DOLLY CONVERTER, HEAVY, TANK/PLANT TRANSPORTER. MC4

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 Dolly Converter, Heavy, Tank/Plant Transporter, MC4.

Principles Of Operation

2. The brake air system is a twin line type with spring brake chambers provided for each wheel.

3. The Semi-Trailer, Heavy, Tank/Plant Transporter, MC4, Haulmark and the Dolly Converter, Heavy, Tank/Plant Transporter, MC4, combine to enable the transport of heavy armoured vehicles and engineer plant.

4. Both trailer and dolly have axle load equalising and load sharing capabilities.

Arrangement of the Equipment

5. The dolly converter is fabricated from MS350 steel and welded construction, with the exception of the cast steel spring hangers.

6. The dolly converter is fitted with a skid plate for connection to the prime mover and a fifth wheel for connection to a trailer.

DETAILED DESCRIPTION

Axle Assemblies

7. The axles fitted to the dolly converter are a single, tubular beam type, manufactured by Dana Spicer. They are fitted with 16.5 in x 7 in, internal expanding shoe type brakes, acting on 20 in wheel hubs, which are in turn carried by tapered roller bearings. They are similar in design to the trailer axle, but have a narrower track.

Wheel Assembly

8. The wheels fitted to the dolly converter are a 8.25 x 22.5, single piece, pressed steel, tubeless type, fitted with 11R 22.5 x 16 ply rating tyres (Figure 1). For the current authorised tyres, see EMEI Vehicle A 291-5 – Tyres and Tubes – Australian Defence Force, B Vehicle Tyre Guide.

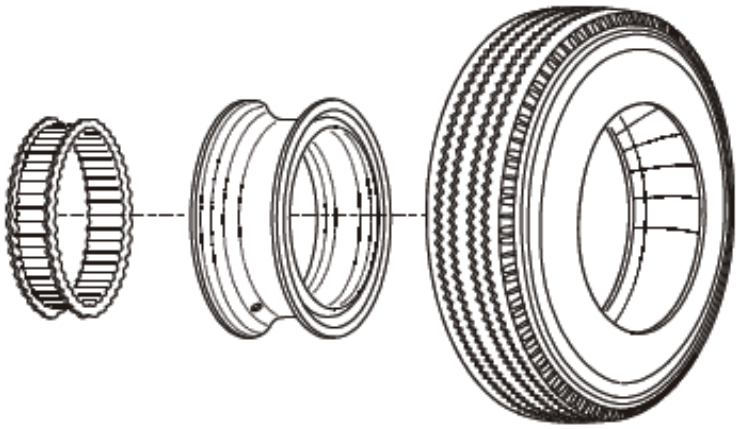


Figure 1 Wheel, Tyre and Spacer

BRAKES - GENERAL

9. The air actuating system is a Westinghouse design, while the foundation brakes are manufactured by Dana Spicer. The dolly converter brake system layout is shown in Figure 2.

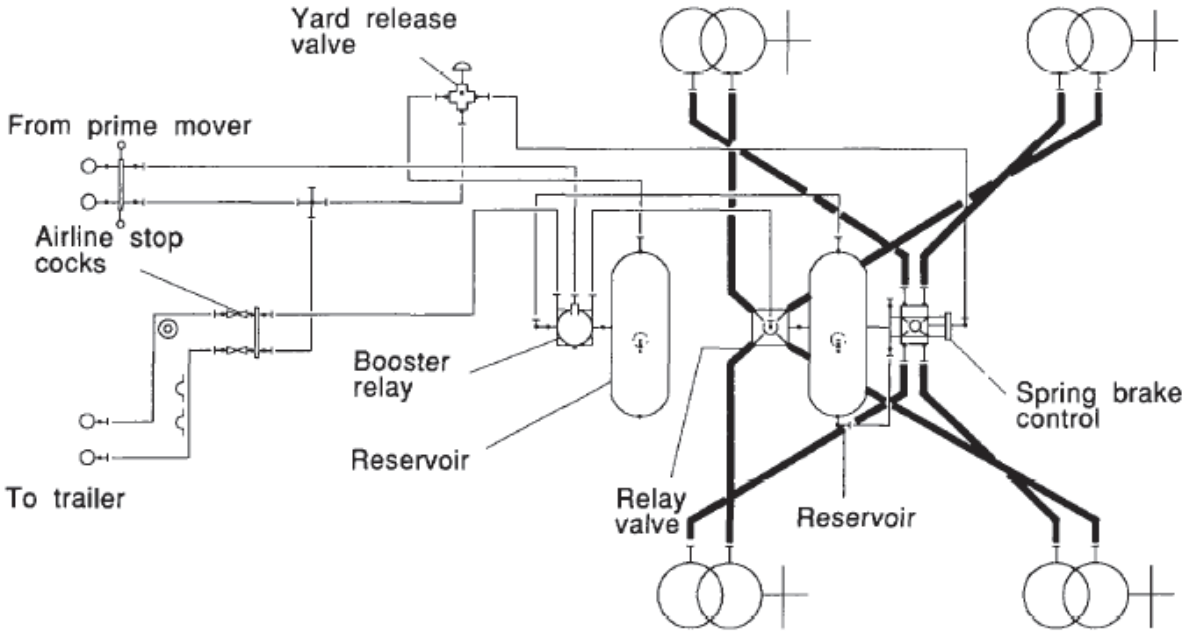


Figure 2 Dolly Converter Braking System

Brake Air Systems

10. The brake air system is a twin line type with spring brake chambers provided for each wheel and is designed to comply with ADR 38/02.

Service Brake Relay Valve

11. An R-12 service brake relay valve is mounted directly onto the rear air reservoir of the dolly converter. 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 port. The dolly converter service relay valve functions in response to control air delivered from the boost relay valve located on the front air reservoir of the dolly converter.

Boost Relay Valve

12. The boost relay valve fitted to the front air reservoir of the dolly converter is a Westinghouse R8-P relay valve. This valve is controlled directly from the prime mover brake control valve. The function of the relay valve is to deliver compressed air to the dolly converter service relay valve and the trailer service pilot relay valve control ports from the dolly converter front air reservoir. The delivered air pressure is in proportion to the air pressure sensed at its own control port.

Spring Brake Control Valves

13. The spring brakes are controlled by SR-3 spring brake control valves which are mounted directly onto the rear air reservoir of the dolly converter. The purpose of the spring brake control valve is to control the operation of the spring brakes during parking and emergency conditions.

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

15. During parking, when the parking control valve is actuated, air pressure is exhausted from the supply line. This causes the spring brake control valve to exhaust all air from the spring brake chambers, causing them to be applied by the internal spring pressure.

16. In the event that air pressure should be 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 and the prime mover. This low pressure causes the warning systems to operate in the prime mover. The spring brakes remain released, allowing the dolly converter 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 dolly converter supply valve or parking control valve, the spring brakes will not release until the system fault has been rectified.

Yard Release Valve

17. This valve is fitted to allow the brakes to be released, using air from the dolly converter reservoirs, for ease of movement within a safe area only. The valve is located on the right-hand side of the gooseneck.

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

Couplings

19. Glad hand type couplings are provided for easy connection between the dolly converter, a trailer and prime mover; with stop cocks and dummy couplings provided on the dolly at the trailer connection points.

Air Reservoirs

20. The dolly converter is fitted with two air reservoirs. The reservoirs provide the air required for the application of the brakes. The larger of the two provides the bulk of the air required for brake application. The smaller reservoir provides additional compressed air for brake application.

21. Each air reservoir is fitted with a condensation drain valve, which is actuated by means of individual pull cords located along the right-hand frame members of the dolly converter, adjacent to the respective air reservoir.

Brake Chambers

22. Each wheel brake is actuated by a TSE Type 3030 spring brake which provides service, parking and emergency braking under the direct control of the brake relay and spring brake control valve.

23. 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 dolly converter.

Foundation Brakes

24. The foundation brakes are a 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.

BRAKES - OPERATION

Service Brake Relay Valve

25. Applying. 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 3).

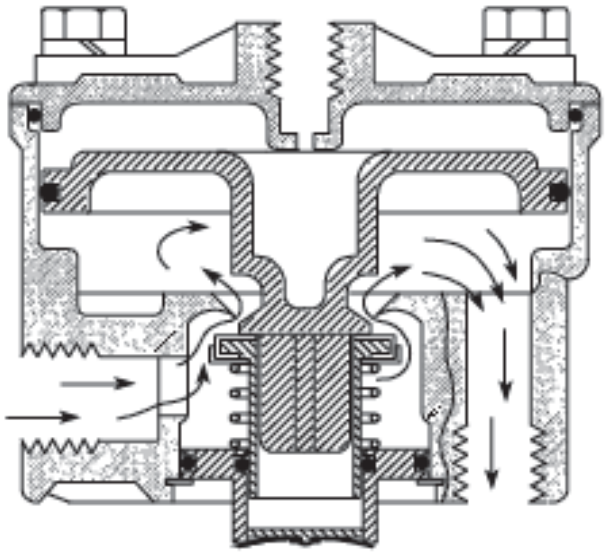


Figure 3 Brake Relay Valve - Applying

26. 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 4).

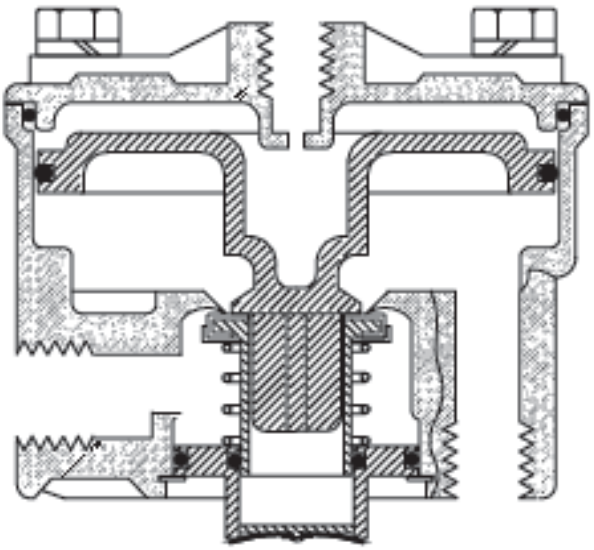


Figure 4 Brake Relay Valve - Balanced Position

27. 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 5).

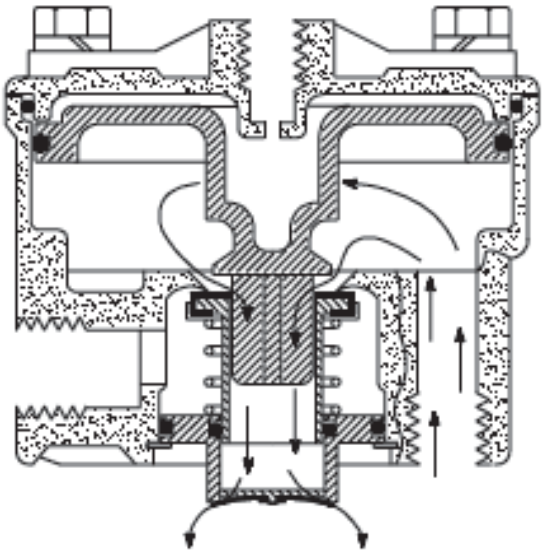


Figure 5 Brake Relay Valve - Releasing

Boost Relay Valve

28. Applying. Air pressure entering the service port flows into the cavity between the cover and the top of the relay piston. This air pressure, acting on the surface of the piston, forces it down. The exhaust valve seat moves down with the piston and seats on the inner or exhaust portion of the inlet and exhaust valve, sealing off the exhaust passage. At the same time the outer or inlet port of the inlet and exhaust valve moves off its seat, allowing supply air to flow from the reservoir past the open inlet valve and out the delivery port (Figure 6).

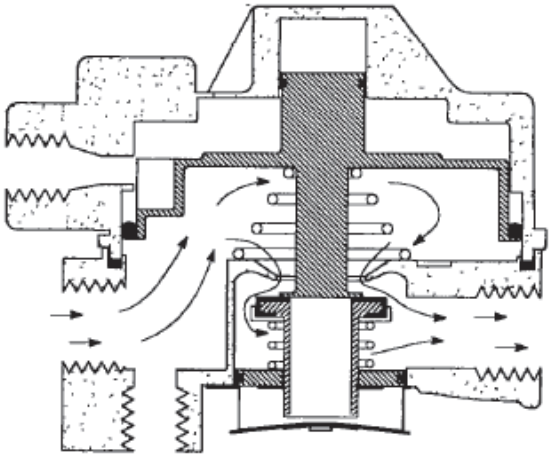


Figure 6 R8-P Boost Relay Valve - Applying

29. Balancing. The air pressure being delivered by the open inlet valve is also effective on the bottom area of the relay piston. When this delivery air pressure beneath the piston equals the service air pressure above, the piston moves slightly and the inlet spring returns the inlet valve to its seat. The exhaust remains closed as service line pressure balances delivery pressure (Figure 7).

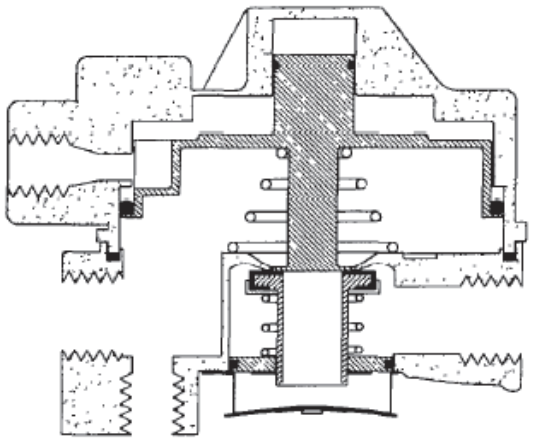


Figure 7 R8-P Boost Relay Valve - Balancing

30. Releasing. When air pressure is exhausted from the service port, the diaphragm in the quick release moves, blocking the service inlet and opening the exhaust of the quick release, allowing the air that was acting on the relay piston to be exhausted at the quick release. When the air above the relay piston is exhausted, the air beneath the piston lifts the piston and the exhaust seat moves off the exhaust valve, opening the exhaust passage to the atmosphere. With the exhaust passage open, the air pressure applied to the relay valve is exhausted out of the exhaust port to atmosphere.

Spring Brake Control Valve

31. Charging. Air from the dolly converter 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 8). 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 service reservoir check valve. Air passing through the service reservoir check valve flows out the service reservoir port and opens the spring brake reservoir check valve, allowing air to fill the brake reservoir. As the air fills the brake reservoir, it also flows by the open control inlet, out the delivery ports of the spring brake control valve and into the spring brake emergency ports, where it releases the spring brakes.

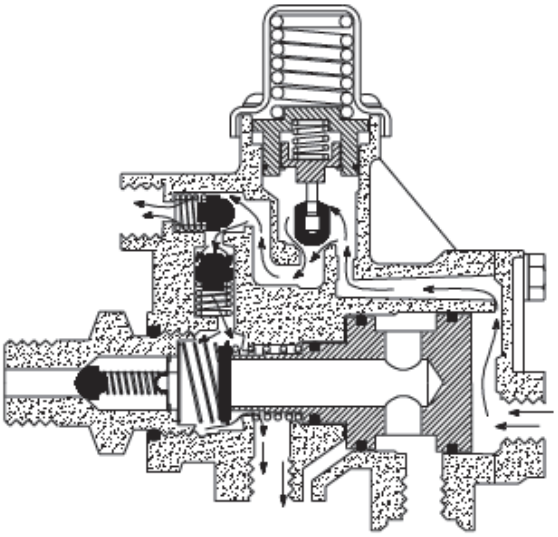


Figure 8 Spring Brake Control Valve - Charging

32. Park Application. To park the dolly converter and trailer, either the trailer valve or the parking control valve, which are located in the cab of the towing vehicle, are actuated. This exhausts the trailer supply line (Figure 9). When the supply line is exhausted, air pressure is removed from the control and pressure protection pistons. 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 emergency section 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.

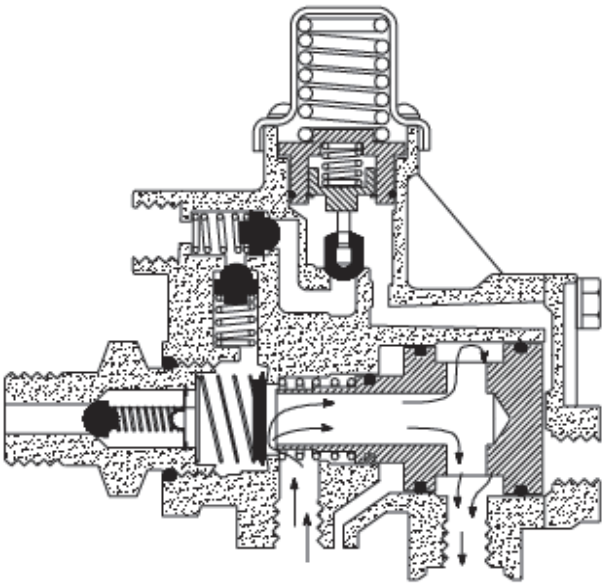


Figure 9 Spring Brake Control Valve - Park Application

Brake System Failure

33. If air pressure is reduced in the service system, pressure in the 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 10). This retains approximately 345-415 kPa in the supply line and in the towing vehicle. With 345-415 kPa pressure held in the supply line and against the control piston in the spring brake control valve, the spring brakes remain released. A low pressure warning occurs in the towing vehicle to warn the driver.

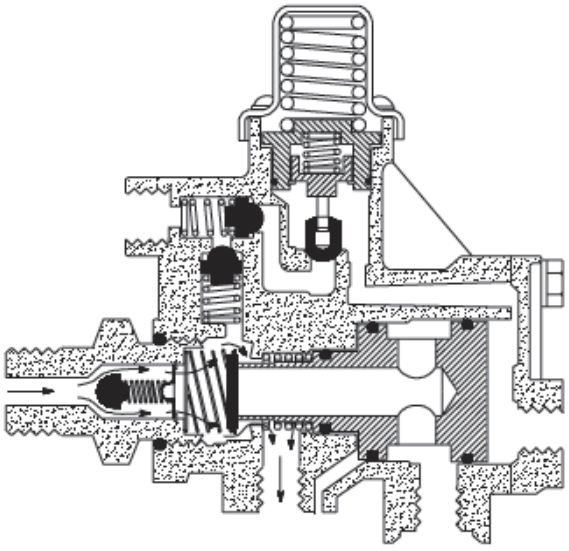


Figure 10 Spring Brake Control Valve - Brake System Failure

34. Emergency Application with Service System Failure. To apply the trailer brakes after a service system failure has occurred, the trailer supply valve or parking control valve exhausts the remaining 345-415 kPa supply line pressure. Exhausting the 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 chamber emergency section exhausts through the spring brake control valve and applies the brakes.

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

Yard Release Valve

36. The yard release valve is a push/pull, manually operated, ON/OFF, air control valve, with an exhaust function (Figure 11). 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).

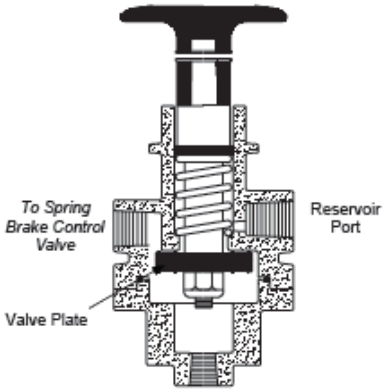
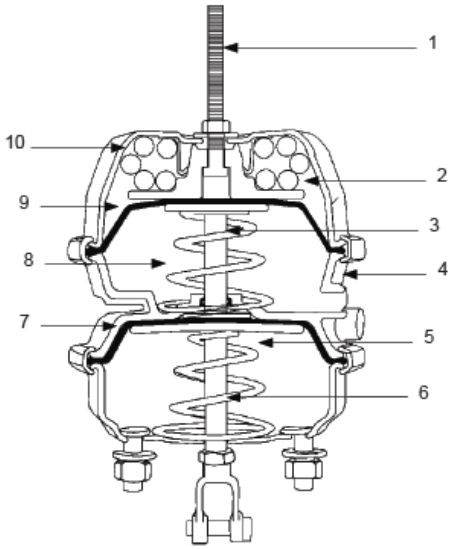


Figure 11 Yard Release Valve - Cross Sectional View

Spring Brake Chambers

37. General. The spring brake chambers are fitted to operate as service brake actuators and parking brakes, and as automatic, emergency brakes in the event of loss of supply air pressure (Figure 12). 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 12 Spring Brake Chamber - Cross Sectional View

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. 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.

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 a spring loaded locking sleeve.

SUSPENSION

43. The dolly converter uses an Engineered Transport Equipment, 1.25 metre, underslung, leaf spring type suspension. Load sharing capabilities are provided by the use of the centre mounted equaliser assembly. The springs are of eight-leaf, semi-elliptic construction and are free to slide in their respective hangers at either end. The axles are located by means of radius rods, which allow free movement of the axles for the full length of the suspension, while still maintaining correct axle alignment.

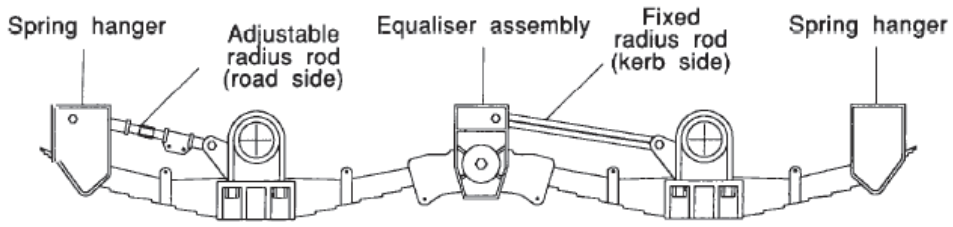


Figure 13 Dolly Converter Suspension Layout

Springs

44. The springs are eight-leaf, semi-elliptic, sliding shackle type, fixed to the axle assemblies by steel U-bolts, and located by cast steel spring seats which are welded to the axle assemblies. The third leaf of each spring assembly has both ends folded down in a vertical plane, to prevent the spring sliding out of the spring equalisers.

Spring Equalisers

45. The equaliser assembly provides the load sharing capabilities of the ETE suspension. The equaliser assembly consists of a centre, 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

46. The radius rods used on the dolly converter are:

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.

b. **Adjustable Rods.** The two adjustable rods each consist of a steel hexagonal rod threaded each end with left- and right-hand threads, and one each of left- and right-hand threaded cast steel ends moulded to accept tapered rubber bushes and associated clamping bolts with Nyloc nuts. 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.

Spring Hangers

47. The spring hangers are cast steel, front and rear, welded to the dolly 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 cross bar at the bottom, which is an extension of the casting.

ELECTRICAL

Description

48. The electrical system is a basic 12 Volt electrical system coupled to the towing vehicle by a 12 pin NATO socket and plug. All lighting connected to the electrical system is 12 Volt.

49. An electrical circuit diagram for the dolly converter in Figure 14.

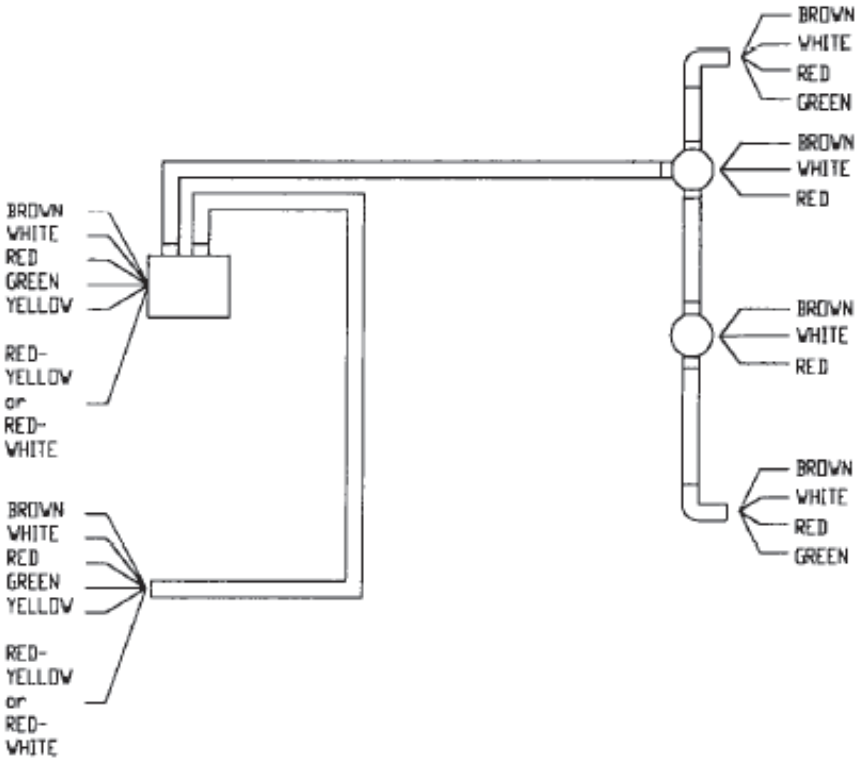


Figure 14 Dolly Converter Electrical Circuit Diagram

FRAME ASSEMBLY

50. The dolly converter frame is a single piece, all steel, welded construction, manufactured from 350 grade steel.

51. The dolly converter frame is fitted with:

- **a.** two stabiliser legs;
- **b.** a fifth wheel Kompensator;
- **c.** a fifth wheel for connecting to the trailer; and
- **d.** a skid plate for connecting to the prime mover.

END

Distribution List: **VEH H 08.0 – Code 2** (Maint Level)
(Sponsor: CGSVSPO, Mdm/Hvy B Vehicle Section)