TRAILER, CARGO, MEDIUM, MC3, HAULMARK, 2-AXLE DOG

TECHNICAL DESCRIPTION

This instruction is authorised for use by command of the Chief of Army. It provides direction, mandatory controls and procedures for the operation, maintenance and support of equipment. Personnel are to carry out any action required by this instruction in accordance with EMEI General A 001.

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INTRODUCTION

1. This EMEI contains the technical description for the Trailer, Cargo, Medium, MC3, Haulmark, 2-Axle Dog. The trailer is designed for the transportation of containerised and palletised loads, medium shelters and general stores. It is generally towed behind the Mercedes Benz Unimog. However, it may be towed by any other suitable towing vehicle. All weights, dimensions and performance figures are detailed in the Data Summary (Ref EMEI Vehicle H 620).

GENERAL INFORMATION

Axles

2. The two axles are a single, tubular beam type manufactured by Dana Spicer and are fitted with 420 x 180 mm internal expanding shoe type brakes. The axles are fitted with 20 inch flange type disc wheel hubs.

Brakes

3. The brake system consists of wheel foundation brake sets manufactured by Dana Spicer and a compressed air and spring actuating system supplied by Westinghouse or Air Brake Corporation, dependent on the model number.

Suspension

4. A leaf spring suspension system is fitted, with the springs fixed to the axle assemblies by steel U-bolts and located by cast steel spring seats welded to the axle assembly.

Electrical

5. The electrical system is a basic 24-volt dc electrical lighting system coupled to the towing vehicle by a 12-pin NATO plug. All lighting connected to the electrical system is 24-volt, with the exception of the blackout lighting, which are 12-volt dc electronic modules.

Frame

6. The trailer frame is of steel construction and consists of a trailer main frame and a dolly frame. The main frame and the dolly frame are connected by means of a ballrace which allows steering of the front axle assembly. The dolly and the main frame cannot be separated as part of normal operation.

Wheels

7. The wheels are a 8.25 x 22.5 in, single piece, pressed steel, tubeless type fitted with 11/70R 22.5 x 16 ply rating tyres.

DETAILED DESCRIPTION

AXLE ASSEMBLIES

8. The single beam axles are connected to the frame via hangers and the leaf springs. The ends of the axles are machined to accept two tapered roller bearings to mount the wheel hubs.

BRAKES

System Overview

9. The brake air system is a twin line type with a spring and a service brake chamber provided for each wheel and is designed to comply with ADR 38/02. The system consists of the following components.

a. Brake Relay Valve. A Bendix R-12 service brake relay valve increases the speed of application of the brakes by delivering air from the local reservoir (the air does not have to travel from the towing vehicle) to the service brake chambers to apply the brakes. The valve also vents the chambers to release the brakes when the control signal is reduced. The brake relay valve functions in direct response to air pressure applied at its control port by the pilot relay valve.

b. **Pressure Proportioning Valve.** The pressure proportioning valve is a variant of the Bendix Westinghouse LQ-2 series of valves, and has an 'inshot spring' fitted above the piston to provide a variable braking ratio between the front and rear brakes. The purpose of this valve is to prevent brake lock-up on the rear axle.

c. **Spring Brake Control Valve.** The spring brakes are controlled by an SR3 or ABV3802 spring brake control valve.

WARNING

The ABV3802 must never be replaced by any other valve as ADR compliance of the trailer will be invalidated.

NOTE

The ABV3802 spring brake control valve is a redesigned version of the SR3 valve used on early models modified to meet ADR requirements. Whilst it is virtually identical in appearance to the SR3 valve, it can be distinguished by the following features:

(1) An identification label around the top cover.

(2) The flat end of the brass pressure protection valve piston visible in the end of the tank mounting nipple.

(3) The pressure protection check valve 'B' built into the new mounting nipple assembly prevents the release of the trailer spring brakes until air reservoir pressure exceeds 450 kPa.

d. This valve has the following functions:

(1) **System Charging.** During normal operation it prevents the passage of compressed air to the spring brakes until the required air pressure (approximately 380 kPa in the SR-3 valve and 450 kPa in the ABV3082 valve) is obtained in the supply line. This ensures that the prime mover has the minimum required air pressure before replenishing the brake reservoir or releasing the spring brakes.

(2) **Parking Brake Applied.** When the towing vehicle parking control valve is activated, air pressure is exhausted from the trailer supply line and the spring brake control valve to exhaust all air from the spring brake chambers. Internal spring pressure causes the brakes to be applied.

(3) **Loss of Air Pressure.** If air pressure is lost from the air reservoir whilst the spring brakes are released, the spring brake control valve retains a pressure of approximately 354 - 415 kPa in the supply line to allow the trailer to be moved to a safe location for parking. Once the air pressure in the supply line has been exhausted, the spring brakes will not release until the system fault has been rectified and air pressure restored to the reservoir.

e. **Yard Release Valve.** A yard release valve allows the brakes to be released using air from the reservoirs for ease of movement within a safe area only.

f. **Couplings.** Glad hand type couplings are provided for easy connection between the dolly and the towing vehicle.

g. **Brake Air Reservoir.** A 60 litre air reservoir provides the air required for the application of the brakes. The air reservoir is fitted with a condensation drain valve.

h. Brake Chambers. Each wheel brake is actuated by a brake cylinder which has both spring brake and service brake chambers.

(1) Spring Brake Chamber

WARNING

Early build trailers up to Serial No. 10228 are fitted with 3030 Spring Brake Chambers. Late build trailers from Serial No. 12371 are fitted with 2430 Spring Brake Chambers. Under no circumstances are Spring Brake Chambers to be cross-fitted.

The spring brake chamber provides parking and emergency braking under the direct control of the spring brake control valve. The spring brakes can also be held off mechanically by means of a release bolt to aid in maintenance and recovery.

(2) Service Brake Chamber. The service brake chamber applies the brakes when pressurised by the brake relay valve.

10. Foundation Brakes. The foundation brakes are a 420 mm diameter, 180 mm wide, internal expanding, twin-shoe type. The two brake shoes are each mounted on individual non-adjustable anchor pins, which allow the brake shoes to pivot under the influence of an S-cam. The S-cam is fitted with an adjustable slack adjuster to allow a simple means of brake adjustment.

Brake Relay Valve

11. The brake relay valve controls the service brakes, using air supplied from the local brake reservoir and operates as described below, dependent on the control signal applied.

12. Application. Air pressure delivered to the control port (Figure 1) enters the small cavity above the piston and moves the piston down. The exhaust seat moves down with the piston and seats on the inner or exhaust portion of the inlet/exhaust valve sealing off the exhaust passage. At the same time the outer or inlet portion of the inlet/exhaust valve moves off its seat, permitting supply air to flow from the reservoir past the open inlet valve and into the chambers.

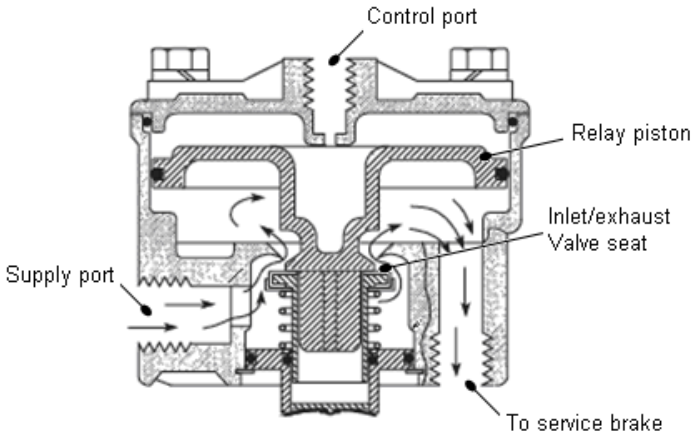


Figure 1 Brake Relay Valve – Brake Application

13. Balancing. The air pressure being delivered by the open inlet valve also acts on the bottom area of the relay piston. When air pressure beneath the piston balances with the service air pressure above the piston it lifts slightly and the inlet spring returns the inlet valve to its seat (Figure 2). The exhaust remains closed as the service line pressure balances the delivery pressure. As air pressure is changed, the valve reacts instantly to the change holding the brake application at the desired level.

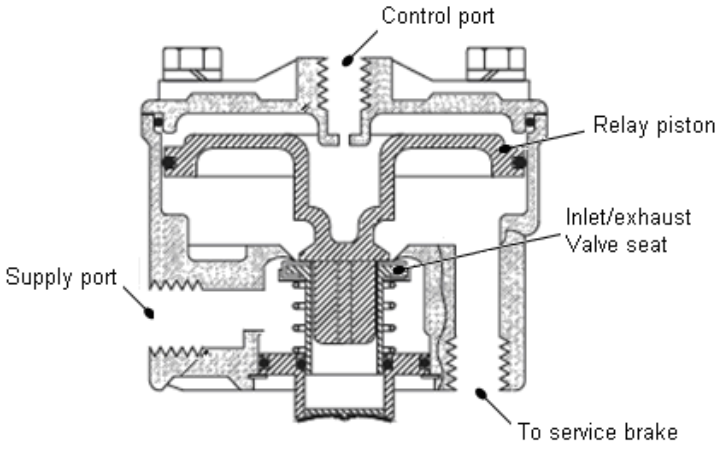


Figure 2 Brake Relay Valve – Balanced Position

14. Releasing. When the pressure at the control port reduces, the pressure in the cavity above the relay piston is also reduced. The air pressure beneath the piston lifts the relay piston and the exhaust valve moves away from its seat opening the exhaust passage (Figure 3). With the exhaust passage open, the air pressure in the brake chambers exhausts through the exhaust port releasing the brakes.

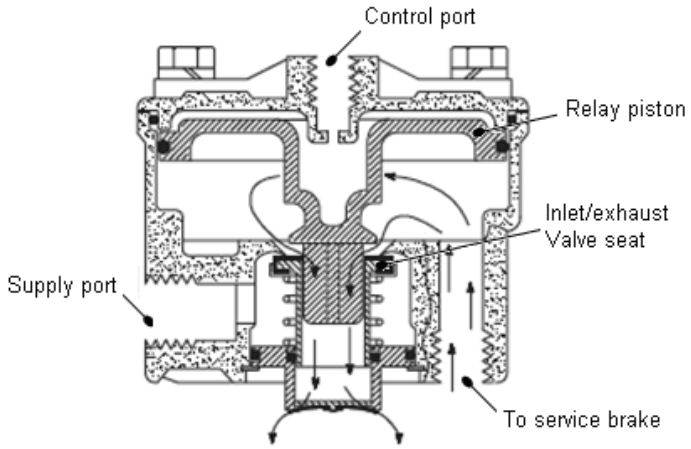


Figure 3 Brake Relay Valve – Releasing

Pressure Proportioning Valve

15. The function of the pressure proportioning valve is to prevent brake lock-up on the rear axle. The valve functions as described below.

16. Applying. Air enters through the inlet port of the proportioning valve (Figure 4) and passes through the open inlet valve to the discharge ports. Air is then directed to the brake relay valve, applying the brakes.

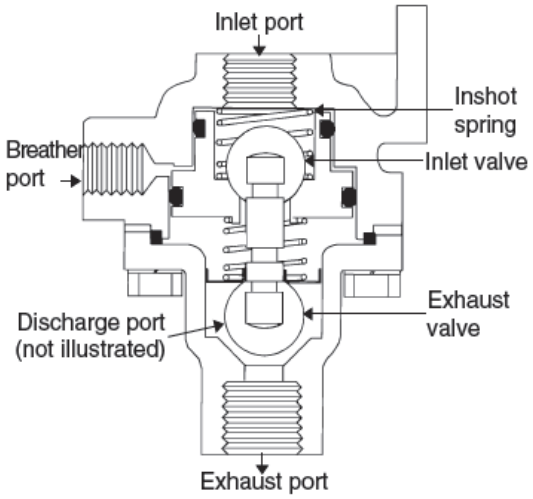


Figure 4 Pressure Proportioning Valve

17. Balancing. As the air passes through the open inlet valve, the pressure begins to act on the lower surface of the piston. This tends to force the piston up against the combined forces of spring pressure and air pressure on the upper surface of the piston, closing the inlet valve.

NOTE

The surface area ratio between the lower side of the piston and the upper side is 2:1.

18. The minimum supply pressure at which the inlet valve closes and the valve reaches a balance position, with both inlet and exhaust valves closed, is called the ‘inshot pressure'. Increasing the supply pressure forces the piston down, opening the inlet valve and allowing more air to pass into the chamber below the piston and on to the brake relay valve. As the air pressure below the piston increases the piston moves upward closing the inlet valve until a balance position is reached once more.

19. Releasing. When the supply pressure is exhausted by the operator the inshot spring is overcome by the air pressure acting on the lower side of the piston, forcing the piston to the fully raised position thus opening the exhaust valve. This allows air to escape from the rear relay valve control line thereby releasing the brakes.

20. Check Valve. As this air pressure decreases, the piston returns to the lower position, tending to reach a balance position between the remaining air pressure and the inshot spring, retaining control air pressure in the relay valve control line. This condition is prevented by the inclusion of a single (one-way) check valve between the discharge and the inlet ports of the proportioning valve to ensure the complete release of all air pressure from the brake relay valve control line.

Spring Brake Control Valve – SR3

21. The spring brake control valve (Figure 5) controls the operation of the spring brakes during parking and emergency conditions as described in the following paragraphs.

22. Charging. Air from the trailer supply line enters the supply port and depresses the control piston into contact with the control inlet and exhaust valve, closing the exhaust passage through the centre of the piston and opening the inlet (Figure 6). Air entering the supply port is also ducted to the cavity under the pressure protection piston. When the air pressure builds to approximately 380 kPa beneath the pressure protection piston, the piston moves against the force of the pressure spring and remains open. Air flowing past the open pressure protection valve opens the service reservoir check valve. This directs air to the service reservoir. Air passing through the service reservoir check valve then opens the spring brake reservoir check valve, allowing air to fill the spring brake reservoir. As the air fills the reservoir it also flows out the open control inlet valve to the spring brake chambers and releases the spring brakes.

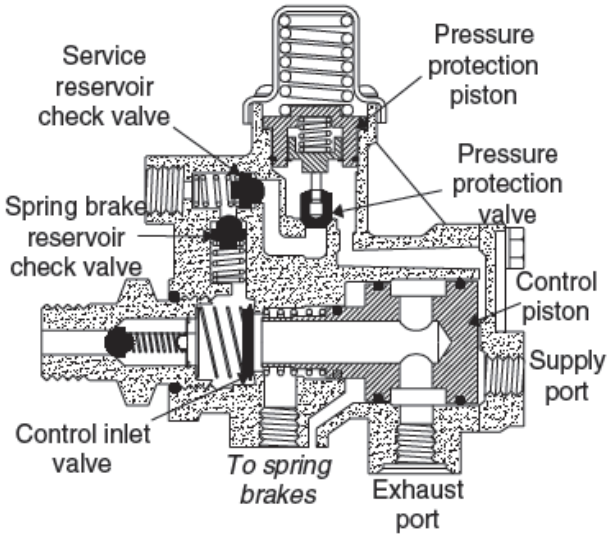


Figure 5 Spring Brake Control Valve – SR3 – Cross Sectional View

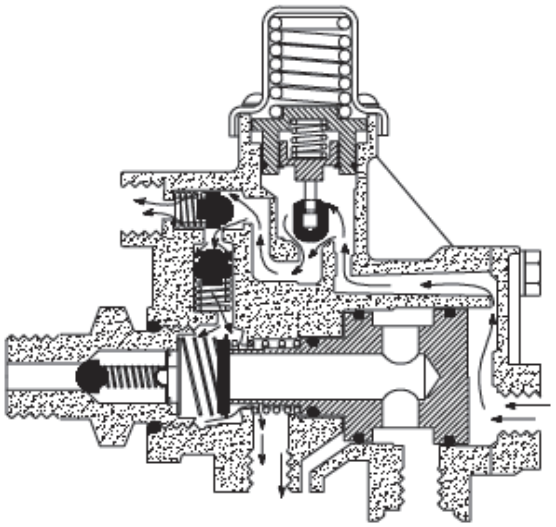


Figure 6 Spring Brake Control Valve – SR3 – Charging

23. Park Application. To apply the trailer spring brakes, either the trailer valve or the parking control valve, which are located in the cab of the towing vehicle, are actuated and the trailer supply line is exhausted. When the trailer supply line is exhausted air pressure is removed from the control and pressure protection pistons. With air pressure removed the control piston is moved by the return spring and the control inlet valve is closed and the exhaust passage through the control piston is opened (Figure 7). Opening the exhaust allows air in the spring brake emergency section to be exhausted at the exhaust port of the spring brake control valve. Spring force above the pressure protection piston closes the pressure protection valve while the brake reservoir check valves close and protect against the loss of pressure in the reservoir.

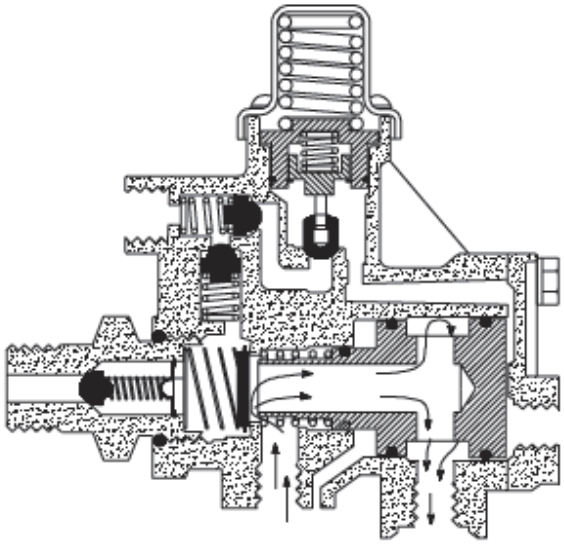


Figure 7 Spring Brake Control Valve – SR3 – Park Application

Brake System Failure

24. If air pressure is reduced in the service system, pressure in the trailer supply line (and likewise in the towing vehicle) is reduced until the pressure protection piston, under spring pressure, moves and closes the inlet valve (Figure 8). This retains approximately 345–415 kPa in the trailer supply line and in the towing vehicle. With 345–415 kPa pressure held in the trailer supply line and against the control piston in the spring brake control valve the trailer spring brakes remain released, while a low pressure warning occurs in the towing vehicle to warn the driver. The spring brake check valve and the brake reservoir check valve protect against loss of air pressure.

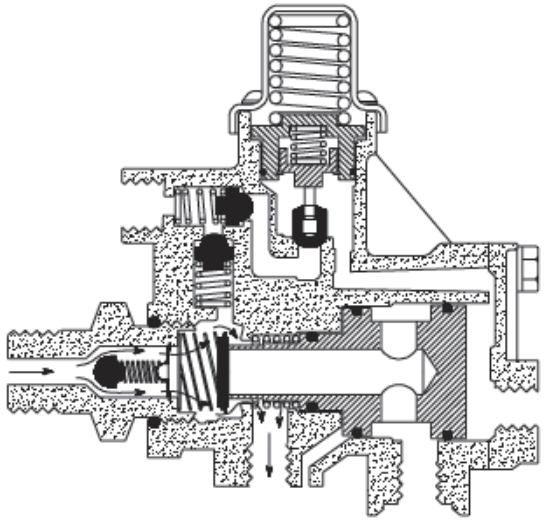
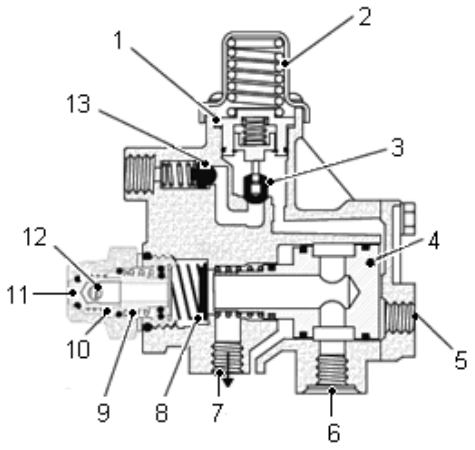


Figure 8 Spring Brake Control Valve – SR3 – Brake System Failure

25. Emergency Application with Service System Failure. To brake the trailer after a service system failure has occurred, the trailer supply valve or parking control valve is used to exhaust the remaining 345–415 kPa trailer supply line pressure. Exhausting the trailer supply line removes air pressure from the control piston of the spring brake control valve allowing the control inlet valve to seat opening the exhaust valve. Air from the spring brake emergency section is then exhausted through the spring brake control valve. Once applied, the brakes cannot be released by air pressure until the fault has been rectified.

Spring Brake Control Valve – ABV3802

26. The spring brake control valve (Figure 9) controls the operation of the spring brakes during parking and emergency conditions as described in the following paragraphs.



1 Pressure protection piston
2 Pressure protection spring
3 Pressure protection valve
4 Control piston
5 Trailer supply line
6 Exhaust port
7 Output to spring brake chamber
8 Inlet/exhaust valve
9 Pressure protection spring
10 Pressure protection piston
11 Service reservoir
12 Check valve
13 Check valve

Figure 9 Spring Brake Control Valve – Cross Section View

27. Charging. Air from the trailer supply line enters at the trailer supply port (Item 5) and depresses the control piston (Item 4), which acts against the inlet/exhaust valve (Item 8), closing the exhaust passage through the centre of the piston and opening the inlet (Item 8). Air also flows to the cavity under the pressure protection piston (Item 1). When air pressure builds to approximately 400 kPa beneath this piston, it moves against the force of pressure protection spring (Item 2) and opens the pressure protection valve (Item 3). The air pressure now flows past the check valve (Item 13), out of the service reservoir port (Item 11) and into the trailer reservoir.

28. Operating Pressure. When the pressure in the reservoir exceeds 450 kPa a check valve (Item 12) opens against the force of the pressure protection spring (Item 9) exposing the larger area of the pressure protection piston (Item 10) to pressure, which rapidly forces both it and the check valve (Item 12) fully open. Air now flows through the centre of the pressure protection piston (Item 10) via cross drillings in the check valve (Item 12), past the open inlet/exhaust valve (Item 8) and out of the delivery ports (Item 7) to the spring brake chambers releasing the spring brakes.

29. Parking Brake Application. When the parking brake is applied the tractor exhausts the trailer supply line by means of the tractor parking brake control. Air pressure is removed from the control piston (Item 4) and its return spring moves it to its rest position. This causes the inlet/exhaust valve (Item 8) to reseat and opens the exhaust passage through the centre of the control piston, allowing air in the spring brake cavities to exhaust to atmosphere via the exhaust port (Item 6). The check valve (Item 13) and the pressure protection valve (Item 3) close, retaining full air pressure in the reservoir.

30. Brake System Failure. If air pressure in the trailer reservoir falls, the trailer supply line and the tractor supply is reduced until the pressure protection valve (Item 3) closes (350–400 kPa). This remaining pressure in the trailer supply line is sufficient to keep the control piston (Item 4) depressed and the inlet/exhaust valve (Item 8) open. A check valve (Item 13) closes to prevent air in the spring brake cavities from flowing back into the leaking reservoir. This effectively locks full system pressure in the spring brake chambers keeping them released. The reduced pressure in the trailer supply line should activate a low pressure warning in the towing vehicle alerting the driver to the failure.

31. Emergency Application with Service System Failure. To brake the trailer after a service system failure (Para 30), the 350–400 kPa remaining in the trailer supply line can be exhausted by the driver via the towing vehicle controls (e.g. the park control valve). Once this occurs the spring brakes can only be released mechanically with their individual release bolts or by repairing the fault and recharging the trailer air system.

32. Emergency/Breakaway Application. If the trailer supply line is exhausted by rupture due to separation of the trailer from its towing vehicle, the spring brakes are applied as previously described (Para 29).

Yard Release Valve

33. The yard release valve is a push/pull, manually operated, ON/OFF, air control valve, with an exhaust function (Figure 10). The valve is pressure sensitive and automatically moves from the applied to the exhaust position as supply pressure is reduced to a set minimum (140–415 kPa). When the control is pushed in air from the reservoir is applied to the spring break control valve releasing the brakes. If the pressure in the reservoir falls below the pre-set limit the spring forces the control out disconnecting the reservoir and connecting the spring brake control valve to the exhaust though the trailer supply line engaging the spring brakes. As the exhaust is through the supply line the brakes can only

be applied by the yard release valve if there is no pressure in the supply line. When a vehicle is subsequently connected pressure in the supply line will reset the valve to the out position.

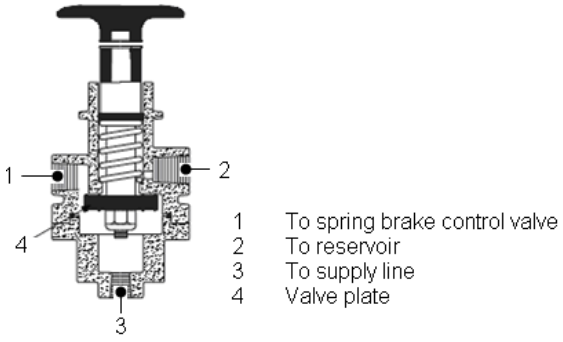


Figure 10 Yard Release Valve – Cross Sectional View

Brake Chambers

34. Wheel Cylinders. The wheel cylinders (Figure 11), as previously described (Para 9.h), are fitted to each wheel. The wheel cylinders have both spring brake and service brake chambers.

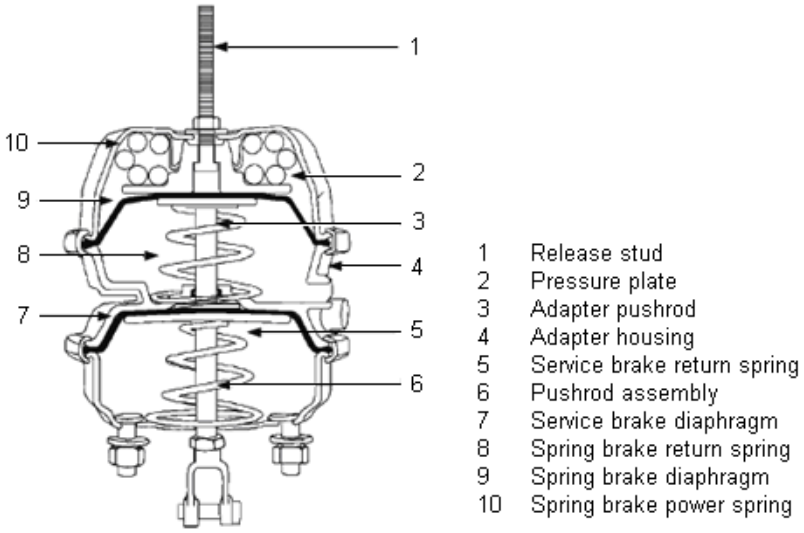


Figure 11 Spring Brake Chamber – Cross Sectional View

35. Spring Brake Released Position. Air supplied from the spring brake control valve enters the spring brake chamber (Figure 12, Item 2) through the adaptor housing and builds up pressure below the spring brake diaphragm (Item 3). When sufficient air pressure is reached it overcomes the power spring (Item 4) and forces the diaphragm and pressure plate into the released position. The return springs move the adaptor and brake pushrod assemblies into the released position and the brakes are released.

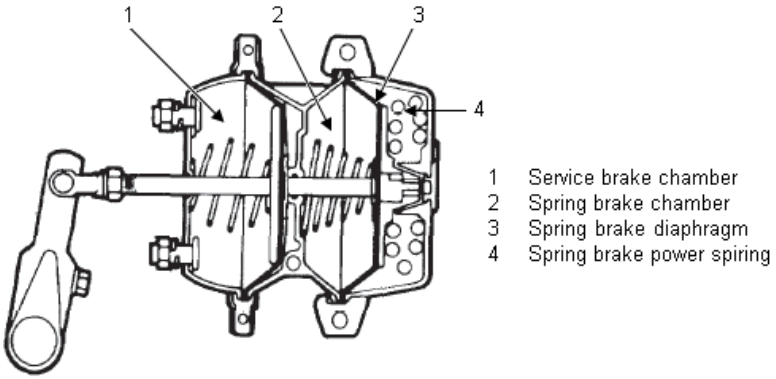


Figure 12 Brake Chambers – Normal Driving

36. Service Brake Application. As the brake control air pressure is supplied to the brake relay valve air is released from the reservoir through the relay valve to the service brake chamber (Figure 13). This air passes through the adaptor housing into the service brake chamber (Item 2) above the service brake diaphragm (Item 1) and forces the diaphragm and pushrod assembly to compress the return spring and to apply the brakes. The spring brake diaphragm and the adaptor pushrod remain in the released position.

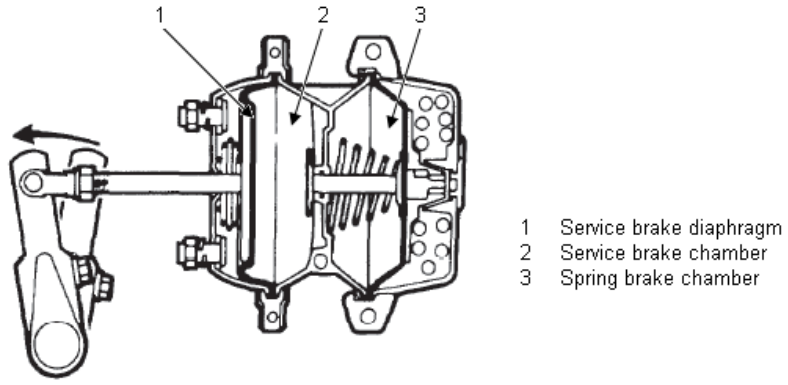


Figure 13 Brake Chambers – Service Brake Applied

37. Spring Brake Application. As air pressure is exhausted from the air supply line (Figure 14) the spring brake control valve exhaust port opens, releasing the air from the spring brake chamber (Item 2). This allows the spring brake power spring (Item 4) to move the pressure plate and diaphragm (Item 3). The brake pushrod assembly compresses the service brake diaphragm and return spring and applies the brakes.

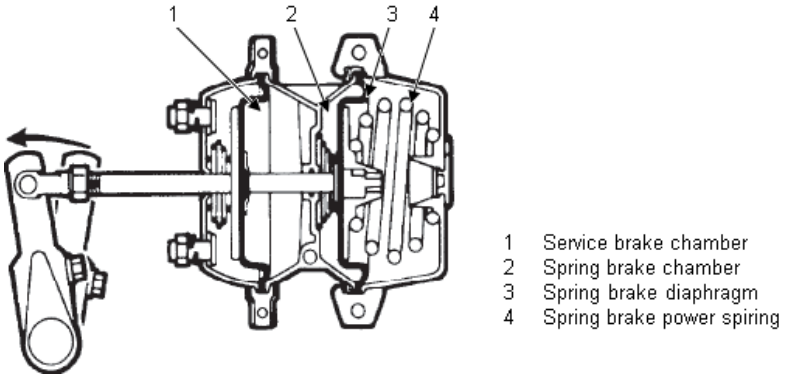


Figure 14 Brake Chambers – Spring Brake Applied

38. Mechanical Release. The spring brake can be mechanically released (Figure 15) by using the spring brake release tool to cage the spring (Item 1). The spring brake release stud (Item 2) is engaged into the spring brake pressure plate (Item 4) by the tang (Item 5) through the access hole in the chamber housing and the brake is released by tightening the nut (Item 2) on the threaded shaft.

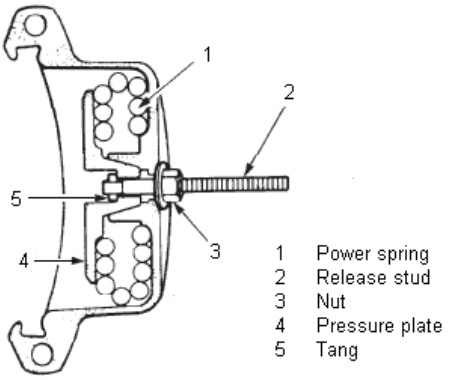
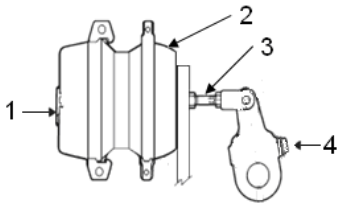


Figure 15 Brake Chambers – Mechanical Release

Slack Adjusters

39. The slack adjusters (Figure 16) convert the reciprocating motion of the brake chamber push rod (Item 3) into rotary motion of the brake camshaft to provide brake actuation. The slack adjusters (Item 4) have an internal worm and wheel gear set to provide adjustment by rotating the worm, which in turn rotates the worm gear. The rotation of the worm gear adjusts the position of the internal splines and therefore the position of the S-cam in relation to the push rod.



1 Spring brake chamber
2 Service brake chamber
3 Push rod
4 Slack adjuster

Figure 16 Slack Adjuster

SUSPENSION

Springs

40. The springs are a ten-leaf, semi-elliptic, sliding shackle type, fixed to the axle assemblies by steel U-bolts and located by cast-steel spring seats welded to the axle assembly. The third leaf of each spring assembly has one end folded down in a vertical position. This end of the spring is fitted into the rear spring hanger and prevents the spring from becoming dislodged from the hanger.

Spring Hangers

41. The spring hangers are cast steel, front and rear, welded to the trailer and dolly converter frames. They are moulded to accept the curvature of the leaf springs which are free to slide within the spring hangers as required by the suspension action. The springs are retained within the rear spring hangers by a ½ inch UNF bolt fitted across the casting.

ELECTRICAL

42. The electrical system fitted to the trailer is a basic 24-volt dc electrical system coupled to the towing vehicle by a 12-pin NATO socket and plug. All lighting connected to the electrical system is 24-volt, with the exception of the blackout lighting, which are 12-volt dc electronic modules. Resistors are incorporated into the system for each module. These resistors are located in the plastic junction boxes.

43. The electrical wiring diagram is shown in Figure 17.

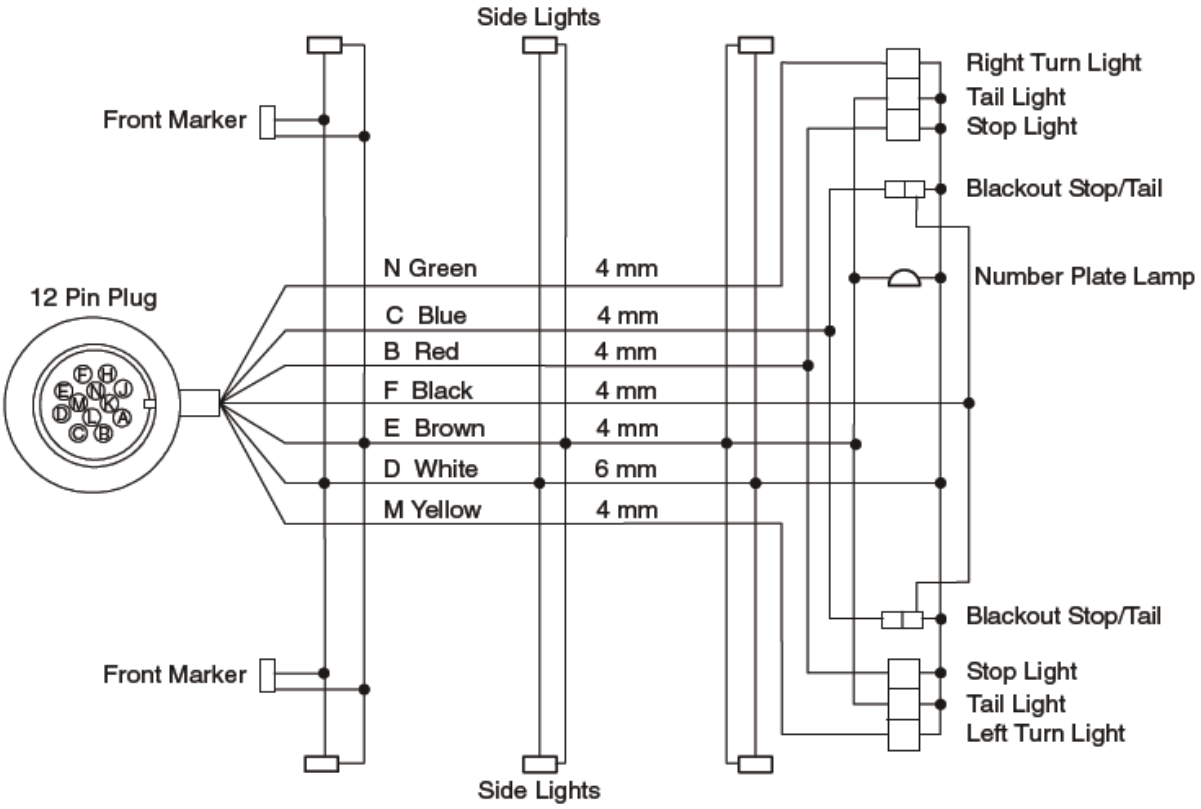


Figure 17 Electrical Wiring Diagram

FRAME ASSEMBLY

44. The trailer is a prefabricated steel frame construction with two major components. These are:

a. the trailer main frame, and

b. the dolly frame.

45. The main frame and the dolly frame are connected by means of a ballrace which allows steering of the front axle assemblies. The dolly and the main frame cannot be separated as part of normal operation.

Spare Wheel Winch Assembly

46. The spare wheel winch is a worm and wheel type winch enclosed in a prefabricated steel housing. The worm gear is engaged by a free fitting mild steel drive shaft. Drive is transferred to the worm gear by a steel roll pin, fitted into the drive shaft and engaging with drive lugs on the worm gear.

47. The worm gear is engaged with the wheel gear which is also coupled to the lift chain. Rotation of the wheel gear raises or lowers the lift chain according to the direction of rotation. A spring type ratchet pawl holds the wheel gear stationary when not being driven by the worm gear.

48. A locking latch is also fitted to provide a positive lock to the chain, holding it in the raised position. This latch is spring loaded and is released by the action of the drive shaft during rotation. Immediately the drive shaft ceases to turn the locking latch engages the chain.

END

Distribution List: **VEH H 04.0 – Code 1** (Maint Level)
(Sponsor: LV SPO, Mdm/Hvy B Vehicles Section)
(Authority: ECO LVSPO 043/08)