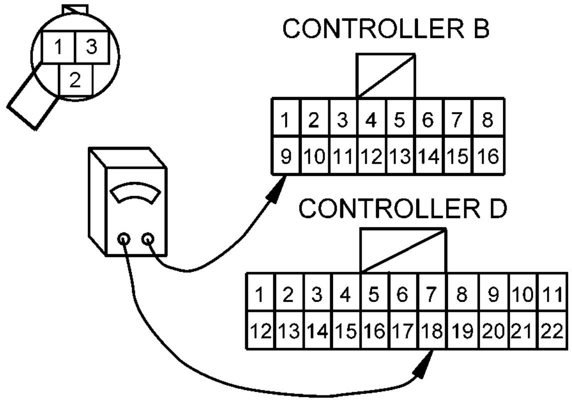
Connect ohmmeter to sensor harness connector pin 3 and ground.

Does ohmmeter read continuity?

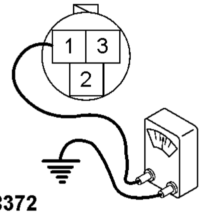
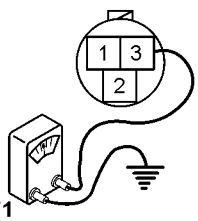
YES: Harness wire is OK. Go to next step.

NO: Wire has failed. Repair.

– – –1/2

	 **T118358** T118358 –19–21NOV98 Install jumper between sensor harness connector pins 1 and 2. Disconnect 22-pin connector D and 16-pin connector B from engine and pump controller. Measure continuity between pin 9 of harness connector B and pin 18 of harness connector D. Is continuity measured?	**YES:** Wire harness is OK. Go to next check. **NO:** Wire from pin 18 of connector D to pin 2 of sensor harness connector has failed. Repair. – – –2/2

ARM IN PRESSURE SENSOR (B20) CHECK	Install pump control test harness JT07353 in series with wiring harness and sensor. Connect voltmeter to test harness jacks. With engine running, pilot control lever forward, and hydraulic functions in neutral, observe voltage. Is voltage between 0.5 and 0.7 volts? Actuate arm in to achieve hydraulic function over relief. Does voltage increase to between 3.3 and 3.5 volts with hydraulic function over relief?	**YES:** Sensor is OK. Engine and pump controller may have failed. **NO:** Sensor has failed. Replace. – – –1/1

REAR PUMP CONTROL PRESSURE SENSOR (B21) AND FRONT CONTROL PRESSURE SENSOR (B22) HARNESS CHECK	 T118372 T118372 –UN–21NOV98 **1—Positive Pin** **2—Sense Pin** **3—Negative Pin** Turn key switch OFF. Disconnect wiring harness connector from front (B22) or rear (B21) pump control pressure sensor. Connect voltmeter to sensor harness connector pin 1 and ground. Turn key switch ON. Does voltmeter read 5 volts?	**YES:** Harness wire is OK. Go to next step. **NO:** Wire or engine and pump controller has failed. Repair.
	 T118371 T118371 –UN–21NOV98 **1—Positive Pin** **2—Sense Pin** **3—Negative Pin** Turn key switch OFF. Connect ohmmeter to sensor harness connector pin 3 and ground. Does ohmmeter read continuity?	**YES:** Harness wire is OK. Go to next step. **NO:** Wire has failed. Repair.
		– – –1/2

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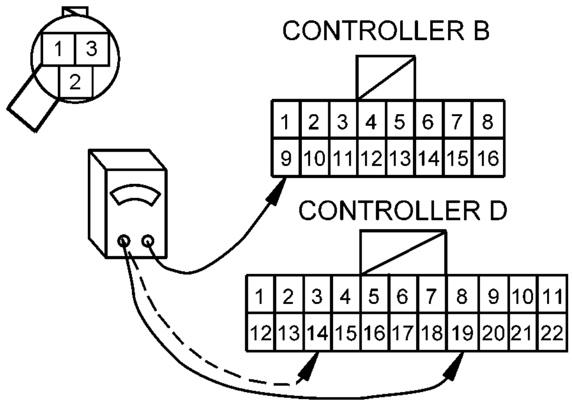


T118359

T118359 –19–21NOV98

Install jumper between sensor harness connector pins 1 and 2.

Disconnect 22-pin connector D and 16-pin connector B from engine and pump controller.

Measure continuity between pin 9 of harness connector B and pin 19 of harness connector D (for front pressure sensor), or pin 14 of harness connector D (for rear pressure sensor) .

Is continuity measured?

YES: Wire harness is OK. Go to next check.

NO: Wire from connector D to sensor harness connector pin 2 has failed. Repair.

– – –2/2

REAR PUMP CONTROL PRESSURE SENSOR (B21) AND FRONT CONTROL PRESSURE SENSOR (B22) CHECK

Install pump control test harness JT07353 in series with wiring harness and sensor.

Connect voltmeter to test harness jacks.

With engine running, pilot control lever forward, and hydraulic functions in neutral, observe voltmeter.

Is voltage 0.5 - 0.7 volts?

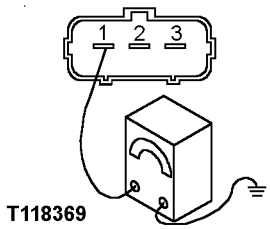
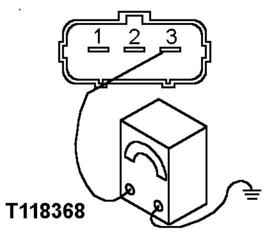
Slowly actuate boom up (for front pressure sensor B22) or left track (for rear pressure sensor B21) until motion just begins.

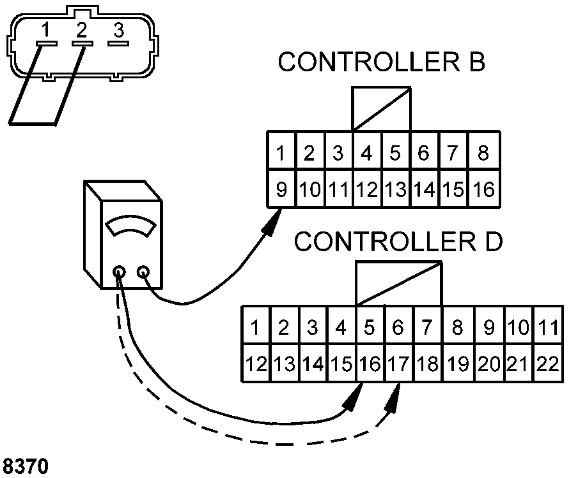
Does voltage increase to 3.3 - 3.5 volts when pilot controller reaches full activation?

YES: Sensor is OK. Engine and pump controller may have failed.

NO: Sensor has failed. Replace.

– – –1/1

REAR PUMP PRESSURE SENSOR (B18) AND FRONT PUMP PRESSURE SENSOR (B19) SENSOR HARNESS CHECK	 T118369 –UN–21NOV98 **1—Positive Pin** **2—Sense Pin** **3—Negative Pin** Turn key switch OFF. Disconnect wiring harness connector from front (B19) or rear (B18) pump pressure sensor. Connect voltmeter to sensor harness connector pin 1 and ground. Turn key switch ON. Does voltmeter read 5 volts?	**YES:** Harness wire is OK. Go to next step. **NO:** Wire or engine and pump controller has failed. Repair.
	 T118368 –UN–21NOV98 **1—Positive Pin** **2—Sense Pin** **3—Negative Pin** Turn key switch OFF. Connect ohmmeter to sensor harness connector pin 3 and ground. Does ohmmeter read continuity?	**YES:** Harness wire is OK. Go to next step. **NO:** Wire has failed. Repair.
		– – –1/2



T118370 –19–21NOV98

1—Positive Pin
2—Sense Pin
3—Negative Pin

Install jumper between sensor harness connector pins 1 and 2.

Disconnect 22-pin connector D and 16-pin connector B from engine and pump controller.

Measure continuity between pin 9 of harness connector B and pin 16 of harness connector D (for front pressure sensor), or pin 17 of harness connector D (for rear pressure sensor) .

Is continuity measured?

YES: Wire harness is OK. Go to next check.

NO: Wire from connector D to sensor harness connector pin 2 has failed. Repair.

– – –2/2

REAR PUMP PRESSURE SENSOR (B18) AND FRONT PUMP PRESSURE SENSOR (B19) CHECK

Install pump pressure sensor test harness JT07354 in series with wiring harness and sensor.

Connect voltmeter to test harness jacks.

With engine running, pilot control lever forward, and hydraulic functions in neutral, observe voltmeter.

Is voltage 0.5 - 0.7 volts?

Actuate arm in to achieve hydraulic function over relief.

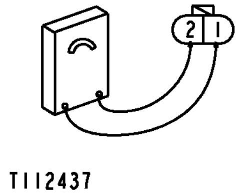
Does voltage increase to 3.3 - 3.5 volts with hydraulic function over relief?

YES: Sensor is OK. Engine and pump controller may have failed.

NO: Sensor has failed. Replace.

– – –1/1

BOOM UP PRESSURE SWITCH (B13) CHECK



T112437 –UN–05DEC97

Turn key switch OFF.

Disconnect wiring harness at boom up pressure switch.

Connect ohmmeter to pins 1 and 2 of pressure switch connector.

With engine running and pilot control lever forward, actuate boom up lever.

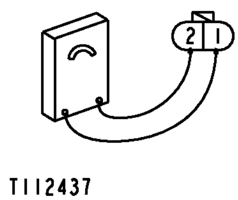
Is continuity measured when boom up lever is actuated?

YES: Pressure switch is OK. Check switch harness. If harness is OK, engine and pump controller may have failed.

NO: Boom up pressure switch has failed. Replace.

– – –1/1

DIG PRESSURE SWITCH (B14) CHECK



T112437 –UN–05DEC97

Turn key switch OFF.

Disconnect wiring harness at dig pressure switch.

Connect ohmmeter to pins 1 and 2 of pressure switch connector.

With engine running and pilot control lever forward, slowly actuate arm in lever while observing ohmmeter.

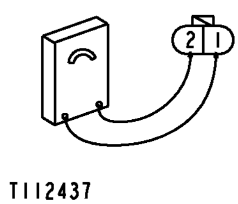
Is continuity measured as arm in lever is actuated?

YES: Pressure switch is OK. Check switch harness. If harness is OK, engine and pump controller may have failed.

NO: Dig pressure switch has failed. Replace.

– – –1/1

PROPEL PRESSURE SWITCH (B15) CHECK



T112437 –UN–05DEC97

Turn key switch OFF.

Disconnect wiring harness at propel pressure switch.

Connect ohmmeter to pins 1 and 2 of pressure switch connector.

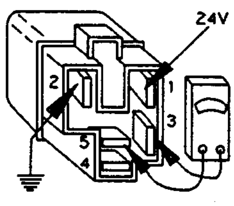
With engine running and pilot control lever forward, slowly actuate propel lever while observing ohmmeter.

Is continuity measured as propel lever is actuated and track begins to move?

YES: Pressure switch is OK. Check for continuity from harness connector pin 1 to ground. If OK, go to next check.

NO: Propel pressure switch has failed. Replace.

– – –1/1

PROPEL AUTO IDLE RELAY (K10) CHECK	 T7447BG –19–14JAN91 **1—24-Volt Terminal** **2—Ground Terminal** **3—Relay Common** **4—Relay Normally Closed** **5—Relay Normally Open** Disconnect relay from harness. Connect ohmmeter to relay terminals 3 and 4. Does ohmmeter read continuity? Connect 24 volts to relay terminal 1, and ground terminal 2. Does relay “click”? With 24 volts still connected to terminal 1, connect ohmmeter to terminals 3 and 5. Does ohmmeter read continuity?	**YES:** Relay is OK. **NO:** Relay has failed. Replace. – – –1/1

TRAVEL ALARM 5 AMP FUSE (F10) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. Go to next check. **NO:** Replace fuse. If fuse blows again, check for short. – – –1/1

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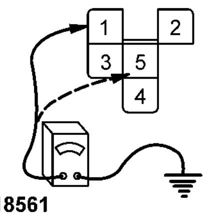
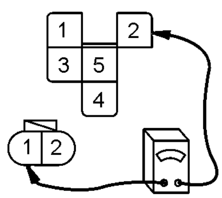
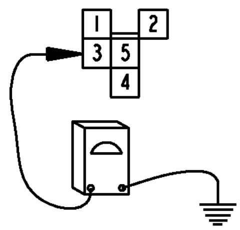
PROPEL AUTO IDLE RELAY (K10) HARNESS CHECK	 T118561 T118561 –UN–21NOV98 Turn key switch OFF. Remove harness connector from relay With ohmmeter measure continuity from relay harness connector pin 5 to ground. Is continuity measured? Connect voltmeter from relay harness connector pin 1 to ground. Turn key switch to ON and measure voltage at pin 1. Is 24 volts measured?	**YES:** Wire are OK. Go to next step. **NO:** Wire has failed. Repair.
	 T118362 T118362 –UN–21NOV98 **1—24-Volt Pin** **2—Ground Pin** **3—Relay Common** **4—Relay Normally Closed** **5—Relay Normally Open** Turn key switch OFF. Disconnect wiring harness at propel pressure switch. *NOTE: Use “diode checking mode” on meter when checking this reading.* Connect an ohmmeter to relay harness connector pin 2 and pressure switch connector pin 1. Measure resistance, then reverse ohmmeter probes and measure resistance again. Does resistance read approximately 500 ohms in one direction, and open in the other direction?	**YES:** Wire and isolation diode V4 are OK. Go to next step. **NO:** Check wire for open. If OK, go to diode V4 check.
		– – –1/2



T102860 –UN–12AUG96

1—24-Volt Pin
2—Ground Terminal
3—Relay Common 5 Volts To D9
4—Relay Normally Closed
5—Relay Normally Open To Ground

Connect voltmeter to relay harness connector pin 3 and ground.

Turn key switch ON.

Does voltmeter read 5 volts.

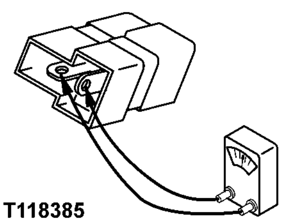
YES: Harness is OK.

NO: Harness or engine and pump controller has failed. Repair or replace.

– – –2/2

PROPEL AUTO IDLE RELAY ISOLATION DIODE (V4) CHECK

NOTE: A diode can fail in two modes, either shorted or open. Continuity will be measured in one direction only in a serviceable diode. Use "diode checking mode" on meter when checking continuity.



T118385

T118385 –UN–21NOV98

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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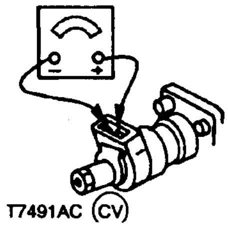
Sub-System Diagnostics

PROPEL SPEED CHANGE PROPORTIONAL SOLENOID (Y6) CHECK	 T7491AC –UN–08APR91	Turn key switch OFF. Remove wire clip from bottom of solenoid harness connector. Disconnect harness from solenoid. Connect ohmmeter to solenoid terminals. Does ohmmeter read approximately 24 ohms?	**YES:** Solenoid is OK. Go to next check. **NO:** Solenoid has failed. Replace. – – –1/1

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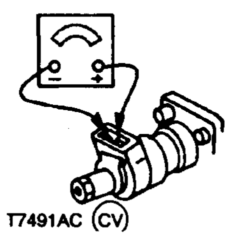
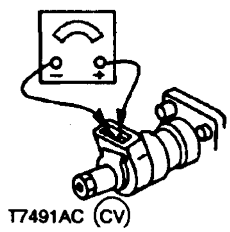
PROPEL SPEED CHANGE PROPORTIONAL SOLENOID (Y6) HARNESS CHECK	Turn key switch OFF. Install proportional solenoid test harness JT07352 in series with wiring harness and sense solenoid. Connect voltmeter to test harness jacks. Start engine and while observing voltmeter, drive machine at full propel speed until fast speed kicks in. Does voltmeter read approximately 6 volts in slow speed, and 12 volts in fast speed?	**YES:** Harness and engine and pump controller are OK. **NO:** Harness or engine and pump controller has failed. Repair or replace. – – –1/1

ARM REGENERATIVE PROPORTIONAL SOLENOID (Y9) CHECK	 T7491AC –UN–08APR91	Turn key switch OFF. Remove wire clip from bottom of solenoid harness connector. Disconnect harness from solenoid. Connect ohmmeter to solenoid terminals. Does ohmmeter read approximately 24 ohms?	**YES:** Solenoid is OK. Go to next check. **NO:** Solenoid has failed. Replace. – – –1/1

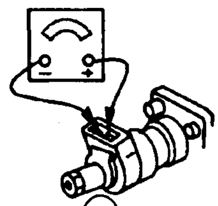
ARM REGENERATIVE PROPORTIONAL SOLENOID (Y9) HARNESS CHECK	Turn key switch OFF. Install proportional solenoid test harness JT07352 in series with wiring harness and sense solenoid. Connect voltmeter to test harness jacks. Start engine and move arm all the way out and boom down. Adjust idle to slow (voltmeter reading approximately 7 volts). Move boom up and arm in at the same time. Does voltmeter read higher voltage (approximately 9 volts) while boom and arm are moving?	**YES:** Harness and engine and pump controller are OK. **NO:** Harness or engine and pump controller has failed. Repair or replace. – – –1/1

POWER BOOST PROPORTIONAL SOLENOID (Y5) CHECK	 T7491AC –UN–08APR91 Turn key switch OFF. Remove wire clip from bottom of solenoid harness connector. Disconnect harness from solenoid. Connect ohmmeter to solenoid terminals. Does ohmmeter read approximately 24 ohms?	**YES:** Solenoid is OK. Go to next check. **NO:** Solenoid has failed. Replace. – – –1/1

POWER BOOST PROPORTIONAL SOLENOID (Y5) HARNESS CHECK	Turn key switch OFF. Install proportional solenoid test harness JT07352 in series with wiring harness and sense solenoid. Connect voltmeter to test harness jacks. Start engine and observe voltmeter while pressing power boost switch. Does voltmeter read approximately 5 volts when switch is not pressed, and approximately 9 volts when switch is pressed? Hold power boost switch pressed. Does the voltage drop to 5 volts after approximately 8 seconds?	**YES:** Harness and engine and pump controller are OK. **NO:** Harness or engine and pump controller has failed. Repair or replace. – – –1/1

Sub-System Diagnostics

SPEED SENSE PROPORTIONAL SOLENOID (Y8) CHECK



T7491AC (CV)

T7491AC –UN–08APR91

Turn key switch OFF.

Remove wire clip from bottom of solenoid harness connector.

Disconnect harness from solenoid.

Connect ohmmeter to solenoid terminals.

Does ohmmeter read approximately 24 ohms?

YES: Solenoid is OK. Go to next check.

NO: Solenoid has failed. Replace.

– – –1/1

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SPEED SENSE PROPORTIONAL SOLENOID (Y8) HARNESS CHECK

Turn key switch OFF.

Install proportional solenoid test harness JT07352 in series with wiring harness and sense solenoid.

Connect voltmeter to test harness jacks.

Start engine, set auto idle mode to OFF, and set engine idle to medium speed so that voltmeter reads approximately 5.5 volts (RPM dial set at first bar after mid range).

Bottom arm in to load engine.

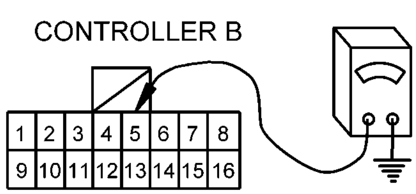
Does voltmeter read approximately 7 volts with arm bottomed in?

YES: Harness and engine and pump controller are OK.

NO: Harness or engine and pump controller has failed. Repair or replace.

– – –1/1

LEARNING SWITCH (S16) CHECK



T118558

T118558 –19–21NOV98

Turn key switch OFF.

Disconnect 16-pin connector B from engine and pump controller.

Turn switch to ON.

Measure continuity from pin 5 of connector B to ground.

Is continuity measured?

YES: Switch and harness are OK.

NO: Switch or harness has failed. Check and repair or replace.

– – –1/1

TRAVEL ALARM CIRCUIT OPERATIONAL INFORMATION

The following conditions must be met for the circuit to function:

- Key switch ON
- Voltage present at travel alarm 5-amp fuse F10

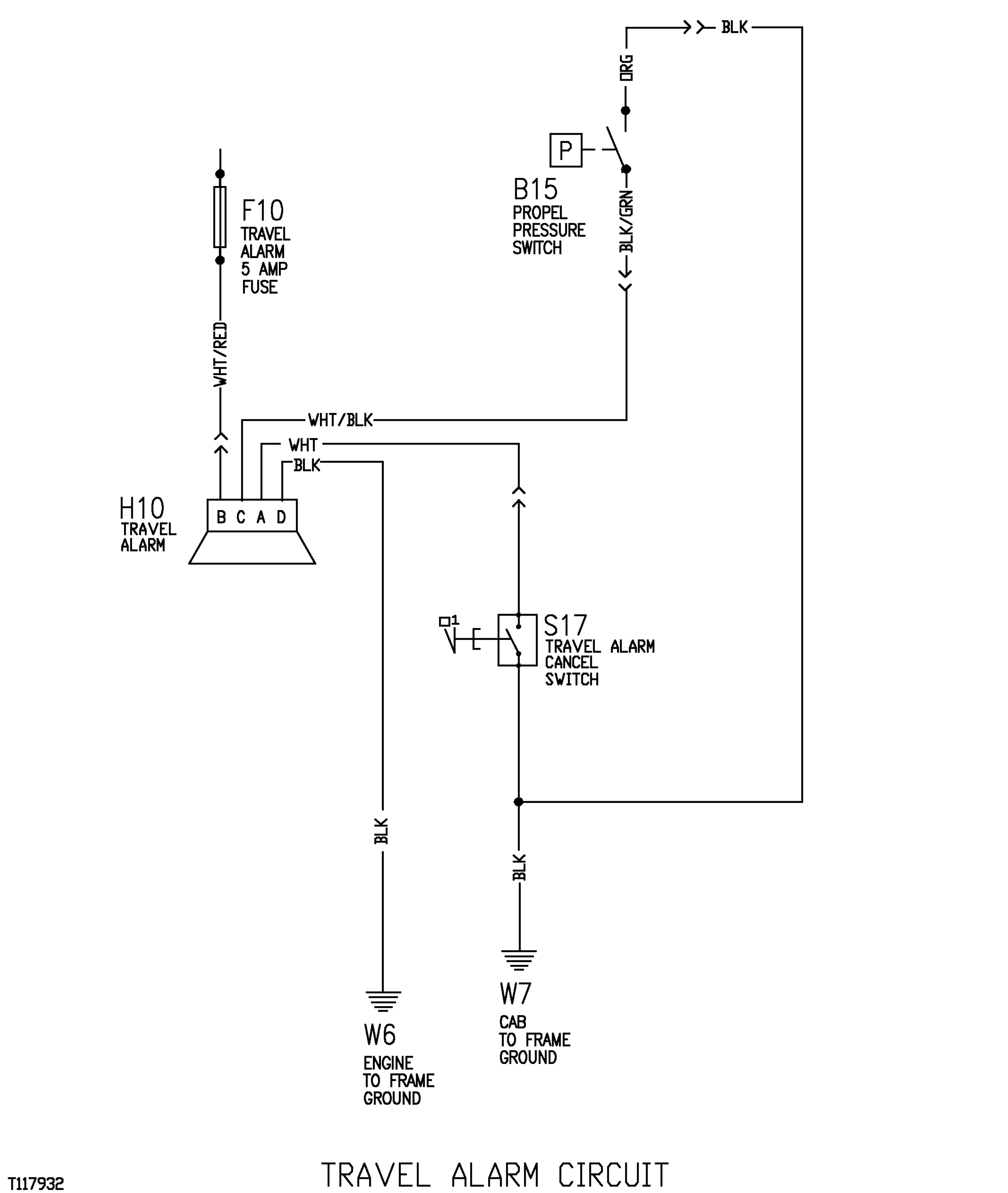
CED,OUOE012,36 –19–22DEC98–1/1

TRAVEL ALARM CIRCUIT THEORY OF OPERATION

The travel alarm circuit contains: travel alarm fuse F10, travel alarm H10, travel alarm cancel switch S17, and propel pressure switch B15. Operating voltage for the travel alarm is applied from fuse F10 to travel alarm pin B. When the propel levers are moved to forward or reverse positions, propel pressure switch B15 senses pilot pressure and closes. With the switch closed, ground is applied to pin C of the travel alarm, activating the alarm. After the travel alarm has sounded for 10 seconds, the travel alarm cancel switch may be pushed to turn the alarm off by grounding alarm pin A.

CED,OUOE012,37 –19–22DEC98–1/1

TRAVEL ALARM CIRCUIT SCHEMATIC



T117932 –19–30NOV98

CED,OUOE012,38 –19–19JAN99–1/1

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❶ TRAVEL ALARM CIRCUIT DIAGNOSTIC PROCEDURES

IMPORTANT: Do not disconnect electrical connectors while the engine is running. Damage to Engine and Pump Controller or other components may result. Disconnect connectors only when instructed during a test or check.

NOTE: Before troubleshooting the circuits, clean all terminals in the engine and pump controller and harness connectors using a non-conductive lubricating contact cleaner, then try circuit operation again before proceeding. TY16324 John Deere Contact Cleaner can be used.

– – –1/1

TRAVEL ALARM 5 AMP FUSE (F10) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. Go to next check. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

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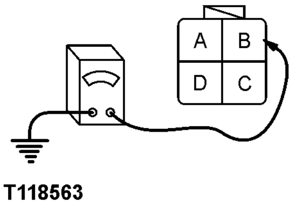
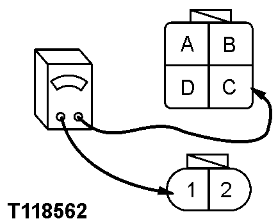
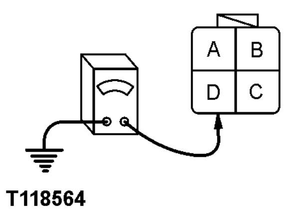
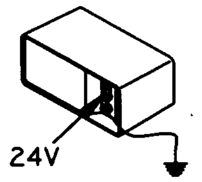
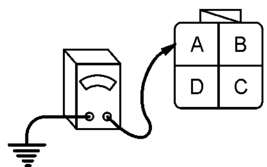
TRAVEL ALARM (H10) HARNESS CHECK	 T118563 –UN–21NOV98 Turn key switch OFF. Disconnect harness connector from travel alarm. Connect voltmeter to harness connector pin B and ground. Turn key switch ON. Is 24 volts measured?	**YES:** Go to next step. **NO:** Harness has failed. Repair.
	 T118562 –UN–21NOV98 Turn key switch OFF. Disconnect harness connector from propel pressure switch. Connect ohmmeter from travel alarm harness connector pin C to propel pressure switch harness connector pin 1. Is continuity measured?	**YES:** Go to next step. **NO:** Harness has failed. Repair.
	 T118564 –UN–21NOV98 Connect ohmmeter from travel alarm harness connector pin D to ground. Is continuity measured?	**YES:** Harness is OK. Go to next check. **NO:** Harness has failed. Repair. – – –1/1

TRAVEL ALARM (H10) CHECK	T8037BB –UN–30JUN93 With harness connector disconnected, connect 24 volts to travel alarm terminal B, and ground terminal D. Then ground terminal C. Does alarm sound?	**YES:** Alarm is OK. **NO:** Alarm has failed. Replace. – – –1/1
TRAVEL ALARM CANCEL SWITCH (S17) CHECK	T118559 –UN–21NOV98 Turn key switch OFF. Disconnect harness connector from travel alarm. Connect ohmmeter from travel alarm harness connector pin A to ground. Push travel alarm cancel switch. Is continuity measured when switch is pressed?	**YES:** Switch and harness are OK. **NO:** Switch or harness has failed. Repair or replace. – – –1/1

OVERLOAD ALARM CIRCUIT OPERATIONAL INFORMATION

The following conditions must be met for the circuit to function:

- Key switch ON
- Voltage present at auxiliary power 10-amp fuse F19

CED,OUOE012,136 –19–16MAR99–1/1

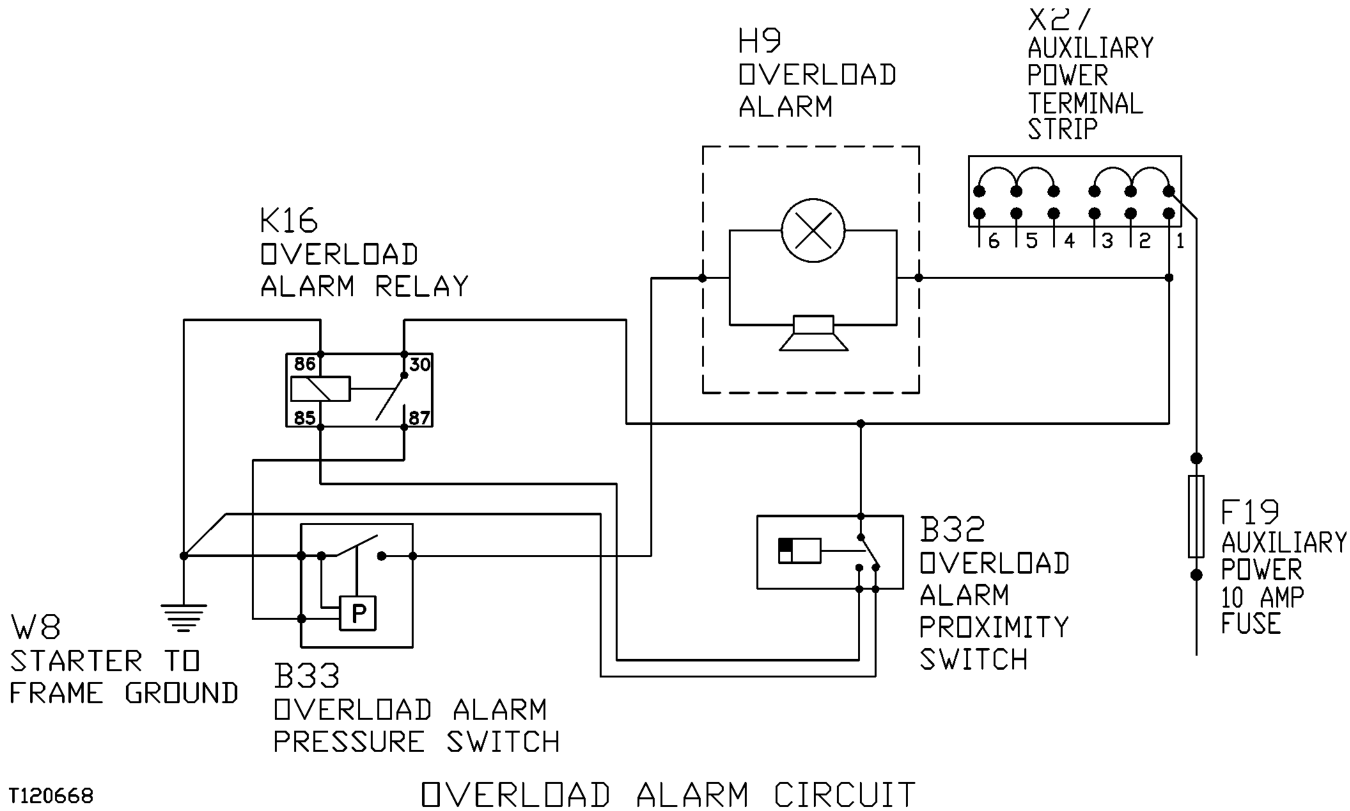
OVERLOAD ALARM CIRCUIT THEORY OF OPERATION

The overload alarm circuit contains: proximity switch B32, pressure switch B33, relay K16, and alarm H9.

Operating voltage for the overload alarm circuit is applied from fuse F19, through terminal strip X27, terminal 1 to the overload alarm power terminal, terminal 30 of relay K16, and terminal 1 of the proximity switch. When the boom is positioned on either side of the machine, proximity switch B32 closes and energizes relay K16 by applying +24 volts to relay terminal 85. With relay K16 energized, +24 volts is applied from terminal 87 to pressure switch B33, enabling the pressure switch. If the boom cylinder hydraulic pressure exceeds 3300 psi, switch B33 closes, activating the alarm, by applying ground to the overload alarm ground terminal.

CED,OUOE012,138 –19–16MAR99–1/1

OVERLOAD ALARM CIRCUIT SCHEMATIC



Overload Alarm Circuit Schematic

T120668 –19–28OCT99

CED,OUOE012,171 –19–13APR99–1/1

❶ OVERLOAD ALARM CIRCUIT DIAGNOSTIC PROCEDURES

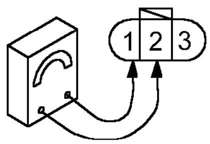
– – –1/1

1a AUXILIARY 10 AMP FUSE (F19) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace Fuse. If fuse blows again, check for short.

– – –1/1

Sub-System Diagnostics

1b OVERLOAD ALARM (H9) CHECK	Turn key switch OFF. Jumper alarm ground terminal (BLK wire) to cab ground. Turn key switch ON. Does alarm sound? Turn key switch OFF.	**YES:** Alarm is OK. Go to next check. **NO:** Replace alarm. – – –1/1

1c OVERLOAD ALARM PROXIMITY SWITCH (B32) CHECK	 **T120671** T120671 –UN–25MAR99 Operate excavator to position boom to either side of excavator. Turn key switch OFF. Remove harness connector from proximity switch. Connect ohmmeter to terminals 1 and 2 of switch connector. Does ohmmeter read continuity?	**YES:** Switch is OK. Go to next check. **NO:** Switch has failed. Replace. – – –1/1

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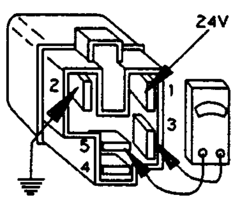
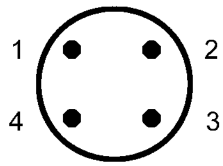
1d OVERLOAD ALARM RELAY (K16) CHECK	 T7447BG –19–14JAN91 Disconnect harness from overload alarm relay. Connect ohmmeter to relay terminals 30 and 87. Does ohmmeter read open? Connect 24 volts to relay terminal 85 and ground terminal 86. Does relay "click"? Connect ohmmeter to terminals 30 and 87. Does ohmmeter read continuity?	**YES:** Relay is OK. Go to next check. **NO:** Relay has failed. Replace. – – –1/1

1e OVERLOAD ALARM HARNESS CHECK	 **T120685** T120685 –UN–25MAR99 Disconnect harness from overload alarm pressure switch With boom positioned at either side of excavator, turn key switch ON. With voltmeter, measure voltage at pressure switch harness connector pin 3. Is 24 volts measured?	**YES:** Go to next step. **NO:** Check wire harness.
	Turn key switch OFF. Connect jumper wire across pressure switch harness connector pins 1 and 4. Turn key switch ON. Does overload alarm sound?	**YES:** Pressure switch has failed. Replace. **NO:** Harness has failed. Replace. – – –1/1

Group 20
References

BATTERY OPERATION

SPECIFICATIONS	
Percent Charged For Stabilized Open Circuit Voltage 12.6 Volts or More	100%
Percent Charged For Stabilized Open Circuit Voltage 12.4 Volts	75%
Percent Charged For Stabilized Open Circuit Voltage 12.2 Volts	50%
Percent Charged For Stabilized Open Circuit Voltage 12.0	25%
Percent Charged For Stabilized Open Circuit Voltage 11.7 or Less	0%

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. 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 12.40 volts or greater. To determine open circuit voltage use the following chart.

CHECK OPEN CIRCUIT VOLTAGE FOR STATE OF CHARGE

NOTE: Stabilize voltage by turning on high beams 15 Amp load for 15 seconds.

Percent Charged For Stabilized Open Circuit Voltage—Specification

12.6 Volts or More	100%
12.4 Volts	75%
12.2 Volts	50%
12.0	25%
11.7 or Less	0%

CED,TX14795,4147 –19–05AUG97–1/1

BATTERY SPECIFICATIONS

Battery Voltage—Specification

Volts.. 12 Volts

Cold Cranking Power—Specification

Amps... 1100 amps at —18°C (0°F)

Reserve Capacity—Specification

Minutes .... 400 minutes at 25 amps

Fully Charged Electrolyte Specific Gravity—Specification

Specific Gravity.. 1.265—1.280

CED,TX14795,4148 –19–13AUG98–1/1

References

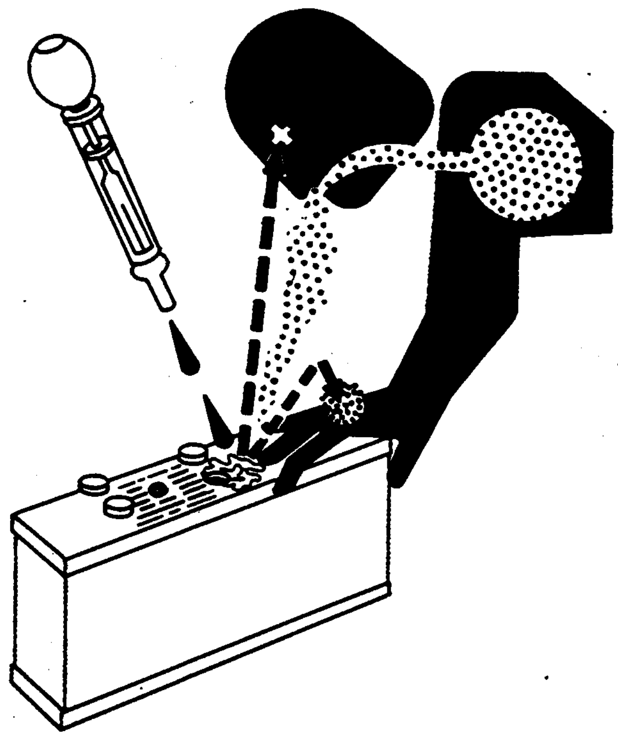
DIAGNOSE BATTERY MALFUNCTIONS

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.

CED,TX14795,4149 –19–05AUG97–1/1

References

CHECK BATTERY ELECTROLYTE LEVEL AND TERMINALS



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.**

1. Remove hold-down clamps.

2. Remove battery covers.

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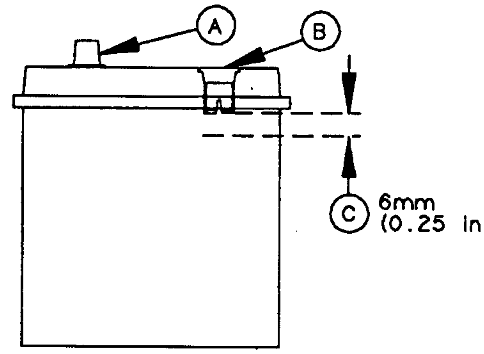
Continued on next page

TX,16,UU3540 –19–01SEP95–1/2

References

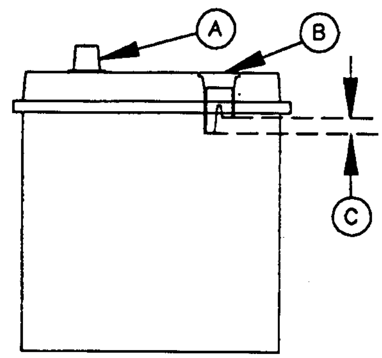
IMPORTANT: During freezing weather, batteries must be charged after water is added to prevent battery freezing. Charge battery using a battery charger or by running the engine.

3. Fill each cell to within specified range with distilled water. DO NOT overfill.



T6996DB –UN–10FEB89

Single Level Fill Tube Application



T6996DA –UN–10FEB89

Dual Level Fill Tube Application

A—Battery Post
B—Fill Tube
C—Electrolyte Level Range

TX,16,UU3540 –19–01SEP95–2/2

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References

PROCEDURE FOR TESTING BATTERIES

1. VISUAL CHECK

   a. Check for damage such as cracked or broken case and electrolyte leakage.

      If damage is seen, replace battery.

   b. Check electrolyte level. (See procedure in this group.)

      If low, add distilled water to specified level and charge battery.

   c. Check terminals for corrosion.

      If corroded, clean using a wire brush or battery post cleaner such as JT05838 Battery Post/Clamp Cleaner.

   d. Check posts for looseness.

      If posts are loose, replace battery.

2. HYDROMETER TEST

   a. Check specific gravity with a hydrometer or battery tester such as JT05460 Coolant/Battery Tester.

   b. Record specific gravity reading for each cell.

   c. 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.

   d. 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.

   e. 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.

3. LOAD TEST

   a. Check battery capacity with a load tester such as JT05832 Battery Load Tester. Follow tester manufacturer's instructions for proper load test procedures.

   b. If one battery fails load test, replace both batteries.

TX,16,UU3538 –19–01SEP95–1/1

USING BOOSTER BATTERIES—24 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 24-volt negative (-) ground. Connect two 12-volt booster batteries together in series as shown for 24 volts.

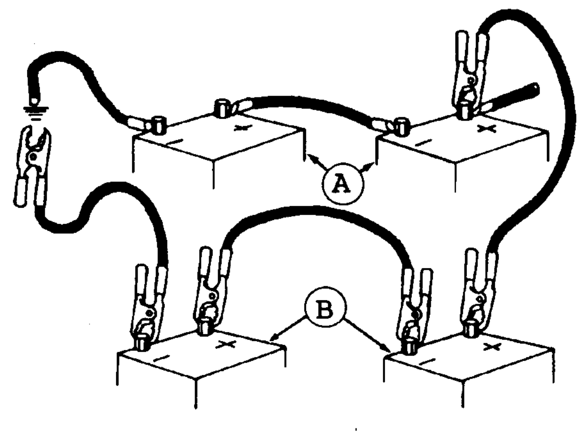
1. Connect one end of the positive cable to the positive terminal of machine batteries (A) and the other end to the positive terminal of booster batteries (B).

2. Connect one end of the negative cable to the negative terminal of booster batteries. Then connect the other end of negative cable to the machine frame as far away from the machine batteries as possible.

3. Start the engine.

4. Immediately after starting the engine, disconnect the end of negative cable from the machine frame first. Then disconnect the other end of negative cable from the negative terminal of booster batteries.

5. Disconnect the positive cable from the booster batteries and machine batteries.



T6713AH1 (CV)

T6713AH1 –UN–24OCT91

Two Battery Application

A—Machine Batteries
B—Booster Batteries

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CED,TX14795,4152 –19–14MAY98–1/1

References

REPLACING BATTERIES

SPECIFICATIONS	
Cold Cranking Amps at -18°C (0°F) amps	1100 Amps
Minutes Reserve Capacity at 25 amps Reserve Capacity	400 Minutes

Your machine is equipped with a negative (-) ground electrical system. It uses two 12-volt batteries. If one of the two batteries fails, both batteries must be replaced. Use only batteries meeting following specifications.

Cold Cranking Amps at -18°C (0°F)—Specification

Amps.. 1100 amps

Minutes Reserve Capacity at 25 amps—Specification

Reserve Capacity .... 400 Minutes

CED,TX14795,4153 –19–25JUN96–1/1

ADDING 12 OR 24 VOLT ACCESSORIES

IMPORTANT: This machine has a 24-volt electrical system. Installing 12-volt accessories without addition of 24-volt to 12-volt converter may cause battery failure.

When possible, use 24-volt accessories. If 12-volt accessories are added, use a 24-volt to 12-volt converter. Converters are available from your authorized dealer. (See the Industrial Equipment Attachment Guide.)

Converter capacity requirements depend on the load of the accessories installed. Follow electronic dealer and manufacturer's recommendations to determine the capacity of the converter required and its installation requirements.

The following precautions must be followed when adding electrical and/or electronic devices:

1. DO NOT mount 24 volt-to-12 volt converters in the cab. Converters should be mounted as close to the battery as possible. Converters supplied through Deere parts system provide installation instructions outlining proper installation procedures and location.

2. DO NOT mount electrical devices directly in front of system controller (between controller and seat). Mounting above the controller on shelf behind seat is acceptable.

3. DO NOT mount electrical devices within 6 inches of existing harnesses.

4. Isolate the case of the electrical device from the vehicle or cab frame. The ground for the device should be through a separate ground wire to the converter (if equipped) or starter ground stud.

5. Twist the power and the ground wires from the device together and run as close to the vehicle frame as possible. Twisting the wires helps to cancel any radio frequency fields that form around the wire.

6. Use of shielded wire reduces radio frequency fields even more. Twist power and ground wire together as above. Ground shield to frame at power source end and metal case of device at the opposite end. If device does not have a metal case, ground shield on device end to frame.

7. DO NOT run the device from the electronic device in parallel with the existing harnesses. DO NOT band wires to vehicle harnesses.

8. Install noise filters on positive end of all electronic devices. Noise filter should be located as close to the device as possible. Filters can be purchased at local electronic stores.

9. Mount antennas as far away from the engine and pump controller as possible. It is best not to mount antennas on the cab at all. Best locations are at the back of the unit on the counterweight or sheet metal above the batteries.

IMPORTANT: DO NOT connect an accessory to one battery. Connecting a 12-volt accessory to one battery will cause one battery to overcharge, and the other battery to undercharge, causing battery failure.

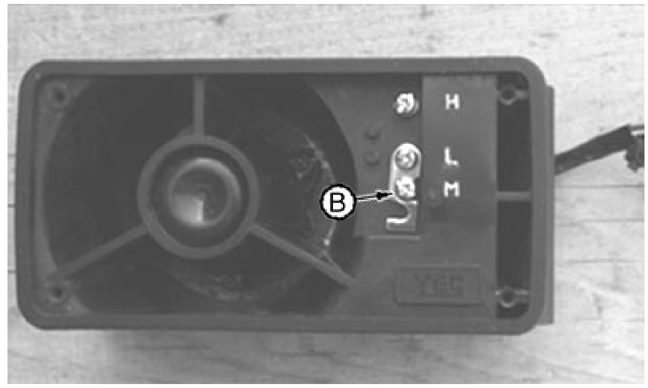
CED,TX14795,4154 –19–13AUG98–1/1

CHANGING TRAVEL ALARM VOLUME

IMPORTANT: It may be necessary to adjust travel alarm volume to meet local regulations.

NOTE: Alarm removed from machine for clarity of photograph.

Move switch (B) to adjust volume of travel alarm. The alarm can be set at HIGH, MED (medium), or LOW volume.



B—Switch
H—High Level
L—Low Level
M—Medium Level

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CED,TX14795,4155 –19–25JUN96–1/1

PROPORTIONAL SOLENOID TEST HARNESS

Test harness JT07352 is used to check proportional solenoid Y5, Y6, Y8, and Y9 circuits.

CED,OUOE012,45 –19–23NOV98–1/1

PUMP CONTROL TEST HARNESS

Test harness JT07353 is used to check arm in and pump control pressure sensors B20, B21, and B22.

CED,OUOE012,46 –19–23NOV98–1/1

References

PUMP PRESSURE SENSOR TEST HARNESS

Test harness JT07354 is used to check front and rear pump pressure sensors B18 and B19.

CED,OUOE012,47 –19–02FEB99–1/1

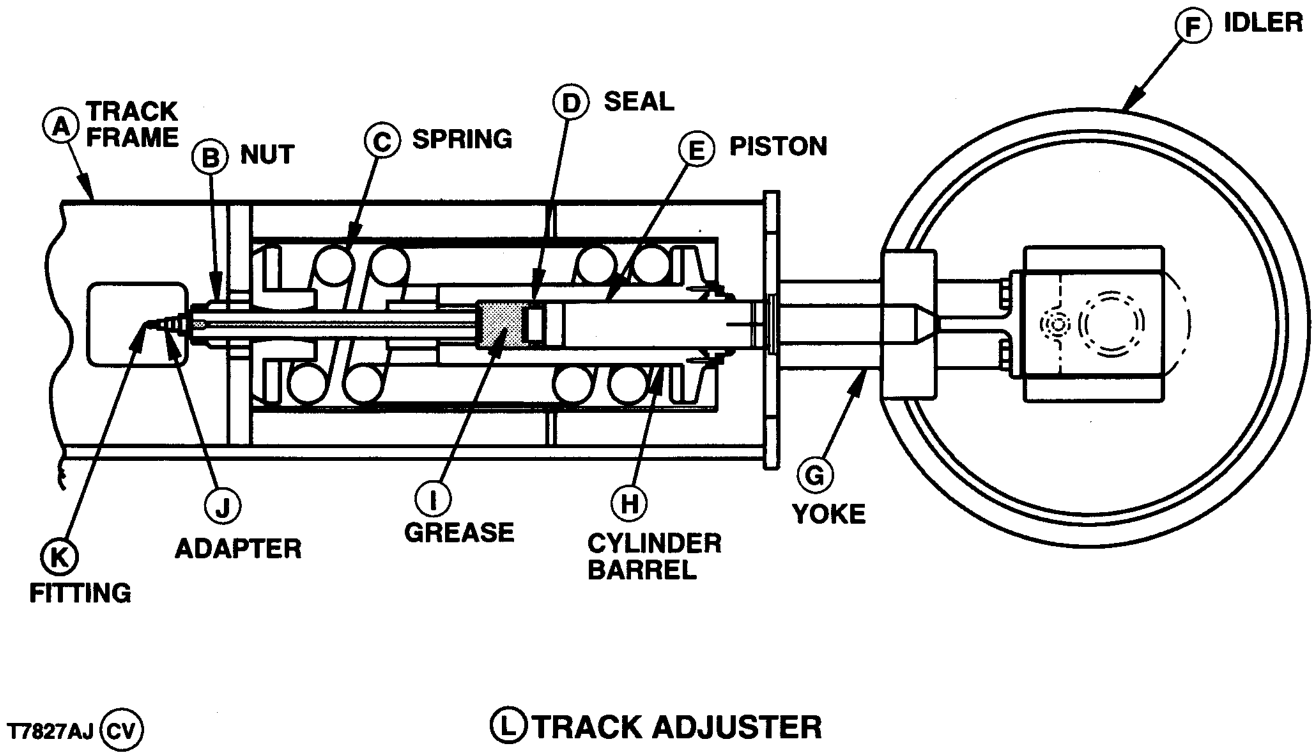
CHAPTER 5

SECTION 9020

POWER TRAIN

BLANK

TRACK ADJUSTER AND RECOIL SPRING OPERATION



L TRACK ADJUSTER

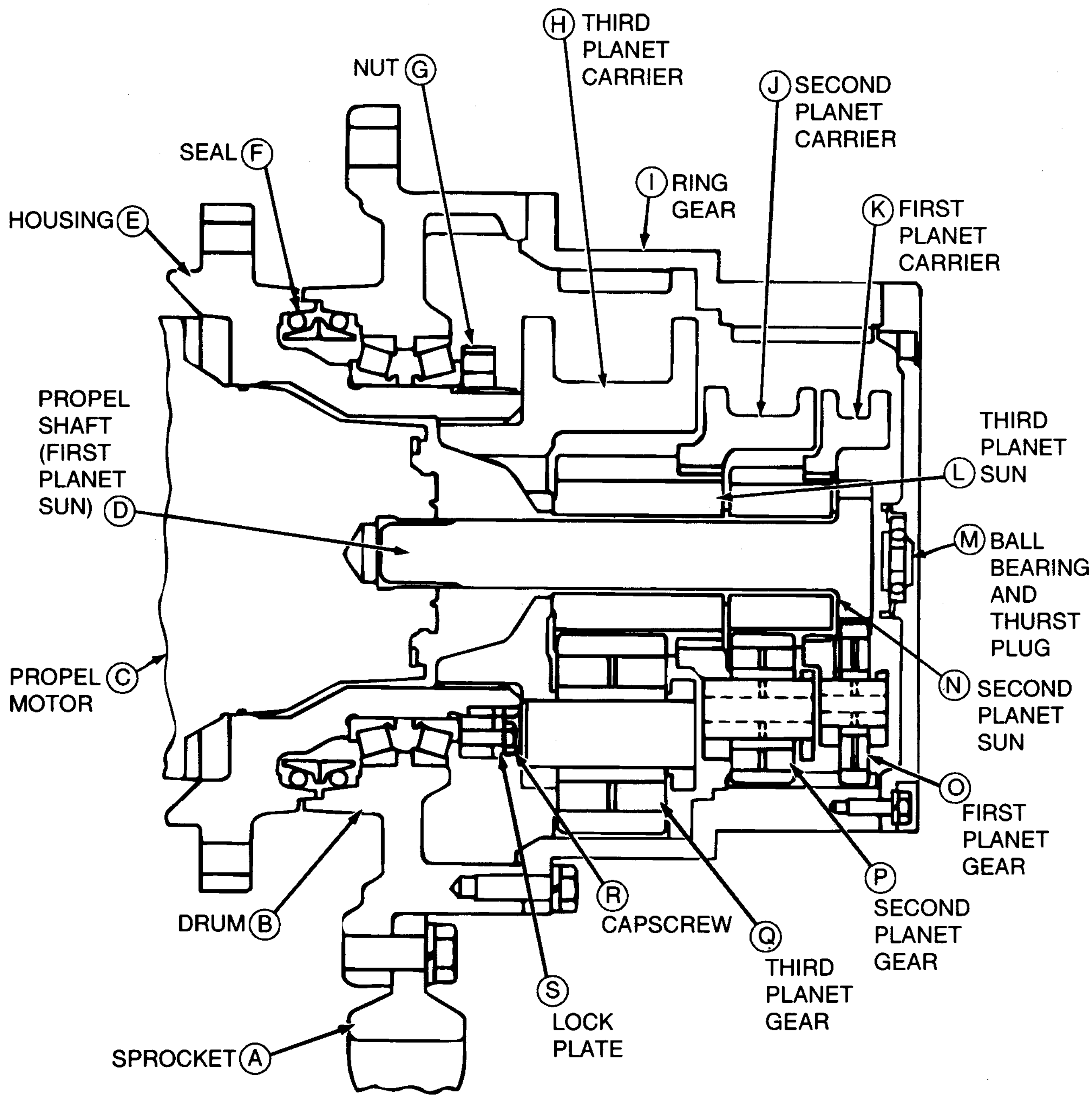
T7827AJ –19–28OCT92

The track adjuster (L) is supported by the track frame (A). Shock loads on the track and front idler (F) are absorbed by the recoil spring (C).

To tighten the track, pump grease (I) into fitting (K) to forces the piston (E) out. As it presses against the yoke (G), the track becomes tighter. Loosen adapter (J), NOT the fitting (K) to release grease to loosen track. Grease will escape through a small passage that is concealed by nut (B).

TX,9020,GG2454 –19–29JAN97–1/1

PROPEL GEARBOX OPERATION



T PROPEL GEARBOX

T8071AS CV

T8071AS –19–06FEB94

Continued on next page

CED,TX08227,3150 –19–30MAY98–1/2

Theory of Operation

The propel gearbox (T) is a triple reduction planetary drive. The gearbox is interchangeable from the right to the left side of machine. The propel motor (C) is connected to and turns the propel shaft (first planet sun gear) (D).

Rotary motion is transferred from the propel shaft to the sprocket (A) by the three planetary gear sets that mesh with the ring gear (I). As the propel shaft is rotated it turns the first planet gears (O). The gears rotate against the ring gear causing the first planet carrier (K) to rotate. The first planet carrier is connected to the second planet sun gear (N) which is in mesh with and rotates the second planet gears (P).

As the second planet gears rotate against the ring gear they turn the second planet carrier (J). The second planet carrier is connected to the third planet sun gear (L). The third planet sun gear rotate the third planet gears (Q). The third planet carrier (H) is fixed to the housing (E) and does not rotate so the rotation of the third planet gears is transferred to the ring gear. Because the ring gear and sprocket (A) are fasten to the drum (B) they all rotate together driving the track chain to move the machine.

A replaceable ball bearing and thrust plug (M) is used in the cover to hold the input shaft in position.

CED,TX08227,3150 –19–30MAY98–2/2

Group 15
Diagnostic Information

DIAGNOSE UNDERCARRIAGE COMPONENTS MALFUNCTIONS

NOTE: Diagnose malfunction charts are arranged from most probable and simplest to verify, to least likely and most difficult to verify.

Symptom	Problem	Solution
Noisy or Loose Track Chain	Incorrect track tension adjustment	Adjust track sag. (See Group 9020-20.)
	Loose shoes	Remove loose shoes to clean material from between shoe and link. Install shoes and tighten cap screws to specified torque. (See Group 0130.)
	Grease leaking from track adjuster seals or relief valve	Inspect between second and third roller, at base of relief valve, and at hole in side of relief valve for leakage. Replace seals or relief valve. (See Group 0130.)
Tight Track Chain	Material packing in sprocket	Adjust track sag with material packed in sprocket. (See Group 9020-20.)
	Track sag less than specification	Adjust track sag. (See Group 9020-20.)
Frequent Track Chain Sag Adjustment Required	Grease leaking from track adjuster seals or relief valve	Inspect between second and third roller, at base of relief valve, and at hole in side of relief valve for leakage. Replace seals or relief valve. (See Group 0130.)
Excessive Oil Leakage From Idlers And Rollers	Loose plug, worn or damaged O-ring, or metal faced seal	Repair roller or idler. (See Group 0130.)
Bent Track Shoes	Excessive grouser wear	Measure grouser height. (See procedure in this group.) Rebuild grousers or replace shoes.

Continued on next page

CED,TX08227,3152 –19–30MAY98–1/2

Diagnostic Information

Symptom	Problem	Solution
	Loose track shoes	Remove loose shoes to clean material from between shoe and link. Install shoes and tighten cap screws to specified torque. (See Group 0130.)
	Excessive high speed operation on rough and rocky terrain	Slow propel speed on rough and rocky terrain.
"Popping" Of Track	High propel loads in reverse	High propel loads in reverse can cause the recoil spring to retract allowing sprocket to slip in chain.
	Material packed in sprocket	Material filling sprocket teeth can cause sprocket tooth to bushing impact.
Cracked Track Link	Excessive high speed operation on rough and rocky terrain	Slow propel speed on rough and rocky terrain.
	Track shoes too wide for ground conditions	Use the narrowest shoes possible for required flotation.
Chipped Link Rails	Repeated high impacts with roller tread on flanges caused by a loose or snaky track, or using shoes that are too wide	Adjust track chain sag. (See Group 9020-20.)
		Check track chain pitch. (See procedure in this group)
		Use the narrowest shoes possible for required flotation.
Individual Undercarriage Component Wear	See Undercarriage Appraisal Manual SP326	Rebuild components using weld or replace components.

CED,TX08227,3152 –19–30MAY98–2/2

MEASURE TRACK CHAIN BUSHING WEAR

SPECIFICATIONS	
Track Chain Bushing OD	66.7 mm (2.63 in.) new
Track Chain Bushing OD	61.9 mm (2.44 in.) minimum used

SERVICE EQUIPMENT AND TOOLS
D17524C1 100 mm Caliper
JT05518A or JT05523 Undercarriage Inspection Service Tool Kit

T82865 –UN–08NOV88

Measure bushing outer diameter at the two worn places using a caliper.

Minimum used is the maximum allowable wear for turning pins and bushings.

Track Chain Bushing—Specification

OD .... 66.7 mm (2.63 in.) new
OD .... 61.9 mm (2.44 in.) minimum used

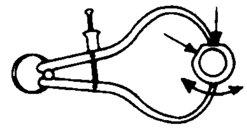
9020
15
3

CED,TX08227,3153 –19–30MAY98–1/1

BUSHING OUTER DIAMETER

Allowable Wear—4.8 mm (0.19 in.)

Dimension	Percent Worn
66.7 mm (2.63 in.)	0
66.5 mm (2.62 in.)	5
66.2 mm (2.61 in.)	10
66.0 mm (2.60 in.)	15
65.7 mm (2.59 in.)	20
65.5 mm (2.58 in.)	25
65.3 mm (2.57 in.)	30
65.0 mm (2.56 in.)	35
64.8 mm (2.55 in.)	40
64.5 mm (2.54 in.)	45
64.3 mm (2.53 in.)	50
64.1 mm (2.52 in.)	55
63.8 mm (2.51 in.)	60
63.6 mm (2.50 in.)	65
63.3 mm (2.49 in.)	70
63.1 mm (2.48 in.)	75
62.9 mm (2.47 in.)	80
62.6 mm (2.47 in.)	85
62.4 mm (2.46 in.)	90
62.1 mm (2.45 in.)	95
61.9 mm (2.44 in.)	**100**
61.7 mm (2.43 in.)	105
61.4 mm (2.42 in.)	110
61.2 mm (2.41 in.)	115
60.9 mm (2.40 in.)	120



T6813AK –UN–29JAN98

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CED,OUOE024,1 –19–18MAR99–1/1

MEASURE TRACK CHAIN LINK WEAR

SPECIFICATIONS	
Track Chain Link Height	116.4 mm (4.58 in.) new
Track Chain Link Height	111.0 mm (4.37 in.) minimum used

SERVICE EQUIPMENT AND TOOLS
D05231ST 300 mm Ruler
JT05521 200 mm Ruler
JT05534 Right Angle Attachment
JT05518A or JT05523 Undercarriage Inspection Service Tool Kit

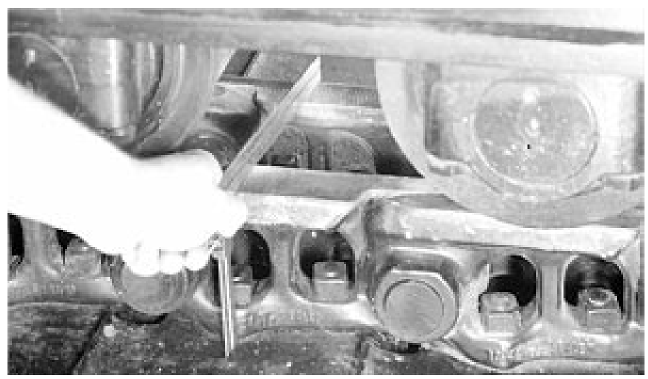
CED,TX08227,3154 –19–30MAY98–1/2

Measure height of several links to find an average using a depth gauge.

Minimum used is the maximum allowable wear for rebuilding links.

Track Chain Link—Specification

Height .... 116.4 mm (4.58 in.) new
Height .... 111.0 mm (4.37 in.) minimum used



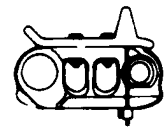
T82864 –UN–08NOV88

CED,TX08227,3154 –19–30MAY98–2/2

LINK HEIGHT

Allowable Wear—5.4 mm (0.21 in.)

Dimension	Percent Worn
116.4 mm (4.58 in.)	0
116.1 mm (4.57 in.)	5
115.9 mm (4.56 in.)	10
115.6 mm (4.55 in.)	15
115.3 mm (4.54 in.)	20
115.1 mm (4.53 in.)	25
114.8 mm (4.52 in.)	30
114.5 mm (4.51 in.)	35
114.2 mm (4.50 in.)	40
114.0 mm (4.49 in.)	45
113.7 mm (4.48 in.)	50
113.4 mm (4.47 in.)	55
113.2 mm (4.46 in.)	60
112.9 mm (4.44 in.)	65
112.6 mm (4.43 in.)	70
112.4 mm (4.42 in.)	75
112.1 mm (4.41 in.)	80
111.8 mm (4.40 in.)	85
111.5 mm (4.39 in.)	90
111.3 mm (4.38 in.)	95
111.0 mm (4.37 in.)	**100**
110.7 mm (4.36 in.)	105
110.5 mm (4.35 in.)	110
110.2 mm (4.34 in.)	115
109.9 mm (4.33 in.)	120



T6813AO –UN–29JAN98

CED,OUOE024,2 –19–18MAR99–1/1

MEASURE TRACK CHAIN PITCH

SPECIFICATIONS	
Track Chain Pitch	816.0 mm (32.13 in.) new
Track Chain Pitch	834.0 mm (32.83 in.) maximum used

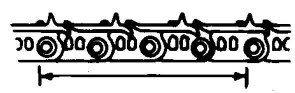
SERVICE EQUIPMENT AND TOOLS
JT05520 Metric Tape
JT05518A or JT05523 Undercarriage Inspection Service Tool Kit

CED,TX08227,3155 –19–30MAY98–1/2

1. Remove slack by putting a wooden block between sprocket and chain, then slowly move machine in reverse to tighten chain.

2. Measure pitch across several four-link sections as shown, except section on either side of master pin, to find average chain wear.

   Maximum used is the maximum allowable wear for turning pins and bushings.



T6813AL –UN–29JAN98

Track Chain—Specification

Pitch.. 816.0 mm (32.13 in.) new
Pitch .... 834.0 mm (32.83 in.) maximum used

CED,TX08227,3155 –19–30MAY98–2/2

PITCH 204.00 MM (8.03 IN.)

Allowable Wear—18.0 mm (0.71 in.)

Dimension	Percent Worn
816.0 mm (32.13 in.)	0
816.9 mm (32.16 in.)	5
817.8 mm (32.20 in.)	10
818.7 mm (32.23 in.)	15
819.6 mm (32.27 in.)	20
820.5 mm (32.30 in.)	25
821.4 mm (32.34 in.)	30
822.3 mm (32.37 in.)	35
823.2 mm (32.41 in.)	40
824.1 mm (32.44 in.)	45
825.0 mm (32.48 in.)	50
825.9 mm (32.52 in.)	55
826.8 mm (32.55 in.)	60
827.7 mm (32.59 in.)	65
828.6 mm (32.62 in.)	70
829.5 mm (32.66 in.)	75
830.4 mm (32.69 in.)	80
831.3 mm (32.73 in.)	85
832.2 mm (32.76 in.)	90
833.1 mm (32.80 in.)	95
834.0 mm (32.83 in.)	**100**
834.9 mm (32.87 in.)	105
835.8 mm (32.91 in.)	110
836.7 mm (32.94 in.)	115
837.6 mm (32.98 in.)	120

CED,OUOE024,3 –19–18MAR99–1/1

9020
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MEASURE TRACK SHOE GROUSER WEAR

SPECIFICATIONS	
600 mm (24 in.) Track Shoe Grouser Height	26.0 mm (1.02 in.) new
600 mm (24 in.) Track Shoe Grouser Height	20.0 mm (0.78 in.) minimum use
800 mm (32 in.) Track Shoe Grouser Height	31.0 mm (1.22 in.) new
800 mm (32 in.) Track Shoe Grouser Height	25.0 mm (0.98 in.) minimum used

SERVICE EQUIPMENT AND TOOLS
D05231ST 300 mm Ruler
JT05521 200 mm Ruler
JT05534 Right Angle Attachment
JT05518A or JT05523 Undercarriage Inspection Service Tool Kit

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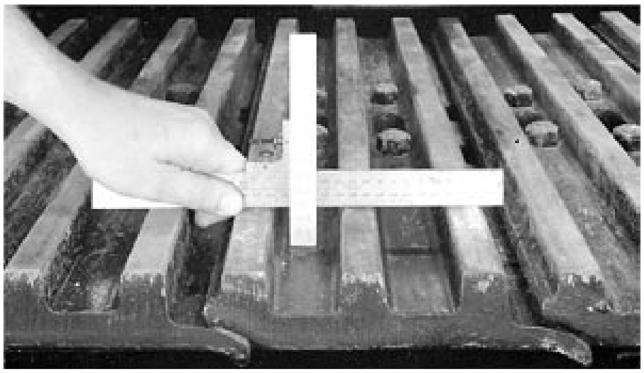
CED,TX08227,3156 –19–30MAY98–1/2



T82859 –UN–08NOV88

Minimum used is the maximum allowable wear for rebuilding grouser bars with weld.

Measure grouser height of several track shoes to find an average using a depth gauge.

600 mm (24 in.) Track Shoe Grouser—Specification

Height .... 26.0 mm (1.02 in.) new
Height .... 20.0 mm (0.78 in.) minimum use

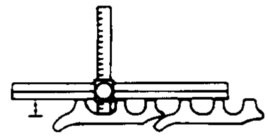
800 mm (32 in.) Track Shoe Grouser—Specification

Height .... 31.0 mm (1.22 in.) new
Height .... 25.0 mm (0.98 in.) minimum used

CED,TX08227,3156 –19–30MAY98–2/2

THREE BAR GROUSER HEIGHT 600 MM (23.6 IN.) WIDTH

Allowable Wear—6.0 mm (0.24 in.)



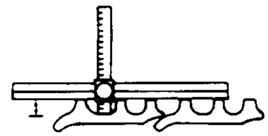
T6813AP –UN–29JAN98

Dimension	Percent Worn
26.0 mm (1.02 in.)	0
25.7 mm (1.01 in.)	5
25.4 mm (1.00 in.)	10
25.1 mm (0.99 in.)	15
24.8 mm (0.98 in.)	20
24.5 mm (0.96 in.)	25
24.2 mm (0.95 in.)	30
23.9 mm (0.94 in.)	35
23.6 mm (0.93 in.)	40
23.3 mm (0.92 in.)	45
23.0 mm (0.91 in.)	50
22.7 mm (0.89 in.)	55
22.4 mm (0.88 in.)	60
22.1 mm (0.87 in.)	65
21.8 mm (0.86 in.)	70
21.5 mm (0.85 in.)	75
21.2 mm (0.83 in.)	80
20.9 mm (0.82 in.)	85
20.6 mm (0.81 in.)	90
20.3 mm (0.80 in.)	95
20.0 mm (0.79 in.)	**100**
19.7 mm (0.78 in.)	105
19.4 mm (0.76 in.)	110
19.1 mm (0.75 in.)	115
18.8 mm (0.74 in.)	120

CED,OUOE024,5 –19–18MAR99–1/1

THREE BAR GROUSER HEIGHT 800 MM (31.5 IN.) WIDTH

Allowable Wear—6.0 mm (0.24 in.)



T6813AP —UN—29JAN98

Dimension	Percent Worn
31.0 mm (1.22 in.)	0
30.7 mm (1.21 in.)	5
30.4 mm (1.20 in.)	10
30.1 mm (1.19 in.)	15
29.8 mm (1.17 in.)	20
29.5 mm (1.16 in.)	25
29.2 mm (1.15 in.)	30
28.9 mm (1.14 in.)	35
28.6 mm (1.13 in.)	40
28.3 mm (1.11 in.)	45
28.0 mm (1.10 in.)	50
27.7 mm (1.09 in.)	55
27.4 mm (1.08 in.)	60
27.1 mm (1.07 in.)	65
26.8 mm (1.06 in.)	70
26.5 mm (1.04 in.)	75
26.2 mm (1.03 in.)	80
25.9 mm (1.02 in.)	85
25.6 mm (1.01 in.)	90
25.3 mm (1.00 in.)	95
25.0 mm (0.98 in.)	**100**
24.7 mm (0.97 in.)	105
24.4 mm (0.96 in.)	110
24.1 mm (0.95 in.)	115
23.8 mm (0.94 in.)	120

CED,OUOE024,4 –19–18MAR99–1/1

MEASURE TRACK ROLLER WEAR

SPECIFICATIONS	
Track Roller Tread OD	175.0 mm (6.89 in.) new
Track Roller Tread OD	165.0 mm (6.50 in.) minimum used

SERVICE EQUIPMENT AND TOOLS
JT05519 Special Roller Caliper
JT05518A or JT05523 Undercarriage Inspection Service Tool Kit

CED,TX08227,3157 –19–30MAY98–1/2

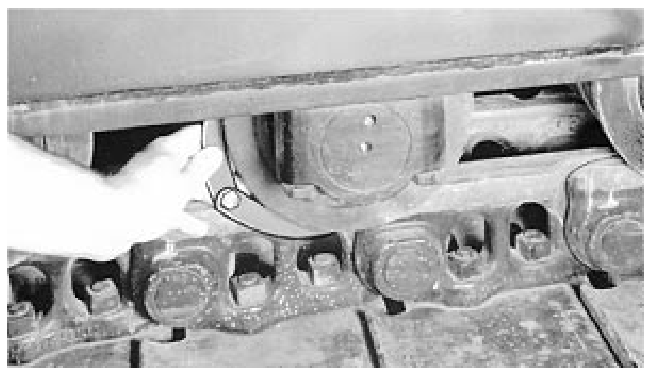
Under some conditions roller wear can be uneven. If wear is uneven, rollers may be interchanged to even out the wear.

Measure roller tread outer diameter using a caliper.

Minimum used is the maximum allowable wear for rebuilding roller tread.

Track Roller Tread—Specification

OD .... 175.0 mm (6.89 in.) new
OD .... 165.0 mm (6.50 in.) minimum used

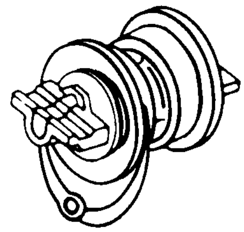

T87973 –UN–08NOV88

CED,TX08227,3157 –19–30MAY98–2/2

TRACK ROLLER TREAD DIAMETER

Allowable Wear—10.0 mm (0.39 in.)

Dimension	Percent Worn
175.0 mm (6.89 in.)	0
174.5 mm (6.87 in.)	5
174.0 mm (6.85 in.)	10
173.5 mm (6.83 in.)	15
173.0 mm (6.81 in.)	20
172.5 mm (6.79 in.)	25
172.0 mm (6.77 in.)	30
171.5 mm (6.75 in.)	35
171.0 mm (6.73 in.)	40
170.5 mm (6.71 in.)	45
170.0 mm (6.69 in.)	50
169.5 mm (6.67 in.)	55
169.0 mm (6.65 in.)	60
168.5 mm (6.63 in.)	65
168.0 mm (6.61 in.)	70
167.5 mm (6.59 in.)	75
167.0 mm (6.57 in.)	80
166.5 mm (6.56 in.)	85
166.0 mm (6.54 in.)	90
165.5 mm (6.52 in.)	95
165.0 mm (6.50 in.)	**100**
164.5 mm (6.48 in.)	105
164.0 mm (6.46 in.)	110
163.5 mm (6.44 in.)	115
163.0 mm (6.42 in.)	120



T6813AM –UN–29JAN98

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CED,OUOE024,8 –19–18MAR99–1/1

MEASURE TRACK CARRIER ROLLER WEAR

SPECIFICATIONS	
Track Carrier Roller Tread OD	120.0 mm (4.72 in.) new
Track Carrier Roller Tread OD	110.0 mm (4.33 in.) minimum used

SERVICE EQUIPMENT AND TOOLS
JT05519 Special Roller Caliper
JT05518A or JT05523 Undercarriage Inspection Service Tool Kit

CED,TX08227,3158 –19–30MAY98–1/2

Measure roller tread outer diameter using a caliper.

Used minimum tread diameter is the maximum allowable wear for rebuilding wear surface.

T6813AQ –UN–29JAN98

Track Carrier Roller Tread—Specification

OD .... 120.0 mm (4.72 in.) new
OD .... 110.0 mm (4.33 in.) minimum used

CED,TX08227,3158 –19–30MAY98–2/2

CARRIER ROLLER TREAD DIAMETER

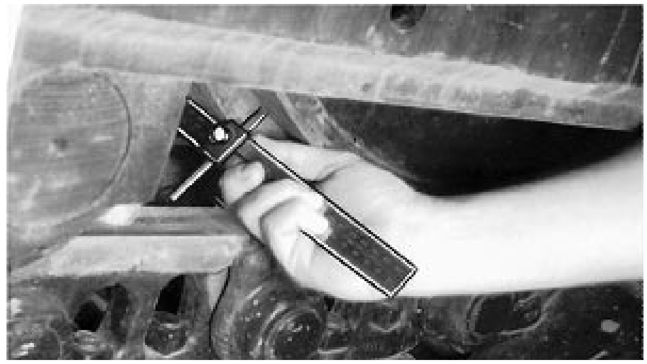
Allowable Wear—10.0 mm (0.39 in.)

T6813AQ –UN–29JAN98

Dimension	Percent Worn
120.0 mm (4.72 in.)	0
119.5 mm (4.70 in.)	5
119.0 mm (4.69 in.)	10
118.5 mm (4.67 in.)	15
118.0 mm (4.65 in.)	20
117.5 mm (4.63 in.)	25
117.0 mm (4.61 in.)	30
116.5 mm (4.59 in.)	35
116.0 mm (4.57 in.)	40
115.5 mm (4.55 in.)	45
115.0 mm (4.53 in.)	50
114.5 mm (4.51 in.)	55
114.0 mm (4.49 in.)	60
113.5 mm (4.47 in.)	65
113.0 mm (4.45 in.)	70
112.5 mm (4.43 in.)	75
112.0 mm (4.41 in.)	80
111.5 mm (4.39 in.)	85
111.0 mm (4.37 in.)	90
110.5 mm (4.35 in.)	95
110.0 mm (4.33 in.)	**100**
109.5 mm (4.31 in.)	105
109.0 mm (4.29 in.)	110
108.5 mm (4.27 in.)	115
108.0 mm (4.25 in.)	120

CED,OUOE024,7 –19–18MAR99–1/1

MEASURE FRONT IDLER WEAR


T87972 –UN–08NOV88

SPECIFICATIONS	
Front Idler Flange Height	22.5 mm (0.89 in.) new
Front Idler Flange Height	27.5 mm (1.08 in.) maximum used

SERVICE EQUIPMENT AND TOOLS
JT05521 200 mm Ruler
JT05534 Right Angle Attachment
JT05518A or JT05523 Undercarriage Inspection Service Tool Kit

Measure height of front idler flange using a depth gauge.

Maximum used flange height is the maximum allowable height of flange for rebuilding wear surface.

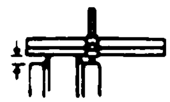
Front Idler Flange—Specification

Height .... 22.5 mm (0.89 in.) new
Height .... 27.5 mm (1.08 in.) maximum used

FRONT IDLER FLANGE HEIGHT

Allowable Wear—5.0 mm (0.20 in.)

Dimension	Percent Worn
22.5 mm (0.89 in.)	0
22.8 mm (0.90 in.)	5
23.0 mm (0.91 in.)	10
23.3 mm (0.92 in.)	15
23.5 mm (0.93 in.)	20
23.8 mm (0.94 in.)	25
24.0 mm (0.94 in.)	30
24.3 mm (0.95 in.)	35
24.5 mm (0.96 in.)	40
24.8 mm (0.97 in.)	45
25.0 mm (0.98 in.)	50
25.3 mm (0.99 in.)	55
25.5 mm (1.00 in.)	60
25.8 mm (1.01 in.)	65
26.0 mm (1.02 in.)	70
26.3 mm (1.03 in.)	75
26.5 mm (1.04 in.)	80
26.8 mm (1.05 in.)	85
27.0 mm (1.06 in.)	90
27.3 mm (1.07 in.)	95
27.5 mm (1.08 in.)	**100**
27.8 mm (1.09 in.)	105
28.0 mm (1.10 in.)	110
28.3 mm (1.11 in.)	115
28.5 mm (1.12 in.)	120



T6813AR –UN–29JAN98

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CED,OUOE024,9 –19–18MAR99–1/1

MEASURE SWING BEARING WEAR

SPECIFICATIONS	
Swing Bearing Play	1.4 mm (0.055 in.) or less new
Swing Bearing Play	4.7 mm (0.185 in.) maximum used

SERVICE EQUIPMENT AND TOOLS
D17526CI Dial Indicator
D17525CI Magnetic Base with Adjustable Arm

Continued on next page CED,TX08227,3160 –19–30MAY98–1/2

CAUTION: Stay clear of moving parts. Position dial indicator so it can be seen while operator can see you.

NOTE: Two people are needed to do the measurement. One to operate the machine and one to take the readings.

1. Check that swing bearing to main frame cap screws are tight. (See Group 4350.)

   Check that bearing is lubricated with the specified grease. (See Track Adjuster, Working Tool Pivot, Swing Bearing, and Swing Bearing Gear Grease in General Information Section.)

   Check that bearing rotation is smooth and without noise.

2. Install the dial indicator with needle point contacting bottom face of swing bearing outer race.

3. Move boom and arm to position shown with bucket off the ground.

4. Turn dial indicator to zero.

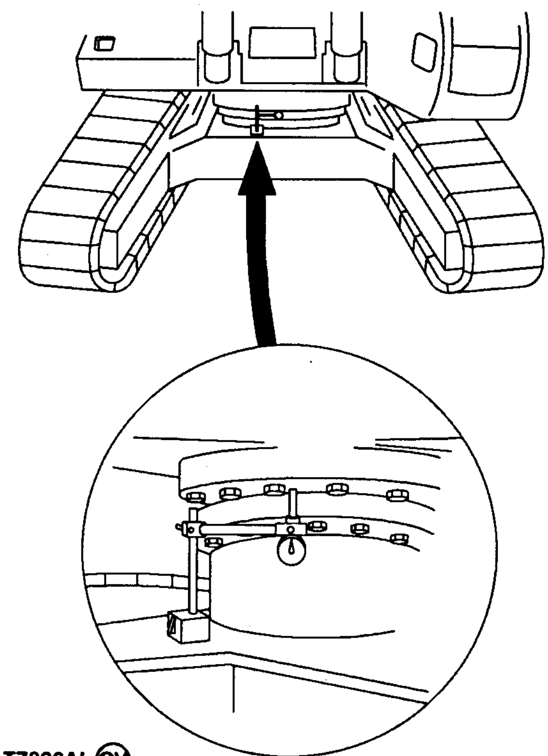
5. Lower boom to raise front idlers off the ground approximately 500 mm (20 in.)

6. Record dial indicator reading.

   If reading is more than maximum allowable, check for steel ball and spacer wear. Repair or replace swing bearing as needed. (See Group 4350.)

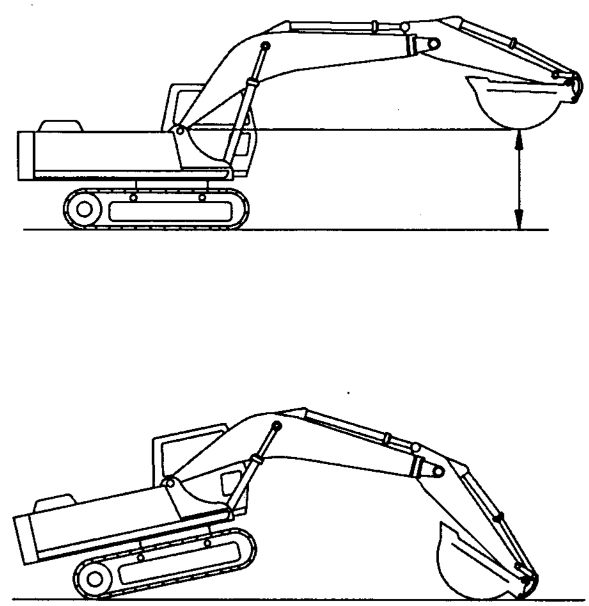
Swing Bearing—Specification

Play	1.4 mm (0.055 in.) or less new
Play	4.7 mm (0.185 in.) maximum used



T7886AI CV

T7886AI –UN–23NOV92



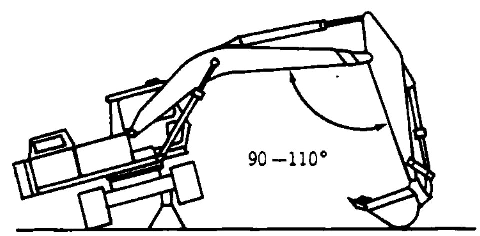
T7886AJ CV

T7886AJ –UN–23NOV92

Group 20
Adjustments

ADJUST TRACK SAG

SPECIFICATIONS	
Excavator Weight	33 058 kg (72 800 lb) approximate
Track Sag	340—380 mm (13-3/8—15 in.)
Nut and Valve Assembly-to-Track Adjuster Cylinder Torque	147 N•m (108 lb-ft)



T6876FG —UN—06DEC88

1. Swing upperstructure to side. Lower boom to raise track off the ground.

   Keep the angle between boom and arm at 90—110° with the round side of bucket on the ground.

CAUTION: Prevent possible injury from unexpected machine movement. Put blocks or shop stands under machine frame to support machine while measuring track sag.

Excavator—Specification

Weight.. 33 058 kg (72 800 lb) approximate

2. Put blocks or shop stands under the machine to support machine.

3. Slowly turn the track forward for two revolution and then in reverse for two revolution. Stop the track while moving in reverse direction so all track sag is at the bottom.

9020
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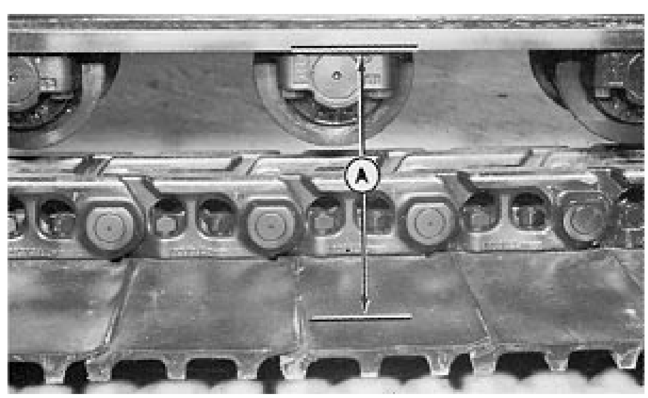
CED,TX08227,3161 –19–30MAY98–1/3

4. Measure track sag (A) at middle track roller from the bottom of tack frame to the top surface of track shoe.

Track—Specification

Sag .... 340—380 mm (13-3/8—15 in.)



T6457DL —UN—23FEB89

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CED,TX08227,3161 –19–30MAY98–2/3

CAUTION: High pressure grease in track adjuster cylinder. Do not remove grease fitting or nut and valve assembly to release grease.

IMPORTANT: Prevent possible damage to track components. Do not use the grease fitting on track adjuster cylinder for lubrication. Use this grease fitting only for track sag adjustment.

5. To decrease track sag, add multi-purpose grease to track adjuster cylinder through grease fitting (A) located in access hole (D) in track frame. Use a grease gun with a maximum capacity of 68 950 kPa (690 bar) (10 000 psi).

   To increase track sag, loosen nut and valve assembly (B) one turn to release grease from track adjuster cylinder through bleed hole (C) in rod.

   Tighten nut and valve assembly when track sag is correct.

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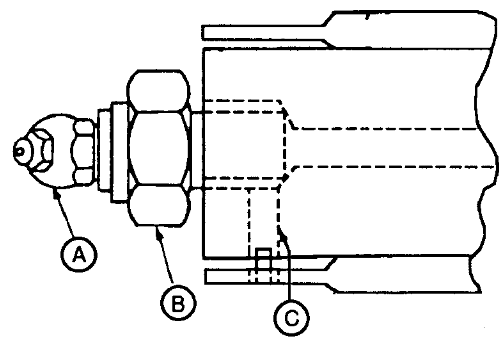
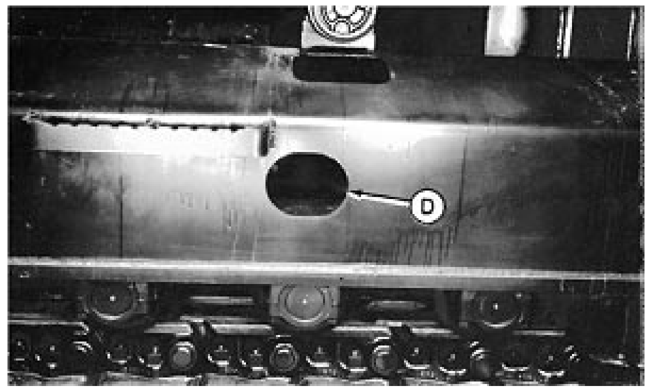
Nut and Valve Assembly-to-Track Adjuster Cylinder—Specification

Torque .... 147 N•m (108 lb-ft)

NOTE: If piston in track adjuster cylinder does not move, remove the cylinder to make repairs. (See Remove and Install Track Adjuster in Group 0130.)



T7396DZ –UN–28NOV90



T7869AQ –UN–22OCT92

A—Grease Fitting
B—Nut and Valve Assembly
C—Bleed Hole
D—Access Hole

CED,TX08227,3161 –19–30MAY98–3/3

CHAPTER 6

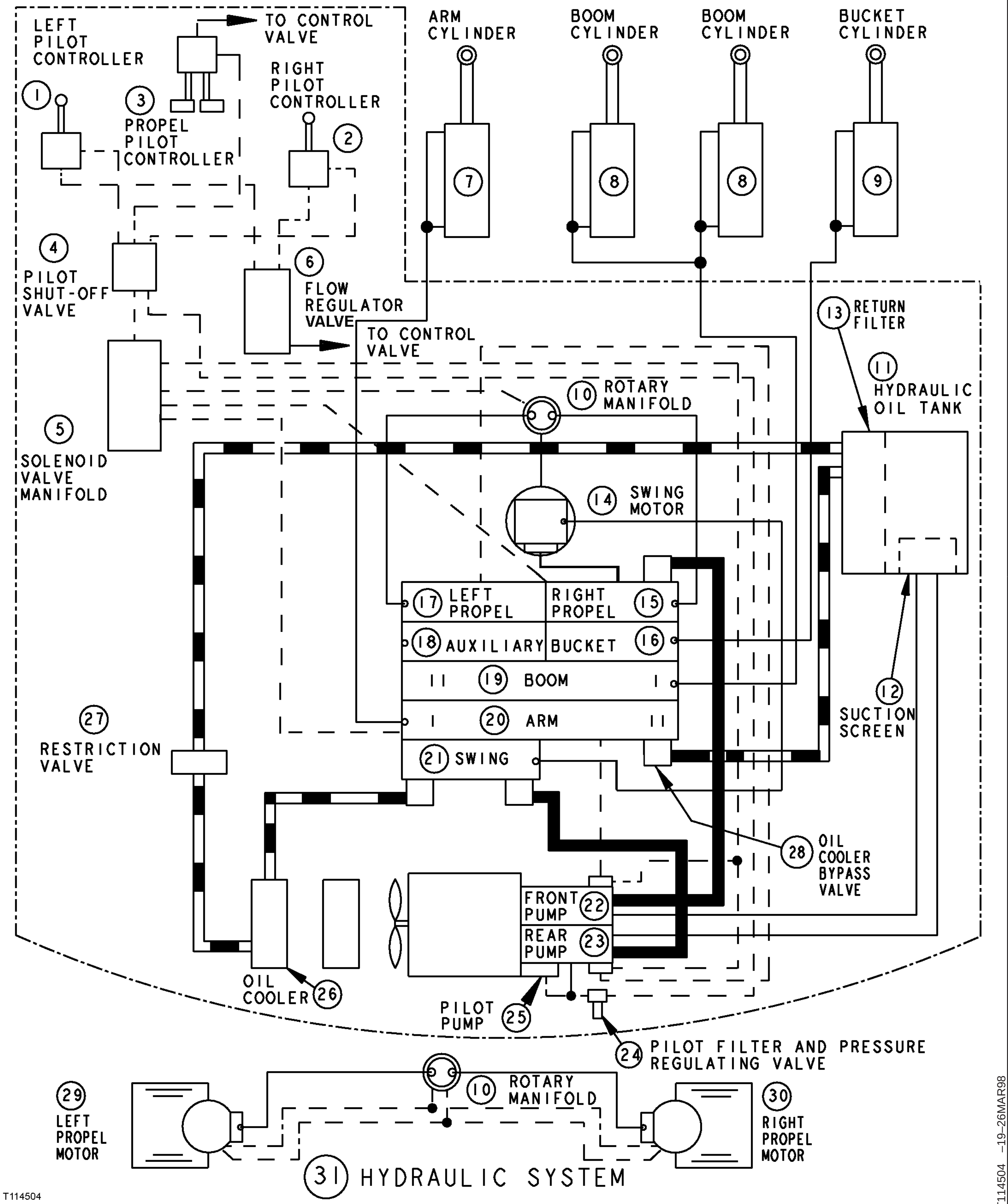
SECTION 9025

HYDRAULIC SYSTEM

BLANK

Group 05
Theory of Operation

HYDRAULIC SYSTEM DIAGRAM



CED,TX08227,3039 –19–25MAR98–1/1

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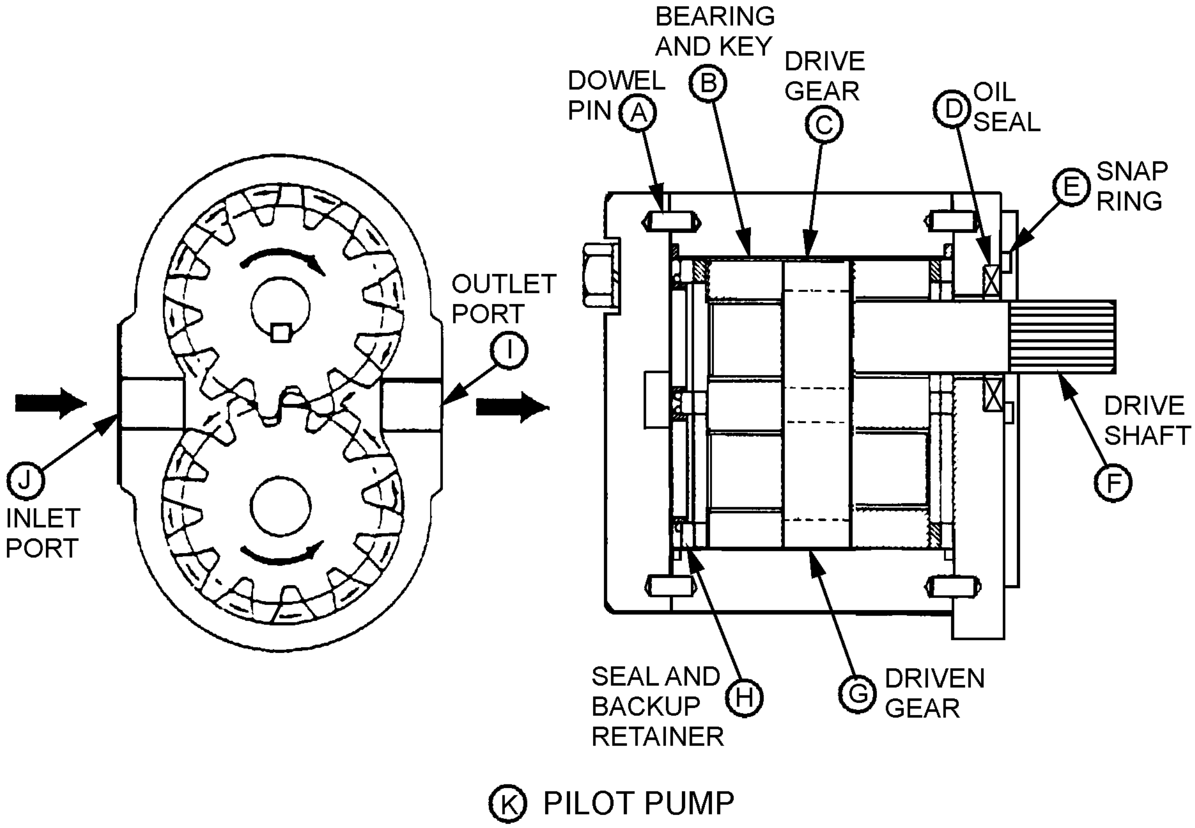
PILOT PUMP OPERATION

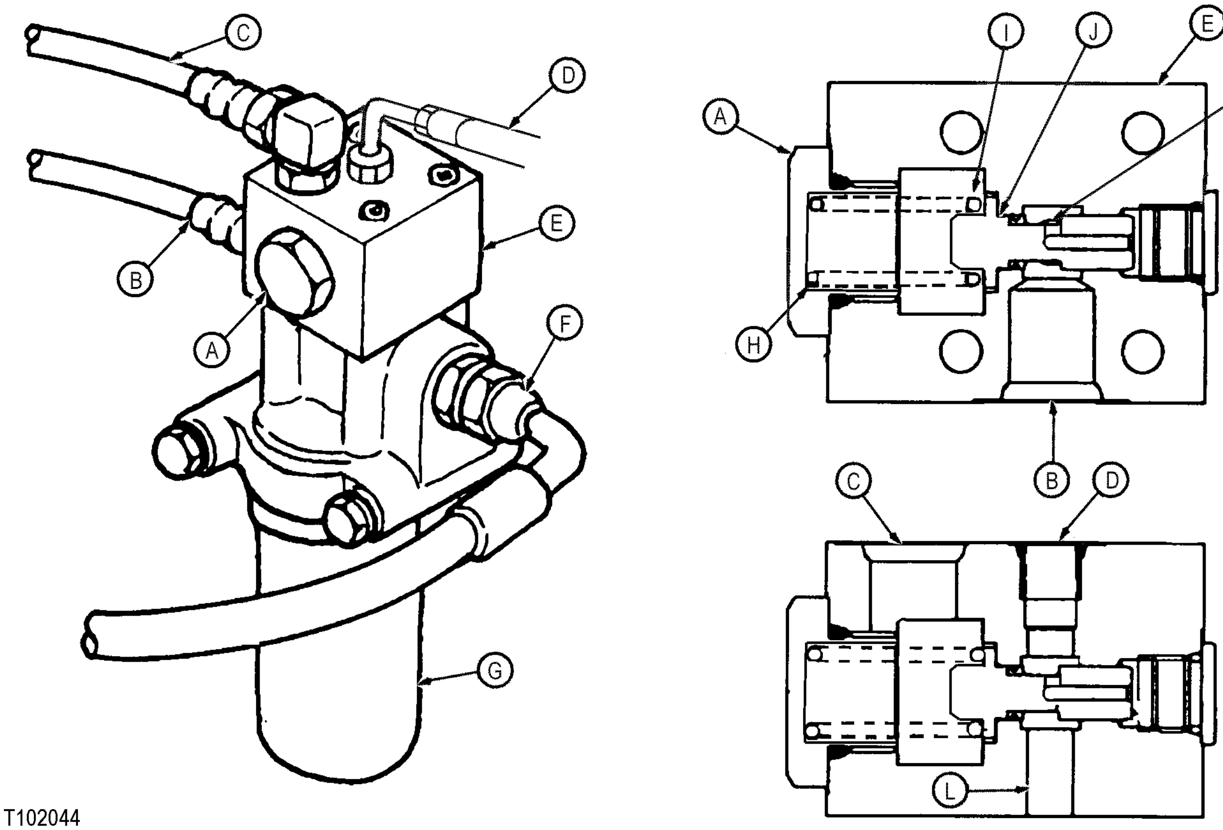


The pilot pump (K) is a fixed-displacement, external gear pump. The pilot pump is attached to the pump drive gearbox between the front and rear pumps. The pump is driven at engine speed by the input drive shaft for the pump drive gearbox.

The inlet port (J) is connected by a suction line to the suction line for the front and rear pumps. Outlet port (I) is connected to the pilot pressure regulating valve and pilot filter. The outlet is also connected by tubes to the front and rear pump regulators and by a passage in the front and rear pump housing to the small end of pump servo pistons.

CED,TX08227,3040 –19–25MAR98–1/1

PILOT PRESSURE REGULATING VALVE AND FILTER OPERATION



T102044

T102044 –UN–01AUG96

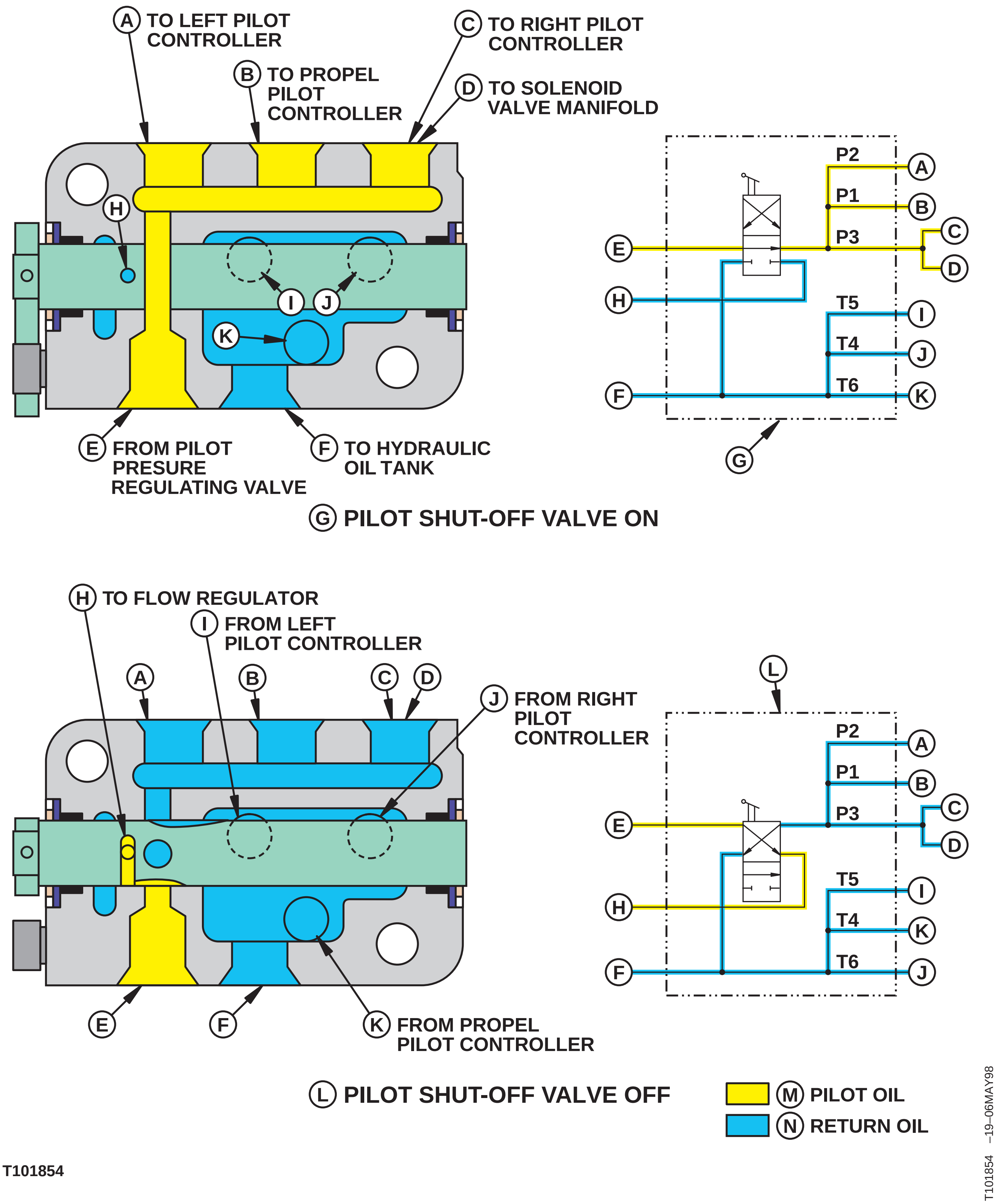
A—Plug
B—Regulated Pilot Oil To Pilot Shut-Off Valve
C—Return Oil to Hydraulic Oil Tank
D—Regulated Pilot Oil to Control Valve
E—Pilot Pressure Regulating Valve
F—Pilot Oil From Pilot Pump
G—Pilot Filter and Bypass Valve
H—Shim
I—Spring
J—Pilot Pressure Regulating Valve Spool
K—Orifice
L—Pilot Oil From Pilot Filter

The pilot filter and pilot pressure regulating valve are incorporated into one assembly.

The pilot filter (G) consists of a filter element and a bypass valve. The bypass valve senses the differential pressure between the inlet side and outlet side of the filter element. During normal operation, the bypass valve is held closed by a spring and pilot oil flows through the filter element and out to the pilot pressure regulating valve. If the filter element becomes plugged, pressure on the inlet side increases forcing the bypass valve open. Pilot oil now bypasses the filter element and unfiltered oil flows to the pilot pressure regulating valve.

The pilot pressure regulating valve (E) is a bypass flow regulating valve and is used to regulate the pilot oil pressure in the pilot oil circuit. Pilot oil flows through the orifice (K) to the end of the pilot pressure regulating valve spool (J). When the pressure in the pilot circuit increases to the pressure setting of the spring (I), the spool is push right against the spring. Regulated pilot oil flows to the pilot shut-off valve (B) and the control valve (D). Oil not needed to maintain the pressure in the pilot circuit flows to the hydraulic oil tank as return oil (C).

PILOT SHUT-OFF VALVE OPERATION



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TX,9025,GG2284 –19–18NOV97–1/2

Theory of Operation

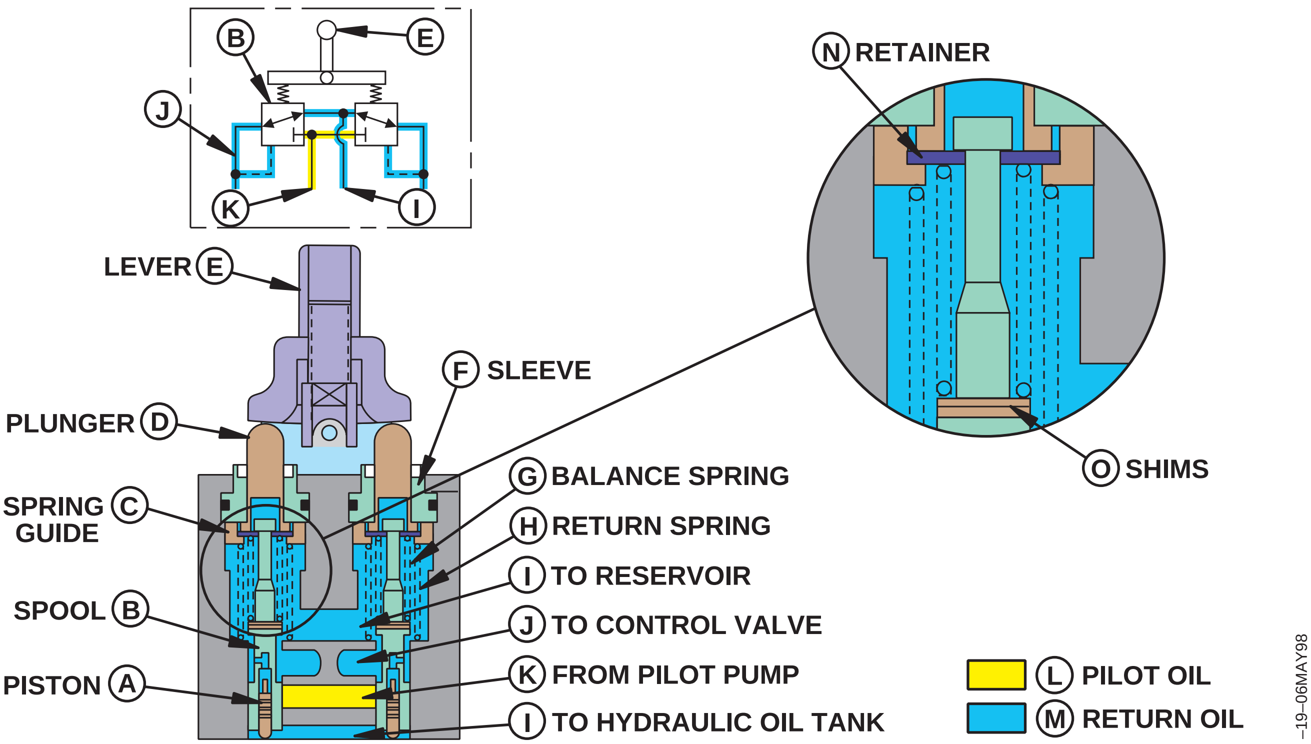
The pilot shut-off valve is a manual-operated, two-position, three-way rotary valve. The shut-off valve is rotated by pushing or pulling the pilot shut-off lever. The valve is located under the cab.

In the on (G) position, shut-off lever pushed forward to the UNLOCK position, pilot oil flows to inlet ports of the pilot controllers, propel pilot controller, and solenoid valve manifold. Return oil from the controllers flows to the shut-off valve and then through the solenoid valve manifold and back to the hydraulic oil tank.

In the off (L) position, shut-off lever pulled rearward to the LOCK position, pilot oil to the controllers and solenoid valve manifold is blocked and the pilot oil now flows to the flow regulator valve (H). Pilot oil that flows to the flow regulator valve when shut-off valve is locked is part of the warm-up circuit. The inlet ports for the controllers are open to hydraulic oil tank through the shut-off valve and solenoid valve manifold.

TX,9025,GG2284 –19–18NOV97–2/2

PILOT CONTROLLER OPERATION—NEUTRAL



T111390

P PILOT CONTROLLER - NEUTRAL

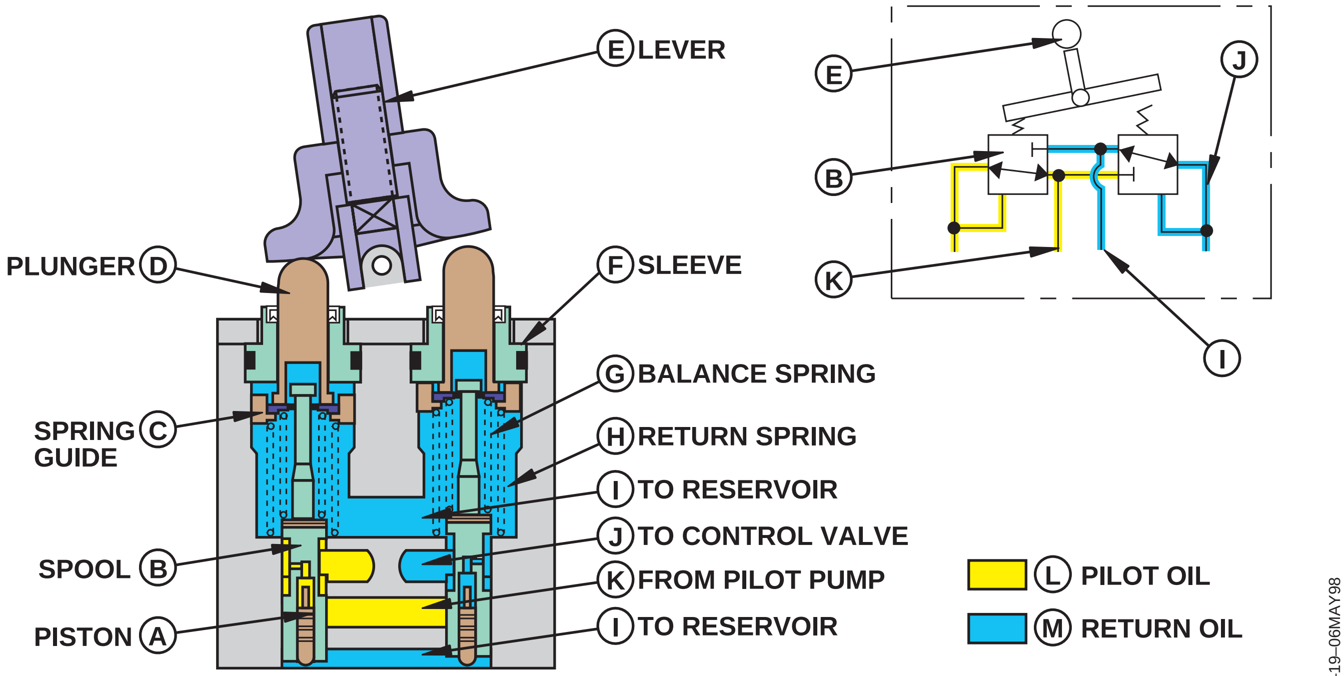
Two hand-operated pilot controllers (right and left) are used to control the dig functions. Each controller assembly contains four valve assemblies, one for each direction of each function.

The pilot controller consists of the plunger (D), sleeve (F), spring guide (C), retainer (N), spool (B), piston (A), balance spring (G), shims (O), and return spring (H). The spools are select fitted to the bores in the housing. The quantity of shims for each balance spring and spool assembly has been determine at the factory for correct operation of controller. The balance and return springs used in ports 1 and 3 are different than the balance and return springs used in ports 2 and 4. The ports numbers are stamped on the housing.

In neutral (P), the spool is pushed up by the return spring to block oil from the pilot pump (K) to control valve (J) pilot cap. With the spool up, the passage to the control valve pilot cap is connected to the hydraulic oil tank (I).

TX,9025,GG2285 –19–17NOV97–1/1

PILOT CONTROLLER OPERATION—METERING AND FULL STROKE



T7350CK N PILOT CONTROLLER – METERING

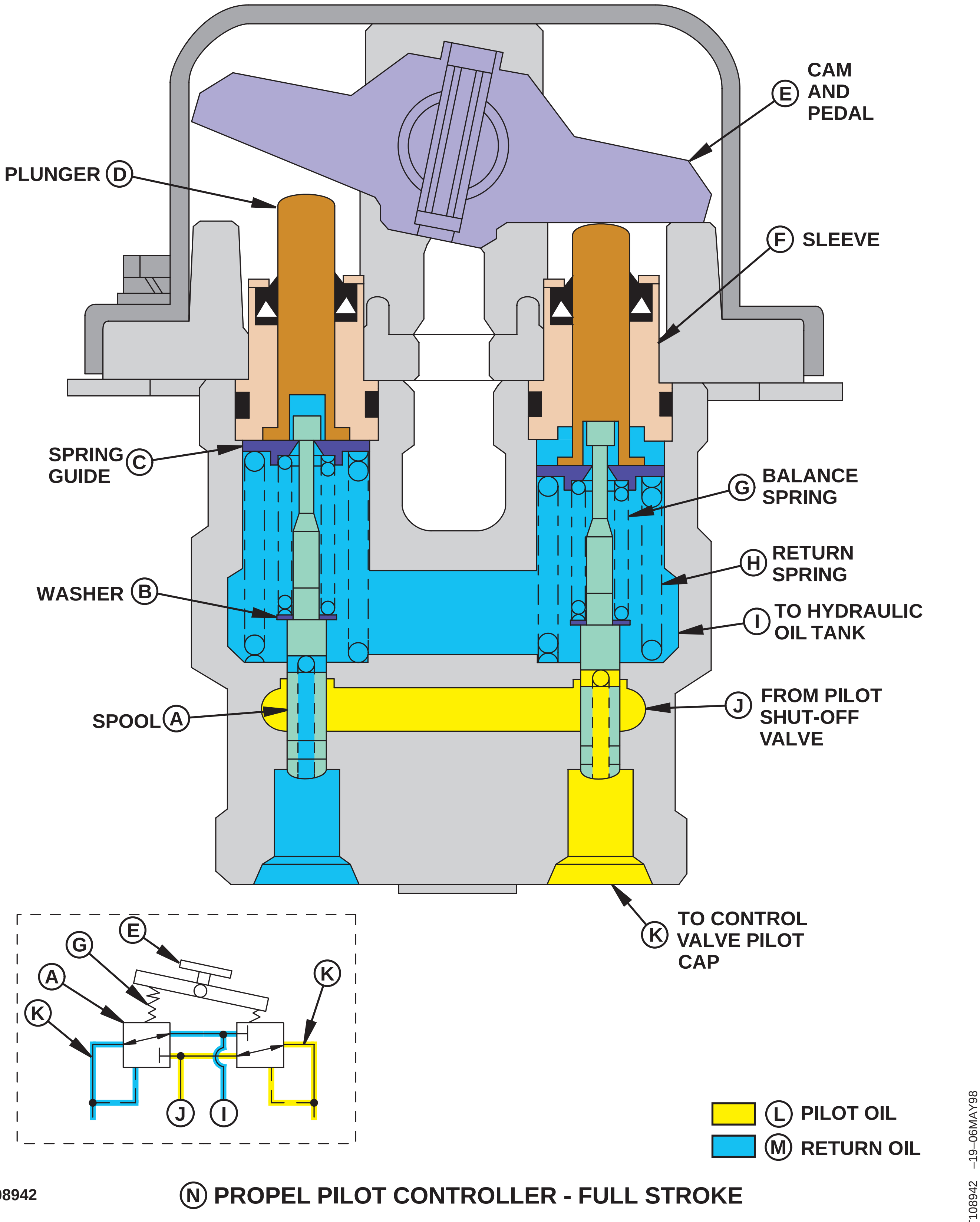
To meter a function, the lever (E) is moved slightly. This moves the plunger (D) and spring guide (C) against the balance spring (G) which moves the spool (B) down. The spool blocks the hydraulic oil tank (reservoir) passage (I) and opens the passage from the pilot pump (K) to control valve (J) pilot cap.

Pilot oil (L) also acts on piston (A) in the spool, moving the spool up against the balance spring which closes the passage to the control valve pilot cap. This maintains pressure in the control valve pilot cap passage according to the force on the balance spring by the plunger. As the lever is moved further, the plunger applies more force to the balance spring and the pressure to control valve pilot cap again increases to balance the spool.

When the lever (E) is moved to full stroke, the plunger (D) movement is transmitted directly to the spool (B). This forces the spool down connecting the passage from pilot pump (K) with the passage to the control valve (J) pilot cap. Oil pressure to the control valve pilot cap now equals pilot circuit pressure.

TX,9025,GG2286 –19–17NOV97–1/1

PROPEL PILOT CONTROLLER OPERATION



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N PROPEL PILOT CONTROLLER - FULL STROKE

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TX,9025,GG2606 –19–17NOV97–1/2

One pilot controller is used to control the propel functions. The controller contains four valve assemblies, one for each direction of travel for each track.

The pilot controller consists of the cam and pedal (E), plunger (D), sleeve (F), spring guide (C), spool (A), balance spring (G), and return spring (H).

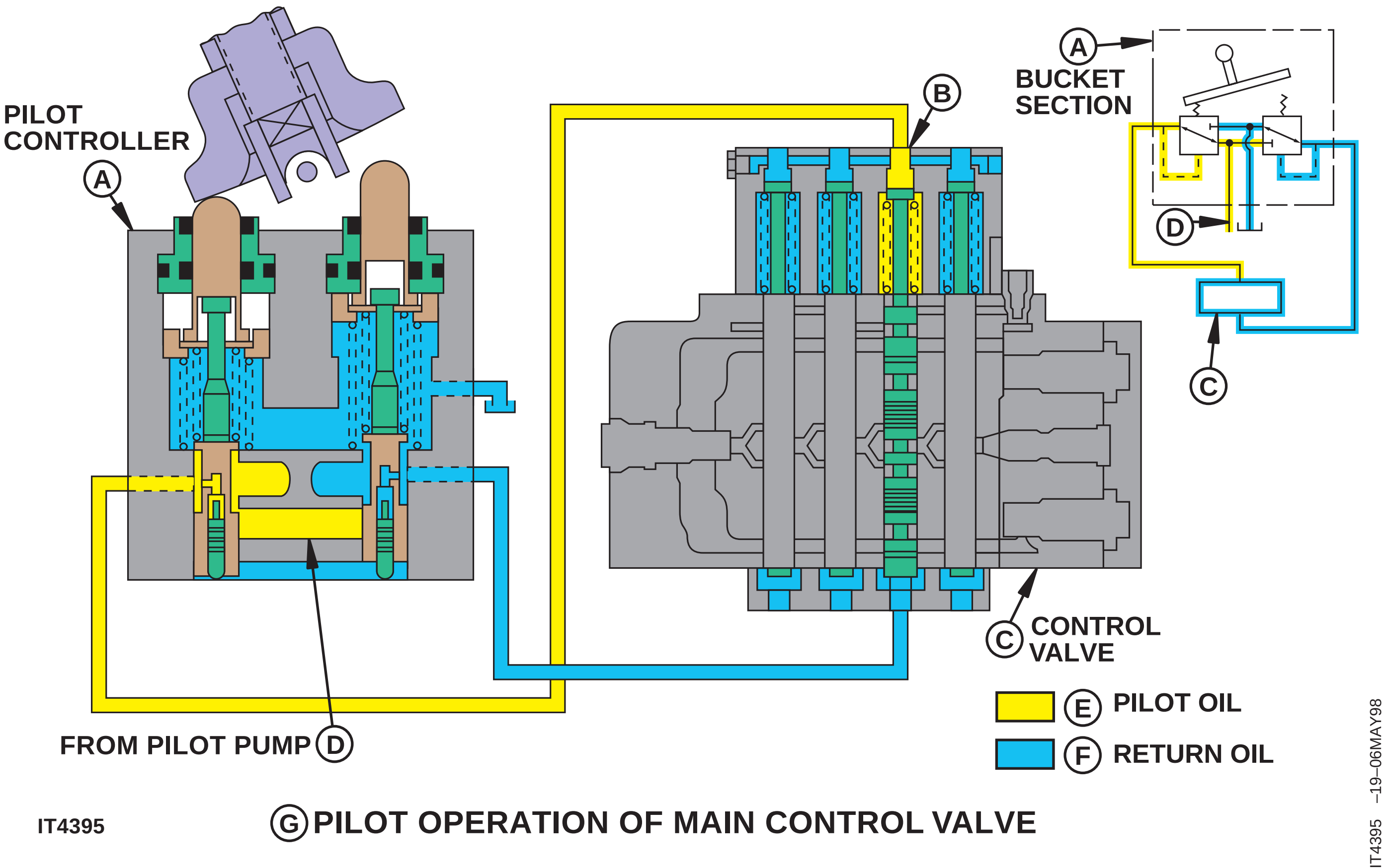
In neutral, the spool is pushed up by the return spring to block pilot oil from the pilot shut-off valve (J). With the spool up, the passage to the control valve pilot cap (K) is connected to the hydraulic oil tank (I) by the passage through the spool (A).

When the pedal is pushed to move the machine, the cam (E) pushes the plunger and spring guide down against the return spring and balance spring. The balance spring pushes the spool down. As the spool is pushed down the passage from the control valve pilot cap to the hydraulic oil tank (I) is closed and then is opened to the pilot oil from pilot shut-off valve. When the pilot oil pressure to the control valve pilot cap is equal to the force applied by the balance spring the spool moves up trapping the oil to the pilot cap.

When the pedal and cam is moved to full stroke, the plunger is pushed down further by the balance spring opening the passage through the spool more to the pilot oil. When pressure to the control valve pilot cap is equal to the force applied by the balance spring, the spool moves up until it contacts the plunger. The plunger holds the spool down so the passage through spool remains open to pilot oil. Oil pressure to the control valve pilot cap now equals pilot oil pressure.

TX,9025,GG2606 –19–17NOV97–2/2

PILOT CONTROLLER OPERATION OF CONTROL VALVE



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G PILOT OPERATION OF MAIN CONTROL VALVE

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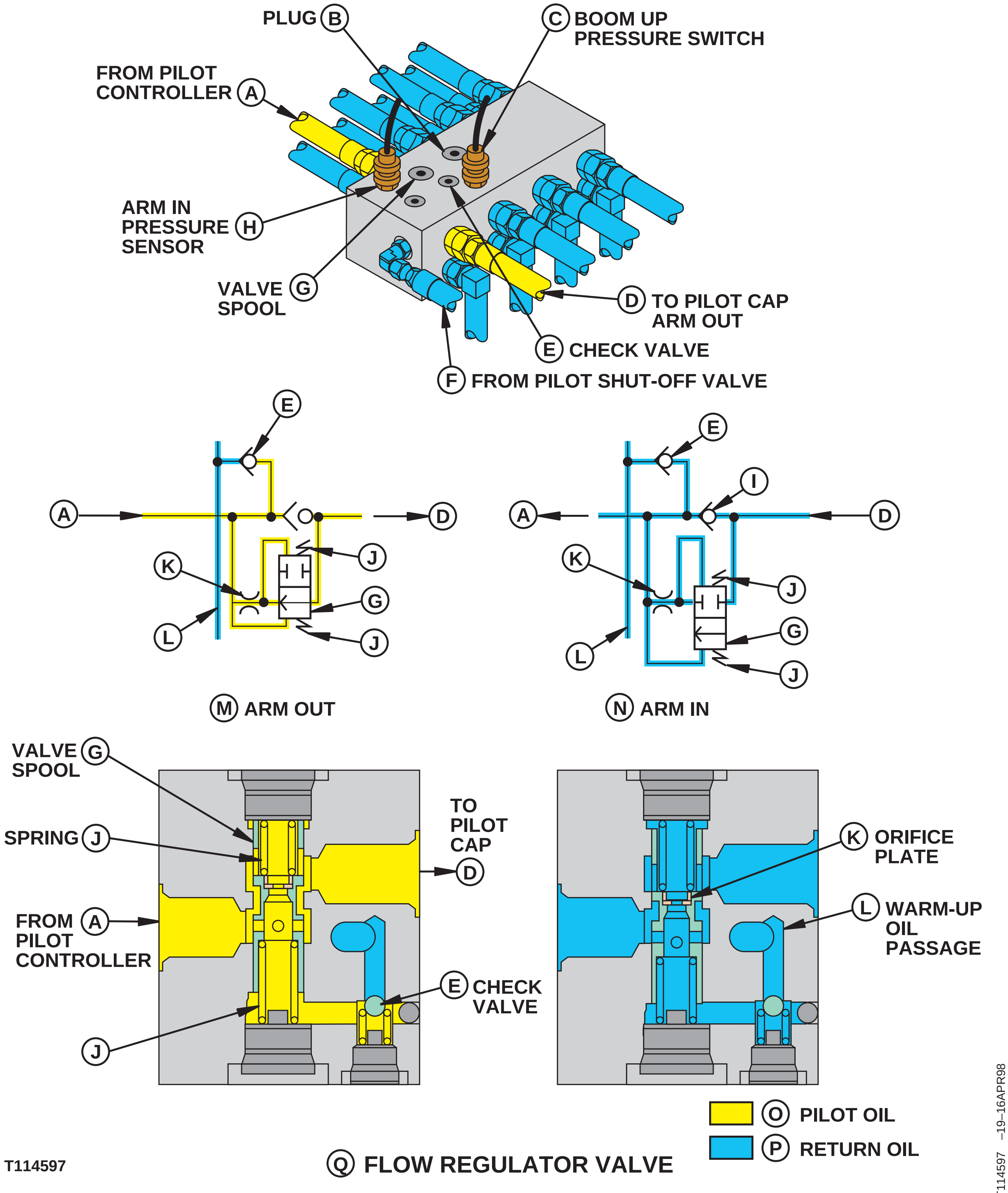
The pilot controllers (A) are connected to the control valve (C) by pilot control hoses through the flow regulator valve. When the pilot controller is actuated, pilot oil (E) from the pilot pump (D) is routed to the control valve pilot cap. In this illustration, the bucket section (B) is actuated. Return oil (F) from the control valve pilot cap is routed through the pilot controller to the hydraulic oil tank.

The pilot hoses for the propel pilot controller are not connected to the flow regulator valve but are connected directly to the control valve pilot caps.

TX,9025,GG2288 –19–25OCT96–1/1

FLOW REGULATOR VALVE OPERATION



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CED,TX08227,3041 –19–27MAR98–1/2

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NOTE: The cross section of flow regulator valve spool shown in the illustration is in the arm out pilot circuit.

The flow regulator valve (Q) is an manifold containing a flow regulator valve spool (G) in the arm out pilot circuit and check valves (E). The check valves (E) are used in the warm-up oil passage (L) for arm in, arm out, boom down, and boom up pilot circuits. No check valves are used in the bucket and swing pilot circuits. The valve spool contains an orifice plate (K) and springs (J) and also operates as a check valve (I).

The pilot lines for boom, arm, bucket, and swing functions are connected through the flow regulator valve manifold to the pilot caps on the control valve. The arm out pilot line (D) is also connected to the PL port at the arm head end reduced leakage valve. The pilot lines for propel function are connected directly to the pilot caps.

When the arm out (M) function is actuated, pilot oil flows from the pilot controller (A), through the valve spool into the bottom spring chamber and through the orifice plate (K) to the pilot cap (D). As the pressure increases the spool is push up letting pilot oil flow unrestricted to the pilot cap to move the control valve spool. The unrestricted pilot oil flow past the spool is represented by the check valve (I) in the schematic. Return oil from the opposite end of control valve spool flows from the pilot cap and through the manifold to the pilot controller.

When the arm in (N) function is actuated, pilot oil flows from the pilot controller through the manifold to the pilot cap shifting the control valve spool. Return oil from the opposite end of control valve spool flows from the pilot cap to the manifold and through the orifice plate (K) in the valve spool (G). As the return pressure increases, the spool is pushed down in proportion to the pressure increase regulating the return oil flow to provide precise movement of the arm in function. From here, oil flows to the pilot controller.

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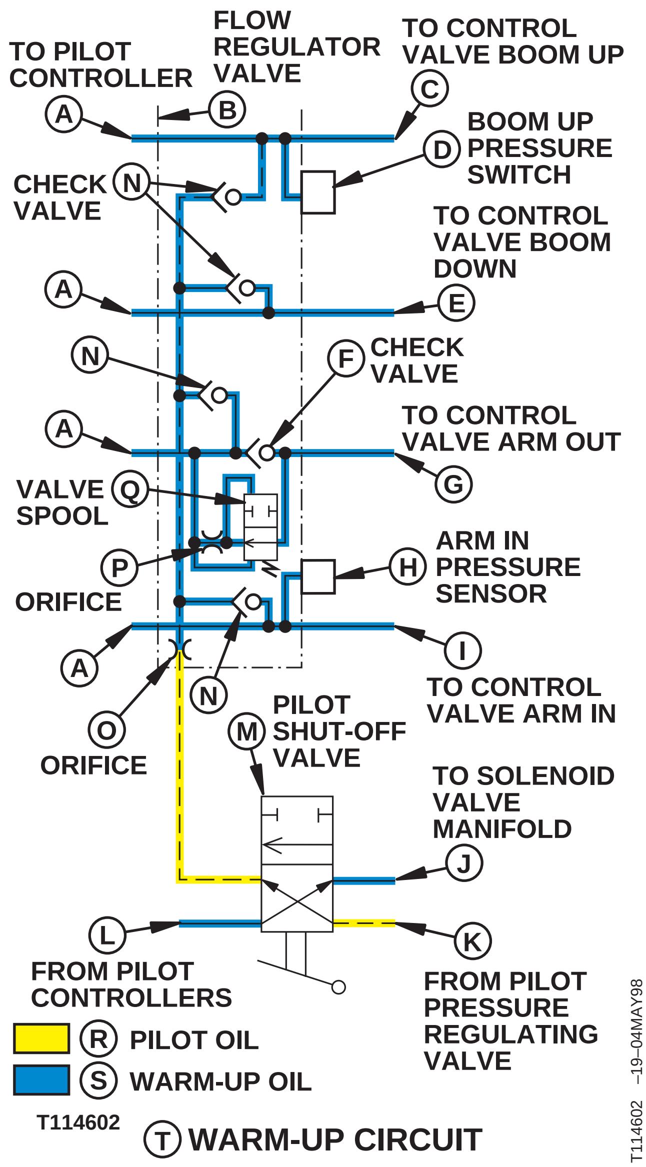
CED,TX08227,3041 –19–27MAR98–2/2

WARM-UP CIRCUIT OPERATION

When the pilot shut-off valve (M) is in the LOCKED position and the engine is running, pilot oil flows from the pilot shut-off valve to the flow regulator valve (B) manifold. The oil is restricted and heated as it flows through the orifice (O) at the inlet to manifold. The warm-up oil flows through the warm-up oil passage, through the check valves (N) and out to the pilot controllers (A), boom pilot caps (C and E) and arm pilot caps (G and I).

At the pilot controllers, warm-up oil flows through the pilot controllers and out the return port to the pilot shut-off valve. Warm-up oil from the pilot controllers (L) flows through the pilot shut-off valve to the solenoid valve manifold, and then to the hydraulic oil tank. For the boom up (C) pilot circuit and arm out (G) pilot circuit, warn-up oil flows to the pilot caps, through orifices to a return passage in the pilot caps, and then to the hydraulic oil tank. For the arm in (I) pilot circuit, warm-up oil flows to the bottom arm I pilot cap, through a return line, an orifice, and then into the hydraulic oil tank. For boom down (E) pilot circuit, warm-up oil flows to the boom II and boom I pilot caps, through a return line, an orifice, and then into the hydraulic oil tank. The orifices at the tank connections are used to restrict the flow of pilot oil so the pressure increases enough to shift the valve spools when arm in and/or boom down functions are actuated.

In the UNLOCKED position, pilot oil flow to the warm-up circuit is blocked at the pilot shut-off valve. When a pilot controller is actuated, the check valves (N) block the flow of pilot oil into the warm-up passage.



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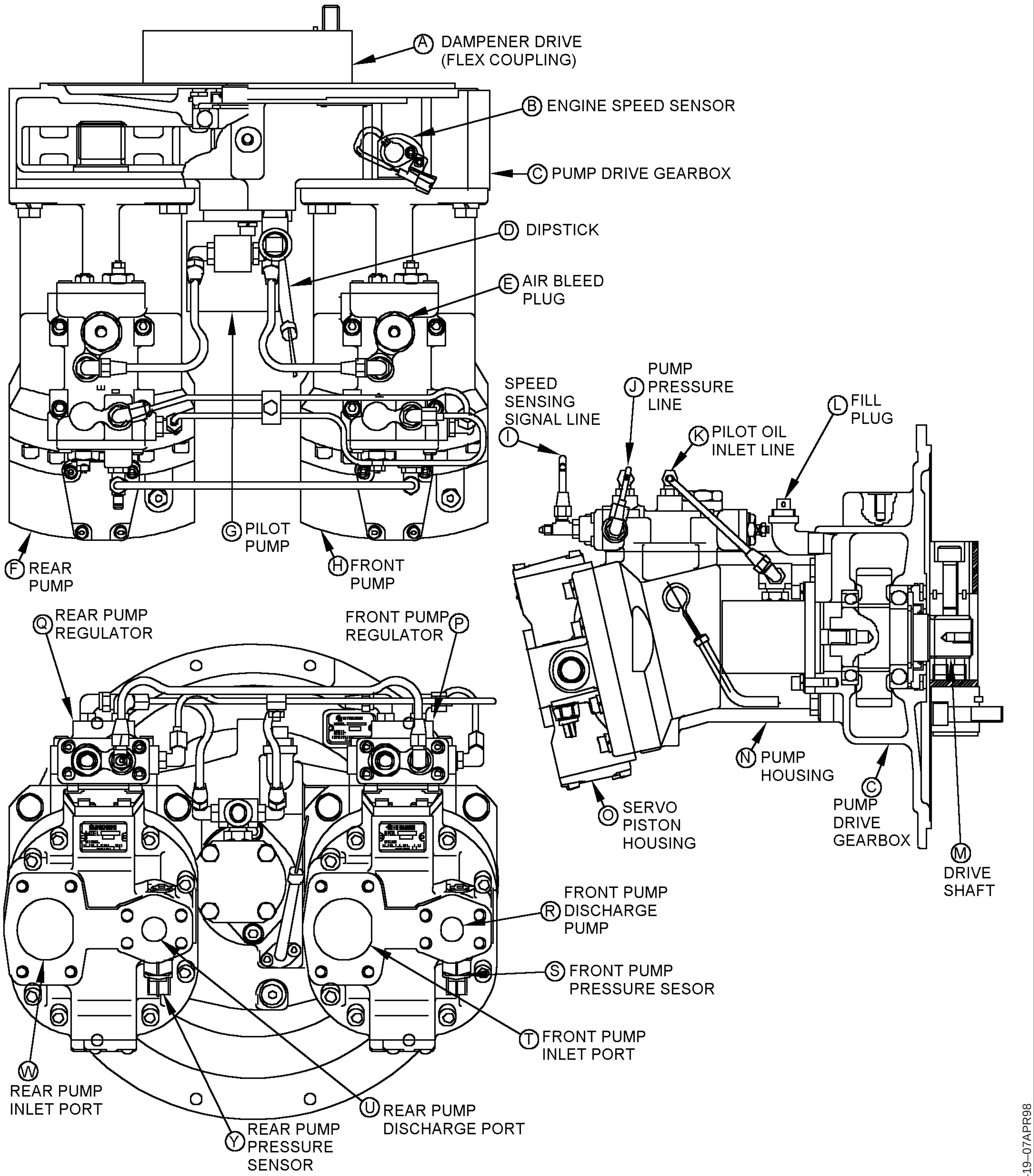
HYDRAULIC PUMPS AND DRIVE GEARBOX OPERATION



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X HYDRAULIC PUMPS AND DRIVE GEARBOX

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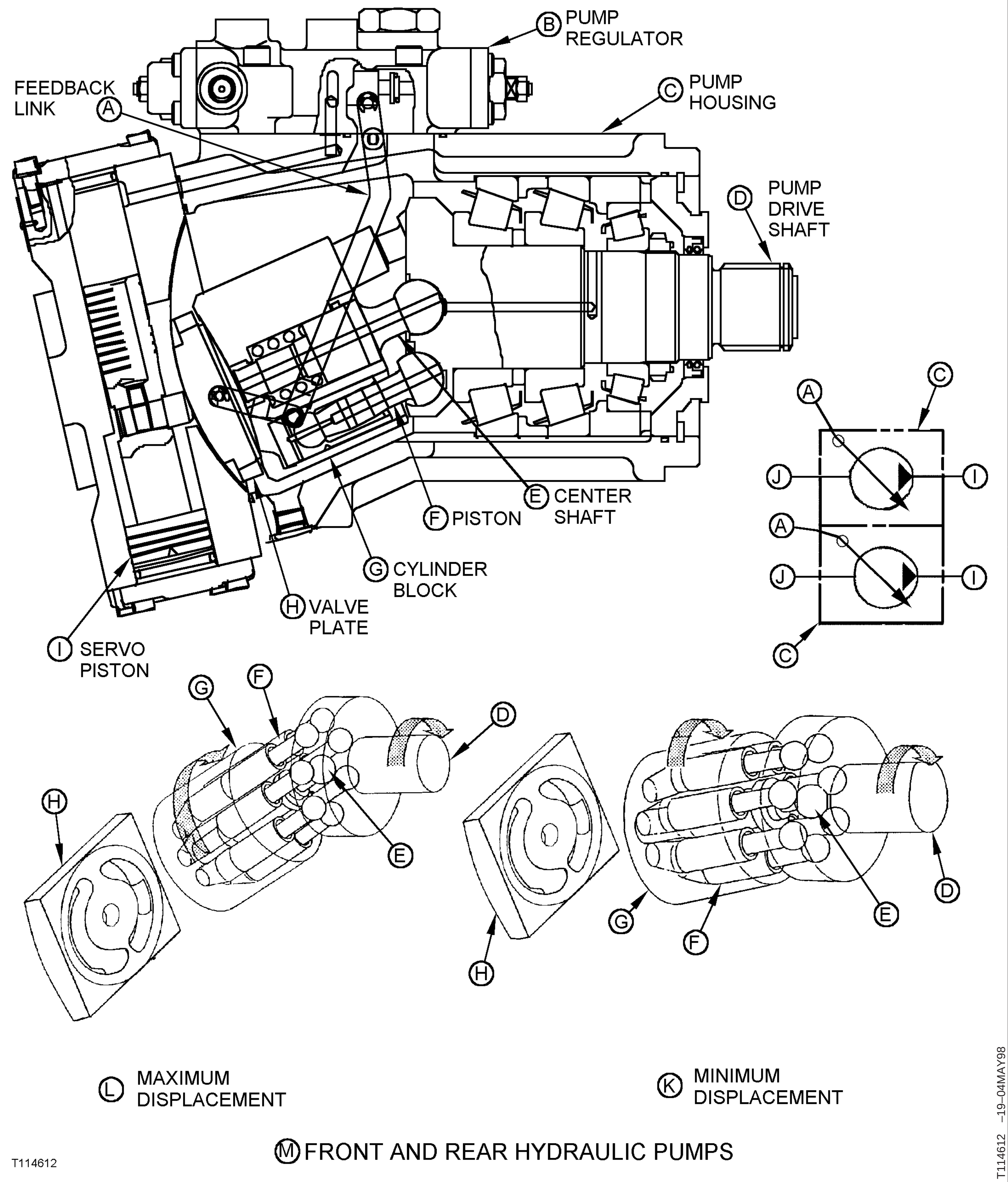
The front pump (H), rear pump (F) and pilot pump (G) are mounted on the pump drive gearbox (C) which is fasten to the engine flywheel housing. Each pump is contain in its own housing.

Engine power is transferred to the pumps by the dampener drive (flex coupling) (A), the pump drive gearbox (C) input drive shaft and gears. The pilot pump is driven at engine speed by the input drive shaft for the pump drive gearbox. The front and rear pumps are driven at a speed slower than engine speed through a gear train by the input drive shaft. The gear ratio for the front and rear pump speed to engine speed is 0.95.

The engine speed sensor (B), front, and rear pump pressure sensors (S and Y) send electrical signals to the engine and pump controller to provide control for engine speed, pumps, and control valve.

CED,TX08227,3043 –19–31MAR98–2/2

HYDRAULIC PUMP OPERATION



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CED,TX08227,3044 –19–31MAR98–1/2

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The front and rear hydraulic pumps (M) are variable displacement, bent-axis, piston type pump. Two identical pumps are used to generate oil flow in the hydraulic system. The pump can vary from minimum displacement (K) to maximum displacement (L) depending on hydraulic demand of the system.

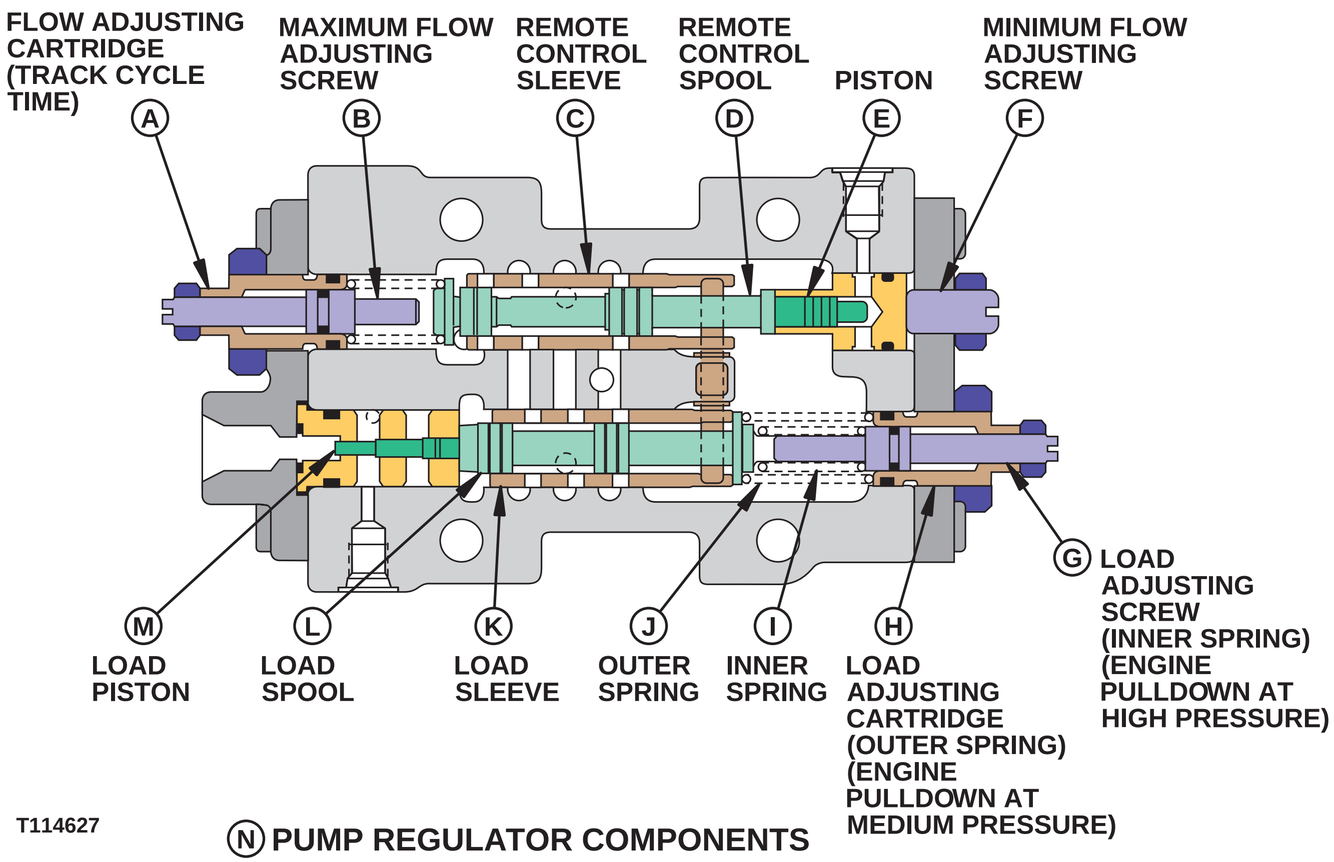
A pump regulator (B) is attached to the top of pump housing (C) for each pump. A pilot oil control signal to the regulator moves a piston which then directs pilot oil to the servo piston (I) which moves the valve plate (H) and cylinder block (G) changing the pump displacement. The feedback link (A), connected to the valve plate, also moves providing a mechanical feedback to the remote control sleeve in the regulator. The remote control sleeve blocks the flow of pilot oil to the servo piston and also traps the oil at both ends of the servo piston stopping its movement.

Engine power is transferred to the pump drive shafts (D) by the dampener drive (flex coupling), the pump drive gearbox input drive shaft and a gear train. The gear ratio for the front and rear pump gear train is 0.9487. The pump drive shafts (D) drive the cylinder blocks (G) through the pistons (F). The center shafts (E) is used to maintain alignment between the drive shaft and cylinder block. The cylinder block is positioned at an angle to the drive shaft. As the cylinder block and drive shaft rotate, the pistons (F) move in and out of their bores because of the angle. The pistons which are moving out of their bores draw oil from the hydraulic oil tank through the pump inlet port and then through ports in the valve plate (H). The pistons which are moving back into their bores push oil through ports in the valve plate out the front and rear discharge ports and to the control valve.

The pump displacement, or flow rate, is varied by changing the angle of the cylinder block with respect to the drive shaft. Increasing the angle increases the distance that each piston travels into and out of the bore which increases displacement. Decreasing the angle reduces the distance that each piston travels into out of the bore which decreases displacement.

CED,TX08227,3044 –19–31MAR98–2/2

HYDRAULIC PUMP REGULATOR COMPONENTS OPERATION



T114627 N PUMP REGULATOR COMPONENTS

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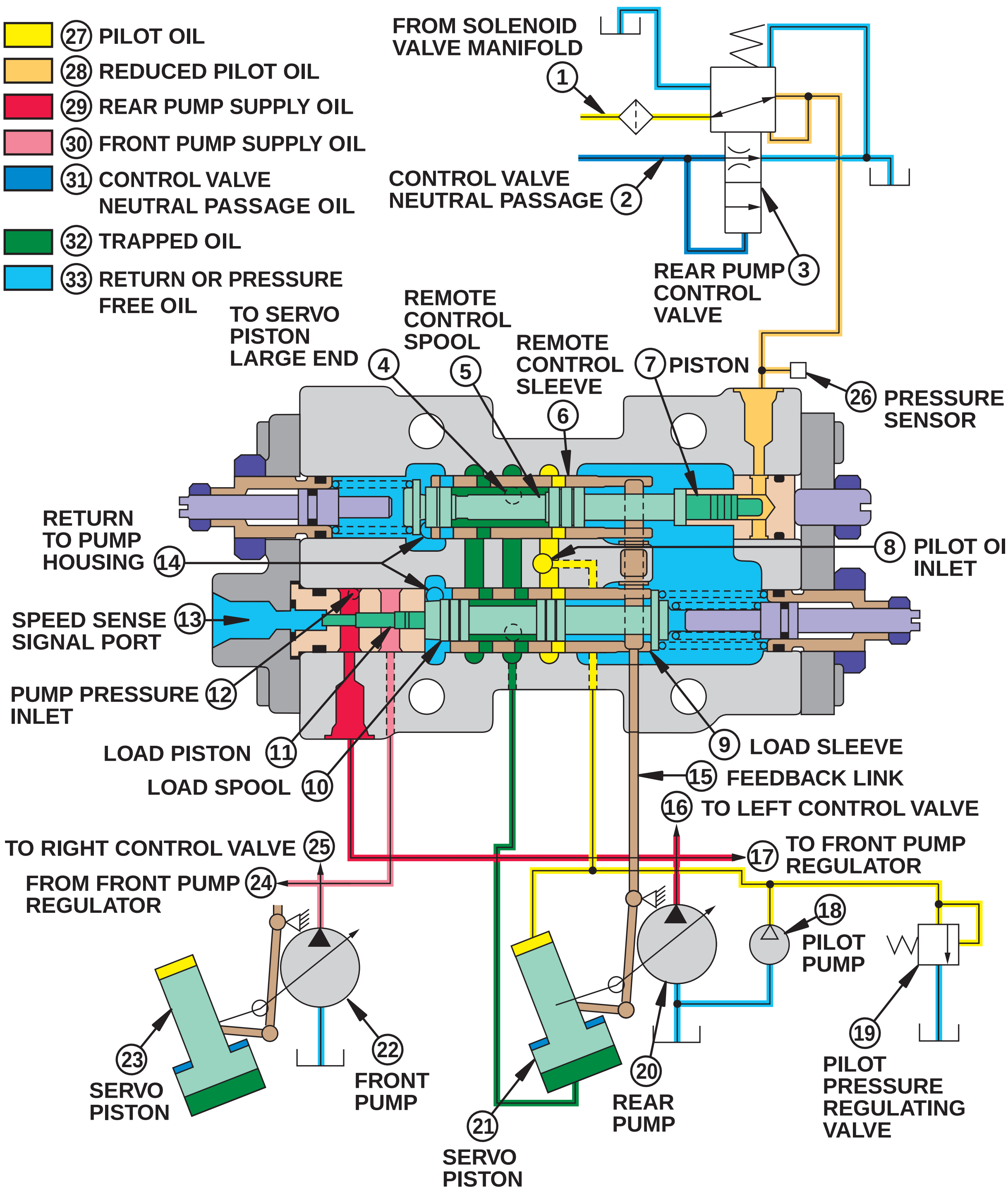
The pump regulators are mounted on the top of the hydraulic pump housings. The major pump regulator components (N) are the flow adjusting cartridge (A), maximum flow (displacement) adjusting screw (B), remote control sleeve (C), remote control spool (D), piston (E), minimum flow (displacement) adjusting screw (F), load adjusting screw (inner spring) (engine pull down at high pressure) (G), load adjusting cartridge (outer spring) (engine pull down at medium pressure) (H), inner spring (I), outer spring (J), load sleeve (K), load spool (L), and load piston (M). Each regulator controls the flow of pilot oil to the large end of its servo piston using the spools and sleeves.

The remote control spool (D) is moved by a reduced pilot oil control signal from the front and rear pump control valve. The pump control valves are located in the left and right control valves. The control signal acts on the end of the piston (E) to control the position of remote control spool against the spring.

The load spool (L) is moved by the load piston (M) against the springs to decrease pump flow (displacement) and avoid overloading the engine when main system pressure becomes too high. At lower system pressures the spool is moved against only the outer spring (J). At higher pressures, the spool contacts and is moved against the inner spring (I) as well as the outer spring. The pump supply oil pressure is sense on one shoulder of the load piston and the pump supply oil pressure from the other pump is sensed on the other shoulder. The end of the load piston receives a reduced pilot oil control signal fro the speed sensing solenoid valve when the actual engine speed pulls down to the target engine speed.

HYDRAULIC PUMP REGULATOR OPERATION



34 REGULATOR OPERATION

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CED,TX08227,3092 –19–18APR98–1/2

The function of pump regulators (34) is to control the flow of pilot oil to and from the servo piston large end (4) in response to reduced pilot oil (28) control signals from the front and rear pump control valves (3) and supply oil pressure signals from the front and rear pumps (22 and 20). Pump displacement (flow) is changed by sending pilot oil to or releasing pilot oil from the servo piston large end.

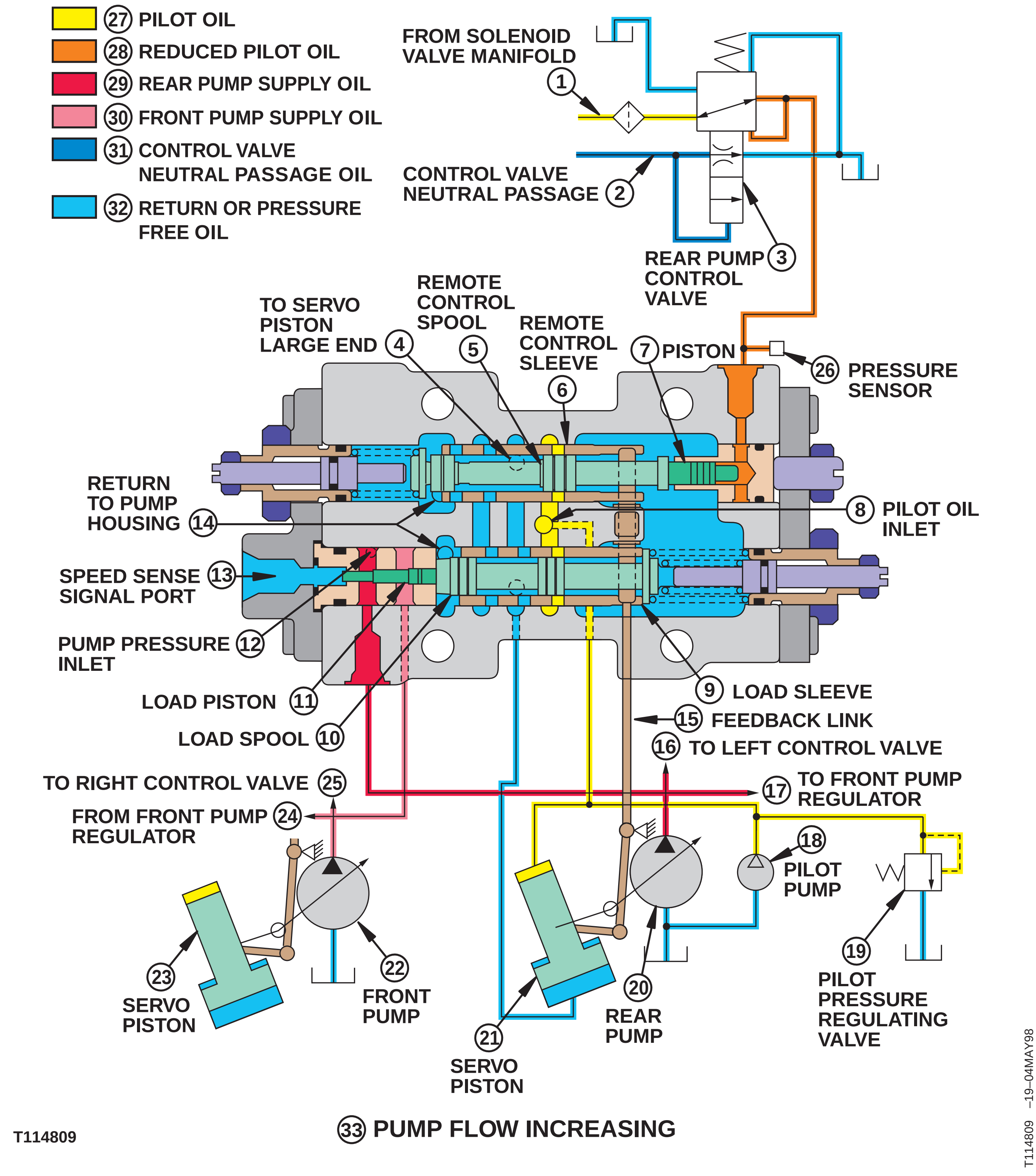
Pilot oil from the pilot pump (18) flows to the pilot oil inlet (8) at each regulator and through drilled passages in the pump housing to the small end of servo pistons. Pilot oil pressure is maintain at the small end of servo pistons and at the inlet of both regulators.

The reduced pilot oil (28) control signals are transferred from the front and rear pump control valves (3) by hoses connected to the left and right control valves and a port in the respective pump regulators. The control signal from the front or pump control valve is sensed by the piston (7) controlling the position of the remote control spool (5) against the spring.

The pump supply oil (29 and 30) control signals are from the pump delivery port through a drilled passage in pump housing to the pump pressure inlet (12) in the regulator and through a line from the other pump regulator (17 and 24). The control signal from the front and rear pumps is sensed by the load piston (11) controlling the position of the load spool (10) against the springs.

CED,TX08227,3092 –19–18APR98–2/2

HYDRAULIC PUMP REGULATOR INCREASING, MAXIMUM, AND DECREASING OPERATION



33 PUMP FLOW INCREASING

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CED,TX08227,3093 –19–18APR98–1/2

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NOTE: For operation of the front and rear pump control valves, see Pump Control Valve Operation in this group.

INCREASING FLOW (DISPLACEMENT)

When a function is actuated, the reduced pilot oil (28) control signal from the pump control valve (3) to the piston (7) increases. The control signal pushes the piston and remote control spool (5) to the left against the spring until the spring force and control signal pressure are equal. Movement of spool opens a path from the large end of servo piston to return in the pump housing (14). Pilot oil on the small end of servo piston pushes the piston down increasing pump angle which increases the displacement (flow). The servo piston movement is transmitted to the remote control sleeve (6) and load sleeve (9) by the feedback link (15). The sleeves move left until the path to return is closed. The oil at the large end of servo piston is now trapped holding the pump at the displacement (flow rate) that is proportional to the pressure of the pump control valve control signal.

MAXIMUM FLOW (DISPLACEMENT)

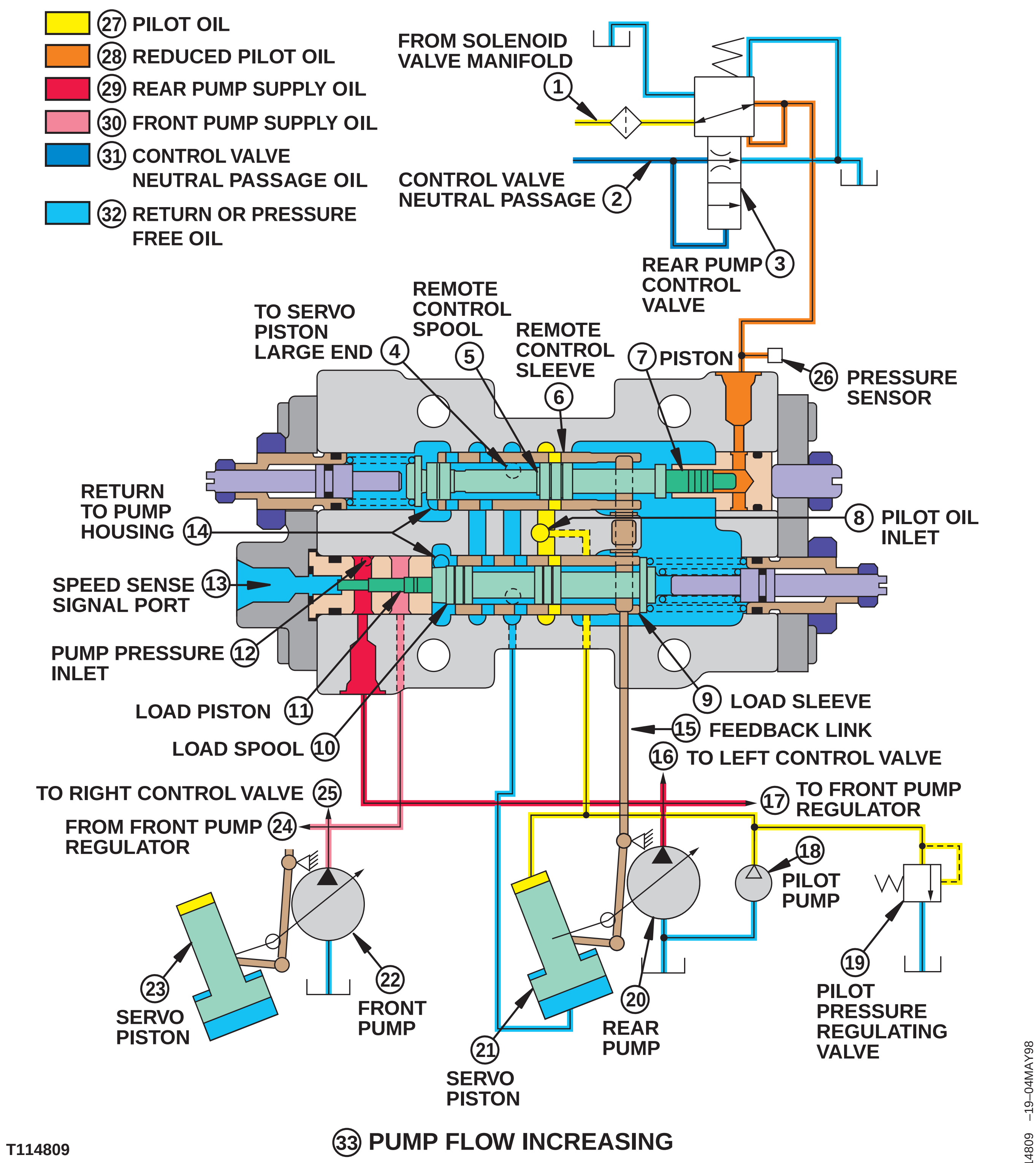
When the pilot controller lever is actuated to full stroke, the reduced pilot oil (28) control signal from the pump control valve (3) to the piston (7) increases to its maximum. The control signal pushes the piston and remote control spool to the left until the spool contacts the maximum flow adjusting screw. Movement of spool opens a path from the large end of servo piston to return in pump housing (14). Pilot oil on the small end of servo piston pushes the piston down increasing pump displacement (flow). The servo piston is transmitted to the remote control sleeve (6) and load sleeve (9) by the feedback link (15). The sleeves move left until the path to return is closed. The oil at the large end of servo piston is now trapped holding the pump at maximum displacement (flow rate) that is proportional to the pressure of the pump control valve control signal.

DECREASING FLOW (DISPLACEMENT)

As the function is returned towards neutral, the reduced pilot oil (28) control signal sensed at the piston (7) also decreases. The spring pushes the remote control spool and piston to the right. Movement of the spool opens a path for pilot oil (27) to flow to the servo piston large end (4). The pilot oil pressure applied to the servo piston large end pushes the piston up against the pressure applied to the small end decreasing pump flow. The piston and remote control spool continues to be pushed to the right until spring force again equals the reduced pilot oil control pressure or until the spool contacts the piston (7) cylinder when function is returned to neutral. As the pump displacement decreases, the movement is transmitted to the remote control sleeve (6) and load sleeve (9) by the feedback link (15). The sleeves move right until the path for pilot oil is closed. The oil at the large end of servo piston is now trapped holding the pump at the displacement (flow rate) that is proportional to the pressure of the pump control valve control signal.

CED,TX08227,3093 –19–18APR98–2/2

HYDRAULIC PUMP REGULATOR SUMMATION AND SPEED SENSING OPERATION



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CED,TX08227,3113 –19–30APR98–1/2

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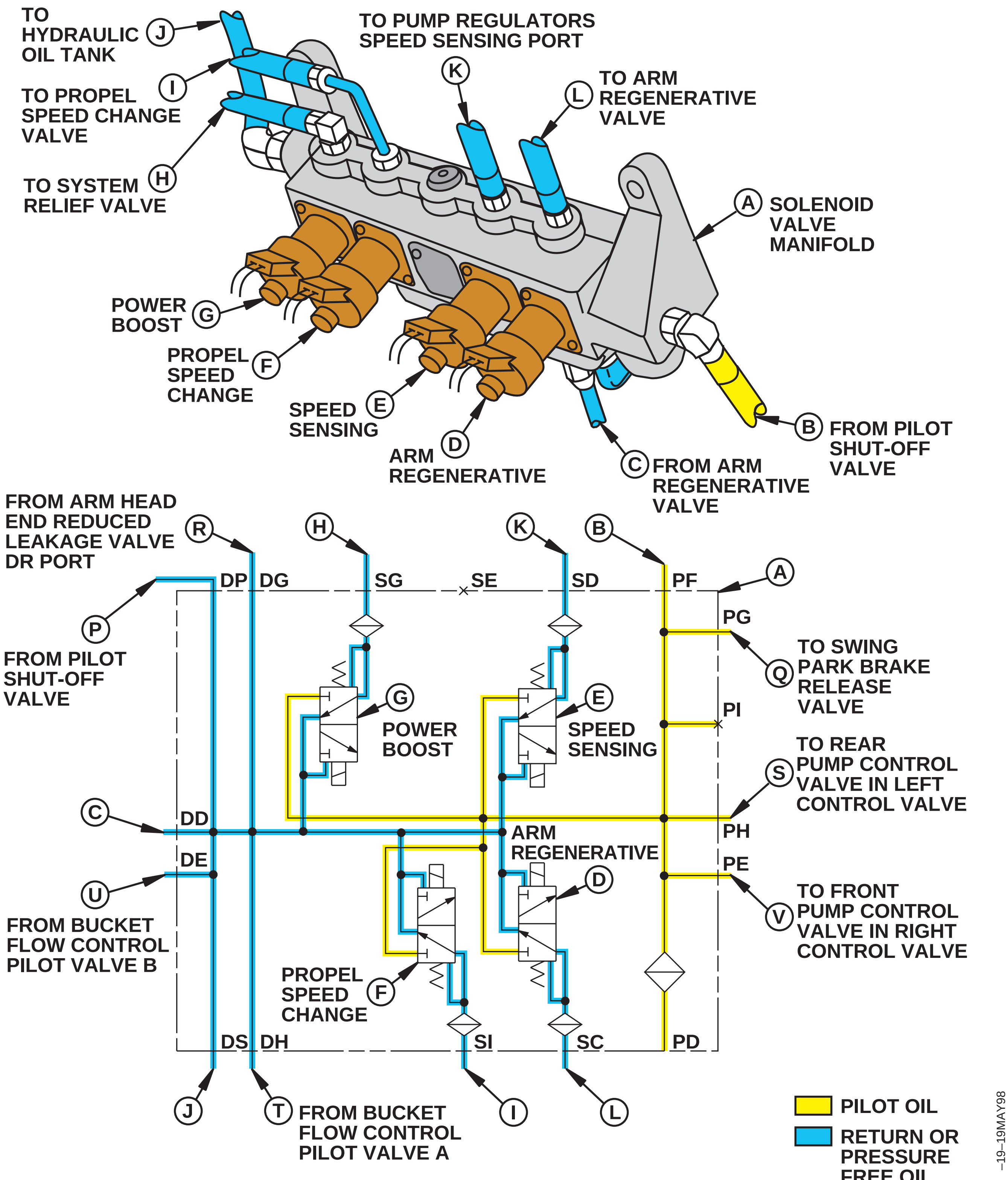
Summation is the flow rate of a pump controlled by monitoring both pump pressures. The pump supply oil pressure (load) for each pump is sensed at the load piston (11) through the pump pressure inlets (12) at its regulator and at the regulator of other pump. The rear pump supply oil pressure is sensed on the end of load piston in each pump regulator. The front pump supply oil pressure is sensed on the shoulder of load piston in each pump regulator. The area on the end of load piston and the shoulder are equal. Therefore, the force applied through the load spool (10) to the inner and outer springs is an average of the pump supply oil pressures. The springs are adjusted against the average pressure so the flow rate of the pumps are approximately equal and each pump uses approximately half the engine output.

If the load on either pump increases, the average pressure on the load pistons pushes the load spools against the springs opening a path for pilot oil to the large end of servo pistons. The flow rate of both pumps decrease so the load on the pumps do not exceed the engine output. If the load on the pumps decrease, the springs push the load pistons to the right against the supply oil pressure opening a path for oil to flow from the large end of servo piston to return. Also engine output is not exceeded even if one pump is loaded relatively high while the other pump stays relatively low.

Speed Sensing operates when the actual engine speed, as measured by engine speed sensor, is pulled down to the target engine speed, as set by engine rpm dial. The speed sensing solenoid valve coil is energized by an electrical signal from the engine and pump controller. A reduced pilot oil control signal is sent to the end of load piston at the speed sense signal port (13) in the front and rear pump regulators. The reduced pilot oil control signal along with the pump supply oil control signals shifts the load spools against the springs opening a path for pilot oil to flow to the servo piston large end. The pilot oil pressure applied to the servo piston large end pushes the piston up against the pressure applied to the small end decreasing pump angle. The flow rate of both pumps decrease so the load on the engine decreases and the actual engine speed can increase.

CED,TX08227,3113 –19–30APR98–2/2

PROPORTIONAL SOLENOID VALVE MANIFOLD OPERATION



T115177

(O) SOLENOID VALVE MANIFOLD

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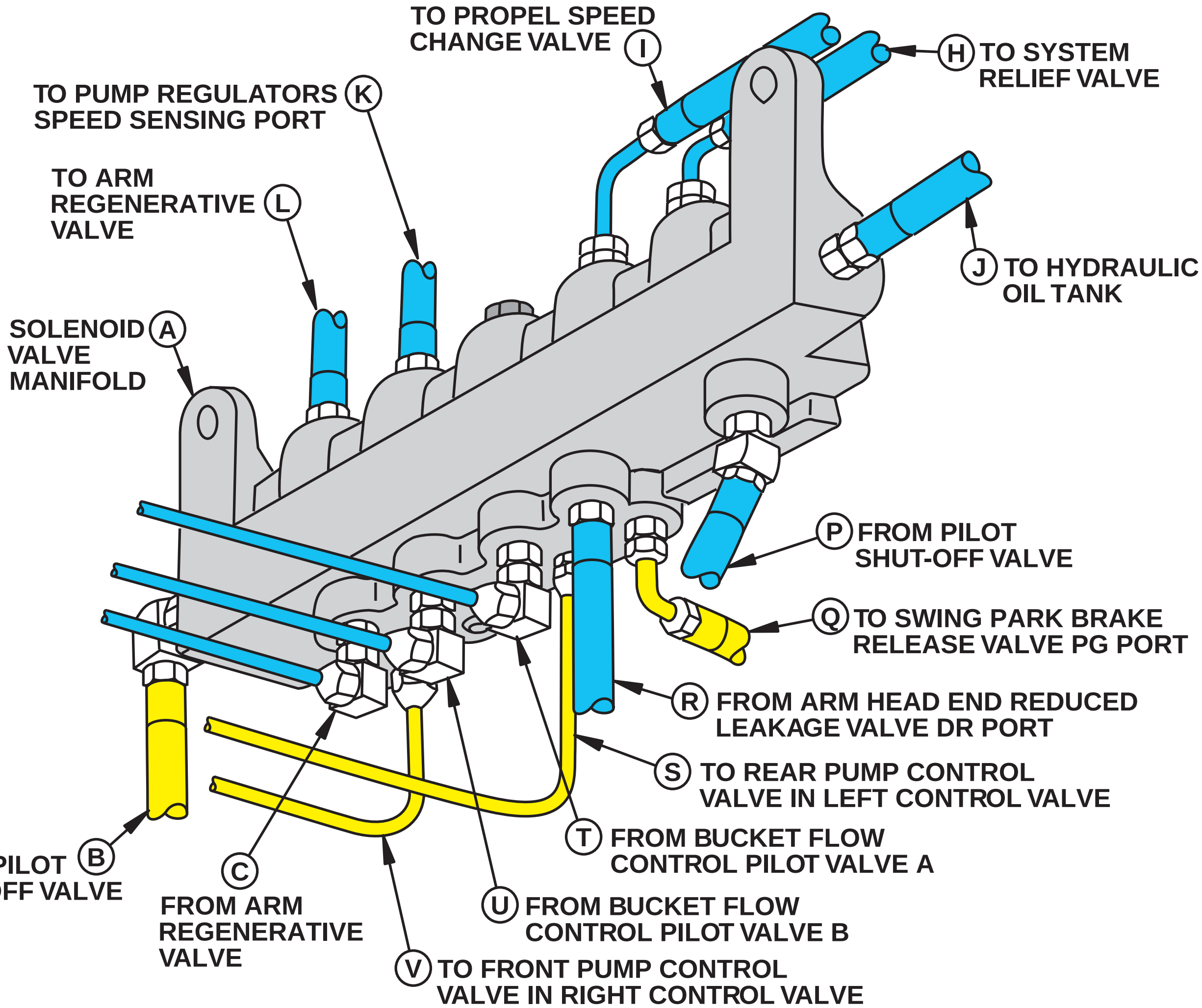


(W) SOLENOID VALVE MANIFOLD — BOTTOM

The solenoid valve manifold (O and W) is mounted on the control valve mounting bracket at the front of the control valve. The manifold serves as the central distribution point for pilot oil (M) to the arm regenerative (D), speed sensing (E), propel speed change (F), and power boost (G) solenoid valves, the front (V) and rear (S) pump control valves, and the swing park brake release valve (Q). Pilot oil flows to the manifold from the pilot shut-off valve (B) when the lever is pushed forward to the unlock position.

Return oil (N) from the spring end of arm regenerative valve (C), pilot shut-off valve (P), arm head end reduced leakage valve DR port (R), and spring end of bucket flow control pilot valve B (U) flows through the manifold to the hydraulic oil tank (J). Also the spool end of bucket flow control pilot valve B is open to the manifold through bucket flow control pilot valve A (T) when arm-in function is not actuated. (See Bucket Flow Control Valve Operation in this group.)

When the solenoid valve coils are de-engerizes, the valves are open to return through the manifold to the hydraulic oil tank. When a solenoid valve coil is energized, the path to return is blocked and a path is opened for pilot oil to flow through the solenoid valve to the function. (See Proportional Solenoid Valve Operation in this group.)

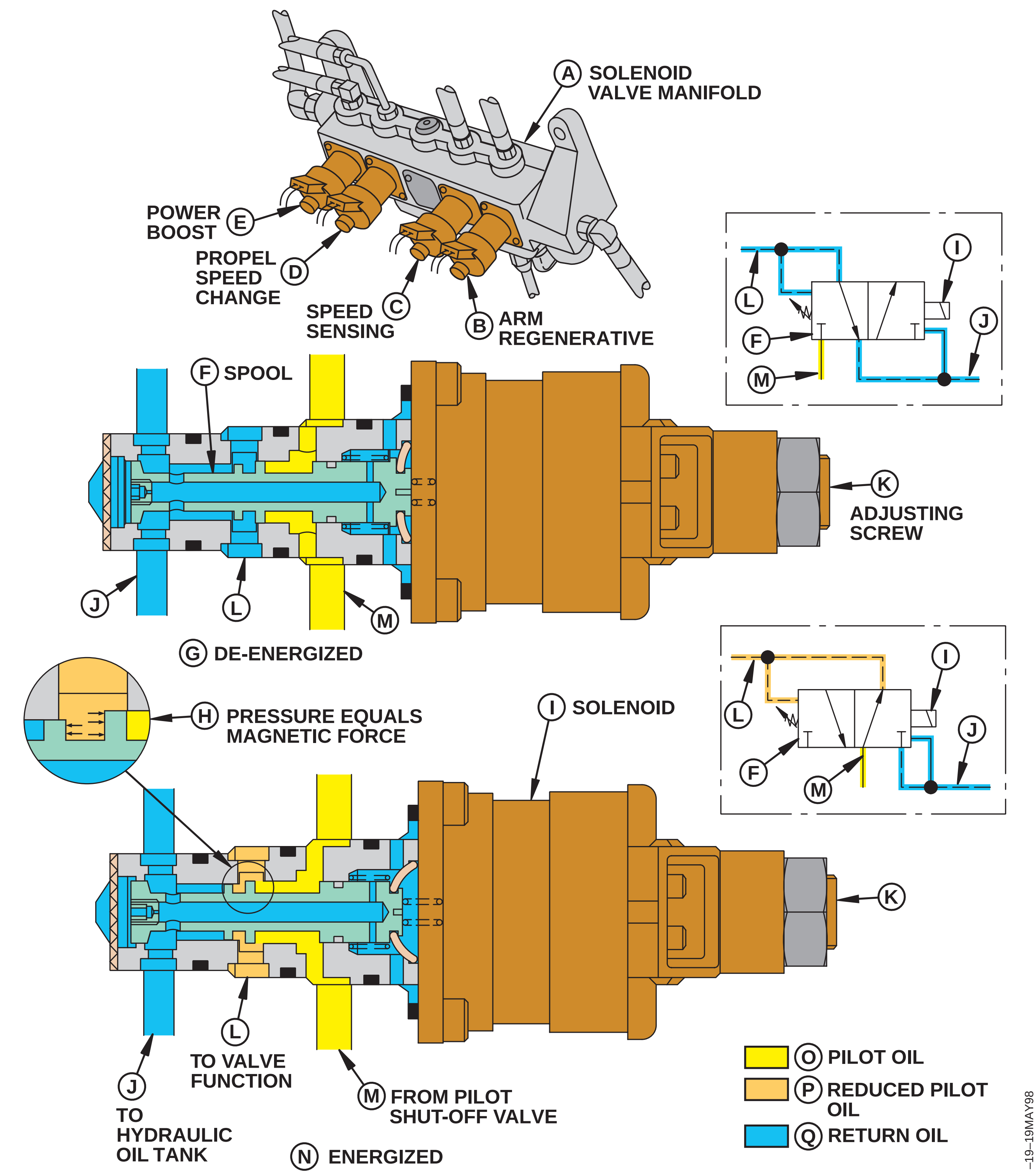
Continued on next page

Theory of Operation

The identification letters shown on the hydraulic schematic are on the manifold housing next to the ports.

CED,TX08227,3115 –19–01MAY98–3/3

PROPORTIONAL SOLENOID VALVE OPERATION



T115181

R PROPORTIONAL SOLENOID VALVE

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CED,TX08227,3114 –19–01MAY98–1/2

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The arm regenerative (SC) (B), speed sense (SD) (C), propel speed change (SI) (D) and power boost (SG) (E) solenoid valve are proportional solenoid valve (R) type. The solenoid valve coil is energized by a electrical signal from the engine and pump controller (EPC). The electrical signal is a DC voltage that is turned on and off to form a pulse width modulated signal. The solenoid coil (I) reacts to the average voltage to create a magnetic force to shift the spool (F) left against a spring. The reduced pilot oil (P) control signal sent to the valve function (L) depends on how long the electrical signal in on verses on how long it is off. The reduced pilot oil control signal is in proportion to the electrical signal to the solenoid coil.

When de-energized (G), the spool is pushed to the right by a spring. The valve function port is connected to the hydraulic oil tank (J) port.

When energized (N), the magnetic force shifts the spool left against the spring. Pilot oil (O) flows past the spool flange and out the valve function port as a reduced pilot oil (P) control signal. Because the flange on the right is larger than the flange on the left, the spool is pushed to the right against the magnetic force as the control signal to the valve function increases. When the control signal becomes equals to or greater than the magnetic force, the spool is pushed to the right closing the passage stopping the pressure increase. The reduced pilot oil control signal to the valve function is trapped. The spool is moving constantly to maintain the control signal in response to the electrical signal to the solenoid coil.

For circuit operation of arm regenerative solenoid valve, see Arm Regenerative Valve Operation in this group.

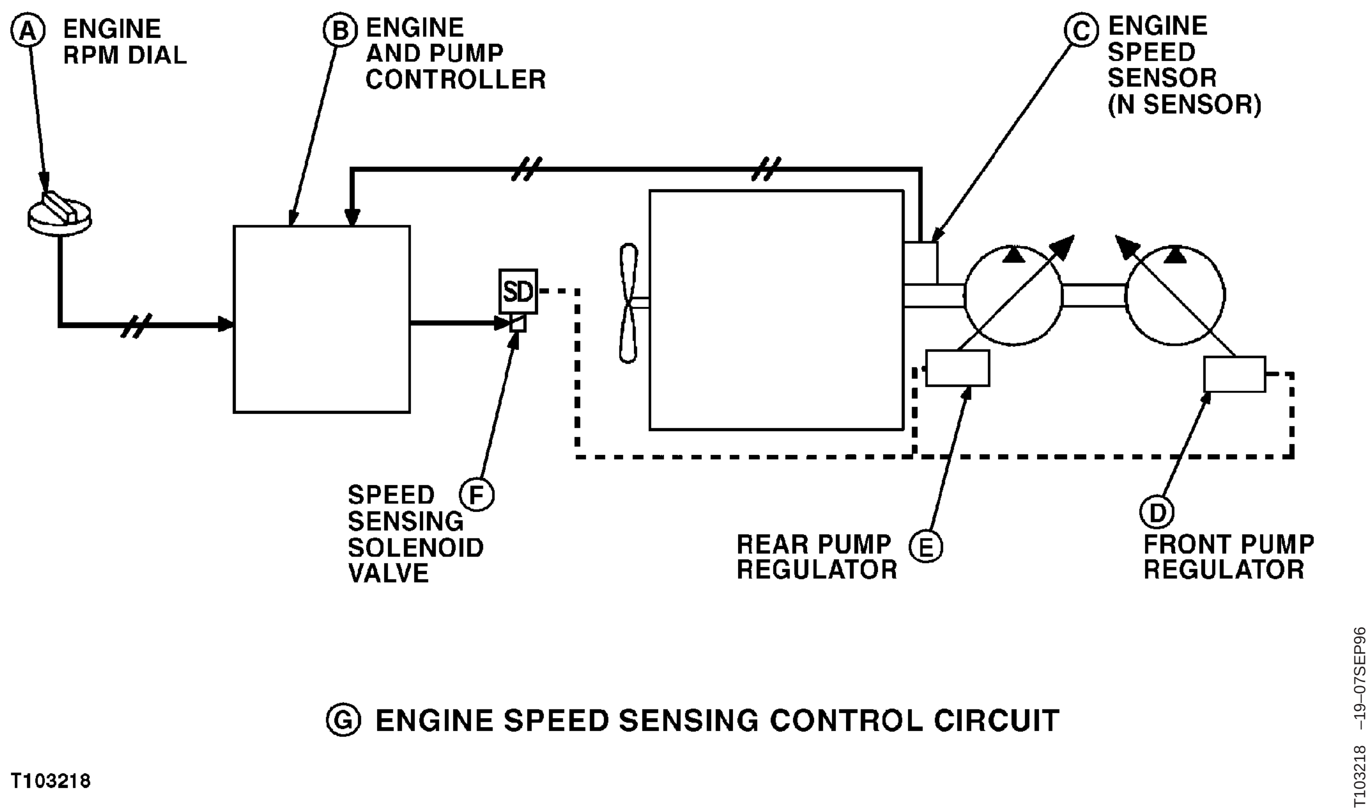
For circuit operation of speed sensing solenoid valve, see Engine Speed Sensing Control Circuit Operation in this group.

For circuit operation of propel speed change solenoid valve, see Propel Speed Change Circuit Operation in this group.

For circuit operation of power boost solenoid valve, see Power Boost Control Circuit Operation in this group.

CED,TX08227,3114 –19–01MAY98–2/2

ENGINE SPEED SENSING CONTROL CIRCUIT OPERATION



G ENGINE SPEED SENSING CONTROL CIRCUIT

T103218

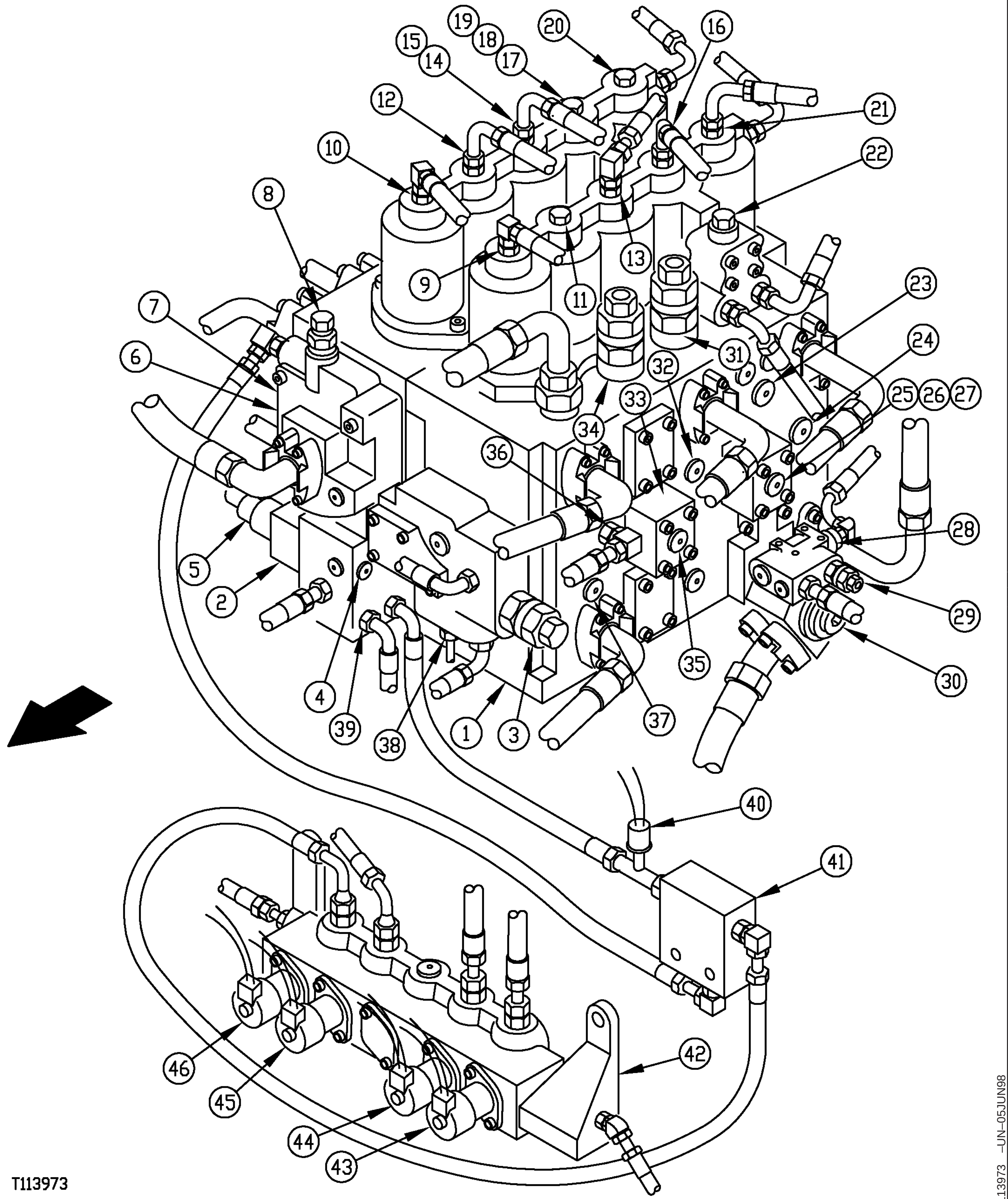
The function of engine speed sensing control circuit (G) is to reduce the hydraulic load on the engine if it exceeds the output torque of the engine.

The speed sensing solenoid valve (C) coil is energized by an electrical signal from the engine and pump controller (B) when the actual engine speed, as sensed by the engine speed sensor (D), is pulled down to the target engine speed. The target engine speed is a function of the engine and pump controller and is selected when the engine rpm dial (A) is turned to the desired actual engine speed.

The pilot oil pressure signal is sent to the end of the load piston in the front and rear pump regulators (E and F) which then operate to reduce pump flow. (See Hydraulic Pump Regulator Operation in this group.)

TX,05,GG2201 –19–02MAY98–1/1

CONTROL VALVE OPERATION



Control Valve Components Left Front

Continued on next page

1—Left Control Valve—5-Spool
2—Right Control Valve—4-Spool
3—Rear Pump Control Valve
4—Flow Combiner Check Valve
5—Flow Combiner Valve
6—System Relief Valve Isolation Check Valve
7—System Relief Valve Isolation Check Valve
8—System Relief and Power Boost Valve
9—Left Propel Valve
10—Right Propel Valve
11—Auxiliary Valve
12—Bucket Valve
13—Boom II Valve
14—Boom I Valve
15—Boom Regenerative Valve (in Boom I Spool)
16—Arm I Valve
17—Arm II Valve
18—Arm Regenerative Valve (in Arm II Spool)
19—Check Valve and Orifice (in Arm II Spool)
20—Bypass Shut-Off Valve
21—Swing Valve
22—Arm Rod End Reduced Leakage Pilot Valve
23—Arm Rod End Reduced Leakage Check Valve
24—Swing Lift Check Valve
25—Power Passage-to-Arm I Neutral Passage Check Valve
26—Arm I Lift Check Valve
27—Restriction Orifice (in housing)
28—Arm Head End Reduced Leakage Pilot Valve
29—Arm Head End Reduced Leakage Relief Valve
30—Arm Head End Reduced Leakage Check Valve
31—Arm Out Circuit Relief and Anti-Cavitation Valve
32—Boom II Power Passage Lift Check Valve
33—Auxiliary Power Passage Lift Check Valve
34—Auxiliary Circuit Relief and Anti-Cavitation Valve
35—Front Pump Bypass Inlet Port
36—Propel Flow Control Valve
37—Left Propel Neutral Passage Lift Check Valve
38—Rear Pump Control Valve Pilot Inlet Filter
39—Pilot Pressure Signal Passage Filter
40—Propel Pressure Switch
41—Shuttle Valve
42—Solenoid Valve Manifold
43—Arm Regenerative Solenoid Valve
442—Speed Sensing Solenoid Valve
45—Propel Speed Change Solenoid Valve
46—Power Boost Solenoid Valve

The control valve consists of two monoblock valve housings called the left control valve (1) and right control valve (2). The control valves are mounted back-to-back to connect the interconnected oil passages through ports in the mounting faces. The left control valve is a 5-spool section valve consisting of left propel (9), auxiliary (11), boom II (13), arm I (16), and swing (21). The right control valve is a 4-spool section valve consisting of right propel (10), bucket (12), boom I (14), and arm II (17). Also included in the 4-spool section is the bypass shut-off valve (20). The bypass shut-off valve is use to route front pump flow from the right control valve neutral passage, by an external hose, to the power passage before the auxiliary valve in the left control valve. Each spool is selectively fitted to its bore in the housings. The spools are moved by pilot oil from the pilot controllers located in the cab.

For the location of all valves used in the control valve, see the three illustrations labeled Left Front, Right Rear, and Bottom and the legends. All valves are accessible from the outside of control valve by removing a plug, cover, or the pilot caps. For line connections to the control valves, see the component location drawings in Group 9025-15. The solenoid valve manifold (42) is located on the front of the control valve mounting bracket.

The control valve is an open-center valve. Each valve section controls the flow rate and direction for its hydraulic circuit. The rear (3) and front (58) pump control valves, located in neutral passage of the left (1) and right (2) control valves, are used to send a pilot control signal to the front and rear pump regulators when a function is actuated. (See Pump Control Valve Operation in this group.)

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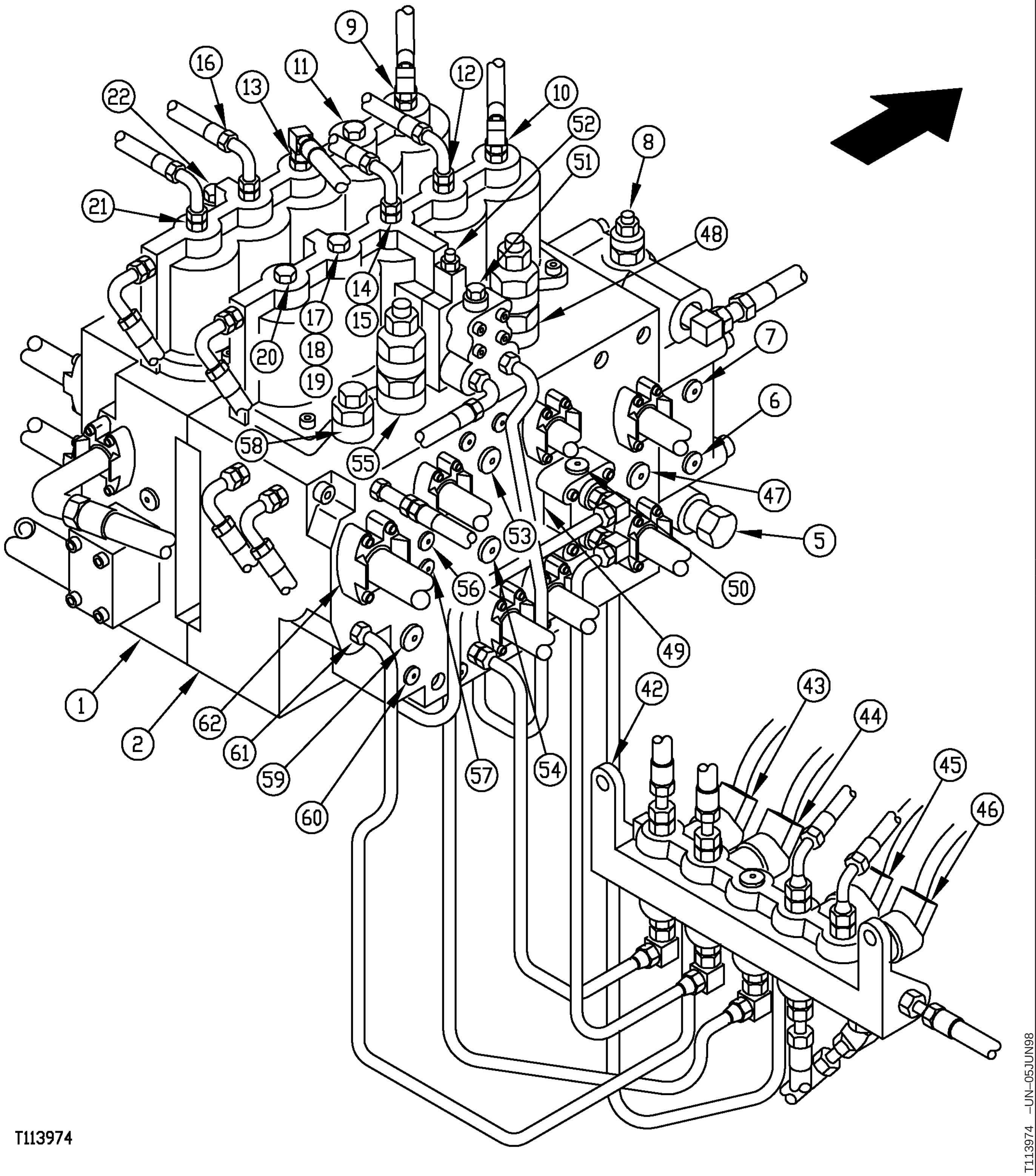

Control Valve Components Right Rear

Continued on next page

Theory of Operation

1—Left Control Valve—5-Spool
2—Right Control Valve—4-Spool
5—Flow Combiner Valve
6—System Relief Valve Isolation Check Valve
7—System Relief Valve Isolation Check Valve
8—System Relief and Power Boost Valve
9—Left Propel Valve
10—Right Propel Valve
11—Auxiliary Valve
12—Bucket Valve
13—Boom II Valve
14—Boom I Valve
15—Boom Regenerative Valve (in Boom I Spool)
16—Arm I Valve
17—Arm II Valve
18—Arm Regenerative Valve (in Arm II Spool)
19—Check Valve and Orifice (in Arm II Spool)
20—Bypass Shut-Off Valve
21—Swing Valve
22—Arm Rod End Reduced Leakage Pilot Valve
42—Solenoid Valve Manifold
43—Arm Regenerative Solenoid Valve
44—Speed Sensing Solenoid Valve
45—Propel Speed Change Solenoid Valve
46—Power Boost Solenoid Valve
47—Orifice and Bucket Power Passage Lift Check Valve
48—Bucket Dump Circuit Relief and Anti-Cavitation Valve
49—Bucket Flow Control Poppet Valve
50—Bucket Flow Control Pilot Valve B
51—Boom Reduced Leakage Pilot Valve
52—Boom Manual Lower Release Screw
53—Boom Reduced Leakage Check Valve
54—Boom I Power Passage Lift Check Valve
55—Boom Up Circuit Relief and Anti-Cavitation Valve
56—Orifice and Arm II Power Passage Lift Check Valve
57—Arm II Neutral Passage Lift Check Valve
58—Front Pump Control Valve
59—Front Pump Bypass Shut-Off Valve Outlet Port
60—Bypass Shut-Off Valve Pilot Port
61—Front Pump Control Valve Pilot Inlet Filter
62—Oil Cooler Bypass Valve

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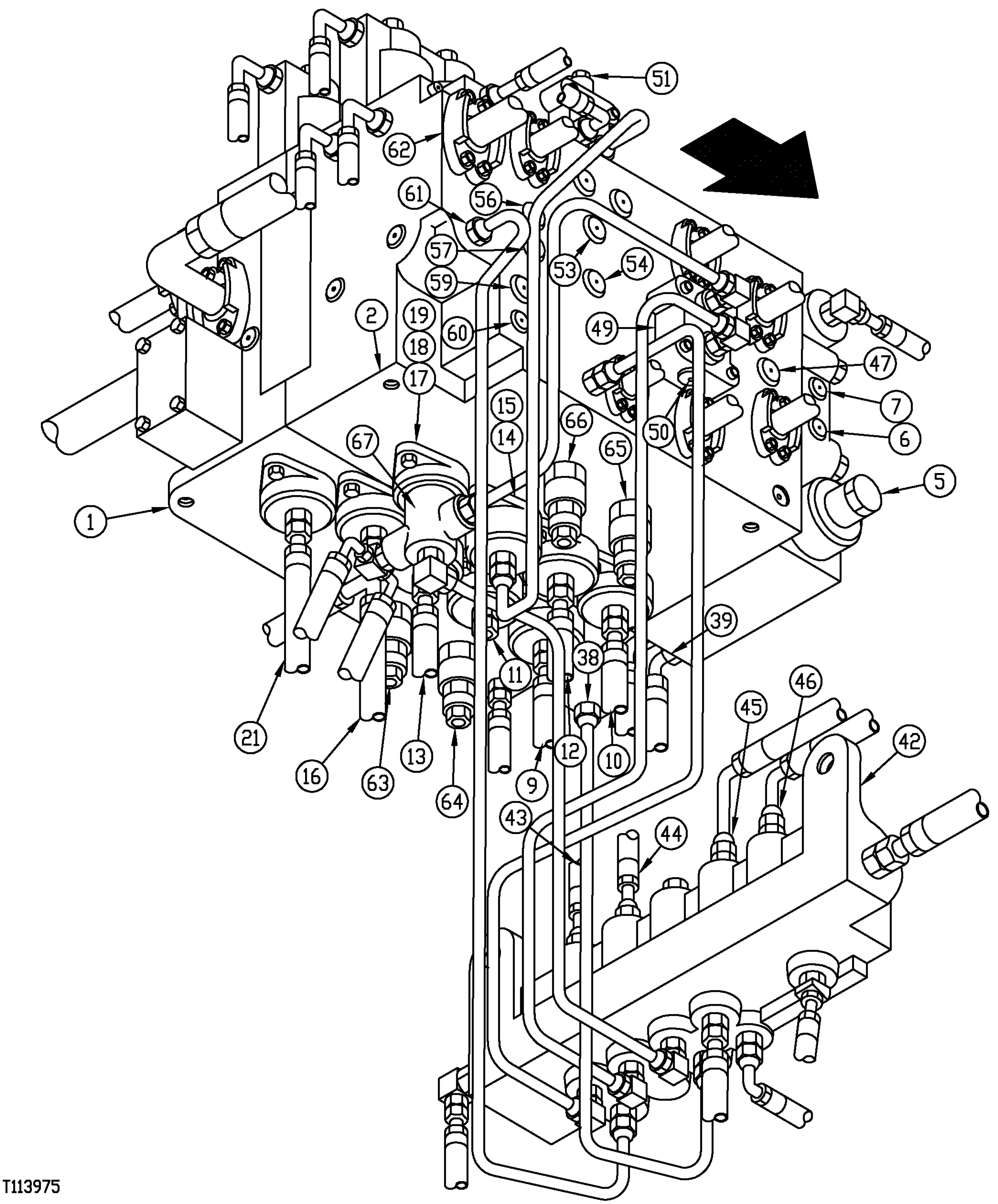
CED,TX08227,3116 –19–02MAY98–4/6



Control Valve Components Bottom

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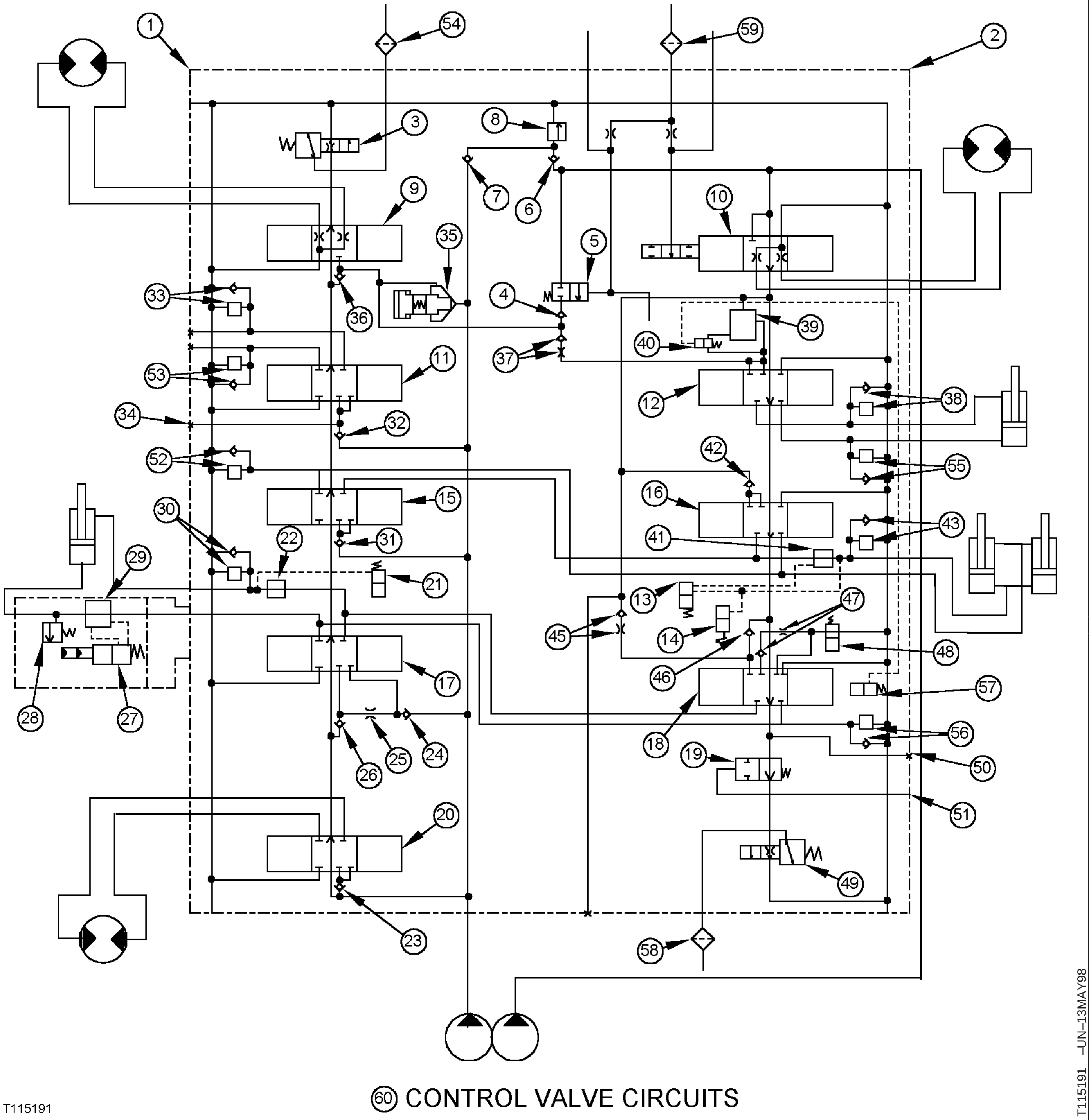
Theory of Operation

1—Left Control Valve—5-Spool
2—Right Control Valve—4-Spool
5—Flow Combiner Valve
6—System Relief Valve Isolation Check Valve
7—System Relief Valve Isolation Check Valve
9—Left Propel Valve
10—Right Propel Valve
11—Auxiliary Valve
12—Bucket Valve
13—Boom II Valve
14—Boom I Valve
15—Boom Regenerative Valve (in Boom I Spool)
16—Arm I Valve
17—Arm II Valve
18—Arm Regenerative Valve (in Arm II Spool)
19—Check Valve and Orifice (in Arm II Spool)
21—Swing Valve
38—Rear Pump Control Valve Pilot Inlet Filter
39—Pilot Pressure Signal Passage Filter
42—Solenoid Valve Manifold
43—Arm Regenerative Solenoid Valve
44—Speed Sensing Solenoid Valve
45—Propel Speed Change Solenoid Valve
46—Power Boost Solenoid Valve
47—Orifice and Bucket Power Passage Lift Check Valve
49—Bucket Flow Control Poppet Valve
50—Bucket Flow Control Pilot Valve B
51—Boom Reduced Leakage Pilot Valve
53—Boom Reduced Leakage Check Valve
54—Boom I Power Passage Lift Check Valve
56—Orifice and Arm II Power Passage Lift Check Valve
57—Arm II Neutral Passage Lift Check Valve
59—Front Pump Bypass Shut-Off Valve Outlet Port
60—Bypass Shut-Off Valve Pilot Port
61—Front Pump Control Valve Pilot Inlet Filter
62—Oil Cooler Bypass Valve
63—Boom Down Circuit Relief and Anti-Cavitation Valve
64—Auxiliary Circuit Relief and Anti-Cavitation Valve
65—Bucket Load Circuit Relief and Anti-Cavitation Valve
66—Arm In Circuit Relief and Anti-Cavitation Valve
67—Bucket Flow Control Pilot Valve A

CED,TX08227,3116 –19–02MAY98–6/6

CONTROL VALVE CIRCUIT SCHEMATIC



60 CONTROL VALVE CIRCUITS

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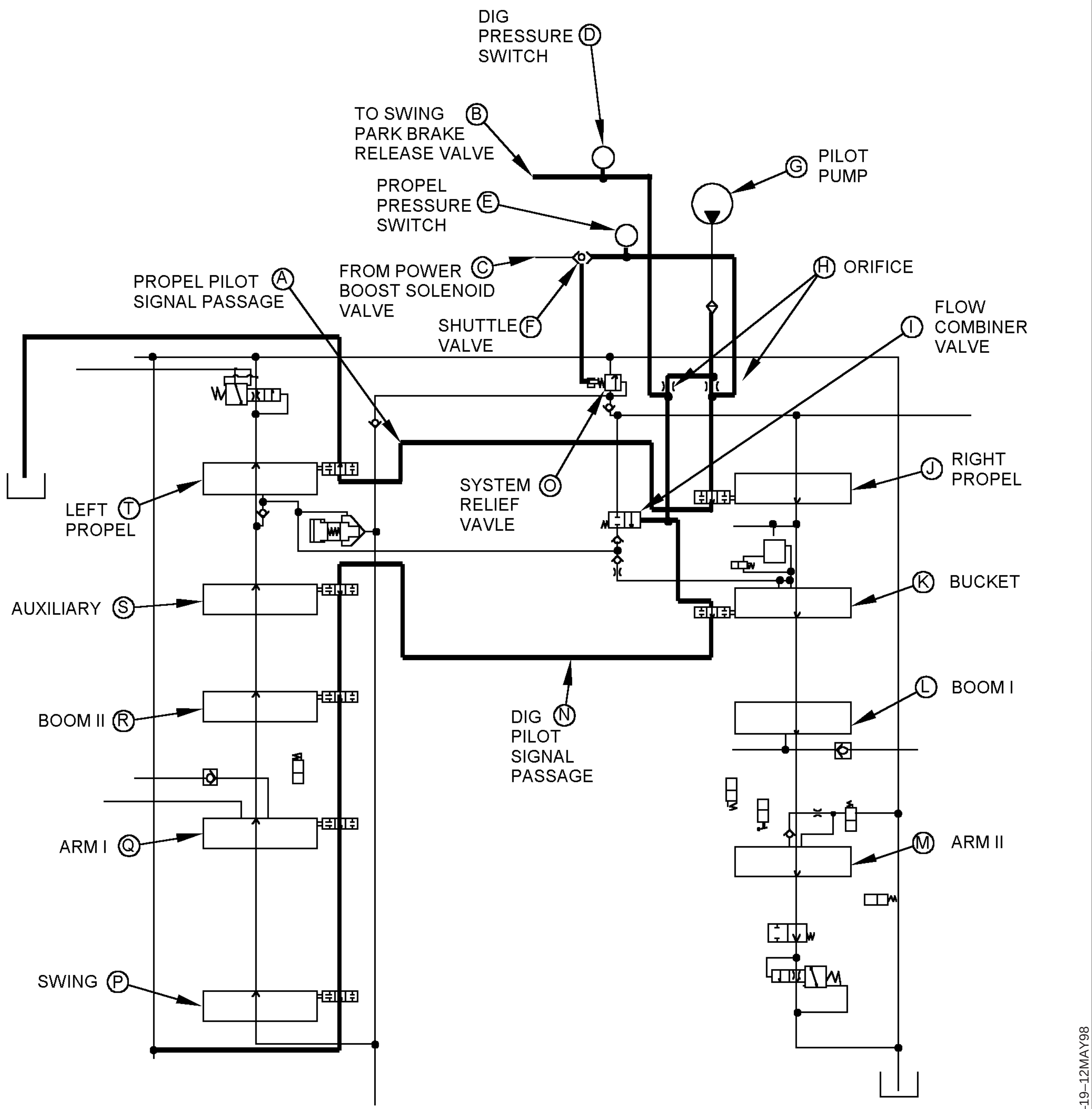
1—Left Control Valve—5-Spool
2—Right Control Valve—4-Spool
3—Rear Pump Control Valve
4—Flow Combiner Valve Circuit Check Valve
5—Flow Combiner Valve
6—System Relief Valve Isolation Check Valve
7—System Relief Valve Isolation Check Valve
8—System Relief and Power Boost Valve
9—Left Propel Valve
10—Right Propel Valve
11—Auxiliary Valve
12—Bucket Valve
13—Boom Reduced Leakage Pilot Valve
14—Boom Manual Lower Release Screw
15—Boom II Valve
16—Boom I Valve
17—Arm I Valve
18—Arm II Valve
19—Bypass Shut-Off Valve
20—Swing Valve
21—Arm Rod End Reduced Leakage Pilot Valve
22—Arm Rod End Reduced Leakage Check Valve
23—Swing Lift Check Valve
24—Power Passage-to-Arm I Neutral Passage Check Valve
25—Arm I Lift Check Valve
26—Restriction Orifice (in housing)
27—Arm Head End Reduced Leakage Pilot Valve
28—Arm Head End Reduced Leakage Relief Valve
29—Arm Head End Reduced Leakage Check Valve
30—Arm Out Circuit Relief and Anti-Cavitation Valve
31—Boom II Power Passage Lift Check Valve
32—Auxiliary Power Passage Lift Check Valve
33—Auxiliary Circuit Relief and Anti-Cavitation Valve
34—Front Pump Bypass Inlet Port
35—Propel Flow Control Valve
36—Left Propel Neutral Passage Lift Check Valve
37—Orifice and Bucket Power Passage Lift Check Valve
38—Bucket Dump Circuit Relief and Anti-Cavitation Valve
39—Bucket Flow Control Poppet Valve
40—Bucket Flow Control Pilot Valve B
41—Boom Reduced Leakage Check Valve
42—Boom I Power Passage Lift Check Valve
43—Boom Up Circuit Relief and Anti-Cavitation Valve
44—Boom Regenerative Valve (in Boom I Spool)
45—Orifice and Arm II Power Passage Lift Check Valve
46—Arm II Neutral Passage Lift Check Valve
47—Check Valve and Orifice (in Arm II Spool)
48—Arm Regenerates Valve (in Arm II Spool)
49—Front Pump Control Valve
50—Front Pump Bypass Shut-Off Valve Outlet Port
51—Bypass Shut-Off Valve Pilot Port
52—Boom Down Circuit Relief and Anti-Cavitation Valve
53—Auxiliary Circuit Relief and Anti-Cavitation Valve
54—Rear Pump Control Valve Pilot Inlet Filter
55—Bucket Load Circuit Relief and Anti-Cavitation Valve
56—Arm In Circuit Relief and Anti-Cavitation Valve
57—Bucket Flow Control Pilot Valve A
58—Front Pump Control Valve Pilot Inlet Filter
59—Pilot Pressure Signal Passage Filter
60—Control Valve Circuits

CED,TX08227,3117 –19–04MAY98–2/2

CONTROL VALVE PILOT SIGNAL PASSAGES OPERATION



(U) DIG AND PROPEL PILOT SIGNAL PASSAGE

T115196

The function of the dig (N) and propel (A) pilot signal passages is to send a electrical signal to the engine and pump controller by the dig (D) and propel (E) pressure switches when a function is actuated. Also to shift the flow combiner valve (I) and to release the swing park brake (B) when a dig function is actuated or to increase the system relief valve (O) pressure setting through the shuttle valve (F) when a propel function is actuated.

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CED,TX08227,3118 –19–05MAY98–1/2

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Pilot oil from the pilot pump (G) flows to the control valve and through the filter, orifices (H), and into the propel pilot signal passage (A) and dig pilot signal passage (N).

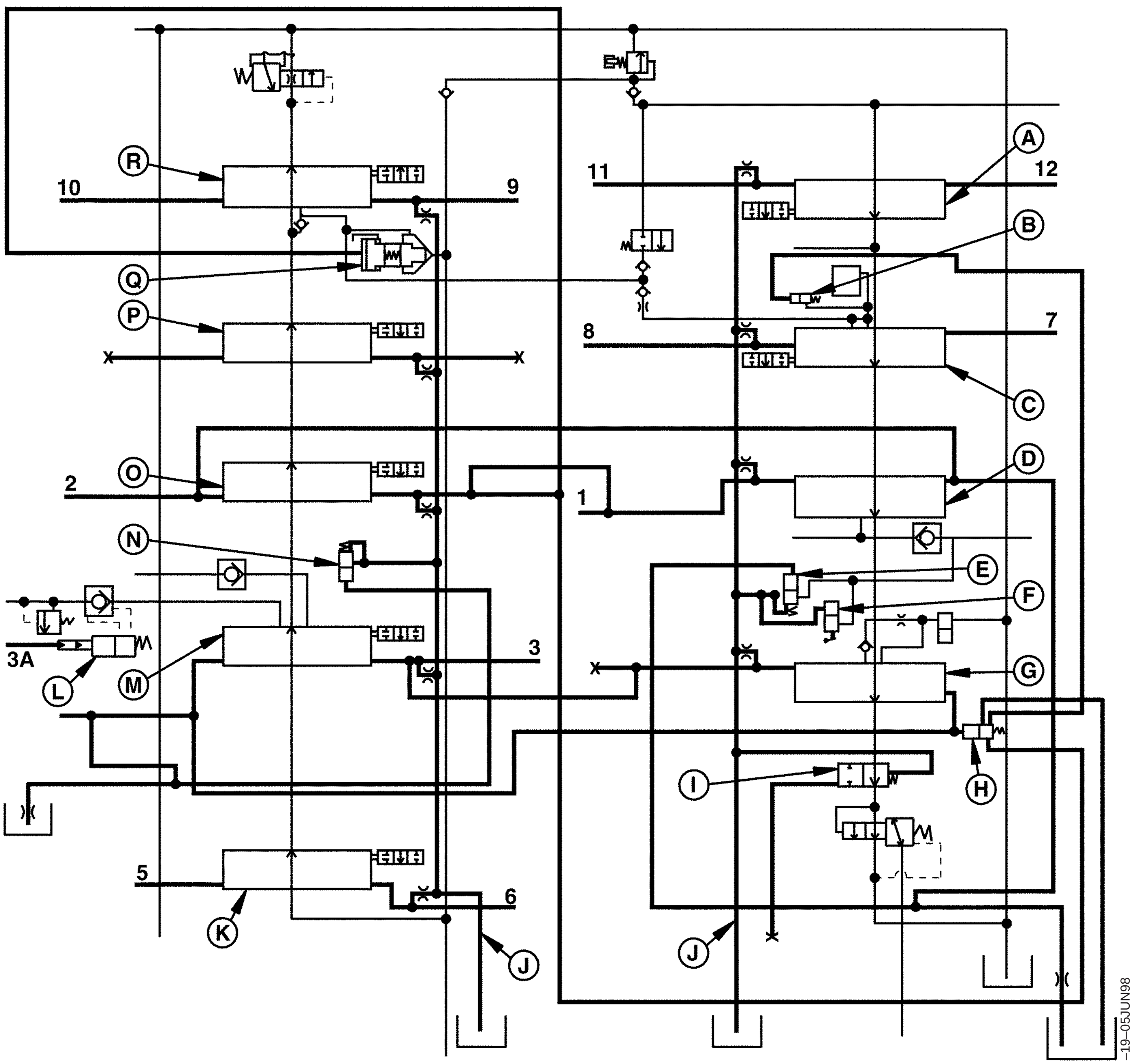
The oil in the propel pilot signal passage flows to the propel pressure switch (E) and shuttle valve (F), past the top end of the right (J) and left (T) propel valve spools, and then to the hydraulic oil tank. The oil in the dig pilot signal passage flows to the dig pressure switch (D), to the swing park brake release valve (B), to the flow combiner valve (I), past the top end of bucket (K), auxiliary (S), boom II (R), arm I (Q), and swing (P) valve spools, and then to the return passage.

The flow of oil through the orifices (H) causes a pressure drop; the pressure of oil downstream of each orifice is less than the pressure upstream of the orifices. When no functions are actuated, none of the switches or valves in the signal passages are actuated.

When a function is actuated, the valve spools shifts blocking the flow of pilot oil through the signal passage. The oil pressure upstream of the valve spool increases to approximately the pressure setting of pilot pressure regulating valve and actuate the switch and valves in that signal passage.

CED,TX08227,3118 –19–05MAY98–2/2

CONTROL VALVE PILOT CIRCUIT OPERATION



T115207 **(S) CONTROL VALVE PILOT CIRCUITS**

A—Right Propel Valve
B—Bucket Flow Control Pilot Valve B
C—Bucket Valve
D—Boom I Valve
E—Boom Reduced Leakage Pilot Valve
F—Boom Manual Lower Release Screw
G—Arm II Valve
H—Bucket Flow Control Pilot Valve A
I—Bypass Shut-Off Valve
J—Warm-Up and Air Bleed Circuit
K—Swing Valve
L—Arm Head End Reduced Leakage Pilot Valve
M—Arm I Valve
N—Arm Rod End Reduced Leakage Pilot Valve
O—Boom II Valve
P—Auxiliary Valve
Q—Propel Flow Control Valve
R—Left Propel Valve
S—Control Valve Pilot Circuits

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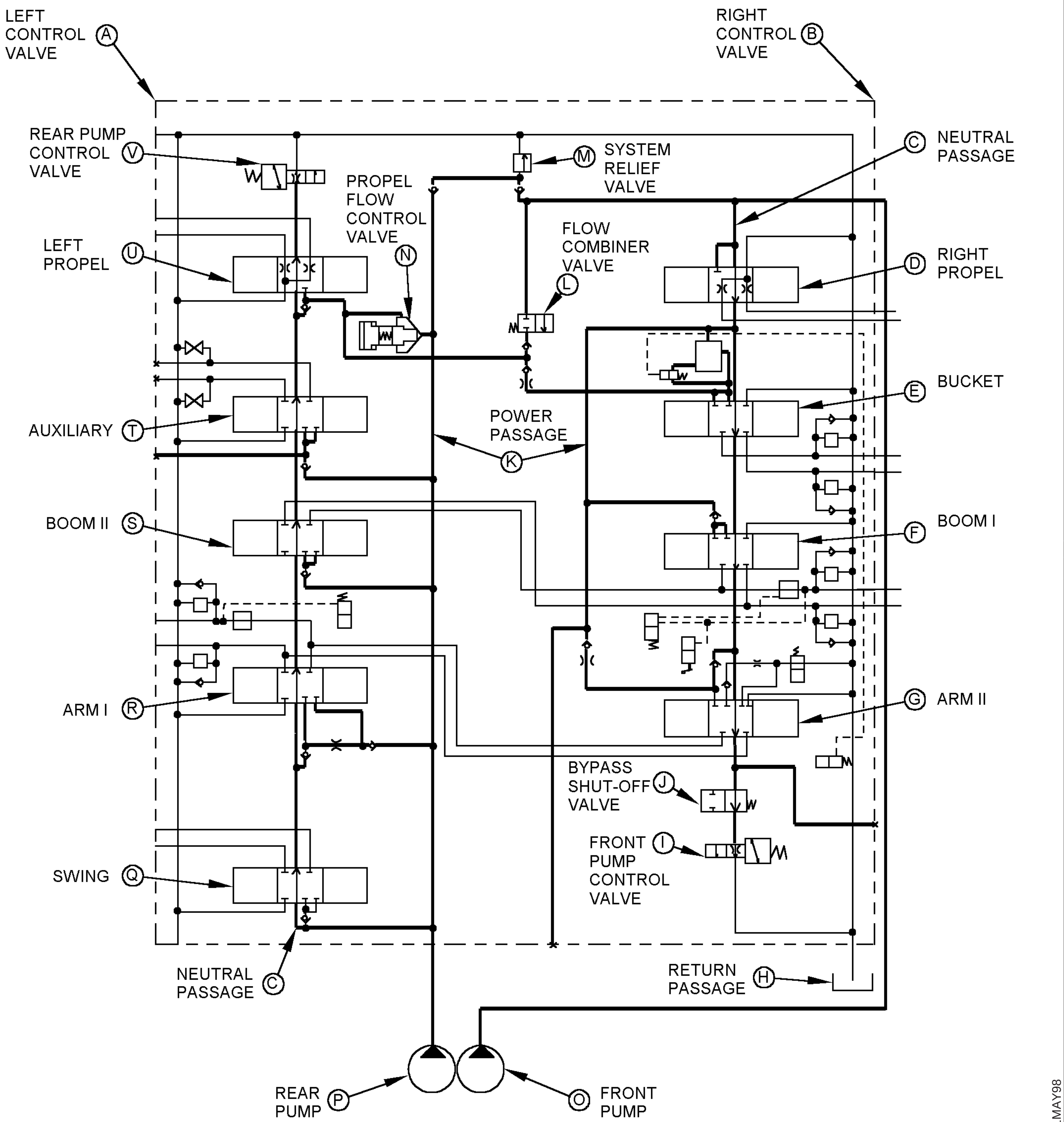
Actuating a pilot controller to operate a dig or propel function sends pilot oil to the pilot cap (1—12) of a control valve spool shifting the spool(s). The pilot oil also flows to other valves for the following functions:

- Boom up—pilot oil flows from the pilot cap (1) to the propel flow control valve (Q) and the bucket flow control pilot valve A (H). If arm-in is actuated, pilot oil flows through pilot valve A to the bucket flow control pilot valve B (B).
- Boom down—pilot oil flows from the pilot cap (2) to the boom reduced leakage pilot valve (E) and through an orifice to the hydraulic oil tank.
- Arm-out—pilot oil flows from the tee connection (3A) at the flow regulating valve to the arm head end reduced leakage pilot valve (L).
- Arm-in—pilot oil flows from the pilot cap (4) to the arm rod end reduced leakage pilot valve (N), the bucket flow control pilot valve A (H), and through an orifice to the hydraulic oil tank.

Orifices in the top pilot caps allows a small amount of pilot oil to flow to the warm-up and air bleed circuit (J) and back to the hydraulic oil tank. The flow of oil removes any air trapped in the top pilot cap and to provides a flow of warm-up oil when functions are not actuated. (See Warm-Up Circuit Operation in this group.)

CED,TX08227,3120 –19–05MAY98–2/2

CONTROL VALVE NEUTRAL AND POWER PASSAGES OPERATION



T115204

(W) NEUTRAL AND POWER PASSAGES

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CED,TX08227,3119 –19–05MAY98–1/2

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Supply oil from the front pump (O) flows to the right control valve (B). Supply oil from the rear pump (P) flows to the left control valve (A).

When all valve spools (D—G and Q—U) are in neutral, supply oil flows through the neutral passages (C), through the front (I) and rear (V) pump control valves and into the return passage (H). The left and right control valves are open-center valves. Power passages (K) in the left and right control valves are used to route supply oil for the combined operation of functions.

The flow combiner valve (L) is in the power passage (K) to route supply oil from the front pump (O) to both the right and left propel functions when used in combined operation with the dig functions so the machine travels straight. The rear pump supplies oil to the dig functions. (See Flow Combiner Operation in this group.)

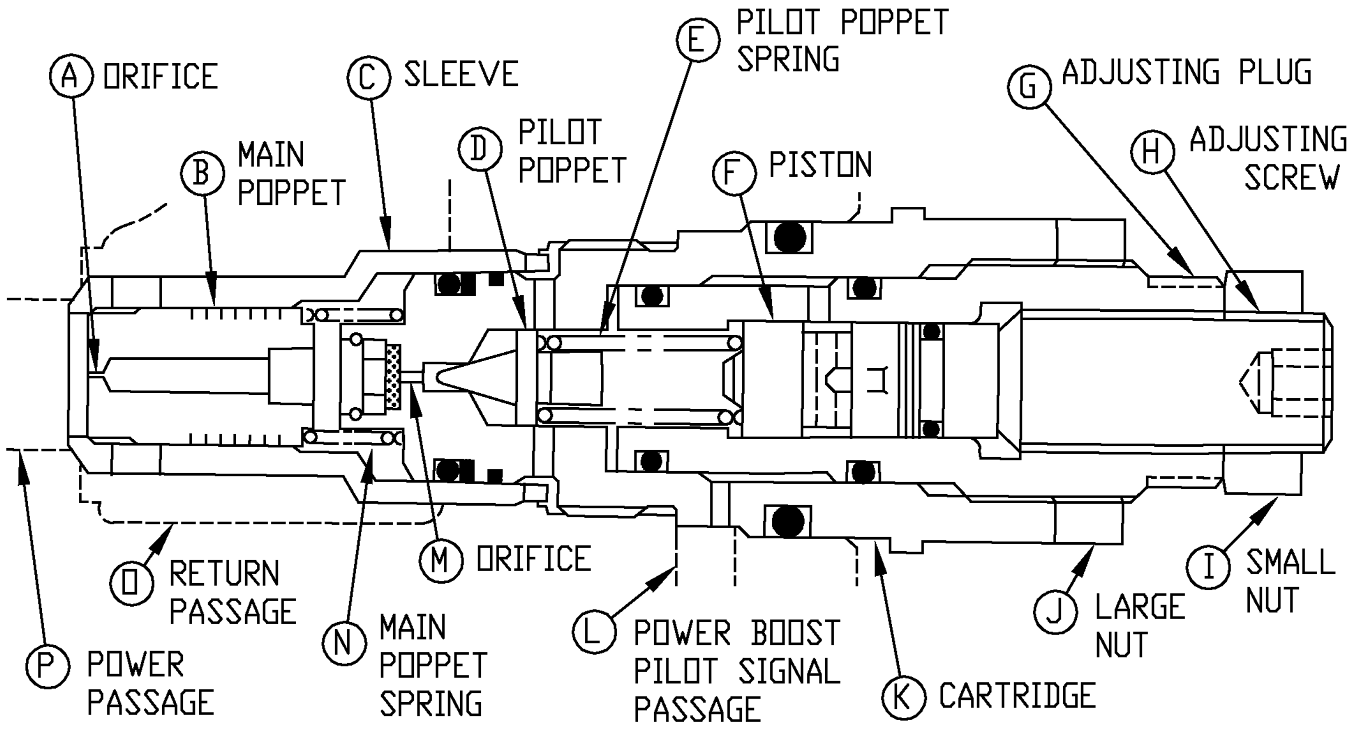
The propel flow control valve (N) is in the power passage (K) to block the flow of supply oil from the power passage to left propel (U) when propel and boom up functions are used in combined operation. (See Propel Flow Control Valve Operation in this group.)

The bypass shut-off valve (J) is used with the auxiliary (T) function to route front pump supply oil by an external line to the power passage at the auxiliary valve spool. (See Bypass Shut-Off Valve Operation in this group.)

The system relief valve (M) senses the operating pressure in the neutral and power passages. The relief valve will open to relieve excess pressure to the return passage.

CED,TX08227,3119 –19–05MAY98–2/2

SYSTEM RELIEF VALVE AND POWER BOOST OPERATION



Q SYSTEM RELIEF VALVE AND POWER BOOST

The function of system relief valve (Q) is to limit the main hydraulic system operating pressure. The system relief valve is pilot-operated poppet type relief valve. The relief valve senses supply oil pressure in the control valve power passages (P). The pressure setting for the system relief valve and power boost are adjusted by the adjusting plug (G) and adjusting screw (H). The relief valve is located at the top right front corner of the control valve.

For power boost operation, the pilot oil control signal from the power boost solenoid valve or the propel pilot signal passage flows through the power boost pilot signal passage (L) to push the piston (F) to the left increasing the pressure setting of the pilot poppet spring (E).

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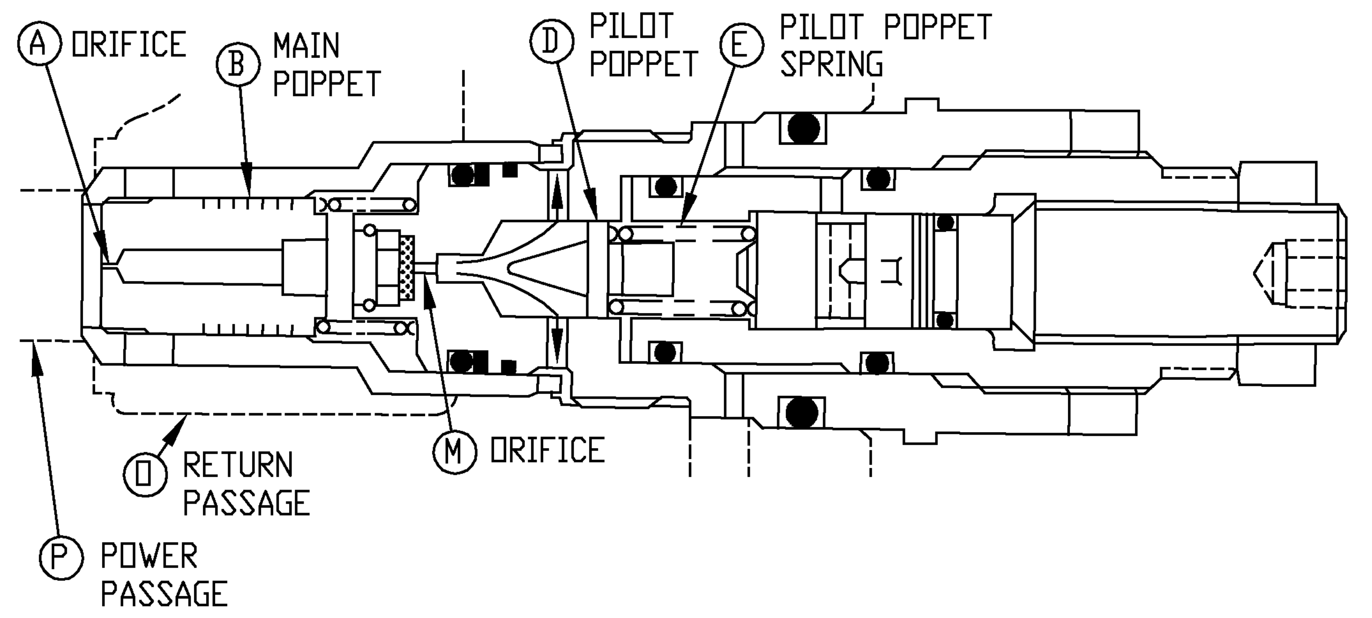
TX,9025,GG2505 –19–17NOV97–1/3



R SYSTEM RELIEF VALVE - PILOT POPPET OPEN

When the supply oil in the power passages (P) exceeds the relief valve pressure setting, the pilot poppet (D) is pushed off its seat by excess supply oil pressure. The oil behind main poppet (D) now flow past the pilot poppet to the return passage (O). The oil pressure behind the main poppet (B) is reduced creating a pressure difference across the main poppet because oil flows out faster than oil can flow through orifice (A) in the main poppet.

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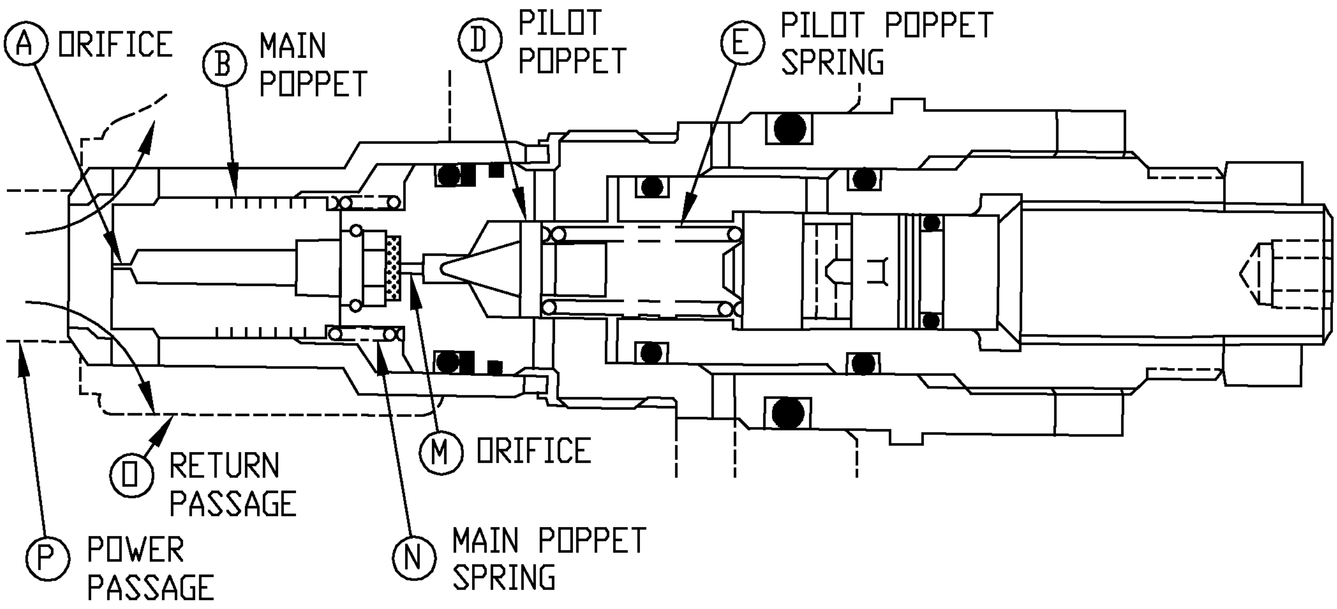
TX,9025,GG2505 –19–17NOV97–2/3



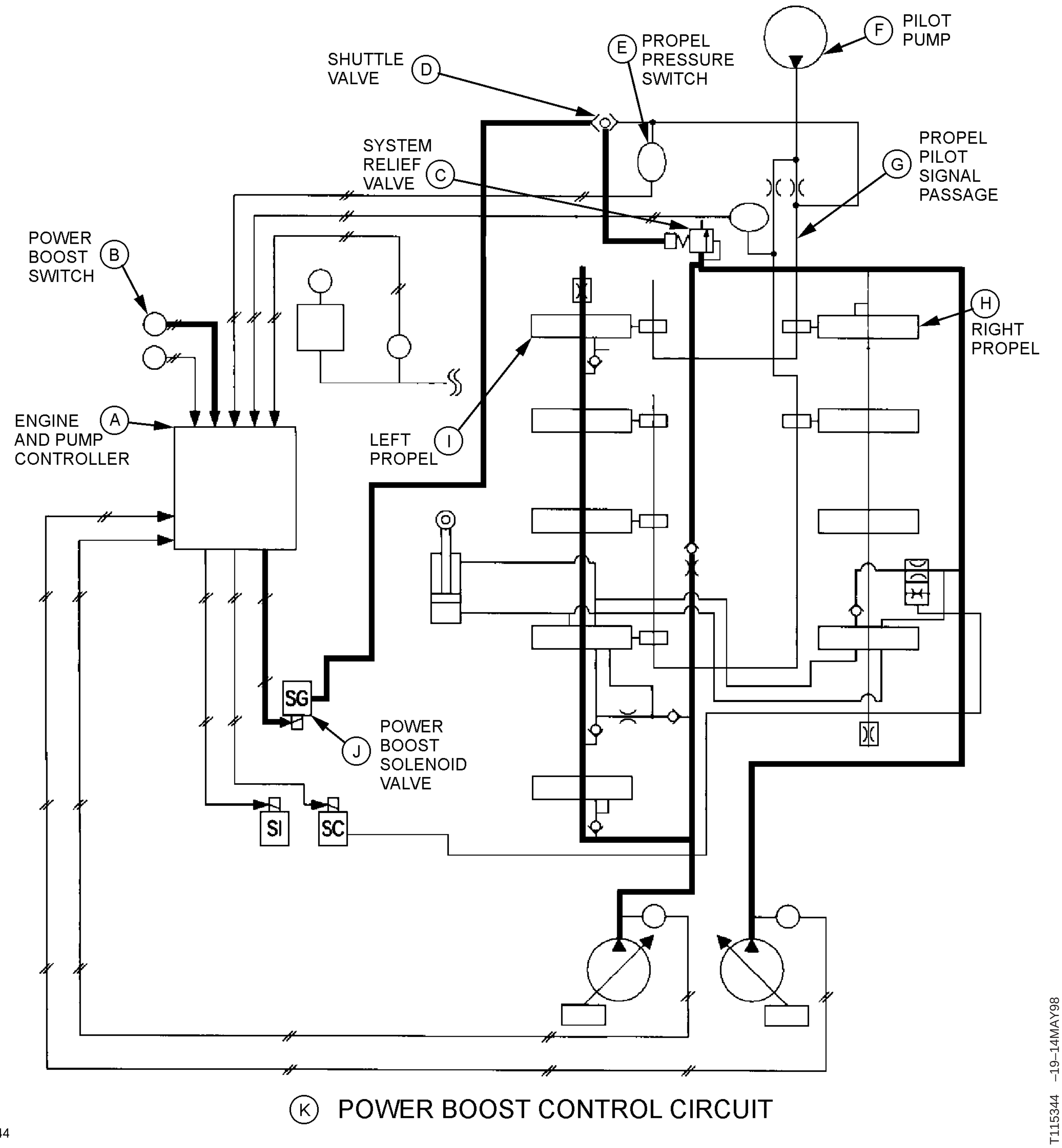
T115339

S SYSTEM RELIEF VALVE – MAIN POPPET OPEN

The excess supply oil pressure pushes the main poppet (B) open to relieve excess supply oil pressure to the return passage (O).

When the supply oil pressure decreases below the pressure setting, the pilot poppet is pushed closed by the pilot poppet spring (E) stopping the flow of oil past the pilot poppet to return passage. The oil pressure behind the main poppet (B) increases pushing it closed.

POWER BOOST CONTROL CIRCUIT OPERATION



T115344

The function of power boost control circuit (K) is to increase system relief valve pressure setting so the main hydraulic system can operate at a higher pressure.

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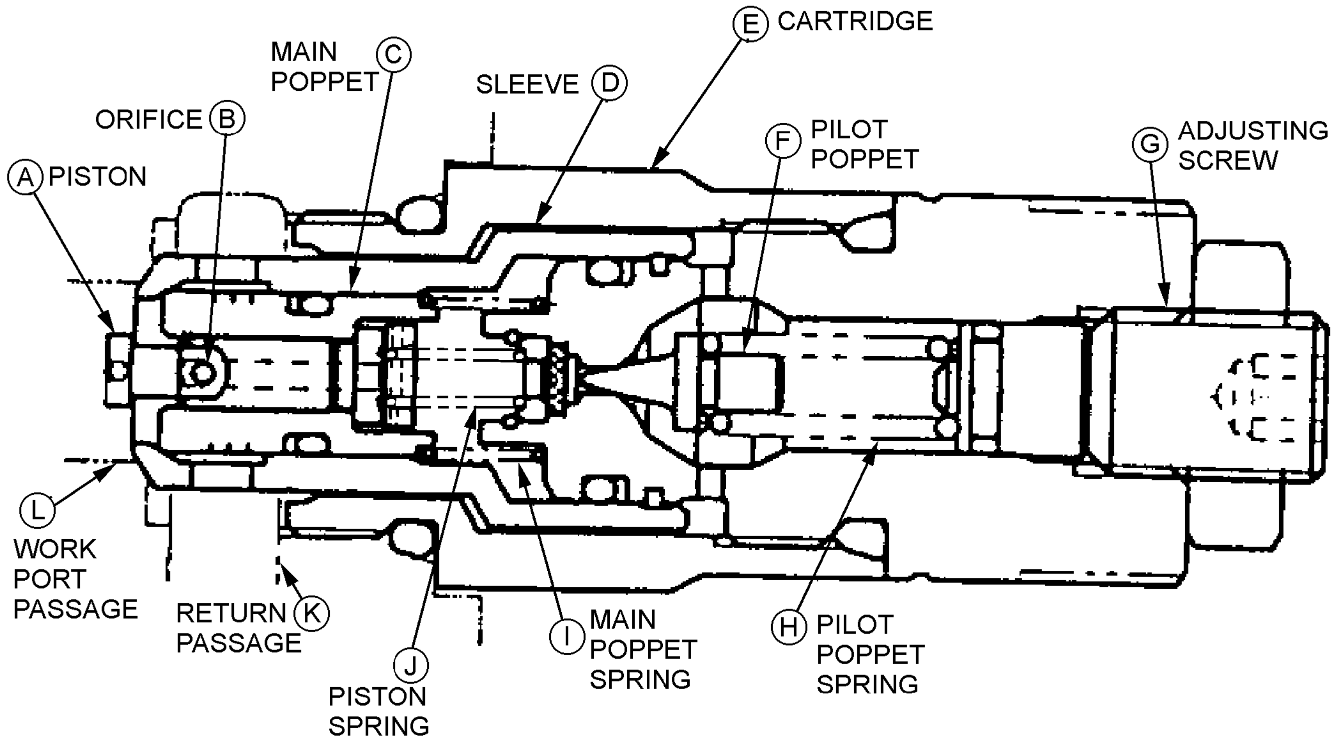
Pushing the power boost switch (B) sends an electrical signal from the engine and pump controller (A) to energize the power boost solenoid valve (J) coil. The solenoid valve shifts sending a pilot oil control signal through the shuttle valve (D) to the system relief valve (C). The control signal pushes the piston in the system relief valve down increasing the pressure setting. The main hydraulic system now operates at a higher operating pressure for approximately 8 seconds. (See System Relief Valve and Power Boost Operation in this group.)

The power boost solenoid valve is also actuated in precision work mode when the boom up function is actuated.

Actuating the left (I) or right (H) propel functions blocks the flow of pilot oil through the propel pilot signal passage (G) causing the pilot oil control signal in the signal passage to increase. The increased control signal flows through the shuttle valve (D) to the system relief valve (C). The control signal pushes the piston in the system relief valve down increasing the pressure setting. The main hydraulic system now operates at the higher operating pressure as long as the propel functions are actuated. The increased pilot oil control signal from the propel pilot signal passage also closes the propel pressure switch (E) sending an electrical signal to the engine and pump controller.

CED,TX08227,3121 –19–11MAY98–2/2

CIRCUIT RELIEF AND ANTICAVITATION VALVE OPERATION



M CIRCUIT RELIEF AND ANTICAVITATION VALVE

The main function of a circuit relief valve (M) is to protect the components of a work circuit from pressure spikes when the control valve spools are in neutral. The circuit relief valve is a pilot-operated poppet type relief valve with anticavitation sleeve (D). Circuit relief and anticavitation valves are used in the bucket, boom, arm, and auxiliary work circuits. The circuit relief valve can be adjusted by the adjusting screw (G).

At pressures below the circuit relief valve setting the main poppet (C) remains closed. The oil pressure in the work port passage (L) is sensed by the pilot poppet through the orifice (B) in the piston (A). During normal operation, the sleeve (D) for anticavitation valve is held closed because the oil pressure on the inner shoulder is greater than the return passage (K) oil pressure on the outer shoulder of the sleeve.

In relief operation, the oil pressure in the work port passage (L) exceeds the relief valve pressure setting. The pilot poppet (F) is pushed off its seat by excess pressure oil. The oil behind main poppet (C) flow past the pilot poppet and then through the clearance between the sleeve (E) and cartridge (E) to the return passage (K). The oil pressure behind the main poppet is reduced creating a pressure differences across the main poppet because oil flows out faster than oil can flow through the orifice in piston. When the pressure difference becomes more than the piston spring (J), the piston (A) moves to the right and the main poppet (C) is pushed open to relieve excess pressure oil to the return passage.

When the oil pressure in the work circuit decreases below the pressure setting, the pilot poppet is pushed closed by the pilot poppet spring (B) stopping the flow of oil past the pilot poppet to the return passage. The oil pressure behind the main poppet increases moving the piston to the left and pushing main poppet closed.

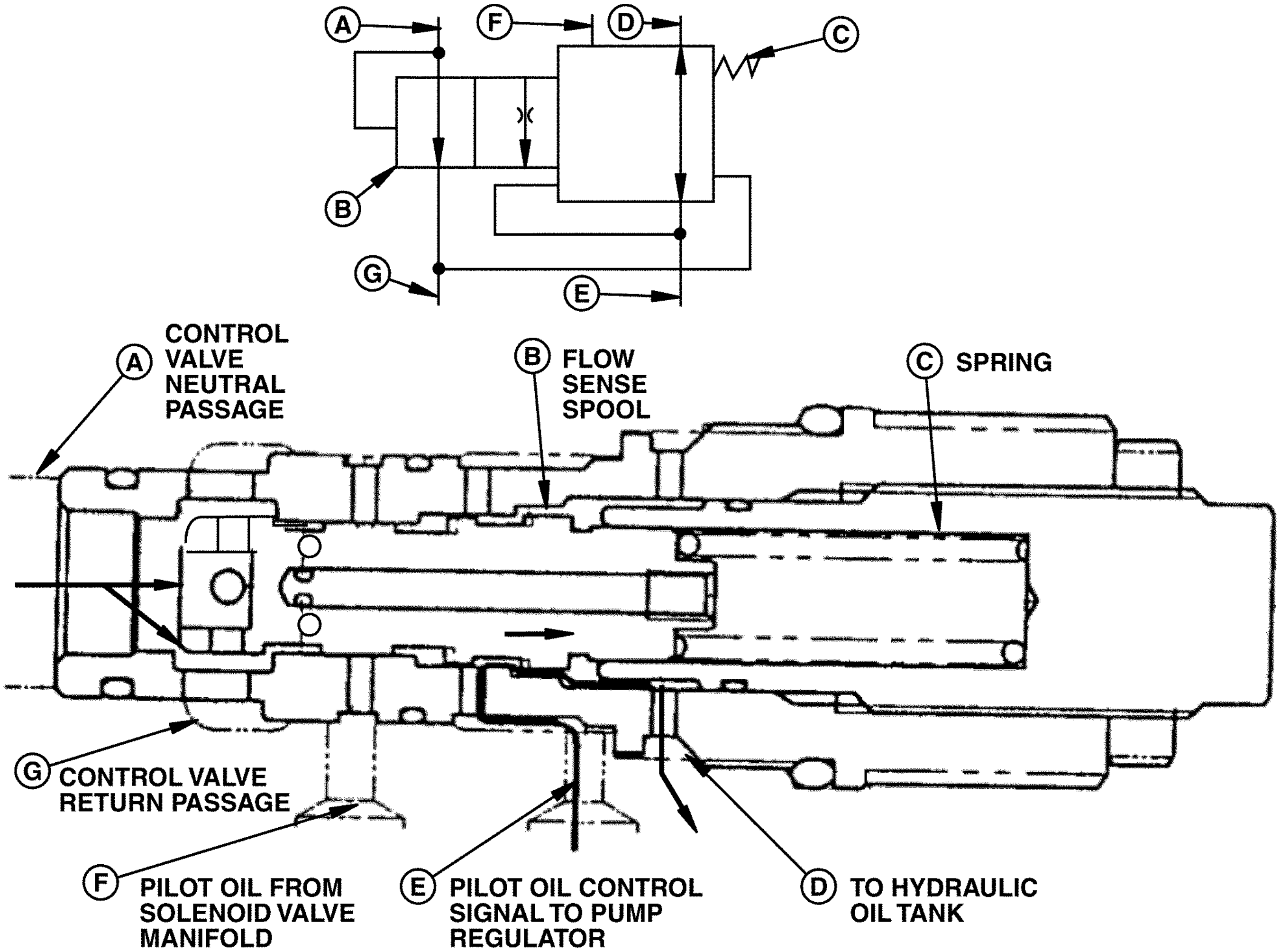
Continued on next page

Theory of Operation

During anticavitation operation, the oil pressure in the work port passage (L) and behind the main poppet (C) becomes less than the pressure in the return passage (K). The higher pressure of return oil acts on the sleeve outer shoulder pushing the sleeve, main poppet, and piston against the springs opening the anticavitation valve. Return oil flows from the return passage flows into the work port passage preventing cavitation.

CED,TX08227,3122 –19–12MAY98–2/2

PUMP CONTROL VALVE OPERATION



H PUMP CONTROL VALVE - NEUTRAL

T115356

T115356 –19–05JUN98

A pump control valve (H) is located at the downstream end of the control valve neutral passage (A) in the right and left control valves. The function of pump control valve is to send regulated pilot oil control signal to the front and rear pump regulators (E) to change pump flow in response to the actuation of control valve spools. (See Hydraulic Pump Regulator Operation in this group.)

Continued on next page TX,9025,GG2512 –19–17NOV97–1/3

Control Valve Spools in Neutral—When all the control valve spools are in neutral the neutral passage (A) through the control valve is not restricted and all oil flow from the pump flows through the neutral passage and pump control valve to the control valve return passage (G). The oil flow shifts the flow sense spool (B) against the spring (C) connecting the passages so the pilot oil control signal can flow from the pump regulator (E) to the hydraulic oil tank (D). The flow of pilot oil control signal to the hydraulic oil tank decreases the control signal to the pump regulator. The decreasing pilot oil control signal causes the pump displacement (flow) to decrease. The pumps are at minimum displacement in neutral. (See Hydraulic Pump Regulator Operation in this group.) As the pump flow through the neutral passage decreases, the flow sense spool is shifted back to the left by the spring.

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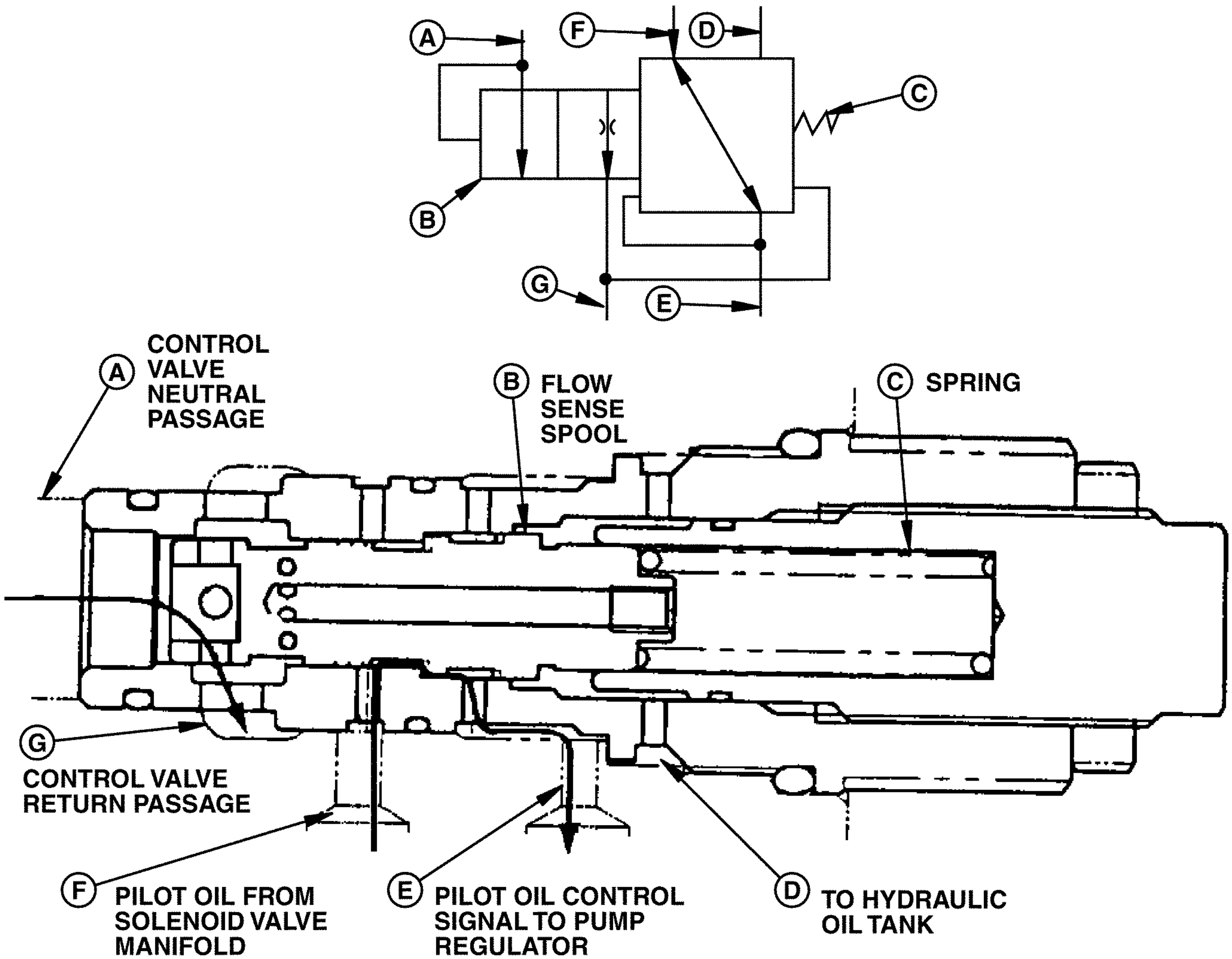


I PUMP CONTROL VALVE - ACTUATED

T115372

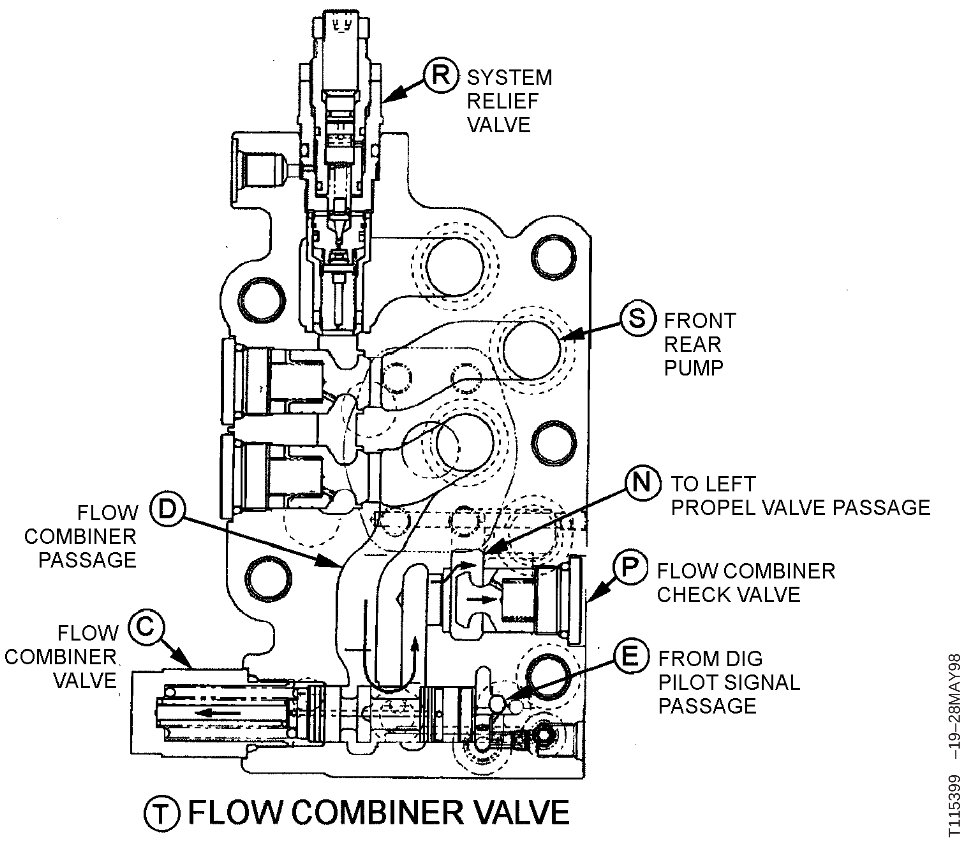
T115372 –19–05JUN98

Control Valve Spool Actuated—Actuating a function shifts the control valve spool routing some pump flow to the function and decreasing oil flow through the control valve neutral passage (A) and pump control valve (I). For combine functions, both the front and rear pump control valves operate to control their respective pump flow. As flow through the pump control valve decreases, the spring (C) pushes the flow sense spool (B) to the left connecting the passages for pilot oil to flow from solenoid valve manifold (F) to the pump regulator (E). As the pilot oil control signal to pump regulator increases, the pump displacement (flow) increases. (See Hydraulic Pump Regulator Operation in this group.)

In addition the pilot oil control signal to pump regulators is senses by the pump control pressure sensors. The sensors send an electrical signal to the engine and pump controller for the propel speed change function. (See Propel Motor Speed Change Circuit Operation in this group.)

TX,9025,GG2512 –19–17NOV97–3/3

FLOW COMBINER VALVE OPERATION



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The function of the flow combiner valve (I) is to ensure machine does not mistrack during combined propel and dig function operation by routing supply oil from the front pump (D) to the left (A) and right (G) propel motors.

Pilot oil from the pilot pump (F) flows through the orifice, into dig pilot signal passage (E), past each dig function valve spools, and then to the return circuit. The flow combiner valve (C) and swing park brake release valve (D) are connected to the signal passage between orifice and valve spools. (See Control Valve Pilot Signal Passages Operation in this group.)

When one or more dig functions are actuated, the flow of pilot oil through dig pilot signal passage to return is blocked by a valve spool (arm I valve shown) (M). The pressure in blocked portion of signal passage increases shifting the flow combiner valve and swing park brake release valve.

Actuating the propel function in combined operation with a dig function now routes the supply oil from the front pump (J) to the right propel valve (H) and through the flow combiner valve to the left propel valve (O). The dig functions, other than bucket, are supplied with oil from the rear pump (K). Supply oil for the bucket function is through the flow combiner valve. Check valve (P) prevents back flow through the flow combiner valve.

When just the propel function is actuated, the left propel valve is supplied with oil from the rear pump (K) and the right propel valve is supplied with oil from the front pump (J).

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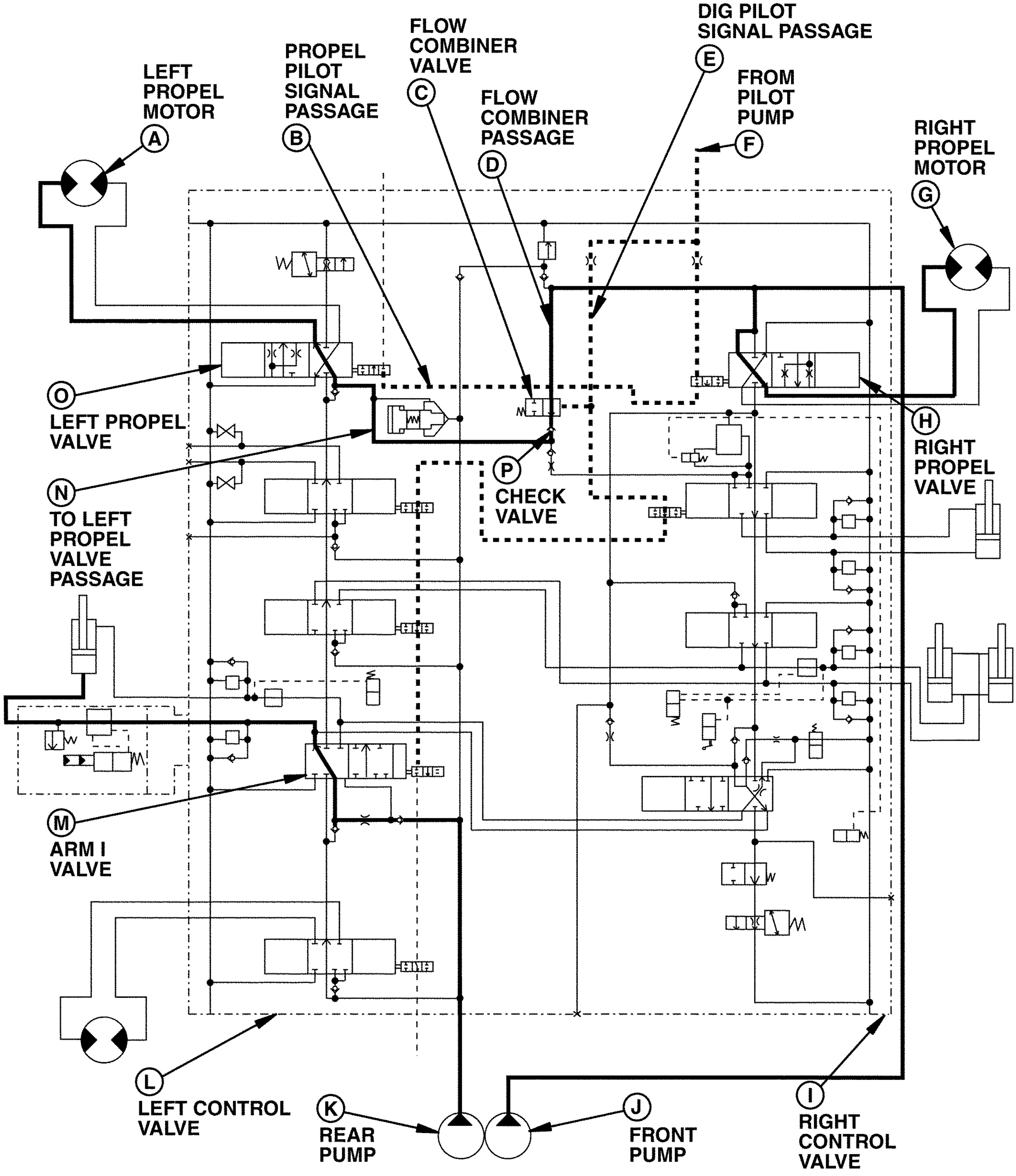
CED,TX08227,3123 –19–13MAY98–1/2



T115400

Q FLOW COMBINER VALVE CIRCUIT

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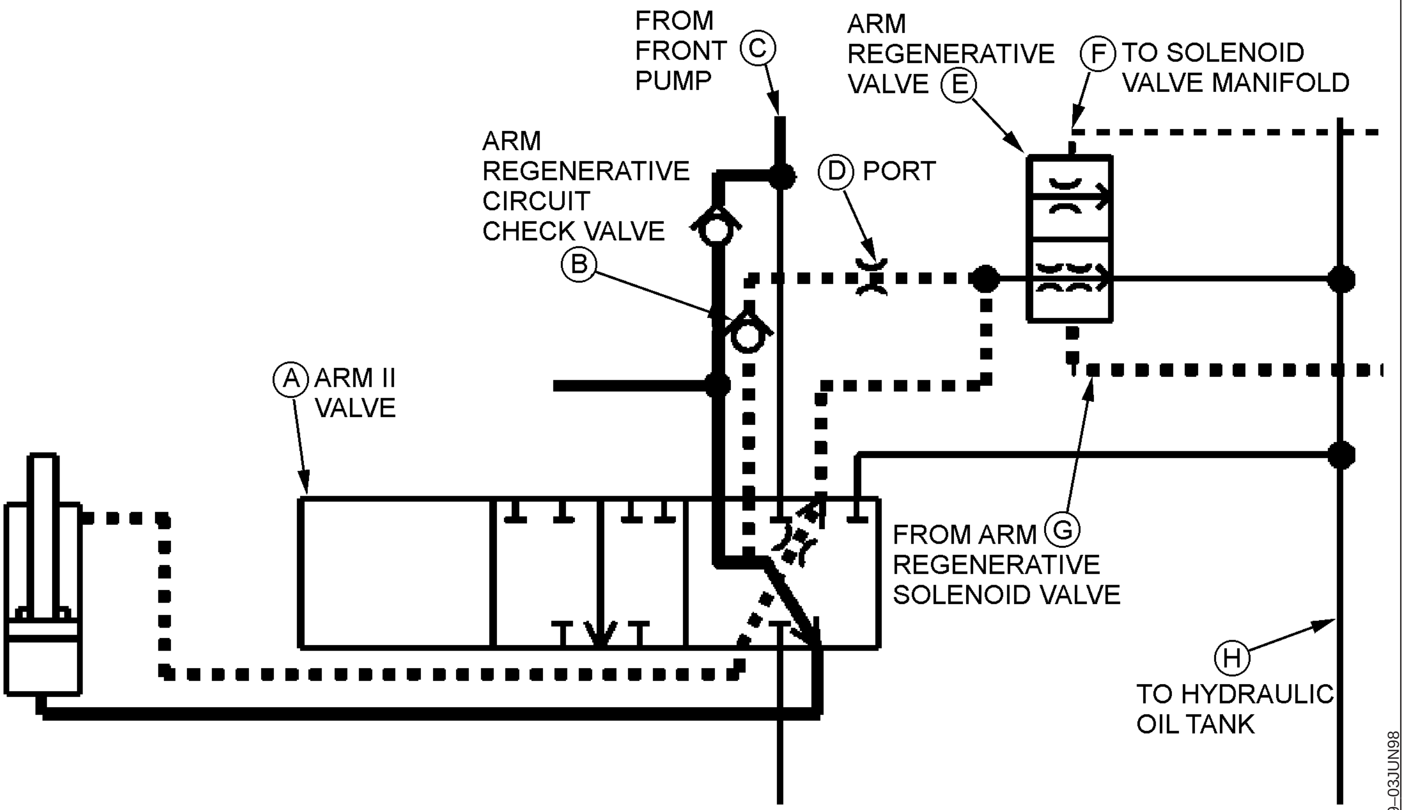
ARM REGENERATIVE VALVE OPERATION



T115695

(I) ARM REGENERATIVE VALVE CIRCUIT

The arm regenerative valve (I) is used to improve arm controllability and prevent arm cylinder cavitation during arm IN operation by combining the return oil from arm cylinder rod end with the pump supply oil to the arm cylinder head end. The arm regenerative function does not operate in the grading and precision work modes.

Under the following operating conditions: low rear pump delivery pressure, high pilot pressure to the pilot cap for arm in, and boom up actuated, gravity can pull the arm in faster than the pumps can supply oil to the arm cylinder head end. The operating conditions are sensed by the rear pump pressure sensor, arm in pressure sensor, and boom up pressure switch. The pressure switch and sensors send electrical signals to the engine and pump controller. The engine and pump controller sends an electrical signal to the arm regenerative solenoid valve to energizes the coil. The solenoid valve then sends a pressure signal (G) to the arm regenerative valve (E) shifting it. The orifices in the arm regenerative valve restrict the flow of return oil to the return passage. Some of the return oil from the rod end of arm cylinder now flows through port (D) and arm regenerative circuit check valve (B) to the head end of arm cylinder with the pump supply oil from the front pump (C). The port and check valve are located in the arm II valve (A) spool. Return oil not used flows through the orifices in the arm regenerative valve to the return passage.

There are two check valves located in the passages to the arm II valve to prevent back flow through the control valve. For arm in function, return oil flows through the arm II valve only.

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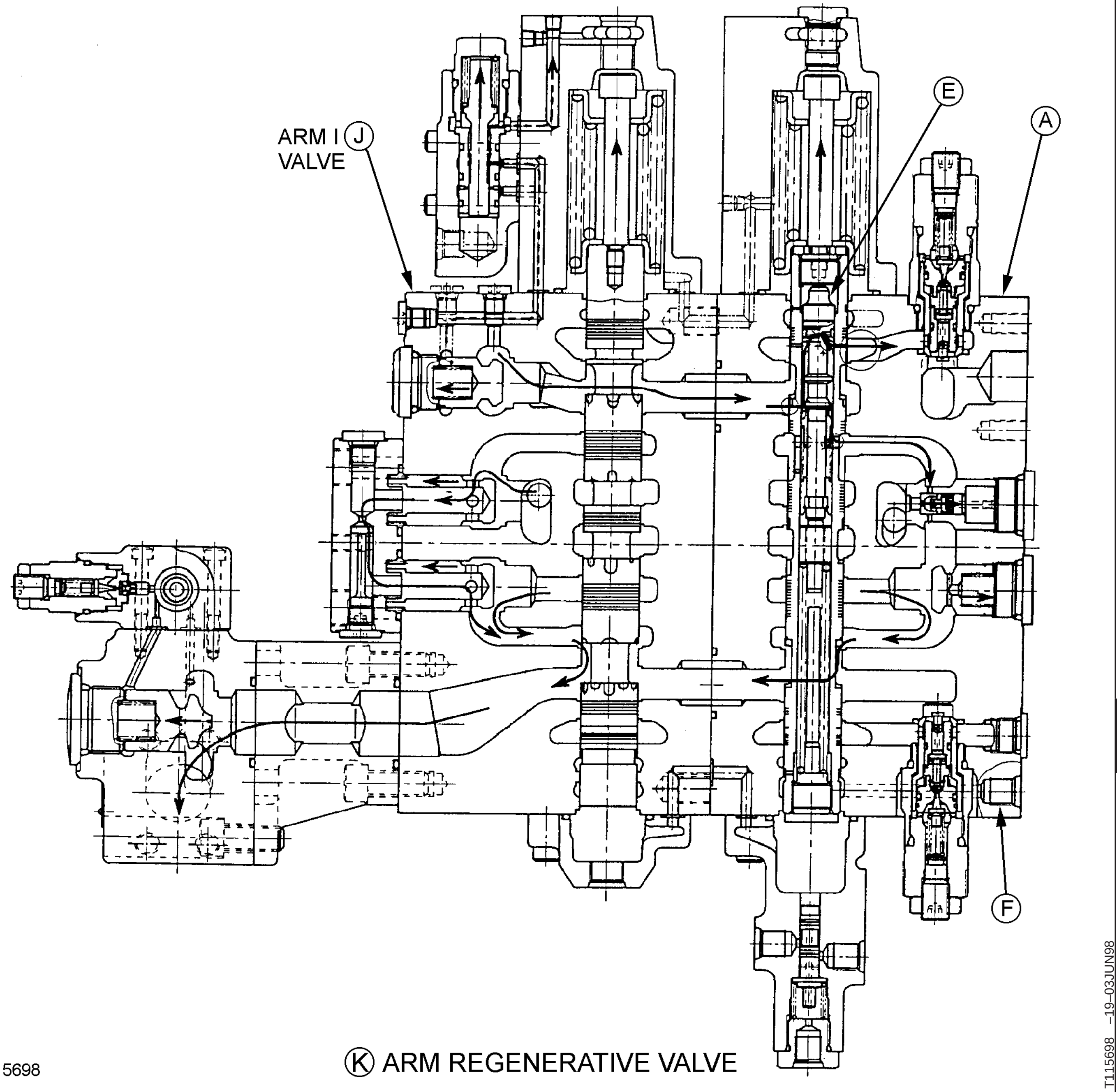
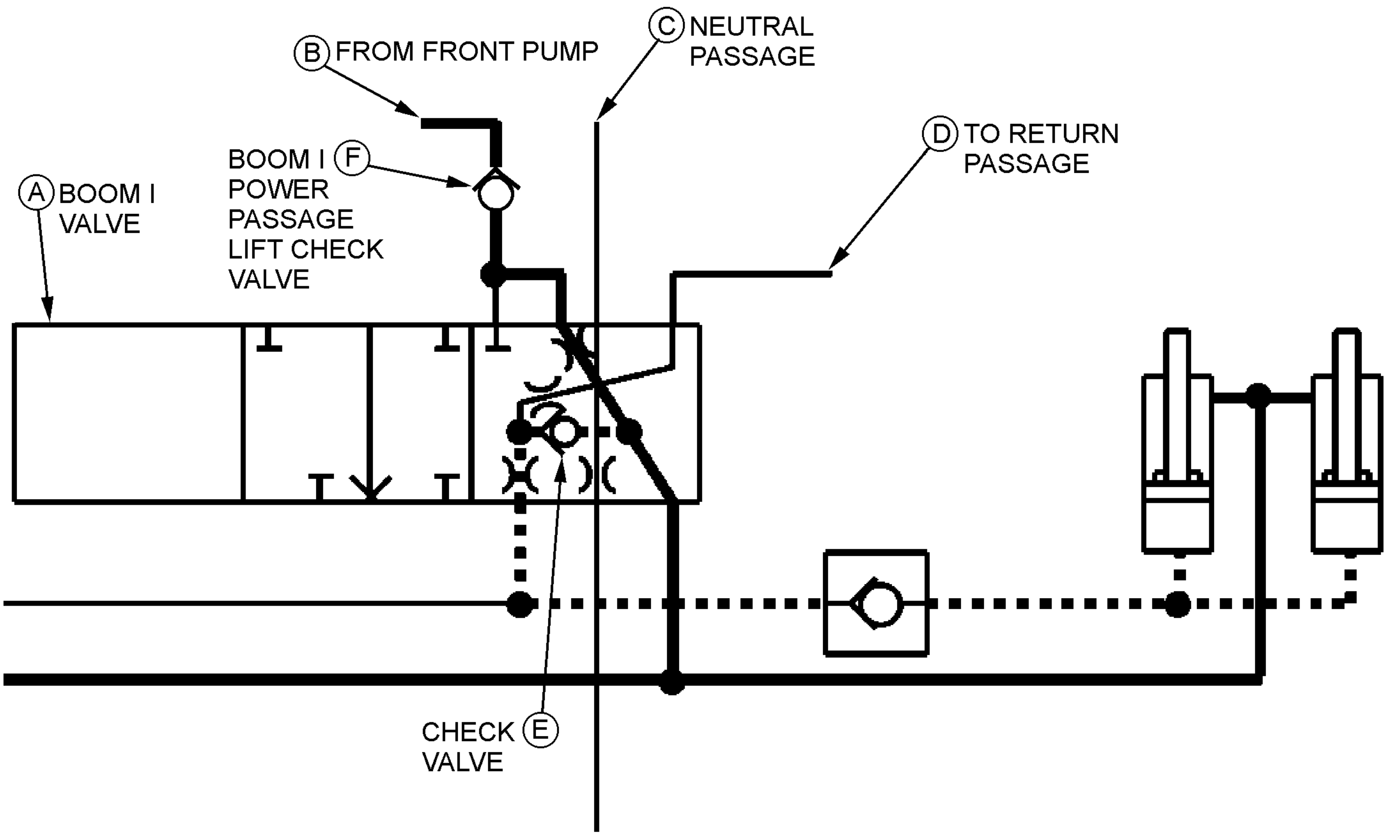


CED,TX08227,3163 –19–02JUN98–2/2

BOOM REGENERATIVE VALVE OPERATION



T115704 G BOOM REGENERATIVE VALVE CIRCUIT

The function of boom regenerative valve (J) during boom down operation is to combine the return oil from head end of boom cylinders with the front pump (B) supply oil to the rod end to prevent cavitation.

During boom down operation, if front pump supply oil pressure is lower than the return oil pressure from the head end the return oil pushes the boom regenerative valve check valve (E) open and flows to the rod end. All return oil from the head end of boom cylinders pushes the check valve (H) at the top of the boom I spool open and flows to the return passage (D).

The boom I power passage lift check valve (E) prevents back flow through the control valve.

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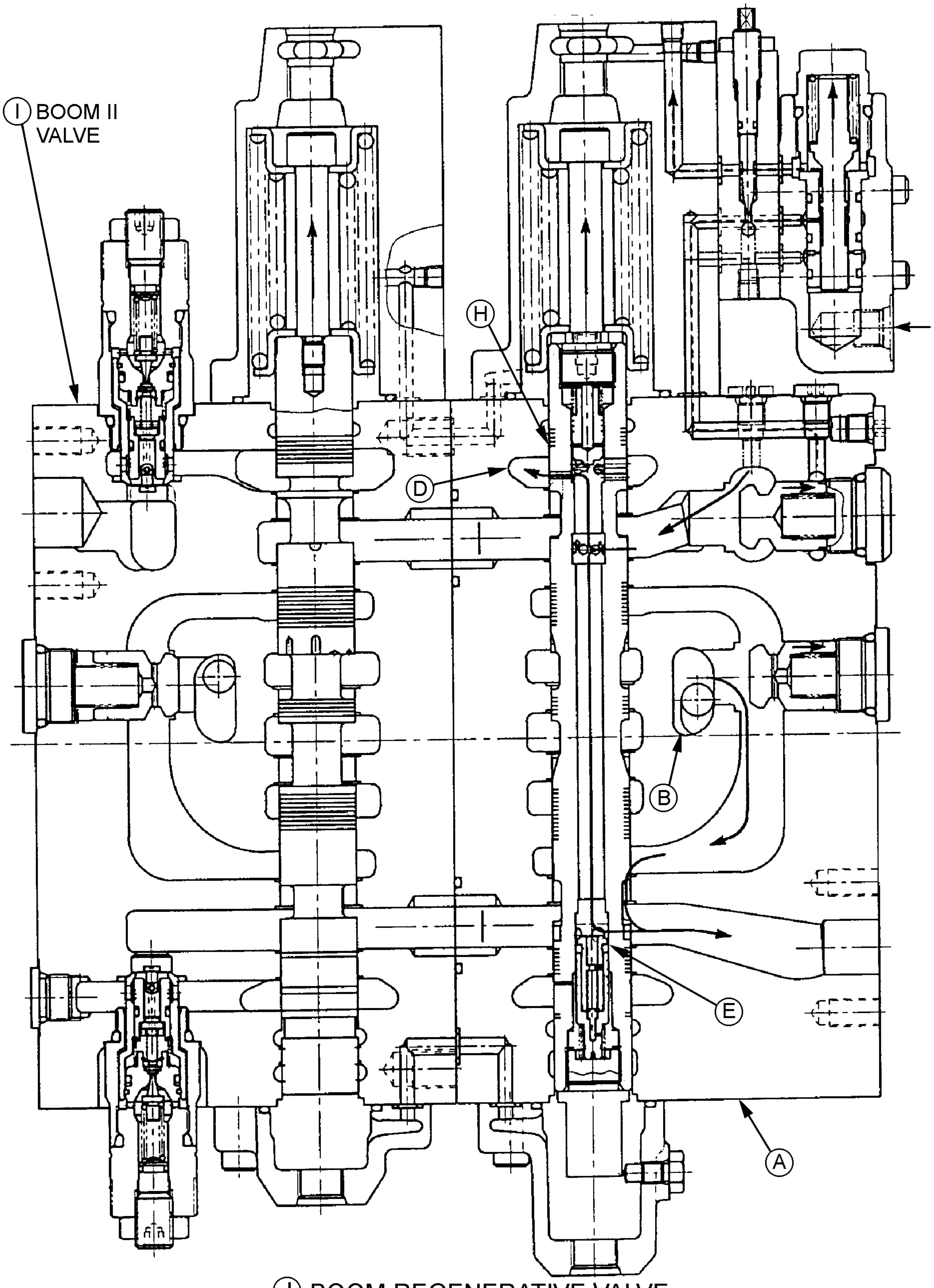


T115705

T115705 –19–03JUN98

ARM ROD END AND BOOM REDUCED LEAKAGE VALVES OPERATION

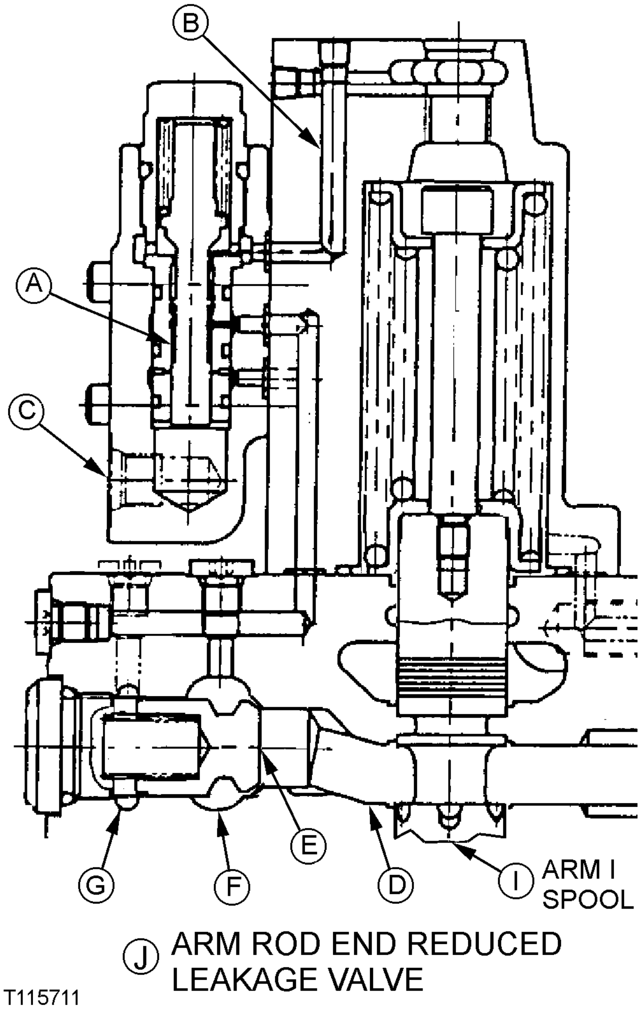
The function of a reduced leakage valve to reduce cylinder drift by reducing leakage from the cylinder back through the control valve.

Reduced leakage valves (H and J) are used in the arm rod end and boom head end circuits. The design and operation of the arm rod end and boom reduced leakage valve are the same. Arm rod end reduced leakage valve is shown. The boom reduced reduce leakage valve has a boom manual lower needle valve mounted between the leakage valve and pilot cap. (See Boom Manual Lower Needle Valve Operation in this group.)

In neutral, the pressure generated in the circuit to arm cylinder rod end (F) or boom cylinder head end by the load on the cylinder is applied to the check valve spring chamber (G) through the pilot valve (A). The check valve poppet (E) is held closed against the seat in housing.

Actuating the pilot controller for arm-in or boom down function also sends the pilot pressure signal (C) to shift the pilot valve (A). The pressure applied to the check valve spring chamber is released to hydraulic oil tank (B) through the pilot valve. The return oil flow from the pilot valve is through the warm-up and air bleed circuit in the pilot cap to the hydraulic oil tank. The return pressure from the cylinder pushes the poppet off its seat opening the passage for oil to flow to return. The poppet is pushed off its seat because the OD of the upper land at the head end of poppet is slightly larger than the lower land.

For arm out or boom up function, the pressure oil from the arm valve (D) or boom valve increases until it overcomes the pressure in the circuit to arm cylinder rod end (F) or boom cylinder head end opening the check valve poppet (E) so pressure oil flows to the cylinder.



T115711

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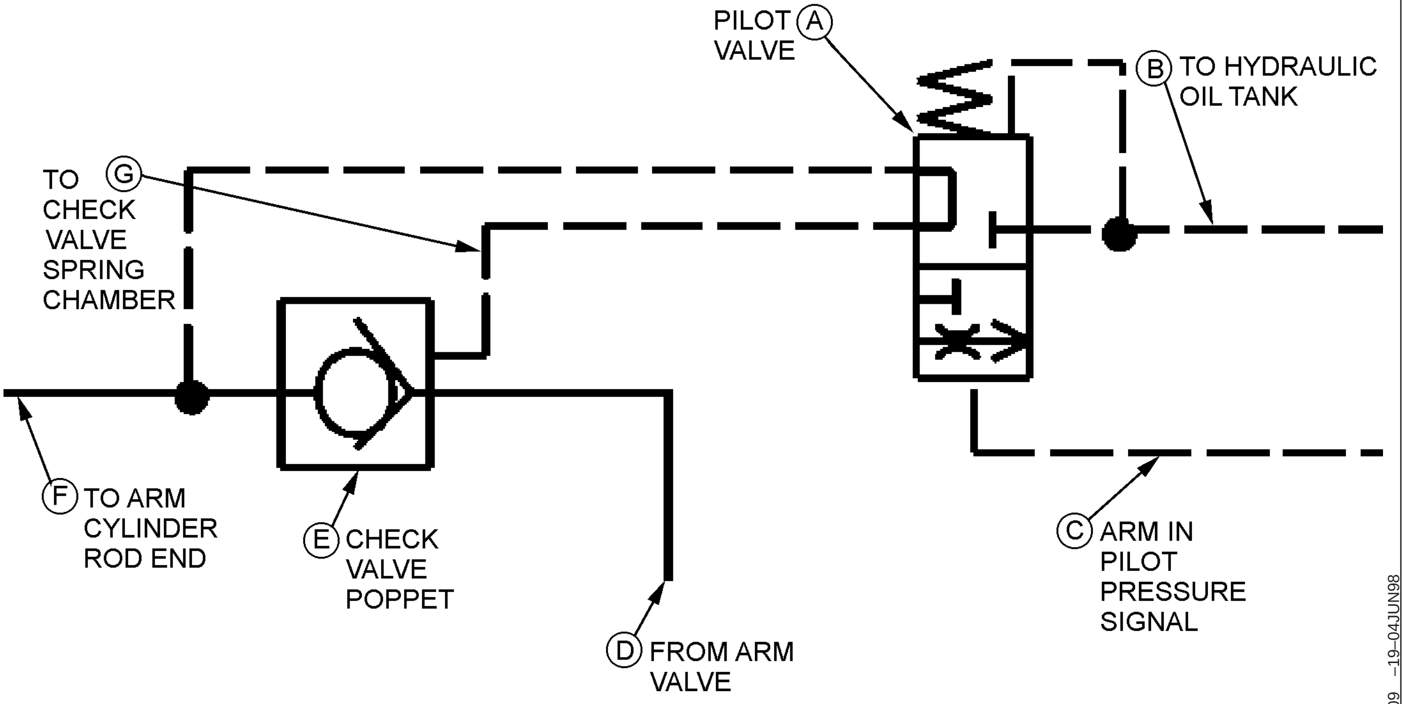
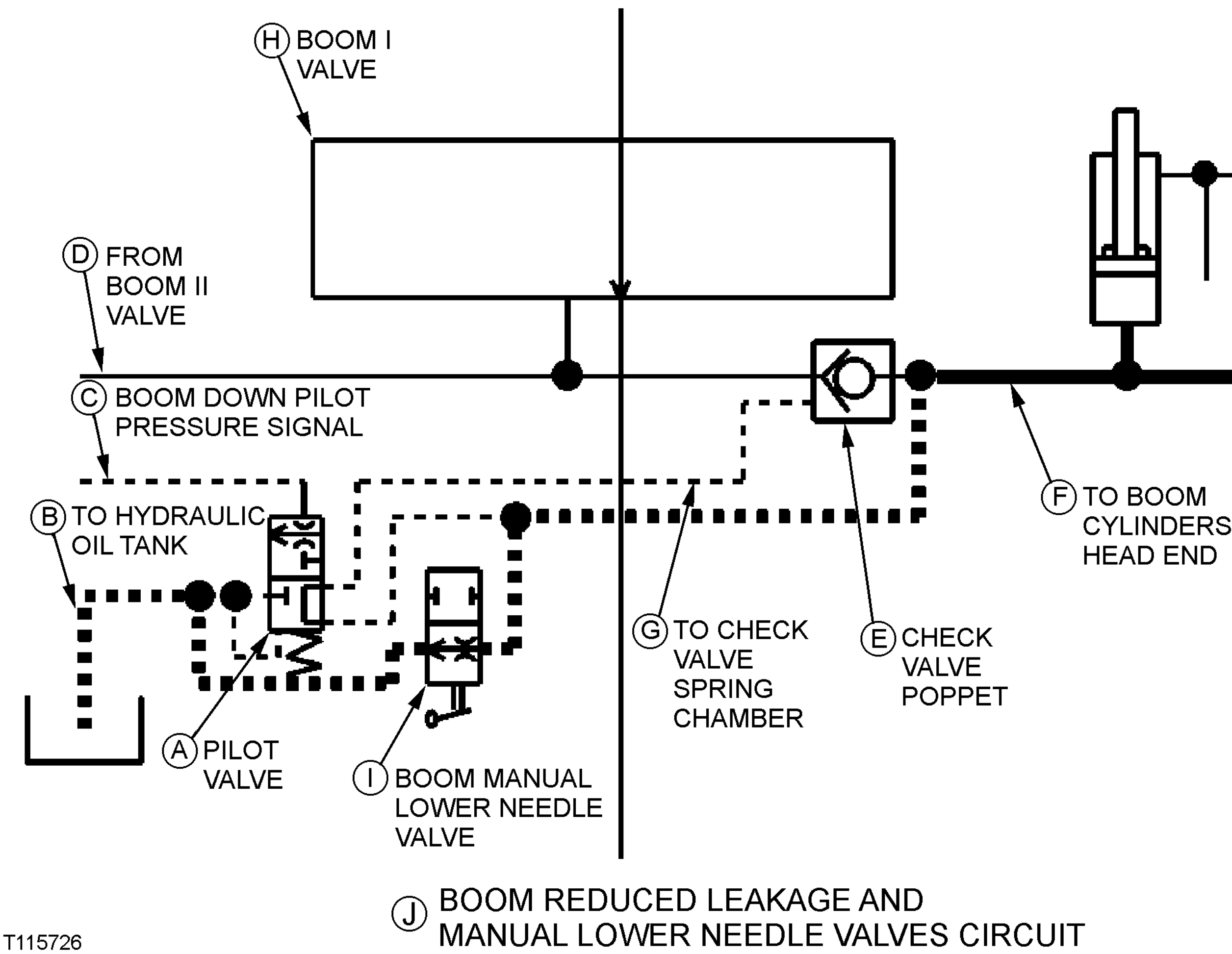
CED,TX08227,3165 –19–02JUN98–1/2



T115709 (H) ARM ROD END REDUCED LEAKAGE VALVE CIRCUIT

CED,TX08227,3165 –19–02JUN98–2/2

BOOM MANUAL LOWER NEEDLE VALVE OPERATION



T115726 –19–04JUN98

The function of the boom manual lower needle valve (I) is to release the pressure oil from the head end of boom cylinders to the hydraulic oil tank to lower the boom to the ground as needed. (See Lower Boom with Engine Stopped procedure in Group 9025-25.)

Opening the needle valve opens a passage for pressure oil from the head end of boom cylinders (F) to flow through the needle valve, into the warm-up and air bleed circuit in the pilot cap, and then to the hydraulic oil tank (B).

For operation of the boom reduced leakage valve, see Arm Rod End and Boom Reduced Leakage Valves Operation in this group.

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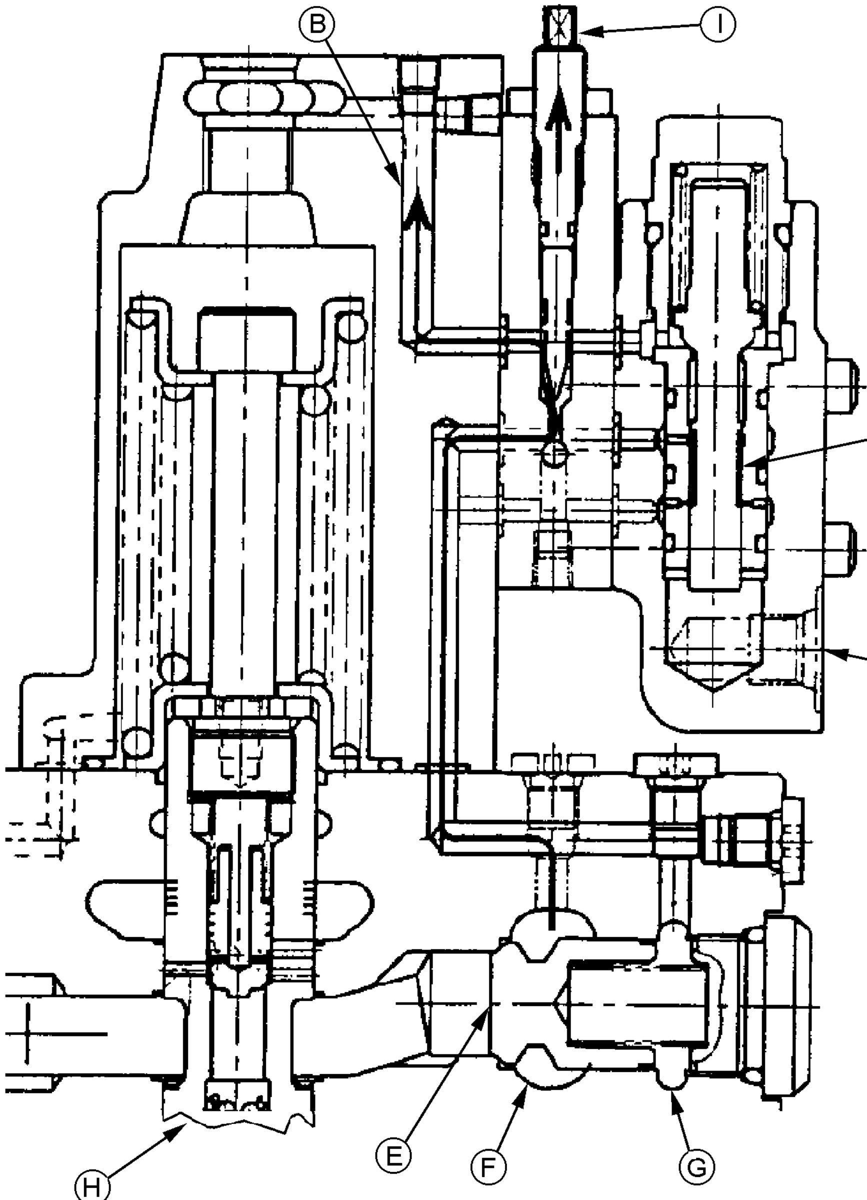
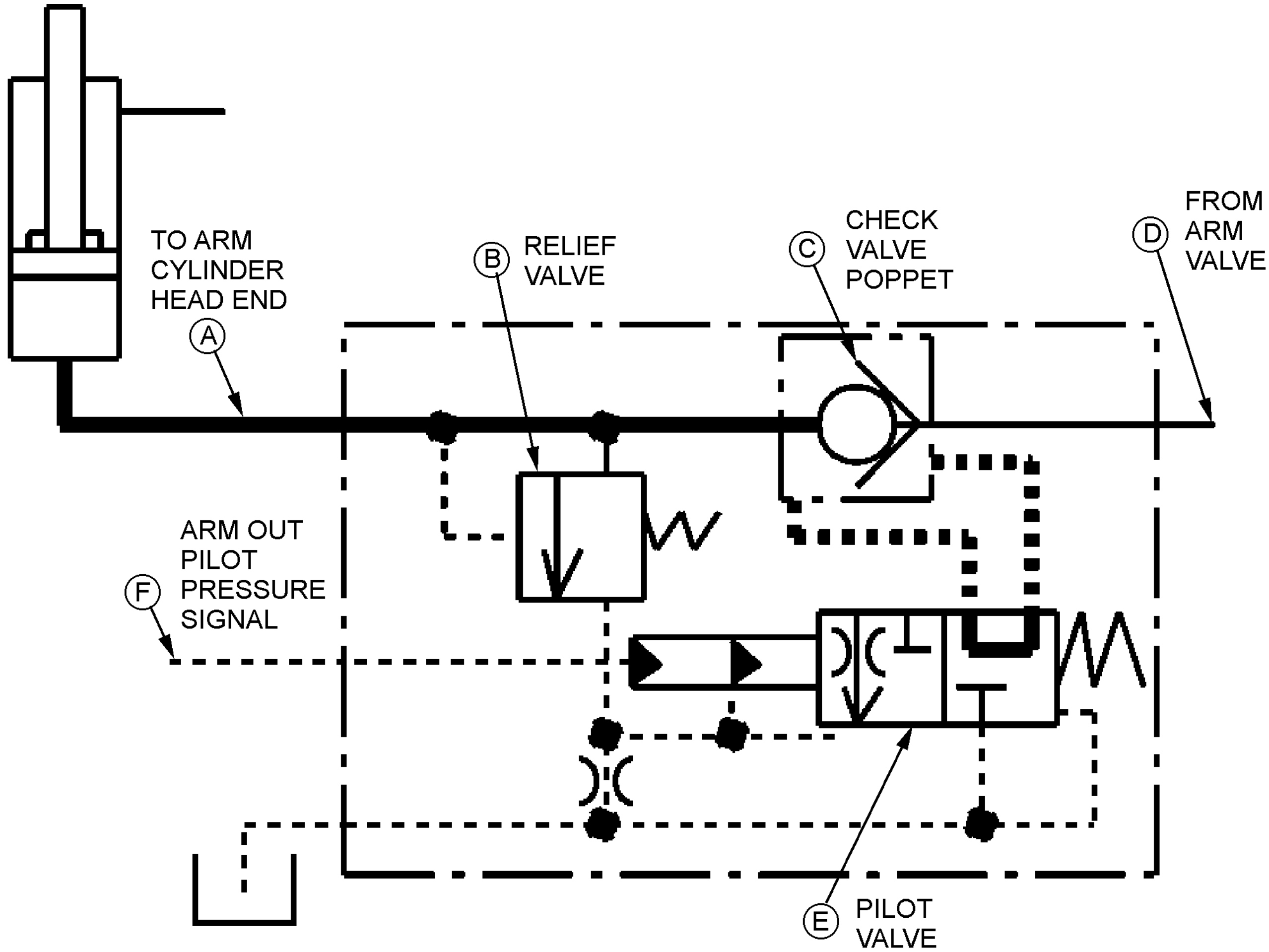


Ⓚ BOOM REDUCED LEAKAGE AND MANUAL LOWER NEEDLE VALVES

CED,TX08227,3166 –19–03JUN98–2/2

ARM HEAD END REDUCED LEAKAGE VALVE OPERATION



G ARM HEAD END REDUCED LEAKAGE VALVE CIRCUIT

T115732

T115732 –19–04JUN98

The function of the arm head end reduced leakage valve (G and H) to reduce cylinder drift by reducing leakage from the cylinder head end back through the control valve. The illustration shows the operation for arm-in function.

Actuating the pilot controller for arm-out function also sends the arm out pilot pressure signal (F) to shift the pilot valve (E). The pressure applied to the check valve poppet (C) spring chamber is released to hydraulic oil tank through the pilot valve (E). The return pressure from the cylinder head end pushes the poppet off its seat opening the passage for oil to flow to return. The poppet is pushed off its seat because the OD of the upper land at the head end of poppet is slightly larger than the lower land.

The relief valve (B) is used to protect the circuit in neutral.

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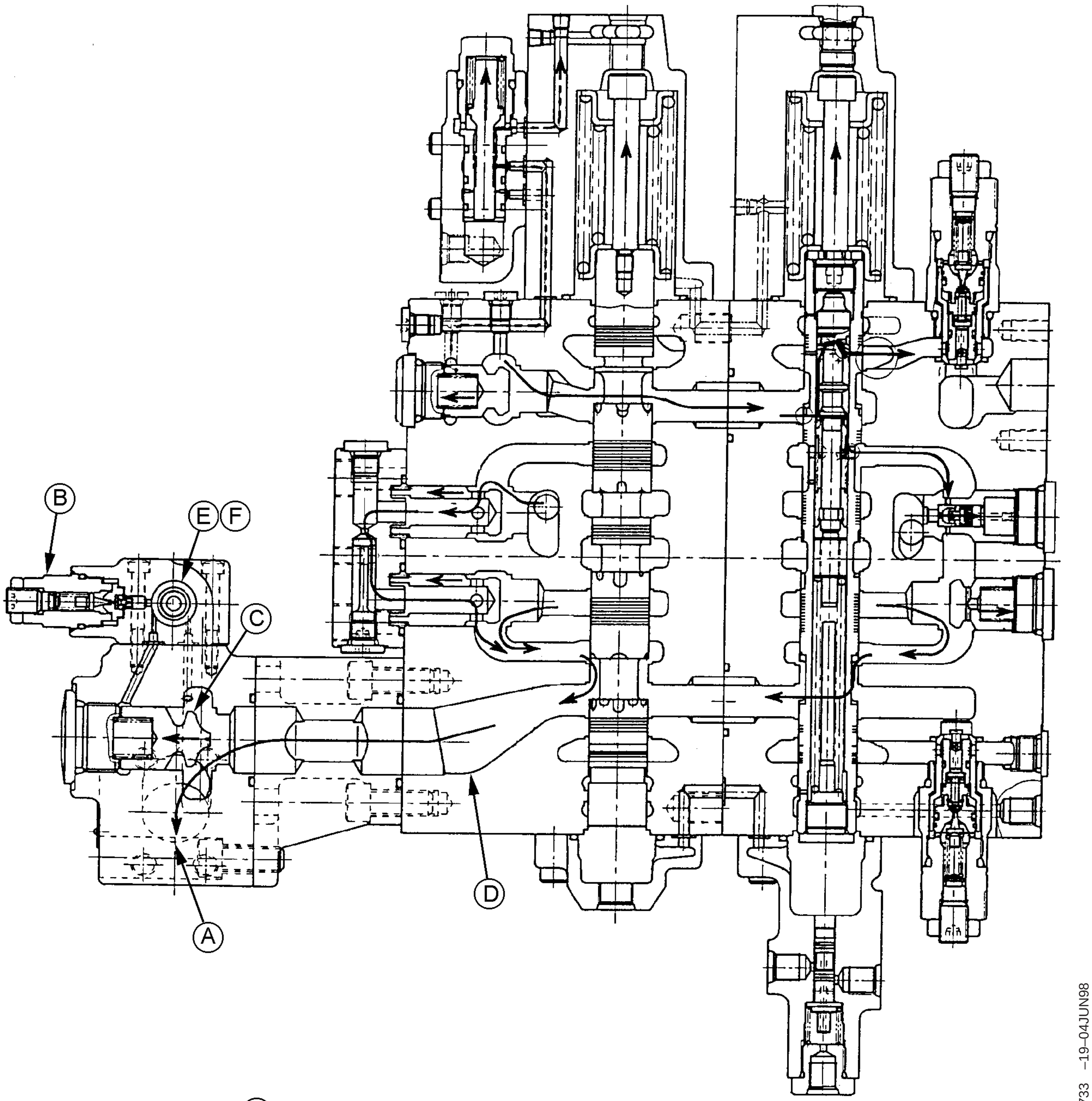
CED,TX08227,3167 –19–03JUN98–1/2

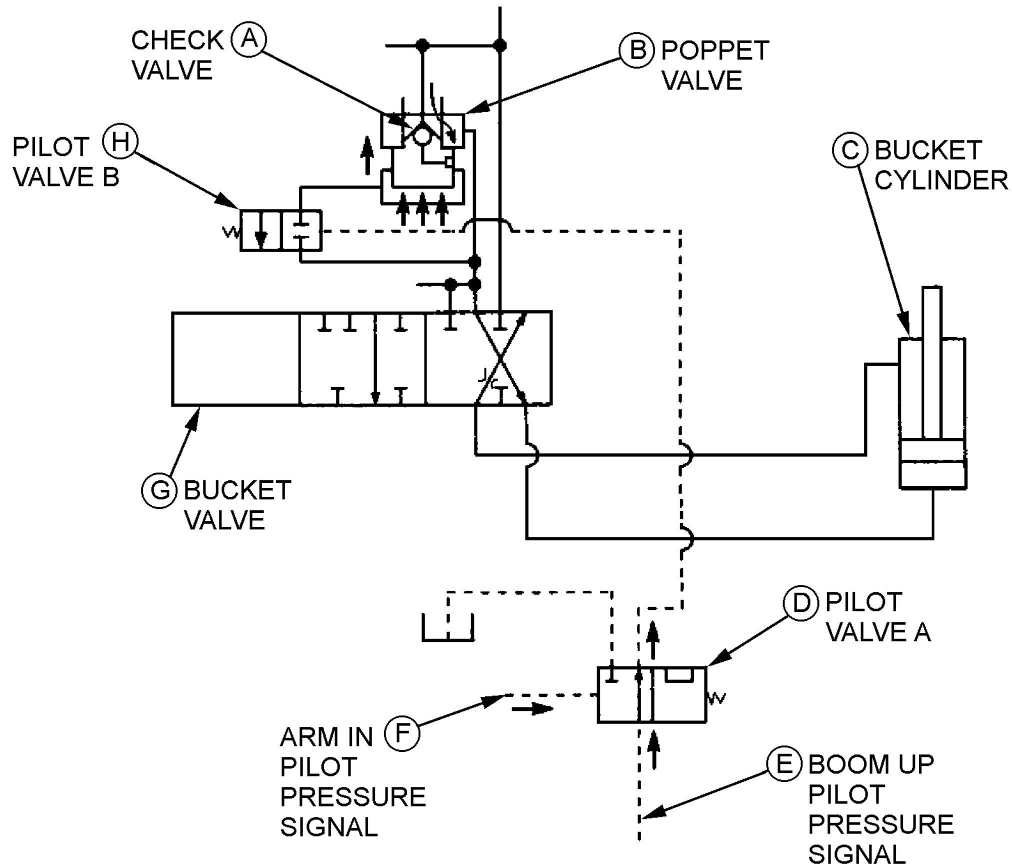


T115733

H ARM HEAD END REDUCED LEAKAGE VALVE

CED,TX08227,3167 –19–03JUN98–2/2

BUCKET FLOW CONTROL VALVE OPERATION



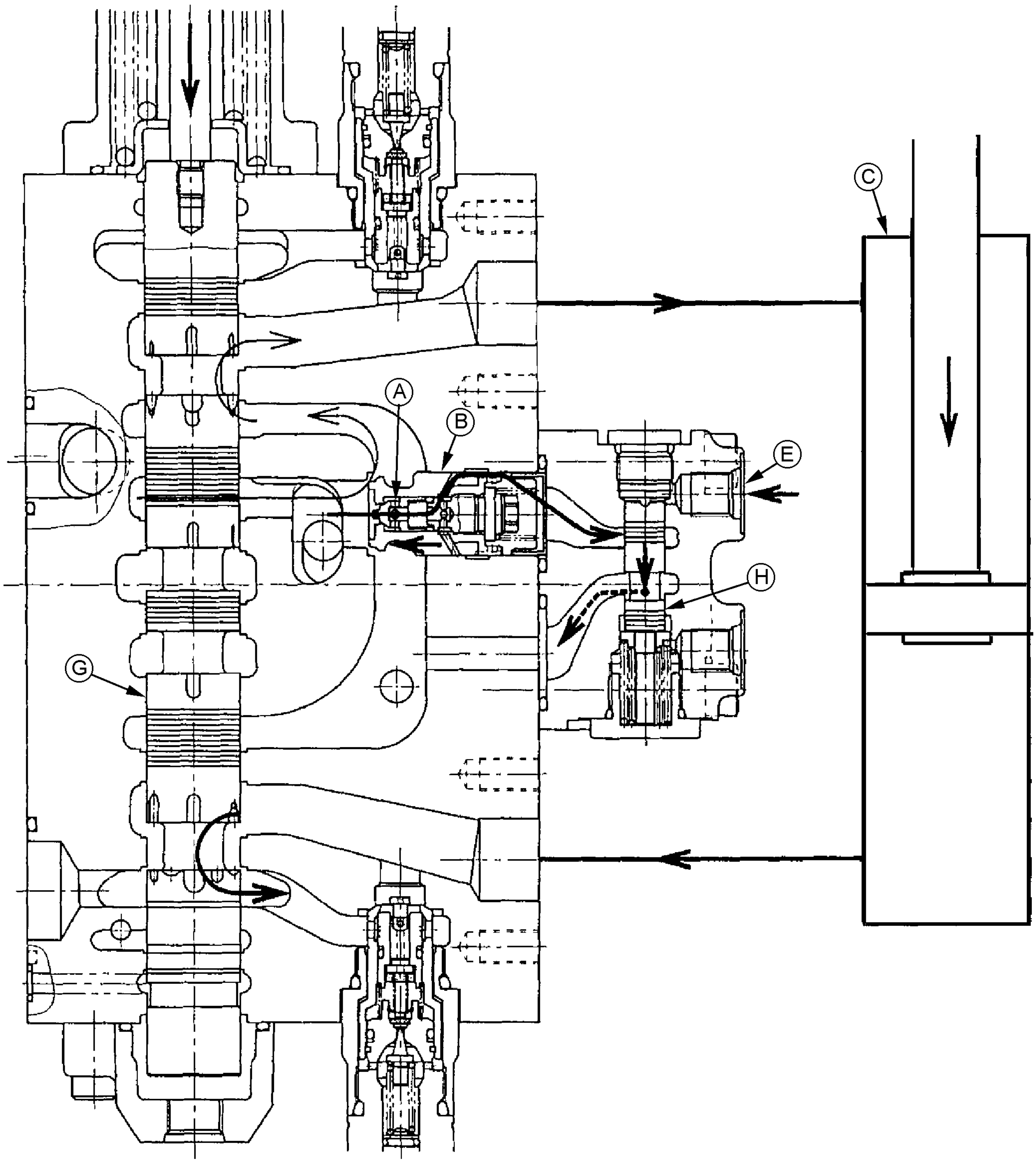
T115735 (I) BUCKET FLOW CONTROL VALVE CIRCUIT

T115735 –19–04JUN98

The bucket flow control valve (I and J) restricts oil flow to the bucket cylinder in the combined operations of bucket, arm in, and boom up to ensure supply oil flow goes to the higher-loaded boom function to raise the boom.

When arm in function is actuated the arm in pilot pressure signal (F) also shifts pilot valve A (D). If boom up function is actuated the boom up pilot pressure signal (E) flows through pilot valve A to shift pilot valve B (H) closing the passage from the poppet valve (B). The pressure on the back side of the poppet valve increases closing the poppet valve causing a restriction for supply oil flow through the poppet valve to the bucket valve (G). Pilot valve A (E) is located on the bottom pilot cap for Arm II valve.

Continued on next page CED,TX08227,3168 –19–03JUN98–1/2



T115736

Ⓙ BUCKET FLOW CONTROL VALVE

T115736 –19–04JUN98

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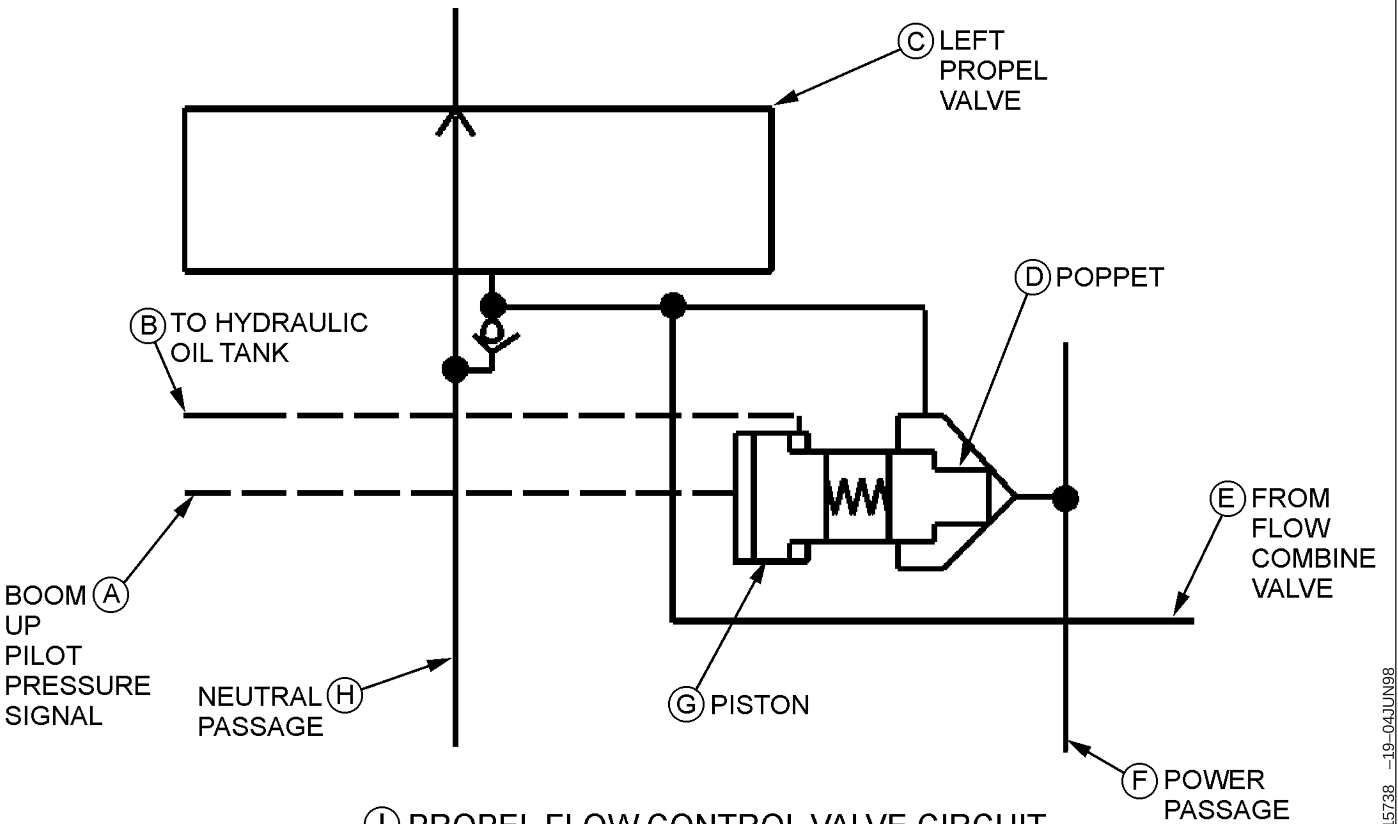
CED,TX08227,3168 –19–03JUN98–2/2

PROPEL FLOW CONTROL VALVE OPERATION



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T115738

I PROPEL FLOW CONTROL VALVE CIRCUIT

The function of propel flow control valve (I and J) is to restrict rear pump supply oil flow through the power passage (F) to the left propel valve (C) during combined operation of propel and boom up functions.

Actuating a dig function opens the flow combiner valve (E) so when used in combined operations with propel function supply oil from front pump goes to the propel valves and supply oil from the rear pump goes to the swing, arm, and boom functions. (See Flow Combiner Valve Operation in this group.)

When traveling on level ground or down a slope, the pressure to turn the propel motors can becomes less than what is needed to raise the boom. Therefore the pressure oil from the rear pump by the power passage (F) will flow to the lower pressure side of the left propel valve and not to the higher pressure side of boom II valve.

Actuating the boom up function also sends the boom up pilot pressure signal (A) to the piston (G) in the propel flow control valve. The piston is pushed to the right increasing the pressure on the poppet (D) by the spring. The poppet restricts the flow of supply oil from the power passage to the left propel valve to ensure there is enough pressure at the boom II valve for boom up operation.

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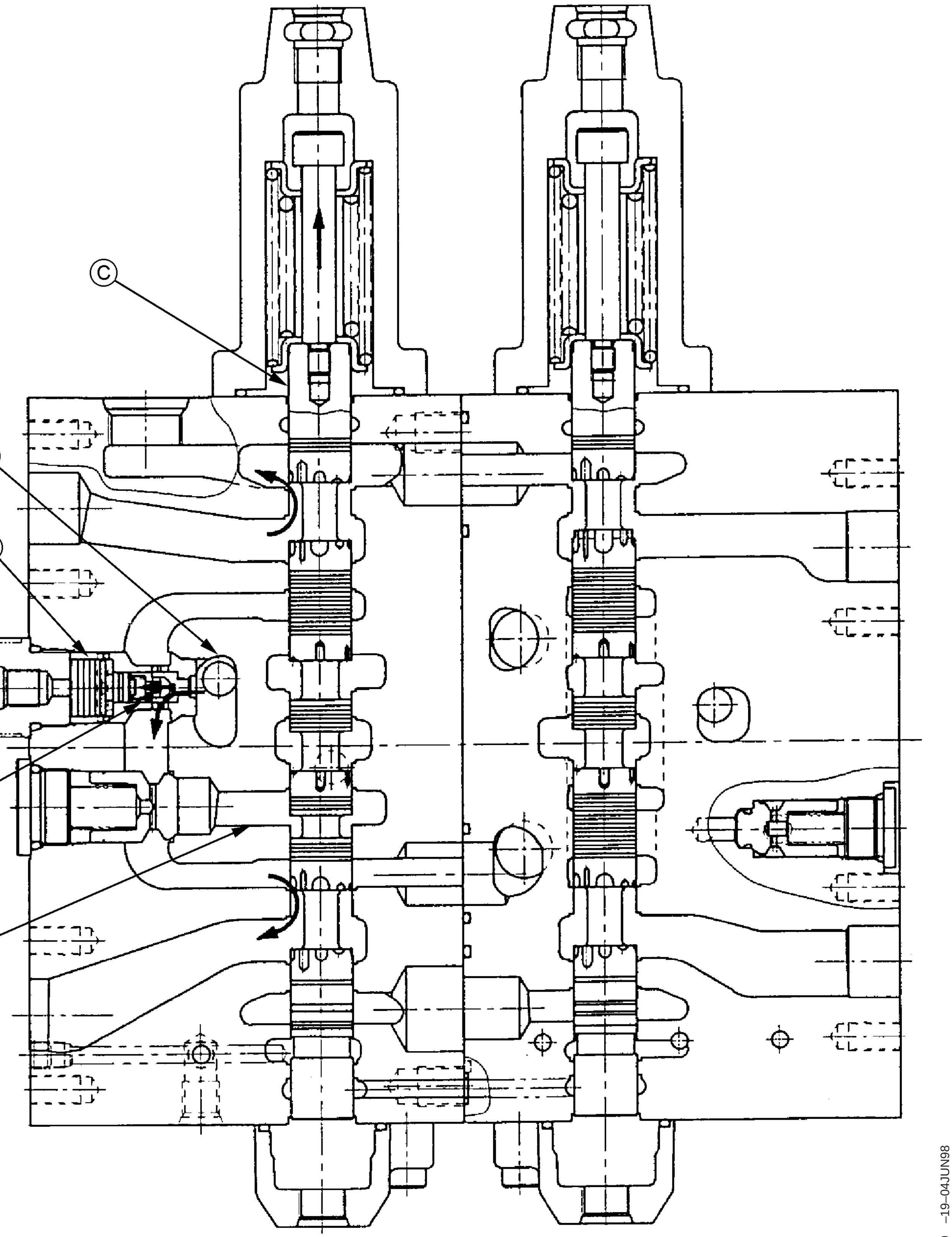
CED,TX08227,3169 –19–04JUN98–1/2



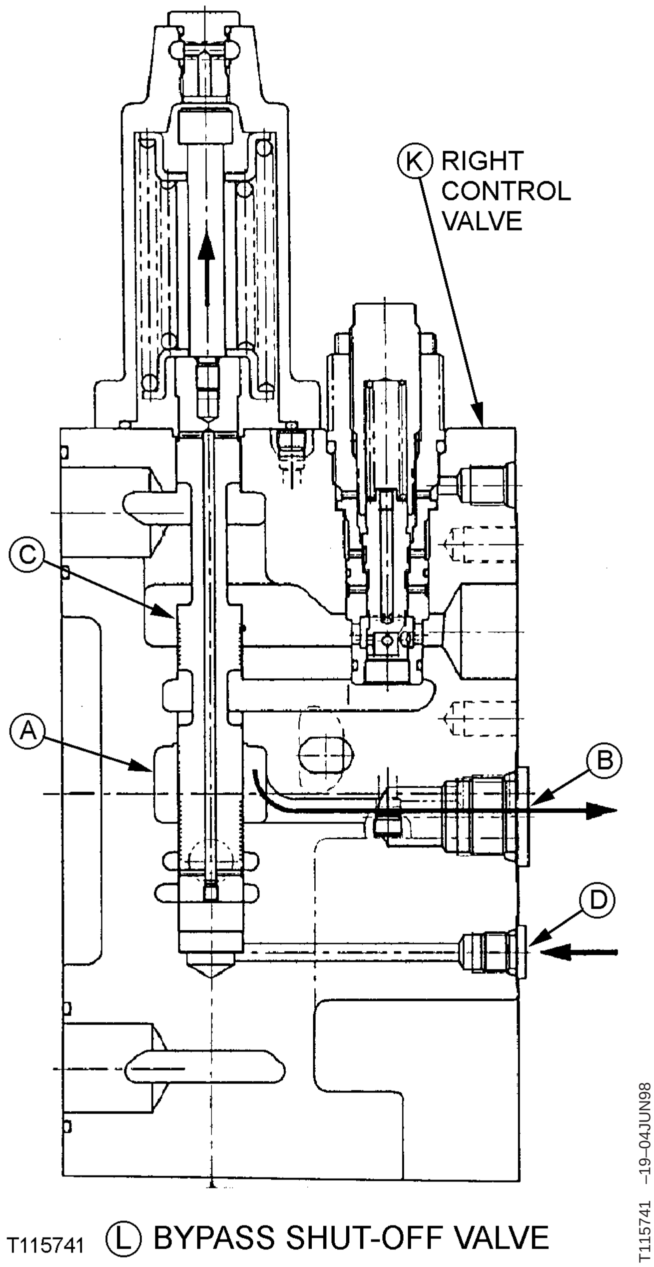
T115739

(J) PROPEL FLOW CONTROL VALVE

BYPASS SHUT-OFF VALVE OPERATION

The function of the bypass shut-off valve is to combined supply oil from the front pump (E) with supply oil from the rear pump (F) for attachment operated by the auxiliary valve (I).

Actuating the auxiliary function also sends the auxiliary pilot pressure signal (D) to the end of the bypass shut-off valve (C) spool shifting the spool up. The spool blocks the flow of supply oil through the neutral passage (A) and routes it by an external hose from the outlet (B) to the inlet (H) for the power passage to the auxiliary valve in the left control valve.



T115741 L BYPASS SHUT-OFF VALVE

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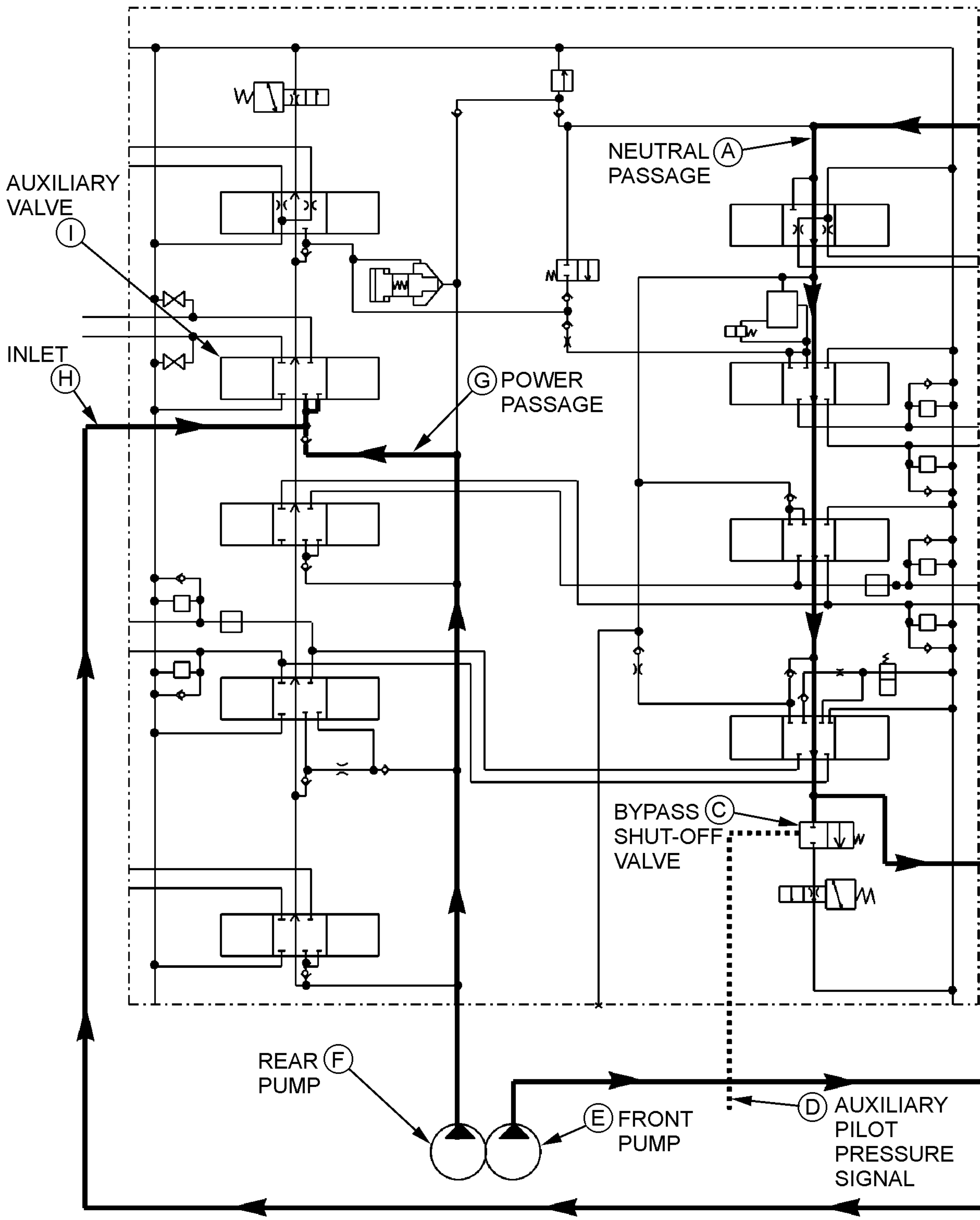

J BYPASS SHUT-OFF VALVE CIRCUIT

T115742 –19–04JUN98

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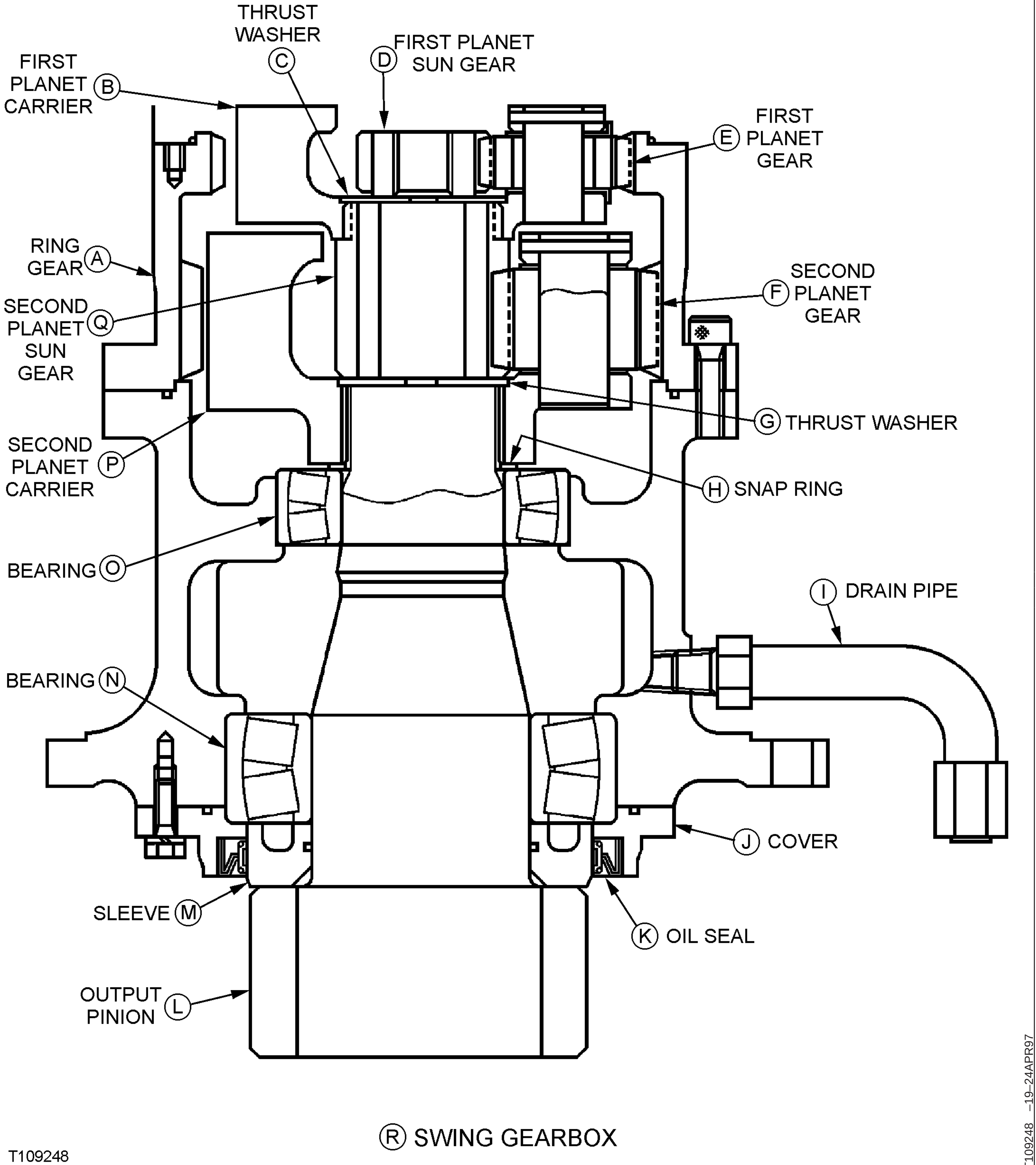
SWING GEARBOX OPERATION



Ⓡ SWING GEARBOX

T109248

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Theory of Operation

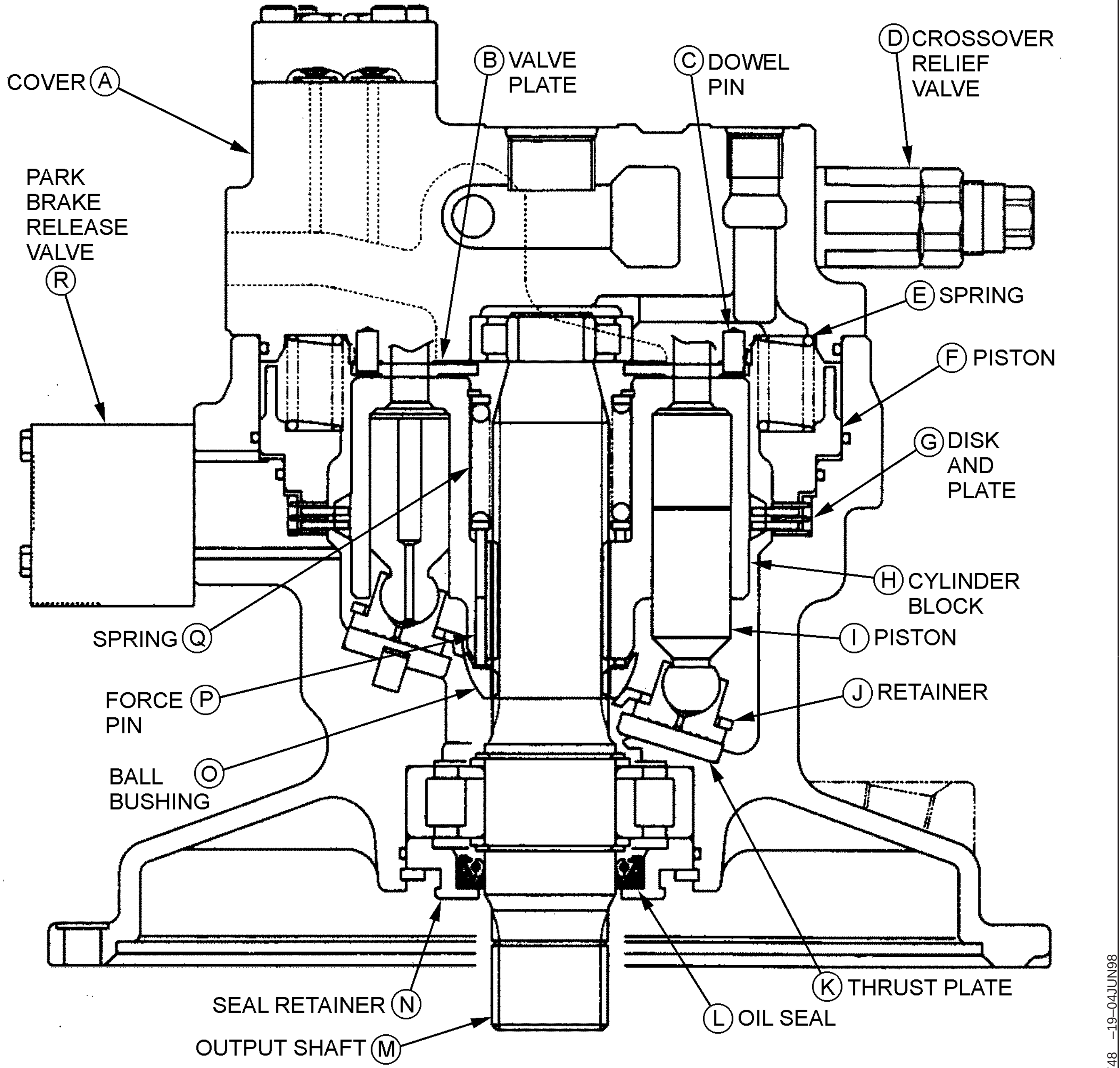
The swing gearbox (R) is a double reduction planetary drive type gearbox. The swing motor is mounted on the swing gearbox and encloses the top side of gearbox. The output pinion (L) is in mesh with the swing gear. Swing motor rotational speed is reduced by the double reduction planetary gear set.

The first planet sun gear (D) is connected to motor output shaft and is located between a retaining ring and thrust washer (C). The first planet gears (E) rotate around roller bearings on shafts in the first planet carrier (B). Rotation of the first planet carrier causes the second planet sun gear (Q) to rotate. The second planet sun gear is located between thrust washers (C and G). Second planet gears (F) rotate around shafts in the second planet carrier (P). The second planet carrier is connected to the output pinion (L) and this causes the output pinion to rotate.

The pinion rotates in two spherical roller bearings (N and O). Downward movement of pinion is prevented by a snap ring (H) seated against upper bearing. Upward movement is prevented by second sun pinion. Oil seal (K) prevents oil from leaking out of swing gearbox and keeps grease from coming in.

CED,TX08227,3171 –19–04JUN98–2/2

SWING MOTOR OPERATION



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(S) SWING MOTOR

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The swing motor (S) consists of the rotating group, park brake plates and disk (G), and cover (A). The cover contains the swing crossover relief valves (D), make-up check valves and inlet and outlet ports. The valve plate (B) is held in position by dowel pins (C) in the cover. The swing motor is a fixed displacement, axial piston, fixed position thrust plate motor. It is bidirectional so the upperstructure can swing in both directions.

Continued on next page

The rotating group consists of cylinder block (H), nine pistons (I). The cylinder block is connected to the output shaft (M). Each piston is connected to a slipper by a ball joint. Slippers slide on the inclined thrust plate (K) forcing the cylinder block to turn. The retainer (J) holds the slippers on the thrust plate and the retainer itself is held against the slippers by force pins (P) and springs (Q).

Oil from swing control valve is routed through cover (A), valve plate (B), and port in the cylinder block to the pistons.

In operation, high pressure supply oil enters the cylinder bores through ports forcing pistons down against the inclined thrust plate. The slippers slide down the inclined thrust plate causing the rotating group to turn. The output shaft is turned by the cylinder block. Swing speed varies depending on the amount of supply oil delivered by the pump through the control valve.

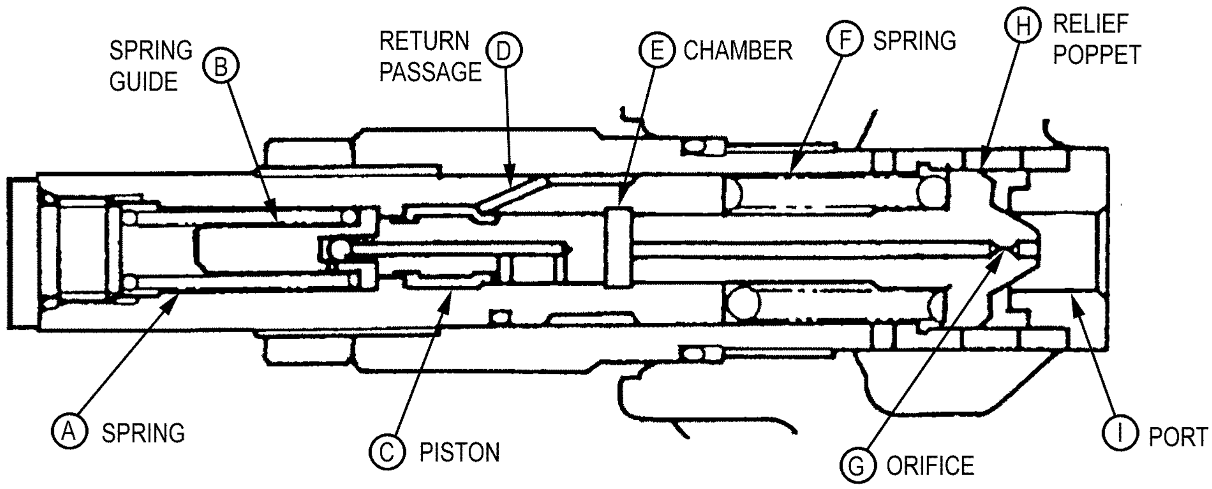
During the second half of motor’s revolution, low pressure oil is discharged as pistons slide back up the inclined thrust plate. To reverse rotation, oil flow is reversed. A small amount of supply oil flows through the center of each piston to the ball joint and the face of slippers for lubrication.

The motor is internally lubricated from leakage inside the motor. Lubrication oil is routed up through the cover to the hydraulic oil tank.

The swing motor park brake is spring applied and hydraulically released. The plates in the brake pack are connected to the housing. The disks are connected to and rotate with the cylinder block. When the pilot controllers are in neutral, pilot oil is blocked from the piston by the swing park brake release valve (R). The brake springs (E) squeeze the plates and disks together to prevent the upperstructure from swinging. The swing park brake is release when the swing, boom, arm, or bucket function is actuated. (See Swing Motor Park Brake Release Valve Operation in this group.)

CED,TX08227,3172 –19–04JUN98–2/2

SWING MOTOR CROSSOVER RELIEF VALVE OPERATION



(J) SWING MOTOR CROSSOVER RELIEF VALVE

The function of swing crossover relief valve (J) is to relieve the high pressure generated in the swing circuit when starting or stopping the swing operation. The oil pressure in the swing circuit becomes high because of the inertia of the upperstructure to starting and stopping.

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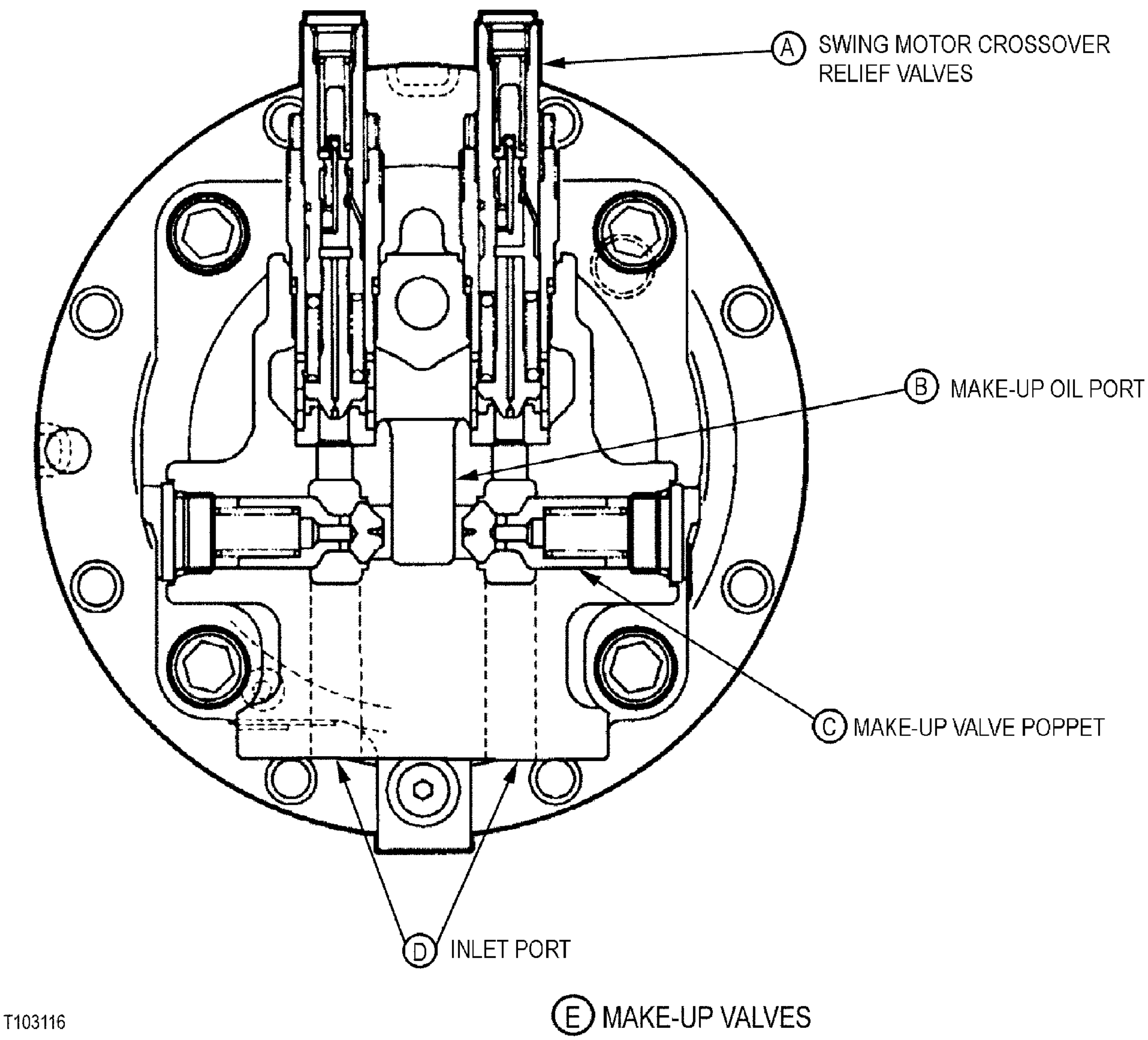
When the oil pressure in port (I) increases to the valve pressure setting, the relief poppet (H) is push off its seat to relieve pressure oil to return. The pressure is also sense in the chamber (E) through the orifice (G). The opening of the relief poppet is further dampen by the action of the piston (C), spring guide (B), and spring (A). Oil from the spring (A) chamber is release through the orifices in the spring guide and piston to the return passage (D). The relief poppet is push back to the right by the spring (F) and the pressure in the chamber.

CED,TX08227,3173 –19–04JUN98–1/1

SWING MOTOR MAKE-UP VALVE OPERATION



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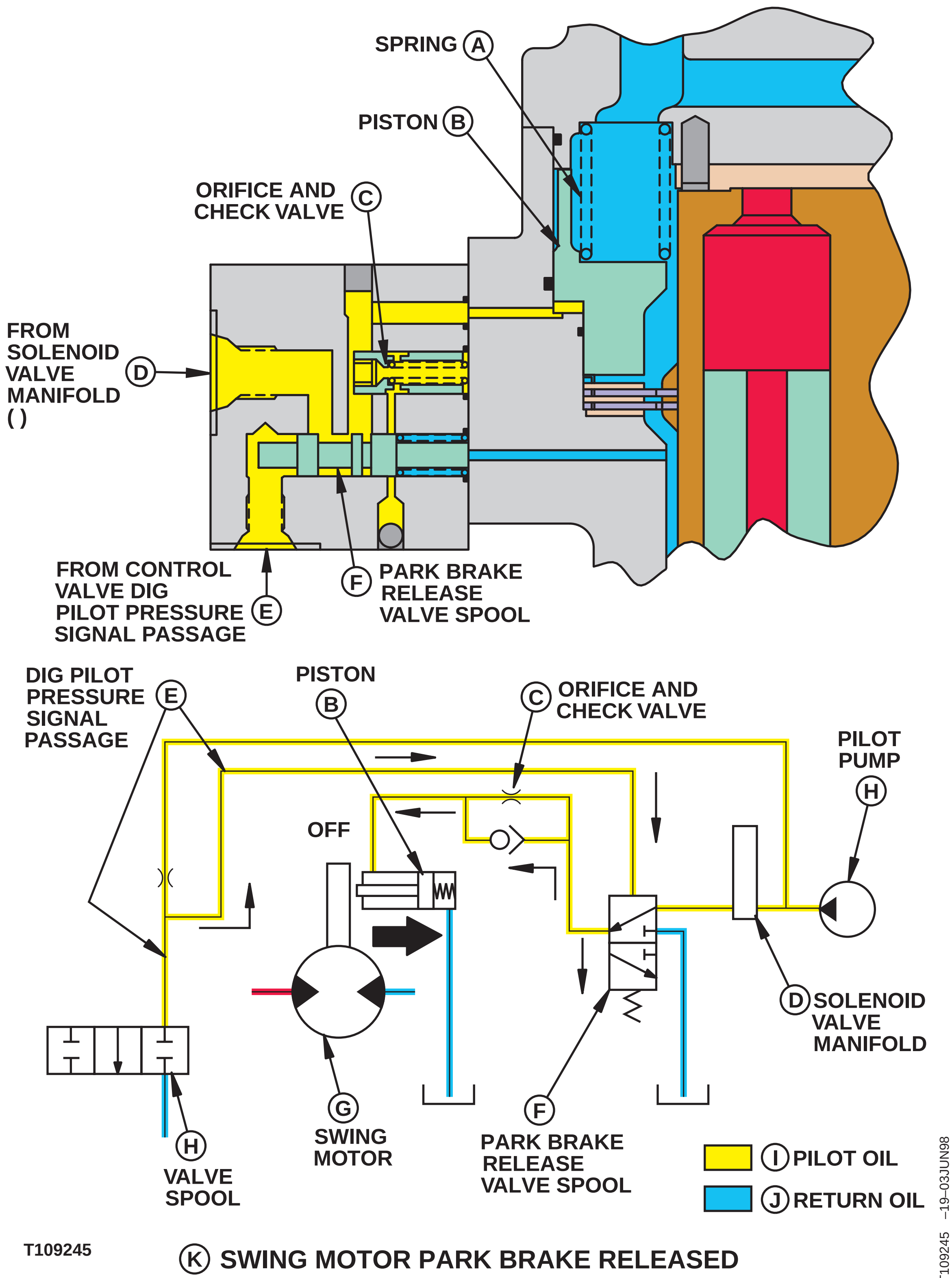
While stopping the swing function the control valve spools go to neutral and the lines to inlet ports (D) at the swing motor are blocked at the control valve. Because of the inertia of the upperstructure the oil pressure in one side of the swing motor becomes high. For a few seconds the motor acts like a pump. The relief poppet in the crossover relief valve opens to relieve the high pressure oil to the make-up oil port (B).

Because the lines to the motor are blocked the continued rotation of the upperstructure lowers the pressure the other side of motor until cavitation starts. When cavitation starts the make-up poppet (C) is pushed open by the return oil in the make-up oil port. The return oil flows in and prevent cavitation. The make-up oil port in connected to the return passage in the control valve. The return oil pressure is maintain by the restriction valve located downstream of the oil cooler.

TX,05,GG2196 –19–04JUN98–1/1

SWING MOTOR PARK BRAKE RELEASE VALVE OPERATION



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K SWING MOTOR PARK BRAKE RELEASED

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The function of park brake release valve spool (F) is to route pilot oil (I) to the piston (B) releasing the brake pack when a dig or swing function is actuated.

Swing Motor Park Brake Released (K): When swing or a dig function is actuated, the flow of pilot oil through dig pilot pressure signal passage (E) in the control valve is blocked by a valve spool (H). The dig pilot pressure signal increases and shifts the park brake release valve spool (F). Pilot pressure oil from the solenoid valve manifold (D) flows through the spool to piston (B) chamber. The pilot pressure oil pushes the piston up against the spring releasing the brake pack. The upperstructure is now free to turn.

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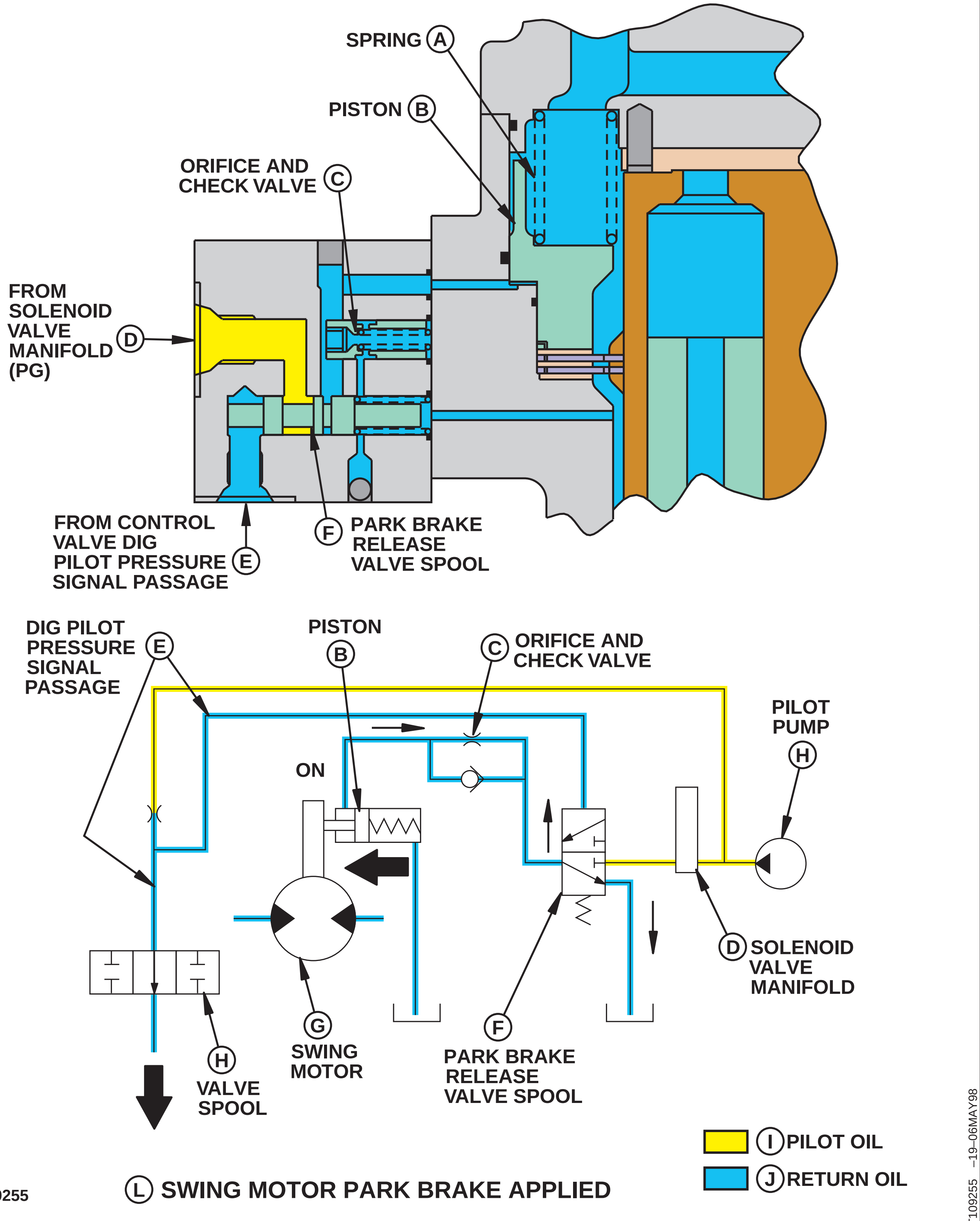

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L SWING MOTOR PARK BRAKE APPLIED

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CED,TX08227,3174 –19–04JUN98–3/4

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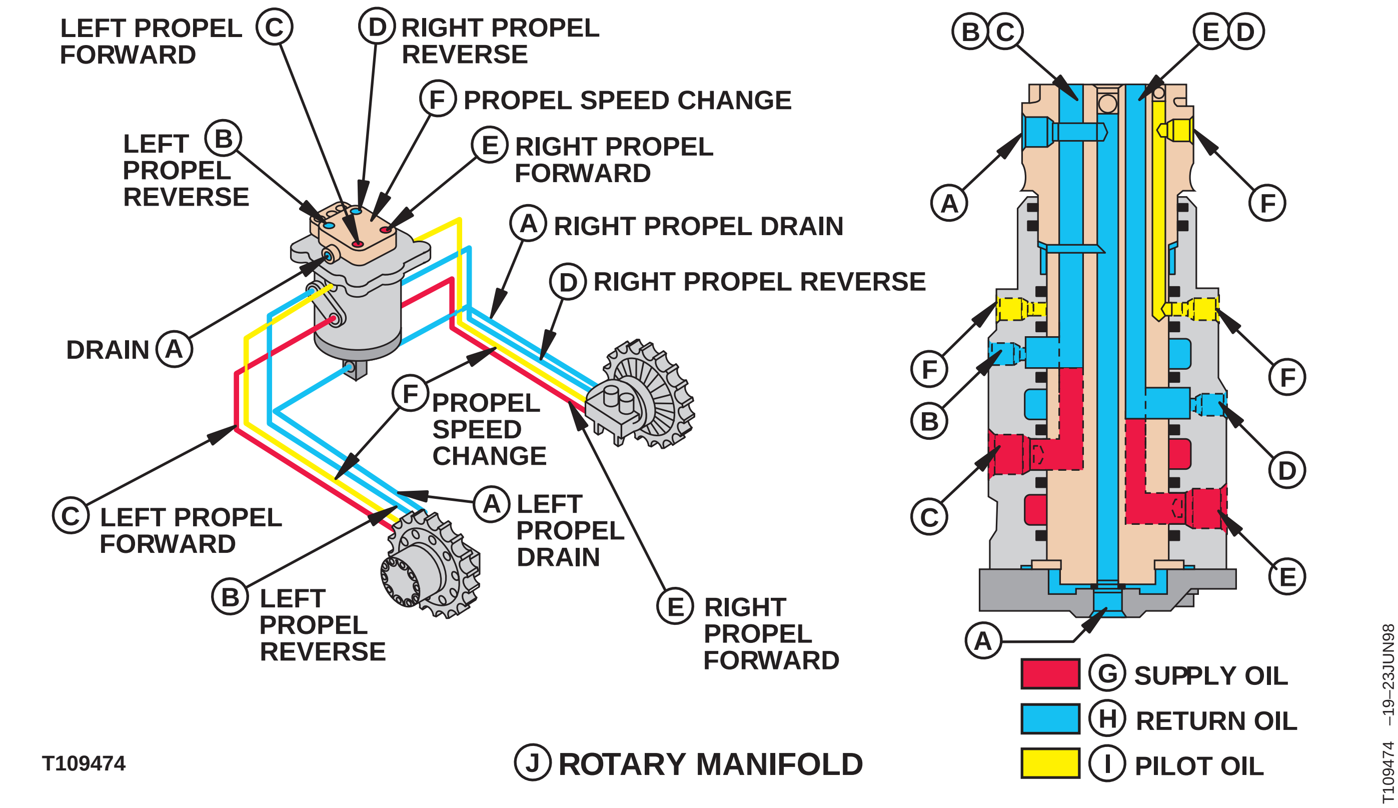
Swing Motor Park Brake Applied (L): When the valve spool (H) is returned to neutral, pilot oil flows through the dig pilot pressure signal passage (E) to the return passage causing the pressure signal to decrease. The park brake release valve spool (F) is shifted by the spring blocking the flow of pilot oil pressure to the piston (B) chamber. The oil in the piston chamber flows through the orifice and check valve (C) to return as the springs push the piston down applying the park brake. The oil is metered through the orifice to slow engagement to ensure that park brake is only fully applied after the upperstructure has stopped. The orifice and check valve is located in a block fasten to the side of the swing motor housing.

Pilot oil pressure is maintained at the park brake release valve spool (F) as long as the pilot shut-off valve in ON. The circuit for pilot oil pressure is from the pilot pump (H), through the pilot shut-off valve, solenoid valve manifold (D), and then to the release valve spool.

CED,TX08227,3174 –19–04JUN98–4/4

ROTARY MANIFOLD OPERATION



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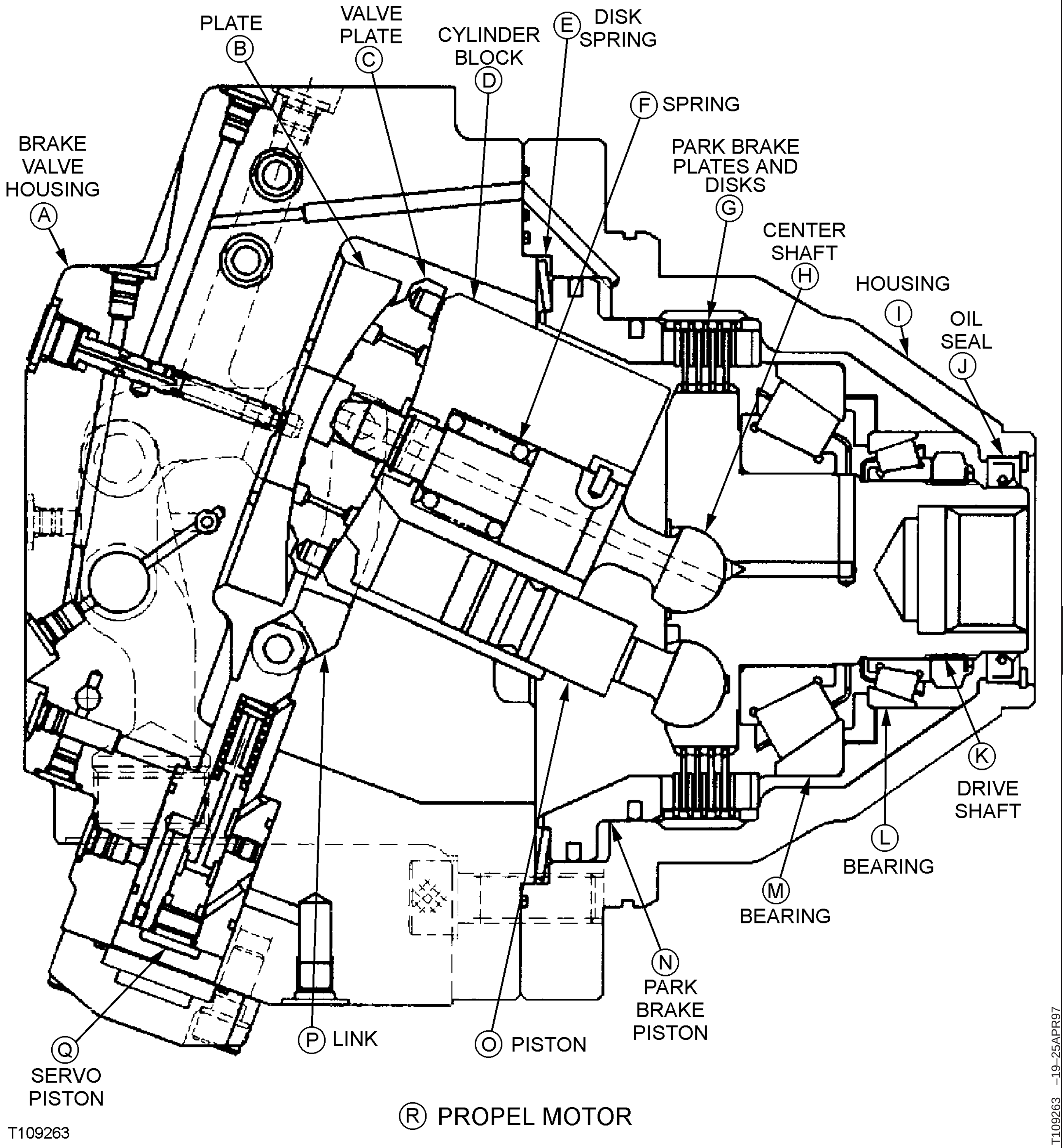
The rotary manifold (J) is a 360° rotary joint. It allows oil to flow to and from the propel motors without twisting hoses when the upper structure is rotated.

The inner spindle is connected to the upper structure and the housing is connected to the undercarriage. The housing rotates about the spindle during swing operation.

Oil flows into and through the spindle to passages in the housing, and then out of the housing to the propel motors. Sealing rings stop oil from leaking between the spindle and housing into adjacent passages.

CED,TX08227,3175 –19–04JUN98–1/1

PROPEL MOTOR OPERATION



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Theory of Operation

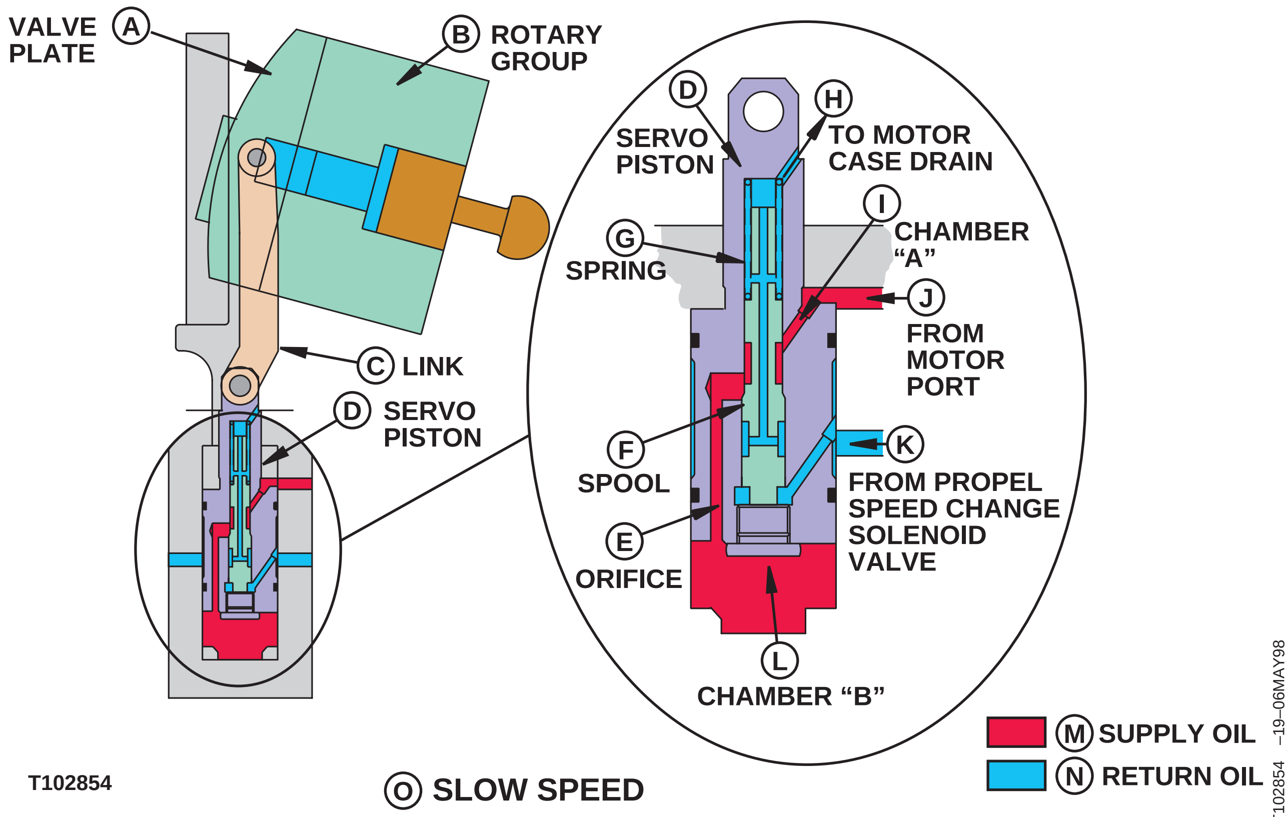
The propel motor (R) is a variable-displacement, bent-axis, axial-piston type motor that includes the brake valve housing (A) and propel park brake. The counterbalance valve, crossover relief valves, park brake release shuttle valve, pressure reducing valve, and the servo piston shuttle valve are integral components of the brake valve housing.

The servo piston (Q) controls the angle of cylinder block (D), pistons (O) and center shaft (F) with respect to the drive shaft (K). As the angle is changed the motor displacement changes which changes propel motor speed.

Supply oil flows through the valve plate (C) to half of the pistons (O) in the cylinder block (D). The oil forces the pistons to slide down the cylinder block bores transferring the force (S) to the drive shaft (K) turning the drive shaft. As the cylinder block and drive shaft rotate, half of the pistons move out of their bores while the remaining pistons in the other half of the cylinder block move back in their bores to discharge oil to return. Supply oil flows to the bottom port for forward travel and to the top port for reverse travel.

CED,TX08227,3098 –19–22APR98–2/2

PROPEL MOTOR SLOW SPEED OPERATION



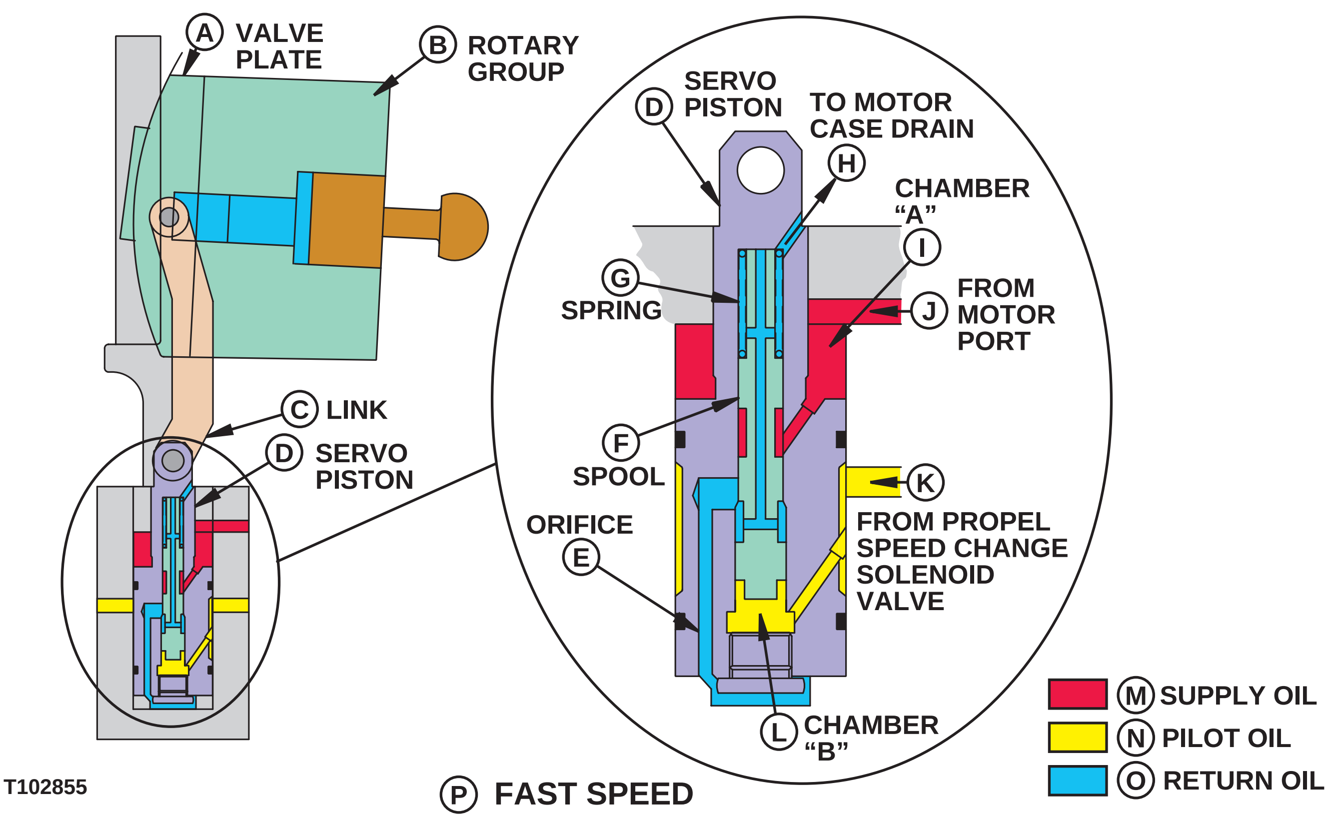
The servo piston (D) is connected by a link (C) to the valve plate (A). When servo piston is extended or retracted by supply oil pressure the angle of the rotary group (B) changes and the propel speed changes accordingly.

When propel speed switch is set to slow speed (turtle) the control signal from the propel speed change solenoid valve to the bottom of speed selector valve spool (F) is too low to shift the spool against the spring (G). The spool (F) is pushed down by the spring (G). (For operation of propel speed change solenoid valve, see Proportional Solenoid Valve Operation in this group. For circuit operation, see Propel Motor Speed Change Circuit Operation in this group.)

Supply oil from motor port (J) is now applied to both chamber "A" (I) and chamber "B" (L) at the same time. Supply oil pressure in chamber "B" acts on a larger area than the supply oil pressure in chamber "A" causing the servo piston to move upward increasing rotary group swash angle. As the swash angle increases, the stroke of each piston is increased resulting in slower revolution of the propel motor for slower propel speed.

CED,TX08227,3099 –19–22APR98–1/1

PROPEL MOTOR FAST SPEED OPERATION

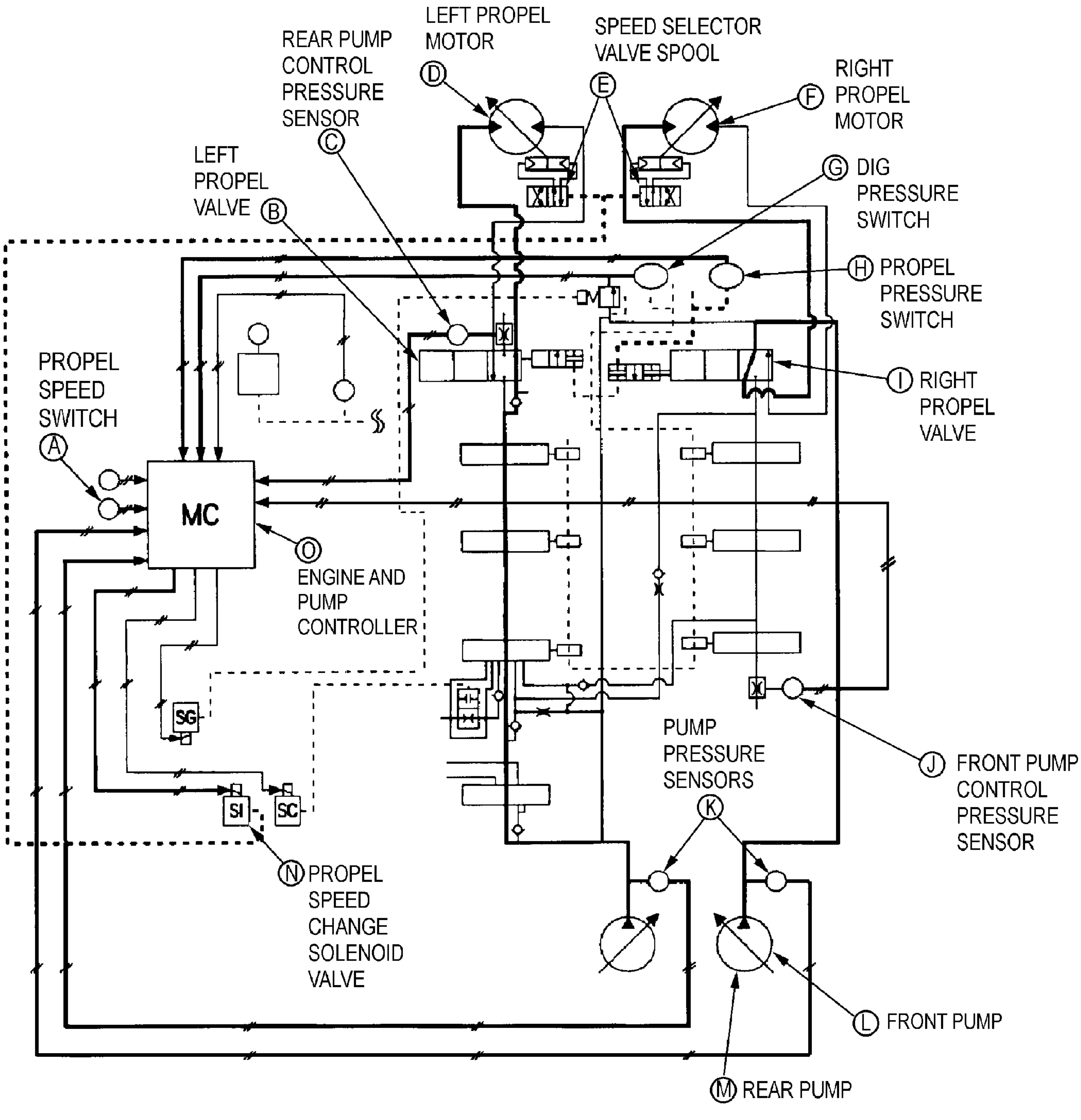


In fast speed propel, the pilot oil (N) control signal from the propel speed change solenoid valve (K) is higher than spring force and spool (F) is pushed up. The oil in chamber "B" is routed to return through motor case drain (H). Supply oil (M) from the motor port (J) is applied to chamber "A", servo piston (D) moves down to reduce rotary group (B) swash angle. With reduced swash angle the piston stroke is reduced which increases rotary group turning speed that increases propel speed.

NOTE: *For operation of propel speed change solenoid valve, see Proportional Solenoid Valve Operation in this group. For circuit operation, see Propel Motor Speed Change Circuit Operation in this group.*

CED,TX08227,3100 –19–22APR98–1/1

PROPEL MOTOR SPEED CHANGE CIRCUIT OPERATION



A—Propel Speed Switch
B—Left Propel Valve
C—Rear Pump Control Pressure Sensor
D—Left Propel Motor
E—Speed Selector Valve Spool
F—Right Propel Motor
G—Dig Pressure Switch
H—Propel Pressure Switch
I—Right Propel Valve
J—Front Pump Control Pressure Sensor
K—Pump Pressure Sensors
L—Front Pump
M—Rear Pump
N—Propel Speed Change Solenoid Valve
O—Engine and Pump Controller

P—PROPEL SPEED CHANGE CIRCUIT

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CED,TX08227,3101 –19–23APR98–1/2

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When the propel speed switch (A) is at slow speed (turtle), the electrical signal to the propel speed change solenoid valve (N) coil is low. The pilot oil control signal to the speed selector valve spools (E) is too low to shift the spools. The propel motors (D and F) are at maximum displacement causing the machine to travel at slow speed.

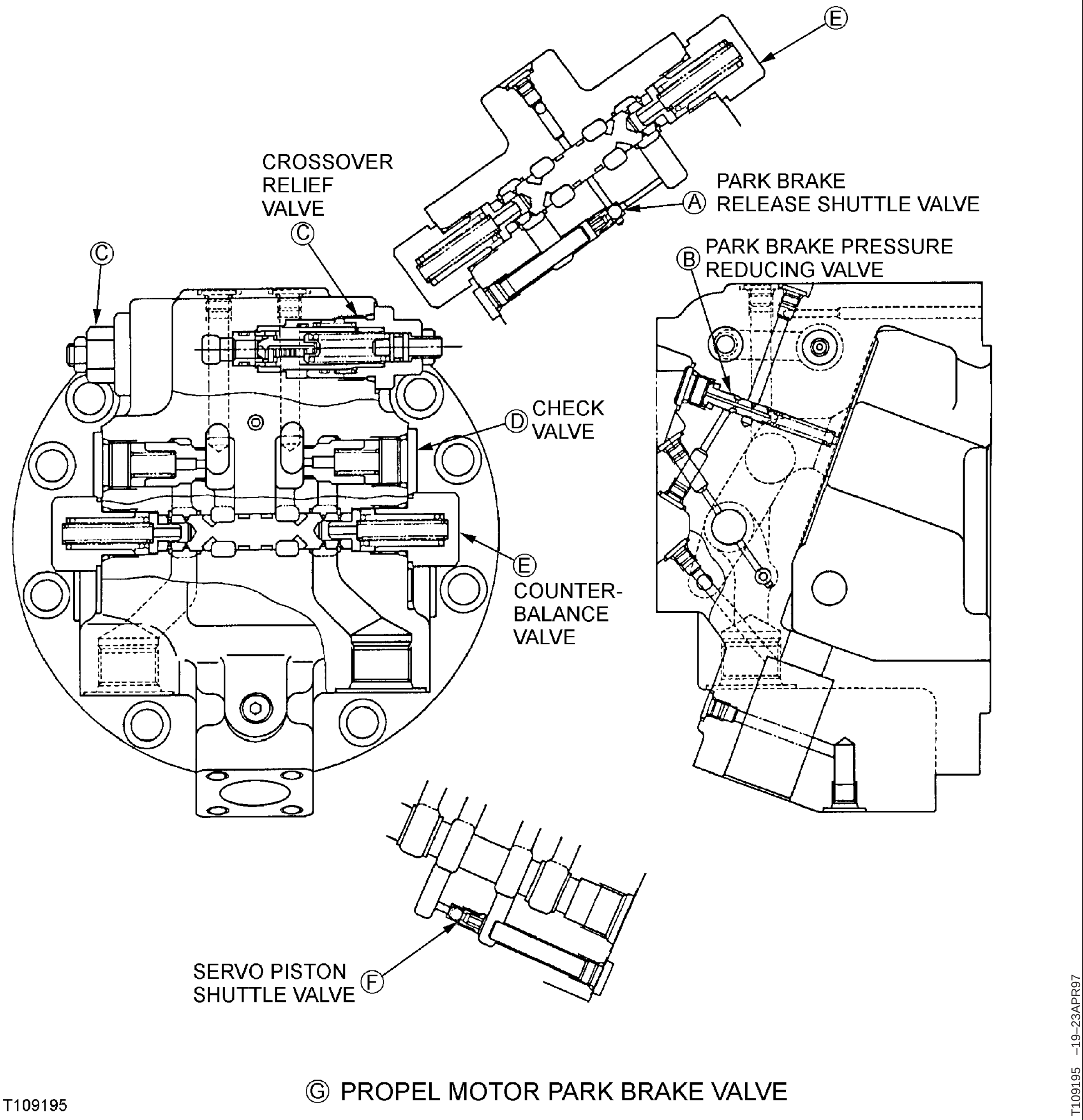
The propel speed goes to fast with the following operating conditions:

- Propel speed switch is at fast speed (rabbit).
- Propel pressure switch (H) in closed (propel function actuated).
- Dig pressure switch (G) is open (no dig function actuated).
- Electrical signal for rear (C) and front (J) pump control pressure sensors increases because the pilot oil control signals from front and rear control valves are increasing.
- Rear and front pump pressure sensors (K) are sensing low pressure.

When the electrical signals are received at the engine and pump controller (O), the electrical signal from the controller to the solenoid valve (N) coil increases. The solenoid valve spool shifts increasing the pilot oil control signal. The higher control signal shift the speed selector valve spool (E) causing the motor to go to minimum displacement and the machine to travel at fast speed. (See Propel Motor Fast Speed Operation in this group.)

CED,TX08227,3101 –19–23APR98–2/2

PROPEL MOTOR PARK BRAKE VALVE HOUSING OPERATION



G PROPEL MOTOR PARK BRAKE VALVE

The propel motor park brake valve (G) housing contains the park brake release shuttle valve (A), park brake pressure reducing valve (B), crossover relief valve (C), check valves (D), counterbalance valve (E), servo piston shuttle valve (F) and servo piston.

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Park brake release shuttle valve (A) routes supply oil from the pressurize motor port through a groove in the counterbalance valve (E), to the park brake pressure reducing valve (B), and then to the park brake piston to release the park brake.

Park brake pressure reducing valve (B) reduces the supply oil pressure routed to the park brake to prevent sudden brake application.

Crossover relief valves (C) protect the motor circuit from pressure spikes.

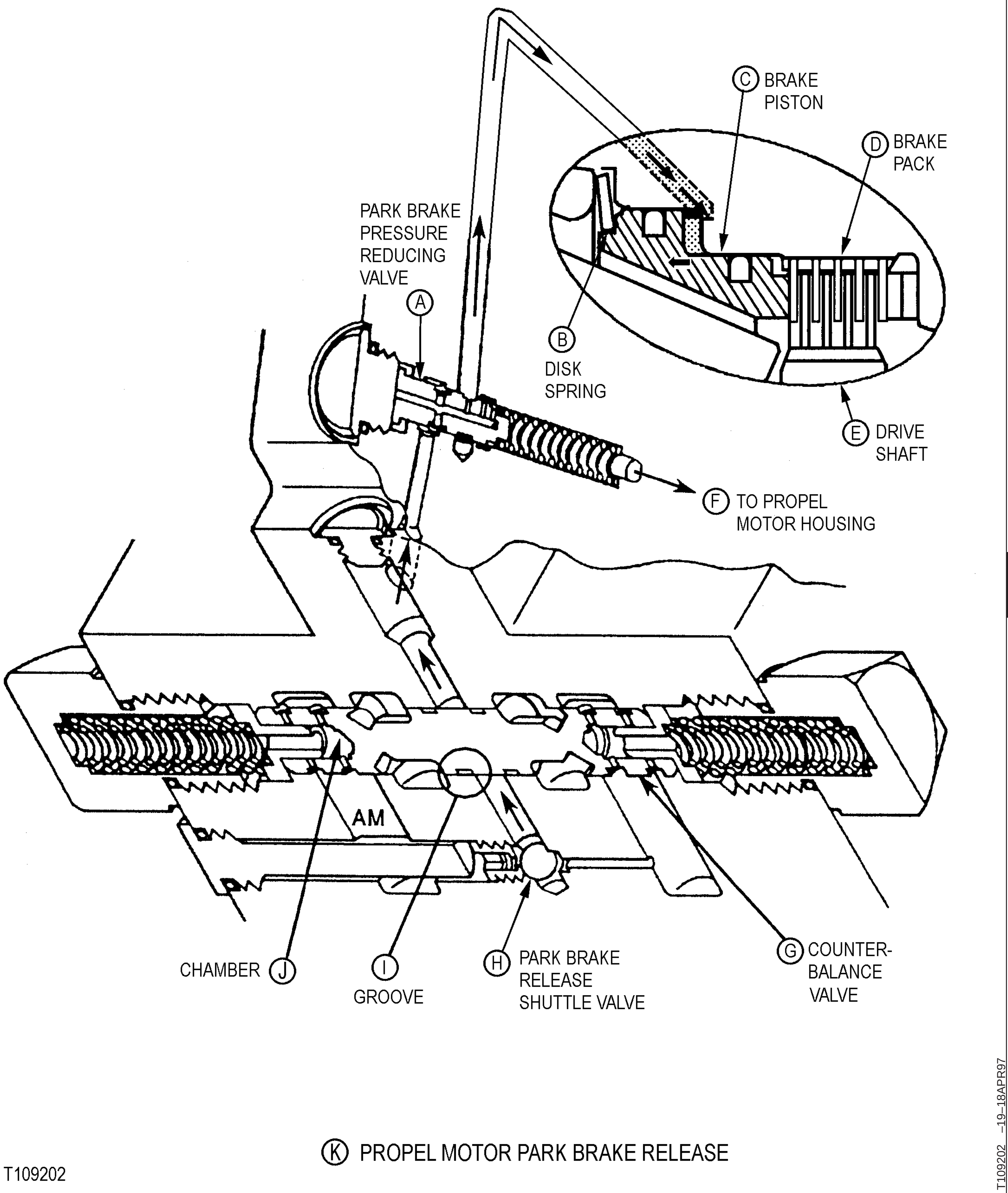
Check valves (D) ensure smooth starts and stops, and prevent motor cavitation by working together with the counterbalance valve (E).

Counterbalance valve (E) is used for smooth starting and stopping and helps prevent overrunning of the motor when traveling down a slope.

Servo piston shuttle valve (F) routes supply oil from the pressurize motor port to the servo piston. (For operation of servo piston and speed selector valve, see Propel Motor Slow Speed Operation and Propel Motor Fast Speed Operation in this group.)

CED,TX08227,3102 –19–23APR98–2/2

PROPEL MOTOR PARK BRAKE RELEASE CIRCUIT OPERATION



K PROPEL MOTOR PARK BRAKE RELEASE

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The propel brakes are a wet type multi-disk brake. The brakes are spring applied and hydraulically released. The brakes are released whenever the propel function is actuated. The brakes are applied by a disk spring (B) whenever the propel control valve spools are in neutral. The plates in the brake pack (D) are connected to the motor housing. The disks are connected to and rotate with the drive shaft (E). The disk spring pushes against the piston to squeeze the plates and disks together to keep the machine from moving.

When the propel pilot controllers are actuated the propel valve spools route supply oil to the bottom work port of propel motor for forward travel or the top work port for reverse travel. The supply oil flows into the chamber (J) at the end of counterbalance valve (G). At the same time supply oil moves the park brake release shuttle valve (H) to route supply oil to the park brake pressure reducing valve (A) but is blocked by the counterbalance valve. When supply oil pressure increases enough to shift the counterbalance valve, supply oil flows through the groove (I) to the park brake pressure reducing valve. The pressure reducing valve operates to reduce the supply oil pressure. Reduced pressure oil flows to the brake piston (C) to move it against the disk spring (B) force and releases the park brake. Oil not used to release the park brake flows through the orifice in the reducing valve spool and into the propel motor housing (F).

When propel pilot controllers are returned to neutral, supply oil is blocked by the valve spools and the propel motor work ports are open to the control valve return passage. The counterbalance valve (G) returns to its neutral position causing the machine to slow and then stop (dynamic braking). The pressure reducing valve (A) is shifted by its spring. The disk spring (B) pushing against the brake piston (C) forces the oil to flow through the orifice in the reducing valve and into the propel motor housing (F). The delay caused by the oil flowing through the orifice is enough to slow engagement to ensure that park brake is only fully applied after the machine has stopped.

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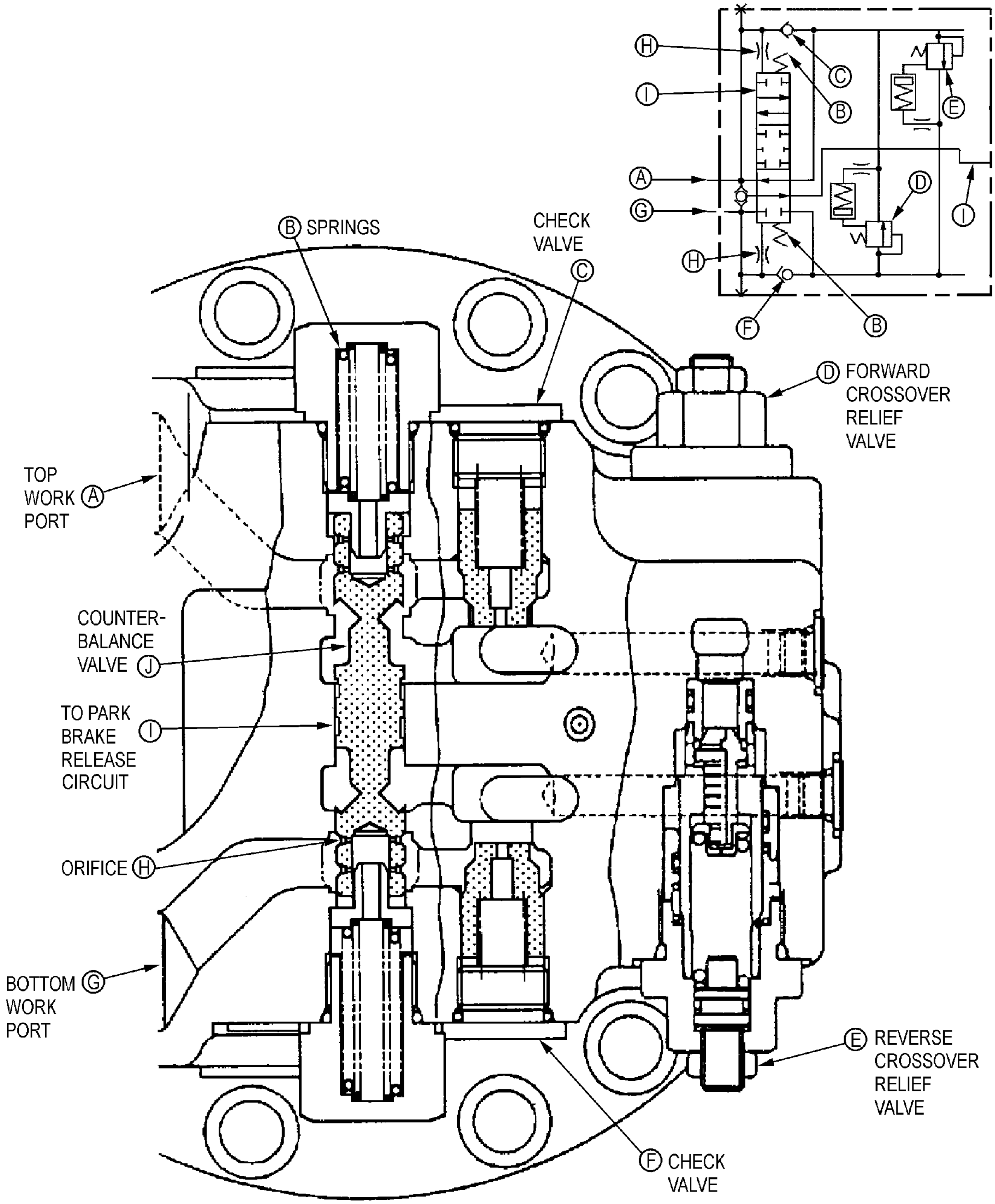
CED,TX08227,3103 –19–23APR98–2/2

PROPEL MOTOR COUNTERBALANCE VALVE OPERATION



K COUNTERBALANCE VALVE -- PROPELLING

T109206 –19–23APR97

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When the propel valve spools in the main control valve are in neutral position, counterbalance valve (J) is held in the center position by springs (B) on both ends of counterbalance valve. Both propel motor oil lines are connected to the control valve return passage. Oil in each motor is trapped by check valves (C and F) and counterbalance valve (J) holding the motors stationary. The park brake release circuit is also routed to return and the brake spring hold the brake on.

When the propel pilot controller is moved to forward position, supply oil is routed from the propel valves in the control valve to bottom work port (G). If propel pilot controller is moved to reverse position, supply oil would be routed to top work port (A).

In forward direction, supply oil enters bottom work port (G), flows around counterbalance valve to check valve (F). Check valve opens and oil flows into the motor.

Return oil from the motor is blocked by check valve (C) and counterbalance valve (J). This, along with the motor's resistance to turning, causes pressure in bottom work port (G) to increase. The increasing pressure is also sense at the end of counterbalance valve through orifice (H). As pressure increases, the spool is pushed upward against the spring force. As spool moves up, oil from the motor flows past notches in the counterbalance valve to the top work port (A) and the propel motors start to turn. Supply oil is also routed to the park brake release circuit (I) to release the park brake. (For park brake release circuit operation, see Propel Motor Park Brake Release Circuit Operation in this group.)

When the propel pilot controller is returned to neutral position, the oil in both work ports (A and G) are routed to control valve return passage. Both check valves will seat and counterbalance valve will center trapping oil in the motor to prevent rotation. Oil will also flow back through the brake passage to the motor housing and the park brake will engage after the propel motor stops rotating. At the same time, the shock pressure caused by the inertia force of the motor stopping is released through of the crossover relief valves (D and E). Check valves (C and F) have a make-up function to prevent cavitation in the motor.

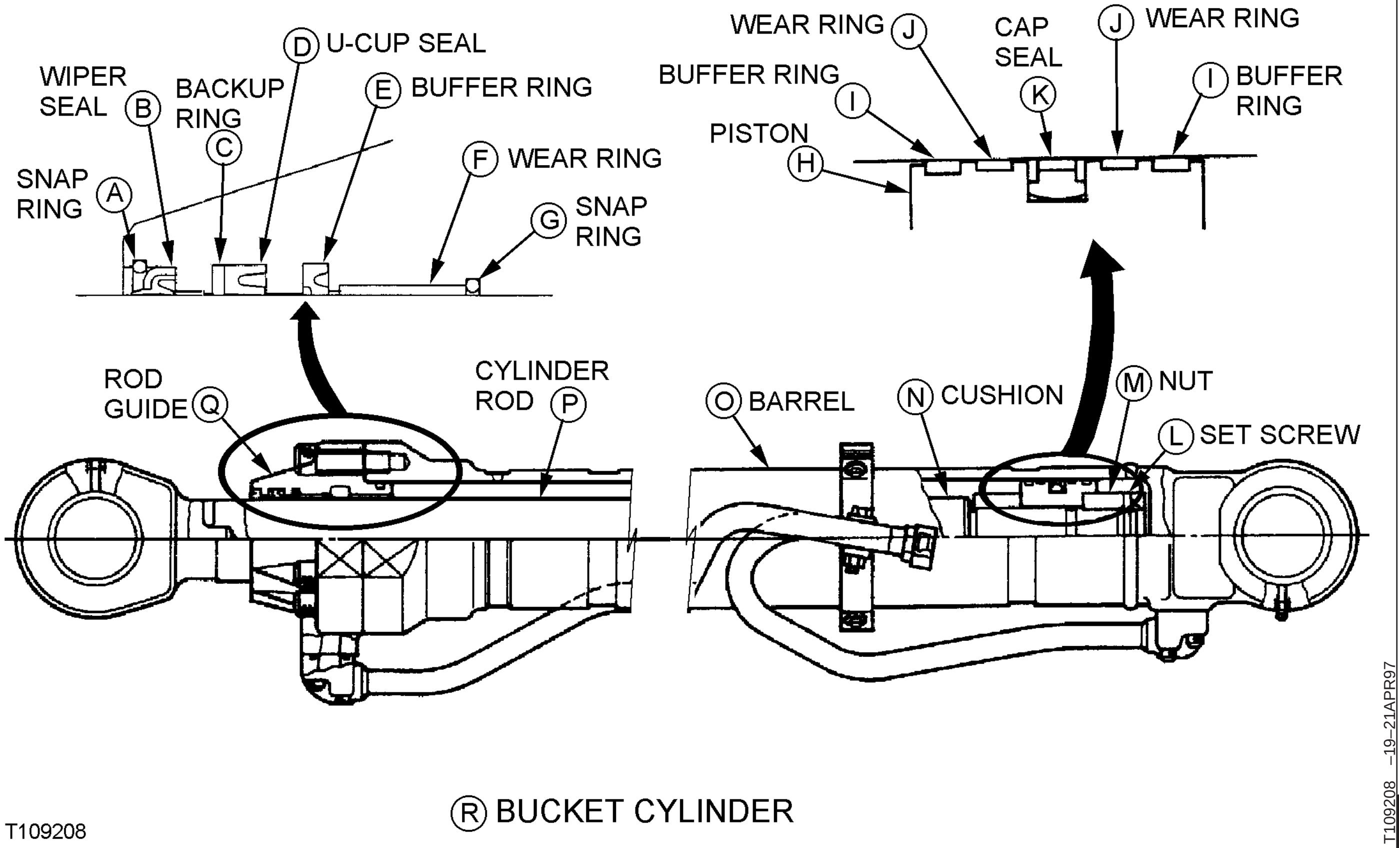
When traveling down a hill, the weight of the machine may begin to overrun the propel motors. This would cause faster travel than desired and cause cavitation at the inlet side of motors. As pressure decreases in the inlet passage of the motor, the pressure holding the counterbalance valve also decreases. Spring (B) force moves the counterbalance valve down thus restricting return flow from the motor slowing motor rotation. This is called "dynamic braking".

During normal operation supply oil from the control valve is routed past the counterbalance valve and check valve to the motor. Supply oil is also routed to the crossover relief valves (D and E). The crossover relief valves are direct acting relief valves with a cushion sleeve. Supply oil is sensed on the end of poppet of one relief valve. Oil also pushes the sleeve up on the other relief valve to help keep its poppet closed.

During relief operation oil pressure overcomes spring force pushing the poppet off its seat. Pressure oil is relieved from the passage that is pressurized to the passage that is at return pressure bypassing the motor.

CED,TX08227,3104 –19–23APR98–2/2

CYLINDER OPERATION



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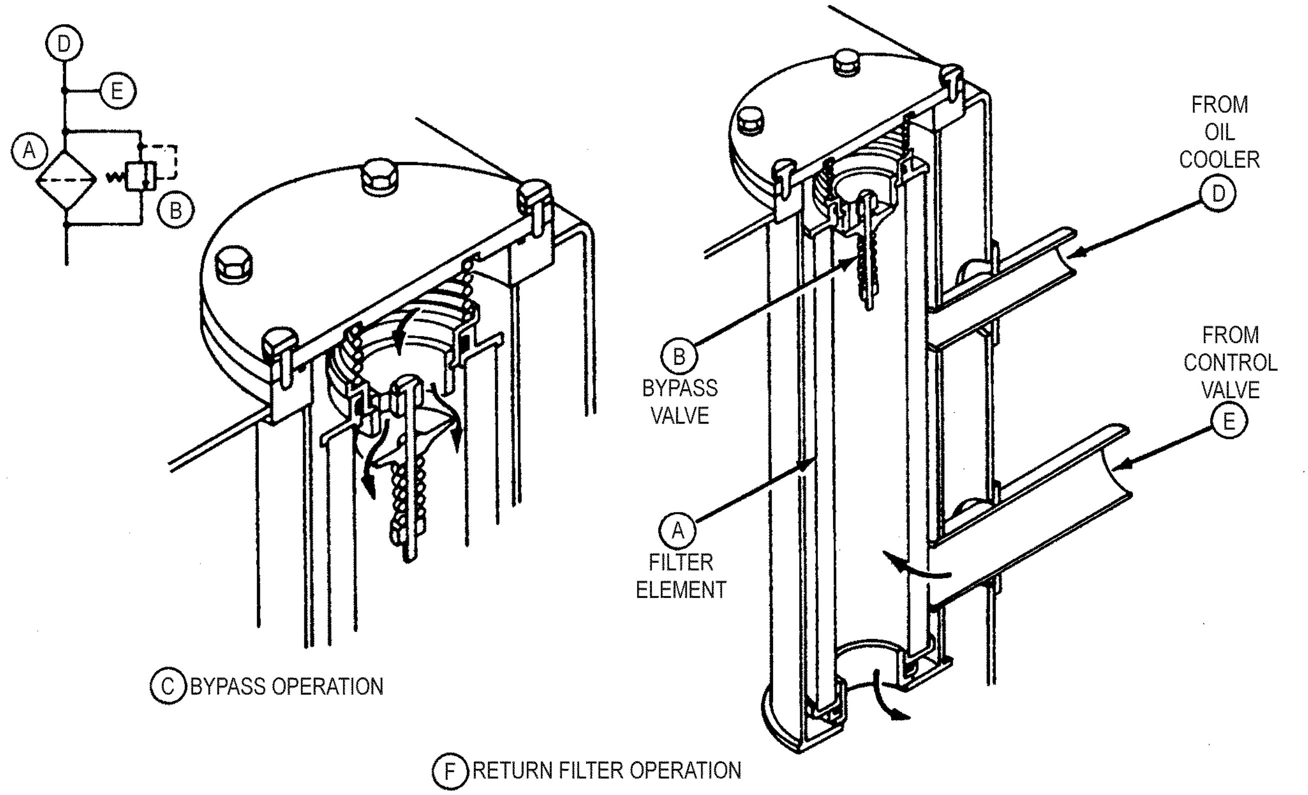
The boom, arm, and bucket cylinders are similar in design. The bucket cylinder (R) is illustrated. The rod guide (Q) is fastened to the cylinder barrel with cap screws and is fitted with a wear guide (F) held in place by a snap ring (G). A buffer ring (E), U-cup seal (D), backup ring (C), and wiper seal (B) are used in the rod guide. A snap ring (A) is used to help hold wiper seal in place. The U-cup seal (D) is protected against high pressure by the buffer ring (E) and stops the small amount of oil which may pass by the buffer ring.

The piston (H) is a slip fit on the cylinder rod (P) and is retained with a nut (M). A set screw (L) prevents loosening of the nut. The piston is fitted with a cap seal (K), wear rings (J), and buffer rings (I).

Boom, bucket and arm cylinders have a cushion (N) in front of the piston to provide cushioning action in cylinder extension. As the cylinder nears the end of stroke the cushion enters a bore in the rod guide. The remaining return oil ahead of piston must flow through a small clearance between the cushion and rod guide. Only the arm cylinder is cushioned in retraction. The end of the rod enters a bore in the head end of the cylinder. The remaining return oil ahead of the piston and nut must flow through this small clearance as the cylinder bottoms out in this direction.

TX,9025,GG2624 –19–23APR98–1/1

HYDRAULIC OIL RETURN FILTER OPERATION



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The filter element (A) is located in a chamber inside the hydraulic oil tank. O-rings are used at each end of the filter element to prevent leakage. A spring holds the filter element on its seat.

Return oil from the oil cooler (D) and the control valve (E) flow through the filter element from the outside to the center. Filtered oil flows out the bottom of filter into the hydraulic oil tank.

A bypass valve (B) is located at the top of the filter. The valve opens to protects the filter element against pressure surges in the return circuit and allows a path for return oil if the filter element becomes plugged. During bypass operation, oil flows into the chamber faster than it can flow through the filter element causing the pressure to increase. The higher pressure forces the bypass valve open allowing oil to flow down the center of the filter element and into the hydraulic oil tank. The bypass valve closes when the pressure decreases below the pressure setting of the bypass valve.

TX,05,GG2147 –19–10JUL96–1/1

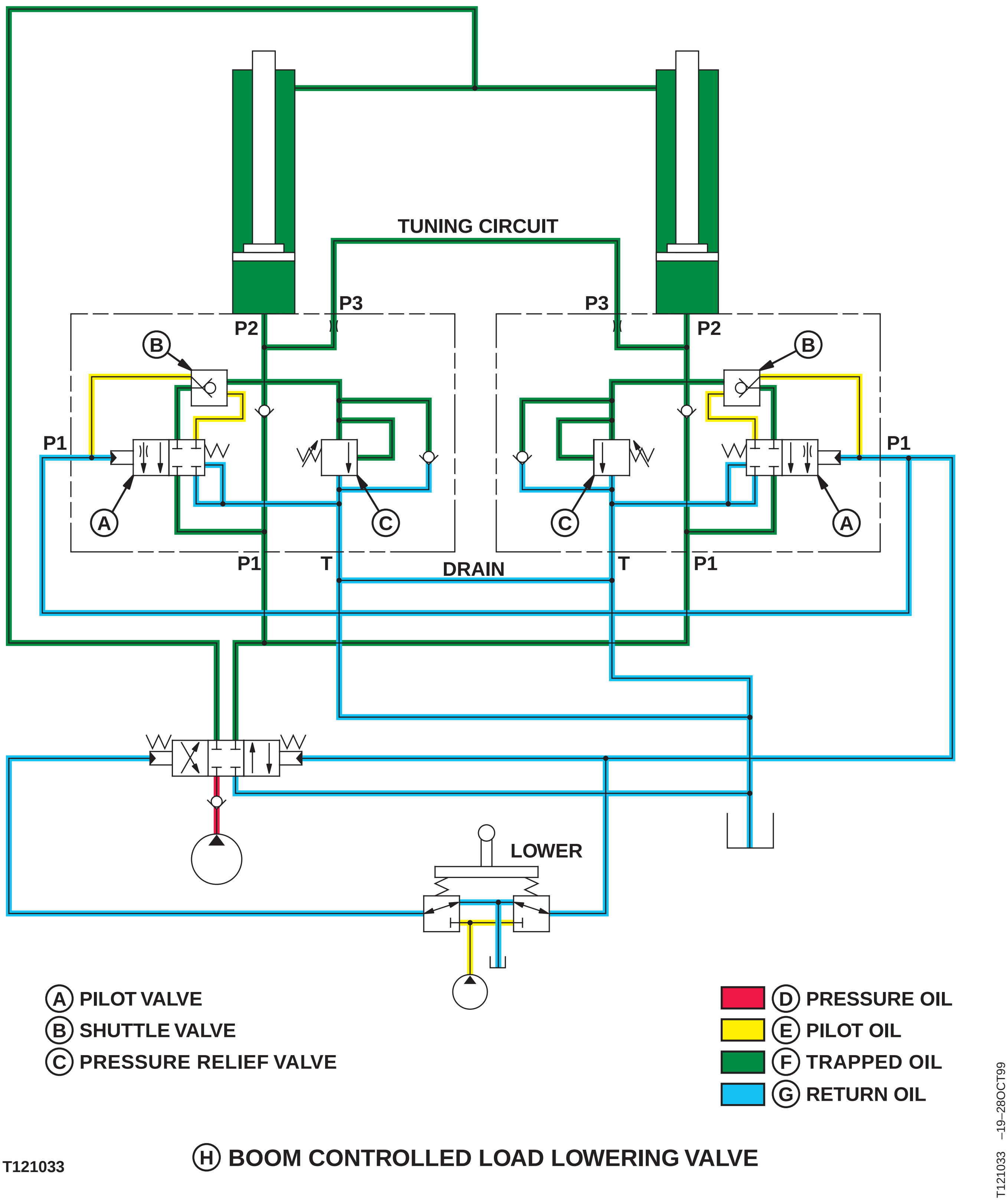
AUXILIARY HYDRAULIC SYSTEM OPERATION

The auxiliary hydraulic control circuit is used to power attachments of various types. This system is set up to power an impact hammer requiring flow in only one direction. A foot switch activates a solenoid valve which directs pilot pressure to the top of the main auxiliary spool. This shifts the spool to direct pressure oil to the attachment plumbing. The return circuit is a low pressure only circuit and returns directly to the return line just before it enters the reservoir. The hammer return oil does not go through the oil cooler circuit. The auxiliary lines use screw-together couplers to attach the hammer hoses. The couplers can be connected under pressure.

This system also controls the flow volume of oil to the hammer by reducing the pump regulation pressure with a pressure reducing valve. this controls the stroke of the pump to only provide the amount of oil needed by the hammer.

CED,OUOE020,1 –19–07APR99–1/1

BOOM CYLINDER CONTROLLED LOAD LOWERING VALVE OPERATION



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Theory of Operation

Boom cylinder controlled load lowering valves are used in the boom circuit. The function of the boom cylinder controlled load lowering valve is to prevent the boom from falling by maintaining pressure in the circuit in case of a hose or line rupture.

In the down position pilot oil acts on pilot valve (A) moving it against spring force. At the same time pilot oil acts on shuttle valve (B), allowing pressure oil from the head end of the boom cylinder to flow through pilot valve (A). The oil then flows through the boom valve and back to sump. The pilot oil acting on shuttle valve (B) also vents through the shuttle, through the pilot valve (A) and back to sump.

CED,OUOE020,2 –19–08APR99–2/2

HYDRAULIC SYSTEM CIRCUIT SYMBOLS

These are ISO and ANSI standard hydraulic symbols for use in reading circuit diagrams.

Pumps

HYDRAULIC PUMP FIXED DISPLACEMENT UNIDIRECTIONAL VARIABLE DISPLACEMENT UNIDIRECTIONAL	

Motors and Cylinders

HYDRAULIC MOTOR FIXED DISPLACEMENT UNIDIRECTIONAL VARIABLE DISPLACEMENT UNIDIRECTIONAL	
CYLINDER SINGLE ACTING	
CYLINDER DOUBLE ACTING SINGLE END ROD DOUBLE END ROD ADJUSTABLE CUSHION ADVANCE ONLY DIFFERENTIAL PISTON	

Miscellaneous Units

ELECTRIC MOTOR	
ACCUMULATOR, SPRING LOADED	
ACCUMULATOR, GAS CHARGED	
HEATER	
COOLER	
TEMPERATURE CONTROLLER	
FILTER STRAINER	
PRESSURE SWITCH	
PRESSURE INDICATOR	
TEMPERATURE INDICATOR	
DIRECTION OF SHAFT ROTATION ASSUME ARROW ON NEAR SIDE OF SHAFT.	

Valves

CHECK	
ON-OFF (MANUAL SHUT-OFF)	
PRESSURE RELIEF	
PRESSURE REDUCING	
FLOW CONTROL ADJUSTABLE - NON-COMPENSATED	
FLOW CONTROL ADJUSTABLE (TEMPERATURE AND PRESSURE COMPENSATED)	
TWO POSITION TWO CONNECTION	
TWO POSITION THREE CONNECTION	
TWO POSITION FOUR CONNECTION THREE POSITION FOUR CONNECTION TWO POSITION IN TRANSITION	
VALVES CAPABLE OF INFINITE POSITIONING (HORIZONTAL BARS INDICATE INFINITE POSITIONS ABILITY)	

Methods of Operation

SPRING	
MANUAL	
PUSH BUTTON	
PUSH-PULL LEVER	
PEDAL OR TREADLE	
MECHANICAL	
DETENT	

PRESSURE COMPENSATED	
SOLENOID, SINGLE WINDING	
REVERSING MOTOR	
PILOT PRESSURE REMOTE SUPPLY INTERNAL SUPPLY	

Lines

LINE, WORKING (MAIN)	
LINE, PILOT (FOR CONTROL)	
LINE, LIQUID DRAIN	
FLOW, DIRECTION OF HYDRAULIC PNEUMATIC	
LINES CROSSING	or
LINES JOINING	
LINE WITH FIXED RESTRICTION	
LINE, FLEXIBLE	
STATION, TESTING, MEASUREMENT OR POWER TAKE-OFF	
TEMPERATURE CAUSE OR EFFECT	
RESERVOIR VENTED PRESSURIZED	
LINE, TO RESERVOIR ABOVE FLUID LEVEL BELOW FLUID LEVEL	

TS700 –19–28SEP89

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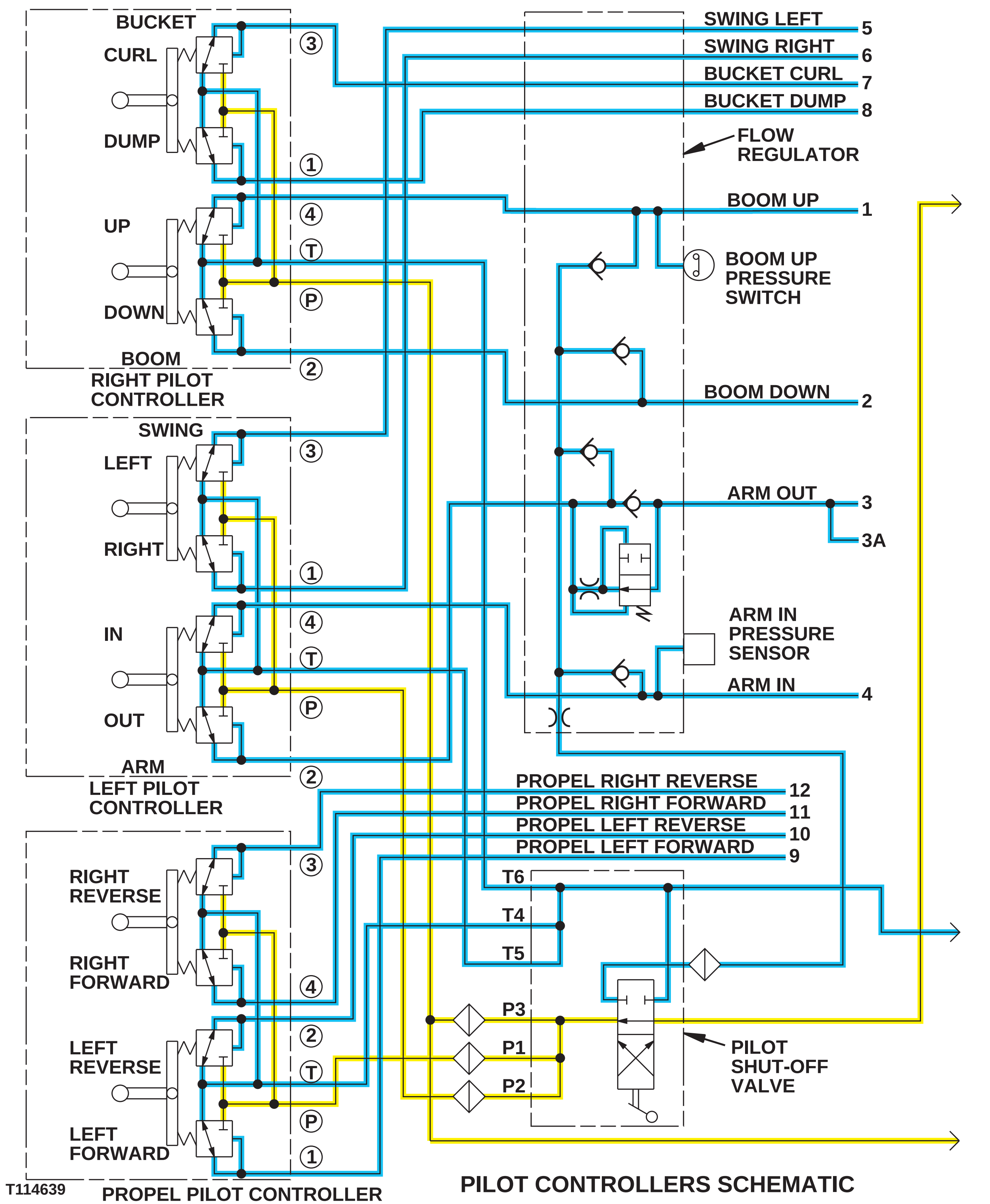
TX,15,GG2166 –19–17NOV97–1/1

PILOT CIRCUIT FOR CONTROLLERS SCHEMATIC



PILOT CONTROLLERS SCHEMATIC

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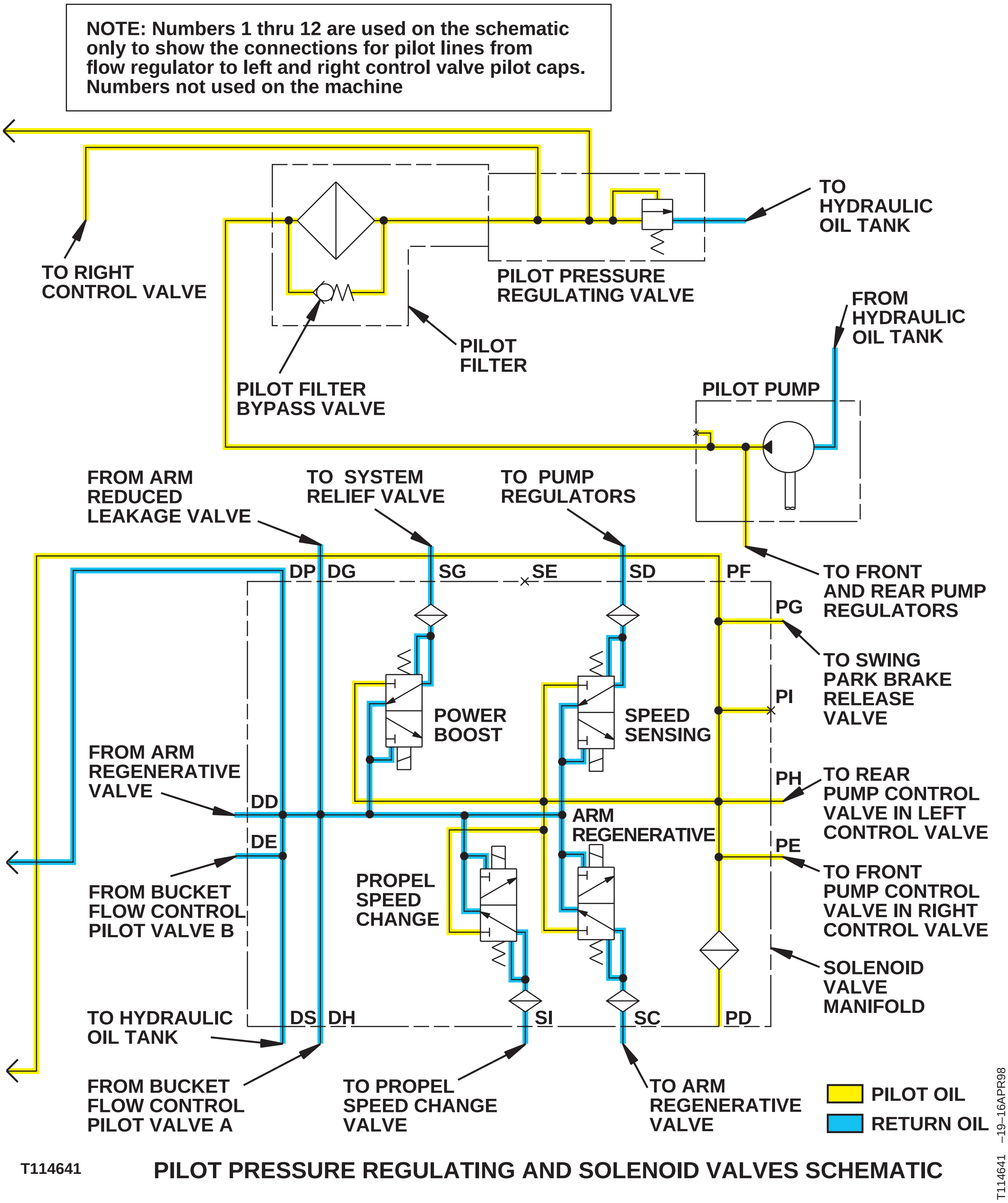
CED,TX08227,3046 –19–31MAR98–1/2

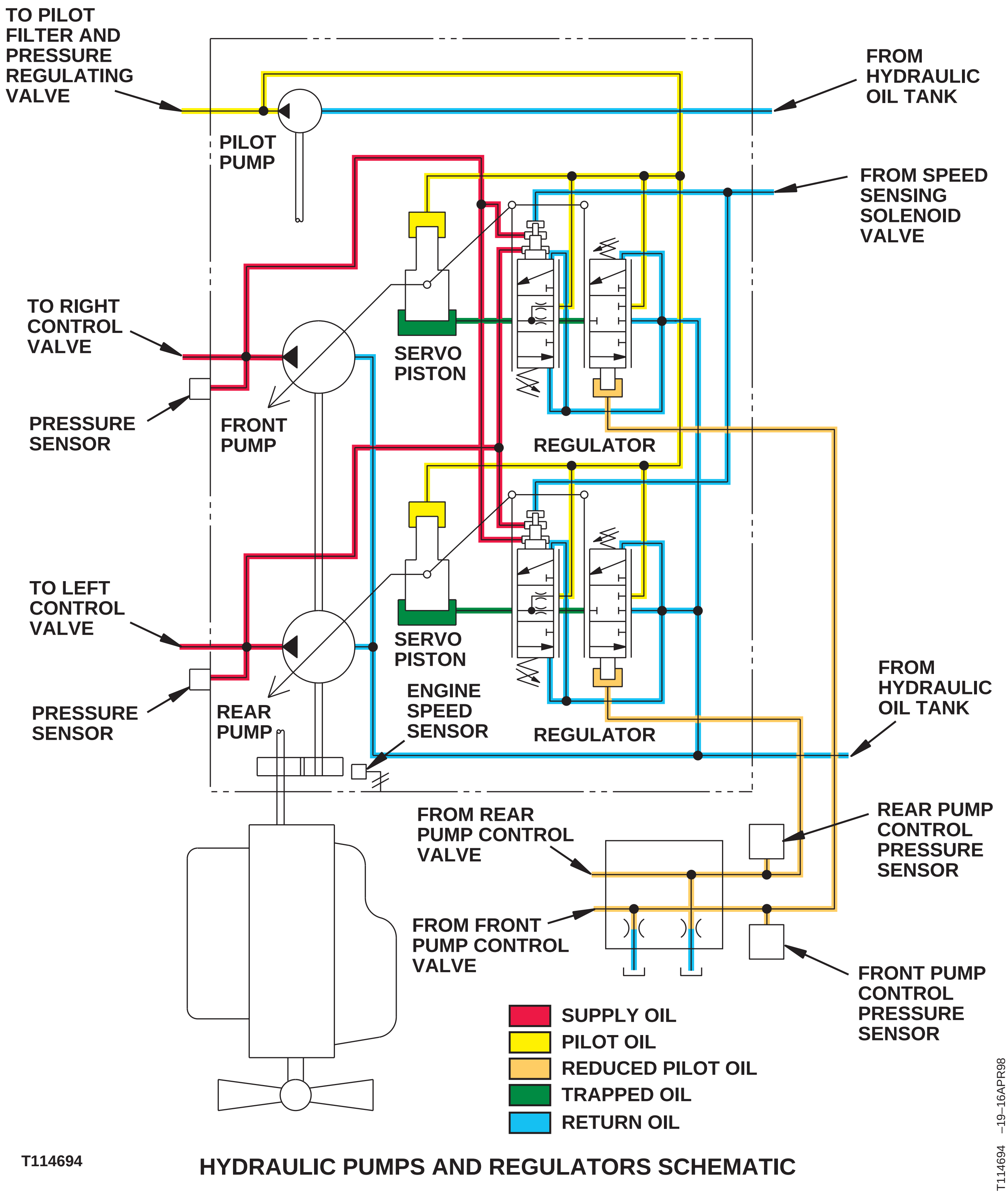


T114641 **PILOT PRESSURE REGULATING AND SOLENOID VALVES SCHEMATIC**

CED,TX08227,3046 –19–31MAR98–2/2

FOLDOUT PAGE 6-104 IS AT REAR OF MANUAL

HYDRAULIC PUMPS AND REGULATORS SCHEMATIC



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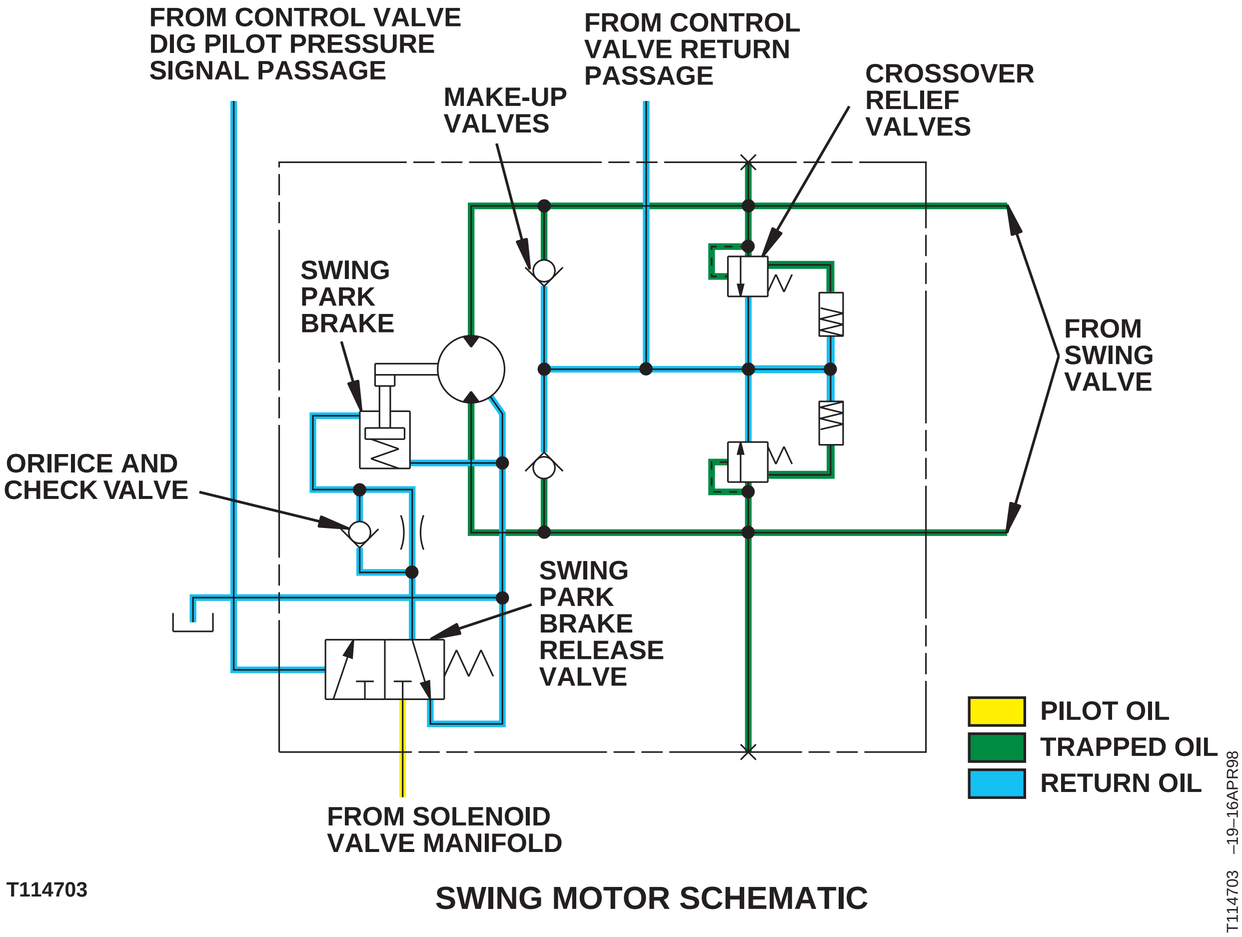
HYDRAULIC PUMPS AND REGULATORS SCHEMATIC

CED,TX08227,3048 –19–02APR98–1/1

SWING MOTOR SCHEMATIC



T114703

SWING MOTOR SCHEMATIC

CED,TX08227,3049 –19–02APR98–1/1

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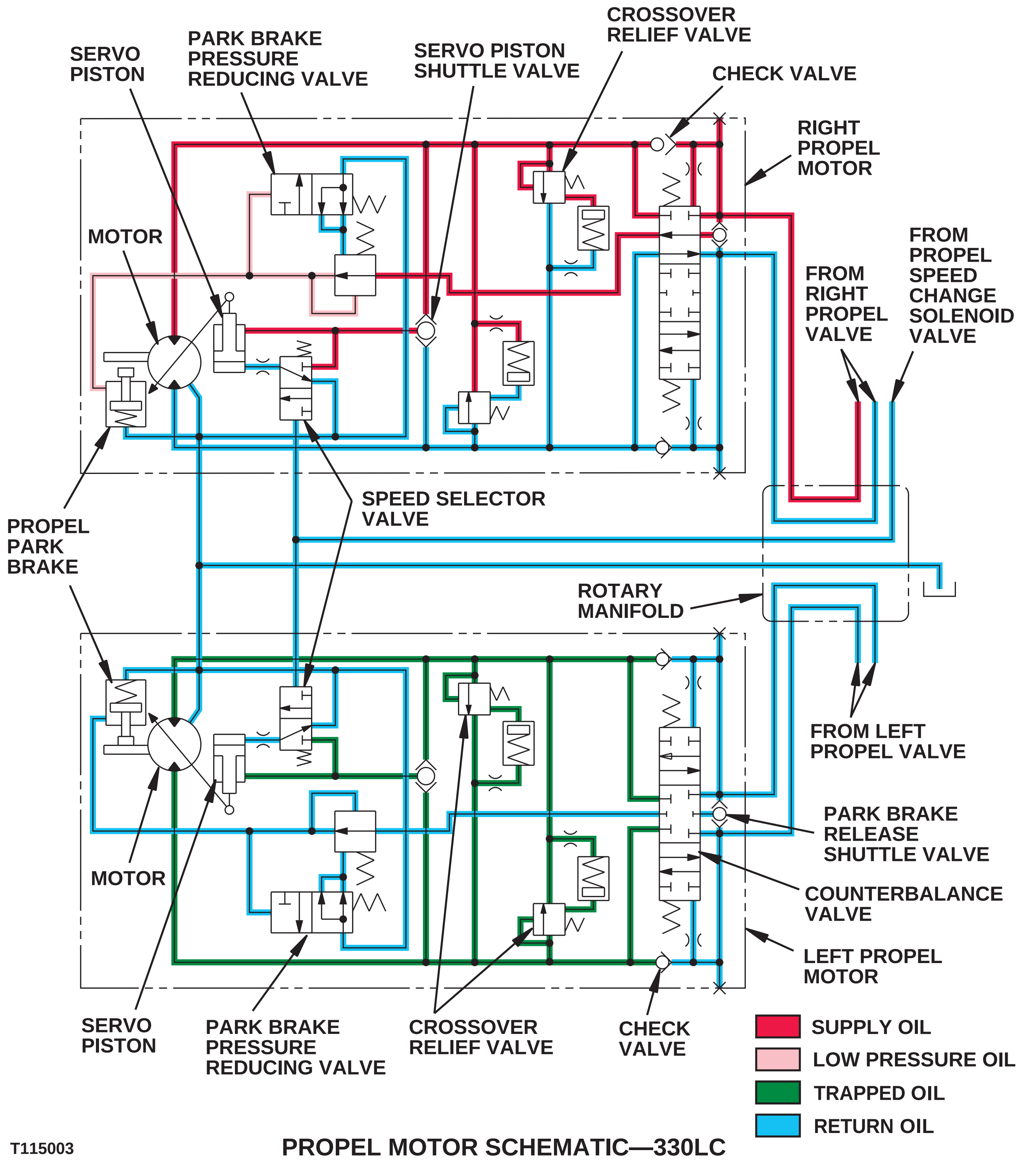
PROPEL MOTOR SCHEMATIC



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PROPEL MOTOR SCHEMATIC—330LC

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CED,TX08227,3096 –19–22APR98–1/1

Group 15
Diagnostic Information

DIAGNOSTIC PROCEDURE

Follow the six basic steps below to carry out troubleshooting efficiently.

1. Know the system.

   Study the machine technical manual. Understand the system and circuits. Use schematics, component location drawings, and theory of operation for each circuit and circuit components to better understand how the system, circuits and components work.

2. Ask the operator.

   What type of work was the machine doing when the trouble was noticed?

   Did the trouble start suddenly or has it been getting worse?

   Did the machine have any previous problems? If so, which parts were repaired?

3. Inspect the machine.

   Check all daily maintenance points. (See the operators manual). Check batteries, fuses, fusible link, and electrical connections.

4. Preform Operational Checkout.

   Check all systems and functions on the machine. Use the helpful diagnostic information in the checkout to pinpoint the possible cause of the problem.

5. Preform troubleshooting.

   Connect laptop computer, if available. The self-diagnosing function lists any service codes and gives corrective action information.

   Before starting any troubleshooting first check battery voltage, fusible link, and fuses.

   Go to test groups to check pressures and voltages. Make sure adjustment are correct.

6. Trace a cause.

   Before reaching a conclusion, check the most probable and simplest to verify. Use the flow charts and symptom, problem, solution charts to help identify probable problem components.

   Make a plan for appropriate repair to avoid other malfunctions.

TX,15,GG2234 –19–17NOV97–1/1

DIAGNOSE ELECTRONIC AND CONTROL VALVE COMPONENT MALFUNCTIONS

Part Name	**Engine Control Motor (EC Motor)**	**Engine Control Sensor (EC Sensor)**	**Engine rpm Dial**
Operational Function	Move fuel injection pump lever.	Senses position of EC motor	Signal to engine and pump controller to set target engine speed for injection pump lever position.
Control Problem	Fuel injection pump lever does not move	Loss of EC motor position sensing. Whenever key switch is ON, injection pump lever position is learned as the slow idle speed position. Accordingly, engine speed is controlled afterward from the learned position which occurred at this time.	Speed does not change when dial is turned.
Machine Symptoms	Turning engine rpm dial does not increase or decrease engine speed.	Engine speeds slower or faster than speed selected by engine rpm dial and E mode switch. Cannot control speed.	Speed is held at 1600 rpm. (Auto-idle function operates and engine stops by turning key switch off.)
Laptop Computer Self-Diagnostic Function	—	01 Service code is displayed	07 Service code is displayed.
Laptop Computer Monitoring Function	—	Monitor No. 2, EC angle. Typical voltage for slow idle is 2.5 volts.	Monitor No. 13, Target Engine Speed.
Harness Check	Install JT07065 Test Harness. Check for control signal.	Install JT07066 Test Harness. Typical voltage for slow idle is 2.5 volts.	—
Note	Engine stopped by fuel shut-off solenoid. If solenoid fails, engine turns over but does not start.	If EC sensor has failed, engine speed learning procedure does not work.	—
Description of Operation	See Engine Speed Control System Operation in Group 9010-05.	See Engine Speed Learning Control Circuit Operation in Group 9010-05.	See Engine RPM Dial Speed Control Circuit Operation in Group 9010-05.

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Part Name	Pump Control Pressure Sensor	Pump Pressure Sensor	Engine Speed Sensor (N Sensor)	Power Boost Solenoid Valve (SG)
Operational Function	Senses pump control valve pressure in control valve to control propel motor speed change	Senses front and rear pump delivery pressure.	Senses actual engine speed for speed sensing system	Sends a pilot pressure signal to temporary increase system relief valve pressure setting.
Control Problems	No sensor output signal. No control signal to propel speed change solenoid valve.	Loss of propel speed control and HP (high power) mode.	Speed sensing system does not function.	No pressure signal sent to system relief valve. System relief valve pressure setting does not increase.
Machine Symptoms	Propel motor operates at slow speed when propel speed switch is turned to fast speed.	Propel speed does not increase when propel speed switch in fast speed (rabbit). HP mode does not work.	Engine may stall when machine operated at high altitude or under heavy operating conditions.	Digging or lifting force does not increase.
Laptop Computer Self-Diagnostic Function	04 and 05 Service codes are displayed.	02 and 03 Service codes are displayed.	—	—
Laptop Computer Monitoring Function	Monitor No. 1 and 6, Front and rear pump control pressure.	—	Monitor No. 14, Actual engine speed.	Monitor No. 12, Power boost control pressure.
Harness Check	—	—	—	Install JT07062 Test Harness. Check that indicator light is on.
Notes	At slow idle with functions in neutral typical pressure is 980—1569 kPa (9.8—15.7 bar) (142—228 psi). A lower pressure may be an open circuit. A higher pressure may be a short circuit.	During combined operation, arm speed is slow if malfunction is at sensor for rear pump.	Located on pump drive gearbox adjacent to front pump.	If indicator light is off, check wiring harness.
Description of Operation	See Propel Motor Speed Change Circuit Operation in Group 9025-05.	See Propel Motor Speed Change Circuit Operation in Group 9025-05 or HP (High Power) Mode Speed Control Circuit Operation in Group 9010-05.	—	See Power Boost Control Circuit Operation in Group 9025-25.

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Diagnostic Information

Part Name	Speed Sensing Solenoid Valve (SD)	Arm Regenerative Solenoid Valve (SC)	Propel Speed Change Solenoid Valve (SI)	Propel Pressure Switch
Operational Function	Sends a pilot pressure signal to load piston in pump regulators to reduce pump flow.	Sends a pilot pressure signal to shift the arm regenerative valve to route return oil from arm cylinder rod end to the head end.	Sends a pilot pressure signal to shift speed selector valve spool in propel motors.	Senses when propel function is actuated.
Control Problems	No pressure signal sent to load piston in pump regulators.	No pressure signal sent to shift arm regenerative valve.	No pressure signal sent to shift speed selector valve spool.	No electrical signal sent to engine and pump controller.
Machine Symptoms	Torque required to drive pumps exceed engine output power. Engine speed can decrease below rated speed.	During arm in operation, there is arm cylinder cavitation and controllability becomes less.	Travel speed does not increase when propel speed switch is turned to fast speed (rabbit).	Engine speed does not increase from auto-idle speed when propel function actuated. Propel speed does not increases with propel speed switch in fast speed (rabbit). Travel alarm does not sound.
Laptop Computer Self-Diagnostic Function	—	—	—	—
Laptop Computer Monitoring Function	Monitor No. 11, Speed sense control pressure.	Monitor No. 9, Arm regenerative control pressure for pressure signal in engine and pump controller.	Monitor No. 10, Propel motor control pressure for pressure signal in engine and pump controller.	Monitor No. 20, Pressure switch.
Harness Check	Install JT07062 Test Harness. Check that indicator light is on.	Install JT07062 Test Harness. Check that indicator light comes on.	Install JT07062 Test Harness. Check that indicator light is on.	—
Notes	If indicator light is off, check wiring harness.	If indicator light is off, check wiring harness.	If indicator light is off, check wiring harness. Also check switches and sensors in propel motor speed change circuit.	Located below front of control valve adjacent to shuttle valve.
Description of Operation	See Engine Speed Sensing Control Circuit Operation in Group 9025-25.	See Arm Regenerative Valve Operation in Group 9025-05.	See Propel Motor Speed Change Circuit Operation in Group 9025-05.	See Propel Motor Speed Change Circuit Operation in Group 9025-05 or Auto-Idle Mode Speed Control Circuit Operation in Group 9010-05.

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Part Name	**Dig Pressure Switch**	**Boom Up Pressure Switch**	**Arm In Pressure Sensor**	**Learning Switch**
Operational Function	Senses when a dig function is actuated.	Senses boom up pilot pressure signal.	Senses arm in pilot pressure signal.	To start engine speed learning function.
Control Problems	No electrical signal sent to engine and pump controller.	No electrical signal sent to engine and pump controller.	No electrical signal sent to engine and pump controller.	Engine speed learning function does not operate.
Machine Symptoms	Engine speed does not increase from auto-idle speed when a dig function actuated.	No arm in regenerative function during boom up and arm in combined operation. When beginning a ground leveling operation, bucket is slightly lowered into the ground.	No arm in regenerative function during boom up and arm in combined operation. HP (high power) mode does not function. Arm speed slow when leveling.	For an open circuit, engine speed control system operates normally. Engine speed learning procedure cannot be actuated. For a short circuit, learning control is actuated when key switch is turned ON.
Laptop Computer Self-Diagnostic Function	—	—	06 Service code is displayed.	—
Laptop Computer Monitoring Function	Monitor No. 20, Pressure switch.	Monitor No. 20, Pressure switch.	Monitor No. 5, Arm roll-in pilot pressure.	Monitor No. 28, Engine learning control.
Harness Check	—	—	—	—
Notes	Located at swing motor.	Switch needed for arm in regenerative operation.	Sensor needed for HP mode and arm in regenerative operation.	—
Description of Operation	See Auto-Idle Mode Speed Control Circuit Operation in Group 9010-05.	See Arm Regenerative Valve Operation in Group 9025-05.	See Arm Regenerative Valve Operation in Group 9025-05 and HP (High Power) Mode Speed Control Circuit Operation in Group 9010-05.	See Engine Speed Learning Control Circuit Operation in Group 9010-05.

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Diagnostic Information

Part Name	Power Boost Switch	HP (High Power) Mode Switch	E (Economy) Mode Switch	Propel Speed Switch
Operational Function	To actuate the power boost function.	To actuate the HP mode function.	To actuate the E mode function	To change propel speed between fast and slow speed.
Control Problems	For open circuit, no electrical signal to engine and pump controller. For short circuit, operates for 8 seconds when key switch turned on, but then becomes inoperative.	No electrical signal to engine and pump controller. For short circuit, electrical signal to engine and pump controller at all times.	For open circuit, no electrical signal to engine and pump controller. For short circuit, electrical signal to engine and pump controller at all times.	No electrical signal sent to engine and pump controller.
Machine Symptoms	Digging or lifting force does not increase.	For open circuit, engine speed does not increase when hydraulic pressure increases to specified pressure. For short circuit, engine speed increases even with switch off (up).	For open circuit, engine speed does not decrease from fast idle. For short circuit, engine speed does not increase to fast idle.	For open circuit, propel speed stays at slow speed when switch is turned to fast speed (rabbit).
Laptop Computer Self-Diagnostic Function	—	—	—	—
Laptop Computer Monitoring Function	Monitor No. 25, Power boost switch	Monitor No. 24, HP mode switch.	Monitor No. 22, E mode switch.	Monitor No. 26, Propel speed switch.
Harness Check	—	—	—	—
Notes	Power boost function operates for 8 seconds after switch is pushed.	HP indicator light on when switch is on (down).	E indicator light on when switch is on (down).	Check switches and sensors in propel speed control circuit.
Description of Operation	See Power Boost Control Circuit Operation in Group 9025-25.	See HP (High Power) Mode Speed Circuit Operation in Group 9010-05.	See E (Economy) Mode Speed Control Circuit Operation in Group 9010-05.	See Propel Motor Speed Change Circuit Operation in Group 9025-05.

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Diagnostic Information

Part Name	**Engine and Pump Controller (EPC)**	**Front and Rear Pump Control Valve**	**Flow Combiner Valve**	**Arm I Power Passage Check Valve and Restriction Orifice**
Operational Function	To control engine speed, pump and valve operations.	To send a regulated pilot pressure signal to pump regulators in responds to the flow rate through neutral passages in control valve.	To supply oil to left and right propel spools during combined operation of dig and propel functions.	To ensure there is enough oil flow to the swing function when used in combined operation with arm function.
Control Problems	Problems may differ depending on the malfunction.	Pressure signal to pump regulator does not increase when a function is actuated. Pump stays at minimum flow.	Sticking or stuck spool. Oil is insufficient or not supplied to left propel spool.	Oil from left control valve power passage insufficient or not supplied to arm I spool.
Machine Symptoms	Problems listed indicate malfunction in EPC. With key switch on, EC motor does not go to slow idle position; engine starts and run at slow idle. Engine speed cannot be increased. Pump stays at minimum, all functions are slow.	For rear pump control valve: left propel cycle time slow, swing also slow; cycle time for bucket, boom or arm almost normal. For front pump control valve: bucket cycle time very slow, boom not raised when leveling, right propel cycle time slow; cycle time for boom, arm, or swing almost normal.	While traveling straight, machine mistracks when swing is actuated.	Arm speed slow when leveling.
Laptop Computer Self-Diagnostic Functions	—	—	—	—
Laptop Computer Monitoring Function	—	Monitor No. 1, Front pump control pressure and No. 6, Rear pump control pressure.	—	
Harness Check	—	—	—	—
Notes	Check fuses before replacing EPC.	—	—	—
Description of Operation.	See Engine and Pump Controller Circuit Theory of Operation in Group 9015-15.	See Pump Control Valve Operation in Group 9025-05.	See Flow Combiner Valve Operation in Group 9025-05.	—

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Diagnostic Information

Part Name	Arm II Power Passage Check Valve and Restriction Orifice in Right Control Valve	Arm Regenerative Valve	Boom Regenerative Valve	Propel Flow Control Valve
Operational Function	To ensure supply oil pressure to boom I and bucket spool when used in combined operation with arm function. Check valve serves as a lift check valve for arm II spool.	To route oil from rod end to head end of cylinder during arm in when shifted by arm regenerative solenoid valve.	To route return oil from head end to rod end of boom cylinder to prevent cavitation when lowering.	To ensure supply oil pressure to boom II spool when propel and boom up function are operated in combined operation.
Control Problems	No supply oil flow from right control valve power passage to arm II spool if check valve stuck closed or orifice is clogged.	No pressure signal from arm regenerative solenoid valve to shift arm regenerative valve spool. Valve spool is sticking or stuck.	Sticking or stuck check valve.	Supply oil flow not restricted or no boom up pilot control signal to shift propel flow control valve piston.
Machine Symptoms	Arm speed is slow when use in combined operation with boom or bucket. When check valve is stuck open, arm may moved in opposite direction at control lever actuation then change direction.	During arm in, there is arm cylinder cavitation and controllability becomes less.	Boom lower speed becomes slow with check valve stuck closed. Cannot raise tracks off the ground using boom down with check valve stuck open.	When stuck closed, shocks felt when changing from propel to combined propel and dig operation. When stuck open, no boom up when combined with propel down a slope and bucket loaded.
Laptop Computer Self-Diagnostic Functions	—	—	—	—
Laptop Computer Monitoring Function	—	—	—	—
Harness Check	—	—	—	—
Notes	—	—	—	—
Description of Operation	See Control Valve Circuit Schematic in Group 9025-05.	See Arm Regenerative Valve Operation in Group 9025-05.	See Boom Regenerative Valve Operation in Group 9025-05.	See Propel Flow Control Valve Operation in Group 9025-05.

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Diagnostic Information

Part Name	Bucket Flow Control Valve	Arm Rod End Reduced Leakage Valve	Arm Head End Reduced Leakage Valve
Operational Function	To restrict oil flow to bucket circuit in combined operation of bucket, arm in, and boom up to ensure oil flows to higher-loaded boom function to raise boom.	To reduce arm in drift caused by leakage from the cylinder back through control valve.	To reduce arm drift caused by leakage from head end of cylinder back through control valve.
Control Problems	Pilot valves and poppet valve sticking or stuck.	Sticking or stuck check valve or pilot valve. No pilot pressure signal to shift pilot spool.	Check valve does not open if pilot valve is seized.
Machine Symptoms	Bucket speed is slow if poppet valve is stuck closed or pilot valve is stuck causing poppet valve to remain closed. Boom is not raised in combined operation with poppet valve stuck open or pilot valves are stuck open keeping the poppet valve open.	If check valve does not open fully, arm in speed is slow. Arm drifts down. Arm in speed is slow or jerky if check valve sticking.	If check valve does not open fully, arm out speed decreases. If check valve seized open, arm drift increases. Also inspect relief valve. Arm out speed becomes slow or jerky if check valve sticking.
Laptop Computer Self-Diagnostic Function	—	—	
Laptop Computer Monitoring Function	—	—	
Harness Check	—	—	
Notes	—	—	
Description of Operation	See Bucket Flow Control Valve Operation in Group 9025-05.	See Arm Rod End and Boom Reduced Leakage Valves Operation in Group 9025-05.	See Arm Head End Reduced Leakage Valve Operation in Group 9025-05.

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Diagnostic Information

Part Name	**Boom Reduced Leakage Valve**	**Bypass Shut-Off Valve**
Operational Function	To prevent boom down drift caused by leakage from the cylinders back through control valve.	To combine supply oil flow from right control valve neutral passage with supply oil flow in left control valve power passage before auxiliary valve.
Control Problems	Sticking or stuck check valve or pilot valve. No pilot control signal to shift pilot spool.	Auxiliary function attachment does not operate at specified speed. No pilot control signal to shift spool.
Machine Symptoms	If check valve does not open, boom cannot be lowered. If check valve is stuck open, boom drifts down. Boom down speed is slow or jerky if check valve sticking or does not open fully.	If spool seized open, auxiliary function attachment does not operate at specified speed. If spool seized in close position and all control lever in neutral, system relief valve is relieving. Front pump control pressure is at maximum. If seized partially open and all control lever in neutral, front pump delivery pressure is higher than rear pump delivery pressure.
Laptop Computer Self-Diagnostic Function	—	—
Laptop Computer Monitoring Function	—	Monitor No. 1 Front pump control pressure, No. 3 Front pump delivery pressure, and No. 4 Rear pump delivery pressure.
Harness Check	—	—
Notes	—	—
Description of Operation	See Arm Rod End and Boom Reduced Leakage Valves Operation in Group 9025-05.	See Bypass Shut-Off Valve Operation in Group 9025-05.

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DIAGNOSE HYDRAULIC SYSTEM MALFUNCTIONS

NOTE: Diagnose malfunction charts are arranged from most probable and simplest to verify, to least likely and most difficult to verify.

Symptom	Problem	Solution
All Hydraulic Functions Slow	Low oil level	Check oil level in hydraulic oil tank.
	Cold hydraulic oil	Heat hydraulic oil.
	Oil viscosity too heavy	Use the recommended oil (see General Information Section).
	Slow engine speed	Check engine fast and slow idle adjustment. Do engine speed learning procedure. See Group 9010-20.
	Precision work mode selected	Select dig work mode.
	Air leak in pump suction line	Check for air bubbles in oil. Tighten clamps, replace O-rings.
	Pilot circuit malfunction	See Diagnose Pilot Circuit Malfunctions. See Group 9025-15.
	Restricted pump suction screen	Clean pump suction screen. See Group 3360.
	Front and rear pump regulators	Adjust pump regulators. See Group 9025-25.
	Worn pumps	Check flow rate using propel cycle times. Do hydraulic pump flow test. See Group 9025-25.
	System relief valve setting too low or malfunctioning	Check system relief valve setting. See Group 9025-25. Inspect. See Group 3360.
	Circuit relief valve setting too low or malfunctioning	Check circuit relief valve setting. See Group 9025-25. Inspect. See Group 3360.

Continued on next page

TX,9025,GG2526 –19–19NOV97–1/3

Diagnostic Information

Symptom	Problem	Solution
	Low pilot oil pressure	Check pilot pressure regulating valve. See Group 9025-25.
	Front and rear pump control valves	Check pressure. See Group 9025-25. Inspect. See Group 3360.
Hydraulic Oil Overheats	Low oil level	Check oil level in hydraulic oil tank.
	Plugged oil cooler	Test air flow through oil cooler.
	Oil viscosity too light	Use recommended oil. See General Information Section.
	Return filter plugged	Replace filter. See Group 3360.
	System relief valve malfunction	Test system relief valve. See Group 9025-25.
	Oil cooler bypass valve stuck open	Repair or replace. See Group 3360.
	Restriction valve stuck closed	Repair or replace. See Group 3360.
	Fan belt slipping	Check for worn belt. Check tension adjuster. See Group 0510.
	Pump stuck at maximum displacement	Check flow rate using propel cycle times. Do hydraulic pump flow test. See Group 9025-25.
No Hydraulic Functions	Pilot shut-off lever in LOCK position (rearward)	Push shut-off lever to UNLOCK position (forward).
	No oil	Check oil level in hydraulic oil tank.
	Pump drive failure	Check pump drive coupling. See Group 3360.
	Restricted pump suction screen	Clean pump suction screen. See Group 3360.
Poor Combined Operation	Dig or propel pressure switch	Check pressure switches. Check wiring harness. See Group 9015-15. See harness test in Group 9025-25.

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Diagnostic Information

Symptom	Problem	Solution
	Engine and pump controller	Check engine and pump controller. See Group 9015-15.
	Pilot controller	Check pilot pressure at control valve. See Group 9025-25.
	Pilot pressure regulating valve	Check pilot pressure regulating valve pressure setting. See Group 9025-25.
	Check valves and flow control valves in control valve	Inspect valves. See Group 3360.

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DIAGNOSE PILOT CIRCUIT MALFUNCTIONS

NOTE: Diagnose malfunction charts are arranged from most probable and simplest to verify, to least likely and most difficult to verify.

Symptom	Problem	Solution
All Functions Cannot Be Operated	Pilot shut-off lever in LOCK position (rearward)	Push shut-off lever to UNLOCK position (forward).
	Pilot pressure regulating valve stuck open	Test pilot pressure regulating valve. See Group 9025-25. Inspect. See Group 3360.
	Pilot pump failure	Remove and inspect pilot pump. See Group 3360.
Function Does Not Stop When Control Lever Released	Control valve spool stuck	Manually move spool to check for sticking. See Group 3360.
	Pilot controller	Check for sticking spool. See Group 3360.
Some Functions Cannot Be Operated, All Others Are Normal	Pilot cap	Inspect for leakage at pilot cap. See Group 3360.
	Pilot controller or hoses to function that cannot be operated	Check pilot controller hoses or pilot controller. See Group 3360.
	Flow regulator valve	Check for stuck spools or check valves. See Group 3360.
	Control valve spool stuck.	Manually move spool to check for sticking. See Group 3360.
All Functions Slow	Pilot filter plugged	Replace pilot filter.
	Low pilot system pressure	Check pilot pressure regulating valve pressure setting. See Group 9025-25.
	Restriction in pilot shut-off valve	Check pilot shut-off lever position. See Group 9025-20.

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Diagnostic Information

Symptom	Problem	Solution
Function Moves In Opposite Direction	Pilot control hoses connected backwards	Check installation of pilot control hoses. See Group 9025-15.

TX,9025,GG2527 –19–19NOV97–2/2

DIAGNOSE DIG CIRCUIT MALFUNCTIONS

NOTE: Diagnose malfunction charts are arranged from most probable and simplest to verify, to least likely and most difficult to verify.

Symptom	Problem	Solution
All Dig Functions Slow or No Power	Hydraulic system malfunction	See Diagnose Hydraulic System Malfunctions. See Group 9025-15.
	Pilot circuit malfunction	See Diagnose Pilot Circuit Malfunctions. See Group 9025-15.
	Front or rear pump regulator	Do Hydraulic Pump Regulator Adjustments. See Group 9025-25.
	System relief valve	Test system relief valve. See Group 9025-25.
	Front or rear pump control valve	Check pressure. See Group 9025-25. Inspect. See Group 3360.
	Hydraulic pumps	Check pumps using cycle time. Do Hydraulic Pump Flow Test. See Group 9025-25.
Some Dig Functions Slow (Not All)	Pilot circuit malfunction	See Diagnose Pilot Circuit Malfunctions. See Group 9025-15.
	Control valve leakage	Check dig functions for drift. See Group 9025-25.
	Cylinder leakage	Test cylinder for leakage. See Group 9025-25.
	Circuit relief valve	Test circuit relief valves. See Group 9025-25.
	Valve spool sticking	Manually move spool to check for sticking. See Group 3360.
	Front and rear pump control valves	Check pressure. See Group 9025-25. Inspect. See Group 3360.

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Symptom	Problem	Solution
Load Drifts Down When Control Valve Is In Neutral Position	Cylinder leakage	Test cylinder for leakage. See Group 9025-25.
	Circuit relief valve	Test circuit relief valves. See Group 9025-25.
	Reduced leakage valve for boom down and arm in	Inspect reduced leakage valve. See Group 3360
	Control valve leakage	Inspect control valve. See Group 3360.
Load Falls When Control Valve Is Actuated To Raise Load With Engine Running At Slow Idle	Lift check valve leakage	Inspect lift check valve in control valve. See Group 3360.
Function Moves in Opposite Direction	Pilot control hoses connected backwards	Check installation of pilot control hoses. See Group 9025-15.
HP (High Power) Function Does Not Operate, Standard Mode Is Normal	Pump pressure or arm-in pressure sensors	Check for Service Codes 02, 03, or 06. See Group 9025-25. Replace sensors as necessary. See Group 1674. Also check wiring harness. See Group 9015-15.
	HP mode switch	Monitor data item 24 to check On, Off state of switch. See Group 9025-25. Also check wiring harness.
	Injection pump fast idle stop bracket	Check adjustment. See Group 9010-20.
	Engine speed	Engine speed must be 1600 rpm or more. Turn engine rpm dial to fast idle position and check again.

TX,9025,GG2528 –19–24FEB98–2/2

DIAGNOSE SWING CIRCUIT MALFUNCTIONS

NOTE: Diagnose malfunction charts are arranged from most probable and simplest to verify, to least likely and most difficult to verify.

Symptom	Problem	Solution
Swing Speed Slow In Both Directions	Low pilot system pressure	All other functions are slow. See Diagnose Pilot Circuit Malfunctions. See Group 9025-15.
	Crossover relief valve	Test crossover relief valve pressure. See Group 9025-25.
	Swing valve leakage	Inspect swing valve. See Group 3360).
	Swing motor leakage	Test swing motor for leakage. See Group 9025-25.
	Swing park brake	Check pilot pressure to swing brake release valve. See Group 9025-25.
	Worn rear pump	Check left track cycle time. It will be slow if rear pump is worn. See Group 9025-25.
Swing Speed Slow or Does Not Operate In One Direction	Pilot circuit malfunction	See Diagnose Pilot Circuit Malfunctions. See Group 9025-15.
	Swing make-up valve leakage	Inspect make-up valves. See Group 3360.
	Swing crossover relief valve malfunction	Test swing crossover relief valves. See Group 9025-25.
Upperstructure Drift With Swing Valve In Neutral	Swing park brake	Inspect swing park brake. See Group 3360.
	Swing crossover relief valve leakage	Test swing crossover relief valves. See Group 9025-25.
	Swing make-up check valve leakage	Inspect make-up valves. See Group 3360.

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Diagnostic Information

Symptom	Problem	Solution
	Swing motor leakage	Test swing motor for leakage. See Group 9025-25.
Swing Function Does Not Operate	Pilot circuit malfunction	See Diagnose Pilot Circuit Malfunctions. See Group 9025-15.
	Swing brake release valve malfunction	Inspect swing brake release valve. See Group 3360.
	Swing valve spool stuck	Manually move spool to check for sticking. See Group 3360.
	Mechanical failure of swing motor or gearbox	Disassemble components to determine cause of failure. See Groups 4350 and 4360.

TX,9025,GG2529 –19–19NOV97–2/2

DIAGNOSE PROPEL SYSTEM MALFUNCTIONS

NOTE: Diagnose malfunction charts are arranged from most probable and simplest to verify, to least likely and most difficult to verify.

Symptom	Problem	Solution
Propel Park Brakes Do Not Apply	Propel speed change valve stuck, oil not released from piston cavity	Remove valve and clean or replace. See Group 0260.
	Propel park brake	Remove and repair brake. See Group 0260.
Track Will Not Move In One Direction	Pilot circuit malfunction	See Diagnose Pilot Circuit Malfunctions. See Group 9025-15.
	Propel crossover relief valve	Do Crossover Relief Valve Test And Adjustment. See Group 9020-25.
	Propel control valve spool stuck	Manually move spool to check for sticking. See Group 3360.
	Counterbalance valve spool stuck	Inspect counterbalance valve. See Group 0260.
	Shuttle valve in brake valve assembly not seating	Inspect shuttle valve. See Group 0260.
	Rotary manifold leakage	Inspect rotary manifold. See Group 0260.
Track Will Not Move In Either Directions	Pilot Circuit Malfunction	See Diagnose Pilot Circuit Malfunctions. See Group 9025-15.
	Crossover relief valve	Do Crossover Relief Valve Test and Adjustment. See Group 9025-25.
	Propel pilot controller	Inspect propel pilot controller. See Group 3360.
	Propel valve spool	Manually move spool to check for sticking. See Group 3360.
	Counterbalance valve spools stuck	Inspect counterbalance valve. See Group 0260.

Continued on next page

TX,9025,GG2530 –19–19NOV97–1/3

Diagnostic Information

Symptom	Problem	Solution
	Mechanical failure of propel motor or gearbox	Disassemble components to determine cause of failure.
	Rotary manifold leakage	Inspect rotary manifold. See Group 0260.
Excavator Mistracks at All Speeds In Both Directions	Track sag adjustment	Adjust track sag. See Group 9020-20.
	Propel pilot controller malfunction	Inspect propel pilot controller. See Group 3360.
	Propel motor crossover relief valve malfunction	Do Crossover Relief Valve Test And Adjustment. See 9020-25.
	Servo piston shuttle valve seat leakage.	Inspect check valve and seat. See Group 0260.
	Leakage in motor	Check tracking while descending a hill. If tracking is within specification when descending a hill, but not when on the level or going up hill, motor leakage is indicated. Do Propel Motor Leakage Test. See Group 9020-25.
	Rotary manifold leakage	Inspect rotary manifold. See Group 0260.
	Front and rear pump regulators	Do pump regulators adjustment. See Group 9025-25.
Slow Propel Speed Or Low Power	Track sag adjustment	Adjust track sag. See Adjust Track Sag in Group 9020-20.
	Propel motor crossover relief valve	Do Crossover Relief Valve Test And Adjustment. See Group 9020-25.
	Propel brake not releasing	Inspect propel brake. See Group 0260.
	Propel motor	Do Propel Motor Operating Leakage Test. See Group 9020-25.

Continued on next page

Diagnostic Information

Symptom	Problem	Solution
	Rotary manifold leakage	Inspect rotary manifold. See Group 0260.
	Low pump flow	Check propel cycle times. Do Hydraulic Pump Flow Test. See Group 9025-25.
	Engine performance low	Test engine performance. See Group 9010-25.
Combined Propel and Dig Functions Slow or No Power	Flow combiner valve	Check for sticking or stuck valve spool. See Group 3360.
	Propel flow control valve	Check for sticking or stuck valve spool. See Group 3360.
Propel Is "Jerky"	Track sag too tight or too loose	Adjust track sag. See Adjust Track Sag in Group 9020-20.
	No oil or low oil level in rollers	Fill with correct oil. See General Information Section
	Servo piston shuttle valve seat leakage.	Inspect shuttle valve seat. See Group 0260.
	Propel park brake leakage	Inspect propel park brake piston. See Group 0260.
	Mechanical failure in propel motor or gearbox	Inspect motor and gearbox. See Group 0260.
	Deformed track frame	See Undercarriage Appraisal Manual SP326. Repair or replace components.
Excavator Will Not Hold Back and Park Brakes Engage and Disengage When Traveling Down An Incline	Counterbalance valve spool stuck	Inspect counterbalance valve spool. See Group 0260.
Excavator Will Not Turn Smoothly In One Direction Or Park Brake Grabs	Counterbalance valve spool stuck	Inspect counterbalance valve spool. See Group 0260.

TX,9025,GG2530 –19–19NOV97–3/3

CONTROL LEVER PATTERN CONVERSION

To change your machine pilot control levers from the standard pattern to a John Deere pattern:

1. Lower bucket to the ground.

2. Turn auto-idle switch off. Run engine with engine rpm dial at 1/3 position without load for 2 minutes.

3. Turn engine rpm dial to slow idle position.

   Turn key switch to OFF to stop engine. Remove key from switch.

4. Pull pilot control shut-off lever to LOCK position.

CAUTION: High pressure release of oil from pressurized system can cause serious burns or penetrating injury. The hydraulic tank is pressurized. Do not remove vent plug. Release air pressure by loosening vent plug.

5. Release air pressure from hydraulic oil tank by loosing vent plug.

6. Open door on storage compartment behind cab.

Continued on next page TX,9025,GG2511 –19–11FEB97–1/2

NOTE: Do not use manufacturer's identification tags or markings on line ends to identify lines for this conversion procedure. The conversion must be done on the side of flow regulator valve that is connected to the pilot controllers.

7. Switch the hoses (A—D) from pilot controllers at the front right side (the side towards oil cooler) of flow regulator valve. Hoses are switched in a X pattern.

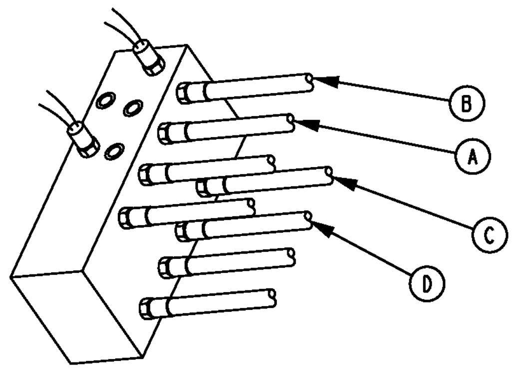
   Switch hose (A) with hose (C).

   Switch hose (B) with hose (D).

CAUTION: Prevent injury from unexpected control lever function. Install new decals on control consoles.

8. Install new decals (black on yellow) on control consoles near the base of control levers. Decals are enclosed in Operator's Manual package. Additional decals are available through parts.

T105646B –UN–17DEC96



T105850 –UN–07JAN97

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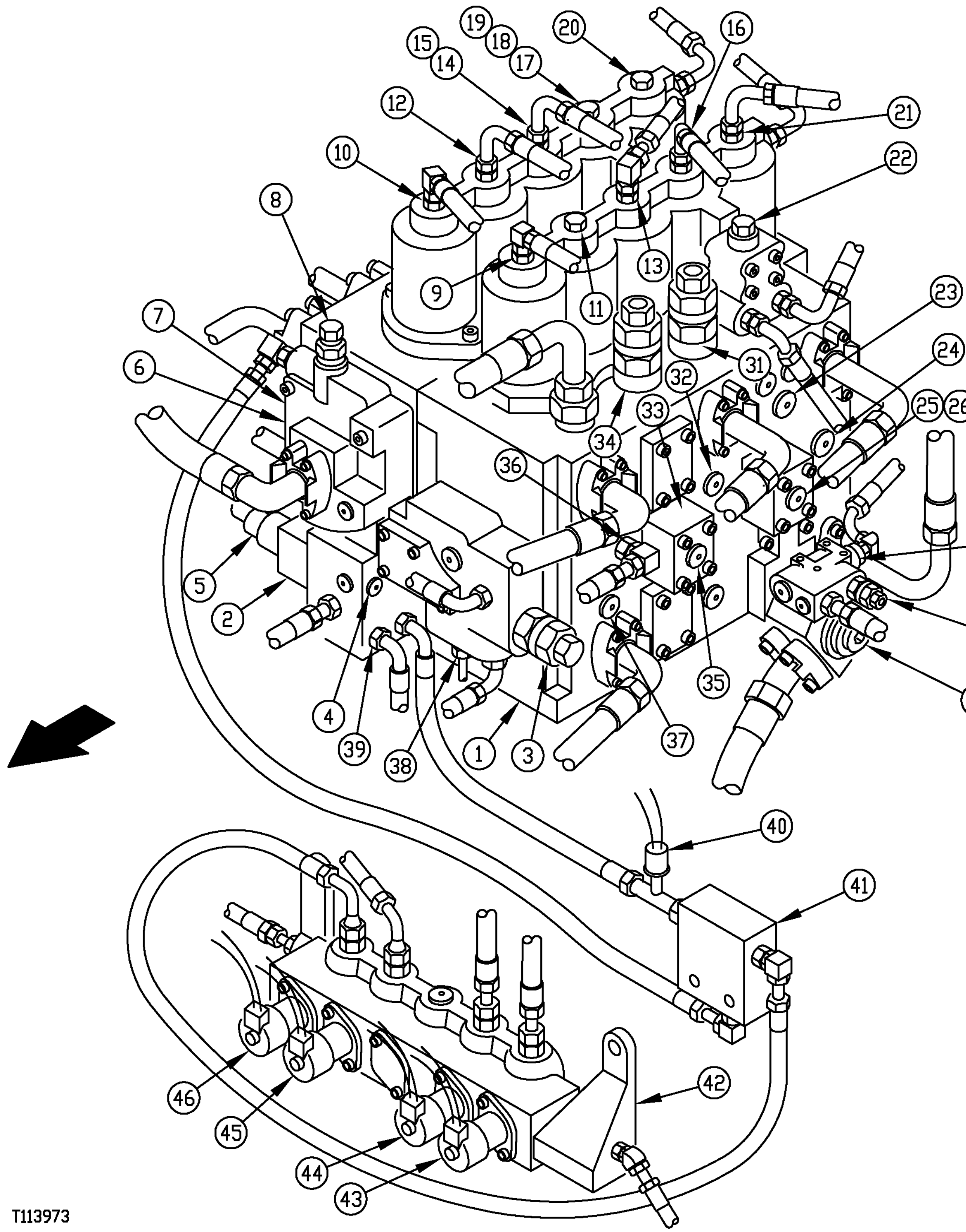
TX,9025,GG2511 –19–11FEB97–2/2

CONTROL VALVE COMPONENT IDENTIFICATION—LEFT FRONT



T113973 –UN–05JUN98

9025
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26

Continued on next page

Diagnostic Information

1—Left Control Valve—5-Spool
2—Right Control Valve—4-Spool
3—Rear Pump Control Valve
4—Flow Combiner Check Valve
5—Flow Combiner Valve
6—System Relief Valve Isolation Check Valve
7—System Relief Valve Isolation Check Valve
8—System Relief and Power Boost Valve
9—Left Propel Valve
10—Right Propel Valve
11—Auxiliary Valve
12—Bucket Valve
13—Boom II Valve
14—Boom I Valve
15—Boom Regenerative Valve (in Boom I Spool)
16—Arm I Valve
17—Arm II Valve
18—Arm Regenerative Valve (in Arm II Spool)
19—Check Valve and Orifice (in Arm II Spool)
20—Bypass Shut-Off Valve
21—Swing Valve
22—Arm Rod End Reduced Leakage Pilot Valve
23—Arm Rod End Reduced Leakage Check Valve
24—Swing Lift Check Valve
25—Power Passage-to-Arm I Neutral Passage Check Valve
26—Arm I Lift Check Valve
27—Restriction Orifice (in housing)
28—Arm Head End Reduced Leakage Pilot Valve
29—Arm Head End Reduced Leakage Relief Valve
30—Arm Head End Reduced Leakage Check Valve
31—Arm Out Circuit Relief and Anti-Cavitation Valve
32—Boom II Power Passage Lift Check Valve
33—Auxiliary Power Passage Lift Check Valve
34—Auxiliary Circuit Relief and Anti-Cavitation Valve
35—Front Pump Bypass Inlet Port
36—Propel Flow Control Valve
37—Left Propel Neutral Passage Lift Check Valve
38—Rear Pump Control Valve Pilot Inlet Filter
39—Pilot Pressure Signal Passage Filter
40—Propel Pressure Switch
41—Shuttle Valve
42—Solenoid Valve Manifold
43—Arm Regenerative Solenoid Valve
442—Speed Sensing Solenoid Valve
45—Propel Speed Change Solenoid Valve
46—Power Boost Solenoid Valve

CED,TX08227,3129 –19–21MAY98–2/2

9025
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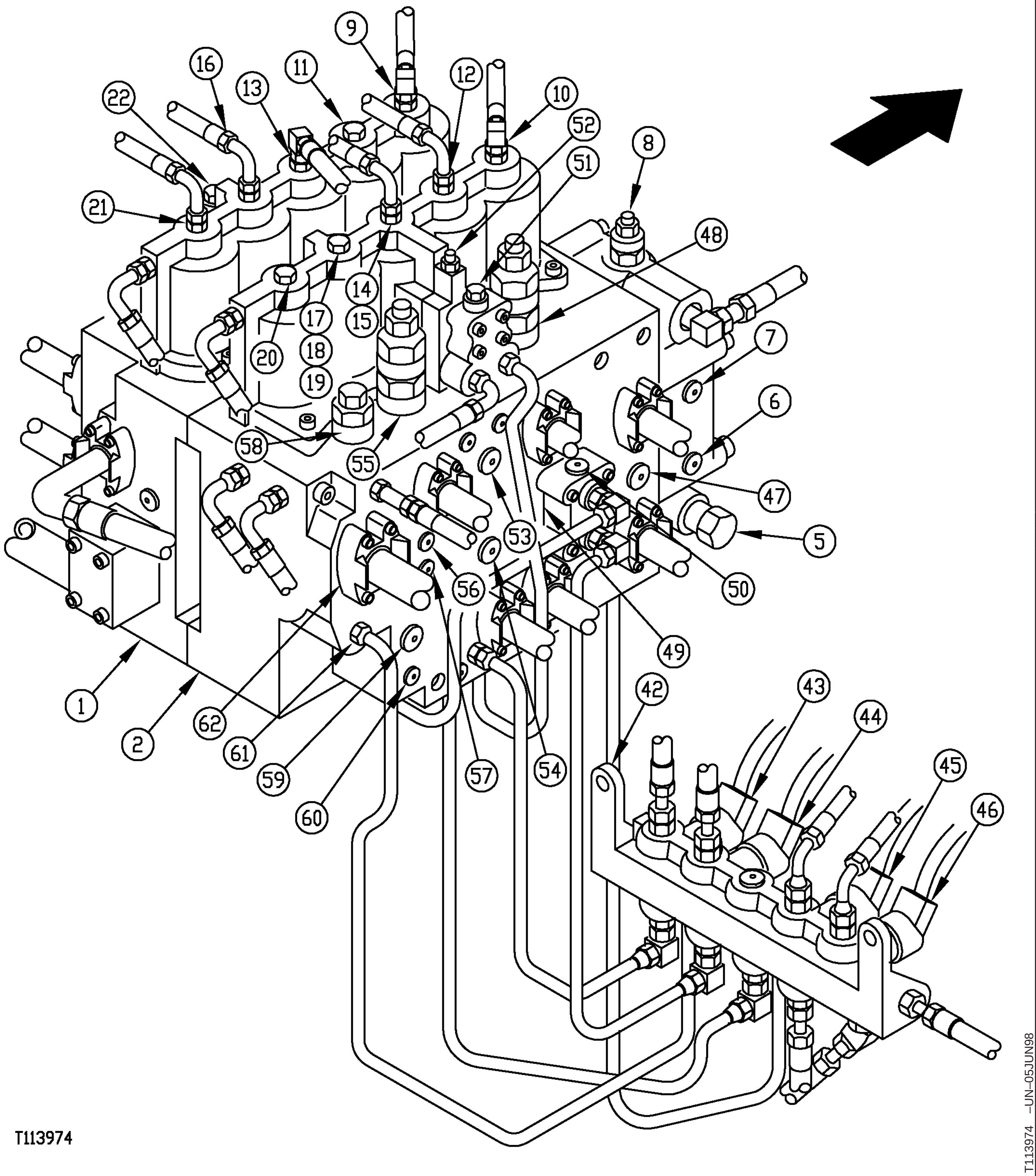
27

CONTROL VALVE COMPONENT IDENTIFICATION—RIGHT REAR



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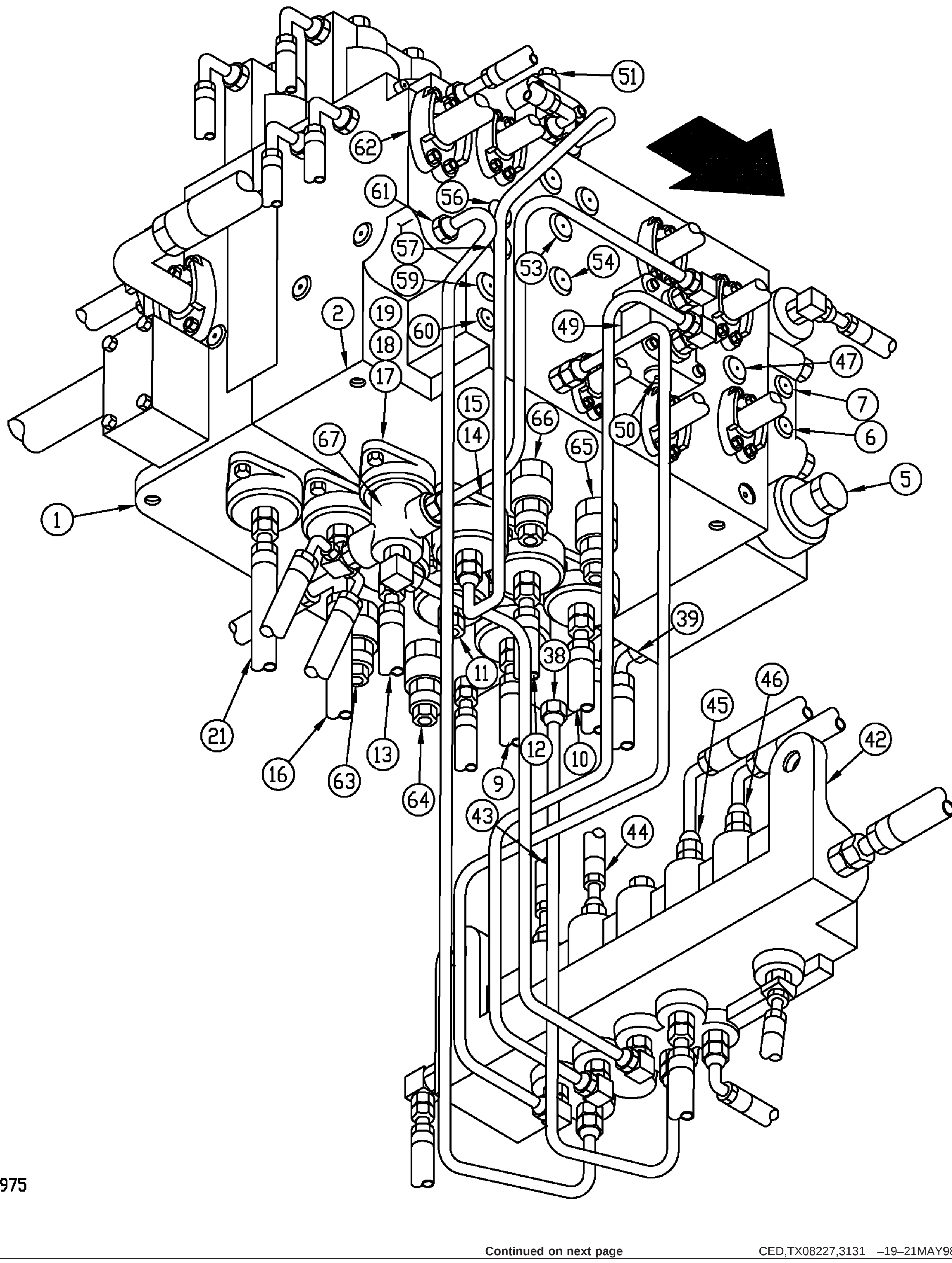
1—Left Control Valve—5-Spool
2—Right Control Valve—4-Spool
5—Flow Combiner Valve
6—System Relief Valve Isolation Check Valve
7—System Relief Valve Isolation Check Valve
8—System Relief and Power Boost Valve
9—Left Propel Valve
10—Right Propel Valve
11—Auxiliary Valve
12—Bucket Valve
13—Boom II Valve
14—Boom I Valve
15—Boom Regenerative Valve (in Boom I Spool)
16—Arm I Valve
17—Arm II Valve
18—Arm Regenerative Valve (in Arm II Spool)
19—Check Valve and Orifice (in Arm II Spool)
20—Bypass Shut-Off Valve
21—Swing Valve
22—Arm Rod End Reduced Leakage Pilot Valve
42—Solenoid Valve Manifold
43—Arm Regenerative Solenoid Valve
44—Speed Sensing Solenoid Valve
45—Propel Speed Change Solenoid Valve
46—Power Boost Solenoid Valve
47—Orifice and Bucket Power Passage Lift Check Valve
48—Bucket Dump Circuit Relief and Anti-Cavitation Valve
49—Bucket Flow Control Poppet Valve
50—Bucket Flow Control Pilot Valve B
51—Boom Reduced Leakage Pilot Valve
52—Boom Manual Lower Release Screw
53—Boom Reduced Leakage Check Valve
54—Boom I Power Passage Lift Check Valve
55—Boom Up Circuit Relief and Anti-Cavitation Valve
56—Orifice and Arm II Power Passage Lift Check Valve
57—Arm II Neutral Passage Lift Check Valve
58—Front Pump Control Valve
59—Front Pump Bypass Shut-Off Valve Outlet Port
60—Bypass Shut-Off Valve Pilot Port
61—Front Pump Control Valve Pilot Inlet Filter
62—Oil Cooler Bypass Valve

CED,TX08227,3130 –19–21MAY98–2/2

CONTROL VALVE COMPONENT IDENTIFICATION—BOTTOM



T113975

T113975 –UN–05JUN98

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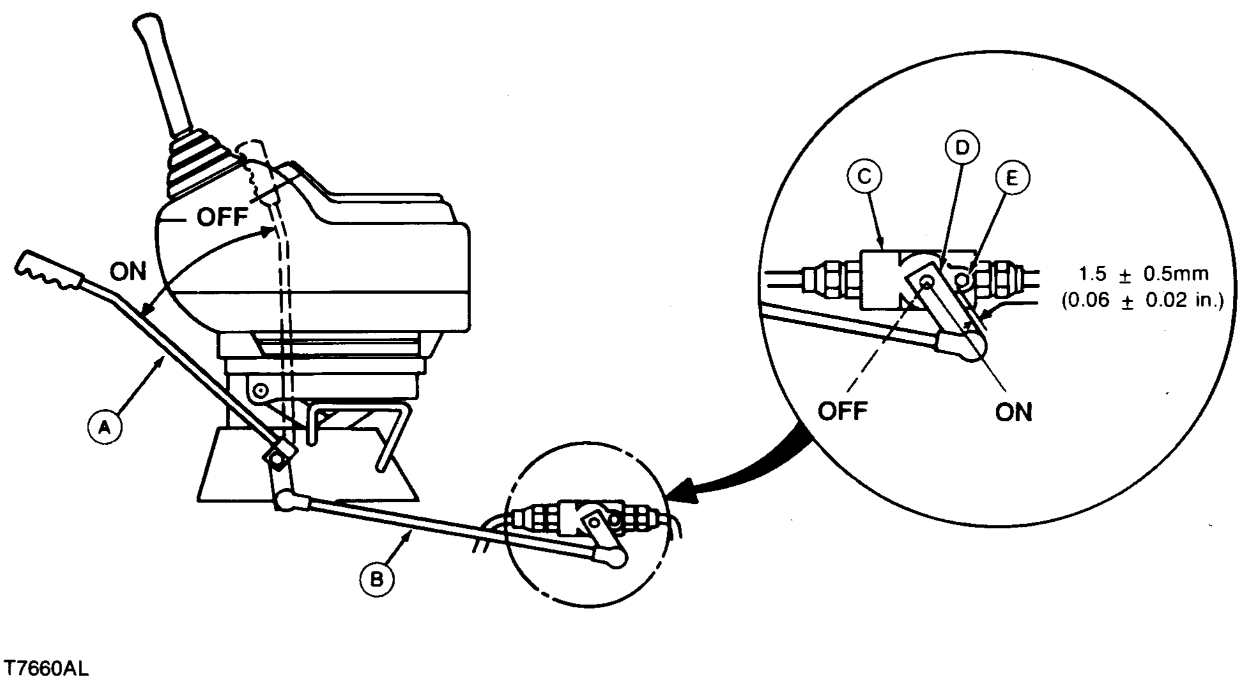
CED,TX08227,3131 –19–21MAY98–1/2

1—Left Control Valve—5-Spool
2—Right Control Valve—4-Spool
5—Flow Combiner Valve
6—System Relief Valve Isolation Check Valve
7—System Relief Valve Isolation Check Valve
9—Left Propel Valve
10—Right Propel Valve
11—Auxiliary Valve
12—Bucket Valve
13—Boom II Valve
14—Boom I Valve
15—Boom Regenerative Valve (in Boom I Spool)
16—Arm I Valve
17—Arm II Valve
18—Arm Regenerative Valve (in Arm II Spool)
19—Check Valve and Orifice (in Arm II Spool)
21—Swing Valve
38—Rear Pump Control Valve Pilot Inlet Filter
39—Pilot Pressure Signal Passage Filter
42—Solenoid Valve Manifold
43—Arm Regenerative Solenoid Valve
44—Speed Sensing Solenoid Valve
45—Propel Speed Change Solenoid Valve
46—Power Boost Solenoid Valve
47—Orifice and Bucket Power Passage Lift Check Valve
49—Bucket Flow Control Poppet Valve
50—Bucket Flow Control Pilot Valve B
51—Boom Reduced Leakage Pilot Valve
53—Boom Reduced Leakage Check Valve
54—Boom I Power Passage Lift Check Valve
56—Orifice and Arm II Power Passage Lift Check Valve
57—Arm II Neutral Passage Lift Check Valve
59—Front Pump Bypass Shut-Off Valve Outlet Port
60—Bypass Shut-Off Valve Pilot Port
61—Front Pump Control Valve Pilot Inlet Filter
62—Oil Cooler Bypass Valve
63—Boom Down Circuit Relief and Anti-Cavitation Valve
64—Auxiliary Circuit Relief and Anti-Cavitation Valve
65—Bucket Load Circuit Relief and Anti-Cavitation Valve
66—Arm In Circuit Relief and Anti-Cavitation Valve
67—Bucket Flow Control Pilot Valve A

CED,TX08227,3131 –19–21MAY98–2/2

FOLDOUT PAGES 6-138 THRU 6-144 ARE AT REAR OF MANUAL

PILOT SHUT-OFF VALVE LINKAGE ADJUSTMENT



T7660AL –19–06DEC91

SPECIFICATIONS	
Pilot Shut-Off Lever to Head of Cap Screw Clearance	1.5 ± 0.5 mm (0.06 ± 0.02 in.)

1. Stop the engine.

2. Remove cover underneath operator's station.

3. Push pilot shut-off lever (A) forward to the ON position. Check that lever is against the front stop.

4. Adjust ball joints on rod (B) to get the specified clearance between valve lever (D) and head of cap screw (E).

Pilot Shut-Off Lever to Head of Cap Screw—Specification

Clearance.. 1.5 ± 0.5 mm (0.06 ± 0.02 in.)

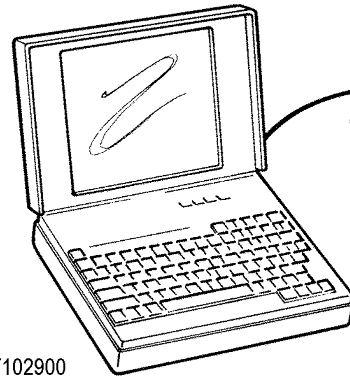
5. Pull pilot shut-off lever to the OFF position. Check that lever is against the rear stop.

CAUTION: Machine may move if adjustment is incorrect. Before checking pilot shut-off lever adjustment, make sure the area around machine is clear.

6. Start the engine. Run engine at slow idle. Actuate the hydraulic functions. Hydraulic functions must not move with the pilot shut-off lever in the OFF position. If hydraulic function move, repeat adjustment procedure.

TX,9025,GG2108 –19–18NOV97–1/1

LAPTOP COMPUTER GENERAL DESCRIPTION



T102900

T102900 –19–29AUG96

NOTE: The laptop cannot be connected to excavator system without 5 volts from the system supply. If laptop cannot establish a successful RS232 connection, check for approximately 5 volts on any of the 5-volt sensor's power wire. A grounded 5-volt sensor power wire will prevent a successful RS232 connection. Without system 5-volt supply, RS232 connection is disabled.

The JT07274F Excavator Diagnostics Program Disk is designed to run on a laptop computer, such as JT07294 Computer Kit, with the following minimal hardware requirements:

- 486 Processor
- 16 megs of RAM
- WINDOWS® 95 or
- WINDOWS NT™
- Standard RS232 Serial Port

The laptop computer is connected to the John Deere excavator by the JT07273 Cable with a standard RS232 connector fitted with a filter to accommodate the voltage levels of the engine and pump controller.

WINDOWS is a trademark of MICROSOFT CORPORATION.
NT is a trademark of MICROSOFT CORPORATION.

CED,TX08227,2893 –19–28JAN99–1/1

EXCAVATOR DIAGNOSTICS PROGRAM—OVERVIEW

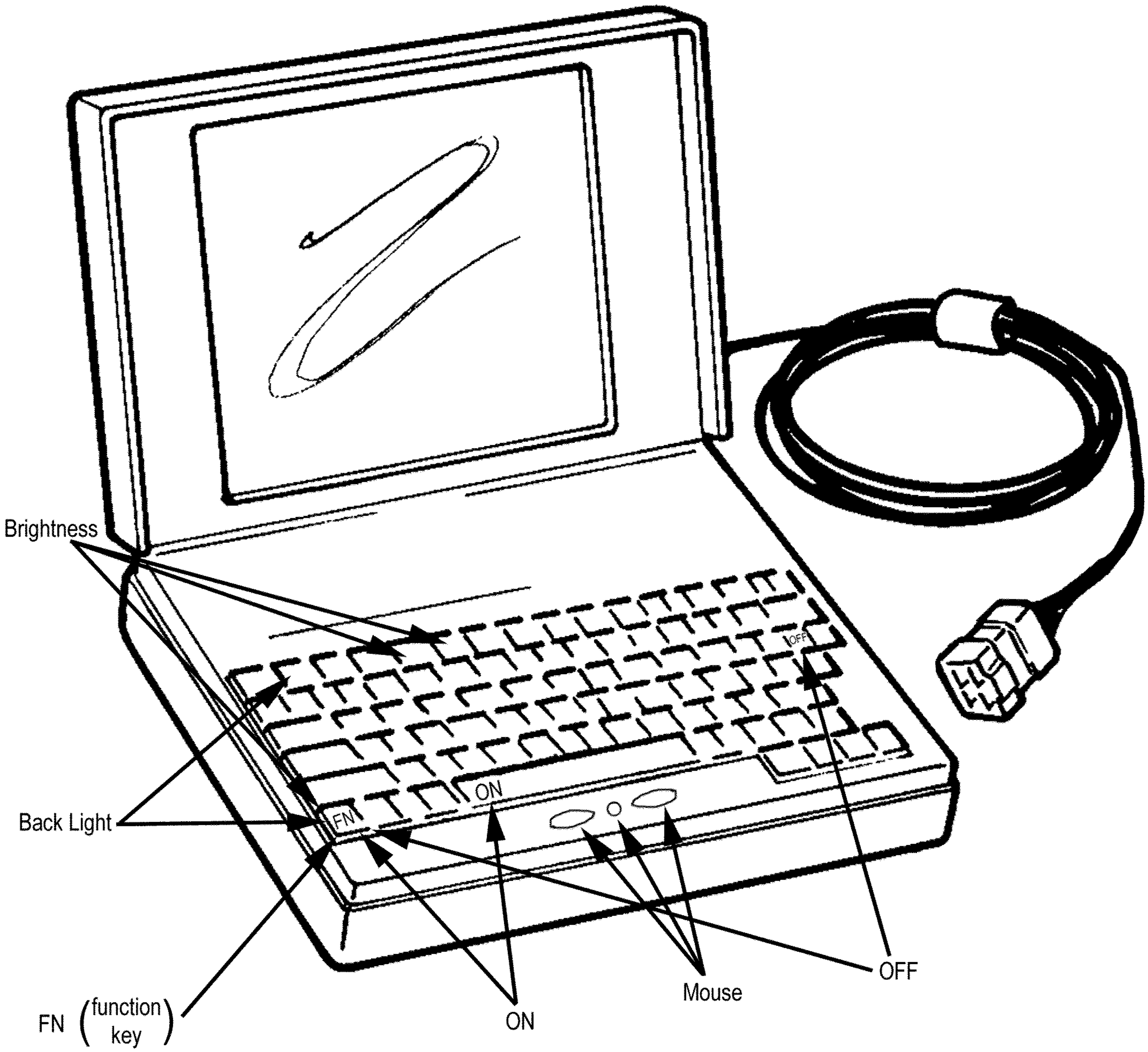
The JT07274F Excavator Diagnostics Program Disk is to be used to monitor information available from the Engine and Pump Controller (EPC) on the John Deere excavator.

In general, the functions provided for John Deere excavators include:

- Identification of Excavator.
- Displaying of Diagnostic Service Codes and Corrective Actions.
- Monitoring Data.
- Adjustment of Parameters.
- On-Line Help.

CED,TX08227,2894 –19–19NOV97–1/1

EXCAVATOR DIAGNOSTICS PROGRAM—INSTALL



T102901

T102901 –19–04SEP96

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TX,9025,CR94 –19–28JAN99–1/5

NOTE: The laptop cannot be connected to excavator system without 5 volts from the system supply. If laptop cannot establish a successful RS232 connection, check for approximately 5 volts on any of the 5-volt sensor's power wire. A grounded 5-volt sensor power wire will prevent a successful RS232 connection. Without system 5-volt supply, RS232 connection is disabled.

The complete excavator diagnostics program is contained on a single floppy disk. The program requires approximately twelve megabytes upon installation. Installation of the program or software updates is best accomplished using the following procedure:

NOTE: The latest version of the excavator diagnostics program now contains a list of supported excavator models in the About John Deere window. To check the list of excavator models supported, click on the **About** *button on the Toolbar or the* **Help** *drop down menu on the Menu Bar and then click on* **About John Deere.**

1. Insert floppy disk in floppy disk drive.

2. Connect floppy disk drive to the computer. As needed, connect an external power source to floppy disk drive.

*NOTE: If floppy disk drive is not connected when the computer is first "booted" (turned on) the floppy disk drive (***e:***) may not be recognized. To "reboot", push* **Ctrl** *and* **Alt** *and* **Delete** *at the same time or push and hold both left and right mouse buttons down for 10 seconds*

3. Turn the computer on. This is done on the recommended computer by pushing function **Fn** and **ON** at the same time.

4. Adjust brightness of screen. Push **Fn** and **F4** or **F5** on computer.

5. Using the mouse, push the **Start** button at the lower left corner of screen.

NOTE: The mouse is a short post located below the space bar. Push the post in direction you want the cursor to move. Click the buttons on the left of the mouse when cursor is in desired location. The tip of the cursor must be on the menu button for menu to open.

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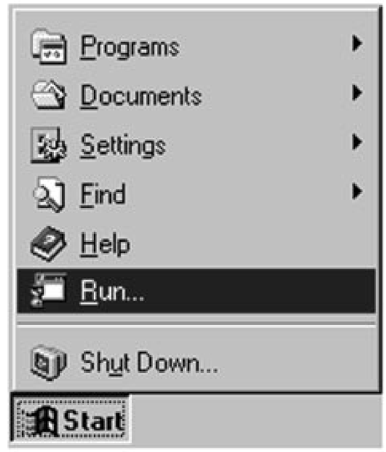
Continued on next page TX,9025,CR94 –19–28JAN99–2/5

6. From the **Start** menu, click on **Run.**

NOTE: To use the Windows 95 Add/Remove Programs feature, click on **Settings** *in the* **Start** *menu, then* **Control Panel, Add/Rem... Programs,** *and then follow the instruction in each window as they are displayed.*



T102902 –19–29AUG96

T102902

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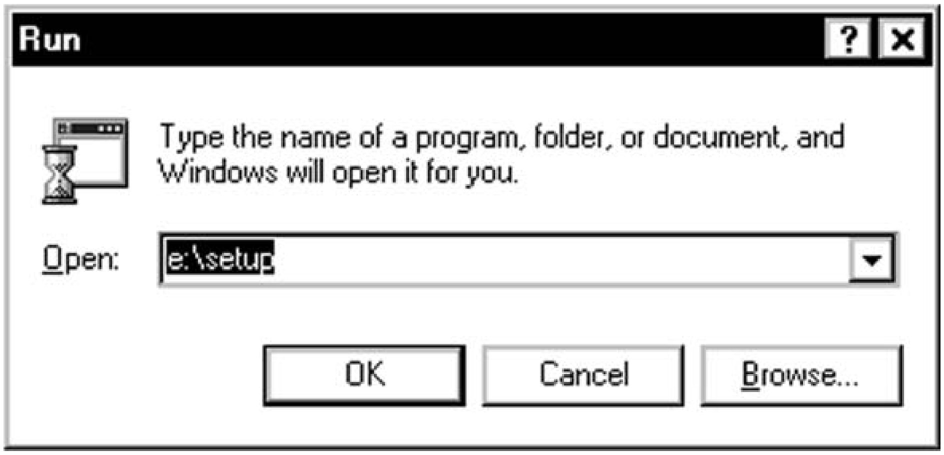


T102903 –19–19SEP96

7. Type **e:** and then a **** (backslash) in the **Run** dialog window. Then type **setup** (or use the Browse button to find and select "setup" from the floppy disk and then select **Open**). See illustration for an example.

NOTE: Some computers use **a:** *as the floppy disk drive. Repeat previous step with* **a:** *instead of* **e:** *if computer doesn't recognize the floppy disk drive.*

8. Once the dialog window contains the correct drive and file name, click on the **OK** button.

NOTE: Your computer will remember which drive a disk is loaded on the last time it was done. Therefore pushing the enter key may be all that is required after a disk has been loaded the first time.

9. Setup prompts you with a welcome dialog window that describes the program and lets you continue or exit

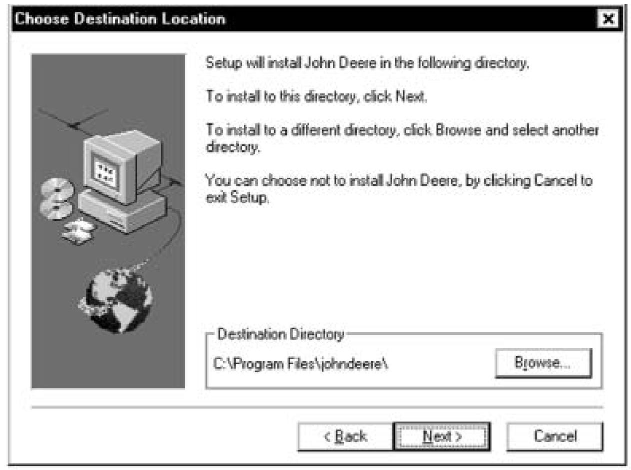
   Click **NEXT**

Continued on next page

TX,9025,CR94 –19–28JAN99–4/5

10. Click **Next** to select default location for software placement or click **Browse** to select desired location.

    Congratulations! The program is now installed.



T102904

T102904 –19–29AUG96

TX,9025,CR94 –19–28JAN99–5/5

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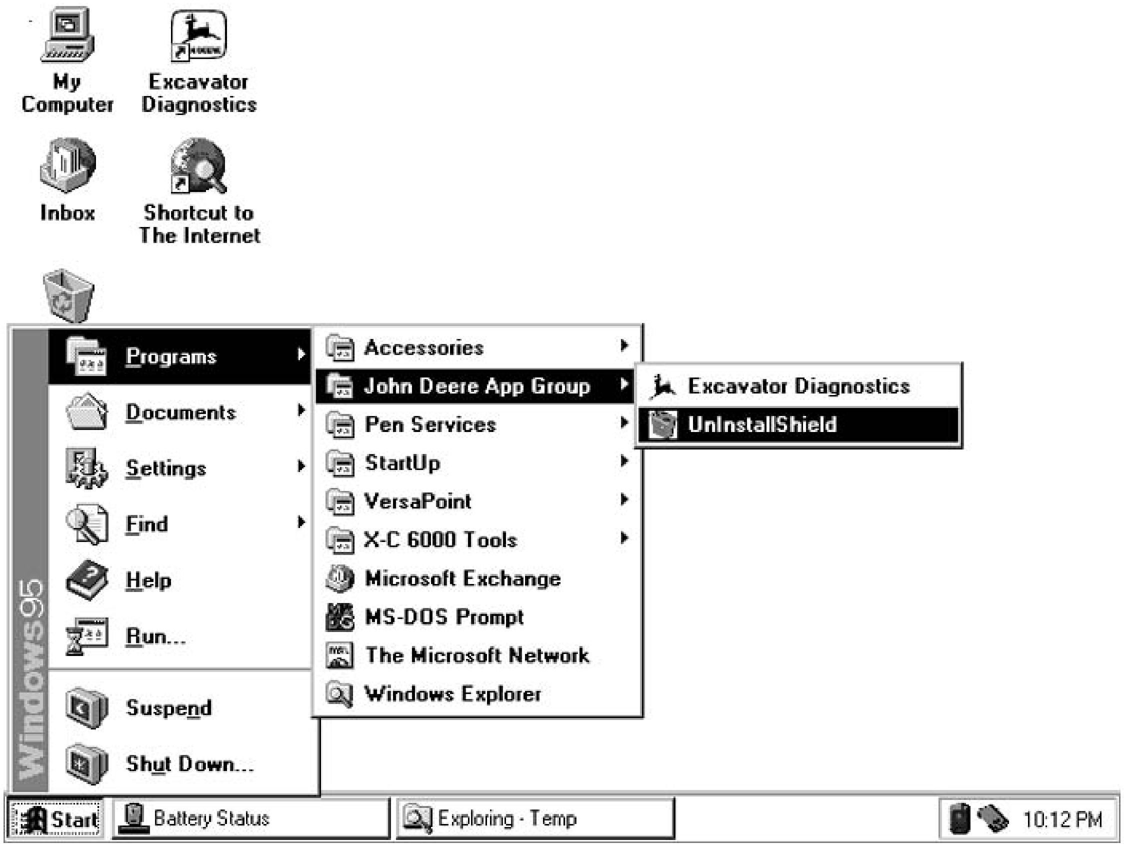
EXCAVATOR DIAGNOSTICS PROGRAM—UNINSTALL



T107199 –19–11FEB97

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An Uninstall feature has been created for your convenience to efficiently remove the program from your computer. Click on **Start, Programs, John Deere App Group,** and then **Uninstall Shield** which is below the Excavator Diagnostics menu. Follow on-screen instructions.

NOTE: If John Deere App Group window is open, just click on Uninstall Shield.

TX,9025,CR100 –19–19NOV97–1/1

EXCAVATOR DIAGNOSTICS PROGRAM—STARTING

T102905

T102905 –19–06SEP96

NOTE: The laptop cannot be connected to excavator system without 5 volts from the system supply. If laptop cannot establish a successful RS232 connection, check for approximately 5 volts on any of the 5-volt sensor's power wire. A grounded 5-volt sensor power wire will prevent a successful RS232 connection. Without system 5-volt supply, RS232 connection is disabled.

The John Deere Excavator Diagnostics Software program is started using the **Excavator Diagnostics** icon on the desktop. Also, can be started from the **John Deere App Group** in the **Programs** menu. The **Excavator Diagnostics** icon is automatically put on the desktop when the program is loaded.

Continued on next page

TX,9025,GG2670 –19–28JAN99–1/5

T109483

T109483 –19–13MAY97

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*NOTE: To install the **Excavator Diagnostics** icon if not on the desktop, use the following procedure:*

1. *Click on **Start** using the right mouse button.*
2. *Click **Open** using the left mouse button.*
3. *Double click on **Programs** in Start Menu window using the left mouse button.*
4. *Double click on **John Deere App Group** icon using the left mouse button.*
5. *Put the mouse pointer on the **Excavator Diagnostics** icon.*
6. *Click and hold the right mouse button down and then drag the icon to an empty area on the desktop using the mouse. Release the mouse button when icon in on the desktop.*
7. *Click on **Create Shortcut(s) Here** using the left mouse button.*
8. *Using the left mouse button, click on the X in the upper right corner of each open window to close it.*

1. Double click on **Excavator Diagnostics** icon to start program from the desktop (also can click once on the icon and then press the Enter key).

Continued on next page

TX,9025,GG2670 –19–28JAN99–2/5

For starting from the Programs menu:

a. Click on **Start** button in lower left corner of screen.

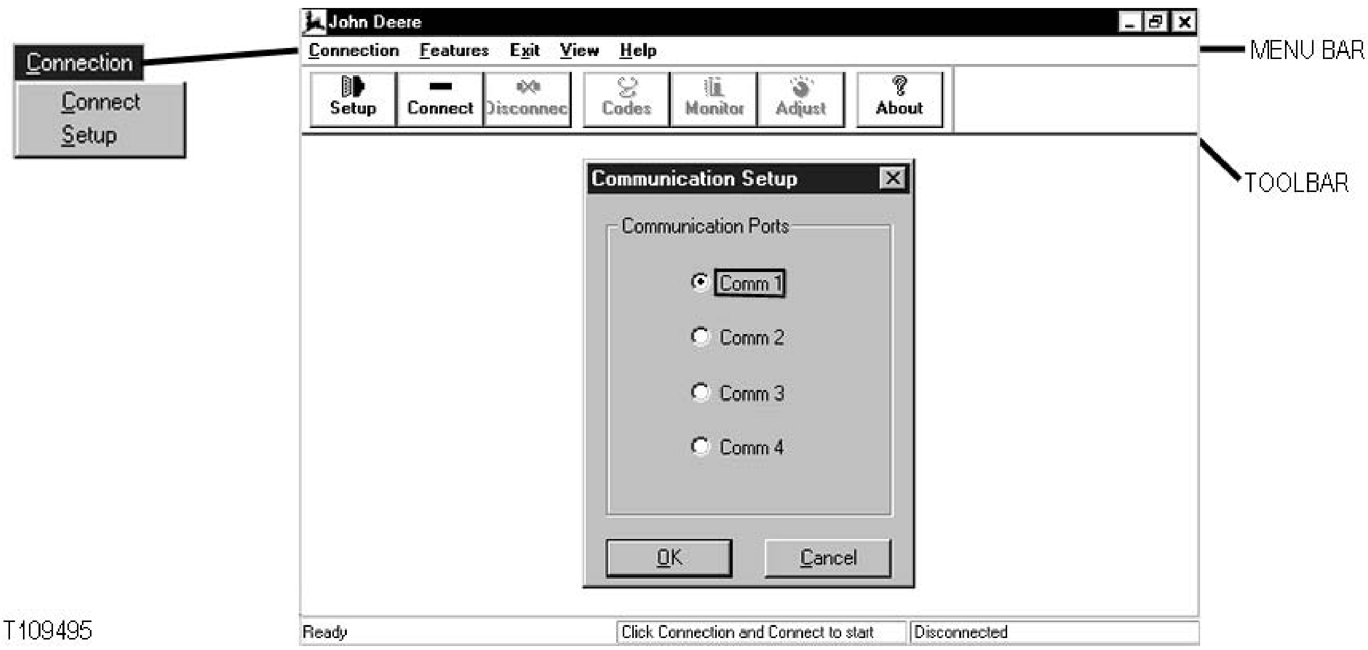
b. Click on **Programs** in Start menu.

c. Click on **John Deere App Group** in the Programs menu.

d. Click on **Excavator Diagnostics.**

2. The John Deere Main Menu screen opens. The menu screen is the gateway to the excavator diagnostic program.

TX,9025,GG2670 –19–28JAN99–3/5



T109495

T109495 –19–14MAY97

3. The first time the excavator diagnostics program is used on the laptop computer, a communication port must be selected.

a. Click on the **Setup** button on the Toolbar or on the **Connection** drop down menu on the Menu Bar and then click on **Setup.**

NOTE: *If the Toolbar is not displayed, click on the* **View** *drop menu and then click on* **Toolbar.** *Also click on* **Status Bar** *if not displayed at bottom of window.*

b. When the **Communication Setup** window opens, click on the communication port your computer needs for communication with the excavator. Most computers use Comm 1.

c. Using the left mouse button, click on the X in the upper right corner of **Communication Setup** window to close it.

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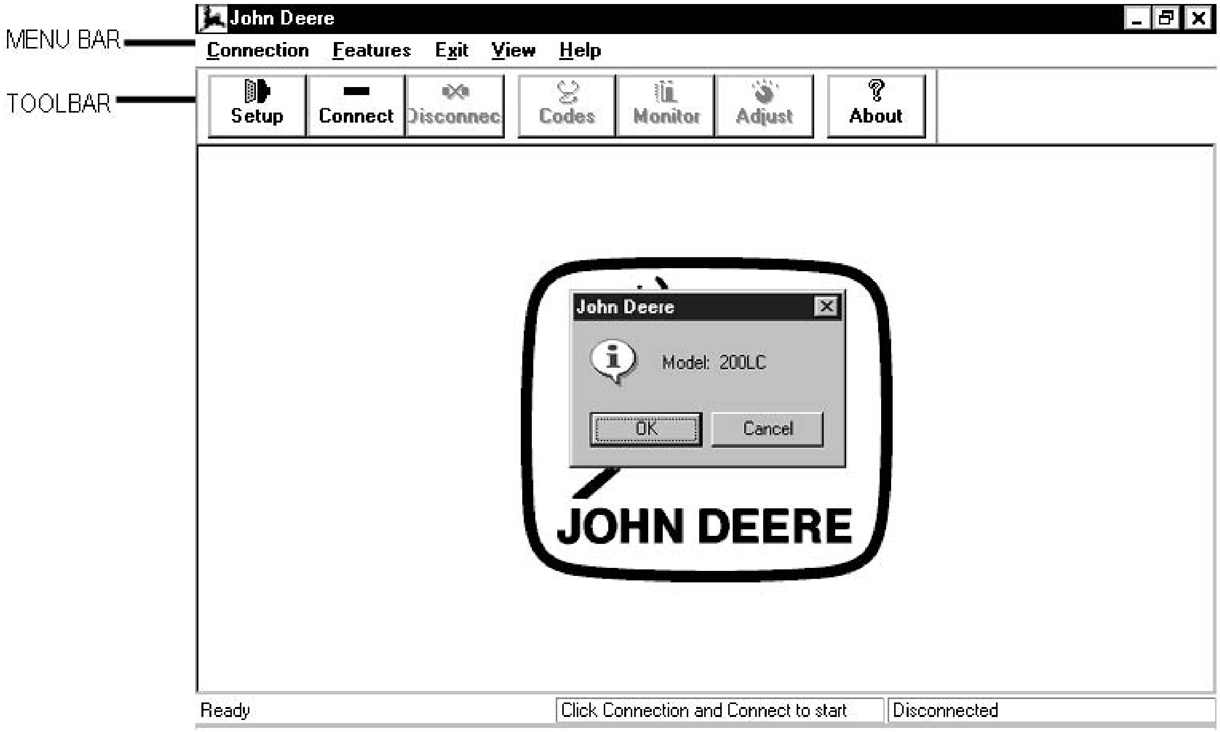
TX,9025,GG2670 –19–28JAN99–4/5



T109499

T109499 –19–14MAY97

4. Click on the **Connect** button on the Toolbar or on the **Connection** drop down menu on the Menu Bar and then click on **Connect.**

NOTE: If the Toolbar is not displayed, click on the **View** *drop menu and then click on Toolbar. Also click on Status Bar if not displayed at bottom of window.*

5. The John Deere Model window opens displaying the Model number. Confirm the model number and then click on **OK** or press Enter to continue.

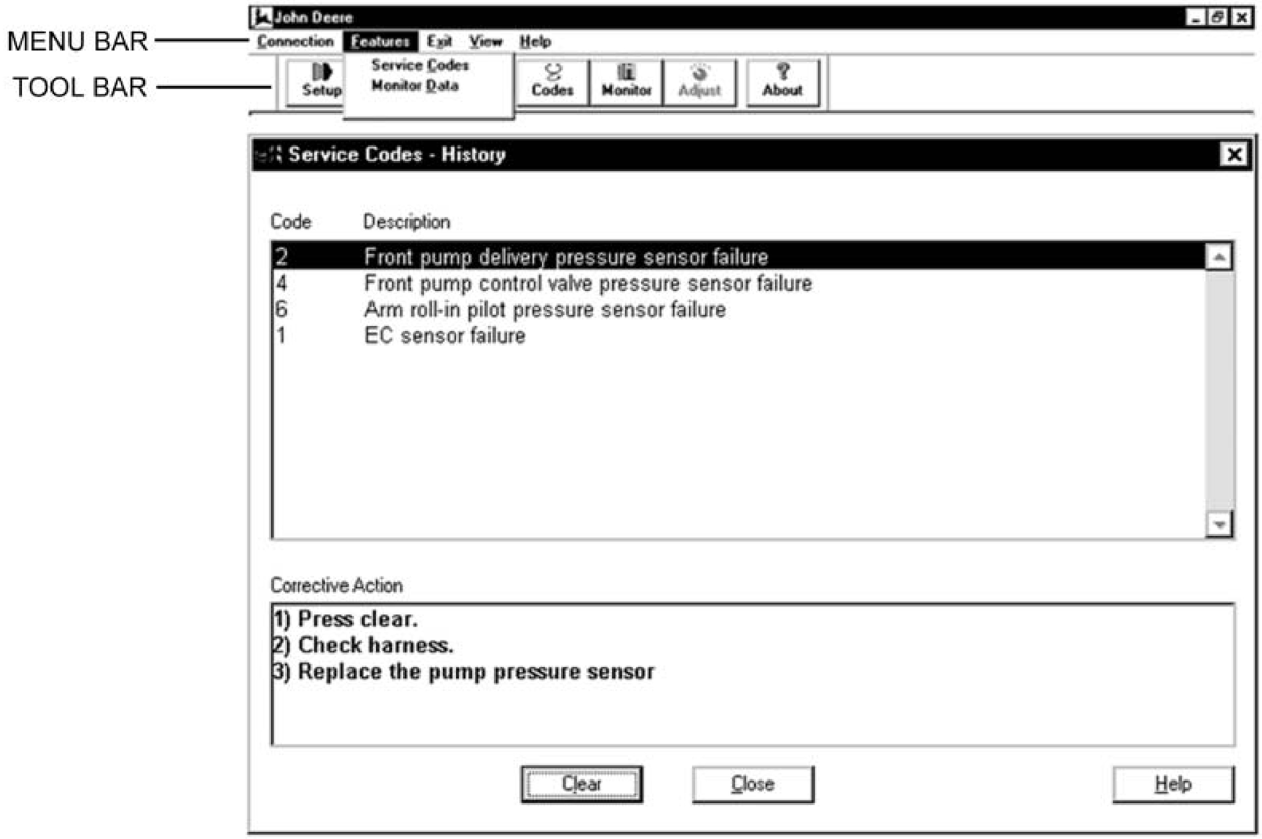
6. When the connection is made, the Toolbar button for **Connect** becomes gray and the **Disconnect, Codes,** and **Monitor** buttons become black.

The current mode for the software is listed in the middle of the Status Bar and the model number to the right. The modes are Main Mode and Service Mode.

The **Disconnect** button on the Toolbar will disconnect the communication with the excavator being diagnosed, no further communication can be performed by the software.

TX,9025,GG2670 –19–28JAN99–5/5

EXCAVATOR DIAGNOSTICS PROGRAM FEATURE—SERVICE CODES



T111267 –19–02SEP97

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1. Click on the **Codes** button on Toolbar or on the **Features** drop down menu on the Menu Bar and then click on **Service Codes.** (See Excavator Diagnostics Program List of Service Codes in this group.)

   The first group of service codes shown is the **Service Codes-History**. If there are any codes found, the option to clear the Service Codes-History is selectable and not grayed out. Service Codes-History are requested only once from the engine and pump controller.

2. After Service Codes-History have been cleared, the **Service Codes-Current** are displayed and updated periodically—at least 4 samples per minute. Click on a specific service code to get Corrective Action window to display diagnostic advice.

Continued on next page

TX,9025,GG2672 –19–19NOV97–1/2

3. If communication is interrupted, such as the key switch being turned off by mistake during service code reading, the **Communication Interruption!** window will display. Click **OK** or press Enter to disconnect. Then turn the key switch back on and click on the **Connect** button or on the **Connection**drop down menu on the Menu Bar and then click on **Connect** to continue.

T102910

T102910 –19–29AUG96

TX,9025,GG2672 –19–19NOV97–2/2

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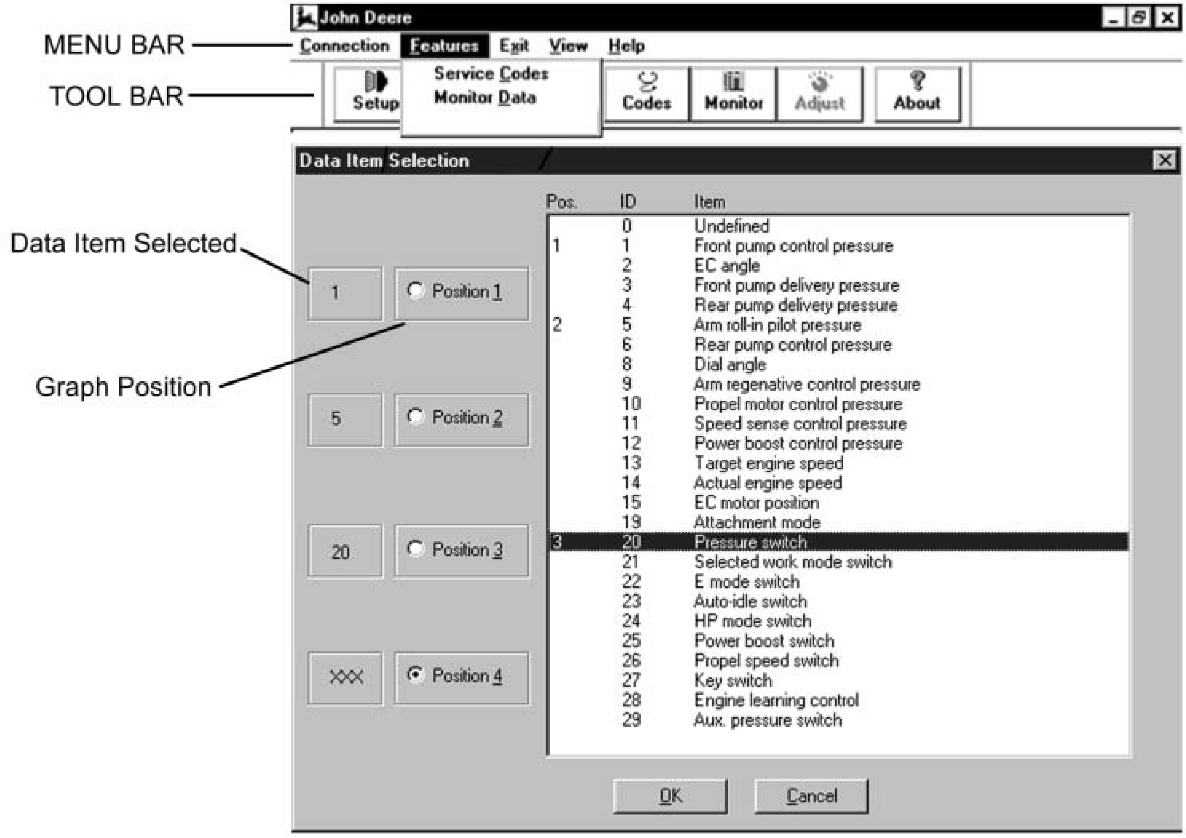
EXCAVATOR DIAGNOSTICS PROGRAM FEATURE—MONITOR DATA



T111272 –19–02SEP97

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1. Click on the **Monitor** button on Toolbar or on the **Features** drop down menu on the Menu Bar and then click on **Monitor Data** to open the **Data Item Selection** window. (See Excavator Diagnostic Software Monitor Data Items in this group.)

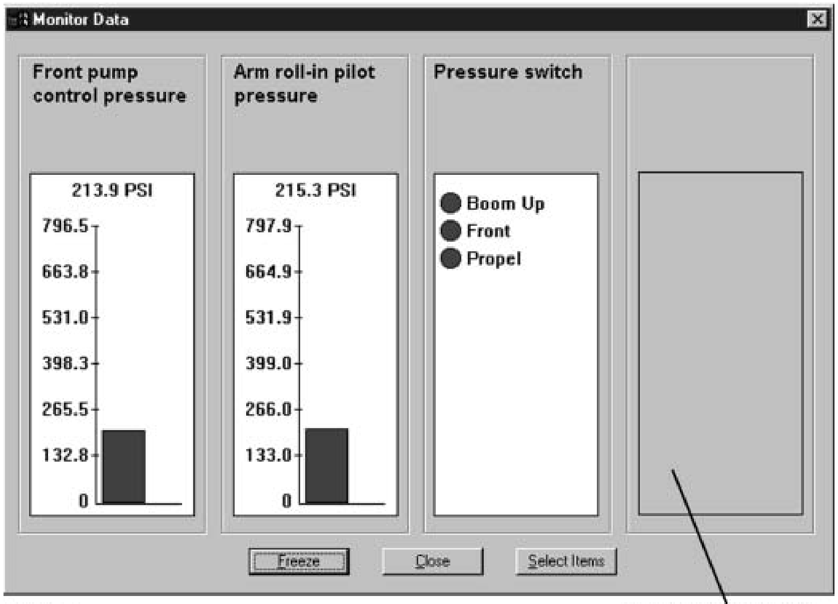
2. Double click (or click once and press the Enter key) on a data item and its ID number appears in the Data Item Selected box at the Graph Position that is highlighted on the left of the screen. The up and down cursor keys and the Enter key also works for selecting data items.

   After your first choice has been made, the next Graph Position is highlighted and allows you to make your second choice. You may choose a data item for each of the four Graph Positions.

3. After choices have been made, click **OK** to view data in graph form in the **Monitor Data** window.

Continued on next page

TX,9025,GG2673 –19–19NOV97–1/3



T102911

T102911 –19–29AUG96

4. To change a data item in the **Monitor Data** window, click **Select Items** to toggle back to **Data Item Selection** window.

   Then highlight the Graph Position by clicking on it or use the tab key and then select a data item as before.

5. The data items are polled at about 4 samples per second. You can “freeze” the data by clicking on **Freeze** button. When you click **Unfreeze**, data reading will resume. When highlighted, you can also press the Enter key to toggle between **Freeze** and **Unfreeze**. To highlight a button, press the tab key to highlight the button desired.

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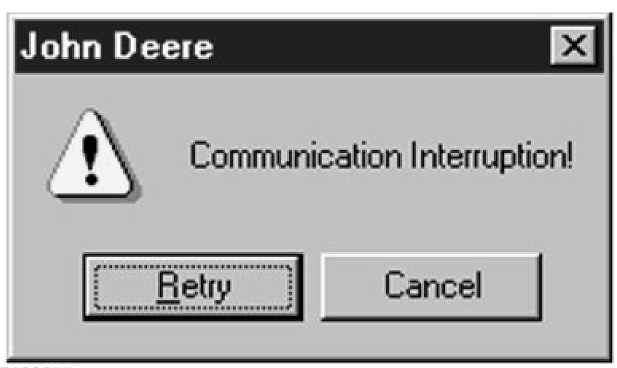
TX,9025,GG2673 –19–19NOV97–2/3

6. If communication is interrupted, such as the key switch being turned off by mistake while reading data, the **Communication Interruption!** window will display. Turn the key switch back on and then click **Retry** or press Enter to continue. When communication is again established, the Monitor Data window opens to its last settings.

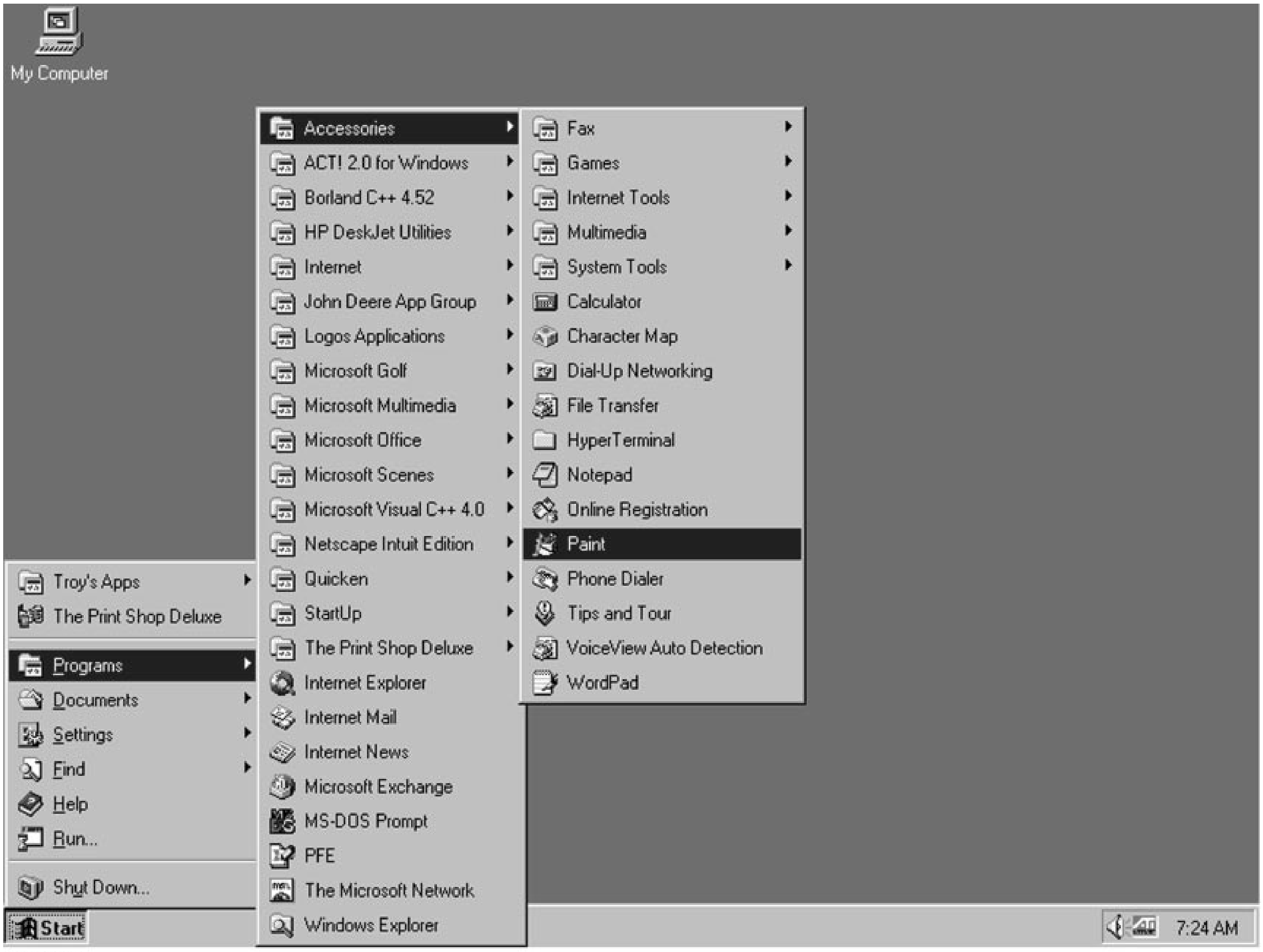


T103375

T103375 –19–29AUG96

TX,9025,GG2673 –19–19NOV97–3/3

EXCAVATOR DIAGNOSTICS PROGRAM FEATURE—SAVING MONITOR DATA



T109321

T109321 –19–28APR97

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1. You can save a copy of “frozen” data to a disk following these steps:

    a. Click on the application to make it the active window.

    b. Press **Alt** and the **PrtScn** keys.

    c. Click on **Start, Programs, Accessories,** and then **Paint.**

    d. When **Paint** opens, paste “frozen” data by pressing **Control** and the **V** keys.

    e. Click on **Edit** and then on **Copy To.**

    f. Type in a File name, select a drive to Save in and then click on **Save.**

2. The saved file may be opened and printed in either a paint or page layout program.

TX,9025,GG2674 –19–19NOV97–1/1

EXCAVATOR DIAGNOSTICS PROGRAM SPECIAL FUNCTION—ENGINE SPEED ADJUSTMENT

Special Function allows you to adjust the following engine speed factory settings parameters: (For factory settings, see Excavator Diagnostics Program Special Function—Engine Speed Factory Settings Parameters in this group.)

- Slow idle (RPM).
- Economy (RPM).
- Fast idle (RPM).
- Auto idle (RPM).
- Attachment (RPM).

Attachment (RPM) is used to adjust the engine speed for an attachment connected to the machine's hydraulic system that requires a specified pump flow rate. When in Attachment Mode and the proper pressure switch and wiring harness are installed, the engine speed changes to the adjusted speed when the attachment is actuated.

See the Engine Speed to Pump Flow Rate Chart in this group for the engine speed to get the specified pump flow rate.

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To change a parameter, the excavator must be in Service Mode. Follow the steps below for placing the excavator in service mode and adjusting parameters.

NOTE: If computer is currently connected, click on the **Disconnect** *button on the Toolbar or on the* **Connection** *drop down menu on the Menu Bar and then click on* **Disconnect***.*

1. Turn the key switch off.

2. Connect the laptop computer cable to the diagnostic test port.

Continued on next page TX,9025,GG2862 –19–22MAY98–1/4

3. Push the learning switch (C) up to the top position and wait for 10 seconds.

4. Turn the key switch on.

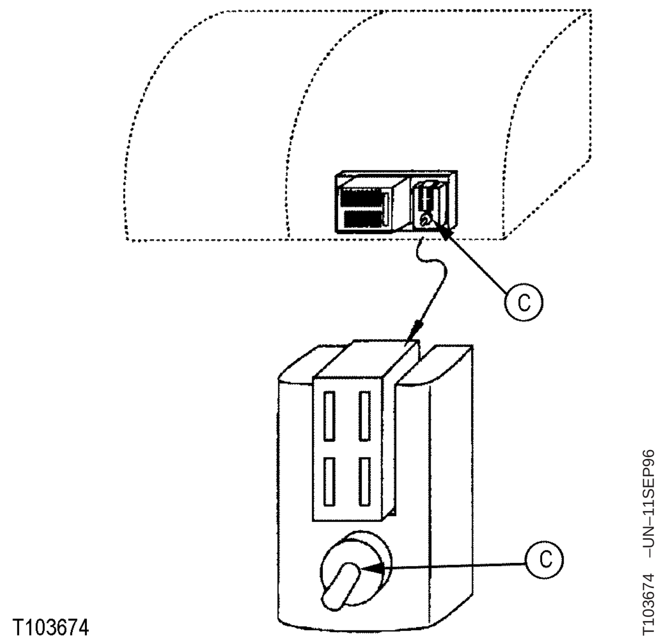
5. Click on the **Connect** button on the Toolbar or on the **Connection** drop down menu on the Menu Bar and then click on **Connect**.

   The John Deere Model window opens displaying the Model number. Confirm the model number and then click on **OK** or press Enter to continue.

6. The **Warning Service Mode** window opens warning that excavator is in Service Mode. Click **OK.**

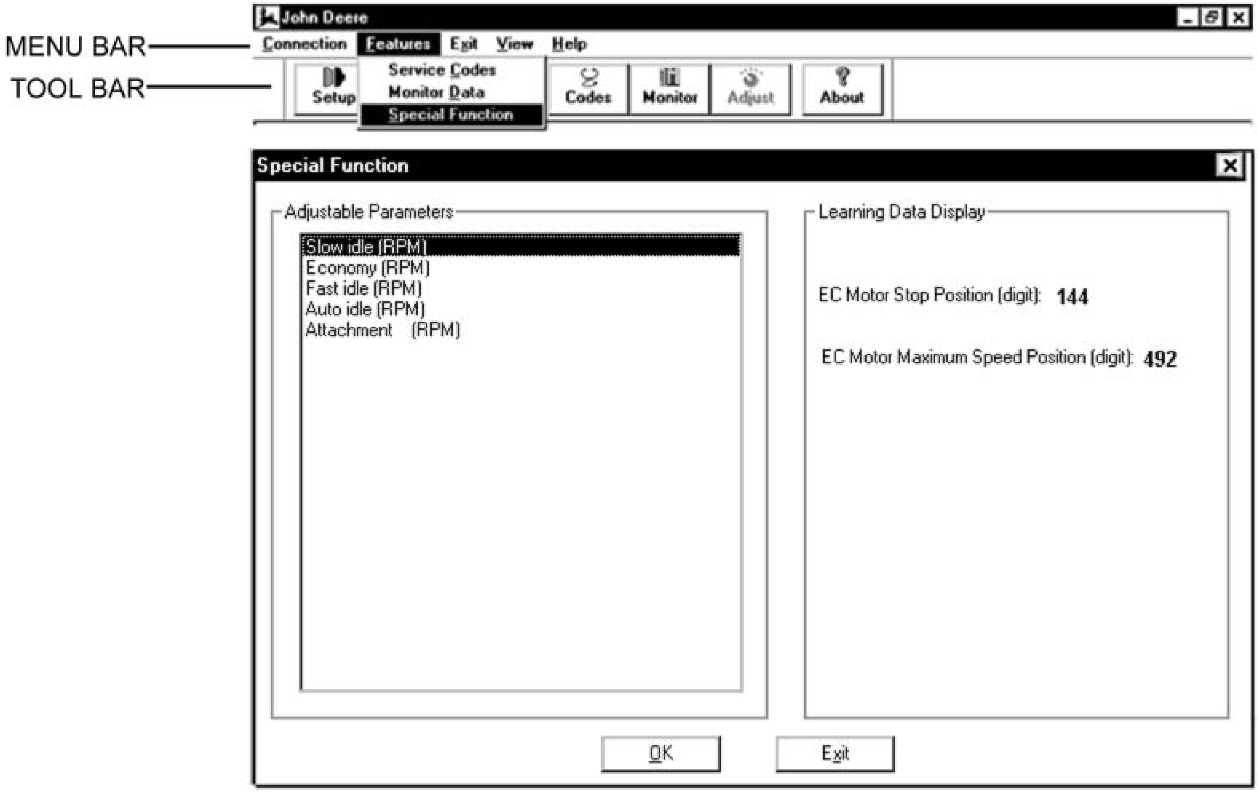
NOTE: Service Mode and machine model number is displayed in the Status Bar at bottom of window.

In Service mode, the Service Codes and Monitor Data cannot be accessed.



C—Learning Switch

Continued on next page TX,9025,GG2862 –19–22MAY98–2/4



T111739 –19–14OCT97

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7. Click on the **Adjust** button on the Toolbar or on the **Features** drop down menu on the Menu Bar and then click on **Special Function** to open the **Special Function** window.

   The Special Function window allows the user to select the Adjustable Parameters for adjustment and view the values under Learning Data Display.

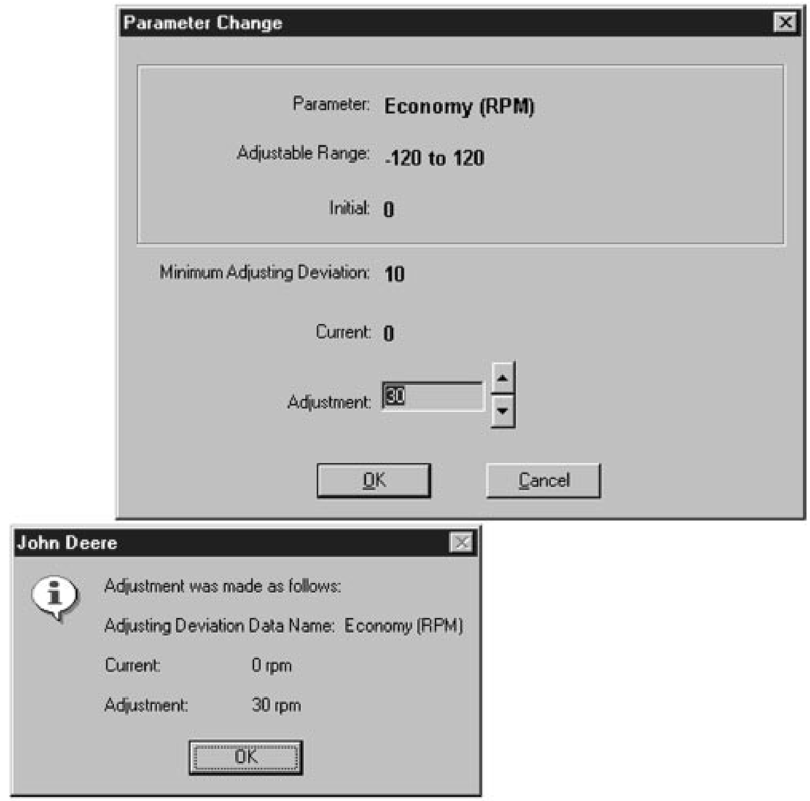
8. Use the cursor keys to move the highlight to the parameter you wish to change then press **Enter** to bring up the Parameter Change screen.

The Parameter Change window contains:

- Parameter (to be changed)
- Adjustable Range
- Initial (deviation from factory set rpm)
- Minimum Adjusting Deviation
- Current (deviation from factory setting)
- Adjustment (were change is made)

Continued on next page

TX,9025,GG2862 –19–22MAY98–3/4



T103378

T103378 –19–29AUG96

9. Use the up and down cursor keys on keyboard to change the value which appears in the Adjustment box.

NOTE: Clicking on the up and down arrows next to box will also change the value.

10. Press the Enter key or click **OK** and the **Adjustment was made as follows:** window opens. Confirm the value and then press the Enter key or click **OK** button to return to the Adjustable Parameters.

NOTE: Only one parameter can be change at a time. Repeat procedure from Adjustable Parameters to adjust additional parameters.

11. Click on **Exit** to close the **Special Function** window.

12. Click on **Disconnect** Toolbar button.

13. Turn the key switch off.

14. Push learning switch down to the center position and wait 10 seconds.

NOTE: Check the Status Bar at bottom of window that computer is in Main Mode after connecting.

15. Start the engine and then check the adjusted parameter using a tachometer

TX,9025,GG2862 –19–22MAY98–4/4

EXCAVATOR DIAGNOSTICS PROGRAM—SERVICE CODES LIST

LIST OF SERVICE CODES		
Service Code	**Trouble**	**Corrective Action**
01	EC sensor failure	1. Press Clear. 2. Check harness. 3. Replace the EC sensor.
02	Front pump delivery pressure sensor failure.	1. Press Clear. 2. Check harness. 3. Replace the pump delivery pressure sensor.
03	Rear pump delivery pressure sensor failure	1. Press Clear. 2. Check harness. 3. Replace the pump delivery pressure sensor.
04	Front pump control pressure sensor failure	1. Press Clear. 2. Check harness. 3. Replace the pump control pressure sensor.
05	Rear pump control pressure sensor failure	1. Press Clear. 2. Check harness. 3. Replace the pump control pressure sensor.
06	Arm Roll-in pilot pressure sensor failure	1. Press Clear. 2. Check harness. 3. Replace the arm in pilot pressure sensor.
07	Engine rpm dial failure	1. Press Clear. 2. Check harness 3. Replace the engine rpm dial.

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TX,9025,GG2643 –19–19NOV97–1/1

EXCAVATOR DIAGNOSTICS PROGRAM— MONITOR DATA ITEMS

NOTE: This chart lists engine and pump controller dynamic data items that can be monitored by the excavator diagnostics program.

330LCR MONITOR DATA ITEMS

Item	Display List	Units	Description
1	Front pump control pressure	psi	Pilot signal from the front pump control valve to pump regulator
2	EC angle	V	Feedback signal from the engine control sensor to the engine and pump controller
3	Front pump delivery pressure	psi	Pump supply pressure at front pump outlet.
4	Rear pump delivery pressure	psi	Pump supply pressure at rear pump outlet.
5	Arm in pilot pressure	psi	Pilot pressure from pilot controller to control valve pilot cap. Pressure measured at flow regulator valve.
6	Rear pump control pressure	psi	Pilot signal from rear pump control valve to pump regulator.
8	RPM dial angle	V	Electrical signal from engine rpm dial.
9	Arm regenerative control pressure	psi	Pilot pressure from arm regenerative solenoid valve to arm regenerative valve in left control valve. A calculated pressure, not actual pressure.
10	Propel motor control pressure	psi	Pilot pressure from propel speed change solenoid valve to speed selector valve in propel motors. A calculated pressure, not actual pressure.
11	Speed sense control pressure	psi	Pilot pressure from speed sense solenoid valve to front and rear pump regulators. A calculated pressure, not actual pressure.
12	Power boost control pressure	psi	Pilot pressure from power boost solenoid valve to the piston in the system relief valve. This is a calculated pressure, not the actual pressure.
13	Target engine speed	rpm	Set by engine rpm dial position. Used with actual engine speed and pump delivery pressure signals to control the load (pulldown) on engine by energizing speed sensing solenoid valve to reduce pump flow. (Approximately 150 rpm less than actual engine speed under no load.)
14	Actual engine speed	rpm	Engine speed sensed by engine speed sensor. Sensor is located in the pump drive gearbox adjacent to front pump.
15	EC motor position	steps	Electrical signal from engine and pump controller to engine control motor.
20	Pressure switch	Boom Up, Dig, Propel	Electrical signal from pressure switches to engine and pump controller when function is actuated. Boom up is located on flow regulator valve. Dig is located at the swing park brake release valve. Propel is located at the shuttle valve fasten to the front of control valve mounting bracket.

Continued on next page CED,TX08227,3018 –19–16MAR98–1/2

330LCR MONITOR DATA ITEMS			
Item	**Display List**	**Units**	**Description**
21	Selected work mode switch	Dig, Grading, Precision, Attachment	Signal from control module to engine and pump controller for selected work mode.
22	E mode switch	On, Off	Signal from control module to engine and pump controller for preset engine speed.
23	Auto-idle switch	On, Off	Signal from control module to engine and pump controller to actuate auto-idle function.
24	HP mode switch	On, Off	Signal from control module to engine and pump controller to actuate High power mode.
25	Power boost switch	On, Off	Signal from power boost switch, in right control lever, to engine and pump controller to actuate power boost function.
26	Propel speed switch	Fast, Slow	Signal from control module to engine and pump controller to change propel speed.
27	Key switch	On, Off	Signal from key switch to engine and pump controller.
28	Engine learning control	Done, Undone, Interruption	Engine and pump controller has to be originally matched to each machine. See engine learning procedure.
29	Attachment mode pressure switch	On, Off	Signal to engine and pump controller when attachment mode is active.

CED,TX08227,3018 –19–16MAR98–2/2

EXCAVATOR DIAGNOSTICS PROGRAM SPECIAL FUNCTION—ENGINE SPEED FACTORY SETTINGS PARAMETERS

SPECIFICATIONS	
Engine Slow Idle Speed	1050 + 100 - 0 rpm
Engine Auto Idle Speed	1200 ± 100 rpm
Engine E (Economy) Mode Speed	1900 ± 100 rpm
Engine Fast Idle in Standard Mode Speed	2050 ± 75 rpm
Engine Attachment Mode Speed	As required to get flow rate specified by supplier

The factory settings for engine speeds can be changed using the excavator diagnostic program special function. (See Excavator Diagnostics Program Special Function—Engine Speed Adjustment in this group.)

Engine Slow Idle—Specification

Speed .... 1050 + 100 - 0 rpm

Engine Auto Idle—Specification

Speed .... 1200 ± 100 rpm

Engine E (Economy) Mode—Specification

Speed .... 1900 ± 100 rpm

Engine Fast Idle in Standard Mode—Specification

Speed .... 2050 ± 75 rpm

Engine Attachment Mode—Specification

Speed .... As required to get flow rate specified by supplier

NOTE: For the engine speed to get a specified pump flow rate, see Engine Speed to Pump Flow Rate Chart in this group.

CED,TX08227,3019 –19–17MAR98–1/1

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ENGINE SPEED TO PUMP FLOW RATE CHART

SPECIFICATIONS	
Excavator Pump Flow Rate to Engine Speed	171 L/min (45 gpm) at 1300 rpm and 14 479 kPa (145 bar) (2100 psi)
Excavator Pump Flow Rate to Engine Speed	189 L/min (50 gpm) at 1450 rpm and 14 479 kPa (145 bar) (2100 psi)
Excavator Pump Flow Rate to Engine Speed	210 L/min (55 gpm) at 1600 rpm and 14 479 kPa (145 bar) (2100 psi)
Excavator Pump Flow Rate to Engine Speed	224 L/min (59 gpm) at 1700 rpm and 14 479 kPa (145 bar) (2100 psi)
Excavator Pump Flow Rate to Engine Speed	237 L/min (62 gpm) at 1800 rpm and 14 479 kPa (145 bar) (2100 psi)
Excavator Pump Flow Rate to Engine Speed	250 L/min (66 gpm) at 1900 rpm and 14 479 kPa (145 bar) (2100 psi)
Excavator Pump Flow Rate to Engine Speed	160 L/min (42 gpm) at 1300 rpm and 20 685 kPa (207 bar) (3000 psi)
Excavator Pump Flow Rate to Engine Speed	174 L/min (46 gpm) at 1450 rpm and 20 685 kPa (207 bar) (3000 psi)
Excavator Pump Flow Rate to Engine Speed	193 L/min (51 gpm) at 1600 rpm and 20 685 kPa (207 bar) (3000 psi)
Excavator Pump Flow Rate to Engine Speed	203 L/min (54 gpm) at 1700 rpm and 20 685 kPa (207 bar) (3000 psi)
Excavator Pump Flow Rate to Engine Speed	216 L/min (57 gpm) at 1800 rpm and 20 685 kPa (207 bar) (3000 psi)
Excavator Pump Flow Rate to Engine Speed	225 L/min (59 gpm) at 1900 rpm and 20 685 kPa (207 bar) (3000 psi)

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The adjustable range is a (minus) -500 to 200 rpm for Attachment in Attachment Mode. The minimum adjusting deviation is 10 rpm. For an engine speeds below the adjustable range, operate in Dig Mode and turn the engine rpm dial to obtain the desired engine speed. (For adjustment procedure, see Excavator Diagnostics Program Special Function—Engine Speed Adjustment in this group.)

Excavator Pump—Specification

Flow Rate to Engine Speed .... 171 L/min (45 gpm) at 1300 rpm and 14 479 kPa (145 bar) (2100 psi)
Flow Rate to Engine Speed .... 189 L/min (50 gpm) at 1450 rpm and 14 479 kPa (145 bar) (2100 psi)
Flow Rate to Engine Speed .... 210 L/min (55 gpm) at 1600 rpm and 14 479 kPa (145 bar) (2100 psi)
Flow Rate to Engine Speed .... 224 L/min (59 gpm) at 1700 rpm and 14 479 kPa (145 bar) (2100 psi)
Flow Rate to Engine Speed .... 237 L/min (62 gpm) at 1800 rpm and 14 479 kPa (145 bar) (2100 psi)
Flow Rate to Engine Speed .... 250 L/min (66 gpm) at 1900 rpm and 14 479 kPa (145 bar) (2100 psi)

Continued on next page CED,TX08227,3132 –19–22MAY98–1/2

Excavator Pump—Specification

Flow Rate to Engine Speed .... 160 L/min (42 gpm) at 1300 rpm and 20 685 kPa (207 bar) (3000 psi)
Flow Rate to Engine Speed .... 174 L/min (46 gpm) at 1450 rpm and 20 685 kPa (207 bar) (3000 psi)
Flow Rate to Engine Speed .... 193 L/min (51 gpm) at 1600 rpm and 20 685 kPa (207 bar) (3000 psi)
Flow Rate to Engine Speed .... 203 L/min (54 gpm) at 1700 rpm and 20 685 kPa (207 bar) (3000 psi)
Flow Rate to Engine Speed .... 216 L/min (57 gpm) at 1800 rpm and 20 685 kPa (207 bar) (3000 psi)
Flow Rate to Engine Speed .... 225 L/min (59 gpm) at 1900 rpm and 20 685 kPa (207 bar) (3000 psi)

The flow rates at the engine speeds and pressures given in the chart are approximately double when the auxiliary function is actuated with the bypass shut-off valve function connected. The bypass shut-off valve is use to route front pump flow from the right control valve neutral passage, by an external hose, to the power passage before the auxiliary valve in the left control valve. The bypass shut-off valve is included in the right control valve.

CED,TX08227,3132 –19–22MAY98–2/2

EXCAVATOR DIAGNOSTICS PROGRAM TROUBLESHOOTING

NOTE: The laptop cannot be connected to excavator system without 5 volts from the system supply. If laptop cannot establish a successful RS232 connection, check for approximately 5 volts on any of the 5-volt sensor's power wire. A grounded 5-volt sensor power wire will prevent a successful RS232 connection. Without system 5-volt supply, RS232 connection is disabled.

Most software problems can be solved by the following:

1. Questions:
   - Is the key switch on the excavator turned on?
   - Are the connectors push in all of the way?
   - Is the software connected? If communication is broken momentarily between the computer and the engine and pump controller?
   - Is the program in the Main Mode or Service Mode? The program will tell you the current mode in the Status Bar at the bottom of window. If it is not in one of these modes you need to click on **Connection** and **Connect**.

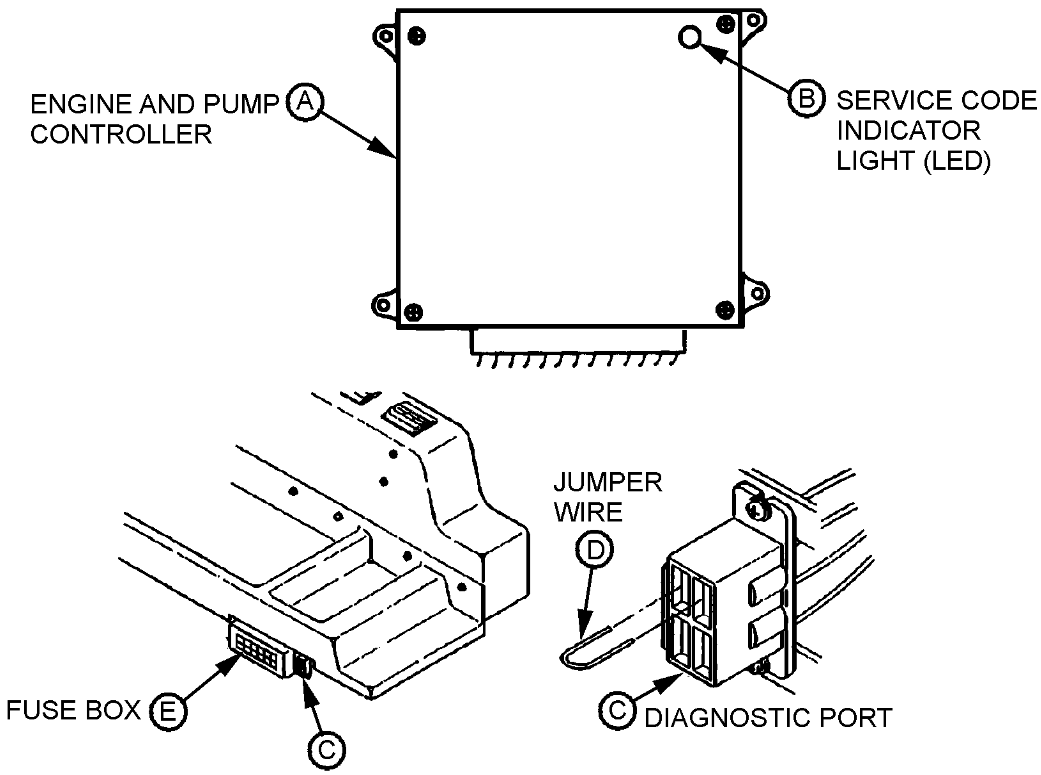
2. Turn key switch **Off.** Wait for 10 seconds.
3. Turn key switch **ON.**

NOTE: Disconnect and Connect does NOT mean to unplug and plug in computer cable.

4. Click on **Disconnect** and **Connect** under the **Connection** menu.
5. Try again.

TX,9025,CR103 –19–28JAN99–1/1

READING SERVICE CODES WITHOUT EXCAVATOR DIAGNOSTICS PROGRAM



T113360 –19–13FEB98

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With practice the self-diagnostic service codes can be read by counting the flashes of the Service Code Indicator Light (LED) (B) in the engine and pump controller (A).

Read the LED in the engine and pump controller several times to make sure the correct service code is read.

1. Lower the bucket to the ground. Stop the engine.
2. Remove the rear console cover from behind the operator’s seat. Remove the bracket that is over the engine and pump controller.
3. Install a jumper wire (D) into the two top terminals of the diagnostic port (C).
4. Turn the key switch ON.

   The LED comes ON steady for several seconds and then goes OFF.

5. For an existing service code, the LED starts a flashing sequence of 1 second ON, 1 second OFF intervals. After the last ON in a sequence, the LED remains OFF for approximately 3 seconds and then repeats the flashing sequence.

   Count the number of times LED is ON in a sequence for the service code number.

   Example, for a service code “03 Rear pump delivery pressure sensor failure,” the LED flashes ON three times in each sequence.

Continued on next page CED,TX08227,2997 –19–13FEB98–1/2

Tests

For more than one, the LED will have a flashing sequence for each existing service code with an approximate 3 second interval between each sequence. The flashing sequence continues as long as the key switch in ON and jumper wire is installed.

NOTE: If no service codes exist or trouble is beyond the scope of self-diagnosing function, the LED is ON for several seconds then goes OFF and remains OFF.

With key switch ON but no jumper wire installed in the diagnostic port, the LED comes ON for several seconds, goes OFF, and then starts a steady one seconds ON, one seconds OFF flashing sequence.

6. Turn the key switch OFF.

7. Remove jumper wire from diagnostic port.

8. Make necessary repairs.

9. Use the following procedure to clear existing service codes:

    a. Install jumper wire into the top two terminals of diagnostic port.

    b. Turn the key switch ON.

    c. Remove jumper wire from diagnostic port.

    d. Wait for two second.

    e. Install jumper wire into the top two terminals of diagnostic port.

    f. Check for service codes. The LED is ON for several seconds then goes OFF and remains OFF if all necessary repairs were made.

    g. Turn the key switch OFF

    h. Remove jumper wire from diagnostic port.

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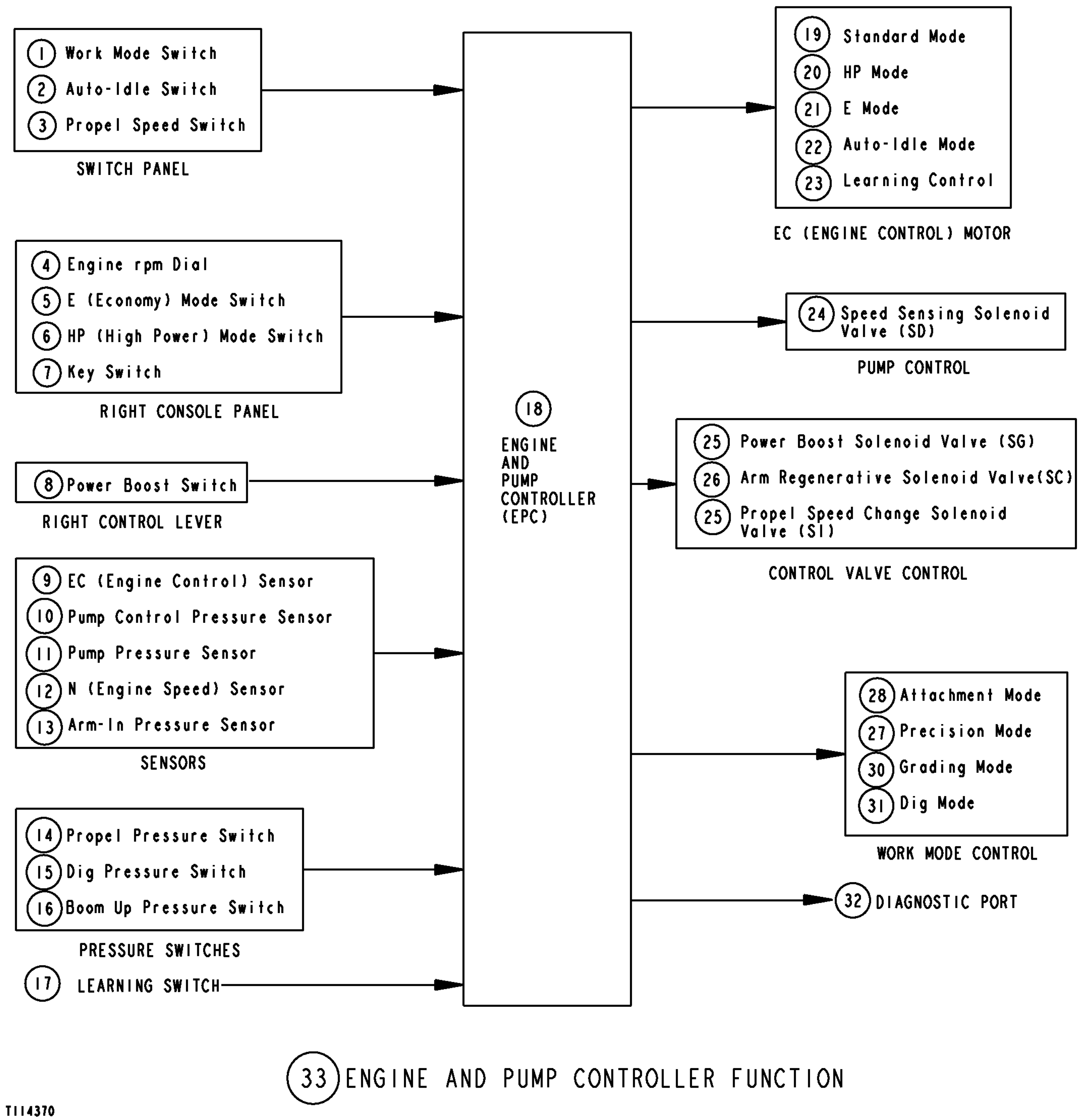
CED,TX08227,2997 –19–13FEB98–2/2

ENGINE AND PUMP CONTROLLER FUNCTION



T114370 –19–18MAR98

The engine and pump controller (18) is used to control machine operation. Electrical input signals from the engine rpm dial (4), sensors (9—13), and switches (1—3, 5—7, and 14—16) are sent to the engine and pump controller (18).

Continued on next page

After the electrical input signal are processed by the logic circuits, an electrical output signal is sent by the controller to control engine speed by the engine control motor (19—23), the control valve by the power boost (25) and arm regenerative (26) solenoid valves, and front and rear pumps by the speed sensing solenoid valve (24). The controller sends an electrical output signal to the propel speed change solenoid valve (27) when all conditions are met to operate at fast speed propel.

The learning switch (17) along with the learning control (23) are used to learn the slow idle position when a component of the engine speed control circuit has been replaced or adjusted.

The laptop computer, with the excavator diagnostics program loaded, is used to check and diagnose problems with the switches and sensors through the diagnostic port (32). Also, engine speeds parameters can be changed using Special Functions in Service Mode.

CED,TX08227,3020 –19–17MAR98–2/2

JT05801 CLAMP-ON ELECTRONIC TACHOMETER INSTALLATION

SERVICE EQUIPMENT AND TOOLS
JT05801 Clamp-On Electronic Tachometer

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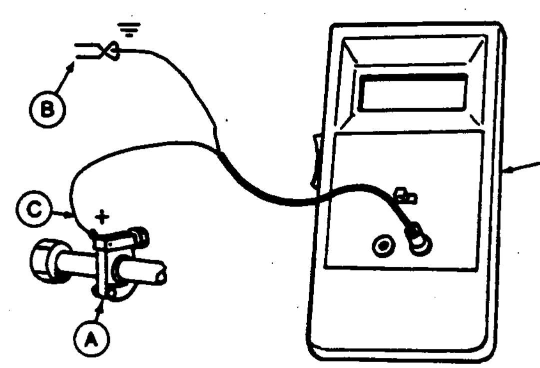
1. Before installing clamp-on electronic tachometer, remove the paint from a straight section of injection line within 100 mm (4 in.) of No. 1 injection nozzle. Use emery cloth to remove the paint.

2. Install the clamp-on transducer (A). Tighten finger tight only—DO NOT overtighten.

3. Connect the red clip (+) (C) to the clamp-on transducer.

4. Connect the black clip (-) (B) to a ground connection such as the head of a cap screw or other metal part on engine.

5. Start the engine. Check for a reading on the digital readout unit (D).



T6813AG –UN–28FEB89

A—Clamp-On Transducer
B—Black Clip (-)
C—Red Clip (+)
D—Digital Readout Unit

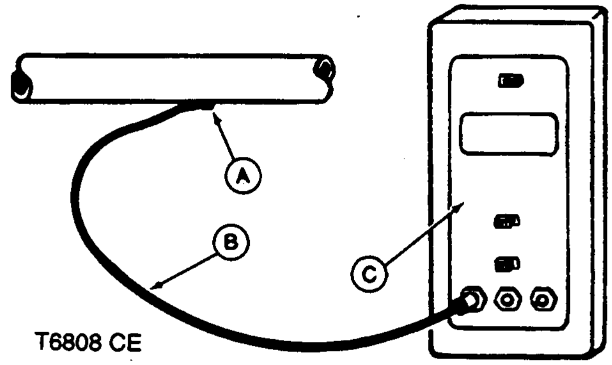
CED,TX08227,2879 –19–11NOV97–1/1

JT05800 DIGITAL THERMOMETER INSTALLATION

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer

1. Fasten temperature probe (A) to a bare metal hydraulic line using a tie band.

2. Wrap temperature probe and line with a shop towel.



T6808CE –UN–28FEB89

A—Temperature Probe
B—Cable
C—JT05800 Digital Thermometer

CED,TX08227,2895 –19–19NOV97–1/1

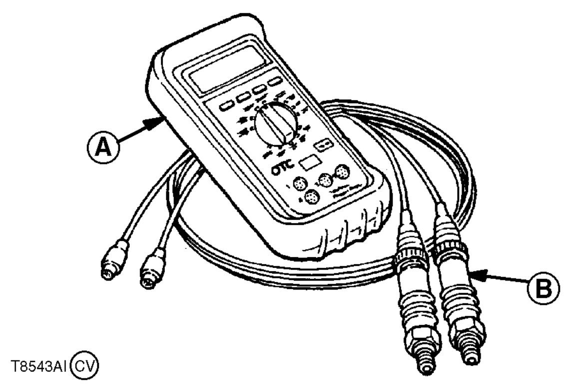
JT02156A DIGITAL PRESSURE AND TEMPERATURE ANALYZER INSTALLATION

SERVICE EQUIPMENT AND TOOLS
JT02156A Digital Pressure and Temperature Analyzer

Use the digital pressure and temperature analyzer (A), and transducers (B) in place of analog gauges and a separate temperature reader.

Transducers are temperature sensitive. Allow transducer to warm to system temperature. After transducer is warmed and no pressure applied, push sensor zero button for one second to set the true zero point.

When using for different pressures, turn selector to OFF for two seconds and then to the pressure range. Readings are inaccurate if proper range for transducer is not used.



T8543AI –UN–25AUG95

A—Digital Pressure and Temperature Analyzer
B—3 400 kPa (35 bar) (500 psi) Transducer
—34 000 kPa (350 bar) (5 000 psi) Transducer
—70 000 kPa (700 bar) (10 000 psi) Transducer

CED,TX08227,2896 –19–19NOV97–1/1

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HYDRAULIC PUMP START-UP PROCEDURE

IMPORTANT: Hydraulic pump will be damaged if not filled with oil before starting engine. Procedure must be performed whenever a new hydraulic pump is installed or oil has been drained from the pump or hydraulic oil tank.

Procedure is to ensure the pumps are filled with oil and air is bled from suction side of pumps to prevent cavitation.

1. Add oil until it is between marks on hydraulic oil tank sight glass. (See Hydraulic Oil in the Fuels and Lubricants group of General Information Section.)

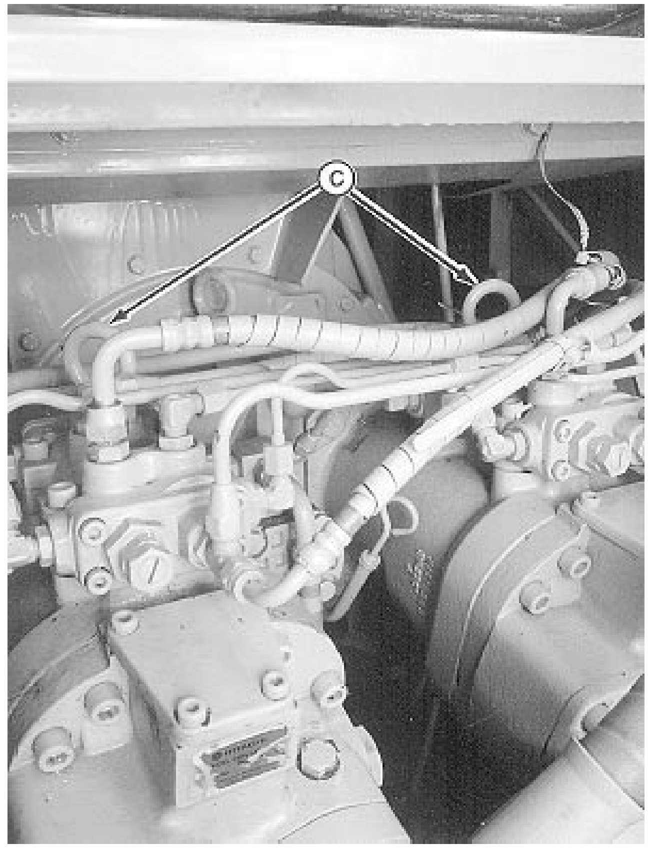
2. Remove air bleed plugs (C) from the top of pump regulators to allow housing to fill with oil from the hydraulic oil tank and to let air escape.

3. When pump housing is full of oil, install plugs.

4. Check oil level in hydraulic oil tank. Add oil as necessary. Tighten hydraulic oil tank cap. Tighten vent plug.

5. Start engine and run at slow idle. Slowly raise boom to full height and then lower to pressurize hydraulic oil tank.

6. Purge air from the hydraulic system by slowly operating each function through three cycles. Air in pilot circuits is purged automatically.



T8262AV –UN–14JUN94

C—Air Bleed Plug (2 used)

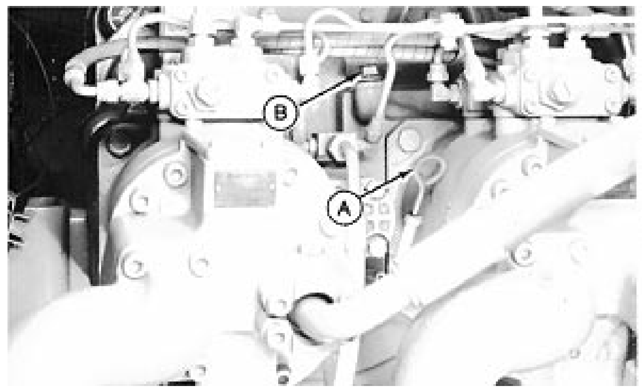
CED,TX08227,3133 –19–22MAY98–1/1

PUMP DRIVE GEARBOX START-UP PROCEDURE

IMPORTANT: Pump drive gearbox will be damaged if not filled with oil before starting the engine. Procedure must be performed whenever a new pump drive gearbox is installed or oil has been drained from the gearbox.

1. Install the drain plug (C).
2. Remove plastic cap from fill plug (B). Remove fill plug.
3. Add oil. (See Diesel Engine and Pump Gearbox Oils in Fuels and Lubricants Group of General Information Section.)
4. Install filler cap and plastic cap.
5. Check oil level on dipstick (A). Oil level must be approximately halfway below “H” (level) mark and end of dipstick.

T7869BI –UN–22OCT92



T7869BH –UN–22OCT92

A—Dipstick
B—Fill Plug
C—Drain Plug

9025
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CED,TX08227,3134 –19–22MAY98–1/1

SWING MOTOR START-UP PROCEDURE

IMPORTANT: Swing motor will be damaged if not filled with oil before operating swing function. Procedure must be performed whenever a new swing motor is installed or oil has been drained from the motor.

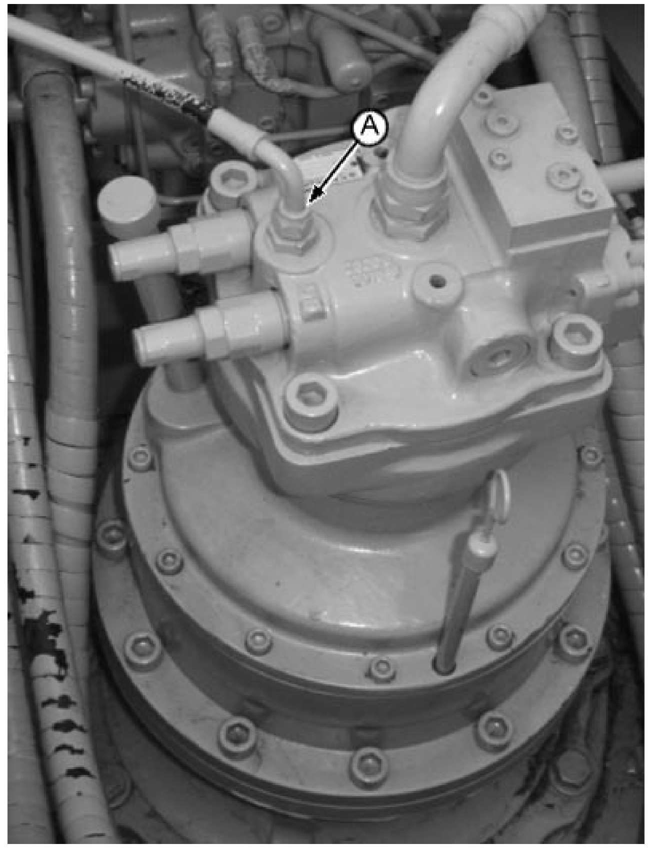
Procedure is to ensure the swing motor is filled with oil.

1. Disconnect swing motor drain line (A).

2. Fill motor with hydraulic oil through drain port until oil reaches the level of drain port. (See Hydraulic Oil in the Fuels and Lubricants group of General Information Section.)

NOTE: Air must be allowed to escape from the swing motor while filling.

3. Connect drain line.



T109982C –UN–26MAY98

A—Swing Motor Drain Line

CED,TX08227,3135 –19–22MAY98–1/1

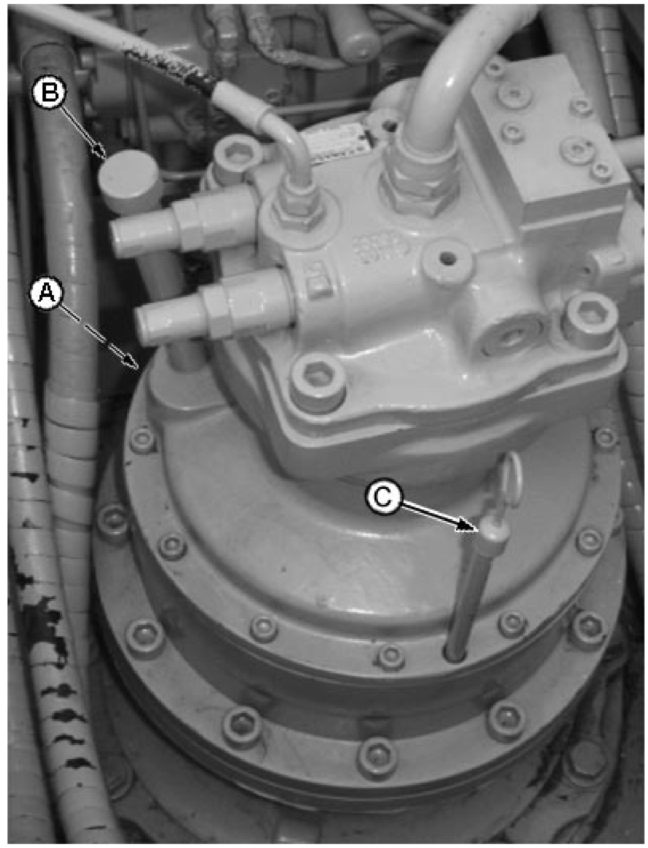
SWING GEARBOX START-UP PROCEDURE

IMPORTANT: Swing gearbox will be damaged if not filled with oil before operating swing function. Procedure must be performed whenever a new swing gearbox is installed or oil has been drained from the gearbox.

1. Check that drain line plug (A) is installed.

2. Remove fill cap (B). Add oil. (See Swing Gearbox and Propel Gearbox Oils in Fuels and Lubricants Group of General Information Section.)

3. Install fill cap. Check oil level on dipstick (C).



T109982D –UN–26MAY98

A—Drain Line Plug
B—Fill Cap
C—Dipstick

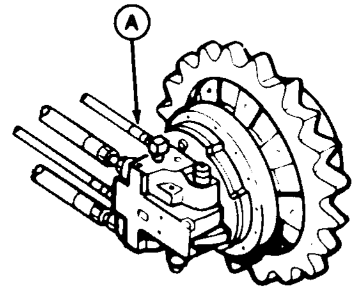
CED,TX08227,3136 –19–22MAY98–1/1

PROPEL MOTOR START-UP PROCEDURE

ESSENTIAL TOOLS
JT03221 (3/4-16 M 37°) (Parker No. X03CP-8) Plug

IMPORTANT: Propel motor will be damaged if not filled with oil before starting engine. Procedure must be performed whenever a new propel motor is installed or oil has been drained from the motor.

1. Disconnect propel motor drain line (A). Install plug.
2. Fill motor with hydraulic oil until oil reaches the top of the drain port. (See Hydraulic Oil in Fuels and Lubricants Group of General Information Section.) Use a funnel with suitable diameter neck to allow air to escape while filling.
3. Connect drain line.



T7660BG –UN–11DEC91

Propel Motor Drain Line

A—Propel Motor Drain Line

CED,TX08227,3137 –19–22MAY98–1/1

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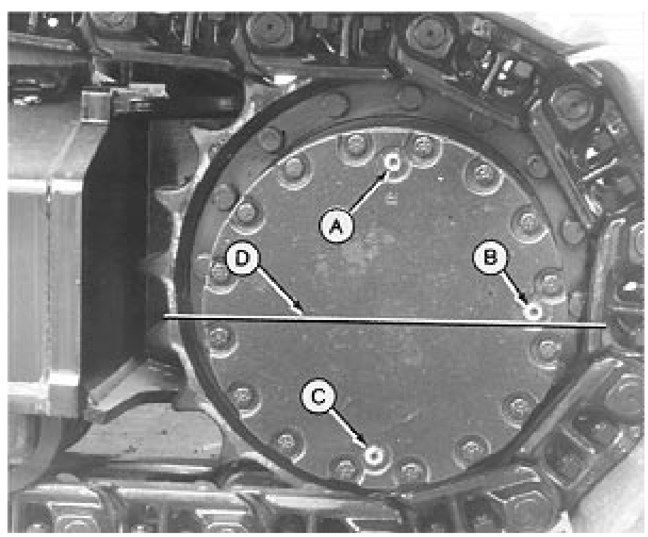
PROPEL GEARBOX START-UP PROCEDURE

IMPORTANT: Propel gearbox will be damaged if not filled with oil before operating propel function. Procedure must be performed whenever a new propel gearbox is installed or oil has been drained from the gearbox.

1. Check that drain plug (C) is installed.
2. Remove fill plug (A).
3. Add oil until oil flows out of check plug (B) hole. (See Swing Gearbox and Propel Gearbox Oils in Fuels and Lubricants Group of General Information Section.)
4. Install check plug and fill plug.



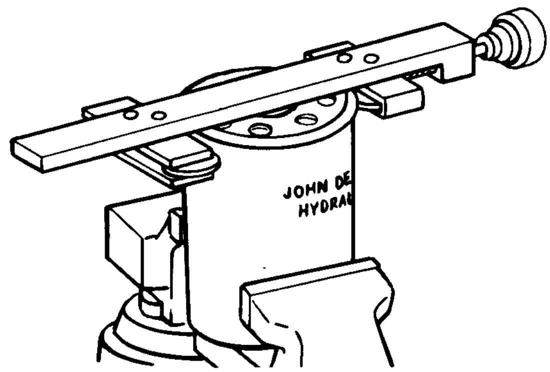
T7396CG –UN–18OCT90

A—Fill Plug
B—Check Plug
C—Drain Plug
D—Horizontal Centerline

CED,TX08227,3138 –19–22MAY98–1/1

HYDRAULIC OIL FILTER INSPECTION PROCEDURE

SERVICE EQUIPMENT AND TOOLS
JT05536 Oil Filter Cutting Tool



IT4633 –UN–19JAN90

1. Pour oil out of filter to inspect for water contamination.

2. Use an oil filter cutting tool to cut top off filter.

3. Remove element and inspect for metal particles and debris in bottom of filter can.

   Excessive amounts of brass and steel particles can indicate a failed hydraulic pump or a pump failure in process.

   A rubber type of material can indicate cylinder packing failure.

TX,25,GG2231 –19–20NOV97–1/1

HYDRAULIC OIL CLEANUP PROCEDURE USING PORTABLE FILTER CADDY

SPECIFICATIONS	
Hydraulic Oil Tank Capacity	159 L (42 gal)
Hydraulic Oil Tank Filtering Time	14 minutes approximate
Hydraulic System Capacity	322 L (85 gal)
Hydraulic System Filtering Time	51 minutes approximate

SERVICE EQUIPMENT AND TOOLS
Portable Filter Caddy
Two 3658 mm (12 ft) x 3/4 in. I.D. 100R1 Hoses with 3/4 M NPT Ends
Quick Disconnect Fittings
Suction Wand
Discharge Wand

1. Install new return filter elements.

NOTE: *For a failure that creates a lot of debris, remove access cover from hydraulic oil tank. Drain the tank. Connect filter caddy suction line to drain port. Add a minimum of 19 L (5 gal) of oil to the tank. Operate filter caddy and wash out the tank.*

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IMPORTANT: The minimum ID for a connector is 1/2 in. to prevent cavitation of filter caddy pump.

2. Put filter caddy suction and discharge wands into the tank filler hole so ends are as far apart as possible to obtain a thorough cleaning of oil.

3. Start the filter caddy. Check to be sure oil is flowing through the filters.

   Operate filter caddy until all oil in the tank has been circulated through the filter a minimum of four times.

Hydraulic Oil Tank—Specification

Capacity .... 159 L (42 gal)

Hydraulic Oil Tank Filtering—Specification

Time .... 14 minutes approximate

NOTE: *Filtering time for hydraulic oil tank is 0.089 minute x number of liters (0.33 minutes x number of gallons).*

4. Leave filter caddy operating for the next step.

5. Start the engine and run it at fast idle.

IMPORTANT: For the most effective results, cleaning procedure must start with the smallest capacity circuit then proceed to the next larger capacity circuit.

6. Starting with the smallest capacity circuit, operate each function through a complete cycle.

   Repeat procedure until the total system capacity has circulated through filter caddy seven times. Each function must go through a minimum of three complete cycles for a thorough cleaning of oil.

Hydraulic System—Specification

Capacity .... 322 L (85 gal)

Hydraulic System Filtering—Specification

Time .... 51 minutes approximate

NOTE: *Filtering time for complete hydraulic system is 0.158 minute x number of liters (0.6 minute x number of gallons). Filtering time for machines with auxiliary hydraulic functions must be increased because system capacity is larger.*

7. Stop the engine. Remove the filter caddy.

Continued on next page

Tests

8. Install new return filter elements.

9. Check oil level in the tank; add oil if necessary. (See Fuels and Lubricants Group in General Information Section.)

CED,TX08227,3022 –19–17MAR98–2/2

HYDRAULIC SYSTEM WARM-UP PROCEDURE

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer

IMPORTANT: If the machine temperature is below -18 degrees C (0°F), start the engine with the speed control in the idle position. If the unit has been prepared for arctic operation with the MIL-L-46167 hydraulic oil, the suction strainer in the hydraulic tank should also have been changed to the coarser strainer for use in arctic conditions. Failure to do this could cause the hydraulic pump to cavitate which can cause pump failure. Operate engine at idle speed for at least 10 minutes before increasing the speed to half. Cover the radiator and oil cooler debris screens to restrict the air flow for faster warmup.

Below -18°C (0°F) an extended warm-up period may be necessary. Hydraulic function will move slowly and lubrication of parts may not be adequate with cold oil. Do not attempt normal machine operation until hydraulic functions move at or close to normal cycle times.

Operate functions slowly and avoid sudden movements until engine and hydraulic oils are thoroughly warmed. Operate a function by moving it a short distance in each direction. Continue operating the function increasing the distance traveled in each cycle until full stroke is reached.

For faster warm-up, restrict air flow through oil cooler using cardboard or other similar material. Use correct viscosity oil to minimize warm-up period. (See Hydraulic Oil in Fuels and Lubricants Group.)

1. Connect digital thermometer. Install temperature probe on hydraulic tank-to-pump inlet line. (See JT05800 Digital Thermometer Installation in this group.)

CAUTION: Avoid possible serious injury from machine movement during warm-up procedure. Clear the area of all bystanders before doing the warm-up procedure.

2. Clear the area of all bystanders to allow for machine movement.

3. Start engine. Run engine at 1/2 speed for approximately 5 minutes before operating any functions. Do not run engine at fast or slow idle.

4. Check that work mode is in Dig Mode and power mode is in Standard Mode (no buttons pushed down, indicators off). Push auto-idle switch to turn off auto-idle function (auto-idle indicator off).

5. Slowly turn upperstructure so boom is to the side.

CAUTION: Avoid possible serious injury from machine sliding backwards. Keep angle between boom and arm at 90—110°

6. Keeping the angle between boom and arm at 90—110°, lower boom to raise one track off the ground.

7. Operate propel function for approximately 5 minute.

8. Once oil temperature is above -18°C (0°F), increase engine speed to fast idle.

Continued on next page TX,25,GG2232 –19–20NOV97–1/2

IMPORTANT: Holding a function over relief for more than 10 seconds can cause damage from hot spots in the control valve.

9. Operate the propel function (side with track off the ground). Also operate the bucket curl function over relief for 10 seconds and then stop for 5 seconds. Repeat the cycle until oil is heated to specifications.

10. Stop periodically and operate all hydraulic functions to distribute the heated oil.

11. Continue procedure until oil temperature is within specifications.

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

TX,25,GG2232 –19–20NOV97–2/2

LOWER BOOM WITH ENGINE STOPPED (USING BOOM CYLINDER LOAD LOWERING VALVE)

When an engine stops during operation, the boom cannot be lowered using the pilot controller because there is no pilot pressure oil to move the boom valve spool or to unlatch the boom load lowering valves.

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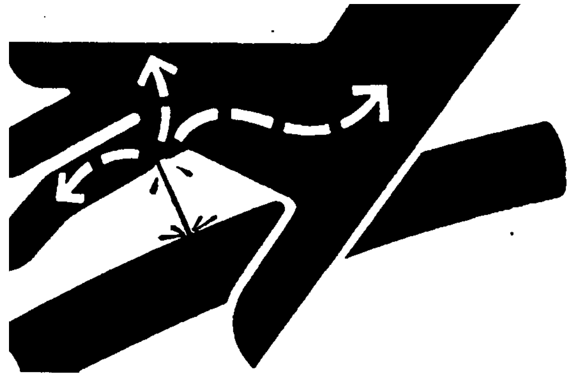
Continued on next page

CED,OUOEBAS,6 –19–24JAN00–1/2

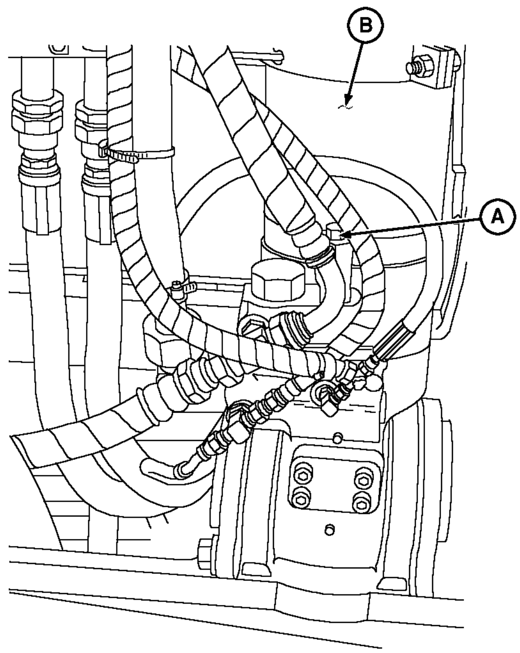
CAUTION: To avoid injury from escaping fluid under pressure, never loosen boom manual lower needle valve more than 4 turns from closed position as valve may come out of housing. Tighten valve and nut before applying pressure.

Prevent possible injury from unexpected machine movement. Clear all persons from the area before lowering the boom with the engine stopped.



X9811 –UN–23AUG88

1. Check that the area is clear of all persons before lowering boom.
2. Loosen jam nut on relief valve (A). Back off relief valve set screw, counting number of turns, until boom starts to lower slowly.
3. After bucket is on ground, reset relief valve (A) by turning set screw clockwise the same number of turns noted in step 2 and lock jam nut.



T127542 –UN–19JAN00

T127542

A—Relief Valve
B—Boom Cylinder

CED,OUOEBAS,6 –19–24JAN00–2/2

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LOWER BOOM WITH ENGINE STOPPED (WHEN NOT EQUIPPED WITH BOOM CYLINDER LOAD LOWERING VALVE)

SPECIFICATIONS	
Boom Manual Lower Needle Valve to Housing Torque	5.9—9.8 N•m (4.4—7.2 lb-ft) (53—86 lb-in.)
Boom Manual Lower Needle Valve-to-Housing Nut Torque	35—47 N•m (25.8—34.7 lb-ft) (310—416 lb-in.)

SERVICE EQUIPMENT AND TOOLS
17 mm Combination Wrench
6 mm Combination Wrench

When an engine stops during operation, the boom cannot be lowered using the pilot controller because there is no pilot pressure oil to move the boom valve spool.

Continued on next page CED,OUOEBAS,7 –19–24JAN00–1/2

1. Remove the control valve access cover.

2. Loosen nut (C).

CAUTION: To avoid injury from escaping fluid under pressure, never loosen boom manual lower needle valve more than 4 turns from closed position as valve may come out of housing. Tighten valve and nut before applying pressure.

Prevent possible injury from unexpected machine movement. Clear all persons from the area before lowering the boom with the engine stopped.

3. Check that the area is clear of all persons before lowering boom.

   Slowly, loosen boom manual lower needle valve (B) 1/2—1 turn. The boom will start to lower.

   Turn needle valve out more to increase boom lowering speed or in to decrease lowering speed. Remember, no more than 4 turns from the closed position.

4. After bucket is on the ground, tighten the needle valve and then the nut.

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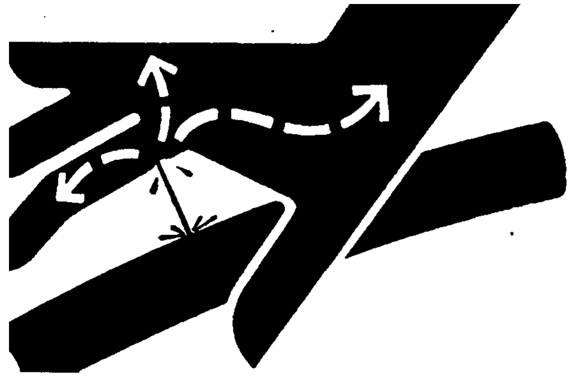
Boom Manual Lower Needle Valve to Housing—Specification

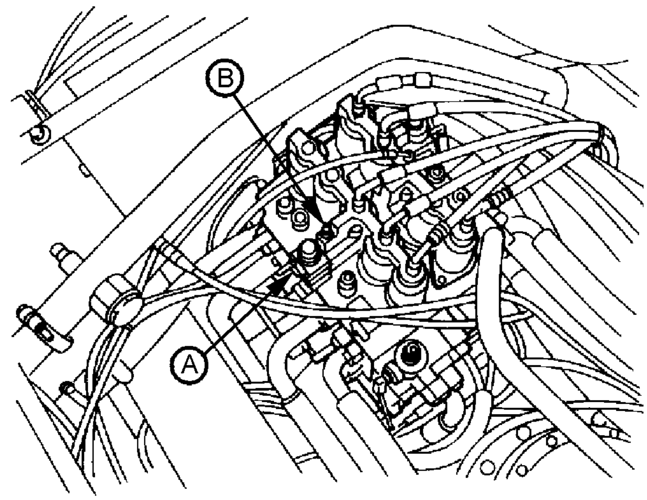
Torque .... 5.9—9.8 N•m (4.4—7.2 lb-ft) (53—86 lb-in.)

Boom Manual Lower Needle Valve-to-Housing Nut—Specification

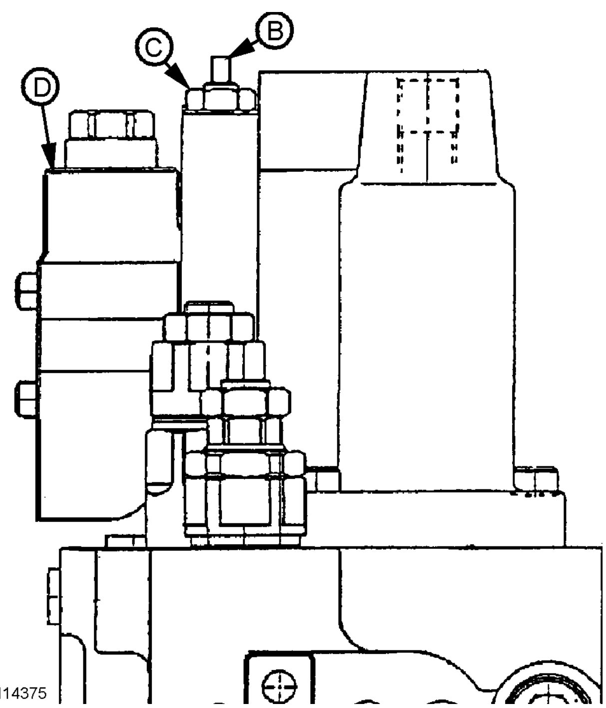
Torque .... 35—47 N•m (25.8—34.7 lb-ft) (310—416 lb-in.)

NOTE: Leakage may result if the boom manual lower needle valve and nut are not tighten to specification. Be sure to tighten the needle valve and nut to specification.





T114374



T114375

A—Boom I Section
B—Boom Manual Lower Needle Valve
C—Nut
D—Boom Reduced Leakage Valve

CED,TX08227,3023 –19–17MAR98–2/2

ARM REGENERATIVE SOLENOID VALVE (SC) HARNESS TEST

ESSENTIAL TOOLS
JT07062 Test Harness

The purpose of test is to check continuity in wiring harness to the arm regenerative solenoid valve (B) coil and there is a signal from engine and pump controller.

NOTE: *Reading displayed on the laptop computer for "9 Arm regenerative control pressure" is a calculated pressure from data stored in the engine and pump controller. A typical reading at fast and slow idle with all function in neutral is 0.0 psi. To actuate the arm in regenerative function, run the engine at fast idle and then operate boom up and arm in functions in combined operation. A typical reading increases to 381.5 psi. The readings can vary from machine to machine. What to look for is that there is a reading and it increases when arm in regenerative function is actuated.*

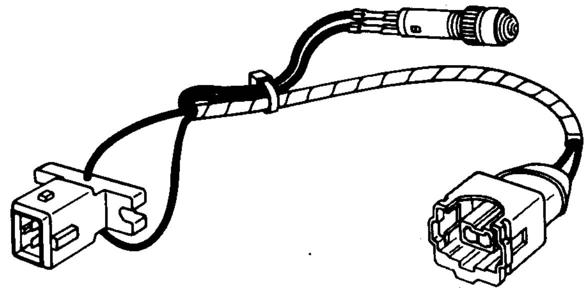
The increased reading indicates that the rear pump pressure sensor, arm in pressure sensor, and boom up pressure switch are OK and a electrical signal to the arm regenerative solenoid valve is generated. (For circuit operation, see Arm Regenerative Valve Operation in Group 9025-05.)

The arm regenerative function does not operate in Grading and Precision Work Modes.

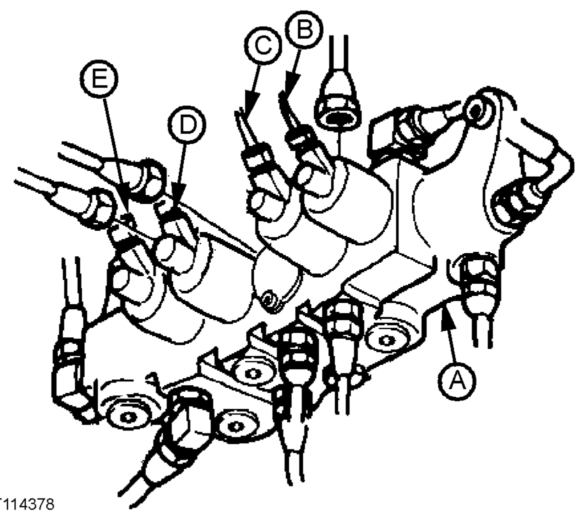
IMPORTANT: Turn key switch off before disconnecting any electrical connectors. Disconnecting electrical connectors while engine is running or with key switch on can damage engine and pump controller or other electrical components.

1. Stop engine. Turn key switch to OFF.

2. Remove wire clip.



T7486AL –UN–19MAR91



T114378

T114378 –UN–25MAR98

A—Solenoid Valve Manifold
B—Arm Regenerative Solenoid Valve (SC)
C—Speed Sensing Solenoid (SD)
D—Propel Speed Change Solenoid (SI)
E—Power Boost Solenoid (SG)

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Continued on next page CED,TX08227,3024 –19–17MAR98–1/2

Wiggle connector half and pull apart; do not pull on wiring leads.

3. Install test harness in series with wiring harness and arm regenerative valve (B).

4. Turn key switch to ON but do not start engine.

   Indicator light must come ON, go OUT, and then ON indicating there is continuity in the wiring harness and there is a signal from engine and pump controller.

5. Start engine.

6. Actuate boom up and arm in functions in combined operation. Pull both control levers to full stroke.

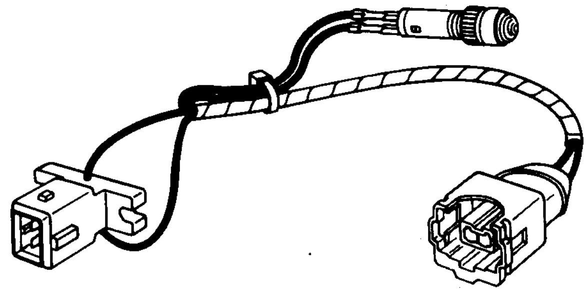
   Indicator light must be ON and brightness must increase slightly.

   If light goes OUT or brightness does not increase, check wiring harnesses, solenoid coil, rear pump pressure sensor, arm in pilot pressure sensor, and boom up pressure switch. (See procedure in Group 9015-15.)

CED,TX08227,3024 –19–17MAR98–2/2

SPEED SENSING SOLENOID VALVE (SD) HARNESS TEST

ESSENTIAL TOOLS
JT07062 Test Harness

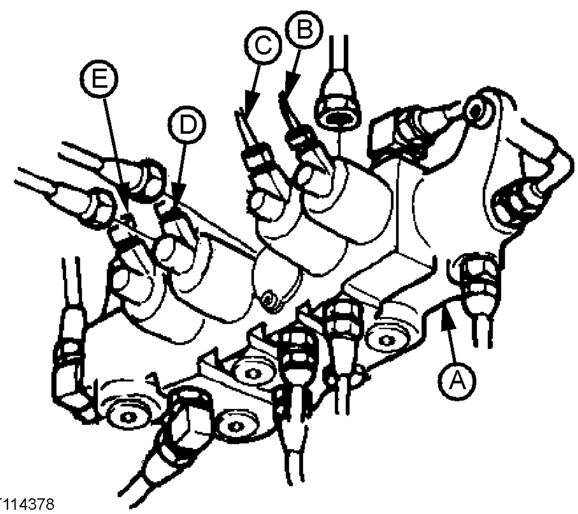


T7486AL –UN–19MAR91

The purpose of test is to check continuity in wiring harness to the speed sensing solenoid valve (C) coil and there is a electrical signal from engine and pump controller.

NOTE: Pressure reading displayed on the laptop computer for “11 Speed sense control pressure” is a calculated pressure from the electrical signal in the engine and pump controller. When all functions are in neutral, a typical reading of 563.9 psi is displayed at slow idle and 0.0 psi is displayed at fast idle.

Increase the engine speed to approximately 1560—1600 rpm so the pressure reading just goes to 0.0 psi. Operate the arm in function over relief. The pressure reading will increase and then stabilize at approximately 20—50 psi. The readings indicates that the engine speed sensor is OK, the electrical signal for target engine speed is selected by the engine rpm dial and a electrical signal is generated. (For circuit operation, see Engine Speed Sensing Control Circuit Operation in Group 9025-05.)



T114378 –UN–25MAR98

A—Solenoid Valve Manifold
B—Arm Regenerative Solenoid Valve (SC)
C—Speed Sensing Solenoid (SD)
D—Propel Speed Change Solenoid (SI)
E—Power Boost Solenoid (SG)

IMPORTANT: Turn key switch off before disconnecting any electrical connectors. Disconnecting electrical connectors while engine is running or with key switch on can damage engine and pump controller or other electrical components.

1. Stop engine. Turn key switch to OFF.

2. Remove wire clip.

   Wiggle connector half and pull apart; do not pull on wiring leads.

Continued on next page

CED,TX08227,3026 –19–17MAR98–1/2

3. Install test harness in series with wiring harness and speed sensing solenoid valve (C).

4. Turn key switch to ON but do not start engine.

   Indicator light must come ON indicating there is continuity in the wiring harness and there is a signal from engine and pump controller.

5. Start engine.

6. Actuate arm in function over relief to load the engine.

   Indicator light must be ON.

   If indicator light goes OUT, check wiring harnesses, solenoid coil, engine rpm dial, and engine speed sensor. (See procedure in Group 9015-15.)

CED,TX08227,3026 –19–17MAR98–2/2

PROPEL SPEED CHANGE SOLENOID VALVE (SI) HARNESS TEST

ESSENTIAL TOOLS
JT07062 Test Harness

The purpose of test is to check continuity in wiring harness to the propel speed change solenoid valve (B) coil and there is a signal from engine and pump controller.

NOTE: The reading displayed on the laptop computer for “10 Propel motor control pressure” is a calculated pressure from data stored in the engine and pump controller. A typical reading of 65.9 psi is displayed when propel function is in neutral or propelling at slow speed. A typical reading of 426 psi is displayed when propelling in fast speed with no other function actuated. The readings can vary from machine to machine. What to look for is that there is a reading and it increases when fast speed propel function is actuated.

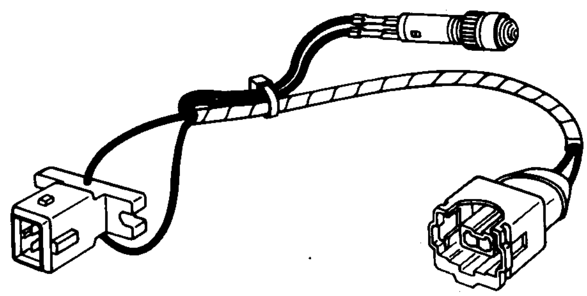
The readings indicates that the propel speed switch, propel and dig pressure switches, front and rear pump control pressure sensors, front and rear pump pressure sensors are OK, and a electrical signal to the propel speed change solenoid valve is generated. (For circuit operation, see Propel Motor Speed Change Circuit Operation in Group 9025-05.)

IMPORTANT: Turn key switch off before disconnecting any electrical connectors. Disconnecting electrical connectors while engine is running or with key switch on can damage engine and pump controller or other electrical components.

1. Stop engine. Turn key switch to OFF.

2. Remove wire clip.

   Wiggle connector half and pull apart; do not pull on wiring leads.



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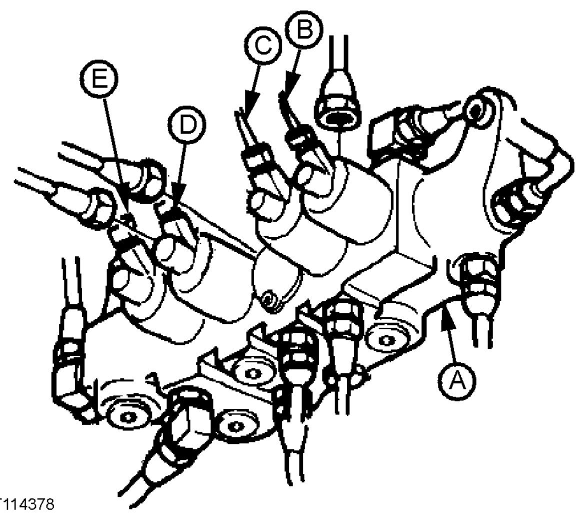


T114378 –UN–25MAR98

A—Solenoid Valve Manifold
B—Arm Regenerative Solenoid Valve (SC)
C—Speed Sensing Solenoid (SD)
D—Propel Speed Change Solenoid (SI)
E—Power Boost Solenoid (SG)

Continued on next page

3. Install test harness in series with wiring harness and propel speed change solenoid valve (B).

4. Turn key switch to ON but do not start engine.

5. Turn propel speed switch to fast speed (rabbit).

   Turn propel speed switch to slow speed propel (turtle).

   Indicator light must be ON indicating there is continuity in the wiring harness and there is a signal from engine and pump controller.

6. Start engine.

7. Actuate propel function.

8. Turn propel speed switch to fast speed (rabbit).

   The brightness of indicator light must increase slightly while propelling in fast speed.

   If light goes OUT or brightness does not increase, check wiring harnesses, solenoid coil, propel pressure switch, pump pressure, and pump control pressure sensors. (See procedure in Group 9015-15.)

NOTE: No dig functions can be actuated. The dig pressure switch must be OFF so it does not send an electrical signal to engine and pump controller.

CED,TX08227,3025 –19–17MAR98–2/2

POWER BOOST SOLENOID VALVE (SG) HARNESS TEST

ESSENTIAL TOOLS
JT07062 Test Harness

The purpose of test is to check continuity in the wiring harness to the power boost solenoid valve (E) coil and there is a signal from the engine and pump controller.

NOTE: Pressure reading shown on the laptop computer for "Power boost control pressure" is a calculated pressure from the electrical signal in the engine and pump controller. A typical reading of 426 psi is displayed when power boost switch on the right control lever is pushed. A reading of 0 psi is displayed when the switch is not pushed. The readings indicates that the power boost switch is OK and a electrical signal is generated. (For circuit operation, see Power Boost Control Circuit Operation in Group 9025-05.)

The power boost solenoid valve is also actuated in Precision Work Mode when the boom up function is actuated.

IMPORTANT: Turn key switch off before disconnecting any electrical connectors. Disconnecting electrical connectors while engine is running or with key switch on can damage engine and pump controller or other electrical components.

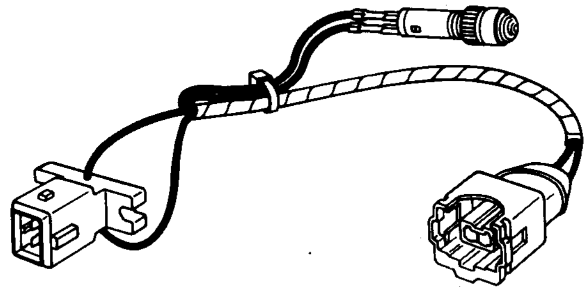
1. Stop engine. Turn key switch to OFF.

2. Remove wire clip.

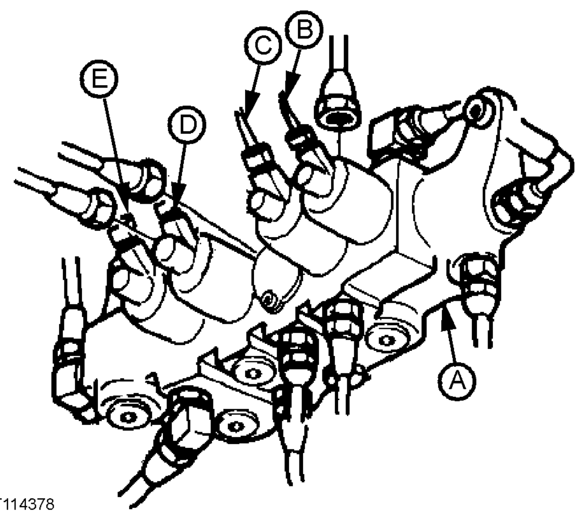
   Wiggle connector half and pull apart; do not pull on wiring leads.

3. Install test harness in series with wiring harness and power boost solenoid valve (E).

4. Turn key switch to ON but do not start engine.



T7486AL –UN–19MAR91



T114378 –UN–25MAR98

A—Solenoid Valve Manifold
B—Arm Regenerative Solenoid Valve (SC)
C—Speed Sensing Solenoid (SD)
D—Propel Speed Change Solenoid (SI)
E—Power Boost Solenoid (SG)

Continued on next page CED,TX08227,3027 –19–18MAR98–1/2

Tests

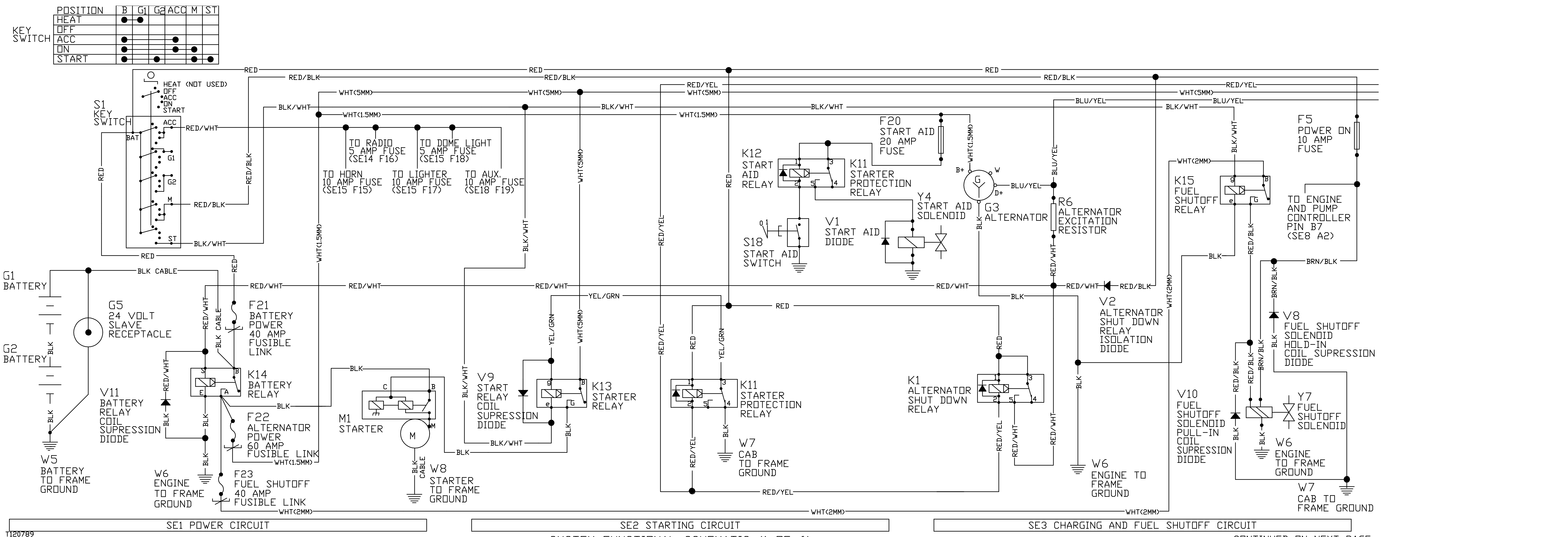
Indicator light must come ON indicating there is continuity in the wiring harness and there is a signal from engine and pump controller.

5. Push the power boost switch on the right control lever.

   The brightness of indicator light must increase slightly.

   If light goes OUT or brightness does not increase slightly, check wiring harnesses, solenoid coil, and power boost switch. (See procedure in Group 9015-15.)

CED,TX08227,3027 –19–18MAR98–2/2



SYSTEM FUNCTIONAL SCHEMATIC (1 OF 6)

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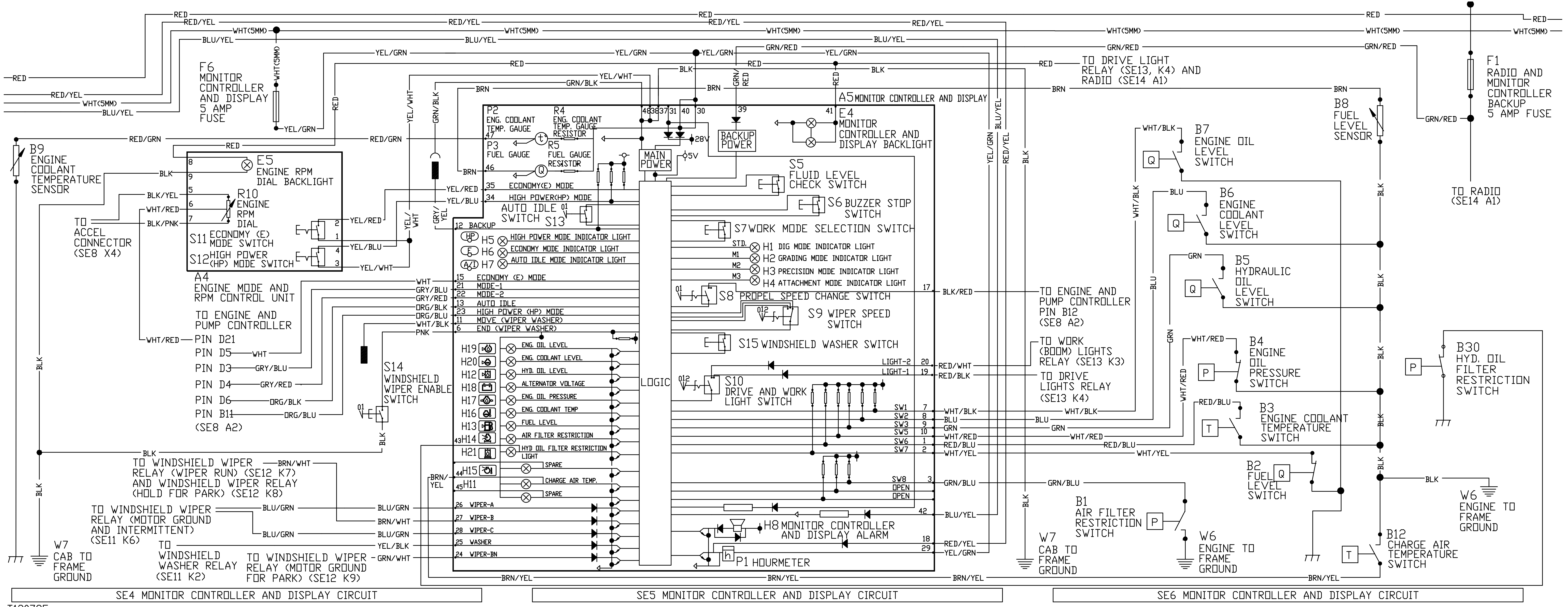

T120785

SYSTEM FUNCTIONAL SCHEMATIC (2 OF 6)

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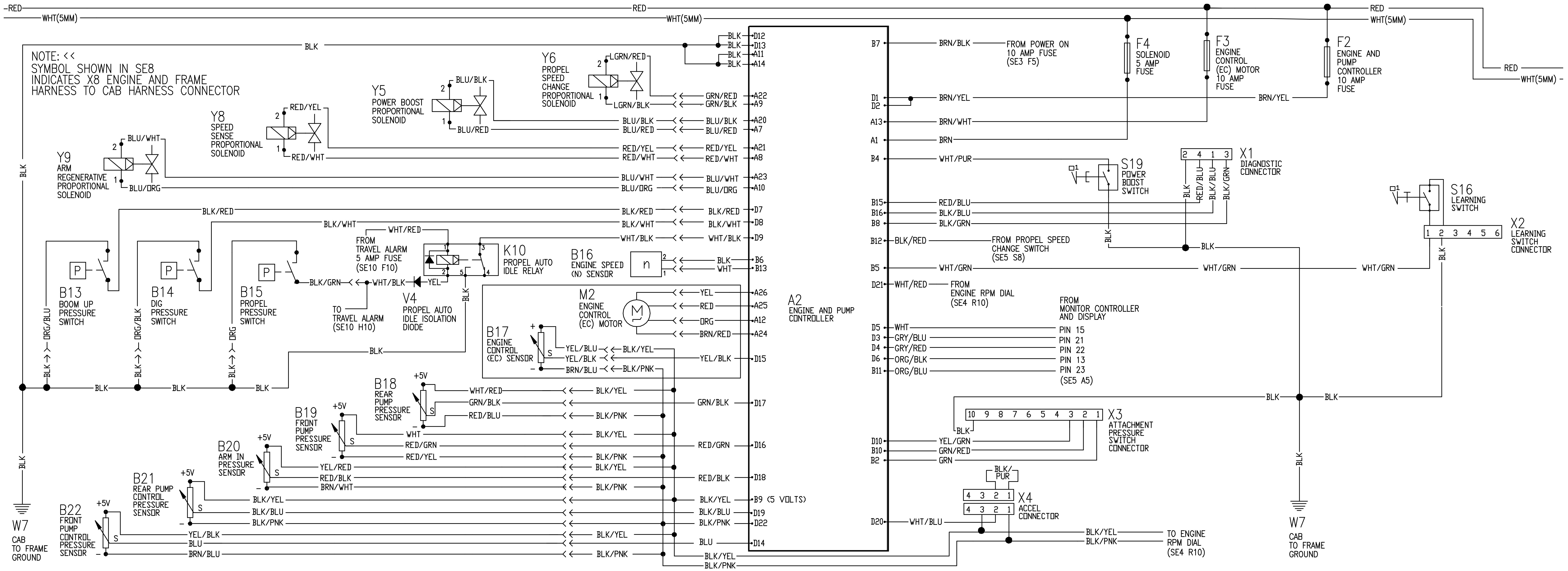

SE7 ENGINE AND PUMP CONTROLLER CIRCUIT

SE8 ENGINE AND PUMP CONTROLLER CIRCUIT

SE9 ENGINE AND PUMP CONTROLLER CIRCUIT

T119274

330LC AND 370 SYSTEM FUNCTIONAL SCHEMATIC (3 OF 6)

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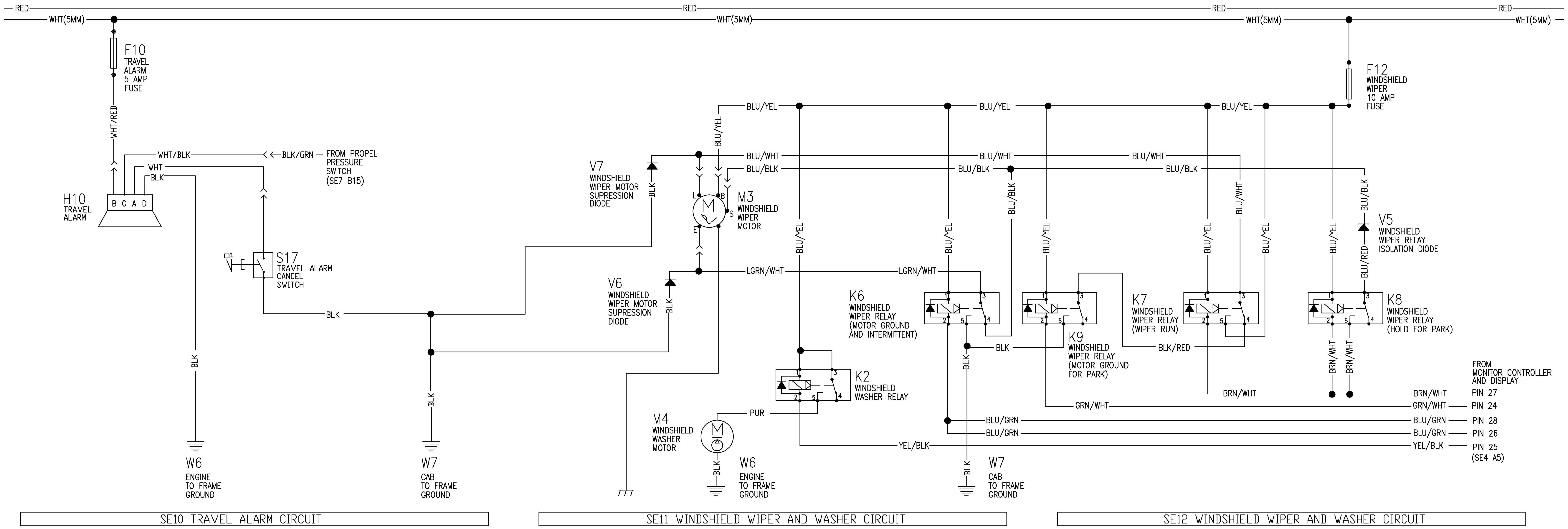

330LC AND 370 SYSTEM FUNCTIONAL SCHEMATIC (4 OF 6)

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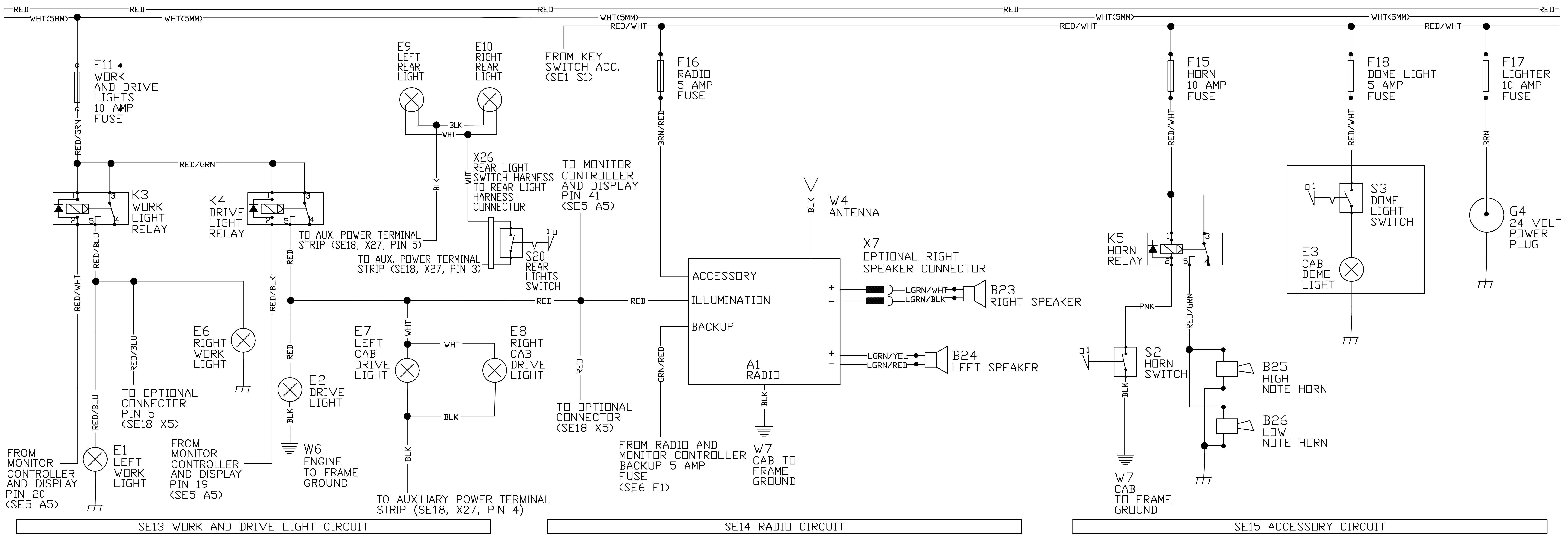

SYSTEM FUNCTIONAL SCHEMATIC (5 OF 6)

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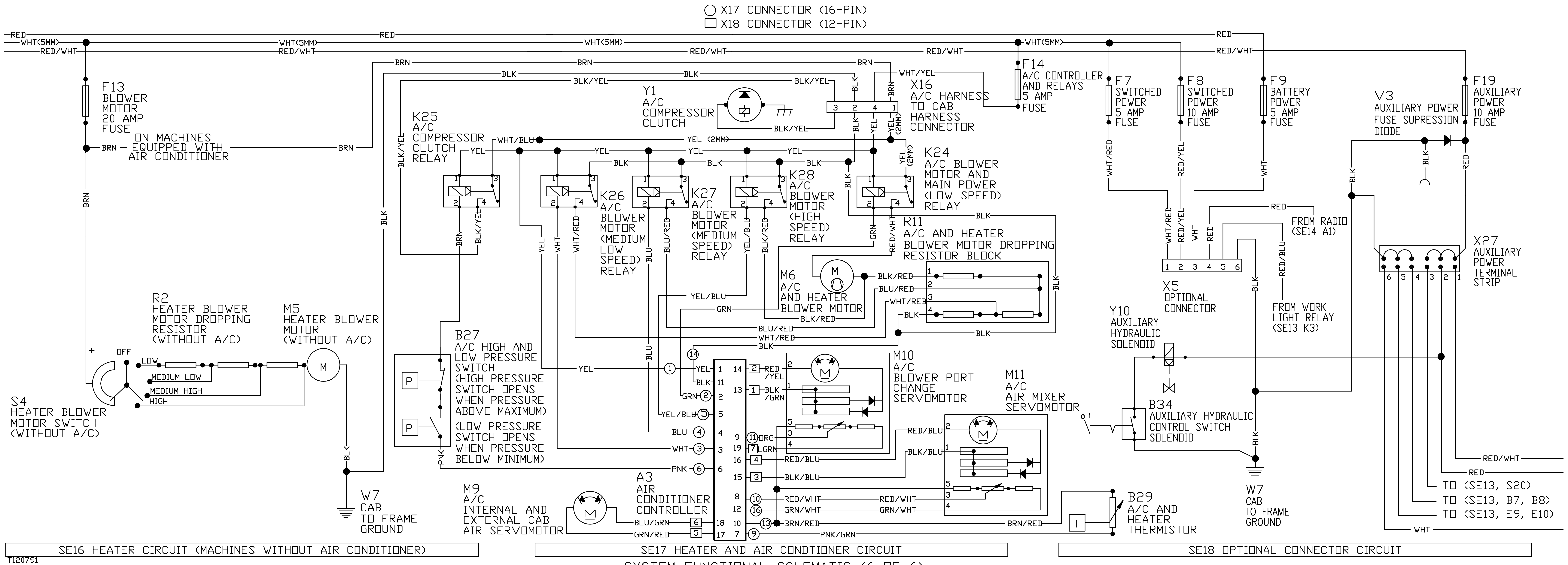
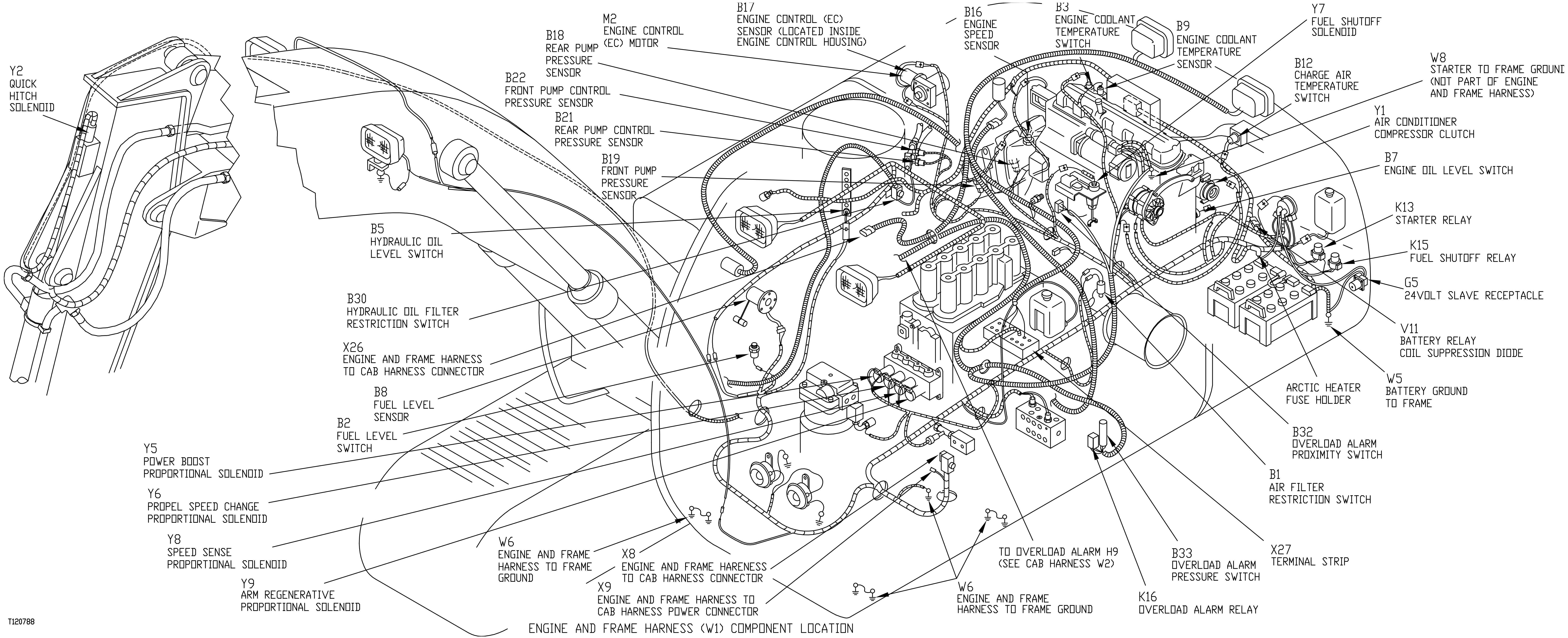
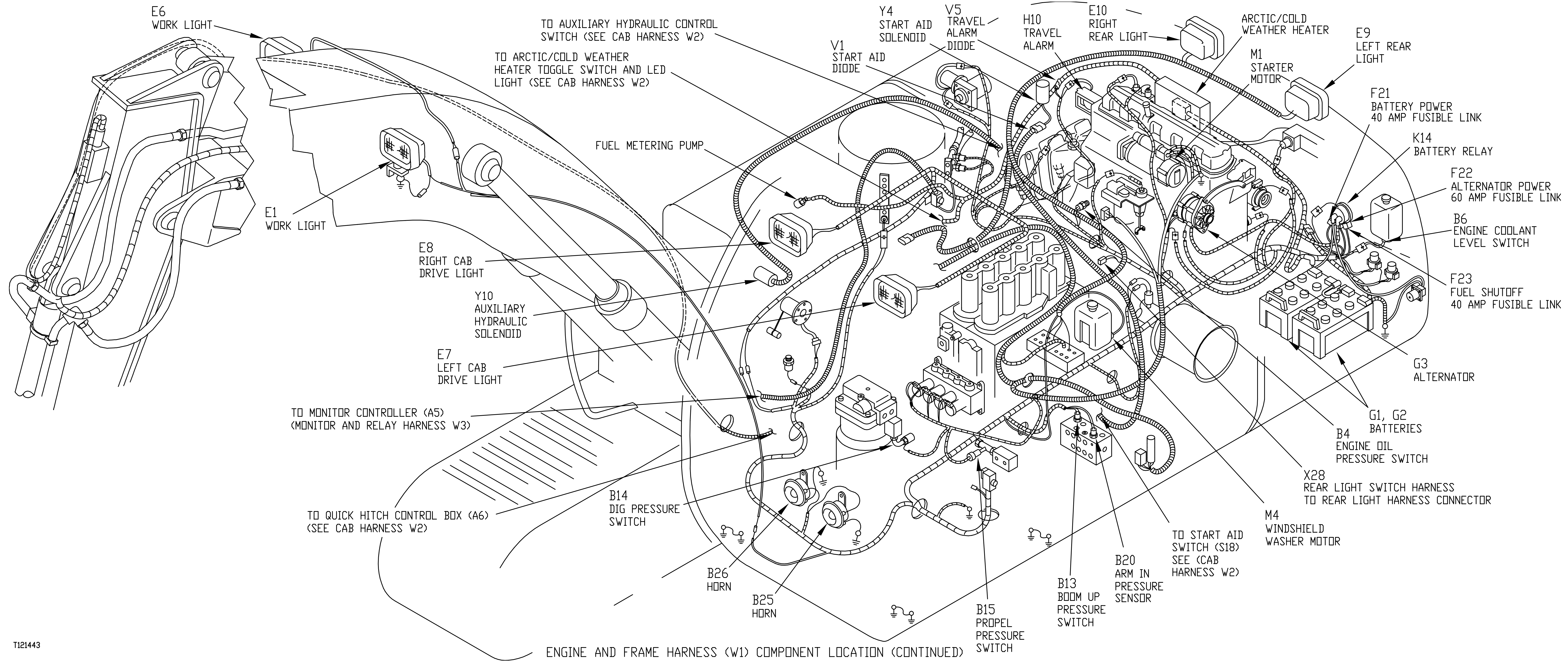
T120790



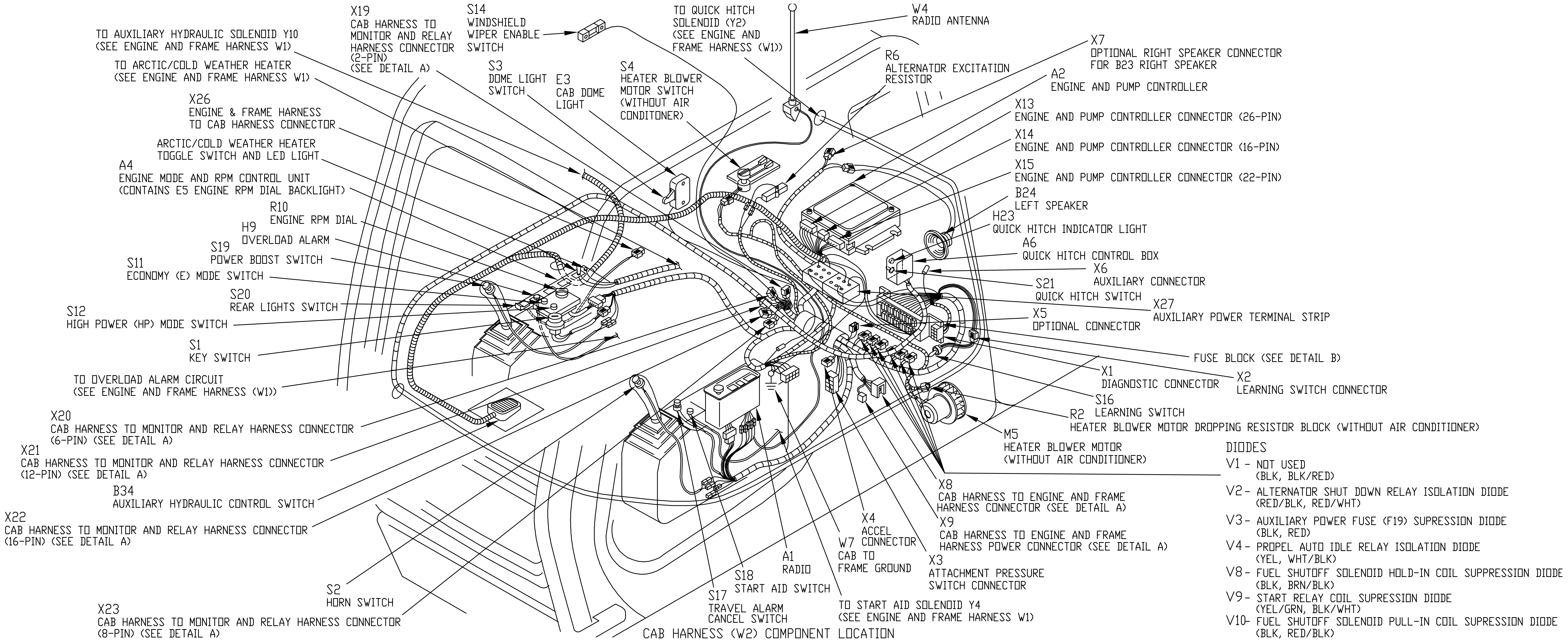
SYSTEM FUNCTIONAL SCHEMATIC (6 OF 6)



ENGINE AND FRAME HARNESS (W1) COMPONENT LOCATION

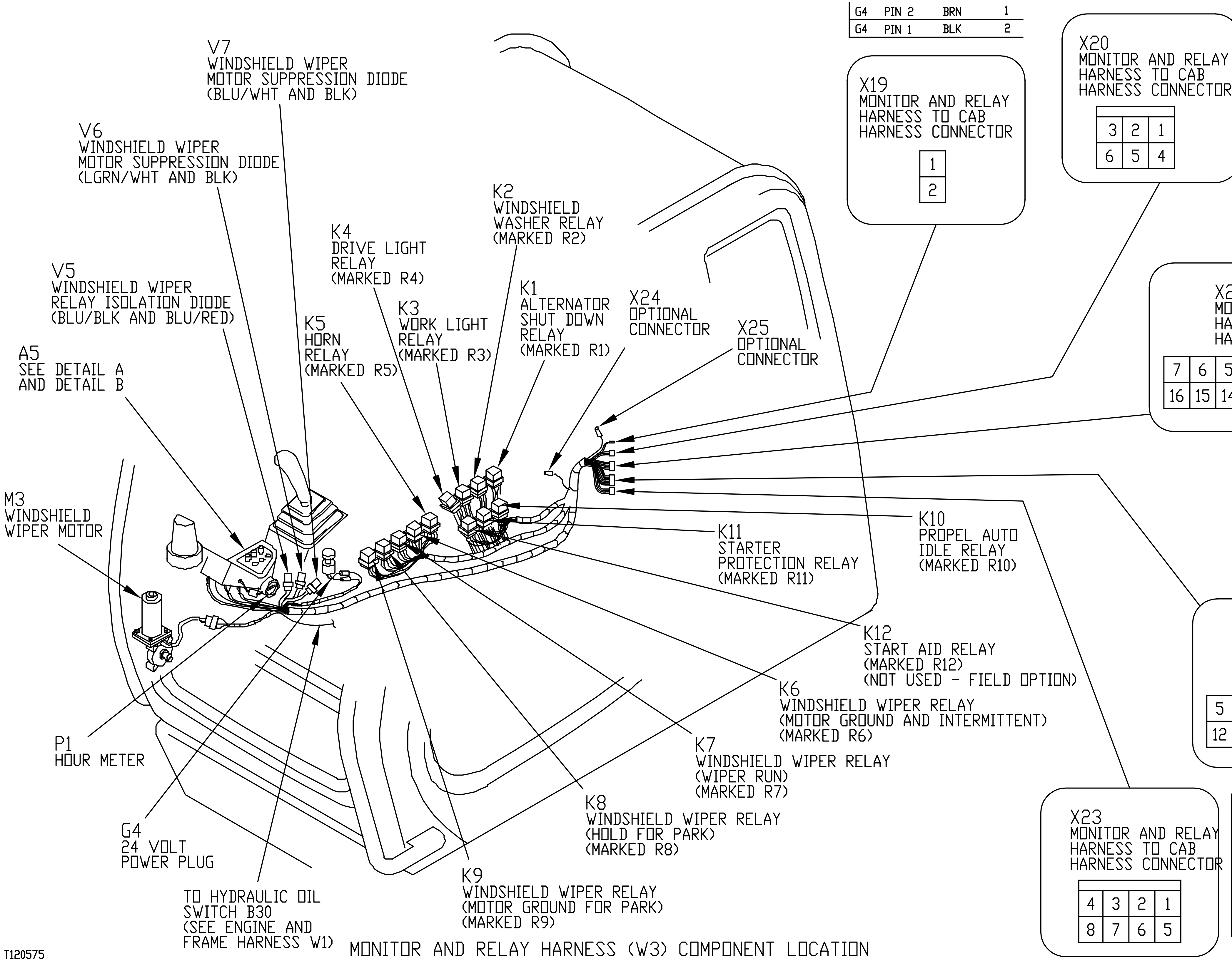


ENGINE AND FRAME HARNESS (W1) COMPONENT LOCATION (CONTINUED)



CAB HARNESS (W2) COMPONENT LOCATION

T120574



G4	PIN 2	BRN	1
G4	PIN 1	BLK	2

K4	PIN 1	RED/GRN	1
K3	PIN 5	RED/BLU	2
K4	PIN 5	RED	3
K1	PIN 1	RED	4
K1	PIN 5	RED/WHT	5
		PLUG	6

X12	PIN 10	WHT/RED	1
X12	PIN 9	GRN	2
X12	PIN 8	BLU	3
X12	PIN 7	WHT/BLK	4
X12	PIN 6	PNK	5
X12	PIN 3	GRN/BLU	6
X12	PIN 2	WHT/YEL	7
X12	PIN 1	RED/BLU	8
X10	PIN 34	YEL/BLU	9
X10	PIN 42	BLU/YEL	10
X10	PIN 29	YEL/GRN	11
X10	PIN 39	GRN/RED	12
X10	PIN 35	YEL/RED	13
X10	PIN 44	BRN/YEL	14
K2	PIN 1	BLU/YEL	15
X10	PIN 38	YEL/WHT	16

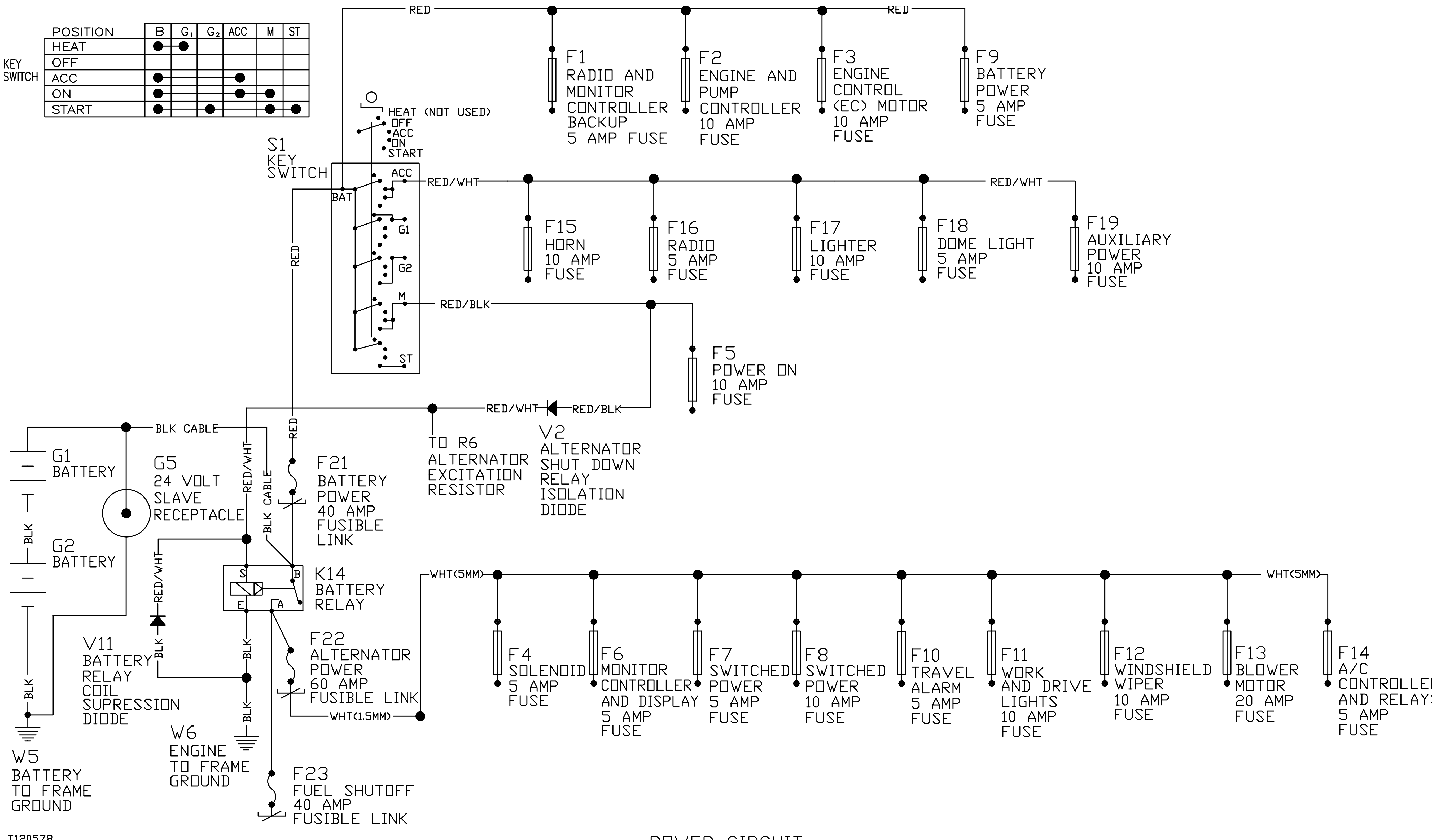
X10	PIN 46	BRN	1
K2	PIN 5	PUR	2
X10	PIN 47	RED/GRN	3
X11	PIN 21	GRY/BLU	4
K5	PIN 1	RED/WHT	5
X11	PIN 13	ORG/BLK	6
X11	PIN 22	GRY/RED	7
X11	PIN 17	BLK/RED	8
X11	PIN 23	ORG/BLU	9
X11	PIN 15	WHT	10
K5	PIN 2	PNK	11
K5	PIN 5	RED/GRN	12

K10	PIN 3	WHT/BLK	1
K10	PIN 1	WHT/RED	2
K10	PIN 2	YEL	3
K11	PIN 1	RED	4
K11	PIN 3	YEL/GRN	5
NOT USED		RED/BLU	6
NOT USED		BLK/WHT	7
NOT USED		BLK/RED	8

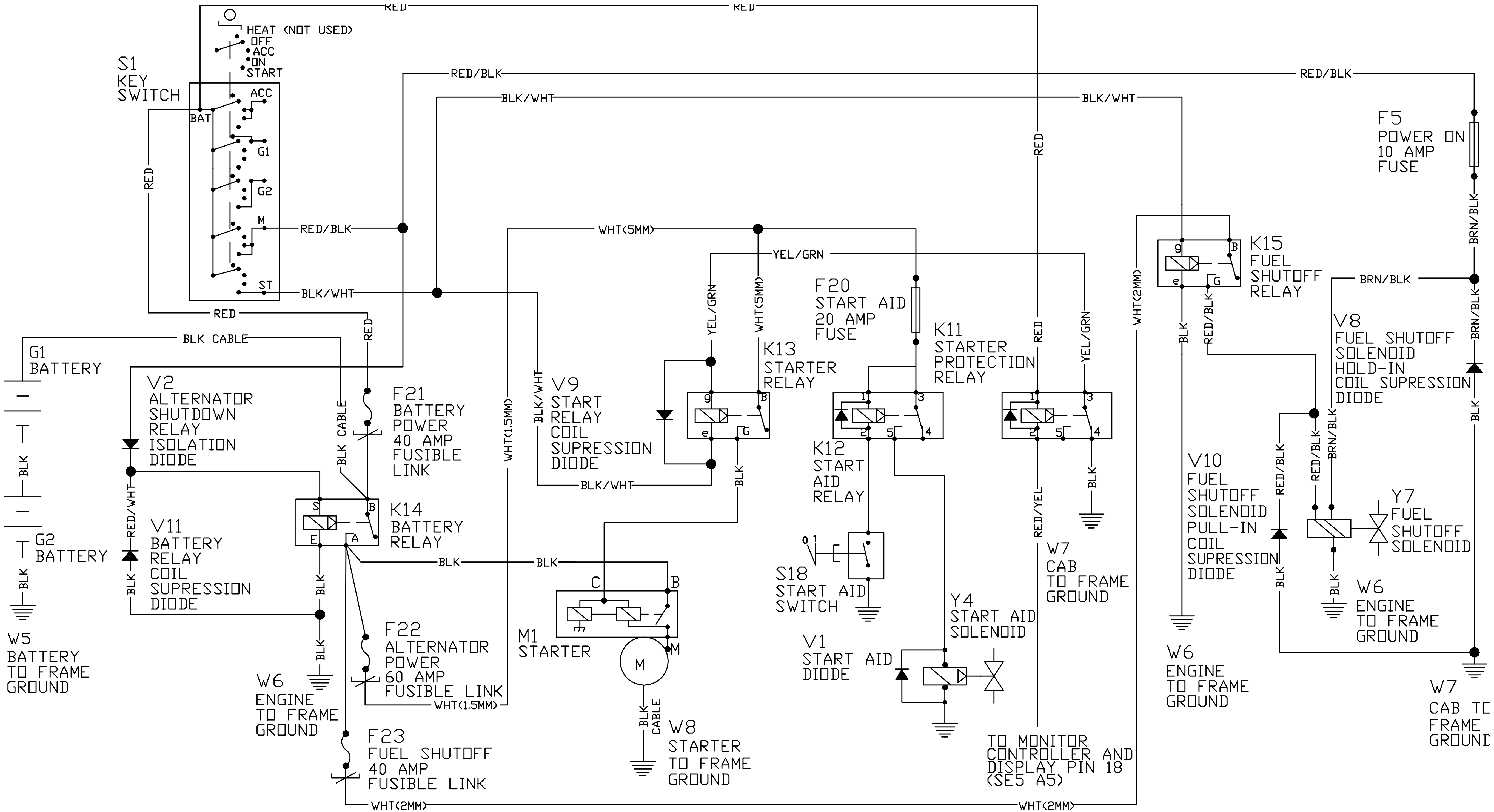
NOTE: PIN NUMBERS ARE LOCATION REFERENCE NUMBERS ONLY - THEY ARE NOT PRINTED ON THE CONNECTOR

MONITOR AND RELAY HARNESS (W3) COMPONENT LOCATION

T120575

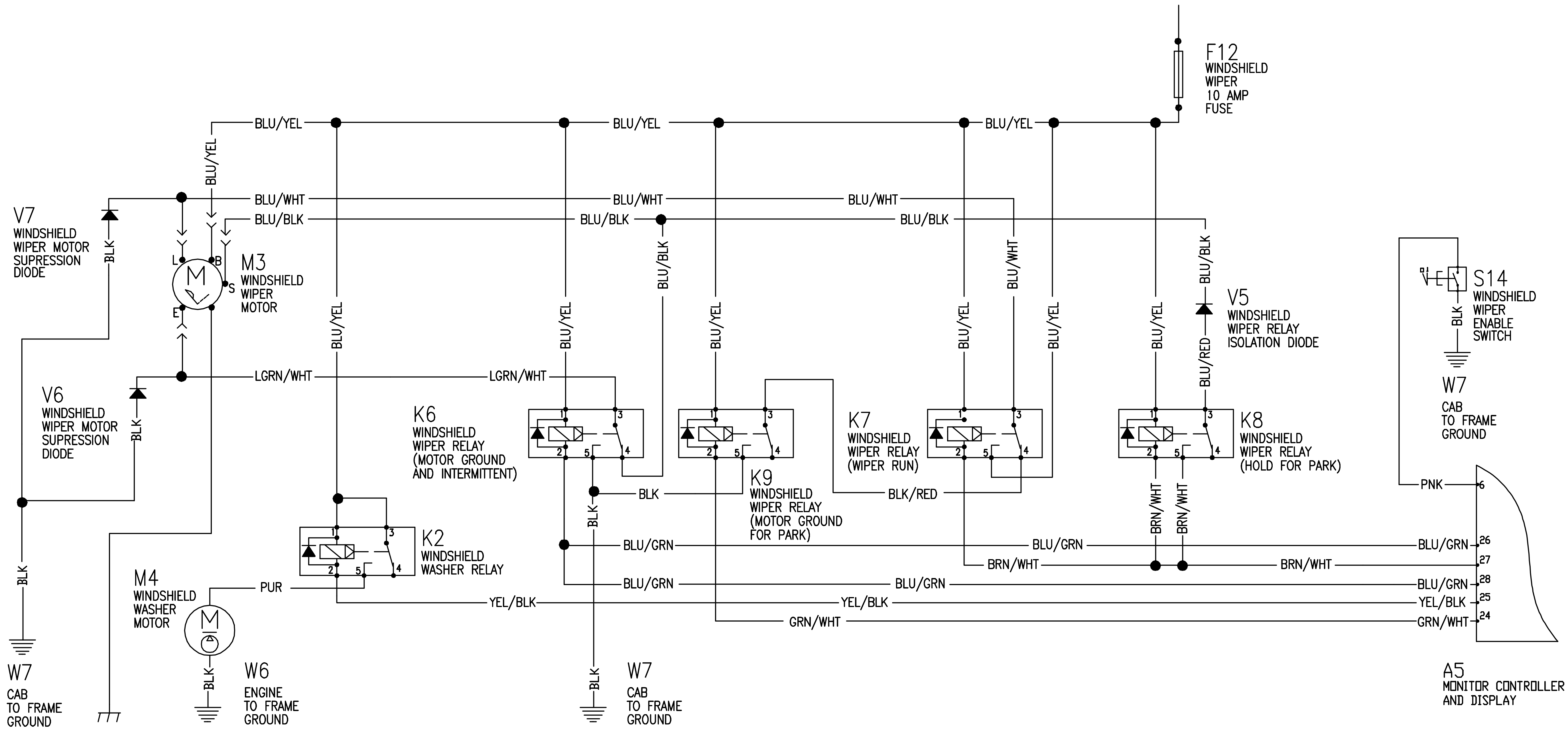


POWER CIRCUIT



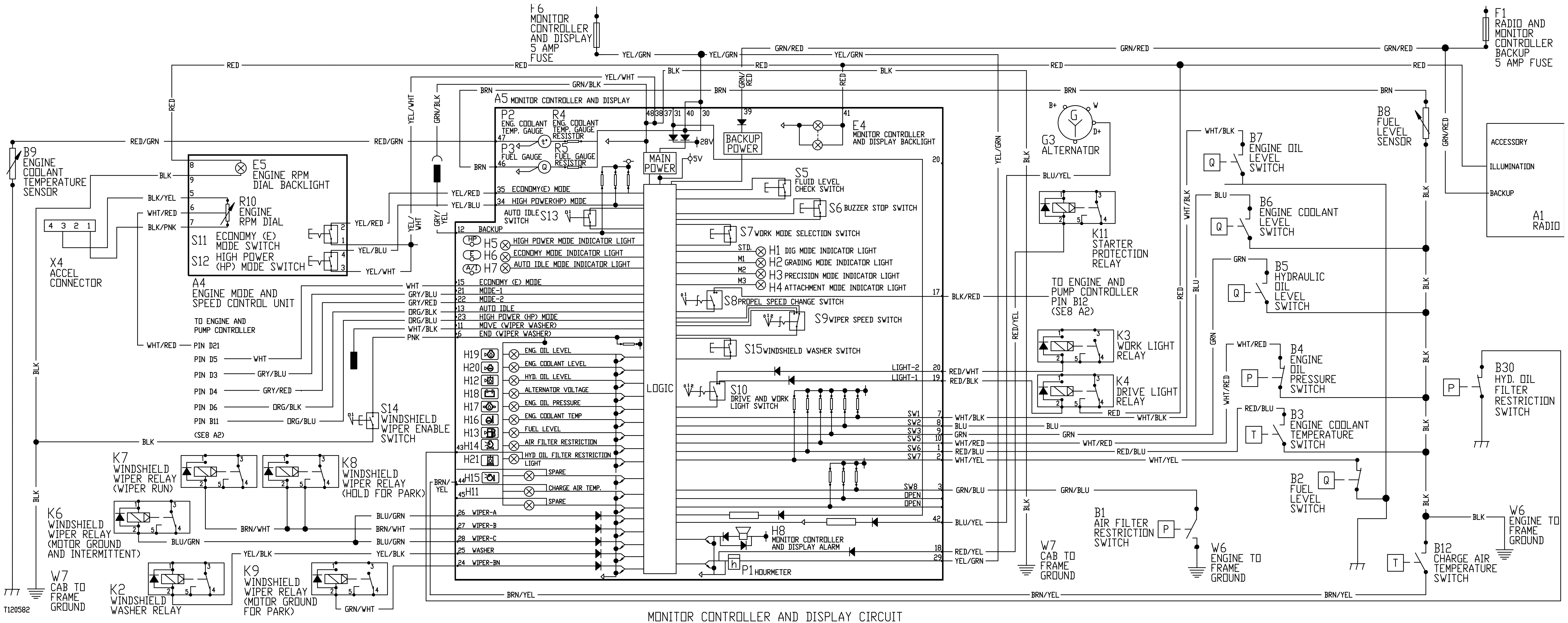
T120580

STARTING AND FUEL SHUTOFF CIRCUIT

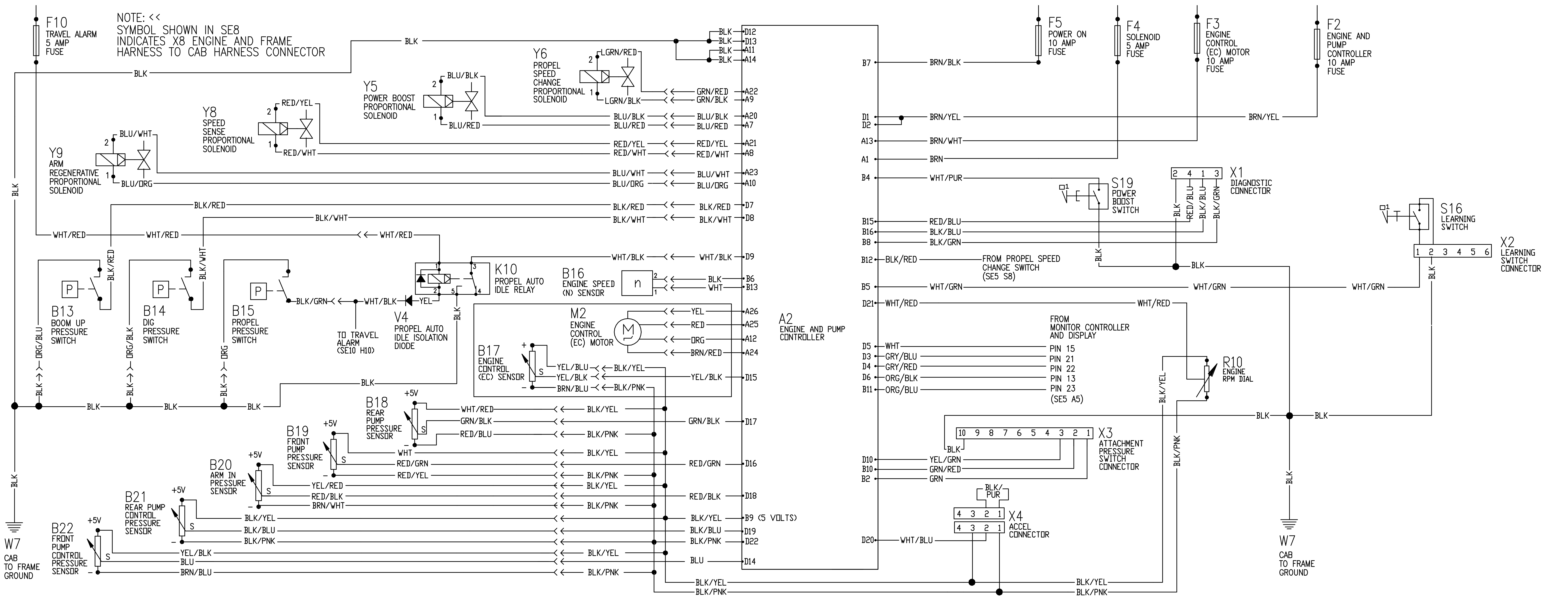


T117933

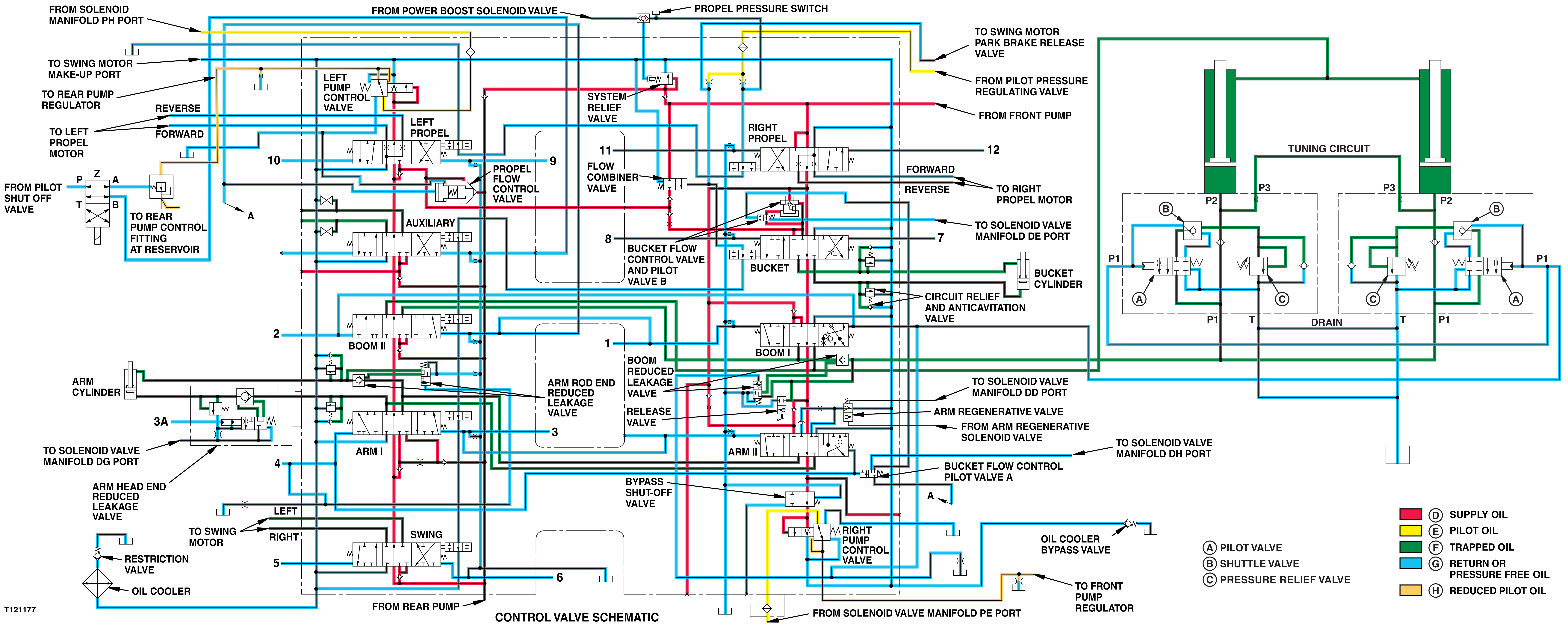
WINDSHIELD WIPER AND WASHER CIRCUIT

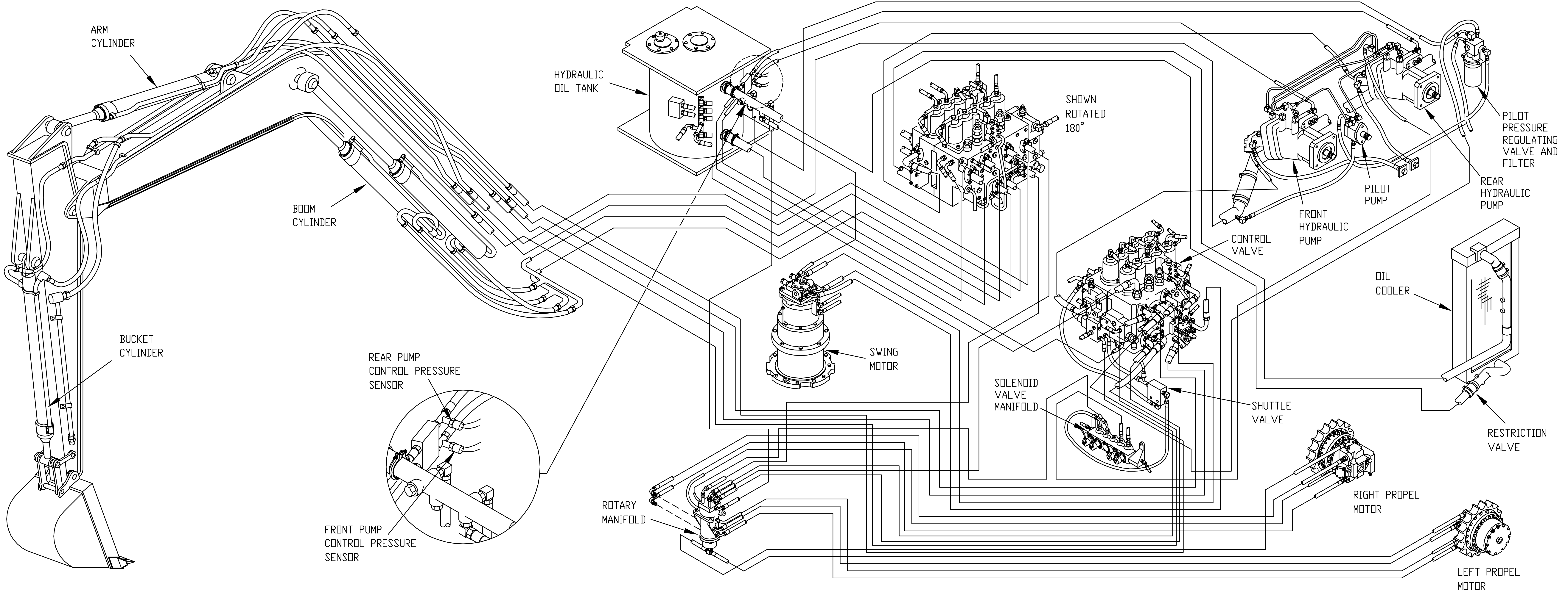


MONITOR CONTROLLER AND DISPLAY CIRCUIT

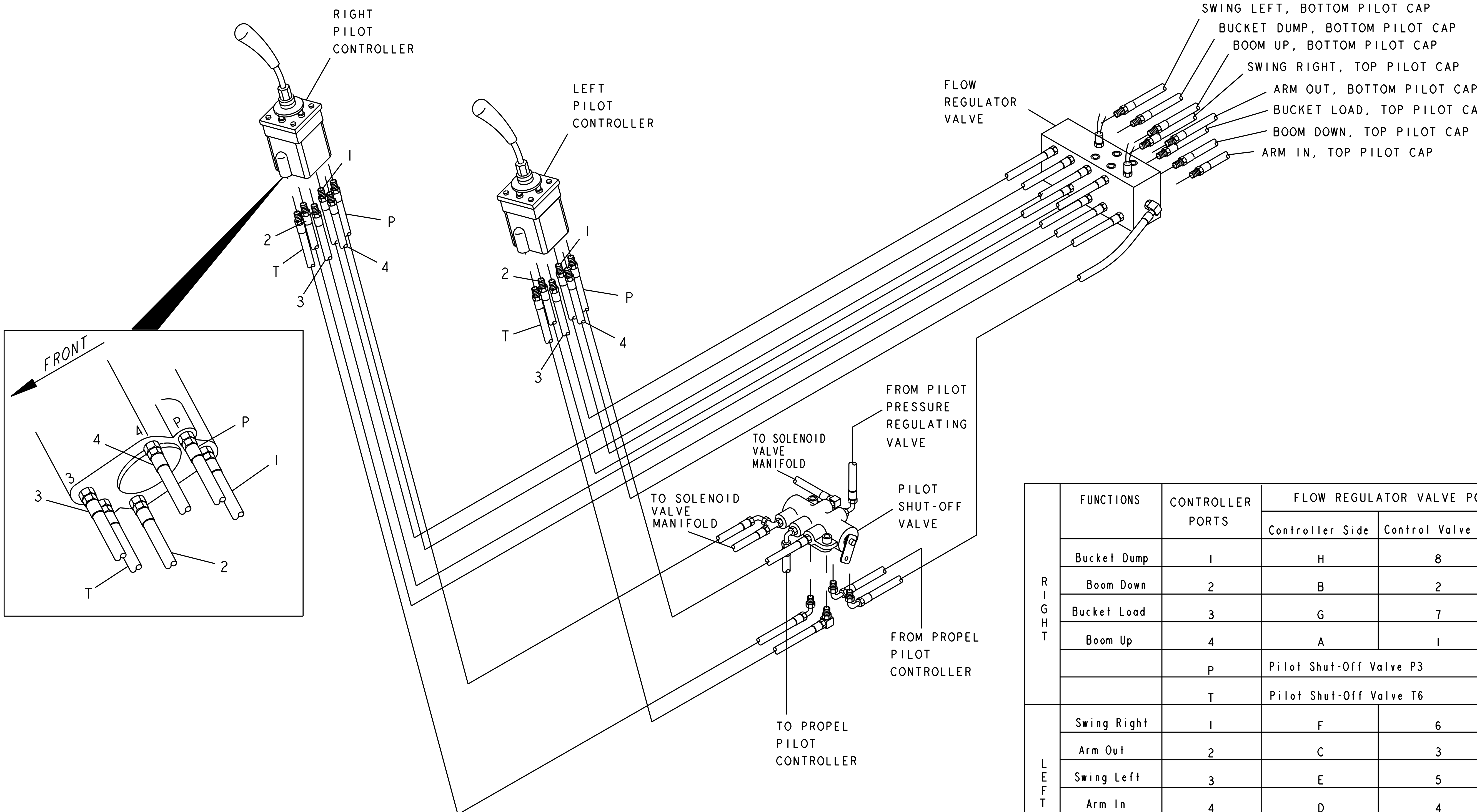


ENGINE AND PUMP CONTROLLER CIRCUIT


FROM SOLENOID MANIFOLD PH PORT
FROM POWER BOOST SOLENOID VALVE
PROPEL PRESSURE SWITCH
TO SWING MOTOR PARK BRAKE RELEASE VALVE
FROM PILOT PRESSURE REGULATING VALVE
FROM FRONT PUMP
TO SWING MOTOR MAKE-UP PORT
TO REAR PUMP REGULATOR
LEFT PUMP CONTROL VALVE
SYSTEM RELIEF VALVE
REVERSE
FORWARD
TO LEFT PROPEL MOTOR
LEFT PROPEL
RIGHT PROPEL
TUNING CIRCUIT
10
9
11
12
FLOW COMBINER VALVE
FORWARD
REVERSE
TO RIGHT PROPEL MOTOR
FROM PILOT SHUT OFF VALVE
P
Z
A
T
B
PROPEL FLOW CONTROL VALVE
TO REAR PUMP CONTROL FITTING AT RESERVOIR
A
AUXILIARY
TO SOLENOID VALVE MANIFOLD DE PORT
8
7
BUCKET FLOW CONTROL VALVE AND PILOT VALVE B
BUCKET
BUCKET CYLINDER
CIRCUIT RELIEF AND ANTICAVITATION VALVE
2
BOOM II
1
BOOM I
ARM CYLINDER
BOOM REDUCED LEAKAGE VALVE
ARM ROD END REDUCED LEAKAGE VALVE
TO SOLENOID VALVE MANIFOLD DD PORT
ARM REGENERATIVE VALVE
FROM ARM REGENERATIVE SOLENOID VALVE
3A
RELEASE VALVE
3
TO SOLENOID VALVE MANIFOLD DG PORT
ARM I
ARM II
TO SOLENOID VALVE MANIFOLD DH PORT
4
ARM HEAD END REDUCED LEAKAGE VALVE
BYPASS SHUT-OFF VALVE
BUCKET FLOW CONTROL PILOT VALVE A
A
LEFT
TO SWING MOTOR
RIGHT
SWING
RIGHT PUMP CONTROL VALVE
OIL COOLER BYPASS VALVE
RESTRICTION VALVE
5
6
OIL COOLER
FROM REAR PUMP
CONTROL VALVE SCHEMATIC
FROM SOLENOID VALVE MANIFOLD PE PORT
TO FRONT PUMP REGULATOR
P1
P2
P3
T
DRAIN
A PILOT VALVE
B SHUTTLE VALVE
C PRESSURE RELIEF VALVE
D SUPPLY OIL
E PILOT OIL
F TRAPPED OIL
G RETURN OR PRESSURE FREE OIL
H REDUCED PILOT OIL
T121177



MAIN HYDRAULIC SYSTEM

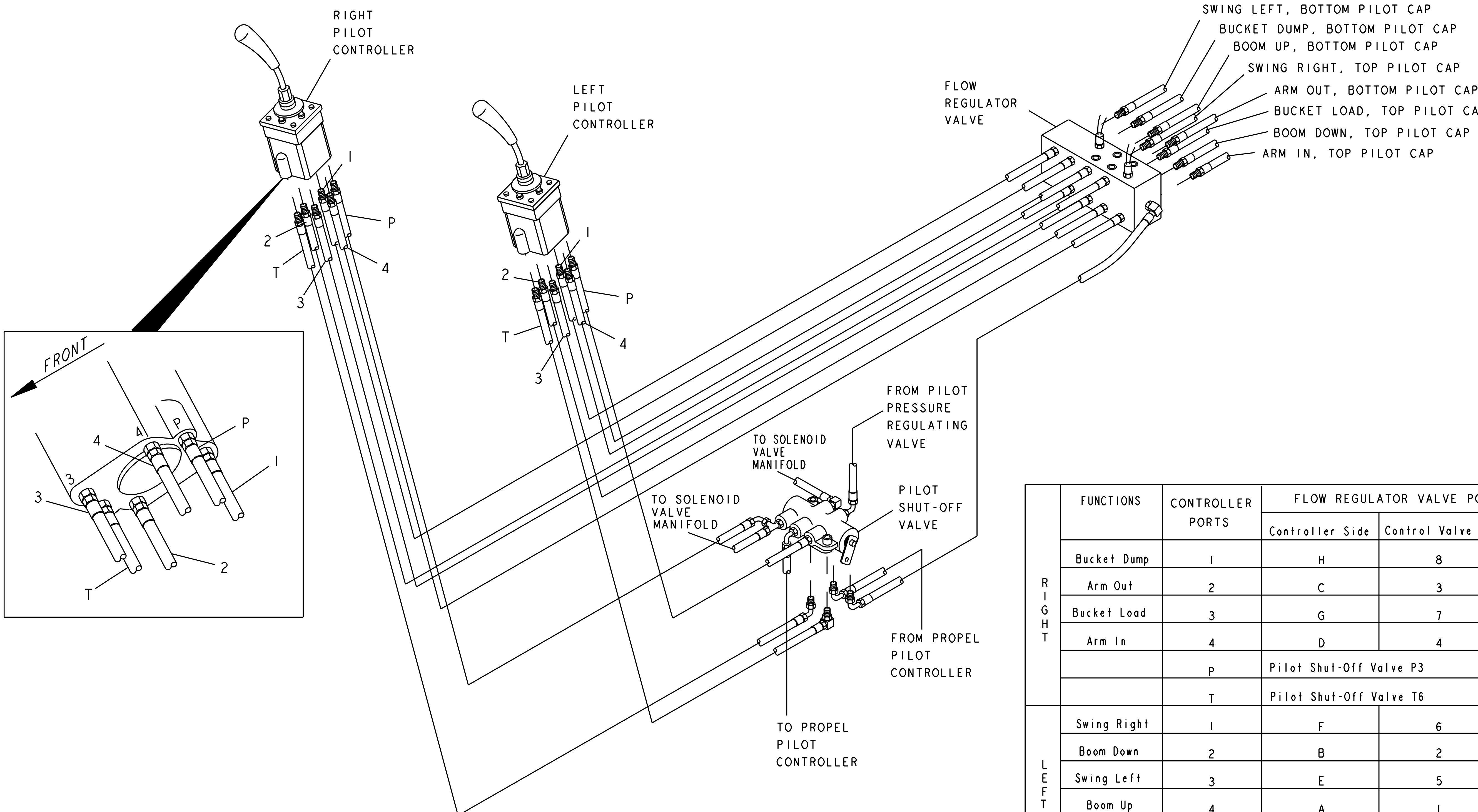


PILOT SYSTEM-CONTROLLERS TO FLOW REGULATOR VALVE-SAE PATTERN

TI09220

	FUNCTIONS	CONTROLLER PORTS	FLOW REGULATOR VALVE PORT	
			Controller Side	Control Valve Side
RIGHT	Bucket Dump	I	H	8
	Boom Down	2	B	2
	Bucket Load	3	G	7
	Boom Up	4	A	I
		P	Pilot Shut-Off Valve P3	
		T	Pilot Shut-Off Valve T6	
LEFT	Swing Right	I	F	6
	Arm Out	2	C	3
	Swing Left	3	E	5
	Arm In	4	D	4
		P	Pilot Shut-Off Valve P2	
		T	Pilot Shut-Off Valve T5	

Note: Letters and numbers are on the housings next to the ports

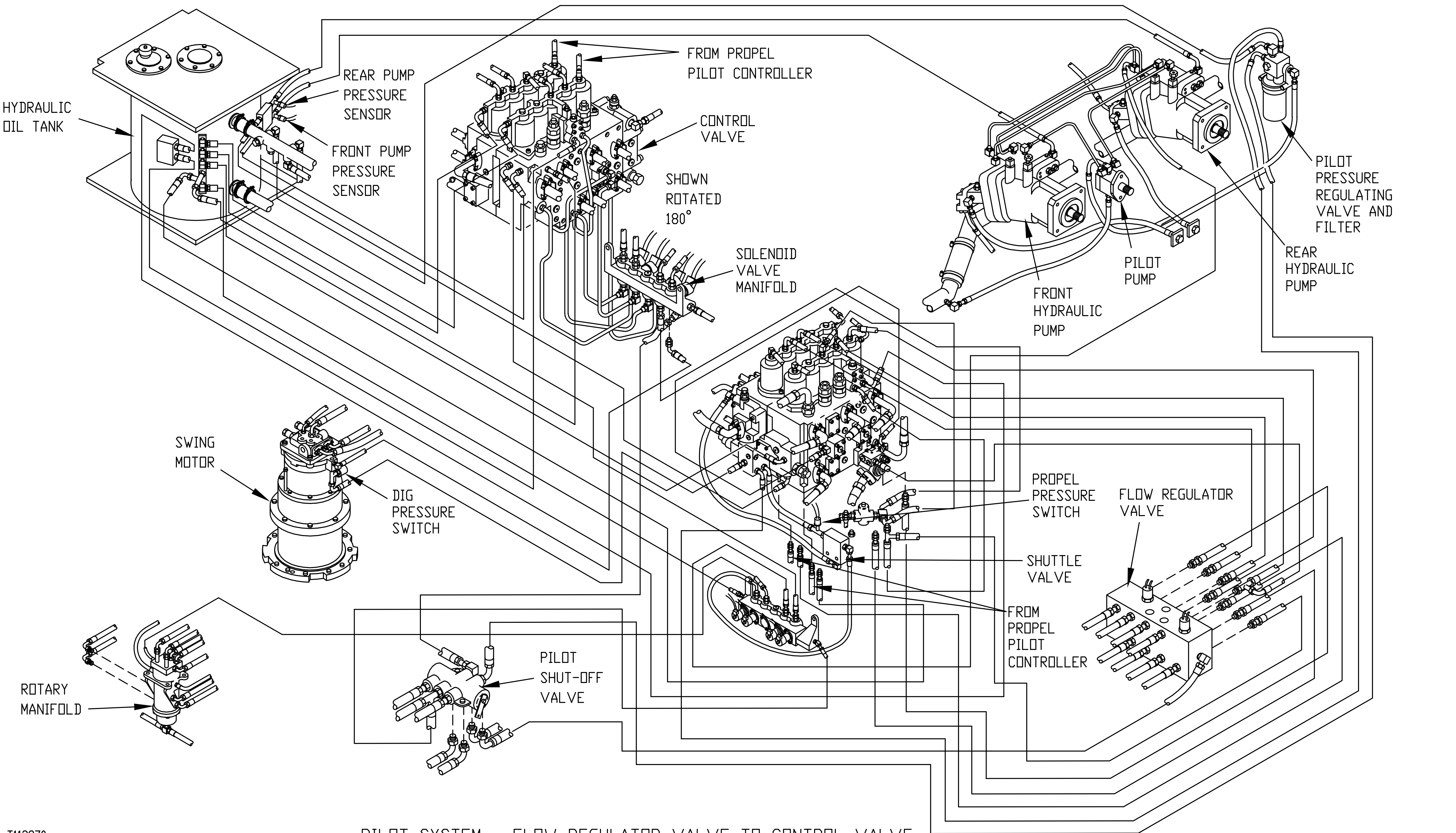


PILOT SYSTEM-CONTROLLERS TO FLOW REGULATOR VALVE-JOHN DEERE PATTERN

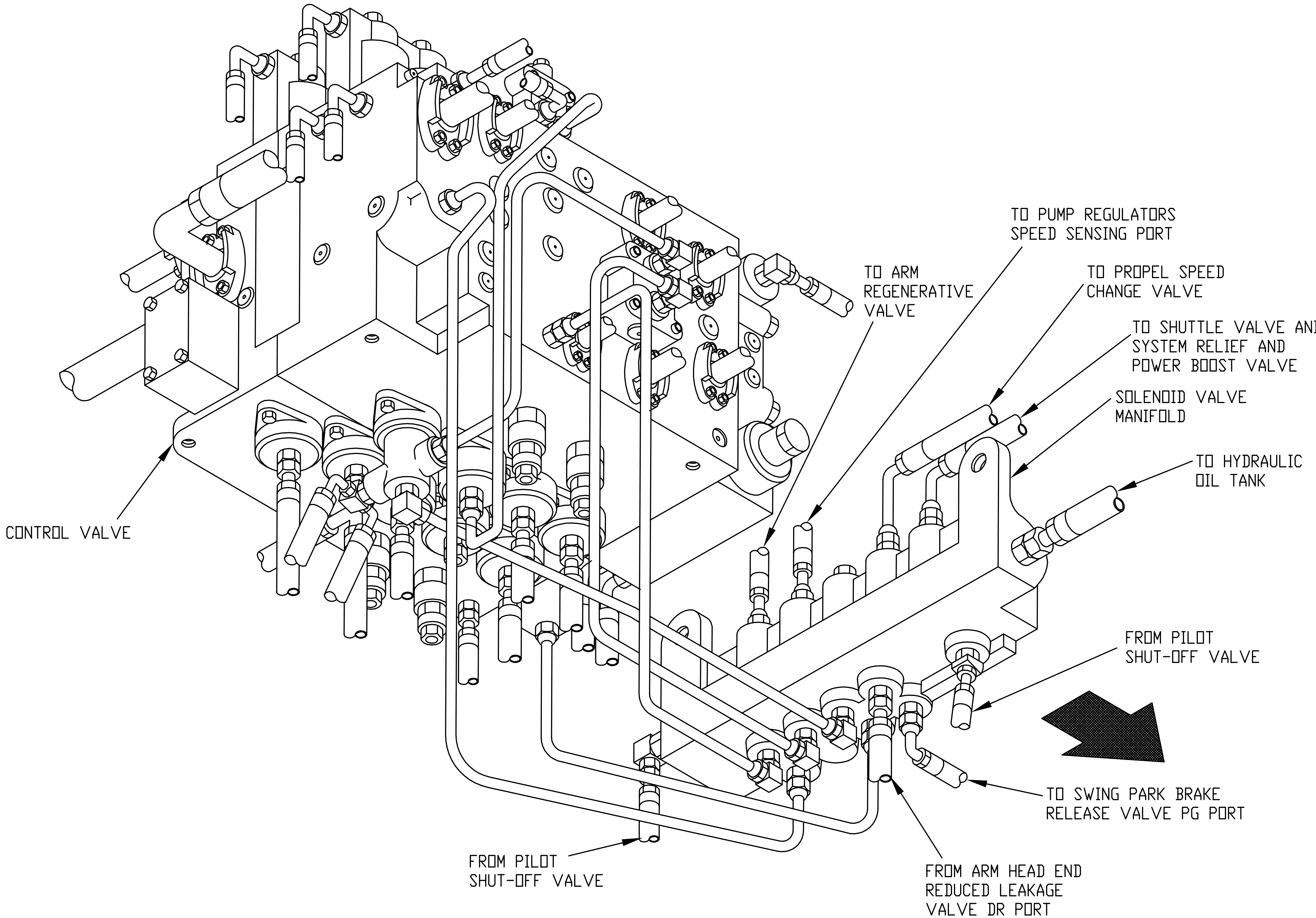
TI09221

	FUNCTIONS	CONTROLLER PORTS	FLOW REGULATOR VALVE PORT	
			Controller Side	Control Valve Side
RIGHT	Bucket Dump	I	H	8
	Arm Out	2	C	3
	Bucket Load	3	G	7
	Arm In	4	D	4
		P	Pilot Shut-Off Valve P3	
		T	Pilot Shut-Off Valve T6	
LEFT	Swing Right	I	F	6
	Boom Down	2	B	2
	Swing Left	3	E	5
	Boom Up	4	A	I
		P	Pilot Shut-Off Valve P2	
		T	Pilot Shut-Off Valve T5	

Note: Letters and numbers are on the housings next to the ports

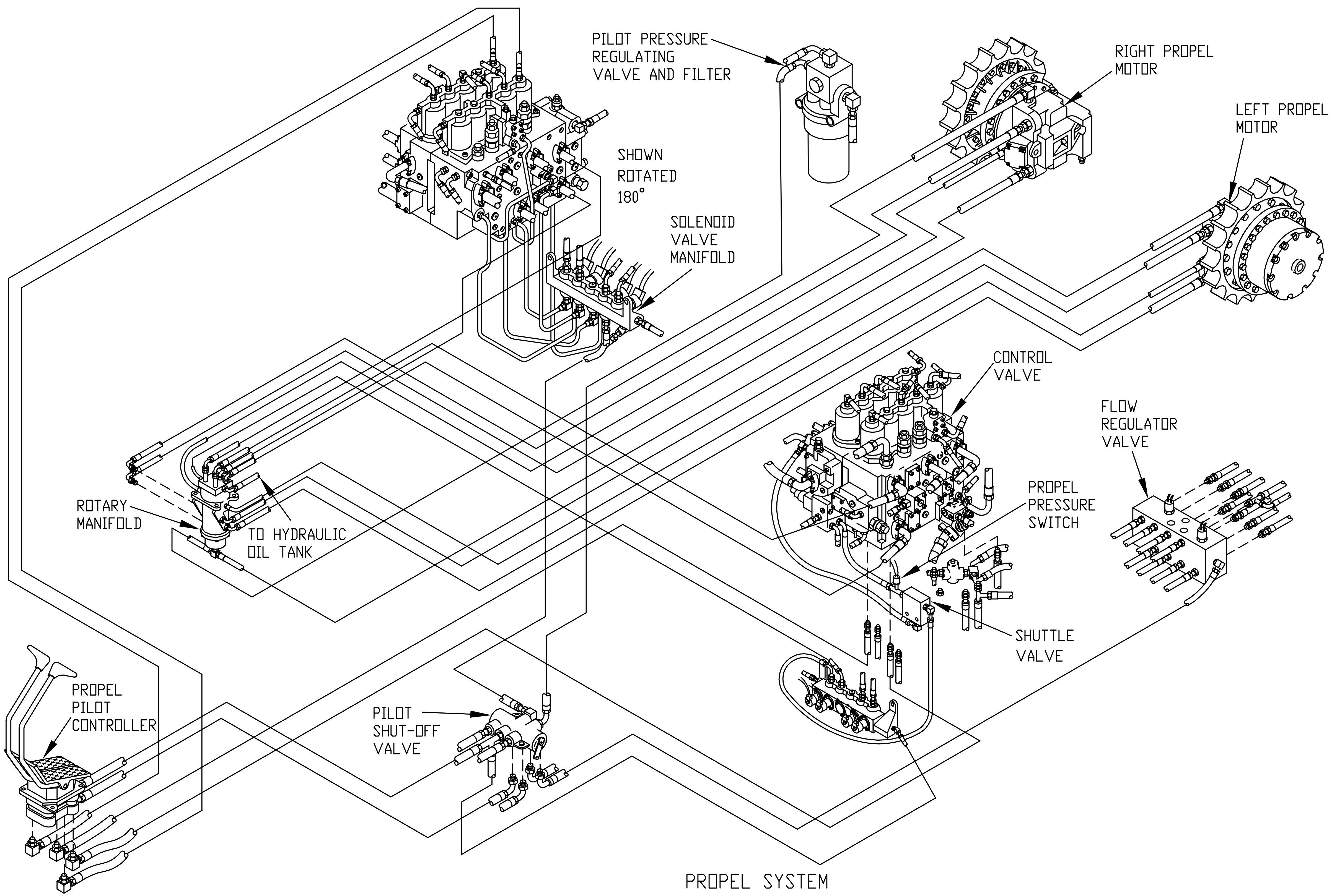


PILOT SYSTEM - FLOW REGULATOR VALVE TO CONTROL VALVE

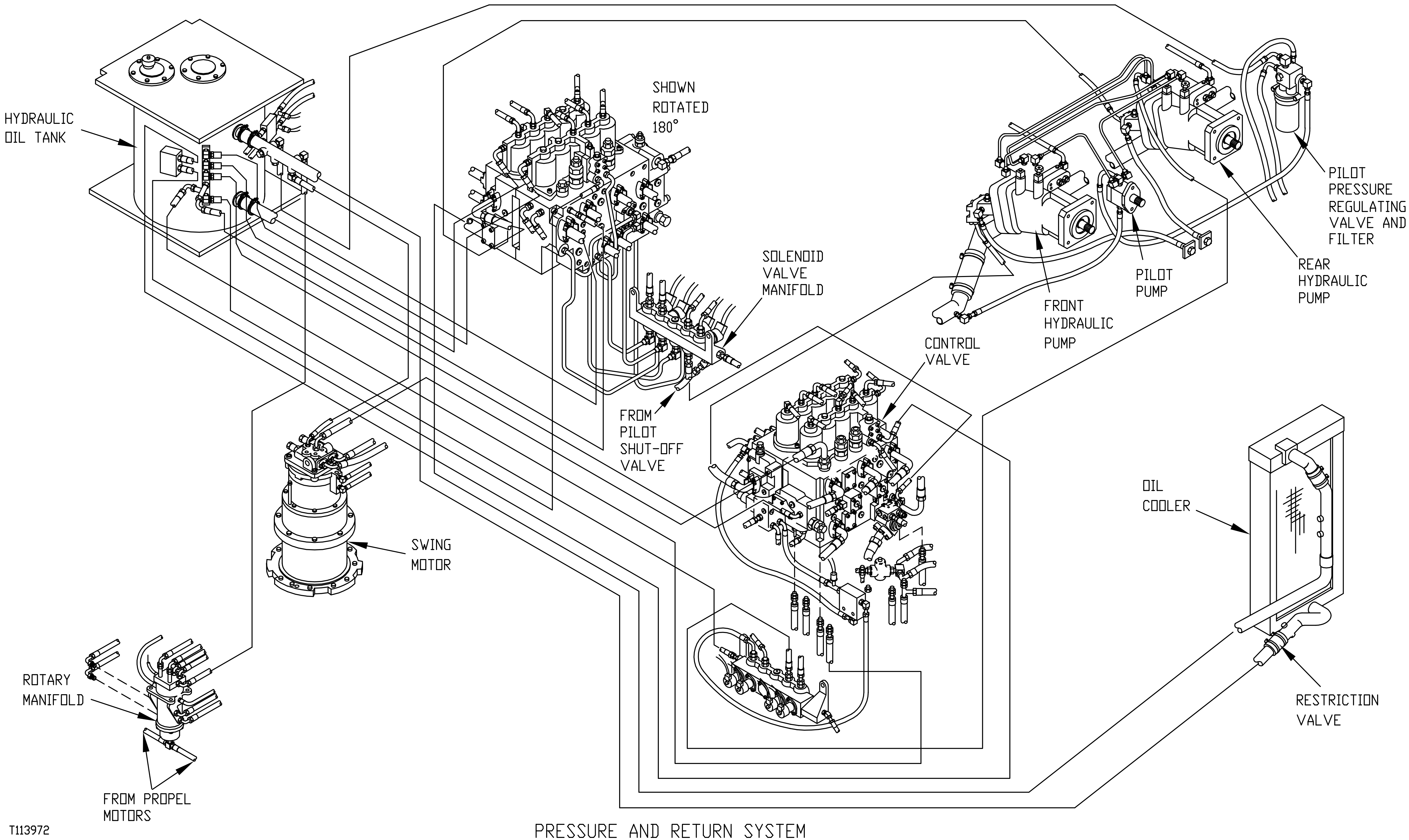


CONTROL VALVE AND SOLENOID VALVE MANIFOLD

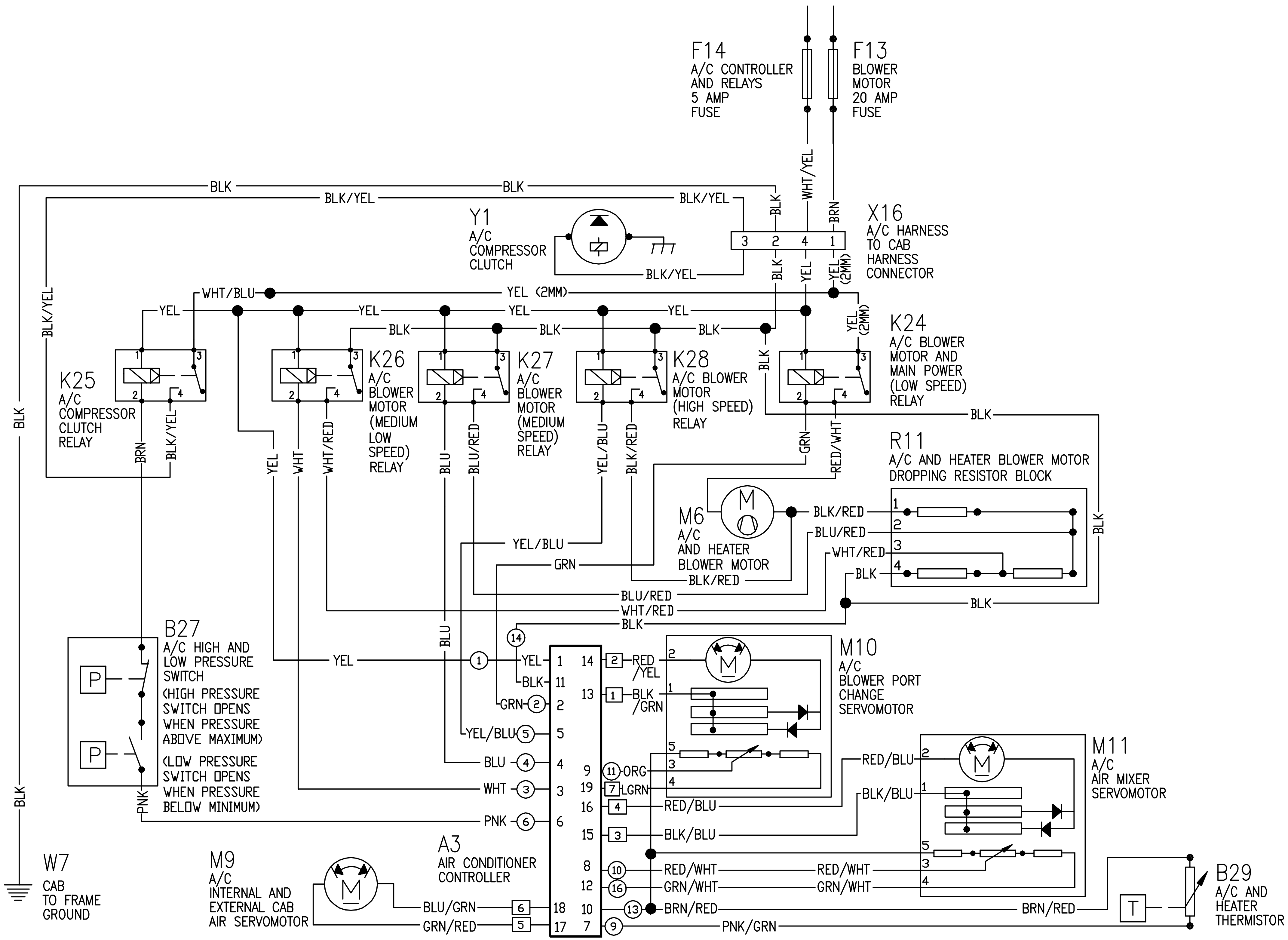
T115558



PROPEL SYSTEM

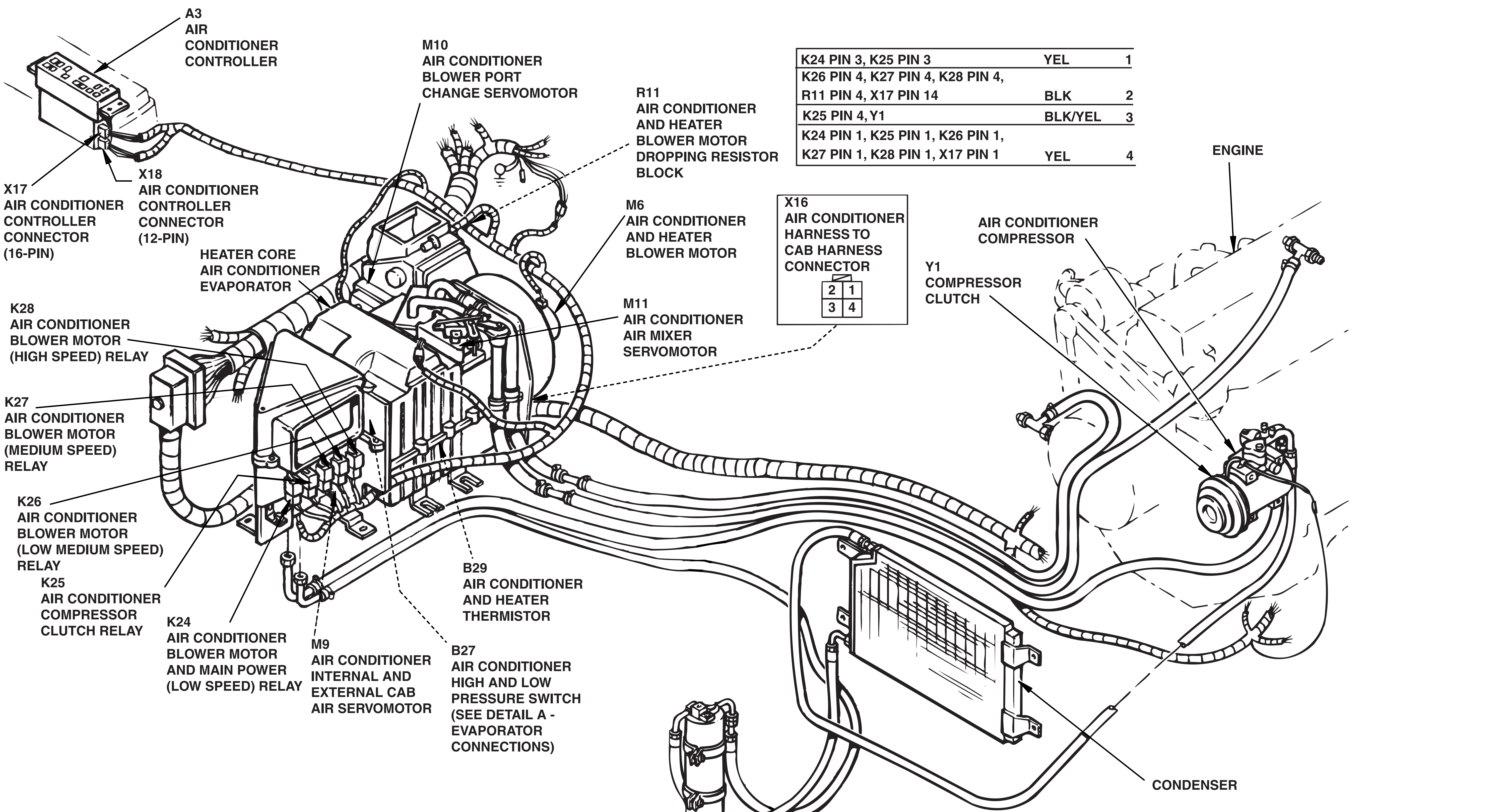


PRESSURE AND RETURN SYSTEM



T117938

HEATER AND AIR CONDITIONER CIRCUIT



K24 PIN 3, K25 PIN 3	YEL	1
K26 PIN 4, K27 PIN 4, K28 PIN 4, R11 PIN 4, X17 PIN 14	BLK	2
K25 PIN 4, Y1	BLK/YEL	3
K24 PIN 1, K25 PIN 1, K26 PIN 1, K27 PIN 1, K28 PIN 1, X17 PIN 1	YEL	4

T118135

AIR CONDITIONER HARNESS (W9) COMPONENT LOCATION

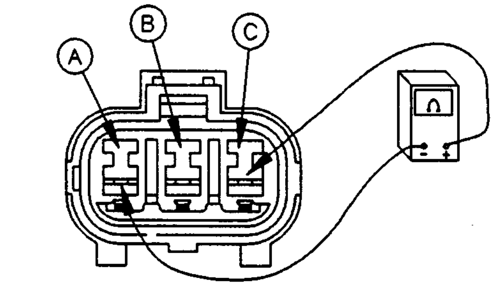
ENGINE CONTROL (EC) SENSOR HARNESS TEST

SPECIFICATIONS	
Engine Control (EC) Sensor Resistance	2000 ± 400 ohms between ground and power terminals
Fast Idle in Standard Mode Voltage	3.3—3.7 volts typical
E (Economy) Mode Voltage	3.0—3.3 volts typical
Auto-Idle Mode Voltage	2.7—2.9 volts typical
Slow Idle Voltage	2.5—2.7 volts typical
HP (High Power) Mode With Arm In Function Over Relief Voltage	Fast idle in standard mode voltage plus 0.2 volts or more typical

ESSENTIAL TOOLS
JT07066 Test Harness

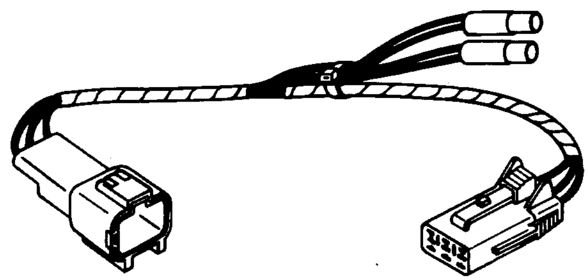
SERVICE EQUIPMENT AND TOOLS
JT07306 Analog/Digital Multimeter

The purpose of test is to check continuity in engine control sensor (EC sensor) wiring harness and there is a signal from the engine and pump controller (EPC).

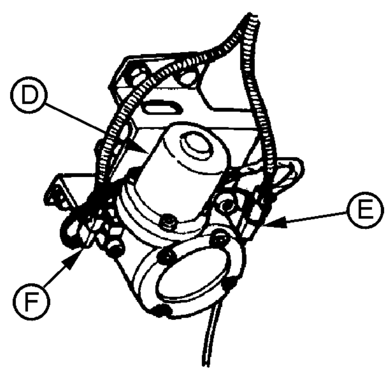


T7482AH (CV)

T7482AH —UN–19MAR91



T7486AB —UN–19MAR91



T106991

T106991 —UN–07FEB97

A—Ground Terminal
B—Signal Terminal
C—Power Terminal
D—Engine Control Motor
E—Engine Control Sensor Wiring Harness
F—Engine Control Motor Wiring Harness

9025
25
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Continued on next page

CED,TX08227,3028 –19–18MAR98–1/3

NOTE: The reading displayed on the laptop computer for "2 EC angle" is the feedback signal from the engine control sensor to the engine and pump controller. See the specification chart above for typical readings for fast idle, slow idle, E mode, HP mode, and auto-idle mode. The readings can vary from machine to machine. What to look for is that the readings change when the engine rpm dial is turned, and the E mode, HP mode, or auto-idle mode is actuated. The readings indicates engine control sensor is OK. (For circuit operation, see Engine Speed Control System Operation in Group 9010-05.)

IMPORTANT: Turn key switch off before disconnecting any electrical connectors. Disconnecting electrical connectors while engine is running or with key switch on can damage engine and pump controller or other electrical components.

1. Stop engine. Turn key switch to OFF.

IMPORTANT: Retainer tab on male half of wiring harness connector halves must be pushed down before pulling halves apart. Never pull on wiring leads

9025
25
54

2. Push retainer tab down then pull connector halves apart.

3. Measure resistance between the ground (A) and power (C) terminals of EC sensor. If resistance is to specification, go to next step. If resistance is not as specified, replace engine control motor.

Engine Control (EC) Sensor—Specification

Resistance .... 2000 ± 400 ohms between ground and power terminals

NOTE: EC sensor is on the inside of EC motor housing.

4. When using a volt meter, install test harness in series with wiring harness for EC sensor (E). Connect volt meter.

Continued on next page CED,TX08227,3028 –19–18MAR98–2/3

When using the laptop computer with excavator diagnostics program, select “2 EC angle” from the Monitor Data Items. (See the installation procedure in this group.)

5. Turn the engine rpm dial to the slow idle position.

6. Turn key switch ON. EC motor (D) goes to the slow idle position.

7. Turn engine rpm dial to fast idle, push E mode switch, push auto-idle switch then wait 4 seconds, and then turn engine rpm dial to slow idle. EC motor must move to each position. Record voltage reading for each mode.

Fast Idle in Standard Mode—Specification

Voltage.. 3.3—3.7 volts typical

E (Economy) Mode—Specification

Voltage.. 3.0—3.3 volts typical

Auto-Idle Mode—Specification

Voltage.. 2.7—2.9 volts typical

Slow Idle—Specification

Voltage.. 2.5—2.7 volts typical

For HP (high power) mode, run engine at fast idle, push HP mode switch, and then actuate arm in function over relief. Record voltage reading.

HP (High Power) Mode With Arm In Function Over Relief—Specification

Voltage... Fast idle in standard mode voltage plus 0.2 volts or more typical

CED,TX08227,3028 –19–18MAR98–3/3

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ENGINE CONTROL MOTOR (EC MOTOR) HARNESS TESTS

ESSENTIAL TOOLS
JT07065 Test Harness

The purpose of test is to check continuity of EC motor wiring harness (F) and there is a signal from engine and pump controller (EPC).

NOTE: The laptop computer with excavator diagnostics program can be used to check the electrical signal from the engine and pump controller to the engine control motor. Select “15 EC motor position” from Monitor Data Items. Typical readings are 110—114 steps at slow idle to 390—410 steps at fast idle. The readings can vary from machine to machine. What to look for is that the readings change when the engine rpm dial is turned, and when the E mode, HP mode, or auto-idle mode is actuated.

IMPORTANT: Turn key switch off before disconnecting any electrical connectors. Disconnecting electrical connectors while engine is running or with key switch on can damage engine and pump controller or other electrical components.

1. Stop engine. Turn key switch to OFF.

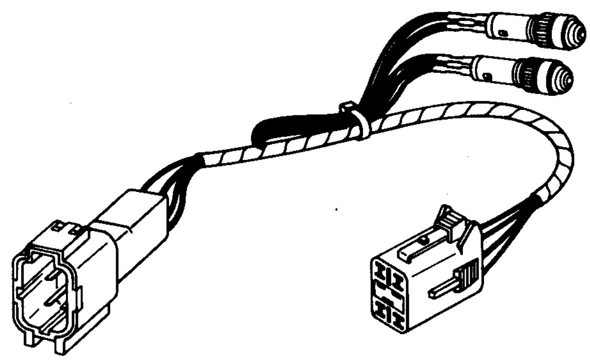
IMPORTANT: Retainer tab on male half of wiring harness connector halves must be pushed down before pulling halves apart. Never pull on wiring leads.

2. Push retainer tab down then pull connector halves apart.

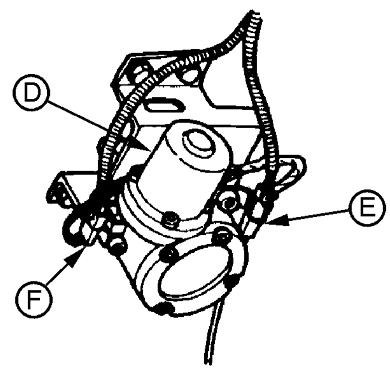
3. Install test harness in series with the engine control motor wiring harness (F).

4. Turn key switch to ON.

5. While observing test indicator lights,



T7486AD —UN—19MAR91



T106991

T106991 —UN—07FEB97

D—Engine Control Motor
E—Engine Control Sensor Wiring Harness
F—Engine Control Motor Wiring Harness

9025
25
56

Continued on next page

CED,TX08227,3029 –19–18MAR98–1/2

a. Turn engine rpm dial from slow idle to fast idle,

b. Push E mode switch,

c. Push auto-idle switch; wait approximately 4 seconds,

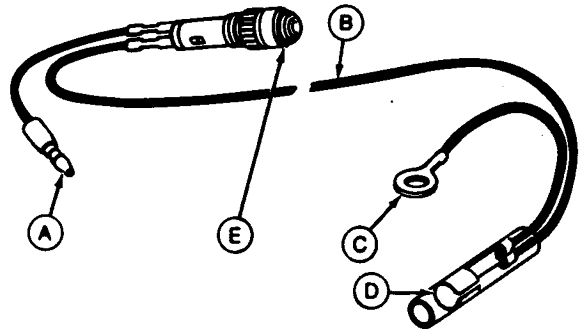
d. And then turn engine rpm dial to slow idle.

EC motor (D) must move the speed control linkage to each position. Indicators must be ON and change randomly from bright to dim or dim to bright as engine rpm dial and switches are pushed to indicate there is continuity in the wiring harness and there is a signal from the engine and pump controller (EPC).

If one indicator is OFF, check continuity in that circuit. If both indicators are OFF, check the wiring harness and relay. (See procedure in Group 9015-15.)

CED,TX08227,3029 –19–18MAR98–2/2

MISCELLANEOUS COMPONENT HARNESS TEST



T7486AG —UN–19MAR91

ESSENTIAL TOOLS
JT07067 Test Harness

The purpose of tests are to check continuity in miscellaneous circuits and wiring harnesses when a volt meter is not available.

IMPORTANT: Turn key switch off before disconnecting any electrical connectors. Disconnecting electrical connectors while engine is running or with key switch on can damage engine and pump controller or other electrical components.

Retainer tab on male half of wiring harness connector halves must be pushed down before pulling halves apart. Never pull on wiring leads.

1. Test harness may be used as a probe light. Indicator light (E) comes ON when connector (A) contacts 24 volts while eyelet (C) or bullet connector (D) is grounded.

2. Test harness may also be connected in series with components using bullet connectors (A and D). When circuit is energized, indicator light (E) comes ON.

NOTE: Indicator light will not come ON if test harness is connected to the ground side of a component.

3. Energize circuit being tested.

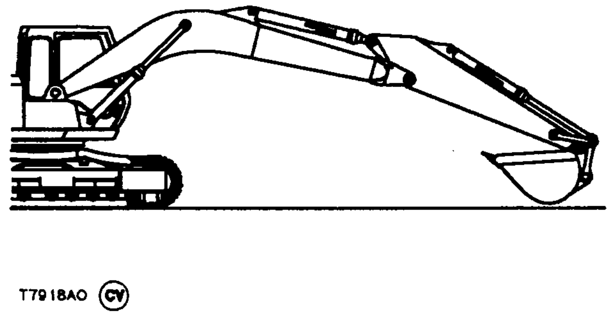
4. Observe indicator light (E). If light come ON, the fuses, wiring harness, and switches to accessory have continuity to the battery.

TX,25,GG2224 –19–23MAY98–1/1

CYCLE TIME TEST

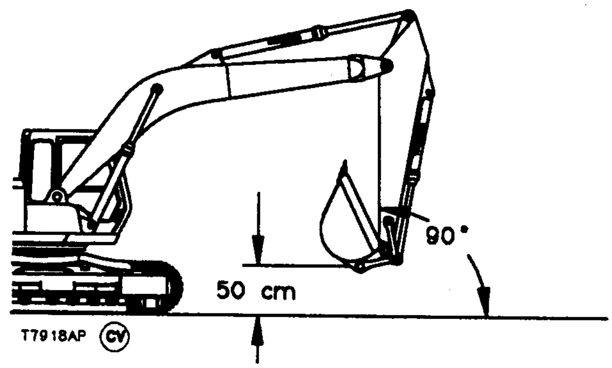
SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Boom Up Cycle Time	3.1 ± 0.3 sec
Boom Down Cycle Time	2.8 ± 0.3 sec
Arm In Cycle Time	3.9 ± 0.3 sec
Arm Out Cycle Time	3.3 ± 0.3 sec
Bucket Load Cycle Time	4.6 ± 0.3 sec
Bucket Dump Cycle Time	2.7 ± 0.3 sec
Swing For Three Revolutions From a Running Start—Check Left and Right Cycle Time	16.5 ± 1.0 sec
Fast Speed Propel 20 m (65 ft) From a Running Start—Check Forward and Reverse Cycle Time	13.1 ± 1.0 sec
Slow Speed Propel 20 m (65 ft) From a Running Start—Check Forward and Reverse Cycle Time	20.0 ± 2.0 sec
Slow Speed Propel With Track Raised Three Revolutions From a Running Start—Check Forward and Reverse Cycle Time	33.0 ± 2.0 sec

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer
Stop Watch



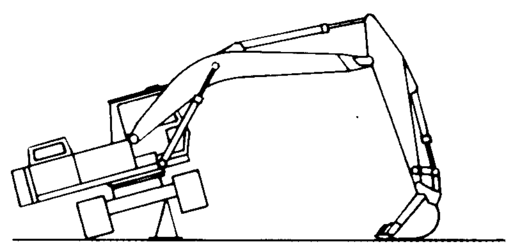
T7918AO –UN–11JAN93

Boom Position



T7918AP –UN–11JAN93

Arm, Bucket, Swing and Propel Position



T7160AL –UN–03JAN90

Propel 3-Revolution Position

Test is used as an indication of overall engine and hydraulic system performance. A slow cycle time is an indication of a leaky or malfunctioning hydraulic system component or a weak engine.

1. Adjust track sag to specifications. (See procedure in Group 9020-20.)

2. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

Continued on next page

Tests

3. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

Continued on next page CED,TX08227,3030 –19–18MAR98–2/4

4. Move machine to position shown for each test. Run machine at specifications.

Engine—Specification

Speed .... Fast Idle

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

Position .... Off

Auto-Idle Switch—Specification

Position .... Off

5. Actuate control valve to full stroke for each function. Record the cycle time for each function.

Boom Up—Specification

Cycle Time.. 3.1 ± 0.3 sec

Boom Down—Specification

Cycle Time.. 2.8 ± 0.3 sec

Arm In—Specification

Cycle Time.. 3.9 ± 0.3 sec

Arm Out—Specification

Cycle Time.. 3.3 ± 0.3 sec

Bucket Load—Specification

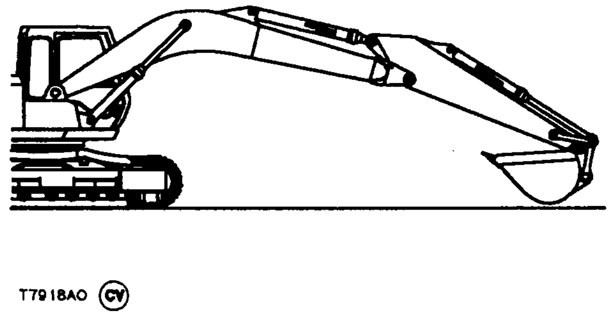
Cycle Time.. 4.6 ± 0.3 sec

Bucket Dump—Specification

Cycle Time.. 2.7 ± 0.3 sec

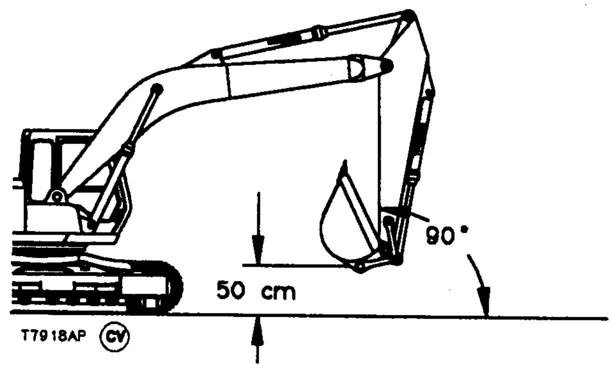
Swing For Three Revolutions From a Running Start—Check Left and Right—Specification

Cycle Time.. 16.5 ± 1.0 sec



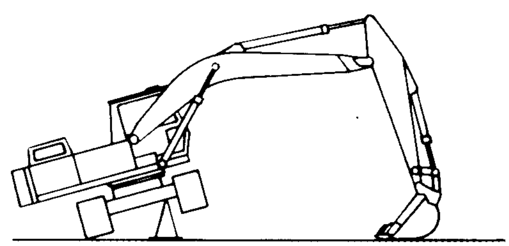
T7918AO –UN–11JAN93

Boom Position



T7918AP –UN–11JAN93

Arm, Bucket, Swing and Propel Position



T7160AL –UN–03JAN90

Propel 3—Revolution Position

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Continued on next page

CED,TX08227,3030 –19–18MAR98–3/4

Tests

Fast Speed Propel 20 m (65 ft) From a Running Start—Check Forward and Reverse—Specification

Cycle Time.. 13.1 ± 1.0 sec

Slow Speed Propel 20 m (65 ft) From a Running Start—Check Forward and Reverse—Specification

Cycle Time... 20.0 ± 2.0 sec

Slow Speed Propel With Track Raised Three Revolutions From a Running Start—Check Forward and Reverse—Specification

Cycle Time... 33.0 ± 2.0 sec

CED,TX08227,3030 –19–18MAR98–4/4

SWING DYNAMIC BRAKING (DRIFT) TEST

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Upperstructure Must Stop Within Distance	1706 mm (67 in.) or less after swinging 180° (1/2 turn) and then releasing control lever

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer

1. Check the lubrication for the swing gear and swing bearing.

2. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

3. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

CAUTION: Area must be clear and large enough to swing the upperstructure with arm extended. Machine must be on level ground.

4. Park the machine on level flat solid ground with enough room to swing the upperstructure with the arm extend.

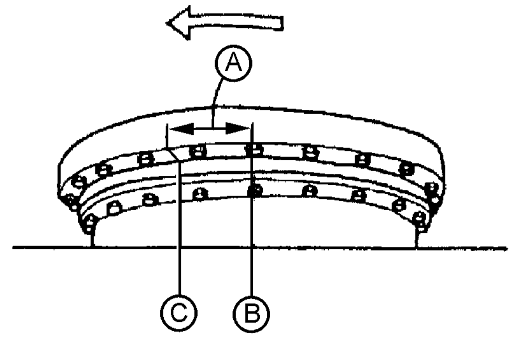
5. Turn the upperstructure so boom is to the front.

Continued on next page CED,TX08227,3031 –19–18MAR98–1/4

Tests

6. Make a mark (C and B) on the swing bearing and one directly below it on the undercarriage.

7. Turn the upperstructure 180° (1/2 turn) so the boom is to the rear.



T107147

CED,TX08227,3031 –19–18MAR98–2/4

8. Extend the arm and curl the bucket.

   Lower boom so bucket pivot pin is at the same level as the boom-to-main frame pin.

9. Operate machine at specifications.

Engine—Specification

Speed .... Fast Idle

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

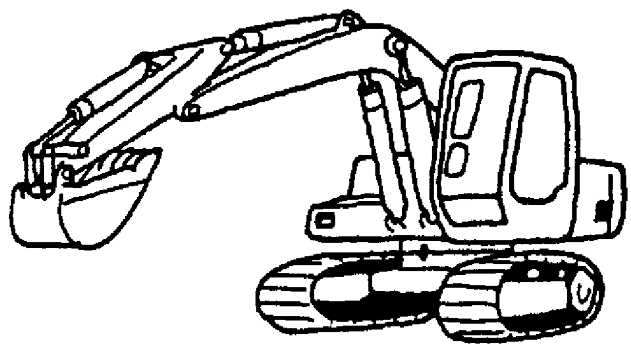
HP Mode Switch—Specification

Position .... Off

Auto-Idle Switch—Specification

Position .... Off

10. Starting with boom to the rear, actuate the swing control lever to full stroke and then release control lever when the two marks are again aligned at the front.



T107146

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Continued on next page

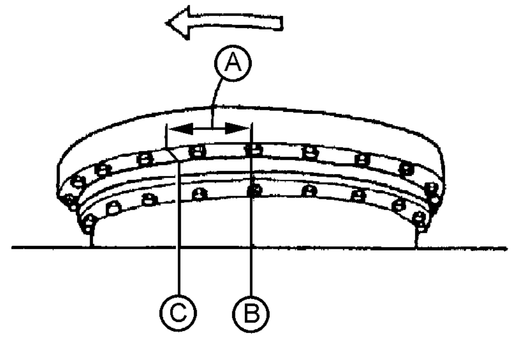
CED,TX08227,3031 –19–18MAR98–3/4

11. Measure the distance (A) between the two marks.

    Upperstructure must come to a stop within the specified distance.

Upperstructure Must Stop Within—Specification

Distance.. 1706 mm (67 in.) or less after swinging 180° (1/2 turn) and then releasing control lever



T107147

T107147 –UN–13FEB97

Repeat procedure in the opposite direction.

If upperstructure does not stop within the specified distance, check the following:

- Swing motor leakage. (See procedure in this group.)
- Swing motor crossover relief valves. (See procedure in this group.)
- Inspect swing valve spool. (See procedure in Group 3360.)

NOTE: The swing park brake does not stop the upperstructure. The engagement of swing park brake is delayed several seconds because hydraulic oil is released from the piston cavity through an orifice to return.

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CED,TX08227,3031 –19–18MAR98–4/4

PILOT PRESSURE REGULATING VALVE TEST AND ADJUSTMENT

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	Slow and Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Pilot Pressure Regulating Valve at Slow Idle Pressure	3 925 ± 980 kPa (39.2 ± 9.8 bar) (570 ± 140 psi)
Pilot Pressure Regulating Valve at Fast Idle Pressure	4 410 ± 980 kPa (44.1 ± 9.8 bar) (640 ± 140 psi)
Per 0.25 mm (0.010 in.) Shim Approximate Change Pressure	78 kPa (0.75 bar) (11 psi)
Per 0.5 mm (0.020 in.) Shim Approximate Change Pressure	157 kPa (1.57 bar) (23 psi)
Per 1.0 mm (0.040 in.) Shim Approximate Change Pressure	304 kPa (3.04 bar) (44 psi)
Plug to Pilot Pressure Regulating Valve Housing Torque	25 N•m (215 lb-in.)

ESSENTIAL TOOLS
202862 (3/4-16 M 37° x 3/4-16 F 37° Sw x 7/16-20 M 37°) Tee
TH108328 Adapter
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler

SERVICE EQUIPMENT AND TOOLS
JT02156A Digital Pressure and Temperature Analyzer
JT02161 Transducer 35 000 kPa (350 bar) (5 000 psi)
Gauge 7 000 kPa (70 bar) (1 000 psi)
JT05800 Digital Thermometer

Purpose of test is to ensure there is enough pilot pressure to operate all the pilot system functions and to adjust the pressure as necessary. The pilot pressure regulating valve is used to regulate the pilot system pressure.

NOTE: *The laptop computer with the excavator diagnostics program can be used to make a quick check of the pilot system pressure using the arm in function. Connect the computer and select "5 Arm roll-in pilot pressure" from monitor data items. Actuate the arm in function over relief. Check the pressure at slow idle and at fast idle. The pressure reading displayed is from the arm in pressure sensor located in the flow regulator valve.*

Before making any adjustments, check the pilot pressure at the pilot pump using a pressure gauge.

1. Stop the engine.

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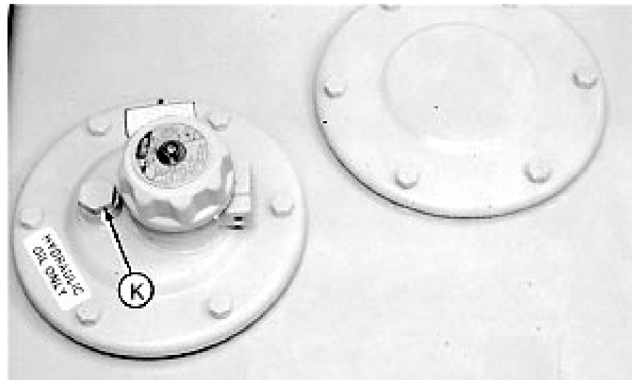
Continued on next page CED,TX08227,3032 –19–18MAR98–1/4

2. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.



T109340 –UN–29APR97

K—Vent Plug

Continued on next page

CED,TX08227,3032 –19–18MAR98–2/4

3. Disconnect pilot pressure line (D) at pilot filter. Install tee (B) and male quick coupler. Connect the digital pressure and temperature analyzer, and transducer, or a gauge (C).

   Pressure can also be checked at the test port in fitting at the pilot pump (F) outlet port. Use adapter (G) in test port.

NOTE: Because the plug is installed dry at the factory, the plug can be difficult to remove.

4. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

5. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

6. Run machine at specifications.

Engine—Specification

Speed .... Slow and Fast Idle

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

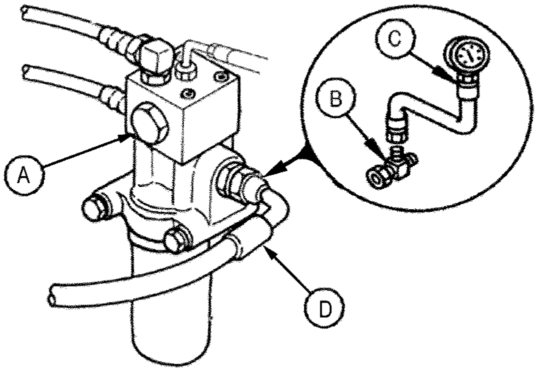
HP Mode Switch—Specification

Position .... Off

Auto-Idle Switch—Specification

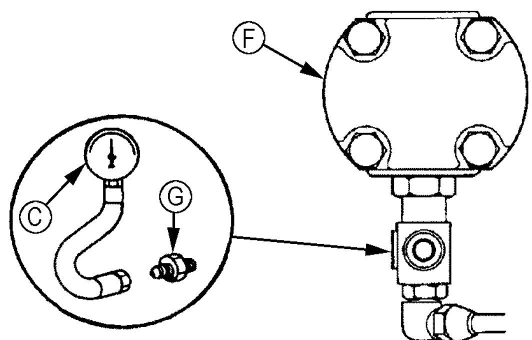
Position .... Off

7. Record pressure readings for pilot pressure regulating valve.



T103346

T103346 –UN–11SEP96



T109473

T109473 –UN–12MAY97

A—Plug
B—202862 Tee
C—7 000 kPa (70 bar) (1 000 psi) Gauge
D—Pilot Pressure Line
E—Shim
F—Pilot Pump
G—TH108328 Adapter

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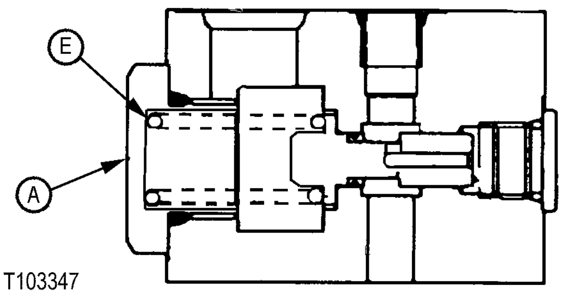
Continued on next page

8. As necessary, remove plug (A) for pilot pressure regulating valve. Add shims (E) to increase pressure; remove shims to decrease pressure.



T103347 –UN–11SEP96

Pilot Pressure Regulating Valve at Slow Idle—Specification

Pressure .... 3 925 ± 980 kPa (39.2 ± 9.8 bar) (570 ± 140 psi)

Pilot Pressure Regulating Valve at Fast Idle—Specification

Pressure .... 4 410 ± 980 kPa (44.1 ± 9.8 bar) (640 ± 140 psi)

Per 0.25 mm (0.010 in.) Shim Approximate Change—Specification

Pressure .... 78 kPa (0.75 bar) (11 psi)

Per 0.5 mm (0.020 in.) Shim Approximate Change—Specification

Pressure .... 157 kPa (1.57 bar) (23 psi)

Per 1.0 mm (0.040 in.) Shim Approximate Change—Specification

Pressure .... 304 kPa (3.04 bar) (44 psi)

9. Tighten plug to pilot pressure regulating valve housing.

Plug to Pilot Pressure Regulating Valve Housing—Specification

Torque .... 25 N•m (215 lb-in.)

CED,TX08227,3032 –19–18MAR98–4/4

CONTROL VALVE SPOOL PILOT ACTUATION PRESSURE TEST

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	Slow Idle to Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Control Valve Spool Pilot Actuation Pressure	3 335—3 925 kPa (33.3—39.2 bar) (485—570 psi)

ESSENTIAL TOOLS
203836 (9/16-18 M 37° x 9/16-18 Sw 37° x 7/16-20 M 37°) Tee
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler

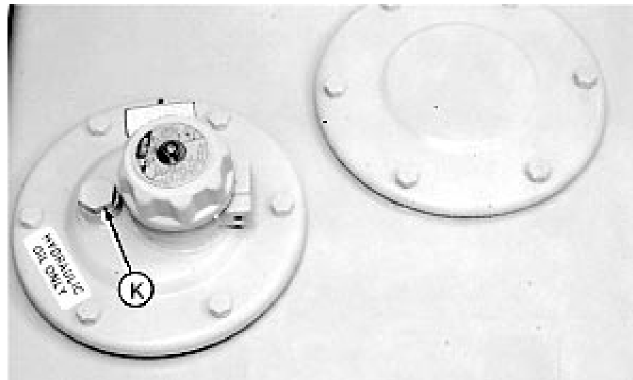
SERVICE EQUIPMENT AND TOOLS
JT02156A Digital Pressure and Temperature Analyzer
JT02161 Transducer 35 000 kPa (350 bar) (5 000 psi)
Gauge 7 000 kPa (70 bar) (1 000 psi)
JT05800 Digital Thermometer

Procedure is used to check that there is enough pilot pressure oil to the pilot cap to shift the valve spools when pilot controllers are actuated at any engine speeds.

1. Stop the engine.

Continued on next page TX,9025,GG2483 –19–21NOV97–1/4

2. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.



T109340 –UN–29APR97

K—Vent Plug

Continued on next page TX,9025,GG2483 –19–21NOV97–2/4

3. Disconnect a pilot line (A) at pilot cap fitting. Install tee (B) and male quick coupler. Install the digital pressure and temperature analyzer, and transducer, or a gauge (C) .

4. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

5. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

6. Start and run engine at specification.

Engine—Specification

Speed .... Slow Idle to Fast Idle

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

Position .... Off

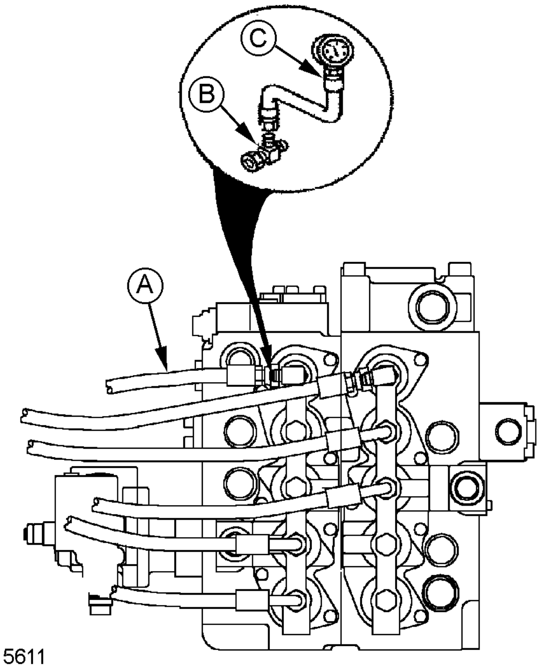
Auto-Idle Switch—Specification

Position .... Off

NOTE: Spool actuation pressure is checked for each function by installing the tee and gauge in that pilot line and then actuating that function.

7. Actuate the function being checked to full stroke.

   If valve spool actuation pressure is not to specification, check pilot system pressure. (See Pilot Pressure Regulating Valve Test and Adjustment in this group.



T115611

T115611 –UN–27MAY98

A—Pilot Line
B—203836 Tee
C—Gauge 7 000 kPa (70 bar) (1 000 psi)

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Continued on next page TX,9025,GG2483 –19–21NOV97–3/4

Control Valve Spool Pilot Actuation—Specification

Pressure .... 3 335—3 925 kPa (33.3—39.2 bar) (485—570 psi)

If pilot system pressure is to specification, then check pilot pressure at the pilot shut-off valve, pilot controllers, and flow regulator valve.

TX,9025,GG2483 –19–21NOV97–4/4

SYSTEM RELIEF AND POWER BOOST VALVE TEST AND ADJUSTMENT

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Power Boost Pressure	34 325 ± 980 kPa (343.2 ± 9.8 bar) (4 980 ± 140 psi)
System Relief Valve Pressure	31 870 ± 980 kPa (318.7 ± 9.8 bar) (4 620 ± 140 psi)
Per 1/4 Turn of Adjusting Plug Approximate Change Pressure	4 415 kPa (44.1 bar) (640 psi)
Adjusting Plug-to-Cartridge Nut Torque	29 N•m (22 lb-ft) (260 lb-in.)
Per 1/4 Turn of Adjusting Screw Approximate Change Pressure	4 415 kPa (44.1 bar) (640 psi)
Adjusting Screw-to-Adjusting Plug Nut Torque	29 N•m (22 lb-ft) (260 lb-in.)

ESSENTIAL TOOLS
TH108328 Adapter (2 used)
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler

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SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable
JT02156A Digital Pressure and Temperature Analyzer
JT02160 Transducer 70 000 kPa (700 bar) (10 000 psi)
70 000 kPa (700 bar) (10 000 psi) Gauge
22 mm Combination Wrench
6 mm Hex Key Wrench
32 mm Combination Wrench
19 mm Combination Wrench

The system relief and power boost valve is used to limit the maximum pressure in the hydraulic system. The purpose of test is to check and adjust system relief and power boost valve to specification to protect components from damage caused by excessive pressure. Power boost is actuated by pushing the button on the right control lever or by actuating boom up in precision work mode. Power boost is also actuated when operating the propel function by the pilot control signal from the propel pilot signal passage.

1. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

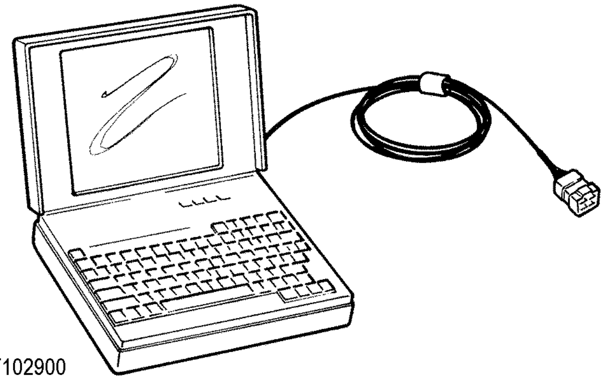
Continued on next page

CED,TX08227,3033 –19–18MAR98–1/5

2. Connect the laptop computer. (See installation procedure in this group.)

   a. Start the engine.

   b. Select “3 Front pump delivery pressure” and “4 Rear pump delivery pressure” from the Monitor Data menu.



T102900 –19–29AUG96

Continued on next page CED,TX08227,3033 –19–18MAR98–2/5

If laptop computer is not available, use the digital pressure and temperature analyzer, and transducers, or gauges.

a. Stop the engine.

b. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.

c. Install adapter (C) and male quick coupler to test port on front pump (B) or rear pump (A). Connect the analyzer and transducers or gauges.

3. Raise and lower boom to pressurize hydraulic oil tank.

4. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

5. Run machine at specification.

Engine—Specification

Speed .... Fast Idle

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

Position .... Off

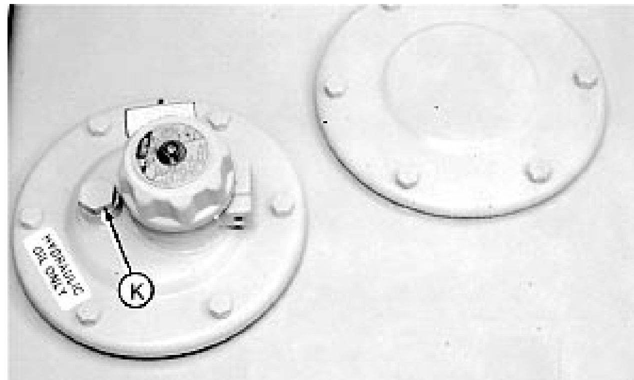
Auto-Idle Switch—Specification

Position .... Off

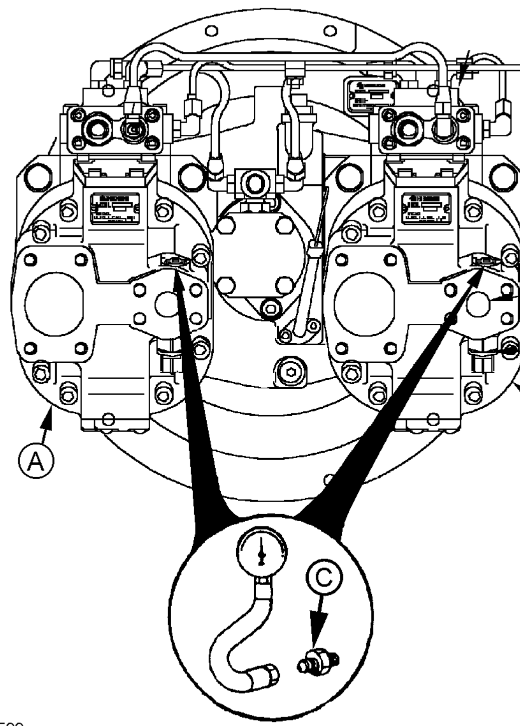
6. Actuate the arm in function over relief.

Record the pressure reading for system relief valve.

7. Actuate the arm in function over relief and then push the power boost button on the right control lever.



T109340 –UN–29APR97



T115599

T115599 –UN–27MAY98

A—Rear Pump
B—Front Pump
C—TH108328 Adapter (2 used)
K—Vent Plug

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Continued on next page

Record the pressure reading for power boost.

8. Adjust the system relief and power boost valve pressure settings as needed.

Power Boost—Specification

Pressure .... 34 325 ± 980 kPa (343.2 ± 9.8 bar) (4 980 ± 140 psi)

System Relief Valve—Specification

Pressure .... 31 870 ± 980 kPa (318.7 ± 9.8 bar) (4 620 ± 140 psi)

Continued on next page

CED,TX08227,3033 –19–18MAR98–4/5

a. Loosen the 22 mm nut (I).

NOTE: The higher pressure setting for power boost must be adjusted first and then the lower pressure setting for the system relief valve. Turning the adjusting screw (H) in pushes the piston (F) down compressing the pilot poppet spring (E) increasing the pressure setting to the power boost pressure setting.

b. Turn the adjusting screw (H) in until piston (F) is against bottom of bore in adjusting plug (G). Tighten the nut just enough to hold the adjusting screw.

c. Loosen the 32 mm nut (J).

d. Turn adjusting plug (G) in to increase power boost pressure; turn plug out to decrease power boost pressure.

Per 1/4 Turn of Adjusting Plug Approximate Change—Specification

Pressure .... 4 415 kPa (44.1 bar) (640 psi)

e. Hold adjusting plug and then tighten 32 mm nut.

Adjusting Plug-to-Cartridge Nut—Specification

Torque .... 29 N•m (22 lb-ft) (260 lb-in.)

f. Loosen the 22 mm nut.

g. Turn the adjusting screw out to decrease pressure to get the specified system relief valve pressure.

Per 1/4 Turn of Adjusting Screw Approximate Change—Specification

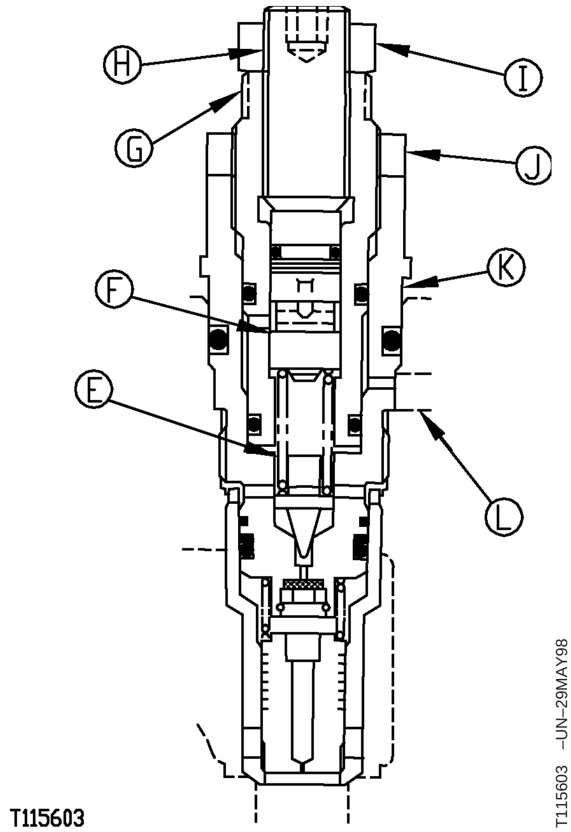
Pressure .... 4 415 kPa (44.1 bar) (640 psi)

h. Hold adjusting screw and then tighten 22 mm nut.

Adjusting Screw-to-Adjusting Plug Nut—Specification

Torque .... 29 N•m (22 lb-ft) (260 lb-in.)

9. Check the pressure settings again.



E—Pilot Poppet Spring
F—Piston
G—Adjusting Plug
H—Adjusting Screw
I—22 mm Nut
J—32 mm Nut
K—System Relief and Power Boost Valve
L—Power Boost Pilot Signal Passage

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CED,TX08227,3033 –19–18MAR98–5/5

CIRCUIT RELIEF VALVE TEST AND ADJUSTMENT

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	1200 rpm approximate
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Boom Up (Head End) and Down (Rod End) Circuit Relief Valves Pressure	33 345 + 980 - 0 kPa (333.4 + 9.8 - 0 bar) (4 835 + 140 - 0 psi)
Bucket Dump (Rod End) Circuit Relief Valve Pressure	35 305 + 980 - 0 kPa (353.1 + 9.8 - 0 bar) (5 120 + 140 - 0 psi)
Bucket Load (Head End) Circuit Relief Valve Pressure	33 345 + 980 - 0 kPa (333.4 + 9.8 - 0 bar) (4 835 + 140 - 0 psi)
Arm In (Head End) Circuit Relief Valve Pressure	33 345 + 980 - 0 kPa (333.4 + 9.8 - 0 bar) (4 835 + 140 - 0 psi)
Arm Out (Rod End) Circuit Relief Valve Pressure	35 305 + 980 - 0 kPa (353.1 + 9.8 - 0 bar) (5 120 + 140 - 0 psi)
Per 1/4 Turn of Adjusting Screw Approximate Change Pressure	4 415 kPa (44.1 bar) (640 psi)
Adjusting Screw-to-Cartridge Nut Torque	29 N•m (22 lb-ft) (260 lb-in.)
System Relief Valve Pressure	31 870 ± 980 kPa (318.7 ± 9.8 bar) (4 620 ± 140 psi)

ESSENTIAL TOOLS
TH108328 Adapter (2 used)
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler

SERVICE EQUIPMENT AND TOOLS
JT05801 Clamp-On Electronic Tachometer
JT05800 Digital Thermometer
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable
JT02156A Digital Pressure and Temperature Analyzer
JT02160 Transducer 70 000 kPa (700 bar) (10 000 psi)
Gauge 70 000 kPa (700 bar) (10 000 psi)
32 mm Combination Wrench
19 mm Combination Wrench
17 mm Combination Wrench
6 mm Hex Key Wrench

The purpose of circuit relief valves is to relieve high pressure spike caused by external forces when functions are in neutral. The valves are checked and adjusted to specification to protect components from damage.

1. Install a tachometer. (See JT05801 Clamp-On Electronic Tachometer Installation in this group.)

2. Install the temperature probe on hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

9025
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79

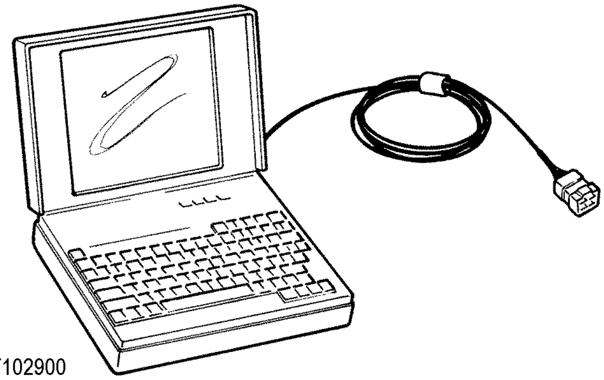
Continued on next page

CED,TX08227,3035 –19–23MAR98–1/6

3. Connect the laptop computer. (See the installation procedure in this group.)

    a. Start the engine.

    b. Select “3 Front pump delivery pressure” and “4 Rear pump delivery pressure” from the Monitor Data Items.



T102900

T102900 –19–29AUG96

Continued on next page

CED,TX08227,3035 –19–23MAR98–2/6

If laptop computer is not available, use digital pressure, temperature analyzer, and transducers, or gauges.

a. Stop the engine.

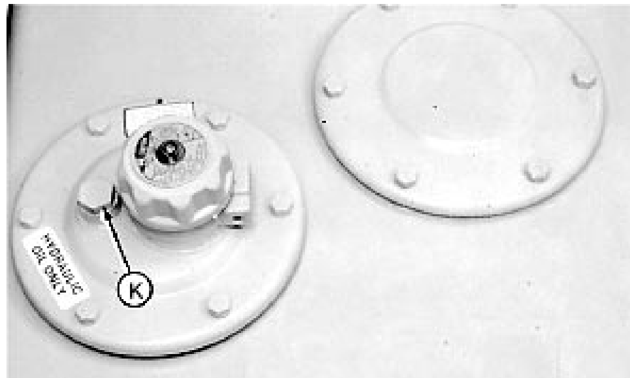
b. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.

c. Install adapter (C) and male quick coupler to test port on front pump (B) or rear pump (A). Connect the analyzer and transducers or gauges.

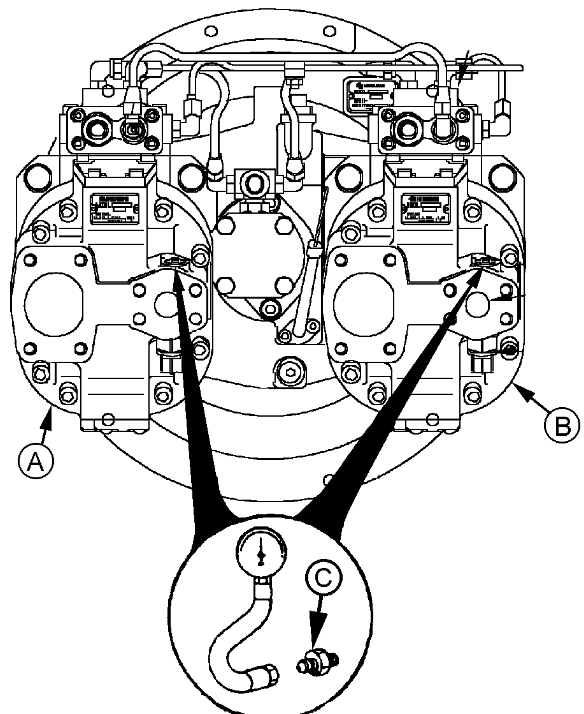
4. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)



T109340 –UN–29APR97



T115599

T115599 –UN–27MAY98

A—Rear Pump
B—Front Pump
C—TH108328 Adapter (2 used)
K—Vent Plug

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Continued on next page

CED,TX08227,3035 –19–23MAR98–3/6

NOTE: The pressure setting for the circuit relief valves are higher than the system relief valve. The adjusting plug for system relief valve must be turned in approximately 1/2 turn to increase the pressure setting.

The power boost function can be used to check the boom up and down, arm in, and bucket load circuit relief valves if it is adjusted to the high side of the specification.

5. Turn the adjusting plug for system relief valve (F) in 1/2 turn to increase the pressure setting.

6. Extend the cylinder to check a head end circuit relief valve; retract the cylinder to check a rod end circuit relief valve.

7. Run machine at specifications.

Engine—Specification

Speed .... 1200 rpm approximate

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

Position .... Off

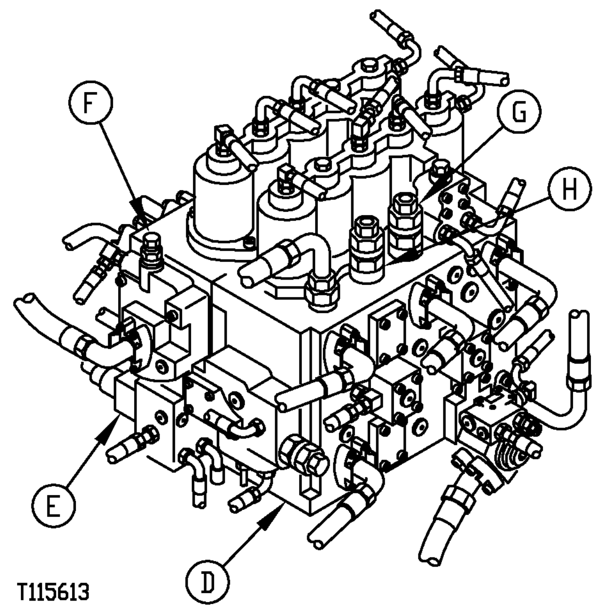
Auto-Idle Switch—Specification

Position .... Off

NOTE: If pressure reading fluctuates, increase engine speed slightly.

8. Actuate the function over relief for circuit relief valve being checked.

9. Record the pressure reading for each circuit relief valve checked.



T115613 –UN–05JUN98

D—Left Control Valve
E—Right Control Valve
F—System Relief and Power Boost Valve
G—Arm Out Circuit Relief Valve
H—Auxiliary Circuit Relief Valve

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Continued on next page

10. Adjust the circuit relief valve (G—J and L—O) as needed.

Boom Up (Head End) and Down (Rod End) Circuit Relief Valves—Specification

Pressure .... 33 345 + 980 - 0 kPa (333.4 + 9.8 - 0 bar) (4 835 + 140 - 0 psi)

Bucket Dump (Rod End) Circuit Relief Valve—Specification

Pressure .... 35 305 + 980 - 0 kPa (353.1 + 9.8 - 0 bar) (5 120 + 140 - 0 psi)

Bucket Load (Head End) Circuit Relief Valve—Specification

Pressure .... 33 345 + 980 - 0 kPa (333.4 + 9.8 - 0 bar) (4 835 + 140 - 0 psi)

Arm In (Head End) Circuit Relief Valve—Specification

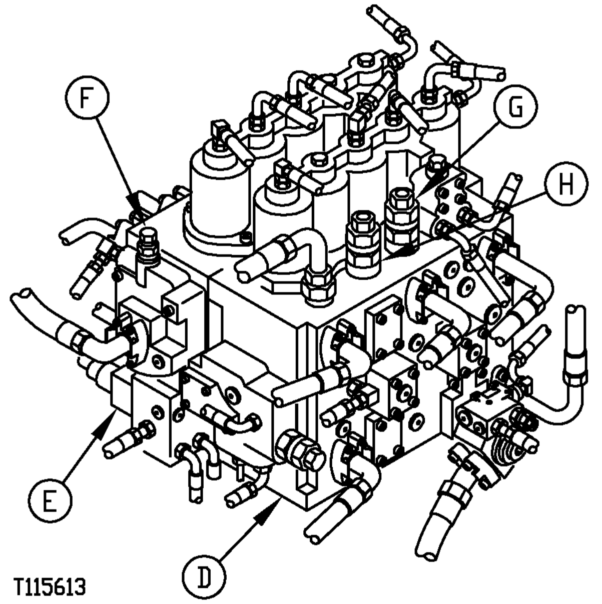
Pressure .... 33 345 + 980 - 0 kPa (333.4 + 9.8 - 0 bar) (4 835 + 140 - 0 psi)

Arm Out (Rod End) Circuit Relief Valve—Specification

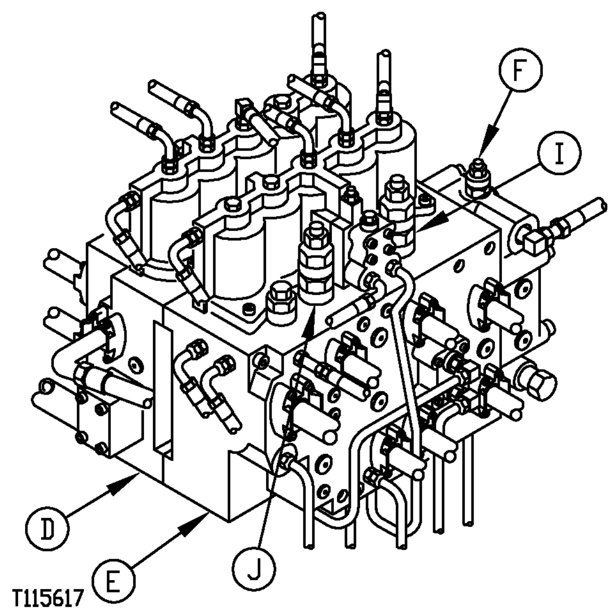
Pressure .... 35 305 + 980 - 0 kPa (353.1 + 9.8 - 0 bar) (5 120 + 140 - 0 psi)

Per 1/4 Turn of Adjusting Screw Approximate Change—Specification

Pressure .... 4 415 kPa (44.1 bar) (640 psi)



T115613 –UN–05JUN98



T115617 –UN–05JUN98

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D—Left Control Valve
E—Right Control Valve
F—System Relief and Power Boost Valve
G—Arm Out Circuit Relief Valve
H—Auxiliary Circuit Relief Valve
I—Bucket Dump Circuit Relief Valve
J—Boom Up Circuit Relief Valve

Continued on next page

CED,TX08227,3035 –19–23MAR98–5/6

Turn adjusting screw in to increase pressure setting; turn adjusting screw out to decrease pressure setting.

Hold screw and tighten nut.

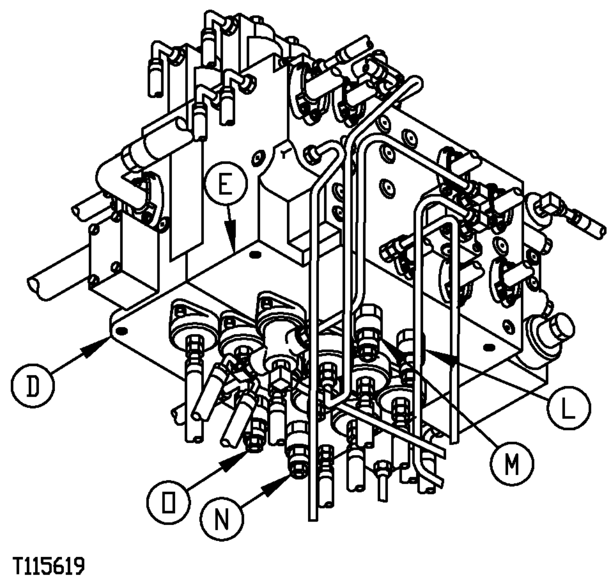
Adjusting Screw-to-Cartridge Nut—Specification

Torque .... 29 N•m (22 lb-ft) (260 lb-in.)

11. Turn the adjusting plug for system relief valve out to its specified pressure setting. (See System Relief Valve Test and Adjustment in this group.)

System Relief Valve—Specification

Pressure .... 31 870 ± 980 kPa (318.7 ± 9.8 bar) (4 620 ± 140 psi)



T115619 –UN–05JUN98

D—Left Control Valve
E—Right Control Valve
L—Bucket Load Circuit Relief Valve
M—Arm In Circuit Relief Valve
N—Auxiliary Circuit Relief Valve
O—Boom Down Circuit Relief Valve

CED,TX08227,3035 –19–23MAR98–6/6

SWING MOTOR CROSSOVER RELIEF VALVE TEST AND ADJUSTMENT

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	1200 rpm approximate
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Swing Crossover Relief Valve Pressure	29 910 ± 980 kPa (299.1 ± 9.8 bar) (4 340 ± 140 psi)
Per 1/4 Turn of Adjusting Plug Approximate Change Pressure	2 500 kPa (25 bar) (363 psi)
Adjusting Plug-to-Cartridge Nut Torque	186 N•m (137 lb-ft)

ESSENTIAL TOOLS
TH108328 Adapter (2 used)
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer
JT05801 Clamp-On Electronic Tachometer
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable
JT02156A Digital Pressure and Temperature Analyzer
JT02160 Transducer 70 000 kPa (700 bar) (10 000 psi)
70 000 kPa (700 bar) (10 000 psi) Gauge
41 mm Combination Wrench
27 mm Combination Wrench

The purpose of swing crossover relief valves is to limit pressure in the swing circuit, to relieve high pressure spike caused by starting and stopping the swing function and to relieve pressure spikes caused by external forces when function is in neutral. The valves are checked and adjusted to specification to protect components from damage.

1. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

2. Install a tachometer. (See JT05801 Clamp-On Electronic Tachometer Installation in this group.)

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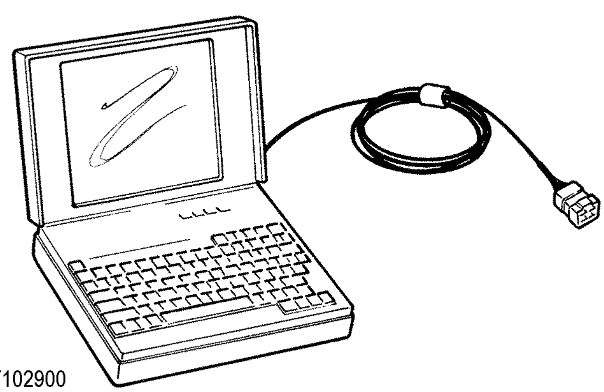
CED,TX08227,3036 –19–23MAR98–1/5

3. Connect the laptop computer. (See the installation procedure in this group.)

   a. Start the engine.

   b. Select “4 Rear pump delivery pressure” from the Monitor Data Items.



T102900 –19–29AUG96

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CED,TX08227,3036 –19–23MAR98–2/5

If laptop computer is not available, use the digital pressure, temperature analyzer, and transducer, or a gauge.

a. Stop the engine.

b. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.

c. Install adapter (C) and male quick coupler to test port on rear pump (A). Connect the analyzer and transducer or a gauge.

4. Raise and lower boom to pressurize hydraulic oil tank.

5. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

6. Run machine at specifications.

Engine—Specification

Speed .... 1200 rpm approximate

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

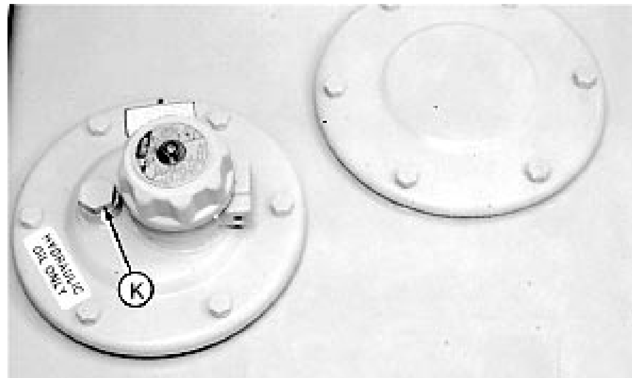
Position .... Off

Auto-Idle Switch—Specification

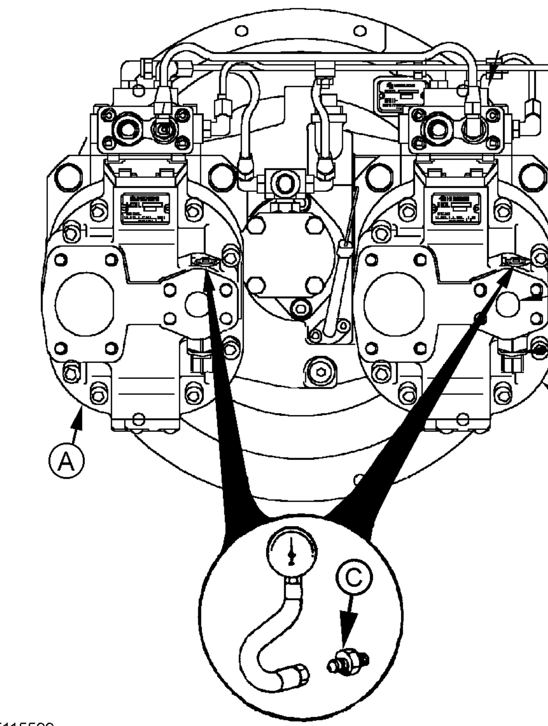
Position .... Off

7. Operate the swing function at stall. To stall swing function, put bucket against an immovable object or in a trench then actuate the control lever to full stroke.

8. Record the pressure reading.



T109340 –UN–29APR97



T115599

T115599 –UN–27MAY98

A—Rear Pump
B—Front Pump
C—TH108328 Adapter (2 used)
K—Vent Plug

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Continued on next page

CED,TX08227,3036 –19–23MAR98–3/5

Tests

Repeat procedure for the opposite direction. Record the pressure reading.

CED,TX08227,3036 –19–23MAR98–4/5

9. Adjust the right and left swing crossover relief valves (C or D) as needed.

Swing Crossover Relief Valve—Specification

Pressure .... 29 910 ± 980 kPa (299.1 ± 9.8 bar) (4 340 ± 140 psi)

10. Loosen nut (E). Turn adjusting plug (F) in to increase pressure setting; turn adjusting plug out to decrease pressure setting.

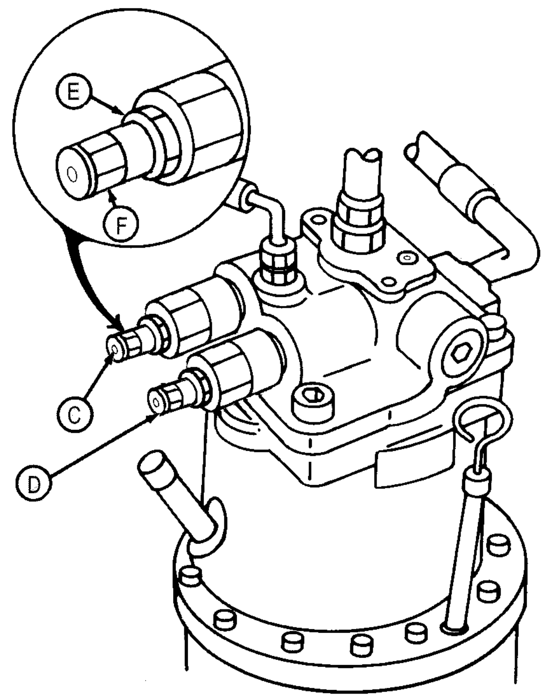
Per 1/4 Turn of Adjusting Plug Approximate Change—Specification

Pressure .... 2 500 kPa (25 bar) (363 psi)

Hold adjusting plug and then tighten nut.

Adjusting Plug-to-Cartridge Nut—Specification

Torque .... 186 N•m (137 lb-ft)



T101716

T101716 –UN–20JUN96

C—Right Swing Crossover Relief Valve
D—Left Swing Crossover Relief Valve
E—Nut
F—Adjusting Plug

CED,TX08227,3036 –19–23MAR98–5/5

PROPEL MOTOR CROSSOVER RELIEF VALVE TEST AND ADJUSTMENT

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	1200 rpm approximate
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Propel Crossover Relief Valve Pressure	34 815 ± 980 kPa (348.1 ± 9.8 bar) (5 050 ± 140 psi)
Per 1/4 Turn of Adjusting Screw Approximate Change Pressure	2 940 kPa (29.4 bar) (427 psi)
Propel Crossover Relief Valve Adjusting Screw-to-Cartridge Nut Torque	49 N•m (36 lb-ft)
System Relief Valve Pressure	31 870 ± 980 kPa (318.7 ± 9.8 bar) (4 620 ± 140 psi)

ESSENTIAL TOOLS
TH108328 Adapter (2 used)
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer
JT05801 Clamp-On Electronic Tachometer
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable
JT02156A Digital Pressure and Temperature Analyzer
JT02160 Transducer 70 000 kPa (700 bar) (10 000 psi)
70 000 kPa (700 bar) (10 000 psi) Gauge
32 mm Combination Wrench
19 mm Combination Wrench
90 mm (3-1/2 in.) OD Pin or Length of Round Bar Stock (2 used)
19 mm Combination Wrench
6 mm Hex Key Wrench

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The purpose of propel crossover relief valves is to relieve high pressure spike caused by starting and stopping the propel function and to relieve pressure spikes caused by external forces while propelling. The valves are checked and adjusted to specification to protect components from damage.

1. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

2. Install a tachometer. (See JT05801 Clamp-On Electronic Tachometer Installation in this group.)

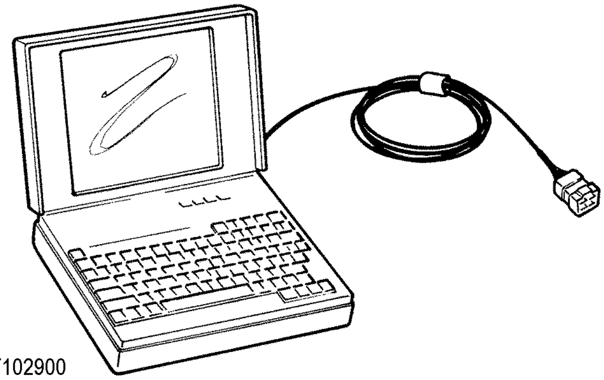
Continued on next page

CED,TX08227,3037 –19–23MAR98–1/5

3. Connect the laptop computer. (See the installation procedure in this group.)

    a. Start the engine.

    b. Select “3 Front pump delivery pressure” and “4 Rear pump delivery pressure” from the Monitor Data menu.



T102900

T102900 –19–29AUG96

Continued on next page CED,TX08227,3037 –19–23MAR98–2/5

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If laptop computer is not available, use the digital pressure, temperature analyzer, and transducers, or gauges.

a. Stop the engine.

b. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.

c. Install adapter (C) and male quick coupler to test port on front pump (B) and rear pump (A). Connect the analyzer and transducers or gauges

4. Raise and lower boom to pressurize hydraulic oil tank.

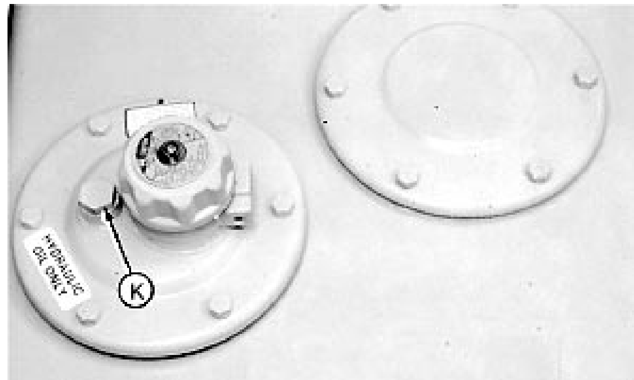
5. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

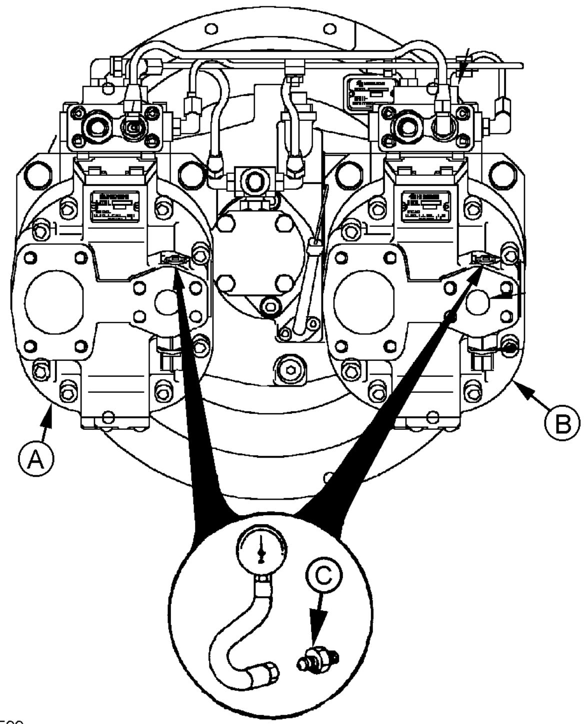
Temperature .... 50 ± 5°C (120 ± 10°F)

NOTE: The pressure setting for propel crossover relief valves are higher than the system relief valve. The adjusting plug for system relief valve must be turned in approximately 1/2 turn to increase the pressure setting.

6. Turn the adjusting plug for system relief valve in 1/2 turn to increase the pressure setting.



T109340 –UN–29APR97



T115599

T115599 –UN–27MAY98

A—Rear Pump
B—Front Pump
C—TH108328 Adapter (2 used)
K—Vent Plug

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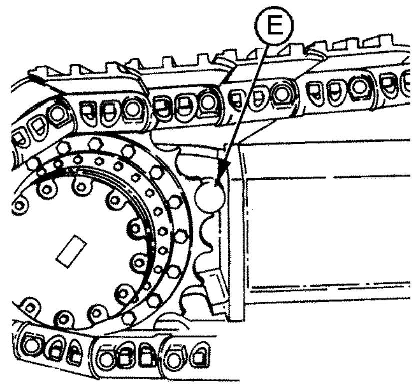
Continued on next page CED,TX08227,3037 –19–23MAR98–3/5

7. Install pins or round bar stock (E) between the sprockets and track frame to stall propel motors.



T107074

T107074 –UN–12FEB97

8. Run machine at specifications.

Engine—Specification

Speed .... 1200 rpm approximate

Work Mode Selector—Specification

Position.. Dig Mode

E Mode Switch—Specification

Position.. Off

HP Mode Switch—Specification

Position.. Off

Auto-Idle Switch—Specification

Position.. Off

9. Slowly push propel pedal to full travel in the direction for the crossover relief valve being checked.

10. Record the pressure reading.

Continued on next page

CED,TX08227,3037 –19–23MAR98–4/5

11. Adjust the crossover relief valves (E and F) as needed.

Propel Crossover Relief Valve—Specification

Pressure .... 34 815 ± 980 kPa (348.1 ± 9.8 bar) (5 050 ± 140 psi)

12. Loosen nut. Turn the adjusting screw in to increase pressure; turn adjusting out to decrease pressure.

Per 1/4 Turn of Adjusting Screw Approximate Change—Specification

Pressure .... 2 940 kPa (29.4 bar) (427 psi)

13. Hold the adjusting screw and then tighten the nut.

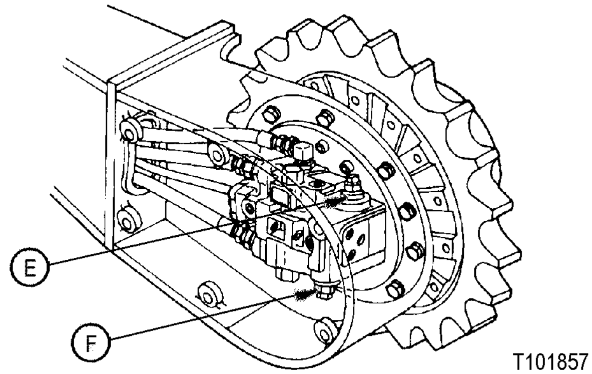
Propel Crossover Relief Valve Adjusting Screw-to-Cartridge Nut—Specification

Torque .... 49 N•m (36 lb-ft)

14. Turn the adjusting plug for system relief valve out to its specified pressure setting. (See System Relief Valve Test and Adjustment in this group.)

System Relief Valve—Specification

9025 25 92 Pressure .... 31 870 ± 980 kPa (318.7 ± 9.8 bar) (4 620 ± 140 psi)



T101857 –UN–02JUL96

Propel Motor Crossover Relief Valves

E—Forward Crossover Relief Valve
F—Reverse Crossover Relief Valve

CED,TX08227,3037 –19–23MAR98–5/5

PROPORTIONAL SOLENOID VALVE TEST AND ADJUSTMENT

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Propel Speed Switch Position	Fast Speed
Arm Regenerative Solenoid Valve (SC) Pressure	Laptop Computer Reading ± 196 kPa (1.96 bar) (28 psi)
Speed Sensing Solenoid Valve (SD) Pressure	Laptop Computer Reading ± 196 kPa (1.96 bar) (28 psi)
Propel Speed Change Solenoid Valve (SI) Pressure	Laptop Computer Reading ± 196 kPa (1.96 bar) (28 psi)
Power Boost Solenoid Valve (SG) Pressure	Laptop Computer Reading ± 196 kPa (1.96 bar) (28 psi)
Per 1/4 Turn of Adjusting Screw Approximate Change Pressure	98 kPa (0.98 bar) (14 psi)
End of Adjusting Screw to Nut Must Not Exceed Length	4 mm (0.157 in.)
Adjusting Screw-to-Housing Nut Torque	8.8 N•m (6.5 lb-ft) (78 lb-in.)

ESSENTIAL TOOLS
JT03001 (7/16-20 M 37° x 7/16-20 F 37° Sw x 7/16-20 M 37°) (Parker No. 063T—4—4) Tee
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler

SERVICE EQUIPMENT AND TOOLS
17, 19, and 22 mm Combination Wrenches
JT02156A Digital Pressure and Temperature Analyzer
JT02162 Transducer 35 000 kPa (350 bar) (5 000 psi)
7 000 kPa (70 bar) (1 000 psi) Gauge
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable
JT05800 Digital Thermometer
13 mm Combination Wrench
4 mm Hex Key Wrench

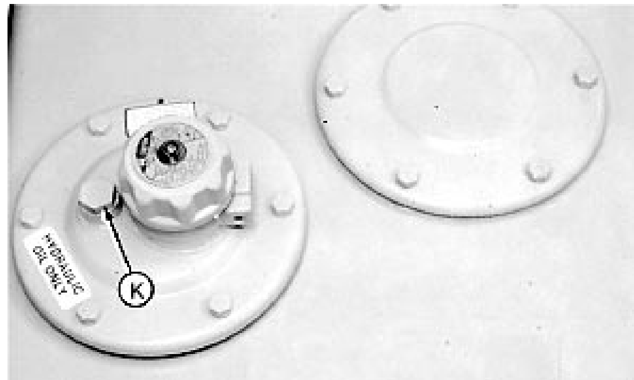
Procedure is to check that the hydraulic pressure output for the proportional solenoid valves are within the specified pressure range of the pressure shown on the laptop computer. The pressure shown on laptop computer is a calculated pressure from the electrical signal from the engine and pump controller (EPC).

Continued on next page CED,TX08227,3038 –19–23MAR98–1/5

Tests

1. Stop the engine.

   Loosen vent plug (K) to release the air pressure in hydraulic oil tank.



K—Vent Plug

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CED,TX08227,3038 –19–23MAR98–2/5

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NOTE: Proportional solenoid valve output pressure must be measured using a pressure gauge. The pressure shown on laptop computer is calculated from data stored in the engine and pump controller. The electrical signal from the controller to solenoid coil does not change as the solenoid valve adjustment is made.

2. Disconnect the line (F, G, K, or L) at solenoid valve manifold (A) for solenoid valve (B—E) being checked.

   Install tee (N) and male quick coupler.

   Connect the digital pressure and temperature analyzer and transducer or a gauge (C).

3. Connect the laptop computer. (See procedure in this group.)

4. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

5. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

6. Run the machine at specification.

Engine—Specification

Speed .... Fast Idle

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

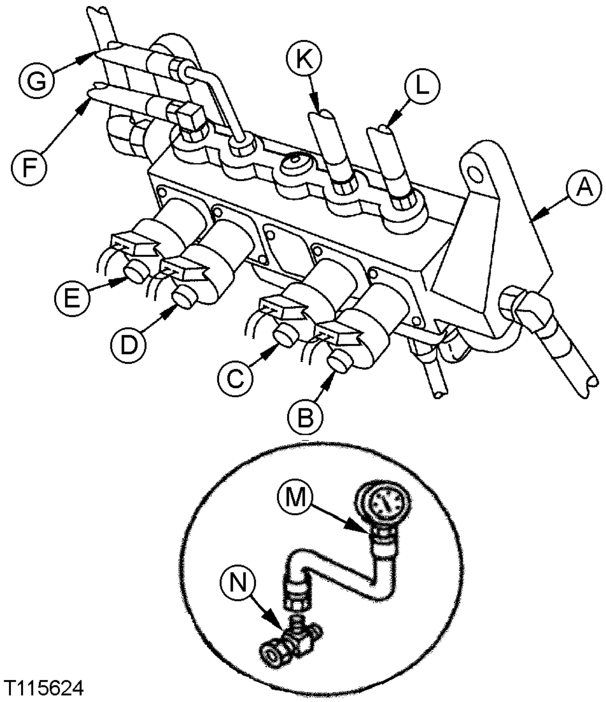
Position .... Off

HP Mode Switch—Specification

Position .... Off

Auto-Idle Switch—Specification

Position .... Off



T115624

T115624 –UN–29MAY98

A—Solenoid Valve Manifold
B—Arm Regenerative Solenoid Valve (SC) Line
C—Speed Sensing Solenoid Valve (SD)
D—Propel Speed Change Solenoid Valve (SI) Line
E—Power Boost Solenoid Valve (SG)
F—To System Relief and Power Boost Valve
G—To Propel Speed Change Valve
K—To Pump Regulators Speed Sensing Port
L—To Arm Regenerative Valve
M—Gauge
N—Tee

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Continued on next page

Propel Speed Switch—Specification

Position .... Fast Speed

7. Operate the machine as follows and then record the pressure readings from the gauge and laptop computer.

- For arm regenerative solenoid valve (B), extend the arm and lower the boom so bucket is in the ground then actuate boom up and arm in functions in combined operation.
- For speed sensing solenoid valve (C), operate the arm in function over relief to load the engine.
- For propel speed change solenoid valve (D), drive the machine at fast speed propel.
- For power boost solenoid valve (E), push the power boost button on right control lever.

8. Compare pressure reading from the gauge and laptop computer. The pressure reading from the gauge must be within the specified range of calculated pressure reading on the laptop computer.

Arm Regenerative Solenoid Valve (SC)—Specification

Pressure .... Laptop Computer Reading ± 196 kPa (1.96 bar) (28 psi)

Speed Sensing Solenoid Valve (SD)—Specification

Pressure .... Laptop Computer Reading ± 196 kPa (1.96 bar) (28 psi)

Propel Speed Change Solenoid Valve (SI)—Specification

Pressure .... Laptop Computer Reading ± 196 kPa (1.96 bar) (28 psi)

Power Boost Solenoid Valve (SG)—Specification

Pressure .... Laptop Computer Reading ± 196 kPa (1.96 bar) (28 psi)

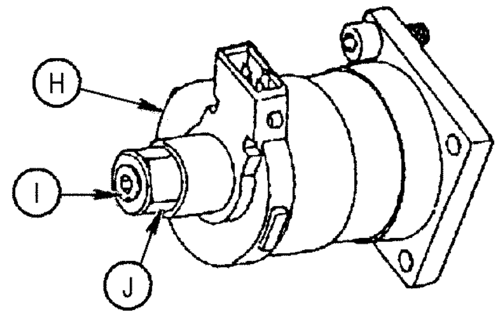
Continued on next page

CED,TX08227,3038 –19–23MAR98–4/5

9. Adjust the solenoid valve (H) as needed.

   a. Make a mark on the end of adjusting screw (I) for the original position of screw. Do not mark on threads of screw.

   b. Loosen nut (J) just enough so adjusting screw (I) can be turned.



T101709

T101709 –UN–20JUN96

IMPORTANT: Turning adjusting screw out too far may cause oil leakage because the O-ring has come off it seat. The length from end of adjusting screw to nut must not exceed 4 mm (0.157 in.).

   c. Turn adjusting screw in to increase pressure setting; turn adjusting screw out to decrease setting. Remember, the length from end of adjusting screw to nut must not exceed 4 mm (0.157 in.).

Per 1/4 Turn of Adjusting Screw Approximate Change—Specification

Pressure .... 98 kPa (0.98 bar) (14 psi)

End of Adjusting Screw to Nut Must Not Exceed—Specification

Length.. 4 mm (0.157 in.)

   d. Hold adjusting screw and then tighten nut.

Adjusting Screw-to-Housing Nut—Specification

Torque .... 8.8 N•m (6.5 lb-ft) (78 lb-in.)

   e. Check the pressure setting again.

CED,TX08227,3038 –19–23MAR98–5/5

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PUMP CONTROL VALVE TEST

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	Slow Idle and Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Typical Front or Rear Pump Control Valve Pilot Oil Control Signal Pressure	980—1569 kPa (9.8—15.7 bar) (142—228 psi) from slow idle to fast idle with all functions in neutral
Typical Front or Rear Pump Control Valve Pilot Oil Control Signal Pressure	2 942—3 923 kPa (29.4—39.2 bar) (427—569 psi) at fast idle with raised track at full speed

ESSENTIAL TOOLS
JT03001 (7/16-20 M 37° x 7/16-20 F 37° Sw x 7/16-20 M 37°) (Parker No. 063T—4—4) (2 used) Tee
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable
JT02156A Digital Pressure and Temperature Analyzer
JT02162 Transducer 35 000 kPa (350 bar) (5 000 psi)
Gauge 7 000 kPa (70 bar) (1 000 psi)
32 mm Combination Wrench
19 mm Combination Wrench

The function of pump control valves is to send a regulated pilot oil control signal to its respective pump regulator to change pump flow in response to the actuation of control valve spools. (See Pump Control Valve Operation in Group 9025-05.) The purpose of test is to check that the regulated pilot oil control signals increases as a function is actuated and decreases when function is returned to neutral by monitoring the front and rear pump control pressure sensor readings. The valves are adjusted at the factory and there should never be any need for an adjustment in the field.

1. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

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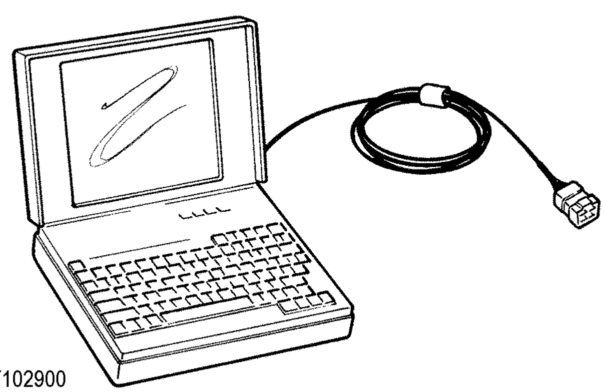
CED,TX08227,3139 –19–27MAY98–1/4

2. Connect the laptop computer. (See the installation procedure in this group.)

    a. Start the engine.

    b. Select “1 Front pump control pressure” and “6 Rear pump control pressure” from the Monitor Data Items.



T102900

T102900 –19–29AUG96

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CED,TX08227,3139 –19–27MAY98–2/4

If laptop computer is not available, use the digital pressure and temperature analyzer, and transducers or gauges.

a. Stop the engine.

b. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.

c. Install tees (C) and male quick couplers in line with rear and front pump control valve pilot lines at rear (A) and front (B) pump regulators. Connect the analyzer and transducers or gauges (D).

3. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

4. Run the machine at specification.

Engine—Specification

Speed .... Slow Idle and Fast Idle

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

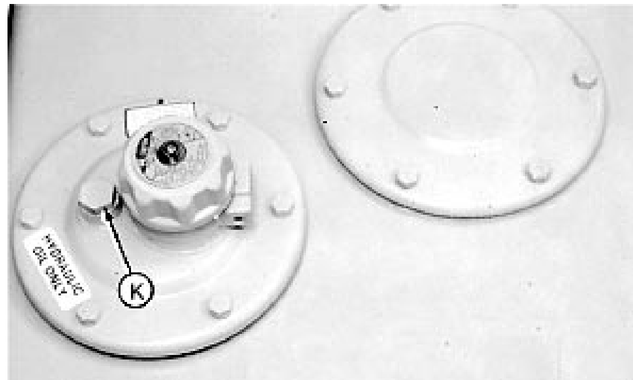
Position .... Off

Auto-Idle Switch—Specification

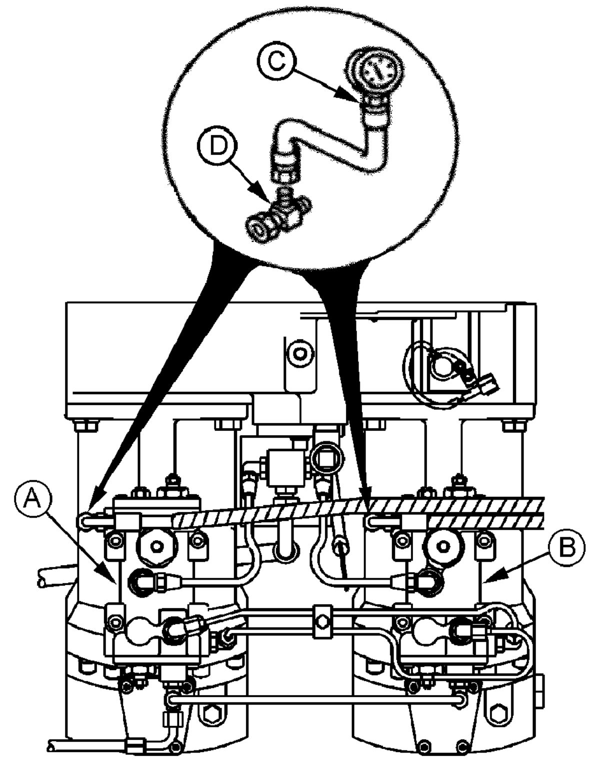
Position .... Off

a. Run engine at slow to fast idle with all functions in neutral. Record pressure reading for front and rear pump control valves.

b. Raise left track off the ground to check rear pump or right track for front pump. Run engine at fast idle. Operate the raised track at full speed. Record pressure readings.



T109340 –UN–29APR97



T115626

T115626 –UN–28MAY98

A—Rear Pump Regulator
B—Front Pump Regulator
C—JT03001 Tee
D—7 000 kPa (70 bar) (1 000 psi) Gauge
K—Vent Plug

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Continued on next page

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5. A pressure reading not in the ranges given can be an indication of contamination or sticking spools in the front (F) or rear (H) pump control valve. Before making any adjustments, check the front and rear pump control pressure sensors and the operation of remote control spool in front and rear pump regulators.

Typical Front or Rear Pump Control Valve Pilot Oil Control Signal—Specification

Pressure .... 980—1569 kPa (9.8—15.7 bar) (142—228 psi) from slow idle to fast idle with all functions in neutral

Typical Front or Rear Pump Control Valve Pilot Oil Control Signal—Specification

Pressure .... 2 942—3 923 kPa (29.4—39.2 bar) (427—569 psi) at fast idle with raised track at full speed

For an adjustment to the front pump control valve, use the right propel with track raised or bucket function over relief. For an adjustment to the rear pump control valve use the left propel with track raised or swing function over relief for the rear pump control valve. Turn the adjusting plug (J) in to decrease pressure reading; turn adjusting plug out to increase pressure reading. Tighten nut (I).

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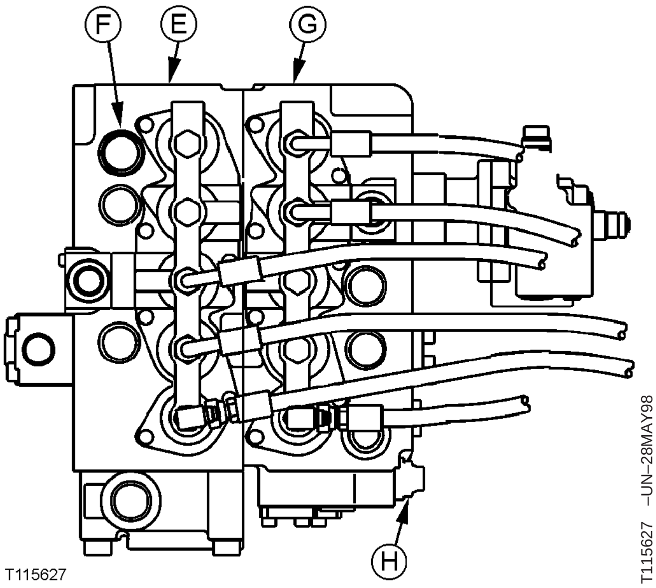
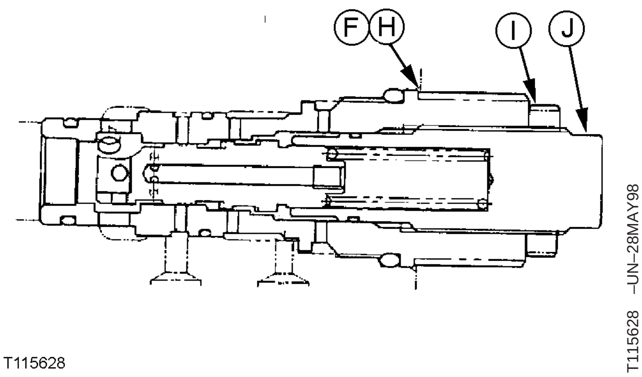


T115627

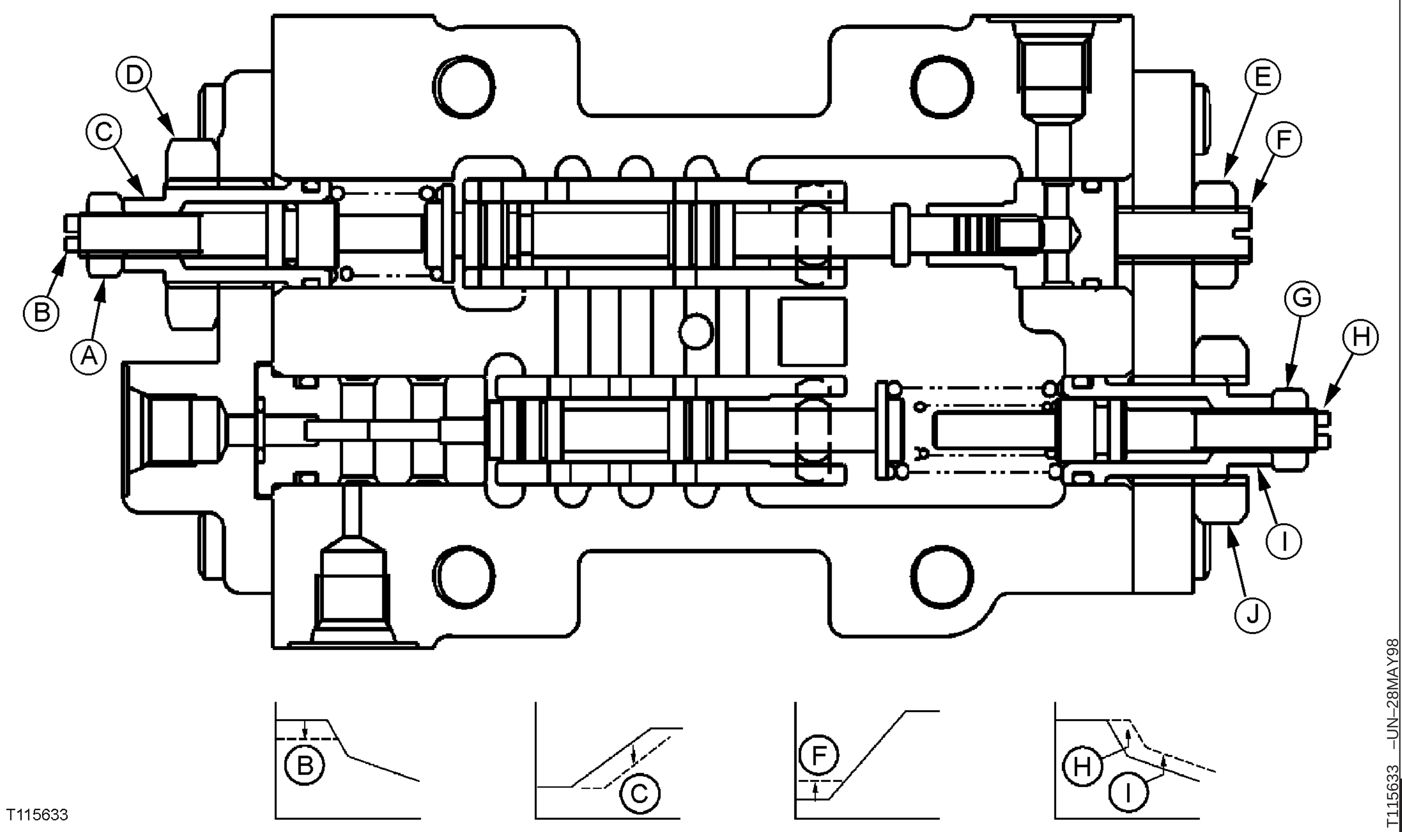


T115628

E—Right Control Valve
F—Front Pump Control Valve
G—Left Control Valve
H—Rear Pump Control Valve
I—Nut
J—Adjusting Plug

CED,TX08227,3139 –19–27MAY98–4/4

HYDRAULIC PUMP REGULATOR ADJUSTMENTS



A—13 mm Nut
B—Maximum Flow Adjusting Screw
C—Flow Adjusting Cartridge (Track Cycle Time)
D—30 mm Nut
E—17 mm Nut
F—Minimum Flow Adjusting Screw
G—13 mm Nut
H—Load Adjusting Screw (Inner Spring) (Engine Pulldown at High Pressure)
I—Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure)
J—30 mm Nut

Continued on next page CED,TX08227,3140 –19–27MAY98–1/3

SPECIFICATIONS	
Pump Speed to Engine Speed Ratio	0.95
Engine Speed	2050 rpm
Pump Speed	1947 rpm
Pump Regulator Maximum Flow Adjusting Screw Turn	1/4 turn IN decreases maximum pump flow rate approximately 18.5 L/min (4.9 gpm)
Pump Regulator Flow Adjusting Cartridge (Track Cycle Time) Turn	1/4 turn IN decreases pump flow rate approximately 31.6 L/min (8.3 gpm)
Pump Regulator Minimum Flow Adjusting Screw Turn	1/4 turn IN increases minimum pump flow rate approximately 15.2 L/min (4.0 gpm)
Pump Regulator Load Adjusting Screw (Inner Spring) (Engine Pulldown at High Pressure) Turn	1/4 turn IN increases pump flow rate approximately 6.9 L/min (1.8 gpm)
Regulator Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure) Turn	1/4 turn IN increases pump flow rate approximately 36.7 L/min (9.7 gpm)

The pumps are driven at 0.95 times engine speed. The approximate flows given are with the engine speed at 2050 rpm and the pump speed at 1947 rpm.

Pump Speed to Engine Speed—Specification

Ratio.. 0.95

Engine—Specification

Speed.. 2050 rpm

Pump—Specification

Speed.. 1947 rpm

IMPORTANT: Random adjustment will cause engine and hydraulic systems malfunctions. See Pump Regulator Tests and Adjustment for Minimum Flow, Maximum Flow and Engine Pulldown in this group.

Maximum Flow Adjusting Screw (B): Turning adjusting screw IN decreases maximum pump flow rate.

Pump Regulator Maximum Flow Adjusting Screw—Specification

Turn... 1/4 turn IN decreases maximum pump flow rate approximately 18.5 L/min (4.9 gpm)

Do not turn adjusting screw in more than two turns. Tighten 13 mm nut (A) after adjustment. Maximum flow adjusting screw must not be turn out to try to increase pump flow rate except after the adjustment of flow adjusting cartridge (C). For adjustment, see Hydraulic Pump Regulator Test and Adjustment—Maximum Flow in this group.

Flow Adjusting Cartridge (Track Cycle Time) (C): Turning adjusting cartridge IN decreases pump flow rate.

Pump Regulator Flow Adjusting Cartridge (Track Cycle Time)—Specification

Turn... 1/4 turn IN decreases pump flow rate approximately 31.6 L/min (8.3 gpm)

Do not turn adjusting cartridge more than one turn. Tighten 30 mm nut (D) after adjustment. When flow adjusting cartridge (C) is turned in or out the maximum flow rate for the pump also changes. To maintain the pump's maximum flow rate, turn maximum flow adjusting screw (B) out twice as much as flow adjusting cartridge (C) is turned in; turn maximum flow adjusting screw (B) in twice as much as flow adjusting cartridge (C) is turned out.

For adjustment, see Hydraulic Pump Regulator Test and Adjustment—Maximum Flow in this group.

Continued on next page

Minimum Flow Adjusting Screw (F):
Turning adjusting screw IN increases minimum flow rate.

Pump Regulator Minimum Flow Adjusting Screw—Specification

Turn.. 1/4 turn IN increases minimum pump flow rate approximately 15.2 L/min (4.0 gpm)

For adjustment, see Hydraulic Pump Regulator Test and Adjustment—Minimum Flow in this group.

Do not turn adjusting more than two turns. Tighten 17 mm nut (E) after adjustment.

Load Adjusting Screw (Inner Spring) (Engine Pulldown at High Pressure) (H):
Turning load adjusting screw IN increases flow rate.

Pump Regulator Load Adjusting Screw (Inner Spring) (Engine Pulldown at High Pressure)—Specification

Turn.. 1/4 turn IN increases pump flow rate approximately 6.9 L/min (1.8 gpm)

Do not turn adjusting screw more than one turn. Tighten 13 mm nut (G) after adjustment.

For adjustment, see Hydraulic Pump Regulator Test and Adjustment—Engine Pulldown in this group.

Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure) (I):
Turning adjusting cartridge IN increases flow rate.

Regulator Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure)—Specification

Turn.. 1/4 turn IN increases pump flow rate approximately 36.7 L/min (9.7 gpm)

Do not turn adjusting cartridge more than one turn. Tighten 30 mm nut (J) after adjustment.

For adjustment, see Hydraulic Pump Regulator Test and Adjustment—Engine Pulldown in this group.

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HYDRAULIC PUMP REGULATOR TEST AND ADJUSTMENT—MINIMUM FLOW

SPECIFICATIONS	
Track Sag	340—380 mm (13-3/8—15 in.)
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	2050 rpm
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Propel Speed Switch Position	Slow Speed (Turtle)
Slow Speed Propel With Track Raised Cycle Time	36.5 ± 1 seconds for one revolution from a running start with pump control valve pilot line disconnected

ESSENTIAL TOOLS
7/16-20 M 37° (Parker No. 03CP-4) (2 used) Plug

SERVICE EQUIPMENT AND TOOLS
JT05801 Clamp-On Electronic Tachometer
JT05800 Digital Thermometer
Stop Watch
17 mm Combination Wrench
Flat Blade Screwdriver

The purpose of check is to test and adjust the minimum flow rate of pumps using the cycle time for propel as an indicator of pump flow rate.

1. Adjust the track sag for both tracks to specification. (See procedure in Group 9020-20.)

Track—Specification

Sag .... 340—380 mm (13-3/8—15 in.)

2. Install a tachometer. (See JT05801 Clamp-On Electronic Tachometer Installation in this group.)

3. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

Continued on next page

4. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

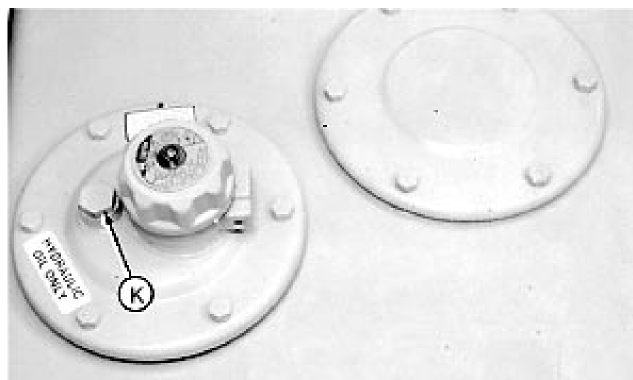
Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

5. Stop the engine.

CED,TX08227,3141 –19–28MAY98–2/5

6. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.



T109340 –UN–29APR97

K—Vent Plug

Continued on next page CED,TX08227,3141 –19–28MAY98–3/5

7. Disconnect pump control valve pilot line at rear pump regulator (B) for rear pump or at front pump regulator (C) for front pump. Install plug (D) in line. Leave the fitting on regulator open. Lay a shop towel over the fitting.

8. Run machine as specified.

Engine—Specification

Speed .... 2050 rpm

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

Position .... Off

Auto-Idle Switch—Specification

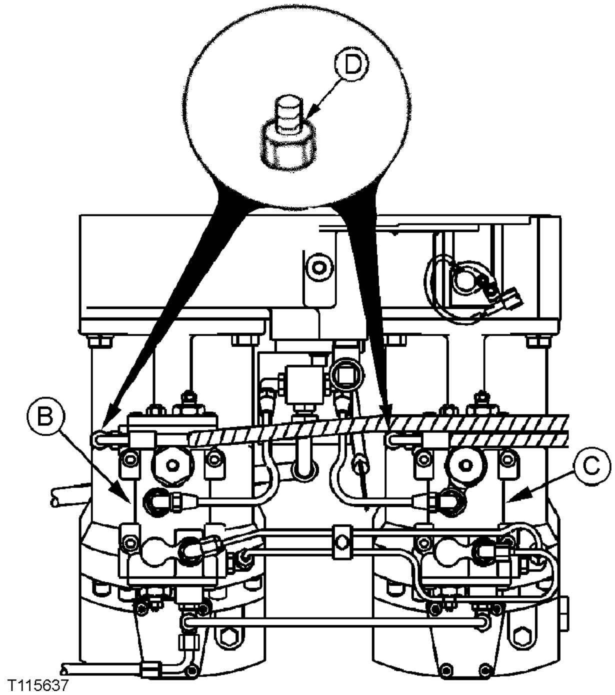
Position .... Off

Propel Speed Switch—Specification

Position .... Slow Speed (Turtle)

9. Raise the left track off ground for rear pump or the right track for front pump.

10. Actuate propel function to full speed. Record the cycle time for one revolution.



T115637

T115637 –UN–29MAY98

B—Rear Pump Regulator
C—Front Pump Regulator
D—7/16-20 M 37° Plug

Continued on next page

CED,TX08227,3141 –19–28MAY98–4/5

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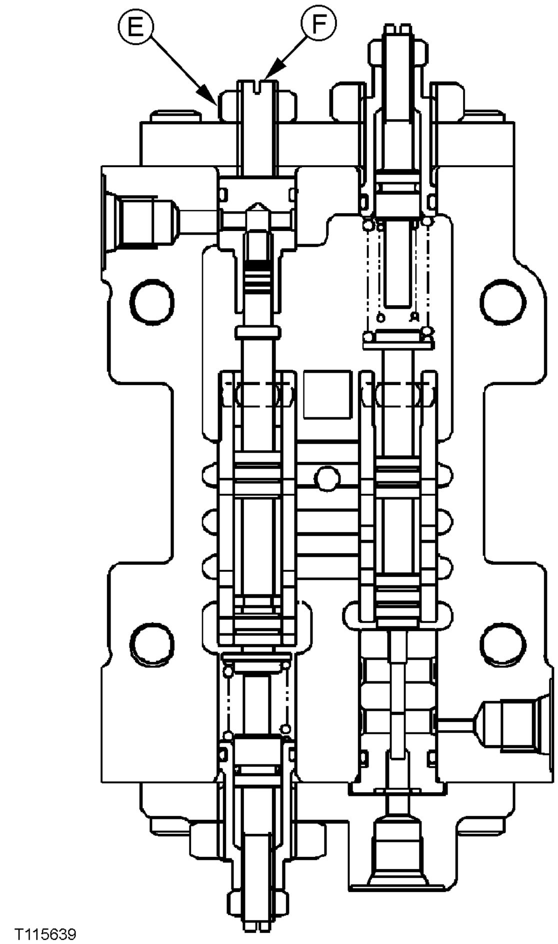
11. Adjust the minimum flow adjusting screw (F) as needed to obtain the specified cycle time. Turn screw in to decrease the cycle time (the minimum flow rate increases); turn screw out to increase the cycle time (the minimum flow rate decreases). Hold the screw and tighten the 17 mm nut (E).

Slow Speed Propel With Track Raised—Specification

Cycle Time.. 36.5 ± 1 seconds for one revolution from a running start with pump control valve pilot line disconnected

12. Repeat procedure for other pump.

    Adjust regulators so cycle times are the same.



T115639 –UN–29MAY98

E—17 mm Nut
F—Minimum Flow Adjusting Screw

CED,TX08227,3141 –19–28MAY98–5/5

HYDRAULIC PUMP REGULATOR TEST AND ADJUSTMENT—MAXIMUM FLOW

SPECIFICATIONS	
Track Sag	340—380 mm (13-3/8—15 in.)
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	2050 rpm
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Propel Speed Switch Position	Slow Speed (Turtle)
Slow Speed Propel With Track Raised For Three Revolutions From A Running Start Cycle Time	33 ± 2 seconds

SERVICE EQUIPMENT AND TOOLS
JT05801 Clamp-On Electronic Tachometer
JT05800 Digital Thermometer
Stop Watch
30 mm Combination Wrench
13 mm Combination Wrench
Flat Blade Screwdriver

The purpose of check is to test and adjust the maximum flow rate of pumps using the cycle time for propel as an indicator of pump flow rate.

1. Adjust the track sag for both tracks to specification. (See procedure in Group 9020-20.)

Track—Specification

Sag.. 340—380 mm (13-3/8—15 in.)

2. Install a tachometer. (See JT05801 Clamp-On Electronic Tachometer Installation in this group.)

3. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

4. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

5. Run machine as specified.

Engine—Specification

Speed.. 2050 rpm

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

Position .... Off

Auto-Idle Switch—Specification

Position .... Off

Propel Speed Switch—Specification

Position .... Slow Speed (Turtle)

6. Raise the left track off ground for rear pump or the right track for front pump.

7. Actuate propel function to full speed. Record the cycle time for three revolution.

8. Repeat procedure for other pump. Record the cycle time for three revolution.

Continued on next page

9. Adjust flow adjusting cartridge (C) on front and rear pump regulators so cycle times are within the specification and are the same.

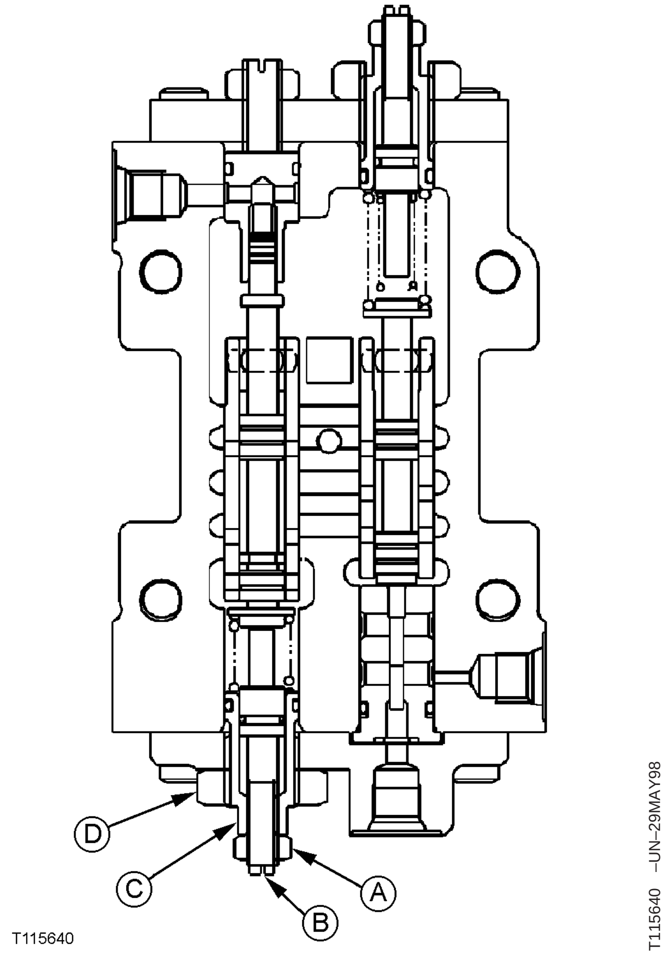
Slow Speed Propel With Track Raised For Three Revolutions From A Running Start—Specification

Cycle Time.. 33 ± 2 seconds

10. Loosen 30 mm nut (D). Turn flow adjusting cartridge (C) in to decrease the cycle time; turn flow adjusting cartridge out to increase the cycle time. Never turn flow adjusting cartridge more than one turn.

    Hold the flow adjusting cartridge and then tighten 30 mm nut.

    When flow adjusting cartridge (C) is turned in or out the maximum flow rate for the pump also changes. To maintain the pump's maximum flow rate, turn maximum flow adjusting screw (B) out twice as much as flow adjusting cartridge (C) is turned in; turn maximum flow adjusting screw (B) in twice as much as flow adjusting cartridge (C) is turned out.



A—13 mm Nut
B—Maximum Flow Adjusting Screw
C—Flow Adjusting Cartridge (Track Cycle Time)
D—30 mm Nut

CED,TX08227,3142 –19–28MAY98–2/2

HYDRAULIC PUMP REGULATOR TEST AND ADJUSTMENT—ENGINE PULLDOWN

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	2050—2125 rpm
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Propel Speed Switch Position	Slow Speed (Turtle)
Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure)—Combined Pump Engine Pulldown Speed	1950—2025 rpm at 20 685 kPa (207 bar) (3 000 psi) with tracks stalled
Load Adjusting Screw (Engine Pulldown at High Pressure) (Inner Spring)—Combined Pump Engine Pulldown Speed	1950—2025 rpm at 24 132 kPa (241 bar) (3 500 psi) with tracks stalled
System Relief Valve Pressure	31 870 ± 980 kPa (318.7 ± 9.8 bar) (4 620 ± 140 psi)

ESSENTIAL TOOLS
TH108328 Adapter (2 used)
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler (2 used)
7/16-20 M 37° (Parker No. X03CP-4) Plug
JT05484 (7/16-20 F 37°) (Parker No. X06CP-4) Cap

SERVICE EQUIPMENT AND TOOLS
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable
JT02156A Digital Pressure and Temperature Analyzer
JT02160 Transducer 70 000 kPa (700 bar) (10 000 psi)
Gauge 70 000 kPa (700 bar) (10 000 psi)
JT05800 Digital Thermometer
JT05801 Clamp-On Electronic Tachometer
90 mm (3-1/2 in.) OD Pin or Length of Round Bar Stock (2 used)
32 mm Combination Wrench
19 mm Combination Wrench
13 mm Combination Wrench
Flat Blade Screwdriver
30 mm Combination Wrench

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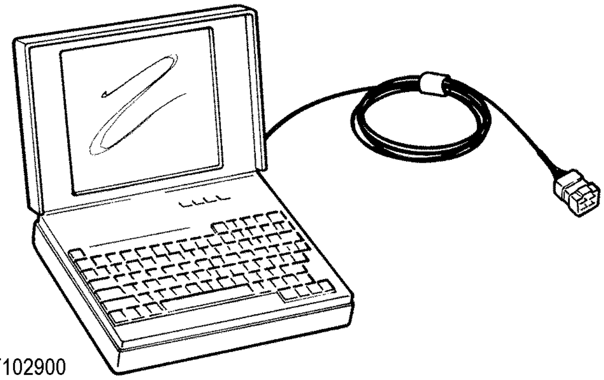
IMPORTANT: In this procedure the pump regulators are adjusted to load the engine to rated speed so all available engine horsepower is used. Prior to performing this adjustment, proper engine performance with number two diesel fuel must be verified. The fast idle speed must be adjusted to specifications.

Pump regulator are sensitive to adjust.



T102900

T102900 –19–29AUG96

1. Connect the laptop computer. (See the installation procedure in this group.)

   a. Start the engine.

   b. Select “3 Front pump delivery pressure” and “4 Rear pump delivery pressure” from the Monitor Data menu.

Continued on next page

CED,TX08227,3143 –19–28MAY98–2/13

If laptop computer with excavator diagnostics program is not available, use the digital pressure and temperature analyzer, and transducer, or a gauge.

a. Stop the engine.

b. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.

c. Install adapters (C) and male quick coupler to test ports in rear (A) and front (B) pumps. Connect the analyzer and transducer or gauges.

2. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

3. Install the electronic tachometer. (See JT05801 Clamp-On Electronic Tachometer Installation in this group.)

4. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

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5. Check that fast idle is 2050—2125 rpm. Record the fast idle speed. Adjust as needed before continuing test. (See procedure in Group 9010-20.)

6. Run machine as specified.

Engine—Specification

Speed .... 2050—2125 rpm

Work Mode Selector—Specification

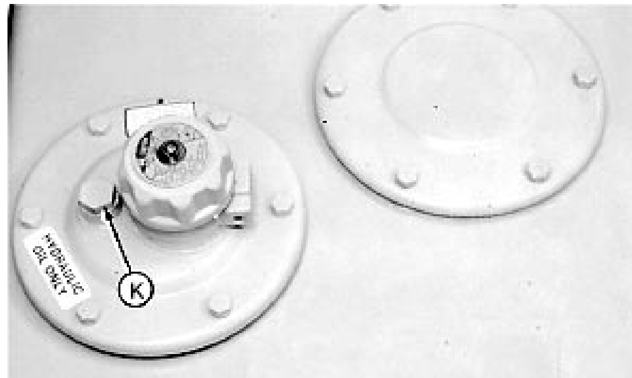
Position.. Dig Mode

E Mode Switch—Specification

Position.. Off

HP Mode Switch—Specification

Position.. Off



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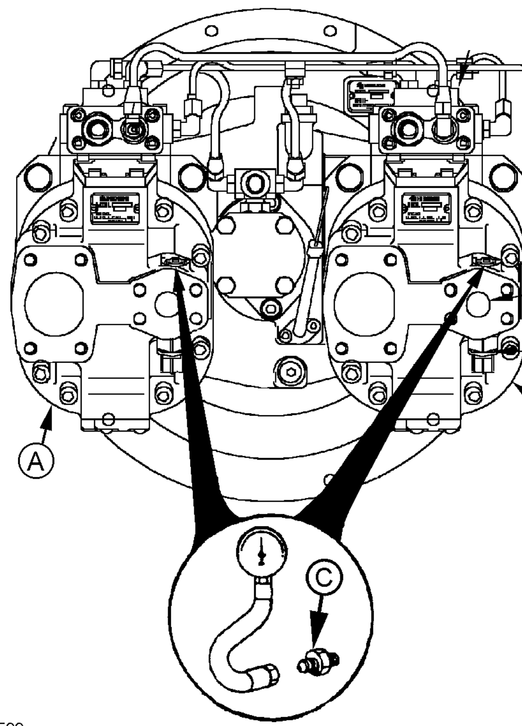


T115599

T115599 –UN–27MAY98

A—Rear Pump
B—Front Pump
C—TH108328 Adapter (2 used)
K—Vent Plug

Continued on next page

CED,TX08227,3143 –19–28MAY98–3/13

Auto-Idle Switch—Specification

Position .... Off

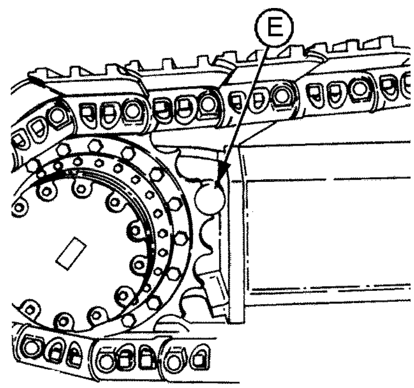
Propel Speed Switch—Specification

Position .... Slow Speed (Turtle)

CED,TX08227,3143 –19–28MAY98–4/13

NOTE: Procedure is written to stall propel functions. Procedure will also work stalling dig functions. Front pump—right propel or bucket function. Rear pump—left propel or swing function. Combined pumps—both propel functions or arm in function.

7. Install two pins or round bar stock (E) between the sprockets and track frame to stall propel motors.



T107074

T107074 –UN–12FEB97

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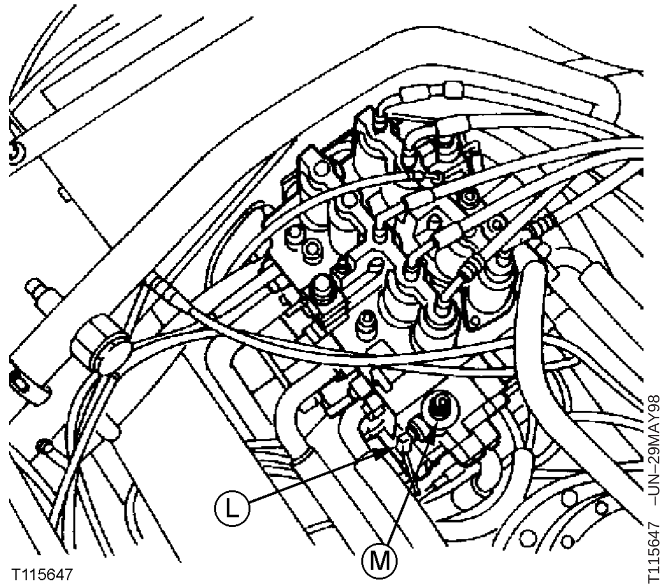
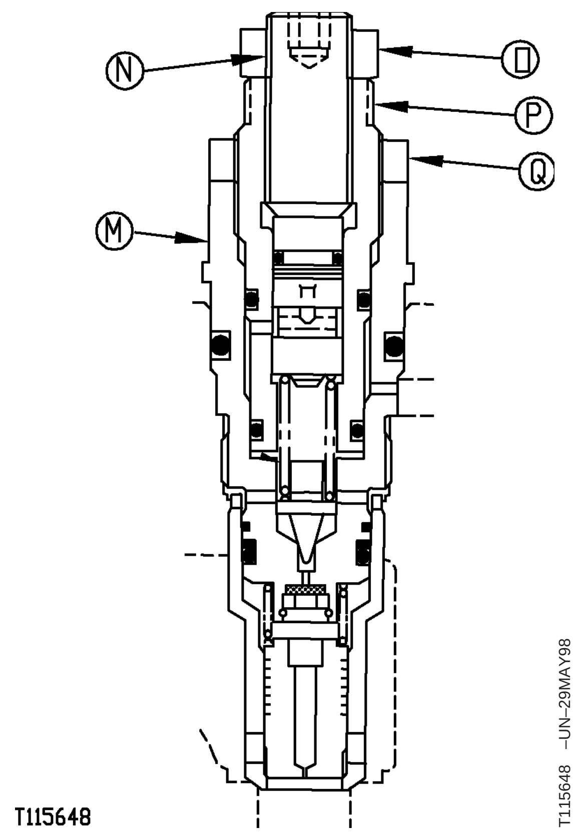
8. **Adjust the Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure):**

   a. Disconnect the power boost pilot line (L) at the right front corner of control valve. Install a plug in the line and a cap on fitting.

   b. Adjust the system relief valve (M) to 20 685 kPa (207 bar) (3 000 psi). (See System Relief Valve Test and Adjustment in this group):

      1. Run engine at fast idle.
      2. Actuate and hold right propel function over relief.
      3. Loosen 32 mm nut (O).
      4. Turn adjusting plug (P) out to obtain specified pressure. Hold the adjusting plug and tighten 32 mm nut.





L—Power Boost Pilot Line
M—System Relief Valve
N—Adjusting Screw
O—22 mm Nut
P—Adjusting Plug
Q—32 mm Nut

Continued on next page CED,TX08227,3143 –19–28MAY98–6/13

NOTE: The load adjusting screw (H) and load adjusting cartridge (I) are located on the end of regulator towards the engine.

c. Loosen 13 mm (G) on both regulators.

d. Turn load adjusting screws (H) out 1-1/2 turns. Tighten 13 mm nuts.

e. Loosen large nuts (J) on both regulators.

f. Turn load adjusting cartridges (I) out 1-1/4 turns. Leave nuts loose.

g. Run engine at fast idle.

h. Actuate and hold both propel functions over relief.

NOTE: Initial procedure is to adjust the load adjusting cartridges (I) to match the two pumps before making the final adjustment to get the combined pump engine pulldown at medium pressure.

Hydraulic pressure increases as the load adjusting cartridges are turned in because the pump flow is increasing.

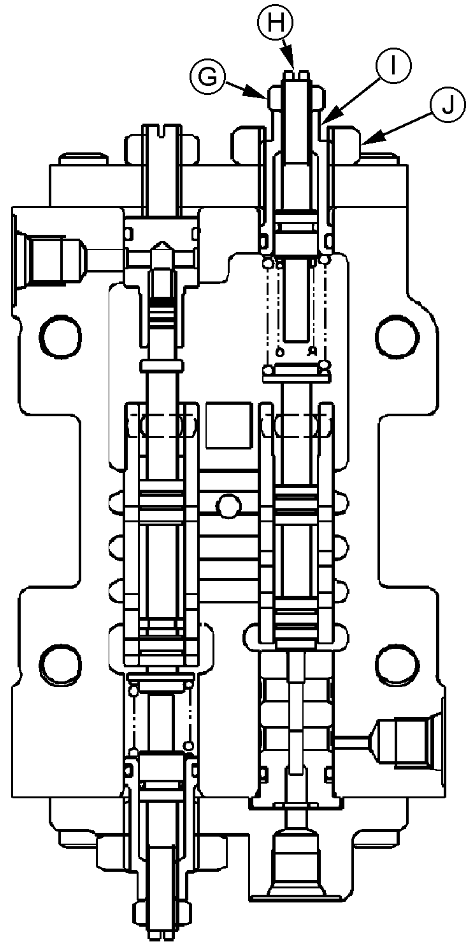
i. Turn the load adjusting cartridge (I) on front pump regulator in until engine speed just starts to decrease. Then, slowly turn load adjusting cartridge out and in to verify the exact point where engine speed starts to decrease (0—5 rpm).

j. Turn the load adjusting cartridge (I) on rear pump regulator in until engine speed just starts to decrease. Then, slowly turn load adjusting cartridge out and in to verify the exact point where engine speed starts to decrease (0—5 rpm).

k. Release both propel functions.

NOTE: To avoid heating the oil excessively, only operate the propel functions over relief to check the pulldown after each adjustment of cartridge.

l. Turn both load adjusting cartridges (I) in equal amounts. Start with 1/4 turn.



T115646

T115646 —UN–29MAY98

G—13 mm Nut
H—Load Adjusting Screw (Inner Spring) (Engine Pulldown at High Pressure)
I—Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure)
J—30 mm Nut

9025
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115

Continued on next page

CED,TX08227,3143 –19–28MAY98–7/13

m. Actuate and hold both propel functions over relief to check that combine pump engine pulldown speed is to specified rpm. Record the rpm reading. Release propel functions.

Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure)—Combined Pump Engine Pulldown—Specification

Speed .... 1950—2025 rpm at 20 685 kPa (207 bar) (3 000 psi) with tracks stalled

n. Hold the cartridge and tighten 30 mm nut on both regulators.

IMPORTANT: If the load adjusting cartridge are not turned in equal amounts, the engine speed will pulldown to the specified rpm but the pump flow rates will not be equal and the machine will mistrack

o. Check the adjustments:

1. Run the engine at fast idle.
2. Actuate and hold right propel function over relief. Record rpm reading. Release propel function.
3. Actuate and hold left propel function over relief. Record rpm reading. Release propel function.
4. The rpm reading for front and rear pumps must be within 10 rpm of each other to prevent machine from mistracking.

Continued on next page CED,TX08227,3143 –19–28MAY98–8/13

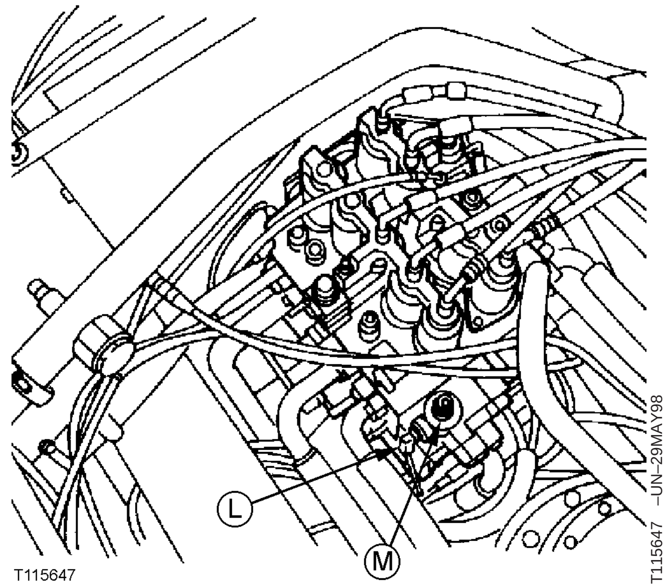
9. **Adjust the Load Adjusting Screw (Inner Spring) (Engine Pulldown at High Pressure):**

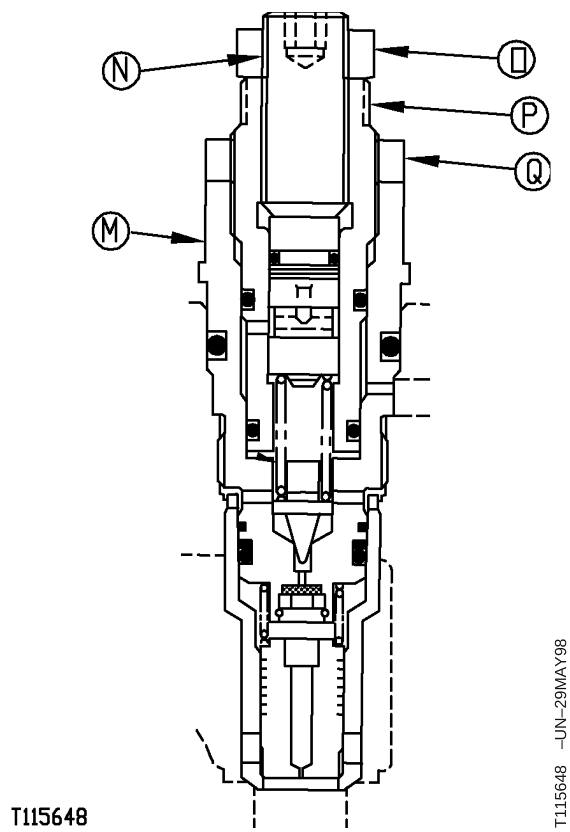
   a. Adjust the system relief valve (D):

      1. Run engine at fast idle.
      2. Actuate and hold right propel function over relief.
      3. Loosen 32 mm nut (Q). Turn adjusting plug (P) in to obtain 24 132 kPa (241 bar) (3 500 psi). Hold the adjusting plug and then tighten 32 mm nut.

   b. Run engine at fast idle.

   c. Actuate and hold both propel functions over relief.





L—Power Boost Pilot Line
M—System Relief and Power Boost Valve
N—Adjusting Screw
O—22 mm Nut
P—Adjusting Plug
Q—32 mm Nut

Continued on next page

NOTE: Initial procedure is to adjust the load adjusting screws (H) to match the two pumps before making the final adjustment to get the combined pump engine pulldown at high pressure.

d. Turn load adjusting screw (H) on front pump regulator in until engine speed just starts to decrease. Then, slowly turn load adjusting screw out and in to verify the exact point where the engine speed just starts to decrease (0—5 rpm).

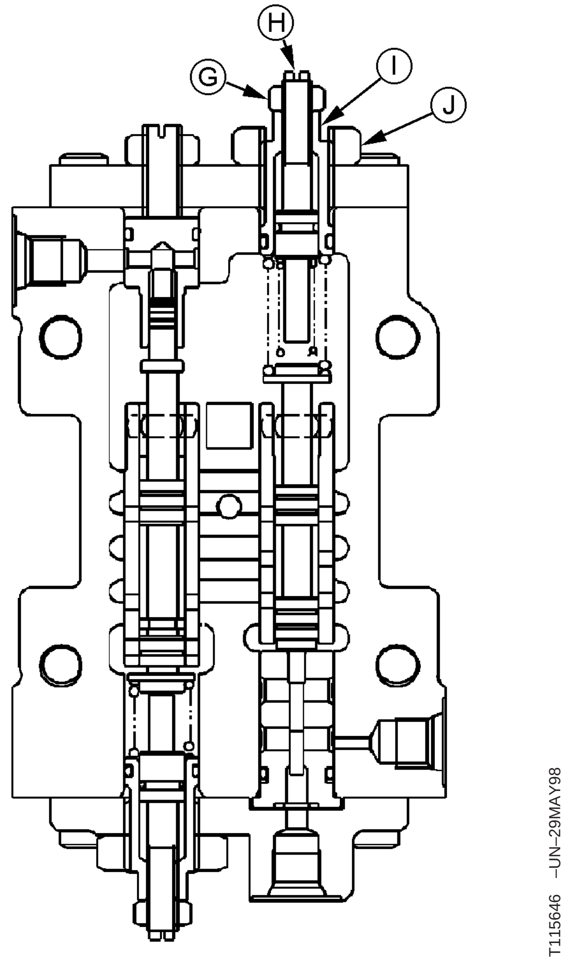
e. Turn load adjusting screw (H) on rear pump regulator in until engine speed just starts to decrease. Then, slowly turn load adjusting screw out and in to verify the exact point where the engine speed just starts to decrease (0—5 rpm).

f. Release both propel functions.

NOTE: To avoid heating the oil excessively, only operate the propel function over relief to check the pulldown after each adjustment of screws

g. Turn both load adjusting screws in equal amounts. Start with 1/4 turn.

h. Actuate and hold both propel functions over relief to check that combined pump engine pulldown speed is to specification.



T115646

G—13 mm Nut
H—Load Adjusting Screw (Inner Spring) (Engine Pulldown at High Pressure)
I—Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure)
J—30 mm Nut

Load Adjusting Screw (Engine Pulldown at High Pressure) (Inner Spring)—Combined Pump Engine Pulldown—Specification

Speed .... 1950—2025 rpm at 24 132 kPa (241 bar) (3 500 psi) with tracks stalled

i. Hold the load adjusting screw and tighten 13 mm nut (G) on both regulators.

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118

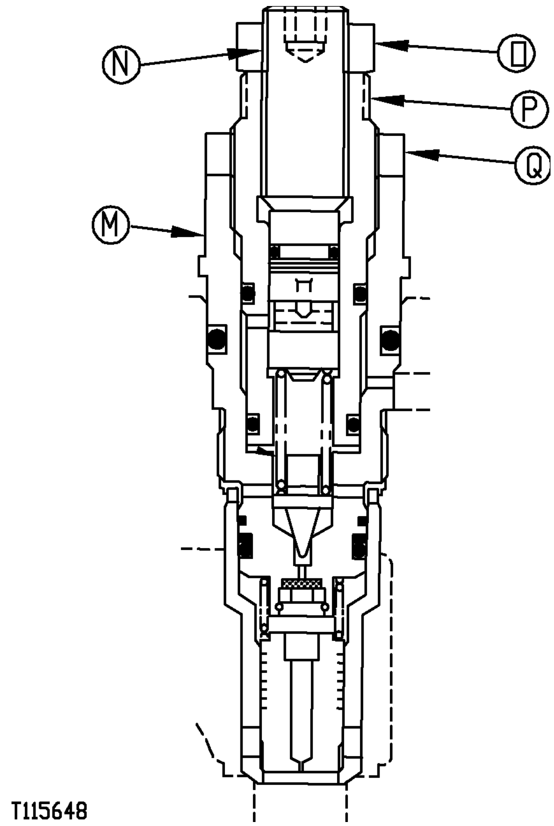
Continued on next page CED,TX08227,3143 –19–28MAY98–10/13

j. Adjust the system relief valve.

1. Run engine at fast idle.
2. Actuate and hold right propel function over relief.
3. Loosen 32 mm nut (Q). Turn adjusting plug (P) in to obtain specified pressure setting. Hold the adjusting plug and then tighten 32 mm nut.

System Relief Valve—Specification

Pressure .... 31 870 ± 980 kPa (318.7 ± 9.8 bar) (4 620 ± 140 psi)



T115648 –UN–29MAY98

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CED,TX08227,3143 –19–28MAY98–11/13

k. Check the adjustments:

1. Actuate and hold right propel function over relief. Engine pulldown must not go below 1950 rpm. If it does, turn front pump load adjusting cartridge (I) out until pulldown is 1950—1970 rpm. Record rpm reading. Release propel function.
2. Actuate and hold left propel function over relief. Engine pulldown must not go below 1950 rpm. If it does, turn rear pump load adjusting cartridge (I) out until pulldown is 1950—1970 rpm. Record rpm reading. Release propel function.
3. The pulldown rpm reading for front and rear pumps must be within 10 rpm of each other to prevent machine from mistracking.
4. Check combined pump pulldown by operating the arm in function through several cycles. The combined pump pulldown must be less than 150 rpm. If more than 150 rpm, turn both load adjusting cartridge out equal amounts so combined pump pulldown is less than 150 rpm.

l. Connect the power boost pilot line at the right front corner of control valve.

m. Make final pump regulator adjustments by observing how straight the machine tracks under load.

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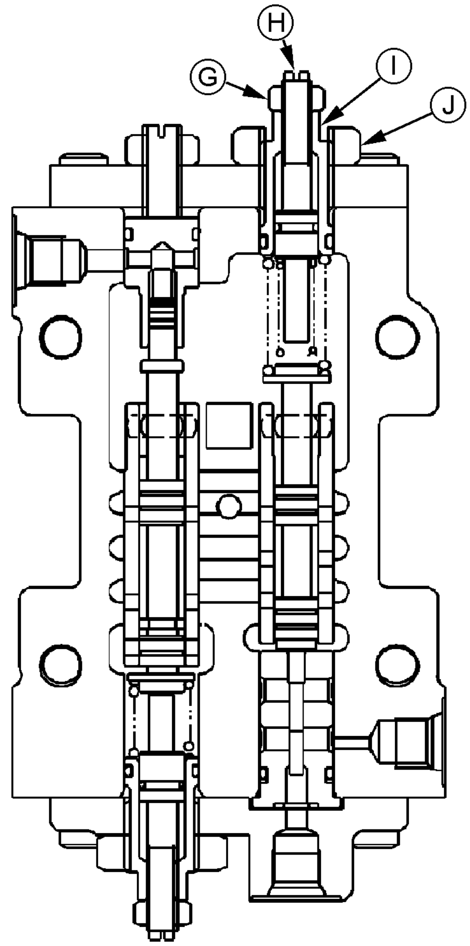


T115646

T115646 –UN–29MAY98

G—13 mm Nut
H—Load Adjusting Screw (Inner Spring) (Engine Pulldown at High Pressure)
I—Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure)
J—30 mm Nut

Continued on next page CED,TX08227,3143 –19–28MAY98–12/13

10. **Do the Final Tracking Checks:**

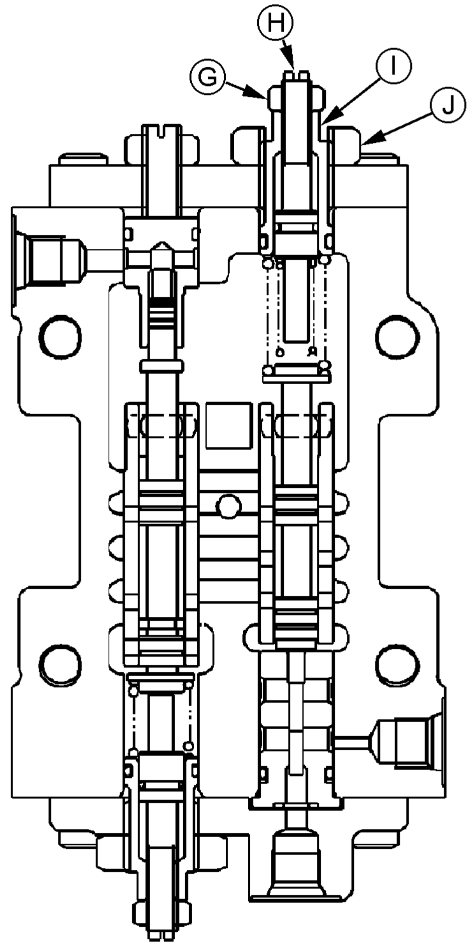
a. Propel machine forward on a flat area of naturally compacted soil and then on a slope of naturally compacted soil.

b. For a mistrack to the left on the flat area, turn load adjusting cartridge (I) on the front pump regulator out to slow the right track.

c. For a mistrack to the right on the flat area, turn load adjusting cartridge (I) on the rear pump regulator out to slow the left track.

d. For a mistrack to the right under load on the slope, turn the load adjusting screw (H) on the rear pump regulator out to slow the left track.

e. For a mistracks to the left under load on the slope, turn the load adjusting screw (H) on the front pump regulator out to slow the right track.



T115646 –UN–29MAY98

G—13 mm Nut
H—Load Adjusting Screw (Inner Spring) (Engine Pulldown at High Pressure)
I—Load Adjusting Cartridge (Outer Spring) (Engine Pulldown at Medium Pressure)
J—30 mm Nut

CED,TX08227,3143 –19–28MAY98–13/13

HYDRAULIC PUMP FLOW TEST

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	2000 ± 10 rpm
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
One New Pump Flow Rate	265 ± 4 L/min (70 ± 1 gpm) typical flow at 13 790 kPa (138 bar) (2000 psi)
One New Pump Flow Rate	235 ± 4 L/min (62 ± 1 gpm) typical flow at 20 685 kPa (207 bar) (3000 psi)
One Used Pump Flow Rate	212 ± 15 L/min (56 ± 4 gpm) minimum flow at 13 790 kPa (138 bar) (2000 psi)
One Used Pump Flow Rate	189 ± 15 L/min (50 ± 4 gpm) minimum flow at 20 685 kPa (207 bar) (3000 psi)

ESSENTIAL TOOLS
202862 (3/4-16 M 37° x 3/4-16 F 37° Sw x 7/16-20 M 37°) Tee
JT05484 (7/16-20 F 37°) (Parker No. X06CP-4) (3 used) Cap
TH100951 (PF 1/4 x 7/16-20 M 37°) (4 used) Elbow
3/8 x 24 in. x 7/16-20 F Sw 37° Hose
JT03387 (SAE Code 62 Split Flange High Pressure 1 SF x 1-5/16-12 M 37°) Flange Fitting
JT03389 (SAE Code 62 Split Flange High Pressure 3/4 SF x 1-1/16-12 M 37°) 90° Flange Fitting
TH108325 (1 M BSPP ORB x —16 M ORFS) Elbow
JT03452 Split Flange Connector Plate Kit
TH108328 Adapter (2 used)
XPD34BTX (1/8 x 7/16-20 F 37°) Male Quick Coupler

SERVICE EQUIPMENT AND TOOLS
JT07290 Laptop Computer
JT07274F Excavator Diagnostics Program Disk
JT07273 Cable
JT02156A Digital Pressure and Temperature Analyzer
JT02160 Transducer 70 000 kPa (700 bar) (10 000 psi)
Gauge 70 000 kPa (700 bar) (10 000 psi)
JT05800 Digital Thermometer
JT05801 Clamp-On Electronic Tachometer

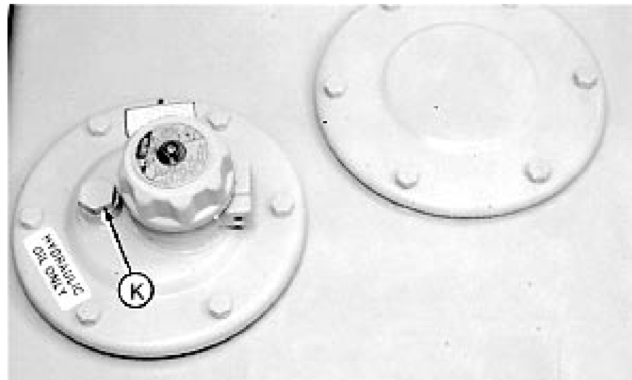
Test is used to determine pump condition and should be performed only if a comparison of actual machine cycle times to specified cycle times indicates low pump flow.

Continued on next page CED,TX08227,3144 –19–29MAY98–1/6

Tests

1. Stop the engine.

   Loosen vent plug (K) to release the air pressure in hydraulic oil tank.



T109340 –UN–29APR97

K—Vent Plug

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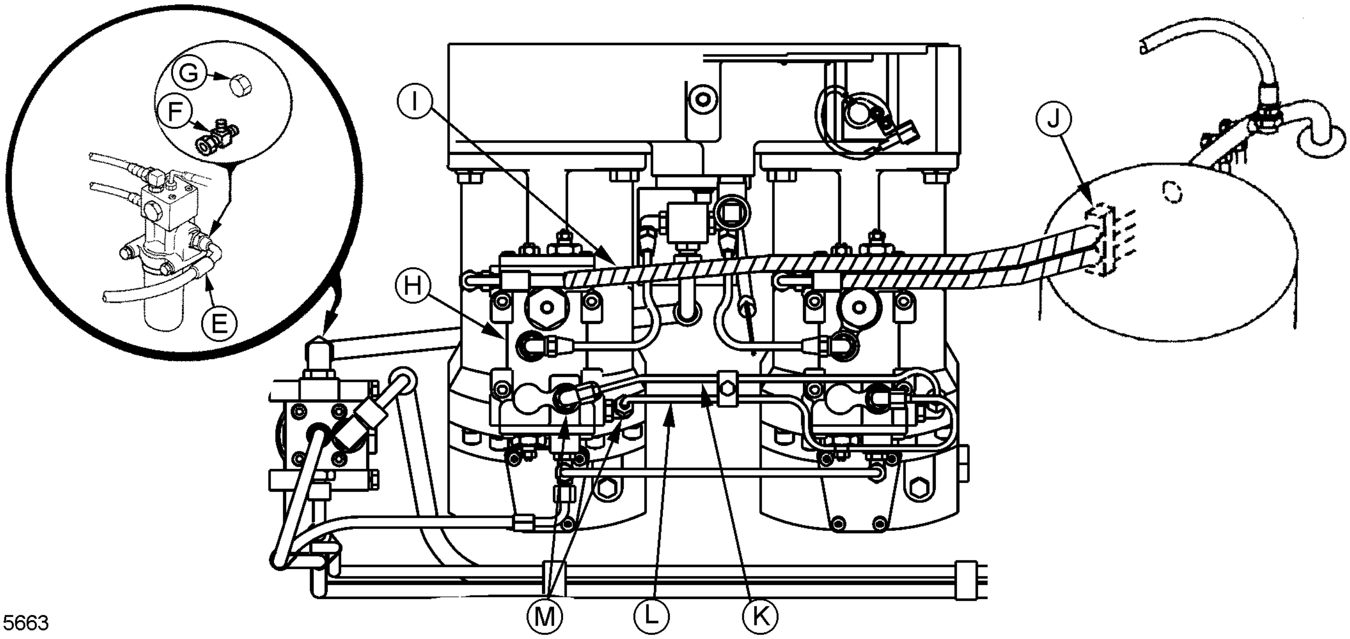

T115663

2. Disconnect pilot pressure inlet line (E) at pilot filter. Install tee (F).

   Connect pilot pressure inlet line to tee.

NOTE: The connection shown for flow test is to the rear pump. The connection for the front pump flow test is the same.

3. Disconnect the pump control valve pilot line (I) to the pump regulator (H) at the manifold (J) on hydraulic oil tank.

   Install cap (G) on fitting in manifold.

   Connect line to the tee at the pilot filter.

NOTE: Pilot pressure is routed to the pump regulator so the pump operates at the maximum displacement for the pressure applied.

4. Remove the steel lines (K and L) from elbows on pump regulators.

   Remove the elbows from both pump regulators and install TH100951 Elbows.

   Connect the ports (elbows) (M) together on the pump being flow tested using a hose.

   Install caps on the elbows of the other pump not being tested.

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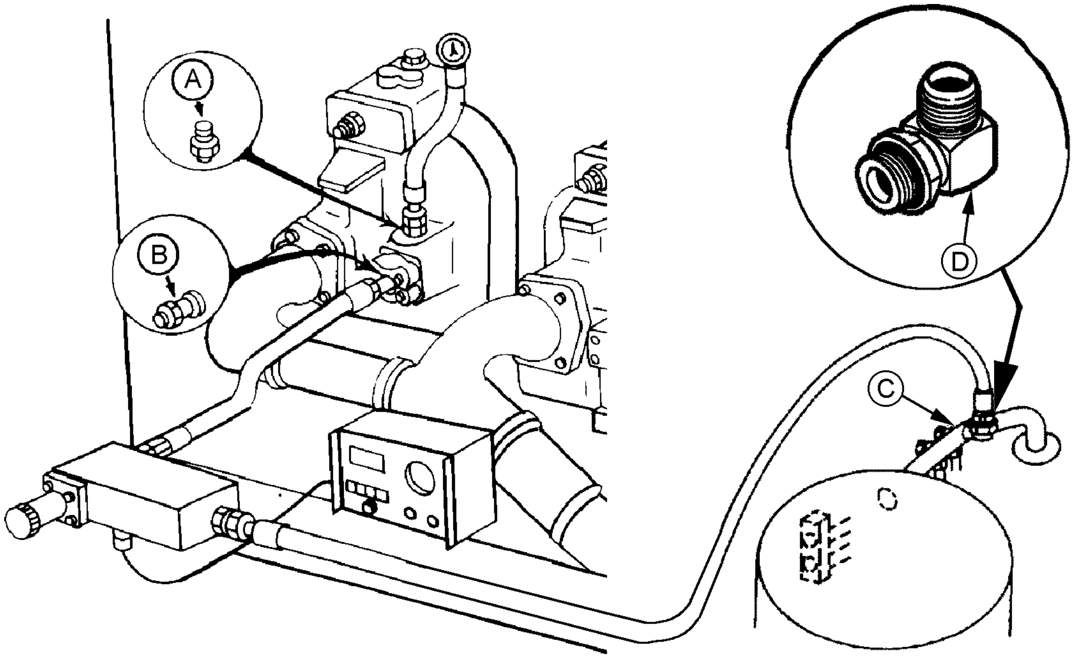
CED,TX08227,3144 –19–29MAY98–3/6



T115664

5. Connect the flow meter to the outlet of the pump being tested using a split flange fitting (B) or a 45° split flange fitting.

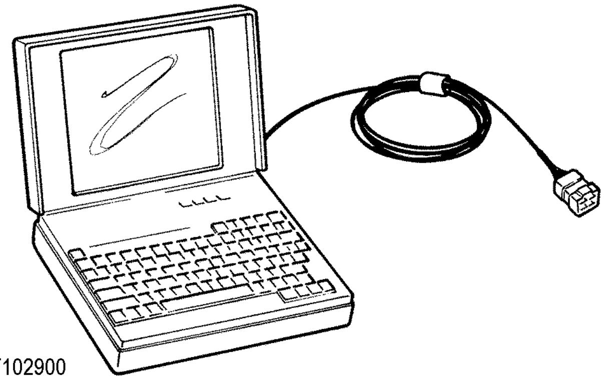
   Connect the return hose from flow meter to the return manifold (C) using an elbow (D).

Install plates, from the split flange connector plate kit, on end of hose to control valve.

Continued on next page

CED,TX08227,3144 –19–29MAY98–4/6

6. To monitor pump delivery pressure, use the pressure gauge on flow meter. As an alternative, use the laptop computer with excavator diagnostics program (See the installation procedure in this group.), the digital pressure and temperature analyzer with transducers, or gauges. For the analyzer or gauges install adapter (A) and male quick couples to test port in pump housing,



T102900

T102900 –19–29AUG96

7. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

8. Use the laptop computer with excavator diagnostics program to monitor engine speed or install a tachometer. (See JT05801 Clamp-On Electronic Tachometer Installation in this group.)

9. Check that the flow meter loading valve is open.

10. Heat the hydraulic oil to the specified temperature by closing flow meter loading valve to increase pressure to approximately 20 685 kPa (207 bar) (3000 psi).

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

11. Operate the machine at specification.

Engine—Specification

Speed .... 2000 ± 10 rpm

Work Mode Selector—Specification

Position.. Dig Mode

E Mode Switch—Specification

Position.. Off

HP Mode Switch—Specification

Position.. Off

Auto-Idle Switch—Specification

Position.. Off

Continued on next page

12. Adjust the flow meter loading valve to obtain the specified test pressures.

13. Adjust engine speed to the specified rpm.

14. Record pump flow at each pressure.

    If pump flow in low, repair or replace pump. (See procedure in Group 3360.)

One New Pump—Specification

Flow Rate .... 265 ± 4 L/min (70 ± 1 gpm)
typical flow at 13 790 kPa (138 bar) (2000 psi)
Flow Rate .... 235 ± 4 L/min (62 ± 1 gpm)
typical flow at 20 685 kPa (207 bar) (3000 psi)

One Used Pump—Specification

Flow Rate .... 212 ± 15 L/min (56 ± 4 gpm)
minimum flow at 13 790 kPa (138 bar) (2000 psi)
Flow Rate .... 189 ± 15 L/min (50 ± 4 gpm)
minimum flow at 20 685 kPa (207 bar) (3000 psi)

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CED,TX08227,3144 –19–29MAY98–6/6

PILOT PUMP FLOW TEST

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	2000 ±10 rpm
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Pilot Pump Flow Rate	25.0 L/Min (6.6 gpm) minimum flow at 3925 kPa (39 bar) (570 psi)

SERVICE EQUIPMENT AND TOOLS
Flow Meter
JT05801 Clamp-On Electronic Tachometer
JT05800 Digital Thermometer

Test will determine the condition of pilot pump. The pump is driven at engine speed. Inspect pilot filter and suction screen for indications of hydraulic system problems.

1. Stop the engine.

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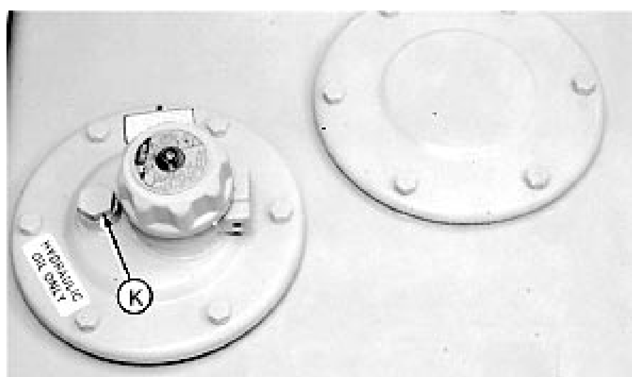
CED,TX08227,3145 –19–29MAY98–1/4

2. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.



T109340 –UN–29APR97

K—Vent Plug

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CED,TX08227,3145 –19–29MAY98–2/4

3. Connect flow meter in series with pilot pressure inlet line (A) at pilot filter (B). Open the flow meter loading valve.

4. Install the tachometer. (See JT05801 Clamp-On Electronic Tachometer Installation in this group.)

5. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

6. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

NOTE: The pilot pressure regulating valve will regulate pump discharge pressure. It is not necessary to load the pump using flow meter loading valve.

7. Run engine at test specifications.

Engine—Specification

Speed .... 2000 ±10 rpm

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

Position .... Off

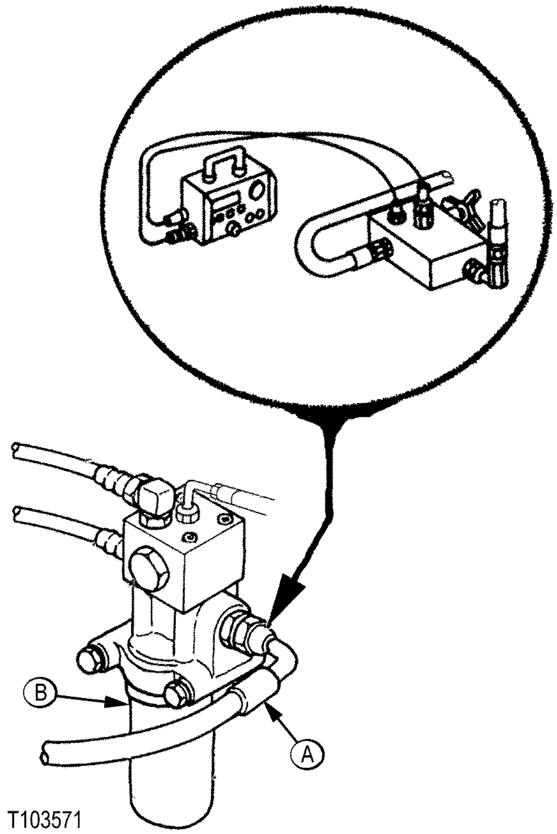
Auto-Idle Switch—Specification

Position .... Off

8. Record flow meter reading.

Pilot Pump—Specification

Flow Rate .... 25.0 L/Min (6.6 gpm) minimum flow at 3925 kPa (39 bar) (570 psi)



T103571 –UN–11SEP96

A—Pilot Pressure Inlet Line (3/4-16 F 37° Sw Fitting)
B—Pilot Filter

Continued on next page

Tests

If pressure is low, check the pilot pressure regulating valve.

If flow is low, check inlet hose to pump for restriction. If there is no restriction, replace pump.

CED,TX08227,3145 –19–29MAY98–4/4

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PROPEL SYSTEM TRACKING TEST

SPECIFICATIONS	
Course Length	20 m (65 ft) plus 3—5 m (10—15 ft)
Track Sag	340—380 mm (13-3/8—15 in.)
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Propel Speed Switch Position	Slow (Turtle) and Fast (Rabbit)
Mistrack Distance	200 mm (7-7/8 in.) or less at 20 m (65 ft)

SERVICE EQUIPMENT AND TOOLS
Tape Measure
JT05800 Digital Thermometer

Test is used to check the overall condition of the propel system from the hydraulic pumps to the propel motors.

1. Lay out a course on a hard flat surface plus an additional length at each end for acceleration and deceleration. Mark a straight line the length of course.

Course—Specification

Length.. 20 m (65 ft) plus 3—5 m (10—15 ft)

2. Adjust the track sag so both side are equal and within specification before doing test. (See Adjust Track Sag in Group 9020-20.)

Track—Specification

Sag .... 340—380 mm (13-3/8—15 in.)

3. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

4. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Continued on next page

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

5. Run the machine at specifications.

Engine—Specification

Speed .... Fast Idle

Work Mode Selector—Specification

Position.. Dig Mode

E Mode Switch—Specification

Position.. Off

HP Mode Switch—Specification

Position.. Off

Auto-Idle Switch—Specification

Position.. Off

Propel Speed Switch—Specification

Position.. Slow (Turtle) and Fast (Rabbit)

6. Lower the boom so bucket is approximately 300—500 mm (12—20 in.) off the ground with the arm retracted and the bucket curled.

7. Start propelling with the machine at the end of course and the tracks aligned with the straight line. Actuate the propel pilot controller to full stroke.

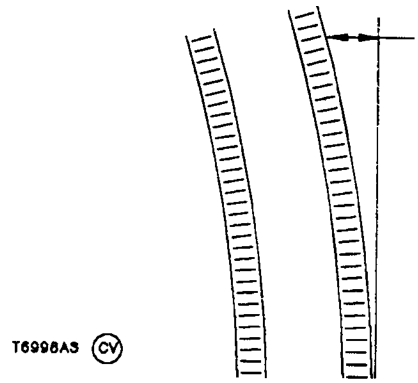
Continued on next page CED,TX08227,3146 –19–29MAY98–2/3

8. Measure the amount of mistrack from the straight line to the track at the 20 m (65 ft) mark. The amount of mistrack has a tendency to be less if done on a concrete surface.

Mistrack—Specification

Distance.. 200 mm (7-7/8 in.) or less at 20 m (65 ft)

9. Turn the upperstructure 180 degrees and repeat procedure for reverse propel.



T6998AS –UN–23MAR89

CED,TX08227,3146 –19–29MAY98–3/3

CYLINDER DRIFT TEST—BOOM, ARM, AND BUCKET

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Arm Length	3.2 m (10 ft 6 in.)
Bucket Capacity	1.76 m^3 (2.3 yd^3)
Bucket Load Weight	2190 kg (4830 lb) approximate
Arm Cylinder Length	50 mm (2.00 in.) approximate extension
Bucket Cylinder Length	50 mm (2.00 in.) approximate retraction
Boom Cylinders Height	Bucket pivot pin at the same height as boom-to-main frame pin
Engine Speed	Off
Boom Cylinder Drift	20 mm (13/16 in.) maximum allowable for 5 minutes
Arm Cylinder Drift	30 mm (1-3/16 in.) maximum allowable for 5 minutes
Bucket Cylinder Drift	20 mm (13/16 in.) maximum allowable for 5 minutes
Bottom of Bucket to Ground Drift	150 mm (6 in.) maximum allowable for 5 minutes

ESSENTIAL TOOLS
JT05800 Digital Thermometer
Tape Measure

Procedure is used to check the leakage past the cylinder piston seals, control valve spools, circuit relief valves, boom reduced leakage valve, and arm reduced leakage valve.

1. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

2. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

3. Fill the bucket to get the specified bucket load with the standard arm and bucket.

Arm—Specification

Length .... 3.2 m (10 ft 6 in.)

Bucket—Specification

Capacity .... 1.76 m^3 (2.3 yd^3)

Bucket Load—Specification

Weight .... 2190 kg (4830 lb) approximate

Continued on next page CED,TX08227,3147 –19–30MAY98–1/2

4. Position arm cylinder so rod is extended the specified length from full retraction.

Arm Cylinder—Specification

Length.. 50 mm (2.00 in.) approximate extension

5. Position bucket cylinder so rod is retracted the specified length from full extension.

Bucket Cylinder—Specification

Length.. 50 mm (2.00 in.) approximate retraction

6. Position the boom cylinders so bucket pivot pin is at the same height as the boom-to-main frame pin.

Boom Cylinders—Specification

Height .... Bucket pivot pin at the same height as boom-to-main frame pin

7. Stop the engine.

Engine—Specification

Speed .... Off

8. After 5 minutes, measure the amount of movement for boom, arm and bucket cylinders and from bottom of bucket to the ground.

Boom Cylinder—Specification

Drift .... 20 mm (13/16 in.) maximum allowable for 5 minutes

Arm Cylinder—Specification

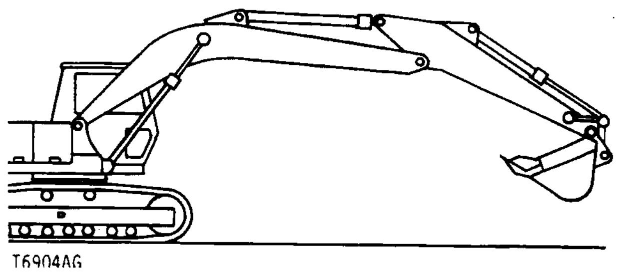
Drift .... 30 mm (1-3/16 in.) maximum allowable for 5 minutes

Bucket Cylinder—Specification

Drift .... 20 mm (13/16 in.) maximum allowable for 5 minutes

Bottom of Bucket to Ground—Specification

Drift .... 150 mm (6 in.) maximum allowable for 5 minutes



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CED,TX08227,3147 –19–30MAY98–2/2

SWING MOTOR LEAKAGE TEST

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine	Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
New Swing Motor While Swinging Leakage	2 L/min (0.53 gpm)
New Swing Motor While Stalled Leakage	31 L/min (8.2 gpm)

ESSENTIAL TOOLS
JT03023 (9/16-18 F 37°) (Parker No. X06CP-6) Cap

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer
Calibrated Container

Purpose of test is to check the efficiency of swing motor. Leakage can occur between the cylinder block and valve plate, and the slippers and swash plate when parts are worn or damaged. Motor must be checked in more than one position in order to check all pistons and the circumference of valve plate and cylinder block.

1. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

2. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

Hydraulic Oil—Specification

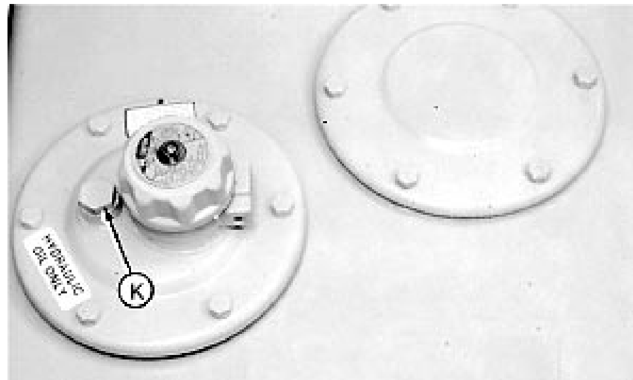
Temperature .... 50 ± 5°C (120 ± 10°F)

3. Stop the engine.

Continued on next page

CED,TX08227,3148 –19–30MAY98–1/4

4. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.



K—Vent Plug

Continued on next page

CED,TX08227,3148 –19–30MAY98–2/4

5. Disconnect swing motor drain line (A) at the return manifold (B). Install a cap on elbow. Put drain line in a calibrated container.

CAUTION: To avoid personnel injury, clear area of all bystanders before doing test. Slowly swing through one complete revolution to ensure that the area is clear of objects before doing test.

6. Raise and lower boom to pressurize hydraulic tank.

7. Operate the machine at specifications.

Engine—Specification

Engine.. Fast Idle

Work Mode Selector—Specification

Position.. Dig Mode

E Mode Switch—Specification

Position.. Off

HP Mode Switch—Specification

9025
25
138

Position.. Off

Auto-Idle Switch—Specification

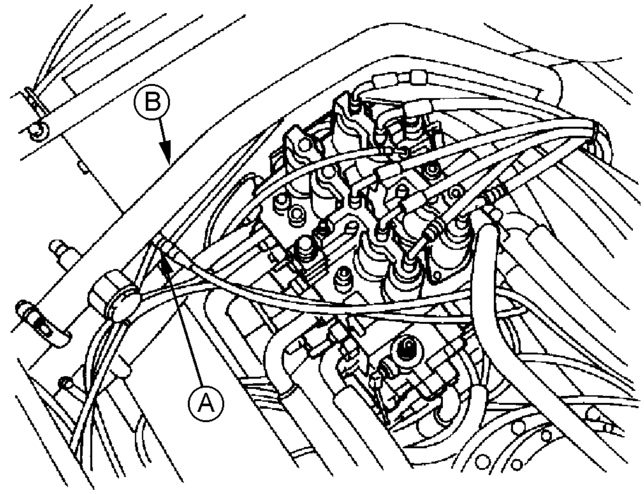
Position.. Off

8. Operate swing function for one minute. Record the amount of leakage. Repeat for swing in opposite direction.

9. Operate swing function at stall for one minute. Put the bucket against an immovable object or in a trench then hold swing control lever fully actuated to stall swing function. Record the amount of leakage.

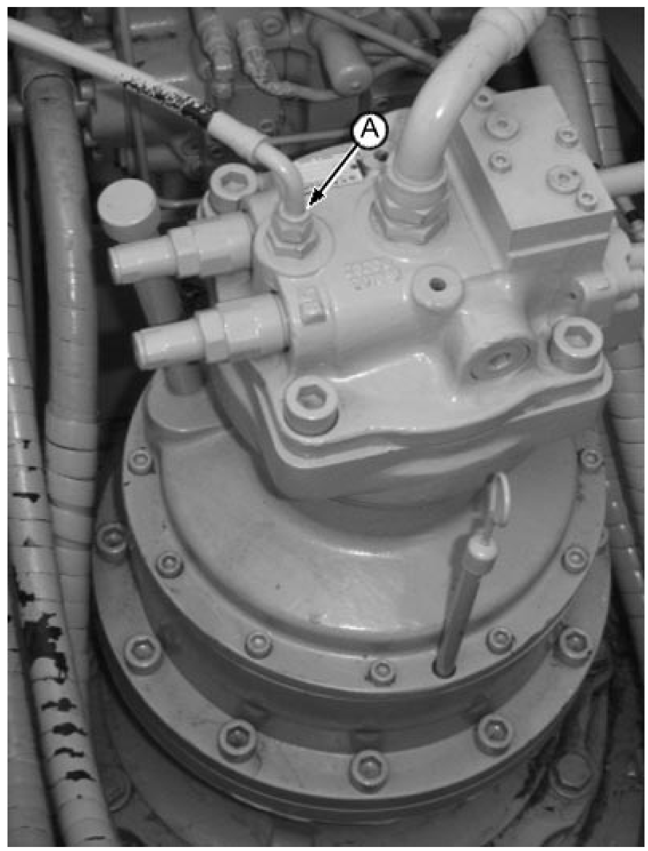
   Repeat procedure by stalling the motor in several position. Repeat procedure in the opposite direction.

10. Compare amount of leakage to specifications.



T115668

T115668 –UN–01JUN98



T109982C –UN–26MAY98

A—Swing Motor Drain Line

Continued on next page

Swing Motor While Swinging—Specification

Leakage .... 2 L/min (0.53 gpm) acceptable new

Swing Motor While Stalled—Specification

Leakage .... 31 L/min (8.2 gpm) acceptable new

If leakage is greater than the maximum specified, repair or replace swing motor. (See procedure in Group 4360.)

11. Connect drain line to return manifold.

CED,TX08227,3148 –19–30MAY98–4/4

PROPEL MOTOR LEAKAGE TEST

SPECIFICATIONS	
Hydraulic Oil Temperature	50 ± 5°C (120 ± 10°F)
Engine Speed	Fast Idle
Work Mode Selector Position	Dig Mode
E Mode Switch Position	Off
HP Mode Switch Position	Off
Auto-Idle Switch Position	Off
Propel Speed Switch Position	Slow Speed (Turtle)
Propel Motor While Propelling With Track Raised Leakage	3.0 L/min (0.79 gpm) typical new
Propel Motor While Stalled Leakage	6 L/min (1.58 gpm) typical new

ESSENTIAL TOOLS
JT03025 (3/4-16 F 37°) (Parker No. X06CP-8) Cap
JT03221 (3/4-16 M 37°) (Parker No. X03CP-8) Plug

SERVICE EQUIPMENT AND TOOLS
JT05800 Digital Thermometer
Calibrated Container
90 mm (3-1/2 in.) OD Pin or Length of Round Bar Stock (2 used)

1. Install the temperature probe on the hydraulic tank-to-pump suction line. (See JT05800 Digital Thermometer Installation in this group.)

2. Heat hydraulic oil to the specified temperature. (See Hydraulic System Warm-Up Procedure in this group.)

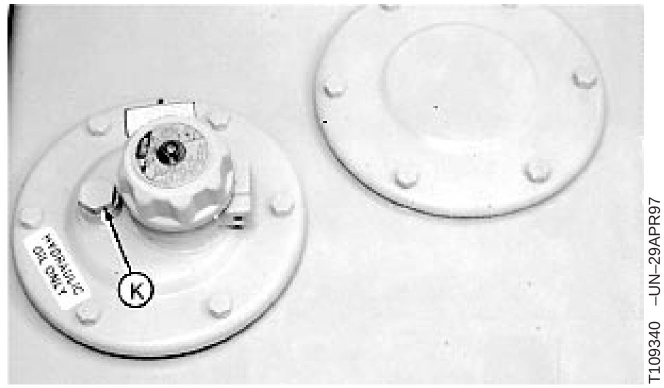
Hydraulic Oil—Specification

Temperature .... 50 ± 5°C (120 ± 10°F)

3. Stop the engine.

Continued on next page CED,TX08227,3149 –19–30MAY98–1/5

4. Loosen vent plug (K) to release the air pressure in hydraulic oil tank.



K—Vent Plug

Continued on next page CED,TX08227,3149 –19–30MAY98–2/5

5. Disconnect the drain line (A) from 90° elbow (D) at return manifold (E). Put line in a calibrated container (D). Install a cap (B) on the elbow.

6. Raise track off the ground for side being check.

7. Run machine at specifications.

Engine—Specification

Speed .... Fast Idle

Work Mode Selector—Specification

Position .... Dig Mode

E Mode Switch—Specification

Position .... Off

HP Mode Switch—Specification

Position .... Off

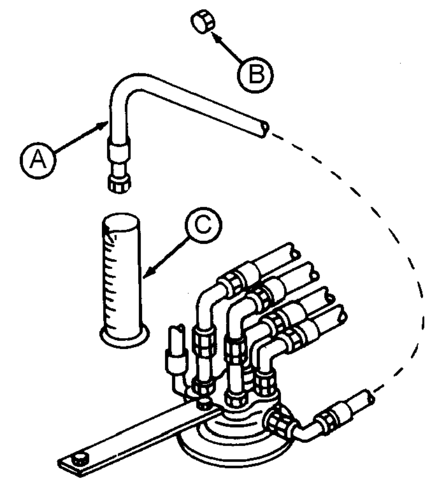
Auto-Idle Switch—Specification

Position .... Off

Propel Speed Switch—Specification

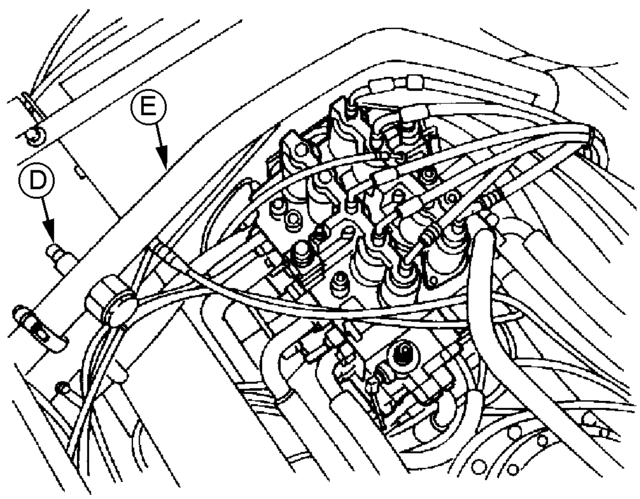
Position .... Slow Speed (Turtle)

8. For propel motor being checked, actuate propel forward function at full speed for one minute. Record amount of leakage. Repeat procedure for reverse.



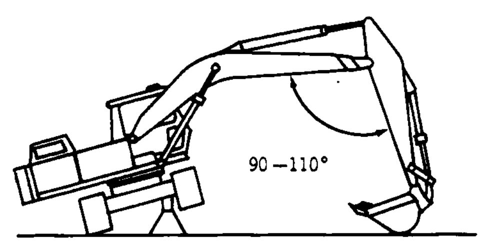
T115666

T115666 –UN–01JUN98



T115667

T115667 –UN–01JUN98



T6876FG –UN–06DEC88

A—Drain Line
B—JT03025 Cap
C—Calibrated Container
D—90° Elbow
E—Return Manifold

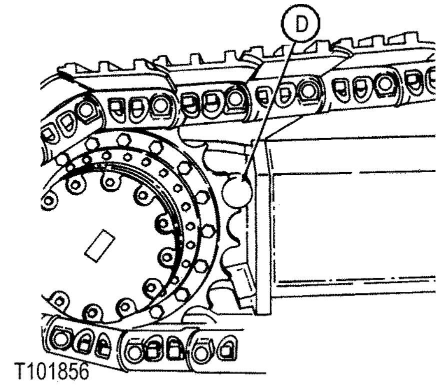
Continued on next page

9. To check propel motor for leakage at stall, install pins or round bar stock (D) between the sprocket and track frame.

   Actuate propel pedal for function being checked to full stroke for one minute.

   Repeat procedure by stalling the propel motor in several positions and then take an average of readings. Repeat procedure for the opposite direction.

10. Compare amount of leakage to specifications.



T101856 –UN–02JUL96

Propel Motor While Propelling With Track Raised—Specification

Leakage .... 3.0 L/min (0.79 gpm) typical new

Propel Motor While Stalled—Specification

Leakage .... 6 L/min (1.58 gpm) typical new

If leakage is more than specification, repair or replace motor.If leakage is substantially more in one direction than the other, a seal in the rotary manifold may be leaking. To isolate leakage to the propel motor or rotary manifold, check leakage at the propel motor.

Continued on next page

CED,TX08227,3149 –19–30MAY98–4/5

11. Disconnect drain line (A) at propel motor. Install a plug in the line.

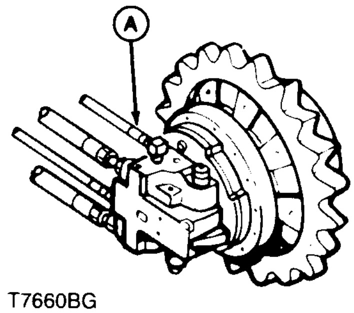
12. Connect a line to fitting on motor. Put line in a calibrated container.

13. Repeat the procedure. Run machine at specifications.

14. For propel motor being checked, actuate propel function at full speed for one minute and then operate the propel motor at stall.

    Record amount of leakage. Repeat procedure for reverse.

    If leakage is more than specification, repair or replace motor. If leakage is within specification, repair or replace rotary manifold.



T7660BG –UN–11DEC91

A—Propel Motor Drain Line

CED,TX08227,3149 –19–30MAY98–5/5

BOOM CYLINDER CONTROLLED LOAD LOWERING VALVE TEST

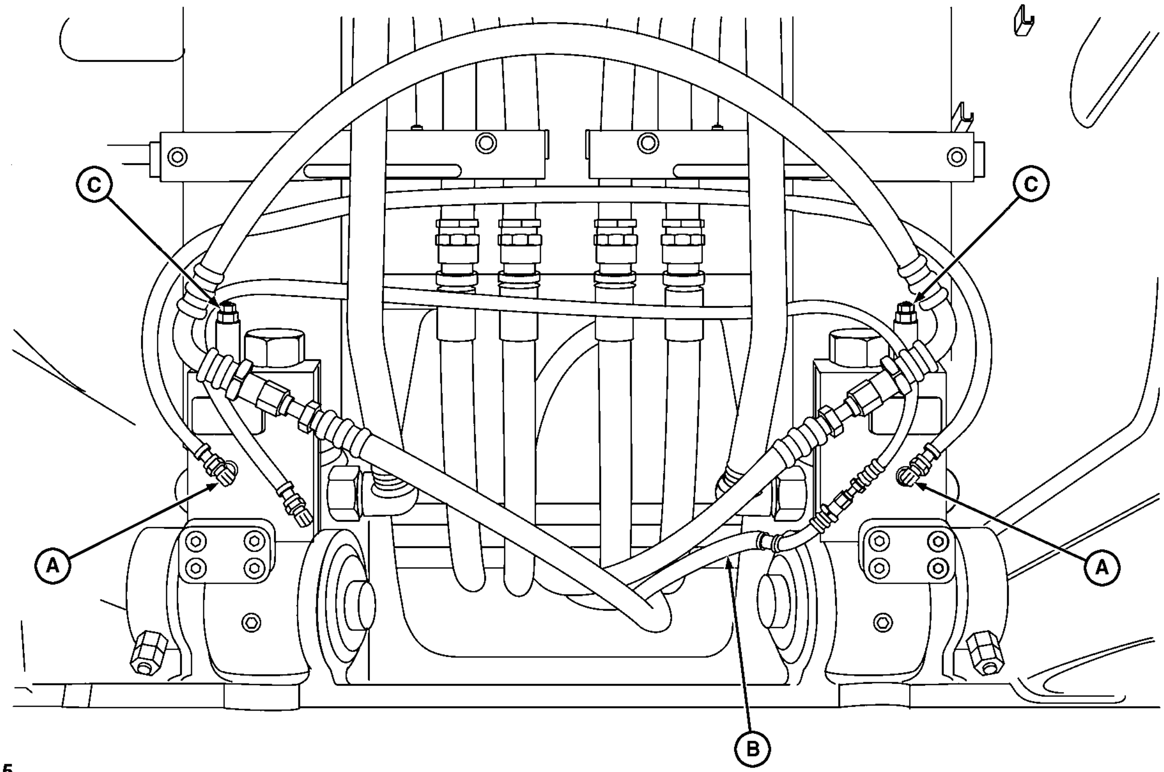
Specifications	
Circuit Relief Pressure	5400 psi

SERVICE EQUIPMENT AND TOOLS
Gauge 70000 kPa (700 bar) (10000 psi)
AT126362 T-fitting

Test is used to measure circuit relief pressure at the load lowering valves.

Continued on next page

CED,OUOE020,3 –19–13APR99–1/2



T121165

T121165 –UN–19APR99

A—Pressure Port
B—Pilot Hose
C—Pressure Relief Valve Adjusting Screw and Jam Nut

1. Connect a pressure gauge and T-fitting between both load lowering valves at pressure port (A).

2. Place a heavy load on the bucket.

3. Extend the boom arm all the way out.

4. Disconnect and plug pilot hose (B).

5. Move boom lever to the down position to force the load lowering valve over relief.

6. Record the relief pressure reading.

Circuit Relief—Specification

Pressure... 37232 kPa (372 bar) (5400 psi)

7. If circuit relief pressure is below specifications, the circuit relief valves need to be reset.

   a. Loosen the jam nut (C) on the circuit relief valve.

   b. Turn adjusting screw (C) in to increase circuit relief pressure.

   c. Hold adjusting screw and then tighten the jam nut.

8. Check the pressure setting again.

CED,OUOE020,3 –19–13APR99–2/2

CHAPTER 7

SECTION 9031

AIR CONDITIONING SYSTEM

BLANK

Group 05
Theory of Operation

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: To meet government standards relating to the use of refrigerants, R134a is used in the air conditioning system. Because it does not contain chlorine, R134a is not detrimental to the ozone in the atmosphere. However, it is illegal to discharge any refrigerant into the atmosphere. It must be recovered using the appropriate recovery stations.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerants, hoses, fittings, components or refrigerant oils.

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,UU3135 –19–13AUG96–1/1

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.

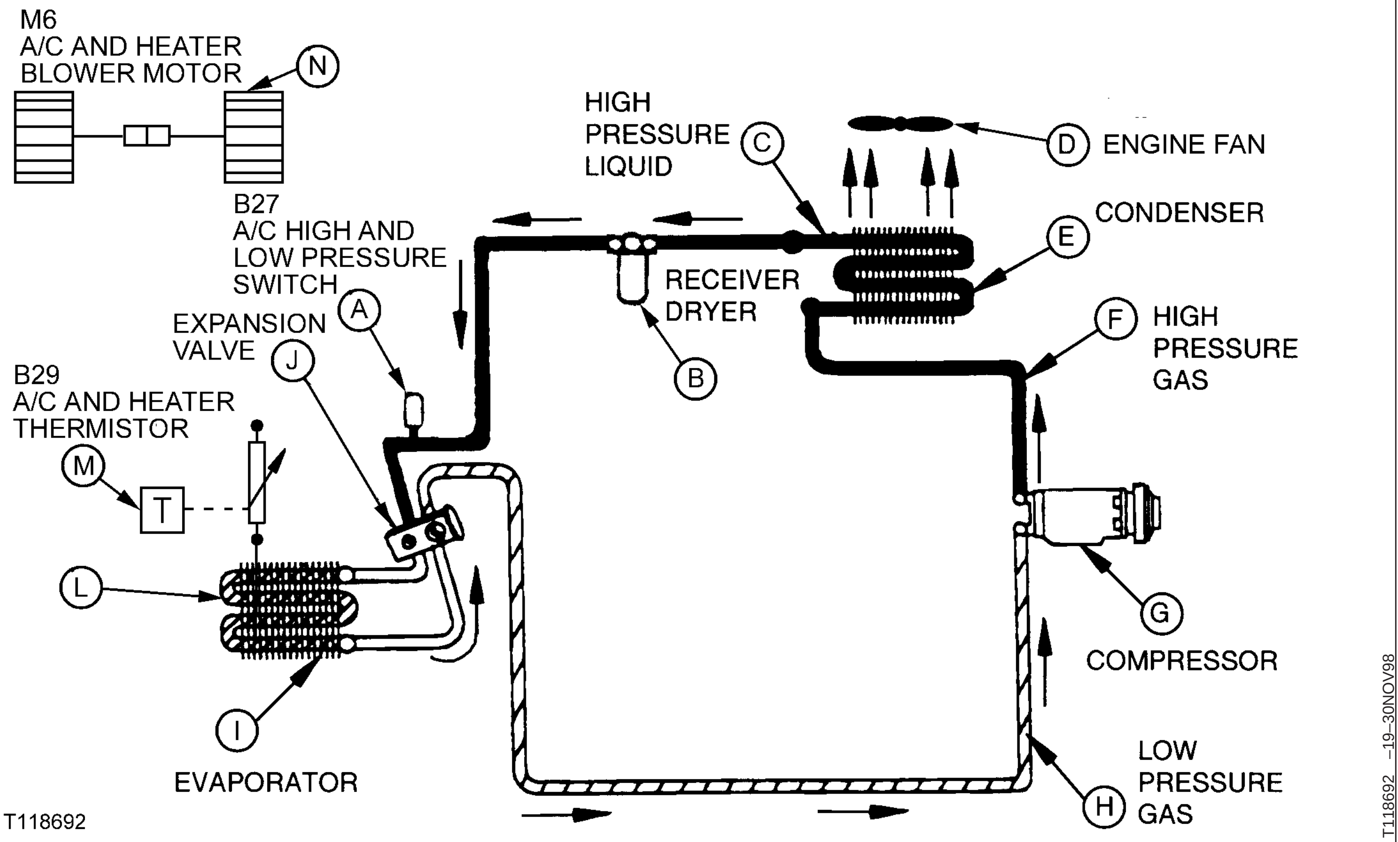
DO NOT handle damp refrigerant container with your bare hands. Skin may freeze to container. Wear gloves.

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,UU3136 –19–13AUG96–1/1

REFRIGERANT THEORY OF OPERATION



A—B27 A/C High and Low Pressure Switch	**E—Condenser**	**J—Expansion Valve**	**N—M6 A/C and Heater Blower Motor**
B—Receiver/Dryer	**F—High Pressure Gas**	**K—Not Used**	
C—High Pressure Liquid	**G—Compressor**	**L—Low Pressure Liquid**	
D—Engine Fan	**H—Low Pressure Gas**	**M—B29 A/C Heater Thermistor**	
	I—Evaporator		

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2

The compressor (G) draws low pressure gas (H) from the evaporator (I) and compresses it into high pressure gas (F). This causes the temperature of the refrigerant to rise higher than that of the outside air.

High pressure gas leaves the compressor and is sensed by the high pressure part of the B27 A/C high and low pressure switch (A). The switch monitors refrigerant pressure. If the pressure becomes too high, the switch will open and stop the compressor, interrupting the cycle.

As the high pressure gas flows through the condenser (E), heat is removed and transferred to the outside air being drawn through the condenser core by the condenser fan (D). Cooling the refrigerant causes it to condense and it leaves the condenser as a high pressure liquid (C). The high pressure liquid flows into the receiver-dryer (B) where moisture and contaminants (acid, solids, etc.) are removed. The receiver-dryer also acts as a reservoir for refrigerant.

The refrigerant flows from the receiver-dryer to the expansion valve (J) and is sensed by the low pressure part of the B27 A/C high and lower pressure switch (A). The switch monitors refrigerant pressure. If the pressure becomes too low from refrigerant loss, the switch will open and stop the compressor, interrupting the cycle.

Continued on next page TX,9031,UU3137 –19–13AUG96–1/2

The actual cooling and drying of cab air takes place at the evaporator. Flow of the high pressure liquid refrigerant is controller by the expansion valve. The expansion valve causes the temperature and pressure of the refrigerant to drop, where it becomes a low pressure liquid (L). The expansion valve is a valve that uses a variable orifice to control the flow of high pressure liquid refrigerant into the evaporator to maintain a constant pressure and temperature.

The M6 A/C and heater blower motor (N) pulls a mixture of warm cab and outside air through the evaporator where it is cooled by the refrigerant. The heat absorbed by the evaporator causes the refrigerant to vaporize into a low pressure gas.

A freeze control switch (M) senses temperature of the evaporator coil through a refrigerant filled capillary tube. The switch closes when the evaporator is above the switch setting and opens when the evaporator is cooled to the switch setting. The switch has a low temperature setting that prevents the evaporator from becoming cold enough to freeze moisture that condenses on the coil.

The B28 A/C and heater thermistor senses temperature of the evaporator coil through a refrigerant filled capillary tube.

The moisture, from the warm air, is condensed as it contacts the cool evaporator coil during the cooling process and is drained away through drain tubes connected to the drain pan under the evaporator. With the cab air cooled and dehumidified, the refrigerant cycle is complete.

TX,9031,UU3137 –19–13AUG96–2/2

HEATER AND AIR CONDITIONER CIRCUIT OPERATIONAL INFORMATION

The following conditions must exist for air conditioning circuit to function:

- Key switch On
- Machine running
- Air conditioning switch turned On
- Any of the four blower motor On speeds selected on air conditioner controller

TX,9031,UU3138 –19–13AUG96–1/1

HEATER AND AIR CONDITIONER CIRCUIT THEORY OF OPERATION

Power flows from the A/C Controller and Relays 5 amp Fuse to the air conditioner controller and energizes the following relays:

- A/C compressor clutch relay (K25)
- A/C blower motor (medium low speed) relay (K26)
- A/C blower motor (medium speed) relay (K27)
- A/C blower motor (high speed) relay (K28)
- A/C blower motor and main power (low speed) relay (K24)

Power from the blower motor 20 amp fuse is applied to terminal 1 of the A/C compressor clutch relay (K25).

Power from the 20 amp fuse also goes through the A/C blower motor and main power (low speed) relay to operate the A/C and heater blower motor (M6).

The air conditioner controller (A3) operates the blower motor in four different speeds:

- Low speed
- Medium low speed
- Medium speed
- High speed

When any of the first three speeds is selected, power flows through the dropping resistor block (R11) and then to the blower motor. When the high speed is selected, the resistor block is bypassed and the blower motor operates at maximum speed.

With air conditioning switch turned ON in the air conditioner controller, power flows to the A/C high and low pressure switch (B27). The switch (B27) contains both a low pressure switch and a high pressure switch. With low pressure switch closed, power flows through high pressure switch. With high pressure switch closed, power flows through the A/C compressor clutch relay (K25) to operate the A/C compressor clutch (Y1).

The low pressure switch opens if the air conditioning system loses its refrigerant charge. The switch opens to stop current flow to the compressor, which prevents compressor engagement.

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, will open to stop current flow to the compressor clutch.

The A/C and heater thermistor (B29) is used to sense the temperature in the evaporator core. When the temperature in the evaporator core raises, the blower thermistor senses the warmer temperature and the air conditioner controller applies voltage to the compressor.

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TX,9031,UU3139 –19–13AUG96–1/1

FOLDOUT PAGE 7-5 IS AT REAR OF MANUAL

RECEIVER/DRYER OPERATION

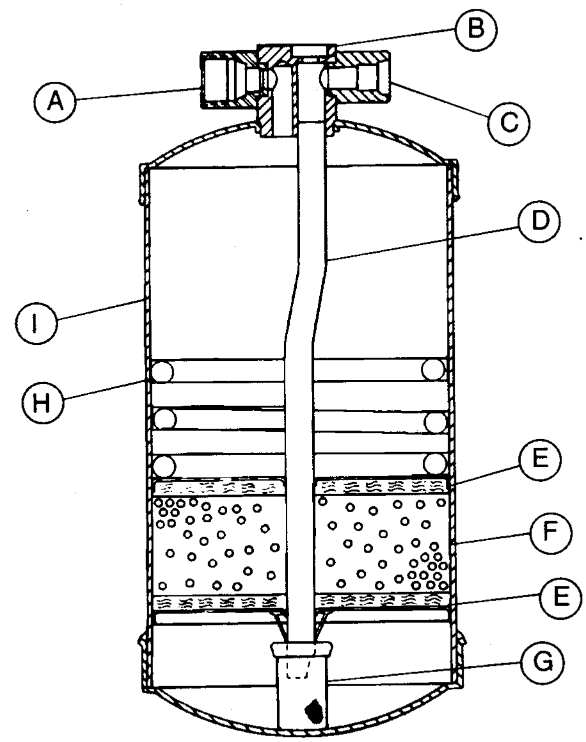
The receiver/dryer is a reservoir to store excess liquid refrigerant in the system. Excess refrigerant is required for two reasons:

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.

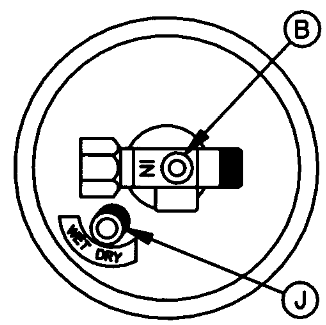
The receiver/dryer also contains two filters (E) and desiccant (F) between the filters. The filters remove solid materials which could be generated by a compressor failure, debris left in the system due to improper service procedures, or particles caused by corrosion of metal parts due to moisture and 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

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Continued on next page

TX,9031,UU3144 –19–13AUG96–1/2

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,UU3144 –19–13AUG96–2/2

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,UU3146 –19–13AUG96–1/1

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,9031,UU3147 –19–13AUG96–1/1

Group 10
System Operational Checks

HEATING AND 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. The technical manual group 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)

CED,OUOE012,172 –19–13APR99–1/1

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

System Operational Checks

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

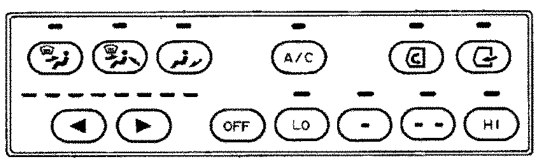
AIR CONDITIONER COMPRESSOR CHECK	Engine OFF. Inspect compressor. Is compressor drive belt tight? Is belt in good condition? Is belt tightening strap straight? Is compressor belt pulley in good condition? Are compressor to bracket and bracket to engine mounting cap screws tight? Is compressor pulley aligned 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

System Operational Checks

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

SYSTEM OPERATING CHECKS

– – –1/1

BLOWER MOTOR CHECK	 T103130 T103130 –19–29AUG96 Engine OFF. Key switch ON. Press blower motor switch to select each of the four speeds. Does fan operate in four speeds? Does air exit from ducts?	**YES:** Check complete. **NO:** See Circuit Checks in this group. Check wiring harness. – – –1/1

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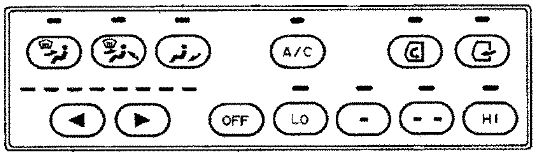
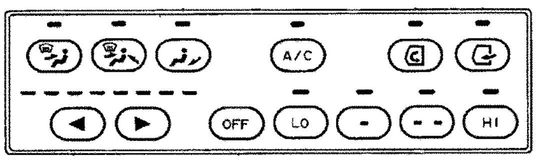
System Operational Checks

HEATER	 T103130 T103130 –19–29AUG96 Start engine and allow to warm several minutes. Press heater temperature switch to maximum heat position. Press blower switch to high speed position. Does warm air exit from ducts?	**YES:** Check complete. **NO:** See Circuit Checks in this group. Check wiring harness. – – –1/1

AIR CONDITIONER	 T103130 T103130 –19–29AUG96 Start engine and run at fast idle. Press air conditioner switch to ON position. Press blower switch to high speed position. 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 this group. See Charging the system in Group 9031-20. – – –1/1

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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

System Operational Checks

HEATER AND AIR CONDITIONER CIRCUIT CHECKS

– – –1/1

BLOWER MOTOR 20 AMP FUSE (F13) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace fuse. If fuse blows again, check for short.

– – –1/1

A/C CONTROLLER AND RELAYS 5 AMP FUSE (F14) CHECK	Remove fuse block cover. Remove fuse from fuse block. Using ohmmeter, check fuse for continuity. Is continuity measured?	**YES:** Fuse is OK. **NO:** Replace fuse. If fuse blows again, check for short.

– – –1/1

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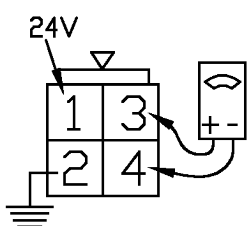
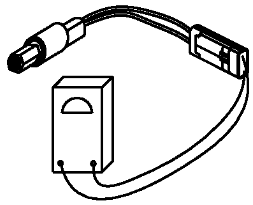
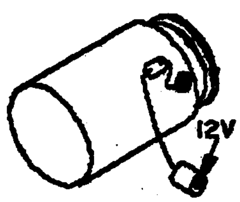
AIR CONDITIONER RELAY (K24, K25, K26, K27 AND K28) CHECK	 T118624 –UN–23NOV98 Disconnect harness from relay. Connect 24 volts to relay terminal 1 and ground terminal 2. Does relay click? Connect ohmmeter to terminals 3 and 4. Does ohmmeter read continuity?	**YES:** Relay is OK. **NO:** Relay has failed. Replace.

– – –1/1

System Operational Checks

AIR CONDITIONER HIGH AND LOW PRESSURE SWITCH (B27) CHECK	 T101619 –19–13JUN96 Disconnect harness from switch. Check for continuity between terminals. Is continuity measured?	**YES:** Switch is good. **NO:** Go to High and Low Pressure Switch Test, Group 9031-25. – – –1/1

A/C AND HEATER BLOWER MOTOR (M6) CHECK	Disconnect harness from blower motor. Ground blk/red wire terminal in connector. Connect 24 volts to red/wht wire pin in connector. Does blower motor operate in high speed?	**YES:** Blower motor is good. Check wiring harness. **NO:** Replace blower motor. – – –1/1

AIR CONDITIONING COMPRESSOR CLUTCH (Y1) CHECK	 T6534CV –UN–19OCT88 Disconnect harness from clutch. Connect battery voltage to clutch connector pin that has black/yellow wire. Ground black wire pin. Does clutch "click"?	**YES:** A/C compressor clutch coil is good. Check wiring harness. **NO:** Replace clutch coil. – – –1/1

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Group 15
Diagnostic Information

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	A/C controller and relays 5 amp fuse (F14)	Replace fuse.
	Blower motor 20 amp fuse (F13)	Replace fuse, Group 9031-10.
	Air conditioner relays (K24, K25, K26, K27, or K28)	Check air conditioner relays, Group 9031-10.
	A/C high and low pressure switch (B27)	Check high and low pressure switch, Group 9031-10.
	A/C and heater blower motor (M6)	Check A/C and heater blower motor, Group 9031-10.
	Compressor clutch (Y1)	Check compressor clutch, Group 9031-10.

TX,9031,UU3149 –19–13AUG96–1/1

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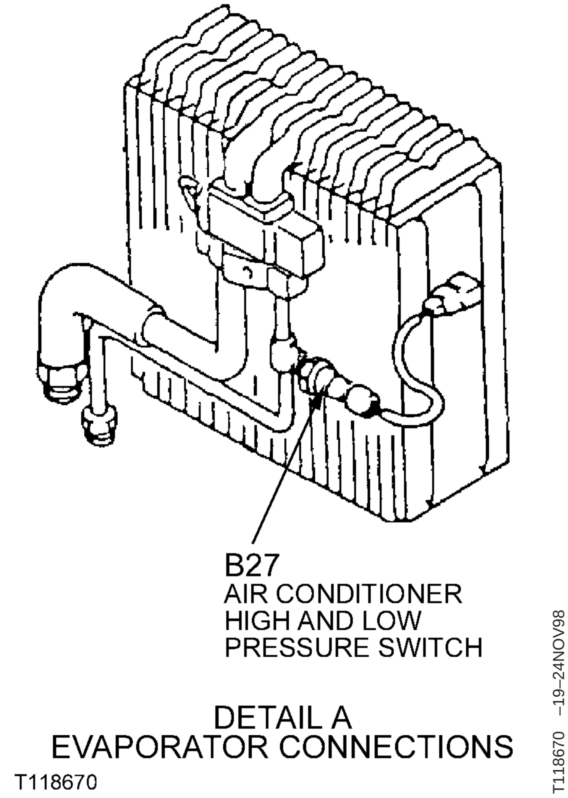
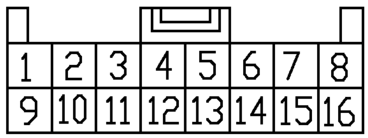


Air Conditioner Harness (W9) Component Location--Detail A

TX,9031,GG2243 –19–12SEP96–2/2

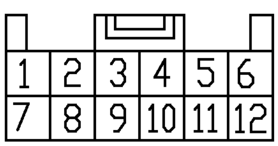
AIR CONDITIONER HARNESS (W9) CONNECTORS, WIRE AND PIN LOCATION

A3
AIR CONDITIONER CONTROLLER
(MADE UP OF X17 AND X18)



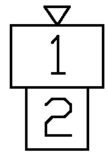
X17
AIR CONDITIONER CONTROLLER
CONNECTOR (16-PIN)

1	YEL
2	GRN
3	WHT
4	BLU
5	YEL/BLU
6	PNK
7	PLUG
8	PLUG
9	PNK/GRN
10	RED/WHT
11	ORG
12	PLUG
13	BRN/RED
14	BLK
15	PLUG
16	GRN/WHT



X18
AIR CONDITIONER CONTROLLER
CONNECTOR (12-PIN)

1	BLK/GRN
2	RED/YEL
3	BLK/BLU
4	RED/BLU
5	GRN/RED
6	BLU/GRN
7	LGRN
8	PLUG
9	PLUG
10	PLUG
11	PLUG
12	PLUG



B27
AIR CONDITIONER
HIGH AND LOW
PRESSURE SWITCH

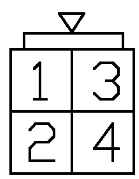
1	PNK
2	BRN

B29
AIR CONDITIONER
AND HEATER THERMISTOR

1	PNK/GRN
2	BRN/RED

M6
AIR CONDITIONER AND HEATER
BLOWER MOTOR

1	RED/WHT
2	BLK/RED



K24
AIR CONDITIONER BLOWER
MOTOR AND MAIN POWER
(LOW SPEED) RELAY

1	YEL
2	GRN
3	YEL (2MM)
4	RED/WHT

K25
AIR CONDITIONER
COMPRESSOR
CLUTCH RELAY

1	YEL
2	BRN
3	WHT/BLU
4	BLK/YEL

K26
AIR CONDITIONER BLOWER
MOTOR (LOW MEDIUM
SPEED) RELAY

1	YEL
2	WHT
3	WHT/RED
4	BLK

K27
AIR CONDITIONER BLOWER
MOTOR (MEDIUM SPEED)
RELAY

1	YEL
2	BLU
3	BLU/RED
4	BLK

K28
AIR CONDITIONER BLOWER
MOTOR (HIGH SPEED)
RELAY

1	YEL
2	YEL/BLU
3	BLK/RED
4	BLK

R11
AIR CONDITIONER AND HEATER
BLOWER MOTOR DROPPING
RESISTOR BLOCK

1	BLK/RED
2	BLU/RED
3	WHT/RED
4	BLK

CONNECTORS FOR AIR CONDITIONER HARNESS (W9)
(HARNESS CONNECTORS – FRONT VIEW SHOWN)

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Continued on next page

CED,OUTX782,5 –19–18NOV98–1/2

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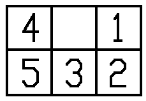


M9
AIR CONDITIONER
INTERNAL AND EXTERNAL
CAB AIR SERVOMOTOR

1	GRN/RED
2	BLU/GRN
3	
4	
5	

M10
AIR CONDITIONER
BLOWER PORT
CHANGE SERVOMOTOR

1	BLK/GRN
2	RED/YEL
3	ORG
4	LGRN
5	BRN/RED

M11
AIR CONDITIONER
AIR MIXER
SERVOMOTOR

1	BLK/BLU
2	RED/BLU
3	RED/WHT
4	GRN/WHT
5	BRN/RED

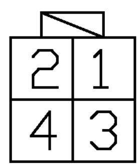
X17
AIR CONDITONER CONTROLLER
CONNECTOR (16-PIN)

SEE A3

X18
AIR CONDITIONER CONTROLLER
CONNECTOR (12-PIN)

SEE A3

Y1
AIR CONDITIONER
COMPRESSOR CLUTCH



X16
AIR CONDITIONER
TO CAB HARNESS CONNECTOR

1	YEL
2	BLK
3	BLK/YEL POWER TO Y1
4	YEL

CONNECTORS FOR AIR CONDITIONER HARNESS (W9)
(HARNESS CONNECTORS - FRONT VIEW SHOWN)

T118196

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Group 20
Adjustments

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: To meet government standards relating to the use of refrigerants, R134a is used in the air conditioning system. Because it does not contain chlorine, R134a is not detrimental to the ozone in the atmosphere. However, it is illegal to discharge any refrigerant into the atmosphere. It must be recovered using the appropriate recovery stations.

IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerants, hoses, fittings, components or refrigerant oils.

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,UU3151 –19–13AUG96–1/1

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,UU3152 –19–13AUG96–1/1

R134A COMPRESSOR OIL CHARGE CHECK

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 expansion 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,UU3153 –19–13AUG96–1/1

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,9031,UU3154 –19–13AUG96–1/1

R134A COMPONENT OIL CHARGE

SPECIFICATIONS	
New Compressor Oil Capacity	230 ± 20 mL (7.7 ± 0.7 fl oz)
Amount Of New Oil Capacity	100 mL (3.4 fl oz)
Flushed Compressor New Oil Capacity	330 ± 20 mL (11.1 ± 0.7 fl oz)
New Compressor, Drained Oil Capacity	45 mL (1.5 fl oz)
Used Compressor, Drained Oil Capacity	45 mL (1.5 fl oz)
Evaporator Oil Charge	130 mL (4.4 fl oz)
Condenser Oil Charge	65 mL (2.2 fl oz)
Receiver-Dryer Oil Charge	30 mL (1.0 fl oz)
Hoses Oil Charge	60 mL (2.0 fl oz) or 3 mL per 30 cm (0.1 fl oz per ft)
Hoses Approximate Total Length	600 cm (20 ft)

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 ± 0.7 fl oz).

New Compressor Oil—Specification

Capacity .... 230 ± 20 mL (7.7 ± 0.7 fl oz)

System requires an additional amount of new oil of 100 mL (3.4 fl oz) of new oil.

Amount Of New Oil—Specification

Capacity .... 100 mL (3.4 fl oz)

- Used compressor removed from operation, oil drained, and flushed requires 330 ± 20 mL (11.1 ± 0.7 fl oz) of new oil.

Flushed Compressor New Oil—Specification

Capacity .... 330 ± 20 mL (11.1 ± 0.7 fl oz)

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.

New Compressor, Drained Oil—Specification

Capacity .... 45 mL (1.5 fl oz)

(See Compressor Oil Removal procedure in this group)

Continued on next page

- 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, Drained Oil—Specification

Capacity .... 45 mL (1.5 fl oz)

- Used compressor removed from operation, oil drained, and flushed add 60 mL (2.0 fl oz) of new oil.
  Components listed which have been removed, drained or flushed, require the removal of the compressor to determine the correct oil charge. Use the chart as a guide for adding oil to components.

Evaporator—Specification

Oil Charge .... 130 mL (4.4 fl oz)

Condenser—Specification

Oil Charge .... 65 mL (2.2 fl oz)

Receiver-Dryer—Specification

Oil Charge .... 30 mL (1.0 fl oz)

Hoses—Specification

Oil Charge .... 60 mL (2.0 fl oz) or 3 mL per 30 cm (0.1 fl oz per ft)
Approximate Total Length .... 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.

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CED,TX14795,4338 –19–04MAR98–2/2

R134A REFRIGERANT RECOVERY, RECYCLING, AND CHARGING STATION INSTALLATION PROCEDURE

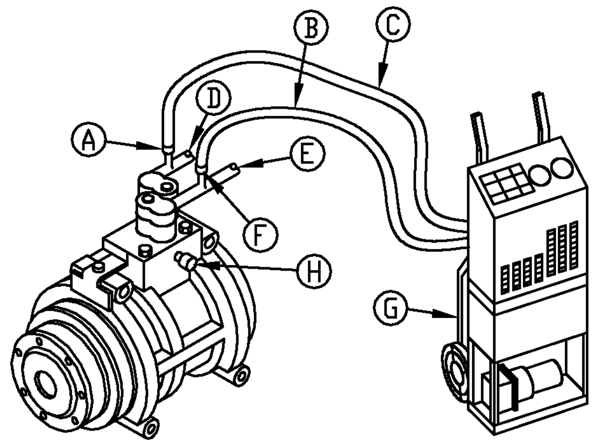
ESSENTIAL TOOLS
JT02045 R134a Refrigerant Recovery/Recycling and Charging Station
JT02046 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)
JT02050 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)

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: JT02046 and JT02050 R134a Refrigerant Recovery/Recycling and Charging Station can be substituted for the JT02045 R134a Refrigerant Recovery/Recycling and Charging Station.

1. Close both high and low pressure valves on refrigerant recovery, recycling and charging station (G).
2. Remove cap from low pressure test port (F).
3. Connect low pressure blue hose (B) from refrigerant recovery, recycling and charging station (G) to low pressure test port (F) on compressor.
4. Connect high pressure red hose (C) to high pressure quick disconnect.
5. Follow the manufacturer's instructions when using the refrigerant recovery, recycling and charging station.



T118687 –UN–01DEC98

A—High Pressure Test Port
B—Blue Hose
C—Red Hose
D—High Pressure Hose
E—Low Pressure Hose
F—Low Pressure Test Port
G—Refrigerant Recovery/Recycling and Charging Station
H—High Pressure Relief Valve

CED,TX14795,4339 –19–04MAR98–1/1

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RECOVER R134A SYSTEM

ESSENTIAL TOOLS
JT02045 R134a Refrigerant Recovery/Recycling and Charging Station
JT02046 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)
JT02050 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)

CAUTION: Do not remove high pressure relief valve (H). Air conditioning system will discharge rapidly causing possible injury.

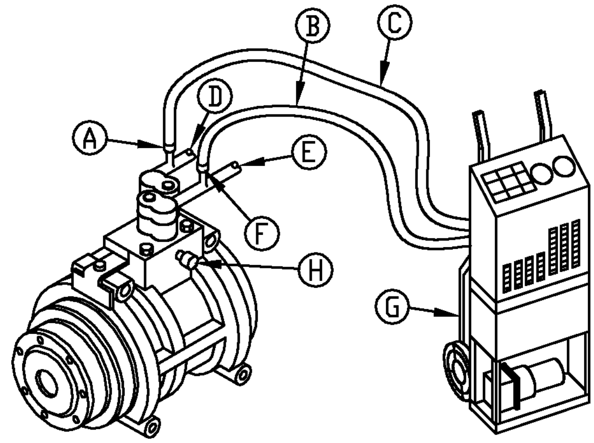
IMPORTANT: Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerant, hoses, fittings, components or refrigerant oils.

NOTE: JT02046 and JT02050 recovery and charging stations can be substituted for the JT02045 station.

1. Run the air conditioning system for three minutes to help in the recovery process. Turn air conditioning system off before proceeding with recovery steps.

2. Connect refrigerant recovery, recycling and charging station. (See installation procedure in this group.)

3. Follow the manufacturer's instructions when using the refrigerant recovery, recycling and charging station.



T118687 –UN–01DEC98

A—High Pressure Test Port
B—Blue Hose
C—Red Hose
D—High Pressure Hose
E—Low Pressure Hose
F—Low Pressure Test Port
G—Refrigerant Recovery/Recycling and Charging Station
H—High Pressure Relief Valve

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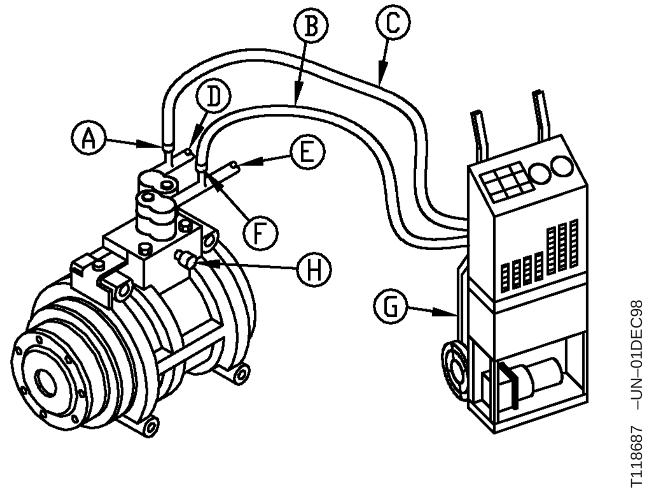
CED,TX14795,4340 –19–04MAR98–1/1

EVACUATE R134A SYSTEM

SPECIFICATIONS	
System Evacuation Vacuum Pressure	98 kPa (980 mbar) (29 in Hg)
If System Evacuation Vacuum Cannot Be Obtained, Test System For Leaks. Time	15 Minutes
Evacuation Time	15 minutes
Subtract Pressure For Each 300 m (1000 ft) Elevation Pressure	3.4 kPa (34 bar) (1 in. Hg)
Leak If Vacuum Decreases More Than Pressure	3.4 kPa (34 mbar) (1 in. Hg)
Evacuate System Time	For 30 min. After 98 kPa (980 mbar) (29 in. Hg) Vacuum

ESSENTIAL TOOLS
JT02045 R134a Refrigerant Recovery/Recycling and Charging Station
JT02046 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)
JT02050 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)



A—High Pressure Test Port
B—Blue Hose
C—Red Hose
D—High Pressure Hose
E—Low Pressure Hose
F—Low Pressure Test Port
G—Refrigerant Recovery/Recycling and Charging Station
H—High Pressure Relief Valve

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.

NOTE: JT02046 and JT02050 recovery and charging stations can be substituted for the JT02045 station.

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.

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Continued on next page CED,TX14795,4341 –19–18AUG98–1/3

3. Follow the manufacturer's instructions and evacuate the system.

NOTE: The vacuum specifications listed are for sea level conditions.

4. Evacuate system until low pressure gauge registers 98 kPa (980 mbar) (29 in. Hg) vacuum.

   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.

System Evacuation Vacuum—Specification

Pressure .... 98 kPa (980 mbar) (29 in Hg)

Subtract Pressure For Each 300 m (1000 ft) Elevation—Specification

Pressure .... 3.4 kPa (34 bar) (1 in. Hg)

If 98 kPa (980 mbar) (29 in. Hg) vacuum cannot be obtained in 15 minutes, test the system for leaks.

If System Evacuation Vacuum Cannot Be Obtained, Test System For Leaks.—Specification

Time.. 15 Minutes

(See Leak Testing in Group 9031-25).

Evacuation—Specification

Time.. 15 minutes

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Correct any leaks.

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.

Leak If Vacuum Decreases More Than—Specification

Pressure .... 3.4 kPa (34 mbar) (1 in. Hg)

7. Repair leak.

8. Start to evacuate.

Continued on next page

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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.

Evacuate System—Specification

Time... For 30 min. After 98 kPa (980 mbar) (29 in. Hg) Vacuum

11. Close low-side and high-side valves. Stop evacuation.

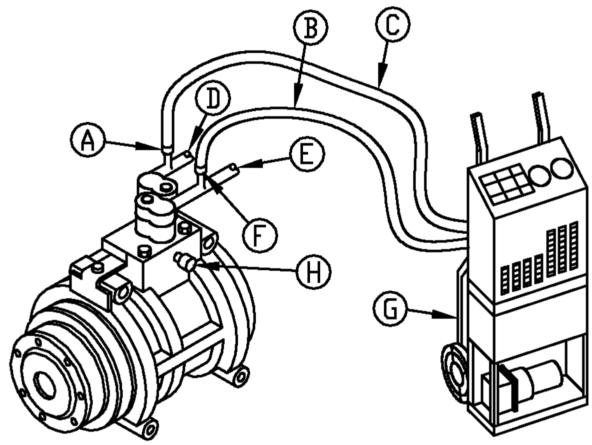
12. Charge the system. (See procedure in this group.)

CED,TX14795,4341 –19–18AUG98–3/3

CHARGE R134A SYSTEM

SPECIFICATIONS	
Pump Must Be Capable Of Pulling Vacuum	28.6 in. Hg at Sea Level
Subtract From Standard Vacuum For Each 300 m (1000 ft) Above Sea Level Vacuum	3.4 kPa (34 mbar) (1 in. Hg)
Refrigerant Added To Charge Weight	2.43 kg (5.25 lb)

ESSENTIAL TOOLS
JT02045 R134a Refrigerant Recovery/Recycling and Charging Station
JT02046 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)
JT02050 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)



T118687 –UN–01DEC98

A—High Pressure Test Port
B—Blue Hose
C—Red Hose
D—High Pressure Hose
E—Low Pressure Hose
F—Low Pressure Test Port
G—Refrigerant Recovery/Recycling and Charging Station
H—High Pressure Relief Valve

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: JT02046 and JT02050 recovery and charging stations can be substituted for the JT02045 station.

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1. Connect refrigerant recovery, recycling and charging station. (See installation procedure in this group.)

2. Evacuate the system. (See Evacuate Air Conditioning System, this group.)

Continued on next page CED,TX14795,4342 –19–04MAR98–1/2

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.

Pump Must Be Capable Of Pulling—Specification

Vacuum .... 28.6 in. Hg at Sea Level

Subtract From Standard Vacuum For Each 300 m (1000 ft) Above Sea Level—Specification

Vacuum .... 3.4 kPa (34 mbar) (1 in. Hg)

3. Follow the manufacturers instructions and charge the system.

4. Add refrigerant until system is charged with 2.43 kg (5.25 lb).

Refrigerant Added To Charge—Specification

Weight.. 2.43 kg (5.25 lb)

5. Do air conditioner checks and tests in Groups 9031-10 and 9031-25.

CED,TX14795,4342 –19–04MAR98–2/2

CHECK AND ADJUST COMPRESSOR BELT TENSION

SPECIFICATIONS	
Belt Deflection at 400 N (90 lb force) Deflection	19 mm (0.75 in.)
If Belt Deflection Not To Specification Cool Time	8—10 Minutes

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.

2. Measure strand tension or deflection at a point halfway between pulleys. Belt must deflect 19 mm (0.75 in.) at 400 N (90 lb force).

Belt Deflection—Specification

Deflection .... 19 mm (0.75 in.) at 400 N (90 lb force)

If belt deflection excessive , allow belt to cool for 8—10 minutes and try again.

If Belt Deflection Excessive—Specification

Cool.. 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.

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CED,TX14795,4343 –19–04MAR98–1/1

Group 25
Tests

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: **To meet government standards relating to the use of refrigerants, R134a is used in the air conditioning system. Because it does not contain chlorine, R134a is not detrimental to the ozone in the atmosphere. However, it is illegal to discharge any refrigerant into the atmosphere. It must be recovered using the appropriate recovery stations.**

IMPORTANT: **Use correct refrigerant recovery, recycling and charging stations. DO NOT mix refrigerants, hoses, fittings, components or refrigerant oils.**

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,UU3151 –19–13AUG96–1/1

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,UU3152 –19–13AUG96–1/1

R134A AIR CONDITIONING SYSTEM TEST

SPECIFICATIONS	
Engine Speed	2180 rpm
Temperature Control Switch Position	Maximum Cooling
Blower Speed	High
Run Unit For At Least Time	5 Minutes

Ambient Temperature	Air Duct Temperature	Low Pressure Gauge	High Pressure Gauge
16°C (60°F)	13°C (55°F)	7—165 kPa (0.07—1.6 bar) (1—24 psi)	630—1095 kPa (6—11 bar) (90—160 psi)
21°C (70°F)	16°C (60°F)	7—180 kPa (0.07—1.8 bar) (1—26 psi)	785—1225 kPa (7.6—12 bar) (110—175 psi)
27°C (80°F)	18°C (65°F)	7—205 kPa (0.07—2.1 bar) (1—30 psi)	955—1410 kPa (9.6—14.1 bar) (140—205 psi)
32°C (90°F)	21°C (70°F)	7—240 kPa (0.07—2.4 bar) (1—35 psi)	1145—1645 kPa (11.4—16.5 bar) (165—240 psi)
38°C (100°F)	27°C (80°F)	7—280 kPa (0.07—2.7 bar) (1—40 psi)	1355—1935 kPa (13.4—19.3 bar) (195—280 psi)
43°C (110°F)	29°C (85°F)	7—330 kPa (0.07—3.3 bar) (1—48 psi)	1580—2275 kPa (15.8—22.7 bar) (230—330 psi)

ESSENTIAL TOOLS
JT02045 R134a Refrigerant Recovery/Recycling and Charging Station
JT02046 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)
JT02050 R134a Refrigerant Recovery/Recycling and Charging Station (Alternate)

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

4. Connect low pressure blue hose (B) from refrigerant recovery, recycling and charging station (G) to low pressure test port (F) on compressor.

5. Connect high pressure red hose (D) to high pressure quick-disconnect on compressor.

6. Follow the manufacturer's instructions when using the refrigerant recovery, recycling and charging station.

7. Start engine and run at fast idle.

Engine—Specification

Speed .... 2180 rpm

8. Press temperature control switch at the maximum cooling position.

Temperature Control Switch—Specification

Position .... Maximum Cooling

9. Press blower switch at high speed position.

Blower—Specification

Speed .... High

10. Check sight glass in receiver-dryer for bubbles or if clean.

11. Run unit for at least 5 minutes.

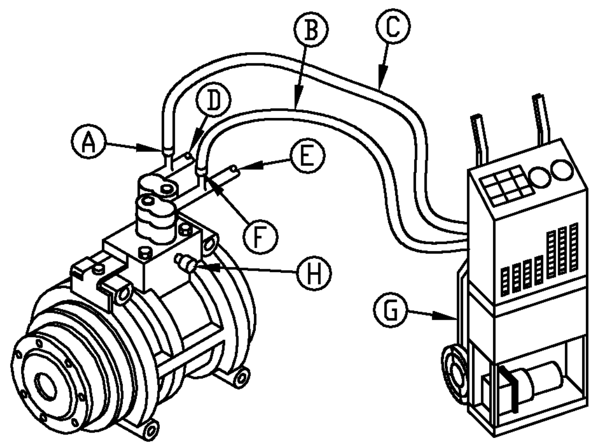
Run Unit For At Least—Specification

Time .... 5 Minutes

12. Measure air temperature at condenser air inlet and at air ducts in air conditioning unit. Record readings.

13. Read low and high pressure gauges on refrigerant recovery, recycling and charging station. Record readings.

14. Compare pressure and temperature readings to the specifications shown.



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A—High Pressure Test Port
B—Blue Hose
C—Red Hose
D—High Pressure Hose
E—Low Pressure Hose
F—Low Pressure Test Port
G—Refrigerant Recovery/Recycling and Charging Station
H—High Pressure Relief Valve

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Continued on next page

CED,OUOE003,1079 –19–19AUG98–2/3

Tests

Ambient Temperature	Air Duct Temperature	Low Pressure Gauge	High Pressure Gauge
16°C (60°F)	13°C (55°F)	7—165 kPa (0.07—1.6 bar) (1—24 psi)	630—1095 kPa (6—11 bar) (90—160 psi)
21°C (70°F)	16°C (60°F)	7—180 kPa (0.07—1.8 bar) (1—26 psi)	785—1225 kPa (7.6—12 bar) (110—175 psi)
27°C (80°F)	18°C (65°F)	7—205 kPa (0.07—2.1 bar) (1—30 psi)	955—1410 kPa (9.6—14.1 bar) (140—205 psi)
32°C (90°F)	21°C (70°F)	7—240 kPa (0.07—2.4 bar) (1—35 psi)	1145—1645 kPa (11.4—16.5 bar) (165—240 psi)
38°C (100°F)	27°C (80°F)	7—280 kPa (0.07—2.7 bar) (1—40 psi)	1355—1935 kPa (13.4—19.3 bar) (195—280 psi)
43°C (110°F)	29°C (85°F)	7—330 kPa (0.07—3.3 bar) (1—48 psi)	1580—2275 kPa (15.8—22.7 bar) (230—330 psi)

15. Use the Operating Pressure Diagnostic Chart in this group to diagnose the malfunction.

CED,OUOE003,1079 –19–19AUG98–3/3

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OPERATING 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	Occasional 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 Contaminated 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

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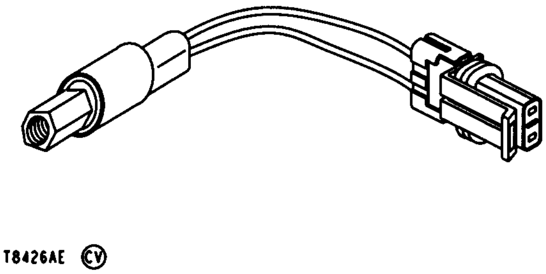
TX,9031,UU3164 –19–19AUG98–1/1

HIGH AND LOW PRESSURE SWITCH TEST

SPECIFICATIONS	
Low Pressure Switch (Normally Open) Closes on Increasing Pressure	345 ± 35 kPa (3.45 ± 0.3 bar) (50 ± 5 psi)
Low Pressure Switch (Normally Open) Opens on Decreasing Pressure	173 ± 35 kPa (1.73 ± 0.3 bar) (25 ± 53 psi)
High Pressure Switch (Normally Closed) Opens on Increasing Pressure	2760 ± 138 kPa (27.6 ± 1.38 bar) (400 ± 20 psi)
High Pressure Switch (Normally Closed) Closes on Decreasing Pressure	1310 ± 138 kPa (13.11 ± 1.38 bar) (190 ± 20 psi)

SERVICE EQUIPMENT AND TOOLS
Volt-Ohm-Amp Meter
JT02051 3-Gauge Manifold w/Hose And Quick Coupler



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NOTE: The line that attaches the high and low pressure switch has a valve installed to prevent discharging the air conditioning system when switch is removed. The high pressure switch is normally closed when removed from the machine. It does not open when installed in the A/C system until pressure exceeds specification.

1. Remove high and low pressure switch.

2. Connect a portable pressure source, such as a hydraulic hand pump, to high and low pressure switch.

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3. Using an ohmmeter measure continuity between terminals A and B until low pressure switch pressure increases to switch closing pressure specification.

Low Pressure Switch (Normally Open)—Specification

Closes on Increasing Pressure .... 345 ± 35 kPa (3.45 ± 0.3 bar) (50 ± 5 psi)

Low Pressure Switch (Normally Open)—Specification

Opens on Decreasing Pressure .... 173 ± 35 kPa (1.73 ± 0.3 bar) (25 ± 53 psi)

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CED,TX14795,4346 –19–04MAR98–1/2

4. Slowly increase pressure. Switch must have continuity until pressure increases to high pressure switch opening pressure specification.

High Pressure Switch (Normally Closed)—Specification

Opens on Increasing Pressure .... 2760 ± 138 kPa (27.6 ± 1.38 bar) (400 ± 20 psi)

High Pressure Switch (Normally Closed)—Specification

Closes on Decreasing Pressure................ 1310 ± 138 kPa (13.11 ± 1.38 bar) (190 ± 20 psi)

5. The low pressure switch can also be checked when installed in air conditioning system, however, pressure is slow to increase to test specification. High test switch is not easily tested in system.

   Connect an 3-gauge manifold for R134a 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.

CED,TX14795,4346 –19–04MAR98–2/2

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.

TX,9031,UU3168 –19–13AUG96–1/1

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.

TX,9031,UU3169 –19–13AUG96–1/1

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CHAPTER 8

SECTION 9035

ARCTIC/COLD WEATHER HEATER

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Group 05
Theory of Operation

ARCTIC/COLD WEATHER HEATER CAUTIONS

CAUTION: Heater must be turned off while refueling.

Do not operate heater in enclosed areas where combustible fumes may be present.

Prior to operating the heater, ensure that the fuel system is intact and there are no leaks.

Extreme care should be taken to ensure a proper mixture of water and antifreeze is used in the coolant system to be heated, to prevent coolant from freezing or slushing. If the coolant becomes slushy or frozen, the heater's coolant pump cannot move the coolant causing a blockage of the circulating system. Once this occurs, pressure will build up rapidly in the heater and the coolant hose will either burst or blow off at the connection point to the heater. This situation could cause engine damage and/or personal injury.

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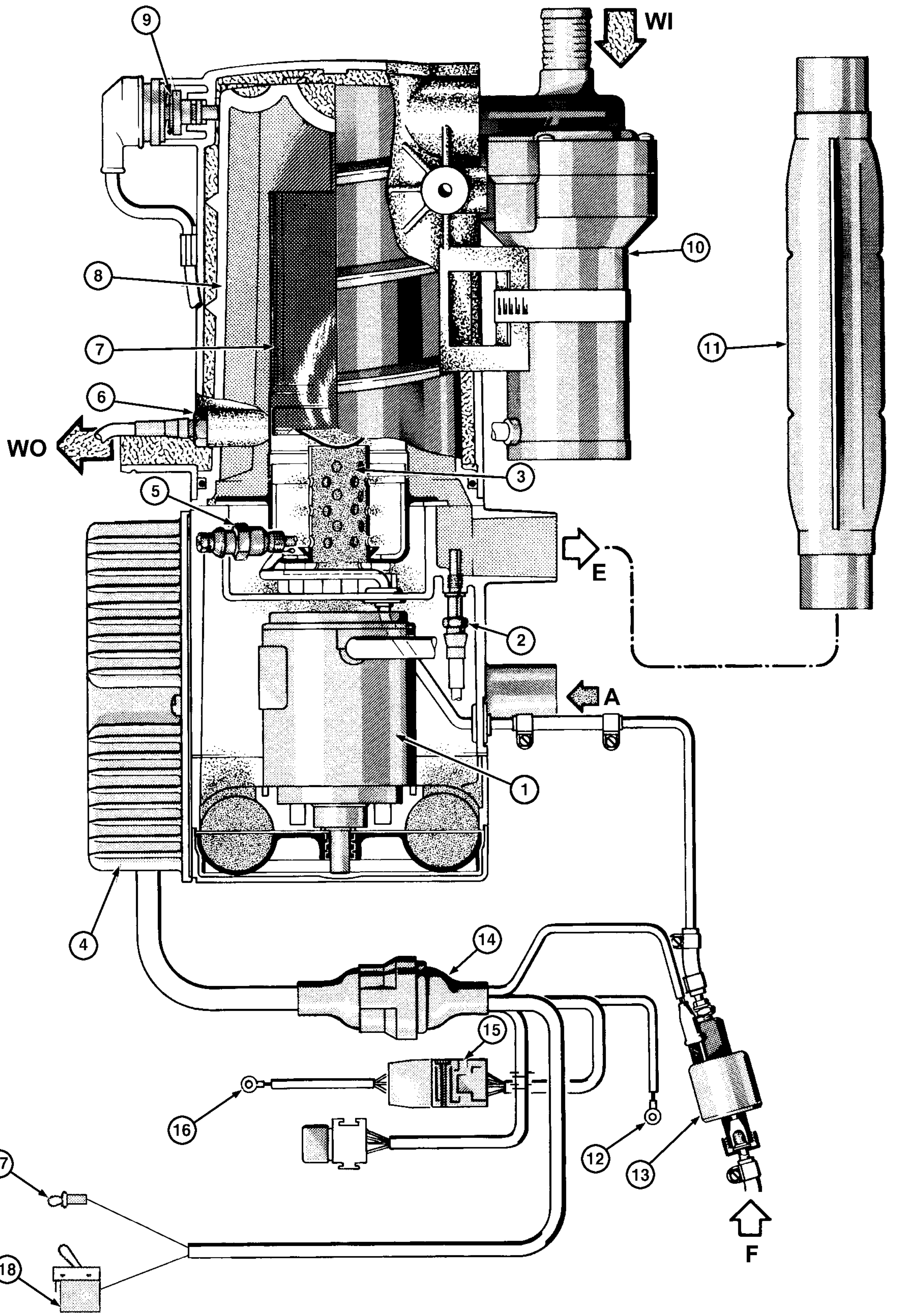
ARCTIC/COLD WEATHER HEATER THEORY OF OPERATION



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1—Burner Motor	**7—Flame Tube**	**13—Fuel Metering Pump**	**A—Combustion Air**
2—Flame Sensor	**8—Heat Exchanger**	**14—Wiring Harness**	**E—Exhaust**
3—Combustion Chamber	**9—Overheat Sensor**	**15—Fuse Holder**	**F—Fuel Supply Line**
4—Control Unit	**10—Water Pump**	**16—Battery—Power**	**WO—Water Outlet**
5—Glow Plug	**11—Exhaust**	**17—LED Light**	**WI—Water Inlet**
6—Temperature Sensor	**12—Battery—Ground**	**18—Toggle Switch**	

The arctic/cold weather heater is an oil fired heater that pumps coolant from the machine engine, heats it and returns it to the engine. The heater utilizes machine 24-volt power and fuel, and operates independently of the machine engine. A temperature regulating switch in the unit regulates the coolant temperature between a low of 53°C (127°F) and a high of 85°C (185°F)

When the heater switch is turned ON, the following sequence occurs:

NOTE: If the heater fails to start the first time, it will automatically attempt a second start. If the second attempt fails, the heater will shut off completely. On the initial start up, the heater may require several start attempts to self-prime the fuel system.

- The control unit does a system check (flame sensor, temperature, safety thermal cut-out fuse and various other control unit checks).
- The water pump starts circulating the coolant.
- The combustion air blower starts.
- The glow plug begins to preheat for 20 - 50 seconds.
- After 20 - 50 seconds the fuel metering pump starts delivering fuel and the combustion air blower ramps up gradually.

Once ignition takes place, the flame sensor alerts the control unit, and the control unit shuts off the glow plug.

When started, the heater runs in the full heat mode and the temperature is monitored at the heat exchanger. When the coolant temperature reaches 72°C (162°F) the heater starts cycling up and down between levels (high, medium, low). If the coolant temperature continues to rise, the heater will automatically shut off. This occurs when the temperature reaches 85°C (185°F).

The water pump continues to circulate coolant after heater shutdown, to allow the heater to monitor coolant temperature. The heater will automatically restart when the coolant temperature drops below 68°C (154°F).

The heater continues to run as described above, until the heater switch is turned OFF.

When the heater switch is turned OFF, the fuel metering pump stops delivering fuel and the flame is extinguished. The combustion air blower and water pump continue to run for 130 seconds to cool down.

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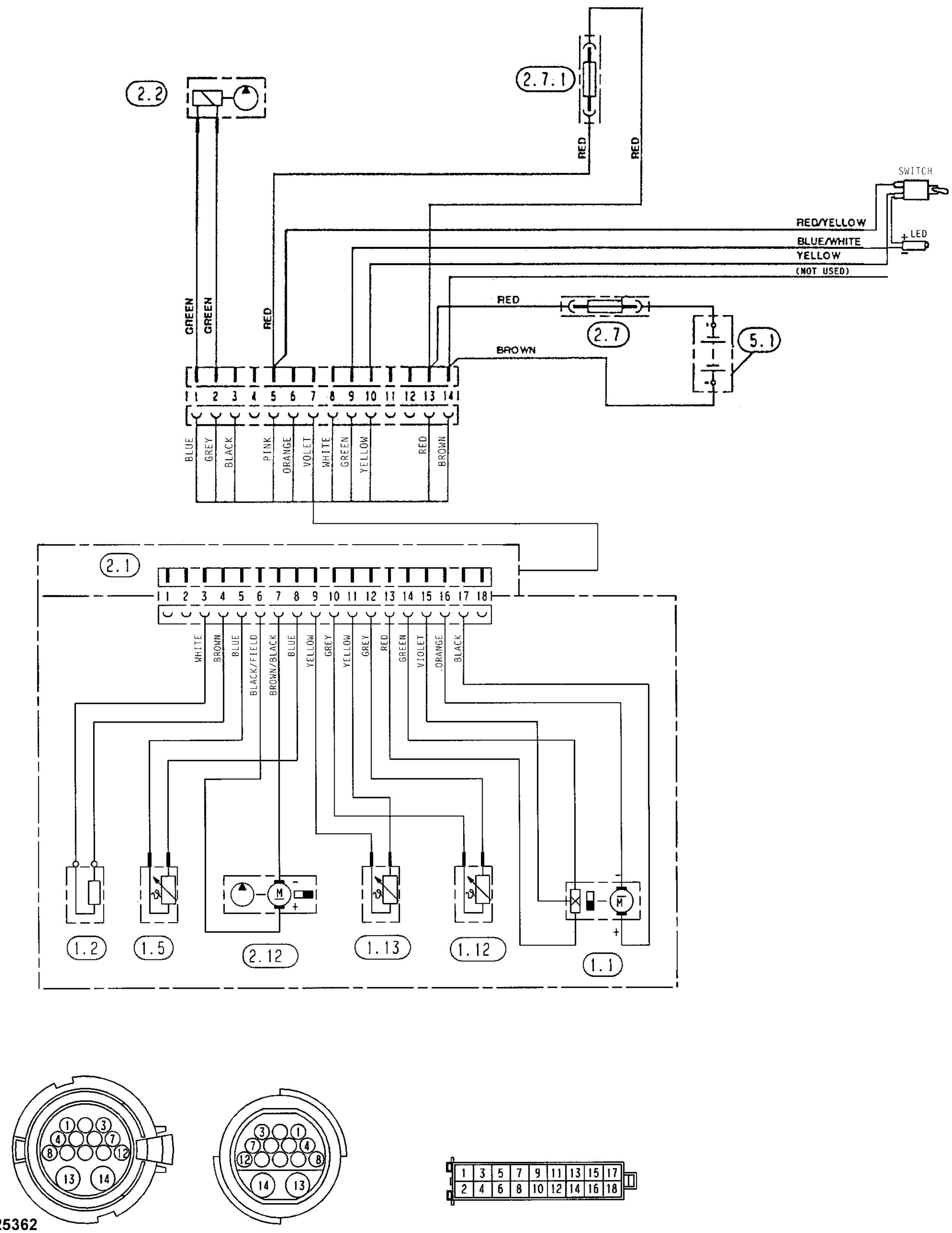
ARCTIC/COLD WEATHER HEATER WIRING DIAGRAM



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T125362 –19–28OCT99

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CED,OUOE012,177 –19–15APR99–1/2

Theory of Operation

1.1—Blower Motor
1.2—Glow Pin
1.5—Overheat Sensor
1.12—Flame Sensor
1.13—Temperature Sensor
2.1—Control Unit
2.12—Water Pump
2.2—Fuel Metering Pump
2.7—15-Amp Main Fuse
2.7.1—5-Amp Switch Fuse
5.1—Battery

CED,OUOE012,177 –19–15APR99–2/2

Group 10
Operational Checks

ARCTIC/COLD WEATHER HEATER CHECKS

The following checks should be performed periodically to ensure the system is in good operating condition:

- Check coolant hoses and clamps, and make sure all valves are open.
- Maintain the proper engine coolant level and ensure that the heater is properly bled after service to or involving the cooling system.
- Visually check all fuel lines for leaks. Check fuel filter inserts and replace if necessary.
- Visually inspect all electrical lines and connections for corrosion.
- Maintain the electrical system in good condition. The heater will not start with insufficient power, and will automatically shut down if high or low voltage fluctuations occur.
- Use fuel suitable for the climate.
- Check the glow plug and replace if necessary.
- Run the heater at least once a month for at least 15 minutes.

CED,OUOE012,180 –19–16APR99–1/1

Group 15
Diagnostic Information

DIAGNOSE ARCTIC/COLD WEATHER HEATER MALFUNCTIONS

In the event of a malfunction, the following items should be checked before performing the heater diagnostic procedure:

- Fuel supply
- Fuses, electrical lines and connections.
- Battery voltage.
- Coolant flow.
- Interference in the combustion air and exhaust pipes

If combustion is sooty, check the following:

- combustion air and exhaust ducts. Clear if necessary.
- Fuel metering pump. Measure for excessive delivery, and replace if necessary.

CED,OUOE012,179 –19–16APR99–1/1

ARCTIC/COLD WEATHER HEATER DIAGNOSTIC PROCEDURE

The heater system utilizes the green LED light located next to the arctic/cold weather heater switch, located on the right hand console inside the cab, to provide fault information. The light provides different illumination sequences depending on the malfunction as shown in the function and fault test chart.

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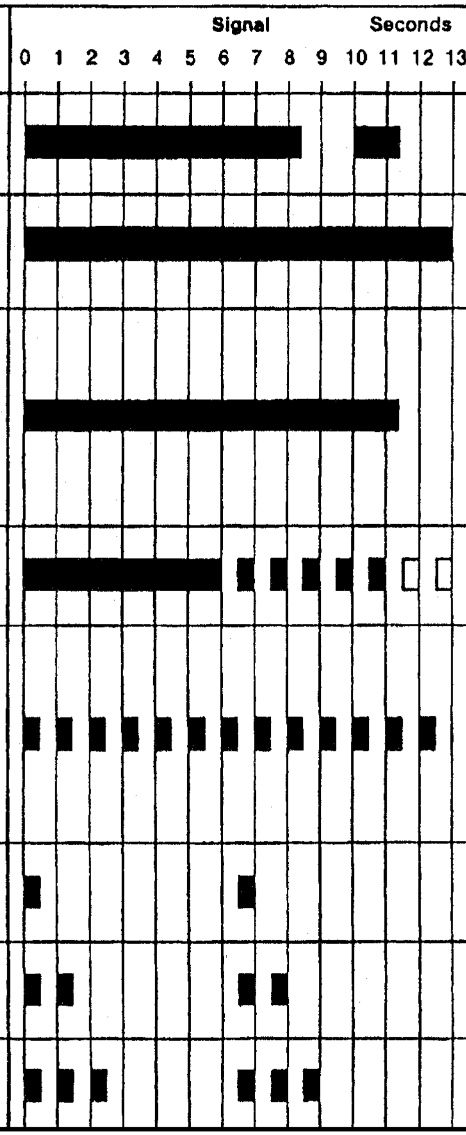
Function and Fault Test Chart



Indication	Cause	Remedy
1 Start, heating phase (trouble-free operation)	———	———
2 Normal operation (trouble-free operation)	———	———
3 Delayed shut-off, restart (heater still not shut off or in the control interval when started)	Heater still not shut off Water temperature still above the triggering point for the temperature sensor (approx. 80°C) Temperature sensor interruption	Wait until end of delayed shut-off Wait until temperature falls below the triggering point Replace temperature sensor
4 Warning: power supply (undervoltage or overvoltage)	Undervoltage Overvoltage	Charge battery Check regulator (see Pos. 11)
5 Overheat (automatic cutout)	Electric line to metering pump interrupted Insufficient cooling water Water circuit not properly bled Water pump defective	Check line Top up cooling water Bleed water circuit Replace water pump Operate safety thermal cutout switch
6 Flame sensor defective (short-circuit)	Flame sensor defective	Replace flame sensor
7 Flame out Low (flame goes out by itself in "Low" setting)	Insufficient fuel Speed of blower not reduced Vapour lock in the fuel line? Control unit defective Flame sensor fouled/ defective	Measure fuel quantity Replace partial-load resistor Re-route line Replace control unit Clean/ replace flame sensor
8 Flame out High (flame goes out by itself in "High" setting)	Insufficient fuel Vapour lock in the fuel line? Flame sensor fouled/defective	Measure fuel quantity Fuel line becomes too hot – re-route line Clean/replace fuel sensor

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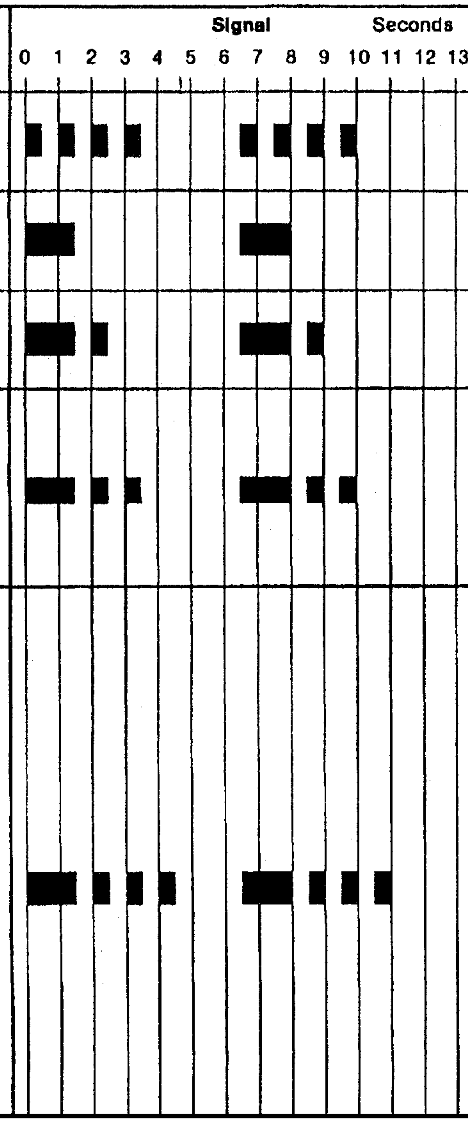
Function and Fault Test Chart (Continued)



Indication	Cause	Remedy
9 Glow plug defective	Glow plug fuse defective Glow plug defective Flame sensor fouled/ defective	Replace fuse Replace glow plug Clean/ replace flame sensor
10 Burner motor defective	Heater fuse defective Electric motor defective or blower blocked Flame sensor fouled/defective	Replace fuse Replace blower Clean/replace flame sensor
11 Cutout due to undervoltage	Undervoltage Corrosion on electrical connections	Charge battery, check battery Clean electrical connections
12 Cutout due to overvoltage	Overvoltage	Check regulator Connect heater to battery
13 Non-start Safety time exceeded and automatic cutout	**No fuel** Metering pump defective Short-circuit at metering pump No pulses at metering pump Fuel line not filled Insufficient fuel Glow plug defective **Automatic cutout after 3–5 mins.** Flame sensor wrongly poled Flame sensor fouled Flame sensor interruption Insufficient fuel	 Replace metering pump Check plug Replace control unit Restart, check fuel line Measure fuel quantity Replace glow plug Check connection against wiring diagram Clean flame sensor Replace flame sensor Measure fuel quantity

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CHAPTER 9

SECTION 01

TRACKS REPAIR

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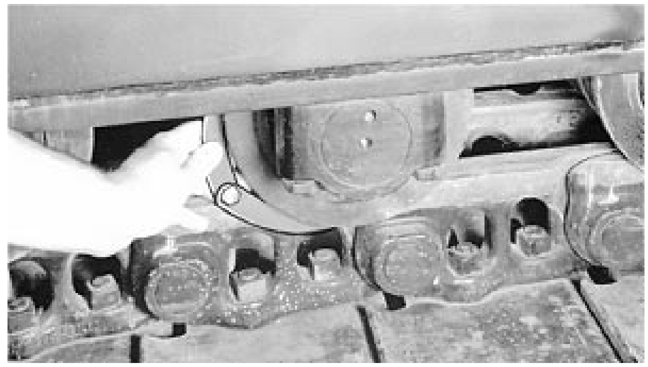
Group 0130
Track System

MEASURE TRACK ROLLER WEAR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Minimum used is the maximum allowable wear for rebuilding roller tread.

Under some conditions roller wear can be uneven. If wear is uneven, rollers may be interchanged to even out the wear.

Measure roller tread diameter using a caliper such as the JT05519 Special Roller Caliper from JT05518A or JT05523 Undercarriage Inspection Service Tool Kit.

Tread Wear—Specification

Diameter .... 175 mm (6.89 in.) new
Diameter .... 165 mm (6.49 in.) minimum used

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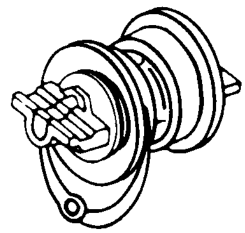
TRACK ROLLER TREAD DIAMETER

Allowable Wear—10.0 mm (0.39 in.)



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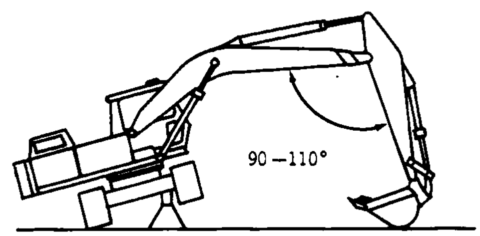
Dimension	Percent Worn
175.0 mm (6.89 in.)	0
174.5 mm (6.87 in.)	5
174.0 mm (6.85 in.)	10
173.5 mm (6.83 in.)	15
173.0 mm (6.81 in.)	20
172.5 mm (6.79 in.)	25
172.0 mm (6.77 in.)	30
171.5 mm (6.75 in.)	35
171.0 mm (6.73 in.)	40
170.5 mm (6.71 in.)	45
170.0 mm (6.69 in.)	50
169.5 mm (6.67 in.)	55
169.0 mm (6.65 in.)	60
168.5 mm (6.63 in.)	65
168.0 mm (6.61 in.)	70
167.5 mm (6.59 in.)	75
167.0 mm (6.57 in.)	80
166.5 mm (6.56 in.)	85
166.0 mm (6.54 in.)	90
165.5 mm (6.52 in.)	95
165.0 mm (6.50 in.)	**100**
164.5 mm (6.48 in.)	105
164.0 mm (6.46 in.)	110
163.5 mm (6.44 in.)	115
163.0 mm (6.42 in.)	120

CED,OUOE020,27 –19–10MAR99–1/1

REMOVE AND INSTALL TRACK ROLLER



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1. Swing upperstructure 90° and lower bucket to raise track off ground. Keep angle between boom and arm 90—110° and position round side of bucket on ground.

CAUTION: Prevent possible injury from unexpected machine movement. Put shop stands under frame to support machine while removing track roller.

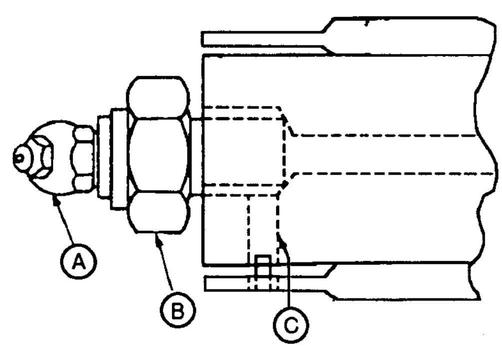
The approximate weight of the 330LCR is 33 049 kg (72,864 lb).

Machine—Specification

Weight.. 33 049 kg (72,864 lb) approximate

2. Put shop stands under machine.

CED,OUOE023,113 –19–20MAY98–1/3



T7396DZ —UN–28NOV90

CAUTION: Prevent possible injury from high pressure grease. Do not remove grease fitting (A) from valve (B).

3. Loosen valve (B) one to two turns to release grease through bleed hole (C).

A—Grease Fitting
B—Valve
C—Bleed Hole

Continued on next page CED,OUOE023,113 –19–20MAY98–2/3

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CAUTION: For the 330LCR, the approximate weight of track roller 55 kg (120 lb).

Track Roller—Specification

Weight... 55 kg (120 lb) approximate

4. Attach hoist to track roller (B).

5. Remove cap screws (A) and track roller (B). Repair or replace parts. (See procedure in this group.)

6. Install roller on track link with flat portion of bracket towards undercarriage.

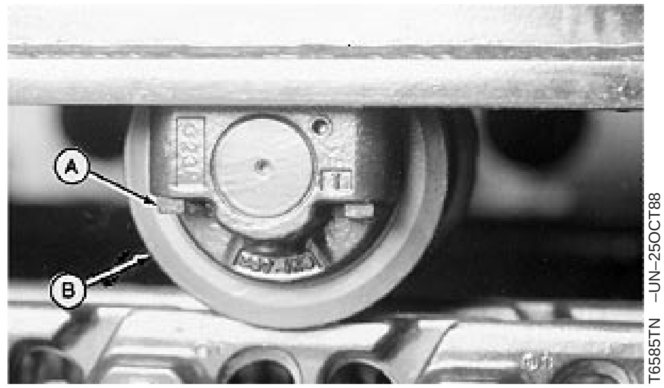
7. Lower excavator enough to allow cap screws (A) to be installed.

8. Tighten cap screws to specification.

Roller-to-Frame Cap Screw—Specification

Torque .... 304 N•m (224 lb-ft)

9. Adjust track sag. (See procedure in this group.)



A—Cap Screw (4 used)
B—Roller

CED,OUOE023,113 –19–20MAY98–3/3

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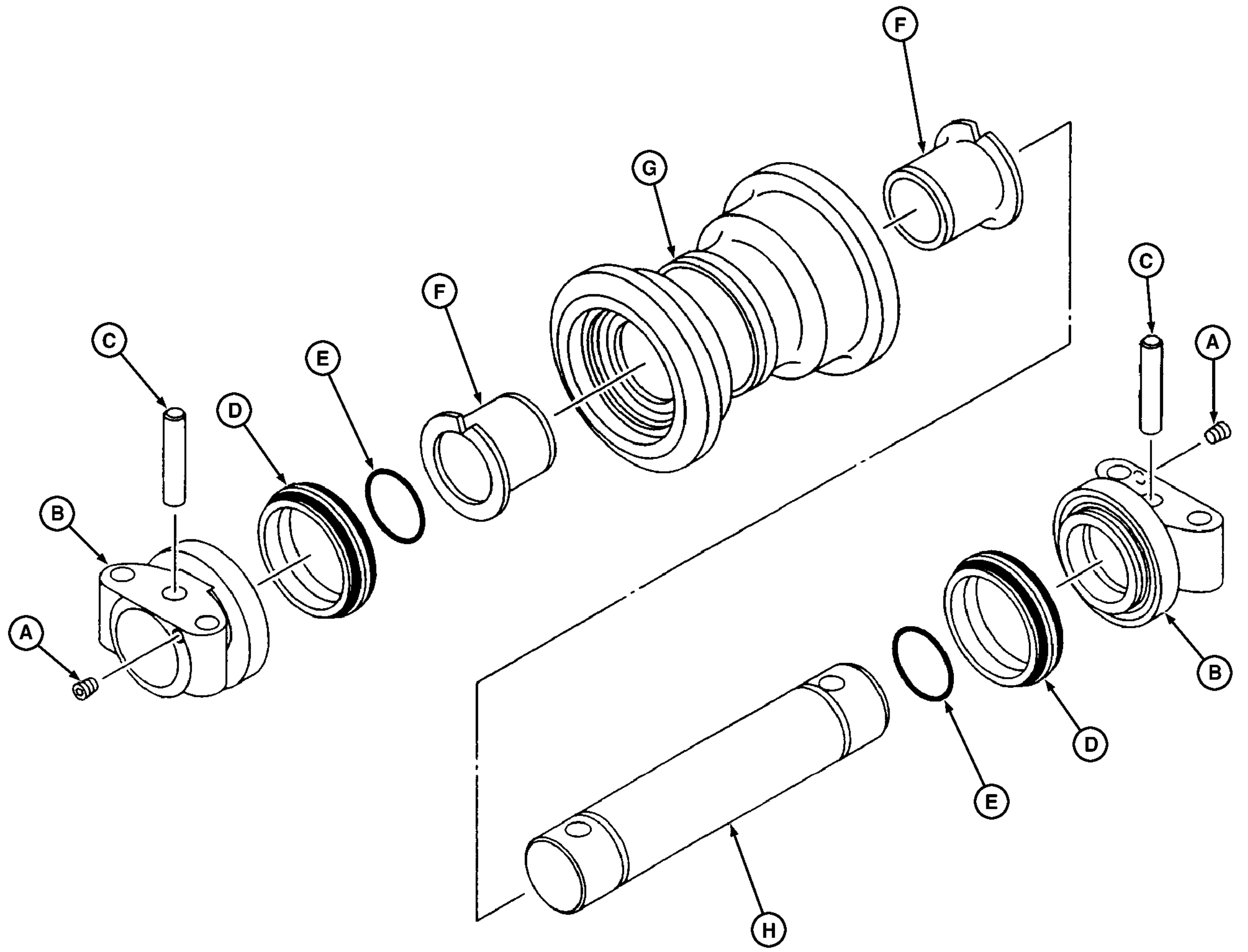
DISASSEMBLE AND ASSEMBLE TRACK ROLLER



T115257

T115257 –UN–08JUN98

A—Plug (2 used)
B—Bracket (2 used)
C—Pin (2 used)
D—Metal Face Seal (2 used)
E—O-Ring (2 used)
F—Bushing (2 used)
G—Roller
H—Axle

1. Remove plug (A) to drain oil. The approximate capacity is 416 mL (14 fl oz).
2. Remove pin (C).

Continued on next page

3. Remove bracket (B) using a bearing puller attachment and adapters from puller set.

IMPORTANT: Metal face seals can be reused if they are not worn or damaged. A used seal must be kept together as a set because of wear patterns on seal ring face.

4. Remove metal face seals (D) from roller (G) and brackets (B). Keep seal rings together as a matched set with seal ring faces together to protect surfaces.

5. Inspect seals. (See Inspect Metal Face Seals in this group.) For seals that are reused, put a piece of cardboard between seal rings to protect seal face.

6. Remove axle (H) from roller (G).

NOTE: Only remove bushing if replacement is necessary.

7. Remove bushings (F) using a 2-jaw puller and adapters from puller set.

8. Replace parts as necessary.

9. Apply a thin film of oil to bushings (F). Install bushings.

10. Install O-rings (E) on axle (H).

IMPORTANT: O-rings and seat surfaces for O-rings must be clean, dry, and oil free so O-rings do not slip when roller is turning.

11. Thoroughly clean O-rings and seat surfaces in brackets (B) and in seal rings using volatile, non-petroleum base solvent and lint-free tissues.

12. Install O-ring in seal rings.

13. Install metal face seals (D) in brackets (B) and in roller (G). Apply equal pressure with fingers at four equally spaced points on seal face. Seal must “pop” down into place so O-ring is tight against seal bore. A volatile, non-petroleum base solvent or talcum powder may be used as a lubricant.

14. Wipe finger prints and foreign material off seal ring face using clean oil and lint-free tissues. Apply a thin film of oil to each seal ring face.

15. Apply a thin layer of NEVER-SEEZ® lubricant or an equivalent to end of axle from O-ring to end of axle, and to bore in bracket (B).

16. Install axle (H) to bracket (B).

17. Apply NEVER-SEEZ lubricant or an equivalent to pin (C). Install pin even with flat surface of bracket.

18. Install axle (H) and assembled parts to roller (G).

19. Repeat procedure for other side of axle.

20. Add track roller oil. (See Track Roller, Front Idler, and Carrier Roller Oil in Fuels and Lubricants, Group 0004.)

21. Clean threads of plugs (A) using cure primer. Apply pipe sealant.

22. Install plugs (A) and tighten.

Track Roller Plug—Specification

Torque.. 29 N•m (21 lb-ft)

NEVER-SEEZ is a trademark of the Emhart Chemical Group.

CED,OUOE023,115 –19–20MAY98–2/2

TEST TRACK ROLLER FOR OIL LEAKAGE

1. Hold shaft and turn shell several turns to seat metal face seals.

2. Remove plug.

CED,OUOE023,2265 –19–28JAN98–1/2

3. Install parts (A—F). Plug, barbed adapter and connector are from a leak detector kit such at the D05361ST Rubber Stopper/Leak Detector Kit.

4. Hold plug so it is not pushed out, slowly pressurize oil cavity to specification using air.

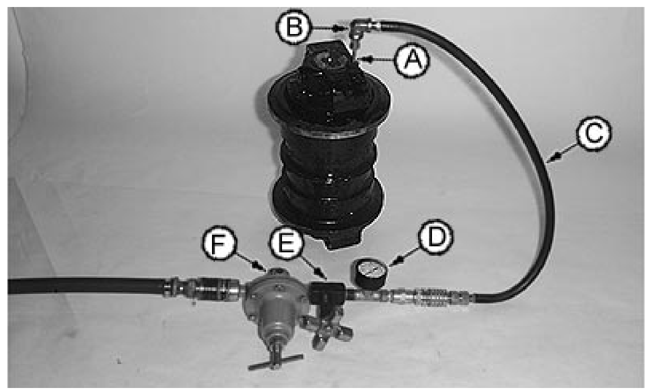
Track Roller Oil Cavity—Specification

Pressure .... 110 ± 18 kPa (1.1 ± 0.3 bar) (16 ± 4 psi)

5. Close valve and wait for a minimum of 30 seconds. Check for oil leakage. Check gauge to see if air pressure has decreased.

6. If there is leakage, disassemble roller and replace parts as necessary.

7. Clean threads of plug using cure primer. Apply pipe sealant to threads. Install plug.



T109691B –UN–02JUN97

A—Plug, Barbed Adapter and Connector
B—JT03001 Tee Fitting 7/16-20M 37° x 7/16-20F 37° SW x 7/16-20M 37°
C—Hose (2 used)
D—Pressure Gauge
E—Snubber (Needle) Valve
F—Air Pressure Regulator

CED,OUOE023,2265 –19–28JAN98–2/2

MEASURE TRACK CARRIER ROLLER WEAR

Used minimum tread diameter is the maximum allowable wear for rebuilding wear surface.

Measure roller tread diameter using a caliper such as the JT05519 Special Roller Caliper from JT05518A or JT05523 Undercarriage Inspection Service Tool Kit.

T6813AQ –UN–29JAN98

Track Carrier Roller Tread—Specification

Diameter .... 120 mm (4.72 in.) new
Diameter .... 110 mm (4.33 in.) minimum used

CED,OUOE023,117 –19–21MAY98–1/1

CARRIER ROLLER TREAD DIAMETER

Allowable Wear—10.0 mm (0.39 in.)

Dimension	Percent Worn
120.0 mm (4.72 in.)	0
119.5 mm (4.70 in.)	5
119.0 mm (4.69 in.)	10
118.5 mm (4.67 in.)	15
118.0 mm (4.65 in.)	20
117.5 mm (4.63 in.)	25
117.0 mm (4.61 in.)	30
116.5 mm (4.59 in.)	35
116.0 mm (4.57 in.)	40
115.5 mm (4.55 in.)	45
115.0 mm (4.53 in.)	50
114.5 mm (4.51 in.)	55
114.0 mm (4.49 in.)	60
113.5 mm (4.47 in.)	65
113.0 mm (4.45 in.)	70
112.5 mm (4.43 in.)	75
112.0 mm (4.41 in.)	80
111.5 mm (4.39 in.)	85
111.0 mm (4.37 in.)	90
110.5 mm (4.35 in.)	95
110.0 mm (4.33 in.)	**100**
109.5 mm (4.31 in.)	105
109.0 mm (4.29 in.)	110
108.5 mm (4.27 in.)	115
108.0 mm (4.25 in.)	120

T6813AQ –UN–29JAN98

CED,OUOE020,28 –19–10MAR99–1/1

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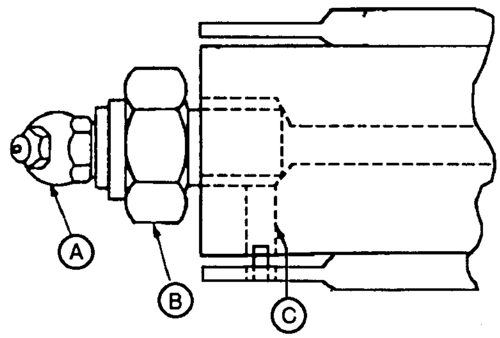
REMOVE AND INSTALL TRACK CARRIER ROLLER

CAUTION: Prevent possible injury from high pressure grease. Do not remove grease fitting (A) from valve (B).

1. Loosen valve (B) one to two turns to release grease through bleed hole (C).



T7396DZ –UN–28NOV90

A—Grease Fitting
B—Valve
C—Bleed Hole

CED,OUOE023,118 –19–21MAY98–1/3

2. Raise track link just enough to permit carrier roller removal.

CAUTION: Securely support track before attempting service procedure to prevent accidental lowering of track.

3. Install wooden blocks between track link and frame.

T108834B –UN–02JUN97

Continued on next page

CED,OUOE023,118 –19–21MAY98–2/3

4. Remove cap screws (B) and carrier roller (A).

5. Install carrier roller and tighten cap screws (B).

Roller-to-Frame Cap Screw—Specification

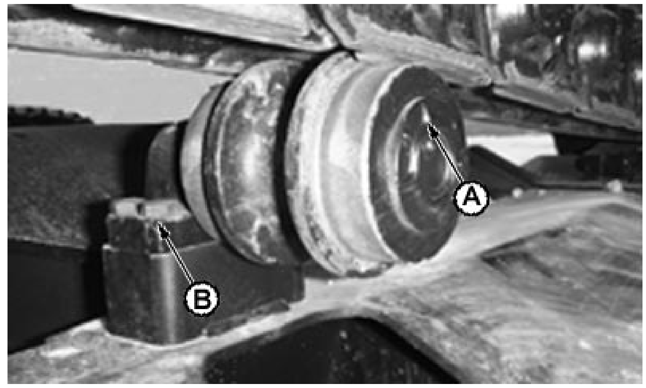
Torque .... 265 N•m (195 lb-ft)

6. Install carrier roller and tighten cap screws (B).

7. Check carrier roller oil level by removing plug in cover and add as necessary. The approximate capacity is 85 mL (2.9 fl oz). (See Track Roller, Front Idler and Carrier Roller Oil in Group 0004.)

8. Remove wooden blocks and jack.

9. Adjust track sag. (See procedure in this group.)



T108835B –UN–03APR97

A—Carrier Roller
B—Cap Screw (4 used)

CED,OUOE023,118 –19–21MAY98–3/3

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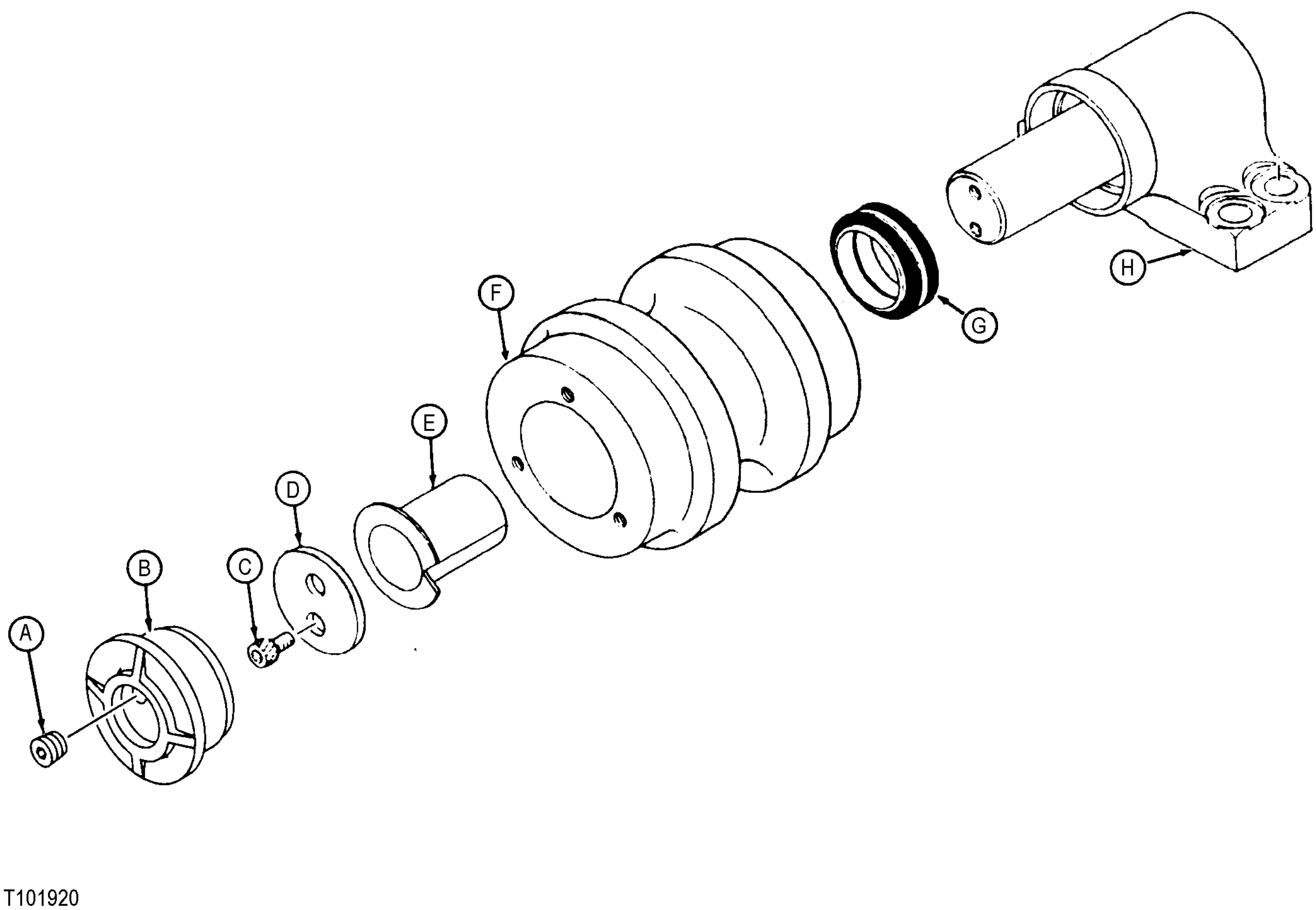
DISASSEMBLE AND ASSEMBLE TRACK CARRIER ROLLER



T101920 –UN–12JUL96

A—Plug
B—Cover
C—Cap Screw (2 used)
D—Thrust Washer
E—Bushing
F—Roller
G—Metal Face Seals
H—Support

1. Remove plug (A) to drain oil.

2. Loosen cap screws (C) by placing an 8 mm hex key wrench through oil plug drain hole.

3. Remove roller (F) from support (H).

Continued on next page

CED,OUOE023,119 –19–21MAY98–1/2

IMPORTANT: Replace entire roller assembly if bushing (E) and shaft surfaces are damaged. Bushing (E) is no longer serviceable because cover (B) cannot be removed.

4. Inspect bushing (E) and shaft on support (H).

IMPORTANT: Metal face seals can be reused if they are not worn or damaged. A seal must be kept together as a set because of wear patterns on seal ring face.

5. Remove metal face seal (G) from roller (F) and support (H). Keep seal rings together as a matched set with faces together to protect lapped surfaces.

6. Inspect metal face seal. (See procedure in this group.)

7. Replace parts as necessary.

IMPORTANT: O-rings may slip when roller is turning if O-rings and seat surfaces are not clean, dry and oil free.

8. Thoroughly clean the O-rings and seat surfaces in roller, support, and seal bushings using a volatile, non-petroleum base solvent and lint-free tissues.

9. Install O-ring on seal rings.

NOTE: Current carrier roller metal face seals use a tapered fit. There is no longer the "pop" into place fit previously used. A volatile, non-petroleum base solvent or talcum powder may be used as a lubricant.

10. Install one half of metal face seal into support (H).

11. Apply a thin coat of oil to the metal faces on each half of the seal. (See Track Roller, Front Idler and Carrier Roller Oil in Fuels and Lubricants, Group 0004.)

12. Install the other half of metal face seal on the half already in place in support (H).

13. Install roller (F) over shaft on support (H) being sure to keep cap screws (C) in alignment with holes on shaft.

14. Tighten cap screws (C).

Cover Cap Screw—Specification

Torque.. 64 N•m (47 lb-ft)

15. Fill carrier with approximately 85 mL (2.9 fl oz) of clean oil through plug hole. (See Track Roller, Front Idler, and Carrier Roller Oil in Fuels and Lubricants, Group 0004.)

16. Clean threads of plug (A) using cure primer.

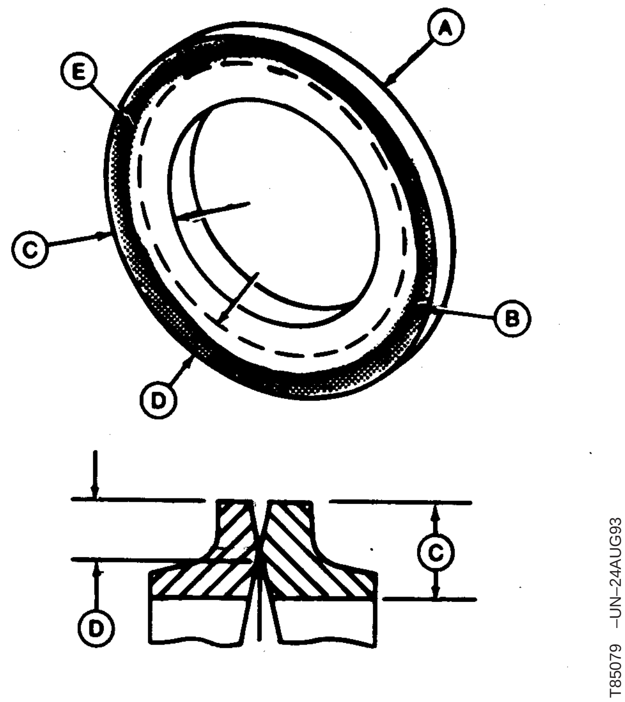
17. Apply pipe sealant to thread of plug. Install plug.

CED,OUOE023,119 –19–21MAY98–2/2

INSPECT METAL FACE SEALS

1. Inspect for the following conditions to determine if seal ring (A) can be reused:

   - The narrow, highly polished sealing area (E) must be in the outer half of seal ring face (D).
   - Sealing area must be uniform and concentric with the ID and OD of seal ring (A).
   - Sealing area must not be chipped, nicked, or scratched.



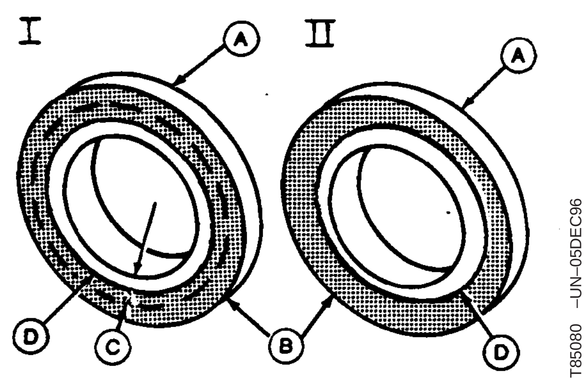
A—Seal Ring
B—Worn Area (Shaded Area)
C—Seal Ring Face
D—Outer Half of Seal Ring Face
E—Sealing Area (Dark Line)

TX,01,VV2521 –19–14FEB97–1/3

2. Illustration shows examples of worn seal rings (A).

   I—Sealing area (D) is in inner half of seal ring face (C).

   II—Sealing area (D) not concentric with ID and OD of seal ring.



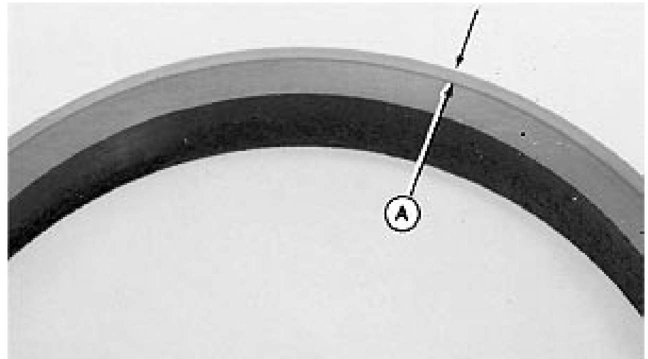
A—Seal Ring
B—Worn Area (Shaded Area)
C—Inner Half of Seal Ring Face
D—Sealing Area (Dark Line)

Continued on next page TX,01,VV2521 –19–14FEB97–2/3

3. Clean reusable seals by removing all foreign material from seal rings, except seal face (A), using a scraper or a stiff bristled fiber brush.

4. Wash seal rings and O-rings using a volatile, non-petroleum base solvent to remove all oil. Thoroughly dry parts using a lint-free tissue.

   Apply a thin film of oil to seal ring face. Put face of seal rings together and hold using tape.



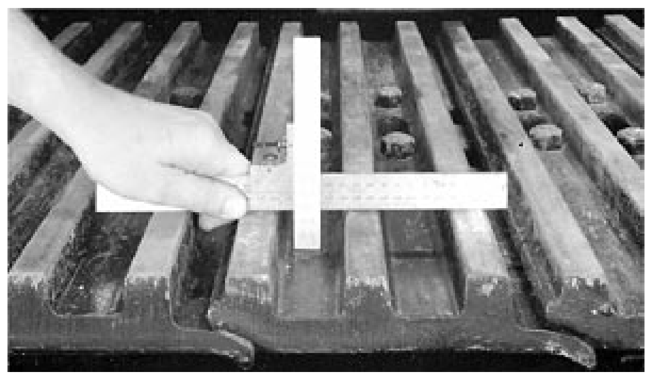
A—Seal Face

TX,01,VV2521 –19–14FEB97–3/3

MEASURE TRACK SHOE GROUSER WEAR

Minimum used is the maximum allowable wear for rebuilding grouser bars with weld.

Measure grouser height of several track shoes to find an average using a depth gauge such as the JT05521 200 mm Ruler, JT05534 Right Angle Attachment, and D05231ST 300 mm Ruler from JT05518A or JT05523 Undercarriage Inspection Service Tool Kit.



Three Bar Grouser—Specification

Height .... 31.0 mm (1.22 in.) new
Height .... 25.0 mm (0.98 in.) minimum used

CED,OUOE023,121 –19–21MAY98–1/1

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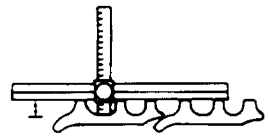
THREE BAR GROUSER HEIGHT 600 MM (23.6 IN.) WIDTH

Allowable Wear—6.0 mm (0.24 in.)

Dimension	Percent Worn
26.0 mm (1.02 in.)	0
25.7 mm (1.01 in.)	5
25.4 mm (1.00 in.)	10
25.1 mm (0.99 in.)	15
24.8 mm (0.98 in.)	20
24.5 mm (0.96 in.)	25
24.2 mm (0.95 in.)	30
23.9 mm (0.94 in.)	35
23.6 mm (0.93 in.)	40
23.3 mm (0.92 in.)	45
23.0 mm (0.91 in.)	50
22.7 mm (0.89 in.)	55
22.4 mm (0.88 in.)	60
22.1 mm (0.87 in.)	65
21.8 mm (0.86 in.)	70
21.5 mm (0.85 in.)	75
21.2 mm (0.83 in.)	80
20.9 mm (0.82 in.)	85
20.6 mm (0.81 in.)	90
20.3 mm (0.80 in.)	95
20.0 mm (0.79 in.)	**100**
19.7 mm (0.78 in.)	105
19.4 mm (0.76 in.)	110
19.1 mm (0.75 in.)	115
18.8 mm (0.74 in.)	120



T6813AP –UN–29JAN98

TX,07,SB5570 –19–26SEP97–1/1

REMOVE AND INSTALL TRACK SHOE

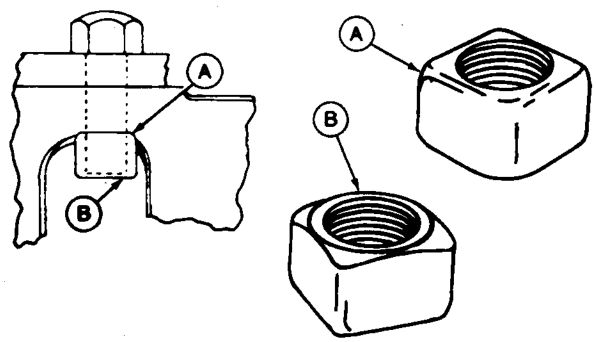
1. Remove nuts, cap screws, and shoe.

2. Apply a light coat of oil to cap screw threads and install shoe.

T6585TF –UN–25OCT88

CED,OUOE023,122 –19–21MAY98–1/3

3. Install all track shoe nuts with rounded edges (A) against link and chamfered edges (B) away from link. Be sure nut is properly positioned in link so there is full contact between nut and link.



T6794AM –UN–23FEB89

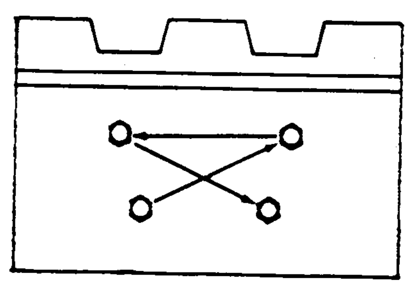
A—Rounded Edge
B—Chamfered Edge

CED,OUOE023,122 –19–21MAY98–2/3

4. Starting at any cap screw, tighten cap screws in sequence shown.

Track Shoe-to-Link Cap Screw—Specification

Torque .... 298 N•m (220 lb-ft) plus 1/2 (180°) turn



T6352AH –UN–23FEB89

CED,OUOE023,122 –19–21MAY98–3/3

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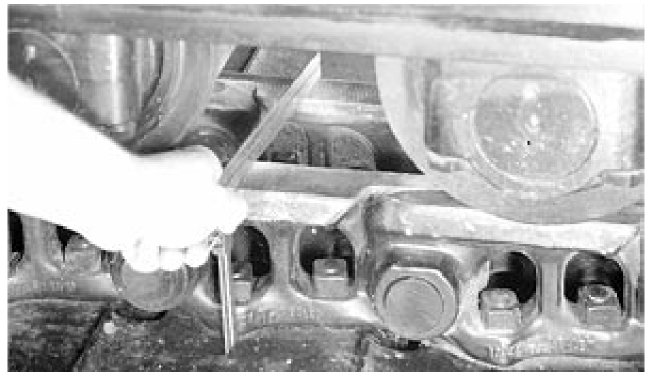
MEASURE TRACK CHAIN LINK WEAR



Minimum used is the maximum allowable wear for rebuilding links.

Measure height of several links to find an average using a depth gauge such as the JT05521 200 mm Ruler, JT05534 Right Angle Attachment, and D05231ST 300 mm Ruler from JT05518A or JT05523 Undercarriage Inspection Service Tool Kit.

Track Chain Link—Specification

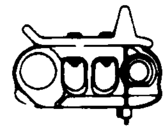
Height .... 116.4 mm (4.58 in.) new
Height .... 111.0 mm (4.37 in.) minimum used

CED,OUOE023,123 –19–21MAY98–1/1

LINK HEIGHT

Allowable Wear—5.4 mm (0.21 in.)

Dimension	Percent Worn
116.4 mm (4.58 in.)	0
116.1 mm (4.57 in.)	5
115.9 mm (4.56 in.)	10
115.6 mm (4.55 in.)	15
115.3 mm (4.54 in.)	20
115.1 mm (4.53 in.)	25
114.8 mm (4.52 in.)	30
114.5 mm (4.51 in.)	35
114.2 mm (4.50 in.)	40
114.0 mm (4.49 in.)	45
113.7 mm (4.48 in.)	50
113.4 mm (4.47 in.)	55
113.2 mm (4.46 in.)	60
112.9 mm (4.44 in.)	65
112.6 mm (4.43 in.)	70
112.4 mm (4.42 in.)	75
112.1 mm (4.41 in.)	80
111.8 mm (4.40 in.)	85
111.5 mm (4.39 in.)	90
111.3 mm (4.38 in.)	95
111.0 mm (4.37 in.)	**100**
110.7 mm (4.36 in.)	105
110.5 mm (4.35 in.)	110
110.2 mm (4.34 in.)	115
109.9 mm (4.33 in.)	120



T6813AO –UN–29JAN98

CED,OUOE020,30 –19–10MAR99–1/1

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MEASURE TRACK CHAIN BUSHING WEAR

Minimum used is the maximum allowable wear for turning pins and bushings.

Measure bushing outer diameter at the two worn places using a caliper such as the D17524C1 100 mm Caliper from JT05518A Undercarriage Inspection Service Tool Kit.

Track Chain Bushing—Specification

OD .... 66.7 mm (2.63 in.) new
OD .... 61.9 mm (2.44 in.) minimum used

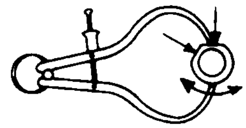
T82865 –UN–08NOV88

CED,OUOE023,124 –19–21MAY98–1/1

BUSHING OUTER DIAMETER

Allowable Wear—4.8 mm (0.19 in.)

Dimension	Percent Worn
66.7 mm (2.63 in.)	0
66.5 mm (2.62 in.)	5
66.2 mm (2.61 in.)	10
66.0 mm (2.60 in.)	15
65.7 mm (2.59 in.)	20
65.5 mm (2.58 in.)	25
65.3 mm (2.57 in.)	30
65.0 mm (2.56 in.)	35
64.8 mm (2.55 in.)	40
64.5 mm (2.54 in.)	45
64.3 mm (2.53 in.)	50
64.1 mm (2.52 in.)	55
63.8 mm (2.51 in.)	60
63.6 mm (2.50 in.)	65
63.3 mm (2.49 in.)	70
63.1 mm (2.48 in.)	75
62.9 mm (2.47 in.)	80
62.6 mm (2.47 in.)	85
62.4 mm (2.46 in.)	90
62.1 mm (2.45 in.)	95
61.9 mm (2.44 in.)	**100**
61.7 mm (2.43 in.)	105
61.4 mm (2.42 in.)	110
61.2 mm (2.41 in.)	115
60.9 mm (2.40 in.)	120



T6813AK –UN–29JAN98

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CED,OUOE020,31 –19–10MAR99–1/1

MEASURE TRACK CHAIN PITCH

Maximum used is the maximum allowable wear for turning pins and bushings.

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1. Remove slack by putting a wooden block between sprocket and chain, then slowly move machine in reverse to tighten chain.

2. Measure pitch across several four-link sections as shown, except section on either side of master pin, to find average chain wear. Use a tape measure such as the JT05520 Metric Tape from JT05518A or JT05523 Undercarriage Inspection Service Tool Kit.

T6813AL –UN–29JAN98

Track Chain—Specification

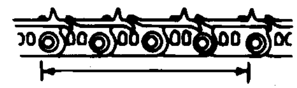
Pitch.. 816.0 mm (32.13 in.) new
Pitch... 834.0 mm (32.8 in.) maximum used

CED,OUOE023,125 –19–22MAY98–1/1

PITCH 204.00 MM (8.03 IN.)

Allowable Wear—18.0 mm (0.71 in.)

Dimension	Percent Worn
816.0 mm (32.13 in.)	0
816.9 mm (32.16 in.)	5
817.8 mm (32.20 in.)	10
818.7 mm (32.23 in.)	15
819.6 mm (32.27 in.)	20
820.5 mm (32.30 in.)	25
821.4 mm (32.34 in.)	30
822.3 mm (32.37 in.)	35
823.2 mm (32.41 in.)	40
824.1 mm (32.44 in.)	45
825.0 mm (32.48 in.)	50
825.9 mm (32.52 in.)	55
826.8 mm (32.55 in.)	60
827.7 mm (32.59 in.)	65
828.6 mm (32.62 in.)	70
829.5 mm (32.66 in.)	75
830.4 mm (32.69 in.)	80
831.3 mm (32.73 in.)	85
832.2 mm (32.76 in.)	90
833.1 mm (32.80 in.)	95
834.0 mm (32.83 in.)	**100**
834.9 mm (32.87 in.)	105
835.8 mm (32.91 in.)	110
836.7 mm (32.94 in.)	115
837.6 mm (32.98 in.)	120



T6813AL –UN–29JAN98

TX,07,SB6028 –19–26SEP97–1/1

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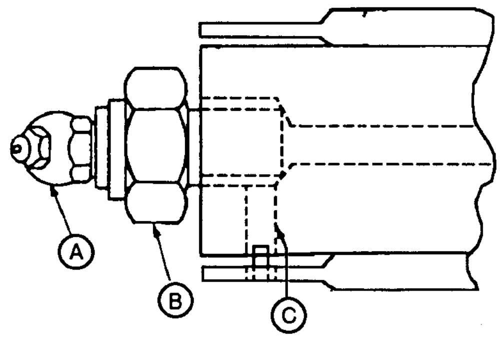
REMOVE TRACK CHAIN

CAUTION: Prevent possible injury from high pressure grease. Do not remove grease fitting (A) from valve (B).

1. Loosen valve (B) one to two turns to release grease through bleed hole (C).

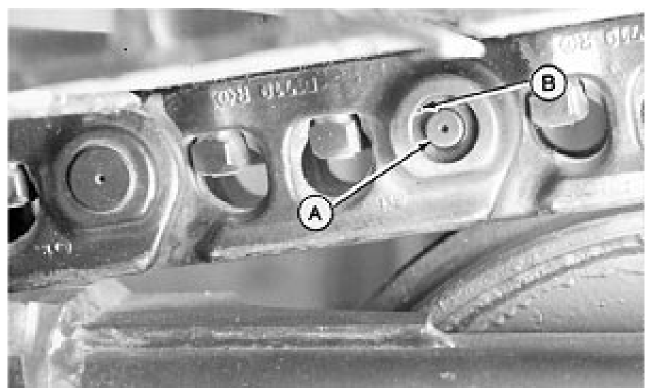


A—Grease Fitting
B—Valve
C—Bleed Hole

CED,OUOE023,126 –19–22MAY98–1/3

NOTE: Disconnect track chain at the end of track frame where the work is to be done.

2. Move track chain so master pin (A) is over front idler or sprocket.
3. Remove snap ring (B).
4. Remove a track shoe on each side of master pin.
5. Put wooden blocks in front of idler and under chain so chain does not fall when master pin is removed.
6. Raise machine so sprocket teeth clear chain.



A—Master Pin
B—Snap Ring

Continued on next page

CED,OUOE023,126 –19–22MAY98–2/3

CAUTION: The approximate weight of track with 800 mm (32 in.) shoes is 2358 kg (5200 lb).

Track Chain with 800 mm (32 in.) Shoes—Specification

Weight.. 2358 kg (5200 lb) approximate

NOTE: The OD of master pin at the snap ring end is larger than the other end. The master pin OD differences are exaggerated.

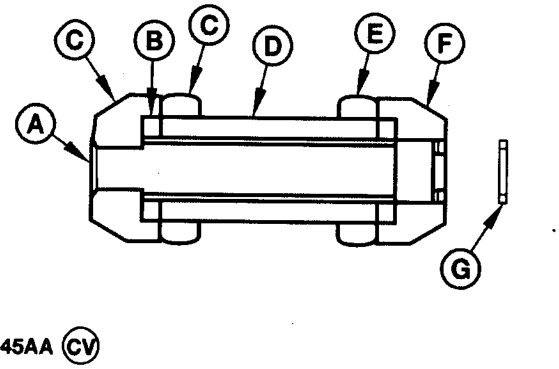
7. Remove master pin (A) through the “snap ring side” of track using a 50 ton track press such as D01030AA 50-Ton Master Pin Pusher Installer.

8. Pry apart chain and lower end of track.

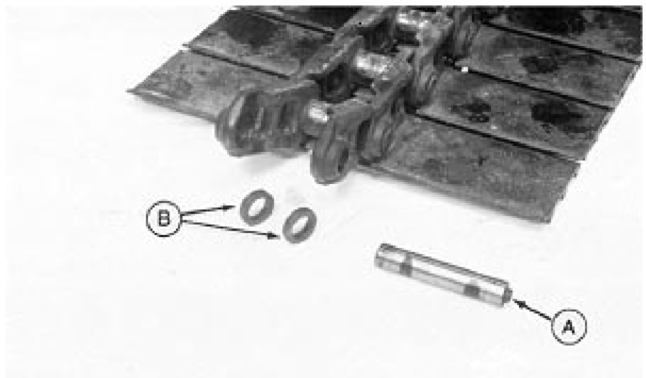
9. Remove spacers (B).

10. Slowly turn sprocket in reverse direction to remove track chain from excavator.

11. Inspect parts and repair as necessary.



T7945AA –UN–23APR93



T6876BO –UN–06DEC88

A—Master Pin
B—Spacer (2 used)
C—Link
D—Master Bushing
E—Link
F—Master Link
G—Snap Ring

CED,OUOE023,126 –19–22MAY98–3/3

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INSTALL TRACK CHAIN

1. Position track chain so section on ground has pin boss on links toward rear of machine.

2. Install end of chain on sprocket and slowly turn sprocket in forward direction to pull chain across top of frame to front idler.

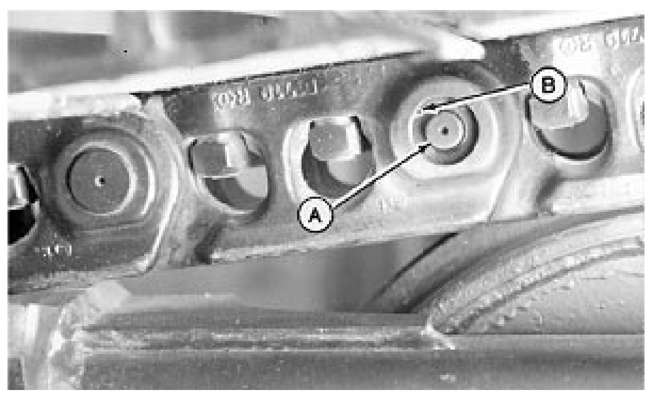
3. Install spacers. Pull ends of chain together.

T6557DN –UN–25OCT88

CED,OUOE023,127 –19–22MAY98–1/5

4. Install master pin (A) and snap ring (B) from snap ring side of track.

5. Lower machine.



T6585TH –UN–25OCT88

A—Master Pin
B—Snap Ring

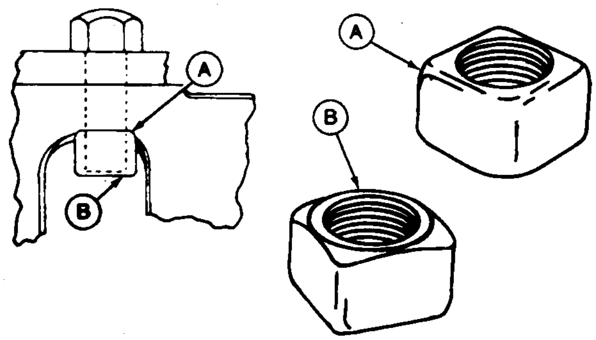
Continued on next page CED,OUOE023,127 –19–22MAY98–2/5

6. Apply a light coat of oil to cap screw threads and install shoe.

T6585TF –UN–25OCT88

CED,OUOE023,127 –19–22MAY98–3/5

7. Install all track shoe nuts with rounded edges (A) against link and chamfered edges (B) away from link. Be sure nut is properly positioned in link so there is full contact between nut and link.



T6794AM –UN–23FEB89

A—Rounded Edge
B—Chamfered Edge

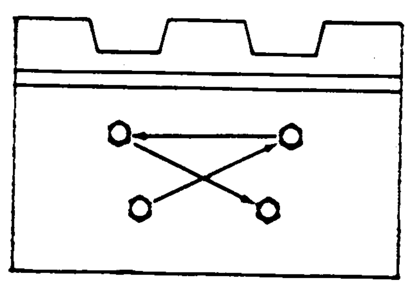
CED,OUOE023,127 –19–22MAY98–4/5

8. Starting at any cap screw, tighten cap screws in sequence shown to specification.

Track Shoe-to-Link Cap Screw—Specification

Torque .... 298 N•m (220 lb-ft) plus 1/2 (180°) turn

9. Adjust track sag. (See procedure in this group.)



T6352AH –UN–23FEB89

CED,OUOE023,127 –19–22MAY98–5/5

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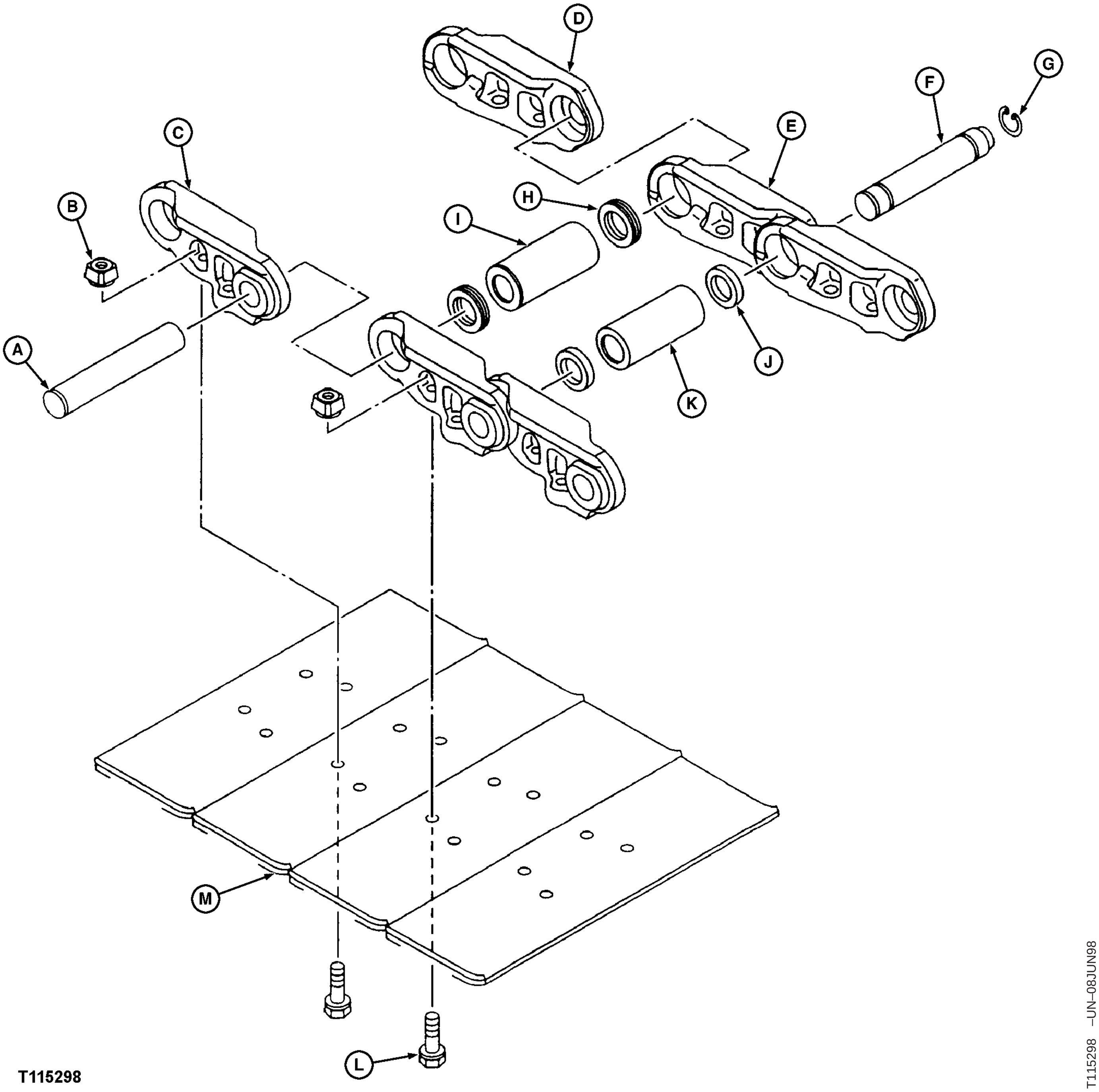
DISASSEMBLE AND ASSEMBLE TRACK CHAIN



A—Pin (47 used)
B—Nut (192 used)
C—Track Link (48 used)
D—Track Link (47 used)
E—Master Track Link
F—Master Pin
G—Snap Ring
H—Dust Seal (94 used)
I—Bushing (47 used)
J—Spacer (2 used)
K—Master Bushing
L—Cap Screw (192 used)
M—Shoe (48 used)

1. Remove parts (A—M). Inspect and replace parts as necessary.
2. Install parts.

Continued on next page

Minimum used is the maximum allowable wear for turning pins and bushings.

Measure bushing outer diameter at the two worn places using a caliper such as the D17524C1 100 mm Caliper from JT05518A or JT05523 Undercarriage Inspection Service Tool Kit.

Master Pin—Specification

OD.. 47.30 mm (1.86 in.) new
OD.. 44.30 mm (1.74 in.) minimum used

Master Bushing—Specification

ID .... 47.90 mm (1.89 in.) new
ID .... 50.90 mm (2.00 in.) minimum used

Track Pin—Specification

OD.. 47.57 mm (1.87 in.) new
OD.. 44.57 mm (1.75 in.) minimum used

Bushing—Specification

ID .... 48.40 mm (1.91 in.) new
ID .... 49.43 mm (1.95 in.) minimum used

CED,OUOE023,130 –19–22MAY98–2/2

DISASSEMBLE AND ASSEMBLE TRACK CHAIN TO REPLACE BROKEN PART

NOTE: It is not necessary to completely disassemble a chain to replace a broken part. If a track press is available, refer to the operator's manual. If a track press is not available, do the following procedure.

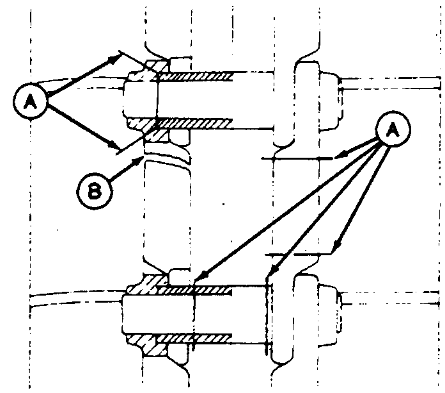
1. Remove track shoe from broken link assembly. Remove track. (See procedure in this group.)

Continued on next page

TX,01,VV2529 –19–16MAR98–1/5

IMPORTANT: When making cuts using cutting torch, be careful not to cut or gouge good parts.

2. Cut links, bushing, and pin at points (A) to remove broken link (B).

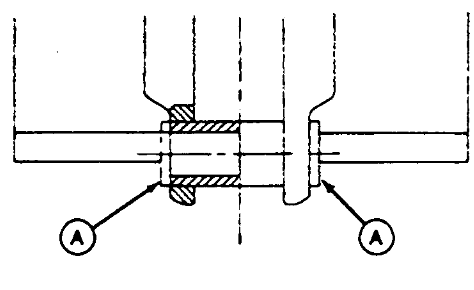


T5821AG –UN–26OCT88

A—Cutting Points
B—Broken Link

TX,01,VV2529 –19–16MAR98–2/5

3. Grind ends of bushing (A) even with links to make it into a master bushing.



T5821AH –UN–26OCT88

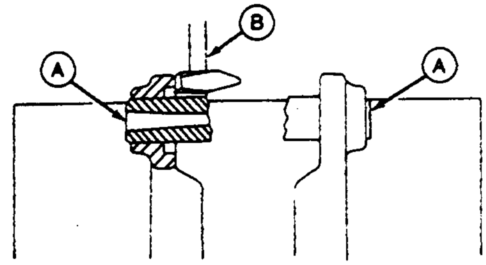
A—Bushing

Continued on next page

TX,01,VV2529 –19–16MAR98–3/5

4. Burn holes through center of pin stubs (A).

5. Hold a heavy hammer (B) against link while pin stub is being driven out.



T5821AI –UN–26OCT88

A—Pin Stub
B—Heavy Hammer

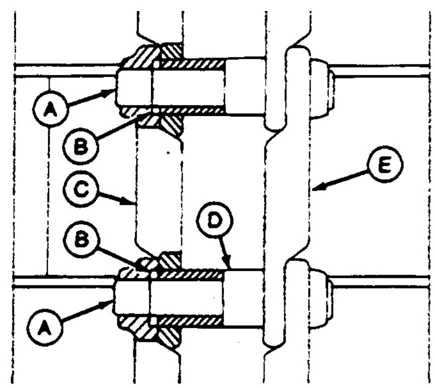
TX,01,VV2529 –19–16MAR98–4/5

NOTE: When new parts are ordered, have dealer assemble the new links and master bushing.

6. Install links (C and E) on master bushing (D). Check cap screw hole spacing using a track shoe.

7. Install spacers (B) into counterbore of links.

8. Install link assembly. Install master pins (A).



T5821AJ –UN–24MAY89

A—Master Pin
B—Spacer
C—Right Link
D—Master Bushing
E—Left Link

TX,01,VV2529 –19–16MAR98–5/5

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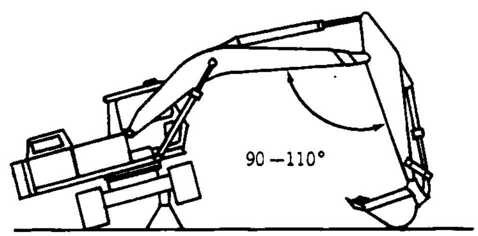
32

ADJUST TRACK SAG



T6876FG —UN–06DEC88

1. Swing upperstructure to side. Lower boom to raise track off the ground. Keep the angle between boom and arm at 90—110° with the round side of bucket on the ground.

CAUTION: Prevent possible injury from unexpected machine movement. Put blocks or shop stands under machine frame to support machine while measuring track sag.

The approximate weight of 330LCR is 33 049 kg (72,864 lb).

Machine—Specification

Weight.. 33 049 kg (72,864 lb) approximate

2. Put blocks or shop stands under machine for support.

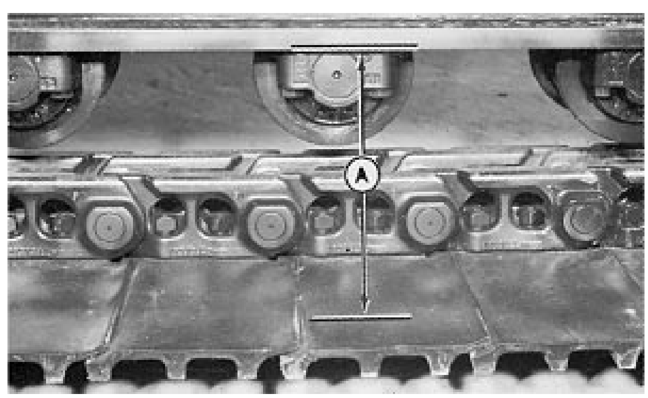
3. Slowly turn track forward two revolutions and then in reverse two revolutions. Stop track while moving in reverse direction so all track sag is at bottom.

CED,OUOE023,132 –19–22MAY98–1/3

4. Measure track sag (A) at center track roller from the bottom of track frame to the top surface of track shoe.

Track Sag—Specification

Distance.. 340—380 mm (13.375—15 in.)



T6457DL —UN–23FEB89

A—Track Sag

Continued on next page CED,OUOE023,132 –19–22MAY98–2/3

CAUTION: Prevent possible injury from high pressure grease in track adjuster cylinder. Do not remove grease fitting or nut and valve assembly to release grease.

IMPORTANT: Prevent possible damage to track components. Do not use the grease fitting on track adjuster cylinder for lubrication. Use this grease fitting only for track sag adjustment.

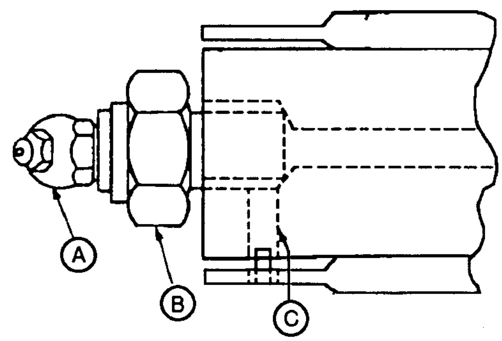
5. To decrease track sag, add multi-purpose grease to track adjuster cylinder through grease fitting (A) located in access hole (D) in track frame. Use a grease gun with a maximum capacity of 68 950 kPa (690 bar) (10,000 psi).

   To increase track sag, loosen nut and valve assembly (B) one turn to release grease from track adjuster cylinder through bleed hole (C) in rod. Tighten nut and valve assembly when track sag is correct.

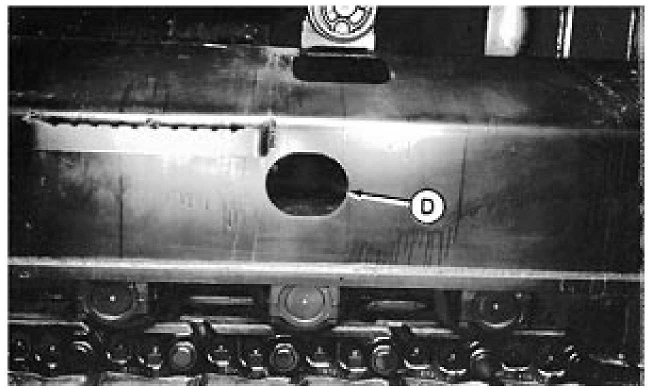
Nut and Valve Assembly—Specification

Torque .... 147 N•m (108 lb-ft)

NOTE: If piston in track adjuster cylinder does not move, remove the cylinder to make repairs. (See Remove and Install Track Adjuster in this group.)



T7396DZ –UN–28NOV90

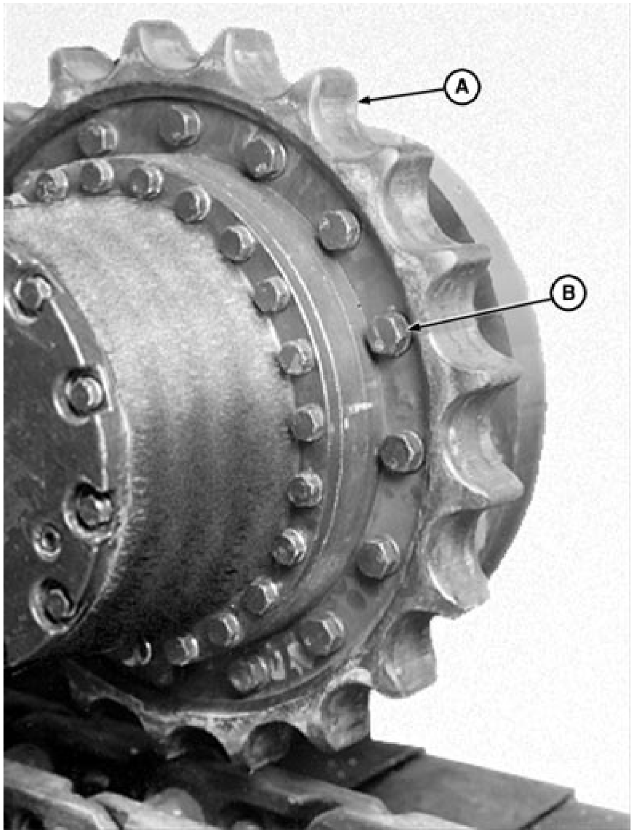


T7869AQ –UN–22OCT92

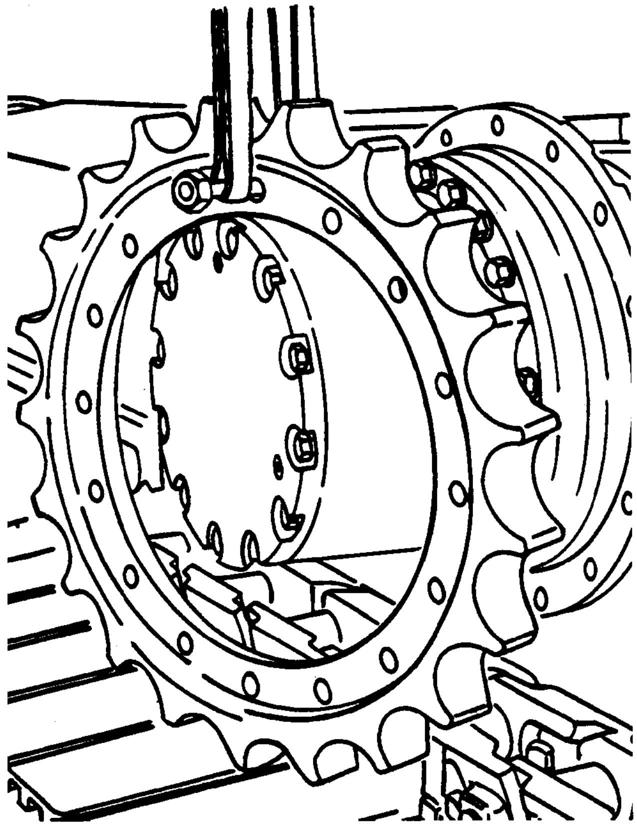
A—Grease Fitting
B—Nut and Valve Assembly
C—Bleed Hole
D—Access Hole

CED,OUOE023,132 –19–22MAY98–3/3

REMOVE AND INSTALL SPROCKET



T115154 –UN–08JUN98



T115153 –UN–08JUN98

A—Sprocket **B—Cap Screw (16 used)**

IMPORTANT: Sprocket must be replaced when the tooth tips become excessively rounded, worn, or chipped to prevent excessive wear to chain. If machine driven in one direction a majority of the time, wear will be on one side of teeth. To extend service life, change sprockets from one side of machine to the other.

1. Disconnect and remove track chain from sprocket (A). (See procedure in this group.)

2. Lift side of machine so sprocket teeth clear chain.

3. Remove cap screws (B).

CAUTION: For the 330LCR, the approximate weight of sprocket is 68 kg (150 lb).

Sprocket—Specification

Weight.. 68 kg (150 lb) approximate

4. Attach sprocket to hoist, remove and move to other side of machine or replace.

5. Clean threads of cap screws (B) using cure primer. Apply thread lock and sealer (high strength).

6. Install sprocket (A) and tighten cap screws (B).

Sprocket-to-Propel Gearbox Cap Screw—Specification

Torque.. 470 N•m (350 lb-ft)

7. Lower machine.

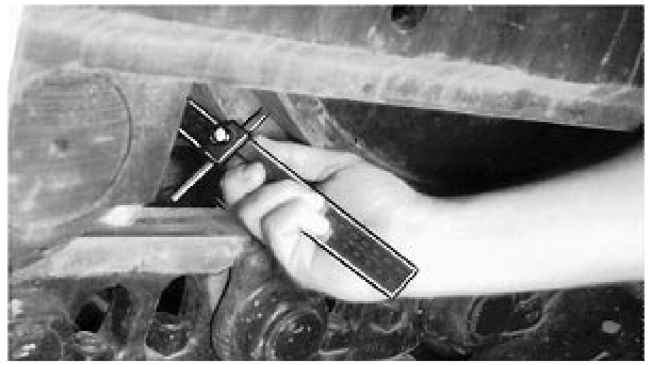
Continued on next page

8. Install track chain. (See procedure in this group.)

9. Adjust track sag. (See procedure in this group.)

CED,OUOE023,133 –19–26MAY98–2/2

MEASURE FRONT IDLER WEAR



T87972 –UN–08NOV88

Maximum used flange height is the maximum allowable height of flange for rebuilding wear surface.

Measure height of flange using a depth gauge such as the JT05521 200 mm Ruler, JT05534 Right Angle Attachment, and D05231ST 300 mm Ruler from JT05518A or JT05523 Undercarriage Inspection Service Tool Kit.

Front Idler Flange—Specification

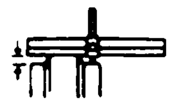
Height .... 22.5 mm (0.89 in.) new
Height .... 27.5 mm (1.09 in.) maximum used

CED,OUOE023,134 –19–26MAY98–1/1

FRONT IDLER FLANGE HEIGHT

Allowable Wear—5.0 mm (0.20 in.)

Dimension	Percent Worn
22.5 mm (0.89 in.)	0
22.8 mm (0.90 in.)	5
23.0 mm (0.91 in.)	10
23.3 mm (0.92 in.)	15
23.5 mm (0.93 in.)	20
23.8 mm (0.94 in.)	25
24.0 mm (0.94 in.)	30
24.3 mm (0.95 in.)	35
24.5 mm (0.96 in.)	40
24.8 mm (0.97 in.)	45
25.0 mm (0.98 in.)	50
25.3 mm (0.99 in.)	55
25.5 mm (1.00 in.)	60
25.8 mm (1.01 in.)	65
26.0 mm (1.02 in.)	70
26.3 mm (1.03 in.)	75
26.5 mm (1.04 in.)	80
26.8 mm (1.05 in.)	85
27.0 mm (1.06 in.)	90
27.3 mm (1.07 in.)	95
27.5 mm (1.08 in.)	**100**
27.8 mm (1.09 in.)	105
28.0 mm (1.10 in.)	110
28.3 mm (1.11 in.)	115
28.5 mm (1.12 in.)	120



T6813AR –UN–29JAN98

CED,OUOE020,32 –19–10MAR99–1/1

REMOVE AND INSTALL FRONT IDLER

1. Disconnect track chain. (See procedure in this group.)

CED,OUOE023,135 –19–26MAY98–1/2

CAUTION: For the 330LCR the approximate weight of the front idler is 163 kg (360 lb).

Front Idler—Specification

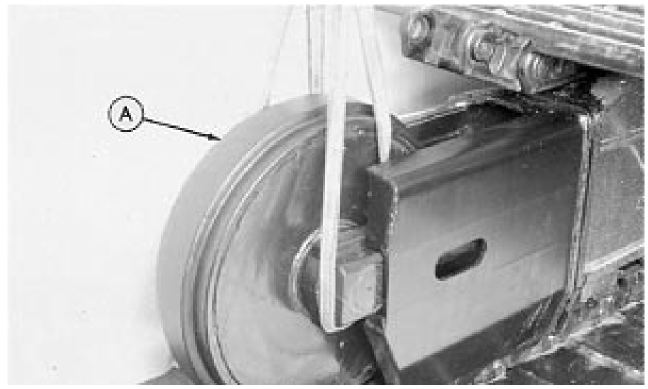
Weight.. 163 kg (360 lb) approximate

2. Slide front idler (A) forward using a pry bar.

3. Attach front idler to hoist, remove from frame, and replace or repair idler. (See procedure in this group.)

4. Install front idler and slide rearward into frame as far as possible.

5. Connect track chain. (See procedure in this group.)



T6876BU –UN–25OCT88

A—Front Idler

CED,OUOE023,135 –19–26MAY98–2/2

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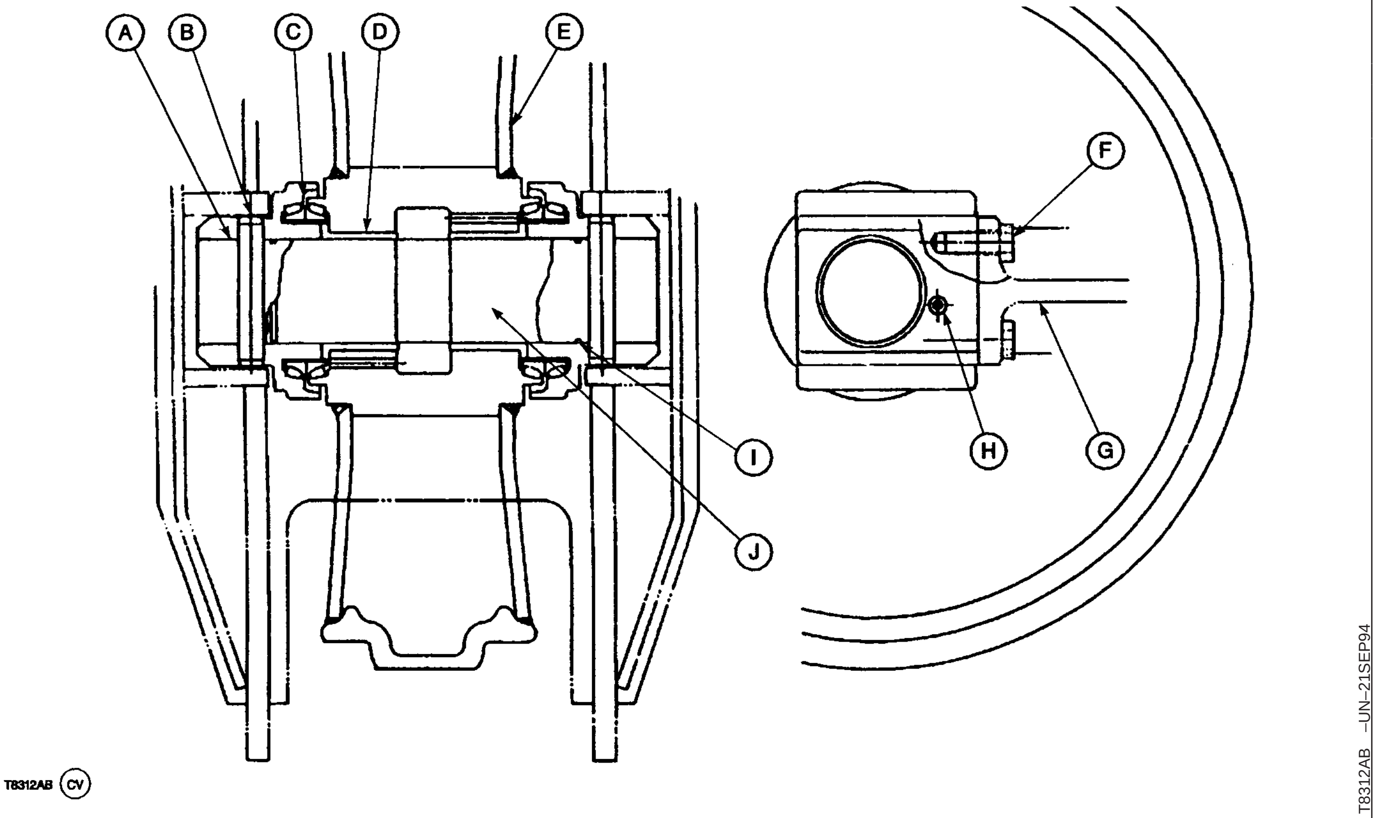
DISASSEMBLE FRONT IDLER



A—Bracket (Bearing) (2 used)
B—Pin (2 used)
C—Metal Face Seal (2 used)
D—Bushing (2 used)
E—Idler
F—Cap Screw (4 used)
G—Yoke
H—Plug (2 used)
I—O-Ring (2 used)
J—Axle

1. Remove cap screws (F). Remove yoke (G).

2. Remove drain plug (H). Drain oil.

IMPORTANT: Metal face seals can be reused if they are not worn or damaged. A used seal must be kept together as a set because of wear patterns on seal ring face.

3. Remove pins (B), brackets (A), O-rings (I), and metal face seals (C).

4. Inspect metal face seals. (See procedure in this group.) Keep seal rings together as a matched set with seal ring faces together to protect surfaces.

5. Remove axle (J). Inspect bushings (D) for scoring or excessive wear.

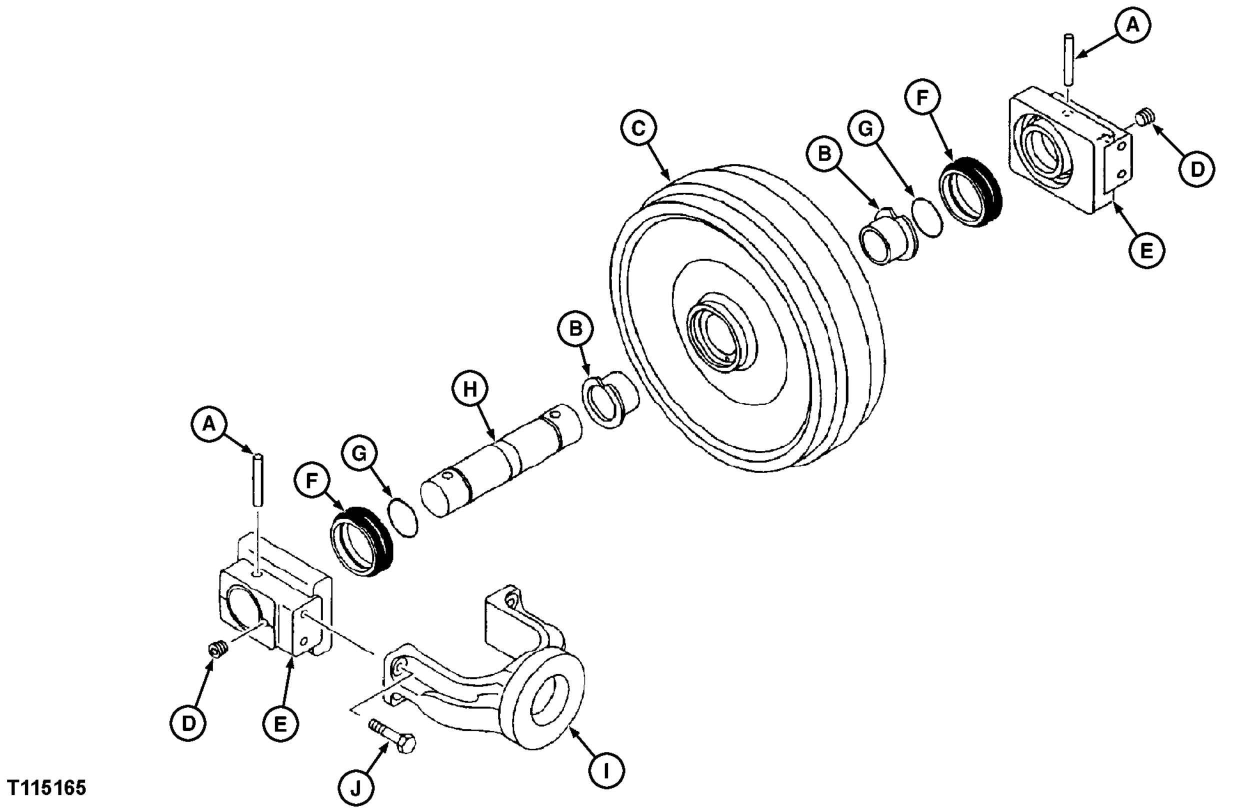
NOTE: Remove bushings only if replacement is necessary.

6. Remove bushing using a 2-jaw puller and adapters from 17-1/2 and 30-ton puller set.

7. Replace parts as necessary.

CED,OUOE023,136 –19–26MAY98–1/1

ASSEMBLE FRONT IDLER



T115165 –UN–08JUN98

A—Pin (2 used)
B—Bushing (2 used)
C—Idler
D—Plug (2 used)
E—Bracket (Bearing) (2 used)
F—Metal Face Seal (2 used)
G—O-Ring (2 used)
H—Axle
I—Yoke
J—Cap Screw (4 used)

1. Apply a thin film of oil to bushings (B). Install bushings so flange is tight against shoulder of idler (C).

2. Install O-rings (G) on axle (H).

3. Apply a thin layer of NEVER-SEEZ® lubricant or an equivalent to end of axle from O-ring to end of axle, and to bore in bracket (E).

4. Install axle (H) into bracket (E).

5. Apply NEVER-SEEZ® lubricant or an equivalent to pin (A). Install pin.

IMPORTANT: O-rings and seat surfaces for O-rings must be clean, dry, and oil free, so O-rings do not slip when idler is turning.

6. Thoroughly clean the O-rings and seat surfaces in idler, bracket, and seal rings using volatile, non-petroleum base solvent and lint-free tissues.

7. Install O-ring on seal rings.

8. Install metal face seals (F) in bracket (E) and idler (C).

NEVER-SEEZ is a trademark of Emhart Chemical Group.

Continued on next page

NOTE: Apply equal pressure with fingers at four equally spaced points on seal face. Seal must "pop" down into place so O-ring is tight against seal bore. A volatile non-petroleum base solvent or talcum powder may be used as a lubricant. Solvent MUST NOT damage the O-rings or leave a oil residue.

9. Wipe finger prints and foreign material off seal ring face using clean oil and lint-free tissues. Apply a thin film of oil to each seal ring face.

10. Install axle (H) into idler (C).

11. Repeat procedure for other side of idler.

12. Fill front idler with 225 mL (7.6 fl oz) of oil. (See Track Roller, Front Idler, and Carrier Roller Oil in Fuels and Lubricants, Group 0004.)

13. Clean threads of drain plug (D) using cure primer. Apply pipe sealant and install plug.

14. Install yoke (I). Tighten cap screws (J).

Yoke-to-Bracket Cap Screw—Specification

Torque.. 206 N•m (152 lb-ft)

CED,OUOE023,137 –19–26MAY98–2/2

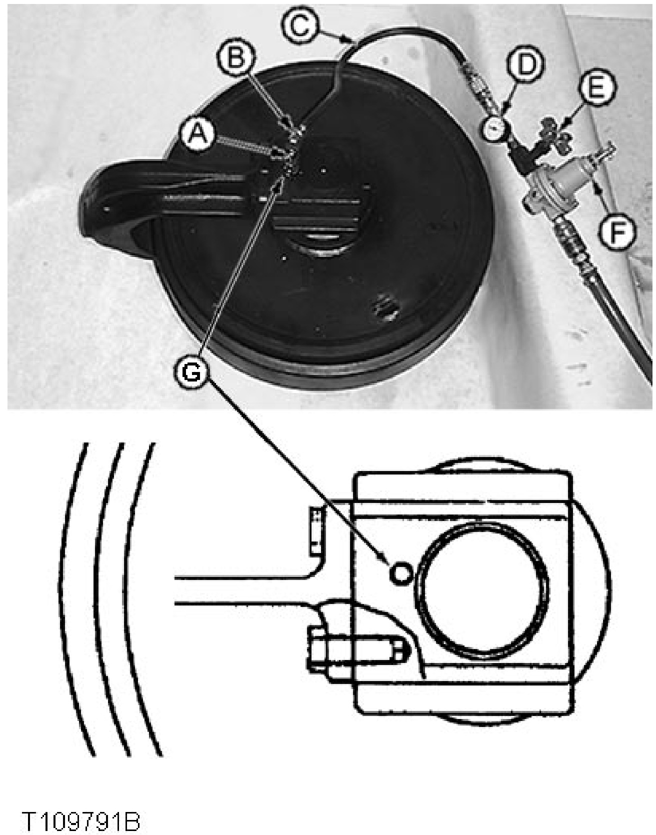
TEST FRONT IDLER FOR OIL LEAKAGE

1. Turn shaft several turns to seat metal face seals.
2. Remove plug (G).
3. Install parts (A—F) as shown. Plug, barbed adapter, and connector are from a leak detector kit such as the D05361ST Rubber Stopper/Leak Detector Kit.
4. Hold plug so it is not pushed out, slowly pressurize oil cavity using air.

Front Idler Oil Cavity—Specification

Pressure .... 110 ± 18 kPa (1.1 ± 0.3 bar) (16 ± 4 psi)

5. Close valve and wait for a minimum of 30 seconds to check for oil leakage. Check gauge to see if air pressure has decreased.
6. If there is external leakage, disassemble idler and replace parts as necessary.
7. Check oil level in idler. If oil level is down and there is no external leakage, check for a leak from oil cavity to interior of idler wheel.
8. Clean threads of plug using cure primer.
9. Apply pipe sealant to threads of plug. Install and tighten plug.



T109791B –UN–13JUN97

A—Plug, Adapter and Connector
B—Connector 1/8 M NPT x 7/16-20 M 37°
C—Hose
D—Pressure Gauge
E—Snubber (Needle) Valve
F—Air Pressure Regulator
G—Drain Plug

CED,OUOE023,2281 –19–30JAN98–1/1

REMOVE AND INSTALL TRACK ADJUSTER CYLINDER AND RECOIL SPRING

1. Remove track chain and front idler. (See procedures in this group.)

Continued on next page

CED,OUOE023,140 –19–26MAY98–1/3

CAUTION: Spring or rod may break if dropped while handling, transporting or disassembling. Nicks or weld craters in spring and rod assembly can cause stress concentration resulting in a weak spot. Weak spots may result in immediate or eventual failure creating a risk of personal injury. Put a heavy protective covering around spring assembly when handling, transporting, or disassembling.

A compression tool must be used for disassembly and assembly because of the extreme preload on spring.

2. Slide track adjuster cylinder and recoil spring (A) forward using a pry bar.

T6557CX –UN–25OCT88

A—Track Adjuster Cylinder and Recoil Spring

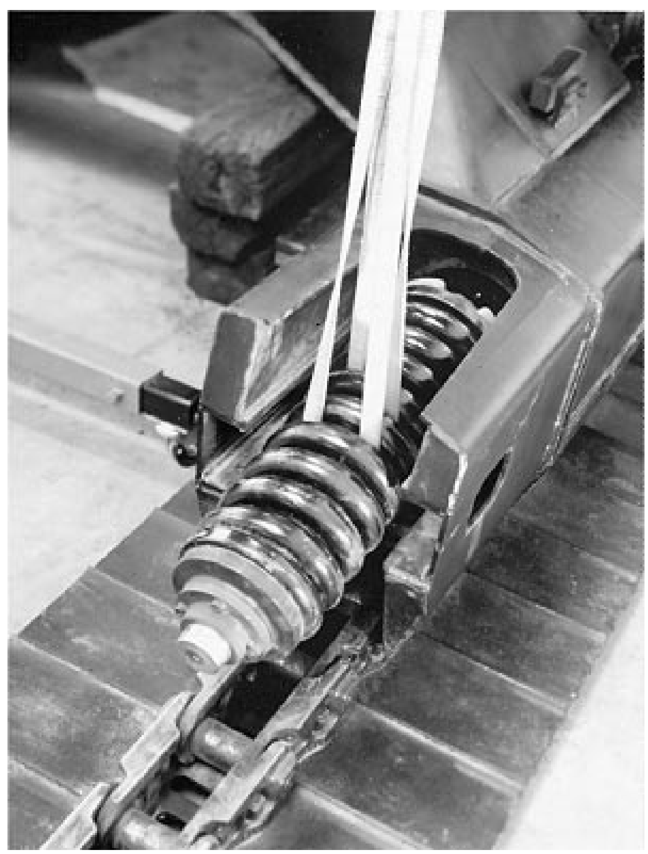
CED,OUOE023,140 –19–26MAY98–2/3

CAUTION: For the 330LCR, the approximate weight of track adjuster cylinder and recoil spring is 180 kg (397 lb).

Track Adjuster Cylinder and Recoil Spring—Specification

Weight.. 180 kg (397 lb) approximate

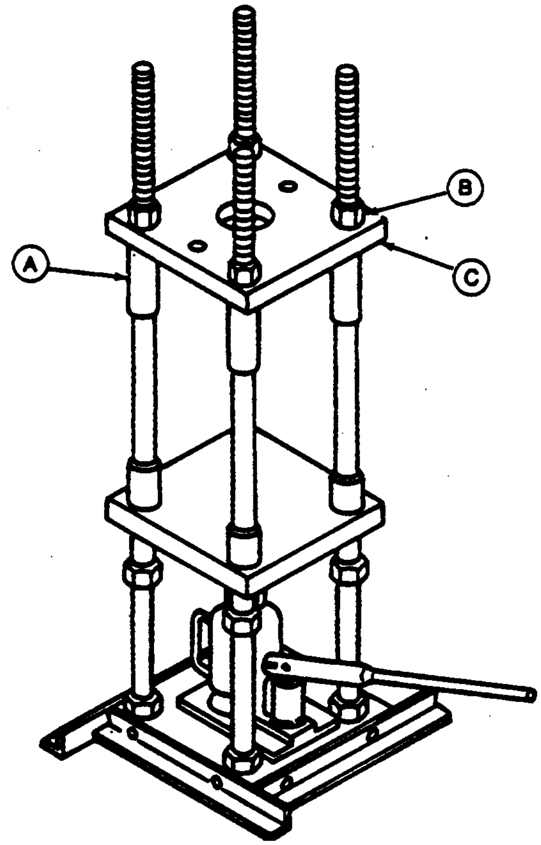
3. Attach track adjuster to hoist, remove from frame, and repair or replace.



T6557CY –UN–25OCT88

CED,OUOE023,140 –19–26MAY98–3/3

DISASSEMBLE AND ASSEMBLE TRACK ADJUSTER AND RECOIL SPRING



A—ST4920 Track Recoil Spring Disassembly and Assembly Tool
B—Nut (12 used)
C—Top Plate

CAUTION: Spring or rod may break if dropped while handling, transporting or disassembling. Nicks or weld craters in spring and rod assembly can cause stress concentration resulting in a weak spot. Weak spots may result in immediate or eventual failure creating a risk of personal injury. Put a heavy protective covering around spring assembly when handling, transporting, or disassembling.

A compression tool must be used for disassembly and assembly because of the extreme preload on spring.

CAUTION: The approximate weight of track recoil spring disassembly and assembly tool is 225 kg (496 lb).

1. Place an 18-t (20-ton) jack on bottom of ST4920 Track Recoil Spring Disassembly and Assembly Tool (A). Remove nuts (B) and top plate (C). (See Section 99 for instruction to make tool.)

NOTE: It is not necessary to remove the recoil spring to replace wear ring and U-ring packing on piston. To replace O-ring in the cylinder, remove recoil spring and rod.

2. Remove nuts (B). Remove top plate (C).

Continued on next page CED,OUOE023,141 –19–26MAY98–1/4

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44

CAUTION: For the 330LCR, the approximate weight of track adjuster and recoil spring is 180 kg (397 lb).

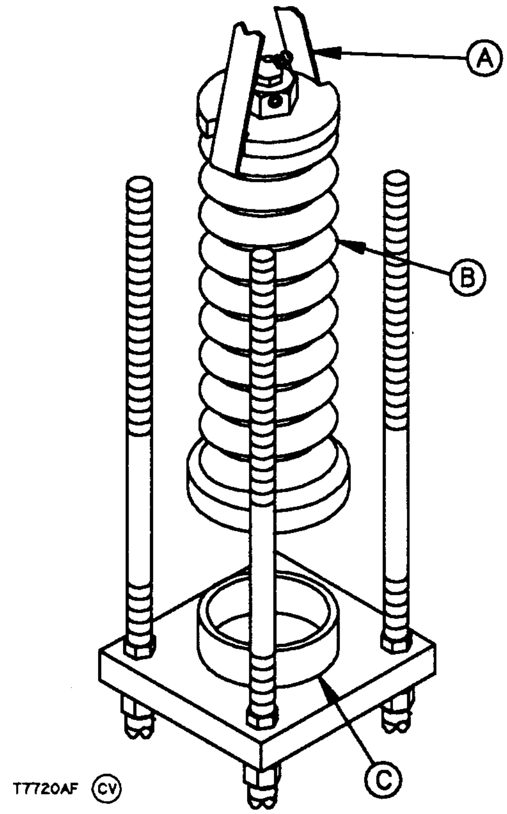
Track Adjuster and Recoil Spring—Specification

Weight... 180 kg (397 lb) approximate

3. Connect track adjuster (B) to a hoist using a lifting strap (A).

4. Put track adjuster in assembly tool with cylinder end on DFT1112 Spacer (C) for 330LCR machines. (See Section 99 for instructions to make tool.)

5. Remove lifting strap.



T7720AF –UN–28APR92

A—Lifting Strap
B—Track Adjuster
C—DFT1112 Spacer

Continued on next page CED,OUOE023,141 –19–26MAY98–2/4

6. Install DFT1087 Track Recoil Spring Disassembly and Assembly Guard Tool (F). (See Section 99 for instruction to make tool.)

7. Install plate (A) and nuts (B) with smallest opening to allow access to nut (D).

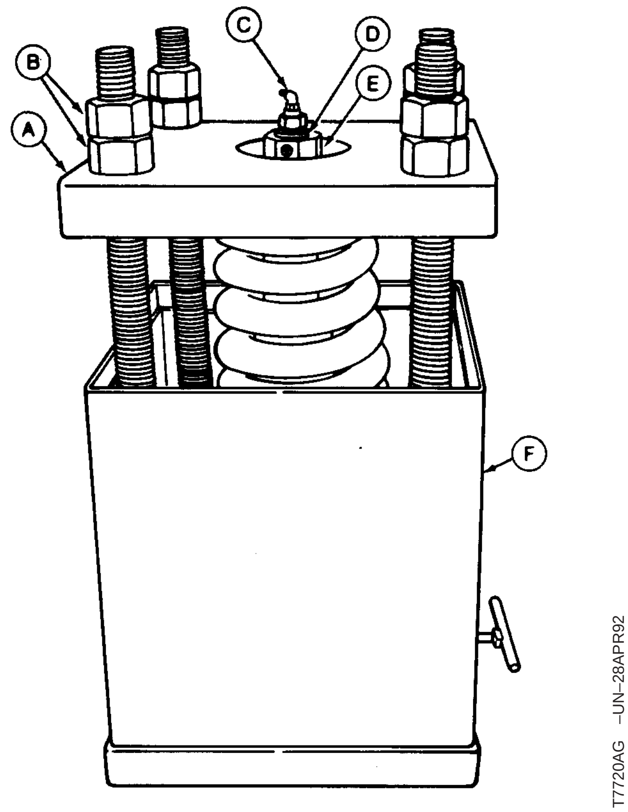
8. Extend jack ram so there is enough travel to release spring to an approximate free length of 677 mm (26.7 in.).

Recoil Spring—Specification

Free Length .... 677 mm (26.7 in.) approximate

9. Tighten nuts (B) so plate is tight against retainer plate.

10. Remove valve (C). Remove special plug (E).



A—Top Plate
B—Nut (8 used)
C—Valve
D—Nut
E—Special Plug
F—DFT1087 Track Recoil Spring Disassembly and Assembly Guard Tool

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45

Continued on next page CED,OUOE023,141 –19–26MAY98–3/4

11. Raise upper half of guard tool (F). Tighten T-handles.

12. Operate jack to compress spring just enough so nut (D) can be removed.

13. Lower jack ram to release spring force.

14. Disassemble and assemble track adjuster cylinder. (See procedure in this group.)

15. Put track adjuster cylinder in assembly tool with cylinder end on spacer.

16. Install spacer on rod.

17. Install spring using a hoist and lifting strap.

18. Install retainer plate.

19. Install guard tool.

20. Install top plate. Install nuts.

21. Raise upper half of guard tool. Tighten T-handles.

22. Operate jack to compress spring to specification.

Recoil Spring (330LCR)—Specification

Compressed Length .... 557 mm (21.93 in.)

23. Install nut (D) so hole is aligned with hole in rod. Install special plug (E).

24. Install special plug (E) and tighten.

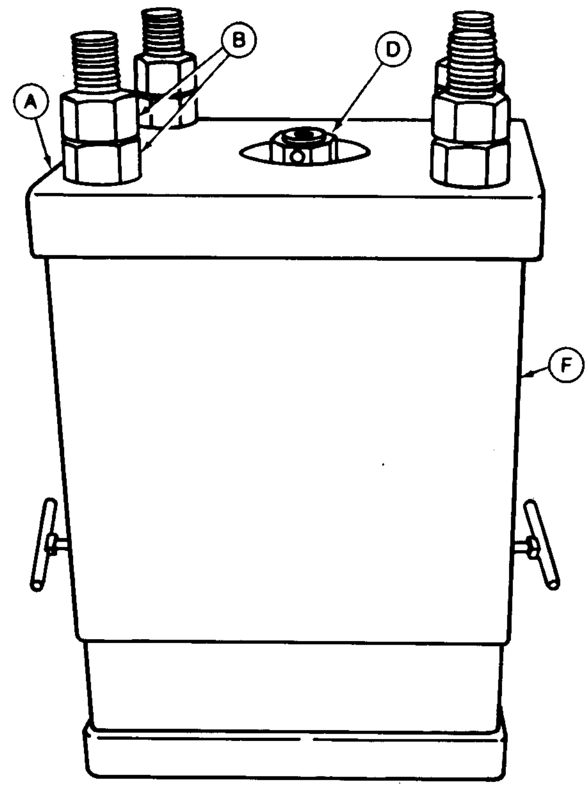
Special Plug—Specification

Torque .... 15 N•m (11 lb-ft)

25. Tighten valve.

Valve—Specification

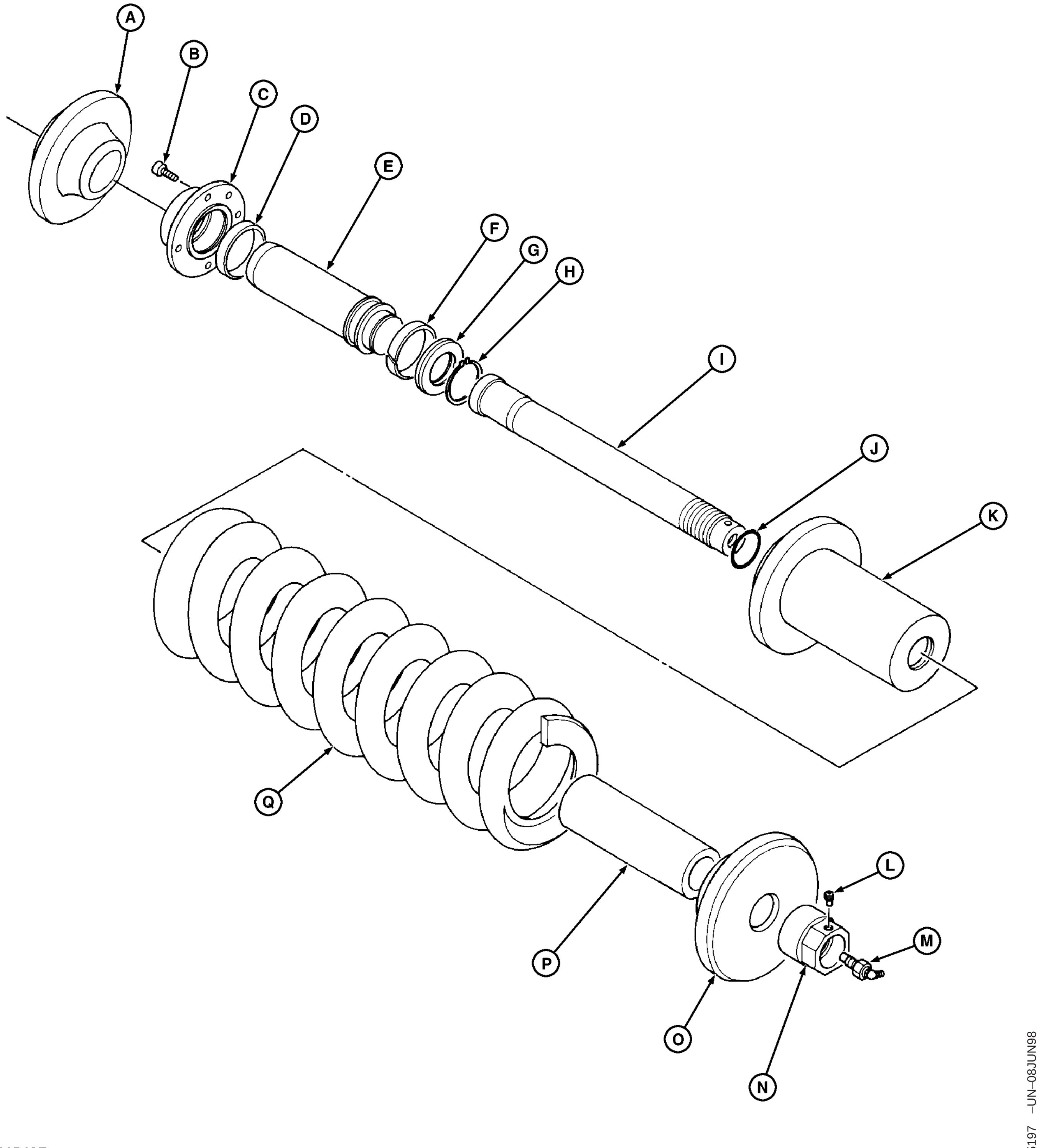
Torque .... 147 N•m (110 lb-ft)



T7720AH –UN–28APR92

A—Top Plate
B—Nut (8 used)
D—Nut
F—DFT1087 Track Recoil Spring Disassembly and Assembly Guard Tool

DISASSEMBLE AND ASSEMBLE TRACK ADJUSTER CYLINDER



T115197

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A—Holder
B—Cap Screw (4 used)
C—Flange
D—Dust Seal
E—Piston (Rod)
F—Wear Rings
G—U-Ring Packing
H—Snap Ring
I—Rod
J—O-Ring
K—Cylinder
L—Plug
M—Valve
N—Nut
O—Retainer Plate
P—Spacer
Q—Spring

CAUTION: Spring or rod may break if dropped while handling, transporting or disassembling. Nicks or weld craters in spring and rod assembly can cause stress concentration resulting in a weak spot. Weak spots may result in immediate or eventual failure of spring or rod creating a risk of personal injury. Put a heavy protective covering around spring assembly when handling, transporting, or disassembling.

A compression tool must be used for disassembly and assembly because of the extreme preload on spring.

NOTE: It is not necessary to remove the recoil spring (Q) to replace wear ring (F) and U-ring (G). To replace O-ring (J), remove recoil spring (Q) and rod (I). The recoil spring is removed using the ST4920 Track Recoil Spring Disassembly and Assembly Tool. (See procedure in this group.)

1. Remove spring (Q) and spacer (P).

2. Remove cap screws (B). Remove parts (C—J).

3. Replace parts as necessary.

4. Apply multi-purpose grease to dust seal (D), wear ring (F), U-ring packing (G) and O-ring (J). Fill grooves inside flange (C) with grease.

5. Install U-ring packing (G) with tip toward inside of cylinder.

6. Install parts (C—J).

7. Install cap screws (B) and tighten.

Flange Cap Screw—Specification

Torque.. 64 N•m (47 lb-ft)

NOTE: The recoil spring is installed using ST4920 Track Recoil Spring Disassembly and Assembly Tool. (See Disassemble and Assemble Track Adjuster Cylinder and Recoil Spring in this group.)

8. Install spacer (P) and spring (Q).

CED,OUOE023,142 –19–26MAY98–2/2

CHAPTER 10

SECTION 02

AXLES AND SUSPENSION SYSTEMS REPAIR

BLANK

Group 0250
Axle Shaft, Bearings, and Reduction Gears

SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools according to information given in the U.S. SERVICEGARD™ Catalog or from the European Microfiche Tool Catalog (MTC). Some tools may be available from a local supplier.

SERVICEGARD is a trademark of Deere & Company.

CED,OUOE003,506 –19–15MAY98–1/4

Propel Gearbox Nut Wrench . . . . DFT1036A[1]

To remove and install propel gearbox nut.

[1]Fabricated tool, dealer made. (See Section 99 for instructions to make tool.)

CED,OUOE003,506 –19–15MAY98–2/4

Holding Bar . . . . DFT1109[1]

Used as a support guide when removing and installing propel gearbox nut.

[1]Fabricated tool, dealer made. (See Section 99 for instructions to make tool.)

CED,OUOE003,506 –19–15MAY98–3/4

Lifting Bracket JT01748

To remove and install ring gear, drum and sprocket.

CED,OUOE003,506 –19–15MAY98–4/4

Axle Shaft, Bearings, and Reduction Gears

OTHER MATERIAL

Number	Name	Use
TY16285 (U.S.) TY9485 (Canadian) 7649 (LOCTITE®)	Cure Primer	Cleans and cures surface prior to application of adhesives or sealants.
T43512 (U.S.) TY9473 (Canadian) 242 (LOCTITE®)	Thread Lock and Sealer (Medium Strength)	Apply to threads of propel gearbox cap screws.
T43513 (U.S.) TY9474 (Canadian) 271 (LOCTITE®)	Thread Lock and Sealer (High Strength)	Apply to threads of lock plate and ring gear-to-drum cap screws.
T43514 (U.S.) TY9475 (Canadian) 277 (LOCTITE®)	Plastic Gasket	Apply to ring gear and drum mounting surfaces and cover.
TY9375 (U.S.) TY9480 (Canadian) 592 (LOCTITE®)	Pipe Sealant	Apply to threads of gearbox fill plug.

LOCTITE is a trademark of Loctite Corp.

CED,OUOE020,45 –19–12APR99–1/1

SPECIFICATIONS

Item	Measurement	Specification
Propel Gearbox:		
Propel Gearbox, Motor and Sprocket	Weight	568 kg (1252 lb) approximate
Gearbox-to-Frame Cap Screw	Torque	620 N•m (457 lb-ft)
Propel Motor “BV” Port-to-Rotary Manifold Port “4” Line Fitting	Torque	205 N•m (150 lb-ft)
Propel Motor “AV” Port-to-Rotary Manifold Port “3” Line Fitting	Torque	205 N•m (150 lb-ft)
Propel Motor Drain Port-to-Rotary Manifold Bottom Tee Port Line Fitting	Torque	93 N•m (69 lb-ft)
Propel Motor Speed Change Port-to-Rotary Manifold “P1” Port Line Fitting	Torque	34 N•m (25 lb-ft)
Propel Motor Cover Cap Screw	Torque	90 N•m (65 lb-ft)
Bearing Cone	Temperature	50—70°C (122—158°F)
Gearbox Bearing Nut	Torque	785 N•m (580 lb-ft)
Gearbox Bearing Nut Lock Plate Cap Screw	Torque	90 N•m (65 lb-ft)
Ring Gear-to-Drum Cap Screw	Torque	265 N•m (195 lb-ft)
Cover-to-Ring Gear Cap Screw	Torque	110 N•m (80 lb-ft)
Propel Gearbox Fill Plug	Torque	50 N•m (35 lb-ft)

CED,OUOE020,46 –19–12APR99–1/1

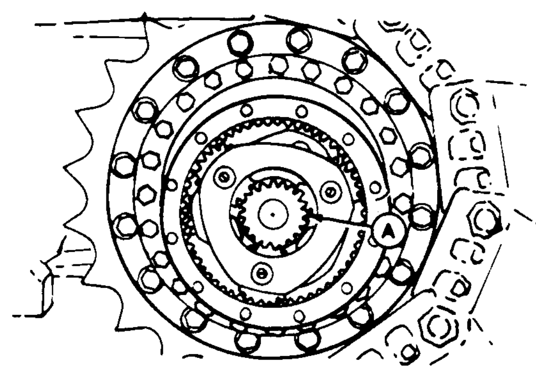
TOWING MACHINE

CAUTION: Prevent possible injury from unexpected machine movement. Block both tracks when disconnecting propel gearboxes. When propel gearboxes are disconnected, machine has no brakes and can move. The machine will roll free on a slope or while being towed.

1. Block tracks.
2. Drain oil from each propel gearbox. The approximate capacity is 7.5 L (8.0 qt).
3. Remove cover from each gearbox.

CED,OUOE023,146 –19–27MAY98–1/3

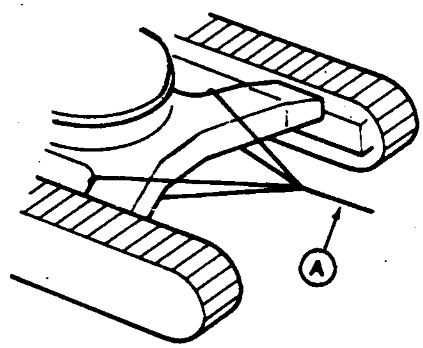
4. Remove sun gear (A) from each gearbox.
5. Install cover. Fill gearbox with oil. (See Swing Gearbox, Propel Gearbox and Pump Gearbox Oils in Fuels and Lubricants, Group 0004.)



A—Sun Gear

Continued on next page CED,OUOE023,146 –19–27MAY98–2/3

6. Attach a tow line (A) around machine frame as shown.



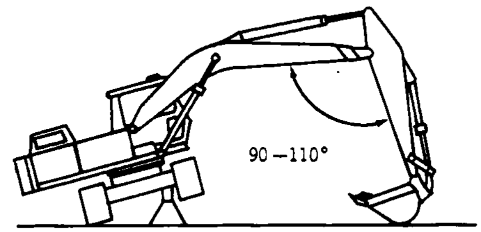
A—Tow Line

CED,OUOE023,146 –19–27MAY98–3/3

REMOVE AND INSTALL PROPEL GEARBOX

1. Swing upperstructure 90° and lower bucket to raise track off the ground. Keep angle between boom and arm 90—110° and position round side of bucket on ground. Put a support stand under the undercarriage.

2. Disconnect tracks. (See Remove Track Chain, Group 0130.)



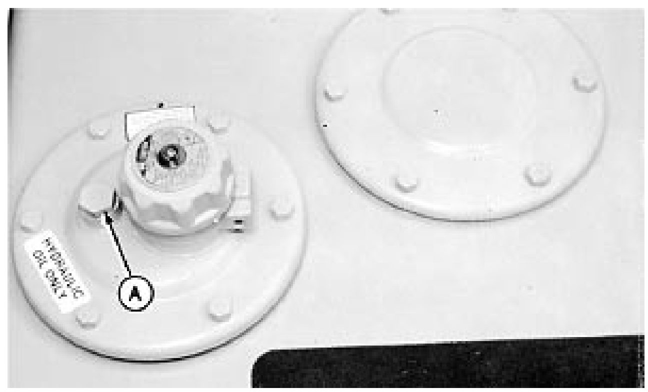
T6876FG –UN–06DEC88

CED,OUOE023,147 –19–27MAY98–1/4

CAUTION: The hydraulic oil tank is pressurized. High pressure release of oil from pressurized system can cause serious burns or penetrating injury. Release pressure from tank by loosening vent plug. It is not necessary to remove vent plug.

3. Loosen vent plug (A) to release air pressure in hydraulic oil tank.

4. Remove propel motor cover.



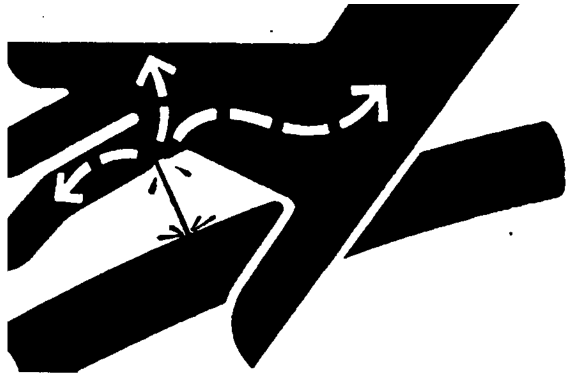
T7869AT –UN–12NOV92

A—Vent Plug

Continued on next page

CED,OUOE023,147 –19–27MAY98–2/4

CAUTION: To avoid injury from escaping fluid under pressure, stop engine and relieve the pressure in the system before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.



X9811 —UN–23AUG88

5. Disconnect hoses (A—D) from propel motor.

CAUTION: The approximate weight of propel gearbox, motor and sprocket is 568 kg (1252 lb).

Propel Gearbox, Motor and Sprocket—Specification

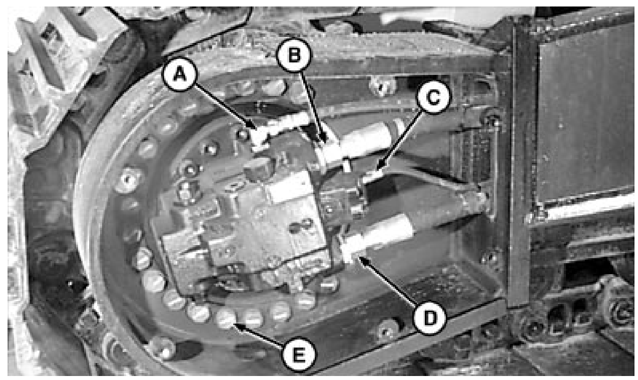
Weight	568 kg (1252 lb) approximate

6. Connect propel gearbox, motor and sprocket to a hoist using lifting straps.

NOTE: For propel motor repair, see Group 0260.

7. Remove cap screws and washers (E). Remove gearbox and motor.

8. Replace parts as necessary.



T115354 —UN–08JUN98

A—Propel Motor Drain Port-to-Rotary Manifold Bottom Tee Port Line
B—Propel Motor “BV” Port-to-Rotary Manifold Port “4” Line
C—Propel Motor Speed Change Port-to-Rotary Manifold “P1” Port Line
D—Propel Motor “AV” Port-to-Rotary Manifold Port “3” Line
E—Cap Screw and Washer (20 used)

Continued on next page

CED,OUOE023,147 –19–27MAY98–3/4

9. Install propel gearbox, motor and sprocket.

10. Install cap screws and washers (E). Tighten cap screws (D).

Gearbox-to-Frame Cap Screw—Specification

Torque .... 620 N•m (457 lb-ft)

11. Connect lines (B and D) and tighten fittings.

Propel Motor “BV” Port-to-Rotary Manifold Port “4” Line Fitting—Specification

Torque .... 205 N•m (150 lb-ft)

Propel Motor “AV” Port-to-Rotary Manifold Port “3” Line Fitting—Specification

Torque .... 205 N•m (150 lb-ft)

12. Connect line (A) and tighten fitting.

Propel Motor Drain Port-to-Rotary Manifold Bottom Tee Port Line Fitting—Specification

Torque .... 93 N•m (69 lb-ft)

13. Connect line (C) and tighten fitting.

Propel Motor Speed Change Port-to-Rotary Manifold “P1” Port Line Fitting—Specification

Torque .... 34 N•m (25 lb-ft)

14. Add gear oil. (See Swing Gearbox, Propel Gearbox and Pump Gearbox Oil in Group 0004.)

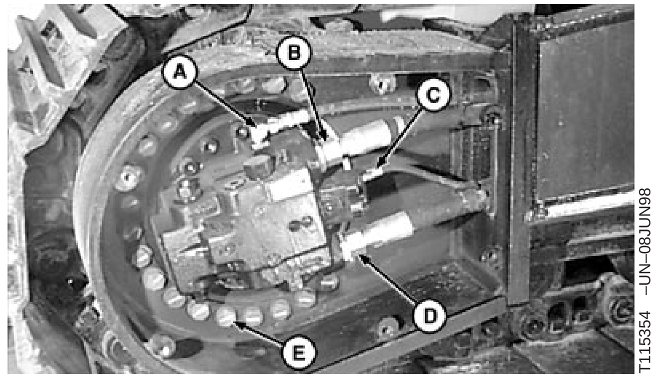
15. Do Propel Motor Start-Up Procedure. (See procedure in Group 0260.)

16. Install propel motor cover. Tighten cap screws.

Propel Motor Cover Cap Screw—Specification

Torque .... 90 N•m (65 lb-ft)

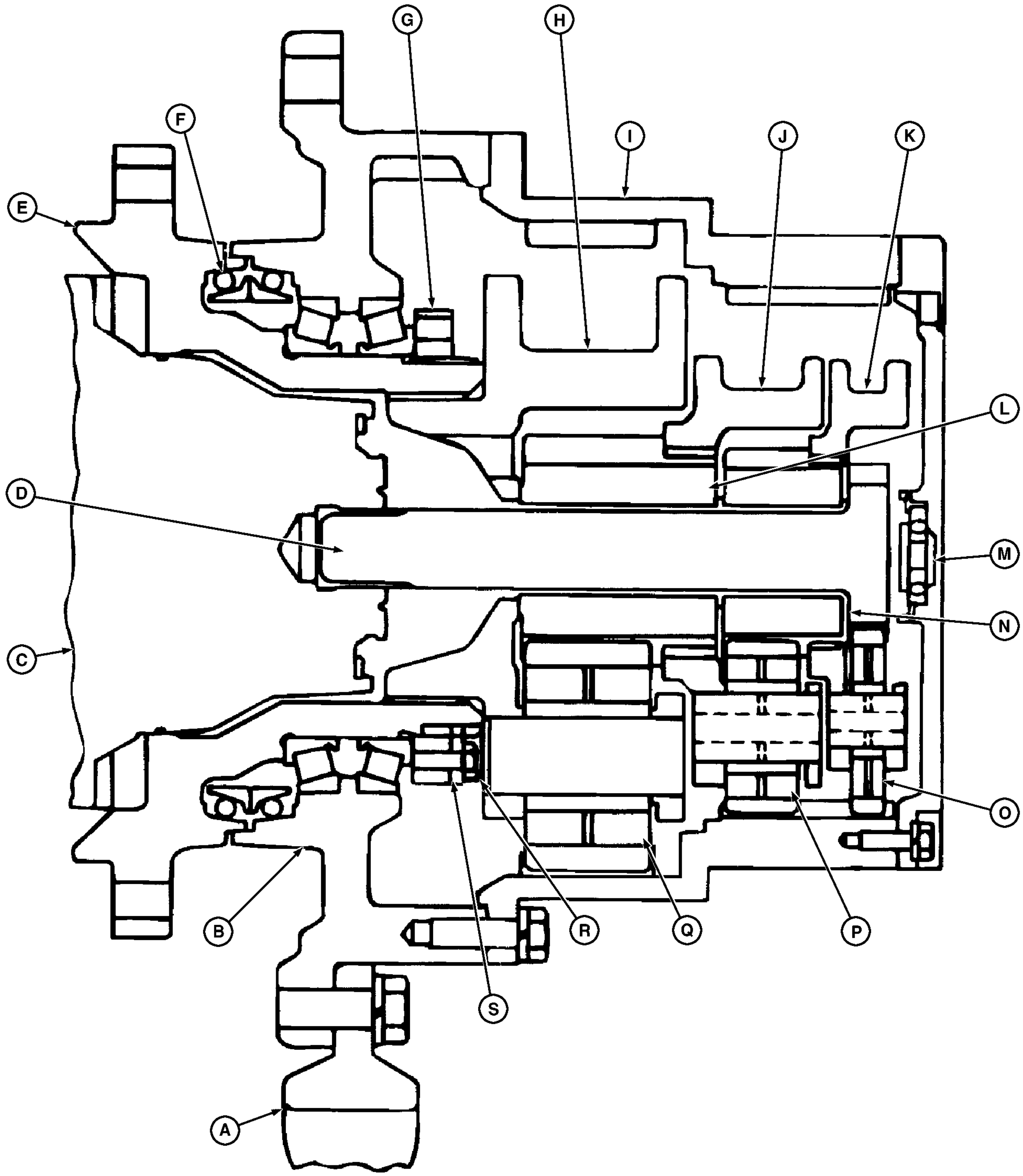
17. Install track. Adjust track sag. (See procedure in Group 0130.)



A—Propel Motor Drain Port-to-Rotary Manifold Bottom Tee Port Line
B—Propel Motor “BV” Port-to-Rotary Manifold Port “4” Line
C—Propel Motor Speed Change Port-to-Rotary Manifold “P1” Port Line
D—Propel Motor “AV” Port-to-Rotary Manifold Port “3” Line
E—Cap Screw and Washer (20 used)

CED,OUOE023,147 –19–27MAY98–4/4

DISASSEMBLE PROPEL GEARBOX



T115410

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A—Sprocket
B—Drum
C—Propel Motor
D—Propel Shaft (First Planet Sun Gear)
E—Housing
F—Metal Face Seal (2 used)
G—Nut
H—Third Planet Carrier
I—Ring Gear
J—Second Planet Carrier
K—First Planet Carrier
L—Third Planet Sun Gear
M—Ball Bearing and Thrust Plug
N—Second Planet Sun Gear
O—First Planet Gear (3 used)
P—Second Planet Gear (3 used)
Q—Third Planet Gear (3 used)
R—Cap Screw (2 used)
S—Lock Plate

1. Remove drain plugs to drain gearbox oil. Approximate capacity is 7.5 L (8.0 qt).

CAUTION: The approximate weight of propel gearbox, motor and sprocket is 568 kg (1252 lb).

Propel Gearbox, Motor and Sprocket—Specification

Weight.. 568 kg (1252 lb) approximate

2. Remove propel motor and brake from gearbox. (See procedure in Group 0260.)

3. Remove sprocket from gearbox housing. (See procedure in Group 0130.)

Continued on next page

Axle Shaft, Bearings, and Reduction Gears

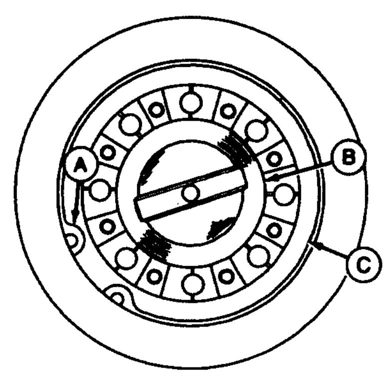
4. Remove cap screws (A). Remove cover (B).

T6557BS –UN–19OCT88

A—Cap Screw (16 used)
B—Cover

CED,OUOE023,156 –19–27MAY98–3/16

5. If replacement is necessary, remove snap ring (A), pin (B), and bearing (C) from cover.



T7966DP –UN–04MAY93

A—Snap Ring
B—Pin
C—Bearing

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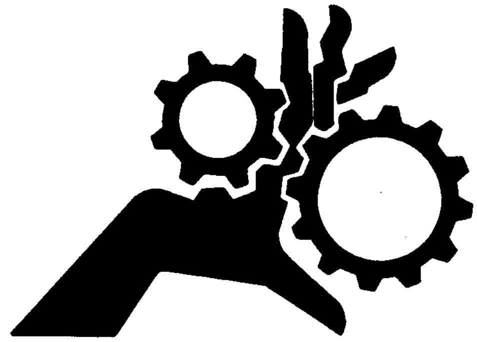
CED,OUOE023,156 –19–27MAY98–4/16

CAUTION: Planet gears may turn. Keep fingers away from gears.



T6639GK –UN–19OCT88

6. Remove propel shaft (first planet sun gear).

   Remove first planet carrier (A).

T8011AF –UN–18MAY93

A—First Planet Carrier

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CED,OUOE023,156 –19–27MAY98–5/16

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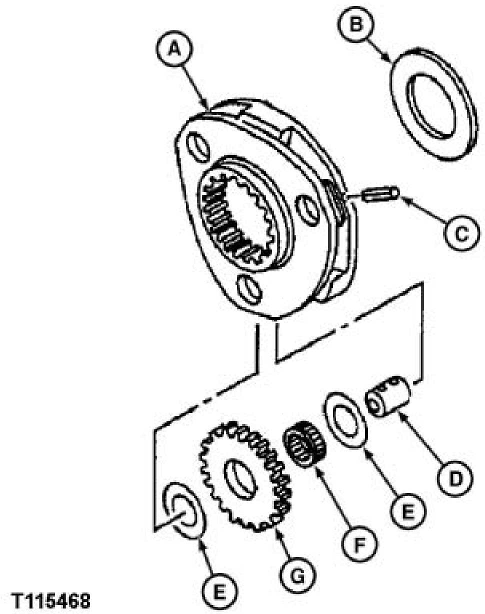
7. Disassemble first planet carrier (A).



T115468 –UN–08JUN98

A—First Planet Carrier
B—Thrust Washer
C—Spring Pin (3 used)
D—Pin (3 used)
E—Thrust Washer (6 used)
F—Needle Bearing (3 used)
G—First Planet Gear (3 used)

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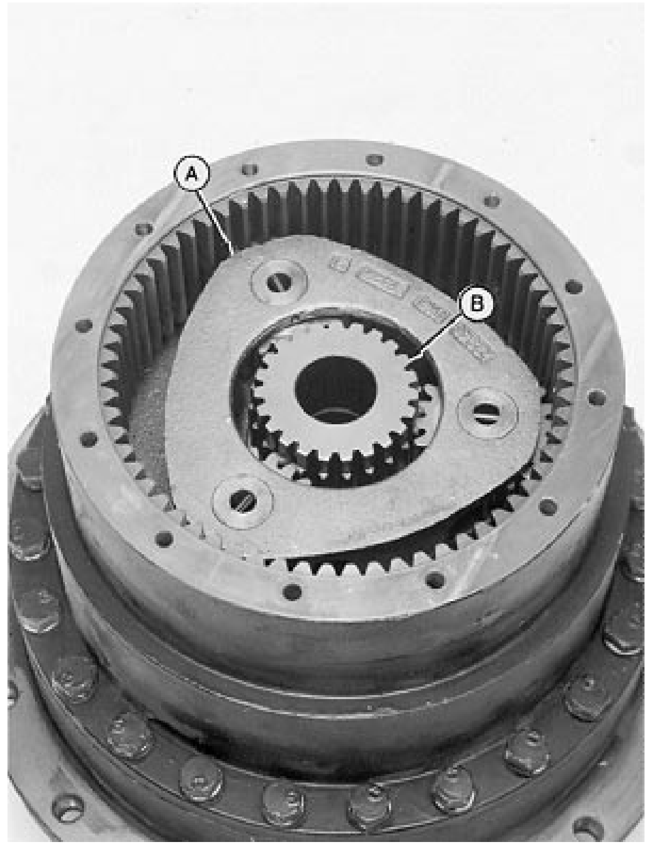
CED,OUOE023,156 –19–27MAY98–6/16

8. Remove second planet sun gear (B) and second planet carrier (A).



A—Second Planet Carrier
B—Second Planet Sun Gear

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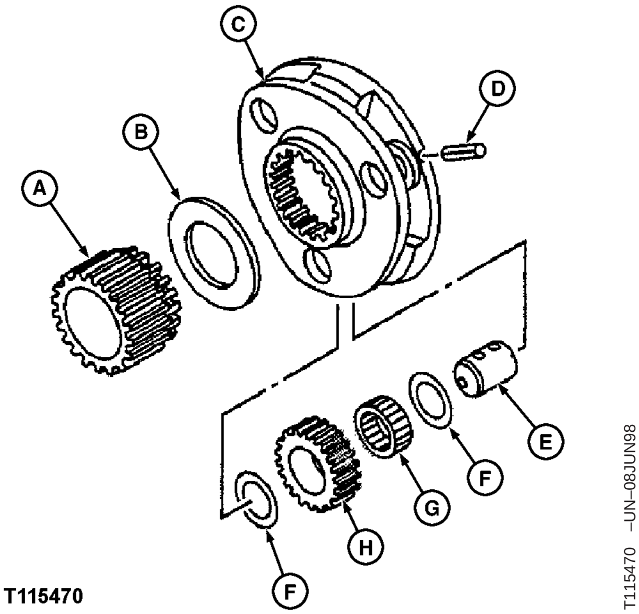
9. Disassemble second planet carrier (C).



T115470

A—Third Planet Sun Gear
B—Thrust Washer
C—Second Planet Carrier
D—Spring Pin (3 used)
E—Pin (3 used)
F—Thrust Washer (6 used)
G—Needle Bearing (3 used)
H—Second Planet Sun Gear (3 used)

Continued on next page CED,OUOE023,156 –19–27MAY98–8/16

10. Remove third planet sun gear (A).

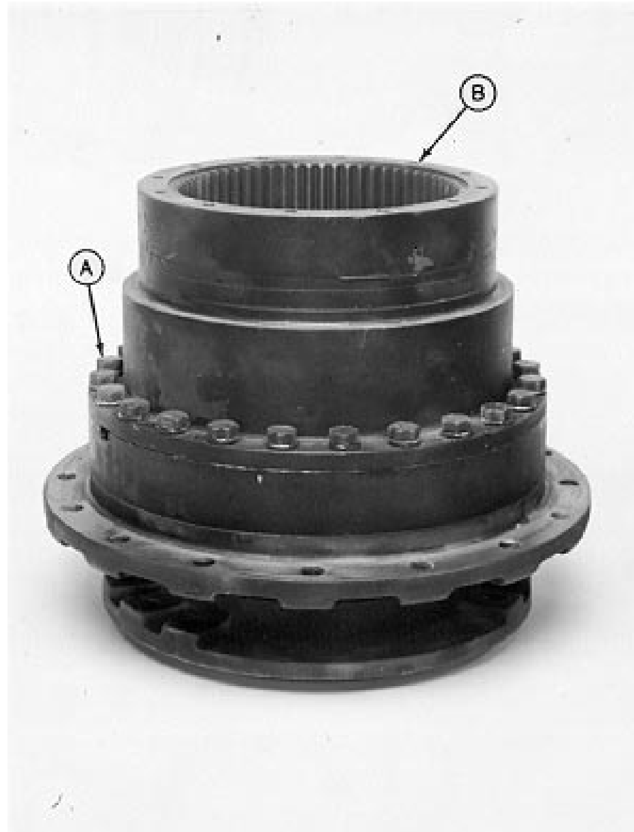
A—Third Planet Carrier

Continued on next page CED,OUOE023,156 –19–27MAY98–9/16

11. Remove cap screws (A).

CAUTION: Use a lifting device for heavy components.

12. Remove ring gear (B) using lifting brackets, such as JT01748 Lifting Brackets, lifting strap, and a hoist.

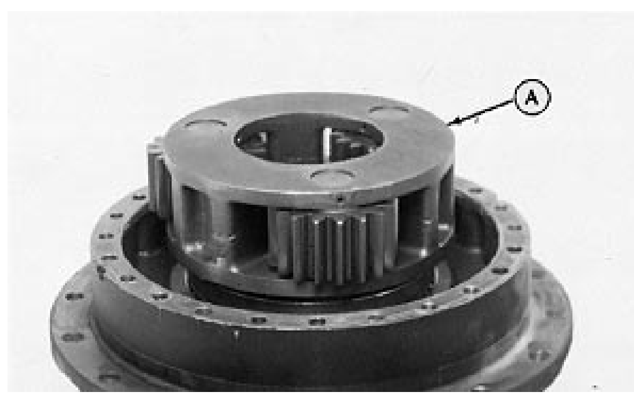


T6557BX –UN–19OCT88

A—Cap Screw (28 used)
B—Ring Gear

CED,OUOE023,156 –19–27MAY98–10/16

13. Remove third planet carrier (A).



T6557BY –UN–19OCT88

A—Third Planet Carrier

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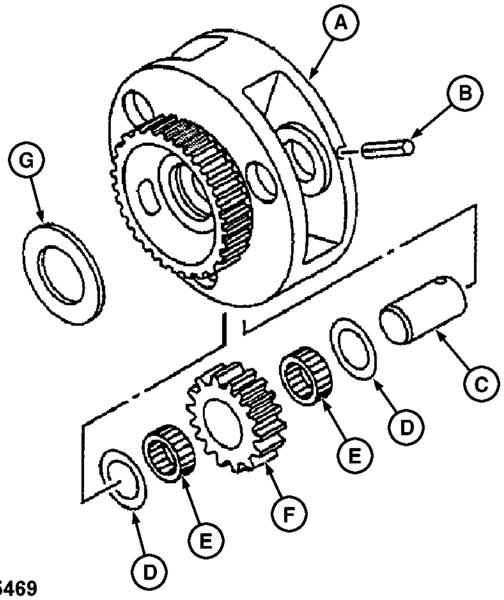
CED,OUOE023,156 –19–27MAY98–11/16

14. Disassemble third planet carrier (A).



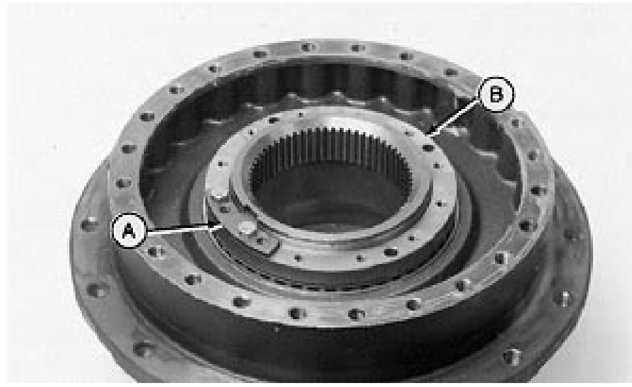
A—Third Planet Carrier
B—Spring Pin (3 used)
C—Pin (3 used)
D—Thrust Washer (6 used)
E—Needle Bearing (6 used)
F—Third Planet Gear (3 used)
G—Thrust Washer

Continued on next page

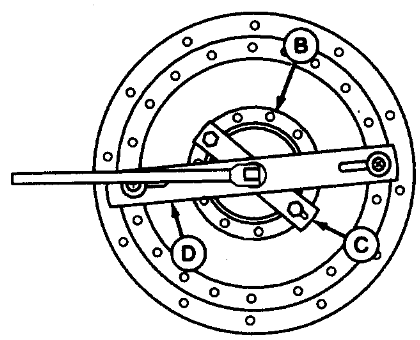
CED,OUOE023,156 –19–27MAY98–12/16

15. Remove cap screws and lock plate (A).

16. Remove nut (B) using DFT1036A Propel Gearbox Nut Wrench (C) and DFT1109 Holding Bar (D). (See Section 99 for instructions to make tools.)



T6557BZ –UN–19OCT88



T7966DQ –UN–04MAY93

A—Lock Plate
B—Nut
C—DFT1036A Propel Gearbox Nut Wrench
D—DFT1109 Holding Bar

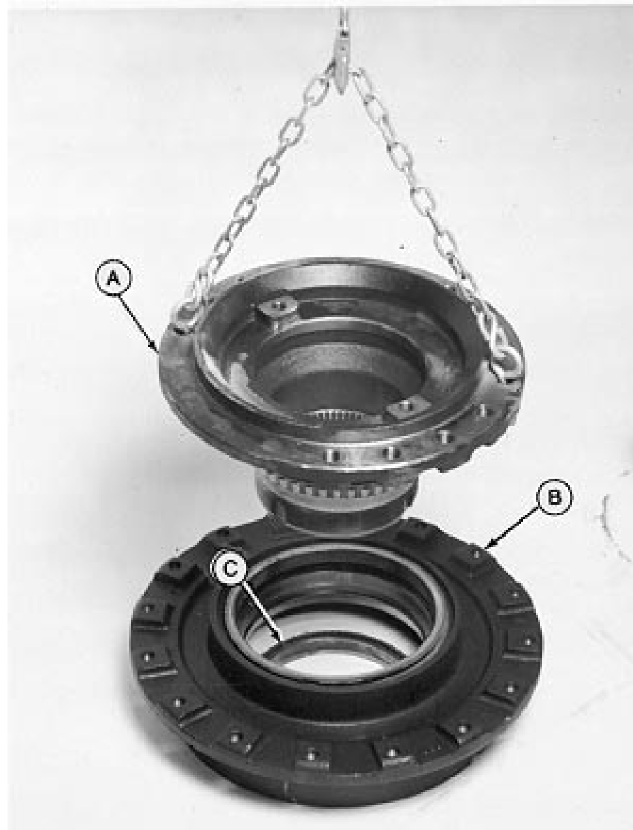
Continued on next page

CED,OUOE023,156 –19–27MAY98–13/16

CAUTION: Use a lifting device for heavy components.

17. Remove bearing cone (C). Bearing cone is a press fit.

18. Remove housing (A) from drum (B) using lifting brackets, such as JT01748 Lifting Brackets, lifting strap, and hoist.



T6557CA –UN–19OCT88

A—Housing
B—Drum
C—Bearing Cone

Continued on next page CED,OUOE023,156 –19–27MAY98–14/16

IMPORTANT: Metal face seals can be reused if they are not worn or damaged. A used seal must be kept together as a set because of wear patterns on seal ring face.

19. Remove metal face seal (A). Keep seal rings together as a matched set with metal faces together to protect surfaces.

20. Inspect metal face seal. (See procedure in this group.) For seals that are reused, put a piece of cardboard between seal rings to protect seal ring face.

21. Remove bearing cone (B) only if replacement is necessary. Bearing cone is a press fit.

T6557CB –UN–19OCT88

A—Metal Face Seal
B—Bearing Cone

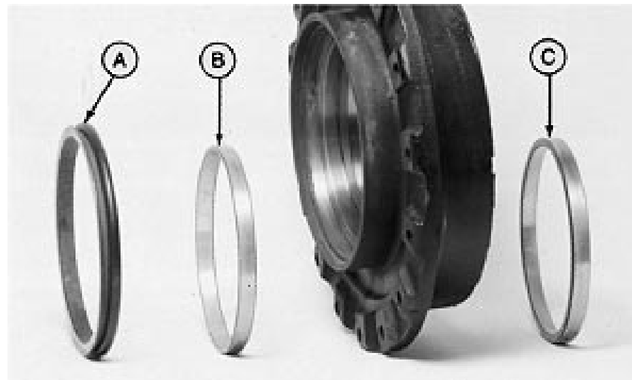
Continued on next page CED,OUOE023,156 –19–27MAY98–15/16

IMPORTANT: Metal face seals can be reused if they are not worn or damaged. A used seal must be kept together as a set because of wear patterns on seal ring face.

22. Remove metal face seal (A). Keep seal rings together as a matched set with metal faces together to protect surfaces.

23. Inspect metal face seal. (See procedure in this group.) For seals that are reused, put a piece of cardboard between seal rings to protect seal ring face.

24. Remove bearing cups (B and C) only if replacement is necessary. Bearing cups are press fit.



T6557CC –UN–19OCT88

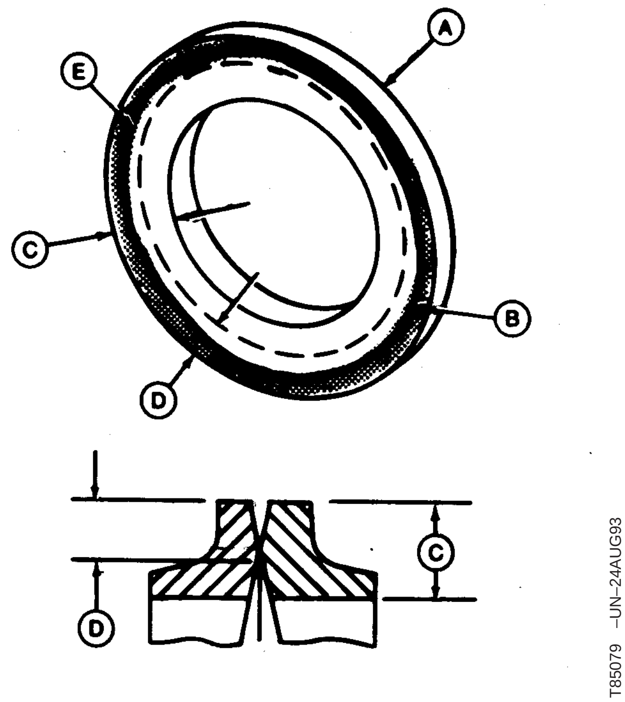
A—Metal Face Seal
B—Bearing Cup
C—Bearing Cup

CED,OUOE023,156 –19–27MAY98–16/16

INSPECT METAL FACE SEALS

1. Inspect for the following conditions to determine if seal rings (A) can be reused:

    - The narrow, highly polished sealing area (E) must be in the outer half of seal ring face (D).
    - Sealing area must be uniform and concentric with the ID and OD of seal ring (A).
    - Sealing area must not be chipped, nicked, or scratched.



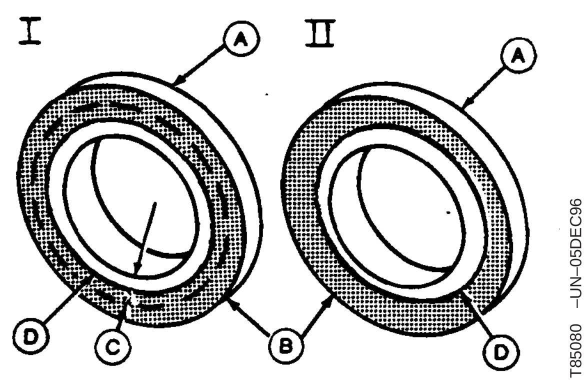
A—Seal Ring
B—Worn Area (Shaded Area)
C—Seal Ring Face
D—Outer Half of Seal Ring Face
E—Sealing Area (Dark Line)

TX,02,VV2544 –19–16MAR98–1/3

2. Illustration shows examples of worn seal rings (A).

    I—Sealing area (D) is in inner half of seal ring face (C).

    II—Sealing area (D) not concentric with ID and OD of seal ring.



A—Seal Ring
B—Worn area (Shaded Area)
C—Inner Half of Seal Ring Face
D—Sealing Area (Dark Line)

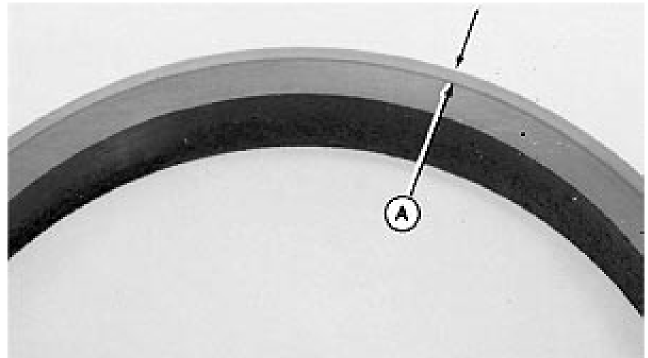
Continued on next page

TX,02,VV2544 –19–16MAR98–2/3

3. Clean reusable seals by removing all foreign material from seal rings, except seal face (A), using a scraper or a stiff bristled fiber brush.

4. Wash seal rings and O-rings using a volatile, non-petroleum base solvent to remove all oil. Thoroughly dry parts using a lint-free tissue.

   Apply a thin film of oil to seal ring face. Put face of seal rings together and hold using tape.



T82840 –UN–23FEB89

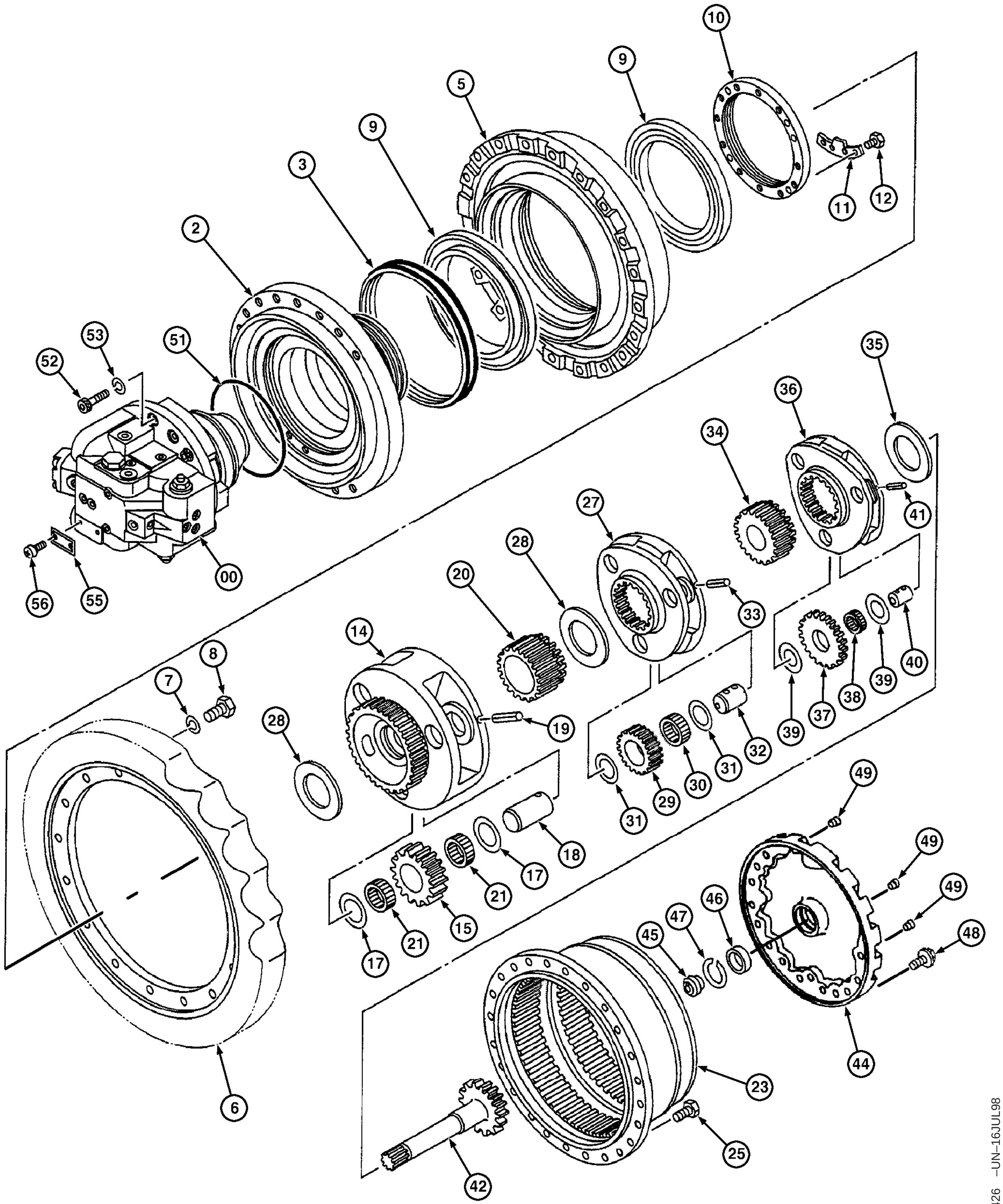
A—Seal Face

02
0250
25

TX,02,VV2544 –19–16MAR98–3/3

02
0250
26

ASSEMBLE PROPEL GEARBOX



T115426

Continued on next page CED,OUOE023,159 –19–28MAY98–1/17

Axle Shaft, Bearings, and Reduction Gears

00—Propel Motor
02—Propel Gearbox Housing
03—Metal Face Seal
05—Drum
06—Sprocket
07—Lock Washer (20 used)
08—Cap Screw (20 used)
09—Roller Bearing (2 used)
10—Nut
11—Lock Plate
12—Cap Screw (2 used)
14—Third Planet Carrier
15—Third Planet Gear (3 used)
17—Thrust Washer (6 used)
18—Pin (3 used)
19—Spring Pin (3 used)
20—Third Planet Sun Gear
21—Needle Bearing (6 used)
23—Ring Gear
25—Cap Screw (28 used)
27—Second Planet Carrier
28—Thrust Washer (2 used)
29—Second Planet Sun Gear (3 used)
30—Needle Bearing (3 used)
31—Thrust Washer (6 used)
32—Pin (3 used)
33—Spring Pin (3 used)
34—Second Planet Sun Gear
35—Thrust Washer
36—First Planet Carrier
37—First Planet Gear (3 used)
38—Needle Bearing (3 used)
39—Thrust Washer (6 used)
40—Pin (3 used)
41—Spring Pin (3 used)
42—Propel Shaft
44—Cover
45—Thrust Plate
46—Roller Bearing
47—Snap Ring
48—Cap Screw (16 used)
49—Plug (3 used)
51—O-Ring
52—Cap Screw (8 used)
53—Lock Washer (8 used)
55—Name Plate
56—Cap Screw (2 used)

CED,OUOE023,159 –19–28MAY98–2/17

02
0250
27

1. Install cups (B and C) tight against bottom of bore. Cups are a press fit.

IMPORTANT: O-ring and seat surfaces for O-ring must be clean, dry, and oil free so O-ring does not slip.

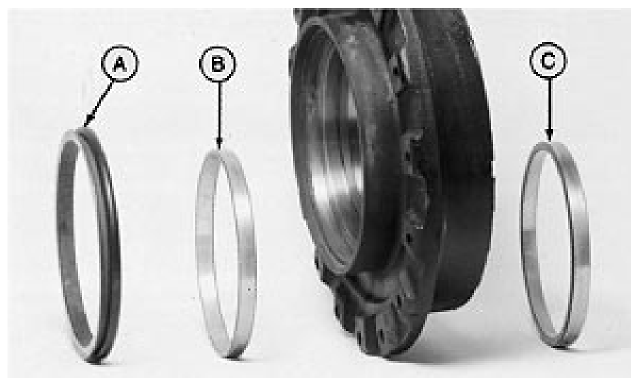
2. Thoroughly clean O-ring and seat surfaces in housing and seal ring using volatile, non-petroleum base solvent and lint-free tissues.

NOTE: A volatile, non-petroleum base solvent or talcum powder can be used as a lubricant. Solvent must not damage the O-ring or leave an oil residue.

3. Apply equal pressure with fingers at four equally spaced points on seal face surface. Seal ring and O-ring must "pop" down into place so O-ring is tight against seal bore and seal is installed squarely.

4. Wipe finger prints and foreign material off seal face using clean oil and lint-free tissues.

5. Apply a thin film of oil on seal face.



T6557CC –UN–19OCT88

A—Metal Face Seal
B—Bearing Cup
C—Bearing Cup

Continued on next page

CED,OUOE023,159 –19–28MAY98–3/17

CAUTION: DO NOT heat oil over 182°C (360°F). Oil fumes or oil can ignite above 193°C (380°F). Use a thermometer. DO NOT allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

TS227 –UN–23AUG88

6. Heat bearing cone (B). Install cone tight against shoulder. Cone is a press fit.

Bearing Cone—Specification

Temperature .... 50—70°C (122—158°F)

IMPORTANT: O-ring and seat surfaces for O-ring must be clean, dry, and oil free so O-ring does not slip.

7. Thoroughly clean O-ring and seat surfaces in housing and seal ring using volatile, non-petroleum base solvent and lint-free tissues.

NOTE: A volatile, non-petroleum base solvent or talcum powder can be used as a lubricant. Solvent must not damage the O-ring or leave an oil residue.

8. Apply equal pressure with fingers at four equally spaced points on seal face surface. Seal ring and O-ring must "pop" down into place so O-ring is tight against seal bore and seal is installed squarely.

9. Wipe finger prints and foreign material off seal face using clean oil and lint-free tissues.

10. Apply a thin film of oil on seal face.

T6557CB –UN–19OCT88

A—Metal Face Seal
B—Bearing Cone

Continued on next page CED,OUOE023,159 –19–28MAY98–4/17

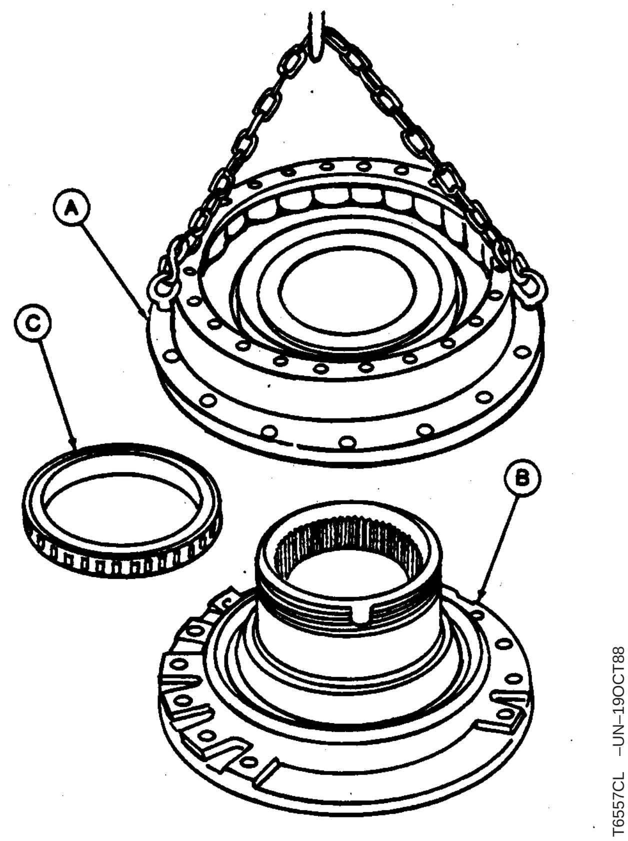
11. Install drum (A) on housing (B).

CAUTION: DO NOT heat oil over 182°C (360°F). Oil fumes or oil can ignite above 193°C (380°F). Use a thermometer. DO NOT allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

12. Heat bearing cone (C). Install cone tight against cup.

Bearing Cone—Specification

Temperature .... 50—70°C (122—158°F)



A—Drum
B—Housing
C—Bearing Cone

Continued on next page

CED,OUOE023,159 –19–28MAY98–5/17

02
0250
29

13. Install nut (D) with the 0.5 mm (0.020 in.) step (E) toward bearing.

14. Tighten nut (D) using DFT1036A Propel Gearbox Nut Wrench (B) and DFT1109 Holding Bar (A). Fasten holding bar to ring gear (C). (See Section 99 for instructions to make tools.)

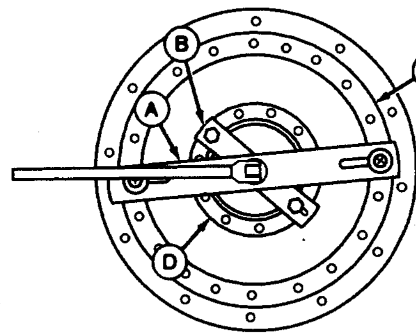
Gearbox Bearing Nut—Specification

Torque .... 785 N•m (580 lb-ft)

15. Tap on ring gear (C) using a plastic hammer.

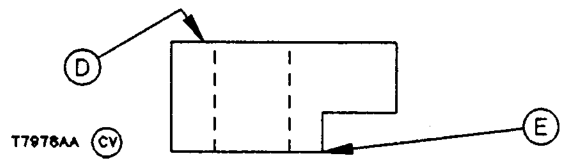
16. Turn drum three times to the right and left to seat roller bearings. Drum must turn smoothly.

17. Repeat procedure again to be sure roller bearings are seated.



T7995AY –UN–04MAY93

T7978AA –UN–01APR93



A—DFT1109 Holding Bar
B—DFT1036A Propel Gearbox Nut Wrench
C—Ring Gear
D—Nut
E—0.5 mm (0.020 in.) Step

CED,OUOE023,159 –19–28MAY98–6/17

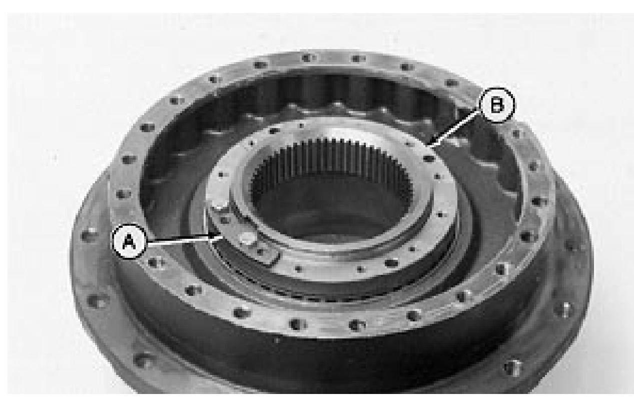
18. Clean threads of cap screws using cure primer. Apply thread lock and sealer (high strength).

19. Install lock plate (A) so tang engages notch in housing. Tighten nut (B) as needed to install cap screws.

20. Tighten cap screws.

Gearbox Bearing Nut Lock Plate Cap Screw—Specification

Torque .... 90 N•m (65 lb-ft)

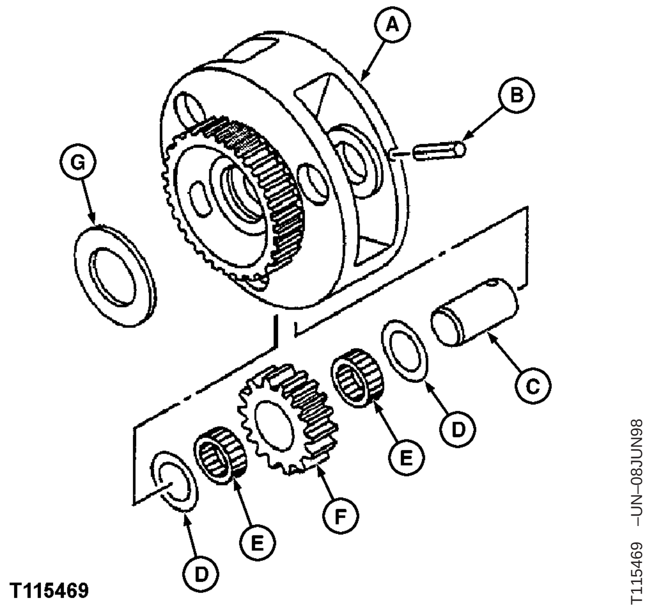


T6557BZ –UN–19OCT88

A—Lock Plate
B—Nut

Continued on next page CED,OUOE023,159 –19–28MAY98–7/17

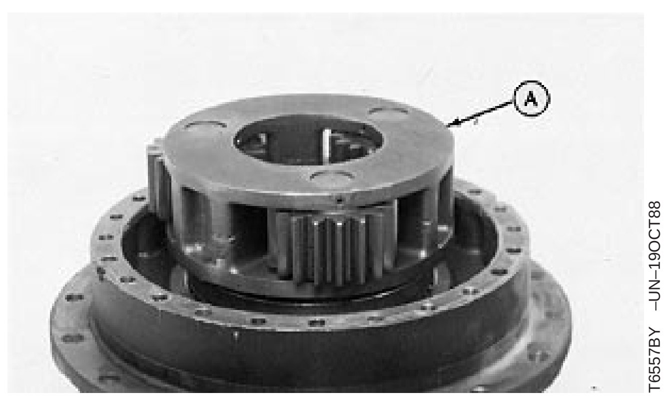
21. Install the thrust washer (G) into third planet carrier (A).
22. Install needle bearings (E), thrust washers (D), third planet gears (F), and pins (C).
23. Install spring pins (B) so slit is towards the nearest end of pin.



A—Third Planet Carrier
B—Spring Pin (3 used)
C—Pin (3 used)
D—Thrust Washer (6 used)
E—Needle Bearing (6 used)
F—Third Planet Gear (3 used)
G—Thrust Washer

CED,OUOE023,159 –19–28MAY98–8/17

24. Install third planet carrier (A).
25. Clean ring gear and drum mounting surfaces using cure primer. Apply plastic gasket.



A—Third Planet Carrier

Continued on next page

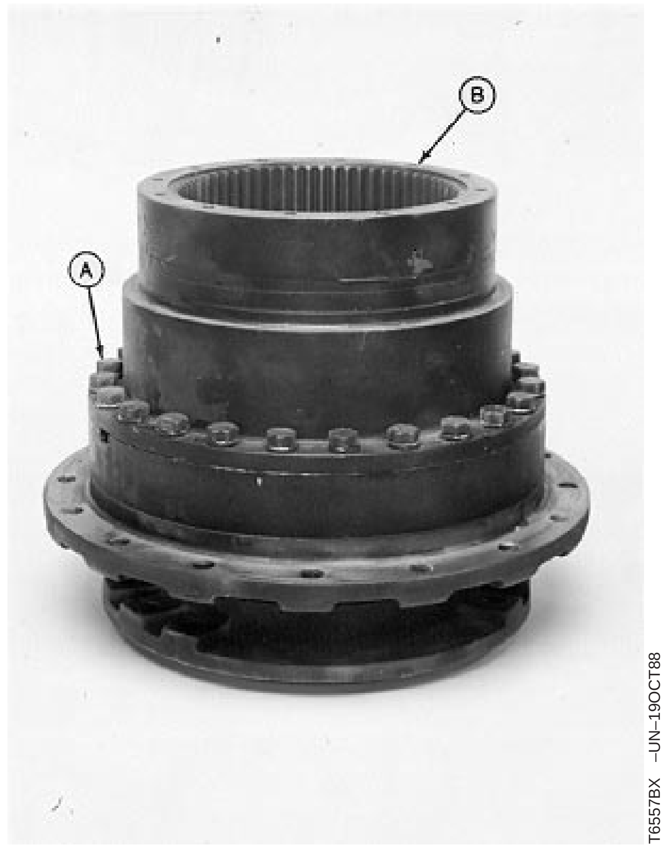
CED,OUOE023,159 –19–28MAY98–9/17

26. Clean threads of cap screws (A) using cure primer. Apply thread lock and sealer (high strength).

27. Install ring gear (B). Tighten cap screws.

Ring Gear-to-Drum Cap Screw—Specification

Torque .... 265 N•m (195 lb-ft)



A—Cap Screw (28 used)
B—Ring Gear

Continued on next page CED,OUOE023,159 –19–28MAY98–10/17

28. Install third planet sun gear (A) with longer teeth mating with the third planet carrier.

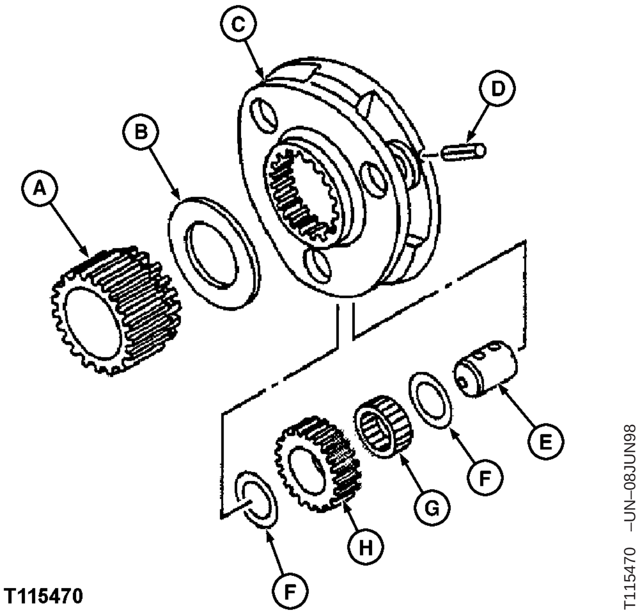
A—Third Planet Sun Gear

Continued on next page CED,OUOE023,159 –19–28MAY98–11/17

29. Install thrust washer (B) into second planet carrier (C).

30. Install needle bearings (G), thrust washers (F), second planet gears (H), and pins (E).

31. Install spring pins (D) so slit is toward the nearest end of pin.



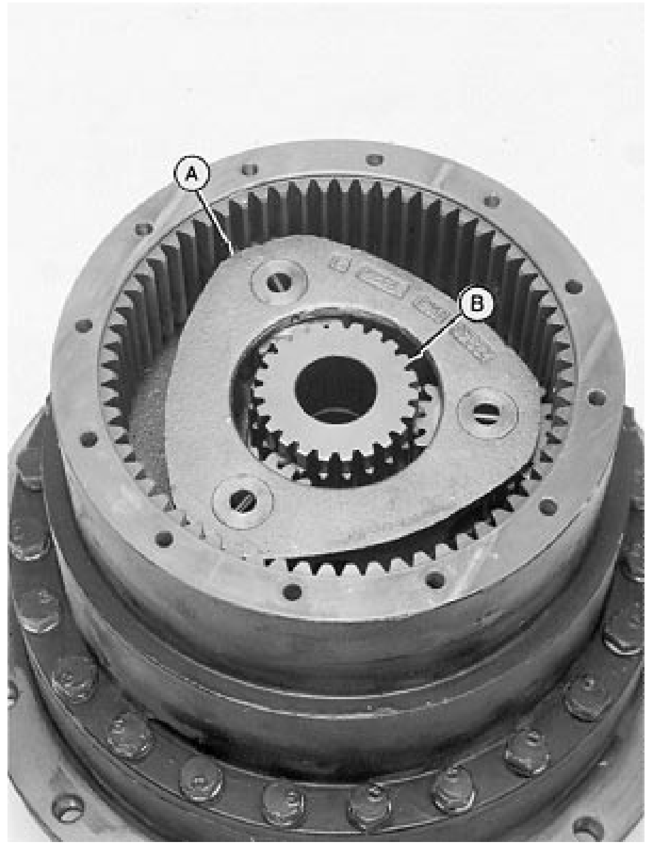
T115470

A—Third Planet Sun Gear
B—Thrust Washer
C—Second Planet Carrier
D—Spring Pin (3 used)
E—Pin (3 used)
F—Thrust Washer (6 used)
G—Needle Bearing (3 used)
H—Second Planet Sun Gear (3 used)

Continued on next page CED,OUOE023,159 –19–28MAY98–12/17

32. Install second planet carrier (A).

33. Install second planet sun gear (B) with longer teeth mating with the second planet carrier.



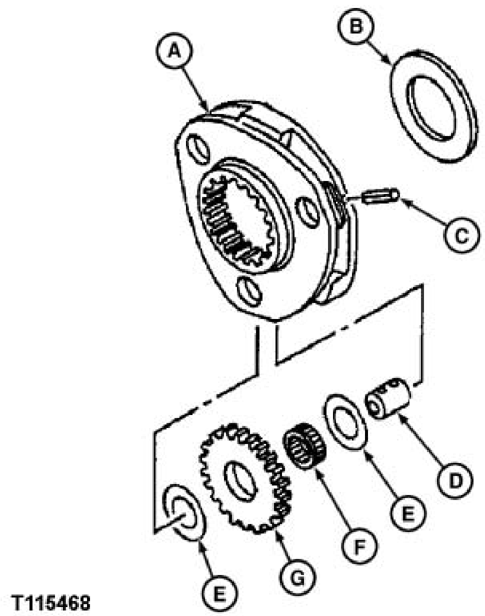
A—Second Planet Carrier
B—Second Planet Sun Gear

Continued on next page CED,OUOE023,159 –19–28MAY98–13/17

34. Install thrust washer (B) into first planet carrier (A).

35. Install needle bearings (F), thrust washers (E), first planet gears (G), and pins (D).

36. Install spring pins (C) so slit is towards the nearest end of pin.



T115468 –UN–08JUN98

A—First Planet Carrier
B—Thrust Washer
C—Spring Pin (3 used)
D—Pin (3 used)
E—Thrust Washer (6 used)
F—Needle Bearing (3 used)
G—First Planet Gear (3 used)

Continued on next page CED,OUOE023,159 –19–28MAY98–14/17

37. Install first planet carrier (A).

38. Install propel shaft (first planet sun gear).

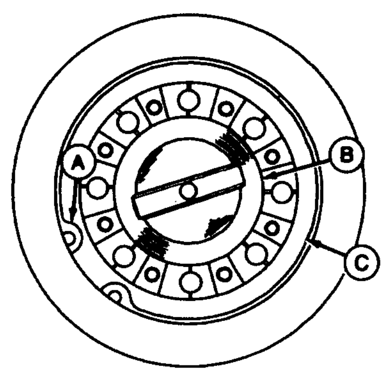
T8011AF –UN–18MAY93

A—First Planet Carrier

CED,OUOE023,159 –19–28MAY98–15/17

39. If removed, install bearing (C), pin (B), and snap ring (A) in cover.

40. Clean cover and ring gear mounting surfaces using cure primer. Apply plastic gasket.



T7966DP –UN–04MAY93

A—Snap Ring
B—Pin
C—Bearing

Continued on next page CED,OUOE023,159 –19–28MAY98–16/17

41. Clean threads of cap screws (A) using cure primer. Apply thread lock and sealer (medium strength).

42. Install cover (B). Tighten cap screws (A).

Cover-to-Ring Gear Cap Screw—Specification

Torque .... 110 N•m (80 lb-ft)

43. Install sprocket. (See procedure in Group 0130.)

44. Install propel motor and brake. (See procedure in Group 0260.)

45. Add gear oil. (See Swing Gearbox, Propel Gearbox, and Pump Gearbox Oils, Group 0004.)

46. Clean threads of plugs using clean and cure primer. Apply pipe sealant. Tighten plugs.

Propel Gearbox Fill Plug—Specification

Torque .... 50 N•m (35 lb-ft)

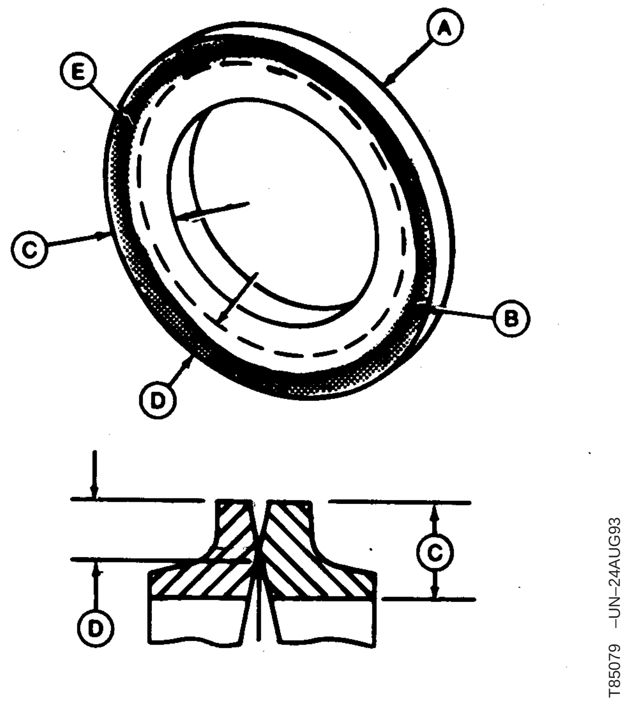
T6557BS –UN–19OCT88

CED,OUOE023,159 –19–28MAY98–17/17

INSPECT METAL FACE SEALS

1. Inspect for the following conditions to determine if seal rings (A) can be reused:

   - The narrow, highly polished sealing area (E) must be in the outer half of seal ring face (D).
   - Sealing area must be uniform and concentric with the ID and OD of seal ring (A).
   - Sealing area must not be chipped, nicked, or scratched.



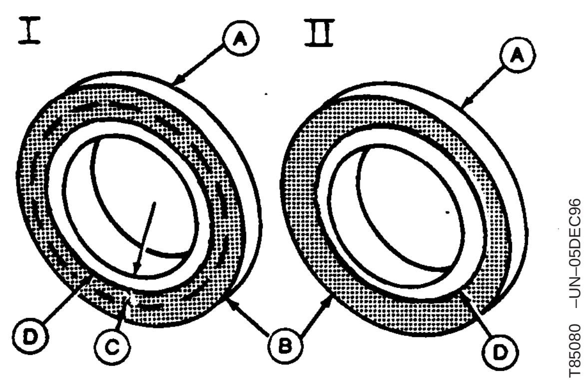
A—Seal Ring
B—Worn Area (Shaded Area)
C—Seal Ring Face
D—Outer Half of Seal Ring Face
E—Sealing Area (Dark Line)

TX,02,VV2544 –19–16MAR98–1/3

2. Illustration shows examples of worn seal rings (A).

   I—Sealing area (D) is in inner half of seal ring face (C).

   II—Sealing area (D) not concentric with ID and OD of seal ring.



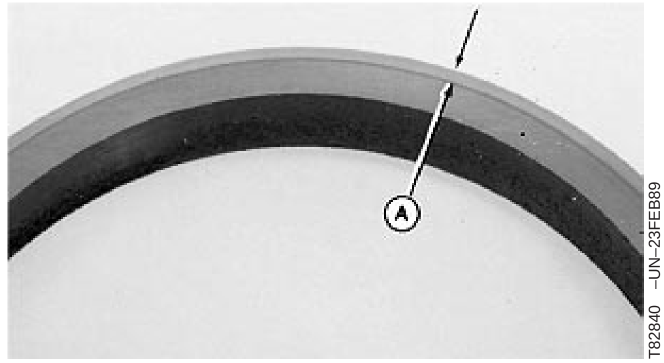
A—Seal Ring
B—Worn Area (Shaded Area)
C—Inner Half of Seal Ring Face
D—Sealing Area (Dark Line)

Continued on next page TX,02,VV2544 –19–16MAR98–2/3

3. Clean reusable seals by removing all foreign material from seal rings, except seal face (A), using a scraper or a stiff bristled fiber brush.

4. Wash seal rings and O-rings using a volatile, non-petroleum base solvent to remove all oil. Thoroughly dry parts using a lint-free tissue.

   Apply a thin film of oil to seal ring face. Put face of seal rings together and hold using tape.



A—Seal Face

TX,02,VV2544 –19–16MAR98–3/3

REMOVE AND INSTALL PROPEL MOTOR AND PARK BRAKE

1. Swing upperstructure 90°. Lower bucket to ground.

CAUTION: Prevent possible injury from unexpected machine movement. Block both tracks when removing propel motors. When propel motors are removed, machine has no brakes and can move. The machine will roll free on a slope or while being towed.

2. Block tracks.

3. Drain oil from propel gearbox. Approximate capacity is 7.5 L (8.0 qt).

T6811AJ –UN–18OCT88

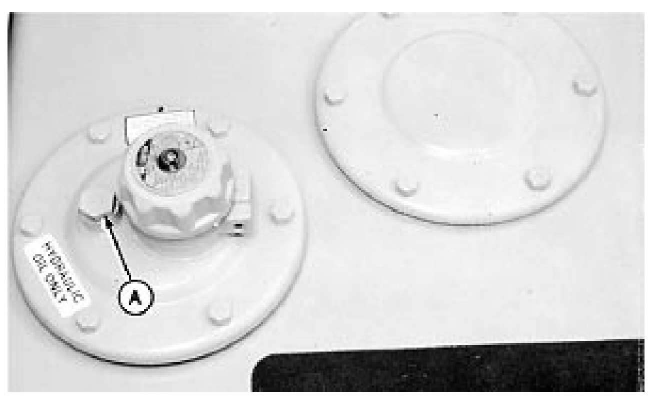
02
0260
1

CED,OUOE023,168 –19–29MAY98–1/5

CAUTION: High pressure release of oil from pressurized system can cause serious burns or penetrating injury. The hydraulic tank is pressurized. Do not remove vent plug (A). Release pressure by loosening vent plug.

4. Loosen vent plug (A) to release air pressure in oil hydraulic tank.

5. Remove propel motor cover.



T7869AT –UN–12NOV92

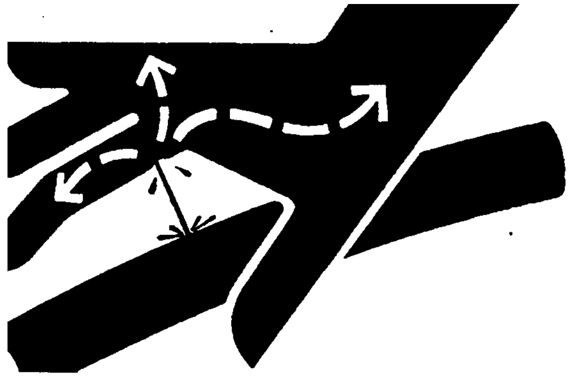
A—Vent Plug

Continued on next page

CED,OUOE023,168 –19–29MAY98–2/5

02
0260
2

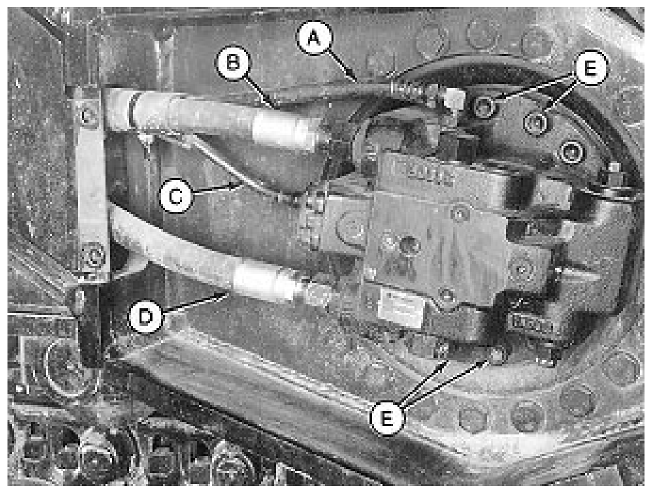
CAUTION: To avoid injury from escaping fluid under pressure, stop engine and relieve the pressure in the system before disconnecting or connecting hydraulic or other lines. Tighten all connections before applying pressure.



X9811 –UN–23AUG88

NOTE: Port AV is forward port for right motor. Port BV is on top and is the forward port for the left motor.

6. Disconnect lines (A—D).



T8318AB –UN–28SEP94

CAUTION: The approximate weight of propel motor and brake is 93 kg (205 lb).

Propel Motor and Brake—Specification

Weight.. 93 kg (205 lb) approximate

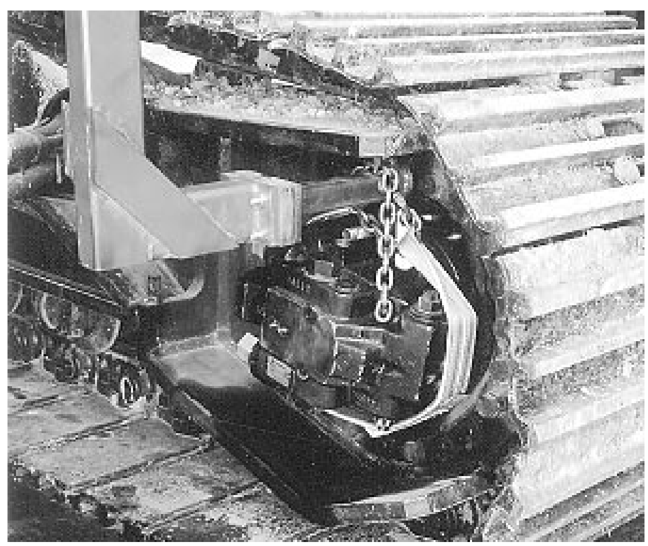
7. Loosen cap screws with lock washers (E).
8. Connect propel motor and brake to a hoist using lifting straps or chains and DF1063 Lifting Bracket and DFT1130 Adapter. (See Section 99 for instructions to make tools.)

NOTE: To assist in removal and installation of propel motor and brake, remove the hex head from two M18 x 2.5, 200 mm long cap screws. Use cap screws as guide pins in the cap screw holes.

9. Remove cap screws and lock washers to remove propel motor and brake. Remove O-ring.
10. Replace parts as necessary.

NOTE: If splines of the motor cannot be aligned during installation, remove cover from propel gearbox and remove propel shaft (first planet sun gear). Finish motor installation and then install propel shaft and cover.

11. Install O-ring. Install propel motor and brake.
12. Install and tighten cap screws (E).



T8318AC –UN–20SEP94

Right Side Shown

A—Motor Drain Port-to-Rotary Manifold Bottom Tee Line
B—Port AV-to-Rotary Manifold Port 2 Line
C—Motor Speed Change Port-to-Rotary Manifold Top Port Line
D—Port BV-to-Rotary Manifold Port 1 Line
E—Cap Screw and Lock Washer (6 used)

Continued on next page

CED,OUOE023,168 –19–29MAY98–3/5

Propel Motor and Brake-to-Frame Cap Screw—Specification

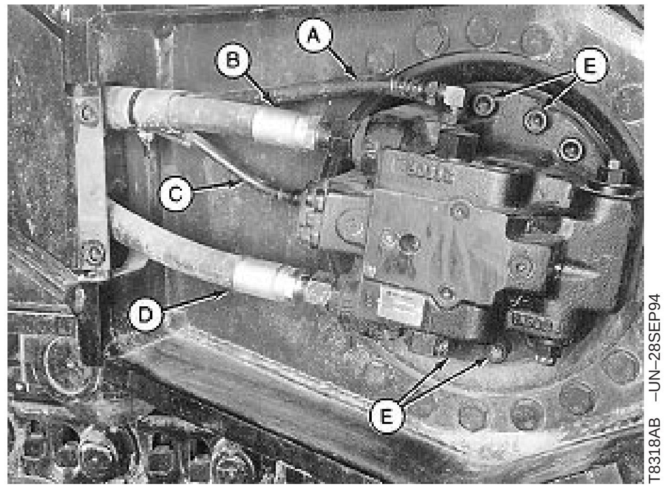
Torque .... 265 N•m (195 lb-ft)

CED,OUOE023,168 –19–29MAY98–4/5

13. Connect lines (A—D).
14. Add gear oil. (See Swing Gearbox, Propel Gearbox, and Pump Gearbox Oil, Group 0004.)
15. Do propel motor start-up procedure. (See procedure in this group.)
16. Install motor cover and tighten cap screws.

Propel Motor Cover Cap Screw—Specification

Torque .... 90 N•m (65 lb-ft)



A—Motor Drain Port-to-Rotary Manifold Bottom Tee Line
B—Port AV-to-Rotary Manifold Port 2 Line
C—Motor Speed Change Port-to-Rotary Manifold Top Port Line
D—Port BV-to-Rotary Manifold Port 1 Line
E—Cap Screw and Lock Washer (6 used)

CED,OUOE023,168 –19–29MAY98–5/5

PROPEL MOTOR AND PARK BRAKE START-UP PROCEDURE

IMPORTANT: Propel motor will be damaged if not filled with oil before operating propel function. Procedure must be performed whenever a new propel motor is installed or oil has been drained from the motor.

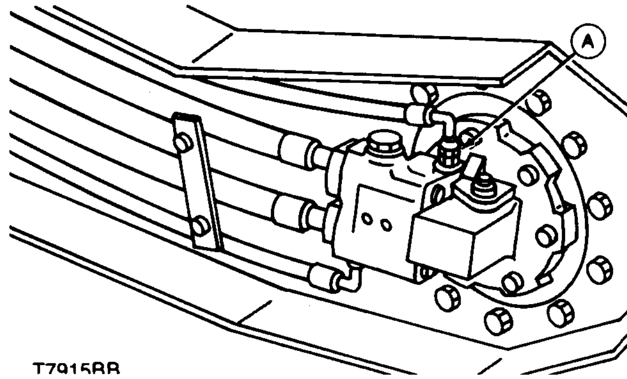
02
0260
4

1. Disconnect propel motor drain line (A).

2. Fill motor with hydraulic oil until oil reaches the top of drain port.

NOTE: Use a funnel with suitable diameter neck to allow air to escape while filling.

3. Connect line (A).



A—Propel Motor Drain Line

CED,OUOE023,169 –19–29MAY98–1/1

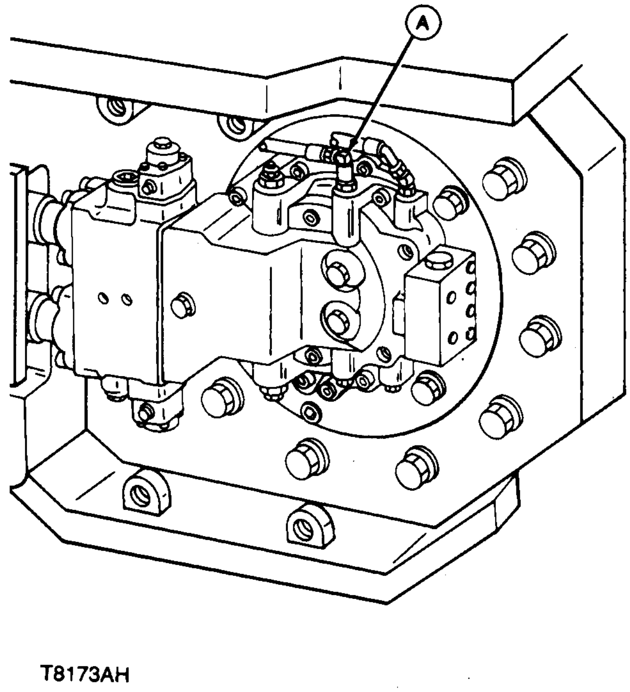
PROPEL MOTOR AND PARK BRAKE START-UP PROCEDURE

IMPORTANT: Propel motor will be damaged if not filled with oil before operating propel function. Procedure must be performed whenever a new propel motor is installed or oil has been drained from the motor.

1. Disconnect propel motor drain line (A).
2. Fill motor with hydraulic oil until oil reaches the top of drain port.

NOTE: Use a funnel with suitable diameter neck to allow air to escape while filling.

3. Connect line (A).



T8173AH –UN–28FEB94

A—Propel Motor Drain Line

CED,OUOE023,171 –19–29MAY98–1/1

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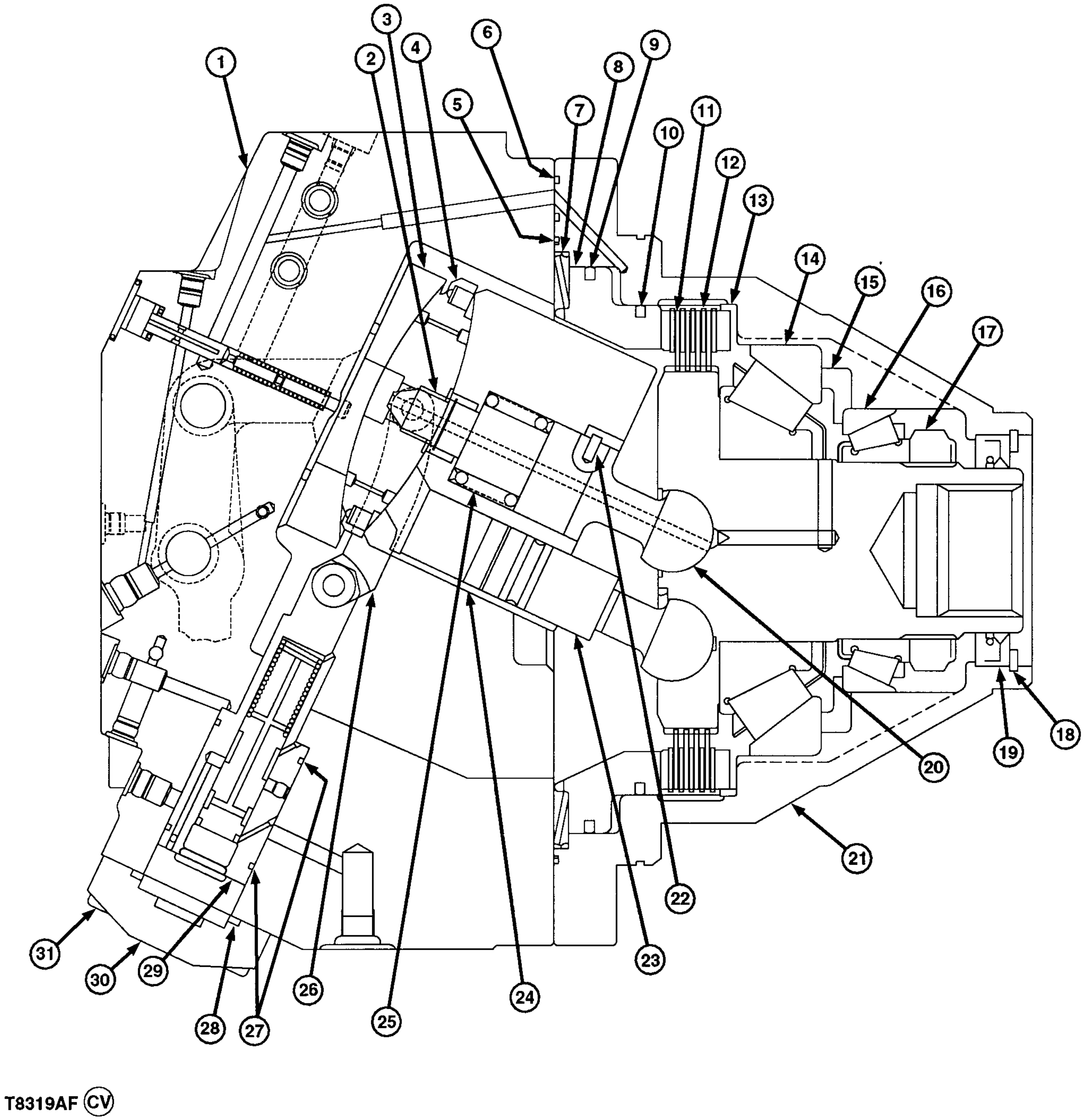
DISASSEMBLE PROPEL MOTOR AND PARK BRAKE



T8319AF –UN–28SEP94

Continued on next page CED,OUOE023,172 –19–29MAY98–1/12

1—Motor Valve Housing
2—Bushing
3—Plate
4—Valve Plate
5—O-Ring
6—O-Ring
7—Disk Spring
8—Piston
9—O-Ring
10—O-Ring
11—Disk (4 used)
12—Plate (5 used)
13—Spacer
14—Bearing
15—Spacer
16—Bearing
17—Nut
18—Snap Ring
19—Lip Seal
20—Center Shaft
21—Motor Shaft and Brake Housing
22—Pin
23—Piston (7 used)
24—Rotor
25—Spring
26—Link
27—Piston Seal (2 used)
28—O-Ring
29—Servo Piston
30—Cover
31—Socket Head Screws (4 used)

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CED,OUOE023,172 –19–29MAY98–2/12

CAUTION: Use a lifting device for heavy components.

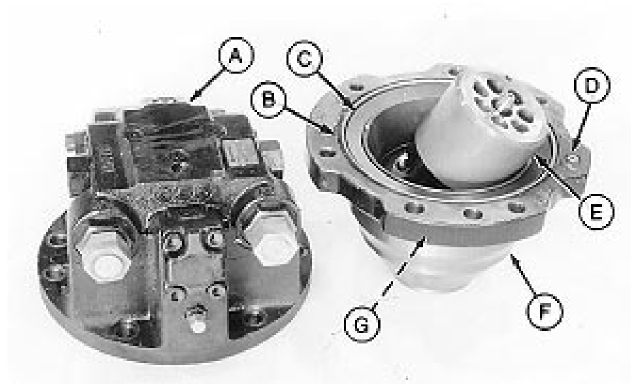
IMPORTANT: Valve plate and pistons have machined surfaces. Do not let valve plate and pistons drop.

1. Remove four cap screws to remove propel motor valve housing (A) from propel motor housing (F). Make sure valve plate in valve housing is not damaged.

2. Remove parts (B—D and G).

IMPORTANT: Pistons must be installed into the same bores because of wear pattern. Mark pistons and respective rotor and shaft bores for assembly.

3. Mark pistons and bores in rotor (E) so pistons are installed into the same bores at assembly. Remove rotor assembly.



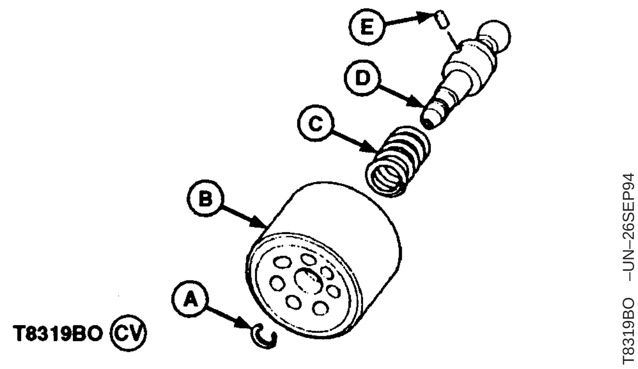
T8319BJ –UN–20SEP94

A—Propel Motor Valve Housing
B—O-Ring
C—Disk Spring
D—O-Ring
E—Rotor Assembly
F—Propel Motor Shaft and Brake Housing
G—O-Ring

Continued on next page

CED,OUOE023,172 –19–29MAY98–3/12

4. Remove retaining ring (A) to disassemble parts (B—E).



A—Retaining Ring
B—Rotor
C—Spring
D—Center Shaft
E—Pin

CED,OUOE023,172 –19–29MAY98–4/12

5. Mark pistons and bores in shaft so pistons are installed into the same bores at assembly.

   Move piston towards the center of the assembly to remove piston. Remove remaining pistons.

Continued on next page

CED,OUOE023,172 –19–29MAY98–5/12

NOTE: Remove piston evenly from bore. Do not scratch or damage piston or bore.

6. Make sure brake port (A) is clear to allow air to enter as piston (B) is removed from bore.

7. Remove brake parts (B—G).

NOTE: If parts are not within specification, replace parts.

8. Inspect brake parts for wear or damage.

Disk Spring—Specification

Height .... 6.4—6.5 mm (0.25—0.26 in.)

Disk—Specification

Thickness.. 3.25—3.30 mm (0.128—0.130 in.)

Plate—Specification

Thickness.. 1.75—1.80 mm (0.069—0.071 in.)

A—Brake Port
B—Piston
C—O-Ring
D—O-Ring
E—Disk (4 used)
F—Plate (5 used)
G—Spacer

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CED,OUOE023,172 –19–29MAY98–6/12

9. Turn motor shaft and brake housing over. Hit end of drive shaft with a soft-faced hammer to remove motor drive shaft assembly from housing.

10. Remove snap ring (A) and lip seal (B).

A—Snap Ring
B—Lip Seal

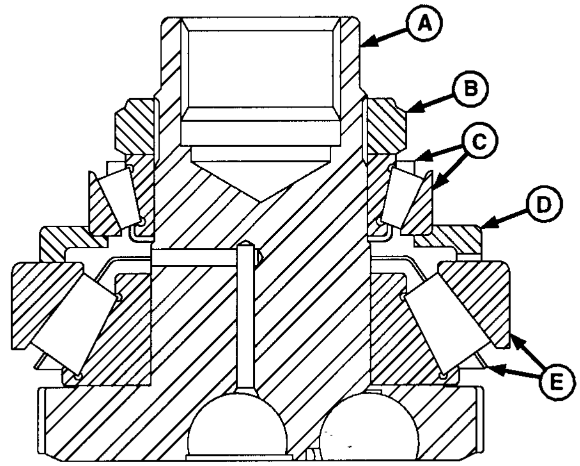
Continued on next page

CED,OUOE023,172 –19–29MAY98–7/12

11. Remove nut (B) using JDG911 Spanner Wrench.

12. Use a knife edge puller and a press to remove parts (C—E) from shaft (A).

13. Replace parts as necessary.



T8320AE –UN–11OCT94

A—Motor Drive Shaft
B—Nut
C—Roller Bearing
D—Spacer
E—Roller Bearing

Continued on next page

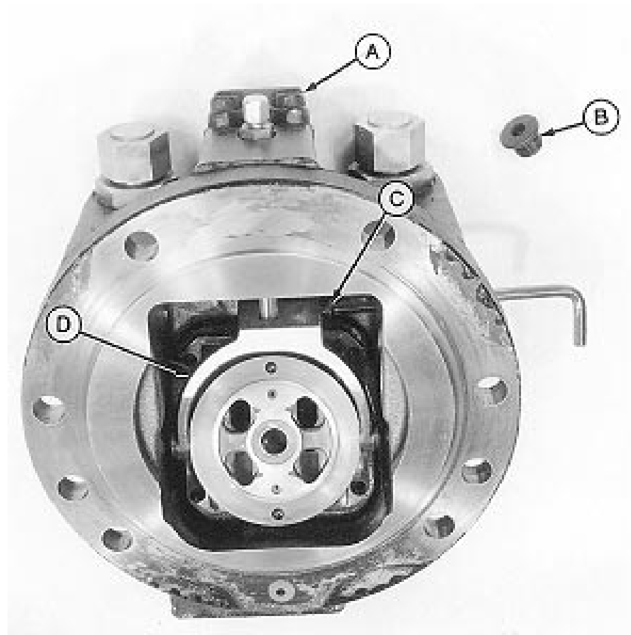
CED,OUOE023,172 –19–29MAY98–8/12

14. Remove cover (A) and O-ring.

IMPORTANT: Valve plate and slide plate have machined surfaces. Do not let plates drop.

15. Remove plug and O-ring (B) from valve housing to remove shoulder bolt (C) using an Allen wrench.

16. Remove valve plate and link assembly (D). Make sure machined surfaces are not damaged during removal.



T8321AF –UN–20SEP94

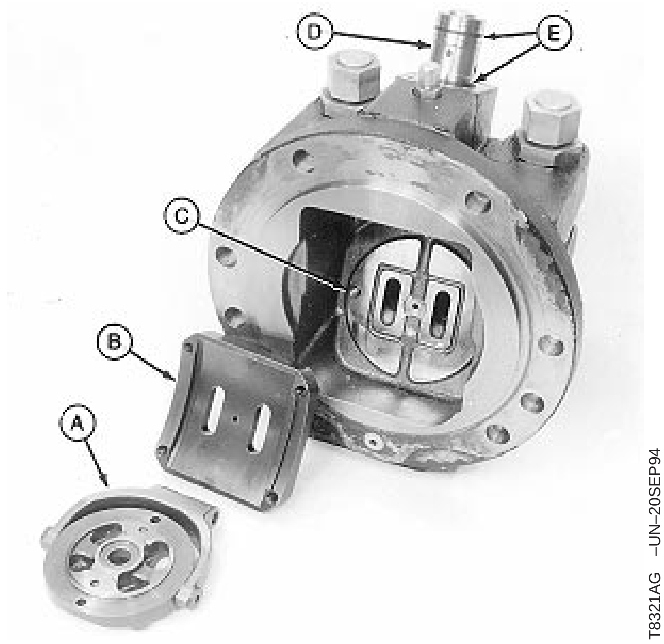
A—Cover
B—Plug and O-Ring
C—Shoulder Bolt
D—Valve Plate and Link Assembly

Continued on next page

CED,OUOE023,172 –19–29MAY98–9/12

17. Remove remaining parts (B—D) from valve housing.

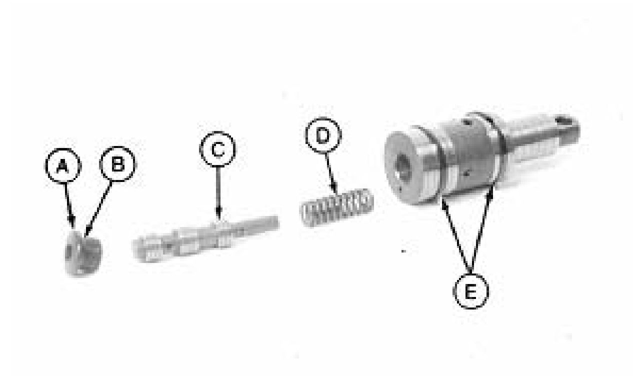
18. Inspect piston seals (E) for wear or damage, replace as necessary.



A—Valve Plate and Link Assembly
B—Plate
C—Pin (2 used)
D—Servo Piston
E—Piston Seal (2 used)

Continued on next page CED,OUOE023,172 –19–29MAY98–10/12

19. Disassemble servo piston parts (A—E).



A—Plug
B—O-Ring
C—Spool
D—Spring
E—Piston Ring (2 used)

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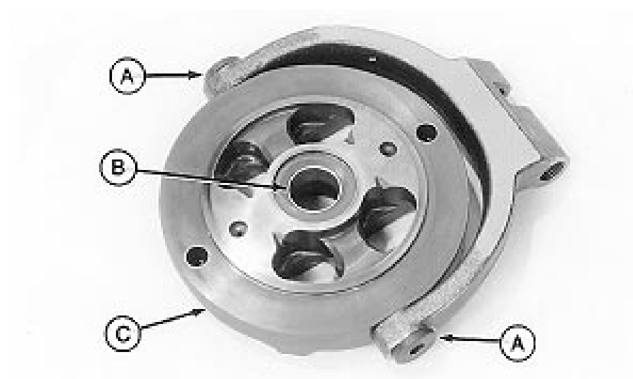
13

CED,OUOE023,172 –19–29MAY98–11/12

20. Inspect bushing (B). Remove bushing if replacement is necessary.

21. If necessary, remove pivot plugs (A) to remove valve plate (C). Mark valve plate so plate can be installed in same position as removed.



A—Pivot Plug
B—Bushing
C—Valve Plate

CED,OUOE023,172 –19–29MAY98–12/12

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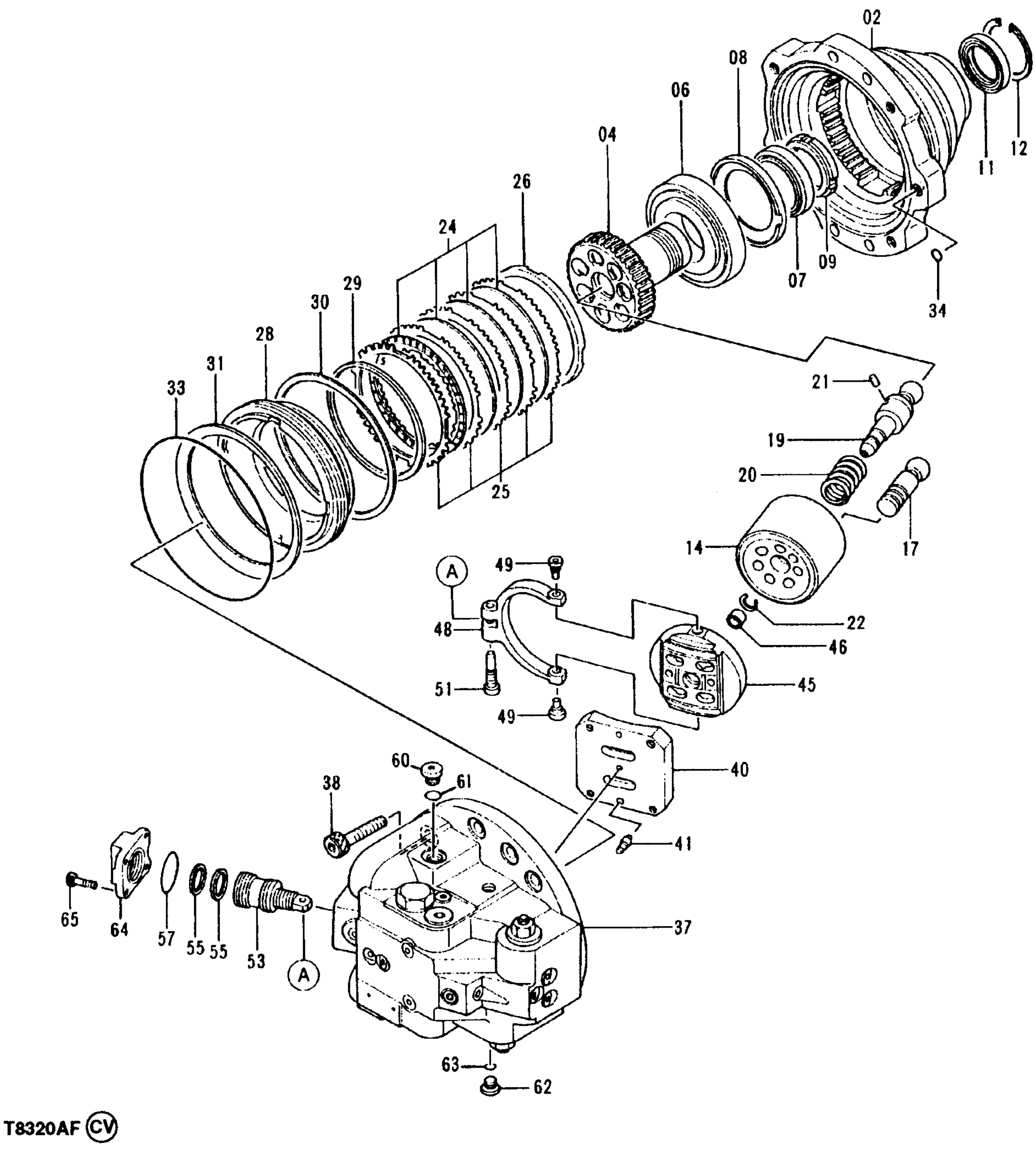
14

ASSEMBLE PROPEL MOTOR AND PARK BRAKE



T8320AF –UN–26SEP94

Continued on next page CED,OUOE023,174 –19–01JUN98–1/14

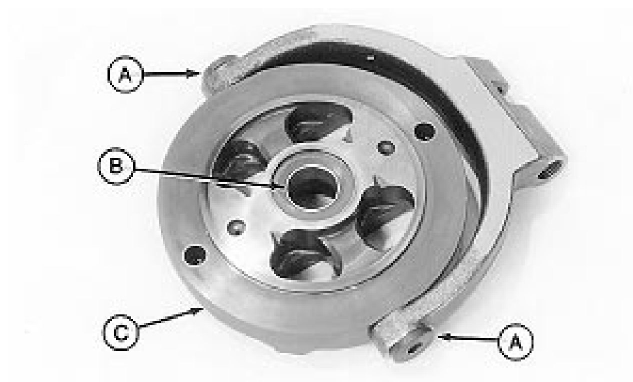
02—Motor Shaft and Brake Housing
04—Motor Drive Shaft
06—Roller Bearing
07—Roller Bearing
08—Spacer
09—Nut
11—Lip Seal
12—Snap Ring
14—Rotor
17—Piston (7 used)
19—Center Shaft
20—Spring
21—Pin
22—Retaining Ring
24—Disk (4 used)
25—Plate (5 used)
26—Spacer
28—Piston
29—O-Ring
30—O-Ring
31—Disk Spring
33—O-Ring
34—O-Ring
37—Motor Valve Housing
38—Cap Screw (4 used)
40—Plate
45—Valve Plate
46—Bushing
48—Link
49—Pivot Plug (2 used)
51—Shoulder Bolt
53—Servo Piston
55—Piston Seal (2 used)
57—O-Ring
60—Plug
61—O-Ring
62—Plug
63—O-Ring
64—Cover
65—Cap Screw (4 used)

CED,OUOE023,174 –19–01JUN98–2/14

1. Install bushing (B) using disk drivers, until bushing is even with valve plate (C).
2. If removed, apply thread lock and sealer (high strength) to threads of pivot plugs (A). DO NOT allow thread lock and sealer on the smooth portion of the pivot plugs.
3. Install valve plate and pivot plugs (A) in link. Tighten pivot plugs.

Pivot Plug—Specification

Torque .... 49 N•m (36 lb-ft)



T8321AH –UN–20SEP94

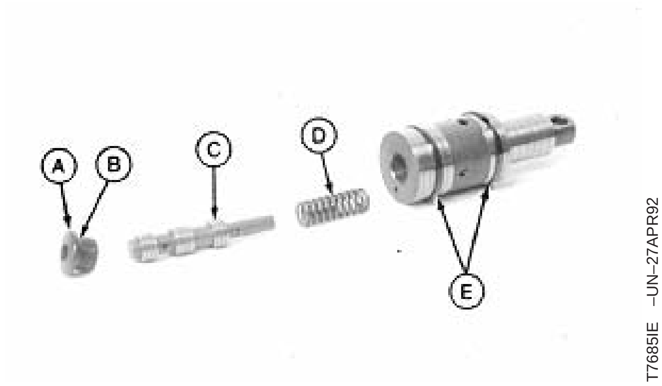
A—Pivot Plug (2 used)
B—Bushing
C—Valve Plate

Continued on next page

CED,OUOE023,174 –19–01JUN98–3/14

IMPORTANT: Piston seals are brittle. Use care not to chip, crack or break seals.

4. Assemble servo piston parts (A—E).



A—Plug
B—O-Ring
C—Spool
D—Spring
E—Piston Ring (2 used)

Continued on next page CED,OUOE023,174 –19–01JUN98–4/14

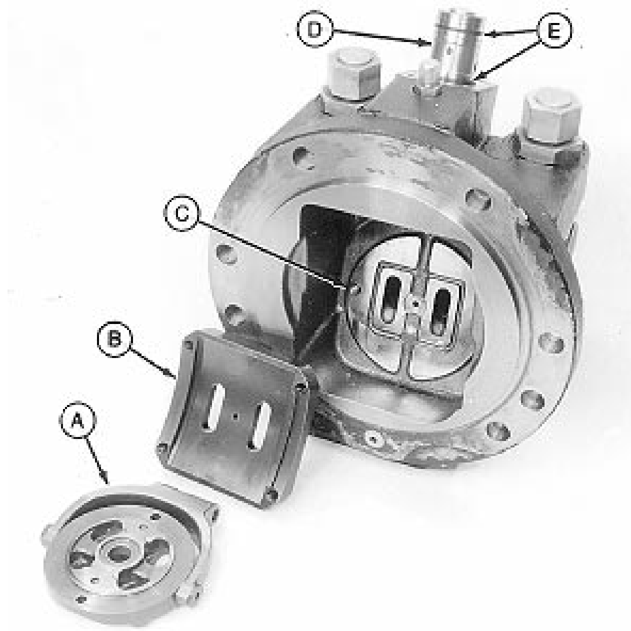
5. Apply clean oil to all internal parts.

6. Use fingers to compress piston seals (E) while installing servo piston (D).

IMPORTANT: Valve plate and slide plate have machined surfaces. Use care not damage or scratch machined surfaces.

7. Apply petroleum jelly to both sides of plate (B).

8. Install parts (A—C). Align link assembly with servo piston.



T8321AG –UN–20SEP94

A—Valve Plate and Link Assembly
B—Plate
C—Pin (2 used)
D—Servo Piston
E—Piston Seal (2 used)

Continued on next page

CED,OUOE023,174 –19–01JUN98–5/14

9. Install shoulder bolt (C) through link assembly (D) and end of servo piston. Tighten bolt.

Shoulder Bolt—Specification

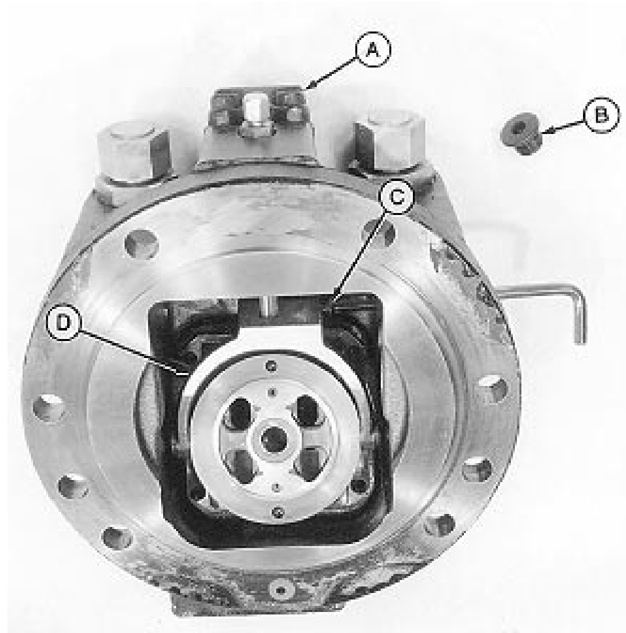
Torque .... 49 N•m (36 lb-ft)

10. Install plug and O-ring (B).

11. Install O-ring and cover (A). Tighten cover cap screws.

Servo Piston Cover Cap Screw—Specification

Torque .... 88 N•m (65 lb-ft)



T8321AF –UN–20SEP94

A—Cover
B—Plug and O-Ring
C—Shoulder Bolt
D—Valve Plate and Link Assembly

Continued on next page CED,OUOE023,174 –19–01JUN98–6/14

CAUTION: DO NOT heat oil over 182°C (360°F). Oil fumes or oil can ignite above 193°C (380°F). Use a thermometer. DO NOT allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

TS227 –UN–23AUG88

12. Heat bearing cones (C and E).

Bearing Cone—Specification

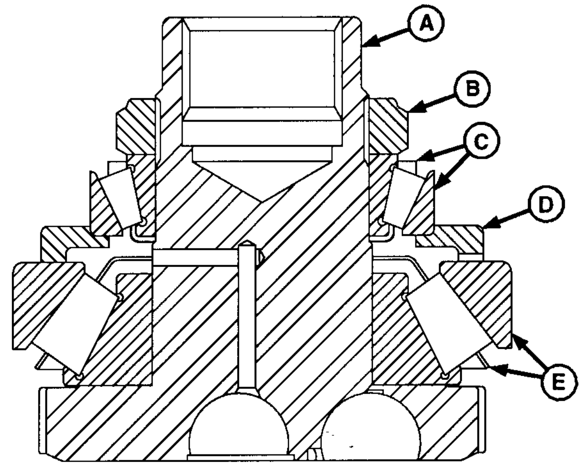
Temperature .... 70—90°C (158—194°F)

13. Install bearing cone (E) on motor drive shaft (A). Make sure cone is tight against shoulder of shaft. Install outer race of bearing.

14. Install outer race of bearing (C) in spacer (D). Make sure race is tight to bottom of bore. Install race and spacer with spacer notches towards larger bearing.

15. Install bearing cone (C) tight against outer race.

16. Apply clean oil to threads of a new nut (B). Install nut with thin shoulder away from bearing.



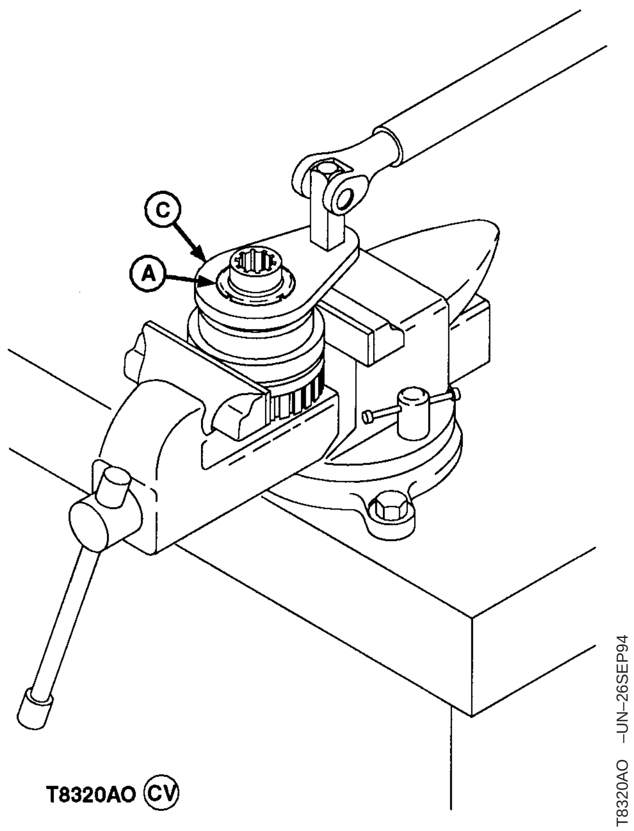
T8320AE CV

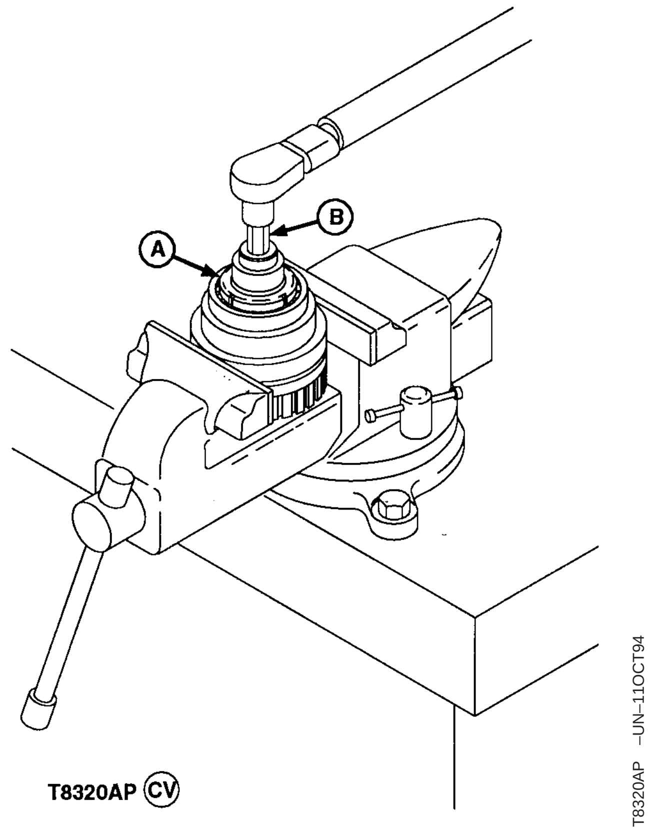
T8320AE –UN–11OCT94

A—Motor Drive Shaft
B—Nut
C—Roller Bearing
D—Spacer
E—Roller Bearing

Continued on next page

CED,OUOE023,174 –19–01JUN98–7/14





A—Nut
B—DF1038 Torque Adapter
C—JDG911 Spanner Wrench

17. Tighten nut (A) using JDG911 Spanner Wrench (C) until rolling drag torque is to specification.

Motor Drive Shaft—Specification

Rolling Drag Torque .... 2.5—3.5 N•m (22—31 lb-in.)

18. Check rolling drag torque using the DF1038 Torque Adapter (B). (See Section 99 for instructions to make tool.)

19. Stake nut in one place on the thin shoulder.

Continued on next page CED,OUOE023,174 –19–01JUN98–8/14

20. Apply plastic gasket (high strength) to outer diameter of oil seal (B).

21. Install seal with spring side into bore first. Use a disk driver to push seal to bottom of bore.

22. Apply multi-purpose grease to seal lips.

23. Install snap ring (A).

NOTE: Use a soft faced hammer to make sure bearings are tight against bottom of bore.

24. Install motor drive shaft assembly into housing, using care not to damage seal lips.

A—Snap Ring
B—Oil Seal

CED,OUOE023,174 –19–01JUN98–9/14

25. Install spacer (G) with notches to bottom of bore and aligned with notches in housing.

26. Install plates (F) and disks (E):

    - Begin with one plate and align notches in plate with notches in housing gear.
    - Install one disk.
    - Repeat step, alternating plates and disks. Keep notches of disks aligned with one another.

27. Apply petroleum jelly to O-rings (C and D). Install O-rings on piston (B) with rounded side out.

28. Make sure brake port (A) is clear to allow air to exit as piston is installed.

NOTE: To ease installation of piston apply petroleum jelly to outer diameter of piston.

29. Install piston (B) evenly into bore.

A—Brake Port
B—Piston
C—O-Ring
D—O-Ring
E—Disk (4 used)
F—Plate (5 used)
G—Spacer

Continued on next page CED,OUOE023,174 –19–01JUN98–10/14

30. Install pistons into same bores as they were removed. Make sure pistons move freely.

T8319BP –UN–20SEP94

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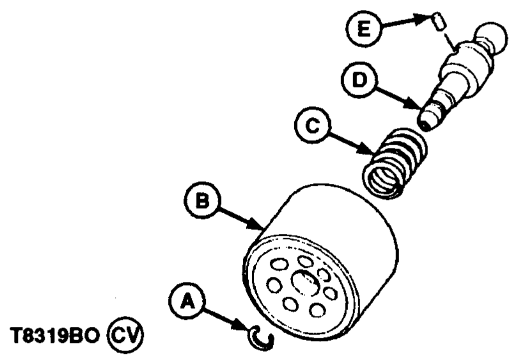
CED,OUOE023,174 –19–01JUN98–11/14

31. Assemble parts (A—E). Make sure pin (E) fits into groove of rotor (B).



T8319BO –UN–26SEP94

A—Retaining Ring
B—Rotor
C—Spring
D—Center Shaft
E—Pin

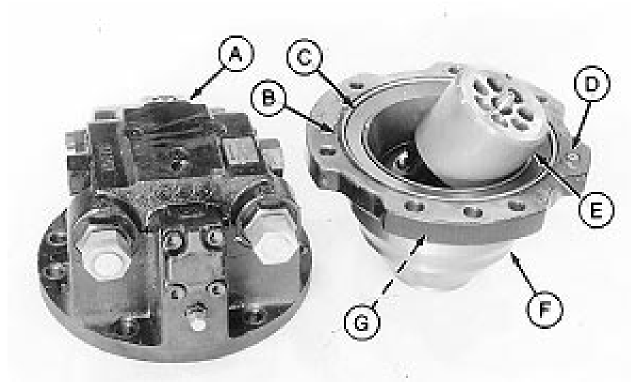
Continued on next page

CED,OUOE023,174 –19–01JUN98–12/14

32. Install rotor (E) so pistons are installed into the same bores as removed.

33. Install disk spring (C) so inner diameter contacts the piston.

34. Install O-rings (B, D and G).



T8319BJ –UN–20SEP94

A—Propel Motor Valve Housing
B—O-Ring
C—Disk Spring
D—O-Ring
E—Rotor Assembly
F—Propel Motor Shaft and Brake Housing
G—O-Ring

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Continued on next page CED,OUOE023,174 –19–01JUN98–13/14

35. Remove parts (A—C) from motor valve housing (D).

36. Remove plug and O-ring from port (E) on side of valve housing.

37. Move valve plate and servo piston to align pivot plug with port. Install a 6 mm Allen wrench in pivot plug to hold valve plate and link in position.

38. Install a 4.8 mm (3/16 in.) wooden dowel or soft rod (F) through reducing valve port and center of valve plate.

39. Lift motor valve housing into position over motor shaft and brake housing. Align housings and put dowel into bore of center shaft (G). Carefully bring the housings together.

40. Install and tighten four housing cap screws.

Brake Valve-to-Motor Housing Cap Screw—Specification

Torque .... 217 N•m (160 lb-ft)

41. Remove dowel and install parts (A—C). Tighten plug.

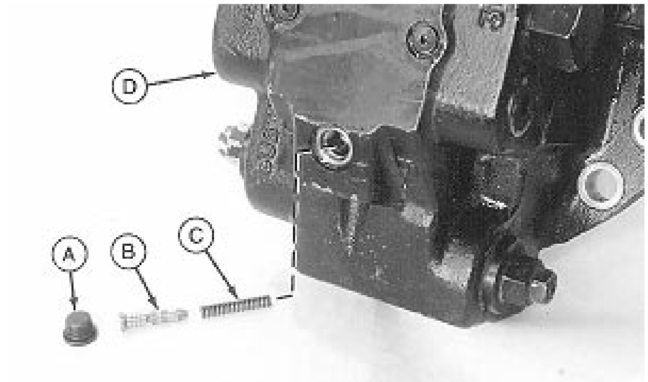
Brake Pressure Reducing Spool Plug—Specification

Torque .... 34 N•m (25 lb-ft)

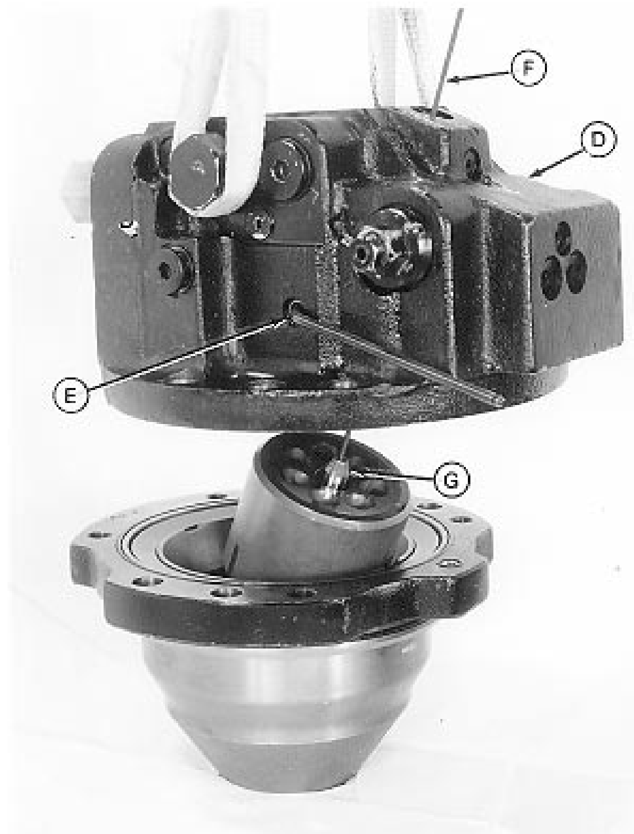
42. Remove Allen wrench. Install and tighten plug and O-ring.

Alignment Port Plug—Specification

Torque .... 88 N•m (65 lb-ft)



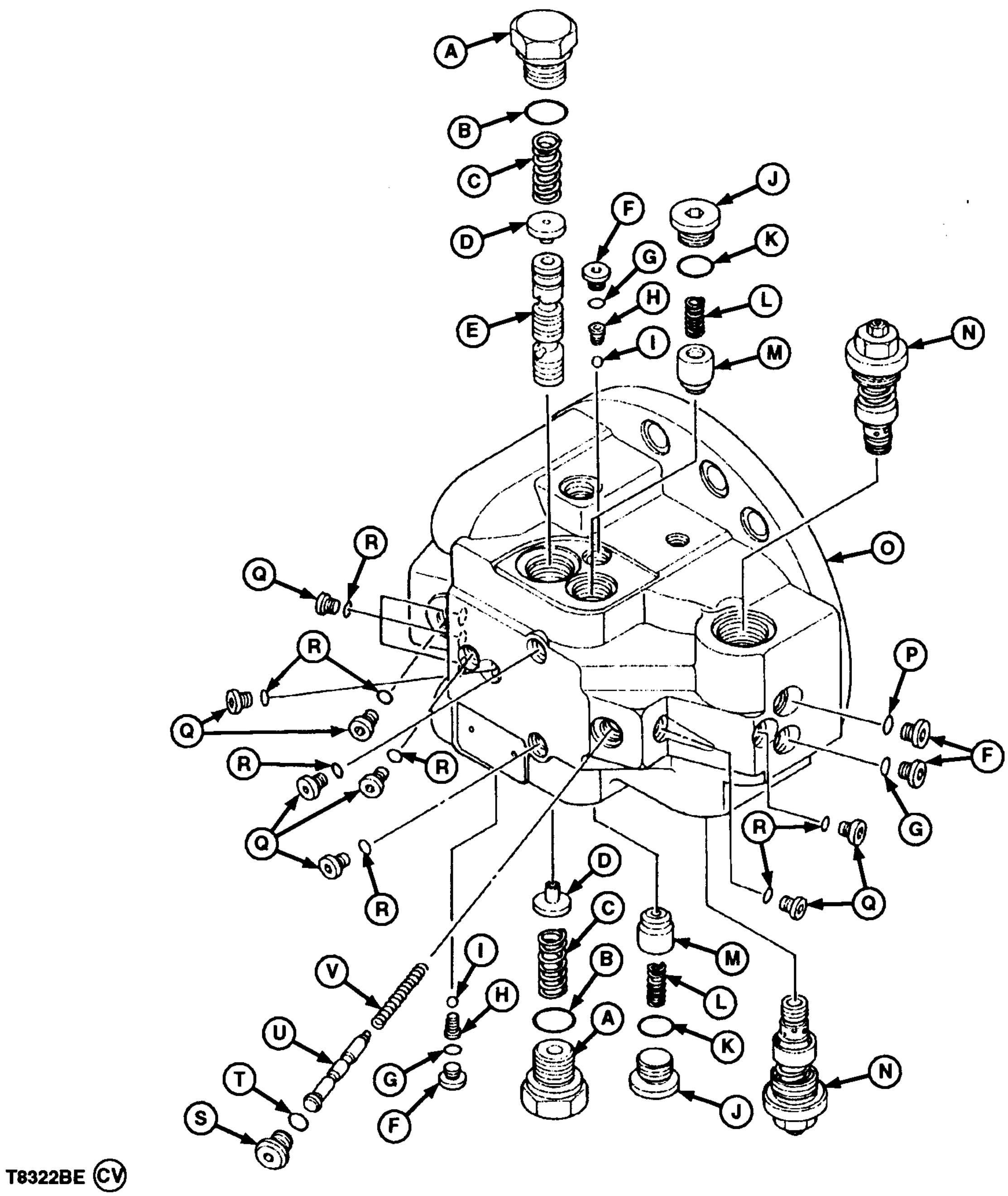
T8322BC –UN–20SEP94



T8322BD –UN–20SEP94

A—Plug and O-Ring
B—Pressure Reducing Spool
C—Spring
D—Motor Valve Housing
E—Alignment Port
F—Wooden Dowel or Rod
G—Center Shaft

DISASSEMBLE AND ASSEMBLE PROPEL MOTOR BRAKE VALVE HOUSING



T8322BE –UN–26SEP94

A—Plug (2 used)
B—O-Ring (2 used)
C—Counterbalance Spring (2 used)
D—Spool Plug (2 used)
E—Counterbalance Spool
F—Plug (4 used)
G—O-Ring (4 used)
H—Ball Seat (2 used)
I—Ball (2 used)
J—Plug (2 used)
K—O-Ring (2 used)
L—Check Valve Spring (2 used)
M—Check Valve Poppet (2 used)
N—Relief Valve (2 used)
O—Motor Valve Housing
P—O-Ring (2 used)
Q—Plug (10 used)
R—O-Ring (10 used)
S—Plug
T—O-Ring
U—Pressure Reducing Valve Spool
V—Pressure Reducing Spring

Continued on next page

PARK BRAKE RELEASE SHUTTLE VALVE

NOTE: Valve can be removed with propel motor on machine.

Clean threads of seat (B) using cure primer. Apply thread lock and sealer (high strength) to threads.

Install ball (C) and seat (B). Tighten seat (B) using an 8 mm hex key wrench.

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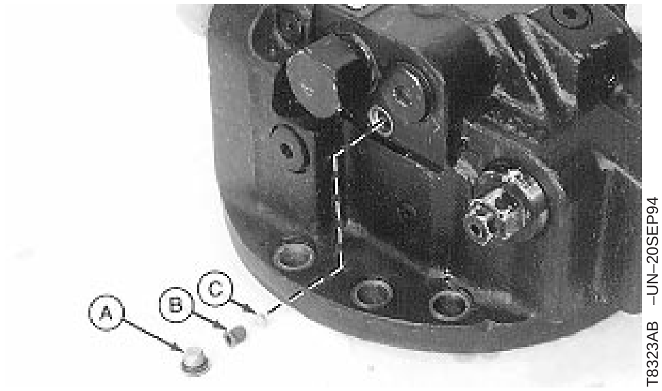
Ball Seat—Specification

Torque .... 14.5 N•m (128 lb-in.)

Install and tighten plug and O-ring (A).

Park Brake Release Shuttle Valve Plug—Specification

Torque .... 14.5 N•m (128 lb-in.)



A—Plug with O-Ring
B—Ball Seat
C—Ball

CED,OUOE023,175 –19–01JUN98–2/7

SERVO PISTON OPERATING SHUTTLE VALVE

NOTE: Valve can be removed with propel motor on machine.

Clean threads of seat (B) using cure primer. Apply thread lock and sealer (high strength) to threads.

Install ball (C) and seat (B). Tighten seat (B) using an 8 mm hex key wrench.

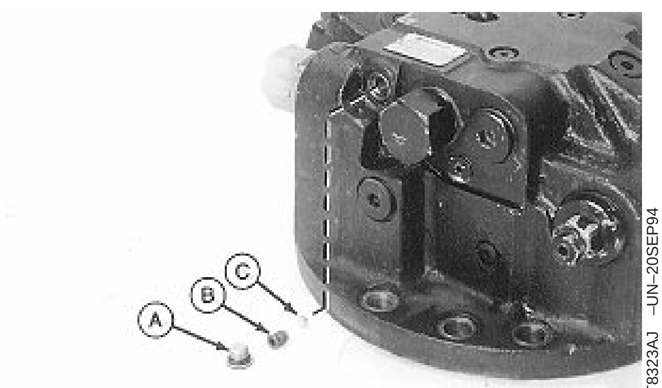
Ball Seat—Specification

Torque .... 14.5 N•m (128 lb-in.)

Install and tighten plug and O-ring (A).

Servo Piston Operating Shuttle Valve Plug—Specification

Torque .... 14.5 N•m (128 lb-in.)



A—Plug with O-Ring
B—Ball Seat
C—Ball

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CED,OUOE023,175 –19–01JUN98–3/7

COUNTERBALANCE VALVE

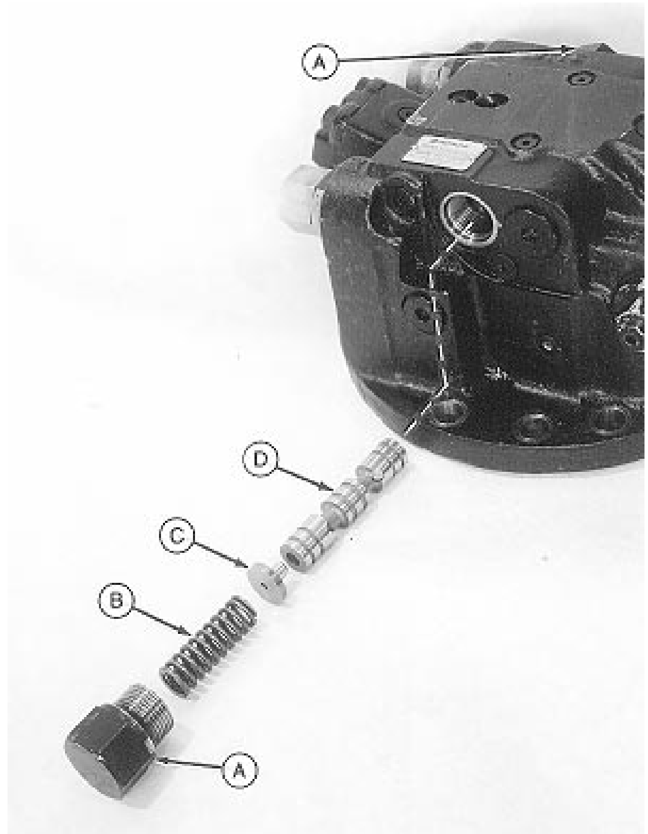
NOTE: Valve can be removed with propel motor on machine.

Apply clean oil to spool (D). Install spool plug (C) with smaller diameter toward spool.

Install and tighten plug and O-ring (A).

Counterbalance Valve Plug—Specification

Torque .... 340 N•m (250 lb-ft)



A—Plug and O-Ring (2 used)
B—Spring (2 used)
C—Spool Plug (2 used)
D—Counterbalance Spool

Continued on next page CED,OUOE023,175 –19–01JUN98–4/7

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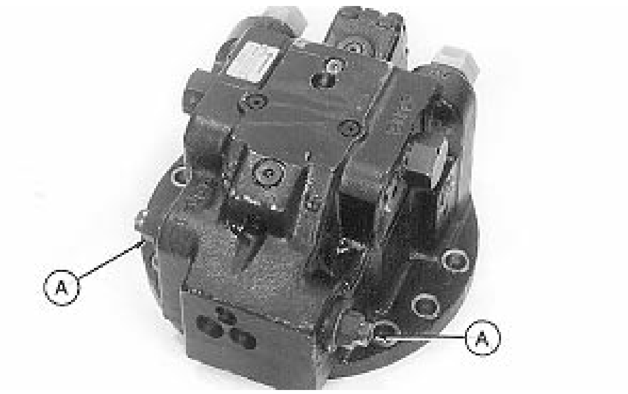
RELIEF VALVES

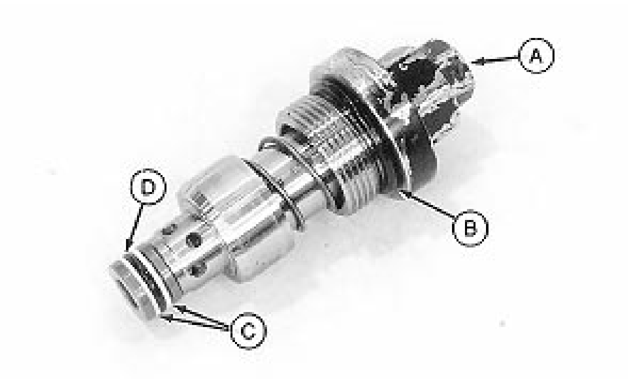
NOTE: Valves can be removed with propel motor on machine.

Tighten relief valve (A).

Relief Valve—Specification

Torque .... 540 N•m (398 lb-ft)





A—Relief Valve
B—O-Ring
C—Backup Ring (2 used)
D—O-Ring

CED,OUOE023,175 –19–01JUN98–5/7

CHECK VALVES

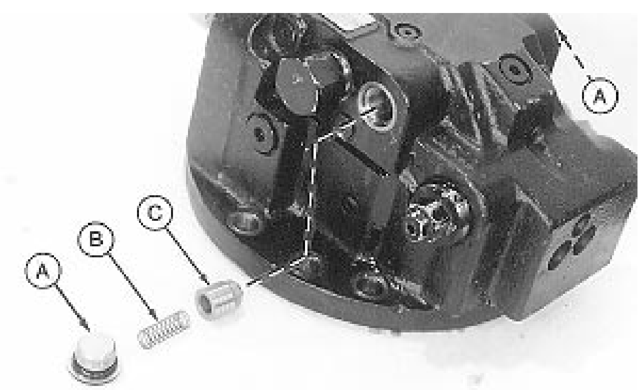
NOTE: Valves can be removed with propel motor on machine.

Install parts (A—C).

Tighten plug (C).

Check Valve Plug—Specification

Torque .... 235 N•m (173 lb-ft)



A—Plug with O-Ring (2 used)
B—Spring (2 used)
C—Poppet (2 used)

Continued on next page CED,OUOE023,175 –19–01JUN98–6/7

BRAKE PRESSURE REDUCING VALVE

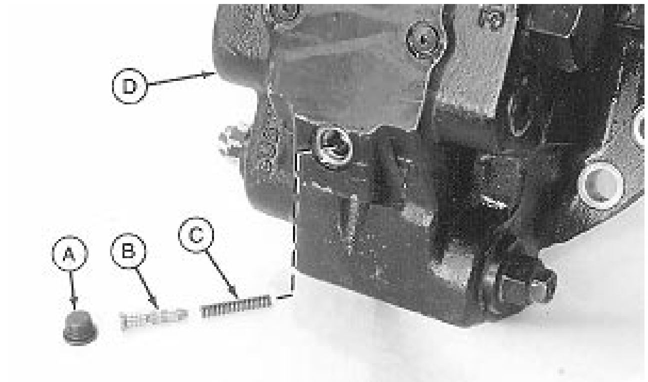
NOTE: Valve can be removed with propel motor on machine.

Install parts (A—C).

Tighten plug (A).

Brake Pressure Reducing Valve Plug—Specification

Torque .... 34 N•m (25 lb-ft)



A—Plug and O-Ring
B—Spool
C—Spring

CED,OUOE023,175 –19–01JUN98–7/7

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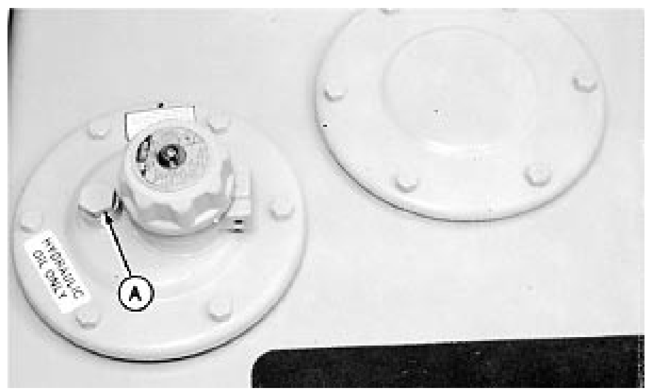
REMOVE AND INSTALL ROTARY MANIFOLD

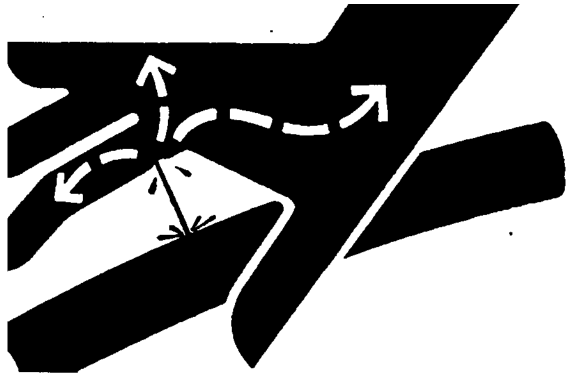
CAUTION: High pressure release of oil from pressurized system can cause serious burns or penetrating injury. The hydraulic tank is pressurized. Do not remove vent plug. Release pressure by loosening vent plug.

1. Loosen vent plug (A) to release air pressure in hydraulic tanks.



Continued on next page CED,OUOE023,179 –19–02JUN98–1/4

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.



X9811 –UN–23AUG88

2. Disconnect lines (A and D—H).

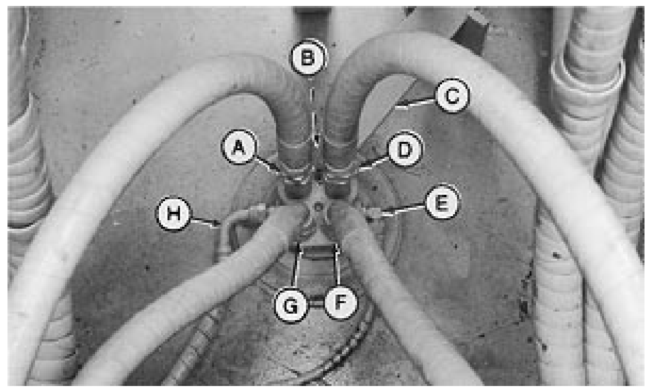
3. Remove cap screws (B). Remove stop (C).

CAUTION: The approximate weight of rotary manifold is 27 kg (60 lb).

Rotary Manifold—Specification

Weight.. 27 kg (60 lb) approximate

4. Attach the rotary manifold to a hoist using a lifting strap and two rotary manifold lifting tools. (See Section 99 for instructions to make tools.)



T7966DT –UN–04MAY93

A—Rotary Manifold Port 3-to-Left Propel Section Bottom (Reverse) Port Line
B—Rotary Manifold Cap Screw (2 used)
C—Stop
D—Rotary Manifold Port 1-to-Right Propel Section Bottom (Reverse) Port Line
E—Rotary Manifold P1 Port-to-Pilot Pressure Regulating and Solenoid Valve Manifold “SA” Port Line
F—Rotary Manifold Port 2-to-Right Propel Section Top (Forward) Port Line
G—Rotary Manifold Port 4-to-Left Propel Section Top (Forward) Port Line
H—Rotary Manifold D Port-to-Reservoir Port Line

Continued on next page CED,OUOE023,179 –19–02JUN98–2/4

5. Disconnect lines (A—H).

6. Remove cap screws (I). Lower rotary manifold. Do not damage rubber boot.

7. Replace parts as necessary.

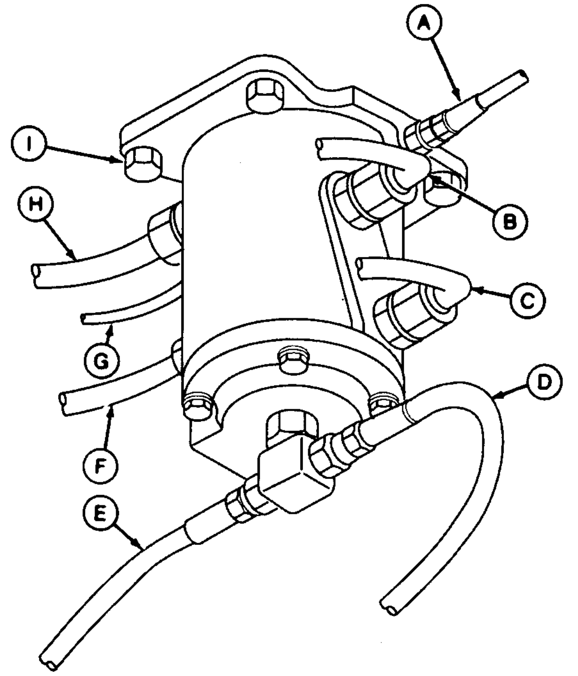
8. Raise rotary manifold into position so that the letter R on mounting flange and the work port number 1 and 2 are toward the right side of machine.

9. Install cap screws (I) and tighten.

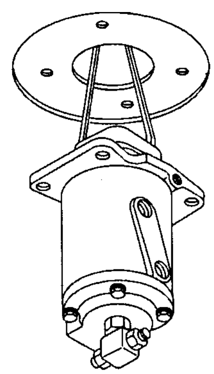
Manifold-to-Frame Cap Screw—Specification

Torque .... 34 N•m (25 lb-ft)

10. Connect lines (A—H).



T7685JB –UN–27APR92



T7685JC –UN–27APR92

A—Rotary Manifold Port P1-to-Right Propel Speed Change Port Line
B—Rotary Manifold Port 2-to-Right Propel Motor “AV” (Forward) Port Line
C—Rotary Manifold Port Port 1-to-Right Propel Motor “BV” (Reverse) Port Line
D—Rotary Manifold Bottom Tee Port-to-Right Propel Motor Top Drain Port Line
E—Rotary Manifold Bottom Tee Port-to-Left Propel Motor Top Drain Port Line
F—Rotary Manifold Port 3-to-Left Propel Motor “AV” (Reverse) Port Line
G—Rotary Manifold Port P1-to-Left Propel Speed Change Port Line
H—Rotary Manifold Port 4-to-Left Propel Motor “BV” (Forward) Port Line
I—Cap Screw (4 used)

Continued on next page

CED,OUOE023,179 –19–02JUN98–3/4

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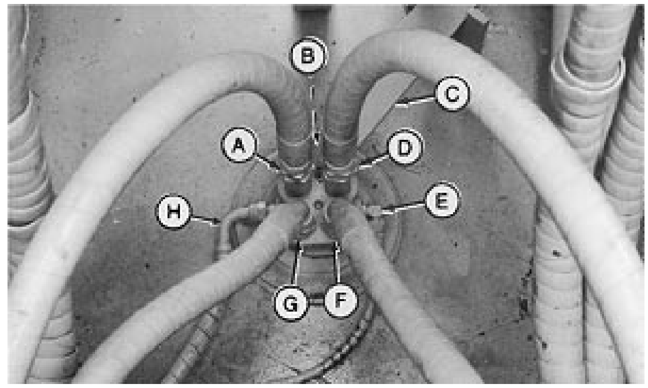
11. Remove lifting device. Install stop (C). Tighten cap screws (B).

Stop Cap Screw—Specification

Torque .... 65 N•m (50 lb-ft)

12. Connect lines (A and D—H).

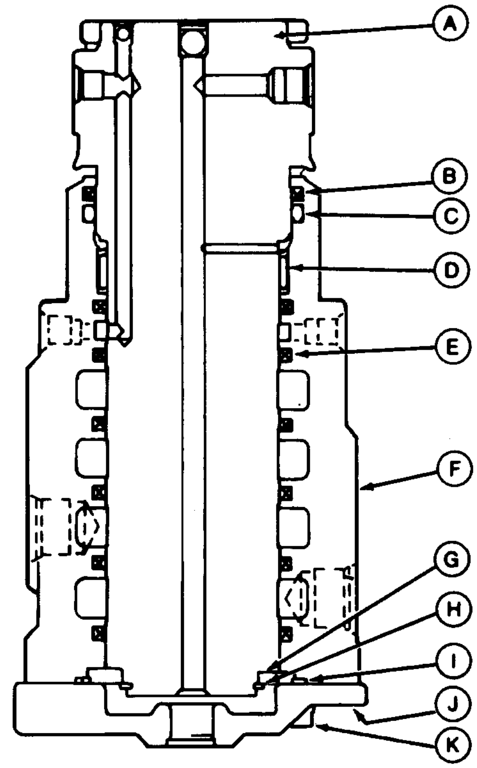


T7966DT –UN–04MAY93

A—Rotary Manifold Port 3-to-Left Propel Section Bottom (Reverse) Port Line
B—Cap Screw (2 used)
C—Stop
D—Rotary Manifold Port 1-to-Right Propel Section Bottom (Reverse) Port Line
E—Rotary Manifold P1 Port-to-Pilot Pressure Regulating and Solenoid Valve Manifold “SA” Port Line
F—Rotary Manifold Port 2-to-Right Propel Section Top (Forward) Port Line
G—Rotary Manifold Port 4-to-Left Propel Section Top (Forward) Port Line
H—Rotary Manifold Port D-to-Reservoir Port Line

CED,OUOE023,179 –19–02JUN98–4/4

DISASSEMBLE AND ASSEMBLE ROTARY MANIFOLD



A—Spindle
B—Seal Dust
C—O-Ring
D—Bushing
E—Oil Seal Ring (6 used)
F—Housing
G—Washer
H—Snap Ring
I—O-Ring
J—Cover
K—Cap Screw

Continued on next page CED,OUOE023,181 –19–02JUN98–1/3

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1. Make a mark on spindle (B), body (G) and cover (K) to aid in assembly.

2. Remove cap screws (L) and cover (K). Inspect O-ring (J) and replace if necessary.

3. Remove snap ring (I) and ring (H).

4. Carefully, remove spindle assembly (B—F) from housing (G).

5. Remove plug (A) in spindle to clean port. Install plug.

6. Remove O-ring (D), oil seal (C), oil seal rings (F) and bushing (E).

7. Inspect and repair as necessary. Keep hydraulic oil on all disassembled parts.

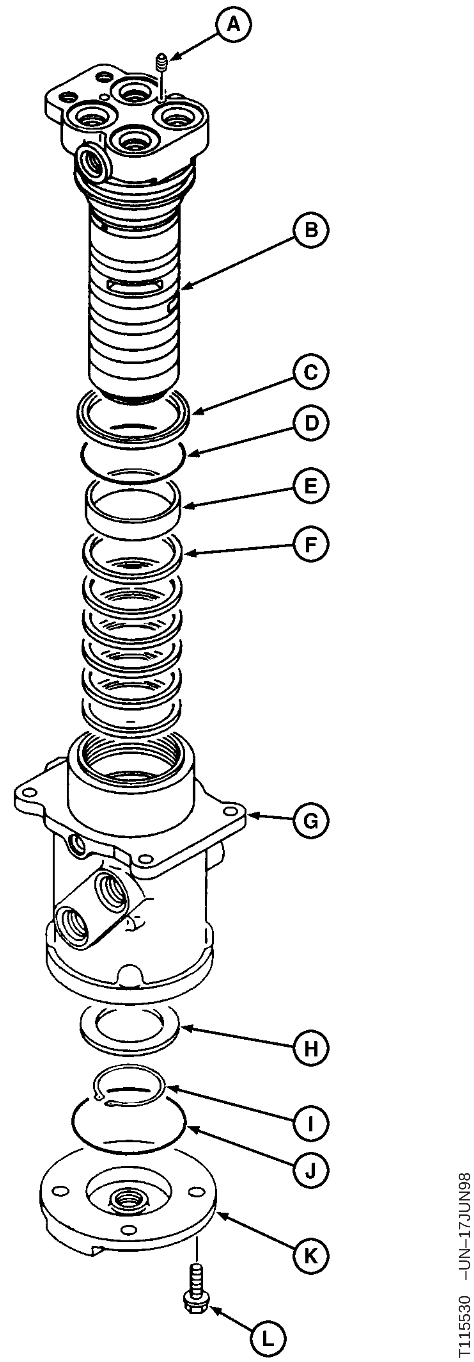
8. Install bushing (E), O-ring (D), oil seal rings (F) and oil seal (C) in housing (G).

9. Install oil seal rings (F) on housing (G).

10. Install parts (B—F) in housing (G) so the mounting holes for stop are towards the pointed indicator on mounting flange and work port numbers are towards the same side as housing.

11. Install ring (H) with chamfered side towards spindle. Install snap ring (I) with flat side against ring (H).

12. Install O-ring (J) and cover (K) with nameplate on cover (K) toward "L" mark on housing (G) mounting flange. Install and tighten cap screws (L).



T115530

A—Plug
B—Spindle
C—Oil Seal
D—O-Ring
E—Bushing
F—Oil Seal Rings (6 used)
G—Housing
H—Ring
I—Snap Ring
J—O-Ring
K—Cover
L—Cap Screw (4 used)

Continued on next page

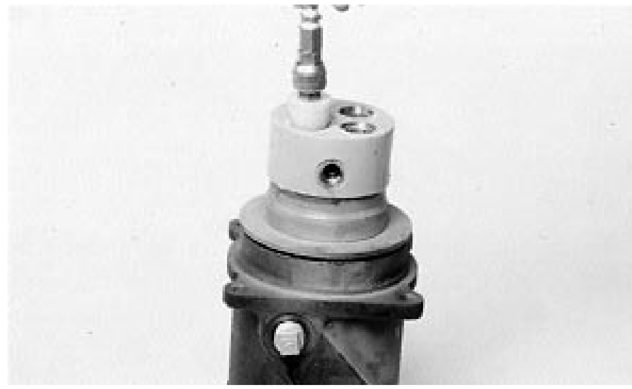
CED,OUOE023,181 –19–02JUN98–2/3

Cover-to-Housing Cap Screw—Specification

Torque .... 50 N•m (35 lb-ft)

CED,OUOE023,181 –19–02JUN98–3/3

ROTARY MANIFOLD AIR TEST



T6557JB –UN–01NOV88

1. Install a plug in one port.
2. Apply air pressure using JDG185 Air Test Plug and shop air pressure through the other port in that passage.
3. Listen for air leaks at ports on either side of pressurized port.

TX,02,VV2557 –19–09APR98–1/1

By order of the Secretary of the Army:

ERIC K. SHINSEKI
General United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
9930506

Distribution: To be distributed in accordance with Initial Distribution Number (IDN) 256564, requirements for TM 5-3805-281-24-1.

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SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS) Your mailing address

DATE SENT Date you fill out this form

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-2350-262-34	Date of TM	M9 DS/GS MAINTENANCE MANUAL

BE EXACT . .PIN-POINT WHERE IT IS / **IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:**

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	
2-2				Fuel tank removal and installation is now a DS/GS task. Delete this task from the unit maintenance list.
4-185	B			There are three clamps securing air cleaner duct, not the two as shown. Suggest changing text and art to show three clamps.
B-5		1		Roadwheel jack does not have an NSN or P/N listed and cannot be found on AMDF. Request correct NSN and P/N be furnished.

SAMPLE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBERS Joe Doe, SFC 555-1212

SIGN HERE: Joe Doe, Sfc

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SAMPLE

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UNIT'S ADDRESS

FOLD BACK

TEAR ALONG PERFORATED LINE

DEPARTMENT OF THE ARMY

PLACE
POSTAGE
HERE

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U.S. Army Tank-automotive and Armaments Command
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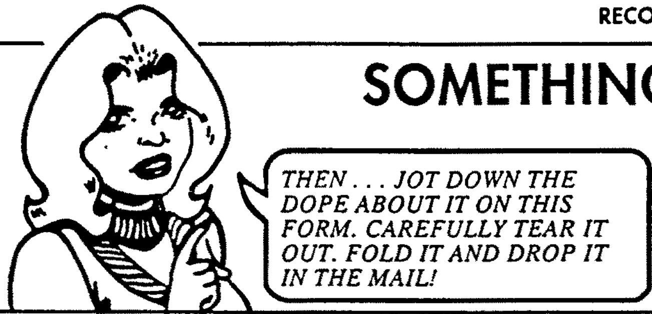

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DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-3805-281-24-1		Hydraulic Excavator 330LCR UNIT, DS, GS Maintenance Manual

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Rock Island, IL 61299-7630

THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'EIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

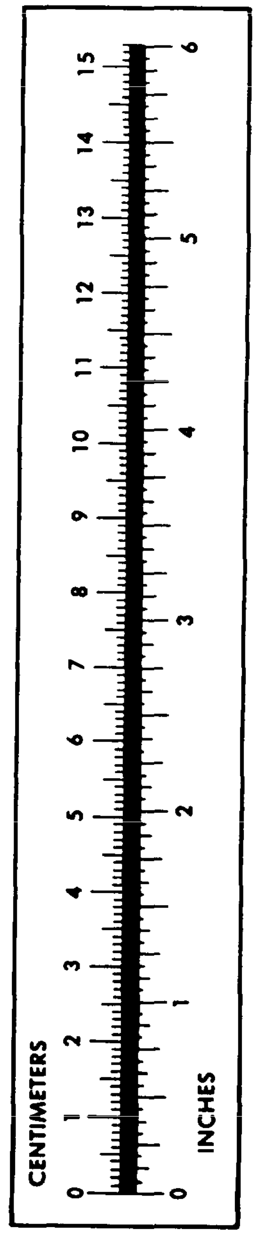
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
'ers	Gallons	0.264
.ms	Ounces	0.035
.ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
'lometers per Liter	Miles per Gallon	2.354
›meters per Hour	Miles per Hour	0.621



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