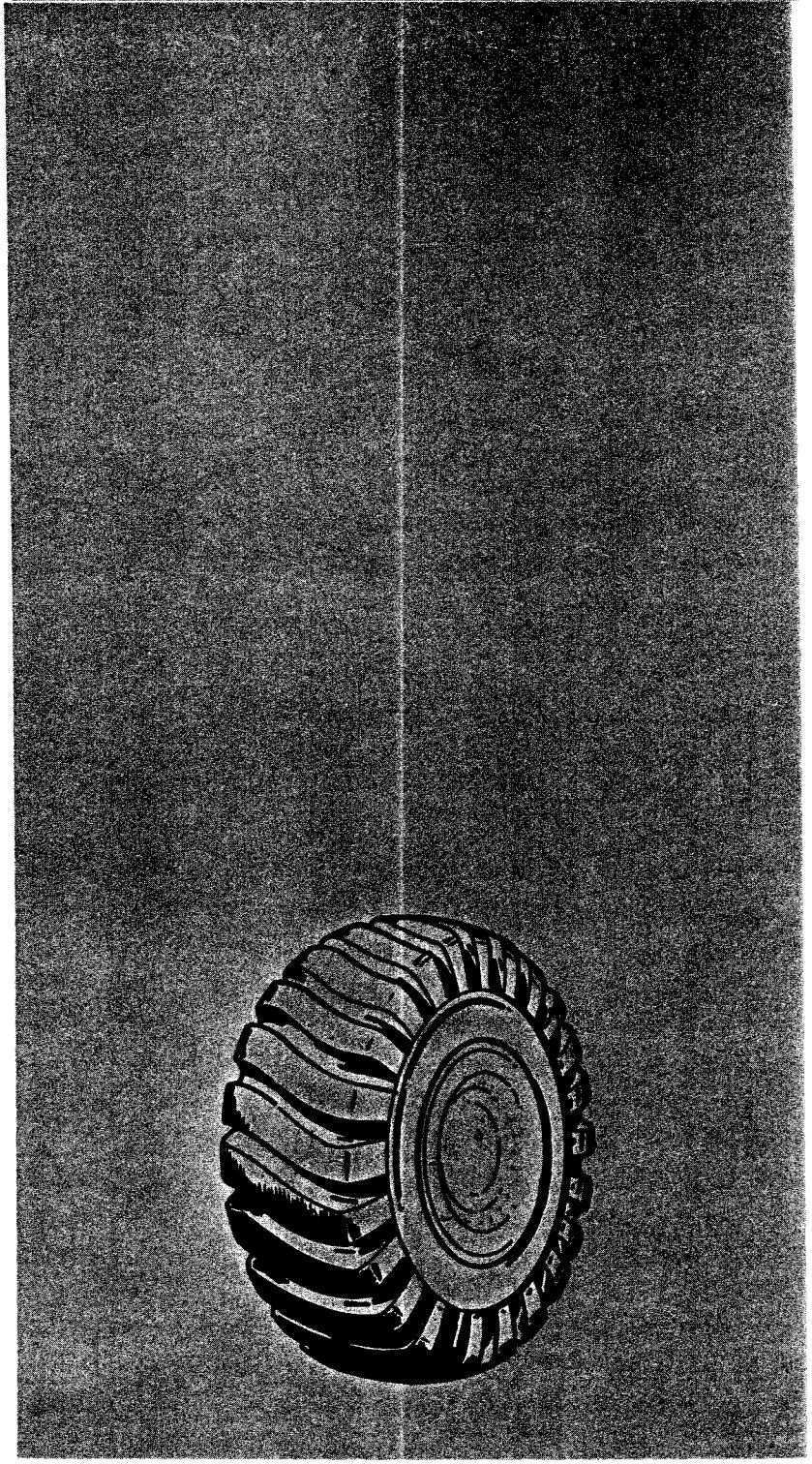


SERVICE MANUAL

950 AIR SYSTEM AND BRAKES

INTRODUCTION

This publication has instructions and procedures for the subject on the front cover. The information, specifications, and illustrations in this publication are on the basis of information that was current at the time this issue was written.

Correct operation, maintenance, test and repair procedures will give this product a long service life. Before starting a test, repair or rebuild job, the serviceman must read the respective sections of the Service Manual, and know all the components he will work on.

Your safety, and the safety of others, is at all times very important. When you see this symbol  or this symbol  in the manual, you must know that caution is needed for the procedure next to it. The symbols are warnings. To work safely, you must understand the job you do. Read all instructions to know what is safe and what is not safe.

It is very important to know the weight of parts. Do not lift heavy parts by hand. Use a hoist. Make sure heavy parts have a good stability on the ground. A sudden fall can cause an accident. When lifting part of a machine, make sure the machine has blocks at front and rear. Never let the machine hang on a hoist, put blocks or stands under the weight.

When using a hoist, follow the recommendation in the manual. Use correct lift tools as shown in illustrations to get the correct balance of the component you lift. This makes your work safer at all times.

SYSTEMS OPERATION

Air Chamber and Master Cylinders 12
Air Flow ..... 5 and 6
Air Pressure Gauge 10
Air Reservoirs 9
Air System and Brakes ..... 5, 6 and 8
Brake Control Valves ..... 10 and 11
Double Check Valve 11
Electric Warning System 7
Emergency and Parking Brake 15
Oil Flow 7
Orifice Check Valves 12
Parking Brake 15
Safety Relief Valve 10
Wheel Brakes 14
Wheel Cylinders 14

TESTING AND ADJUSTING

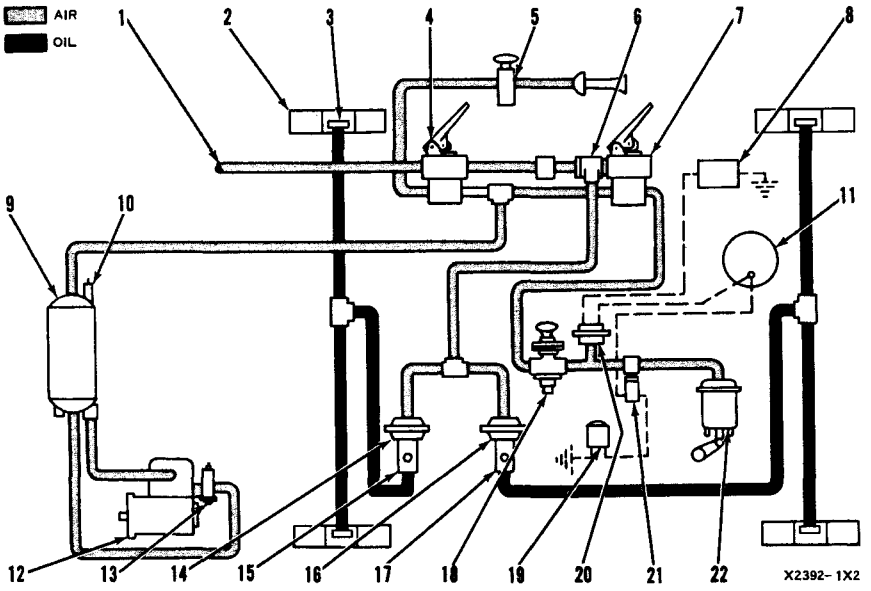
Air Compressor Governor 18
Air Pressure Gauge 17
Air System and Brakes 17
Bleeding the Brakes 20
Brake Control Valve 18
Double Check Valves 18
Electric Warning System 23
Emergency and Parking Brake Adjustment 22
Emergency and Parking Brake Control Valve 18
Parking Brake Control 22
Service Brakes 19
Safety Relief Valve 18

SPECIFICATIONS

NOTE: For Specifications with illustrations, make reference to 950 AIR SYSTEM AND BRAKES SPECIFICATIONS Form No. REG01474. If the Specifications in Form REG01474 are not the same as in the Systems Operation and the Testing and Adjusting, look at the printing date on the back cover of each book. Use the Specifications in the book with the latest date.

AIR SYSTEM AND BRAKES

(Machines with Emergency Brake System)



SCHEMATIC OF AIR AND BRAKE SYSTEM

1. Line to transmission neutralizer valve. 2. Brake shoe. 3. Wheel cylinder. 4. Left service brake control valve. 5. Horn valve. 6. Double check valve. 7. Right service brake control valve. 8. Warning buzzer. 9. Air reservoir. 10. Safety relief valve. 11. Starter switch. 12. Air compressor. 13. Air compressor governor. 14. Air chamber. 15. Hydraulic master cylinder. 16. Air chamber. 17. Hydraulic master cylinder. 18. Emergency and parking brake control valve. 19. Low air pressure indicator. 20. Normally-closed pressure switch (buzzer). 21. Normally-open pressure switch (low air pressure indicator). 22. Emergency and parking brake chamber.

This machine is equipped with air-actuated hydraulic service brakes and an emergency brake system. Air pressure for brake operation is supplied by a compressor and stored in an air reservoir. An electric warning system informs the operator of low air pressure and a spring actuator chamber applies the emergency brake if air pressure becomes dangerously low.

Tandem control valves and a double check valve deliver air to two entirely separate hydraulic master cylinders. Each master cylinder supplies braking power to only one axle, thus assuring a safe stop even if one brake should fail.

AIR FLOW

The engine driven air compressor (12) delivers air to the reservoir (9) with the pressure controlled by the air compressor governor. The governor responds to air pressure in the system and cuts the compressor in and out. A safety relief valve (10) opens if the system air pressure builds up beyond a safe level.

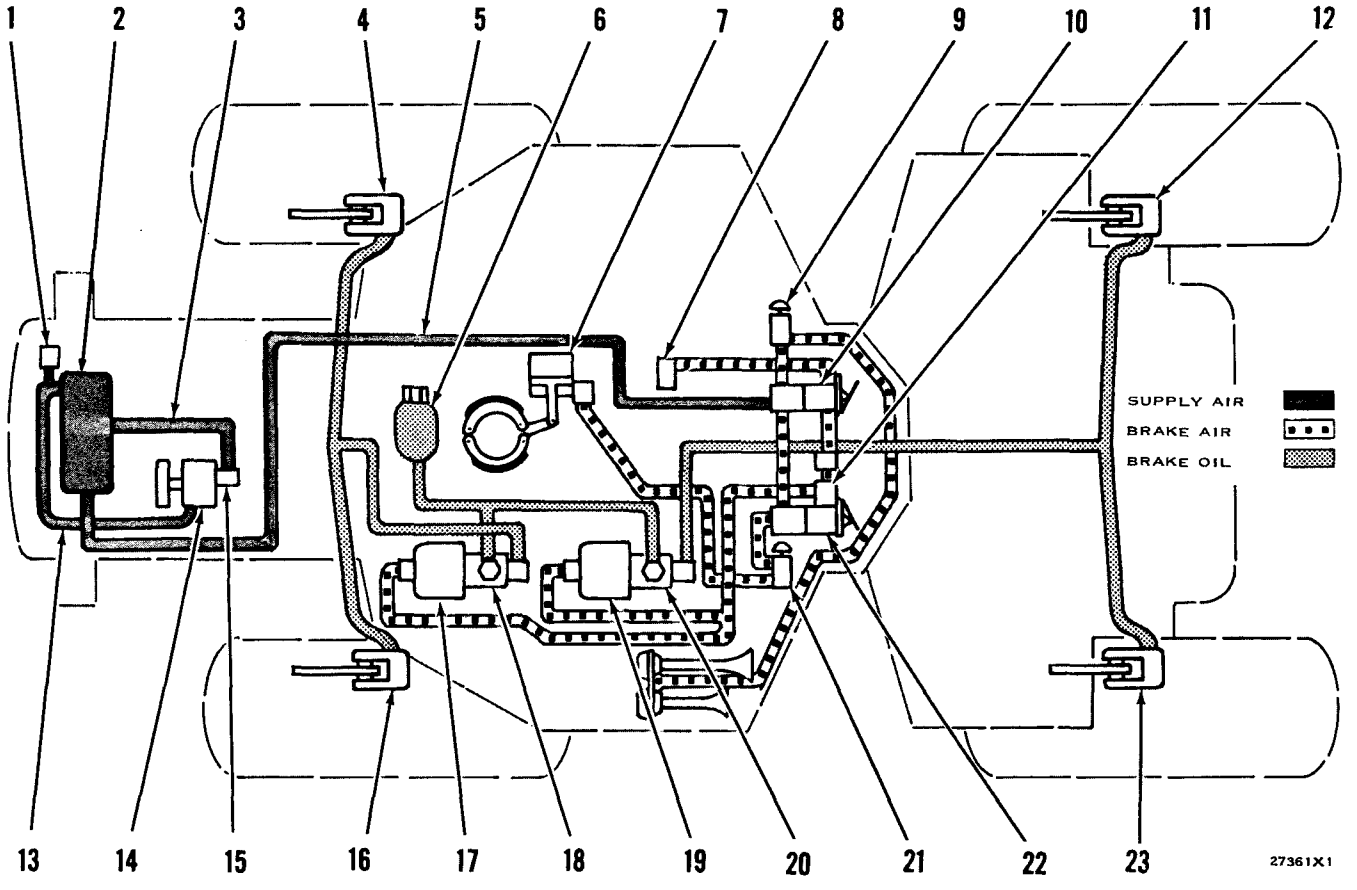
Compressed air flows from the reservoir (9) to the two service brake control valves, (4) and (7). Air flows directly through the lower chamber of the left control valve (4) to the horn valve (5). Air flows through the lower portion of the right control valve (7) to the emergency and parking brake control valve (18). With the air pressure in the normal operating range and the emergency and parking brake control valve in the RELEASED (pushed in) position, air will flow through the valve to the emergency and parking brake chamber (22) where the air pressure compresses the spring and releases the emergency and parking brake. If the control valve is in the APPLIED (pulled out) position, the line to the emergency and parking brake chamber is vented to atmosphere. The spring in the brake chamber will no longer be held compressed and the brake will apply.

Depressing either the right or the left service brake control valve pedal will allow air to flow through the valves upper chambers and apply the service brakes. However, depressing the left valve will also send air through line (1) to the transmission neutralizer valve neutralizing the transmission. Depressing the right pedal does not "neutralize" the transmission. Double check valve (6) prevents air delivered by the right valve from passing through the left valve and neutralizing the transmission.

Air delivered by the service brake control valves passes through a single line to the engine compartment where it divides and flows to the two air chambers (14) and (16). Two separate hydraulic brake systems are provided as a safety feature. The system actuated by chamber (16) controls the front wheel brakes while the system actuated by chamber (14) controls the rear wheel brakes.

AIR SYSTEM AND BRAKES

(81J3502–UP) (31K943–UP)



SCHEMATIC OF AIR AND BRAKE SYSTEM
(Machines effective with 81J9510 and 31K1055)

1. Safety relief valve. 2. Air reservoir. 3. Air compressor governor pressure sensing line. 4. Disc brake. 5. Pressure air line from air reservoir. 6. Auxiliary tank. 7. Parking brake chamber. 8. Neutralizer valve for transmission. 9. Horn valve. 10. Left control valve. 11. Double check valve. 12. Disc brake. 13. Pressure air line to air reservoir. 14. Air compressor. 15. Air compressor governor. 16. Disc brake. 17. Air chamber for rear wheel brakes. 18. Master cylinder. 19. Air chamber for front wheel brakes. 20. Master cylinder. 21. Emergency and parking brake control valve. 22. Right control valve. 23. Disc brake.

NOTE: The air system and the hydraulic part of the brake system is the same for machines with disc brakes and machines with shoe brakes. One exception is, machines with shoe brakes have a hydraulic cylinder for each shoe brake assembly and the master cylinders are not connected together, and they are not supplied with make-up oil from an auxiliary tank.

Effective with serial numbers 81J9510 and 31K1055 the machines are equipped with disc brakes and an auxiliary tank for the brake master cylinders. This brake system is illustrated in the schematic of the air and brake system described in this topic.

The engine driven air compressor (14) delivers air to reservoir (2) with the pressure controlled by the air compressor governor (15). The governor is mounted on the compressor and causes the compressor to cut-in and cutout as air is required. An electric warning system informs the operator of low air pressure, and a fail safe emergency brake system applies the emergency brake if the air pressure becomes dangerously low.

Compressed air provides only the power to actuate the hydraulic system of the hydraulic disc brakes. When the service brakes are applied, the air chamber rods extend pushing against the hydraulic master cylinder pistons. Oil flows from the master cylinders to the heads and applies the service brakes.

AIR FLOW

Compressed air flows from the reservoir (2) to the two service brake control valves (10) and (22). Air flows directly through the lower chamber of the left control valve (10) to the horn valve (9). Air

flows through the lower portion of the right control valve (22) to the emergency and parking brake control valve (21). With the air pressure in the normal operating range and the emergency and parking brake control valve in the RELEASED (pushed in) position, air will flow through the valve to the emergency and parking brake chamber (7) where the air pressure compresses the spring and releases the emergency and parking brake. If the control valve is in the APPLIED (pulled out) position, the line to the emergency and parking brake chamber is vented to atmosphere. The spring in the brake chamber will no longer be held compressed and the brake will apply.

Depressing either the right (22) or the left (10) service brake control valve pedal will apply the service brakes. However, depressing the left pedal will send air through the transmission neutralizer line to neutralizer valve (8) for the transmission releasing the transmission directional clutch. This will neutralize the transmission. Depressing the right pedal applies the service brakes only. Double check valve (11) prevents air delivered by the right valve from passing through the left valve and neutralizing the transmission.

Air delivered by the service brake control valves passes through a single line to the engine compartment where it is divided and flows to the two air chambers (17) and (19). Two separate hydraulic brake systems are provided as a safety feature. The system actuated by chamber (19) controls the front wheel brakes while the system actuated by chamber (17) controls the rear wheel brakes.

OIL FLOW

The hydraulic disc brake for each axle consists of the master cylinders (18) and (20), connecting lines, and the brake assemblies (4), (12), (16) and (23). The hydraulic brake fluid reservoirs are an integral part of each master cylinder. The disc brake for each axle consists of the master cylinders (18) and (20), connecting lines, and the brake assemblies (4), (12), (16) and (23). The hydraulic brake fluid reservoirs are an integral part of each master cylinder. The master cylinder reservoirs are connected to auxiliary tank (6). The auxiliary tank provides brake fluid to the master cylinder reservoirs to keep them full of brake fluid at all times. This will prevent air from getting into the brake fluid lines for the disc brakes when the discs and pads begin to wear.

As the air chamber rod extends it pushes the master cylinder piston. Piston movement sends oil through the lines and into the brake assemblies. At each brake the oil extends the pistons causing them to push the friction pads against the disc.

Releasing the brake pedal relieves the air pressure acting against the master cylinder. The master cylinder piston retracts and relieves hydraulic pressure on the pistons. The pistons and pads release the pressure on the disc. The pads remain very close to the disc. Since the pads move only far enough away from the disc to release, no adjustment is required to compensate for pad wear. Due to the close running clearance, the pads keep the discs clean.

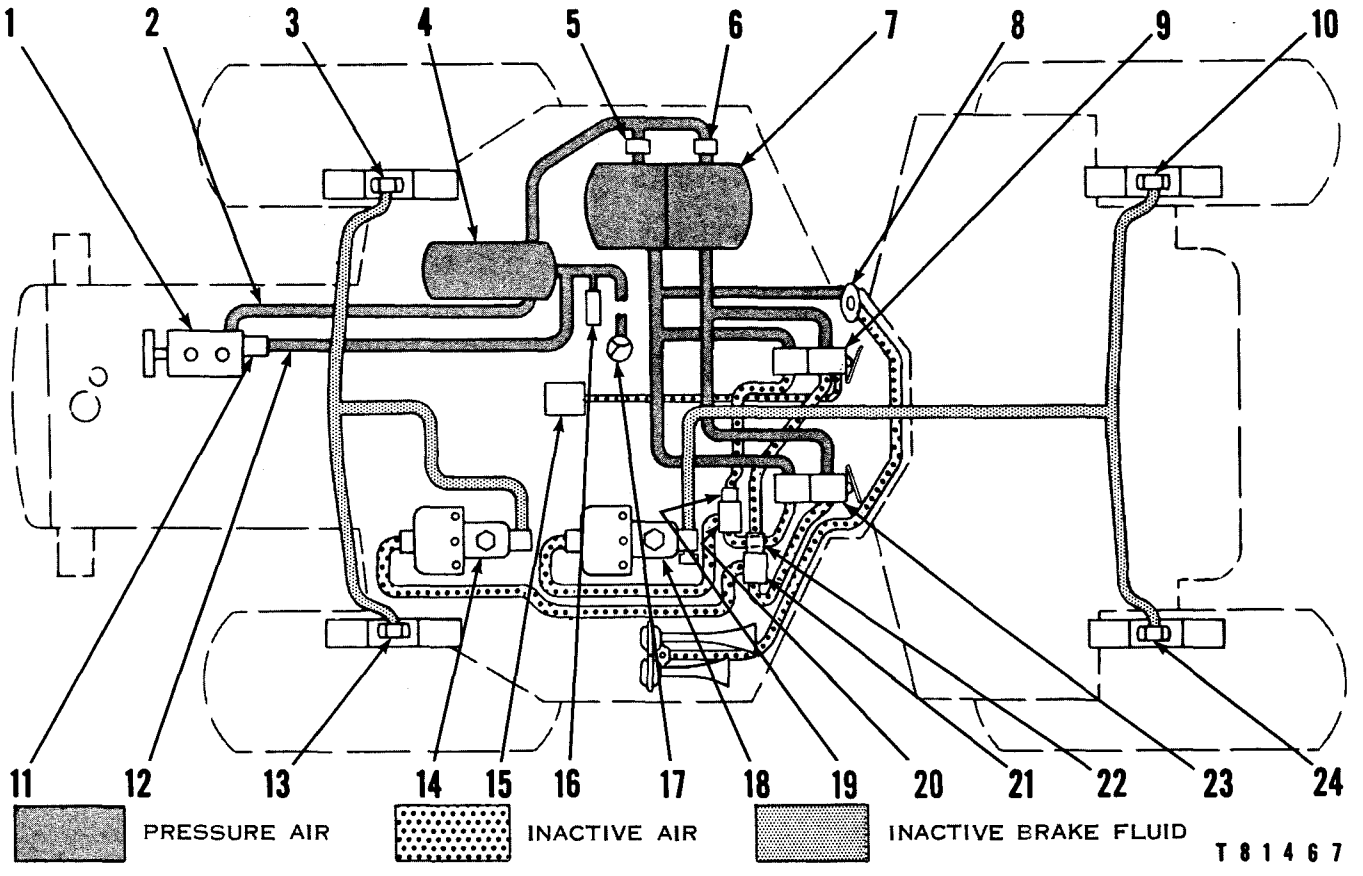
ELECTRIC WARNING SYSTEM

A buzzer and a visible indicator warn of low air pressure. The buzzer and indicator switches sense pressure in the line from the emergency and parking brake control valve to the emergency and parking brake chamber. The pressure switch for the buzzer is closed and the buzzer sounds when the pressure is below 70 to 80 psi (4.9 to 5.6 kg/cm^2). The indicator pressure switch is closed and the indicator appears green when the pressure is above 70 to 80 psi (4.9 to 5.6 kg/cm^2). The low pressure indicator is mounted on the dash and shows the red side of a magnetic ball when the pressure is low. When the pressure is high enough for safe operation, the switch is closed and current is to the indicator. The current energizes an electromagnet and causes the ball to turn and expose the green side.

Since the pressure switches are mounted downstream from the emergency brake control valve, the buzzer will sound and the indicator will show red, regardless of system air pressure, whenever the emergency brake control valve is in the APPLIED (pulled out) position. However, with the valve pushed in and the pressure descending, the buzzer sounds and the indicator shows red before the emergency and parking brake applies. This is due to the control valve's lower actuating pressure.

AIR SYSTEM AND BRAKES

(81J1 thru 81J3501) (31K1 thru 31K942)



SCHEMATIC OF AIR AND BRAKE SYSTEM

1. Air compressor. 2. Pressure air line to primary air reservoir. 3. Left rear wheel cylinder. 4. Primary air reservoir. 5. Check valve. 6. Check valve. 7. Two-section air reservoir. 8. Horn valve. 9. Left tandem brake valve. 10. Left front wheel cylinder. 11. Air compressor governor. 12. Air compressor governor pressure sensing line. 13. Right rear wheel cylinder. 14. Rear air chamber and master cylinder assembly. 15. Transmission neutralizer valve. 16. Safety relief valve. 17. Air pressure gauge. 18. Front air chamber and master cylinder assembly. 19. Orifice check valve. 20. Double check valve. 21. Double check valve. 22. Orifice check valve. 23. Right tandem brake valve. 24. Right front wheel cylinder.

The machine is equipped with air-actuated, hydraulic service brakes (expanding shoe) and a mechanical parking brake. A two-section air reservoir, tandem control valves, and double check valves combine to ensure a double safe delivery of air to actuate the two, entirely separate, hydraulic master cylinders. Each master cylinder supplies braking power to only one axle, thus assuring a safe stop even if one brake should fail.

Air compressor (1) supplies pressure for the air-actuated hydraulic brake system. Primary air reservoir (4) is charged by the air compressor. Pressure air flows from the reservoir through check valves (5 and 6) to the two-section air reservoir (7). The check valves prevent pressure air from escaping from the reservoir in the event of air compressor failure.

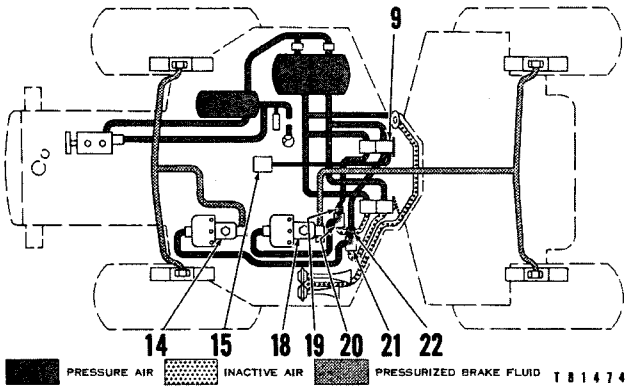
Line (12) connects the primary air reservoir to the air compressor governor. The governor senses air pressure in the system and cuts the compressor in and out. Safety relief valve (16) opens if the pressure builds up beyond a safe level. Air pressure gauge (17) registers system pressure.

The top section of reservoir (7) supplies pressure air to the top section of tandem valves (9 and 23) (rear brakes). The bottom section of reservoir (7) supplies pressure air to the bottom section of the tandem valves (front brakes).

Depressing either brake pedal sends air to the air chamber of each master cylinder assembly. The master cylinders transmit hydraulic pressure to wheel cylinders to apply the brakes. The front brakes remain separate from the rear.

When the pedal is depressed on the left tandem brake valve (9), pressure air is directed through orifice check valves (19 and 22), double check valves (20 and 21) and to air brake and master cylinders to apply the brakes. Pressure air is also directed to the transmission neutralizer valve (15), neutralizing the transmission.

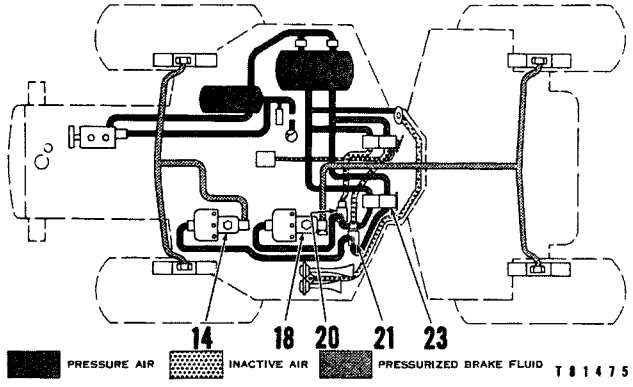
Orifice check valves cause a restriction in the exhaust air from the air chambers to allow the transmission to engage before the brakes release.



LEFT BRAKE PEDAL DEPRESSED

9. Left tandem brake valve. 14. Rear air chamber and master cylinder assembly. 15. Transmission neutralizer valve. 18. Front air chamber and master cylinder assembly. 19. Orifice check valve. 20. Double check valve. 21. Double check valve. 22. Orifice check valve.

The right brake pedal does not neutralize the transmission. When the right pedal is depressed, pressure air is directed through double check valves (20 and 21) to the air chambers of the master cylinders.



RIGHT BRAKE PEDAL DEPRESSED

14. Rear air chamber and master cylinder assembly. 18. Front air chamber and master cylinder assembly. 20. Double check valve. 21. Double check valve. 23. Right tandem brake valve.

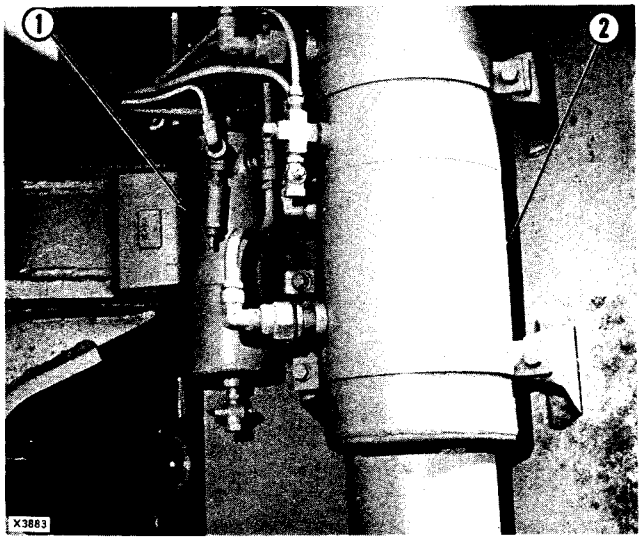
The hydraulic brakes for each axle include the master cylinders (14) and (18), the connecting lines, the brake shoes, and the wheel cylinders (3), (10), (13) and (24). The hydraulic brake fluid reservoir is a part of each master cylinder. The fluid level of each reservoir must be maintained separately. As the air chamber rod extends it pushes the master cylinder piston. Piston movement sends oil through the lines and into the brake assemblies. At each brake, the oil extends the wheel cylinders causing them to push the shoes against the drum.

Releasing the brake pedal relieves brake system pressure. The master cylinder piston retracts and relieves hydraulic pressure from the wheel cylinders. The brake shoes are spring returned.

AIR RESERVOIRS

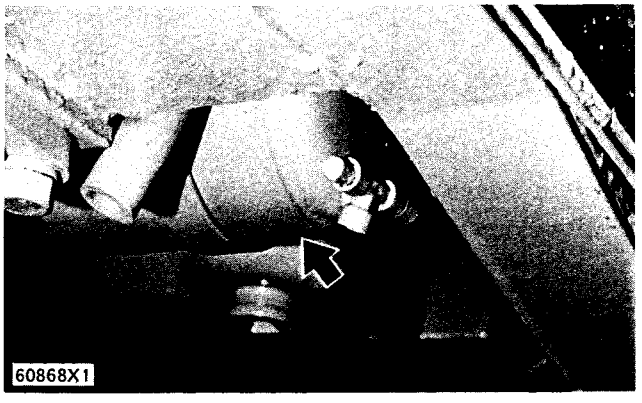
The two air reservoirs on machines 81J1 thru 81J3501 and 31K1 thru 31K942 are located on the left side of the machine in front of the fuel tank. The air compressor charges the primary air reservoir. The primary air reservoir is equipped with a safety relief valve. The two-section air reservoir is supplied by the primary air reservoir. Both sections of the partitioned air reservoir and the primary air reservoir have drain cocks.

Machines effective with 81J3502 and 31K943 have one air reservoir. It is located at the rear of the machine under the engine oil pan. It is equipped with a safety relief valve and a drain cock.



AIR RESERVOIRS
(81J1 thru 81J3501 and 31K1 thru 31K942)

1. Primary reservoir. 2. Partitioned reservoir.



AIR RESERVOIR
(Machines 81J3502–Up and 31K943–Up)

AIR PRESSURE GAUGE

The air pressure gauge is located on the instrument panel and connected to the air compressor governor supply line.

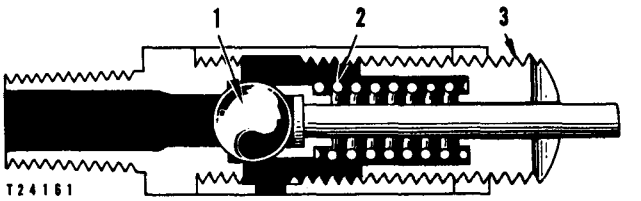
AIR PRESSURE GAUGE LOCATION

1. Air pressure gauge. (Earlier machine illustrated).

⚠ WARNING: Do not operate the machine until the air pressure gauge registers in the operating (green) range.

SAFETY RELIEF VALVE

A ball-type safety relief valve is installed on the primary air reservoir on machines 81J1 thru 81J3501 and 31K1 thru 31K942 and on the air reservoir on machines 81J3502—Up and 31K943—Up. The safety relief valve prevents a build-up of pressure in excess of 150 psi (10.5 kg/cm^2). Ball (1) in the valve is forced off its seat and excess air is exhausted. When the pressure drops, spring (2) forces the ball back on its seat.

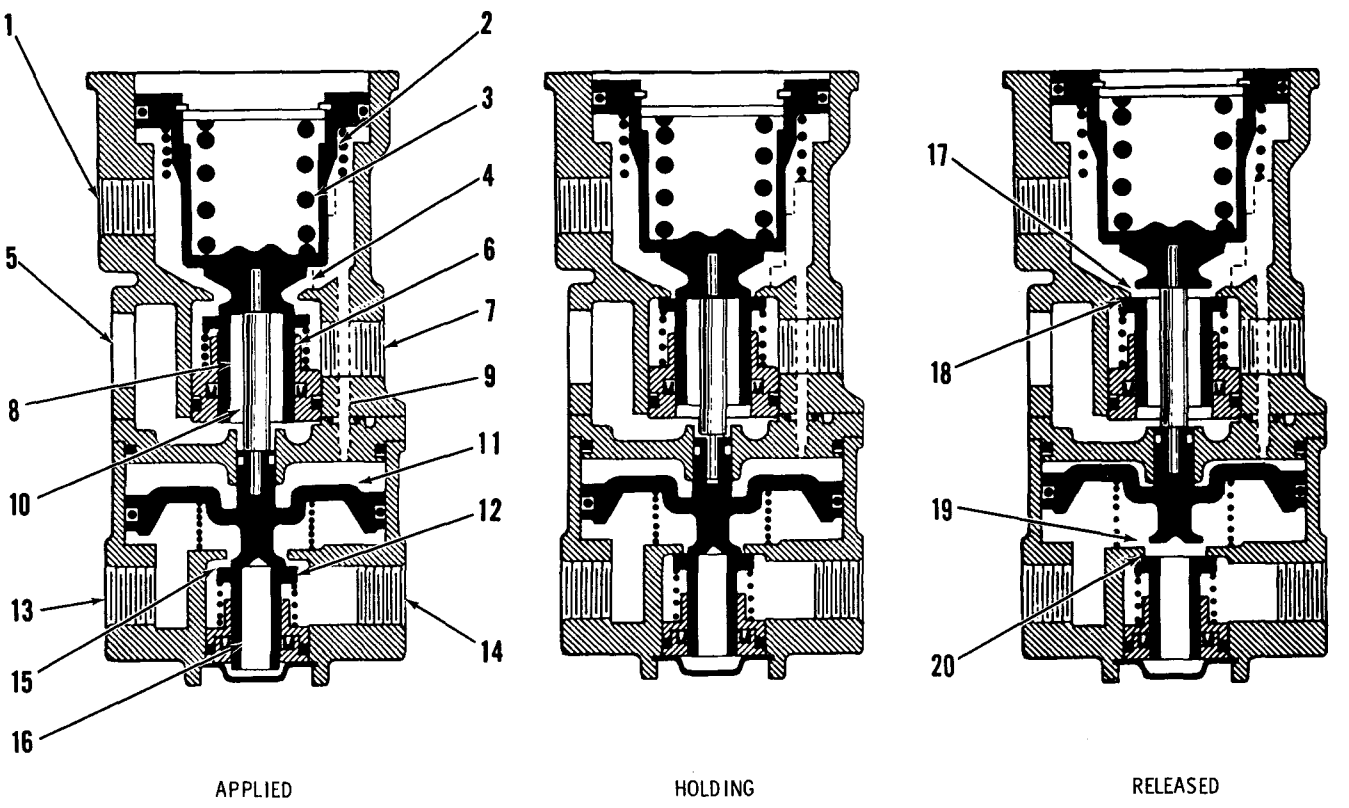


SAFETY RELIEF VALVE

1. Ball. 2. Spring. 3. Adjusting screw.

BRAKE CONTROL VALVES (81J1 THRU 81J3501 AND 31K1 THRU 31K942)

Two indentical brake control valves are used. Each valve has individual supply and delivery ports for the front and rear brake system. Equal air pressure is delivered to the front and rear brakes. However, a failure of either system will not effect the operation of the other portion of the valve. The lower portion of each valve controls the front brakes and the upper portion controls the rear brakes.



BRAKE CONTROL VALVE

1. Delivery port. 2. Reaction piston. 3. Metering spring. 4. Inlet valve (open). 5. Exhaust port. 6. Valve assembly. 7. Supply port. 8. Exhaust passage. 9. Connecting passage. 10. Push rod. 11. Reaction piston. 12. Valve assembly. 13. Delivery port. 14. Supply port. 15. Inlet valve (open). 16. Exhaust passage. 17. Exhaust valve (open). 18. Inlet valve (closed). 19. Exhaust valve (open). 20. Inlet valve (closed).

Brakes Applied

Depressing the pedal sends both reaction pistons (2 and 11) down against valves (6 and 12). As the pistons contact the valves they first seal exhaust passages (8 and 16). Continued piston movement pushes the valves downward, opening the inlet passages. When the inlet portion (4 and 15) of the valves open, air flows from the supply ports over the valve and out the delivery ports.

Holding Position

Holding the pedal in an APPLIED position results in the following: Force from the delivery air pressure moves the reaction pistons up against the metering spring (3). If the pedal is lightly depressed (metering spring force low), the force from the delivery air pressure will raise the reaction pistons and valves enough to seal the inlet portion of the valves. In the holding position, the delivery pressure raises the pistons and valves enough to shut off its supply. If the delivery pressure drops off, the metering spring opens the valves and allows supply air to flow in. The action of the metering spring and the reaction pistons maintains the delivery pressure constant at each pedal position. The harder the pedal is pushed, the higher the pressure delivered.

Connecting passage (9) insures equal delivery pressure between the front and rear brakes by allowing the same balance pressure to act on each reaction piston. If one brake system (front or rear) should fail, push rod (10) allows the valve to continue operating.

Brakes Released

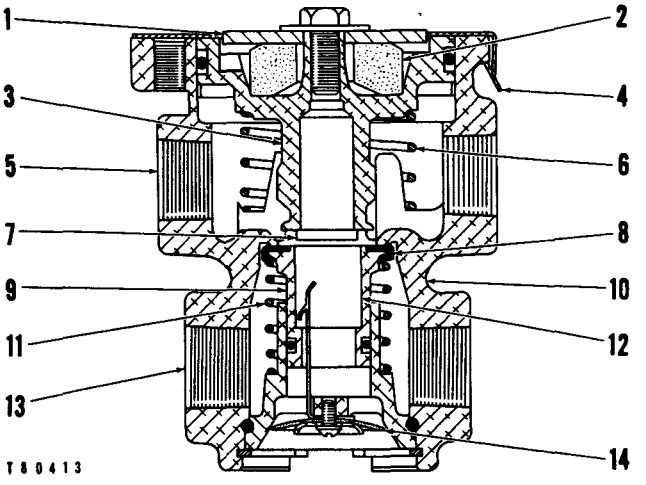
All force is removed from the metering spring and the reaction pistons move up. Air flow from the two supply ports is blocked by both inlet valves (18 and 20). Both delivery ports (17 and 19) are open to exhaust.

BRAKE CONTROL VALVE (81J3502–UP AND 31K943–UP)

Two brake control valves are used in the braking system. The operation is the same for each valve.

When the brake control valve treadle is depressed, a force is exerted on seat (1). The force compresses rubber spring (2) and moves piston assembly (3) downward. The exhaust valve seat (7) contacts and closes exhaust port (12) in valve (9). Continued downward movement of the piston assembly pushes the valve (9) off inlet valve seat (8). Pressure air from inlet port (13) passes around the valve and out through outlet port (5). Air travels to the double check valve, air chamber and transmission neutralizer control valve when the left brake treadle is depressed, or the double check valve and air chamber when the right brake treadle is depressed.

When the air pressure below piston assembly (3) becomes greater than the force exerted above the piston, the piston lifts sufficiently to permit valve (9) to move upward and seat. This blocks off further supply of pressure air. Piston assembly (3) remains seated against valve (9), preventing any loss of air pressure through exhaust port (12). Thus, the brake control valve is in a balanced position and air pressure is held in the lines and air chambers.



BRAKE CONTROL VALVE

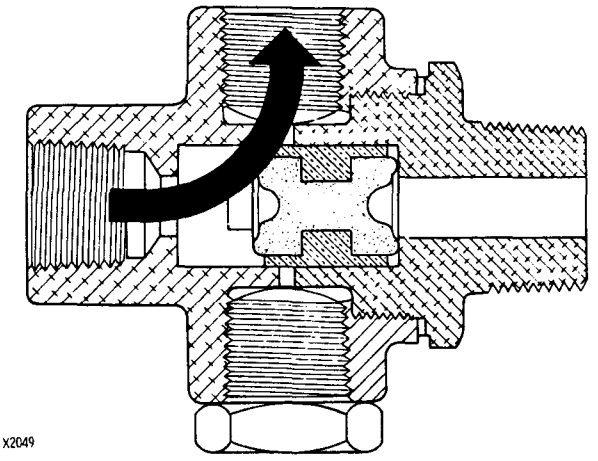
1. Seat. 2. Rubber spring. 3. Piston assembly. 4. Retainer. 5. Outlet port. 6. Spring. 7. Exhaust valve seat. 8. Inlet valve seat. 9. Valve. 10. Valve body. 11. Valve spring. 12. Exhaust port. 13. Inlet port. 14. Exhaust diaphragm.

If the treadle is partially raised, mechanical force above piston assembly (3) is decreased. The greater force below the piston assembly, exerted by pressure air and spring (6), lifts the piston assembly, unseating it from valve (9). Pressure air in the lines and air chambers is permitted to excape past exhaust diaphragm (14) until forces above and below the piston are balanced. When the treadle is completely raised, piston assembly (3) will remain unseated from valve (9), exhausting all pressure air to atmosphere and releasing the brakes. Valve (9) is held in its seat by valve spring (11).

DOUBLE CHECK VALVE

The double check valve prevents air delivered by one service brake control valve from entering the delivery circuit of the other control valve.

Air from the right service brake control valve passes into one side of the double check valve and air from the left service brake control valve passes into the other side. Air entering from either control valve passes out through one delivery port.



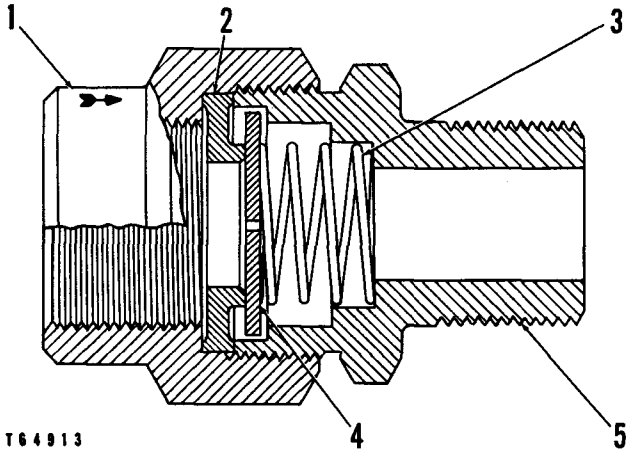
DOUBLE CHECK VALVE

Applying the left control valve sends air to the transmission neutralizer and into the double check valve. Air pushes the shuttle against the port leading to the right control valve, sealing that port, and flows to the air chambers.

Applying the right brake moves the shuttle against the left port, blocking air flow to the transmission neutralizer valve and allows the air to flow only to air chambers.

ORIFICE CHECK VALVES

The check valves are used in the air lines between the left brake control valve and double check valves. The check valves allow the transmission to re-engage before the brakes fully release. The brake release delay is caused by the restricting orifice in the valve (4).



CHECK VALVE CONSTRUCTION

1. Body. 2. Seat. 3. Spring. 4. Valve. 5. Cap.

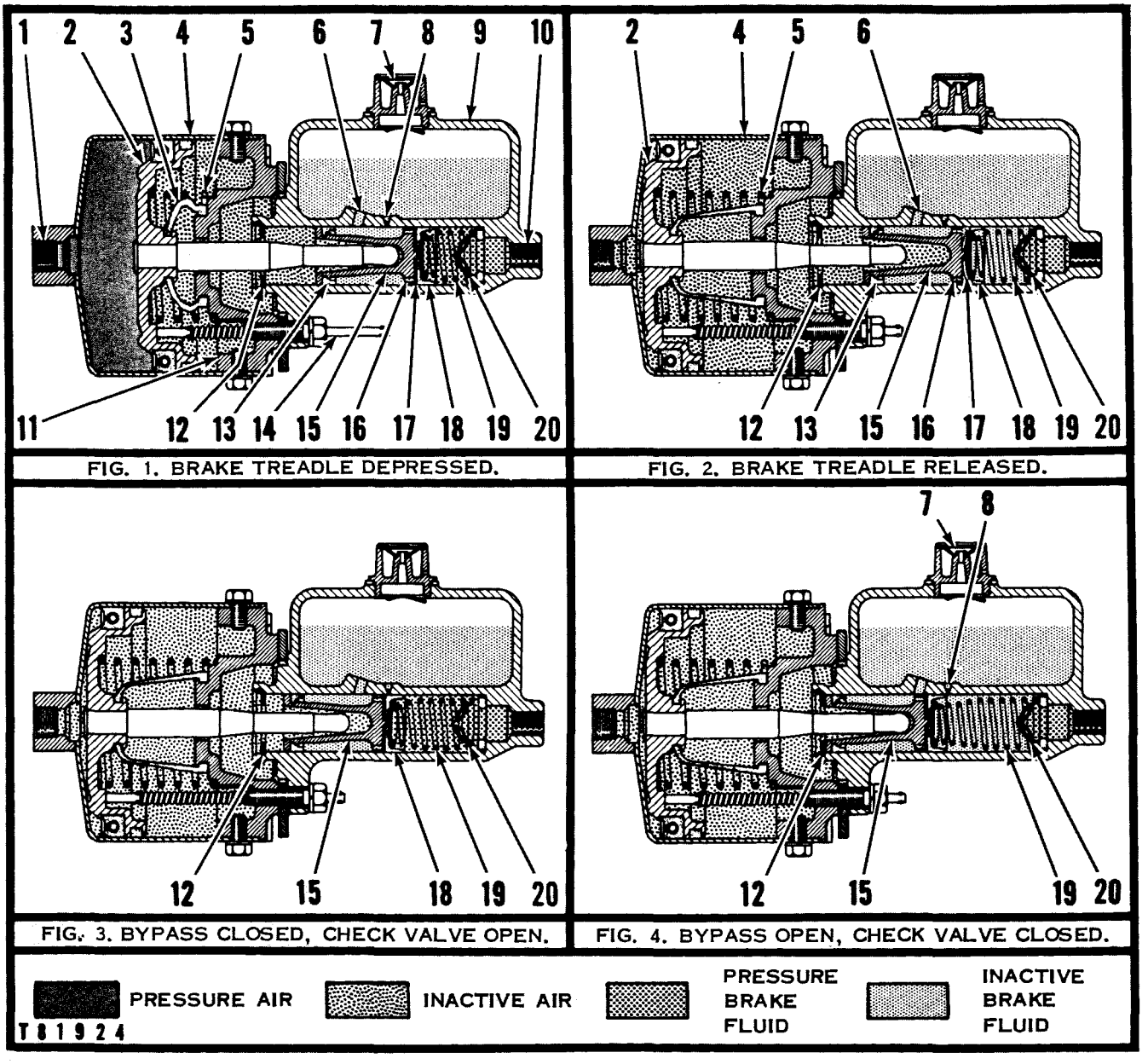
AIR CHAMBER AND MASTER CYLINDERS

Fig. 1. Depressing either brake pedal sends air from the brake control valve to air chamber (4) at port (1). Pressure air acting on piston (2) moves piston (2), indicator (14) and piston (15) to the right. As piston (15) moves cup (18) past bypass port (8), brake fluid in the master cylinder bore is forced past valve (20) and through port (10) to the wheel cylinders.

Fig. 2. When the brake pedal is released, pressure air exhausts from air chamber (4) and spring (5) moves piston (2) to the released position. Piston (2) moves faster than piston (15) due to the brake fluid which must be displaced. This creates a reduced pressure area between cup (18) and valve (20). Brake fluid ahead of cup (13) is drawn through port (6), passages (16) in piston (15) and past valve (17).

Fig. 3. When the displaced brake fluid unseats valve (20), spring (19) moves cup (18) and piston (15) toward plate (12).

Fig. 4. When piston (15) contacts plate (12), bypass port (8) is open to the master cylinder bore. Spring (19) seats valve (20) to maintain a low residual pressure in the brake hydraulic system. Cap (7) has drilled passage to vent the master cylinder reservoir.

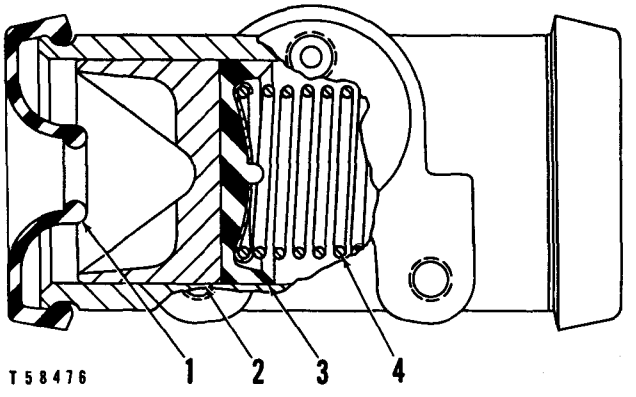


AIR CHAMBER AND MASTER CYLINDER OPERATION

1. Air chamber inlet port from brake valve. 2. Piston. 3. Boot. 4. Air chamber assembly. 5. Spring. 6. Supply port. 7. Cap. 8. Bypass port. 9. Master cylinder assembly. 10. Master cylinder outlet port. 11. Cylinder head. 12. Plate. 13. Cup. 14. Indicator rod. 15. Piston. 16. Passages. 17. Valve. 18. Cup. 19. Spring. 20. Valve and seat assembly.

WHEEL CYLINDERS (81J1 THRU 81J9509 AND 31K1 THRU 31K1054)

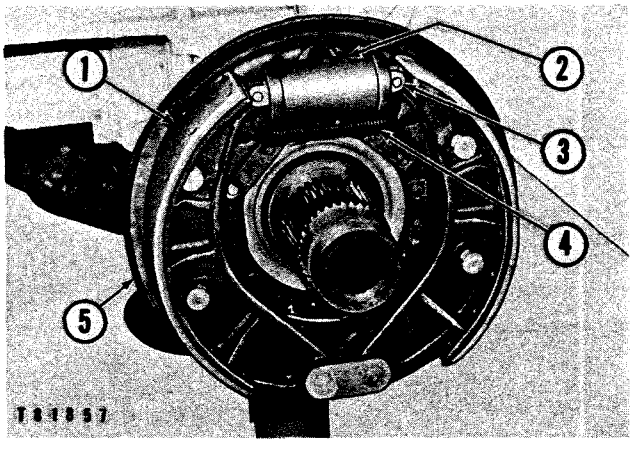
The wheel cylinder assemblies convert oil pressure into mechanical movement to actuate the brake shoe assemblies.



WHEEL CYLINDER ASSEMBLY CONSTRUCTION

1. Boot. 2. Piston. 3. Cup. 4. Spring.

WHEEL BRAKES (81J1 THRU 81J9509 AND 31K1 THRU 31K1054)



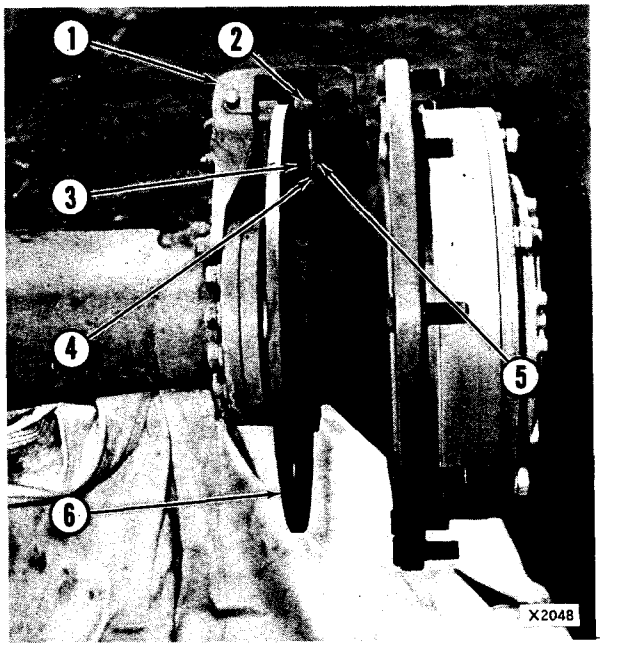
BRAKE ASSEMBLY
(Right front wheel illustrated)

1. Shoe assembly. 2. Cylinder assembly. 3. Link assembly. 4. Spring. 5. Brake backing plate.

Depressing either brake pedal sends brake fluid from the master cylinder to the wheel cylinder assembly (2) and forces link assemblies (3) against shoe assemblies (1). The shoes are forced against the brake drum. After the brake pedal is released, spring (4) returns the brake shoes to their original position.

WHEEL BRAKE ASSEMBLY (81J9510–UP AND 31K1055–UP)

Hydraulic pressure in the head (1) acts on discs to provide wheel braking. The discs revolve with the wheel hubs and the head is mounted on the axle flange. The head has two pistons and a friction



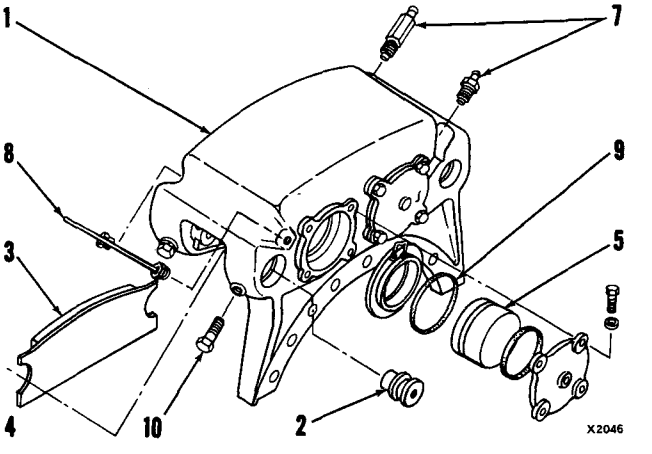
DISC BRAKE COMPONENTS
(Typical example)

1. Head assembly. 2. Anchor pin. 3. Friction pad. 4. Metal backing. 5. Piston. 6. Disc.

pad, bonded to a metal backing, on each side of the disc. The pads and backing are held in place by anchor pins. When the brakes apply, oil pushes the piston and pads out against the disc.

CAUTION: To prevent damage to pistons and seals, do not apply brakes when brake pads are removed.

Oil flows through lines and drilled passages to all pistons within each head assembly.



HEAD ASSEMBLY (Disc Brakes)

1. Head assembly. 2. Anchor pin. 3. Friction pad. 4. Metal backing. 5. Piston. 7. Bleed valves. 8. Line. 9. Piston seal. 10. Anchor retaining bolt.

When the brakes are applied, the hydaulic pressure balances the pistons and the force exerted on each side of the disc is equal. The pistons do not have return springs.

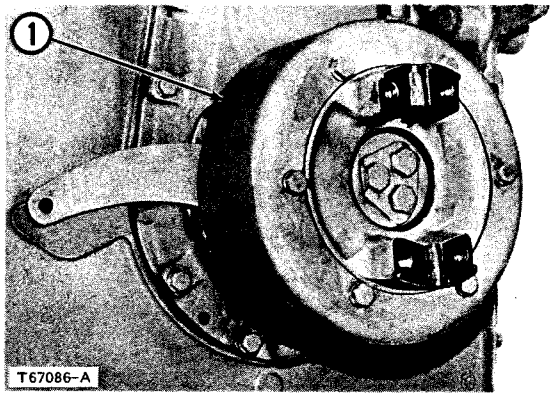
The pads may be replaced, without removing the head, by removing the anchor pin and sliding the pad out.

CAUTION: Do not apply brakes with pads removed. The pistons must not be allowed to extend out of their bores with the pads removed. Open the bleed valves on the head to relieve any pressure acting on the pistons. If the pistons should extend and expose the seals, head removal will be required to reinstall the pistons.

Two bleed valves on each head are used to bleed the air from the hydraulic brake system. Bleed the brakes whenever a line is disconnected in the hydraulic brake circuit.

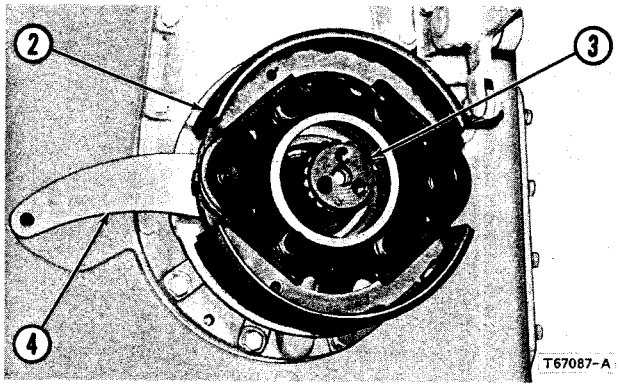
PARKING BRAKE (81J THRU 81J3501 AND 31K1 THRU 31K942)

The parking brake is an internally expanding shoe brake mounted on the front of the transfer drive case. The parking brake acts on the brake drum secured to the output shaft. Mechanical linkage connects the parking brake lever to the transmission forward-reverse lever. When the parking brake is applied, the forward-reverse lever is moved to and locked in the NEUTRAL position.



BRAKE DRUM

1. Brake drum.

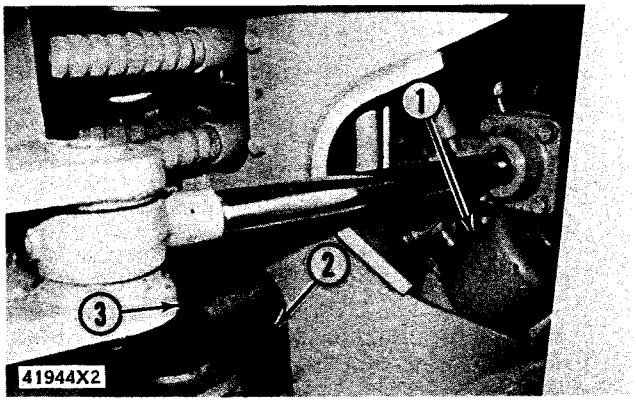


BRAKE ASSEMBLY

2. Brake shoe. 3. Transfer drive output shaft. 4. Lever.

EMERGENCY AND PARKING BRAKE (81J-3502–UP AND 31K943–UP) AND EARLIER MACHINES AS AN ATTACHMENT

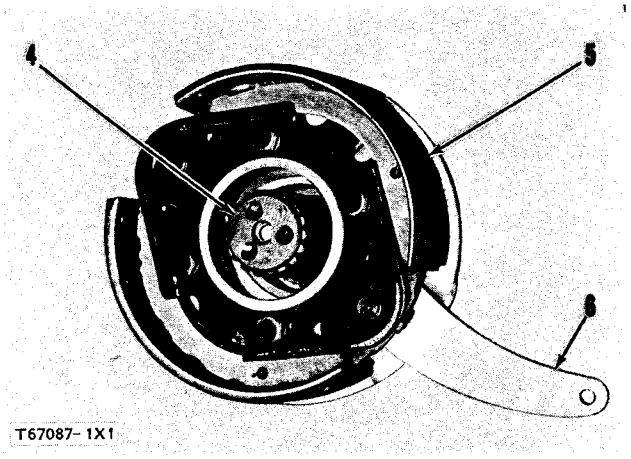
⚠ WARNING: The emergency and parking brake prevents only the drive shaft from turning. Therefore, differential action will allow the machine to articulate with the parking brake applied. Always place the safety bar in LOCKED POSITION before working beneath machine.



EMERGENCY AND PARKING BRAKE CHAMBER AND DRUM

1. Brake chamber. 2. Brake drum. 3. Drive shaft.

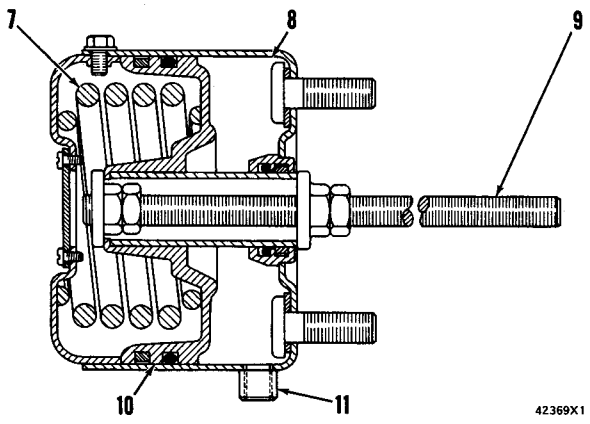
The emergency and parking brake prevents the drive shaft from turning whenever air pressure to the emergency brake chamber is below a safe operating level. The parking brake acts on the brake drum (2) secured to output shaft (4).



BRAKE ASSEMBLY

4. Transfer drive output shaft. 5. Brake shoe. 6. Lever.

The brake chamber actuates the expanding shoes. The brakes are spring applied and air released. The spring force extends the brake chamber rod (9) pushing the brake lever (6) down to APPLY the brake. Air pressure acts on piston (10) to compress spring (7), retract the brake chamber rod, and pull the brake lever up to RELEASE the brake.



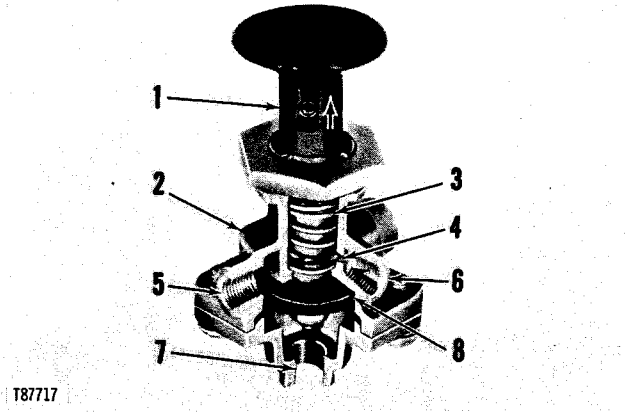
BRAKE CHAMBER

7. Spring. 8. Air chamber. 9. Brake chamber rod. 10. Piston. 11. Air inlet port.

Emergency and Parking Brake Control Valve

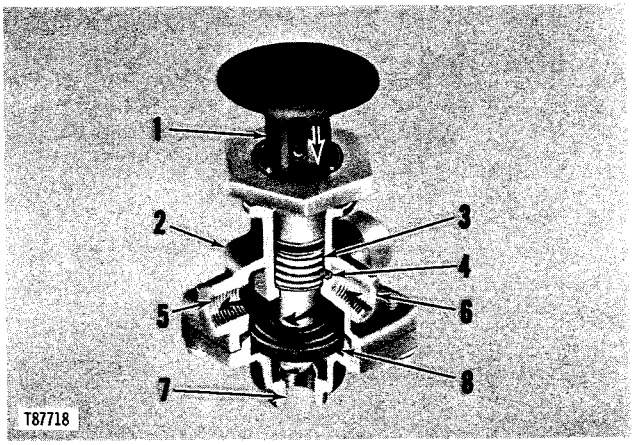
The dash-mounted emergency and parking brake valve controls the supply of air to the emergency and parking brake chamber. With the valve pulled out, the line to the emergency parking brake chamber is vented to atmosphere. With the valve pushed in, air flows from the reservoir into the emergency and parking brake chamber and releases the brake.

With the air reservoir discharged, the emergency and parking brake control valve will be in the APPLIED position [Knob (1) pulled out.] Valve (8) will be seated against upper face of valve body (2) sealing off pressure air supply to outlet port (5), and exhaust port (7). Air pressure in the reservoir is allowed to build to the operating range.



FLOW OF AIR—PARKING BRAKES APPLIED

1. Knob and pin assembly. 2. Valve body. 3. Spring. 4. Orifice. 5. Outlet port (to emergency brake chamber). 6. Inlet port (from air reservoir). 7. Exhaust port (to atmosphere). 8. Valve assembly.



FLOW OF AIR—PARKING BRAKES RELEASED

1. Knob and pin assembly. 2. Valve body. 3. Spring. 4. Orifice. 5. Outlet port (to brake chambers). 6. Inlet port (from reservoir). 7. Exhaust port (to atmosphere). 8. Valve assembly.

When the air pressure gauge registers in the operating range, the operator must push in and hold knob (1) on the emergency and parking brake control valve to release the parking brake. Pressure air from the reservoir enters the valve through inlet port (6), passes through orifice (4), and outlet port (5) to the brake chamber, releasing the parking brake. Air pressure then holds valve (8) seated over exhaust port (7).

In the event of an air system failure or if the pressure drops below 40 ± 5 psi (2.8 ± 0.4 kg/cm^2), spring (3) will unseat valve (8) exhausting pressure air to the atmosphere and will apply the emergency and parking brake.

AIR SYSTEM AND BRAKES

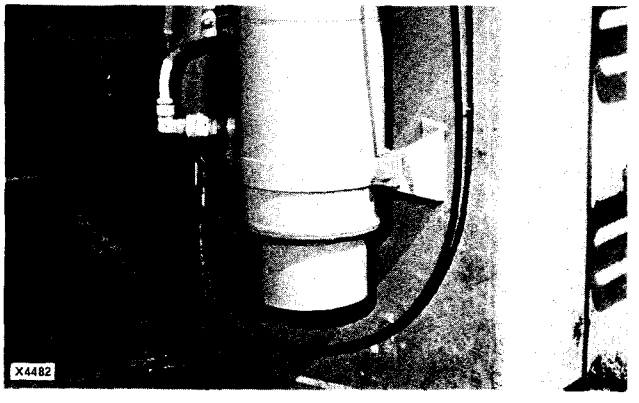
Tools Needed: 8M2885 Pressure Gauge (0 to 200 psi) 9S5800 Pump Group and 8F24 Hose Assembly.

⚠ WARNING: The parking brake prevents only the drive shaft from turning. The differential will allow the machine to articulate with the parking brake applied. Always place the safety bar in LOCKED POSITION before working beneath machine.

AIR PRESSURE GAUGE (81J1 THRU 81J3501 AND 31K1 THRU 31K942)

Install a coupling onto the drain cock of the primary air reservoir.

Thread hose into coupling and attach 8M2885 Pressure Gauge (known to be accurate) onto end of hose.



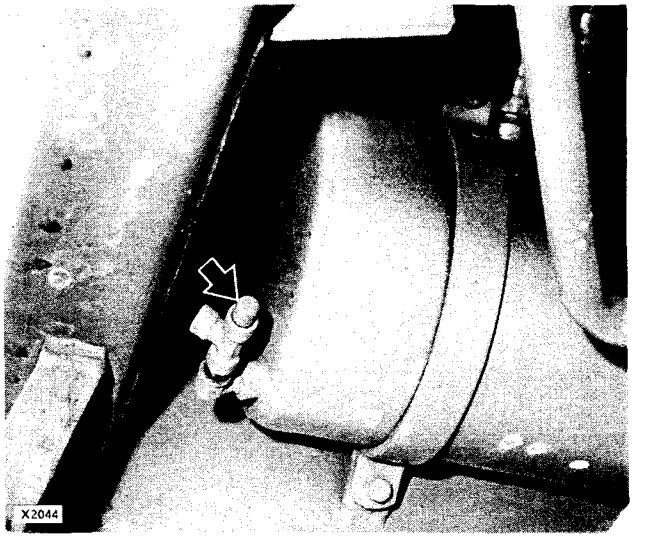
TEST HOSE CONNECTED

Start the diesel engine and compare the gauge readings at cutout pressure.

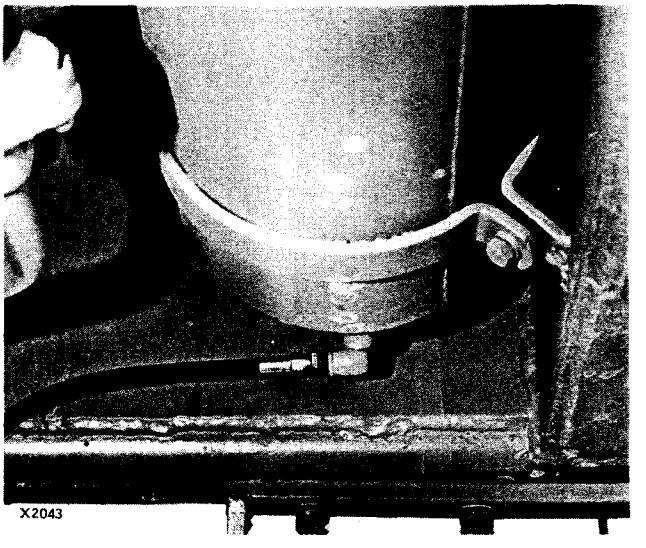
If the gauge varies 5 psi (0.4 kg/cm^2) or more from the test gauge, install a new gauge.

Machines 81J3502–Up and 31K943–Up

Exhaust the air pressure from reservoir by depressing the cap on the bleed valve.



BLEED VALVE

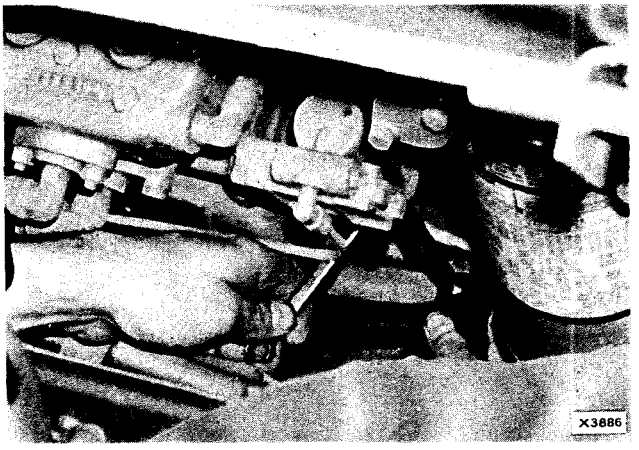


GAUGE CONNECTED

Remove the bleed valve and install the pressure gauge and hose. Leave the gauge installed for all pressure tests.

CAUTION: To prevent damage to pistons and seals on machines with disc brakes, do not apply brakes when brake pads are removed.

AIR COMPRESSOR GOVERNOR

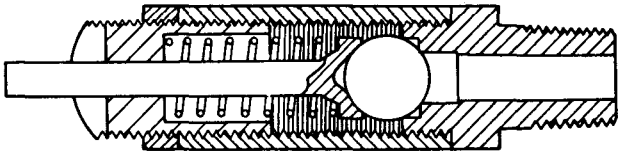


AIR COMPRESSOR GOVERNOR ADJUSTMENT
(Typical Example)

Set the governor to maintain the maximum reservoir pressure (cutout setting) of 120 ± 2 psi (8.4 ± 0.1 kg/cm^2). Cut-in pressure of 101 ± 3 psi (7.1 ± 0.2 kg/cm^2) is obtained automatically after cutout adjustment is made. Tighten the locknut after the adjustment is completed.

SAFETY RELIEF VALVE

Exhaust air pressure from the reservoir and remove the safety relief valve. Connect valve to a 9S5800 Pump Group. Apply the pressure on the valve. The valve should open at 150 psi (10.5 kg/cm^2). Adjust the valve by loosening the locknut and turning the adjusting screw.



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SAFETY RELIEF VALVE

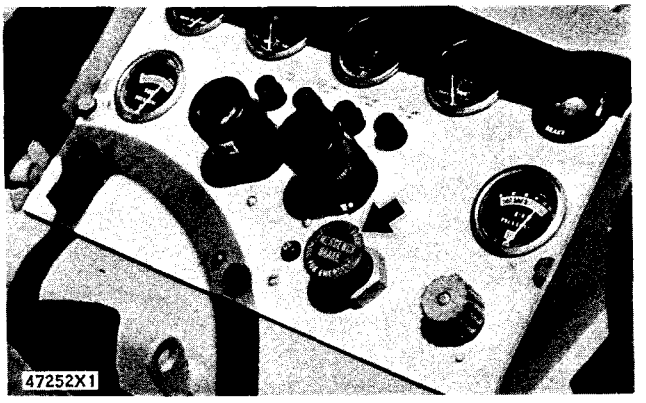
BRAKE CONTROL VALVE

Start the diesel engine and allow the air pressure to build up. Depress either brake pedal and hold the pedal in the depressed position.

Release the brake pedal and depress the other pedal. The service brake should function the same. Failure of front and/or rear service brakes to release indicates faulty brake control valves.

EMERGENCY AND PARKING BRAKE CONTROL VALVE (81J8502–UP AND 31K943–UP)

Start the diesel engine and allow the air pressure to build up to cutout pressure. Push the emergency brake in to release the emergency and parking brake. Shut off the diesel engine and relieve the air pressure by repeatly applying the service brakes. Note the test gauge pressure reading at which the emergency and parking brake control knob moves to the APPLIED (pulled out) position. This should occur at 40 ± 5 psi (2.8 ± 0.4 kg/cm^2). If not, recondition the valve.



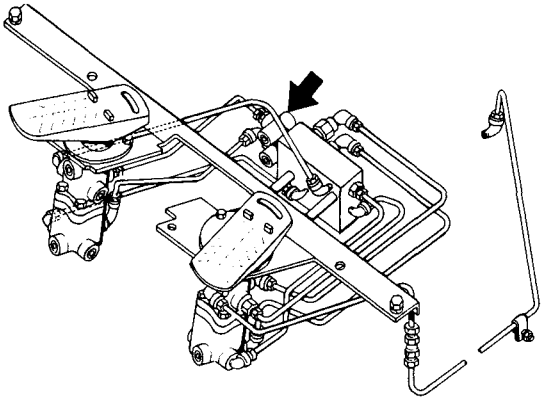
EMERGENCY AND PARKING BRAKE CONTROL VALVE

DOUBLE CHECK VALVES

Test the double check valves with the engine running and the powershift transmission in 3rd speed forward.

1. Depress the right service brake pedal.
2. Depress the governor pedal. The transmission should stay in gear and the engine should incur load.
3. Depress the left service brake pedal and the transmission should neutralize. All load should be removed from the engine.

If the machine fails either test, the double check valves are probably defective. Remove the valves and bench test for proper sealing and movement.



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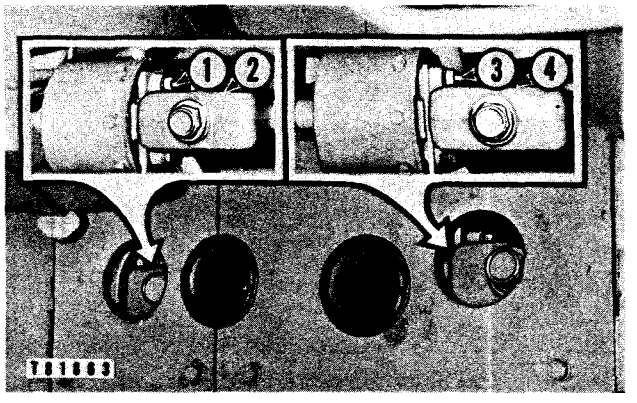
DOUBLE CHECK VALVES

SERVICE BRAKES

Operational Check (81J1 thru 81J9509 and 31K1 thru 31K1054)

The need for brake adjustment is indicated by rods (1) and (3). With either pedal depressed, note stroke of rod on each master cylinder. Brake adjustment is necessary when the stroke indicator rod extends 1.25 in. (31.8 mm).



STROKE INDICATOR RODS

1. Stroke indicator rod. 2. Rear master cylinder. 3. Stroke indicator rod. 4. Front master cylinder.

1. Start and operate the diesel engine until the air reservoirs are at operating pressure.
2. Depress either brake pedal and hold it depressed.
3. Observe the stroke indicator rods (1) and (3).
   (a) Stroke indicator rod creep indicates leakage in the hydraulic brake system.
   (b) Excessive indicator rod travel (with brakes properly adjusted) indicates air in the brake hydraulic system.
4. Release the brake pedal.
   (a) Failure of one or both master cylinder stroke indicator rods to retract indicates a master cylinder with a bypass port blocked by dirt, corrosion or a swollen primary cup.

⚠ WARNING: A swollen cup indicates improper or contaminated brake fluid. If the brake hydraulic system is contaminated, remove and recondition all components in the brake hydraulic system and flush the brake lines with denatured alcohol.

Leakage Check

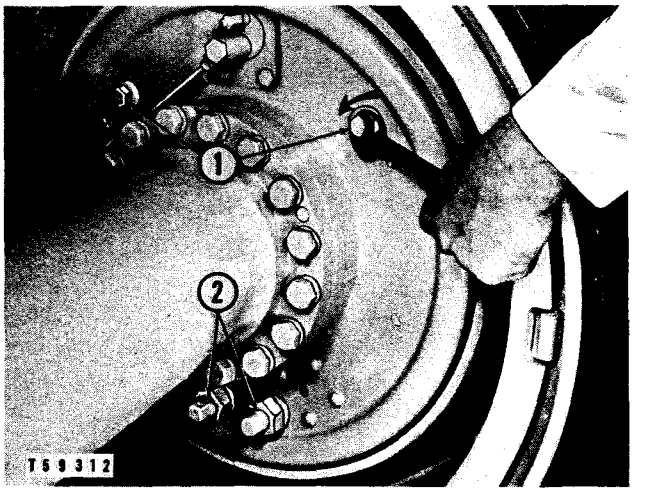
Depress either brake pedal and hold it depressed. Coat air line connections at the air chambers with soap suds and check for air leakage. Release the brake pedal. Coat the exhaust ports of each brake control valve with soap suds. Leakage must not exceed a 1 in. (25.4 mm) soap bubble in one minute. Correct any air leaks that may exist.

Brake Adjustment

To adjust the wheel brakes rotate the upper cams (1) in the direction indicated by the arrows (the top of the cams move toward the axle) until they are against the stops.

Rotate the upper cams (1) opposite the direction indicated by the arrows (the top of the cams move away from the axle) until tight and back off one-fourth turn.

NOTE: Anchor pins (2) have nothing to do with wheel brake adjustment and should not be disturbed.

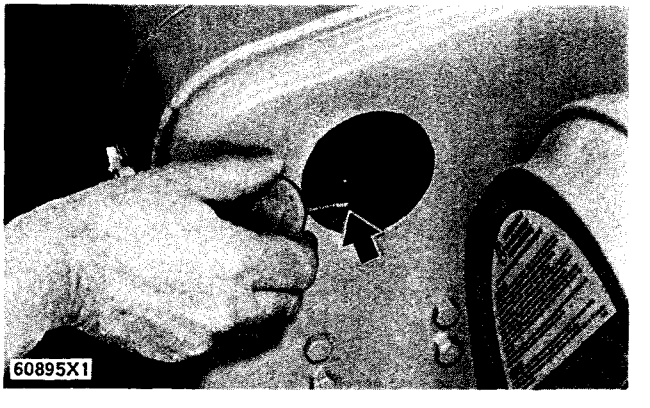


ADJUSTING BRAKE

1. Upper cams. 2. Anchor pins.

Operational and Leakage Checks (81J9510—UP and 31K1055—UP)

The operational and leakage checks for machines with disc brakes is the same as for machines with shoe brakes.



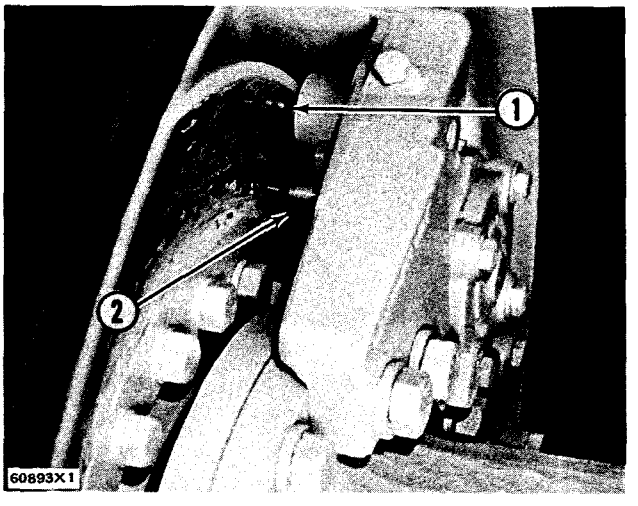
CHECKING LEVEL OF BRAKE FLUID IN AUXILIARY TANK

Check level of the brake fluid in auxiliary tank as shown. The level of brake fluid must be kept at the full mark on the gauge.

Brake Adjustment

Hydraulic disc brakes require no adjustment. There is no return mechanism to force the lining assembly away from the discs; therefore, the lining assemblies remain in slight contact with the discs to keep them clean.

Check for minimum permissible thickness (worn) in area where disc (1) and lining assembly (2) make contact. Apply service brakes and hold in the engaged position. Inspect discs and lining assemblies for wear. Minimum permissible thickness of disc is .44 in. (11.2 mm). Minimum permissible thickness of lining assembly is .38 in. (9.6 mm).



DISC BRAKE

1. Disc. 2. Lining assembly.

BLEEDING THE BRAKES

Whenever air has entered the hydraulic brake system, or a master cylinder has become dry, the system must be bled. This can be done manually or by using a pressure hydraulic system bleeder.

Manual Bleeding Method

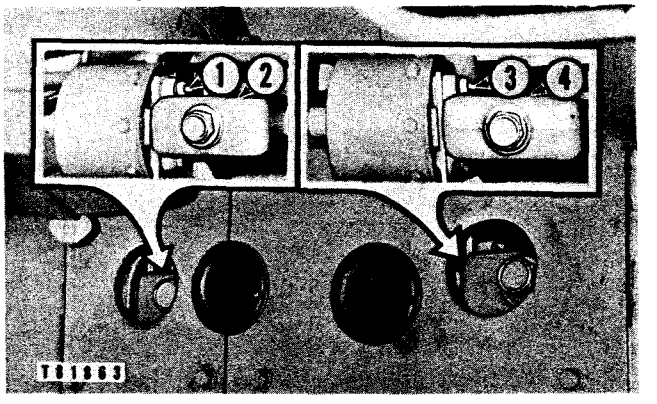
Each system is bled separately. Bleed the rear wheel brake system which is actuated by master cylinder (2), and then repeat the procedure for the front wheel brake system which is actuated by master cylinder (4).

1. Check the fluid level in each master cylinder. The initial level should be within .5 in. (12 mm) from the top of the reservoir.

NOTE: To prevent an air lock from developing in the master cylinders, fluid must always be visible in the reservoir while the system is being bled.

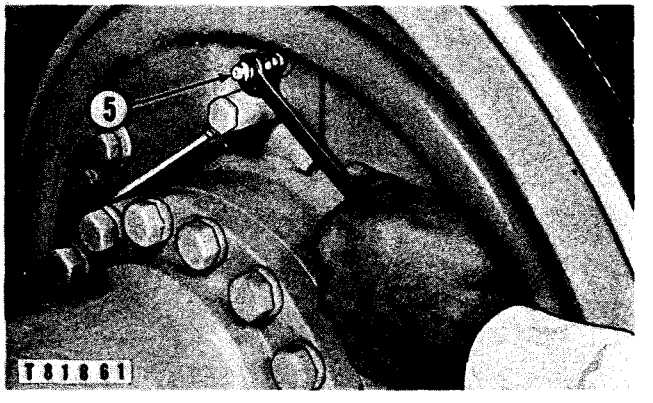
2. Attach a hose to bleed valve (5). Place the loose end of the hose into a jar containing enough fluid to submerge the end of the hose.

NOTE: Machines equipped with hydraulic disc brakes have two bleed valves for each wheel. Both valves must be opened to remove all of the air from the brake system.



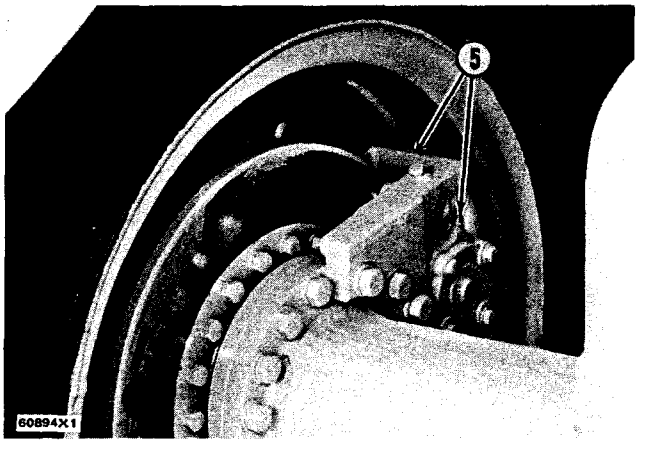
STROKE INDICATOR RODS
(Earlier machine illustrated)

1. Stroke indicator rod. 2. Rear master cylinder. 3. Stroke indicator rod. 4. Front master cylinder.



BLEEDING WHEEL BRAKE CYLINDER
(Machines with shoe brakes)

5. Wheel cylinder bleed valve.



BLEED VALVES
(Machines with disc brakes)

5. Bleed valves.

3. Repeatedly depress and release one of the brake pedals until a shorter stroke is observed on the stroke indicator rods.

4. Hold the brake pedal down and observe the stroke indicator rod.

5. Open bleed valve (5) and observe the brake fluid escaping from the bleed line. (Machines with disc brakes have two bleed valves for each brake.) Close the bleed valve when the stroke indicator rod is extended 1.25 in. (30 mm).

6. Repeat Steps 3, 4, and 5 until the brake fluid escaping through the bleed line contains no air bubbles.

7. Refill the master cylinder to within .5 in. (12 mm) from the top of the reservoir.

8. Bleed the cylinder on the other wheel.

9. Repeat procedure for other brake system.

Pressure Hydraulic System Bleeder Method

A commercially available pressure hydraulic system bleeder can be used. Before using the pressure hydraulic system bleeder, be sure tank (5) contains a sufficient quantity of brake fluid of the recommended type and grade. Maintain a pressure of 45 to 60 psi (3.2 to 4.2 kg/cm^2) in the tank while bleeding the system.

Each system is pressure bled separately. Bleed the rear wheel brake system by pressurizing rear master cylinder (1) and then repeat the procedure for the front wheel brake system by pressurizing master cylinder (6). On machines equipped with disc brakes, attach the adapter (2) to the top of the auxiliary tank.

1. Remove the plug from the master cylinder reservoir and install adapter (2).

2. Attach the hose (3) to the adapter and open the valve (4).

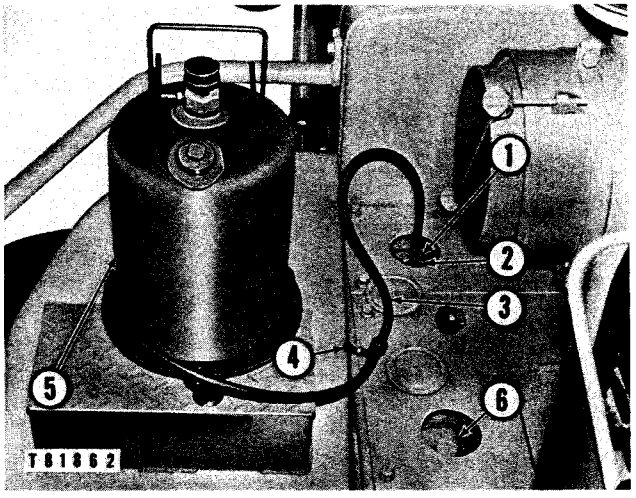
3. Attach a bleed hose to the bleed valve (7), insert the other end of the hose into a jar containing enough brake fluid to submerge the end of the hose, and open the bleed valve approximately one-half turn. Machines with disc brakes have two bleed valves on each brake head.

4. When the fluid flows into the jar without air bubbles, close the bleed valve and remove the hose.

5. Bleed the cylinder on the other wheel.

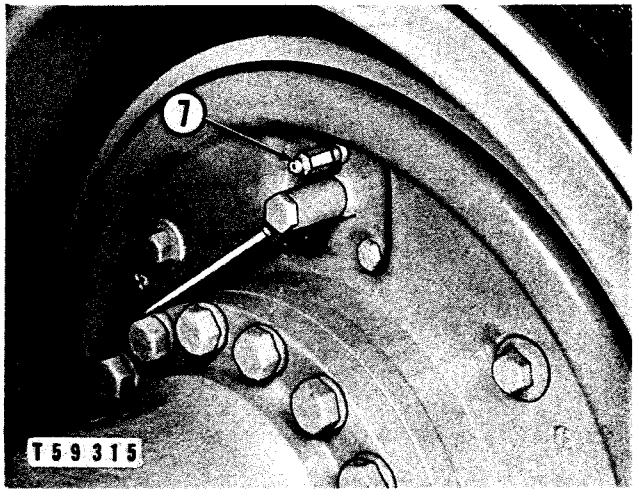
6. Disconnect the pressure hydraulic system bleeder from the master cylinder, remove the adapter, and install the plug.

NOTE: All four of the brake systems can be bled with pressure tank connected to auxiliary tank on machines equipped with hydraulic disc brakes.



PRESSURE HYDRAULIC SYSTEM BLEEDER
(Earlier machine illustrated)

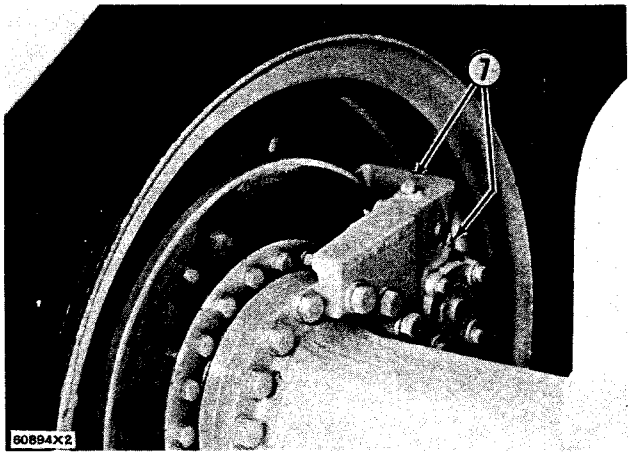
1. Rear master cylinder. 2. Adapter. 3. Hose. 4. Valve. 5. Tank. 6. Front master cylinder.



WHEEL CYLINDER BLEED VALVE
(Machine with shoe brakes)

7. Bleed valve.

7. Repeat procedure for other brake system.



WHEEL CYLINDER BLEED VALVES
(Machines with disc brakes)

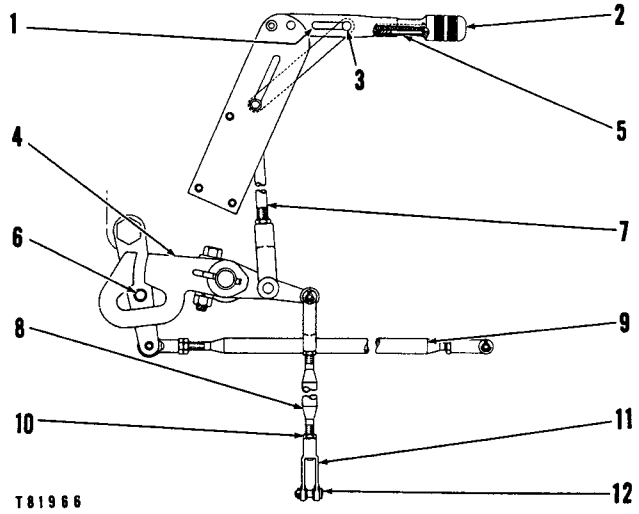
7. Bleed valves.

PARKING BRAKE CONTROL (81J1 THRU 81J3876 AND 31K1 THRU 31K979)

1. Move lever assembly (5) to brake APPLIED position to locate bolt (6) in narrow slot of bellcrank (4).

2. Adjust rod assembly (9) to put directional selector valve of transmission hydraulic control valve in NEUTRAL position.

3. Move lever assembly (5) to brake RELEASED position. Turn knob (2) to move pin (3) to knob end of slot (1).



PARKING BRAKE CONTROL ADJUSTMENT
(Lever in brake released position)

1. Slot. 2. Knob. 3. Pin. 4. Bellcrank. 5. Lever assembly. 6. Bolt. 7. Rod assembly. 8. Rod. 9. Rod assembly. 10. Locknut. 11. Yoke. 12. Pin.

4. Loosen locknut (10), remove pin (12) and turn yoke (11) onto rod (8), (clockwise) about four turns.

5. Install pin (12).

6. Pull up on lever assembly (5) to apply the brake. Brake adjustment is correct when a force of 50 to 60 lbs. (23 to 27 kg) at end of lever (5) is needed to snap lever over center to brake applied position. For tighter adjustment, turn yoke (11) (clockwise) farther, onto rod (8). For less adjustment, turn yoke (counter-clockwise).

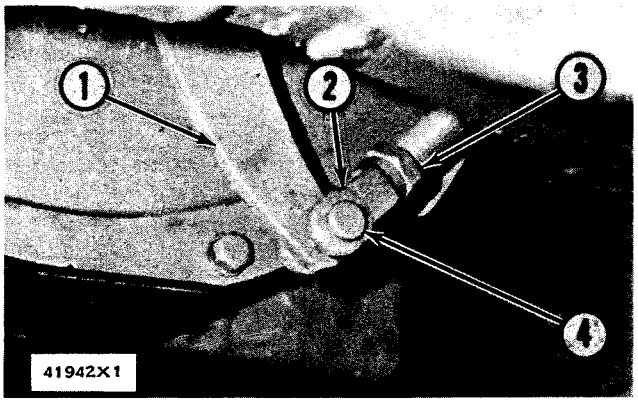
7. When parking brake control adjustment is correct install pin (12) and cotter pin. Tighten locknut (10).

EMERGENCY AND PARKING BRAKE ADJUSTMENT (81J3877—UP AND 31K980—UP)

Emergency and parking brake is in correct adjustment when machine will not move in third gear, with brake applied. Brake lining must be free when brake is released.

Since the adjustment is performed with the brake chamber charged and the spring compressed, observe the following WARNING:

⚠ WARNING: If the buzzer begins sounding while the linkage is being adjusted, stop adjusting at once and restart the engine to build the air pressure back up. The buzzer begins sounding at 70 to 80 psi (4.9 to 5.6 kg/cm^2). If the system pressure were to continue to bleed down to approximately 45 psi (3.2 kg/cm^2) the brake would unexpectedly apply.



BRAKE LINKAGE

1. Lever. 2. Yoke. 3. Locknut. 4. Cotter pin and pin.

1. Block the wheels and start the engine. Allow the air system pressure to build up to cutout pressure.

2. Shut off the diesel engine. Turn the disconnect switch ON. With the emergency and parking brake APPLIED, mark the position of the spring chamber rod. Push the control valve IN and release the brake. Measure the rod travel.

If the rod travel is not 1.2 to 1.5 in. (30.5 to 38.1 mm), loosen locknut (3) remove pin (4) and turn the yoke (2) as required.

3. Loosen the yoke locknut (3) and remove cotter pin and pin (4).

4. Push down on lever (1) by hand until brake linings contact drum.

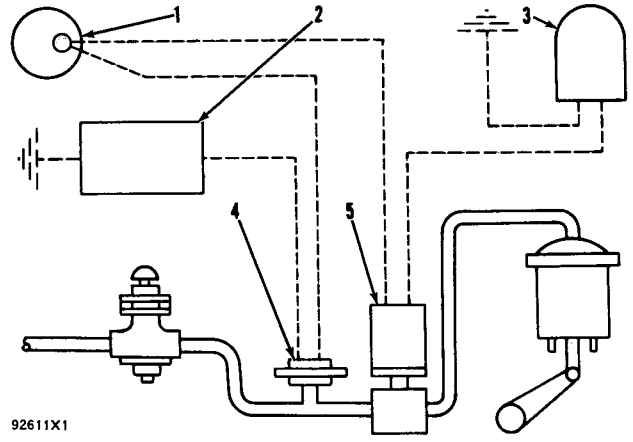
5. Turn yoke (2) on rod until holes in yoke align with hole in lever, when lever is pushed down.

CAUTION: With lever pushed down, pin must slip freely into yoke and lever holes.

6. Install pin and cotter pin (3) and tighten locknut (1).

ELECTRIC WARNING SYSTEM

NOTE: Before beginning any test of the electric warning system, check all electrical connections and grounds to assure good contact.



SCHEMATIC OF ELECTRIC WARNING SYSTEM

1. Starter switch. 2. Warning buzzer. 3. Low air pressure indicator. 4. Normally closed pressure switch (buzzer). 5. Normally open pressure switch (low air pressure indicator).

Start the diesel engine and allow the air system pressure to build up to cutout pressure. Push the emergency and parking brake control valve in. Shut off the diesel engine. Turn the disconnect switch ON.

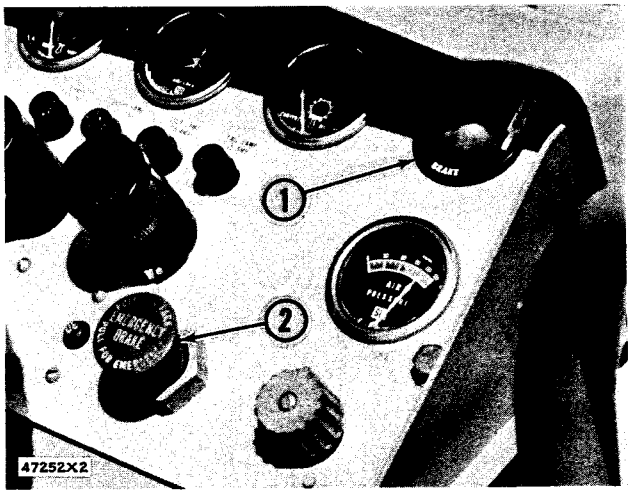
Slowly exhaust the air pressure by depressing the service brake pedal. Note the air pressure reading on the test gauge at which the buzzer begins to sound and the low air pressure indicator changes from green to red. Both should act between 70 and 80 psi (4.9 and 5.6 kg/cm^2).

Buzzer

If the buzzer does not begin to sound in the correct pressure range, check continuity of the normally closed pressure switch. The switch should be closed. If the switch is good, check the buzzer. If either is defective install a new one.

Indicator

The low air pressure indicator switch should open and the indicator should appear red. If the low pressure indicator remains green, the indicator may be sticking or the switch may not be opening. If there is current to the indicator, install a new switch. If there is no current and the indicator continues to show green, install a new indicator.



BRAKE CONTROLS

1. Indicator. 2. Emergency and parking brake control valve.

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