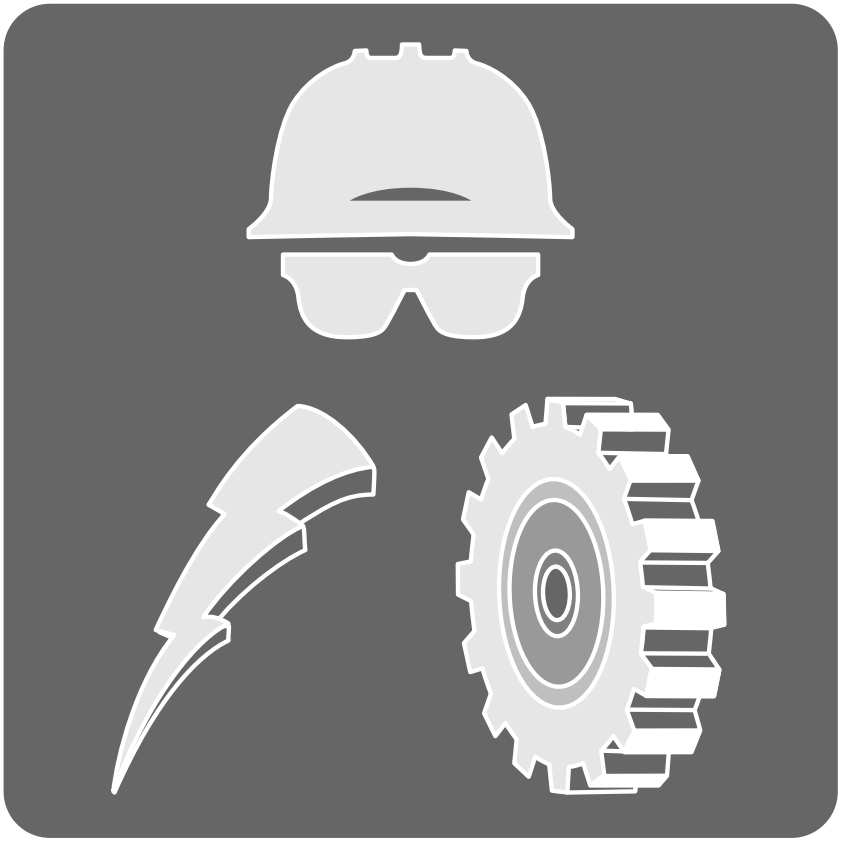
KOMATSU

P&H

Compressed Air System Component Description

Section 05–01–03 Gen2



LDG2-S-V-AS-EN-0001

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Preface

This Manual is provided as a guide to personnel involved with the operation, maintenance and repair of Komatsu Mining Corp. equipment. We recommend that such personnel review and become familiar with the general procedures and information contained within this manual. In addition, we recommend that this manual be kept readily available for reference when repairs or maintenance are necessary.

Read and become familiar with this Manual and any other general safety practices before attempting any procedures.

Due to the complexities of mining equipment and the environment in which it operates, situations may arise which are not directly discussed in detail in this Manual. When such a situation arises, past experience, availability of equipment and common sense play a large part in what steps are to be taken. In addition, a Komatsu Mining Corp. service center representative is available to answer your questions and assist you upon request.

Komatsu Mining Corp. reserves the right to continually improve its products and associated documentation. Therefore, physical alterations to Komatsu equipment may not be identified in this Manual. Revisions may be frequently made to this Manual in an effort to ensure that information contained within is current as alterations occur to the equipment. If you find an error or have other feedback regarding this Manual, please contact Product Training and Publications at *Pro.Train.Pub@mining.komatsu*.

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Safety

This publication contains special instructions that pertain to safety, operation, maintenance, and repair of the machine. Listed below are the signal words and symbols that precede these instructions and their meanings:

DANGER

The danger label indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

The warning label indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

The caution label, used with the safety alert symbol indicates a hazardous situation which, if not avoided, could result in minor or moderate injury (includes the safety alert symbol).

CAUTION

The caution label (without safety alert symbol) is used to address practices not related to personal injury – only equipment damage.

NOTICE

The notice label indicates areas of importance to the reader that are not related to personal injury or machine damage.

Safety, Warnings, and Cautions, 05–01–03

WARNING

CRUSH HAZARD

- **Crush hazards exist if releasing air from the hydraulic system without releasing hydraulic pressure. Releasing air pressure from the hydraulic system does NOT relieve hydraulic pressure from the hydraulic system. Use caution when working around components that are actuated by the hydraulic system. Use the hydraulic bleed valve assembly to relieve hydraulic pressure from the hoist and bucket circuit prior to working on components actuated by hydraulic pressure. Components actuated by hydraulic pressure can move if hydraulic connections are loosened while containing hydraulic pressure. Refer to the manual Section "HYDRAULIC & GREASE SYSTEMS" for information on relieving the hydraulic pressure in the hydraulic system. Failure to use the hydraulic bleed valve assembly to relieve hydraulic pressure from the hoist and bucket circuit prior to working on components actuated by hydraulic pressure can cause crush hazards resulting in serious injury or death.**

SKIN INJECTION HAZARD

- **Skin injection hazard exists when around diesel fuel, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid leaks under pressure may not be visible. When searching for leaks, NEVER use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. DO NOT tighten or loosen fuel, hydraulic, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.**

EXPLOSION HAZARDS EXIST

- **Explosion hazards exist when manually pressurizing the air system. Do not allow the air pressure to exceed operating pressure of the system. Reservoirs in the system have relief valves, but can be overcome by applying too much pressure too fast. Do not overpressure the air system. Failure to control air pressure during manual pressurization can cause explosion hazards resulting in serious injury or death.**

System Description

Following is a brief function description of the components and their interaction within the compressed air system.

- Air is compressed by the:
  - HPD Gearbox mounted air compressor.
    - Gets filtered intake air from cooling air tube going to the front frame.
- Compressed air is passed from the compressor to the air dryer.
  - Dryer dries air and removes particulates from air.
  - Compressor Cut-in/Cut-out pressure is controlled by the governor.
  - When Cut-out pressure is reached, air is vented to atmosphere by a dryer DLU valve
- Air is passed from the air dryer to the Distribution reservoir.
- Air is passed from the Distribution reservoir to:
  - Front Brake Reservoir:
    - Passed to the front brake relay valve
      - Passed to brake actuator
      - Actuated by brake treadle “signal” air
    - Brake treadle
      - “Signal” air passed to front brake relay valve
    - Front Park Brake Solenoid Valve (releases air to set front park brake)
  - Rear Brake Reservoir
    - Passed to the rear brake relay valve
      - Passed to brake actuator
      - Actuated by brake treadle “signal” air
    - Brake treadle
      - “Signal” air passed to rear brake relay valve
    - Rear Park Brake Solenoid Valve (releases air to set rear park brake)
  - KLENZ™ Reservoir
    - Passed to Hydraulic reservoir
    - Passed to KLENZ™ manifold
      - Passed to the Pulse valves
        - Sends air pulses (acoustic wave) inside filters
        - Controlled by KLENZ™ Pilot Signal Solenoid Valves
          - Uses “signal” air pressure to actuate pulse valve
          - Timer set in LINCS II software
  - Air Horn
    - Controlled by solenoid
  - Cab cleanout hose
    - Controlled with manual valve

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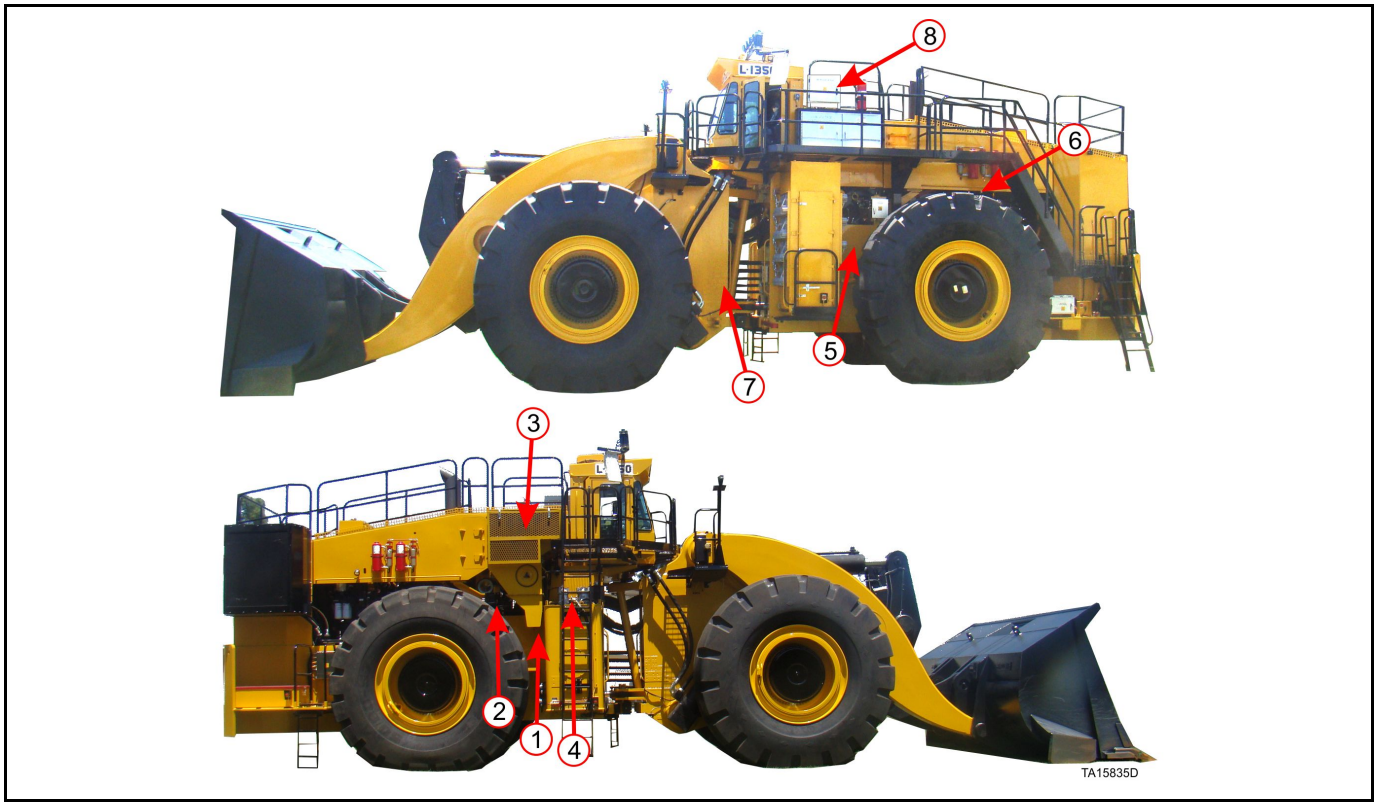
Component Functions

Air Compressor		
Type:	Piston type	
Mounted location**:**	**L-1350/L-1850/L-2350:** Hydraulic Pump Drive (HPD) gearbox mount	
Air Intake Supply**:**	**L-1350/L-1850/L-2350:** Cooling air tube going to front frame	
Compressor cycle times:	Continually flows air when engine is running (no compressor cut-out).	
Pressure Control**:**	When the governor **is** demanding air system pressure:	Compressor provides compressed flow at about: • L-1350/1850 - 135 psi (9.3 bar) • L-2350 - 140 psi) (9.65 bar)
	When the governor is **not** demanding air system pressure:	Discharge Line Unload valve (DLU) flows air to atmosphere at about 15 psi (1 bar). • DLU: built into the air dryer (bottom)
Maintenance:	**Internal:**	Sealed and requires no internal maintenance
	External:	Should be kept clean of external foreign debris buildup (to help prevent heat buildup). Fitting connections/securing bolts should be periodically checked for tightness/leaks.
Compressor Cooling:	BENDIX BA-922	Cooled by engine coolant provided by the water pump on the engine Engine coolant is circulated through the cooling passages in the compressor and back to the engine. Check water tight connections for leaks and repair as necessary.
Lubrication:	HPD Gearbox Mounted Compressor	On HPD Gearbox mounted compressors, the gearbox oil is used to lubricate the compressor.
Safety Relief	Non-adjustable 250 psi (17 bar). Mounted in the compressed air side of the compressor head.	
Stainless steel 120 inch length hose	Provides compressed air to the dryer and allows for cooling of the air before entering the dryer. It has better heat dissipation than standard Teflon hoses.	

Model	Displace-ment (cfm) at 1250 rpm	Displacement (cfm) at 1900 rpm (120 psi)	Displacement (cfm) at 1900 rpm (140 psi)	Allowa-ble inlet Temp	Allowa-ble outlet Temp.	Boosted cfm at 1900 rpm (120 psi)	Lubrication	Cool-ing
BEND-IX *BA-922*	31.7 cfm	27.8 cfm	23.8 cfm	170°F	350°F	N/A	HPD Gearbox	En-gine cool-ant
	898 lpm	787 lpm	674 lpm	76.6°C.	176.7°C.	N/A		

Figure 1: Compressed air system typical major component locations (Typical machine illustrated)



01 - HPD mounted air compressor

02 - Air Dryer

03 - KLENZ™ Filtration unit

04 - Hydraulic reservoir air release valve

05 - Distribution and Rear brake reservoirs mounted inside of rear frame. L-1850 and L-2350: KLENZ™ reservoir mounted inside of rear frame

06 - L-1350: KLENZ™ reservoir mounted above generator.

07 - Front brake reservoir mounted in front frame.

08 - Air box mounted on top of the low voltage control cabinet

Air Compressor

The air compressor is used to provide and maintain a compressed air supply to operate various devices on the machine; such as brakes, KLENZ™, horn, and other auxiliary systems and devices.

BENDIX BA-922: The hydraulic pump drive gearbox mounted BENDIX BA-922 is a two cylinder, reciprocating air compressor. The average weight is 60 lbs. (27.3 kgs.). It consists of two 2.78” (70.6 mm) pistons with a rod stroke of 1.87” (47.5 mm). It is capable of displacing air at a rate of 16.5 cubic feet (0.467 cubic meters) per minute at 1250 rpm. The discharge air temperature is typically 350°F (176.6°C).

The compressor consists of two major subassemblies, the cylinder head and the crankcase.

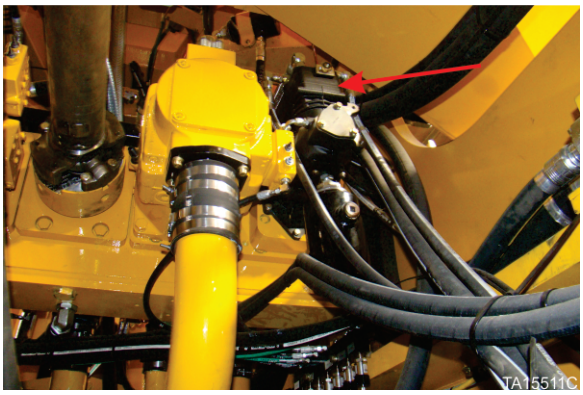
The cylinder head houses the inlet, discharge, and unloader valving (unloader valve not used on the current loaders). The cylinder head also houses the coolant inlet and outlet ports, governor mounting pad (not used on current loaders), and a 250 psi (17 bar) safety valve. The cylinder head is cooled by the engine coolant.

The crankcase houses the cylinder bores, pistons, crankshaft and main bearings, and provides a flange for base mounting surface. It also provides a sump for the lubrication oil to pass through. This lubrication is supplied by the engine oil.

This compressor is supplied with inlet air that is taken from the filtered engine air (from the air tube coming from the KLENZ™ system). This provides a slight pressurized air to the compressor cylinders during unloaded state (free flowing air) of the compressor to keep the piston rings seated and prevent crankcase oil from passing through during this portion of the operating cycle.

For more specific information on the BENDIX BA-922 air compressor refer to the manufacturers data in the Vendor Literature Section of this manual.

Figure 2: Air compressor location (gearbox-Hydraulic Pump Drive (HPD) mounted)



Air Compressor Intake Location

The air compressor is plumbed into the cooling air tube going to the front frame.

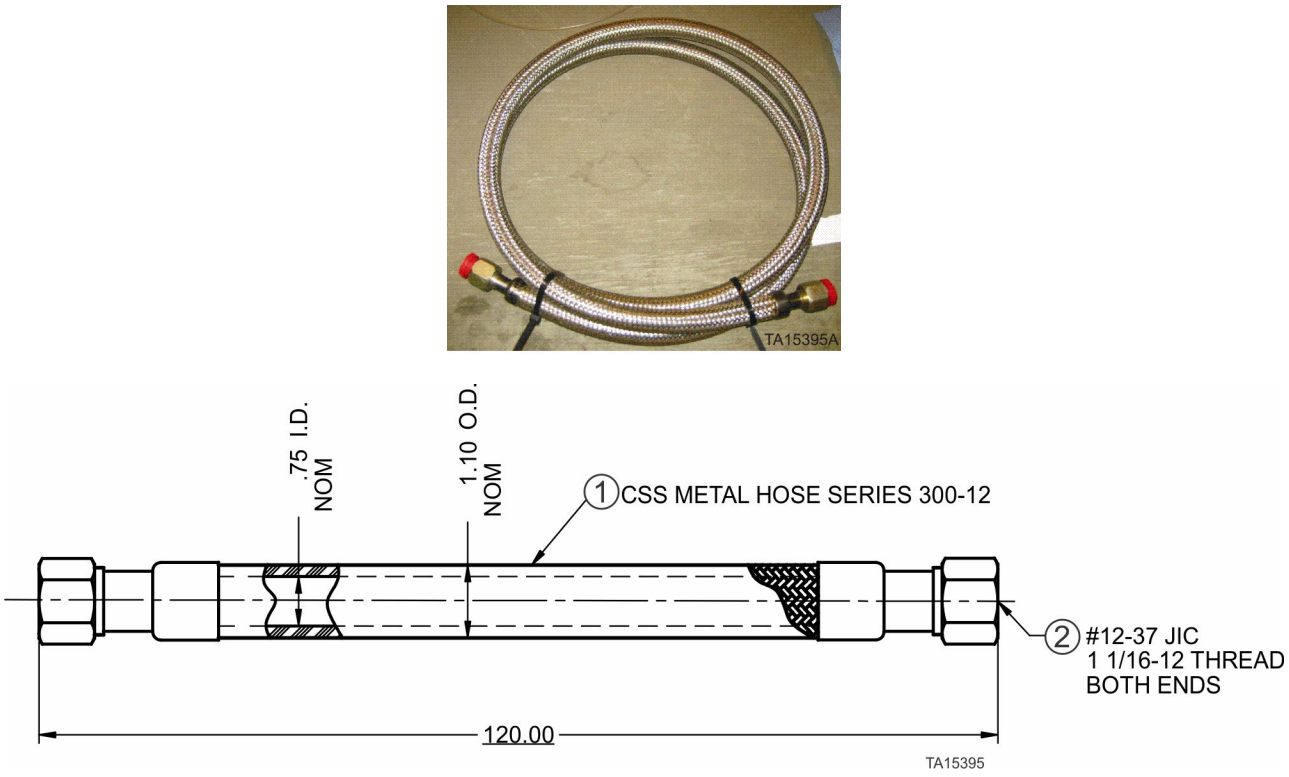
Figure 3: HPD gearbox mounted compressor intake hose

1) Air compressor intake hose connection, **2)** Cooling air tube going to front frame

Compressor Outlet Hose

The compressor outlet port is connected to the inlet of the air dryer by a 120” (304.8 cm) corrugated stainless steel hose with a stainless steel braided sleeve. This material provides a very flexible hose that is capable of flexing around sharp bends without collapsing. The length of this hose provides a cooling effect of the outlet air to the operating temperature of the air dryer desiccant. The ends of the hose are brazed onto the corrugated stainless steel material. It has a maximum recommended working pressure of 800 psi (55 bar) and a minimum bursting pressure of 3200 psi (220 bar).

Figure 4: Compressor outlet hose (stainless steel)



1) Corrugated stainless steel metal hose series 300-12, **2)** Thread both ends

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Desiccant Air Dryer

Air enters the dryer directly from the air compressor through the 120 inch (304.8 cm) stainless steel hose. The air passes through the desiccant which removes any carbon and contaminates. Air vapor concentration is reduced as air travels through the desiccant in the top of the dryer cartridge. The clean air then passes through a check valve and out of the outlet port of the air dryer, to the Distribution Reservoir. The air is not allowed to reenter from the outlet port due to the check valve.

When the air system reaches the governor’s cutout pressure, air pressure from the unloader line enters the unit and lifts the purge valve off its seat:

This sudden opening of the purge valve permits the pressurized air in the compressor discharge lines to flush the housing and sump of:

- Moisture and contaminants.

The pressurized air in the desiccant bed cleanses the oil separator of oil and contaminants.

- The contaminants are discharged out the bottom of the unit.

Lower control pressure allows for a cooler system.

Excessive heat increases oil carryover which results in:

- Carbon buildup in the lines.
- Increased restriction and system pressure (low volume, high pressure).

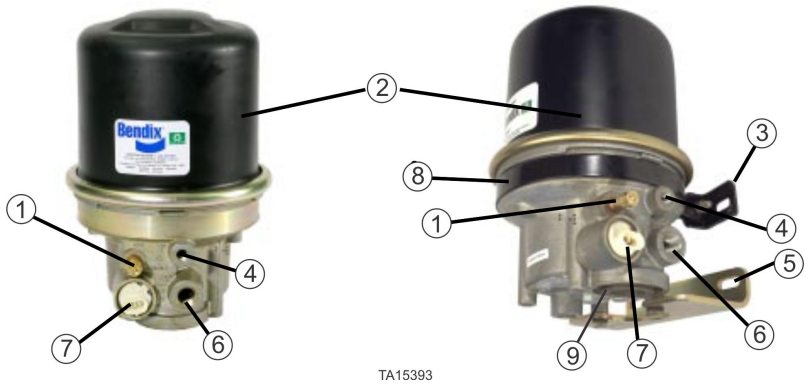
Once the system pressure drops to the cut-in pressure, the unloader line pressure evacuates through the exhaust port of the governor and a "resume pressure" signal is sent to the DLU (Discharge Line Unloader) valve located on the bottom of the air dryer. The valve stops venting to atmosphere and directs air pressure into the compressed air system.

For more information, refer to the VENDOR LITERATURE section of this manual.

Components of the dryer:

1. Desiccant Cartridge
2. DLU (Discharge Line Unloader) purge valve
3. Outlet check valve
4. 24 VDC heater and thermostat (turns on at 40° F (4.4° C) and shuts off at 90° F (32.2° C.).
5. 200 psi (13.7 bar) safety relief

Figure 5: Dessicant air dryer



1. Safety valve	**6.** Supply port
2. Desicant cartridge	**7.** Heater & thermostat connector
3. Saddle mounting bracket	**8.** Mounting strap
4. Control port	**9.** Discharge port
5. Lower mounting bracket	

Compressed Air Dryer General Information

For more information about any of these following subjects, refer to the VENDOR LITERATURE section in this manual.

GENERAL The AD-IP™ air dryer alternates between two operational modes or “cycles” during operation: the *Charge Cycle* and the *Purge Cycle*. The following description of operation is separated into these “cycles” of operation.

Charge Cycle

When the compressor is loaded (compressing air) compressed air, along with oil, oil vapor, water and water vapor flows through the compressor discharge line to the supply port of the air dryer body. As air travels through the end cover assembly, its direction of flow changes several times, reducing the temperature, causing contaminants to condense and drop to the bottom or sump of the air dryer end cover. After exiting the end cover, the air flows into the desiccant cartridge. Once in the desiccant cartridge, air first flows through an oil separator located between the outer and inner shells of the cartridge. The separator removes water in liquid form as well as liquid oil and solid contaminants.

Purge Cycle

As air system pressure reaches the cutout setting of the governor, the governor unloads the compressor by signaling the DLU (Discharge Line Unloader) to redirect compressed air to atmosphere (keeping 10-15 psi on the compressor). Then the purge cycle of the air dryer begins. When the governor unloads the compressor, it pressurizes the line connecting the governor unloader port to the AD-IP™ air dryer end cover control port. The purge piston moves in response to air pressure causing the purge valve to open to the atmosphere. Water and contaminants in the end cover sump are expelled immediately when the purge valve opens. Also, air which was flowing through the desiccant cartridge changes direction and begins to flow toward the open purge valve. Liquid oil and solid contaminants collected by the oil separator are removed by air flowing from the purge volume through the desiccant drying bed to the open purge valve.

Reactivation

The actual reactivation of the desiccant drying bed begins as dry air flows from the purge volume through the purge orifice in the desiccant cartridge bolt, then through the center of the bolt and into the desiccant bed. Pressurized air from the purge volume expands after passing through the purge orifice; its pressure is lowered and its volume increased. The flow of dry air through the drying bed reactivates the desiccant material by removing the water vapor adhering to it. Generally, 30 seconds are required for the entire purge volume of a standard AD-IP™ air dryer to flow through the desiccant drying bed.

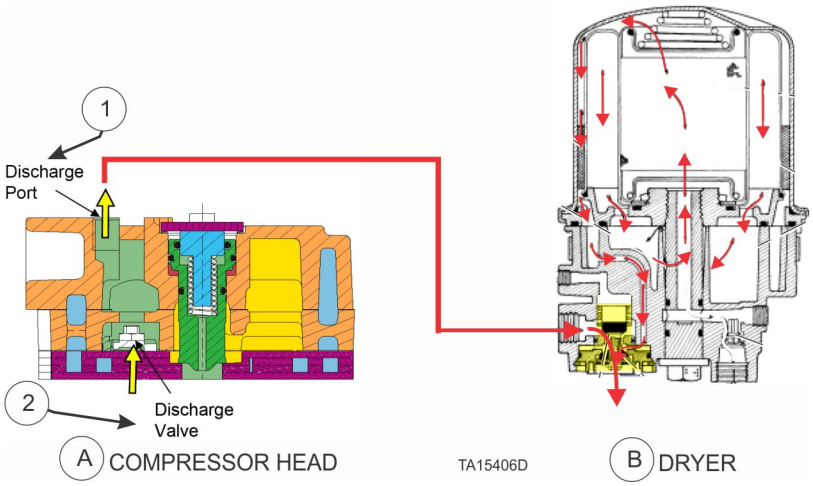
The delivery check valve assembly prevents air pressure in the system from returning to the air dryer during the purge cycle. After the 30 second purge cycle is complete the desiccant has been reactivated or dried. The air dryer is ready for the next charge cycle to begin. However, the purge valve will remain open and will not close until air system pressure is reduced and the governor signals the compressor to charge the system.

Air Dryer Service Requirements

The air dryer should be serviced a minimum of every 2000 hours of operation or twice a year. The desiccant must be replaced immediately if contamination is detected or if performance of the unit is reduced (evidenced by oil or moisture coming from a reservoir). Instructions for servicing the air dryer are included in the manufacturer’s product information, located in the VENDOR LITERATURE.

When the compressor is discharging air, the air is exhausted out the bottom of the dryer and the compressor has a load of about 10-15 psi (0.69 1 bar).

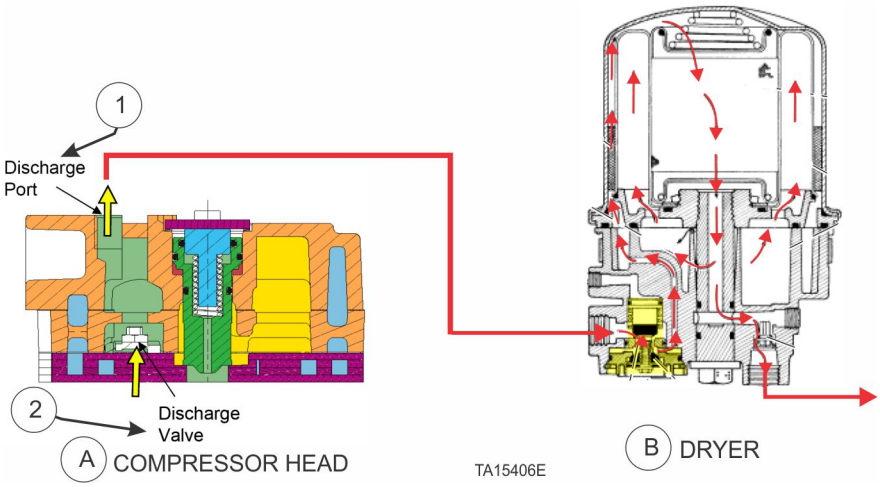
Figure 6: DLU air compressor unloading in the dryer purge valve



1. Discharge port **2.** Discharge valve	**A.** Compressor head **B.** Dryer

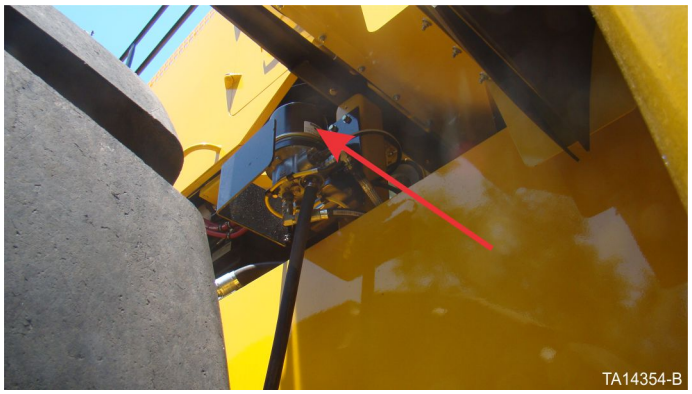
When the compressor is loaded (compressing air), the air is directed at high pressure through the dryer and into the air system.

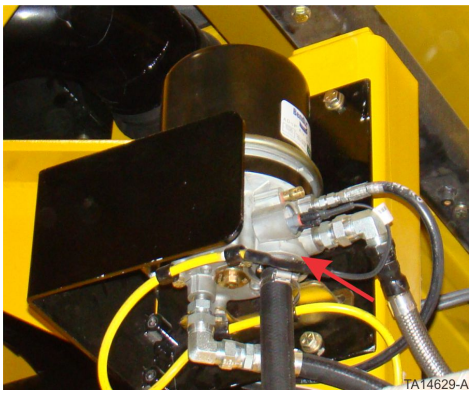
Figure 7: DLU air compressor charge through the dryer



1. Discharge port **2.** Discharge valve	**A.** Compressor head **B.** Dryer

Figure 8: Air dryer mounted right side of rear frame





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Governor

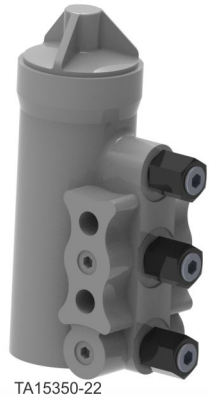
The governor operates in conjunction with a mechanical Discharge Line Unload valve (DLU) (located on the bottom of the air dryer) that will unload the compressor's outlet air when desired system pressure is reached. When actuated, the DLU either vents compressed air to atmosphere or directs it into the air system. The governor controls the DLU by reacting to minimum and maximum cut-in and cut-out pressures or on/off hysteresis. It controls system pressure by reacting to the pressure in the distribution reservoir. A "sense" line connects the governor and the distribution reservoir and allows the governor to respond to the pressures in the reservoir.

Location: Mounted behind the air dryer (typically).

Weighs 1 lb. (0.45 kg.).

Current production machines are fitted with a governor that provides a low band on/off and comes preset from the vendor at 142 to 148 psi (64.4 67.1 bar). Its ports are tapped for 10 mm threads and requires 10 mm to 1/8 NPT adapters.

Figure 9: Governor used on current production machines

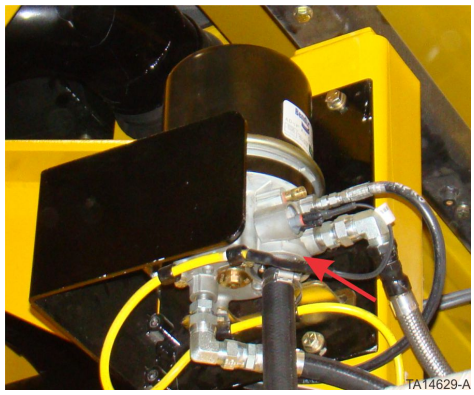


A breather check valve is installed in the exhaust port to prevent dirt and dust from entering through this port while air is not passing out of it.

For additional information on the governor, refer to the vendor information.

Figure 10: Locations of compressor governor on various machine models

Figure 11: Discharge line unloader (DLU) valve

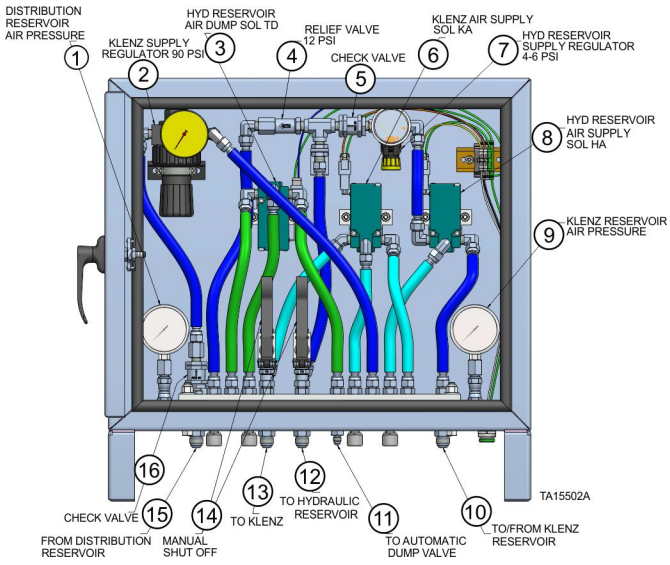


Air Box

Current production models have an “air box” mounted on top of the low voltage cabinet. This box contains air regulators, solenoids, and other components used to control air pressure on various systems. Some of the components shown in the following instructions have been installed in this box on some machine models. Refer to illustrations below for more information.

Figure 12: Air box component layout

Air box mounted on top of the low voltage control cabinet



1. Distribution reservoir air pressure
2. KLENZ™ Supply regulator 90 psi
3. Hydraulic reservoir air dump solenoid TD
4. Relief valve 12 psi
5. Check valve
6. KLENZ™ Air supply solenoid KA
7. Hydraulic reservoir supply regulator 4-6 psi
8. Hydraulic reservoir air supply solenoid HA
9. KLENZ™ reservoir air pressure
10. To/From KLENZ™ reservoir
11. To automatic dump valve
12. To hydraulic reservoir
13. To KLENZ™
14. Manual Shut Off
15. From distribution reservoir
16. Check valve

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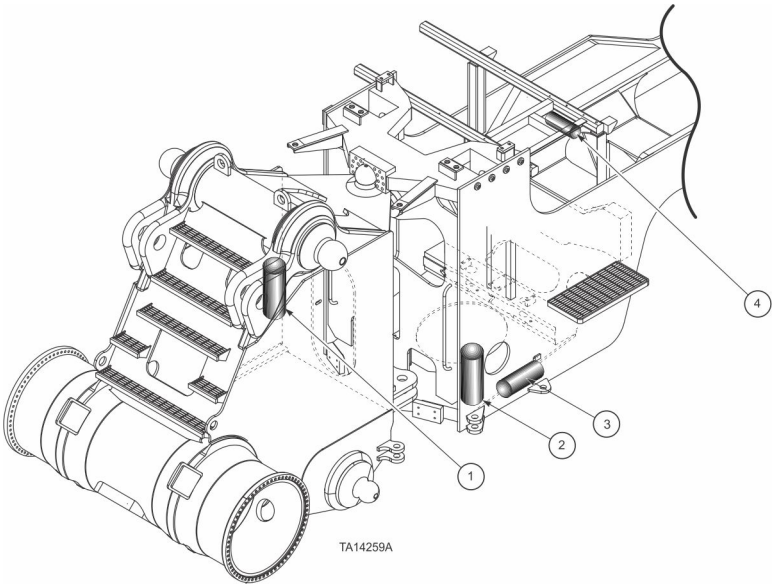
Air Reservoirs

The Generation 2 machines are fitted with three (3) 2146 cubic inch (35.2 liter) reservoirs (front brake system reservoir, rear brake system, and distribution reservoir) and a single 557 cubic inch (9.13 liter) reservoir for the KLENZ™ system.

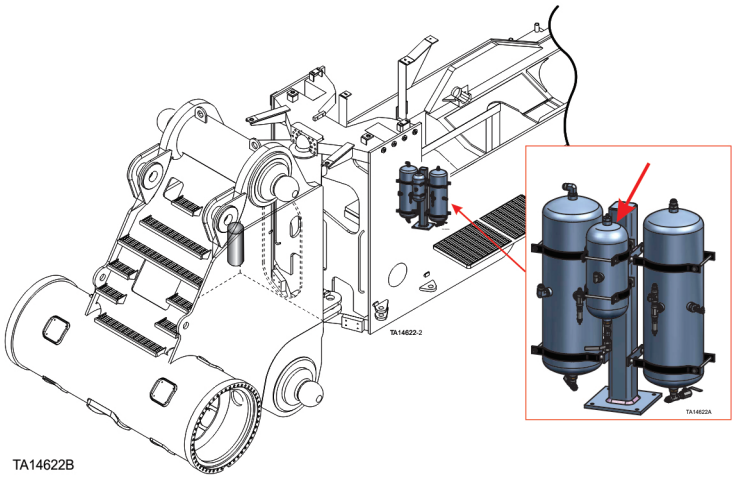
Reservoir Locations

Figure 13: L-1350 Compressed air system reservoir locations



1) Front brake reservoir, **2)** Distribution reservoir, **3)** Rear brake reservoir, **4)** KLENZ™ reservoir

Figure 14: L-1850/2350 Compressed air system reservoir locations



1. Front brake reservoir
2. Rear brake reservoir
3. KLENZ™ reservoir
4. Distribution reservoir

NOTICE

Located in approximately in the same location as early production.

Distribution Reservoir

The distribution reservoir receives compressed air that has been passed through the air dryer. It then distributes this air throughout the rest of the system. This reservoir is unique because it doesn't have an inlet check valve. Its isolation is provided by the internal check valve located in the air dryer.

A pressure gauge is used to display system air pressure. It is located inside the Air Box. On early production machines, it can be located on the reservoir, on a tee at the pressure transducer, or at the outlet of the air dryer.

The distribution reservoir supplies air for the activation of the emergency air dump valve on the hydraulic reservoir. This control air pressure is supplied to the dump valve when the emergency stop is activated or the fire suppression system is activated. Either action energizes a control solenoid valve; sending the control air pressure to the dump valve. The dump valve used on the machine is a Versa Valve. This is a remotely operated valve that must be manually reset.

The air horn and cab cleanout are supplied air pressure from the distribution reservoir.

⚠ WARNING

Explosion hazards exist when manually pressurizing the air system. Do not allow the air pressure to exceed operating pressure of the system. Reservoirs in the system have relief valves, but can be overcome by applying too much pressure too fast. Do not overpressure the air system. Failure to control air pressure during manual pressurization can cause explosion hazards resulting in serious injury or death.

If the system is manually pressurized, it is normally pressurized through the air distribution reservoir.

Components of the Reservoir, Distribution

1. Check valve.
2. 175 psi (12 bar) safety relief.
3. Manual drain valve "direct" located on bottom of reservoir.
4. Manual drain valve "remote" located outside the rear and front frame.
5. Pressure gauge (at inlet line of the distribution reservoir only).
6. Pressure Transducer (on the Distribution and KLENZ™ reservoir only).
7. Reservoir: 2146 cu in. (35.2 liters)

NOTICE

If this part of the system develops a leak, identifying this section as containing the leak can be quickly done by using the LINCS II system to isolate the leak location.

Front Brake Reservoir (Front Brake Reservoir Service and Park Brakes)

Air passes from the Distribution reservoir, through a check valve (pressure blocked from returning to distribution reservoir) and into the Front Brake reservoir. The Front Brake reservoir provides compressed air pressure to operate the front Park Brake and front Service Brake. Pressure within this section of the air system is contained by a check valve and is only released by use of the brake system (Service or Park brake application). There is a pressure transducer that monitors system pressure on the Front Park Brake and a transducer that monitors system pressure in the Front Service Brake.

Components of the Reservoir, Front Brake

1. Check valve.
2. 175 psi (12 bar) safety relief.
3. Manual drain valve “direct” located on bottom of reservoir.
4. Manual drain valve “remote” located outside the rear and front frame.
5. Reservoir: 2146 cu in. (35.2 liters).

NOTICE

If this part of the system develops a leak, identifying this section as containing the leak can be quickly done by using the LINCS II system to isolate the leak location.

Rear Brake Reservoir (Rear Brake Reservoir Service and Park Brakes)

Air passes from the Distribution reservoir, through a check valve (pressure blocked from returning to distribution reservoir) and into the Rear Brake reservoir. The Rear Brake reservoir provides compressed air pressure to operate the rear Park Brake and rear Service Brake. Pressure within this section of the air system is contained by the check valve and is only released by use of the brake system (Service or Park brake application).

Components of the Reservoir, Rear Brake

1. Check valve.
2. 175 psi (12 bar) safety relief.
3. Manual drain valve “direct” located on bottom of reservoir.
4. Manual drain valve “remote” located outside the rear and front frame.
5. Reservoir: 2146 cu in. (35.2 liters).

NOTICE

If this part of the system develops a leak, identifying this section as containing the leak can be quickly done by using the LINCS II system to isolate the leak location.

KLENZ™ Reservoir

Air passes from the Distribution reservoir, through a check valve (pressure blocked from returning to distribution reservoir), through a pressure regulator (90 psi) (6.2 bar), through an orifice and into the KLENZ™ reservoir. The KLENZ™ reservoir provides compressed air pressure to the KLENZ™ system and to the hydraulic reservoir. It is used to provide a burst of air necessary to facilitate the KLENZ™ cleaning action (through the pulse valves) and it is also used to pressurize the hydraulic reservoir. Pressure within this section of the air system is contained by the check valve and is only released by activation of the KLENZ™ pulse valves or pressurization of the hydraulic reservoir.

Components of the Reservoir, KLENZ

1. Check valve.
2. Manual drain valve “direct” located on bottom of reservoir.
3. Manual drain valve “remote” located outside the rear and front frame.
4. Pressure Transducer.
5. Reservoir: 557 cubic inch (9.1 liter).

NOTICE

If this part of the system develops a leak, identifying this section as containing the leak can be quickly done by using the LINCS II system to isolate the leak location.

Air Reservoir Drain Valves

The reservoirs must be drained regularly to prevent moisture buildup in the reservoir and air lines. Each reservoir has two drain valves. Both are connected to a tee on the bottom of the reservoir. One “direct” drain is located at the bottom of each reservoir. The second valve on the tee is located remotely, connected by a hose, on the outside of the front or rear frame. The “remote” drain valves allow for remote drainage of any moisture that might collect in the bottom of the reservoirs. During routine draining if air does not exit the valve, the “direct” valve must be used. If nothing exits the remote valve, the reason must be determined before operating the machine. It is possible for the remote hose to have frozen water during cold weather.

NOTICE

If an unusual amount of oil or moisture contamination is found when draining any reservoir, the air dryer must be inspected and serviced.

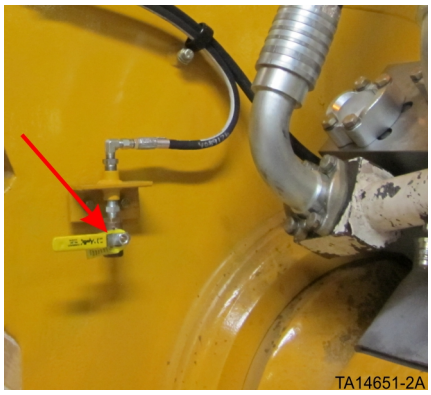
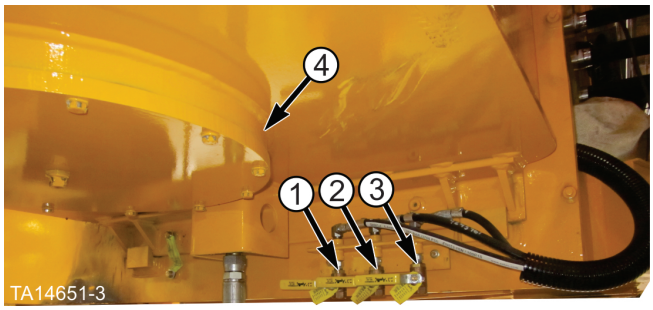
Drain valve remote location: Under hydraulic reservoir

- Rear Brake
- Distribution
- KLENZ™

Front brake drain valve location:

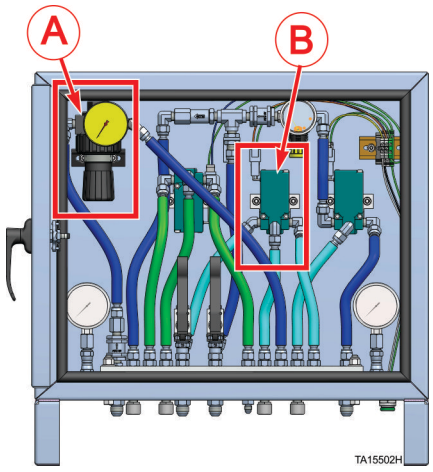
- On the right side of the machine, beside the hoist cylinder ball base on front frame.
- L-1350 early production location: On the left side of the machine, beside the hoist cylinder ball base on front frame, below the frame lock bracket.

Figure 15: Remote air reservoir drain bank (typical installation)

	
Right side of front frameFront Brake remote drain valve	**1.** KLENZ™ Reservoir drain valve. **2.** Rear brake Reservoir drain valve. **3.** Distribution Reservoir drain valve. **4.** Hydraulic Reservoir cover plate.
L-1350 early production location is in same approximate location on left side of front frame	L-1350 early production location is under electrical converter cabinet

KLENZ™ Regulator

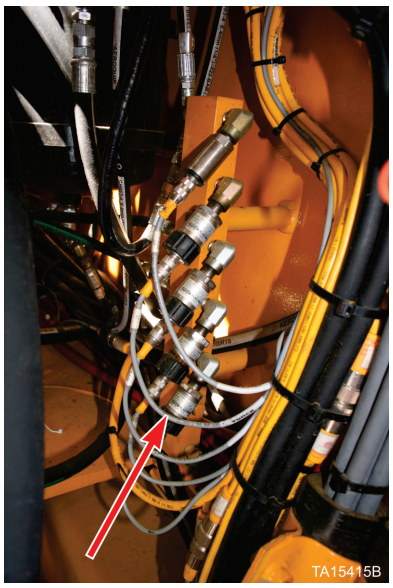
Figure 16: KLENZ™ supply regulator and air supply solenoid

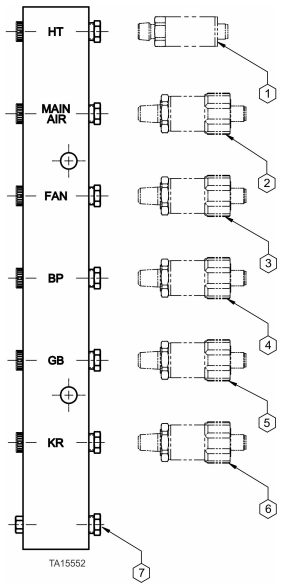
	**A.** KLENZ™ Supply regulator 90 psi (6.21 bar) **B.** KLENZ™ Air supply solenoid KA

Transducers, Typical Locations

A pressure transducer serves as the interface between the onboard monitoring/control system (LINCS II) and the system air pressure in the Distribution Reservoir. It is located on the transducer manifold.

Figure 17: Typical pressure transducer location on transducer manifold





1. Hydraulic reservoir air pressure
2. Distribution reservoir air pressure
3. Radiator fan oil
4. Blower fan pump pressure
5. Gearbox oil pressure
6. KLENZ™ Reservoir air pressure
7. Some models plugged

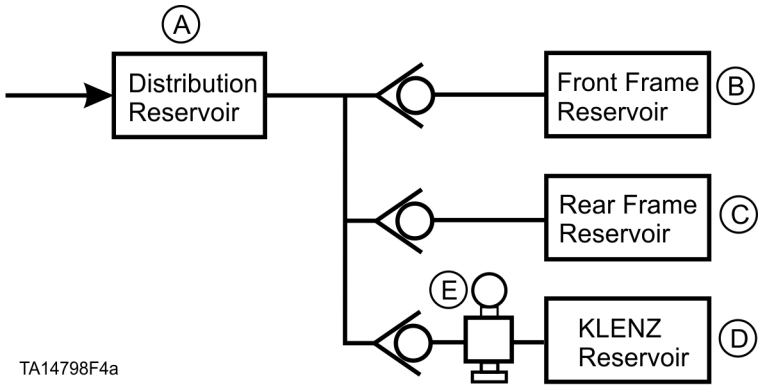
Typically located on left side of rear frame at articulation area between HPD gearbox and high voltage cabinet.

Check Valves, System Separation

Check valves are used to separate the different areas of the system. The Front Brake, Rear Brake and KLENZ™ reservoirs have a check valve between them and the Distribution Reservoir.

Check valves help to isolation each reservoir, making leak detection and location easier.

Figure 18: Check valve location



A) Distribution Reservoir, **B)** Front Frame, **C)** Rear Frame Reservoir, **D)** KLENZ Reservoir, **E)** Regulator

Safety Relief Valves

The Distribution, Front Brake, and Rear Brake reservoirs have a 175 psi (12 bar) safety relief valve that provides protection from building unsafe system pressure. The KLENZ reservoir does not have a relief valve.

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Brakes

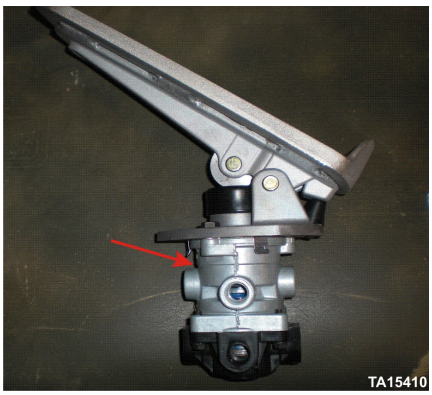
Brake (Treadle) Valve

The service brakes are controlled by a foot operated dual brake valve commonly referred to as a treadle valve. This valve is mounted to the floor of the cab. The function of this valve is related to the pedal movement. The amount of force exerted on the brake actuators is in direct relation to the amount the treadle valve is depressed. This action allows for gradual and controlled stopping of the machine.

Machines are fitted with a Haldex/Midland dual brake valve. It is ported to accept 3/8” NPT fittings. Its approximate weight is 2.8 lbs. (1.27 kg.). Particular note should be made of the rubber stop at the back of the pedal as this should be cut at a 42 degree angle.

The brake treadle includes a dual circuit valve that modulates the application of the service brakes by controlling the delivery of air into the service brake chambers in the brake actuators. There are two service circuits that serve to prevent failure of one circuit from affecting the other circuit. One of these circuits is connected to the front brake quick release valve and the other circuit is connected to the rear brake quick release valve.

Figure 19: Brake treadle valve



Valve is attached to bottom of brake pedal (mounted under the cab floor)

Relay Valve

In the air brake system, the relay valve functions as a relay station to speed up and increase the force of the application and release of the park brakes. This valve is located in close proximity to the brake actuators it serves (valves inside each axle). It controls the park brake functions in response to the signal air sent to it by a solenoid valve. The Solenoid valve is controlled by the console mounted switch inside the operator cab.

The machine is equipped with six BENDIX R-12 valves. They are ported to ½” NPT service ports and ¼” NPT signal ports, and weigh approximately 2.25 lbs. (1.02 kg.) each.

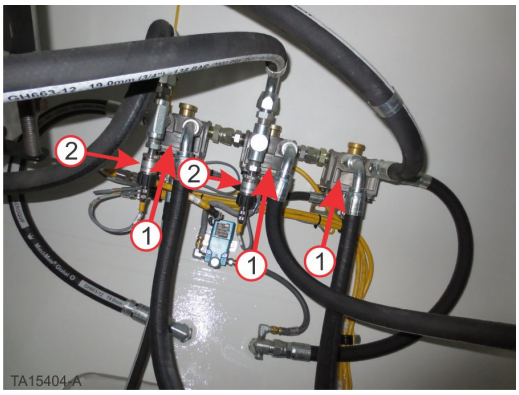
For additional information on this valve, refer to the vendor information.

Quick Release Valve

The Quick Release Valve is a pneumatic-mechanical valve used to speed up the release of air pressure from the service brake chamber in the brake actuator. It controls the service brake functions in response to signal air sent to it by a manually operated brake treadle valve.

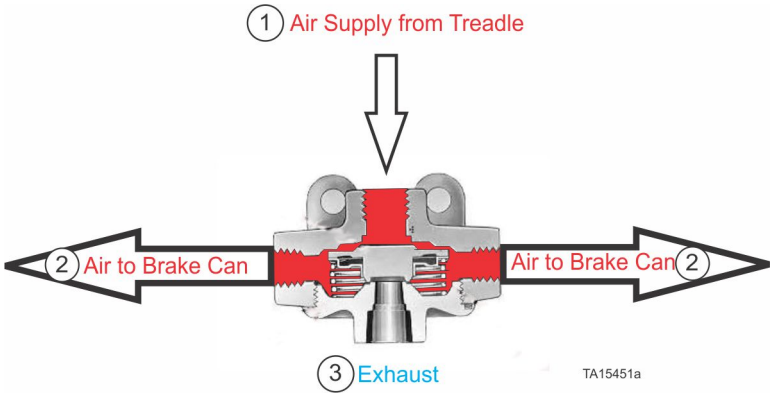
The illustrations below show the internal operation of the valve, once the brake treadle is operated.

Figure 20: Brake relay valve and brake quick release valve



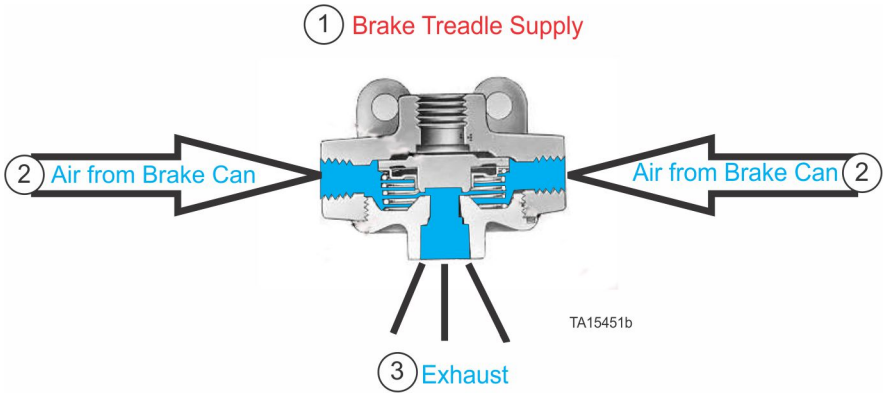
1) Brake relay valve (R12), **2)** Transducers

Figure 21: Brake quick reaction valve (pressurizing brake actuators)



1) Brake treadle supply **2)** Air to brake CAN **3)** Exhaust
Valve is mounted in front and rear axles

Figure 22: Brake quick reaction valve (pressure releasing from actuators)



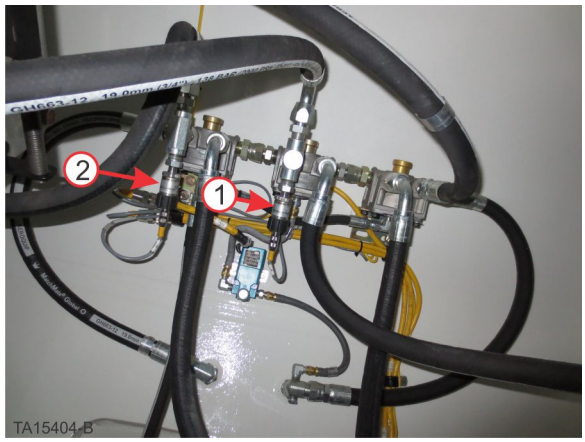
1) Brake treadle supply, **2)** Air from brake CAN, **3)** Exhaust
Valve is mounted in front and rear axles

For more information about this valve, refer to vendor literature.

Transducers, Brake Air Pressure

The onboard monitoring/control system (LINCS II) uses two sets of transducers to monitor the brake system air pressure in the front and rear axles. One set is for the park brake and is actively monitored when the park brake solenoid switch is active. The second set is the service brake and monitors for correct service brake air pressure. An alarm is issued and/or inhibit is active if one or both are out of range.

Figure 23: Park and service brake transducers



1) Park brake transducer, **2)** Service brake transducer

Park Brake Solenoid Valve

The park brake section of the brake system is controlled by a 24 VDC 3-way valve. When it receives an electrical 24 VDC signal from the park brake switch, this valve sends signal air pressure to the park brake R-12 relay valve to activate the park brake.

This valve is a Lincoln/MAC 3-way, solenoid operated, normally closed valve. It is ported to accommodate ¼" NPT fittings.

For additional information on this valve, refer to the vendor information.

Figure 24: Park brake solenoid

L1350/L1850/L2350

Actuator, Brakes

The brake actuator is a dual chamber device that allows for application and release of the park or emergency brake and the operation of a service brake during machine operation.

The release of the park brake is accomplished by air pressure working against a piston to compress a spring in the park brake section of the brake actuator causing the brakes to mechanically release. When applying the park brake, air pressure is vented from this chamber and the spring pressure is allowed to mechanically apply the brakes.

During machine operation the park brake is held and then released by air pressure in the park brake spring chamber. Service brakes are applied by supplying air pressure from the treadle valve to the service brake chamber which works against the service brake piston and mechanically applies the brakes.

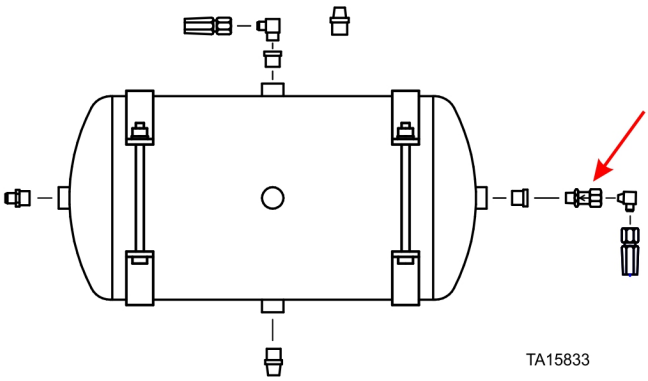
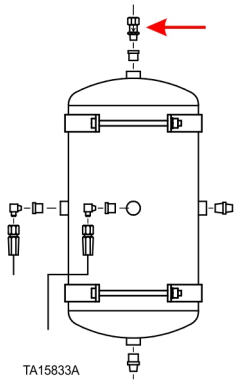
For additional information on these brake actuators refer to the vendor information and to the section of the Service Manual named "BRAKES".

Figure 25: Brake actuator

Check Valves, Reservoir Separation

The Front Brake and Rear Brake reservoirs have a check valve between them and the Distribution Reservoir and are typically located on one end of the respective brake reservoir. The valves are used to separate the different areas of the system which isolates each reservoir, making leak detection and location easier.

Figure 26: Brake reservoir check valve

	
L1350 rear brake reservoir (orientated horizontally)	L-1850/2350 rear brake reservoir L-1350/1850/2350 front brake reservoir)

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Air Cleanout Hose

Air passes directly from the distribution reservoir to the cleanout hose. The cleanout hose is used to clean the inside of the cab. It has a manual valve (no solenoid) and is located beside the operator seat.

Figure 27: Air cleanout hose location

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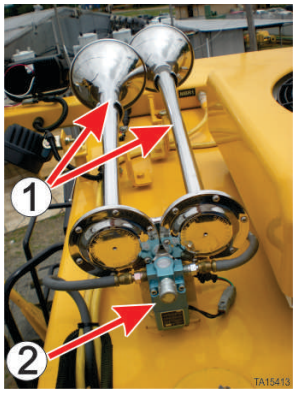
Air Horn

Air passes from the distribution reservoir to the air horn (activated by Solenoid AH). The horn and solenoid are located on top of the cab.

Figure 28: Air horn

	**1.** Horn(s) **2.** Horn solenoid (AH)

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KLENZ™ System Components

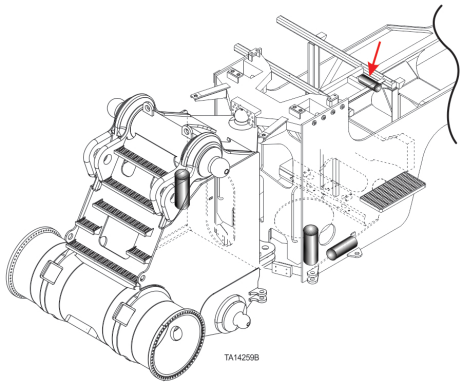
Air is provided to the 557 cu. in. (9.1 liter) KLENZ™ reservoir through a check valve, an air regulator that is set at 90 psi (6.2 bar), and a .062” (1.57mm) orifice. The check valve isolates the KLENZ™ reservoir from the rest of the system. A mechanical drain valve is used to remove moisture from the reservoir and a pressure transducer monitors the pressure in the reservoir.

Reservoir, KLENZ™

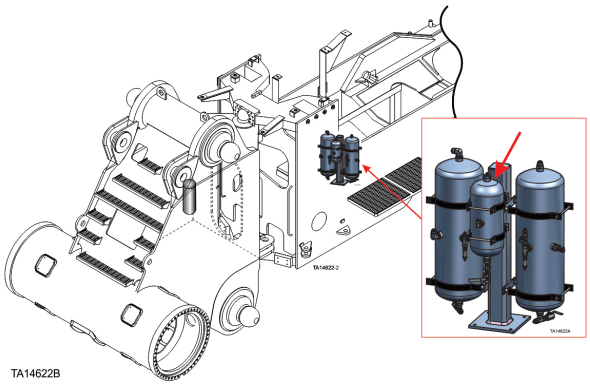
Air passes from the Distribution reservoir into the KLENZ™ reservoir. A burst of air necessary to facilitate the KLENZ™ cleaning action is provided through the KLENZ™ then into the KLENZ™ manifold. The reservoir provides a metered volume of air to the KLENZ™ manifold.

Physical location

Figure 29: KLENZ™ Reservoir typical



L-1350



L-1850/2350

Transducer, KLENZ™

The onboard monitoring/control system (LINCS II) uses a transducer to monitor the air pressure in this section of the air system and provide a warning or alarm when there is a leak detected or malfunction has occurred.

Figure 30: KLENZ™ reservoir transducer

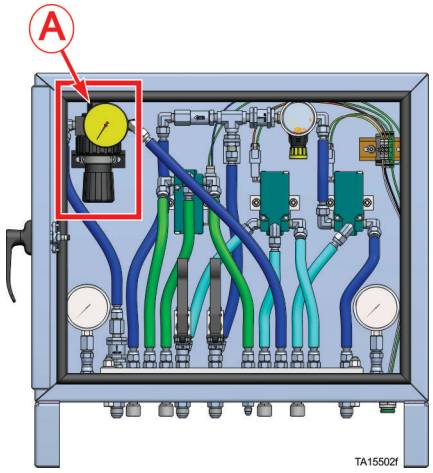
Regulator, KLENZ™

The regulator is used to control the pressure entering the KLENZ™ reservoir.

The air regulator is used to drop system air pressure [135 psi (9.3 bar) to 90 psi (6.2 bar)] and maintains this reservoir at that pressure. The machines are fitted with an “IR ARO” regulator. This regulator is designed to operate with a maximum inlet pressure of 200 psi (13.7 bar). With ½” porting it can pass 150 cfm (4.24 cubic meters) of air.

Physical location: Inside the Air Box.

Figure 31: KLENZ™ Reservoir regulator



A). KLENZ™ Supply regulator 90 psi

Orifices

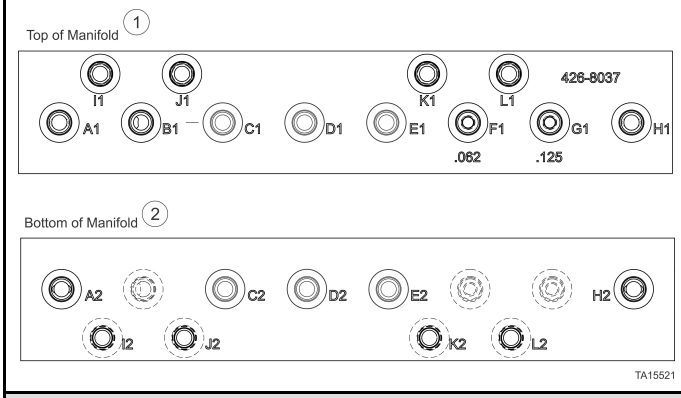
Air passes through a .062” (1.57 mm) orifice prior to entering the KLENZ™ reservoir. This orifice is located in the manifold inside the “Air Box”. It controls the rate at which the KLENZ™ reservoir is refilled after a cleaning pulse of the KLENZ™ system; preventing a significant pressure drop in the air system.

Air is supplied to the KLENZ™ manifold from the KLENZ™ reservoir through a .125” (3.175 mm) orifice and a solenoid valve. The .125” (3.175 mm) orifice is installed in the manifold inside the “Air Box” and meters the flow of air that replenishes the air in the KLENZ™ manifold after a cleaning pulse.

NOTICE

Due to the (orifice) fill rate, the KLENZ™ timing should not be set below 45 seconds between pulses.

Figure 32: Location of inlet and outlet orifices in the “air box”



1. Top of manifold

2. Bottom of manifold

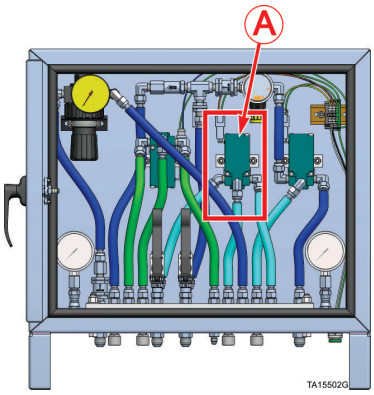
Port Identification			
A1	To KLENZ™ regulator	A2	From distribution reservoir
B1	To hyd reservoir air dump SOL TD (inlet)		
C1	from KLENZ™ air supply SOL KA	C2	to KLENZ™
D1	from hyd reservoir air supply regulator	D2	to hyd resevoir
E1	from hyd reservoir air dump SOL TD	E2	to automatic pump valve
F1	from KLENZ™ regulator .062” (1.57mm) orifice	-	
G1	to KLENZ™ air supply .125” (3.17mm) orifice	-	
H1	to hyd reservoir air supply SOL HA	H2	to/from KLENZ™ reservoir
I1	from relief valve	I2	to breather vent
J1	from hyd reservoir air pump SOL TD return	J2	to breather vent
K1	from KLENZ™ air supply SOL KA return	K2	to breather vent
L1	from hyd reservoir air supply SOL HA	L2	to breather vent
M1	air gauge	-	
N1	air gauge	-	

Solenoid Valve, KLENZ™

During the LINCS system boot up process (machine key switch is “ON”), the KLENZ™ solenoid energizes, allowing air to flow into the KLENZ™ manifold. This 3-way valve is controlled by a 24 VDC. This valve is a Lincoln/MAC 3-way, solenoid operated, normally closed valve. It is ported to accommodate ¼” NPT fittings.

For additional information on this valve, refer to the vendor information.

Figure 33: Solenoid valve



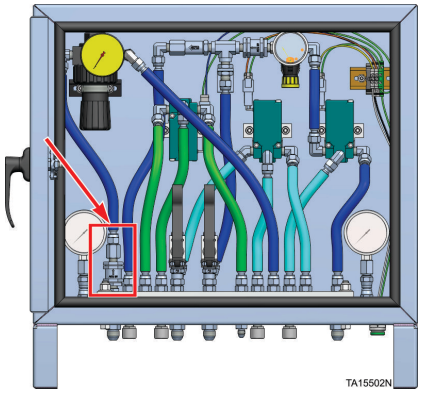
A). KLENZ™ Air supply solenoid KA

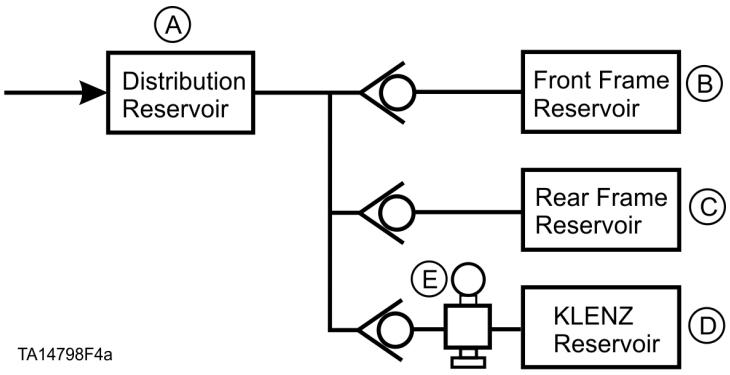
Check Valve, KLENZ™

The check valve isolates the system from the distribution system, making it easier to isolate leak locations by using the LINC II system.

Physical location: Inside the Air Box.

Figure 34: Check valve location and simplified schematic





A) Distribution Reservoir, **B)** Front Frame, **C)** Rear Frame Reservoir, **D)** KLENZ Reservoir, **E)** Regulator

KLENZ™ Unit (Box)

Air passes from the KLENZ™ reservoir to the KLENZ™ cleaning system (activated by solenoid).

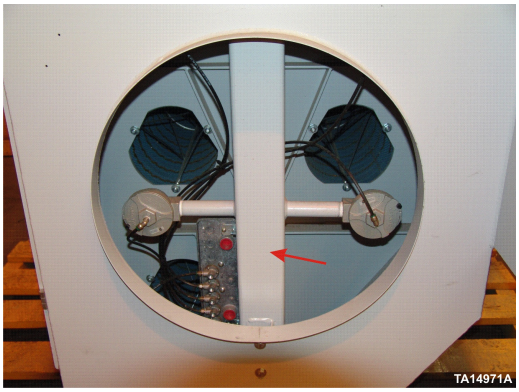
- Consists of self-cleaning filters.
- At High Throttle, a single filter receives a burst of air once every minute, (typical setting).
- At Low Throttle, a single filter receives a burst of air once every 240 seconds. (typical setting).
- There are five to seven filter banks (depending on machine type) in the unit.
- Requires five to seven minutes for a series of runs (at high throttle).

Figure 35: Typical KLENZ™ unit (box)

Manifold, KLENZ

The KLENZ™ manifold is located inside the KLENZ™ unit (box). This device provides a volume of air for the pulse valves. It can be configured to accommodate five to seven valves; depending on machine filter demand.

Figure 36: Typical KLENZ™ manifold



Pilot Signal Solenoid Valves

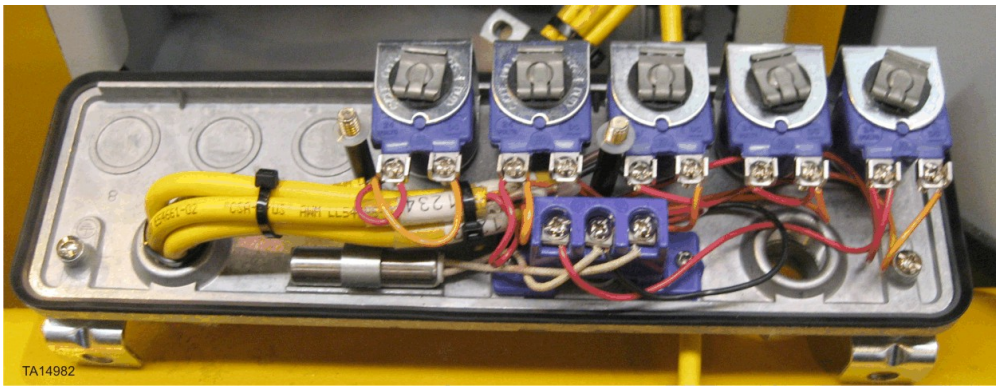
The pilot signal solenoid valve is the remote device used to actuate the diaphragm pulse valve. The solenoid valve is mounted in the solenoid enclosure and connected to the diaphragm valve by means of capillary tubing. When the solenoid valve coil receives a 24 VDC signal it opens the valve poppet and releases the air pressure in the capillary tubing connected to one side of the diaphragm valve.

NOTICE

The structure must be orientated so the solenoid valve poppets operate in a vertical position.

For more information on the KLENZ™ system refer to the cooling air system section.

Figure 37: Typical KLENZ™ pilot signal solenoid valves



L-1350 GEN2 (6 valves)

L-1850 (7 valves)

L-2350 (7 valves)

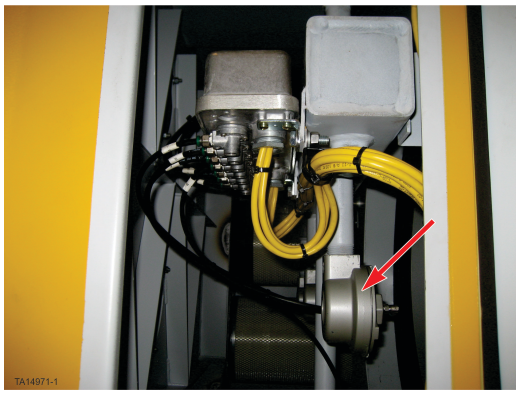
Only 5 valves shown

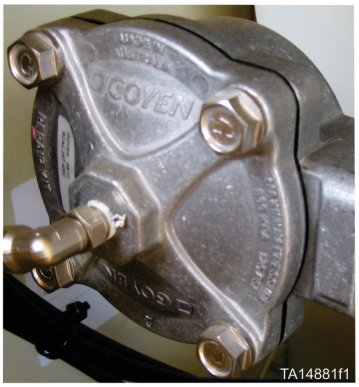
Diaphragm Pulse Valve

Each KLENZ™ diaphragm pulse valve causes an acoustic wave that performs the cleaning cycle of a single primary air filtration element. The pulse valve accomplishes this by releasing compressed air in a rapid pulse and directing it inside a filter. The valve has an internal diaphragm that has a small volume of compressed air (signal air) on one side and a much larger volume (partial volume of the manifold) of compressed air on the other side. The compressed air pressure on both sides of the diaphragm is of equal PSI because of a connected internal passage with an orifice. A spring inside the valve holds the diaphragm closed (seated) until the signal air, on one side of the diaphragm, is rapidly released to atmosphere (by pilot signal solenoid valve). Releasing the signal air causes a pressure differential on one side of the diaphragm. This causes the diaphragm to unseat rapidly, releasing the larger volume of air (from the manifold side) which causes an acoustic cleaning wave inside each filter.

KLENZ™ systems are equipped with rounded housing diaphragm pulse valves. This valve housing is made of die cast aluminum; the inlet and outlet ports are machine0d to 1” NPT. The signal port is ¼” NPT.

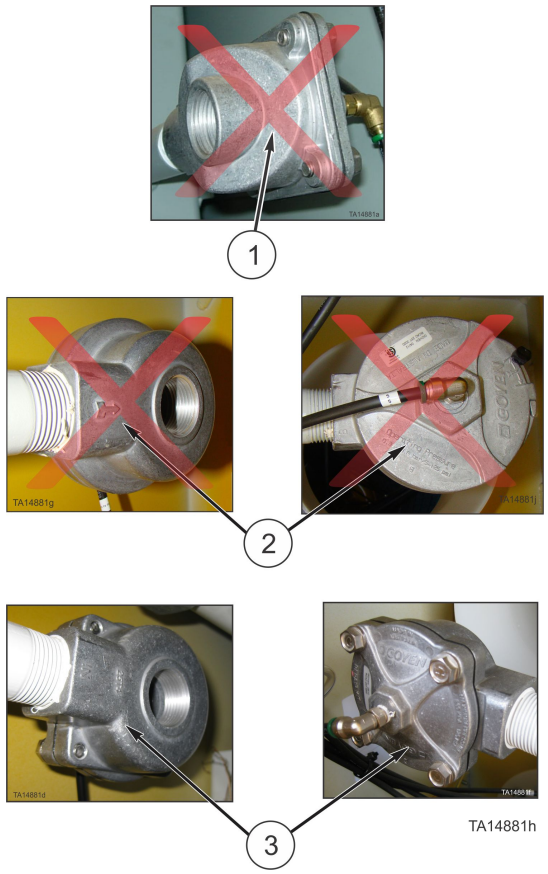
Figure 38: Current production diaphragm pulse valve





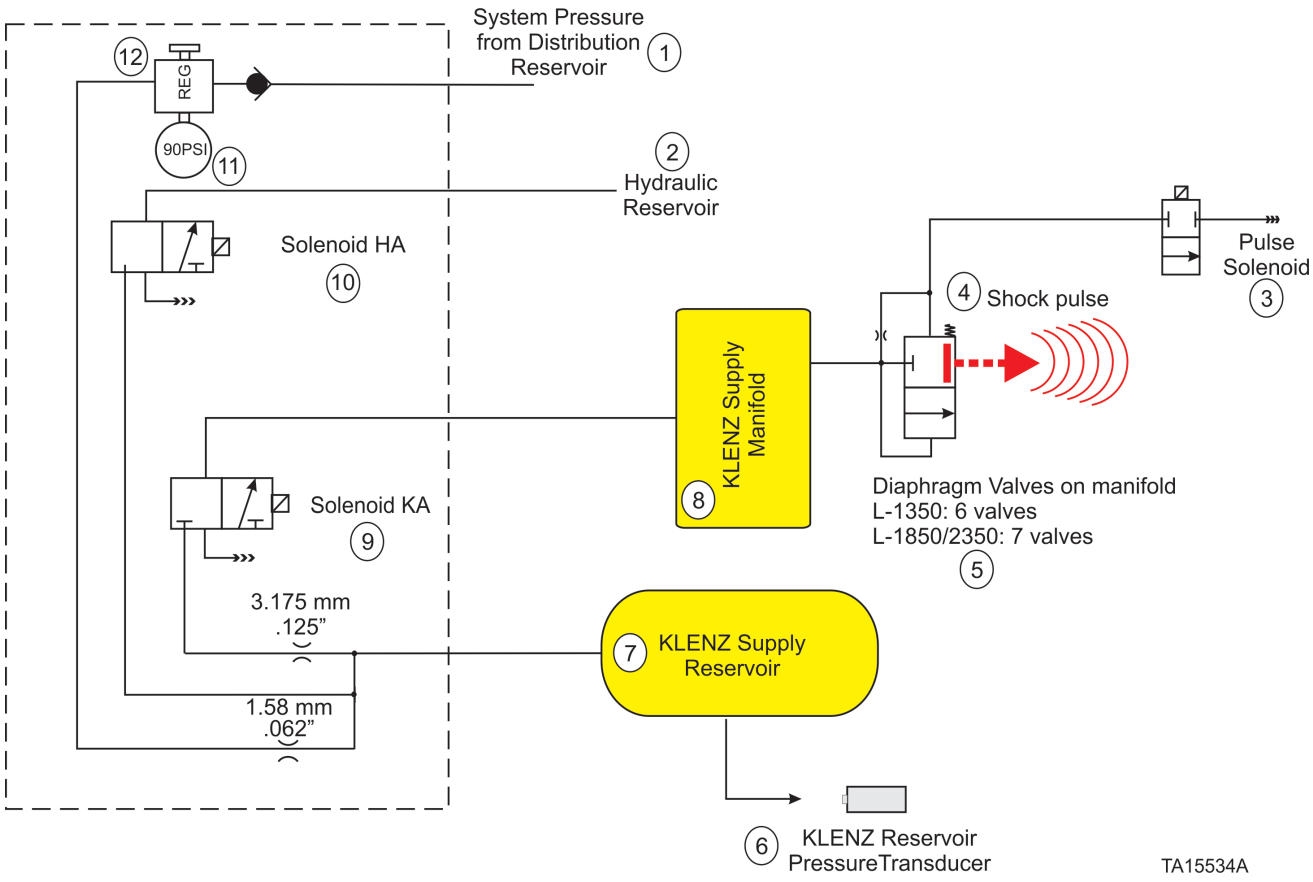
The original design of the pulse valve is no longer used on current production machines, however, the function and basic operation of the valve remains the same. The pulse valve assemblies are interchangeable and can be replaced individually in any air cleaner system. The rebuild kits provided in the Parts Manual are not interchangeable between designs.

Figure 39: Figure 39. Diaphragm pulse valve



1) Old style pulse valve, **2)** Old style pulse valve **3)** Current style pulse valve

Figure 40: KLENZ™ Pulse valve circuit



1. System pressure from distribution reservoir

2. Hydraulic reservoir

3. Pulse solenoid

4. Shock pulse

5. Diaphragm valves on manifold (L-1350 (GEN2) 6 valves) (L-1850/2350: 7 valves)

6. KLENZ™ Reservoir pressure transducer

7. KLENZ™ Supply reservoir

8. KLENZ™ Supply manifold

9. Solenoid KA

10. Solenoid HA

11. 90 psi

12. Regulator

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Hydraulic Reservoir

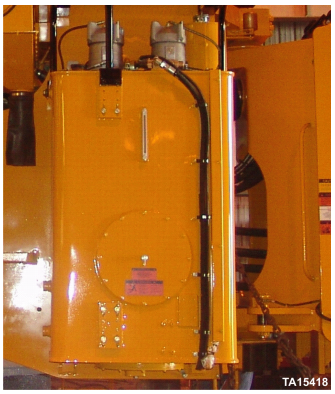
⚠ WARNING

Skin injection hazard exists when around diesel fuel, hydraulic fluid, or grease that is under pressure. Fluids under pressure can penetrate the skin and cause serious personal injury, blindness, or death. If any fluid is injected into the skin, it must be removed as soon as possible by a doctor familiar with treating this type of injury. Fluid leaks under pressure may not be visible. When searching for leaks, NEVER use your hand; use a piece of metal. Wear work gloves and keep your hand well away from the possible source of leakage. DO NOT tighten or loosen fuel, hydraulic, or grease lines without first relieving the pressure. Wear safety goggles for eye protection and wear all other locally required personal protective equipment (PPE) when working around possibly pressurized liquids. Failure to use proper PPE can cause a skin injection hazard resulting in serious injury or death.

The hydraulic reservoir is pressurized to reduce the possibility of hydraulic pump cavitation. This pressurization is provided by air from the KLENZ™ reservoir that is passed through a solenoid valve and an air regulator.

- Physical location: On the right-hand side of the machine below the cab.

Figure 41: Hydraulic reservoir (ladder not shown)



Air Regulator

The air that is supplied from the KLENZ™ reservoir passes through a regulator that drops the pressure from 90 psi (6.2 bar) to 4 to 6 psi (0.41 0.55 bar).

The lower operating range of the Parker regulator makes it easier to achieve the lower pressure required for this system.

For more information on this regulator refer to the vendor information.

- Current Production physical location: inside the Air Box

Solenoid Valve

Air passes from the KLENZ™ reservoir through the hydraulic reservoir control solenoid valve. During LINCS II boot-up (the machine's key switch is ON), the hydraulic reservoir control solenoid valve is energized allowing air to flow into the hydraulic reservoir. This 3-way valve is controlled by 24 VDC. This valve is a LINCOLN/MAC 3-way, solenoid operated, normally closed valve. It is ported to accommodate ¼" NPT fittings.

- Current Production physical location: inside the Air Box.

Pressure Gauge

The Pressure Gauge is used to visually verify regulator pressure when manually setting air pressure in hydraulic reservoir.

- Physical location: Located inside the air box (mounted above the Low Voltage Control Cabinet (LVCC).

NOTICE

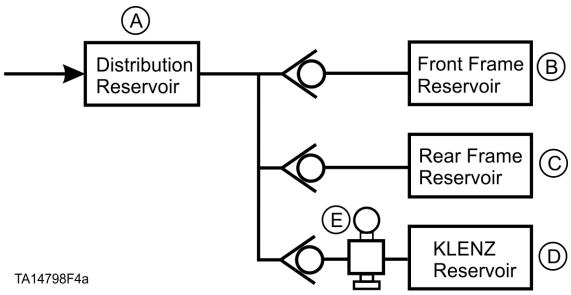
Always set the pressure by using the LINCS screen. The gauge is for reference only.

Check Valve, Hydraulic Reservoir

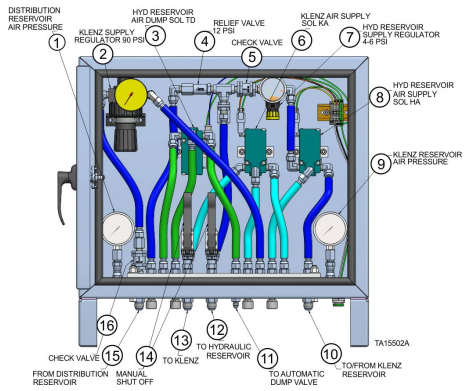
The Hydraulic Reservoir check valve blocks air from being forced into the air regulator and allows easier diagnosing of air leaks in the hydraulic reservoir system.

- Physical location: inside the Air Box.

Figure 42: Air box component layout



A) Distribution Reservoir, **B)** Front Frame Reservoir, **C)** Rear Frame Reservoir, **D)** KLENZ Reservoir, **E)** Regulator



1. Distribution reservoir air pressure
2. KLENZ™ Supply regulator 90 psi
3. Hydraulic reservoir air dump solenoid TD
4. Relief valve 12 psi
5. Check valve
6. KLENZ™ Air supply solenoid KA
7. Hydraulic reservoir supply regulator 4-6 psi
8. Hydraulic reservoir air supply solenoid HA
9. KLENZ™ Reservoir air pressure
10. To/From KLENZ™ Reservoir
11. To automatic dump valve
12. To hydraulic reservoir
13. To KLENZ™
14. Manual shut off
15. From distribution reservoir
16. Check valve

Relief Valve 12 psi (0.83 bar)

The operation of the lift arms causes the hydraulic fluid level to rise and fall in the hydraulic reservoir. Rising fluid level causes air pressure to increase in this system. To control this increase in pressure there is a relief valve installed on the outlet of the regulator.

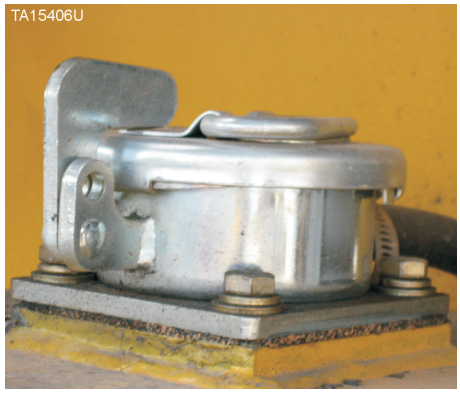
- Physical location: Located inside the air box (mounted above the Low Voltage Control Cabinet (LVCC).

Pressure Relief Cap

The hydraulic reservoir is fitted with a surge reservoir to accommodate a surge of fluid in the reservoir during the operation of the hydraulic system. This surge reservoir is equipped with a safety relief cap. This is to limit the maximum air pressure of the hydraulic reservoir.

- Physical location: Located on top of the surge reservoir.

Figure 43: Pressure relief cap



NOTICE

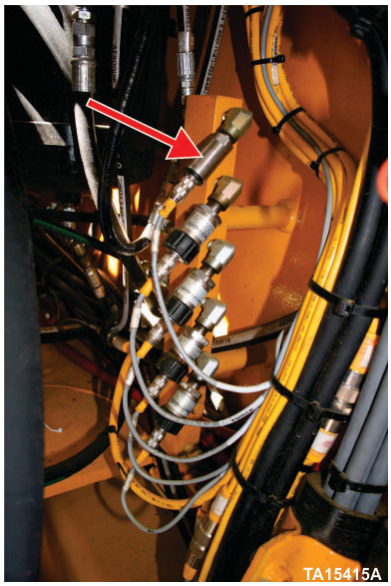
After opening the hydraulic system for service or repair or draining and refilling the hydraulic reservoir, the hydraulic pumps must be bled to remove air. Refer to the manual Section "HYDRAULIC & GREASE SYSTEMS" for information on bleeding the hydraulic system.

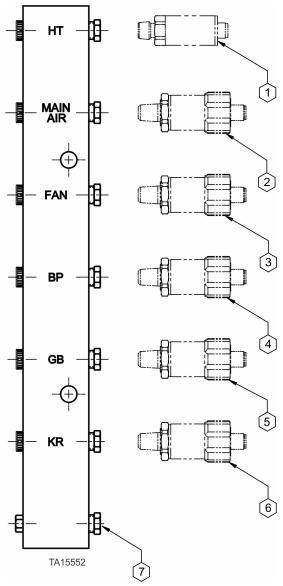
Transducer

This is where the onboard monitoring/control system (LINCS II) interfaces with the hydraulic reservoir air pressure. It is located on the transducer manifold. This is a 0 to 15 psi (0-1 bar) transducer.

Physical location: Typically located on left side of rear frame at articulation area between HPD gearbox and electrical converter cabinet

Figure 44: Hydraulic reservoir transducer mounted in manifold





1. Hydraulic reservoir air pressure
2. Distribution reservoir air pressure
3. Radiator fan oil
4. Blower fan pump pressure
5. Gearbox oil pressure
6. KLENZ™ Reservoir air pressure
7. Some models plugged

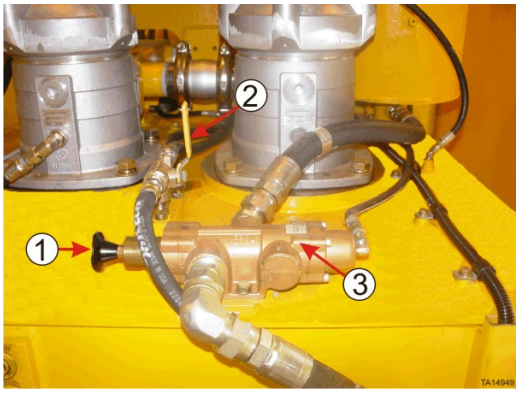
Typically located on left side of rear frame at articulation area between HPD gearbox and electrical converter cabinet.

Automatic Air Release Valve

Hydraulic reservoir air pressure is automatically released when an emergency stop or fire suppression system is activated. Either action energizes a solenoid valve (TD) that sends a pilot signal to the “Versa” automatic release valve which releases the air pressure from the hydraulic reservoir. Once activated, the “Versa” valve must be manually reset by pushing the button plunger to the CLOSED position.

- Physical location: on top of the hydraulic reservoir.

Figure 45: Automatic hydraulic air dump valve



1. Reset button on automatic air release valve
2. Manual 3-way relief valve
3. Automatic air release valve

Manual 3-Way Relief Valve

The air enters the hydraulic reservoir through a manual 3-way valve. This valve is located on the top of the hydraulic reservoir and is used to manually release the air pressure when working on the hydraulic system.

Before servicing or repairing any part of the hydraulic system, release the air pressure in the hydraulic reservoir and hydraulic pressure in the hydraulic system.

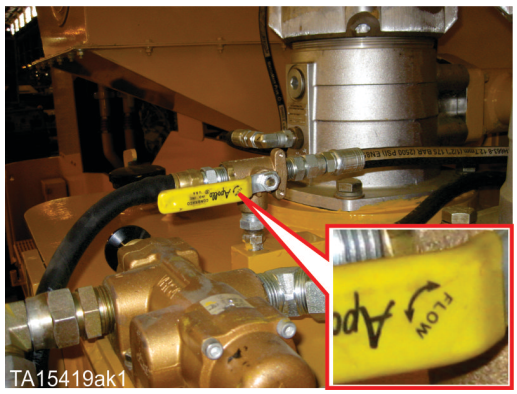
To release the air pressure from the hydraulic reservoir, move the manual air release valve lever to the open position (lever in the up position). The air pressure in the hydraulic reservoir will be released, and at the same time the valve will lock in the air pressure in the rest of the air system.

- Physical location: On top of the hydraulic reservoir.

⚠ WARNING

Crush hazards exist if releasing air from the hydraulic system without releasing hydraulic pressure. Releasing air pressure from the hydraulic system does NOT relieve hydraulic pressure from the hydraulic system. Use caution when working around components that are actuated by the hydraulic system. Use the hydraulic bleed valve assembly to relieve hydraulic pressure from the hoist and bucket circuit prior to working on components actuated by hydraulic pressure. Components actuated by hydraulic pressure can move if hydraulic connections are loosened while containing hydraulic pressure. Refer to the manual Section "HYDRAULIC & GREASE SYSTEMS" for information on relieving the hydraulic pressure in the hydraulic system. Failure to use the hydraulic bleed valve assembly to relieve hydraulic pressure from the hoist and bucket circuit prior to working on components actuated by hydraulic pressure can cause crush hazards resulting in serious injury or death.

Figure 46: Hydraulic reservoir air release valves



NOTICE

There is a small "arc arrow" on the handle of the valve that shows the air path direction when the handle is moved in either position.

Valve position shows Reservoir pressurized.

After servicing, repairing, or inspecting the hydraulic oil reservoir, make certain to move the air release valve handle to the CLOSED position to allow the reservoir to pressurize.

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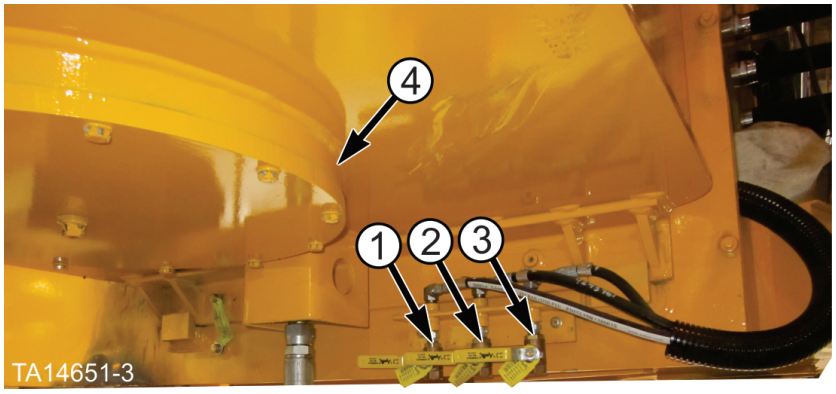
Post Service Pre-Start Pressurization, Compressed Air

If air pressure was bled to “0” psi/bar for maintenance or repair of the compressed air system, pressure can be applied prior to start-up by attaching shop air to a quick connect fitting on the Air Reservoir Remote Drain Kit, located.

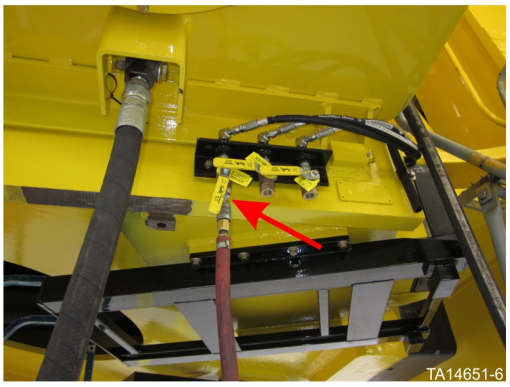
- Early production physical location: L-1350 early production location is under electrical converter cabinet
- Current production physical location: below the hydraulic reservoir

Figure 47: Remote air reservoir drain bank (typical installation)



1) KLENZ™ Reservoir drain valve, **2)** Rear brake Reservoir drain valve, **3)** Distribution Reservoir drain valve, **4)** Hydraulic Reservoir cover plate.

Figure 48: Air hose connected to remote drain kit to charge the air system



⚠ WARNING

Explosion hazard exists when manually pressurizing the air system. Do not allow the air pressure to exceed operating pressure of the system. Reservoirs in the system have relief valves, but can be overcome by applying too much pressure too fast. Do not overpressure the air system. Failure to control air pressure during manual pressurization can cause explosion hazards resulting in serious injury or death.

NOTICE

A quick connect fitting can be installed in the Distribution Reservoir ball valve. The quick connect fitting is not furnished with the machine.

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