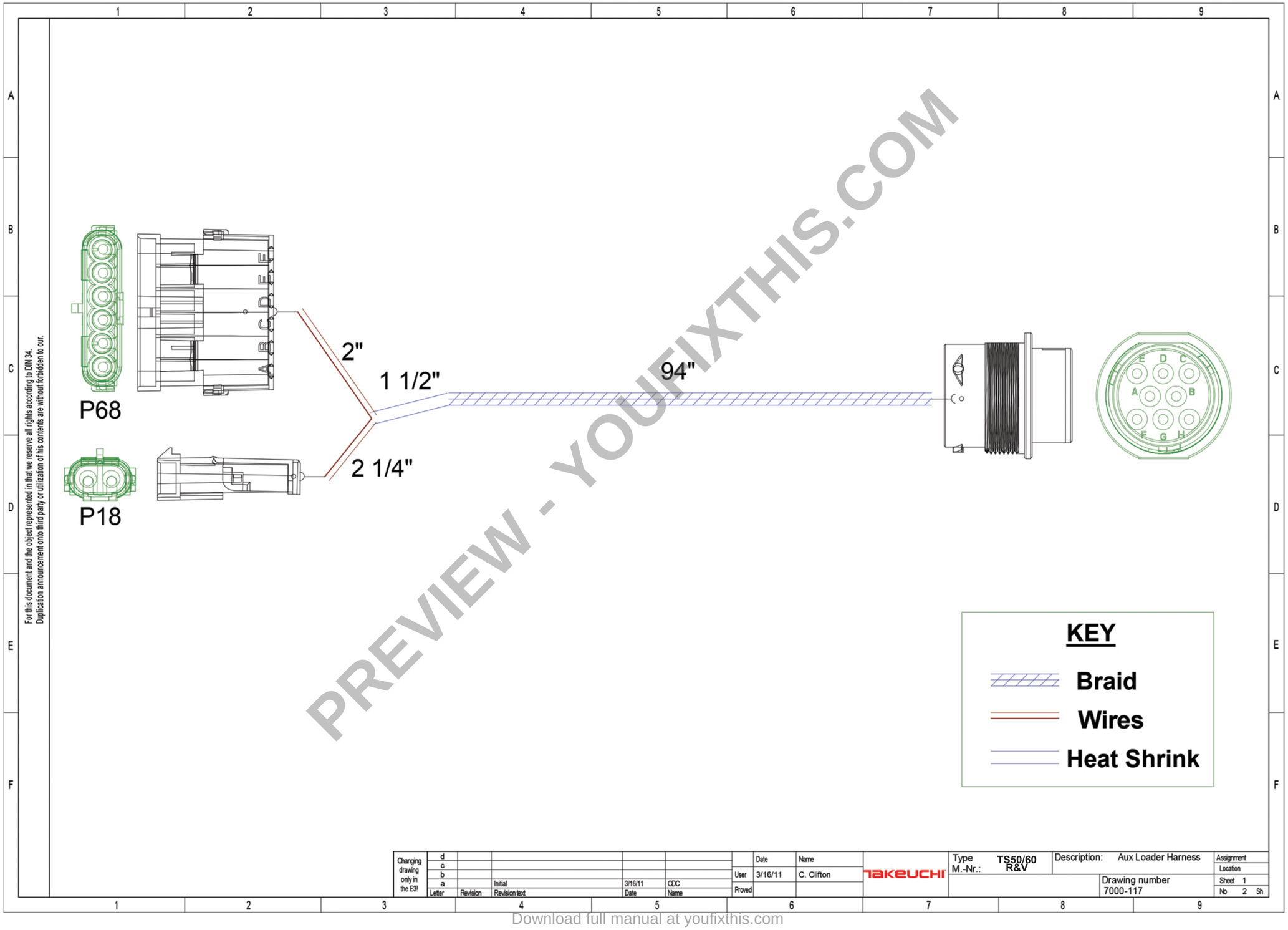
TS50/60R&V - Auxiliary Loader Harness



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3. Circuit Diagrams

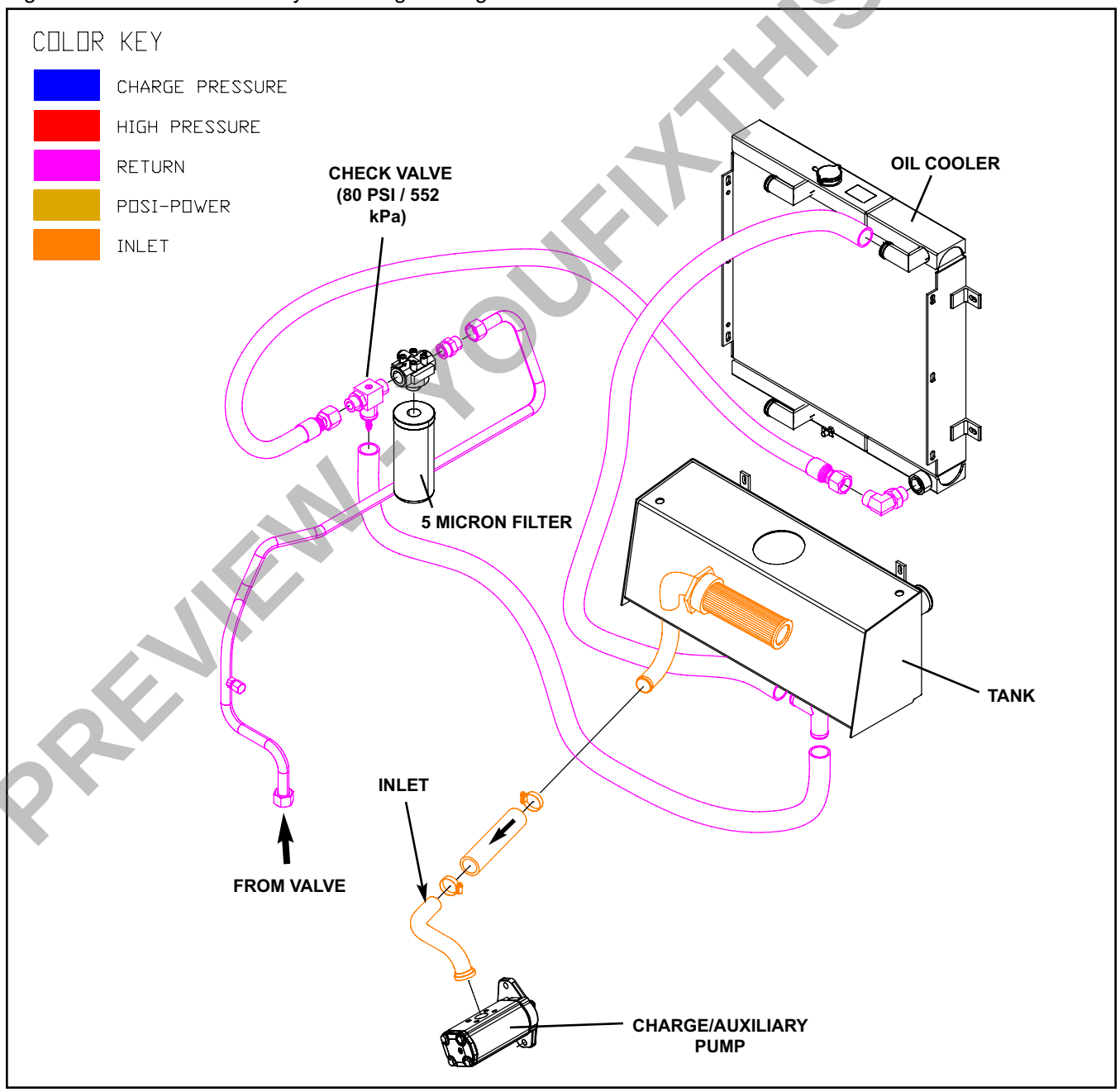
Chapter Overview

This chapter contains diagrams for the following TS50V and TS60V circuits: hydraulic filtering/cooling circuit, hydraulic control/auxiliary circuit, hydraulic drive circuit (single speed), hydraulic drive circuit (two speed), lift arm control valve, hydraulic solenoid blocks, drive control routing, lift arm control routing and electrical attachment outlet.

cuit

Hyd. Filtering/Cooling Circuit

Figure 3-1 TS50V / TS60V Hyd. Filtering/Cooling Cir-



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19. Service Aids & Supplements

General Torque Specifications

Inch Fasteners

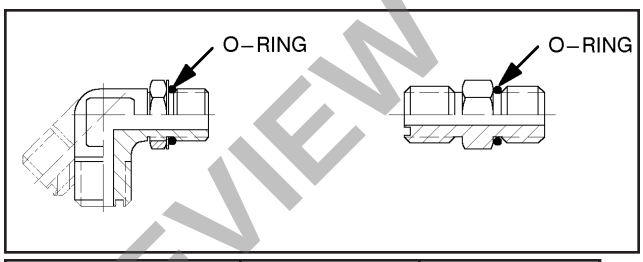
Thread Size	Standard Torque
1/4"	9 +/- 2 lb ft
5/16"	18 +/- 4 lb ft
3/8"	35 +/- 7lb ft
7/16"	50 +/- 11 lb ft
1/2"	75 +/- 15 lb ft
9/16"	120 +/- 22 lb ft
5/8"	160 +/- 30 lb ft
3/4"	275 +/- 37 lb ft
7/8"	460 +/- 60 lb ft
1"	660 +/- 75 lb ft
1-1/8"	960 +/- 110 lb ft
1-1/4"	1320 +/- 150 lb ft
1-3/8"	1780 +/- 220 lb ft
1-1/2"	2280 +/- 260 lb ft

Metric Fasteners

Thread Size	Standard Torque
M6	12 +/- 3 Nm
M8	28 +/- 7 Nm
M10	55 +/- 10 Nm
M12	100 +/- 20 Nm
M14	160 +/- 30 Nm
M16	240 +/- 40 Nm
M20	460 +/- 60 Nm
M24	800 +/- 100 Nm
M30	1600 +/- 200 Nm
M36	2700 +/- 300 Nm

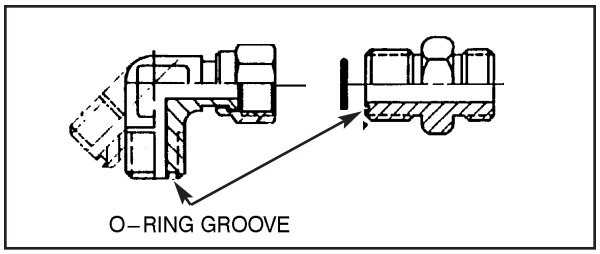
Fitting Torque Specifications

O-Ring Port (in conjunction with ORFS connectors)



REF NOMINAL TUBE OD		THREAD SIZE	DYNAMIC ASSEMBLY TORQUE
mm	INCH		(N·m)
4.76	.188	3/8	12+2
6.35	.250	7/16	22+2
7.94	.312	1/2	30+3
9.52	.375	9/16	48+5
12.70	.500	3/4	82+8
15.88	.625	7/8	140+14
19.05	.750	1–1/16	190+15
22.22	.875	1–3/16	250+20
25.40	1.000	1–5/16	300+30
31.75	1.250	1–5/8	350+35
38.10	1.500	1–7/8	415+40

O-Ring Face Seal (ORFS)



REF NOMINAL TUBE OD		THREAD SIZE
mm	INCH	
6.35	.250	9/16
9.52	.375	11/16
12.70	.500	13/16
15.88	.625	1
19.05	.750	1–3/16
25.40	1.000	1–7/16
31.75	1.250	1–11/16
38.10	1.500	2

Note: For o-ring port fittings, use 50% of listed torque values if fitting or port material is non-ferrous.

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Engine Oil/Filter Change

Regular oil changes are necessary to maintain a strong running engine. Takeuchi recommends a normal oil change interval of 250 hours or every six months. This recommendation has been made to help ensure proper lubrication during operation and to prolong engine life under typical operating conditions.

To change the oil and filter:

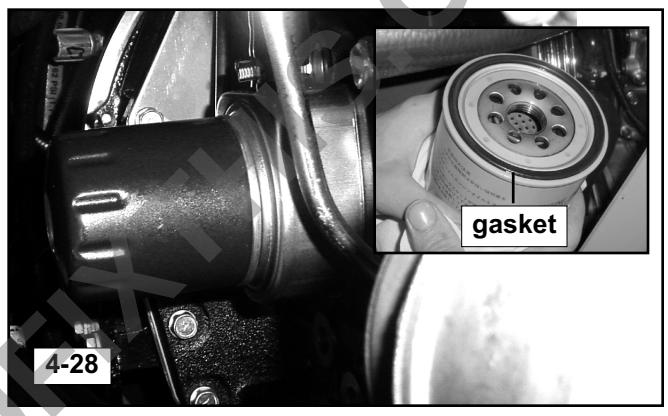
1. Start and run the engine for a few minutes to warm the oil.
2. Shut the machine down according to the procedure in section 5.13 of the operation and maintenance manual and allow the machine to cool before per forming this procedure.
3. Remove the large bolt (oil drain plug) in the floor of the chassis to the right of the oil pan and route the engine oil drain hose through it.
4. Place a suitable container under the engine oil drain plug.
5. Open the rear door and hood to access the engine compartment.
6. Lift the drain valve tab upward and then rotate it counter clockwise in the slot as shown figure 4-27. Drain the oil into a suitable catch container.
7. Remove engine oil filter . Upon removal, make sure the filter gasket is still present on the filter. If not, remove it from the filter port (on the engine) prior to installing the new filter to prevent leaks (fig. 4-28).

NOTICE

If the old filter gasket is not removed from the filter head and the new filter is installed on top of it, an oil leak will result when the engine is started. If unnoticed, the engine can run itself out of oil causing engine failure.

8. Prepare new filter by applying fresh oil on the exposed gasket surface and install the new filter.
9. Thread the new filter onto the filter head. Tighten the filter by hand as instructed by the label located on the filter or filter box.
10. Reverse steps 3 and 4 to close the drain valve and store the hose.
11. Remove the oil filler cap and fill the engine crankcase with Takeuchi 10W-30 Heavy Duty Engine Oil (capacity: 11.2 quarts (10.6 gal) including filter) (fig. 4-29).
12. Install the oil filler cap.
13. Perform a visual inspection to make sure the drain plug, filter and oil filler cap are in place and tight.







14. Start the engine and watch the display to ensure the oil pressure guage needle rises into the green zone (or warning light goes out) shortly after startup indicating oil pressure.
15. Once oil pressure has been verified, have an assistant visually inspect the machine for engine oil leaks. If none are found, shut the engine down and exit the machine.
16. Perform the oil level check procedure.
17. Dispose of the used oil and filter according to mandates.

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17. Troubleshooting

Chapter Overview

This chapter contains basic troubleshooting procedures for the TS50V / TS60V Skid Steer Loaders.

Additional troubleshooting aids are provided in Chapter 3 (Circuit Diagrams) and in chapters containing disassembly and assembly procedures for the appropriate component or assembly.

Personal Safety

Improper or incomplete maintenance/repair of a Skid Steer Loader can be dangerous and may result in machine damage, injury or even death.

Do not attempt to perform any type of repair or maintenance on a Skid Steer Loader until you have read and fully understood the information in this manual.

Refer to the Operation and Maintenance manual for instructions regarding proper machine operation techniques before operating any Skid Steer Loader.

Prior to performing any type of service work on a Skid Steer Loader, read and understand Chapter 1 (Product Safety) for personal safety information.

Visual Inspection

Prior to troubleshooting, walk around the machine and perform an overall visual inspection. Look for missing, loose, worn or broken parts. Pay particular attention to the following items:

- Case Chain tension
- Fluid levels
- Fan belt tension and condition
- Hoses (no visible sign of wear)
- Fittings (no apparent leaks)
- Battery cables
- Fuse panel (fuses in place and operational)
- Controls (for neutral)

A simple visual inspection and operational check can identify many problems without the need for extensive troubleshooting. However, if these checks indicate a problem that requires further analysis, proceed to Troubleshooting.

General Troubleshooting

The most effective way to prevent a malfunction from occurring is to closely follow the recommended maintenance schedule and instructions throughout the life of the machine. However, if a malfunction does occur, finding the problem and fixing it quickly are important. This section covers a select set of symptoms that may occur and suggests possible causes.

Problem 1:
Machine will not crank over.

Possible causes:

1. Power quick-attach switch in unlocked position. (if equipped)
2. Battery cables loose or corroded.
3. Ignition fuse blown.
4. Main starter fuse blown.
5. Starter relay malfunctioning.
6. Weak or dead battery.
7. Faulty continuous hydraulic flow switch.
8. Faulty power quick attach switch.
9. Faulty ignition switch.
10. Faulty starter.
11. Loose, broken or disconnected wiring at key, relay or starter.
12. Main power fuse (60-80 amp) blown.

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Maintenance Item	Service Required	Interval	Notes	Service Capacity
Grease fittings	Lubricate	Daily	Grease often	
Fluid levels	Check	Daily	Adjust levels as necessary	
Fan tension	Check	Daily	Adjust tension as necessary	
Fan condition	Inspect	Daily	Replace if damaged	
Water seperator	Drain	Daily		
Wheel Condition	Inspect	Daily	Replace if severly damaged	
Air Cleaners	Inspect	Daily	Replace if damaged of heavily soild	
Raidator / Oil Cooler	Inspect	Daily	Clean often as necessary	
Chain Tension	Inspect	500 hr	Adjust tension as necessary	
Tire Pressure	Check	Daily	Adjust pressure as necessary	Inflate to pressure indicated on sidewall
Chaincase Oil	Check	1000 hr	Service change	80/90 gear lube 4.25 quarts to each case
Engine Compartment	Inspect	Daily	Clean often as necessary	
Engine oil and filter	Replace	250 hr		11.2 qt. (10.6 l)
Hydraulic filter	Replace	250 hr		
Hydraulic Oil	Replace	1000 hr	Service refill capacity only	8 gal. (30.2 l)
Water Seperator -Fuel Filter	Replace	500 hr	Repalce fuel filter element	
Radiator Coolant	Replace	1000 hr	Coolant with SCA additive required	3.5 gal. (13 L)

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TS50V / TS60V two speed / flow

Engine (TS50V)

- Model: Perkins 404D-22
- Displacement: 2.2 liter
- Gross horsepower: 50 hp (37.3 kW)
- Torque: 105 lb-ft., 143 Nm
- Idle rpm: 1175 (low idle), 2800 (high idle)
- Average water /thermostat temperature: 190°F, 87.8°C

Engine (TS60V)

- Model: Perkins 404D-22 T
- Displacement: 2.2 liter
- Gross horsepower: 60 hp (44.7 kW)
- Torque: 140 lb-ft., 190 Nm
- Idle rpm: 1175 (low idle), 2800 (high idle)
- Average water /thermostat temperature: 190°F, 87.8°C

Drive Pumps

- Model: A20VG45 tandem (Rexroth)
- Displacement: 1.71 in3/rev (28 cc/rev)
- Relief pressure: 5500 psi (380 bar)
- Flow: 20.7 gpm (78.4 lpm) @ 2800 rpm (per pump)

Charge Pump

- Displacement @ 1.098 in3/rev (18 cc/rev)
- Relief pressure: 400-450 psi (2758-3103 kPa)
- Flow: 13.5 gpm (51.1 lpm) @2800 rpm

Drive Motors

- Model: Rexroth MCR3
- Displacement (High): 12.2 in3/rev (200 cc/rev)
- Displacement (Low): 24.4 in3/rev (400 cc/rev)

Controls (Joysticks)

- Model: Rexroth R908353009 (LH)
- Model: Rexroth R908352996 (RH)
- Type: Pilot

Auxiliary Pump

- Model: Barnes Haladex
- Type: Gear pump
- Displacement: 1.343 in3/rev (22 cc/rev)
- Aux. Flow: 17.4 gpm (65.9 lpm) @ 2800 rpm
- Aux. Flow Relief Pressure: 3300 psi (22,750 kPa)
- LS (Standby) Pressure: 218 psi (1,503 kPa)
- Cooling/filtering: Oil is filtered at all times and is cooled at all times with the exception of an 80 psi cooler bypass valve to prevent excessive pressure in the cooling system when the oil is cold.

Lift Arm Control Valve

- Make: Husco
- Model: 9610-CXX

Oil Cooler

- Operating pressure: 150 psi (1034 kPa)
- Bypass relief pressure: 80 psi (689 kPa)
- Hot oil sending unit: 225°F (107.2°C)
- Avg. oil operating temp. 50-60°F / 28-33°C above ambient.
  (High flow application 80°F / 44°C above ambient.)

Critical Torque Specs

- Drive Pump Mounting Bolts
  -- 85 ft-lb. w/Blue Loctite
- Wheel Lug Nuts
  -- 150 ft-lb.+ / - 8 / 203 Nm -Dry
- Drive Motor Mounting Bolts
  -- 88 ft-lbs. / 119 Nm -Dry
- Pod Mounting Bolts
  -- 150 ft-lb.+ / - 8 / 203 Nm -Dry
- Axle Sprocket Retaining Bolts
  -- 190 ft-lb. / 258 Nm -Dry
- Motor Sprocket Retaining Bolts
  -- 65 ft-lb. / 88 Nm -Dry

Service Tools

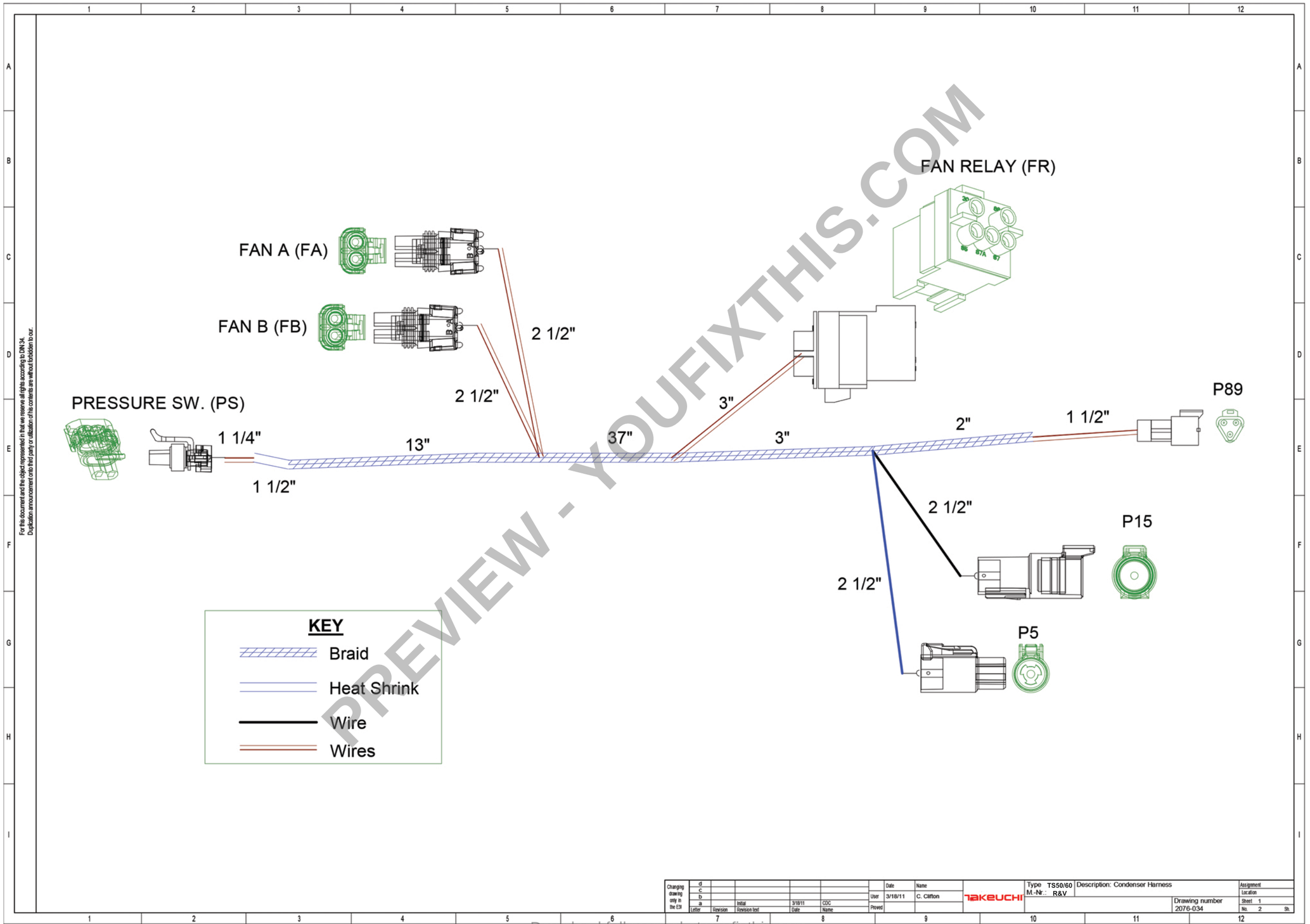
Listed below are common service tools which are identified and utilized in the service procedures described in this manual. Use tools recommended by Takeuchi whenever possible to reduce risk of injury and or machine damage during service.

- Heavy Duty Hydraulic Jack (5-ton rating)
- Test Gauge Kit (TAKEUCHI P/N: 0402-935)
- Ratchet Strap
- Long Pry Bar(s)

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TS50/60R&V AC Condenser Harness

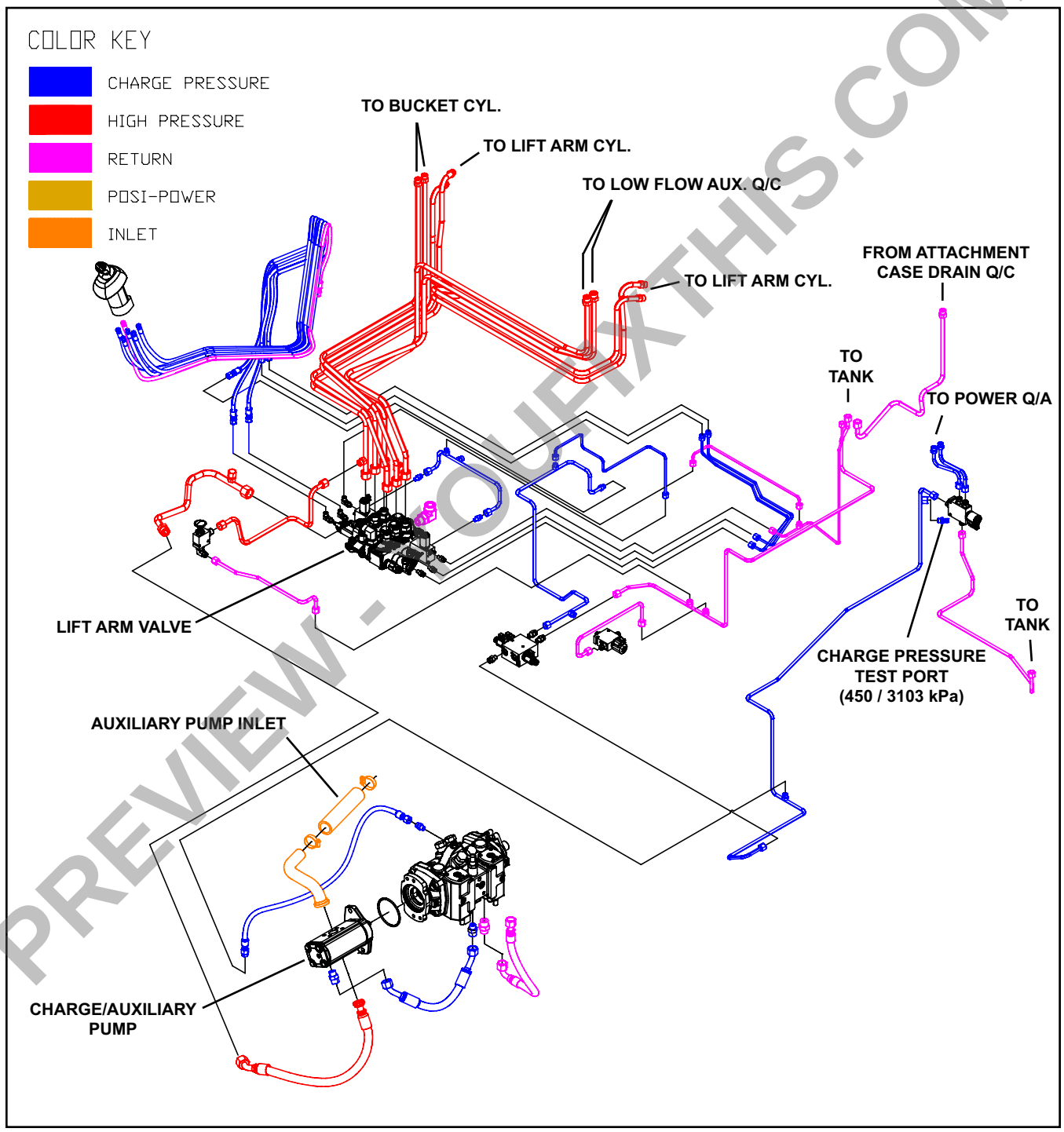


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Hydraulic Control/Auxiliary Circuit

Figure 3-2 TS50V / TS60V Control Auxiliary Circuit



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2. Technical Specifications & Service Tools

TS50V / TS60V single speed / flow

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Engine (TS60V)
- Model: Perkins 404D-22 T
- Displacement: 2.2 liter
- Gross horsepower: 60 hp (44.7 kW)
- Torque: 140 lb-ft., 190 Nm
- Idle rpm: 1175 (low idle), 2800 (high idle)
- Average water /thermostat temperature: 190°F, 87.8°C

Drive Pumps
- Model: A22VG (38.5cc) tandem (Rexroth)
- Displacement: 2.349 in3/rev (38.5 cc/rev)
- Relief pressure: 5500 psi (380 bar)
- Flow: 28 gpm (106 lpm) @ 2800 rpm (high idle)

Charge Pump
- Displacement @ 1.098 in3/rev (18 cc/rev)
- Relief pressure: 400-450 psi (2758-3103 kPa)
- Flow: 13.5 gpm (51.1 lpm) @2800 rpm

Drive Motors
- Model: Rexroth MCR3
- Displacement: 24.4 in3/rev (400 cc/rev)

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- Model: Rexroth R908352996 (RH)
- Type: Pilot

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- Aux. Flow: 17.4 gpm (65.9 lpm) @ 2800 rpm
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- Model: 9610-CXX

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- Avg. oil operating temp. 50-60°F / 28-33°C above ambient.
  (High flow application 80°F / 44°C above ambient.)

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- Wheel Lug Nuts
  -- 150 ft-lb.+ / - 8 / 203 Nm -Dry
- Drive Motor Mounting Bolts
  -- 88 ft-lbs. / 119 Nm -Dry
- Pod Mounting Bolts
  -- 150 ft-lb.+ / - 8 / 203 Nm -Dry
- Front/Rear Drive Sprocket Retaining Bolts
  -- 190 ft-lb. / 258 Nm -Dry
- Center (Drive Motor) Sprocket Retaining Bolts
  -- 65 ft-lb. / 88 Nm -Dry

Service Tools

Listed below are common service tools which are identified and utilized in the service procedures described in this manual. Use tools recommended by Takeuchi whenever possible to reduce risk of injury and or machine damage during service.

- Heavy Duty Hydraulic Jack (5-ton rating)
- Test Gauge Kit (TAKEUCHI P/N: 0402-935)
- Ratchet Strap
- Long Pry Bar(s)

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Hydraulic Fluid/Filter Change

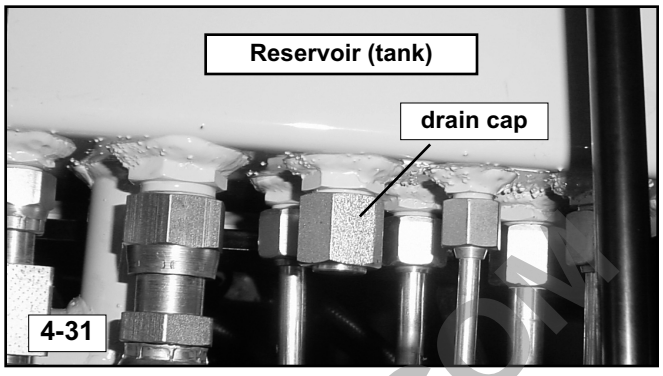
Hydrostatic components require extremely clean oil in order to have a long service life. Use extreme caution when changing the hydraulic oil. Introducing dirt or debris could be detrimental to the hydraulic system. Takeuchi recommends service intervals of 500 hours for hydraulic fluid and 250 hours for hydraulic fluid filters.

To change the hydraulic fluid:

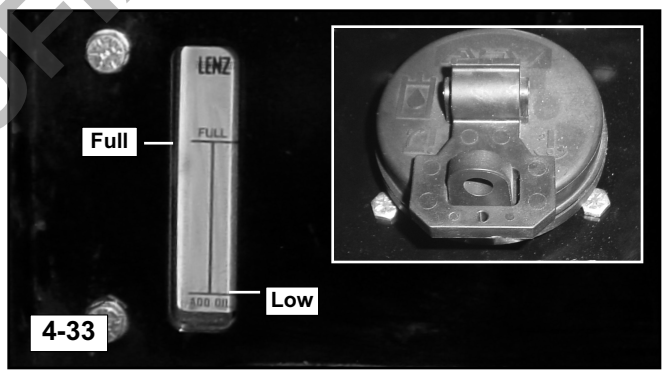
1. Lower the lift arms until flat on a solid surface.
2. Shut the machine down according to the procedure in section 5.13 of the operation manual.
3. Allow the machine to cool, then release any residual pressure in the hydraulic system by following the procedure in section 4.7 in the operation manual.
4. Raise the cab according to page 4-2 of this chapter to access the tank drain.
5. Remove the hydraulic fluid drain cap from the left side of the tank (fig 4-31).
6. Drain the used oil into a suitable catch container.
7. Dispose of the oil according to local mandates.
8. Locate the hydraulic filter underneath the cab on the left side of the machine (fig. 4-32).
9. Thoroughly clean around the filter to prevent dirt or debris from entering the system and remove the filter by hand or with a strap as required.
10. Check to make sure the filter gaskets are still present on the old filters. If not, check the filter heads to make sure they are free from old gasket material prior to installing the new filter.
11. Prepare the new filter by rubbing a small amount of fresh hydraulic oil onto the filter gasket surface and then threading it onto the filter head. Tighten the filter by hand as instructed by the label located on the filter or filter box.
12. Install the hydraulic system drain plug and tighten.
13. Remove the hydraulic reservoir filler cap (black) and fill the hydraulic system with Mobile DTE 10 Excel Series 46 Hydraulic Oil or equivalent until the full mark on the hydraulic fluid sight gauge has reached (approx. 8 gal. (30.2l) (fig. 4-33).

Note: When checking or adding to the hydraulic fluid level, do so with the lift arms in the lowered position. If the level is checked with the lift arms in the raised position, an inaccurate reading will result.

Note: When adding hydraulic fluid, add fluid slowly until it is visible in the sight gauge. Once visible, add fluid in one quart increments until the full mark has been reached.







14. Install and secure the hydraulic reservoir filler cap.
15. Start the machine and operate all hydraulic circuits to work any trapped air out of the system.
    - Drive the machine forward and backward.
    - Raise and lower the lift arms(unloaded).
    - Dump and curl bucket/quick attach.
16. Once you have purged the air from the system, check the level on the hydraulic fluid level sight gauge. If the level is low repeat step 12 and 13 to complete the procedure.

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Problem 2:
Machine cranks, but will not start.
Possible causes
1. Fuel tank empty, fuel filter plugged or fuel line restricted.
2. Battery discharged (engine rotates slowly).
3. Injection pump fuse blown.
4. Power relay (B) fuse blown (40 amp).
5. Faulty power relay (B).
6. Loose, broken or disconnected wiring at injection pump, fuel pump or fuse.
7. Glow plugs not pre-heating (look for black smoke).
   a) Main glow plug fuse blown.
   b) Glow plug relay malfunctioning.
   c) Loose, broken, or disconnected wiring at ignition switch, relay or glow plug ground strip.
   d) Faulty glow plugs.
8. Faulty ignition switch.
9. Loose, broken or disconnected wiring in starting circuit.
10. Loose, broken or disconnected wiring at fuel shutoff solenoid.
11. Air in fuel system or defective fuel injection pump.

Problem 3:
Machine starts, but hydraulics will not operate.
Possible causes
1. Operator not in seat.
2. Seat belt not fastened.
3. Safety relay fuse and or or safety solenoid fuse for seat belt or operator presence safety switches blown.
4. Faulty operator presence safety switch.
   a) Test for continuity through operator presence and seat belt switches. Adjust or replace as necessary.
5. Loose, broken or disconnected ground wires (check ground connections behind the operator seat, from cab to chassis and on the chassis crossmember.)
6. Faulty safety relay.
7. Faulty safety solenoid or safety solenoid spool.
8. Loose, broken or disconnected wiring at fuse, relay, or safety solenoid.
9. Low charge pressure.

Problem 4:
Lift arm/bucket controls are operational, but wheels will not move.
Possible causes
1. Leak in feed line to drive control joystick (pilot control).
2. Loose, broken or disconnected wire to DA control solenoid.
3. Drive control joystick (pilot control) malfunction.
4. Low charge pressure.
5. Parking brake switch in on position.
6. Faulty parking brake switch.

Problem 5:
Wheels are operational, but lift arms will not move.
Possible causes
1. Continuous hydraulic flow switch activated, sending oil over relief. (lift arms work, but move slowly)

If auxiliary flow hydraulics work check for:
   a) Leak in feed line to lift arm control joystick (pilot control).
   b) Lift arm control joystick (pilot control) malfunc tion.
   c) Lift arm control valve assembly malfunction.

If auxiliary flow hydraulics do not work check for:
   a) Main auxiliary relief malfunction.
   b) Faulty auxiliary pump.

Problem 6:
Lift arms are operational, but high/low flow auxiliary circuits are not.
Possible causes
1. Micro hydraulic fuse blown.
2. Faulty auxiliary hydraulic switch.
3. Faulty auxiliary hydraulic solenoid at the valve.
4. Loose, broken or disconnected wire at fuse, auxiliary hydraulic switch, pin connector P40.
5. Faulty or improperly connected quick coupler.
6. Quick coupler block pressure release stuck in down (open) position.

Problem 7:
Multiple switches/electrical accessories are not operational in ON or RUN position.
Possible causes
1. Power A or B fuse blown.
2. Faulty power relay (A or B).
3. Faulty ignition switch.
4. Loose, broken or disconnected wiring at ignition switch, fuse or relay.

Problem 8:
Battery will not charge/maintain charge.
Possible causes:
1. Loose alternator belt.
2. Alternator fuse blown.
3. Faulty alternator diode.
4. Loose, broken or disconnected wiring at battery, alternator, diode or fuse.
5. Excessive current draw with key in "off" position.
6. Faulty battery.
7. Faulty alternator.

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