TRUCK, TRANSPORTER, FLOATING BRIDGE, MC3, W/WINCH, MACK, LAUNCH AND RECOVERY VEHICLE (LRV) NSN 2320-66-131-6653

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.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Blank Page

INTRODUCTION

1. This EMEI describes the technical system and details of the Truck, Transporter, Floating Bridge, MC3, W/Winch, Mack, Launch and Recovery Vehicle (LRV). The LRV consists of a modified Atlas loader, mounted onto a Mack 8 ton cab/chassis to form a self-contained system for the transport, launch and recovery of the Floating Support Bridge (FSB) modules and the Bridge Erection and Propulsion Boat (BEPB).

2. The system comprises four major assemblies (Figure 1 and Table 1):

- **a.** sub-frame;
- **b.** front lift frame;
- **c.** rear lift frame; and
- **d.** hook arm/winch assembly.

NOTE

Information applicable to the Mack 8 tonne cab/chassis is contained in EMEI Vehicle G 702, Truck Cargo Heavy, Winch, MC3 - Technical Description.

PRINCIPLES OF OPERATION

3. The sub-frame is attached to the truck chassis rails. Mounted onto the sub-frame at a pivot, is the rear lift frame. The front lift frame is connected to the front of the rear lift frame by a manually locked pivot joint.

4. The movement of these frames is initiated by hydraulic cylinders connected between the front lift frame and the sub-frame. If the pivot joint is unlocked, the front lift frame pivots about the rear lift frame. Conversely, a locked pivot joint causes the two frames to act as a single beam, pivoting about the rear of the LRV. The lift frame lock is normally in the unlocked position. A safety limit switch prevents the rear lift frame being raised too high.

5. The hook arm is attached at right angles to the front of the front lift frame. The hook arm pivots under the action of a hydraulic cylinder located inside the hook arm. A hydraulic winch is mounted on the hook arm with its cable passing over a sheave to the load hook.

6. Further features of the system are front and rear hydraulically telescoping module locating rollers.

7. During transport, a hydraulically actuated module lock secures either the bridge module with a pin through the hole in the module rope guide, or a BEPB, by locking into a recess in the hull. Two manually fastened catch plates, located adjacent to the rear rollers, secure the module or BEPB rear. The catch plate assemblies are also used to locate the module or BEPB during recovery onto the LRV.

8. Hydraulic power is derived from a pump, driven by a power take off (PTO), mounted on the right side of the transmission gear box.

9. The LRV operator's station controls are mounted on a platform at the right rear of the drivers cabin. Red illumination is provided for night operation and two blackout lights are mounted at the rear of the LRV to allow for module recovery at night. White light work lights are also positioned on the vehicle to allow work to be conducted at night without affecting the visibility of BEPB operators.

10. The LRV is equipped with extendable rear view mirrors and clearance lights for use when laden with FSB modules or a BEPB (oversize operation). There are two rotating amber warning lights affixed to the roof rack. A removable amber warning light is attachable to the rear of the vehicle to be used when travelling on public roads in oversize configurations. Oversize signs are attached to the vehicle as follows:

- **a.** on the front bumper of the LRV, and
- **b.** to the rear of a loaded bridge module or BEPB.

11. The LRV is adaptable to a general cargo vehicle with a capacity of 4.5 tonne by fitting a purpose designed cargo pallet tray. The cargo pallet tray is secured to the LRV using load binders connected between the rear of the cargo pallet tray and the LRV rear chassis cross-member.

12. Communications with a waterborne BEPB, or an escort vehicle when travelling oversize on public roads, is provided by a UHF radio set mounted in the vehicle cabin. 12-volt electrical power for the radio is provided by a 24-volt to 12-volt power converter mounted on the rear wall of the cabin.

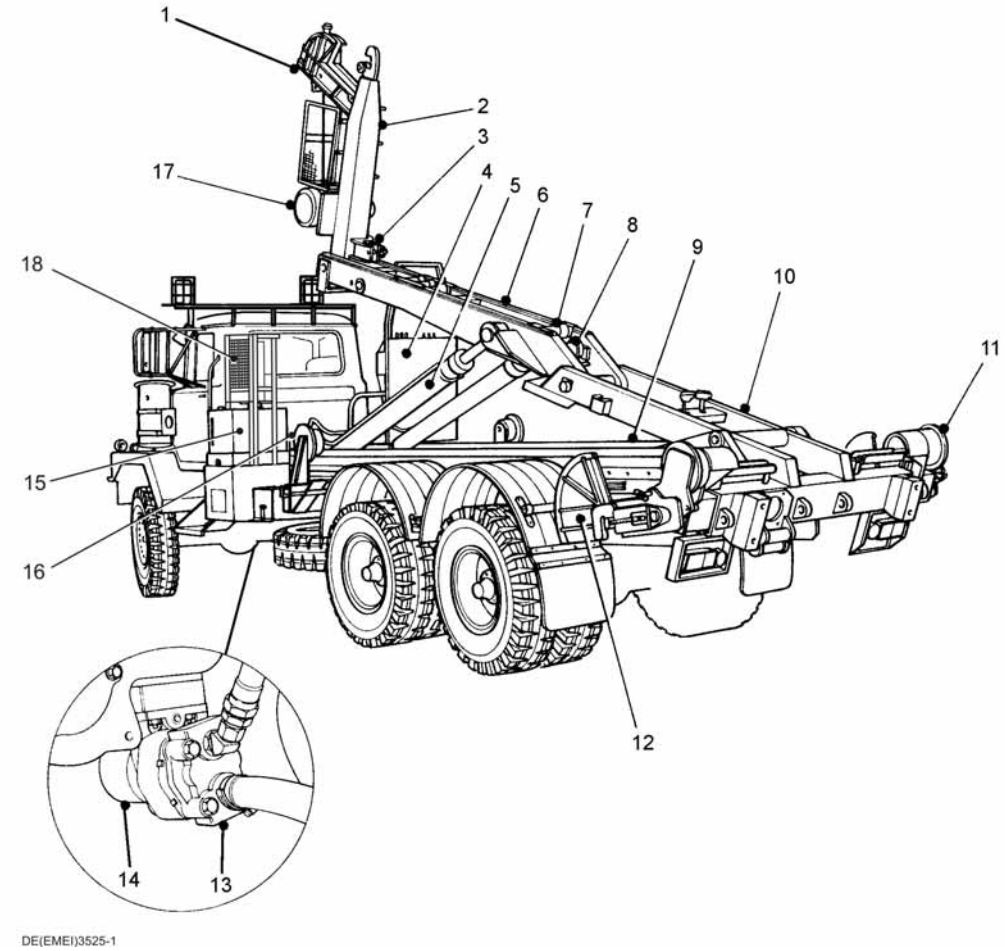

Figure 1 Launch and Recovery Vehicle (LRV) Systems

13. Items called out in Figure 1 are described in Table 1.

Table 1 Figure 1 Callout Designations

Figure 1 Item Number	Designation	Figure 1 Item Number	Designation
1	Hook guide arm	10	Rear lift frame
2	Hook arm	11	Rear telescopic roller and cylinder
3	Module lock	12	Module catch plate
4	Operator's control platform	13	Hydraulic pump
5	Lift cylinders	14	Power take off
6	Front lift frame	15	Hydraulic oil tank
7	Inner rollers	16	Front telescopic roller and cylinder
8	Inner frame lock	17	Lift winch assembly
9	Sub-frame	18	Hydraulic oil cooler and frame

DETAILED TECHNICAL DESCRIPTION

Hydraulic System Operation

14. The frame assembly components are operated by hydraulic pressure from a pump powered by the PTO from the vehicle transmission assembly. The PTO is engaged and disengaged by a pneumatic servo mechanism, operated by an electric toggle switch, mounted in the cabin.

15. Hydraulic power is provided to the following sub-assemblies (Figure 2) via marinised control valves located on the operator's control platform:

- **a.** lift winch,
- **b.** hook cylinder,
- **c.** hook guide arm cylinder,
- **d.** lift cylinders,
- **e.** forward roller cylinders,
- **f.** rear roller cylinders, and
- **g.** module lock mechanism.

16. A 24-volt electrically powered hydraulic oil cooler is located in the hydraulic oil return line. This is to ensure that the hydraulic oil does not overheat during launch and recovery operations.

Lift Winch

17. The lift winch is a planetary, hydraulic winch, which has equal speed in both directions. The main components of the winch are:

- **a.** hydraulic gear motor,
- **b.** multi disc brake with static and dynamic function,
- **c.** primary planet and final planet reduction gearing giving a total reduction ratio of 41:1,
- **d.** brake housing, and
- **e.** final drive assembly and cable drum.

18. The winch is mounted onto the back of the hook arm. The cable assembly consists of an eyehook, clevis and 20 metres of 10 core wire rope. The winch cable passes up the hook arm over a sheave to the hook guide.

19. The hook guide and sheave can pivot about the hook arm to allow the cargo pallet tray to be fitted.

20. A mesh guard is bolted onto the hook arm body to protect the operator from the winch cable.

21. The winch directional control valve is operated from the operator's control platform. When the pump is engaged, forward movement of the control lever directs fluid at a pressure of 21 MPa, from the oil tank through the control valve to the lift winch, causing the winch drum to rotate and pay out the cable.

22. In forward rotation, the output torque and rotation of the hydraulic motor are transmitted to the final reduction stage by the final sun-gear shaft, which is splined to the primary planet hub. In forward rotation (or when a load is raised) an over-running clutch, which connects the motor drive shaft to the automatic brake assembly, permits free rotation of the sun-gear without affecting the brake. When the winch rotation is stopped, the load on the cable drum causes the over-running clutch to lock and the maximum load is held by the disc brake with a safety ratio of 3:1.

23. Movement of the control lever to the rear reverses the direction of rotation of the winch by causing fluid to flow to the winch, through the alternative line and back to the tank.

24. In reverse rotation (when lowering), hydraulic pressure from the reversing side of the hydraulic motor is channelled to the brake piston, causing the brake piston to release the multi disc brake against a number of brake springs. The pressure required to release the brake is 2.75 MPa to 5.5 MPa.

25. The over-running clutch that connects the motor drive shaft to the brake assembly, locks. This causes the brake discs to rotate between divider plates. If the load on the cable drum affects the lowering speed, the resulting pressure drop in the brake piston causes friction between the brake discs and the divider plates. Thus, a completely smooth lowering speed can be achieved in a step-less operation by modulation of the winch control handle. When the control handle is returned to the neutral position, rotation stops and the disc brake applies automatically.

26. A relief valve, set to a maximum pressure loading of 15 MPa, limits the fluid pressure to the maximum operating pressure of the winch hydraulic motor.

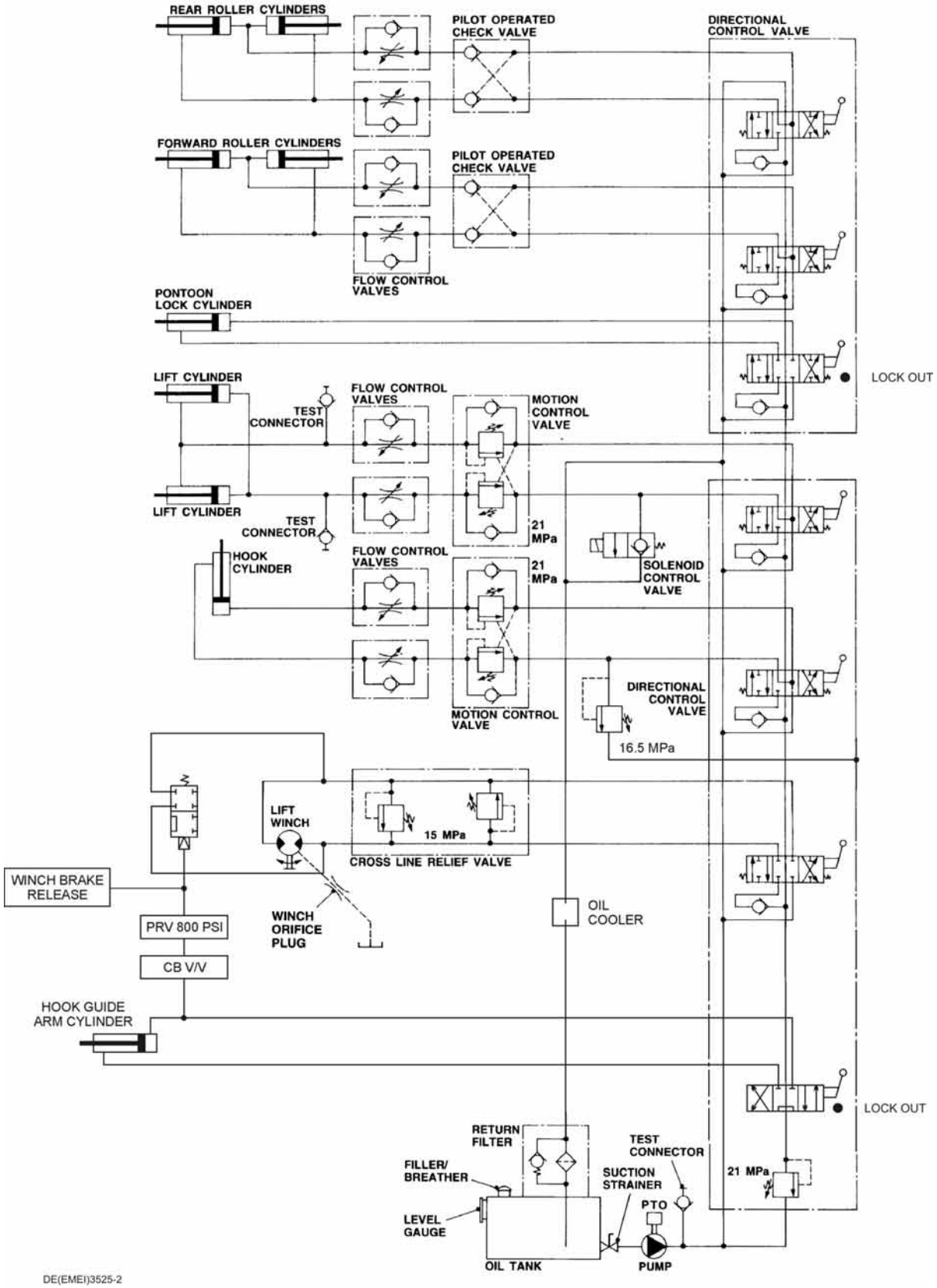

Figure 2 Hydraulic Circuit Diagram

Hook Cylinder

27. The hook cylinder is connected between the front lift frame and the hook arm assembly. The hook cylinder provides the turning force to move the hook arm in a pivotal motion around the frame.

28. The hook arm directional control valve is located near the winch control and operates in a similar fashion to that of the winch control. Forward movement of the lever causes the fluid to flow to the hook cylinder through a flow control valve and onto the face of the piston in the cylinder. Fluid returns from the other side of the cylinder through a return line to the fluid tank. Movement of the control lever to the rear reverses the direction of flow of the fluid and the piston.

29. Flow control and motion control valves are fitted to both fluid lines to enable the speed of movement of the hook arm to be controlled. The valves limit the effect of hydraulic shock to the cylinder and minimise fluid flow effects from any tendency of the cylinder to be starved of fluid during movement.

Hook Guide Arm Cylinder

30. The hook guide arm cylinder is connected between the hook arm and the hook guide arm assembly. The hook guide arm cylinder provides the turning force to move the hook guide arm in a pivotal motion around the hook arm. The hook guide arm is pivoted away from the hook arm during transport or when lifting a cargo pallet tray. The hook guide arm cylinder hydraulic circuit includes hydraulic control valves to disable the winch brake when the hook guide arm is being moved. This prevents over-tensioning or bird caging of the winch rope during hook guide arm movement.

Lift Cylinders

31. Lift cylinders give the front lift frame the lifting capacity to raise the bridge module or BEPB smoothly to allow for a controlled launch and to position the lift frame for recovery operations.

32. The two lift cylinders are attached between the LRV sub-frame assembly and the front lift frame. The front lift frame is constrained at its rear by a lockable pivot. Under the action of hydraulic pressure, the lift cylinders extend or retract and pivot the front lift frame around its rear pivot pin. If the frame lock is engaged, this causes the front and rear frame assembly to pivot around the rear lift frame pivot as a single beam.

Forward and Rear Roller Cylinders

33. The front and rear roller cylinders position the rollers for various operating modes. The three positions are:

- **a.** full retraction for cargo pallet tray positioning,
- **b.** partial retraction for FSB and BEPB transport, and
- **c.** full extension for FSB and BEPB recovery.

NOTE

During FSB Module or BEPB transportation, spacer blocks are provided to ensure correct positioning of the front and rear rollers when partially retracted.

34. The roller cylinders operate in a similar manner to the other cylinders with extension and retraction controlled by the flow direction of the hydraulic fluid.

Module Lock Cylinder

35. The module lock cylinder allows hydraulic locking of the following items to the front of the lift frame during transportation:

- **a.** both FSB modules,
- **b.** the BEPB, and
- **c.** the cargo pallet tray.

Electrical

36. The electrical circuit diagram is shown in Figure 3.

37. Warning Lights. A rotating warning light is permanently mounted to each front corner of the roof rack. A removable rotating warning light can be positioned in a bracket mounted to the right-hand rear light assembly bracket. These three rotating warning lights are to be used when the LRV is being operated oversize on public roads. The rear rotating warning light is removable to prevent it being immersed in water during launch and recovery operations.

38. Work Lights. Two low wattage work lights (white light) are positioned on the vehicle to facilitate failing light or night operations without excessively illuminating the surrounding area. These lights do not interfere with the vision of the BEPB operator during launch and recovery operations. The work lights are controlled by a switch located on the operator's control platform and can be dimmed if required. The operator's control platform is equipped with both red and white light console illumination, selectable by the operator.

39. Inter-vehicle Connection Panel. An Anderson plug, an interconnection switch and a NATO plug are located on a panel at the rear of the operator's control platform.

40. The Anderson plug is controlled by the interconnection switch and has the following functions:

a. connecting a battery charger to the LRV, and

b. to slave start a BEPB loaded on the LRV.

41. The NATO plug provides power to the removable rear signage via an interconnecting cable.

42. Safety Switches. The LRV lift frame includes three proximity switches to ensure that the lift frame and hook arm cannot exceed their travel limits. A micro-switch located on the hook arm provides indication to the LRV driver that the hook guide arm is in the raised position by illuminating an indicator light in the LRV cabin.

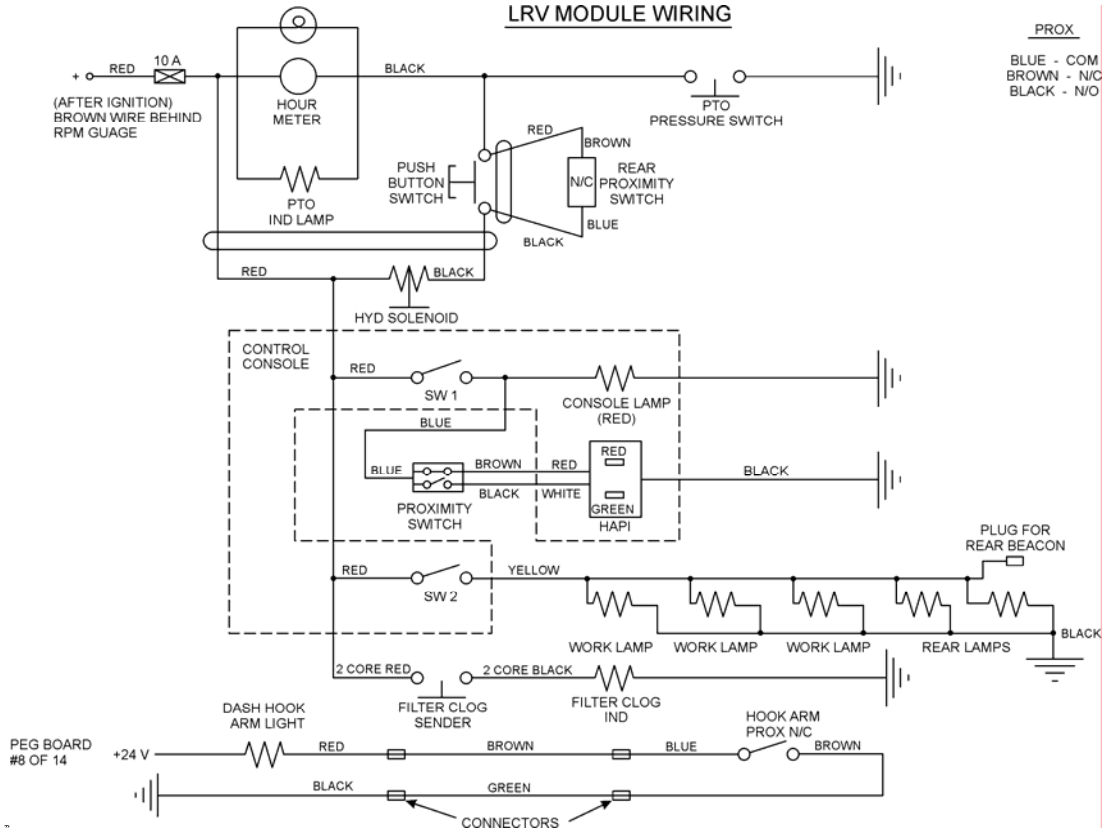

Figure 3 Electrical Circuit Diagram

END

Distribution List: **VEH G 59.0 – Code 2** (Maint Level)
(Sponsor: ENG SPO, Engr Equip)
(Authority: ECO EE 18/07)