TRAILER, LT/MDM, CARGO, 4 TONNE, MC3

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 describes the technical system and details of the Trailer, Light/Medium, Cargo, 4 Tonne, MC3. All relevant weights, dimensions and performance figures are detailed in EMEI Vehicle H 420.

Principles of Operation

2. The Trailer, Lt/Mdm, Cargo, 4 Tonne, MC3, is a Haulmark 2-axle trailer designed to carry general cargo on and off road.

Arrangement of the Equipment

3. The trailer has a prefabricated steel frame fitted with air brakes and leaf spring suspension. The deck is manufactured from steel floor plate and incorporates twist-locks and tie-down points for securing loads. Ratchet straps, an access ladder, a CES box and a spare wheel carrier are fitted beneath the deck. The deck incorporates rope rails for securing the tarpaulin. Side and rear gates, a front load rack and a tarpaulin are supplied with the trailer for load security and protection.

AXLE ASSEMBLIES

4. The axles fitted to this trailer are a single, tubular beam type axle manufactured by Dana Spicer. They are fitted with 16.5 inch x 7 inch internal expanding shoe type brakes. The axles are fitted with flange-type disc wheel hubs supported by tapered roller bearings. A hubodometer is fitted to the right-hand rear hub to record the distance that the trailer has travelled.

BRAKES

General

5. The brake system fitted to the trailer consists of four wheel foundation brake sets manufactured by Dana Spicer and a compressed air actuating system supplied by Air Brake Corporation. A schematic of the air brake control system is shown in Figure 1.

Brake Air System

6. The brake air system is a twin-line type, with service brake chambers on all wheels and spring brake chambers on the rear wheels. The system is designed to comply with ADR 38/02.

7. A Bendix R-12 service brake relay valve is mounted directly onto the rear of the brake air reservoir. This valve functions as a relay station to speed up the application and release of the service brakes. The relay valve delivers air from the reservoir to, or releases air to atmosphere from the service brake chambers. These actions are carried out in direct proportion to the air pressure applied at the service brake chambers control port. The service relay valve functions in response to the control air delivered from the towing vehicle brake control valve, via the pressure proportioning valve.

8. The rear axle mounted spring brakes are controlled by an Air Brake Corporation ABV3802 spring brake control valve, which is mounted directly onto the front of the brake air reservoir. The spring brake control valve controls the operation of the spring brakes during parking and emergency conditions.

9. During normal operation, the spring brake control valve prevents the passage of compressed air to the spring brakes until the required air pressure, approximately 380 kPa, is reached in the supply line. This ensures that the towing vehicle has the minimum required air pressure before replenishing the brake reservoir or releasing the spring brakes. Once this minimum air pressure has been achieved, compressed air is directed to the air reservoir and the spring brake chambers concurrently.

10. During parking, when the parking control valve is actuated, air pressure is exhausted from the trailer supply line. When this occurs, the spring brake control valve exhausts all air from the spring brake chambers, causing them to be applied by the internal spring pressure.

11. 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. The spring brakes remain released, allowing 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 system.

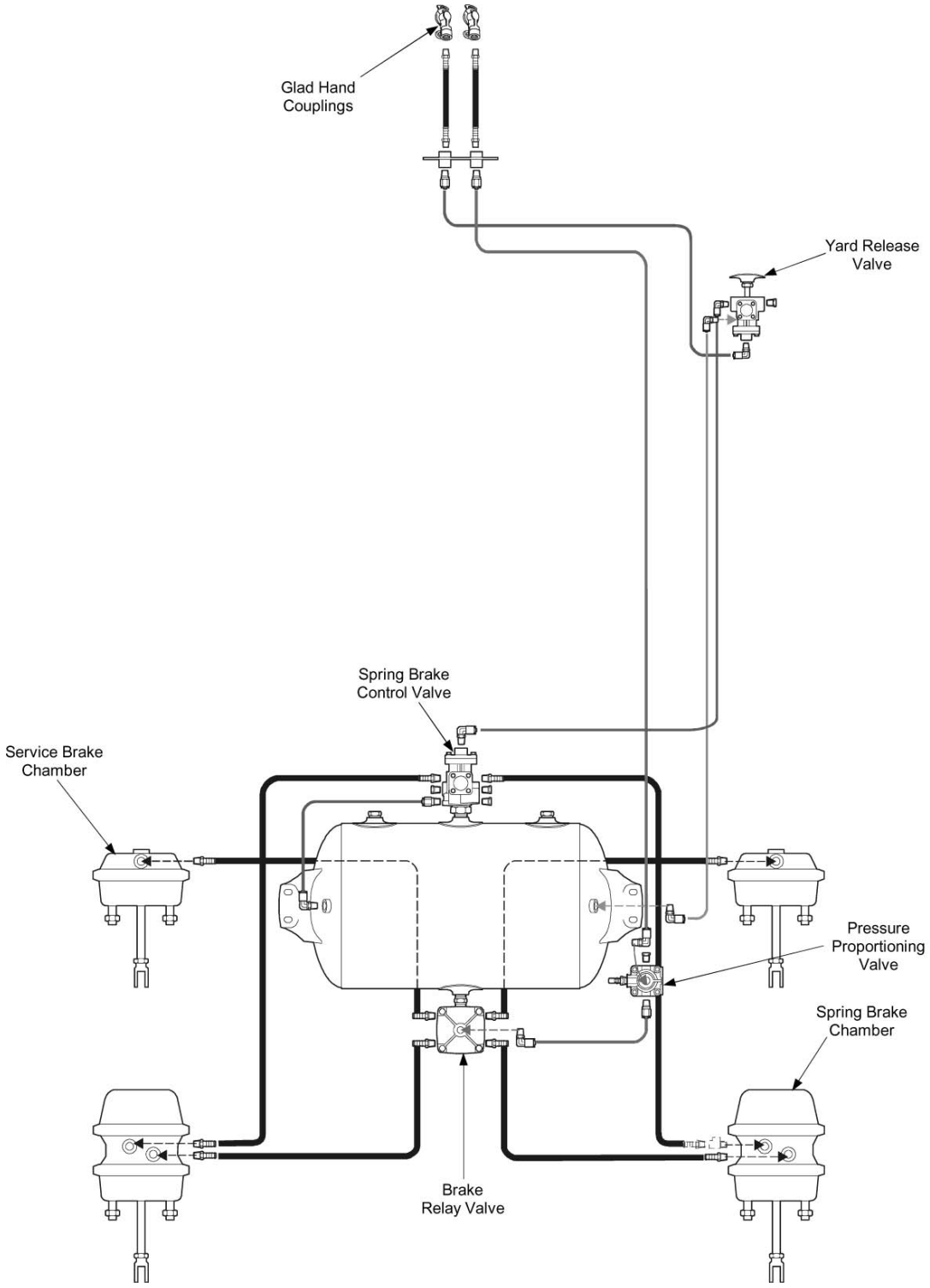


Figure 1 Air Brake Actuating System Layout

12. A yard release facility is provided in the braking system. This allows the brakes to be released without the need for connection to a towing vehicle. The yard release valve uses air contained in the trailer air reservoir to release the spring brakes. The yard release valve is located inside the right-hand drawbar 'A' frame channel, adjacent to the stiffening cross-member.

13. The yard release 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).

14. Glad-hand type couplings are provided for easy connection between the trailer and the towing vehicle.

Brake Air Reservoir

15. The trailer is fitted with a single 60 litre capacity air reservoir, which provides the air required for the application of the brakes. The air reservoir is fitted with a condensation drain valve.

Brake Chambers

16. Type T24 service brake chambers are fitted to the front axle and type 2424 spring brake chambers are fitted to the rear axle.

17. Service Brake Chambers. The service brake chambers, which provide service braking only, are under the direct control of the brake relay valve.

18. Spring Brake Chambers. The spring brake chambers, which provide service, parking and emergency braking, are under the direct control of the brake relay and spring brake control valves. Each spring brake chamber has two separate air chambers, each equivalent in size, to provide the required braking functions. A heavy duty spring fitted into the spring brake chamber applies the brakes when air pressure is exhausted from the spring brake chamber. The spring brakes may be released mechanically by means of a release bolt to aid in recovery of the trailer.

Foundation Brakes

19. The foundation brakes are a 16.5 inch x 7 inch twin-shoe, internal expanding, mechanical brake. The brake friction linings consist of two segment linings riveted to the brake shoe. The two brake shoes are mounted on individual non-adjustable anchor pins that allow the brake shoes to pivot under the influence of an 'S' cam. The cam shaft is fitted with a slack adjuster that performs two functions:

a. It provides a means of connecting the camshaft to the spring brake chamber pushrod, converting the reciprocating motion of the brake chamber into the required rotary motion of the camshaft.

b. It provides a quick and simple means of brake adjustment, through the use of an internal worm and wheel gear.

Brake Relay Valve

20. The brake relay valve is a Bendix model R-12 air-operated, graduating directional control valve with a high capacity and fast response. This valve is fitted to increase the speed of application and release of the brakes. The valve is direct mounted onto the rear of the brake air reservoir and delivers, or releases, air to or from the brake chambers in response to the control air delivered from the towing vehicle brake control valve via the pressure proportioning valve.

Spring Brake Control Valve

21. The spring brake control valve controls the spring brakes during parking and emergency applications. It automatically applies the spring brakes and prevents trailer air pressure loss in the event of breakaway or supply line failure. The spring brake control valve also prevents the automatic application of the trailer spring brakes after the loss of trailer service reservoir pressure, while allowing failure indication to occur in the towing vehicle. The spring brake control valve is mounted directly to the front of the brake air reservoir.

OPERATION

Brake Relay Valve

22. Application. Air pressure delivered to the service port 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 2)

23. 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 lifts slightly and the inlet spring returns the inlet valve to its seat. 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 3).

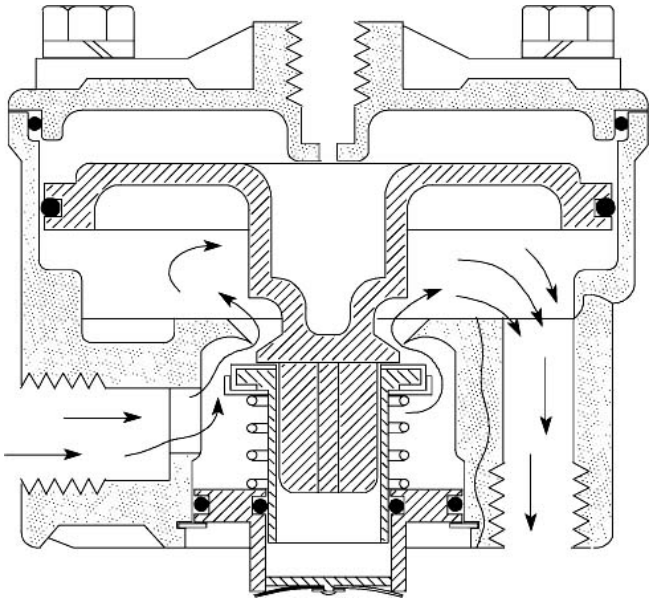


Figure 2 Brake Relay Valve – Application

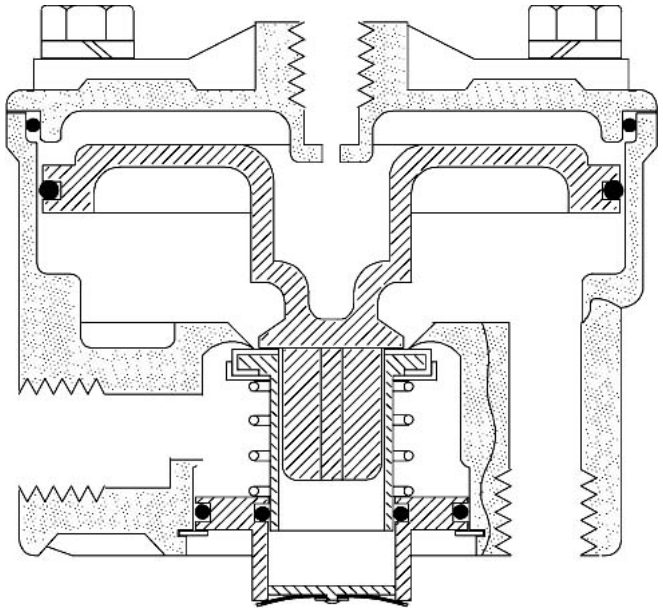


Figure 3 Brake Relay Valve - Balanced Position

24. Releasing. When air pressure is released from the service port and the air pressure in the cavity above the relay piston is exhausted, air pressure beneath the piston lifts the relay piston and the exhaust seat moves away from the exhaust valve, opening the exhaust passage. With the exhaust passage open, the air pressure in the brake chambers exhausts through the exhaust port, releasing the brakes (Figure 4).

25. Charging. Air from the trailer supply line enters at the trailer supply port (marked 'Trailer Supply' Figure 5) and depresses the control piston, which acts against the inlet/exhaust valve, closing the exhaust passage through the centre of the piston and opening the inlet. Air is also sent to the cavity under the pressure protection piston (Figure 5 Item 1). When air pressure builds to approximately 400 kPa beneath this piston, it moves against the force of the pressure protection spring (Item 2) and opens the pressure protection valve (Item 3). The air now flows past the check valve (Item 9), out of the service reservoir port (marked 'To service reservoir') and into the trailer reservoir.

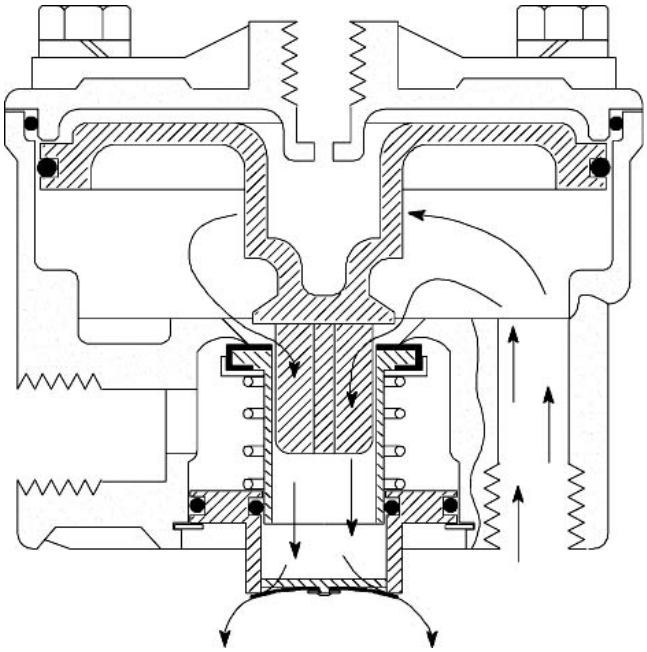
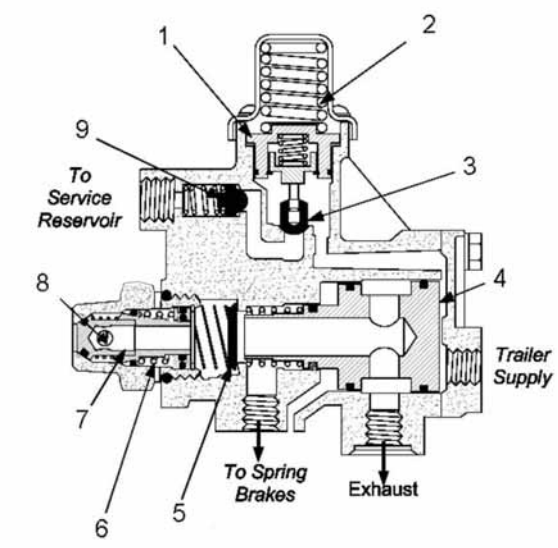


Figure 4 Brake Relay Valve – Releasing



1	Pressure protection piston	6	Pressure protection spring
2	Pressure protection spring	7	Pressure protection piston
3	Pressure protection valve	8	Check valve
4	Control piston	9	Check valve
5	Inlet/exhaust valve		

Figure 5 Spring Brake Control Valve - Cross Sectional View

Spring Brake Control Valve

26. When air pressure in the reservoir exceeds 450 kPa, the check valve (Figure 5, item 8) opens against the force of the pressure protection spring (item 6). This exposes the larger area of the pressure protection piston (item 7) to pressure, which snaps it and the check valve fully open. Air now flows through the centre of the pressure protection

piston, via cross drillings in the check valve, past the open inlet/exhaust valve, and out of the delivery ports, (marked 'To spring brakes') to the spring brake cavities, releasing the spring brakes.

27. Park Application. To apply the trailer spring brakes, the trailer supply line is exhausted by means of one of the towing vehicle cab controls. Air pressure is removed from the control piston and the control piston return spring moves the piston to its rest position. This causes the inlet/exhaust valve to reseat and opens the exhaust passage through the centre of the control piston, allowing air in the spring brake cavities to exhaust to the atmosphere. The check valve (item 9) and the pressure protection valve (item 3) close, retaining full air pressure in the reservoir.

28. Brake System Failure. If air pressure in the trailer reservoir falls, pressure in the trailer supply line (and in the towing vehicle) also falls, until the pressure protection valve closes, maintaining 350 – 400 kPa in the trailer supply line. This is sufficient to keep the control piston depressed and the inlet/exhaust valve open. The check valve (item 8) closes to prevent air in the spring brake cavities from flowing back into the leaking reservoir. This locks full system pressure in the spring brakes and keeps them released. The reduced pressure in the trailer supply line activates a low pressure warning in the towing vehicle, alerting the driver to the failure.

29. 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 described at Para 27.

30. Emergency Application with Service System Failure. To brake the trailer after a service system failure, the remaining 350 – 400 kPa in the trailer supply line can be exhausted by the driver, via the appropriate cab control valve (e.g. the park control valve). The spring brakes can then be released manually, one at a time, with their respective release bolts, or the brakes can be released by repairing the fault and recharging the trailer air system.

Pressure Proportioning Valve

31. The pressure proportioning valve is a Bendix Westinghouse LQ-2 valve. The valve reduces brake application pressures to prevent brake lock-up during partial braking. A sectioned view of the valve is shown at Figure 6.

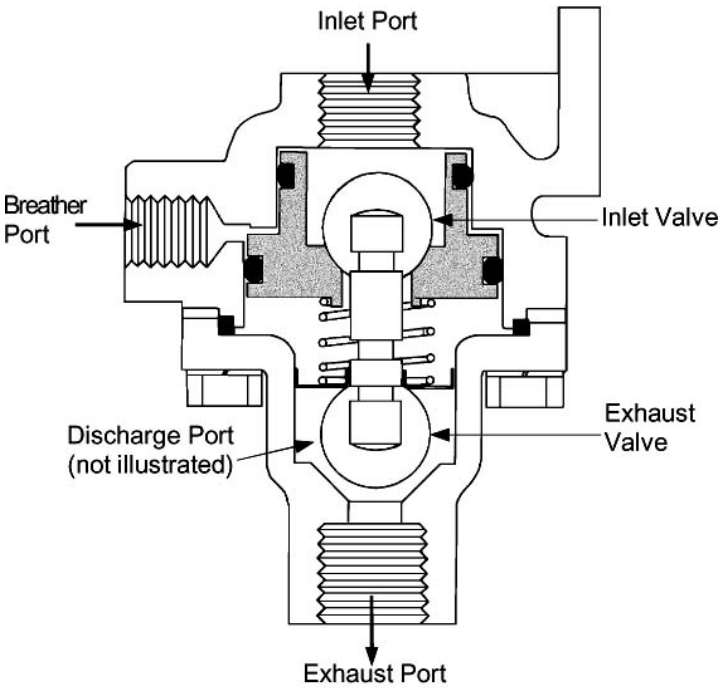


Figure 6 Pressure Proportioning Valve - Cross Sectional View

32. Applying. When the footbrake is applied, air enters the inlet port of the proportioning valve. Air pressure acts on the upper inner area of the piston, moving the piston down, closing the exhaust valve and opening the inlet valve. Air passes through the open inlet valve to the discharge port. Air is then directed to the brake relay valve applying the brakes.

33. Balancing. As the air passes through the open inlet valve, the pressure begins to act on the lower surface of the piston (which is approximately twice the size of the upper inner area of the piston). When the pressure acting on the lower area of the piston is approximately half of the brake valve delivered pressure, the piston lifts and closes the

inlet valve. In this position, the air pressure in the brake chambers is approximately 50 per cent of brake valve application pressure.

34. 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 again, opening the inlet valve, 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.

35. Releasing. When the supply pressure is exhausted by the operator, the air pressure acting on the lower side of the piston forces the piston to the fully raised position and opens the exhaust valve. Air escapes from the relay valve control line and releases the brakes.

Yard Release Valve

36. The yard release valve is a push/pull, manually operated, ON/OFF, air control valve, with an exhaust function (Figure 7). The valve is pressure sensitive and automatically moves from the applied to the exhaust position as supply pressure is reduced to a set minimum. (i.e. 140 – 415 kPa).

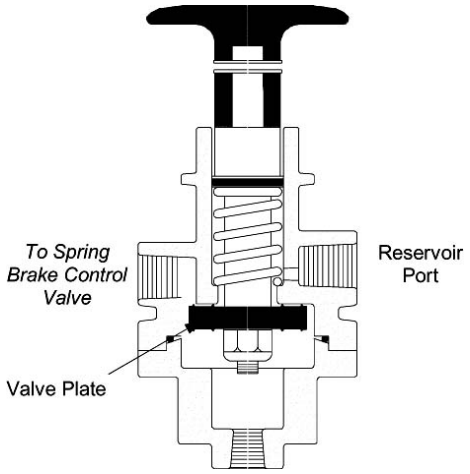


Figure 7 Yard Release Valve - Cross Sectional View

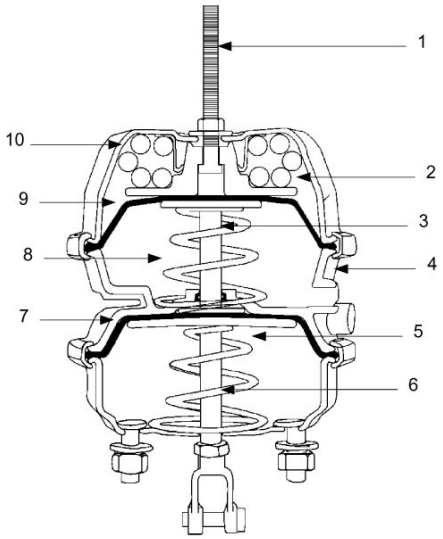
Brake Chambers

37. General. Spring brake chambers are fitted to the rear axle to operate as service brake actuators and parking brakes, and as automatic emergency brakes in the event of loss of supply air pressure (Figure 8). Service brake chambers are fitted to the front axle, where their sole function is to act as service brake actuators. Air pressure is required to release the spring brakes, whilst, conversely, air pressure is required to apply the service brakes. The spring brake can be mechanically released by using the spring brake release tool provided with each brake chamber.

38. Spring Brake Released Position. Air supplied from the spring brake control valve enters the spring brake chamber through the adaptor housing and builds up pressure below the diaphragm. When the air pressure attains sufficient force, it overcomes the spring pressure 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.

39. Service Brake Application. As the brake control air pressure is supplied to the brake relay valve, service brake air is released from the reservoir, through the relay valve, to the service brake chamber. This air passes through the adaptor housing into the chamber above the service brake diaphragm and forces the diaphragm and pushrod assembly down, to apply the brakes. On the spring brake chamber, the spring brake and the adaptor pushrod remain in the released position.

40. Spring Brake Application. As air pressure is exhausted from the air supply line to the spring brake control valve, the exhaust port opens, releasing the air from the spring brake lines and the chamber. This allows the spring brake power spring to reapply force to the pressure plate and diaphragm. This force is applied through the adaptor pushrod to the brake pushrod assembly, compressing their respective return springs and applying the brakes.



1	Release bolt	6	Pushrod assembly
2	Pressure plate	7	Service brake diaphragm
3	Adapter pushrod	8	Spring brake return spring
4	Adapter housing	9	Spring brake diaphragm
5	Service brake return spring	10	Spring brake power spring

Figure 8 Spring Brake Chamber - Cross Sectional View

41. Mechanical Release. The spring brake can be mechanically released by using the spring brake release tool supplied with the brake chamber. The spring brake release tool is engaged into the spring brake pressure plate through the access hole in the chamber housing. The brake is released by using the spring brake release tool to tighten the nut on the threaded shaft.

Slack Adjusters

42. The slack adjusters convert the reciprocating motion of the brake chambers into the required rotary motion of the brake camshaft to provide brake actuation. The slack adjusters are of cast construction, with an internal worm and wheel gear set which provides the adjustment facility. The brakes are adjusted by rotating the worm, which in turn rotates the worm gear. The rotation of the worm gear adjusts the position of the internal splines in relation to the body. The adjustment is locked by means of a spring loaded locking sleeve. Figure 9 illustrates a slack adjuster in exploded view.

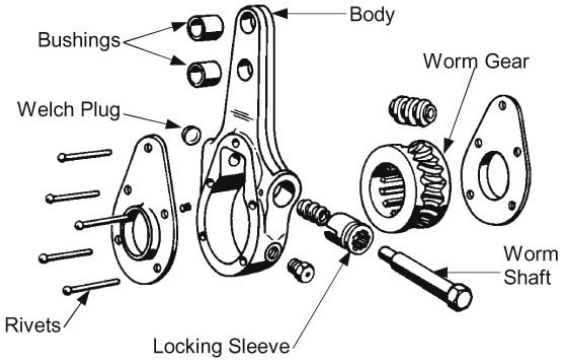


Figure 9 Slack Adjuster Assembly - Exploded View

SUSPENSION

Description

43. The trailer employs an Engineered Transport Equipment (ETE), overslung, spring-type suspension, as shown in Figure 10.

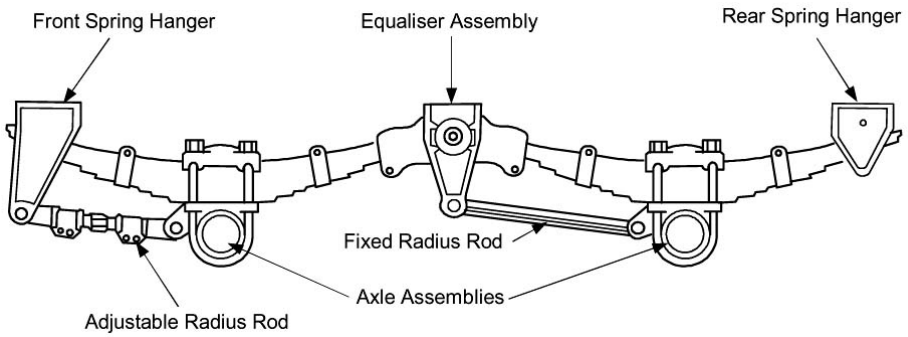


Figure 10 Trailer Suspension Layout

44. Load sharing capabilities are provided by the use of the centre mounted equaliser assemblies. The suspension has six-leaf, semi-elliptic springs, that are free to slide at either end in their respective hangers. The axles are located by radius rods that allow free vertical movement of the axles for the full extent of suspension travel, whilst maintaining correct axle alignment.

Springs

45. The springs are six-leaf, semi-elliptic, sliding shackle types. They are fixed to the axle assemblies by steel U-bolts and located by cast steel spring seats welded to the axle assemblies. The third leaf of each spring assembly has one end folded down. The folded end is fitted into the equaliser and this prevents the spring sliding out of the equaliser.

Spring and Equaliser Hangers

46. The front and rear spring hangers are constructed of cast steel and are welded to the trailer frame. 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 spring hangers by a bolt fitted across the spring hangers. Transverse braces are welded to the front hangers and the equaliser hangers to strengthen the suspension arrangement.

47. The equaliser assembly provides the load sharing capabilities of the ETE suspension. The equaliser assembly consists of a cast steel equaliser hanger carrying a cast steel equaliser beam, which is pivoted on two tapered rubber bushes. The springs are free to slide in the equaliser beam and are held in position by a single bolt.

Radius Rods

48. The radius rods used in this application are both fixed length and adjustable types. Each type exists in two different lengths as follows:

a. Fixed Length Rods. These are of cast construction, moulded to accept tapered rubber bushes in each end. The two lengths applicable to the fixed length radius rods are 498 mm and 397 mm. The longer of the two is fitted to the left-hand-rear of the suspension whilst the shorter is fitted to the left-hand-front (Figure 11).

b. Adjustable Rods. The two adjustable radius rods each consist of a steel rod threaded each end (one end left-hand (LH) thread and one end right-hand (RH) thread, and one each of LH and RH threaded cast steel ends. These adjusting ends are moulded to accept tapered rubber bushes. The longer of the two is fitted to the right-hand-rear and the shorter to the right-hand-front. The adjustment range of these rods is designed to suit the fixed rod lengths (Figure 12).

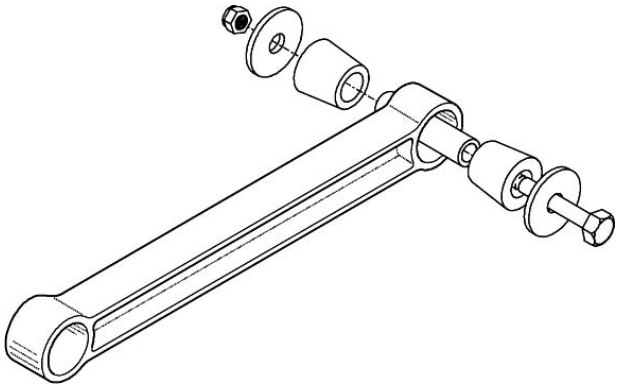


Figure 11 Fixed Length Radius Rod

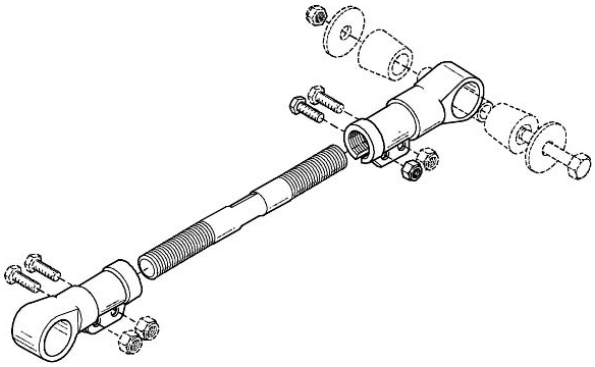


Figure 12 Adjustable Length Radius Rod

ELECTRICAL

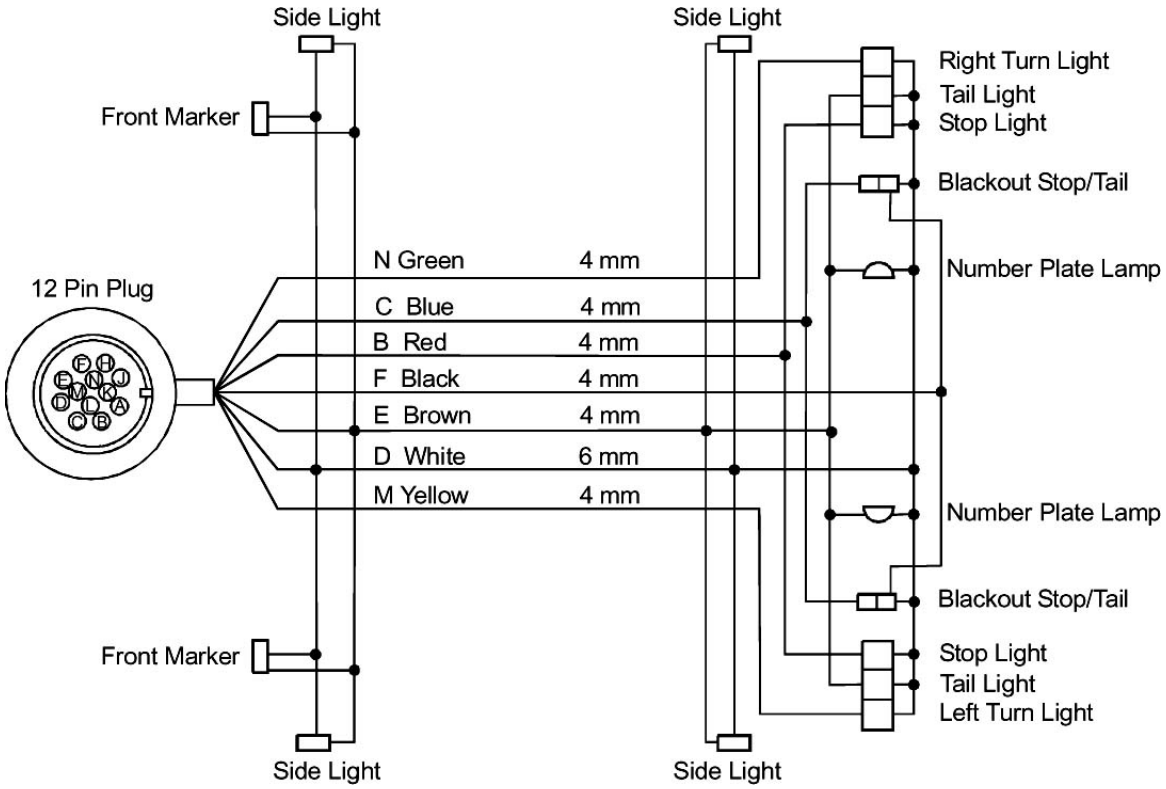
Description

49. The trailer employs a dual voltage system allowing coupling to vehicles with either 12 or 24-volt dc systems. The lights used in the system are replaceable modules, which have Light Emitting Diodes (LED) as the light source. The voltage range of the lights used varies between 8 and 33 volts, with full illumination being provided across the whole range. Table 1 provides the LED voltage range for individual lights. A 12-pin NATO plug, marked '12/24 volt' is used to connect the trailer to the towing vehicle.

Table 1 Light Voltage Ranges

Light Description	Voltage Range
Stop/Tail Indicator	8 to 28 V
Number Plate	10 to 33 V
Clearance Markers	8 to 28 V
Blackout Markers	24 V

50. An electrical wiring diagram is shown at Figure 13.



Key to Pin Connections		Colour Code	Key to Pin Connections		Colour Code
A	Not used	Not used	H	Not used	Not used
B	Stop light	Red	J	Not used	Not used
C	Blackout tail	Blue	K	Not used	Not used
D	Earth	White	L	Not used	Not used
E	Tail/side/front marker/No plate light	Brown	M	Left turn indicator	Yellow
F	Blackout stop	Black	N	Right turn indicator	Green

Figure 13 Electrical Circuit Diagram

FRAME ASSEMBLY

Description

51. The prefabricated steel frame and drawbar assembly is constructed as a single piece, all steel welded components. It is manufactured from 350 grade steel for the frame and drawbar members and 250 grade steel for the decking area (Figure 14).

52. The trailer deck is fitted with six twist-lock assemblies and seven deck tie-down rings for securing of cargo. A spare wheel winch is mounted below the front section of the deck, to raise and lower the spare wheel when required.

53. The drawbar section of the frame carries the brake air system connection lines/dummy couplings and the electrical cable for connection to the towing vehicle. An adjustable wind down support leg is attached to the drawbar for support when parking without a towing vehicle, and two additional legs are fitted at the rear of the frame to support the rear of the trailer. The drawbar is fitted with a pair of safety chains, which are attached to the towing vehicle when the trailer is hooked up.

54. To provide convenient access to the deck area a pullout ladder is fitted to the frame under the right-hand front corner of the trailer. A toolbox, designed to carry CES items and ancillary equipment, is mounted beneath the deck at the left-hand front corner of the trailer.

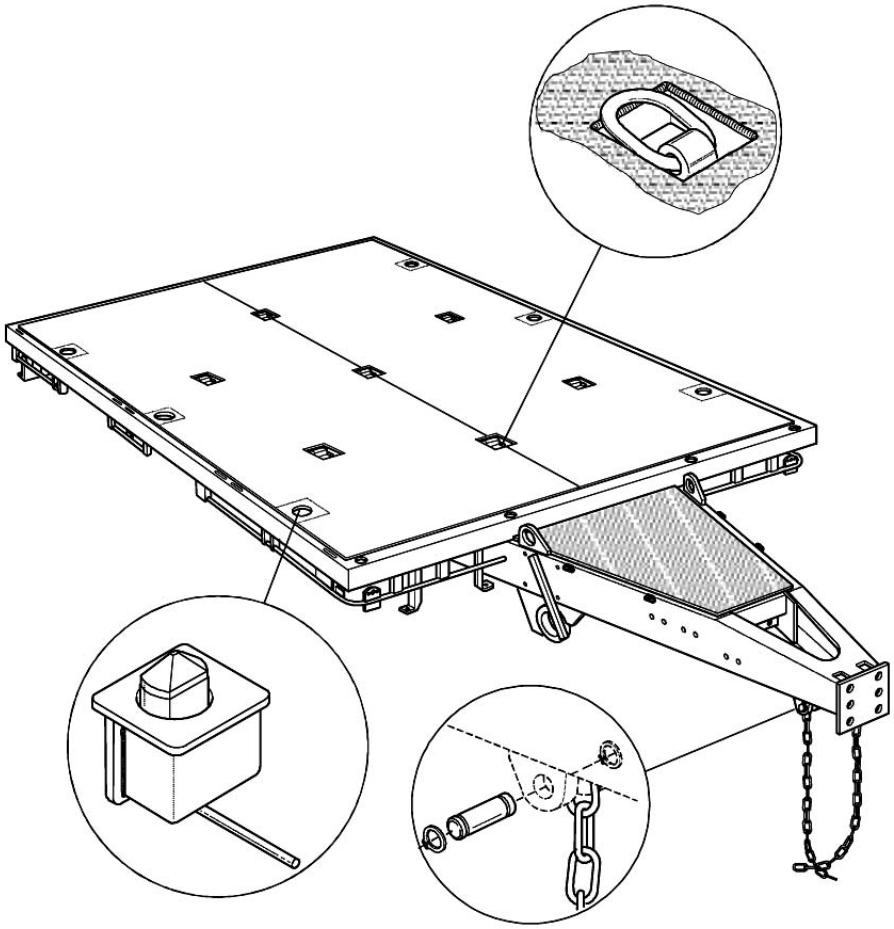


Figure 14 Trailer Frame

END

Distribution List: **VEH H 04.0 – Code 2** (Maint Level)
(Sponsor: LV SPO Mdm/Hvy B Vehicles)
(Authority: LVSPO ECO 040/08)