TRAILER, RECOVERY, HEAVY, MC3, HAULMARK MODEL MC-4DT

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 detail of the Trailer, Recovery, Heavy, MC3, Haulmark Model MC-4DT.

ARRANGEMENT OF THE EQUIPMENT

2. The Trailer, Recovery, Heavy, MC3, Haulmark Model MC-4DT is a Haulmark four axle trailer designed to transport equipment casualties, including wheeled and tracked vehicles and engineering plant. In a secondary role it is suitable for transporting ISO containers.

3. The rated payload for the trailer is 20 000 kg with a gross trailer mass of 28 580 kg.

4. The trailer has a prefabricated steel frame fitted with air brakes and leaf spring suspension. The frame is fitted with timber decking and incorporates twist-locks and tie-down points for securing loads. The trailer has an integrated dolly converter.

DETAILED TECHNICAL DESCRIPTION

AXLE ASSEMBLIES

5. The axles fitted to this trailer are a single, tubular beam type, manufactured by Dana Spicer. They are fitted with 16.5 inch × 7.5 inch, internal expanding shoe type brakes. The axles are fitted with spider type wheel hubs carried on tapered roller, grease lubricated bearings.

WHEEL ASSEMBLY

6. The rims fitted to this trailer are 8.25 × 22.5 single piece, pressed steel, tubeless type. The current authorised tyres are detailed in EMEI Vehicle A 291-5 – Tyres and Tubes – Australian Defence Force B Vehicle Tyre Guide.

BRAKES – GENERAL

7. The air actuating system on this trailer is a Westinghouse design, while the foundation brakes are manufactured by Dana Spicer. The air actuating system is represented in Figure 1.

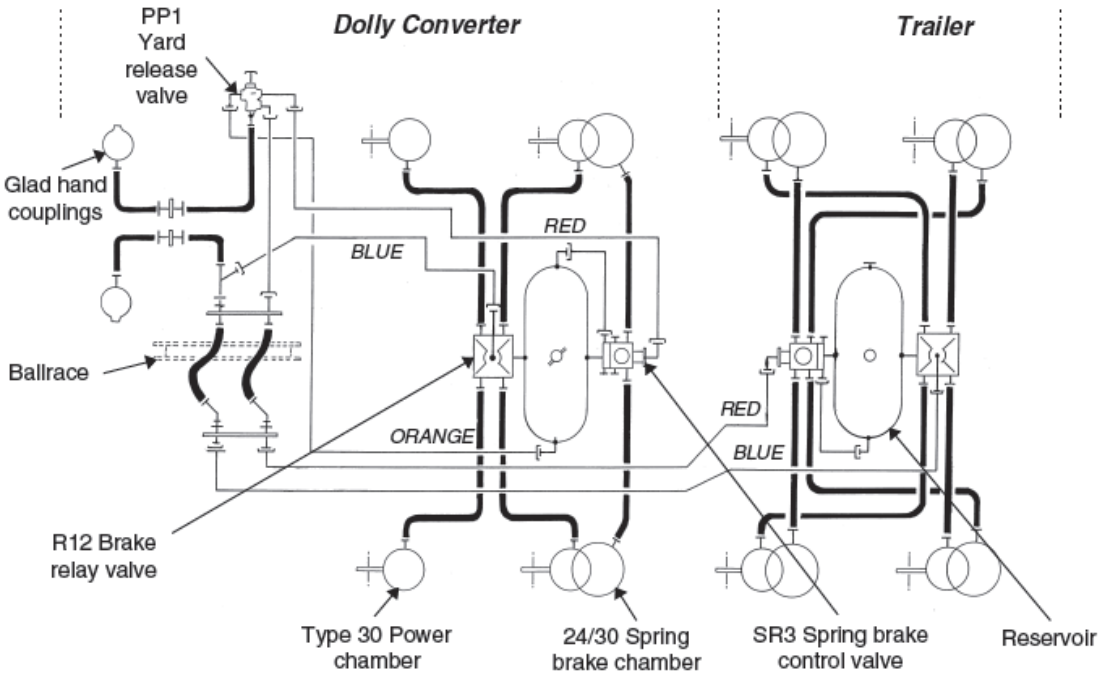


Figure 1 Air Actuating System – Westinghouse

Brake Air Systems

8. The brake air system is a twin line type designed to comply with ADR 38. The system has spring brake assemblies provided on three axles and power chambers fitted to the front axle of the dolly converter. The spring brake

assemblies consist of a spring brake chamber and a power brake chamber. The power brake chambers are commonly referred to as the service brakes.

9. An R-12 service brake relay valve is mounted directly onto each of the air reservoirs of the trailer. These valves function as relay stations to speed up the application and release of the service brakes. The relay valves deliver air from the reservoirs to, or release air to atmosphere from, the service brake chambers. These actions are carried out in proportion to the air pressure applied at the control ports.

10. The spring brake chambers are controlled by SR3 spring brake control valves which are also mounted directly onto the air reservoirs of the trailer. The spring brake control valves control the operation of the spring brakes during parking and emergency conditions.

11. During normal operation, the spring brake control valves prevent the passage of compressed air to the spring brakes until the air pressure in the trailer supply line reaches approximately 380 kPa. This ensures that the towing vehicle has the minimum required air pressure before replenishing the trailer reservoirs or releasing the spring brakes. Once this minimum air pressure has been achieved, compressed air is directed to both the trailer air reservoirs and the spring brake chambers concurrently.

12. 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 the spring brakes to be applied by the internal spring pressure.

13. 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 to 415 kPa in the supply line and the towing vehicle. This low pressure causes the warning systems to operate in the towing vehicle. 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 by the use of the trailer supply valve or parking control valve, the spring brakes cannot be released until the system fault has been rectified.

14. A yard release valve is fitted to the trailer. This valve allows the brakes to be released using air from the trailer reservoir, for ease of movement within a safe area only.

15. The yard release valve is pressure sensitive and will automatically move from the applied to the exhaust position as supply pressure is reduced to a set minimum (140 to 415 kPa).

16. Glad hand type couplings are provided for connection between the trailer and the towing vehicle.

Air Reservoirs

17. The reservoirs provide compressed air for the following purposes:

- **a.** actuation and control air for the brake relay valves,
- **b.** actuating air for the service brakes,
- **c.** actuating air for the yard release facility, and
- **d.** release and control of the spring brakes.

Brake Chambers

18. Spring brake chambers provide service, parking and emergency braking to three axles under the direct control of the brake relay and spring brake control valves. The front axle is fitted with brake power chambers only, which are also actuated by the front brake relay valve. 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 Brake

19. The foundation brakes are a Dana Spicer 16.5 in diameter, 7 in 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 which has a twofold function:

- **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. Adjustment is locked by a spring loaded locking collar.

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 time (Figure 2). The valves are fitted to increase the speed of application and release of the brakes. The valve is mounted directly onto the brake air reservoir where they act as remote controlled brake valves, controlled by the operation of the service pilot valve. The valves deliver, or release, air to or from the brake chambers in response to the control air delivered from the towing vehicle's brake control valve.

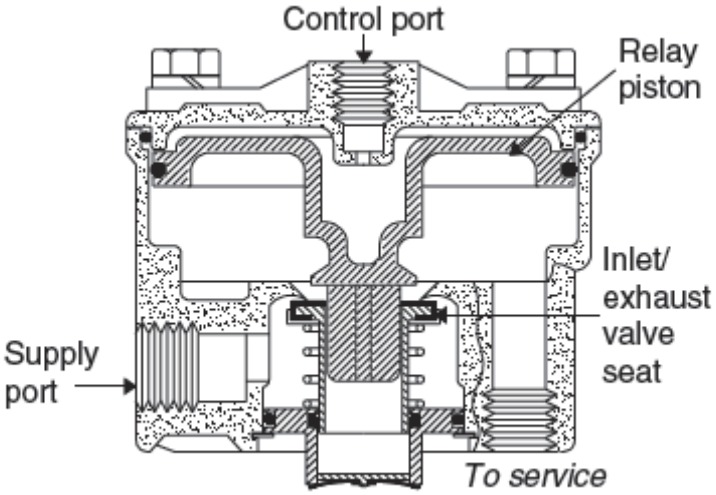


Figure 2 Brake Relay Valve – Cross Sectional View

Spring Brake Control Valve

21. The spring brake control valve (Figure 3) is fitted into the braking system to control 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.

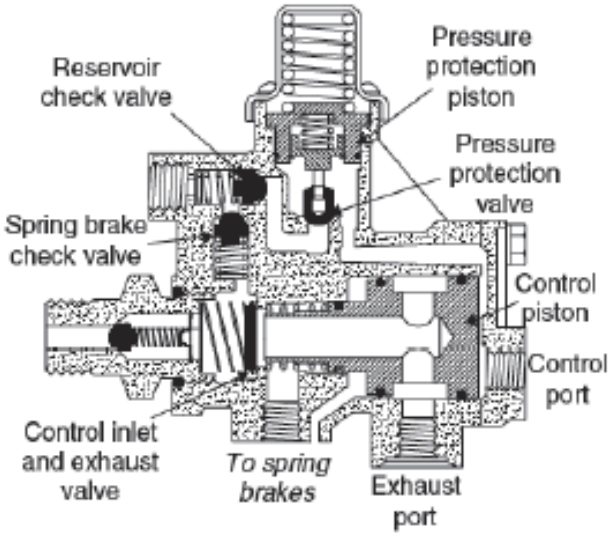


Figure 3 Spring Brake Control Valve – Cross Sectional View

BRAKES – OPERATION

Brake Relay Valve

22. Applying. Air pressure delivered to the control port enters the small cavity above the relay 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 service brake chambers (Figure 4).

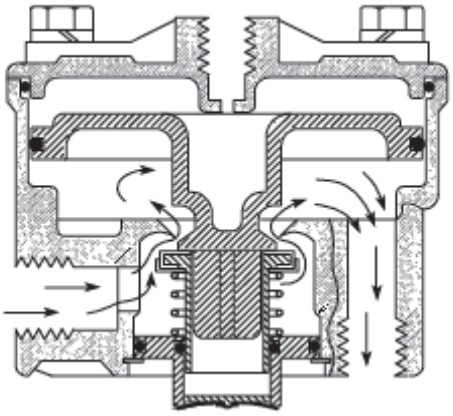


Figure 4 Brake Relay Valve – Applying

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 5).

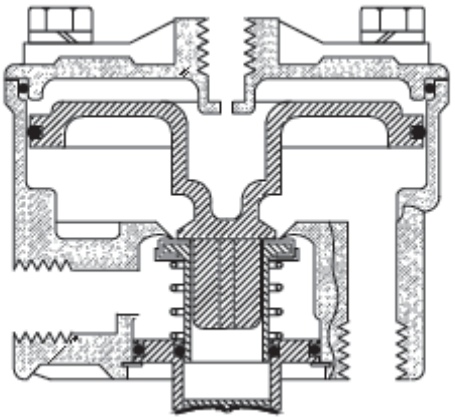


Figure 5 Brake Relay Valve – Balanced Position

24. Releasing. When air pressure is released from the control 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 6).

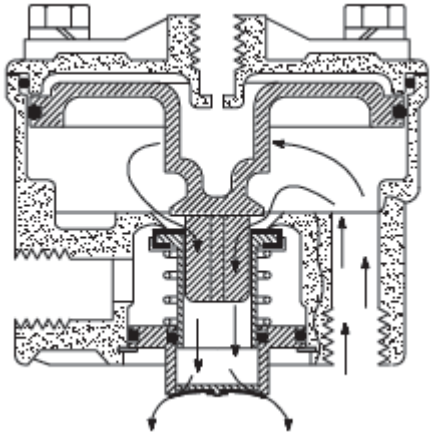


Figure 6 Brake Relay Valve – Releasing

Spring Brake Control Valve

25. Charging. Air from the trailer supply line enters the control port and moves the control piston into contact with the control port inlet and exhaust valve, sealing off the exhaust passage through the control piston, and opening the inlet (Figure 7). Air entering the control port is also directed to the underside of the pressure protection piston. When air pressure builds to approximately 380 kPa beneath the pressure protection piston, the piston moves against the force of the piston spring and remains open. Air flowing past the open pressure protection valve opens the reservoir check valve. Air passing through the reservoir check valve flows out the reservoir port and also opens the spring brake check valve, allowing air to fill the brake reservoir. As the air fills the brake reservoir, it also flows by the open control inlet valve, out the spring brake ports of the spring brake control valve and into the spring brake chambers, where it releases the spring brake assemblies.

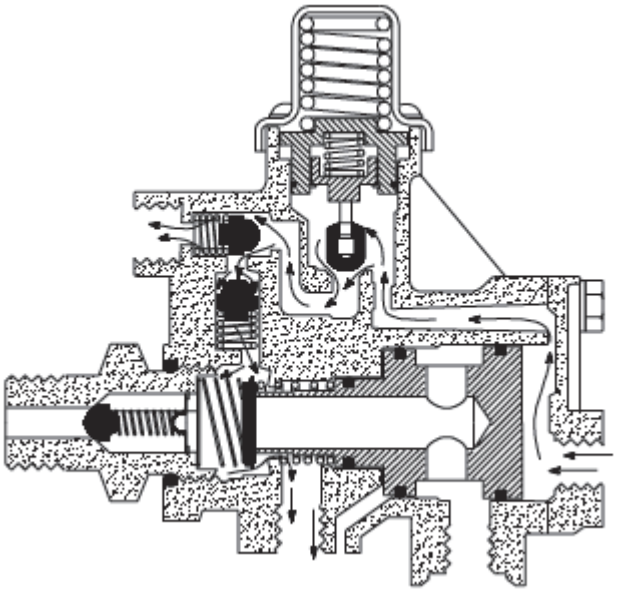


Figure 7 Spring Brake Control Valve – Charging

26. Park Application. To park the trailer, either the trailer valve or the parking control valve, which are located in the cab of the towing vehicle, are actuated, and this exhausts the trailer supply line. When the trailer supply line is exhausted, air pressure is removed from the control and pressure protection pistons (Figure 8). With air pressure removed, the return spring moves the control piston, the control inlet valve closes and the exhaust passage through the control piston opens. This allows air in the spring brake chambers to exhaust through 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 loss of pressure in the reservoir.

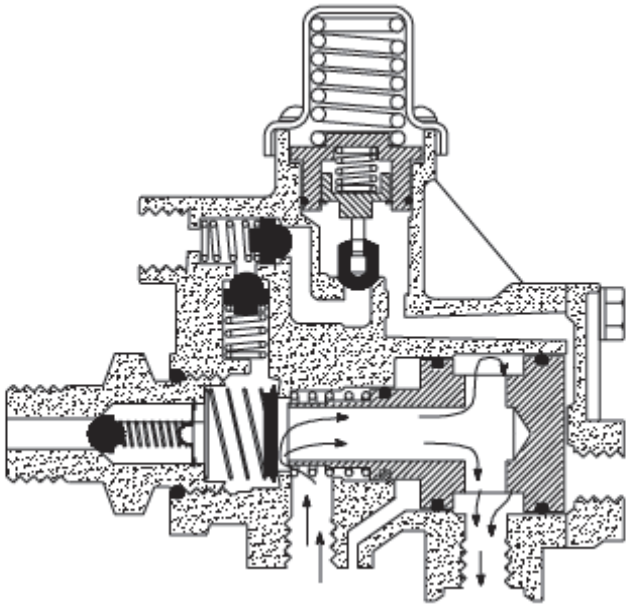


Figure 8 Spring Brake Control Valve – Park Application

27. Brake System Failure. If air pressure is reduced in the 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 pressure protection valve (Figure 9). This retains approximately 345 to 415 kPa in the trailer supply line and in the towing vehicle. With 345 to 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. A low pressure warning occurs in the towing vehicle to warn the driver. The spring brake check valve will protect against loss of air pressure from the reservoir which is keeping the spring brakes released.

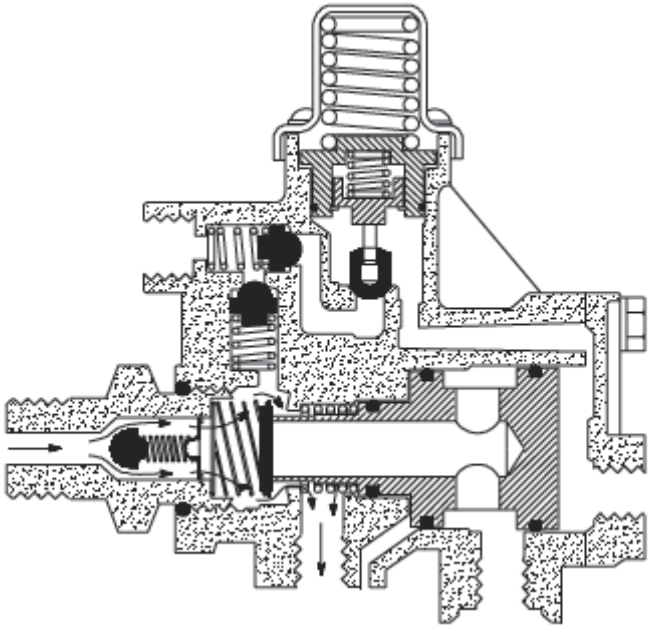


Figure 9 Spring Brake Control Valve – Brake System Failure

28. Emergency Application with Service System Failure. To apply the trailer brakes after a system failure has occurred, the trailer supply valve or parking control valve exhausts the remaining 345 to 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 and the exhaust valve to open. Air from the spring brake chambers exhausts through the spring brake control valve and applies the brakes.

29. Once applied, the brakes cannot be released by air pressure until the fault has been rectified.

Yard Release Valve

30. 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 to 415 kPa).

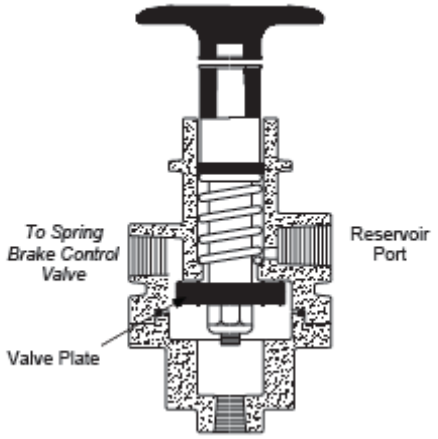
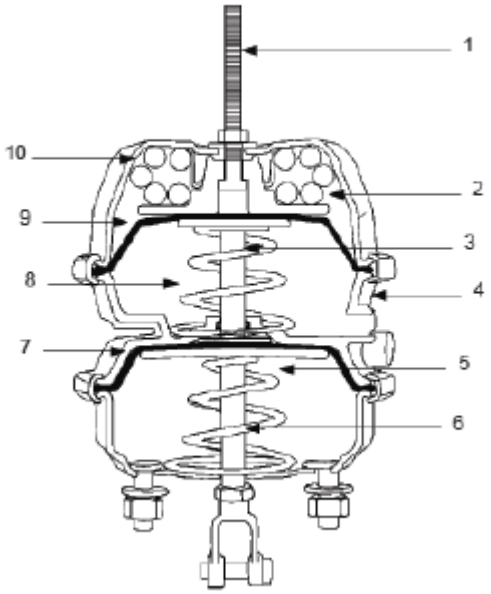


Figure 10 Yard Release Valve – Cross Sectional View

Spring Brake Chambers

31. General. The spring brake assemblies (Figure 11) consist of a spring brake chamber and a service brake chamber. The spring brake chambers are fitted to operate as park brakes and as automatic, emergency brakes in the event of loss of supply air pressure. The service brake chambers sole function is to act as service brake actuators. Air pressure is required to release the spring brakes, and 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.



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 11 Spring Brake Chamber – Cross Sectional View

32. 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.

33. 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.

34. 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 and compresses their respective return springs and applies the brakes.

35. 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. It is used to cage the spring brake power spring.

Slack Adjusters

36. The slack adjusters (Figure 12) 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.

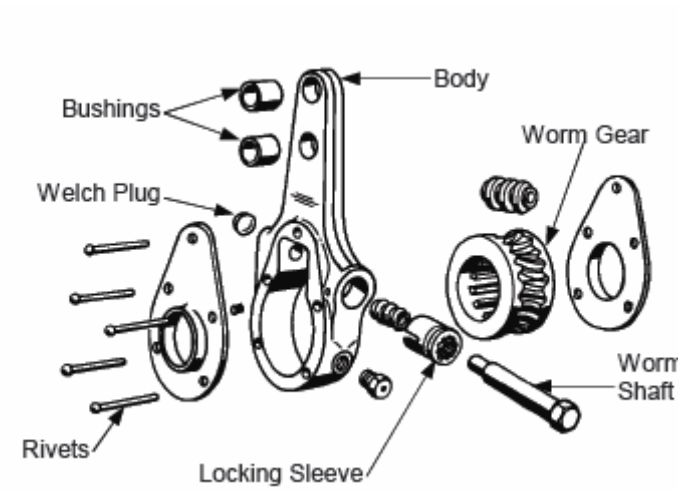


Figure 12 Slack Adjuster Assembly – Exploded View

SUSPENSION

Description

37. The trailer employs an Engineered Transport Equipment (ETE), overslung, spring-type suspension (Figure 13) on each of the two axle assemblies.

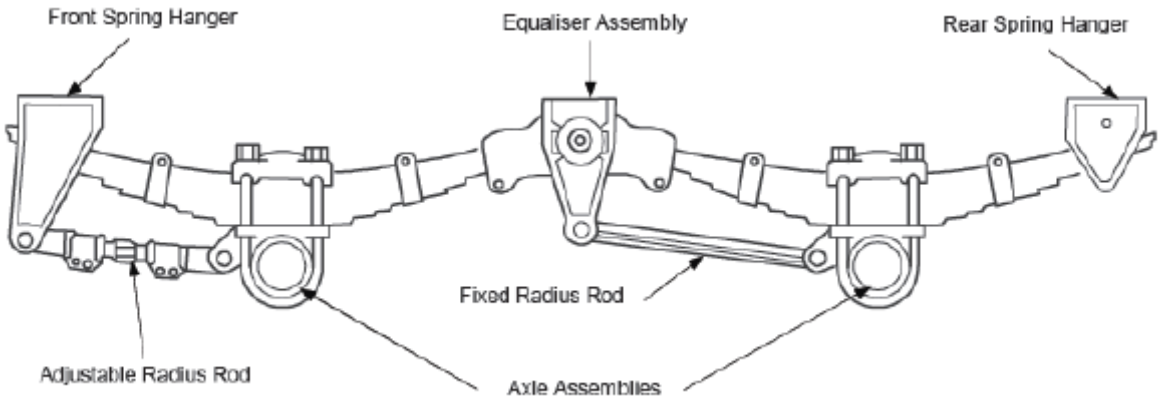


Figure 13 Trailer Suspension Layout

38. Load sharing capabilities are provided by the use of centre mounted equaliser assemblies. The suspension has eight-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

39. The springs are eight-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 Hangers

40. 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 spring hangers by a ½ in UNF bolt fitted across the spring hangers.

Equaliser Assembly

41. The equaliser assembly provides the load sharing capabilities of the ETE suspension. The equaliser assembly consists of a centre mounted, cast steel equaliser hanger carrying a cast steel equaliser beam which is pivoted on two tapered rubber bushes. As with the spring hangers, the springs are free to slide in the equaliser beam and are held in position by a single ½ in UNF bolt.

Radius Rods

42. The radius rods used in this application are both fixed length and adjustable types. Each type comes in two different lengths. These are:

a. **Fixed Length Rods.** These are of cast construction, moulded to accept tapered rubber bushes in each end (Figure 14). 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.

b. **Adjustable Rods**. The two adjustable radius rods each consist of a steel rod threaded each end (one end left-hand thread and one end right-hand thread), and one each of left-hand and right-hand threaded cast steel ends (Figure 15). 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.

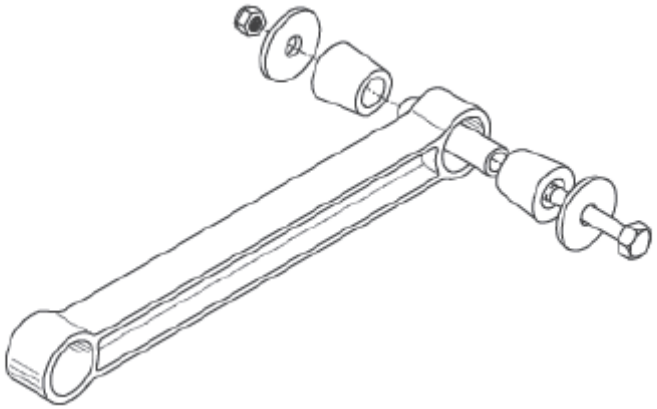


Figure 14 Fixed Length Radius Rod

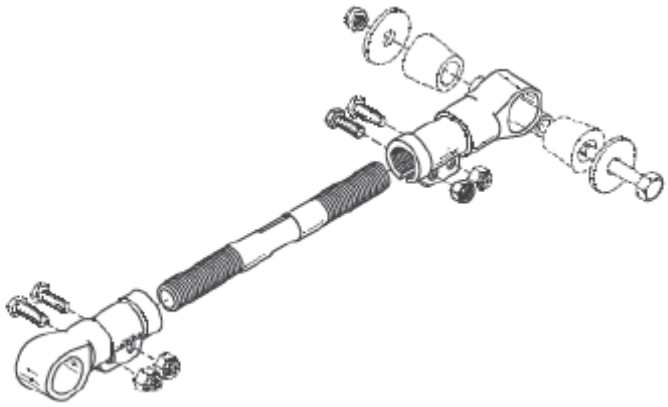


Figure 15 Adjustable Length Radius Rod

ELECTRICAL

Description

43. The electrical system is a basic 24-volt electrical system, coupled to the towing vehicle socket by a 12-pin NATO plug (Figure 16). All lighting connected to the electrical system is 24-volt, with the exception of the blackout lighting, which are 12-volt dc electronic modules. A resistor is incorporated into the system for each blackout module. These resistors are located in the plastic junction boxes fitted inside the beaver tail on either side of the trailer.

44. The trailer is also fitted with four sockets for use with a flood lamp (which forms part of the SCES). These sockets are found at each corner of the trailer.

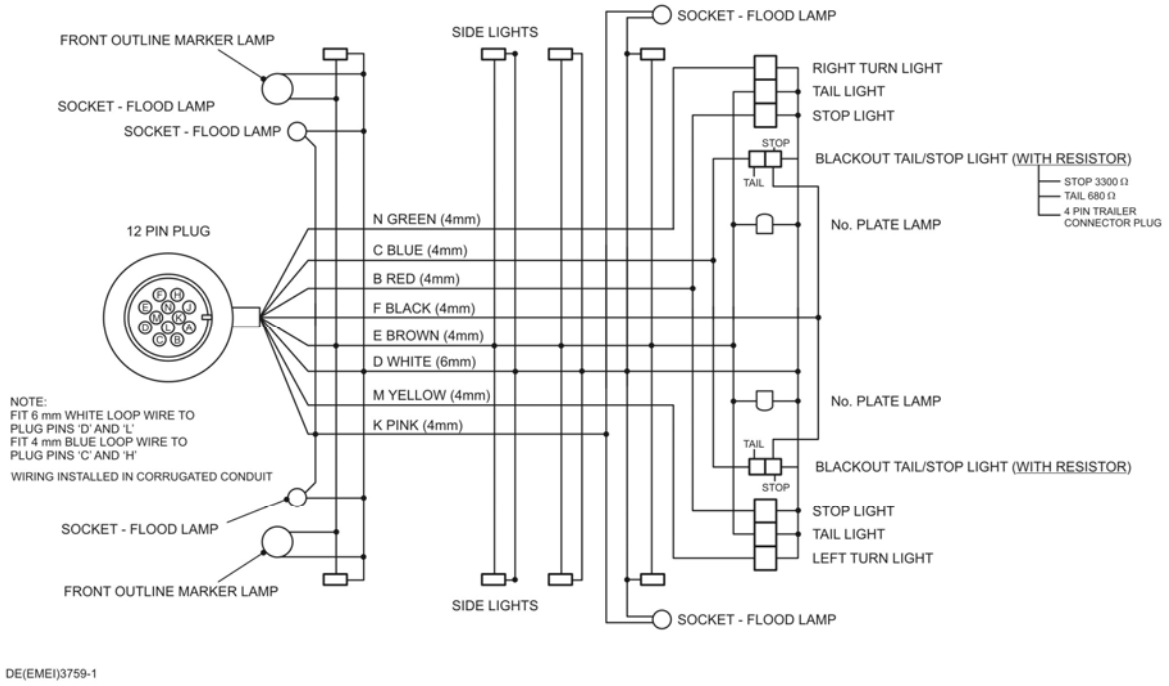


Figure 16 Electrical Circuit Diagram

FRAME ASSEMBLY

Description

45. The trailer is a prefabricated steel frame construction consisting of two major components as follows:

a. the trailer main frame, and

b. the dolly converter frame.

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

47. The dolly converter frame carries the front bogie suspension units and braking system, and the main frame carries the rear bogie suspension units, braking system, stowage facilities, spare wheel and loading ramps. A beaver tail formed at the rear of the trailer frame allows for ease of loading using the ramps. A pair of wind down legs supports the trailer during loading and unloading activities.

Loading Ramps

48. The trailer is fitted with two 2 730 mm long × 800 mm wide loading ramps. The ramps are attached to the trailer with two raised head pins. The ramps are fitted with a spring loaded assistance mechanism which is provided to assist with the lowering and raising of the ramps. The ramps are also fitted with retaining chains to secure it in the upright position except when the ramp is actually being lowered or raised.

Spare Wheel Winch

49. The spare wheel winch is a worm and wheel type winch enclosed in a prefabricated steel housing (Figure 17). The worm gear has a free fitting mild steel shaft.

NOTE

The spare wheel winch fitted to this trailer is a non repairable item and therefore needs to be replaced when defective.

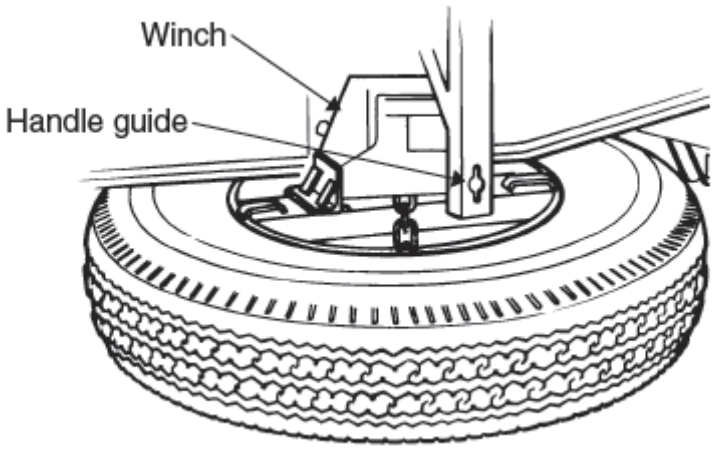


Figure 17 Spare Wheel Winch Mounting

50. This shaft incorporates the external driving dog which engages the winding handle. 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.

51. 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.

52. 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.

Hubodometer

53. A hubodometer is fitted to one hub on the left hand-side of the trailer. The hubodometer is a non-repairable item and is to be replaced when defective.

END

Distribution List: **VEH H 05.0 – Code 1** (Maint Level)
(Sponsor: LV SPO Mdm/Hvy B Vehicles)
(Authority ECO LVSPO 044/08)