<table>
<thead>
<tr>
<th>Amendment No.</th>
<th>Actioned by:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signature and Date:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SYNOPSIS

The Truck, Wrecker, Medium MC2 with Crane is intended for the recovery of Truck Medium MC2, Truck Light MC2 and, Truck Lightweight MC2 vehicles. This includes assistance over difficult going, extrication of bogged equipment, battlefield clearance and backloading of equipment to repair facilities.
WARNINGS

WARNING
At a pressure below 1.1 BAR (110 kPa) a tyre can roll off the rim if the wheel is turned.

WARNING  36, 54, 56, 81, 92, 116
If the engine is switched off during winching operations the six-wheel brake will release and the MRV may move.

WARNING
When operating with the PTO engaged, the main transmission shift lever must be in the neutral position (7th - 8th gear), the forward/reverse gear lever in the neutral position, and the splitter transmission in LOW ratio.

WARNING
Braking efficiency is reduced when the engine brake is isolated from the service brake pedal. The engine brake/service brake switch is only to be activated during testing of the service brakes. Do not disconnect the engine brake from the service brake pedal when driving on public roads.

WARNING
The MRV must not be driven if a brake warning light or low air pressure warning light is operating. These warning devices indicate that the brake system is not functioning correctly.

WARNING
Do not operate the central tyre inflation system when driving on public roads. Low/uneven tyre pressures make the MRV difficult to control and dangerous in traffic.
WARNING
The refrigeration system components and copper pipework used in the air conditioning system are under high pressure and can cause serious injury if the air conditioning system is opened.

WARNING
The refrigeration system components and copper pipework contain liquid-vapour mixtures under pressure, which on contact can freeze, and cold-burn human body tissue resulting in permanent damage. This damage can occur within 1(one) second. If refrigerant does enter the eye, freezing of the eye can occur and blindness could result.

WARNING
When operating, the air conditioning system has several hot (> 60°C) and cold (>5°C) areas. When working on the vehicle be well aware of these areas to avoid injuries.

WARNING
Welding tasks are not to be performed on the refrigerant circuit or in the immediate vicinity. The refrigerant gas is non-flammable, however ensure that there are no naked flames within the vicinity as toxic gas is produced when the refrigerant gas comes in contact with fire.

WARNING
Do not clean the air conditioning condenser with steam cleaning equipment, as the expansion of the refrigerant gas within, may cause excessively high pressures in the air conditioning system that may result in an explosion.

WARNING
The maximum static load that can be placed on the side step is 150kg.

WARNING
Ensure the side step is stowed and the safety locking pin inserted before moving the MRV.
WARNING
The air supply pressure at the tyre inflation point is unmonitored. Take care not to exceed the recommended tyre pressure. Over inflation could result in tyre damage/blowout and injury to personnel.

WARNING
Ensure the accelerator pedal is not depressed after the engine has been shut down as this action will release the positive engine stop allowing the engine to be roll started.

WARNING
Do not drive the MRV on a firm surface with the differential locks engaged as there is no differential operation between the wheels when cornering. This leads to increased tyre wear, poor steering behaviour and severe loads being placed on drive line components.

WARNING
To prevent severe tyre vibration and possible loss of steering control remove all mud from the front wheels and tyres after cross country operation.

WARNING
When slave starting the MRV ensure that a 24V source is used and slave lead polarity connections are correct. Incorrect voltage or polarity connections may result in battery explosion and injury to personnel.

WARNING
The MRV is equipped with six-wheel drive and differential locks. Do not attempt to apply drive to a wheel that has been jacked up off the ground if either six wheel drive or the differential locks are engaged. Serious injury to personnel and damage to the vehicle could result.

WARNING
Before changing a wheel secure the MRV to prevent movement.
WARNING
If a casualty MRV has no brakes, then it cannot be towed by another MRV on public roads.

WARNING
Prior to mechanically releasing the park brakes the wheels must be chocked to prevent any movement of the MRV.

WARNING
Chock the wheels of the MRV to prevent it from rolling when the towing device is removed.

WARNING
When installing the batteries in the MRV ensure that connections with the battery leads are of the correct polarity i.e. (+) to (+) and (−) to (−). Incorrect polarity connections will cause damage to the vehicle electrical system and may result in battery explosion and injury to personnel.

WARNING
Do not stand in front of a tyre whilst inflating it.

WARNING
During all recovery operations, take care in the presence of overhead power lines.

WARNING
Ensure personnel are clear before operating main boom.

WARNING
Keep clear of the main and folding boom when operating the main boom locking pins.

WARNING
Ensure personnel are clear before operating the folding or the extension boom.
WARNING 126
Ensure that the extension boom is locked prior to towing.

WARNING 131
On completion of lowering the load the two M8 X 20 screws must be removed and the plugs must be refitted to the winch brake end plate. If this is not done, an accident can occur since the winch brake is completely out of action.

WARNING 133
Ensure personnel are clear before operating earth anchors.

WARNING 134
Removal of the valves mounted on the top of the earth anchor leg cylinder may result in sudden movement of the earth anchor leg and explosive release of hydraulic fluid.

WARNING 134
Removal of the valve adjacent to the hydraulic cylinder port marked ‘R’ (stamped on the top face of the cylinder end cap) may result in the earth anchor leg dropping if it is unrestrained.

WARNING 134
If the MRV is supported on the earth anchor legs the hydraulic valve immediately adjacent to the hydraulic cylinder port marked ‘E’ (stamped on the top face of the cylinder end cap) must not be removed.

WARNING 135
Attempting to lower the MRV by large movements on each side may result in overturning of the vehicle.
WARNING

The Unimog U1700L rear lift towing adapters are suitable only for rear lift towing of an unladen Unimog U1700L vehicle.

WARNING

During all static lifting operations, take care in the presence of overhead power lines.

WARNING

Do not allow bystanders to stand inside the risk area of the rope when a winch is operating.

WARNING

Leather gloves must always be worn when handling steel wire rope and slings.

WARNING

A vehicle mounted crane is dangerous if operated incorrectly. The operator must exercise extreme caution to avoid mistakes which may result in personal injury or property damage. The crane should be operated by trained personnel.

WARNING

Do not operate the crane until both stabiliser legs have been lowered and the stabiliser feet are on firm standing.

WARNING

Do not drive the MRV with damaged or incorrectly inflated tyres.
WARNING

Do not remove the coolant expansion tank filler cap while the engine is hot. The cooling system is pressurised and sudden release of pressure may cause boiling coolant to be ejected. If the engine has overheated and steam is escaping from the coolant expansion tank, allow the engine to cool before adding more water to the coolant expansion tank. When the engine is quite cool, the filler cap can be removed. Place a thick cloth over the cap and slowly unscrew it until a sudden drop in resistance is felt. At this point, if the engine and coolant is still hot, vapour will be heard escaping. Only when this ceases should the cap be fully removed.

WARNING

Do not remove the coolant expansion tank filler cap while the engine is hot. The cooling system is pressurised and sudden release of pressure may cause boiling coolant to be ejected. When the engine is quite cool, the filler cap can be removed.

WARNING

Beware of the rotating cooling fan behind the radiator when checking the power steering fluid level.
LIST OF CONTENTS

Preliminary Pages

Front Page.................................................................i
Amendment Record..................................................ii
Synopsis........................................................................iii
Warnings......................................................................iv
List of Contents.........................................................xi
List of Illustrations....................................................xxiii
List of Tables.............................................................xxvii
Associated Publications............................................xxviii
Frontispiece...............................................................xxx
Maintenance Supply Items..........................................xxxii

Title Para No.

Chapter 1 General Description

Chapter 1 Section 1 - Data Summary

General.................................................................1.1
Engine .................................................................1.2
Air Cleaner............................................................1.3
Fuel System..........................................................1.4
Cooling System......................................................1.5
Engine Starter.......................................................1.6
Clutch.....................................................................1.7
Splitter Transmission.............................................1.8
Transmission........................................................1.9
PTO .......................................................................1.10
Front Axle.............................................................1.11
Intermediate Rear Axle.........................................1.12
Rear Axle...............................................................1.13
Front Suspension..................................................1.14
Rear Suspension....................................................1.15
Propeller Shafts......................................................1.16
Steering System.....................................................1.17
Brakes.................................................................1.18
Trailer Brake System...............................................1.19
Chassis.................................................................1.20
Tyres......................................................................1.21
**LIST OF CONTENTS (Continued)**

<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rims</td>
<td>1.22</td>
</tr>
<tr>
<td>Central Tyre Inflation System (CTIS)</td>
<td>1.23</td>
</tr>
<tr>
<td>Electrical System</td>
<td>1.24</td>
</tr>
<tr>
<td>Audio Kit</td>
<td>1.25</td>
</tr>
<tr>
<td>Air Conditioner</td>
<td>1.26</td>
</tr>
<tr>
<td>Hydraulic System</td>
<td>1.27</td>
</tr>
<tr>
<td>Recovery Boom</td>
<td>1.28</td>
</tr>
<tr>
<td>Winches</td>
<td>1.29</td>
</tr>
<tr>
<td>Fairleads</td>
<td>1.30</td>
</tr>
<tr>
<td>Earth Anchors</td>
<td>1.31</td>
</tr>
<tr>
<td>Crane</td>
<td>1.32</td>
</tr>
<tr>
<td>Accessories</td>
<td>1.33</td>
</tr>
<tr>
<td>Performance</td>
<td>1.34</td>
</tr>
</tbody>
</table>

Chapter 1 Section 2 - Shipping and Transportation Data

<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>1.35</td>
</tr>
<tr>
<td>Capacities</td>
<td>1.36</td>
</tr>
<tr>
<td>Fording depth</td>
<td>1.37</td>
</tr>
<tr>
<td>Bridge Classification</td>
<td>1.38</td>
</tr>
<tr>
<td>Ground Clearance</td>
<td>1.39</td>
</tr>
<tr>
<td>Transportability</td>
<td>1.40</td>
</tr>
<tr>
<td>Slinging and Tie-down Points</td>
<td>1.41</td>
</tr>
<tr>
<td>Shipping Volume</td>
<td>1.42</td>
</tr>
<tr>
<td>Approach and Departure Angles</td>
<td>1.43</td>
</tr>
</tbody>
</table>

Chapter 1 Section 3 - Equipment Description

<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1.44</td>
</tr>
<tr>
<td>Main Features</td>
<td>1.45</td>
</tr>
<tr>
<td>Operational and Logistic Concept</td>
<td>1.46</td>
</tr>
<tr>
<td>Engine</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>1.47</td>
</tr>
<tr>
<td>Lubrication</td>
<td>1.48</td>
</tr>
<tr>
<td>Oil Filter</td>
<td>1.49</td>
</tr>
<tr>
<td>Oil Cooler</td>
<td>1.50</td>
</tr>
<tr>
<td>Air Cleaner</td>
<td>1.51</td>
</tr>
<tr>
<td>Engine Cooling</td>
<td>1.52</td>
</tr>
<tr>
<td>Fuel System</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>1.53</td>
</tr>
<tr>
<td>Diesel Engine Exhaust Smoke Emission Control</td>
<td>1.54</td>
</tr>
<tr>
<td>Clutch</td>
<td>1.55</td>
</tr>
</tbody>
</table>
LIST OF CONTENTS (Continued)

<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splitter Transmission</td>
<td>1.56</td>
</tr>
<tr>
<td>Transmission</td>
<td></td>
</tr>
<tr>
<td>Main Transmission</td>
<td>1.57</td>
</tr>
<tr>
<td>Auxiliary Transmission (Working Gear Group)</td>
<td>1.58</td>
</tr>
<tr>
<td>Transfer Case</td>
<td>1.59</td>
</tr>
<tr>
<td>Drivelines and Axles</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>1.60</td>
</tr>
<tr>
<td>Differential Locks</td>
<td>1.61</td>
</tr>
<tr>
<td>Chassis</td>
<td>1.62</td>
</tr>
<tr>
<td>Suspension</td>
<td></td>
</tr>
<tr>
<td>Front Suspension</td>
<td>1.63</td>
</tr>
<tr>
<td>Rear Suspension</td>
<td>1.64</td>
</tr>
<tr>
<td>Steering System</td>
<td>1.65</td>
</tr>
<tr>
<td>Brake System</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>1.66</td>
</tr>
<tr>
<td>Exhaust Brake</td>
<td>1.67</td>
</tr>
<tr>
<td>Foot Brake</td>
<td>1.68</td>
</tr>
<tr>
<td>Park Brake</td>
<td>1.69</td>
</tr>
<tr>
<td>Trailer Brake</td>
<td>1.70</td>
</tr>
<tr>
<td>Six-Wheel Work Brake</td>
<td>1.71</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
</tr>
<tr>
<td>Accelerator Pedal Linkage</td>
<td>1.72</td>
</tr>
<tr>
<td>Speed Limiting Device</td>
<td>1.73</td>
</tr>
<tr>
<td>Hand Throttle</td>
<td>1.74</td>
</tr>
<tr>
<td>Clutch Pedal</td>
<td>1.75</td>
</tr>
<tr>
<td>Foot Brake Pedal</td>
<td>1.76</td>
</tr>
<tr>
<td>Trailer Brake Lever</td>
<td>1.77</td>
</tr>
<tr>
<td>Forward/Reverse Selector Lever</td>
<td>1.78</td>
</tr>
<tr>
<td>Gear Selector Lever</td>
<td>1.79</td>
</tr>
<tr>
<td>Gear Shift Gate Position Indicator</td>
<td>1.80</td>
</tr>
<tr>
<td>Splitter Transmission Selector Lever</td>
<td>1.81</td>
</tr>
<tr>
<td>Park Brake Lever</td>
<td>1.82</td>
</tr>
<tr>
<td>Auxiliary Transmission (Working Gear Group)</td>
<td></td>
</tr>
<tr>
<td>Selector Switch</td>
<td>1.83</td>
</tr>
<tr>
<td>PTO Selector Switch</td>
<td>1.84</td>
</tr>
<tr>
<td>Steering Wheel/Column</td>
<td>1.85</td>
</tr>
<tr>
<td>All Wheel Drive, Transfer Case and Differential Lock Controls</td>
<td>1.86</td>
</tr>
<tr>
<td>Instrument Panel All Wheel Drive and Control Panel</td>
<td></td>
</tr>
<tr>
<td>Power Divider Control Switch</td>
<td>1.87</td>
</tr>
<tr>
<td>Control Panel Differential Lock Control Switch</td>
<td>1.88</td>
</tr>
<tr>
<td>Title</td>
<td>Para No.</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Electrical System</strong></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>1.89</td>
</tr>
<tr>
<td>Alternator</td>
<td>1.90</td>
</tr>
<tr>
<td>Circuit Breakers</td>
<td>1.91</td>
</tr>
<tr>
<td>Battery Mains Switch</td>
<td>1.92</td>
</tr>
<tr>
<td>Auxiliary Start Socket</td>
<td>1.93</td>
</tr>
<tr>
<td>Starter Motor</td>
<td>1.94</td>
</tr>
<tr>
<td>Windscreen Wipers</td>
<td>1.95</td>
</tr>
<tr>
<td>Windscreen Washers</td>
<td>1.96</td>
</tr>
<tr>
<td>Horn</td>
<td>1.97</td>
</tr>
<tr>
<td><strong>Lighting System</strong></td>
<td></td>
</tr>
<tr>
<td>Normal Lights</td>
<td>1.98</td>
</tr>
<tr>
<td>Blackout Lights</td>
<td>1.99</td>
</tr>
<tr>
<td>Cabin Lighting</td>
<td>1.100</td>
</tr>
<tr>
<td><strong>Audio Kit</strong></td>
<td>1.101</td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td>1.102</td>
</tr>
<tr>
<td><strong>Switches</strong></td>
<td></td>
</tr>
<tr>
<td>Ignition Switch</td>
<td>1.103</td>
</tr>
<tr>
<td>Indicator Control Combination Switch</td>
<td>1.104</td>
</tr>
<tr>
<td>Turn Indicator Control (Fig 1-15(A))</td>
<td>1.105</td>
</tr>
<tr>
<td><strong>Headlight Beam Control (Fig 1-15(B))</strong></td>
<td>1.106</td>
</tr>
<tr>
<td>Headlight Flasher Control (Fig 1-15(C))</td>
<td>1.107</td>
</tr>
<tr>
<td>Horn Control (Fig 1-15(D))</td>
<td>1.108</td>
</tr>
<tr>
<td>Windscreen Wiper Control (Fig 1-15(E))</td>
<td>1.109</td>
</tr>
<tr>
<td>Windscreen Washer Control (Fig 1-15(F))</td>
<td>1.110</td>
</tr>
<tr>
<td>Headlight Adjustment Control</td>
<td>1.111</td>
</tr>
<tr>
<td>Main/Masked Light Switch</td>
<td>1.112</td>
</tr>
<tr>
<td><strong>Instrument Panel</strong></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>1.113</td>
</tr>
<tr>
<td>Speedometer</td>
<td>1.114</td>
</tr>
<tr>
<td>Tachometer</td>
<td>1.115</td>
</tr>
<tr>
<td>Dual Air Pressure Gauge</td>
<td>1.116</td>
</tr>
<tr>
<td>Coolant Temperature Gauge</td>
<td>1.117</td>
</tr>
<tr>
<td>Fuel Gauge</td>
<td>1.118</td>
</tr>
<tr>
<td>Oil Pressure Gauge</td>
<td>1.119</td>
</tr>
<tr>
<td>GPS Power Supply Sockets</td>
<td>1.120</td>
</tr>
<tr>
<td>Six-Wheel Work Brake Switch</td>
<td>1.121</td>
</tr>
<tr>
<td>Engine Brake/Service Brake Switch</td>
<td>1.122</td>
</tr>
<tr>
<td>Hazard Warning Light Switch</td>
<td>1.123</td>
</tr>
<tr>
<td>Title</td>
<td>Para No.</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Warning Beacon Switch</td>
<td>1.124</td>
</tr>
<tr>
<td>All Wheel Drive and Power Divider</td>
<td></td>
</tr>
<tr>
<td>Control Switch</td>
<td>1.125</td>
</tr>
<tr>
<td>Warning/Indicator Light Cluster</td>
<td>1.126</td>
</tr>
<tr>
<td>Central Tyre Inflation System (CTIS) Control Panel</td>
<td>1.127</td>
</tr>
<tr>
<td>Heating, Cooling and Ventilation</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>1.128</td>
</tr>
<tr>
<td>Air Conditioner</td>
<td>1.129</td>
</tr>
<tr>
<td>Air Conditioner Compressor</td>
<td>1.130</td>
</tr>
<tr>
<td>Air Conditioner Condenser</td>
<td>1.131</td>
</tr>
<tr>
<td>Air Conditioner Evaporator</td>
<td>1.132</td>
</tr>
<tr>
<td>Climatic Controls</td>
<td>1.133</td>
</tr>
<tr>
<td>Cabin and Fittings</td>
<td></td>
</tr>
<tr>
<td>Cabin</td>
<td>1.134</td>
</tr>
<tr>
<td>Cabin Seats</td>
<td>1.135</td>
</tr>
<tr>
<td>Cabin Seat Belts</td>
<td>1.136</td>
</tr>
<tr>
<td>Windows</td>
<td>1.137</td>
</tr>
<tr>
<td>Rear View Mirrors</td>
<td>1.138</td>
</tr>
<tr>
<td>Observation Hatch</td>
<td>1.139</td>
</tr>
<tr>
<td>Weapon Clips and Butt Boxes</td>
<td>1.140</td>
</tr>
<tr>
<td>Chassis and Body Fittings</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>1.141</td>
</tr>
<tr>
<td>Climbing Bars</td>
<td>1.142</td>
</tr>
<tr>
<td>Bonnet Release</td>
<td>1.143</td>
</tr>
<tr>
<td>Stowage</td>
<td>1.144</td>
</tr>
<tr>
<td>Fire Extinguishers</td>
<td>1.145</td>
</tr>
<tr>
<td>POL Stowage</td>
<td>1.146</td>
</tr>
<tr>
<td>Side Step</td>
<td>1.147</td>
</tr>
<tr>
<td>Towing Pintle</td>
<td>1.148</td>
</tr>
<tr>
<td>Electrical Trailer Connection Socket</td>
<td>1.149</td>
</tr>
<tr>
<td>Tyre Inflation Point</td>
<td>1.150</td>
</tr>
<tr>
<td>Camouflage Nets Stowage</td>
<td>1.151</td>
</tr>
<tr>
<td>Spare Wheel Stowage</td>
<td>1.152</td>
</tr>
<tr>
<td>Auxiliary Wire Rope Stowage</td>
<td>1.153</td>
</tr>
<tr>
<td>Personal Equipment Stowage</td>
<td>1.154</td>
</tr>
<tr>
<td>Bridge Classification Sign</td>
<td>1.155</td>
</tr>
<tr>
<td>Unit Formation Signs</td>
<td>1.156</td>
</tr>
<tr>
<td>Vehicle Nomenclature Plate (Fig 1-29)</td>
<td>1.157</td>
</tr>
<tr>
<td>Centre of Gravity Plate (Fig 1-30)</td>
<td>1.158</td>
</tr>
</tbody>
</table>
# LIST OF CONTENTS (Continued)

<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servicing Data Decal (Fig 1-31)</td>
<td>1.159</td>
</tr>
<tr>
<td>Recovery Equipment and Controls</td>
<td></td>
</tr>
<tr>
<td>Lifting and Towing Gear</td>
<td>1.160</td>
</tr>
<tr>
<td>Hydraulic System</td>
<td>1.161</td>
</tr>
<tr>
<td>Winches</td>
<td>1.162</td>
</tr>
<tr>
<td>Earth Anchors</td>
<td>1.163</td>
</tr>
<tr>
<td>Recovery and Towing Hydraulic Systems Controls</td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>1.164</td>
</tr>
<tr>
<td>Six-Wheel Work Brake</td>
<td>1.165</td>
</tr>
<tr>
<td>Exhaust Brake</td>
<td>1.166</td>
</tr>
<tr>
<td>CTIS</td>
<td>1.167</td>
</tr>
<tr>
<td>Crane</td>
<td>1.168</td>
</tr>
<tr>
<td>Crane Hydraulic Systems Control</td>
<td>1.169</td>
</tr>
<tr>
<td>Recovery Unit Lighting</td>
<td>1.170</td>
</tr>
<tr>
<td>Audio Kit</td>
<td>1.171</td>
</tr>
<tr>
<td>Tools</td>
<td>1.172</td>
</tr>
</tbody>
</table>

## Chapter 2 Operating Instructions

### Chapter 2 Section 1 - Vehicle Operation

#### New Vehicle

- Pre-Operational Check .................................................. 2.1
- Running-In ......................................................................... 2.2

#### Normal Operation

- General ............................................................................. 2.3
- Before Starting ............................................................. 2.4
- Before Starting the Engine ............................................. 2.5
- Starting the Engine (Hot Or Cold) ................................... 2.6
- Shutting Down the Engine ................................................. 2.7
- Engaging/Disengaging the PTO .......................................... 2.8

#### Driving Procedures

- Moving Off - Normal Conditions ...................................... 2.9
- Moving Off - Slippery Road Conditions and Rough Terrain ....... 2.10
- Cross Country Driving .................................................... 2.11
- Fording ............................................................................. 2.12
- Braking ............................................................................. 2.13
- Parking ............................................................................. 2.14
- Six-Wheel Work Brake ..................................................... 2.15
- Towing a Trailer ............................................................ 2.16
<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Temperature</td>
<td>2.17</td>
</tr>
<tr>
<td>Instruments</td>
<td>2.18</td>
</tr>
<tr>
<td>Clutch</td>
<td>2.19</td>
</tr>
<tr>
<td>Gear Changing</td>
<td>2.20</td>
</tr>
<tr>
<td>Emergency Procedures</td>
<td></td>
</tr>
<tr>
<td>Brake Failure</td>
<td>2.21</td>
</tr>
<tr>
<td>Fire</td>
<td>2.22</td>
</tr>
<tr>
<td>Breakdown Procedures</td>
<td></td>
</tr>
<tr>
<td>Flat Batteries</td>
<td>2.23</td>
</tr>
<tr>
<td>Flat Tyre</td>
<td>2.24</td>
</tr>
<tr>
<td>Removing the Spare Wheel</td>
<td>2.25</td>
</tr>
<tr>
<td>Changing a Wheel</td>
<td>2.26</td>
</tr>
<tr>
<td>Stowing the Spare Wheel</td>
<td>2.27</td>
</tr>
<tr>
<td>Towing</td>
<td></td>
</tr>
<tr>
<td>Towing a Casualty MRV</td>
<td>2.28</td>
</tr>
<tr>
<td>MRV to MRV Towing Preparation – Option 1</td>
<td>2.29</td>
</tr>
<tr>
<td>MRV to MRV Towing Preparation – Option 2</td>
<td>2.30</td>
</tr>
<tr>
<td>Emergency Park Brake Release</td>
<td>2.31</td>
</tr>
<tr>
<td>Electrical System</td>
<td></td>
</tr>
<tr>
<td>Battery Removal</td>
<td>2.32</td>
</tr>
<tr>
<td>Battery Installation</td>
<td>2.33</td>
</tr>
<tr>
<td>Circuit Breakers</td>
<td>2.34</td>
</tr>
<tr>
<td>Central Tyre Inflation System (CTIS)</td>
<td></td>
</tr>
<tr>
<td>Inflate Front Axle Tyres</td>
<td>2.35</td>
</tr>
<tr>
<td>Deflate Front Axle Tyres</td>
<td>2.36</td>
</tr>
<tr>
<td>Inflate Intermediate and Rear Axle Tyres</td>
<td>2.37</td>
</tr>
<tr>
<td>Deflate Intermediate and Rear Axle Tyres</td>
<td>2.38</td>
</tr>
<tr>
<td>Inflate/Deflate Front and Rear Axles Tyres</td>
<td>2.39</td>
</tr>
<tr>
<td>Inflating a Tyre from an External Source</td>
<td>2.40</td>
</tr>
<tr>
<td>MRV Loading onto C-130 Aircraft</td>
<td></td>
</tr>
<tr>
<td>Operators Preparation Procedure</td>
<td>2.41</td>
</tr>
<tr>
<td>Cleaning</td>
<td></td>
</tr>
<tr>
<td>Vehicle Washing</td>
<td>2.42</td>
</tr>
<tr>
<td>Chapter 2 Section 2 - Recovery System Operation</td>
<td></td>
</tr>
<tr>
<td>Precautions Prior to Use</td>
<td>2.43</td>
</tr>
<tr>
<td>Precautions During Use</td>
<td>2.44</td>
</tr>
<tr>
<td>Preparation for Recovery</td>
<td>2.45</td>
</tr>
</tbody>
</table>
### LIST OF CONTENTS (Continued)

<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layout and Operation of Controls</td>
<td></td>
</tr>
<tr>
<td>Vehicle Mounted Recovery/Towing Controls</td>
<td>2.46</td>
</tr>
<tr>
<td>Winch Pressure/Tension Gauges</td>
<td>2.47</td>
</tr>
<tr>
<td>Remote Control</td>
<td>2.48</td>
</tr>
<tr>
<td>Remote Control Function Switch</td>
<td>2.49</td>
</tr>
<tr>
<td>Front Winching</td>
<td>2.50</td>
</tr>
<tr>
<td>Main Boom</td>
<td></td>
</tr>
<tr>
<td>Main Boom Operation</td>
<td>2.51</td>
</tr>
<tr>
<td>Folding Boom and Extension Boom</td>
<td></td>
</tr>
<tr>
<td>Lowering the Folding Boom</td>
<td>2.52</td>
</tr>
<tr>
<td>Extending the Extension Boom</td>
<td>2.53</td>
</tr>
<tr>
<td>Retracting the Extension Boom</td>
<td>2.54</td>
</tr>
<tr>
<td>Raising the Folding Boom</td>
<td>2.55</td>
</tr>
<tr>
<td>Winches</td>
<td></td>
</tr>
<tr>
<td>Precautions Prior to Winching</td>
<td>2.56</td>
</tr>
<tr>
<td>Precautions During Winching</td>
<td>2.57</td>
</tr>
<tr>
<td>Operation of Winches</td>
<td>2.58</td>
</tr>
<tr>
<td>Free Spooling</td>
<td>2.59</td>
</tr>
<tr>
<td>Paying Out/Winching In Under Power using the Control Panel</td>
<td>2.60</td>
</tr>
<tr>
<td>Paying Out/Winching In Under Power using the Remote Control Unit</td>
<td>2.61</td>
</tr>
<tr>
<td>Disconnecting the Casualty</td>
<td>2.62</td>
</tr>
<tr>
<td>Lowering a Load in an Emergency</td>
<td>2.63</td>
</tr>
<tr>
<td>Earth Anchors</td>
<td></td>
</tr>
<tr>
<td>Precautions Prior to Use</td>
<td>2.64</td>
</tr>
<tr>
<td>Precautions During Use</td>
<td>2.65</td>
</tr>
<tr>
<td>Soil Conditions</td>
<td>2.66</td>
</tr>
<tr>
<td>Earth Anchor Operation</td>
<td>2.67</td>
</tr>
<tr>
<td>Earth Anchor Emergency</td>
<td></td>
</tr>
<tr>
<td>Retract Procedure</td>
<td>2.68</td>
</tr>
<tr>
<td>Tackle Attachment Points</td>
<td></td>
</tr>
<tr>
<td>Precautions Prior to Use</td>
<td>2.69</td>
</tr>
<tr>
<td>Boom Head Anchor Points</td>
<td>2.70</td>
</tr>
<tr>
<td>Earth Anchor Leg Reeving Points</td>
<td>2.71</td>
</tr>
<tr>
<td>Emergency Towing Points</td>
<td>2.72</td>
</tr>
<tr>
<td>Pintle Hook</td>
<td>2.73</td>
</tr>
<tr>
<td>Front Winching Anchor Points</td>
<td>2.74</td>
</tr>
</tbody>
</table>
# LIST OF CONTENTS (Continued)

<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travelling Empty</td>
<td></td>
</tr>
<tr>
<td>Boom Stowed Positions</td>
<td>2.75</td>
</tr>
<tr>
<td>Towing</td>
<td></td>
</tr>
<tr>
<td>Towing Precautions</td>
<td>2.76</td>
</tr>
<tr>
<td>Towing Attachments</td>
<td>2.77</td>
</tr>
<tr>
<td>Fitting of Adapter Unimog Rear</td>
<td>2.78</td>
</tr>
<tr>
<td>Lift Towing</td>
<td></td>
</tr>
<tr>
<td>Lifting the Casualty</td>
<td>2.79</td>
</tr>
<tr>
<td>Releasing the Load</td>
<td>2.80</td>
</tr>
<tr>
<td>Flat Towing</td>
<td></td>
</tr>
<tr>
<td>Connecting a Trailer/Casualty to the MRV</td>
<td>2.81</td>
</tr>
<tr>
<td>Towing Pintle</td>
<td>2.82</td>
</tr>
<tr>
<td>Attaching the Towing Pintle to the MRV</td>
<td>2.83</td>
</tr>
<tr>
<td>Removing the Towing Pintle from the MRV</td>
<td>2.84</td>
</tr>
<tr>
<td>Static Lifting</td>
<td></td>
</tr>
<tr>
<td>Main Boom Static Lifting</td>
<td>2.85</td>
</tr>
<tr>
<td>Rear Winching</td>
<td></td>
</tr>
<tr>
<td>Precautions Prior to Use</td>
<td>2.86</td>
</tr>
<tr>
<td>Unloading Effect (front of MRV lifting off ground)</td>
<td>2.87</td>
</tr>
<tr>
<td>Increasing Boom Height to Gain Winching Advantage</td>
<td>2.88</td>
</tr>
<tr>
<td>Side Winching</td>
<td></td>
</tr>
<tr>
<td>Stabilised Pull</td>
<td>2.89</td>
</tr>
<tr>
<td>Unstabilised Pull</td>
<td>2.90</td>
</tr>
<tr>
<td>Side Winching Layouts</td>
<td>2.91</td>
</tr>
<tr>
<td>Front Self Recovery and Front Winching</td>
<td></td>
</tr>
<tr>
<td>Front Winch Components Layout</td>
<td>2.93</td>
</tr>
<tr>
<td>Front Winching Controls</td>
<td>2.94</td>
</tr>
<tr>
<td>Maximum Fleet Angles</td>
<td>2.95</td>
</tr>
<tr>
<td>Reieving to the Front of the MRV</td>
<td>2.96</td>
</tr>
<tr>
<td>Changing from Reieving to the Front to Reieving to</td>
<td>2.97</td>
</tr>
<tr>
<td>the Rear</td>
<td></td>
</tr>
<tr>
<td>Rear Self Recovery</td>
<td></td>
</tr>
<tr>
<td>Precautions Prior to and During Use</td>
<td>2.98</td>
</tr>
<tr>
<td>Self Recovery and Driving</td>
<td></td>
</tr>
<tr>
<td>Precautions Prior to and During Use</td>
<td>2.99</td>
</tr>
<tr>
<td>Winching and Driving Simultaneously</td>
<td>2.100</td>
</tr>
</tbody>
</table>
LIST OF CONTENTS (Continued)

Title | Para No.
--- | ---
Winch Ropes | 2.101
  Replacing a Winch Rope | 2.101

Chapter 2 Section 3 - Crane Operation

Safety Precautions | 2.102
Crane Operation
  Crane Preparation | 2.104
  Lowering the Stabilisers | 2.105
  Unstowing the Crane | 2.106
  Lifting a Load | 2.107
  Overload Protection System | 2.108
  Releasing a Load | 2.109
  Stowing the Crane | 2.110
  Stowing the Stabilisers | 2.111
  Prior to Moving Off | 2.112
  Operating in Darkness | 2.113

CHAPTER 3 – Operator Servicing

Chapter 3 Section 1 - Parade Servicing

Introduction | 3.1
Lubricants and Fluids | 3.2
Daily Servicing
  General | 3.3
  First Parade Service | 3.4
  Start the MRV | 3.11
  Moving Off and Running | 3.12
  Halt Parade Service | 3.13
  Last Parade Service | 3.14
  Opening the Bonnet and Grille for Servicing Access | 3.15
Operator Check Procedures
  Cooling System
    Coolant Expansion Tank Coolant Level Check | 3.16
    Radiator Core and Hoses | 3.17
  Engine
    Engine Oil Level Check | 3.18
  Fuel System
    Fuel Tank Filler Cap | 3.19
    Fuel Lift Pump and Pre-Filter | 3.20
# LIST OF CONTENTS (Continued)

<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Filter and Priming Pump</td>
<td>3.21</td>
</tr>
<tr>
<td>Priming the Fuel System</td>
<td>3.22</td>
</tr>
<tr>
<td>Air Cleaner</td>
<td>3.23</td>
</tr>
<tr>
<td>Steering Hydraulic Reservoir</td>
<td>3.25</td>
</tr>
<tr>
<td>Clutch Reservoir</td>
<td>3.26</td>
</tr>
<tr>
<td>Brake System</td>
<td></td>
</tr>
<tr>
<td>Brake Master Cylinders</td>
<td>3.27</td>
</tr>
<tr>
<td>Wheels</td>
<td>3.28</td>
</tr>
<tr>
<td>Accessories</td>
<td>3.29</td>
</tr>
<tr>
<td>Drive Belts (Fig 3-6)</td>
<td>3.30</td>
</tr>
<tr>
<td>Main Transmission</td>
<td>3.31</td>
</tr>
<tr>
<td>Splitter Box</td>
<td>3.32</td>
</tr>
<tr>
<td>Drive Lines and Axles</td>
<td>3.33</td>
</tr>
<tr>
<td>Compressed Air Tanks</td>
<td>3.34</td>
</tr>
</tbody>
</table>

Chapter 3 Section 2 - Periodic Servicing

| Introduction                                               | 3.35     |
| Lubricants and Fluids                                     | 3.37     |
| Periodic Servicing - Cab/Chassis                          |          |
| Introduction                                               | 3.38     |
| Special Requirements                                       | 3.40     |
| Periodic Servicing - Recovery Unit                         |          |
| Introduction                                               | 3.43     |
| Special Requirements                                       | 3.45     |
| Periodic Servicing - Crane                                 |          |
| Introduction                                               | 3.46     |
| Special Requirements                                       | 3.47     |

Chapter 3 Section 3 - Lubrication

| Introduction                                               | 3.50     |
| Lubricants and Fluids                                     | 3.52     |
| Service and Lubrication Points                             |          |
| Cab/Chassis (Fig 3.8)                                      | 3.53     |
| Engine Oil Level Check                                     | 3.54     |
| Engine Oil and Filter Change Procedure                    | 3.55     |
| Transmissions                                             |          |
| Splitter Transmission                                      | 3.61     |
| Main Transmission Group                                    | 3.62     |
| Clutch Reservoir                                           | 3.64     |
# LIST OF CONTENTS (Continued)

<table>
<thead>
<tr>
<th>Title</th>
<th>Para No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Divider and Axles</strong></td>
<td></td>
</tr>
<tr>
<td>Power Divider</td>
<td>3.65</td>
</tr>
<tr>
<td>Intermediate Axle</td>
<td>3.66</td>
</tr>
<tr>
<td>Rear Axle</td>
<td>3.67</td>
</tr>
<tr>
<td>Front Axle</td>
<td>3.68</td>
</tr>
<tr>
<td>Propeller Shafts</td>
<td>3.69</td>
</tr>
<tr>
<td>Reduction Hub Drives</td>
<td>3.70</td>
</tr>
<tr>
<td><strong>Steering System</strong></td>
<td></td>
</tr>
<tr>
<td>Steering Hydraulic Reservoir</td>
<td>3.71</td>
</tr>
<tr>
<td><strong>Brake System</strong></td>
<td></td>
</tr>
<tr>
<td>Brake Master Cylinders</td>
<td>3.72</td>
</tr>
<tr>
<td><strong>Service and Lubrication Points – Recovery</strong></td>
<td></td>
</tr>
<tr>
<td>Unit (Fig 3.21)</td>
<td>3.73</td>
</tr>
<tr>
<td>Service and Lubrication Points – Crane (Fig 3.22)</td>
<td>3.74</td>
</tr>
<tr>
<td><strong>Chapter 3 Section 4 - Fault Finding</strong></td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>3.75</td>
</tr>
<tr>
<td>Fault Finding Tables</td>
<td>3.77</td>
</tr>
<tr>
<td><strong>CHAPTER 4 - Warranty</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 4 Section 1 - Warranty and Repair</strong></td>
<td></td>
</tr>
<tr>
<td>Warranty Provisions</td>
<td>4.1</td>
</tr>
<tr>
<td>Warranty Rights</td>
<td>4.6</td>
</tr>
<tr>
<td>Special Provisions</td>
<td>4.8</td>
</tr>
<tr>
<td>Application of Warranty</td>
<td>4.13</td>
</tr>
<tr>
<td>Prior Consultation</td>
<td>4.19</td>
</tr>
<tr>
<td>Obtaining Warranty Service</td>
<td>4.22</td>
</tr>
<tr>
<td>Warranty Procedures</td>
<td>4.23</td>
</tr>
<tr>
<td>Recording of Repairs</td>
<td>4.24</td>
</tr>
<tr>
<td>Reporting of Defects</td>
<td>4.25</td>
</tr>
<tr>
<td>Replacement Parts and Accessories during Vehicle Warranty</td>
<td>4.26</td>
</tr>
<tr>
<td>List of Agents</td>
<td>4.27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Index</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>251</td>
</tr>
<tr>
<td>Notes</td>
<td>257</td>
</tr>
<tr>
<td>Fig. No.</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>1-1</td>
<td>Truck Wrecker Medium MC2 - Front View</td>
</tr>
<tr>
<td>1-2</td>
<td>Truck Wrecker Medium MC2 - Rear View</td>
</tr>
<tr>
<td>1-3</td>
<td>Slinging and Tie-Down Points</td>
</tr>
<tr>
<td>1-4</td>
<td>Front/Left Hand Side View of Engine</td>
</tr>
<tr>
<td>1-5</td>
<td>Chassis and Suspension</td>
</tr>
<tr>
<td>1-6</td>
<td>Steering System</td>
</tr>
<tr>
<td>1-7</td>
<td>Controls</td>
</tr>
<tr>
<td>1-8</td>
<td>Trailer Brake Lever</td>
</tr>
<tr>
<td>1-9</td>
<td>Control Panel</td>
</tr>
<tr>
<td>1-10</td>
<td>Gate Position Indicator</td>
</tr>
<tr>
<td>1-11</td>
<td>Park Brake Lever</td>
</tr>
<tr>
<td>1-12</td>
<td>Instrument Panel All Wheel Drive and Power Divider Control Switch</td>
</tr>
<tr>
<td>1-13</td>
<td>Control Panel Differential Lock Switch</td>
</tr>
<tr>
<td>1-14</td>
<td>Circuit Breakers</td>
</tr>
<tr>
<td>1-15</td>
<td>Indicator Control Combination Switch</td>
</tr>
<tr>
<td>1-16</td>
<td>Headlight Adjustment Control</td>
</tr>
<tr>
<td>1-17</td>
<td>Main/Masked Light Switch</td>
</tr>
<tr>
<td>1-18</td>
<td>Instrument Panel</td>
</tr>
<tr>
<td>1-19</td>
<td>Warning/Indicator Light Cluster</td>
</tr>
<tr>
<td>1-20</td>
<td>CTIS Control Panel</td>
</tr>
<tr>
<td>1-21</td>
<td>Heating, Cooling and Ventilation Controls</td>
</tr>
<tr>
<td>1-22</td>
<td>Air Conditioner Condenser</td>
</tr>
<tr>
<td>1-23</td>
<td>Cool Mode</td>
</tr>
<tr>
<td>1-24</td>
<td>Vent Mode</td>
</tr>
<tr>
<td>1-25</td>
<td>Heat Mode</td>
</tr>
<tr>
<td>1-26</td>
<td>Demist Mode</td>
</tr>
<tr>
<td>Fig. No.</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>1-27</td>
<td>Observation Hatch</td>
</tr>
<tr>
<td>1-28</td>
<td>Climbing Bar</td>
</tr>
<tr>
<td>1-29</td>
<td>Vehicle Nomenclature Plate</td>
</tr>
<tr>
<td>1-30</td>
<td>Centre of Gravity Plate</td>
</tr>
<tr>
<td>1-31</td>
<td>Servicing Data Decal</td>
</tr>
<tr>
<td>1-32</td>
<td>Winches</td>
</tr>
<tr>
<td>1-33</td>
<td>Recovery/Towing Controls (Right Hand)</td>
</tr>
<tr>
<td>1-34</td>
<td>Winch Pressure/Tension Gauge</td>
</tr>
<tr>
<td>1-35</td>
<td>Remote Control Unit</td>
</tr>
<tr>
<td>1-36</td>
<td>Remote Control Function Switch</td>
</tr>
<tr>
<td>1-37</td>
<td>Crane - General Arrangement</td>
</tr>
<tr>
<td>1-38</td>
<td>Crane Control Levers (Viewed from Cab)</td>
</tr>
<tr>
<td>2-1</td>
<td>Transmission Shift Cylinder</td>
</tr>
<tr>
<td>2-2</td>
<td>Casualty MRV Front Wheels – Stowage</td>
</tr>
<tr>
<td>2-3</td>
<td>Emergency Parking Brake Release</td>
</tr>
<tr>
<td>2-4</td>
<td>Battery Connection Diagram</td>
</tr>
<tr>
<td>2-5</td>
<td>CTIS Control Panel</td>
</tr>
<tr>
<td>2-6</td>
<td>Control Lever Lay Out (Right Hand Side)</td>
</tr>
<tr>
<td>2-7</td>
<td>Winch Pressure/Tension Gauge</td>
</tr>
<tr>
<td>2-8</td>
<td>Remote Control Unit</td>
</tr>
<tr>
<td>2-9</td>
<td>Remote Control Function Switch</td>
</tr>
<tr>
<td>2-10</td>
<td>Front Winch Control</td>
</tr>
<tr>
<td>2-11</td>
<td>Boom Locks</td>
</tr>
<tr>
<td>2-12</td>
<td>Folding Boom – Lowered</td>
</tr>
<tr>
<td>2-13</td>
<td>Extension Boom Positions</td>
</tr>
<tr>
<td>2-14</td>
<td>Winch Emergency – Lowering of Load</td>
</tr>
<tr>
<td>Fig. No.</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>2-15</td>
<td>Boom Head Tackle Anchor Points – Maximum Operating Angles</td>
</tr>
<tr>
<td>2-16</td>
<td>Earth Anchor Leg Tackle Attachment Points</td>
</tr>
<tr>
<td>2-17</td>
<td>Earth Anchor Reewing Points – Operating Angle Limits</td>
</tr>
<tr>
<td>2-18</td>
<td>Emergency Towing Points</td>
</tr>
<tr>
<td>2-19</td>
<td>Pintle Hook Anchor Point – Maximum Operating Angles</td>
</tr>
<tr>
<td>2-20</td>
<td>Front Anchor Points</td>
</tr>
<tr>
<td>2-21</td>
<td>Towing Attachments</td>
</tr>
<tr>
<td>2-22</td>
<td>Unimog U1700 Rear Lift Towing Adapter - Fitted</td>
</tr>
<tr>
<td>2-23</td>
<td>Lift Tow T-bar Position</td>
</tr>
<tr>
<td>2-24</td>
<td>A-Frame Operating Limitations</td>
</tr>
<tr>
<td>2-25</td>
<td>Clamping Straps - Installation</td>
</tr>
<tr>
<td>2-26</td>
<td>Towing Pintle - Installed</td>
</tr>
<tr>
<td>2-27</td>
<td>Static Lift</td>
</tr>
<tr>
<td>2-28</td>
<td>Side Winching – Single Line Pull</td>
</tr>
<tr>
<td>2-29</td>
<td>Side Winching – 2:1 Tackle Layout</td>
</tr>
<tr>
<td>2-30</td>
<td>Side Winching – 3:1 Tackle Layout</td>
</tr>
<tr>
<td>2-31</td>
<td>Side Winching – 2:1 Tackle Layout</td>
</tr>
<tr>
<td>2-32</td>
<td>Side Winching – 3:1 Tackle Layout</td>
</tr>
<tr>
<td>2-33</td>
<td>Front Winch Components – Layout</td>
</tr>
<tr>
<td>2-34</td>
<td>Front Winch Roller Fleet Angles</td>
</tr>
<tr>
<td>2-35</td>
<td>Rope Guide - Dismantling</td>
</tr>
<tr>
<td>2-36</td>
<td>Left Hand Fairlead – Locking</td>
</tr>
<tr>
<td>2-37</td>
<td>Top, Horizontal and Vertical Rollers - Removal</td>
</tr>
<tr>
<td>2-38</td>
<td>Winch Rope - Attachment</td>
</tr>
<tr>
<td>2-39</td>
<td>Layout of Stowage</td>
</tr>
<tr>
<td>Fig. No.</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>2-40</td>
<td>Stabiliser</td>
</tr>
<tr>
<td>2-41</td>
<td>Crane Control Levers (Viewed from Cab)</td>
</tr>
<tr>
<td>2-42</td>
<td>Crane Safe Working Loads</td>
</tr>
<tr>
<td>3-1</td>
<td>Expansion Tank</td>
</tr>
<tr>
<td>3-2</td>
<td>Engine Dipstick and Filler</td>
</tr>
<tr>
<td>3-3</td>
<td>Fuel Lift Pump and Pre-Filter</td>
</tr>
<tr>
<td>3-4</td>
<td>Air Cleaner</td>
</tr>
<tr>
<td>3-5</td>
<td>Brake Master Cylinders</td>
</tr>
<tr>
<td>3-6</td>
<td>Drive Belts</td>
</tr>
<tr>
<td>3-7</td>
<td>Drive Belt Adjustment</td>
</tr>
<tr>
<td>3-8</td>
<td>Service and Lubrication Points – Cab/Chassis</td>
</tr>
<tr>
<td>3-9</td>
<td>Engine Dipstick and Filler</td>
</tr>
<tr>
<td>3-10</td>
<td>Engine Oil Filter</td>
</tr>
<tr>
<td>3-11</td>
<td>Splitter Transmission Filler/Level and Drain Plug</td>
</tr>
<tr>
<td>3-12</td>
<td>Transmission Filler/Level Plug</td>
</tr>
<tr>
<td>3-13</td>
<td>Transmission Group Drain Plugs</td>
</tr>
<tr>
<td>3-14</td>
<td>Power Divider and Intermediate Axle Oil Filler Level and Drain Plugs</td>
</tr>
<tr>
<td>3-15</td>
<td>Rear Axle Housing Oil Filler/Level and Drain Plug</td>
</tr>
<tr>
<td>3-16</td>
<td>Front Axle Housing Oil Filler/Level and Drain Plug</td>
</tr>
<tr>
<td>3-17</td>
<td>Rear Axle Reduction Hub Drain and Filler/Level Plugs</td>
</tr>
<tr>
<td>3-18</td>
<td>Front Axle Reduction Hub Drain and Filler/Level Plugs</td>
</tr>
<tr>
<td>3-19</td>
<td>Steering Hydraulic Reservoir</td>
</tr>
<tr>
<td>3-20</td>
<td>Brake Master Cylinders</td>
</tr>
<tr>
<td>3-21</td>
<td>Service and Lubrication Points – Recovery Unit</td>
</tr>
<tr>
<td>3-22</td>
<td>Service and Lubrication Points – Crane</td>
</tr>
<tr>
<td>Fig. No.</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>1-1</td>
<td>Location of Identification Numbers on MSI's</td>
</tr>
<tr>
<td>2-1</td>
<td>Remote Control Functions</td>
</tr>
<tr>
<td>2-2</td>
<td>Remote Control Switch Functions</td>
</tr>
<tr>
<td>2-3</td>
<td>Earth Anchor Holding Power</td>
</tr>
<tr>
<td>2-4</td>
<td>Boom Positions When Lift Towing</td>
</tr>
<tr>
<td>2-5</td>
<td>Driving and Winching – MRV and Winch Speeds</td>
</tr>
<tr>
<td>3-1</td>
<td>Daily Tasks - Cab/Chassis</td>
</tr>
<tr>
<td>3-2</td>
<td>Weekly Task - Air Conditioning System</td>
</tr>
<tr>
<td>3-3</td>
<td>Fortnightly Tasks - Cab/Chassis</td>
</tr>
<tr>
<td>3-4</td>
<td>Monthly Service - Cab/Chassis</td>
</tr>
<tr>
<td>3-5</td>
<td>Daily Tasks - Recovery Unit</td>
</tr>
<tr>
<td>3-6</td>
<td>Monthly Tasks - Recovery Unit</td>
</tr>
<tr>
<td>3-7</td>
<td>Daily Tasks - Crane</td>
</tr>
<tr>
<td>3-8</td>
<td>Weekly Tasks - Crane</td>
</tr>
<tr>
<td>3-9</td>
<td>Monthly Tasks - Crane</td>
</tr>
<tr>
<td>3-10</td>
<td>List of Lubricants and Fluids</td>
</tr>
<tr>
<td>3-11</td>
<td>Engine Faults and Probable Causes</td>
</tr>
<tr>
<td>3-12</td>
<td>Drive Line Faults and Probable Causes</td>
</tr>
<tr>
<td>3-13</td>
<td>Steering, Brake and Suspension Faults and Probable Causes</td>
</tr>
<tr>
<td>3-14</td>
<td>Electrical Faults and Probable Causes</td>
</tr>
<tr>
<td>3-15</td>
<td>Air Conditioning System Faults and Probable Causes</td>
</tr>
<tr>
<td>3-16</td>
<td>Recovery Unit Hydraulics Faults and Probable Causes</td>
</tr>
<tr>
<td>3-17</td>
<td>Crane System Faults and Probable Causes</td>
</tr>
<tr>
<td>4-1</td>
<td>DaimlerChrysler Australia/Pacific Pty. Ltd. Dealers</td>
</tr>
</tbody>
</table>
ASSOCIATED PUBLICATIONS

Defence Road Transport Instructions (DRTI)
MEMA Vol 3
Australian Army Books: GM 120 Record Book for Servicing Equipment - Army
EMEI GENERAL R 008 Inspection of Recovery Equipment
EMEI MISCELLANEOUS EQUIPMENT O Series
EMEI MISCELLANEOUS EQUIPMENT O 018 Cranes, Hoists and Winches - Inspection Data
EMEI VEHICLE A 029 Servicing of B Vehicles, Trailers, Stationary Equipment, Auxiliary and Small Engines
EMEI VEHICLE A 119-18 Repair of Vehicles Under Warranty Agreement, General Instruction.
EMEI VEHICLE A 119-24 Truck, Wrecker, Medium, MC2 (UNIMOG U2450L) 6x6, - Repair of Vehicle Under Warranty Agreement.

10. EMEI VEHICLE A 591-1 Servicing of Dry Type Air Cleaners
11. EMEI VEHICLE D 390 Data Summary
12. EMEI VEHICLE D 391 Operator Instruction
13. EMEI VEHICLE D 392 Technical Description
14. EMEI VEHICLE D 393 Light Repair
15. EMEI VEHICLE D 394 Medium Repair
16. EMEI VEHICLE D 394-1 Heavy Repair (Not Issued)
17. EMEI VEHICLE D 395 Preparation for Special Purpose (TBA)
18. EMEI VEHICLE D 396 Workshop Manual (TBA)
19. EMEI VEHICLE D 397 Modification Instruction (TBA)
20. EMEI VEHICLE D 398 Equipment Inspection and Examination Data (TBA)
21. EMEI VEHICLE D 398-1 Inspection for Serviceability (TBA)
22. EMEI VEHICLE D 398-2 Inspection after Repair (TBA)
23. EMEI VEHICLE D 399 Servicing Instruction EMEI
24. EMEI VEHICLE G 619-10 Fitting of Caution Label and Manufacture and use of Selector Lever Locking Bracket
25. EMEI WORKSHOP E652 Use of Polyurethane Paints and Solvents
26. EMEI WORKSHOP EQUIPMENT H 031 Tyre Changing
27. Complete Equipment Schedule (CES) No. 19634
28. Repair Parts Scale 02229
30. MRV Integrated Logistic Support Instruction (ILSI) ALI-MM 10-6 dated Aug 99
Figure 1-1 Truck Wrecker Medium MC2 – Front View

Figure 1-2 Truck Wrecker Medium MC2 - Rear View
MAINTENANCE SUPPLY ITEMS (MSI)

Table 1-1 Location of Identification Numbers on MSI’s

Chassis No. – On the outside of the right hand chassis rail, just forward of the front wheel.

Body No. – Right hand end corner of dash.

Engine No. – Right hand side of the engine behind fuel pump injection pump identification – Side of the pump.

Transmission and transfer case – Rear of transfer case adjacent to the filler/level plug.

Hydraulic pump – Opposite end to drive shaft connection (suction end).

Front axle No. – Plate fitted to centre of the differential housing.

Intermediate axle No. – Plate fitted to centre of the differential housing.

Rear axle No. – Plate fitted to centre of the differential housing.

Frame – Top face, rear left hand side.

Subframe – Front left hand side running vertically along crane bolt housing.

Winches – External face, left hand side.

Main boom – End of boom between fairleads, top of end plate.

Boom, lifting, folding, extension and spade cylinders – Cylinder body.

Boom extension – Top, rear, left hand face on left hand side of vehicle.

Towing Pintle – Front face, top of locking jaw.

Towbar – Left hand front face, beside towing pintle.

Crane – Crane post, left hand side.

Front LHS cabinet assembly – Front left upright for storage platform (inside face).

Front RHS cabinet assembly – Front right upright for storage platform (inside face).

Rear LHS and RHS cabinet assemblies – Rear end bin on bottom door sill.
CHAPTER 1

GENERAL DESCRIPTION

SECTION 1 — DATA SUMMARY

SECTION 2 — SHIPPING AND TRANSPORTATION DATA

SECTION 3 — EQUIPMENT DESCRIPTION

NOTE

For clarity and brevity the Truck, Wrecker, Medium, MC2, Unimog U2450L is referred to throughout this document as the MRV (Medium Recovery Vehicle).
### SECTION 1
DATA SUMMARY

<table>
<thead>
<tr>
<th>Vehicle Model No. 356.980</th>
<th>Mercedes-Benz Unimog U2450L</th>
</tr>
</thead>
</table>

**1.1. General**
- **Crew**: One driver and one passenger
- **Driving position**: Right hand side

**1.2. Engine**
- **Manufacturer/Model**: Mercedes-Benz/356.980
- **Make**: OM 366 LA series, six cylinder in-line, diesel, direct injection, turbocharged with intercooler
- **Displacement**: 5.958 litres
- **Bore**: 97.5 mm
- **Stroke**: 133 mm
- **Compression ratio**: 17:1
- **Compression pressure**: 28 bar
- **Output to DIN**: 177 kW at 2600 RPM
- **Nominal engine speed**: 2600 RPM
- **Torque max.**: 660 Nm at 1400 - 1700 RPM
- **Valve clearance (Engine temperature under 50°C)**
  - **Inlet**: 0.40 mm
  - **Exhaust**: 0.60 mm
- **Oil pressure**
  - **Normal**: 2 - 5 bar (200 - 500 kPa)
  - **At idling (min)**: 0.6 bar (60 kPa)
1.3. Air Cleaner
Type: Mercedes-Benz - cyclonic
Location: Engine compartment, right side of engine

1.4. Fuel System
Fuel pump: Diesel (Bosch EP3807), 6-plunger in-line type with smoke limiter fitted
Governor: Bosch RS3807, centrifugal, mechanical
Injection timer: Segment, centrifugal mechanical
Start of delivery: 11° before TDC
Injectors: Bosch, four hole spray type
Injection sequence: 1-5-3-6-2-4
Transfer pump: Bosch FP/KG 24 MW301, mechanical. Driven by fuel pump camshaft. Hand primer incorporated
Main filter: Cylindrical, felt type, replaceable cartridge. Engine mounted (RH side)
Fuel tank: One, 302 litre capacity, welded steel tank

1.5. Cooling System
Type: Water cooled with twin thermostat control, coolant to air fin and heat exchanger
Circulation: Centrifugal, engine belt driven water pump
Operating range: 80°C - 95°C
Operating pressure: 0.7 bar (70 kPa)
<table>
<thead>
<tr>
<th>Section</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>20 litres</td>
</tr>
<tr>
<td>Corrosion protection</td>
<td>50% Glycol base anti-boil, anti-freeze</td>
</tr>
<tr>
<td>Cooling fan</td>
<td>Viscous clutch type</td>
</tr>
<tr>
<td><strong>1.6. Engine Starter</strong></td>
<td></td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Bosch</td>
</tr>
<tr>
<td>Type</td>
<td>Waterproof, gear reduction, electric powered</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>24V</td>
</tr>
<tr>
<td>Output</td>
<td>4 KW</td>
</tr>
<tr>
<td><strong>1.7. Clutch</strong></td>
<td>Model GFM 360X. Single dry-plate clutch 360 mm dia. with automatic adjustment</td>
</tr>
<tr>
<td>Type</td>
<td>Hydraulic by central clutch operator</td>
</tr>
<tr>
<td>Actuation</td>
<td></td>
</tr>
<tr>
<td><strong>1.8. Splitter Transmission</strong></td>
<td></td>
</tr>
<tr>
<td>Make</td>
<td>Daimler-Benz G 09/SA 36 855</td>
</tr>
<tr>
<td>Number of ratios</td>
<td>2 (High and low ratio)</td>
</tr>
<tr>
<td>Lubrication method</td>
<td>Splash feed</td>
</tr>
<tr>
<td>Location</td>
<td>Mounted to rear of clutch bell housing</td>
</tr>
<tr>
<td><strong>1.9. Transmission</strong></td>
<td></td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Daimler-Benz</td>
</tr>
<tr>
<td>Model No.</td>
<td>718.815 (UG 3/65-8/13.01 GPA)</td>
</tr>
<tr>
<td>Type</td>
<td>8 speed, all synchromesh, spur-gear, manually-shifted with auxiliary transmission SA 35.736 (working gear group), and integrated transfer case for six-wheel drive operation</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Number of ratios</td>
<td>8 forward 8 reverse</td>
</tr>
<tr>
<td>Ratios</td>
<td>Main gears</td>
</tr>
<tr>
<td>Forward</td>
<td>1st gear</td>
</tr>
<tr>
<td></td>
<td>2nd gear</td>
</tr>
<tr>
<td></td>
<td>3rd gear</td>
</tr>
<tr>
<td></td>
<td>4th gear</td>
</tr>
<tr>
<td></td>
<td>5th gear</td>
</tr>
<tr>
<td></td>
<td>6th gear</td>
</tr>
<tr>
<td></td>
<td>7th gear</td>
</tr>
<tr>
<td></td>
<td>8th gear</td>
</tr>
<tr>
<td>Reverse</td>
<td>1st gear</td>
</tr>
<tr>
<td></td>
<td>2nd gear</td>
</tr>
<tr>
<td></td>
<td>3rd gear</td>
</tr>
<tr>
<td></td>
<td>4th gear</td>
</tr>
<tr>
<td></td>
<td>5th gear</td>
</tr>
<tr>
<td></td>
<td>6th gear</td>
</tr>
<tr>
<td></td>
<td>7th gear</td>
</tr>
<tr>
<td></td>
<td>8th gear</td>
</tr>
<tr>
<td>Lubrication type</td>
<td>Pressure fed</td>
</tr>
<tr>
<td>Cooling</td>
<td>Oil to air heat exchanger</td>
</tr>
</tbody>
</table>
### 1.10. PTO

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model No.</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercedes-Benz</td>
<td>U 3/65 - 8/13 GPA</td>
<td></td>
</tr>
</tbody>
</table>

Externally mounted on the transmission. A spur gear on the transmission input shaft is connected via a pneumatically operated sliding collar to the PTO gear which drives the hydraulic pump.

**Ratio**

1:1

### 1.11. Front Axle

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercedes-Benz</td>
<td>737.207 (UG 3/65-8/13 CS-7.0)</td>
</tr>
</tbody>
</table>

Rigid incorporating portal hub reduction with pneumatically operated differential locks.

**Ratios**

- Differential: 2.55:1
- Hub reduction drive: 1.94:1
- Overall: 4.96:1

**Track width**: 2295 mm

**Maximum loading (unladen)**: 5600 kg

### 1.12. Intermediate Rear Axle

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercedes-Benz</td>
<td>747.470 (HU 3/5 CS 6.5)</td>
</tr>
</tbody>
</table>

Rigid incorporating, an interaxle drive, portal hub reduction with pneumatically operated differential locks.
Overall ratio  
Track width  
Maximum loading (unladen)  

4.96:1  
1875 mm  
4550 kg  

1.13. Rear Axle  
Manufacturer  
Model No.  
Design  

Mercedes-Benz  
747.480 (HU 3/5 CS 6.5)  
Rigid incorporating portal hub reduction with pneumatically operated differential locks  
4.96:1  
1874 mm  
3800 kg  

1.14. Front Suspension  
Type  

Torque tube and struts located live axle with anti-roll bar. Double acting telescopic shock absorbers and single rate coil springs with progressive rubber bump stops mounted beside each coil spring  
5300 kg  

1.15. Rear Suspension  
Type  

Two U2150L Unimog type live axles located by longitudinal struts, a torque tube, lateral Panhard rods and anti-roll bars. Double acting telescopic shock absorbers and single coil springs with progressive rubber bump stops mounted beside the springs at each wheel station  
13700 kg
1.16. Propeller Shafts

Transmission to interaxle and front axle
Mercedes-Benz (U2150L Unimog type) shafts enclosed in torque tubes. A splined joint is employed at the differential ends to compensate for variations in length during operation.

Splitter transmission to main transmission
A two piece open shaft, supported by a chassis mounted centre bearing, and incorporating a Hookes type universal joint at either end. Articulation of the shaft rear section is achieved through the use of a splined joint.

Interaxle to rear differential
Open shaft, incorporating a Hookes type universal joint at either end and a splined joint to compensate for variations in length during operation.

1.17. Steering System

Make
Mercedes-Benz AG

Steering gear
Type
LS6
Design
Worm and nut
Power assistance
Hydraulic
Ratio
17.4:1 to 20.8:1
Turning circle
Between kerbs
Between 19 and 20 metres
## Brakes

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating system</strong></td>
<td>Dual circuit air over hydraulic with pneumatic controlled ALB and ratio valve load proportioning system</td>
</tr>
<tr>
<td><strong>Supply pressure</strong></td>
<td>18.3 bar (1830 kPa)</td>
</tr>
<tr>
<td><strong>Operating pressure</strong></td>
<td>7.3 bar (730 kPa)</td>
</tr>
<tr>
<td><strong>Service brakes</strong></td>
<td>Twin caliper disc brakes on the front wheels and single caliper disc brakes on the intermediate and rear wheels</td>
</tr>
<tr>
<td><strong>Actuation</strong></td>
<td>Hydraulic</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>Pneumatic</td>
</tr>
<tr>
<td><strong>Modulation</strong></td>
<td>Automatic load dependent control on primary system.</td>
</tr>
<tr>
<td><strong>Parking brake</strong></td>
<td>Spring-applied actuation on intermediate and rear disc brakes. Mechanical over-ride, pneumatically released</td>
</tr>
<tr>
<td><strong>Method of actuation</strong></td>
<td>Park brake valve in cab</td>
</tr>
<tr>
<td><strong>Six wheel work brake</strong></td>
<td>Air pressure actuated to hydraulic cylinders on all wheels</td>
</tr>
<tr>
<td><strong>Method of actuation</strong></td>
<td>Switch on dash couples the service and parking brakes electro-pneumatically</td>
</tr>
<tr>
<td><strong>Engine exhaust brake</strong></td>
<td>Pneumatically operated engine brake valve.</td>
</tr>
<tr>
<td><strong>Method of actuation</strong></td>
<td>Electro/pneumatic; actuated by brake light switch on brake pedal in cab or button on cab floor</td>
</tr>
</tbody>
</table>
1.19. Trailer Brake System

Design: Pneumatically controlled dual circuit brake system with dual-line trailer brake front and rear

Operating pressure: 7.3 bar (730 kPa)

Method of actuation: Brake valve on steering column

1.20. Chassis

Type: U section rails with six circular and U section cross members

Wheelbase:
- Front to intermediate axle: 3895 mm
- Intermediate axle to rear axle: 1392 mm

1.21. Tyres

Make: Michelin

Type: Radial, tubeless with 4 steel plies

Size: 365/85 R20 XZL 164G

Speed rating:
- Nominal (164G): 90 km/h @ 5000 kg/tyre
- Dispensation for increased speed (ETRTO std): 100 km/h @ 4750 kg/tyre

1.22. Rims

Make: Mercedes-Benz

Type: Two piece with split flange locking ring and rubber bead lock
1.23. Central Tyre Inflation System (CTIS)

Manufacturer and model  
Mercedes-Benz U2150L

Operating system  
Dual circuit automatic tyre inflation/deflation system

WARNING

At a pressure below 1.1 bar (110 kPa) a tyre can roll off the rim if the wheel is turned.

Tyre pressures (cold). Adjust pressure for warm tyres as follows:
First class road add 20%. Formed road 10%. Loose ground as indicated below.

<table>
<thead>
<tr>
<th></th>
<th>Front axle</th>
<th>Rear axles</th>
</tr>
</thead>
</table>
| **First class road – unladen**  
(max speed 100 km/h) | 6.0 bar (600 kPa) | 6.0 bar (600 kPa) |
| **First class road – up to ½ capacity of hook load**  
(max speed 100 km/h) | 6.0 bar (600 kPa) | 6.0 bar (600 kPa) |
| **First class road – ½ to max capacity of hook load**  
(max speed 100 km/h) | 6.0 bar (350 kPa) | 6.0 bar (590 kPa) |
| **Formed road – unladen**  
(max speed 60 km/h) | 3.4 bar (340 kPa) | 2.7 bar (270 kPa) |
| **Formed road – up to ½ capacity of hook load**  
(max speed 60 km/h) | 2.8 bar (280 kPa) | 3.6 bar (360 kPa) |
| **Formed road – ½ to max capacity of hook load**  
(max speed 60 km/h) | 2.5 bar (250 kPa) | 4.7 bar (470 kPa) |
| **Cross country – unladen**  
(max speed 20 km/h) | 1.9 bar (190 kPa) | 1.4 bar (140 kPa) |
| **Cross country – up to ½ capacity of hook load**  
(max speed 20 km/h) | 1.5 bar (150 kPa) | 2.0 bar (200 kPa) |
| **Cross country – ½ to max capacity of hook load**  
(max speed 20 km/h) | 1.3 bar (130 kPa) | 2.6 bar (260 kPa) |
| **Emergency – unladen**  
(max speed 10 km/h) | 1.3 bar (130 kPa) | 1.1 bar (110 kPa) |
| **Emergency – up to ½ capacity of hook load**  
(max speed 10 km/h) | 1.1 bar (110 kPa) | 1.3 bar (130 kPa) |
| **Emergency – ½ to max capacity of hook load**  
(max speed 10 km/h) | 1.1 bar (110 kPa) | 1.8 bar (180 kPa) |
| **C130 Loading – unladen** | 3.5 bar (350 kPa) | 3.5 bar (350 kPa) |
### 1.24. Electrical System

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>System voltage</td>
<td>24 V</td>
</tr>
<tr>
<td>Earth</td>
<td>Negative</td>
</tr>
<tr>
<td>Batteries</td>
<td>2 X 12V DC fitted with isolation switch</td>
</tr>
<tr>
<td>Capacity (per battery)</td>
<td>125 Ah, 550 A</td>
</tr>
<tr>
<td>Auxiliary start socket</td>
<td>24 V</td>
</tr>
<tr>
<td>Alternator</td>
<td>Bosch 24 Volt, 55 Amp</td>
</tr>
<tr>
<td>Horn</td>
<td>24V electrically operated</td>
</tr>
<tr>
<td>Windscreen wipers</td>
<td>24V electrical, intermittent, two speed, self parking</td>
</tr>
<tr>
<td>Windscreen washers</td>
<td>24V electrical, manual control.</td>
</tr>
<tr>
<td>Heater/demister</td>
<td>Three speed electric fan, engine cooling water heated</td>
</tr>
<tr>
<td>Lighting system</td>
<td></td>
</tr>
<tr>
<td>Headlights</td>
<td>Basic setting 1.5% (15 cm lowering over 10 metres)</td>
</tr>
<tr>
<td>Recovery platform lighting</td>
<td></td>
</tr>
<tr>
<td>Flood lights</td>
<td>2 X 24V mounted on stowage frame at rear of cab. 1 X 24V portable stowed in stowage compartment</td>
</tr>
<tr>
<td>Manufacturer/model</td>
<td>HELLA 1511</td>
</tr>
<tr>
<td>Emergency beacon</td>
<td>2 X 24V, amber, rotating mounted on telescopic post at rear of cabin</td>
</tr>
<tr>
<td>Manufacturer/model</td>
<td>HELLA 1713</td>
</tr>
<tr>
<td>NATO trailer socket</td>
<td>12-pin to DEF (Aust) 135</td>
</tr>
<tr>
<td>Cab/Chassis Bulbs</td>
<td>Wattage</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lighting Front</strong></td>
<td></td>
</tr>
<tr>
<td>Front lights</td>
<td></td>
</tr>
<tr>
<td>High beam/low beam head lights</td>
<td>75/70 W</td>
</tr>
<tr>
<td>Parking lights</td>
<td>5 W</td>
</tr>
<tr>
<td>Turn indicator lights</td>
<td>21 W</td>
</tr>
<tr>
<td>Outer Indicator</td>
<td>21 W</td>
</tr>
<tr>
<td><strong>Lighting Internal</strong></td>
<td></td>
</tr>
<tr>
<td>Control indicator lights</td>
<td>1.2 W</td>
</tr>
<tr>
<td>Map reading light</td>
<td>2 W</td>
</tr>
<tr>
<td>Dome light</td>
<td>10 W</td>
</tr>
<tr>
<td><strong>Military Lighting</strong></td>
<td></td>
</tr>
<tr>
<td>Black-out head lights</td>
<td>18 W</td>
</tr>
<tr>
<td>Reduced head light</td>
<td>18 W</td>
</tr>
<tr>
<td>Black-out tail lights</td>
<td>L.E.D.</td>
</tr>
<tr>
<td>Black-out stop light</td>
<td>L.E.D.</td>
</tr>
<tr>
<td>Convoy cross lights</td>
<td>2 W</td>
</tr>
<tr>
<td><strong>Recovery System Bulbs</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Lighting Rear</strong></td>
<td></td>
</tr>
<tr>
<td>Reversing/work lights</td>
<td>21 W</td>
</tr>
<tr>
<td>Rear position lights</td>
<td>10 W</td>
</tr>
<tr>
<td>Stop/rear directional lights</td>
<td>21 W</td>
</tr>
<tr>
<td>Side clearance lights</td>
<td>5 W</td>
</tr>
<tr>
<td>Rear end outline lights</td>
<td>10 W</td>
</tr>
</tbody>
</table>
## Lighting Recovery System

<table>
<thead>
<tr>
<th>Light Type</th>
<th>Power</th>
<th>Type</th>
<th>Fuse No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beacon lights</td>
<td>70 W</td>
<td>P14.5</td>
<td>H1</td>
</tr>
<tr>
<td>Flood lights</td>
<td>70 W</td>
<td>PK22s</td>
<td>H3</td>
</tr>
<tr>
<td>Spot lights</td>
<td>70 W</td>
<td>PK22s</td>
<td>H3</td>
</tr>
<tr>
<td>Control cabinet lights</td>
<td>10 W</td>
<td>BA15s</td>
<td>R 10W</td>
</tr>
</tbody>
</table>

### Cab/Chassis Fuses

<table>
<thead>
<tr>
<th>Description</th>
<th>Fuse No.</th>
<th>Fuse Current (Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low beam, near side</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Low beam, far side</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Spare</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Spare, auxiliary headlamp</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Stop lamp, relay (56), independent trailer brake</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Horn, starter lockout</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Splitter transmission solenoid valve</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Windshield wiper, windshield washer, auxiliary heater</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>washer, auxiliary heater coolant pump</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blower/heater ventilation</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Instruments, indicator lights, blackout lights relay,</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>terminal connection (15), tyre inflation control system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High beam</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Spare</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Park lamp near side, tail lamp far side, license plate lamp</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Park lamp far side, tail lamp near side</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Instruments</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
### Cab/Chassis Fuses (Cont’d)

<table>
<thead>
<tr>
<th>Description</th>
<th>Fuse No.</th>
<th>Current (Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift gate indicator, terminal connection (58), hazard warning flasher switch</td>
<td>F16</td>
<td>4</td>
</tr>
<tr>
<td>Ignition switch, blackout switch</td>
<td>F17</td>
<td>12</td>
</tr>
<tr>
<td>Accessories socket (dash), engine shut-off, terminal connection (D+), six-wheel work brake</td>
<td>F18</td>
<td>8</td>
</tr>
<tr>
<td>Blackout headlights</td>
<td>F19</td>
<td>4</td>
</tr>
<tr>
<td>Blackout tail lights</td>
<td>F20</td>
<td>4</td>
</tr>
<tr>
<td>Masked convoy lights (marker lamps)</td>
<td>F21</td>
<td>4</td>
</tr>
<tr>
<td>Spare</td>
<td>F22</td>
<td>4</td>
</tr>
<tr>
<td>Spare</td>
<td>F23</td>
<td>8</td>
</tr>
<tr>
<td>Spare</td>
<td>F24</td>
<td>8</td>
</tr>
</tbody>
</table>

### Recovery System Fuses and Relays

<table>
<thead>
<tr>
<th>Description</th>
<th>Fuse No.</th>
<th>Relay No.</th>
<th>Current (Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not used</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spare</td>
<td>2</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Cooling fan</td>
<td>3</td>
<td>R6</td>
<td>15</td>
</tr>
<tr>
<td>Hydraulics</td>
<td>4</td>
<td>R5</td>
<td>10</td>
</tr>
<tr>
<td>Work lights</td>
<td>5</td>
<td>R3</td>
<td>10</td>
</tr>
<tr>
<td>Flood lights</td>
<td>6</td>
<td>R4</td>
<td>15</td>
</tr>
<tr>
<td>Blackout control</td>
<td>7</td>
<td>R2</td>
<td>15</td>
</tr>
<tr>
<td>Beacon lights</td>
<td>8</td>
<td>R1</td>
<td>15</td>
</tr>
<tr>
<td>Throttle control</td>
<td>4</td>
<td>R7</td>
<td>10</td>
</tr>
</tbody>
</table>
1.25. Audio Kit
Radio/cassette player
Speakers
AM/FM 24V - Eurovox
2 X Eurovox TX910V

1.26. Air Conditioner
Manufacturer
Air International
Type
Sigma D-Series (24V-R134a version). Split medium duty A/C system
Models
Evaporator
Condenser
DFW4BX1
DCF6BX1
R134a
Refrigerant
Cooling capacity
Hot/dry
Hot/wet
3.3 kW (nominal)
3.6 kW (nominal)
Vents
2 directional in dash
Supply voltage
24 V DC

1.27. Hydraulic System
Hydraulic circuits
Independent circuits for:
1. Left winch and earth anchors
2. Lifting boom, folding boom and right winch
3. Crane
Hydraulic system capacity
135 litres
Hydraulic pump
Triple element pump driven from P.T.O.
Hydraulic system working pressure (except crane) 175 bar (17.5 MPa)

Crane hydraulic system working pressure 280 bar (28 MPa)

1.28. **Recovery Boom**

**Manufacturer**
EDI, Gecko-D8

**Type**
Underlift

**Maximum static lifting capacity**

<table>
<thead>
<tr>
<th>Hole</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>7 tonnes</td>
</tr>
<tr>
<td>Second</td>
<td>6 tonnes</td>
</tr>
<tr>
<td>Third</td>
<td>5 tonnes</td>
</tr>
<tr>
<td>Fourth</td>
<td>4 tonnes</td>
</tr>
</tbody>
</table>

**Safe working load, lift towing**

<table>
<thead>
<tr>
<th>Hole</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>4.3 tonnes</td>
</tr>
<tr>
<td>Second</td>
<td>3.7 tonnes</td>
</tr>
<tr>
<td>Third</td>
<td>3.2 tonnes</td>
</tr>
<tr>
<td>Fourth</td>
<td>2.5 tonnes</td>
</tr>
</tbody>
</table>

**Reach**

<table>
<thead>
<tr>
<th>Hole</th>
<th>Reach</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>540 mm</td>
</tr>
<tr>
<td>Fourth</td>
<td>1040 mm</td>
</tr>
</tbody>
</table>

**Maximum lifting height**

1.8 metres

**Recovery boom hydraulic system working pressure**

175 bar (17.5 MPa)

**Oil supply**

Common with winches, earth anchors and crane
1.29. Winches

Manufacturer/model: Sepson H120P (63.01-043)

Type: 2 X hydraulic 11 tonne, 2 speed, under wound with automatic safety brake and pneumatically operated free-spooling

Maximum pulling capacity (limited): 8 tonnes per winch rope

Winch drum:
- Diameter: 290 mm
- Length: 310 mm

Rope layers: 4

Winch rope:
- 2 X Casar, Superplast c/w solid thimble and latch-lock safety hook
- Diameter: 13 mm
- Working length (max.): 90 metres
- Breaking strain: 16.27 tonne

Pulling force controlled to:
- 8 tonne

Manufacturers maximum rated tension:
- Pulling force, inner winch rope layer:
  - High speed: 15 kN (1.5 tonne)
  - Low speed: 110 kN (11 tonne) flat rated to 80 kN (8 tonne)
- Pulling force, outer winch rope layer:
  - High speed: 12 kN (1.2 tonne)
  - Low speed: 80 kN (8 tonne)
Cable speed, bottom winch rope layer
- High speed: 14.5 m/min
- Low speed: 5.3 m/min

Cable speed, top winch rope layer
- High speed: 18.2 m/min
- Low speed: 6.6 m/min

Pulling force, front winching: 7.5 tonne

Winch hydraulic system working
- Pressure: 175 bar (17.5 MPa)

Oil flow: 75 l/min
Oil supply: Common with boom and crane

Setting pressure
- Overcentre valve in: 75 bar (7.5 MPa)
- Overcentre valve out: 85 bar (8.5 MPa)
- Sequence valve changing pressure: 100 bar (10 MPa)

Winch mass (including rollers, excluding rope): 297 kg

1.30. Fairleads
Maximum fairlead angles
- Rear recovery: 330 degrees
- Front recovery:
  - Elevation and depression: 45 degrees
  - Left and right: 45 degrees

1.31. Earth Anchors
Spade hydraulic system working
- Pressure: 175 bar (17.5 MPa)

Oil supply: Common with boom, winches and crane
### 1.32. Crane

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Palfinger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>PK 3700 P067</td>
</tr>
<tr>
<td>Type/location</td>
<td>Hydraulically driven, mounted behind cab</td>
</tr>
<tr>
<td>Slewing torque</td>
<td>4.4 kN</td>
</tr>
<tr>
<td>Slewing range</td>
<td>180°</td>
</tr>
<tr>
<td>Crane hydraulic system working pressure</td>
<td>280 bar (28 MPa)</td>
</tr>
<tr>
<td>Pump capacity</td>
<td>20 l/min</td>
</tr>
<tr>
<td>Oil supply</td>
<td>Common with boom and winches</td>
</tr>
<tr>
<td>Dead weight (excluding tie down bolts)</td>
<td>590 kg</td>
</tr>
</tbody>
</table>

**Crane Maximum Safe Working Loads**

<table>
<thead>
<tr>
<th>Radius (hook to support column)</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.7 m</td>
<td>2140 kg</td>
</tr>
<tr>
<td>3.4 m</td>
<td>1100 kg</td>
</tr>
<tr>
<td>5.1 m</td>
<td>730 kg</td>
</tr>
</tbody>
</table>

### 1.33. Accessories

| Fire extinguishers | 1 X 1.5 kg dry chemical beside drivers seat, 1 X 4.5 kg dry chemical front left hand side of recovery platform, 1 X 9l foam front right hand side of recovery platform |
1.34. Performance

Maximum gradient (no casualty)

Climb 1:1.67 (60%) 31°
Start 1:1.67 (60%) 31°

Maximum gradient lift towing a cross country laden UL1700 cargo

Climb 1:3 (33%) 18.4°

Maximum gradient lift towing an unladen UL1700 cargo

Climb 1:2 (50%) 26.5°

Maximum gradient lift towing all LR 6x6 cargo

Climb 1:2 (50%) 26.5°

Range of operation (MRV solo)

First class roads 1000 km approx.
Formed roads 650 km approx.

Fuel consumption (MRV solo)

First class road laden 32 litres per 100 km
Formed road laden 44 litres per 100 km

Maximum towing speed

MRV with casualty 100 km/hr
(first class road, fine weather)

MRV with casualty 60 km/hr
(former road, fine weather)

MRV with/without casualty
(cross country, any weather)

Discretionary dependent on terrain but no more than 20 km/hr.

Towing capacity (total towbar/pintle/vehicle capability) (ATM) 12,500 kg

NOTE

Observe the maximum lifting capacity listed in para. 1.28.

Recommended lift towing capacity 4,300 kg
(total boom/T-bar/vehicle capability)
(ATM)
SECTION 2
SHIPPING AND TRANSPORTATION DATA

1.35. Dimensions

Overall length 7990 mm

Overall width — over mirrors 2695 mm
  — Reduced 2386 mm
  — Parts removed RH crane extension cylinder, hub caps and mirrors folded
  — Limiting feature LH fuel cap

Overall height — laden 3034 mm
  — Limiting feature Emergency light, snorkel

Reducible height

NOTE

Ensure, all aerials are removed or tied down, and no item on the working platform protrudes above the cupola ring.

Reducible height — laden 2819 mm
  — Parts removed Emergency light, snorkel, cupola post
  — Limiting feature

Reducible height — laden 2725 mm
(suspension lock on front axle)
  — Parts removed Emergency light, snorkel, cupola post
  — Limiting feature

Reducible height — laden 2597 mm
(suspension lock on front axle)
  — Parts removed Emergency light, cupola and post, snorkel, crane lever caps
  — Limiting feature Cupola ring

Reducible height (all tyres 1.4 bar (140 kPa)) 2606 mm
  — Parts removed Emergency light, cupola and post, snorkel, crane lever caps
  — Limiting feature Cupola ring
<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelbase overall</td>
<td>5300 mm</td>
</tr>
<tr>
<td>- Front to intermediate axle</td>
<td>3900 mm</td>
</tr>
<tr>
<td>- Intermediate to rear axle</td>
<td>1400 mm</td>
</tr>
<tr>
<td>Track</td>
<td></td>
</tr>
<tr>
<td>- Front</td>
<td>1905 mm</td>
</tr>
<tr>
<td>- Intermediate</td>
<td>1875 mm</td>
</tr>
<tr>
<td>- Rear</td>
<td>1875 mm</td>
</tr>
<tr>
<td>Middle distance between intermediate and rear axles to rear of vehicle overhang</td>
<td>2200 mm</td>
</tr>
<tr>
<td>Towing pintle height - laden</td>
<td>800 mm</td>
</tr>
<tr>
<td>Mass (combat laden), includes the MRV, all CES, two personnel, personal equipment, weapons, ammunition, rations, all fuels and lubricants, full jerry cans and defence stores, no casualty on tow</td>
<td></td>
</tr>
<tr>
<td>- Front</td>
<td>5350 kg</td>
</tr>
<tr>
<td>- Intermediate</td>
<td>4550 kg</td>
</tr>
<tr>
<td>- Rear</td>
<td>3800 kg</td>
</tr>
<tr>
<td>- Total</td>
<td>13,700 kg</td>
</tr>
<tr>
<td>Maximum gross combination mass</td>
<td></td>
</tr>
<tr>
<td>- Highway</td>
<td>28,000 kg</td>
</tr>
<tr>
<td>- Cross country</td>
<td>28,000 kg</td>
</tr>
<tr>
<td>Shipping Cubage</td>
<td></td>
</tr>
<tr>
<td>- Overall</td>
<td>54.3 m³</td>
</tr>
<tr>
<td>- Height reduced</td>
<td>51.9 m³</td>
</tr>
</tbody>
</table>
### 1.36 Capacities

<table>
<thead>
<tr>
<th>System</th>
<th>DEF (AUST)</th>
<th>Capacity (Litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel</td>
<td>Diesel fuel auto</td>
<td>302</td>
</tr>
<tr>
<td>Cooling system (with inhibitor)</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>— Inhibitor (Castrol Antifreeze DB or BP Coolant 007/400F mix)</td>
<td>50% (with water)</td>
<td></td>
</tr>
<tr>
<td>Engine system (including filter)</td>
<td>OMD 115</td>
<td>14.5</td>
</tr>
<tr>
<td>Main transmission (incl. transfer case and PTO)</td>
<td>Castrol Syntrans 75W/85</td>
<td>12</td>
</tr>
<tr>
<td>Splitter transmission</td>
<td>Castrol Syntrans 75W/85</td>
<td>2.8</td>
</tr>
<tr>
<td>Interaxle drive</td>
<td>OEP 220</td>
<td>3.5</td>
</tr>
<tr>
<td>Front axle</td>
<td>OEP 220</td>
<td>2.5</td>
</tr>
<tr>
<td>Intermediate axle</td>
<td>OEP 220</td>
<td>2.5</td>
</tr>
<tr>
<td>Rear axle</td>
<td>OEP 220</td>
<td>2.5</td>
</tr>
<tr>
<td>Hub drives (all)</td>
<td>OEP 220</td>
<td>0.25</td>
</tr>
<tr>
<td>Steering system</td>
<td>OX 47 Grade 10</td>
<td>3.2</td>
</tr>
<tr>
<td>Brake system</td>
<td>OX (AUST)-8</td>
<td>1.0</td>
</tr>
<tr>
<td>Clutch system</td>
<td>OX (AUST)-8</td>
<td>0.2</td>
</tr>
</tbody>
</table>

**Hydraulic system capacity**

- **At ambient temperatures 5°C to 42°C (maximum oil temperature 80°C)**
  - Hydraulic fluid, Petroleum, Antiwear Grade 68 (Tellus 68) 135
- **At ambient temperatures -6° to 25°C (maximum oil temperature 60°C)**
  - Hydraulic fluid, Petroleum, OM -33 135
1.37 Fording Depth

Unprepared vehicle 1200 mm
  Limiting feature (over 1200 mm)
Prepared vehicle No facility available, as for unprepared vehicle

1.38 Bridge Classification

Combat laden 13
Combat laden (lift towing a combat laden MRV) 25

1.39 Ground Clearance

Combat laden (limiting feature earth anchor spades) 430 mm

1.40 Transportability

Railway loading gauges local authorities must be consulted

<table>
<thead>
<tr>
<th>Rail Authority</th>
<th>Gauge</th>
<th>Maximum rolling stock height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commonwealth</td>
<td>1435 mm</td>
<td>2532 mm</td>
</tr>
<tr>
<td>Commonwealth</td>
<td>1067 mm</td>
<td>2532 mm</td>
</tr>
<tr>
<td>New South Wales</td>
<td>1435 mm</td>
<td>2182 mm</td>
</tr>
<tr>
<td>Queensland</td>
<td>1067 mm</td>
<td>1806 mm</td>
</tr>
<tr>
<td>South Australia</td>
<td>1600 mm</td>
<td>2075 mm</td>
</tr>
<tr>
<td>South Australia</td>
<td>1435 mm</td>
<td>2075 mm</td>
</tr>
<tr>
<td>Tasmania</td>
<td>1067 mm</td>
<td>1992 mm</td>
</tr>
<tr>
<td>Victoria</td>
<td>1435 mm</td>
<td>2182 mm</td>
</tr>
<tr>
<td>Western Australia</td>
<td>1435 mm</td>
<td>2532 mm</td>
</tr>
<tr>
<td>Western Australia</td>
<td>1067 mm</td>
<td>1973 mm</td>
</tr>
</tbody>
</table>
1.41 Slinging and Tie-Down Points

Slinging and tie-down points are illustrated in Fig 1-3

![Diagram of Slinging and Tie-Down Points]

Figure 1-3 Slinging and Tie-Down Points

1.42 Shipping Volume

Overall \( 54.3 \text{ m}^3 \)

Height reduced \( 51.9 \text{ m}^3 \)

1.43 Approach and Departure Angles

Approach angle — combat laden \( 42 \text{ degrees} \)

(leading features front towing lugs)

Departure angle — combat laden \( 35 \text{ degrees} \)

with boom raised and locked in 2nd quadrant hole from bottom

(limiting features folding boom)

Ramp breakover angle — combat laden \( 143 \text{ degrees} \)

(limiting features side equipment bins)
SECTION 3
EQUIPMENT DESCRIPTION

Introduction

1.44. The Truck, Wrecker, Medium, MC2, Unimog U2450L (MRV) is built to Specification Army (Aust) 6620 and has been specifically designed for military use to meet operational requirements. To meet these requirements the vehicle has been fitted with a recovery system capable of recovering vehicles of the mobility capability MC2.

Main Features

1.45. The main features of the MRV are as follows:

a. A cab/chassis based on a proven UNIMOG U2450L 6x6 chassis providing commonality with the UNIMOG vehicles in service.

b. A 5.958 litre, in-line six cylinder, turbocharged, diesel engine fitted with an intercooler.

c. An eight speed, all synchromesh transmission with integrated transfer gearcase providing permanent four-wheel drive on the rear wheels, with selective six-wheel drive for negotiating difficult terrain. An auxiliary transmission (working gear group) is also fitted to provide a lower range of ratios when towing heavy loads and for negotiating heavy going.

d. A splitter transmission to enable gear splits in the main transmission to optimise vehicle performance under all conditions.

e. Differential locks on each axle.

f. A central tyre inflation system.

g. A hydraulically operated underlift extendable towing boom. The towing boom is provided with a mechanical support, independent of the hydraulic system, for towing of casualty vehicles.

h. Hydraulically operated earth anchors.

i. Self recovery from the front using the on-board winching system.
j. Two, 2-speed, drum type hydraulically operated, winches for recovery operations. Each winch has a free spooling capability.

k. A hydraulically operated crane for material handling.

Operational and Logistic Concept

1.46. The MRV assists in the maintenance of the mobility of deployed forces and contributes to the ability of those forces to sustain operation in areas remote from industrial and logistic infrastructure.

ENGINE (Fig 1-4)

1.47. General

The vehicle is fitted with a Mercedes-Benz 5.958 litre OM 366 LA, six cylinder in-line, direct injection, turbocharged intercooler engine, which produces 177 Kw of power at 2600 rpm and 760 Nm of torque at 1400 - 1700 rpm.

1.48. Lubrication

The engine lubrication pressure feed system consists of a gear type oil pump with a built-in pressure relief valve. The pump is driven from the engine crankshaft. Oil under pressure, is fed through a filter and an engine mounted oil cooler before being delivered to the main bearings, camshaft assembly, piston assemblies and valve lifters. The timing gears, air compressor, injection pump and turbocharger are lubricated from the same supply.

1.49. Oil Filter

The engine oil filter is externally mounted, full-flow type, fitted with a replaceable element.

1.50. Oil Cooler

The labyrinth-type oil cooler is mounted on the left-hand side of the crankcase casting.

1.51. Air Cleaner

The air cleaner outlet is connected to the turbocharger inlet. The air cleaner housing contains an element that must be cleaned and/or replaced at specified intervals.
1. Water pump
2. Thermostat
3. Filler cap
4. Hand primer
5. Engine breather
6. Intake manifold
7. Exhaust manifold
8. Oil cooler
9. Engine brake manifold
10. Clutch bell housing
11. Flywheel
12. Main bearing cap
13. Big end bearing
14. Oil pump
15. Sump plug
16. Crankshaft pulley
17. Fuel filter
18. Injector
19. Oil feed line (turbocharger)
20. Turbocharger
21. Oil return line (turbocharger)
22. Starter motor
23. Crankshaft
24. Sump
25. Oil pump pick-up
26. Oil filter
27. Camshaft
28. Rear engine mount
29. Hand primer
30. Fuel injection pump

Figure 1-4 Front/Left Hand Side View of Engine
1.52. **Engine Cooling**

The engine (Fig 1-4) is water-cooled by a thermo-syphon system assisted by a centrifugal water pump and a viscous clutch cooling fan. The fan and water pump are driven by belts from the crankshaft pulley. The expansion tank is fitted with a pressure cap that operates at 0.7 bar (70 kPa). A turbocharger charge air cooling radiator (intercooler) is fitted to the front of the radiator to cool the engine intake air. The vehicle heater utilises waste heat from the engine cooling system.

**FUEL SYSTEM**

1.53. **General**

The fuel system consists of a 302 litre fuel tank, a fuel pump, a disposable pre-filter, a fuel filter, and an in-line injection pump delivering fuel to direct injection nozzles mounted in the cylinder head. The fuel is delivered into the injectors at a pressure of approximately 2000 kPa. Excess fuel is returned to the fuel tank.

1.54. **Diesel Engine Exhaust Smoke Emission Control**

A smoke limiter rated to ADR 36/00 is fitted between the fuel injection pump governor and the fuel rack. The smoke limiter senses inlet manifold pressure and decreases fuel delivery at full throttle openings, thereby preventing the engine from operating with an excessively rich fuel/air mixture.

**CLUTCH**

1.55. The clutch is hydraulically actuated by a slave cylinder connected via an in-line booster cylinder to the master cylinder at the clutch pedal.

**SPLITTER TRANSMISSION**

1.56. A splitter transmission is mounted on the rear of the clutch housing. The transmission provides a high/low ratio in all gears effectively providing another eight speeds to the drive. The greater range of gear selection permits the driver to optimise the performance capabilities of the vehicle, particularly when operating cross country and on second class roads.

**TRANSMISSION**

1.57. **Main Transmission**

The manually-shifted main transmission comprises of a four speed gearbox with a forward/reverse change, together with a set of planetary gears. The planetary gear set is engaged and disengaged pneumatically to allow the selection of a total of eight forward or eight reverse ratios.
1.58. Auxiliary Transmission (Working Gear Group)

An auxiliary transmission (working gear group) is mounted on the front of the main transmission and provides a lower range of ratios than the main transmission when towing heavy loads.

1.59. Transfer Case

The transfer case is mounted on the left hand side of the main transmission group. Six-wheel drive may be selected for adverse terrain. A pneumatically operated dog clutch enables six-wheel or four-wheel drive to be selected at the transfer gearcase.

DRIVELINES AND AXLES

1.60. General

The MRV drivelines consist of open type drive shafts and drive shafts enclosed in torque tubes.

The transmission to interaxle and front axle drivelines employ Mercedes-Benz (Unimog type) shafts enclosed in torque tubes. Splined joints at the differential ends compensate for variations in length during operation.

The splitter transmission to main transmission and the interaxle to rear differential drives use an open shaft, incorporating a Hookes type universal joint at either end. A splined joint is employed to compensate for variations in length during operation.

The front axles include constant velocity joints to the front wheels.

1.61. Differential Locks

Cross locks are incorporated in the front, rear and intermediate (power divider) axle differentials to enable power to be divided equally to each wheel when difficult terrain is encountered. The differential lock, locks one half shaft to the crown wheel causing the road wheels to rotate at the same speed irrespective of unequal grip of the road wheels.
**CHASSIS**

1.62. The chassis (Fig 1-5) is a ladder type with extreme torsional flexibility, consisting of two U-section side members and tubular cross members. The cab and recovery unit subframes are mounted torsion free onto the chassis. The front of the engine is supported on a cross-member between the two chassis rails. The rear of the engine is supported on each side by mountings secured to the chassis rails.

![Diagram of Chassis and Suspension](image)

**Figure 1-5 Chassis and Suspension**

**SUSPENSION**

1.63. **Front Suspension**

The front suspension consists of a live axle located by a torque tube and struts and fitted with an anti-roll bar and Panhard rod. Double acting telescopic shock absorbers and single rate coil springs are fitted with progressive rubber bump stops mounted beside each coil spring.

1.64. **Rear Suspension**

The rear suspension consists of two Mercedes-Benz (Unimog type) live axles. The intermediate axle is located by a torque tube and Panhard rod, and the rear axle is located by longitudinal and lateral Panhard rods. Double acting telescopic shock absorbers and single coil springs with rubber bump stops are mounted beside the springs at each wheel station.
STEERING SYSTEM

1.65. The MRV is fitted with a power assisted steering system (Fig 1-6). The steering system employs a hydraulically boosted worm and nut steering box linked to a two spoke steering wheel by universal joints, shafts and angle drives. Mechanical linkage to the wheel hubs from the steering box is via the Pitman arm, drag link, steering arms and tie rod. The steering hydraulic circuit comprises of a belt driven (from the engine crankshaft pulley) hydraulic pump, connected to a hydraulic reservoir, and the steering box via hydraulic lines.

---

BRAKE SYSTEM

1.66. General

The front wheels are fitted with two sets of calliper disc brakes and the intermediate and rear wheels are fitted with a single set of calliper disc brakes. Two single circuit brake master cylinders hydraulically operate the callipers. One brake master cylinder operates the intermediate and rear callipers and the other master cylinder operates the two sets of front callipers. If a malfunction occurs in one brake system, the remaining system provides sufficient braking effort to enable the vehicle to be driven safely, at a reduced speed, to a suitable repair facility.

1.67. Exhaust Brake

The engine exhaust manifold is fitted with an engine brake that restricts exhaust gas flow, so retarding the engine. The exhaust brake consists of
a cylinder and piston pneumatically operated which is connected to a throttle valve at the exhaust manifold. The brake is controlled via a switch on the dash and applied either by the brake pedal through the stop light switch, or a foot operated valve fitted in the floor in front of the drivers seat.

1.68. Foot Brake

The foot brake pedal (Fig 1-7(2)) is connected to a pneumatic valve that directs compressed air, at variable pressure, to the single circuit diaphragm-actuating cylinders. This variable pressure is also available at the trailer brake control valve, so that when the vehicle brakes are applied the trailer brakes are also applied to assist in the braking application.

1.69. Park Brake

A park brake is provided by the intermediate and rear wheel callipers. The callipers are fitted with mechanical over-rides and operated by spring-retracted pneumatic cylinders. The park brake is controlled by the park brake control valve mounted adjacent to the left hand side of the driver's seat. The system is fail-safe, as the park brake cannot be released unless there is a pressure of at least 6 bar (600 kPa) in the compressed air receivers.

1.70. Trailer Brake

The trailer brake lever applies a pneumatic signal to the trailer brake control valve, proportional to the position of the brake lever. Only the trailer brakes are applied.

**WARNING**

If the engine is switched off during winching operations the six-wheel brake will release and the MRV may move.

1.71. Six-Wheel Work Brake

When performing recovery operations the service brakes and the park brake can be coupled electro-pneumatically to apply the brakes to all wheels. A switch, located on the left-hand corner of the dash, when pressed activates the front and rear brakes in the same way the foot brake valve does. The system only operates when the engine is running, the park brake is applied and there is an air supply pressure of 7.5 bar (750 kPa) or more in the system. The work brake is not to be used as a park brake.
CONTROLS

1.72. Accelerator Pedal Linkage

The accelerator pedal linkage is the manual control from the accelerator pedal to the fuel injection pump and receives input from the accelerator pedal, the hand throttle, the speed limiter, and input from the recovery throttle control switches (control cabinets and remote control) via a pneumatic cylinder connected to the throttle linkage. The accelerator pedal (Fig 1-7(1)) controls the setting of the fuel delivery mechanism at the fuel injection pump. An integral governor on the injection pump controls the idle and maximum engine speeds.

1.73. Speed Limiting Device

The MRV is fitted with a speed limiter, which consists of an electronic control unit that operates an electric motor in an actuator connected via a Bowden cable to the accelerator pedal linkage. Maximum speed of the vehicle is limited to 100 km/h.
1.74. **Hand Throttle**

A hand throttle (Fig 1-7) enables a constant engine speed to be set when the vehicle is stationary. To set the engine to a particular speed, the throttle lever is pushed downwards until the tachometer indicates the desired speed. The hand throttle can also be used for setting a constant engine speed whilst operating the crane. After use, the hand throttle must be carefully relocated in the top of the recess (idle position) of the throttle lever stop bracket.

1.75. **Clutch Pedal**

The clutch pedal (Fig 1-7) operates the transmission clutch when changing gears, activates the splitter transmission solenoid and permits starting when the pedal is depressed.

1.76. **Foot Brake Pedal**

The foot brake pedal (Fig 1-7) operates the disc brakes on each wheel, the exhaust brake if actuated, and the trailer brakes if applicable.

1.77. **Trailer Brake Lever**

The trailer brake lever (Fig 1-8) applies the trailer brakes independently of the vehicle brakes.

![Figure 1-8 Trailer Brake Lever](image)
1.78. **Forward/Reverse Selector Lever**

The forward/reverse selector lever (Fig 1-9(3)) selects either forward or reverse drive direction.

1.79. **Gear Selector Lever**

The main gear shift lever (Fig 1-9(6)) selects the desired gear ratio. The eight available ratios are shifted on a 2 x 4 principle. When changing from 4th up to 5th gear, a pneumatic control valve automatically disengages the auxiliary planetary gear set in the transmission and automatically engages the planetary gear set when changing down from 5th to 4th gear. The neutral positions between the individual ratios, e.g. shifting from 1st and 2nd or 5th and 6th gears are provided with detents to prevent inadvertent gear selection, e.g. shifting from 7th to 4th gear. All gear shifts, including forward and reverse selection, are fully synchronised.
1.80. Gear Shift Gate Position Indicator
The gear shift gate position indicator (Fig 1-10) is located at the centre of the dashboard and indicates the position of the gear selector lever within the gear gate. The gear shift gate position indicator is not illuminated under blackout conditions.

![Gear Ratios Diagram](image)

Figure 1-10 Gate Position Indicator

1.81. Splitter Transmission Selector Lever
The splitter transmission selector switch (Fig 1-9(7)) is located on the main gear shift lever and is used to engage and disengage the splitter transmission in each ratio e.g., 1st gear low ratio (splitter transmission - direct drive), 1st gear high ratio (splitter transmission - overdrive). Engaging the splitter transmission effectively gives an extra selection of eight ratio's in forward or reverse, whilst driving. To engage the splitter transmission, depress the clutch pedal to the floor, hold the pedal down momentarily (min of 0.5 seconds), raise the selector switch on the main gear change lever and then release the clutch pedal. The splitter transmission engaged indicator light (Fig 1-19(10)) will be illuminated.

1.82. Park Brake Lever
The park brake lever (Fig 1-9(8)) is located to the right of the main gear shift lever. The park brakes are released by lifting the collar on the hand brake lever and pushing the park brake lever forward (Position 1, see Fig 1-11). The park brake indicator light will then extinguish, provided that the supply of air pressure is above 6 bar (600 kPa). A test position (Position 2, see Fig 1-11) is incorporated in the park brake circuit. The test position is utilised only when towing a trailer and is activated by moving the park brake lever to position 0, depressing the lever firmly and moving it backwards. This action releases the trailer brakes only, allowing the driver to check that the vehicle brakes alone will hold the vehicle/trailer combination on a gradient when parked. The park brake lever automatically returns to position 0 when released from test position 2.
1.83. Auxiliary Transmission (Working Gear Group) Selector Switch

The auxiliary transmission (working gear group) selector switch (Fig 1-9(4)) is located beside the forward/reverse selector lever and operates the auxiliary transmission (working gear group) mounted at the front of the transfer case. The auxiliary transmission (working gear group) is employed to increase the traction power of the vehicle during operation on formed roads and over cross country.

To engage the auxiliary transmission (working gear group), stop the vehicle, declutch and turn the selector switch (Fig 1-9(4)). To disengage, stop the vehicle, declutch and turn the selector switch. Only select the working gear group when the vehicle is stationary.

1.84. PTO Selector Switch

WARNING

When operating with the PTO engaged, the main transmission shift lever must be in the neutral position (7th - 8th gear), the forward/reverse gear lever in the neutral position, and the splitter transmission in LOW ratio.

The PTO control switch (Fig 1-9(10)) is located at the bottom right corner of the centre control plate. The PTO can only be engaged when the
vehicle is stationary. Engagement/disengagement is effected by a pneumatic control valve mounted on top of the PTO housing.

To engage the PTO, disengage the clutch, rotate the control switch to right until it lines up with the “PTO on” symbol and engage the clutch. Ensure the PTO light is illuminated. To disengage the PTO, disengage the clutch, rotate the control switch to the left until it lines up with the “0” symbol and engage the clutch. Ensure the PTO indicator light is extinguished.

1.85. Steering Wheel/Column

The two spoke steering wheel operates a hydraulically boosted steering box. The stalk control switch, trailer brake control switch and ignition switch housing are clamped to a tube bolted to the steering column housing.

1.86. All Wheel Drive, Power Divider and Differential Lock Controls

All wheel drive, power divider and differential lock control is provided by two switches. One switch is located on the top right hand side of the instrument panel (Fig 1-12) and the other is mounted on the centre control panel (Fig 1-9(5)). Both switches are used in conjunction with each other to provide varying combinations of differential locks and engagements depending on terrain. The MRV is to be stationary prior to engaging the all wheel drive, power divider and differential lock control switches.

For normal highway driving, only rear four wheel drive is necessary. When driving over difficult terrain, six-wheel drive and differential locks can be engaged to ensure that the vehicle movement is maintained.

1.87. Instrument Panel All Wheel Drive and Power Divider Control Switch (Fig 1-12)

The instrument panel all wheel drive and power divider control switch operating positions are:

a. Position 0 - the intermediate and rear axles are in constant drive.
Figure 1-12 Instrument Panel All Wheel Drive and Power Divider Control Switch

b. Position (I) - the front axle is engaged (six-wheel drive) and the front axle all wheel drive indicator light (Fig 1-19(16)) is illuminated. Pressurisation of all axles occurs at this point to facilitate fording.

c. Position (II) - the inter-axle power divider lock is engaged and the power divider differential lock indicator light (Fig 1-19(13)) is illuminated.

1.88. Control Panel Differential Lock Control Switch (Fig 1-13)

Note

To engage the control panel differential lock control switch the instrument panel all wheel drive and power divider control position (II) must be selected

Figure 1-13 Control Panel Differential Lock Switch

The control panel differential lock control switch operating positions are:

a. Position (III) - the intermediate and rear axle differential locks are engaged and the power divider and rear axle differential lock indicator lights (Fig 1-19(13) and (14)) are illuminated.
b. Position (IV) - the front axle differential lock is engaged and the front axle differential lock indicator light (Fig 1-19(15)) is illuminated.

ELECTRICAL SYSTEM

1.89. General

The electrical system is a 24V DC negative to earth system using two 12 volt, 125 Ah capacity wet cell batteries. The batteries are mounted on the right-hand chassis under the drivers' side door, in a lockable battery box. The electrical system controls and monitors the electrical components of various systems of the vehicle via harnesses and electrical boxes.

1.90. Alternator

The three-phase alternator supplies rectified and regulated direct current (DC) to the batteries. The alternator is bolted on the lower left hand side of the engine and is belt driven. Fins mounted on the pulley cool the alternator.

1.91. Circuit Breakers

The electrical system is protected from overload conditions by two main circuit breaker panels (Fig 1-14) fitted to the top of the dashboard immediately forward of the steering wheel. Relays located on the inner wall of the remote control stowage bin isolate the load of the recovery system devices from the cab/chassis circuits. Refer to Section 1 - Data Summary for ratings and circuit information.

Figure 1-14 Circuit Breakers
1.92. Battery Mains Switch

The battery mains switch is a rotary switch, located on top of the battery compartment, and is used to isolate the vehicle electrical system from the batteries. When the switch is rotated anti-clockwise, the vehicle electrical system is isolated from the batteries. When the switch is rotated to clockwise, electrical power is restored to the vehicle electrical system.

1.93. Auxiliary Start Socket

The auxiliary start socket is located next to the battery mains switch and enables power to be supplied to another vehicle from the MRV batteries via an interconnecting slave lead. The MRV can also be slaved from another vehicle.

1.94. Starter Motor

The starter motor is an electrically operated DC motor fitted with an integral, pre-engaged drive operated by a solenoid. The starting circuit includes the ignition/start key-operated switch, the start solenoid and, a starter interlock switch.

1.95. Windscreen Wipers

Two windscreen wiper arms are driven via linkages by a two-speed, self-parking electric motor mounted under the dashboard. The wipers are controlled by the indicator control combination switch mounted on the steering column.

1.96. Windscreen Washers

The windscreen washer tank and electric pump assembly is mounted at the right hand front side of the engine compartment between the air cleaner and cab body. The wiper washer motor drives the pump to deliver water from the water tank via plastic hoses to the nozzles on the windscreens. A switch, incorporated in the wiper controls on the combination switch stalk, operates the washer pump.

1.97. Horn

An electric horn is mounted behind the left-hand headlight. The horn is operated by depressing a button on the end of the indicator control combination switch mounted on the steering column. The maximum period of operation at any one time should not exceed 5 seconds.
LIGHTING SYSTEM

1.98. Normal Lights

Exterior lighting consists of:

a. Two headlights, each with a double-filament bulb, one filament for high beam and the other for low beam. Headlight aiming is adjustable, to compensate for different chassis heights, due to varying load conditions. A height control switch is located on top of the vehicle dash to the right of the steering wheel.

b. Turn indicators at front and rear. The turn indicator lights are also utilised as hazard warning lights. The turn indicator lights/hazard lights will not operate under blackout conditions.

c. Two front marker lights.

d. Two double-filament rear tail/brake lights. The right hand rear tail light illuminates the license plate.

e. Two reversing lights that can also be employed as work lights at the rear of the MRV. The reversing lights will not operate under blackout conditions.

f. Two floodlights mounted on the cargo platform supports for crane and recovery operations. The floodlights are controlled by a switch located within the recovery control panels.

g. A portable floodlight. The floodlight is stowed in an equipment bin and is installed in a custom made fitting on the top or side of a rear bin if required.

h. Two rotating warning beacons mounted on the recovery unit.

i. Clearance lights on the side and on top of the recovery unit.

1.99. Blackout Lights

The blackout exterior lighting consists of a reduced headlight, two masked front markers, two masked rear markers, a convoy cross light and two masked brake lights. Under blackout conditions, the cabin dome light, headlight flasher, reversing lights, turn indicator lights, gear shift gate position indicator lights, hazard warning lights and the radio/cassette player illumination and audio are all inoperative.
1.100. Cabin Lighting

Cabin lighting consists of:

a. A dome light in the cab roof. In addition to the three position switch (ON/OFF/DOOR/) at the light, switches on the both cabin door pillars operate the light when either door is opened. The cabin door pillars switches are isolated when the dome light is switched to OFF. The cabin dome light will not operate under blackout conditions.

b. A map light is fitted to the glove box door. The light is illuminated when the cover over the light is opened.

c. Instrument panel lighting.

d. Central Tyre Inflation System (CTIS) control panel lighting.

e. A trouble light on a flexible lead is also provided.

1.101. Audio Kit

An AM/FM radio/cassette unit is centrally mounted to the front of the roof in the vehicle cab. Speakers are mounted at each rear corner of the cab, and the antenna is mounted to the outside right hand rear corner of the cab roof.

1.102. Communications

Provision for a HF low powered station and a VHF medium powered station is made in the top, front right hand equipment bin on the vehicle body. The stations are connected via shielded control cables to an extended front panel situated between the seats in the cab. The extended front panel provides mountings for two LSF 300 speakers, two MF301 microphones, two CF307 remote channel selectors and a power supply socket. Provision is also made for aerial mountings on the storage platform support.

SWITCHES

1.103. Ignition Switch

The key operated ignition switch has three positions - OFF, ON and START. When rotating the ignition switch from the ON position to the START position, the starter motor is energised. As soon as the engine fires, the key must be released to allow it to return to the ON position. If the engine does not start immediately, return the key to the lock position and wait before repeating the starting procedure.
1.104. Indicator Control Combination Switch

An indicator control combination switch (Fig 1-15) is mounted on the steering column and selects the following functions:

a. Left and right turn indicator control,
b. Headlight high/low beam control,
c. Headlight flasher control,
d. Horn control,
e. Windscreen wiper control, and
f. Windscreen washer control.

A. Left and right turn indicator control D. Horn control
B. Headlight high/low beam control E. Windscreen wiper control
C. Headlight flasher control F. Windscreen washer control

Figure 1-15 Indicator Control Combination Switch

1.105. Turn Indicator Control (Fig 1-15(A))

The self-cancelling turn indicators operate only when the ignition is switched ON. The combination switch lever is moved forwards for left hand turn indication and backwards for right hand turn indication. Slight pressure in either forward or rearwards direction operates the indicator lights when lane changing on highway or freeway. The steering wheel must be rotated up to one quarter of a turn before the turn indicator cancels automatically from the normal turn position.
1.106. **Headlight Beam Control (Fig 1-15(B))**

The headlights are switched on with the main light switch (see para 1.112). To select high beam the combination switch lever is moved downwards. The reverse movement cancels high beam and selects low beam. The turn indicators can be operated with high beam selected.

1.107. **Headlight Flasher Control (Fig 1-15(C))**

By gently lifting the combination switch lever towards the steering wheel, the headlights can be flashed on high beam with the ignition or light switch in either the ON or the OFF positions.

1.108. **Horn Control (Fig 1-15(D))**

To operate the horn, depress the button on the end of the combination switch.

1.109. **Windscreen Wiper Control (Fig 1-15(E))**

The combination switch is rotated to operate the windscreen wipers and the following speeds are available:

a. Intermittent wiper operation - wiper arrow symbol aligned with the intermittent symbol (I) at the base of the switch.

b. Slow speed - wiper arrow symbol aligned with the slow symbol (II) on the switch base.

c. Fast speed - wiper arrow symbol aligned with the fast symbol (III) on the switch base.

1.110. **Windscreen Washer Control (Fig 1-15(F))**

To operate the windscreen washer control, push the combination switch body towards the steering column. This action activates the windscreen washer pump and four jets of water will be directed at the windscreen. Release the switch body to turn the pump off. Before operating the windscreen washers, ensure that the washer bottle has fluid inside.

1.111. **Headlight Adjustment Control**

The MRV is fitted with a headlight adjustment control switch (Fig 1-16) located at the top right corner of the dash. The headlight beams can be adjusted by the driver to compensate for the vehicle load. In this way maximum visibility at night can be maintained irrespective of the load. The headlights can be adjusted (depending on vehicle load) as follows:

0 - for basic position vehicle unladen, and
1 - for vehicle fully laden/towing (max permissible rear axle load).
1.112. Main/Masked Light Switch

A main/masked light switch (Fig 1-17) is situated on the lower right-hand side of the instrument panel and has seven functional positions:

a. Position 0: all lights off.
b. Position **Tag** (Day): The switch detent can be released in this position.
c. Position 1: The front and rear marker clearance lights are illuminated.
d. Position 2: The headlights, front and rear markers, clearance lights and instrument lights are illuminated.
e. Position **S1**: The masked front and rear markers and the convoy cross lights are illuminated.
f. Position **S2**: This position is used when driving without lights.
g. Position **S3**: The reduced headlight, masked front and rear markers and the convoy cross are illuminated.
0 - All lights off
Tag - Switch detent released
1 - Front and rear markers, clearance lights
2 - Headlights, front and rear markers, clearance lights and instrument lights
S1 - Masked front and rear markers, convoy cross lights
S2 - No lights
S3 - Reduced headlight, masked front and rear markers, convoy cross lights

Figure 1-17 - Main/Masked Light Switch

Normal brake lights are available in position Tag, positions 1 and 2 and masked brake lights in positions S1 and S3.

To change positions between Tag 1 and 2 move the detent lever to the right and rotate the switch as required.

To change positions from Tag to 0 move the detent lever to the left, push the switch in and rotate switch to 0.

To change positions between 0 to Tag push in switch and rotate switch to Tag.

To change between 0, S1, S2 and S3 move the detent lever to the left and rotate the switch as required.

To change positions between 0 and position 1 move detent to right and rotate switch to 1.
INSTRUMENT PANEL

1.1.13. General

The instrument panel (Fig 1-18) is mounted on the dashboard in front of the driver and combines electrical switches, gauges, indicating and warning lights, and auxiliary power sockets. The switches (with the exception of the all wheel drive power divider control switch) are a rocker type located on both sides of the indicator/warning light cluster. Function symbols are etched on the switches, and the switches are illuminated when the driving lights are switched on. A dimmer switch mounted below the instrument panel controls the level of illumination of the gauges.

1. Indicator/warning light cluster (see Fig 1-19)
2. Warning beacon switch
3. All wheel drive and power divider control switch
4. 24V Auxiliary socket
5. Coolant temperature gauge
6. Dual air pressure gauge
7. Fuel gauge
8. Oil pressure gauge
9. Tachometer
10. Speedometer
11. GPS power supply socket
12. Six-wheel work brake switch
13. Engine brake/service brake switch
14. Hazard warning light switch

Figure 1-18 Instrument Panel
1.114. Speedometer

The speedometer (Fig 1-18(10)) is calibrated from 10 to 120 km/h in 10 km/h increments and at the last increment to 125 km/h in 5 km/h. A six figure odometer that indicates total kilometres travelled by the vehicle is also housed in the speedometer.

1.115. Tachometer

The tachometer (Fig 1-18(9)), mounted in the centre of the instrument panel is calibrated from 0 to 3000 RPM at 100 RPM intervals. A green band indicates the economic speed range. The cut-off speed range (commencing at the maximum continuous engine speed limit of 2600 RPM) is indicated by a red warning band, on the gauge face.

1.116. Dual Air Pressure Gauge

The dual pressure gauge (Fig 1-18(6)) is mounted in the centre of the gauge cluster and is calibrated from 0 to 25 bar in increments of 2 bar. Two pointers indicate the compressed air pressure in brake circuits 1 and 2. If either gauge shows less than 12 bar the low air indicator light will be illuminated.

1.117. Coolant Temperature Gauge

The coolant temperature gauge (Fig 1-18(5)) is mounted to the right of the instrument cluster and is calibrated from 40°C to 120°C in increments of 20°C. The gauge indicates the temperature of the coolant in the cooling system. At normal operating temperature the gauge should indicate 80°C to 95°C. If the temperature reaches 100°C during a long uninterrupted drive on a highway or freeway, the engine revolutions should be increased, (but not at the maximum 2600 RPM) for a short distance by changing to a lower gear ratio. If the higher engine revolutions do not lower the coolant temperature, the vehicle should be stopped, well clear of the road and the reason for the high coolant temperature investigated. The engine should be run at a fast idle for 2 or 3 minutes before stopping it.

1.118. Fuel Gauge

The fuel gauge (Fig 1-18(7)) is located at the bottom of the instrument cluster and is calibrated in four divisions from reserve (R) to 1/1 with increments of 1/4. Each division indicates about 75 litres of fuel in the tank.
1.119. Oil Pressure Gauge

The oil pressure gauge (Fig 1-18(8)) is mounted to the left of the gauge cluster calibrated from 0 bar to 5 bar in increments of 1 bar. When the engine oil is hot and the engine at low idle speed, the oil pressure gauge should indicate a minimum of 0.6 bar. When driving, the oil pressure gauge should indicate an engine oil pressure of 2 to 5 bar.

1.120. GPS Power Supply Sockets

Two connections (Fig 1-18(11)) are provided on the left hand side of the instrument panel to supply power to the GPS unit.

WARNING

If the engine is switched off during winching operations the six-wheel brake will release and the MRV may move.

1.121. Six-Wheel Work Brake Switch

The six-wheel work brake switch (Fig 1-18(12)) is a rocker type located on the left hand side of the instrument panel. When pressed, the front and rear brakes are applied in the same manner as the application of the park and service brake. The six-wheel work brake only operates when the engine is running, the park brake is applied and there is an air supply pressure of 7.5 bar (750 kPa) or more in the system. The work brake is not to be used as a park brake.

To engage the six-wheel work brake, apply the park brake, operate the six-wheel work brake switch and ensure that the indicator light (Fig 1-19(1)) illuminates. If the vehicle is off road, engage the differential locks and ensure the differential lock indicator light is illuminated. To disengage the six-wheel work brake:

a. Release the park brake (park brake and six-wheel parking brake are released simultaneously), or

b. Rotate the ignition switch to position “0” where the park brake only will remain on.
WARNING

Braking efficiency is reduced when the engine brake is isolated from the service brake pedal. The engine brake/service brake switch is only to be activated during testing of the service brakes. Do not disconnect the engine brake from the service brake pedal when driving on public roads.

1.122. Engine Brake/Service Brake Switch

The engine brake/service brake switch (Fig 1-18(13)) is a rocker type located on the left hand side of the instrument panel outboard of the six-wheel work brake switch. During normal operation the engine brake/service brake switch is disengaged, the warning light is not illuminated and the engine brake can be activated by:

a. The service brake pedal where the engine brake operates in conjunction with the service brakes, or
b. By a foot operated valve on the floor.

When the engine brake/service brake switch is pressed and the red warning light is illuminated, the engine brake is disconnected from the service brakes and the engine brake can only be operated via the foot operated valve on the floor.

1.123. Hazard Warning Light Switch

The hazard warning light switch (Fig 1-18(14)) is located at the left hand side of the instrument panel, above the engine brake/service brake switch, and is coloured red. The switch, when turned on, initiates simultaneous flashing of both front and rear turn indicator lights. The vehicle must not be driven on any public road with the hazard switch turned on.

1.124. Warning Beacon Switch

The warning beacon switch (Fig 1-18(2)) is located on the top right hand corner of the instrument panel. The switch activates two amber rotating lights mounted on the recovery unit frame. The beacons are normally turned on when operation of the MRV may present a hazard.

1.125. All Wheel Drive and Power Divider Control Switch

The all wheel drive and power divider lock control switch (Fig 1-18(3)) activates the all wheel drive dog clutch and power divider lock.
WARNING
If the engine is switched off during winching operations the six-wheel brake will release and the MRV may move.

1.126. Warning/Indicator Light Cluster

The warning/indicator light cluster (Fig 1-19) is mounted at the top of the instrument panel in three rows of apertures. Function symbols are etched to the respective warning/indicator light cover, which are illuminated when activated or de-activated. The warning/indicator lights provide a visual indication that a fault has occurred, or a system has been activated, in the component represented by the warning/indicator lights.

The warning/indicator lights that will illuminate when activated are:

a. **Six-Wheel Work Brake Indicator Light.** The six-wheel work brake indicator light (Fig 1-19(1)) will illuminate when the six-wheel parking brake switch is activated. The system only operates when the engine is running, the park brake is applied and there is a minimum supply pressure of 7.5 bar (750 kPa) or more in the brake system. The six-wheel work brake is not to be used for normal park brake operation.

b. **Brake Pad Wear Indicator Light.** The brake pad wear indicator light (Fig 1-19(2)) will illuminate when the brake pads have been worn down to a safety margin of about 5%. Wires embedded in the brake pads on the left hand wheels contact the brake disc and an electrical circuit is completed illuminating the indicator light. Brake pad wear indicators are provided for on the front, intermediate and rear axles. The MRV can still be operated normally without taking any extra safety precautions, however the vehicle should be fitted with new disc brake pads, by a qualified mechanic, as soon as possible.
WARNING

The MRV must not be driven if a brake warning light or low air pressure warning light is operating. These warning devices indicate that the brake system is not functioning correctly.

c. **Low Brake Fluid/Supply Pressure Warning Light.** The low brake fluid/supply pressure warning light (Fig 1-19(3)) will illuminate when the brake fluid in the brake master cylinder reservoirs is low or if the operating pressure in either or both of the brake circuits is low. When the light illuminates the brake master cylinder reservoirs level should be checked and topped up, if required. If the warning light is still illuminated the vehicle should be recovered to the nearest repair facility immediately, and checked by a qualified mechanic.

d. **Park Brake Indicator Light.** The park brake indicator light (Fig 1-19(4)) will illuminate when the park brake is applied and when the air pressure in the park brake supply line falls below 4.2 bar (420 kPa). The vehicle must not be moved if the light is illuminated. When the park brake indicator light is illuminated, a bulb check circuit illuminates the differential pressure and brake pad wear warning lights. All the lights should be extinguished when the park brake is released and before moving off.

e. **Alternator Charge Indicator Warning Light.** The alternator charge indicator warning light (Fig 1-19(5)) will illuminate when the ignition switch is turned on and will remain illuminated until the engine is started and the alternator starts to operate and charge over 24V. If the light becomes illuminated during driving operations, check the alternator drive belt adjustment and that the battery connections are tight and clean. If the light remains illuminated, the vehicle charging system must be checked by a qualified tradesperson.

f. **PTO Engaged Indicator Light.** The PTO engaged indicator light (Fig 1-19(6)) will be illuminated when the PTO is engaged and extinguished when the PTO is disengaged.
g. **Headlight High Beam Indicator Light.** The headlight high beam indicator light (Fig 1-19(7)) will illuminate when high beam or the high beam flasher is selected on the combination switch stalk.

h. **Speed Limiter Malfunction and Overspeed Indicator Light.** When the ignition switch is turned on the road speed limiter malfunction indicator light (Fig 1-19(17)) will be illuminated. After the MRV speed reaches approx. 7 km/h the light will extinguish. The light will illuminate if a speed of approximately 10% over limited speed is reached to indicate over speeding. The vehicle top speed is programmed by an electronic regulator to be limited to 100 km/h. At a road speed of 100 km/h the engine speed is controlled by an actuator connected between the electronic regulator and the fuel injection pump throttle linkage. If the indicator light is illuminated during driving operations, indicating a malfunction in the speed limiter, the system must be checked by a qualified tradesperson.

i. **All Wheel Drive/Front Axle Drive Engaged Indicator Light.** The all wheel drive/front axle drive engaged indicator light (Fig 1-19(16)) will illuminate when all wheel drive is selected by engaging front wheel drive.

j. **Power Divider Differential Lock Indicator Light.** The power divider differential lock indicator light (Fig 1-19(13)) will illuminate when the power divider differential lock is engaged.

k. **Rear Axle Differential Lock Indicator Light.** The rear axle differential lock indicator light (Fig 1-19(14)) will illuminate when the rear axle differential lock is engaged.

l. **Front Axle Differential Lock Indicator Light.** The front axle differential lock indicator light (Fig 1-19(15)) will illuminate when the front axle differential lock is engaged.

m. **Air Filter Indicator Light.** The air filter indicator light (Fig 1-19(9)) will illuminate if the filter is partially blocked and requires a service.
n. **Turn Signal Indicator Light.** The turn signal indicator light (Fig 1-19(12)) flashes synchronously with the turn indicator lights on the vehicle. If a turn signal globe fails the turn signal indicator light will cease flashing.

o. **Trailer Turn Signal Indicator Light.** The trailer turn signal indicator light (Fig 1-19(11)) flashes synchronously with the trailer and MRV turn indicator lights, when a trailer is connected. If a trailer turn signal globe fails the trailer turn signal indicator light will cease flashing.

p. **Instrument Light Switch and Dimmer Control.** The control for the instrument panel lights is located on the lower right corner of the dash next to the main/mask light switch. The rheostat switch controls the intensity of the instrument panel lights. The switch is rotated clockwise to turn on and brighten, and anticlockwise to dim and turn off, the instrument lights.

q. **Instrument Panel Bulb Replacement.** The instrument cluster bulbs are bayonet types and are replaced from the rear of the instrument panel. The remainder of the bulbs are replaced from the front after removing the lens assemblies. When replacing any bulb, the glass must not be touched with the fingers, as any grease or dirt tends to reduce the effectiveness of the bulb.
1. Six-wheel work brake indicator light
2. Brake pad wear indicator light
3. Brake fluid/supply pressure warning light
4. Park brake indicator light
5. Alternator charge indicator light
6. PTO indicator light
7. Headlight high beam indicator light
8. Exhaust brake warning light
9. Air filter indicator light
10. Splitter gear engaged indicator light
11. Trailer connected turn signal indicator light
12. Turn signal indicator light
13. Power divider differential lock indicator light
14. Rear axle differential lock indicator light
15. Front axle differential lock indicator light
16. All wheel drive indicator light
17. Speed limiter malfunction and overspeed indicator light

Figure 1-19 Warning/Indicator Light Cluster
1.127. Central Tyre Inflation System (CTIS) Control Panel

NOTE

Refer to CHAPTER 2, SECTION 1 for the CTIS Operating Instructions.

WARNING

Do not operate the central tyre inflation system when driving on public roads. Low/uneven tyre pressures make MRV control difficult and dangerous in traffic.

The CTIS control panel is located centrally above the driver’s windscreen. The CTIS is designed to improve off-road manoeuvrability and traction. The system can be activated whilst the vehicle is on the move and has a fail-safe system where the maximum and minimum tyre pressures are limited by a safety device. The control panel consists of the following controls and indicator lights:

a. An indicator light (Fig 1-20(1)) that is illuminated when tyres are being deflated.

b. An indicator light (Fig 1-20(2)) that is illuminated when the tyres are being inflated.

c. A three position switch (Fig 1-20(3)) (inflate (I), off(■), and deflate (II)) that permits adjustment of the vehicle tyre pressures.

d. A gauge (Fig 1-20(4)) indicating the air pressure in the front axle tyres.

e. A three position axle selection switch (Fig 1-20(5)) that permits selection of either the front axle (-), all axles (■), or rear axles (=) when inflating/deflating tyres.

f. An indicator light (Fig 1-20(6)) that is illuminated when the front axle tyres are being inflated/deflated.

g. An indicator light (Fig 1-20(7)) that is illuminated when the intermediate and rear axle tyres are being inflated/deflated.
1. Indicator light “deflate tyres”
2. Indicator light “inflate tyres”
3. Selector switch “inflate/off/deflate” tyres
4. Pressure gauge, front axle
5. Selector switch, front/all/rear axles
6. Indicator light front axle “deflate/inflate tyres”
7. Indicator light rear axles “deflate/inflate tyres”
8. Pressure gauge, rear axles
9. Instrument lights, brightness control

Figure 1-20 CTIS Control Panel

h. A gauge (Fig 1-20(8)) with twin pointers indicating the air pressure in the intermediate and rear axle tyres.

i. A rheostat switch (Fig 1-20(9)) that controls the intensity of the tyre inflation control panel lights. The control is rotated clockwise to brighten, and anticlockwise to dim the panel lights.
HEATING, COOLING AND VENTILATION

1.28. General

The heating, cooling and ventilation controls (Fig 1-21) permit fresh air to be drawn from outside the vehicle or recirculate air in the cabin. Regardless of the operation mode selected filtered air is delivered to the cab to provide a positive cab pressure and prevent the ingress of dust through cab seals. The operator has control over air direction within the cab by means of adjustable dampers fitted to the cabin supply air duct. A three-speed fan is provided to obtain adequate ventilation in the cabin. Air can be directed to the body, feet, windscreen and side windows as required.

Figure 1-21 Heating, Cooling and Ventilation Controls

1. Heater: (left - cold, right - heat)
2. Vent leg space: (left open, right - closed)
3. Nozzle regulation (demister): (down - open, up - closed)
4. Vent nozzles
5. Vent or heat windscreen and windows: (left - open, right - closed)
6. Vent or heat leg space: (left - open, right - closed)
7. Cabin heating (down - open, up - closed)

Optimum ventilation is obtained by selecting fresh air and opening one side window about 10 mm.

The heating system utilises heat from the engine coolant system. The amount of heat can be varied to achieve the desired air temperature.
1.129. Air Conditioner

**CAUTION**

All maintenance and repair procedures to the refrigeration components and copper pipe work used in the air conditioning system must be performed by a Technician Electrical (ECN 418) or a civilian equivalent technician working to the current code of ethics.

**WARNING**

The refrigeration system components and copper pipe work used in the air conditioning system are under high pressure and can cause serious injury if the air conditioning system is opened.

**NOTE**

Refrigerant R134a is transparent and colourless in both gaseous and liquid states. At normal temperatures and pressures it will be a vapour. The vapour is heavier than air and is non-flammable, non-explosive, non-poisonous and non-corrosive (except when in contact with moisture or fire).

**WARNING**

The refrigeration system components and copper pipe work contain liquid-vapour mixtures under pressure, which on contact can freeze, and cold-burn human body tissue resulting in permanent damage. This damage can occur within 1(one) second. If refrigerant does enter the eye, freezing of the eye can occur and blindness could result.

**WARNING**

When operating, the air conditioning system has several hot (> 60°C) and cold (>5°C) areas. When working on the vehicle be well aware of these areas to avoid injuries.
WARNING

Welding tasks are not to be performed on the refrigerant circuit or in the immediate vicinity. The refrigerant gas is non-flammable, however ensure that there are no naked flames within the vicinity as toxic gas is produced when the refrigerant gas comes in contact with fire.

WARNING

Do not clean the air conditioning condenser with steam cleaning equipment, as the expansion of the refrigerant gas within, may cause excessively high pressures in the air conditioning system that may result in an explosion.

The Sigma D-Series air conditioner is a split configuration utilising a remote mounted condenser, and an engine mounted, belt driven, compressor. The air conditioner system is designed specifically for the MRV and includes integration with the Mercedes Benz cab heating/ventilation system to provide complete climate control of the cabin. The air conditioner will only operate with the engine running and the system is filled with CFC-free refrigerant R134a gas.

1.130. Air Conditioner Compressor

CAUTION

TO AVOID COMPRESSOR DAMAGE THE AIR CONDITIONER MUST BE OPERATED FOR A MINIMUM PERIOD OF 5 MINUTES AT LEAST ONCE A WEEK.

The compressor is a rotary cam type mounted to the engine and driven via a V-belt from the water pump pulley. The compressor compresses the R134a refrigerant through the system for air conditioning and continues to operate during the heating mode.
1.131. Air Conditioner Condenser

CAUTION

THE USE OF EXCESSIVE WATER PRESSURE MAY DAMAGE
THE CONDENSER COIL COOLING FINS.

Figure 1-22 Air Conditioner Condenser

The air conditioner condenser unit (Fig 1-22) is housed on the top right hand rear section of the recovery unit and the receiver/drier is included at this position. The condenser coil is constructed from heavy duty copper tubing with aluminium cooling fins and acts as a heat exchanger for the refrigerant passing through the coils. Three electric fans mounted against the condenser draw air upwards over the condenser core to:

a. Provide the heat rejection necessary for the refrigeration circuit, and

b. Prevent lightweight fallen debris/foliage from entering the condenser fans and coil whilst in operation.

A heavy duty metal frame covers the condenser unit to protect it from physical abuse during operation in close country and rough terrain. The frame is fitted with a fine mesh to prevent foliage, and other foreign material from entering the condenser fans and coil.
NOTE
Ensure that the condenser and surrounding areas are clear of any foreign material that may cause obstruction to normal airflow and the operation of fans. The area can be cleared using a water spray or compressed air taking care not to damage the cooling fins. Physically remove any remaining foreign objects.

1.132. Air Conditioner Evaporator
The evaporator is a console mounted split type, mounted in the cabin, centre front, between the driver and passenger. The evaporator is equipped with two forward curved fans in parallel that draw a predetermined mixture of return air (internally filtered) and fresh air (externally filtered) through an evaporator coil to deliver either conditioned (cool mode) or unconditioned (vent mode) into the cab.

1.133. Climatic Controls
Two rocker switches initiate operation of the air conditioner system, an ON/OFF switch and, a three-speed fan switch with Low, Medium and High speed positions. Further climatic control is via the console mounted, manually operated slide controls fitted to the cabin supply air ducts. The following operation modes are available:

a. **Cool Mode.** The cool mode provides a predetermined mixture of conditioned fresh air and recirculated cab air. The air conditioner (A/C) switch is fully depressed and either low, medium or high speed fan operation may be selected. The maximum cooling effect is achieved by selecting high speed fan operation and sliding the heater control lever to the cold position (Fig 1-23).

![Figure 1-23 Cool Mode](image-url)
**Vent Mode.** The vent mode provides a predetermined mixture of unconditioned fresh air and recirculated cab air. The A/C switch is not depressed and either low, medium or high speed fan operation may be selected. The heater control lever may be placed anywhere between the cold and heat positions (Fig 1-24).

![Figure 1-24 Vent Mode](image)

**Heat Mode.** The heat mode provides a predetermined mixture of conditioned fresh air and recirculated cab air. The air conditioner switch is not depressed and either low, medium or high speed fan operation may be selected. The heater control lever may be placed anywhere between the cold and heat positions. Maximum heating effect is achieved by sliding the heater control lever fully across to the heat position (Fig 1-25).

![Figure 1-25 Heat Mode](image)
d. **Demist Mode.** The demist mode provides a predetermined mixture of conditioned fresh air and recirculated cab air for rapid demisting. The A/C switch must be fully depressed and either low, medium or high speed fan operation may be selected. The vent nozzle regulator lever must be in the up position. The heater control lever may be placed anywhere between the cold or heat positions (Fig 1-26).

![Figure 1-26 Demist Mode](image)

**CABIN AND FITTINGS**

1.134. Cabin

The vehicle cabin is mounted on the chassis with anti-vibration mountings and dampeners. The cabin can be tilted forwards to provide access to the engine/transmission area. The cabin tilting operation is to be carried out only in conjunction with a qualified mechanic. Refer to EMEI VEHICLE D 393.

1.135. Cabin Seats

An individual seat is provided for the driver and a single seat for the passenger. The driver’s seat is provided with the following adjustments:

a. Fore and aft adjustment;

b. The back rest can be tilted forwards and backwards; and

c. The front and rear of the driver’s seat squab is adjustable up and down.

The back of the passenger’s seat may be folded forward to create a platform for the observer.
1.136. Cabin Seat Belts

All seating positions are fitted with inertial reel, emergency lock, lap/sash type seat belts. Seat belts are to be worn at all times when the vehicle is in motion and should not be twisted or too loose. When the belt latch tongue is pushed into the lock mechanism, it should be pushed in firmly until a click is heard.

1.137. Windows

The side windows, which are fitted in the doors, can be opened with a manual regulating mechanism. The windscreen and rear cabin windows cannot be opened.

1.138. Rear View Mirrors

The external rear vision mirrors may be adjusted by moderate hand pressure. The mirrors are hinged to avoid damage during operation in close country.

1.139. Observation Hatch

An observation hatch (Fig 1-27) is fitted in the cabin roof above the passenger’s seat. To open the hatch, release the two twist catches on the roof of the cabin, then rotate the hatch towards the right and lock with the lever. The crane can be operated from the observer’s position.

Figure 1-27 Observation Hatch
1.140. Weapon Clips and Butt Boxes

Facilities for mounting the driver's and passenger's personal weapons and a Minimi weapon are provided in the cabin.

CHASSIS AND BODY FITTINGS

1.141. Construction

The vehicle cab is fabricated from steel and is mounted on the chassis with anti-vibration mountings. The recovery unit is mounted to a subframe, which in turn is secured to the vehicle chassis. The subframe absorbs stresses associated with recovery operations without placing excess strain on the vehicle chassis. Two independently operated anchor legs are fitted at the rear of the subframe. Tie down and anchor lugs are provided at the rear of the subframe and on the front of the chassis.

1.142. Climbing Bars

A climbing bar (Fig 1-28) is located under the front bumper bar beneath the left hand headlight. The bar is used to enable personnel to access the vehicle bonnet. To unfold grasp the bar, pull out firmly until it clears the spring clip then slide fully out. To stow the bar lift up and push in firmly until the bar is engaged in the spring clip. A climbing bar is also fitted to the side step and is deployed in a similar manner.

1.143. Bonnet Release

Access to the engine compartment is obtained by unlocking the bonnet catches at the left and right hand side of the bonnet. When opened the bonnet is to be supported by engaging the bonnet support strut. After closing the bonnet always check that the bonnet latches have locked by attempting to lift the bonnet.
1.144. Stowage
Weatherproof equipment bins with lockable doors are mounted on the subframe either side of the main boom. The bins are fitted with plywood dampers on the floor and brackets to secure items of CES when required. A stowage plan is depicted in Chapter 2, Section 2, Fig 2-39.

1.145. Fire Extinguishers
Three fire extinguishers are mounted on the MRV. In the event of a fire, remove the extinguisher from the mounting bracket, read the instructions and use the extinguisher accordingly. Fire extinguishers are mounted in the following positions:

a. One X 1.5 kg dry chemical fire extinguisher beside the drivers seat between the seat and the door.

b. One X 4.5 kg dry chemical fire extinguisher on the front left hand side of the recovery platform, and

c. One X 9 litre foam fire extinguisher on the front right hand side of the recovery platform.

1.146. POL Stowage
A jerrican holder, mounted on top of the left hand front equipment bin of the recovery unit, provides stowage for 3 X Cans, Water, Plastic, 22 litres or 3 X Cans, Fuel, Military, Steel, 20 litre, or a combination of each.

1.147. Side Step

**WARNING**

The maximum static load that can be placed on the side step is 150kg.

**WARNING**

Ensure the side step is stowed and the safety locking pin inserted before moving the MRV.

A side step is fitted to the fuel tank mounts to aid in the removal of the water cans and jerricans. To unfold the step, remove the safety pin from the rear hinge, lift the entire step up until it has cleared the two catches then pull out. To stow the step, fold up the climbing bar, fold in, lift up and lower the step into the two catches. Insert the safety pin in the rear hinge.
1.148. Towing Pintle
An approved towing pintle with mounting fame is stowed in the LHS front top equipment bin and is fitted to the rear of the vehicle on an as required basis.

1.149. Electrical Trailer Connection Socket
A 12-pin, 24V, NATO trailer socket connector is fitted adjacent to the left hand rear mudguard. With the exception of the blackout stoplight circuit, which is connected through terminal F, the connector is wired in accordance with DEF (AUST) 5101.

**WARNING**

The air supply pressure at the tyre inflation point is unmonitored. Take care not to exceed the recommended tyre pressure. Over inflation could result in tyre damage/blowout and injury to personnel.

1.150. Tyre Inflation Point

**NOTE**

Run the engine during the tyre inflation procedure.

A tyre inflation connection is located on the right hand side of the vehicle in front of the intermediate axle. Prior to connecting the tyre inflation hose first reduce the supply pressure to below the cut-in pressure of the pressure regulator (15.8 bar (1580 kPa)) by stopping the engine and draining air from both brake air reservoirs or actuating the brake pedal several times.

1.151. Camouflage Nets Stowage
A purpose built stowage platform, with tie down points, and the capacity to stow three camouflage nets, is mounted on the vehicle body behind the cabin.

1.152. Spare Wheel Stowage
The spare wheel is mounted on the main boom and can only be removed with the aid of a crane.

1.153. Auxiliary Wire Rope Stowage
A circular frame is attached to the rim of the spare wheel to accommodate the storage of the auxiliary wire ropes and slings.
1.154. Personal Equipment Stowage
A platform located on the main boom in front of the spare wheel provides stowage space for crew personal equipment. The platform also provides a secondary location for stowage of the spare wheel.

1.155. Bridge Classification Sign
A bridge classification sign with the number 13/25 is attached to the brushguard.

1.156. Unit Formation Signs
Four unit/formation sign holders are fitted to the vehicle.

1.157. Vehicle Nomenclature Plate (Fig 1-29)
The vehicle manufacturer's identification number is stamped on a plate that is riveted to the driver's door pillar. The identification number is also stamped on the outside of the right-hand chassis rail just forward of the front wheel.

![Figure 1-29 Vehicle Nomenclature Plate](image)

1.158. Centre of Gravity Plate (Fig 1-30)
A "C of G" plate designating the longitudinal point of balance of the unladen MRV is fitted to the bottom rear corner of the left hand front equipment bin.

![Figure 1-30 Centre of Gravity Plate](image)
1.159. Servicing Data Decal (Fig 1-31)

The servicing data decal listing the lubricants used in the MRV is affixed to the glove box lid.

![Servicing Data Decal](image)

**Figure 1-31 Servicing Data Decal**

**RECOVERY EQUIPMENT AND CONTROLS**

1.160. Lifting and Towing Gear

The lifting and towing equipment is an underlift system and consists of a main boom which is mounted by pivot bushes to the subframe at the front end, with two hydraulic cylinders at the rear to provide the lifting capacity. Attached to the main boom is a folding boom with an extension boom. The extension boom is equipped with a cross bar (T-bar) with various forks and connections for attaching a casualty. The folding boom can be raised and lowered independently of the main boom and the extension boom can be extended and retracted independently of the folding boom. All operations of the main and extension booms are hydraulic.

1.161. Hydraulic System

A triple element pump driven by the transmission PTO is used to provide hydraulic fluid, under pressure, to three independent hydraulic circuits for:

a. The left winch and the earth anchor legs,
b. The lifting boom, folding boom and the right winch, and
c. The material handling crane and stabilisers.

1.162. Winches
Two hydraulic, dual speed winches (Fig 1-32) are mounted on the main boom. The winches are independently driven and fitted with an automatic safety brake and spring loaded pressure rollers that maintain rope tension on the drums. The winches can be operated together without the loss of capacity. The winch drums are fitted with a pneumatically operated free spooling control and each drum contains 95 metres of 13 mm wire rope which is fed permanently through two swivelling (360°), self aligning fairleads mounted at the rear of the main boom. The winches are factory sealed/lubricated.

![Figure 1-32 Winches](image)

1.163. Earth Anchors
Two hydraulically operated, telescopic earth anchor legs are located on each side of the recovery subframe at the rear. The anchor legs are independently operated each fitted with spade attachments and provide stability to recovery operations when deployed.

1.164. Recovery and Towing Hydraulic Systems Controls
Controls for recovery and towing (Fig 1-34) are provided as follows:

a. **Directional Control Valves.** Two sets of heavy duty, spring loaded control levers (connected by cables to a centrally located directional control valve bank) are fitted in the rearmost left and right equipment bins, permitting
operation of the recovery equipment from either side of the vehicle. Switches for engine speed control, winch free spooling, cabinet lights, work lights and flood lights are also fitted to both control panels.

Figure 1-33 Recovery/Towing Controls (Right Hand)

Figure 1-34 Winch Pressure/Tension Gauge

The control stations are equipped with pressure gauges that indicate the load on each winch. Each gauge has two scales, an outer scale indicating system hydraulic pressure in bar, and an inner scale that indicates the winch load for each rope layer in tonnes (Fig 1-34). The winch load gauges carry out the following functions:

1. Monitor the hydraulic system condition, e.g. indicate low system pressure at winch cut-out.
2. During winching provide a general indication of the load on the winch.
(3) At winch cut-out provide an accurate indication of the load on the winch.

(4) The gauges can also be used to calibrate the flat rating devices on the winches.

c. **Winch Remote Control.** A multi-function remote control unit (Fig 1-35), with 30 metres of cable, is carried in the left hand side equipment bin, second from the rear of the vehicle. The remote control lead is connected to a socket located on the wall of the same equipment bin. The remote control unit is of a pendant style and permits an operator to initiate winch, boom, earth anchor and engine throttle control functions whilst standing a distance from the MRV. A low oil warning lamp and remote control disable switch is also fitted.

![Figure 1-35 Remote Control Unit](image)

**Figure 1-35 Remote Control Unit**

d. **Remote Control Function Switch.** A function switch (Fig 1-36) is located above the remote control unit socket. The switch controls the operation of the remote control unit and front winching from the cab. Table 2-2 in Chapter 2 details the switch positions and functions available at each position.

![Figure 1-36 Winch Remote Control Function Switch](image)
WARNING
If the engine is switched off during winching operations the six-wheel brake will release and the MRV may move.

1.165. Six-Wheel Work Brake
When performing static recovery operations the service brakes and the park brake can be coupled electro-pneumatically by applying the six-wheel work brake switch, located on the left-hand corner of the dash. The six-wheel work brake system only operates when the engine is running, the park brake is applied and there is an air supply pressure of 7.5 bar (750 kPa) or more in the system. The work brake is not to be used as a park brake.

1.166. Exhaust Brake
The exhaust brake is controlled via a switch on the dash and applied either by the brake pedal or a foot operated valve fitted in the floor in front of the drivers seat. The exhaust brake provides assistance to the service brakes when slowing/stopping the vehicle, especially under heavy load conditions during mobile recovery operations.

1.167. CTIS
The CTIS provides options to improve vehicle traction during recovery operations. Refer to Chapter 1, Section 1 for optimum tyre pressures over a range of recovery tasks.
A material handling, hydraulic crane is mounted east/west on the sub-frame between the recovery unit and the cabin. The crane is operated independently of other hydraulic equipment.

The assembly is made up of a crane main boom (Fig 1-37(3)), a crane outer boom (Fig 1-37(4)), and a crane extension boom (Fig 1-37(6)) mounted on a vertical support column (Fig 1-37(12)). The booms may be operated individually or simultaneously by double-acting hydraulic control cylinders mounted between each assembly.

The crane controls may be operated to lift or lower the crane main boom and the crane outer boom, to extend and retract the crane extension boom and to slew, clockwise or anticlockwise through an arc of 180°. The crane is stabilised by two hydraulically operated legs (Fig 1-37(11)). The legs are controlled independently of the crane.
1.169. Crane Hydraulic Systems Controls

A set of heavy duty spring loaded control levers (Fig 1-38) is mounted on a column at the left rear of the vehicle cab to enable operation of the crane and stabilisers from the observer's position in the cab. The controls are connected via rods to a directional control valve bank mounted on the crane base. Controls are provided as follows:

a. Crane Control Levers. The controls consist of four levers, slew, main boom, outer boom and boom extension. A label fixed above the levers indicates each lever operation and function. The crane lifting capacity at various radii is shown on a label fixed to the cab roof.

b. Stabiliser Control Lever (Fig 1-38). The left-hand and right-hand stabilisers are raised or lowered using a control lever at the crane operator's station. Each stabiliser is retained in the vertical position (operational and stowed) by a locking pin.

1.170. Recovery Unit Lighting

The lighting equipment fitted to the recovery unit consists of:

a. Clearance lights on the recovery unit.
A portable floodlight to illuminate recovery operations is normally carried stowed in an equipment bin. Power is provided by an unswitched connection (two jacks) on the facia panel of the left and right control cabinets. Custom-made fittings located on the top of the rear equipment bins are provided to locate the floodlight when it is required to illuminate the recovery area.

c. Two floodlights for crane and recovery operations are mounted permanently on a recovery unit frame behind the cabin. The floodlights are controlled by individual switches located on each light and, the floodlight switches on the recovery equipment control panel.

d. Two rotating hazard warning beacons mounted on the recovery unit frame.

1.171. Audio Unit

A radio/cassette unit is fitted in the vehicle cabin for the comfort of the crew during protracted recovery tasks.

TOOLS

1.172. Tools supplied with the cab/chassis are stored on or in compartments on either side of the MRV. For all CES items and stowage location refer to Figure 2-39.
CHAPTER 2
OPERATING INSTRUCTIONS

SECTION 1 — VEHICLE OPERATION

SECTION 2 — RECOVERY SYSTEM OPERATION

SECTION 3 — CRANE OPERATION

NOTE
For clarity and brevity the Truck, Wrecker, Medium, MC2, Unimog U2450L is referred to throughout this document as the MRV (Medium Recovery Vehicle).
SECTION 1
VEHICLE OPERATION

NEW VEHICLE

CAUTION

The engine and power train in a new MRV is not to be operated under full load during the first 50 hours of operation (about 2000 km). After this period the speed or tractive load can be gradually increased to full capacity.

2.1. Pre-Operational Check

Before operating a new MRV for the first time, carry out the daily and fortnightly service as detailed in Chapter 3 Section 1.

2.2. Running In.

When "running in" the MRV observe the following procedures and precautions:

a. **Up to 1500 Kilometres.** Until the engine is at operating temperature, restrict MRV speed to below 50 km/h. Otherwise any reasonable speed within legal limits is permissible to a governed speed of 100 km/h. Avoid sudden, hard stops whenever possible. The brakes bed in more uniformly if slow, gradual stops from various speeds are made.

b. **Beyond 1500 Kilometres.** If traffic conditions permit, deliberately vary the speed from fast to slow and back again. Any steady unchanging speed during this period tends to cause uneven wear of precisely fitted parts. Accelerate moderately up to legal speed limits for short bursts. Provided the engine speed is below 2600 RPM, any legal speed is allowable. Six-wheel drive may be used. Travel slowly over extremely rough terrain when the MRV is fully laden to minimise shock loads on the driveline components.
NORMAL OPERATION

2.3. General
Proper driving techniques and operation determines the service life and operating economy of the MRV. This includes, careful driving, normal road speeds, reasonable rates of acceleration and braking, and shifting controls in a manner to avoid shock loading and labouring.

2.4. Before Starting
Carry out a first parade service as detailed in Chapter 3 Section 1.

2.5. Before Starting the Engine

NOTE

Ensure that the crane and any loose fittings are stowed and the equipment bin doors on the recovery unit are secured. If a casualty is undertow, ensure that it is secured.

Before starting the engine carry out the following:

a. Apply the parking brake.

b. Ensure the PTO selector switch is in the “OFF” position.

c. Select the four-wheel drive position on the all wheel drive and power divider switch at the instrument panel.

d. Set the hand throttle and the winch engine speed control to the engine idle position and leave it in that position whilst driving.

e. Depress the clutch pedal, to disengage the clutch and select neutral with the gear change lever.
2.6. Starting the Engine (Hot Or Cold)

CAUTION

Do not operate the starter for longer than 20 seconds if the engine does not start. Allow one minute for the starter motor to cool and the battery to recover sufficiently. If the engine fails to start at the third attempt, abandon the start procedure and report the fault.

NOTE

The MRV is equipped with a starter interlock feature and therefore before the starter circuit can be activated, the clutch pedal must be depressed as far as the stop before starting can be achieved.

Start the engine as follows:

a. Depress the clutch pedal to the stop (starter interlock).

b. Move the accelerator pedal and the hand throttle to the engine idle position.

c. Slightly depress the accelerator pedal to release the engine stop mechanism.

d. Turn the ignition key clockwise to the START position. Release the key as soon as the engine starts. If the engine does not start after five seconds slowly depress the accelerator pedal.

e. Release the accelerator pedal as soon as the engine is running smoothly.

f. When the engine is running, allow the air pressure (displayed on the dual pressure gauge) to build up to 12 bar (120 kPa), (7 bar (70 kPa) in an emergency). Check that the parking brake warning light is illuminated, and the brake fluid/supply pressure and the brake pad wear warning lights are not illuminated.
2.7. Shutting Down the Engine

**WARNING**

Ensure the accelerator pedal is not depressed after the engine has been shut down as this action will release the positive engine stop allowing the engine to be roll started.

**NOTE**

Before shutting down the engine, allow it to idle for about 1-2 minutes.

**CAUTION**

Ensure the coolant temperature is not higher than 90°C before turning the engine off. If the temperature is higher than 90°C, run the engine at high idle for a couple of minutes to allow the engine to cool.

To shut down the engine proceed as follows:

a. Switch the engine speed control lever to “IDLE” at the recovery unit control panel and ensure the hand throttle in the cab is in the engine idle position.

b. Disengage the clutch and select neutral with the gear change lever, and turn the PTO switch to the “OFF” position if engaged.

c. Turn the ignition switch key to the “O” (engine off) position.

2.8. Engaging/Disengaging the PTO

**CAUTION**

To avoid overspeeding the hydraulic pump, the splitter transmission must be in LOW range prior to engaging the PTO.

To engage the PTO proceed as follows:

a. Apply the hand brake.

b. Apply the six-wheel work brake.
c. Move the hand throttle to the engine idle position.

d. Disengage the clutch, position the gear change lever in neutral in gate between 7th and 8th and ensure the fwd/rev shift lever is in neutral and the splitter transmission is in LOW ratio.

e. Turn the PTO switch to the right until the indicator is aligned with the “PTO ON” symbol. Ensure the PTO engaged indicator light is illuminated.

f. Engage the clutch slowly.

To disengage the PTO proceed as follows:

g. Switch the engine speed control lever to “IDLE” at the recovery unit control panel and ensure the hand throttle in the cab is in the engine idle position.

h. Disengage the clutch and turn the PTO switch to the “OFF” position. Ensure the PTO indicator light is extinguished.

**DRIVING PROCEDURES**

**WARNING**

Do not drive the MRV on a firm surface with the differential locks engaged as there is no differential operation between the wheels when cornering. This leads to increased tyre wear, poor steering behaviour and severe loads being placed on drive line components.

2.9. **Moving Off - Normal Conditions**

Depress the clutch and engage the desired gear: Steadily depress the accelerator and simultaneously release the clutch and parking brake. Check that the parking brake, differential pressure and brake pad wear warning lights, are extinguished.

**CAUTION**

Do not operate the forward/reverse selector lever whilst the MRV is in motion, even in an emergency such as “rocking” the vehicle when stuck in mud or sand, as damage to the transmission may result.
2.10. Moving Off - Slippery Road Conditions and Rough Terrain

Select the appropriate all wheel drive and power divider lock control switch position to suit the terrain conditions. Depress the clutch and engage the appropriate gear for the vehicle load conditions. Steadily depress the accelerator and simultaneously release the clutch and parking brake. Check that the parking brake, differential pressure and brake pad wear warning lights, are extinguished.

NOTE

To provide the maximum departure angle when operating over rough terrain the boom should be raised and secured at minimum height (second hole from bottom of quadrant).

If the road wheels commence to slip stop the MRV and select the appropriate all wheel drive and power divider lock control switch position. When using the six-wheel drive mode, the differential locks can be engaged if one or more wheels tend to slip due to poor ground conditions. When the six-wheel drive and differential lock functions are engaged, two separate indicator lights on the instrument panel light illuminate. Tyre pressures may be altered to suit terrain conditions. Refer to Chapter 1, Section 1.

2.11. Cross Country Driving

WARNING

To prevent severe tyre vibration and possible loss of steering control remove all mud from the front wheels and tyres after cross country operation.

Stop the vehicle. Select the appropriate drive selector switch position for the driving conditions. When using the six-wheel drive mode, the differential locks can be engaged if one or more wheels tend to slip during cross country operation. When the six-wheel drive and differential lock functions are engaged, two separate indicator lights on the instrument panel light illuminate. Disconnect the differential locks before attempting to corner on a hard surface. During cross country driving maintain a safe speed for the conditions encountered. The mobility of the MRV is greatly enhanced if the recommended tyre pressures are adhered to, refer to Chapter 1, Section 1.
2.12. Fording

**CAUTION**

*Always select six-wheel drive before fording.*

The MRV can be forded unprepared to a depth of 1200 mm, the limiting feature being the cooling fan. When fording is undertaken select six-wheel drive mode and avoid excessive speed. When six-wheel drive is selected the axles housings are automatically pressurised thus preventing the ingress of water into the housings.

Once the crossing has been accomplished ensure the brakes are dry and fully effective before proceeding.

2.13. Braking

To brake the MRV, release the accelerator and progressively apply the brakes. The brakes may be applied in four ways:

a. Applying the service brake (foot brake);

b. Applying the exhaust brake (exhaust brake button on floor);

c. Applying the service brake (foot brake) and the exhaust brake (engine brake/service brake switch on dash switched); or

d. Applying the trailer brake when towing a trailer (trailer brake control on steering column).

2.14. Parking

When stationary the parking brake is used to park the MRV.

2.15. Six-Wheel Work Brake

**WARNING**

*If the engine is switched off during winching operations the six-wheel brake will release and the MRV may move.*

**NOTE**

The six-wheel work brake is not to be used as a park brake.

When stationary and the MRV is employed on a recovery task the six-wheel work brake should be applied.
2.16. Towing a Trailer

When connecting a trailer to the MRV, ensure that the trailer towing eye is fully seated in the towing pintle, the pintle locking device is fully closed and the pintle safety pin is inserted and secured. Connect the two trailer brake lines and ensure that there is no leakage at the couplings. Connect the trailer lighting cable and check the trailer lights. Release the trailer brake before moving off.

Good Driving Habits

2.17. Engine Temperature

Before entering high speed traffic conditions, allow the engine to reach operating temperature (80 to 95 degrees C).

2.18. Instruments

Check the readings of the instruments frequently. When trouble is indicated, take prompt action to correct.

2.19. Clutch

To avoid damage, engage the clutch without "shock loading" the drive line, especially on grades with loads.

2.20. Gear Changing

Upward and downward gear changes should be made to keep the engine operating in the green band (1500 RPM to 2000 RPM range) on the tachometer. When driving down long grades, the braking effect of the engine should be employed by shifting to a lower gear.

Ensure that the correct gear is selected for the terrain, vehicle load and speed. Use the same gear down hill as up hill. Avoid gear clashing by synchronising engine and vehicle speeds and by double de-clutching. Do not permit the load to drive the engine above governed speed. Shift gears smartly and smoothly, do not actuate the clutch for too long as undue wear on the clutch throw-out bearing will result.

The splitter transmission can be used in all gears on-road or off-road. To change the splitter transmission gears, depress the clutch pedal all the way to the floor and hold down momentarily (min of 0.5 seconds), select overdrive (up) or direct drive (down) on the switch on the gear change lever then release the clutch pedal.

To engage reverse gear, stop the MRV, declutch, shift the fwd/rev selector to reverse and then accelerate normally, after engaging the
clutch. All eight main transmission gears and the splitter transmission gears are available in reverse.

EMERGENCY PROCEDURES

CAUTION

Observe all warning lights.

WARNING

The MRV must not be driven if a brake warning light or low air pressure warning light is operating. These warning devices indicate that the brake system is not functioning correctly.

2.21. Brake Failure

If a brake warning device is actuated when the brakes are applied or braking effectiveness is in doubt, the MRV must be stopped immediately and the cause investigated. With a partial failure of the system, it is still possible to bring the MRV to rest by applying the footbrake, although the stopping distance will be increased. The engine may be used to assist braking by selection of a lower gear ratio or by actuating the engine brake.

In an emergency the hand brake may be progressively applied to stop the MRV.

2.22. Fire

If a fire occurs, stop the MRV immediately and stop the engine. Switch off all electrical services and the battery isolation switch. Evacuate all personnel from the vehicle and attempt to put out the fire with the extinguishers provided. Operating instructions are printed on the body of the fire extinguishers. Allow all fumes to dissipate before re-entering the vehicle. The fire is to be reported immediately so that the cause can be determined.
BREAKDOWN PROCEDURES

WARNING

When slave starting the MRV ensure that a 24V source is used and slave lead polarity connections are correct. Incorrect voltage or polarity connections may result in battery explosion and injury to personnel.

CAUTION

If the MRV batteries are flat do not attempt a rolling jump start or a tow start with a tow rope. Once started there will be minimal air pressure, no brake capability and no stopping ability.

2.23. Flat Batteries

If the batteries are flat start the engine using an inter-vehicle slave start when the MRV is stationary or a rolling jump start with the MRV attached to a tow vehicle by a rigid inter-vehicle A-frame.

2.24. Flat Tyre

If a tyre deflates, stop the MRV as soon as possible, avoid harsh breaking or steering manoeuvres. If possible, bring the vehicle to rest on a hard level surface, well clear of the road. Turn on the hazard warning lights if the tactical situation allows.

Apply the parking brake, stop the engine and chock the wheels to prevent movement of the MRV when it is jacked up.
WARNING
The MRV is equipped with six-wheel drive and
differential locks. Do not attempt to apply drive to a
wheel that has been jacked up off the ground. If
either six-wheel drive or the differential locks are
engaged serious injury to personnel and damage to

2.25. Removing the Spare Wheel
Remove the spare wheel from the stowed position on the main boom as follows:

NOTE
The approximate mass to be lifted is 220 kg. Use a suitable crane.

   a. Position the main boom in 'fully down' position.
   b. Remove the spare wheel cover.
   c. Release spare wheel locking screw and remove the screw and clamping bar from centre of spare wheel.
   d. Attach the sling to the wire rope spool lifting lugs and lift the wheel clear of locating dowels on main boom.
   e. Lower the spare wheel to ground and stand upright (still attached to crane), then remove the two locking pins securing the rope spool supports and lower the wheel to lie flat on bolting face of rim.
   f. Remove the wire rope spool and support brackets (2).

NOTE
Before proceeding with changing the wheel, ensure that the MRV is on flat, firm level ground and not obstructing traffic.

WARNING
Before changing a wheel secure the MRV to prevent movement.
2.26. Changing a Wheel

Change the wheel as follows:

a. Apply the parking brake and chock the wheels.
b. Ensure there are no passengers in the MRV.

**NOTE**

The jack, operating handle and wheel brace are located in an equipment bin on the left hand side of the MRV.

**CAUTION**

Do not position the jack under the differential housing as the axle will be unstable and the jack capacity could be exceeded and collapse. Position the jack at the outer end of the axle housing as close to the wheel as is practicable.

c. Place the jack under the outboard end of the axle tube adjacent to the faulty wheel.
d. Remove any dirt from the wheel nut cover and remove the cover.
e. Unstow the crane. Refer to Section 3.
f. Remove the locking screw securing the spare tyre to the recovery boom and lift the spare wheel into a position adjacent to the wheel to be changed, with the crane.
g. Loosen the wheel nuts a couple of turns and jack up the axle until the wheel is clear of the ground.
h. Remove the wheel nuts, the two hub cap mounting brackets, and the four bevelled washers located underneath the brackets.
i. Disconnect the central tyre inflation quick release coupling and then remove the wheel.
Check the spare wheel and tyre for serviceability before fitting.

k. Check that the wheel nuts and studs are clean.

l. Fit the spare wheel ensuring that the tyre valve stem is aligned with the slot in the wheel hub and taking care not to damage the stud threads.

m. Fit the four bevelled washers, two hub cap mounting brackets and four wheel nuts with flat ends so that the brackets are located diagonally opposite on the wheel. Fit the remaining wheel nuts with the bevelled ends inwards.

n. Tighten the wheel nuts evenly in a criss-cross pattern around the wheel.

**NOTE**

Tighten the wheel nuts using a torque wrench. Check the wheel nuts again after 50 km of travel or at the next Last Parade Service whichever occurs first.

o. Lower the MRV to the ground and torque the wheel nuts to 400 Nm in a criss-cross pattern (diagonally opposite) around the wheel.

**NOTE**

Tighten the union nuts of the tyre inflation hose by hand (2-3 Nm). Do not overtighten.

p. Refit the central tyre inflation quick release coupling and refit the wheel nut cover.

**NOTE**

To inflate the tyre from an external source connect the air hose to the Schraeder valve at the central tyre inflation quick release coupling and inflate the tyre to the desired pressure.

q. Check the tyre pressure (refer to Chapter 1, Section 1) and if required, inflate the tyre using the central tyre inflation system, see paras 2.35 to 2.40.
r. Stow the crane (refer to Section 3), the jack, operating handle and wheel brace.

s. Remove the chocks from the wheels.

**NOTE**

Check the wheel nuts torque after 50 km of travel, or at the next Last Parade Service whichever occurs first.

t. Report the occurrence so that the necessary repair action to the defective tyre can be taken.

2.27. Stowing the Spare Wheel

a. Stow the spare wheel on the recovery boom, using the crane, as follows:

**NOTE**

The approximate mass to be lifted is 220 kg. Use a suitable crane.

b. Lay the spare wheel flat with the bolting face of the rim on the ground.

c. Attach the wire rope spool and support brackets (2) to the spare wheel with the two locking pins.

d. Attach the sling to the wire rope spool lifting lugs and lift the wheel into position on the locating dowels on the main boom.

e. Install the clamping bar at the centre of spare wheel and secure with the spare wheel locking screw.

f. Install the spare wheel cover, tighten and tie-off the securing rope.
TOWING

2.28. Towing a Casualty MRV

**WARNING**

If a casualty MRV has no brakes, then it cannot be towed by another MRV on public roads.

**CAUTION**

Braking efficiency is jeopardised if the MRV is towed or coasted with the engine stopped or not operating. The vehicle may only be towed with a RIGID towing bar or frame. Maximum towing speed is 40 km/h.

**CAUTION**

When flat towing, the Aggregate Trailed Mass (ATM) is not to exceed 12.5 tonnes.

**CAUTION**

If the MRV is to be towed with the rear wheels on the ground, the engine not operating, and with no air supply the parking brake system must be mechanically released.

**NOTES**

1. If there is no compressed air supply to the MRV (casualty) it is necessary to provide an auxiliary air supply from the towing vehicle to maintain the park brake in the released position during towing. Using the hoses supplied with the MRV CES connect the supply and control couplings at the rear of the towing vehicle to the couplings at the front of the casualty. With no air supply the park brakes must be released manually, see para 2.31

2. If the MRV (casualty) is to be flat towed without the engine running the hydraulically assisted steering system will not operate and manual forces will be considerably higher than normal for steering.

3. If the MRV is to be lift towed, refer to Section 2 Table 2-4 Boom Positions for Lift Towing.
When the MRV is towed observe the following precautions:

a. When the MRV is to be towed up to one km (and up to 40 km/h):

1. Position the gear change lever in NEUTRAL (between 7th and 8th gears).
2. Position the fwd/rev shift lever in the FWD position.
3. Position the all wheel drive and power divider selector switch in the four wheel drive position (0).
4. Position the working gear group switch in high ratio (road gear) position.

(5) Physically check whether the HIGH/LOW RANGE selector lever on the RH side of the transmission is in the HIGH RANGE (fully forward) position. To ensure that HIGH RANGE is fully engaged rotate the main drive shaft by hand whilst the main transmission is in gear and the clutch pedal is depressed. At the same time, using a lever apply a firm forward pressure to shift the HIGH/LOW RANGE selector lever forward (Fig 2-1). When HIGH RANGE is fully engaged the main drive shaft will cease to rotate.
(6) Secure the HIGH/LOW RANGE selector lever in the high range position by fitting the selector lever locking bracket between the underside of the selector lever shift cylinder clevis and over the head of the transmission housing mounting bolt below and approximately horizontal to the shift cylinder clevis. Refer to EMEI VEHICLE G 619-10 for more details.

(7) Secure the Working Gear Group selector lever in the high range (road gear) position with the working gear group locking bracket. Refer to EMEI VEHICLE G 619-10 for more details.

(8) Release the spring loaded park brakes, manually if the air supply is exhausted, see para 2.31.

b. When the MRV is to be towed over one km (or when 40 km/h will be exceeded):

(1) Remove the engine to transmission drive shaft.

(2) Position the gear change lever in 8th gear.

(3) Position the fwd/rev shift lever in the FWD position.

(4) Position the working gear group switch in high ratio (road gear) position.

(5) Physically check whether the HIGH/LOW RANGE selector lever on the RH side of the transmission is in the HIGH RANGE (fully forward) position. To ensure that HIGH RANGE is fully engaged rotate the main drive shaft by hand whilst the main transmission is in gear and the clutch pedal is depressed. At the same time, using a lever apply a firm forward pressure to shift the HIGH/LOW RANGE selector lever forward (Fig 2-1). When HIGH RANGE is fully engaged the main drive shaft will cease to rotate.

(6) Secure the HIGH/LOW RANGE selector lever in the high range position by fitting the selector lever locking bracket between the underside of
the selector lever shift cylinder clevis and over the head of the transmission housing mounting bolt below and approximately horizontal to the shift cylinder clevis. Refer to EMEI VEHICLE G 619-10 for more details.

(7) Secure the Working Gear Group selector lever in the high range (road gear) position with the working gear group locking bracket. Refer to EMEI VEHICLE G 619-10 for more details.

(8) Release the spring loaded park brakes, manually if the air supply is exhausted, see para 2.31.

2.29. MRV to MRV Towing Preparation - Option 1

To prepare a casualty MRV, that has the engine and hydraulic system operable, for towing, proceed as follows:

a. Make the MRV casualty safe i.e. on level ground and with wheels chocked.

b. Prepare the MRV for towing.

c. Connect the casualty MRV to recovery MRV.

NOTE

Loosen both sets of front wheel nuts before raising the casualty MRV.

d. Fit the front axle spring compressors. Ensure the compressors are tightened sufficiently to bring the axle to the bump stops.

e. Loosen both sets of front wheel nuts.

f. Lift the casualty MRV clear of the ground, remove both front wheels and position the wheels near the casualty rear wheel group. Position the recovery MRV boom to provide the minimum possible clearance under the casualty front axle. Lock the recovery MRV main boom not higher than the fourth hole from the bottom of the boom support quadrant.

g. Cover the exposed front wheel disc and brake calipers of the casualty MRV.
h. Unstow the casualty MRV crane.

i. Relocate the casualty MRV spare wheel in the alternate stowage position on top of the personal equipment platform (Fig 2-2), using the crane. Secure the wheel.

j. Stow the two wheels of the casualty MRV on either side of the casualty MRV main boom (Fig 2-2), using the crane.

![Figure 2-2 Casualty MRV Front Wheels - Stowage](image)

Figure 2-2 Casualty MRV Front Wheels - Stowage

k. Lash the two wheels together through the main boom section using chains or other suitable equipment.

l. Stow the casualty crane.

m. Complete the preparations for towing.

2.30. MRV to MRV Towing Preparation - Option 2

When the casualty MRV does not have an operable engine and hydraulic system prepare for towing as follows:

a. Make the MRV casualty safe i.e. on level ground and with wheels chocked.

b. Position the recovery MRV so the crane is within reach of the spare wheel and one of the front wheels on the casualty MRV.

c. Unstow the recovery MRV crane.
d. Relocate the casualty MRV spare wheel in the alternate stowage position on top of the personal equipment platform (Fig 2-2), using the crane. Secure the wheel.

e. Relocate the spare wheel on the recovery MRV on one side of the main boom of the casualty MRV (Fig 2-2), using the crane. Secure the wheel.

f. Fit the front axle spring compressors to the casualty MRV. Ensure the compressors are tightened sufficiently to bring the axle to the bump stops.

g. Remove a front wheel from the casualty MRV, using the vehicle jack, see para 2.26.

h. With the recovery MRV crane, position the removed front wheel beside the casualty MRV main boom. Lash it to the wheel located there previously using chains or other suitable equipment.

i. Prepare the recovery MRV for towing.

j. Secure and lift the casualty MRV. Position the recovery MRV boom to provide the minimum possible clearance under the casualty front axle. Lock the recovery MRV main boom not higher than the fourth hole from the bottom of the boom support quadrant.

k. Cover the exposed front wheel disc and brake calipers of the casualty MRV.

l. Retrieve and stow the vehicle jack.

m. Remove the remaining front wheel of the casualty MRV, and stow the wheel on the main boom of the recovery MRV in the normal spare wheel position. Secure the wheel with the locking screw.

n. Stow the recovery MRV crane.

o. Complete the preparations for towing.
2.31. Emergency Park Brake Release

**WARNING**

Prior to mechanically releasing the park brakes the wheels must be chocked to prevent any movement of the MRV.

To mechanically release the park brakes on the intermediate and rear wheels, use a hammer or tyre lever (if there is no room to use the hammer) to move the park brake release latches towards the wheels (Figure 2-3). The emergency release mechanism should disengage with a click.

**WARNING**

Chock the wheels of the MRV to prevent it from rolling when the towing device is removed.

Figure 2-3 Emergency Parking Brake Release

To reapply the park brake charge the system with air pressure then release and reapply the handbrake.
ELECTRICAL SYSTEM

2.32. Battery Removal

To remove the batteries proceed as follows:

a. Rotate the battery isolation switch to isolate the batteries from the MRV electrical system.

b. Unlock the battery box door with the square bonnet key, and lower the door.

c. Unlock the battery cradle and slide out the cradle with batteries.

CAUTION

Disconnect the negative (-) lead from the MRV chassis to the battery terminal first to prevent accidental shorting of the electrical system.

d. Disconnect the lead from the MRV chassis to the negative (-) terminal and then the lead from the vehicle electrical system to the positive (+) terminal.

e. Remove the connector cable between the two batteries.

Figure 2-4 Battery Connection Diagram
2.33. Battery Installation

**WARNING**

When installing the batteries in the MRV ensure that connections with the battery leads are of the correct polarity i.e. (+) to (+) and (-) to (-). Incorrect polarity connections will cause damage to the vehicle electrical system and may result in battery explosion and injury to personnel.

To install the batteries proceed as follows:

a. Install the batteries into position on the cradle. See Figure 2-4 for the battery connection diagram.

b. Connect the lead from the MRV to the positive (+) terminal and then the lead from the vehicle electrics to the negative (-) terminal. Tighten the battery terminals firmly.

c. Connect the connector cable between the two batteries and tighten the battery terminals firmly.

d. Slide the cradle, with batteries into the battery box and lock the battery cradle.

e. Rotate the battery isolation switch to connect the batteries to the MRV electrical system.

2.34. Circuit Breakers

The cab/chassis electrical system is protected from overload conditions by two main circuit breaker panels (Fig 1-14) fitted to the top of the dashboard immediately forward of the steering wheel. A failure in an electrical circuit could be indicated by the black button on top of the relevant circuit breaker being raised, to reset push the button down. If the button is raised a second time report the fault and have it rectified before using the equipment again. Relays and fuses that isolate and protect the load of the recovery system from the cab/chassis circuits are located behind the inner wall of the remote control equipment bin. A failure of an electrical circuit could be indicated by a recovery system blown fuse.
CENTRAL TYRE INFLATION SYSTEM (CTIS)

WARNING
Do not operate the central tyre inflation system when driving on public roads. Low/uneven tyre pressures make vehicle control difficult and dangerous in traffic.

1. Indicator light “deflate tyre”
2. Indicator light “inflate tyres”
3. Selector switch “inflate/off/deflate” tyre
4. Front axle pressure gauge,
5. Selector switch, front/all/rear axles
6. Indicator light front axle “deflate/inflate tyres”
7. Indicator light rear axles “deflate/inflate tyres”
8. Rear axles pressure gauge
9. Instrument lights, brightness control

Figure 2-5 CTIS Control Panel

2.35. Inflate Front Axle Tyres

To inflate the front axle tyres push the selector switch, front/all/rear axles (Figure 2-5(5)) marked “-“ to the left (indicator light front axle “deflate/inflate tyres” (Figure 2-5(6)) should illuminate) and then press the selector switch “inflate/off/deflate” tyre (Figure 2-5(3)) marked “-“ at the top (indicator light “inflate tyres” (Figure 2-5(2)) should illuminate).
The front axle tyres will inflate to the pressure indicated on the front axle pressure gauge (Figure 2-5(4)). When the desired tyre pressure is reached, turn the selector switch “inflate/off/deflate” tyre (Figure 2-5(3)) to the central “■” (off) position and the selector switch, front/all/rear axles (Figure 2-5(5)) to the central “■” (all) position. Check that the tyre pressure indicated on the pressure gauge is being maintained and all the indicator lights are extinguished.

2.36. Deflate Front Axle Tyres

To deflate the front axle tyres push the selector switch, front/all/rear axles (Figure 2-5(5)) marked “−” to the left (indicator light front axle “deflate/inflate tyres” Figure 2-5(6)) should illuminate) and then press the selector switch “inflate/off/deflate” tyre (Figure 2-5(3)) marked “−“ at the bottom (indicator light “deflate tyre” (Figure 2-5(1)) should illuminate).

The front axle tyres will deflate to the pressure indicated on the front axle pressure gauge (Figure 2-5(4)). When the desired tyre pressure is reached, turn the selector switch “inflate/off/deflate” tyre (Figure 2-5(3)) to the central “■” (off) position and the selector switch, front/all/rear axles (Figure 2-5(5)) to the central “■” (all) position. Check that the tyre pressure indicated on the front axle pressure gauge is being maintained and all the indicator lights are extinguished.

2.37. Inflate Intermediate and Rear Axle Tyres

To inflate the rear and intermediate axle tyres push the selector switch, front/all/rear axles (Figure 2-5(5)) marked “=“ to the right (indicator light rear axles “deflate/inflate tyres” (Figure 2-5(7)) should illuminate) and then press the selector switch “inflate/off/deflate” tyre (Figure 2-5(3)) marked “−“ at the top (indicator light “inflate tyres” (Figure 2-5(2)) should illuminate).

The rear axles tyres will inflate to the pressure indicated on the rear axle pressure gauge (Figure 2-5(8)). When the desired tyre pressure is reached, turn the selector switch “inflate/off/deflate” tyre (Figure 2-5(3)) to the central “■” (off) position and the selector switch, front/all/rear axles (Figure 2-5(5)) to the central “■” (all) position. Check that the tyre pressure indicated on the rear axle pressure gauge is being maintained and all the indicator lights are extinguished.

2.38. Deflate Intermediate and Rear Axle Tyres

To deflate the rear and intermediate axle tyres push the selector switch, front/all/rear axles (Figure 2-5(5)) marked “−“ to the right (indicator light
rear axles "deflate/inflate tyres" (Figure 2-5(7)) should illuminate) and then press the selector switch "inflateloff/deflate" tyre (Figure 2-5(3)) marked "=“ at the bottom (indicator light "deflate tyre" (Figure 2-5(1)) should illuminate).

The rear axles tyres will deflate to the pressure indicated on the rear axle pressure gauge (Figure 2-5(8)). When the desired tyre pressure is reached, turn the selector switch "inflateloff/deflate" tyre (Figure 2-5(3)) to the central “■” (off) position and the selector switch, front/all/rear axles (Figure 2-5(5)) to the central “■” (all) position. Check that the tyre pressure indicated on the pressure gauge is being maintained and the indicator lights are extinguished.

2.39. Inflate/Deflate Front and Rear Axle Tyres

To inflate/deflate front and rear axle tyres at the same time, place the selector switch, front/all/rear axles (Figure 2-5(5)) at the central position “■” (all). Operate the selector switch "inflateloff/deflate" tyre (Figure 2-5(3)) to either inflate or deflate all the tyres to the desired pressure. Depending on selection the indicator light "inflatel deflate tyres" (Figure 2-5(1)) or indicator light "deflate tyres" (Figure 2-5(2)) should illuminate. The indicator light front axle “deflatelinflate tyres” Figure 2-5(6)) and indicator light rear axles "deflatelinflate tyres” (Figure 2-5(7)) should also illuminate. When the desired tyre pressure is reached, turn the selector switch "inflateloff/deflate" tyre (Figure 2-5(3)) to the central “■” (off) position and leave the selector switch, front/all/rear axles (Figure 2-5(5)) in the central “■” (all) position. Check that the tyre pressures indicated on the front and rear axle pressure gauges are being maintained and the indicator lights are extinguished.

2.40. Inflating a Tyre from an External Source

**WARNING**

Do not stand in front of a tyre whilst inflating it.

To inflate the tyre on the MRV from an external source proceed as follows:

a. Remove the wheel hub cap.

b. Remove the valve cap from the Schraeder valve on the CTIS connection at the wheel hub.
Connect the external air hose to tyre inflation connection at the pressure regulator and inflate the tyre to the desired pressure.

d. Replace the valve cap and the wheel hub cap.

**MRV LOADING ONTO C-130 AIRCRAFT**

**2.41. Operators Preparation Procedure**

To prepare the MRV for air transportation in a C-130 aircraft, the vehicle operator must carry out the following procedure:

a. Check that the recovery boom is in the lowered position, and the folding boom is secure.

b. Check the contents of the MRV to ensure that only those items defined within the vehicle CCES and MRV personal stores list are on the vehicle.

c. Check that all contents of the vehicle are stored and secured in accordance with the MRV CES layout plan as detailed in the ILSI.

d. Remove the following equipment from the vehicle and store:

(1) Cupola hatch and hinge,

(2) Snorkel filter,

(3) Beacon lights (amber rotating lights),

(4) Crane operating lever caps,

(5) All radio/communication aerials if fitted, and

(6) GPS antennae if fitted.

e. Inflate/deflate all MRV tyres to 3.5 bar (3500 kPa).

f. Confirm that axle clamps will be fitted to the front axle in accordance with the Approved Tie-Down Procedures once the MRV is loaded into the C130. Show the Unit Emplaning Officer (UEO) where the axle clamps are stored.
CLEANING

2.42. Vehicle Washing

The MRV consists of sensitive electrical, mechanical and pneumatic components that are prone to damage if care is not taken when cleaning, particularly high pressure cleaning.

CAUTION

The ingress of water into the hydraulic oil tank, the directional control valves (including the crane controls) and, the winch drums adjacent to the right hand side main seal will lead to equipment failure.

When washing the vehicle, using high pressure water blast cleaning, the following must be observed:

NOTE

Cabinet seals and latches will not seal against a direct water jet blast.

a. High pressure water blasts must not be directed at the top of the hydraulic oil tank, the hydraulic directional control valves (including crane controls), the winch drums adjacent to the right hand side main seal and cabinet seals and latches.

CAUTION

The ingress of water causes rust and lubricant contamination and may result in the premature failure of equipment.

b. Use pH neutral, biodegradable cleaning agents to avoid damage to chrome parts.

c. When cleaning the crane and recovery equipment with a high pressure cleaning device the temperature of the cleaning agent must not exceed 60°C.

d. Protect the PTFE diaphragm on the speed limiter actuator (situated under the gear shift control panel) against high pressure water jet.
After water blast cleaning all lubrication points on the recovery system are to be serviced to expel water from bushes, bearings and seals.
SECTION 2
RECOVERY SYSTEM OPERATION

NOTE

The information contained in this Section details the use of specific MRV recovery equipment. Where applicable, warnings, precautions, cautions and limitations on the use of the equipment are included. This Section does not provide information on the application of general recovery techniques. For information on the application of general recovery techniques, including warnings, precautions, cautions and limitations on equipment refer to the Recovery Manual, EMEI’s and Training Précis.

2.43. Precautions Prior To Use

Prior to operating the recovery system on this vehicle observe the following precautions:

a. Ensure the hydraulic system is filled with the approved grade of oil as detailed in EMEI Vehicle D 399 Servicing Instructions.

NOTE

The left hand winch is used for self recovery.

b. Ensure equal use is made of both winches. This action will ensure wear is evenly distributed across both winch systems.

CAUTION

If a warm up period is not carried out when the ambient temperature is below 20°C (when using Tellus 68) or below 10°C (when using OM-33) damage to the hydraulic system can occur. Observe the temperature gauge fitted to the hydraulic tank and do not carry out winching, towing or lifting operations until an oil temperature of 5°C (Tellus 68) or -6°C (OM 33) is indicated.
Under normal conditions and after engaging the PTO allow five (5) minutes for the hydraulic oil to warm up prior to operating the system. In extremely cold conditions, and if after the normal five (5) minute warm up period the oil still has not reached operating temperature the following procedure is the only one to be used to assist in warming the oil:

1. Set the engine at idle speed.

**NOTE**

Care must be exercised to ensure the engine is not stalled.

2. Partially and very gradually push in an earth anchor control lever allowing oil to flow over the control valve spool.

### 2.44. Precautions During Use

The following precautions are to be observed when operating the recovery system:

a. If a hydraulic oil leak is detected or the low oil level warning light for the hydraulic system is illuminated during recovery operations switch the throttle to idle speed and disengage the PTO immediately. A delay of more than one minute can allow the system to be pumped dry and damage to the pump may occur.

**WARNING**

If the engine is switched off during winching operations the six-wheel brake will release and the MRV may move.

**CAUTION**

All recovery equipment is hydraulically operated. Due to the speed and power of hydraulic operations extreme care must be exercised when operating equipment controls.

Always operate the hydraulic control levers with slow even pressure. Never jerk any control lever and never suddenly release a control lever to stop a function. Always return the lever to neutral in a smooth, even manner.
c. Lifting/tie down lugs are not to be used for the return of tackle during winching operations.

d. When winching to the front or rear, compensating bridles are to be used on all return of tackle including single line return of tackle.

e. Always engage the lifting boom safety lock pins after the casualty has been lifted for towing and before the safety chains/straps are attached.

**WARNING**

*During all recovery operations, take care in the presence of overhead power lines.*

f. When travelling with the boom raised, be particularly watchful for overhead obstructions, i.e. power lines and low bridges.

**PREPARATION FOR RECOVERY**

2.45. To prepare the MRV for recovery operations proceed as follows:

a. Position the MRV so that the casualty can be recovered with a straight pull, where possible.

b. If a side pull is necessary select the lowest position possible for the main boom. Refer to Side Winching paras 2.89 to 2.92.

**NOTE**

*Prior to engaging the PTO apply the handbrake and the six-wheel work brake.*

c. Engage the PTO (refer to Chapter 2, Section 1) and warm up the hydraulic oil.
LAYOUT AND OPERATION OF CONTROLS

2.46. Vehicle Mounted Recovery/Towing Controls

Two sets of heavy duty spring loaded control levers (connected by cables to a centrally located directional control valve bank) and winch pressure tension gauges are fitted in the rearmost left and right equipment lockers, permitting operation of the recovery equipment from either side of the vehicle (Fig 2-6).

1. Winch pressure/tension gauge-left winch
2. Free spool switch-left winch
3. Engine throttle switch
4. Work lights switch
5. Floods light switch
6. Free spool switch-right winch
7. Winch pressure/tension gauge-right winch
8. Cabinet light switch
9. Control lever-right winch in/out
10. Control lever-right earth anchor down/up
11. Control lever-left earth anchor down/up
12. Control lever-left winch in/out
13. Control lever-main boom up/down
14. Control lever-folding boom up/down
15. Control lever-extension boom in/out
16. Unswitched 24V power supply jacks

Figure 2-6 Control Lever Lay Out (Right Hand Side)
2.47. Winch Pressure/Tension Gauges

The control stations are equipped with pressure gauges that indicate the load on each winch. Each gauge has two scales, an outer scale indicating system hydraulic pressure in bar, and an inner scale that indicates the winch load for each rope layer in tonnes (Fig 2-6). During winching the operator should monitor the appropriate scale on the pressure/tension gauge to:

a. Monitor the hydraulic system condition, e.g. indicate low system pressure at winch cut-out;

b. Get a general indication of the load on the winch, during winching;

c. Obtain an accurate indication of the load on the winch at winch cut-out; and

d. Relate the reading on the appropriate scale on the gauge to the number of layers of rope on the drum.

Figure 2-7 Winch Pressure/Tension Gauge

2.48. Remote Control

The remote control unit (Fig 2-8) is a pendant style and permits an operator to initiate recovery control functions whilst standing a distance from the MRV. A throttle control switch, a remote control disable switch and, a low oil level warning lamp is also fitted. The recovery functions that can be initiated using the remote control are listed in Table 2-1.
### Table 2-1 Remote Control Functions

<table>
<thead>
<tr>
<th>Serial</th>
<th>Symbol</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td>Pendant disable switch</td>
</tr>
<tr>
<td>2.</td>
<td>LHS WINCH OUT</td>
<td>Winch out the left hand winch rope</td>
</tr>
<tr>
<td>3.</td>
<td>LHS SPD DOWN</td>
<td>Lower the left hand earth anchor leg</td>
</tr>
<tr>
<td>4.</td>
<td>BOOM DOWN</td>
<td>Lower the main boom</td>
</tr>
<tr>
<td>5.</td>
<td>RHS SPD DOWN</td>
<td>Lower the right hand earth anchor leg</td>
</tr>
<tr>
<td>6.</td>
<td>EXTENS OUT</td>
<td>Extend the extension boom</td>
</tr>
<tr>
<td>7.</td>
<td>RHS WINCH OUT</td>
<td>Winch out the right hand winch rope</td>
</tr>
<tr>
<td>8.</td>
<td>RHS WINCH IN</td>
<td>Winch in the right hand winch rope</td>
</tr>
<tr>
<td>9.</td>
<td>EXTENS IN</td>
<td>Retract the extension boom</td>
</tr>
<tr>
<td>10.</td>
<td>RHS SPD UP</td>
<td>Raise the right hand earth anchor leg</td>
</tr>
<tr>
<td>11.</td>
<td>BOOM UP</td>
<td>Raise the main boom</td>
</tr>
<tr>
<td>12.</td>
<td>LHS SPD UP</td>
<td>Raise the left hand earth anchor leg</td>
</tr>
<tr>
<td>13.</td>
<td>LHS WINCH IN</td>
<td>Winch in the left hand winch rope</td>
</tr>
<tr>
<td>14.</td>
<td></td>
<td>Throttle control switch</td>
</tr>
<tr>
<td>15.</td>
<td>LOW OIL</td>
<td>Low hydraulic oil level warning light</td>
</tr>
</tbody>
</table>

![Figure 2-8 Remote Control Unit](image_url)
2.49. Remote Control Function Switch

A function switch (Fig 2-9) is located above the remote control unit socket in the equipment locker. The switch controls the operation of the remote control unit and front winching from the cab. Table 2-2 details the switch positions and functions available at each position.

![Remote Control Function Switch](image)

Figure 2-9 Remote Control Function Switch

**Table 2-2 Remote Control Switch Functions**

<table>
<thead>
<tr>
<th>Function Control Switch Setting</th>
<th>Function Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cab LHS Winch Switch</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Front Recover</td>
<td>Yes</td>
</tr>
<tr>
<td>Off</td>
<td>No</td>
</tr>
<tr>
<td>Tow</td>
<td>No</td>
</tr>
<tr>
<td>Recover</td>
<td>No</td>
</tr>
</tbody>
</table>
2.50. Front Winching

A function switch is located on a pedestal mount on the control panel in the MRV cab (Fig 2-10). The switch initiates the operation of the front winch when carrying out front winching/self recovery operations.

![Figure 2-10 Front Winch Control](image)

2.51. Main Boom Operation

Prepare the main boom for operation as follows:

a. Prepare the vehicle for recovery, see para 2.45.

**CAUTION**

Always equalise the pull when reeved for a stabilised side pull.

**WARNING**

Ensure personnel are clear before operating main boom.

b. Operate the main boom lever to slightly raise the boom and release the weight off the boom locking pins (Fig 2-11).
WARNING

Keep clear of the main and folding boom when operating the main boom locking pins.

Figure 2-11 Boom Locks

c. Rotate the locking pins (Fig 2-11) through 90° so the pin handles are horizontal and withdraw both pins fully.

CAUTION

Ensure the top cabinet lids are closed prior to lowering the main boom. Lowering the boom with the lids open may result in the lids being crushed.

CAUTION

Before raising the main boom ensure loads carried on the boom platform will not foul stowage bin bracing.

d. Raise/lower the boom as required.

e. Align the locking pin holes on the main boom and the quadrant.

f. Insert the boom locking pins fully and rotate 90° until the handles are vertical and pointing down.

g. Lower the main boom onto the locking pins.
FOLDING BOOM AND EXTENSION BOOM

WARNING

Ensure personnel are clear before operating the folding or the extension boom.

CAUTION

Except when raising and lowering the folding boom, the folding boom must be left in the up and locked position or in the completely down position.

2.52. Lowering the Folding Boom

To lower the folding boom proceed as follows:

a. Prepare the MRV for recovery, see para 2.45.

b. Prepare the main boom for operation, see para 2.51

CAUTION

When lift towing a vehicle always ensure the extension boom lock is engaged.

c. Disengage the extension boom lock by rotating the fixed handle on the left hand side of the folding boom body (Fig 2-11).

d. Regulate the engine at idle speed with the appropriate throttle control switch.

e. Using the appropriate control lever at the recovery unit control panel extend the extension boom slightly; this action should disconnect the automatic lock.

f. Operate the folding boom control lever and lower the boom until it rests against the stops (Fig 2-12).

g. Manually stow the automatic lock locking arm.
2.53. Extending the Extension Boom

NOTE

Refer to Table 2-4 Boom Positions when Lift Towing for recommended extension boom positions for varying loads.

To extend the extension boom proceed as follows:

a. Disengage the spring loaded extension boom locking pin.

b. Using the appropriate control lever/button extend the extension boom until the desired position is achieved (Fig 2-13).

c. Engage the spring loaded extension boom locking pin.
WARNING

Ensure that the extension boom is locked prior to towing.

2.54. Retracting the Extension Boom

To retract the extension boom proceed as follows:

a. Disengage the spring loaded extension boom locking pin.

b. Using the appropriate control lever/button control panel retract the extension boom until all inwards movement ceases (Fig 2-13).

c. Engage the spring loaded extension boom locking pin.

2.55. Raising the Folding Boom

To raise the folding boom proceed as follows:

a. Lower the locking arm against its stop.

b. Disengage the spring loaded extension boom locking pin by rotating the folding boom lock (Fig 2-11), on the left hand side of the folding boom body.

c. Fully retract the extension boom.

d. Regulate the engine using the throttle control at the control panel to high speed.

e. Operate the folding boom control lever and raise the folding boom until it has lifted approximately 400 mm.

f. Regulate the engine at idle speed with the appropriate throttle control switch.

g. Extend the extension boom slightly (about 60-80 mm).

h. Operate the folding boom control lever and raise the folding boom until it engages the automatic lock arm. Using the control lever at the recovery unit control panel retract the extension boom; this action should close the automatic lock.

i. Engage the spring loaded extension boom locking pin.

j. When the task is completed prepare the MRV for travel.
WINCHES

CAUTION

Do not attempt to free spool the winch when the rope is under load.

CAUTION

Tension must be maintained on the winch rope when paying out.

2.56. Precautions Prior to Winching

Prior to rear winching the following precautions are to be observed:

a. When rear winching the MRV should be positioned so that the casualty can be recovered with a direct pull.

b. If a side pull is necessary the main boom should be locked in the lowest position practicable to maintain the stability of the MRV.

c. The winch rope must be aligned in the fairlead rope guide during winching operations. To minimise side loads being applied to the winch rope by the rope guide the operator is to ensure the main boom fairleads are aligned in the direction of pull. For example the fairleads must be rotated:

(1) When making pulls directly to the rear of the MRV; and

(2) When winching to the rear and the hitching point of a casualty or an anchor point is above the height of the main boom fairleads.
2.57. Precautions During Winching

In the event of the winch rope fouling on the drum it may be necessary to lever the pressure roller away from the winch drum, using a crow bar or other suitable lever, to release the rope.

Operation of Winches

2.58. The winch ropes can be paid out/winched in using the following methods:

   a. Pulled out by hand independently (free spooling); or
   b. Paid out or winched in under power independently using the control levers, or the remote control unit.

2.59. Free Spooling

To pull a winch rope out by hand proceed as follows:

   a. Prepare the MRV for recovery, see para 2.45.

   **NOTE**

   For ease of access to the winch rope ends lower the main boom to its stop.

   b. Prepare the main boom for operation. Position the boom at the required winching height and engage the main boom locking pins, see para 2.51.

   **NOTE**

   Ensure that the free spool switch that is selected to release the winch drum is the one that was selected to re-engage the winch drum.

   c. Lift the respective free spool switch guard and push the toggle switch up to the disengaged position. Pull the winch rope out by hand to the desired length. The speed of the free spooling drum is controlled by a drum brake.

   d. Engage the winch drum by lowering the free spool switch guard. The winch drum may need to rotate slightly before the free spool dog clutch engages. Select the appropriate winch control levers and pull **Out** to winch in slightly until the drum dog clutch is engaged.

   e. When the task is completed prepare the MRV for travel.
CAUTION

Tension must be maintained on the winch rope when paying out.

2.60. Paying Out/Winching In Under Power using the Control Panel

To pay out/winching in from the operator stations, proceed as follows:

a. Prepare the vehicle for recovery, see para 2.45.

NOTE

For ease of access to the winch rope ends lower the main boom to its stop.

b. Regulate the speed of the engine with throttle control at the control panel.

c. Prepare the main boom for operation.

d. Lower the folding boom until it rests against its stops, see para 2.52.

e. Position the main boom at the required winching height and engage the main boom locking pins, see para 2.51.

f. Move to the operator station that affords the best view of the crew commander and the recovery operation.

g. Select the appropriate winch control levers winching in/out as required.

h. When the task is completed prepare the MRV for travel.

2.61. Paying Out/Winching In Under Power using the Remote Control Unit

To pay out/winching in using the remote control, proceed as follows:

a. Prepare the MRV for recovery, see para 2.45.

b. Connect the remote control unit to the socket in the left hand side equipment bin and select RECOVER at the remote control unit function switch located above the socket.

c. Regulate the speed of the engine with throttle control.
NOTE

For ease of access to the winch rope ends lower the main boom to its stop.

d. Prepare the main boom for operation. Position the boom at the required winching height and engage the main boom locking pins, see para 2.51.

e. Lower the folding boom until it rests against its stops, see para 2.52.

f. Move to a position that affords the best view of the crew commander and the recovery operation.

g. Push the appropriate button to pay out/winch in.

h. When the task is completed prepare the MRV for travel.

2.62. Disconnecting the Casualty

CAUTION

Before releasing the winch rope, secure the casualty so that it cannot roll back or tip over.

When the casualty is able to be disconnected, briefly operate the winch control lever/button, to run out sufficient winch rope to relieve the load on the tackle layout then disconnect the winch rope from the chains or slings.
2.63. Lowering a Load in an Emergency

NOTE

If this procedure does not provide sufficient tolerance to lower the load, or if the load cannot be removed by use of alternative means, then the task is to be referred to support workshop element. EMEI Veh D 393 details an alternative method of lowering and this procedure is to be performed by unit tradesman (ECN 229 or civilian equivalent.

In the event of hydraulic hose rupture or engine failure; the winch brake can be released and a suspended load lowered, using the following procedure:

**WARNING**

On completion of lowering the load the two M8 X 20 screws must be removed and the plugs must be refitted to the winch brake end plate. If this is not done, an accident can occur since the winch brake is completely out of action.

a. Remove the two plugs on the winch brake end plate (Fig 2-14).

b. Fit two M8 x 20 screws with flat washers and tighten the screws evenly to disengage the brake. Note that the load will begin to creep once the brake is disengaged.
NOTE

In an emergency two of the M8 x 20 screws fitted with flat washers securing either, the cover plate on top of either earth anchor leg, or the stanchion support brackets adjacent to the LH winch, can be used.

c. Remove the cap from the counterbalance valve immediately above the port in the winch hydraulic manifold block which is stamped “V2”.

d. Insert a 3/16” Allen key into the adjustment screw of the valve, and note its position. Release the lock nut by four turns.

e. Screw the adjustment screw IN, on the counterbalance valve, noting its position including number of full turns from the original position. As the rope begins paying off the drum, control the rate at which the rope pays out by adjusting the screw in to increase the rate, and out to decrease the rate.

f. Controlled lowering of the load is possible until there is approximately 1400kg rope tension remaining when the screw is adjusted in to its limit. While the load remains on the rope, the load will creep slowly.

g. After the load is released from the winch rope, withdraw the two M8 x 20 screws from the winch brake.

h. Refit the two plugs in the winch end plate and tighten securely

i. Reset the counterbalance valve to its original position using a 3/16” Allen key and secure with the lock nut. Replace the valve cap.

j. If the above procedure is not sufficient to allow removal of the load from the rope use alternative means to restrain the load and disconnect the rope. A more detailed procedure is given in EMEI Vehicle D 393.
EARTH ANCHORS

WARNING

Ensure personnel are clear before operating earth anchors.

2.64. Precautions Prior to Use
Prior to using the earth anchors the following should be considered:

a. The spades are likely to break up paved road surfaces. Careful consideration should be given to the use of the earth anchors in that application.

b. The tackle attachment points on the earth anchor legs have restrictions on the type of returns and their angles of use. Refer to the information contained in Tackle Attachment Points paras 2.69 to 2.71.

2.65. Precautions During Use
During use of the earth anchors the following precaution should be observed:

a. All return of tackle to the tackle attachment points on the earth anchor legs must be removed prior to raising the legs.

2.66. Soil Conditions

NOTES

1. In soft soil the holding power of the earth anchors may be increased by elevating the main boom.

2. Elevation of the main boom may cause the front wheels of the MRV to lift off the ground.

The maximum holding power of the earth anchors is about 32 tonnes but will change with varying soil conditions. Refer to Table 2-3.

Table 2-3 Earth Anchor Holding Power

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Approximate Holding Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard clay</td>
<td>320 kN</td>
</tr>
<tr>
<td>Hard soil</td>
<td>160 kN</td>
</tr>
<tr>
<td>Wet soil</td>
<td>80 kN</td>
</tr>
</tbody>
</table>
2.67. Earth Anchor Operation

To operate the earth anchors proceed as follows:

a. Prepare the vehicle for recovery, see para 2.45.

b. Prepare the main boom for operation. Ensure the main boom locking pins are engaged, see para 2.51.

c. Regulate the speed of the engine with the appropriate throttle control.

d. Move to a control panel, or with the remote control unit to a position that affords the best view of the operation.

e. Operate the appropriate lever/button to operate the earth anchor legs.

2.68. Earth Anchor Emergency Retract Procedure

**WARNING**

*Removal of the valves mounted on the top of the earth anchor leg cylinder may result in sudden movement of the earth anchor leg and explosive release of hydraulic fluid.*

**WARNING**

*Removal of the valve adjacent to the hydraulic cylinder port marked ‘R’ (stamped on the top face of the cylinder end cap) may result in the earth anchor leg dropping if it is unrestrained.*

**WARNING**

*If the MRV is supported on the earth anchor legs the hydraulic valve immediately adjacent to the hydraulic cylinder port marked ‘E’ (stamped on the top face of the cylinder end cap) must not be removed.*

**CAUTION**

*Valve adjustments made using this emergency procedure alters the calibration of the load holding valves, which are factory set. The load holding valves of the earth anchor hydraulic cylinders must be replaced to return the MRV to an operational condition. The removed valves are to be retained for recalibration.*
To retract the earth anchors in an emergency proceed as follows:

a. Ensure that the remote control and front winching control switch (in cab) is set to OFF. Set the Remote Control Selector Switch to OFF.

b. Ensure that the hydraulic control levers are in a neutral position.

c. If the rear of the MRV is supported by the earth anchors, place packing under the rear wheels so that when the vehicle is lowered the weight at the rear is immediately transferred to the packing.

d. Remove the four M8 X 20 hex head setscrews, fitted with flat and spring washers, securing the cover plates on the top of the left and right hand earth anchor legs housings, then remove the cover plates. Stow the bolts and washers for re-use.

e. Insert a 3/16 inch Allen key into the valve stem (the threaded shaft extending from the top of the hydraulic cylinder) immediately adjacent to the port marked 'E'. Mark the Allen key initial position relative to the valve stem and the earth anchor leg housing. Loosen the 9/16 inch lock nut and ensure that there is approximately 4mm clearance between the bottom of the nut and the top of the valve body. Ensure that the Allen key is not allowed to rotate. Repeat this procedure on the other earth anchor cylinder.

**WARNING**

Attempting to lower the MRV by large movements on each side may result in overturning of the vehicle.

f. Slowly screw in the threaded valve stem, permitting one side of the MRV to be lowered. The operation can be halted by unscrewing the valve stem. Note the number of turns from the initial position to the final position. If no movement occurs, screw in the valve stem until it is firm.
NOTE

It may be necessary to release the brakes to release longitudinal loads on the earth anchor legs and fully lower the MRV. However no attempt should be made to release the brakes until after the MRV can be lowered no further. Return the valve stems to their original position prior to releasing the brakes.

g. Lower the MRV onto the wheel packing by small movements of the earth anchor legs on alternate sides. Limit each movement to approximately 150mm of travel at each earth anchor leg.

h. When a valve stem is screwed in until firm, and no further movement of the earth anchor leg occurs, push down on the valve stem to continue lowering the MRV. The operation can be halted by releasing the valve stem.

NOTE

The valve stems must be returned to their original position (sub-para e.) to retain the earth anchor legs in the raised position.

j. Install the left and right hand earth anchor leg housing cover plates and secure each plate with four M8 X 20 hex head setscrews, fitted with flat and spring washers. Tighten the bolts securely.
TACKLE ATTACHMENT POINTS

CAUTION

All tackle attachment points have limited angles of use. Applying a load to tackle attachment points outside these angles can result in catastrophic equipment failure.

2.69. Precautions Prior to Use

Prior to the selection of tackle attachment points on the MRV the following precautions are to be observed:

a. Lifting/tie down lugs on the MRV are not to be used for the return of tackle during winching operations.

b. A compensating bridle must be used on all front and rear tackle attachment points even when using a single line return of tackle.

c. The angle between the legs of the compensating bridle is not to exceed 60° (Fig 2-17).

d. The boom head anchor points must never be used during a balanced pull where a component of the rope load is perpendicular to the vehicle centre line. The maximum operating angles for the main boom and earth anchor legs (see Figs 2-15 and 2-17) are not to be exceeded.
Attachment (reeving) points for return of tackle are attached on either side of the boom head below the fairlead swivels. No more than two falls of rope are to be attached to the boom head anchors at one time. The boom head tackle attachment points are rated at 16 tonnes RLL. Operating angle limits for single line and two part return of tackle are shown in Figure 2-15.
2.71. Earth Anchor Leg Reiving Points

Attachment (reeving) mounting holes for return of tackle lugs are provided in the earth anchor legs (Fig 2-16). The tackle lugs are normally carried in the equipment bins and are fitted when rear winching is to be carried out. The lugs must be fitted to the outside of the earth anchor legs to prevent undue strain on the legs. The earth anchor points are only to be used for rear winching.

Figure 2-16 Earth Anchor Leg Tackle Attachment Points

The operating angle limits for the earth anchor leg tackle attachment points are shown in Figure 2-17.

Figure 2-17 Earth Anchor Reieving Points – Operating Angle Limits
2.72. Emergency Towing Points

Two emergency towing lugs are welded to the earth anchor leg housings above the earth anchor leg anchor points (Fig 2-18). The lugs are only for use when carrying out self recovery and a compensating bridle must be used.

![Emergency Towing Lugs](image)

*Figure 2-18 Emergency Towing Points*

2.73. Pintle Hook

The pintle hook may be used for a tackle attachment point under the following conditions:

a. The return of tackle is limited to a single line.

b. The angle of the return line to the pintle hook is not to exceed 10° off the centre line of the MRV (Fig 2-19).

![Pintle Hook Anchor Point](image)

*Figure 2-19 Pintle Hook Anchor Point - Maximum Operating Angles*
c. The total pull on the line to the pintle hook is not to exceed 8 tonnes.

Refer to paras 2.82 to 2.84 for the pintle hook assembly fitting and removal procedures.

2.74. Front Winching Anchor Points

Two attachment (reeving) points on the front of the MRV are provided for return of tackle when winching to the front (Fig 2-20). The RLL of each point is 6.1 tonnes (straight pull) and a compensating bridle must be used in conjunction with the front winching anchor points.

![Figure 2-20 Front Anchor Points](image)

TRAVELLING EMPTY

2.75. Boom Stowed Positions

When the MRV is travelling empty, the main, folding and extension booms should be stowed. All safety locks and lock pins should be engaged.

TOWING

2.76. Towing Precautions

When towing vehicles observe the following precautions:

a. When lift towing a vehicle ensure the extension boom lock is engaged.

b. When towing heavy vehicles, where provision is made connect the air-brake system of the casualty to the MRV so that the casualty’s brake system is operational.
When towing casualties lifted at the front, it is advisable to disconnect the tail shaft to avoid transmission damage. Most heavy gearboxes have an engine driven oil pump. If the vehicle is towed with the engine not running, the gearbox will not receive lubrication and extensive damage could result. If the differential is damaged remove all the drive shafts in the axle(s).

2.77. Towing Attachments

Towing attachments that are used with the MRV to lift tow in-service vehicles are:

a. Fork, Crescent (Fig 2-21/1).
b. Fork, Long (Fig 2-21/2).
c. Extension Bars, MRV Front LH/RH (Fig 2-21/3).
d. Adapter, Light/Medium (Fig 2-21/4).
e. Adapter Unimog Rear (Fig 2-21/5).
f. Adapter, Chain (Fig 2-21/6).
g. Adapter, Fork (Fig 2-21/7).
h. Adapter, Fork Extension (Fig 2-21/8).
i. Adapter, Land Rover 6X6, Rear (Fig 2-21/9).
j. Spacer, T-bar (Fig 2-21/10).
k. Pin, Drawbar (Fig 2-21/11).

Figure 2-21 Towing Attachments
Figure 2-21 Towing Attachments (Continued)
2.78. Fitting of Adapter Unimog Rear

**WARNING**

The Unimog U1700L rear lift towing adapters are suitable only for rear lift towing of an unladen Unimog U1700L vehicle.

To install the Unimog U1700L rear lift towing adapter to a casualty proceed as follows:

a. Retrieve the Unimog U1700L rear lift towing adapter assemblies from the storage locations on the MRV.

b. If fitted, remove the pins fixing the rigging screws to the adapter.

c. Unscrew the rigging screw so that there is at least 460mm between the bearing points of the eyes.

d. Hook the lip on the bottom of each adapter over the lower flange of the U1700L towing plate, and slide the adapter to the outside until the chamfered edge on the hook is butted against the corner gusset of the Unimog U1700L towing plate.

e. Using the adapter shackle fitted to the chain, attach the chain with rigging screw to the rear of the adapter.

f. Pass the rigging screw from the rear and up and over the towing plate, and locate the chains adjacent to the inside face of the slinging/tie down eyes.

g. Lift the rear of the adapter so that the plate angle is located against the back and bottom of the Unimog U1700L towing plate. Ensuring that the chain is not twisted, pin the free end of the rigging screw to the front of the adapter, and insert the lynch pin to lock the assembly around the Unimog towing plate (Fig 2-19).

h. Tighten the rigging screw using a tommy bar of not less than 300mm length, ensuring that the chain and rigging screw are neatly aligned, and that the adapter is firmly located against the towing plate corner gusset without being twisted.
NOTE

Light/Medium towing adapters on the T-bar must be pinned to ensure that the U1700L rear lift tow adapters are securely located and to prevent movement of the adapters towards the centre of the MRV.

i. Attach the vehicle to be towed to the MRV using the Light/Medium towing adapters fitted to the T-bar.

Figure 2-22 Unimog U1700 Rear Lift Towing Adapter - Fitted
Lift Towing

CAUTION
Do not lift tow without the T-bar safety pins fitted.

CAUTION
Using the fork set extensions places increased loads on towing attachments and the extensions should only be used when absolutely necessary.

CAUTION
When using the fork set extensions always inspect the lift extension adapters for damage after cross country operation and prior to high speed operation on sealed roads.

NOTES

1. The fork adapters can be fitted on to the T-bar before the boom has been extended under the casualty, or later depending on circumstances. If there are a lot of obstructions at the front of the vehicle it is sometimes easier to fit forks and fork adapters after the boom has been extended under the casualty. It may be necessary to raise and block the casualty to provide sufficient clearance.

2. If the towing clevises of the casualty are damaged, select the towing attachments most suited for the job.

3. If the T-bar is not centralized along the centre line of the casualty the earth anchors can be used to jack the MRV sideways to align it.

4. Lifting points on the chassis rails or any other part of the vehicle strong enough to take the weight can be used.

5. The fork adapters can be moved to any position on the T-bar and the forks can be turned to the most suitable position.

6. Chain and fork adapters are only to be used as a last resort to attach a casualty to the T-bar. If the adapters have to be used additional 13 mm chains must also be used.
2.79. Lifting the Casualty

When a casualty requires to be lifted at one end for towing proceed as follows:

a. Prepare the MRV for operation, taking care to line the two vehicles up, see para 2.45.
b. Prepare the main boom for operation, see para 2.51.
c. Lower the folding boom, see para 2.52.
d. Extend the extension boom halfway out.
e. Reverse the MRV until the T-bar is adjacent to the towing lugs or the selected point of attachment (Fig 2-21).
f. Select the appropriate towing attachment(s) and connect them to the T-bar.
g. Carefully raise the main boom until the towing attachments are close to making contact with the casualty. Check the position of the towing attachments and adjust if necessary.

**NOTE**

Both T-bar safety pins must be positioned to prevent the T-bar adapters and attached casualty vehicle from sliding to the right or left on the T-bar. Both pins must be positioned either on the outside or the inside of the adapters on the T-bar.

h. Fit spacers as required and insert the T-bar safety pins in the hole closest to the edge of the T-bar adapter/spacer.
Raise the main boom to a towing height that will suit the road conditions. When using the Adapter, Light/Medium or the Adapter, Unimog Rear refer to Table 2-4 Boom Positions when Lift Towing for recommended boom positions. When using any other attachment method a suitable height to raise the casualty off the ground is 300 mm to 500 mm for cross country operation and 150 mm to 200 mm for sealed road operation.

**NOTE**

*When lift towing the lower the boom height the greater the stability of the vehicles.*

**Table 2-4 Boom Positions When Lift Towing**

<table>
<thead>
<tr>
<th>Vehicle &amp; Condition</th>
<th>Lift</th>
<th>Boom Extension from Retracted</th>
<th>Desirable Boom Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unimog 1700 (Unladen)</td>
<td>Front</td>
<td>2nd lock position</td>
<td>7th hole from bottom</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>3rd lock position</td>
<td>5th hole from bottom</td>
</tr>
<tr>
<td>Unimog 1700 (Cross country laden)</td>
<td>Front</td>
<td>2nd lock position</td>
<td>7th hole from bottom</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>No lift, must be unladen</td>
<td>No lift, must be unladen</td>
</tr>
<tr>
<td>Unimog 1700 (Front axle load &gt; 5000 kg)</td>
<td>Front</td>
<td>1st lock position</td>
<td>7th hole from bottom</td>
</tr>
<tr>
<td>MRV (Combat Mass)</td>
<td>Front</td>
<td>1st lock position</td>
<td>3rd hole from bottom</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>Rear lift not permitted</td>
<td>Rear lift not permitted</td>
</tr>
<tr>
<td>Land Rover 6x6 Cargo (Unladen and Cross country laden)</td>
<td>Front</td>
<td>1st lock position</td>
<td>5th hole from bottom</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>3rd lock position</td>
<td>6th hole from bottom</td>
</tr>
<tr>
<td>Land Rover 4x4 Cargo (Unladen and Cross country laden)</td>
<td>Front</td>
<td>1st lock position</td>
<td>4th hole from bottom</td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>3rd lock position</td>
<td>5th hole from bottom</td>
</tr>
</tbody>
</table>

j. Engage the main boom locking pins.
k. Lower the boom slightly so that the load of the boom is taken, via the boom locking pins, on the quadrants.

**NOTES**

1. When using forks and adapters, securing chains must be fitted to both the casualty and the T-bar so that the chains prevent the casualty lifting out of or sliding in the forks or the adapters sliding on the T-bar.

2. When using fork adapters secure the casualty to the T-bar using 8 mm chain and load binders.

3. The tension on the securing chains should be checked regularly during cross country operation.
   l. Attach securing chains around the T-bar and around the part on the casualty that is providing the lifting point.
   m. Retract the extension boom to the shortest position suitable for towing; allow enough clearance between the vehicles for negotiating corners.
   n. Prepare the MRV and casualty for travel. If necessary adjust the MRV tyre pressures, and if operating at night, the headlights, to compensate for the load. Refer to Section 1 and Chapter 1, Section 2.

**CAUTION**

When parking on a gradient, test the ability of the MRV brakes to hold the combination by moving the hand brake lever to the check position (position 2), see Chapter 1, Section 2. If any doubt exists chock the wheels of the MRV and the casualty.

2.80. Releasing the Load

To release a casualty after a lift tow proceed as follows:

a. Prepare the MRV for operation, see para 2.45.

b. Prepare the main boom for operation, see para 2.51.

c. If using fork securing chains, disconnect and remove other securing chains.
Operate the main boom to release the boom locking pins.

e. Unlock and extend the extension boom to halfway.

f. Lower the casualty to the ground until all connection points are not under load. Do not release the connections at this stage. It may be necessary to extend or retract the extension boom to achieve the desired position.

g. Chock the wheels and/or apply the handbrake of the casualty.

h. Release the connections between the MRV and the casualty.

i. Prepare the MRV for travel. If necessary adjust tyre pressures, and if operating at night, the headlights, to compensate for the release of the load. Refer to Section 1 and Chapter 1, Section 2.

Flat Towing

CAUTION

When flat towing the Aggregate Trailed Mass (ATM) is not to exceed 12.5 tonnes.

CAUTION

All components of the towing pintle adapter must be fitted and secured prior to the connection of a trailer.

NOTES

1. Trailer/casualty articulation is restricted and is less than that available when lift towing.

2. During cross-country operation it may be necessary to adjust the height of the main boom to provide greater vertical articulation.

3. Safety chain attachment points for 13-mm chains are located beneath the sub-frame circular cross member on the MRV.
CAUTION

Should any part of the towing pintle, towing pintle adapter assembly, clamps or stays be damaged they must be replaced. The clamp bands must not be bent during fitting to the subframe. Straightening of damaged clamp bands is not permitted.

2.81. Connecting a Trailer/Casualty to the MRV

When connecting a trailer/casualty to the MRV, ensure that:

a. The trailer/A-frame towing eye is fully seated in the towing pintle.

b. The pintle locking device is fully closed and the pintle safety pin is inserted and secured.

c. The two trailer/casualty brake lines are connected and do not leak at the couplings.

d. The trailer/casualty lighting cable is connected and the trailer/casualty/on tow board lights work.

e. The trailer/casualty brakes are released before moving off.

Figure 2-24 A-Frame Operating Limitations
2.82. Towing Pintle

CAUTION

The towing pintle, adapter, clamps, stays and fittings are matched to a specific MRV. If new parts are installed or the towing pintle or mounting parts are swapped between vehicles, the adjustable stay must be altered to match the towing pintle assembly to the MRV.

The towing pintle, adapter, clamps, stays and fittings are normally carried in the LHS rear equipment bin (front, inner, top opening) and are fitted on an as required basis. When mounted, the towing pintle assembly is secured on the rear circular cross member and supported with stays connected to the recovery platform. The towing pintle assembly, when fitted, will restrict the movement of the main boom during recovery operations. It is recommended that the assembly is not permanently mounted.

2.83. Attaching the Towing Pintle to the MRV

To attach the towing pintle to the MRV proceed as follows:

a. Prepare the MRV for operation, see para 2.45.

b. Prepare the main boom for operation and ensure the folding boom is in the stowed position, see para 2.51.

c. Raise the main boom and insert the boom locking pins in the sixth hole from the bottom of the locking quadrant.

NOTE

A crane will need to be employed in this operation. Mass to be lifted will be about 54 kg.

d. Retrieve all towing pintle components from stowage in the LHS inner equipment bin.

e. Position the pintle unit centrally between quadrant rails at rear of vehicle and vertically in line with the centre of the rear cross member (Fig 2-26).

CAUTION

Do not try to force the clamp straps over the rear crossmember. Any distortion of the clamps could result in premature failure of the straps.
NOTE

Clamp straps can only be installed adjacent to the LHS chassis rail (Fig 26(9)). Push the two straps over the flats on the cross member and rotate them until the threaded ends face rearwards (Fig 2-25).

![Diagram of installing clamp straps]

Figure 2-25 Clamping Straps - Installation

f. Install both clamp straps onto the rear cross member. Guide the straps along the crossmember, rotating each strap as required to clear the stop blocks (Fig 2-26(6)) and the safety chain clevises, until each strap lays outside each stop block.

g. Install the fixed stay bar (Fig 2-26(5)) to the RHS lug on the subframe with the upper pivot pin. Secure the pin with the lock pin.

h. Install the adjustable stay bar (Fig 2-26(3)) to the LHS lug on the subframe with the upper pivot pin. Secure the pin with the lock pin.

Guide the pintle unit into position between the lower ends of the stay bars and attach the stay bars to the pintle unit with the lower stay bar pivot pins. Secure the pins with the lock pins.

Detach the crane. Guide the pintle unit into position between the stop blocks (Fig 2-26(6)) on the crossmember.
k. Slide the clamp straps (Fig 2-26(11)) into recesses provided in the pintle unit and install the four (4) M16 x 65 bolts fitted with flat washers. Tighten the bolts finger tight at this stage.

NOTES

1. If the towing pintle has not been fitted to the MRV previously, or replacement parts are being used, remove the lower pivot pin of the adjustable stay before tightening the clamp strap bolts.

2. The four (4) M16 x 65 clamp strap mounting bolts must be as tight as possible using a standard hand spanner (not less than 105 Nm).

l. Tighten the four (4) M16 x 65 clamp strap mounting bolts securing the pintle unit to the rear cross member (Fig 2-26(12)) by sequentially tightening each bolt by equal part turns. The gap between the end of the threaded faces on the clamp straps and the mounting frame must be equal at the completion of tightening. Install the bolt head anti-turn plates and secure with lock pins.

m. If the adjustable stay is not connected to the towing frame remove the M8 self locking nuts, flat washers and clevis lock bolts at each clevis.

n. Adjust the length of the stay by rotating the central section of the stay until the lower pivot pin mounting holes are aligned.

o. Insert the lower pivot pin and secure with the lock pin.

CAUTION

Over tightening of the clevis lock bolts will distort the clevis ends and clamp the pivot pins in the clevises.

p. Install the clevis lock bolts and flat washers at each clevis and secure with the M8 self locking nuts. The M8 locking nuts must be tightened to a stage that will prevent the clevis end from being turned by hand (i.e. tight enough to require a lever to rotate the clevis end).

q. Prepare the MRV and trailer/casualty for flat towing, see para 2.78.
1. Sub-frame  
2. Quadrant rail  
3. Adjustable stay bar  
4. Towing pintle  
5. Fixed stay bar  
6. Stop blocks  
7. Pintle hook mounting bolts  
8. Mounting frame  
9. Clamp strap installing area  
10. Clevis locking bolt  
11. Clamp strap  
12. Rear cross member

Figure 2-26 Towing Pintle - Installed
2.84. **Removing the Towing Pintle from the MRV**

To remove the towing pintle from the MRV proceed as follows:

a. Prepare the MRV for operation, see para 2.45.

b. Prepare the main boom for operation and ensure the folding boom is in the stowed position, see para 2.51.

c. Raise the main boom and insert the boom locking pins in the sixth hole from the bottom of the locking quadrant.

**NOTE**

A crane will need to be employed in this operation. Mass to be lifted will be about 54 kg.

**CAUTION**

The clamping bracket end blocks must be passed over the flats on the cross member without bending the clamps.

- Support the weight of the pintle unit with a crane and remove the bolt head anti-turn plates locking the four clamp strap bolts.

- Remove the four bolts with washers securing the clamp straps (Fig 2-26(11)) to the rear cross member (Fig 2-26(12)).

- Remove the pins securing the fixed and adjustable stays (Fig 2-26(5) and (3)) to the sub-frame.

- Lift the pintle unit off the rear cross member and stow in the LHS rear equipment bin (front, inner, top opening).

- Dismount the two clamp straps from the rear cross member and stow in the LHS rear equipment bin (front, inner, top opening).

**NOTE**

If the towing pintle is to be replaced ensure the four bolts and nuts (Fig 2-26(7)) securing the pintle to the pintle mounting frame (Fig 2-26(8)) are replaced. Torque the mounting bolts to 95 Nm.

Stow all components in the LHS rear equipment bin (front, inner, top opening).
STATIC LIFTING

WARNING

During all static lifting operations, take care in the presence of overhead power lines.

CAUTION

Ensure the recovery vehicle is on firm level ground when carrying out static lifting.

CAUTION

Sling the load so that the weight is evenly distributed about the T-bar axis.

2.85. Main Boom Static Lifting

The main boom can be used for static lifting tasks. Refer to Chapter 1, Section 1 - Data Summary for boom lifting limits. To prepare the MRV for static lifting tasks proceed as follows:

a. Position the MRV so that the maximum lift can be obtained.

b. Prepare the MRV for operation, see para 2.45.

c. Prepare the main boom for operation, see para 2.51.

d. Prepare the folding and extension booms for operation, see paras 2.52 to 2.55.

NOTE

Ensure that adequate packing is used under the earth anchor spades.

e. Deploy the earth anchors to level and stabilise the MRV.

f. Fit the Adapters, Light/Medium to the T-bar with the lugs facing downwards (Fig 2-27). Secure the adapters to the T-bar with the locking pins.
g. Attach an appropriate size shackle or oblong link to the Adaptors, Light/Medium lift tow adapter pins.

h. Sling the load from the adapter pins ensuring an equal load is placed on each side of the T-bar.

Raise and lower the main boom as required, using the appropriate main boom control lever/button. The load may also be extended and retracted providing the load remains within the limits contained in Chapter 1, Section 1 - Data Summary.
REAR WINCHING

2.86. Precautions Prior to Use

When winching to the rear observe the following:

a. All generally used tackle layouts can be applied using the MRV.

b. Rear winching is carried out with the right hand winch when the left hand winch is required for front winching/self recovery. However, ensure equal use is made of both winches to ensure wear is evenly distributed across both winch systems.

2.87. Unloading Effect (front of MRV lifting off ground)

When winching to the rear the following should be taken into consideration:

a. When winching with the boom completely lowered and a 2:1 mechanical advantage using both winch ropes a load of 16 tonnes can be applied to the MRV. This will tend to lift the front wheels of the MRV off the ground.

b. With the boom elevated, the tendency to lift the front wheels of the MRV off the ground is much greater.

c. The unloading effect on the front axle can be reduced byanchoring return of tackle where possible to the earth anchor attachment points.

2.88. Increasing Boom Height to Gain Winching Advantage

CAUTION

The main boom is not to be elevated when the winch ropes are under load.

Rear winching can be conducted with the main boom elevated providing the following precautions are observed:

a. If the winch rope is off-line to the centre line of the MRV, that is pulling to one side, then there will be a tendency to overturn the vehicle. Ensure that the winch rope is pulling directly to the rear of the MRV.

b. With the boom elevated, the tendency the lift the front wheels of the MRV off the ground is much greater.
When righting a vehicle with the boom elevated, vehicle stability becomes critical.

SIDE WINCHING

2.89. Stabilised Pull

All normally used side winching tackle layouts can be applied using the MRV providing the following precautions are observed:

a. During side winching operations the earth anchors on the MRV are to be lowered for stability.

b. To enhance stability and improve load transfer between the earth anchors and the ground, adequate packing must be placed between the spade tips and the ground.

c. Side winching is only to be conducted when the MRV is stabilised with an appropriate tackle layout on the opposite side to the pull.

d. When side winching, care must be taken to ensure that the steadying tackle is sufficiently tensioned to prevent undue side lean of the MRV.

e. Side winching can be conducted with the boom at any height, however with the boom elevated the tendency to lift the one side of the MRV off the ground is much greater.

2.90. Unstabilised Pull

In an emergency when side winching has to be carried out without the use of steadying tackle then the maximum safe loads listed below are not to be exceeded:

a. BOOM DOWN - 3 Tonnes.

b. BOOM UP - 1.5 Tonnes.
Side Winching Layouts

NOTE

Once a light load has been applied to the tackle the position of the MRV can be adjusted to prevent tackle fouling the rear of the vehicle.

2.91. Figures 2-28 to 2-30 illustrate examples of simple indirect layouts using one winch rope as a service line and the other as an anchor line. The 2:1 and 3:1 layouts utilise the boom head tackle attachment points for the return of tackle. The same layout is used on both sides of the MRV to stabilise the vehicle and ensure loads and forces exerted are equal on both sides.

Figure 2-28 Side Winching - Single Line Pull

Figure 2-29 Side Winching - 2:1 Tackle Layout

Figure 2-30 Side Winching - 3:1 Tackle Layout
2.92. Figures 2-31 and 2-32 illustrate examples of a 2:1 and 3:1 indirect layout where both winch ropes can be employed as service lines during recovery.
FRONT SELF RECOVERY AND FRONT WINCHING

CAUTION

Do not use the MRV mounted earth anchors when recovering a casualty using front winching.

NOTE

The RLL of each of the front winching anchor points on the MRV is 6.1 tonnes (straight pull) and a compensating bridle must be used in conjunction with the anchor points.

2.93. Front Winch Components Layout

Front winching is achieved by utilising the left hand winch rope reeved through a series of sheaves, rollers and guides along the left hand chassis member to the front of the vehicle (Fig 2-33).

Figure 2-33 Front Winch Components - Layout

2.94. Front Winching Controls

Front winching can be controlled by:

a. A toggle switch on the drivers control panel. If operating from the drivers position set the remote control function switch to FRONT RECOVER; or

b. The remote control unit. If using the remote control unit, set the remote control function switch to TOW or RECOVER.
2.95. Maximum Fleet Angles

The maximum fleet angles formed by the front rollers are depicted in Figure 2-34.

![Diagram of front winch roller fleet angles with top and side views]

**Figure 2-34** Front Winch Roller Fleet Angles

2.96. Reeving to the Front of the MRV

To reeve the winch rope to the front of the MRV proceed as follows:

- a. Prepare the MRV for operation, see para 2.45.
- b. Prepare the main boom for operation and ensure the folding boom is in the stowed position, see para 2.51.
- c. Position the main boom to a minimum height of the second hole from the bottom of the locking quadrants. Ensure the boom locking pins are engaged.
- d. Prepare the MRV for winching, see para 2.58.
- e. Disengage the left winch for free spooling.
- f. Remove the latchlock hook and shackle from left hand winch rope.
g. Remove the self locking nut and bolt retaining the wear inserts in the rope guide end, and slide the inserts out of the guide mouth (Fig 2-35). Stow the guide inserts and retaining bolt and nut in a secure place e.g. the glove box.

![Figure 2-35 Rope Guide - Dismantling](image)

h. Remove the left hand winch rope from the rope guide end, and rotate the rope guide towards the rear.

i. Rotate the left hand fairlead and insert the fairlead locking pin in the front face to align the fairlead sheave to the left hand side of the main boom (Fig 2-36).

![Figure 2-36 Left Hand Fairlead - Locking](image)
Guide the rope end under the boom left hand side stay, detach the rat line from the rope support under the boom storage platform, then attach the rat line to end of the winch rope.

**CAUTION**

To prevent damage to equipment and maintain control, the winch rope with rat line attached is to be pulled through the sheaves, rollers and guides by hand. The winch is not to be used.

k. At the front of the vehicle, detach the rat line from the front rope window anchor point and gradually pull the winch rope through the sheaves, rollers and guides to the front of the vehicle.

l. Remove the top horizontal and vertical rollers from the rope window and pull the rope end through the window (Fig 2-37).

![Figure 2-37 Top Horizontal and Vertical Rollers - Removal](image)

m. Check the alignment of the winch rope on the sheaves, guides and rollers.

n. Replace the front rope window top horizontal and vertical rollers.
o. Detach the rat line from the rope end and stow on the vehicle.

p. Engage the left hand winch for winching.

q. Prepare the MRV for winching.

2.97. Changing from Reeving to the Front to Reeving to the Rear

To reeve the winch rope to the rear of the MRV proceed as follows:

a. Prepare the MRV for operation, see para 2.45.

b. Prepare the main boom for operation and ensure the folding boom is in the stowed position, see para 2.51.

c. Operate the main boom and insert the boom locking pins in the second hole from the bottom of the locking quadrants.

d. Prepare the MRV for winching, see para 2.58.

e. Winch the left hand rope in until the hook is just short of the front rollers.

f. Remove the latchlock hook and shackle from left hand winch rope.

g. Attach the rat line to the rope end.

h. Remove the front rope window top horizontal and vertical rollers.

CAUTION

To prevent damage to equipment and maintain control, the winch rope with rat line attached is to be pulled through the sheaves, rollers and guides by hand. The winch is not to be used.

From the recovery platform pull the rope in slowly, guiding the rope end with rat line attached through the sheaves, rollers and guides to the left hand fairlead on the main boom.

j. Detach the rat line from the winch rope and attach the rat line to the rope support under the boom storage platform.
k. Feed the left hand winch rope through the rope guide end.

l. Fit the inserts in the guide mouth of the rope guide end and secure with the retaining bolt. Tighten the bolt securely.

m. Install the shackle and the latchlock hook on the left hand winch rope end.

n. Remove the fairlead locking pin locking the front left hand fairlead (Fig 2-30).

o. At the front of the vehicle, replace the front rope window top horizontal and vertical rollers, and attach the rat line to the front rope window anchor point.

p. Prepare the MRV for travel.

REAR SELF RECOVERY

WARNING

Do not allow bystanders to stand inside the risk area of the rope when a winch is operating.

NOTE

The main boom should be kept as low as possible to maximise the lifting effect during rear self recovery.

2.98. Precautions Prior To and During Use

Self recovery to the rear is carried out using tackle layouts calculated to suit the prevailing situation and observing the following precautions:

a. When carrying out self recovery to the rear, fully lower the boom and ensure the winch rope remains close to horizontal as possible.

b. Select an anchor point so a straight pull can be used for self recovery, where possible.

c. Rear winching is carried out with the right hand winch when the left hand winch may be required for front winching/self recovery.
SELF RECOVERY AND DRIVING

2.99. Precautions Prior To and During Use

During self recovery it may be necessary to winch and drive simultaneously to extricate the MRV. When carrying out this procedure the following precautions are to be observed:

a. Ensure that only splitter LOW range and working gear group LOW ratio is used during winching and driving.

b. Ensure that the engine revolutions do not exceed 1500 revolutions per minute when the winch is engaged.

c. Note that the hydraulic pump will very quickly slow the gearbox and drive train if the clutch is depressed while the PTO is engaged. Attempt to change gears only when the vehicle and pump have stopped.

d. The winch is engaged only when the remote control function switch is switched to FRONT RECOVER, and then the cab mounted switch is held in the forward or reverse positions.

e. Winch speed is controlled by engine speed except where clutch slip occurs. When clutch slip occurs it is not possible to know pump speed and wheel speed.

f. If the winch rope becomes slack during winching and driving, it may become entangled under, within or around vehicle components, resulting in damage or failure of the vehicle. At all times take care to ensure the rope does not become slack. If the rope becomes slack, check the location of the rope through the vehicle.

g. The only gears to be used for front winching are 1st and 2nd gear. The ground speed of the vehicle on firm ground exceeds the high speed winching rope speed in both 1st and 2nd gear and overrunning the winch rope is possible. The speed of the periphery of the tyre in 2nd gear is about twice the high speed winching speed.

h. Ensure that winching in is only attempted with the forward/reverse lever in forward or neutral.

i. Ensure that winching out is only attempted with the forward/reverse lever in reverse or neutral.
2.100. Winching and Driving Simultaneously

To winch and drive simultaneously proceed as follows:

a. Prepare the vehicle for winching, with reeving of the winch to the front, see para 2.96.

b. Engage the PTO.

c. Engage the working gear group.

d. Ensure splitter LOW range (direct drive) is selected, see Section 1.

e. Set the remote control function switch to FRONT RECOVER mode.

f. Using the cab mounted winch control switch or the remote control unit take up the slack in the winch rope, ensuring that no part of the vehicle is fouled by the rope.

g. Select 1st or 2nd gear, refer to Table 2-5 Driving and Winching - MRV and Winch Speeds.

h. Gradually release the clutch, while engaging the winch using the cab mounted control switch.

i. If a gear change is required, disengage the winch by releasing the cab mounted control switch prior to attempting the gear change. Change gears when the MRV has ceased movement and the hydraulic pump has stopped.

j. Drive while winching to recover to firm ground.

k. Position the forward/neutral/reverse selector to the neutral position.

l. Retrieve the winch rope, see para 2.97.

m. Disengage the PTO, refer to Section 1.

n. Prepare the MRV for travel.
Table 2-5 Driving and Winching - MRV and Winch Speeds

<table>
<thead>
<tr>
<th>Gear</th>
<th>Ground speed at full tyre inflation and engine speed of 1500 RPM</th>
<th>Maximum/Minimum winch speed available</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st gear</td>
<td>25.2 m/min</td>
<td>Between 5.3 m/min and 18.2 m/min</td>
</tr>
<tr>
<td>2nd gear</td>
<td>36.4 m/min</td>
<td>depending on rope layer and load</td>
</tr>
</tbody>
</table>

**NOTE**

Refer to Chapter 1, Section 1 - Data Summary for winch speeds

**WINCH ROPES**

**WARNING**

*Leather gloves must always be worn when handling steel wire rope and slings.*

**NOTE**

When being rewound onto the drum, a tension equal to 50 kg should be maintained on the winch rope at all times.

**2.101. Replacing a Winch Rope**

To replace a winch rope proceed as follows:

a. Release winch free spool lock at the control panel and run out old wire rope.

b. Release any tension on the drum and knock the rope wedge (Fig 2-38) out of the drum. Detach the wire rope from drum.

**NOTE**

The winch rope must be fitted underwound i.e. the rope is layed on from underneath the drum (Fig 2-38).

c. Lever the pressure roller away from the drum.
d. Feed the end of the new wire rope underneath the winch drum.

e. Thread the end of the wire rope through the wedge rope pocket from its narrow end.

f. Bend the wire rope and thread it back through the wedge rope pocket to form a loop, with the rope free end adjacent to the drum flange.

Figure 2-38 Winch Rope - Attachment

Place the wedge inside the loop (Fig 2-38).

h. Hold the end of the wire rope firmly inside the rope pocket and pull on the other end of the rope; the wire rope and wedge should fill up the pocket in the winch drum.

NOTE

If the wire rope is not laid on correctly initially then it will be damaged subsequently when placed under load.

i. Winch in the rope carefully with a weight of about 50 kg on the rope, ensuring the turns lay on to the drum together and spool evenly.
Figure 2-39 Layout of Stowage
173/(174 blank)
SECTION 3
CRANE OPERATION

SAFETY PRECAUTIONS

2.102. The crane operator is the vital link in the safe accident-free performance of crane and lifting operations. Written rules can never cover all situations that may arise when operating a crane. Most hazards can be avoided by the exercise of intelligence, care and common sense.

2.103. To ensure the Palfinger crane is operated safely, observe the following instructions:

   a. The crane should only be operated by trained personnel.
   c. Always operate the crane control levers with slow even pressure. Never jerk any control lever and never suddenly release a control lever to stop a function. Always return the lever to neutral in a smooth, even manner.
   d. When operating the crane the inclination of the MRV must not exceed 5° in any direction.
   e. If operating the crane when the MRV is parked on a gradient, ensure that the vehicle is facing uphill and not along it.
   f. The MRV must be level if the crane is lifting to full capacity otherwise the centre of gravity will alter.
   g. Do not use the stabilisers to lift the MRV.
   h. Never use the crane without first deploying the stabilisers.
   i. If support plates are used under the crane foot, ensure they are of adequate construction for the job.
   j. When operating in confined spaces take extreme care.
   k. Never travel with a suspended load or boom over the side of the MRV.
   l. Never stand under a load or between the load and the MRV.
Always ensure you observe the load while it is being moved. If you have to look in another direction, stop the operation immediately.

Check that the hook, shackles and slings are correctly fitted.

Keep booms away from any overhead electrical lines (minimum distance 6m).

Never slew a load if it is not clear of the ground.

Do not lift heavy loads with the boom fully extended, especially over the side of the MRV.

Keep heavy loads as close as possible to the ground.

Ensure the crane is folded down correctly, the stabiliser feet are stowed, and the stabiliser legs are stowed vertically up before resuming driving operations.

Ensure the PTO is disengaged before moving the MRV.

Only operate the crane from the standing position in the cupola area.

CRANE OPERATION

WARNING

A vehicle mounted crane is dangerous if operated incorrectly. The operator must exercise extreme caution to avoid mistakes which may result in personal injury or property damage. The crane should be operated by trained personnel.

2.104. Crane Preparation

Prepare the MRV and crane for use as follows:

a. Position the MRV so that the crane is within reach of the load. Check that the ground below the stabiliser leg position is firm, ensuring that the maximum vehicle inclination is below 5°.

b. Apply the park brake and MRV work brake. Ensure that the transmission is in neutral, the gear shift lever is at the 7-8 gate, the splitter transmission is in low range, and the FWD/REV lever is in neutral.
Engage the PTO (refer to Section 1) and set the hand throttle at 1500 RPM or activate the recovery equipment throttle control (refer to Section 2).

d. Position the passenger seat in the collapsed position ready for standing on by lifting the seat cushion up to the vertical position, releasing the back rest and folding down flat, exposing the foot tread for standing.

e. Release the cupola hatch on the passenger side ceiling using the two locking handles.

f. Slide the cupola lid across the top of the cab roof and lock in position.

g. Access to the crane controls is available from the standing position on the passenger side seat.

2.105. Lowering the Stabilisers

![Figure 2-40 Stabiliser]

NOTE

If the standing under the stabilisers is soft or of doubtful stability, lower the stabiliser on the side of the softer ground first. This action saves time should it become necessary to re-site the MRV to gain stability for crane operation. If required reinforce the standing by laying steel mesh or sand bags under the stabiliser feet.
NOTE

Each stabiliser is retained in the operational or the stowed positions, by a lock pin.

Lower the stabilisers as follows:

a. Remove the stabiliser leg end cap and stow in a safe place.
b. Select the right hand or left hand stabiliser leg as appropriate, then to unstow remove the lock pin (Fig 2-40).
c. Rotate the stabiliser leg 180° until it is vertical and the ram is pointing down then insert the lock pin.
d. Position the foot on the stabiliser cylinder ram and secure the foot with the bolt and nut

NOTE

The first stabiliser leg operated will raise the MRV chassis about 50-100 mm. The second stabiliser when lowered is used to level the vehicle.

e. Set the stabiliser control lever (Fig 2-41(1) or (7)), to the down position and lower the stabiliser to the ground.
f. Repeat the steps listed in sub-paras a. to e. for the stabiliser leg on the other side of the MRV.

2.106. Unstowing the Crane

WARNING

Do not operate the crane until both stabiliser legs have been lowered and the stabiliser feet are on firm standing.

Unstow the crane and prepare it for use as follows:

a. Move the crane main boom control lever to the RAISE position and raise the boom to its full extent at full speed, then release the lever to neutral. The overload protection should respond when the cylinder reaches its full extent (avoid this configuration while working).
b. Briefly press the overload bypass button and lower the main boom to approximately 45°.
c. Move the crane extension boom control lever to the RETRACT position to disengage the boom from the locking block, then release the lever to neutral.

d. Move the crane outer boom control lever to the LOWER position to lift the boom off the lock, then release the lever to neutral.

e. Move the crane extension boom lever to the EXTEND position until the boom lock is disengaged, then release the lever to neutral.

1. Stabiliser control lever (right hand)
2. Crane slew control lever
3. Main boom control lever
4. Overload bypass button
5. Outer boom control lever
6. Extension boom control lever
7. Stabiliser control lever (left hand)

Figure 2-41 Crane Control Levers (Viewed from Cab)

f. Move the crane outer boom control lever to the RAISE position. Hold the lever in that position until the outer boom is raised to the position required, then release the lever to neutral.

g. Move the crane extension boom control lever to the EXTEND position. Hold the lever in that position until the boom is extended to the position required, then release the lever to neutral.

h. Fit crane hook and shackle with pin.
2.107. Lifting a Load

CAUTION

Ensure that the maximum safe working load for the various radii is not exceeded. Refer to the SWL decal on the cab roof (Fig 2-42).

Figure 2-42 Crane Safe Working Loads

Carry out the following procedures to lift a load with the crane:

NOTE

Set the crane main boom angle to 16° above the horizontal for maximum lift.

a. Slew the crane so that the booms are aligned directly above the load to be lifted.

b. Adjust the height of the booms so that the crane may be slewed in the desired direction without contacting obstructions.

c. Fit the hook to the boom for the load (Fig 2-42) and using the control levers as necessary position the hook to engage the sling around the load.

d. Attach the hook to the load and ensure that the safety catch on the hook is fully closed and secure.
CAUTION

Ensure the load is clear of any obstructions before slewing the crane. Slew the crane gently and gradually to prevent load swing.

e. Take up the load gently by raising the appropriate boom.

2.108. Overload Protection System

NOTE

Type OS is used on the P 067 crane

When an overload situation is encountered, the levers controlling movements which effect the load moment of the crane are blocked from movements which would increase the load moment.

Movements which are no longer possible are;

a. Main Boom Lower
b. Outer Boom Lift
c. Extension boom Extend

The functions remain blocked until the crane is out of the overload range. If a blocked function is required to get out of the overload situation, press the overload bypass button to unblock the function.

2.109. Releasing a Load

CAUTION

Ensure that the load is completely stable and on firm standing before releasing the hook.

Carry out the following procedures to release a load from the crane:

a. Using the appropriate boom and slewing controls, position the crane, and lower the load gently and accurately into place.

NOTE

Raise the appropriate boom until the crane is clear of the load and any obstructions before slewing the crane.
Open the safety catch on the crane hook and release the hook from the load.

2.110. Stowing the Crane

Carry out the following procedures to stow the crane:

a. Remove the crane hook and shackle with pin.
b. Slew the crane until the booms extend over the driver's side of the MRV and are aligned above the space between the cabin and the recovery unit.
c. Retract the extension boom to about 700 mm from the limit of its travel.
d. Raise the main boom to approximately 45° and lower the outer boom to the bottom of its travel.
e. Retract the extension boom until the boom lock is engaged.
f. Raise the outer boom to place the boom onto the lock.
g. Extend the extension boom to engage the locking block.
h. Lower the main boom until the stowing boss engages the stowing lug on the crane support column.

2.111. Stowing the Stabilisers

Carry out the following procedures to retract and stow the stabilisers:

CAUTION

If the ground under the road wheels is of doubtful firmness, retract the stabiliser on the side of the firmer ground first. Do not move the MRV until both stabilisers are fully retracted and stowed.

a. Set the stabiliser control lever (Fig 2-41(1)) or (7), to the raise position and retract the leg fully.
b. Remove the stabiliser foot and stow.
c. Remove the lock pin, rotate the stabiliser 180° to its vertical stowed position and insert the lock pin (Fig 2-40).
d. Fit the stabiliser leg end cap.
e. Repeat the steps listed in sub-para a. to d. for the stabiliser leg on the other side of the MRV.

f. Disengage the PTO (refer to Section 1).

2.112. Prior to Moving Off

CAUTION

Ensure the crane is folded down AND the stabilisers are stowed before resuming driving operations.

a. Disengage the PTO (refer to Section 1).

b. Set the hand throttle and/or the recovery equipment throttle control to the engine idle position (refer to Section 2).

c. Disengage the MRV work brake.

2.113. Operating in Darkness

If the operational situation prevents the use of light, use an assistant to call boom and slewing instructions. If there are no lighting restrictions, use the recovery floodlights.
CHAPTER 3

OPERATOR SERVICING

SECTION 1 - PARADE SERVICING

SECTION 2 - PERIODIC SERVICING

SECTION 3 - LUBRICATION

SECTION 4 - FAULT FINDING

NOTE

For clarity and brevity the Truck, Wrecker, Medium, MC2, Unimog U2450L is referred to throughout this document as the MRV (Medium Recovery Vehicle).
SECTION 1
PARADE SERVICING

Introduction

3.1. Parade servicing must be carried out in accordance with EMEI VEHICLE A 029, EMEI VEHICLE D 399, and as detailed this Section. If servicing cannot be performed when it is due, the fact is to be reported immediately.

Lubricants and Fluids

3.2. Lubricants and fluids required for servicing the MRV are listed in Section 3, however, refer to EMEI VEHICLE D 399 for the approved list of lubricants.

Daily Servicing

3.3. General. The purpose of the Daily Servicing is to ensure the safety and reliability of the MRV for the day's running. Defects, damage and malfunctions must be reported daily by the driver on the Transport Work Ticket or on a Defective Vehicle Report.

First Parade Service

NOTE

Report all defects/damage.

3.4. Before moving off with a laden or unladen MRV, carry out the inspections, checks and tests as laid down in this section. Inspect for damage, security and serviceability.

NOTES

1. Wheel nuts are to be checked for security using a tension wrench set at 400 Nm. If a tension wrench is unavailable, care must be taken not to overtighten the wheel nuts.
2. Signs of uneven or excessive wear, which indicates a fault in the tyre, wheel or suspension alignment, must be reported.
3.5. Check the wheels and tyres for the following:
   a. Loose wheel nuts.
   b. Correct tyre pressures (visual).
c. Inspect the treads and sidewalls for weak spots, uneven wear, cuts, exposed cords, or clogged tyres. Remove any material found.

d. Security and condition of the wheel split rim C-clips, safety pins and CTIS hub fittings.

e. Hub caps security.

3.6. Check the following fittings:

a. All cabin and body fittings.

b. Windscreen, driving mirrors, door windows, hinges, catches and latches for security.

c. Check light lenses, driving mirrors and windows for cleanliness.

d. Inspect the air conditioner return air filter, replace/clean as necessary.

e. Spare wheel, security and pressure.

f. Exterior equipment lockers locked.

g. Inspect the MRV for any damage, and loose or missing parts.

3.7. Check and service the recovery unit as follows:

a. Rear boom in the travelling position and locked.

b. Winch ropes security.

c. Pintle hook, coupling and security (if fitted).

d. Check for any visible damage of the recovery unit. Repair or replace any defective parts.

e. Check for any oil leakage. Tighten connections or repair any defective parts.

f. Check that recovery unit control levers automatically return to neutral when released.

g. Check the oil level in the hydraulic reservoir, top up if required.

h. Lubricate the T-bar pivot pins and folding boom pivot pin.
3.8. Check the crane as follows:
   a. Inspect for oil leaks at hose and pipe connections and tighten if required.
   b. Check load carrying parts such as hooks, hook attachments, chains, pulleys, swivels, lines, clips, cables and other tools used for lifting are serviceable.
   c. Check that control levers automatically return to neutral when released.
   d. Check that the crane has suffered no other damage that could affect its safe operation.
   e. Check that the stabilisers are stowed and locked.

3.9. Check the stowed items as follows:
   a. Completeness of equipment and correct stowage.
   b. For loose items in cabin or recovery unit.
   c. Fuel and water jerricans security.
   d. Fire extinguishers (3) fully charged and correctly stowed.

3.10. Check the fuel, lubricants, cooling system and batteries as follows:
   a. Fuel level, refuel if necessary.
   b. Fuel jerricans, refill as necessary.
   c. Engine oil level, top up if required.
   d. Check the disposable fuel pre-filter for contamination.
   e. Check the battery electrolyte level (10 mm above the plates).
   f. Rotate the viscous fan by hand to ensure that a residual drag is present.
   g. Check the cleanliness and security of the battery terminals. Lubricate terminals if required.
   h. Coolant level in radiator expansion tank, top up if required.
   i. Windscreen washer reservoir, check water level and top up if necessary.
   j. Water jerricans, refill as necessary.
   k. Check for fuel, lubricant and coolant leaks. Examine major assemblies and the ground below the MRV for evidence.
Start the MRV

3.11. Start the MRV as detailed in Chapter 2, Section 1 and check the following:

a. **Clutch Pedal.** Check for free travel.

b. **Air Pressure Check.** When the engine is running smoothly, check that the air pressure warning lamp extinguishes.

c. **Accessories.** Check the following accessories for operation:

   **NOTE**

   Switch off all lights not required.
   
   Head-lights
   Horn
   Indicator lights
   Hazard lights
   Windshield wipers/washers
   Air conditioner
   Heater

   **WARNING**

   Do not drive the MRV with damaged or incorrectly inflated tyres.

   **NOTES**

   1. Tyres must be inflated to the pressures detailed in Chapter 1, Section 1.

   2. Tyre pressures will increase when the tyres become hot. If the tyres are checked immediately after driving, the pressures may be higher than those recommended. Under these circumstances, do not bleed off the extra pressure.

   3. Periodically during the day, feel the temperature of the tyres. If any tyre is excessively hot, check thoroughly for the cause.

   4. Check the spare tyre pressure daily.
d. **Tyre Pressures.** Check the tyre pressure readouts on the CTIS control panel gauges. Adjust tyre pressures if required. Refer to Chapter 2, Section 1.

e. **Park Brake.** Check release, holding ability and application.

**Moving Off and Running**

3.12. Check the following:

a. **Load -** Make a final check of the security of the casualty/trailer and lashings if applicable.

b. **Moving off -** Release the park brake. DO NOT move off if the park brake warning light remains illuminated.

c. **Whilst Moving Slowly -** Allow the MRV to move forward slowly and check that the foot brake operates. Check that the steering is free and responsive without any undue slack or sponginess.

**Halt Parade Service**

3.13. A Halt Parade Service must be carried out after each four hours of continuous operation. The service may be made at shorter intervals during scheduled stops. Check the following:

a. The security of the casualty or trailer if attached.

b. The engine oil level.

c. The fuel level.

d. The tyres for damage/ clogged treads/overheating.

e. Test all lights (prior to night operation).

f. Security of stowed items.

g. Fuel oil, or coolant leaks.
WARNING

Do not remove the coolant expansion tank filler cap while the engine is hot. The cooling system is pressurised and sudden release of pressure may cause boiling coolant to be ejected. If the engine has overheated and steam is escaping from the coolant expansion tank, allow the engine to cool before adding more water to the coolant expansion tank. When the engine is quite cool, the filler cap can be removed. Place a thick cloth over the cap and slowly unscrew it until a sudden drop in resistance is felt. At this point, if the engine and coolant is still hot, vapour will be heard escaping. Only when this ceases should the cap be fully removed.

h. The coolant expansion tank water level.

Last Parade Service

3.14. At the end of each day of operation the driver must:

a. Fill the fuel tank.

b. Check the coolant expansion tank water level.

NOTE

The engine oil level can be checked either hot or cold. For the most accurate reading, check the oil level at least three minutes after stopping the engine at operating temperature, and with the MRV on level ground.

c. Check the engine oil level.

d. If operating under very dusty conditions, service the air cleaner.

e. If the MRV has been subject to deep water crossings during daily exercise, the oil in the reduction hub housings, the front, intermediate and rear axles, the transmissions and the power divider should be checked for water contamination. If any traces are found, the oil should be drained and replenished with the correct type as soon as possible.
CAUTION
Do not use excessive pressure on the cooling fins when cleaning radiators with compressed air or water; damage to the cooling fins could occur.

f. Check the engine radiator, inter-cooler, transmission oil cooler, air conditioner condenser and hydraulic oil cooler cores for insects, mud, foliage, rubbish or any other material which may cause obstruction to normal air flow. Clear with a water spray or compressed air if required.

g. Check the condition of the hydraulic oil filters, replace as required.

h. Ensure that the MRV is correctly parked with the park brake engaged, the transmission in neutral and the fwd/rev selector in the fwd position.

i. Ensure that the MRV is left in a clean condition.

j. Report any servicing due.

k. Report any malfunctions and/or damage.

l. Ensure that the windows are closed and the MRV cabin and equipment bins are locked.

Opening the Bonnet and Grille for Servicing Access

NOTE
After closing the bonnet check that the bonnet latches are locked by attempting to lift the bonnet.

3.15. Access to the engine compartment is gained by unlocking the bonnet catches at the left hand and right hand sides of the hood. A climbing step is provided underneath the left hand headlight. When the bonnet has been raised, it is to be held in the open position by the bonnet support. The front grille can be removed after unlocking the catches at the left hand side and right hand side of the grille.
Operator Check Procedures

Cooling System

**WARNING**

Do not remove the coolant expansion tank filler cap while the engine is hot. The cooling system is pressurised and sudden release of pressure may cause boiling coolant to be ejected. When the engine is quite cool, the filler cap can be removed.

![Coolant Expansion Tank](image)

Figure 3-1 Expansion Tank

3.16. **Coolant Expansion Tank Coolant Level Check.** Normal cooling system replenishment is via the coolant expansion tank (Fig 3-1). The tank is mounted on top of the engine rocker cover beside the engine oil filler cap. The expansion tank coolant level must be checked at the beginning of each day and at intervals during the day.

a. **Fill Procedure - Cold Engine.** Remove the coolant expansion tank cap and add the coolant mixture until the level reaches the FULL mark on the side of the tank. Replace the tank cap securely.

b. **Fill Procedure - Warm Engine.** Place a thick cloth over the cap and slowly unscrew it until a sudden drop in resistance is felt. At this point, if the engine and coolant is still hot, vapour will be heard escaping. **Only when the vapour ceases to escape should the cap be fully removed.** Remove the coolant expansion tank cap and add the
coolant mixture until the level reaches the FULL mark on the side of the tank. Replace the tank cap securely.

3.17. Radiator Core and Hoses. The radiator core, radiator and heater hoses should be checked daily and any leaks reported. If the water level falls at an abnormal rate between checks, the fault must be reported. Leaves, insect bodies and other debris must be removed from the radiator cores.

![Engine Oil Filler](image)

Figure 3-2 Engine Dipstick and Filler

3.18. Engine Oil Level Check. The engine oil level must be checked at the start and the finish of each day of operation and at the Halt Parade Service. The engine oil dipstick (Fig 3-2) is located on the right hand side of the engine. Check the engine oil level as follows:

a. Park the MRV on level ground, stop the engine and wait for at least three minutes.

b. Remove the dipstick and wipe it with a clean cloth.

c. Replace the dipstick ensuring that it is pushed fully home. Remove the dipstick and check the oil level. The oil level must be between the ADD and FULL marks on the dipstick.
When pouring engine oil into the filler (Fig 3-2), do not spill oil on the engine. Check for evidence of engine oil leaks and report any faults.

d. The engine oil filler cap (Fig 3-2) is located rearwards of the dipstick and is fitted with a dust cap. Top-up the engine oil if necessary, do not overfill. Refer to Section 3 for the list of lubricants and fluids.

Fuel System

3.19. **Fuel Tank Filler Cap.** The fuel tank filler cap is on the left hand side of the MRV, in the vicinity of the intermediate wheel. The area around the fuel tank filler cap must be kept clean. Use only the correct grade of diesel fuel. Ensure that the filler cap is fitted securely after refuelling. Clean off any spilt fuel from the tank.

![Figure 3-3 Fuel Lift Pump and Pre-Filter](image)

NOTE

The pre-filter (Fig 3-3) should be checked when carrying out inspection or maintenance on the fuel system.
3.20. **Fuel Lift Pump and Pre-Filter.** The fuel lift pump, fitted with a hand priming pump (Fig 3-3) is bolted to the side of the fuel injection pump. The lift pump and injection pump are located on the right-hand side of the engine. The lift pump pre-filter is located directly above the lift pump.

3.21. **Fuel Filter and Priming Pump.** The fuel filter assembly (Fig 3-3) is located on the right-hand side of the engine above the fuel injection pump. The fuel filter assembly is bolted to a support bracket on the engine block. An additional hand operated priming pump for the fuel system is fitted next to the fuel filter. The priming pump has the same function as the priming pump fitted to the fuel lift pump.

**Priming the Fuel System**

3.22. The fuel system is self bleeding, however it must be primed to expel air that may have entered during routine maintenance or repairs to the fuel system that involved a break in the fuel system circuit, or if an airlock has occurred in the fuel system for any other reason. Prime the fuel system as follows:

**NOTE**

Ensure the fuel tank has sufficient fuel.

a. Raise and secure the bonnet.

**NOTE**

If access to the priming pump on the lift pump is difficult use the priming pump at the fuel filter.

b. Unscrew and release the priming pump handle on the lift pump.

c. Pump the priming pump until the overflow valve inside the injection pump opens (at this point a rattling noise will be heard).

d. Continue pumping for a few more strokes to ensure all the air is cleared.

e. Fully depress the priming pump handle and screw it clockwise to lock it in the depressed position.

f. Start and run the engine for a brief period checking for any leaks (report any leaks).
g. Lower and secure the bonnet.

3.23. **Air Cleaner.** The air cleaner (Fig 3-4) is mounted above the front right-hand wheel in the upper right-hand side engine compartment. A two piece flexible hose with a mid-mounted aluminium tube insert connects the outlet of the air cleaner to the turbocharger inlet on the left-hand side of the engine. A dust ejection valve is located on the lower front of the air cleaner housing.

![Air Cleaner Diagram](image)

**Figure 3-4 Air Cleaner**

3.24. The air cleaner will require cleaning or replacement when the indicator light on the dash panel illuminates. To clean or replace the air cleaner element, proceed as follows:

a. Remove the bonnet and the grille.

b. Release the clips securing the air cleaner base to the air cleaner housing and remove the base.

c. Remove the wing nut and washer securing the filter element to the head of the filter housing, then remove the element.

d. Wipe out the air cleaner housing with a clean damp cloth. Remove and clean the dust valve.

e. Clean or discard the element. If the element is to be cleaned, use compressed air to blow from inside to outside of element.
f. Install the dust ejection valve on the air cleaner housing.
g. Install the air cleaner element and secure with the wing nut and washer.
h. Install the air cleaner base, aligning the arrows and secure with the four clips.
i. Start the engine and check the air cleaner indicator light on the dash panel extinguishes, rectify as required.
j. Replace the grille and the bonnet.

Steering Hydraulic Reservoir

**WARNING**

*Beware of the rotating cooling fan behind the radiator when checking the power steering fluid level.*

3.25. The steering system hydraulic fluid reservoir with filter is mounted above the front left-hand wheel in the engine compartment. The reservoir is to be filled with oil (OX-47 Grade 10) to the prescribed mark on the dipstick. The power steering fluid level is checked with the engine running.

Clutch Reservoir

3.26. The clutch reservoir is located on the firewall in the engine compartment behind the air cleaner. To check the level remove the reservoir cap and ensure that the fluid level is between the maximum and minimum levels marked on the reservoir. If required, top up with clean brake fluid (OX (Aust) 8).
Brake System

3.27. **Brake Master Cylinders.** Dual hydraulic brake system master cylinders are mounted on the MRV chassis immediately forward of the left hand intermediate wheel. Check the fluid in the brake reservoirs against the maximum and minimum levels marked on each of the reservoirs. To remove the reservoir cap, unscrew the small cap securing the wiring harness, lift the harness plug from the terminals then remove the reservoir cap. Top up with clean brake fluid (OX (Aust) 8) (Fig 3-5).

![Brake Master Cylinder Reservoir](image)

**Figure 3-5 Brake Master Cylinders**

Wheels

3.28. The spare wheel is mounted on top of the main boom, at the rear of the MRV. The spare tyre pressure is to be checked daily.

Accessories

3.29. The windscreen washer reservoir is located at the front right-hand side of the engine compartment.

3.30. **Drive Belts (Fig 3-6).** The alternator, coolant pump, cooling fan, air compressor, air conditioner compressor and power steering pump drive belt tensions must be checked monthly or when indications in the electrical, cooling, braking or steering systems suggest that they may be incorrect. Check the tension of new drive belts after the first hour of operation and adjust if necessary. Medium thumb pressure exerted in the middle of the longest run of the belt should give a deflection of about
5 mm to 10 mm (Fig 3-7) depending upon belt length. If the belt is incorrectly tensioned, the fault must be rectified.

1. Air conditioner drive belt  
2. Intermediate drive belt  
3. Cooling fan drive belt  
4. Alternator drive belt  
5. Steering pump drive belt  
6. Air compressor drive belt

Figure 3-6 Drive Belts

Figure 3-7 Drive Belt Adjustment

Main Transmission

3.31. Driver maintenance of the transmission is restricted to checking for leaks at drive shaft and shift seals. Any faults must be reported.
Splitter Box

3.32. Driver maintenance of the splitter box is restricted to checking for leaks at the drive shaft.

Drive Lines and Axles

3.33. The drive shafts and front, intermediate and rear axles require no maintenance by the driver. Vibration, noise, oil leaks or other faults in the drivelines and axles must be reported.

Compressed Air Tanks

3.34. Operate the drain valves on all air tanks and check if water condensation flows out. If water condensation is expelled the dehumidifier element must be replaced.
SECTION 2
PERIODIC SERVICING

Introduction

3.35. Periodic servicing must be carried out in accordance with EMEI Vehicle A 029, EMEI Vehicle D 399, and as detailed in this section. If servicing cannot be performed when it is due, the fact is to be reported immediately.

3.36. This section lists all the periodic maintenance procedures that must be performed on the MRV, and specifies the frequency at which they are to be carried out.

Lubricants and Fluids

3.37. Lubricants and fluids required for servicing the MRV are listed in Section 3, however, refer to EMEI Vehicle D 399 for the approved list of lubricants.

Periodic Servicing - Cab/Chassis

Introduction

3.38. The driver/operator is responsible for carrying out the daily, weekly, fortnightly and monthly servicing tasks on the cab/chassis of the MRV: All other servicing tasks are to be carried out by a vehicle mechanic (or where applicable an accredited refrigeration mechanic), unless otherwise specified. The driver/operator is to check the periodic and distance servicing lists and to report each servicing as it becomes due.

3.39. Cab/chassis servicing is to be carried out at the following intervals:

a. **Daily Tasks.** Daily tasks are listed in Table 3-1.

b. **Weekly Tasks - Air Conditioning System.** The servicing tasks that are to be carried out weekly are listed in Table 3-2.

c. **Fortnightly Tasks.** The servicing tasks that are to be carried out fortnightly are listed in Table 3-3.

d. **Monthly Tasks.** The servicing tasks that are to be carried out monthly are listed in Table 3-4.
e. **Minor Service**. A minor service is to be carried out every 12 months or 10,000 km of operation after a major service, whichever occurs first. Refer to EMEI Vehicle D 399.

f. **Major Service**. A major service is to be carried out every 24 months or 20,000 km of operation after the last minor service, whichever occurs first. Refer to EMEI Vehicle D 399.

g. **Alternate Major Service**. An alternate major service is to be carried out every 48 months or 40,000 km of operation after the last major service. Refer to EMEI Vehicle D 399.

**Special Requirements**

3.40. During the early life of a vehicle the working parts settle down, with the result that various clearances and adjustments need to be corrected. Operators should report problems for rectification at the earliest opportunity.

3.41. The Initial Service for the cab/chassis is to be performed by an authorised Mercedes Benz Agency/Dealer. The service will include all servicing and repair rectification action required, and will be accompanied by an Inspection Report to be handed to the Owner Unit.

3.42. The MRV is to be inspected by a qualified tradesperson prior to the expiry date of the warranty.
Table 3-1 Daily Tasks - Cab/Chassis

The following operations are to be carried out by the driver/operator:

1. Check the fuel supply (refuel if necessary).
2. Check the engine oil level (top up if required).
3. Check the fuel filter pre-filter for contamination (replace if necessary).
4. Check the coolant level in radiator expansion tank (top up if required).
5. Check the operation of the windshield wipers/washers, and the washer reservoir water level (top up if necessary).
6. Check the viscous clutch on the cooling fan by rotating it to ensure residual drag is present.
7. Check the operation of all gauges and warning lights, report any defects.
8. Check tyres and wheels. Inflate tyres if necessary. Inspect wheel nuts, CTIS hub fittings, hub caps, split rim C-clips and safety pins for security and condition.
9. Check the operation of the steering.
10. Check the operation of the footbrake, parking brake and clutch.
11. Check the operation of all lights and report any defects.
12. Check the operation of the horn.
13. Check for fuel, lubricant and coolant contamination if the vehicle has been subject to deep water crossings during daily operation.
14. Check the fluid level in the clutch and both brake master cylinder reservoirs (top-up if required).
15. Check the engine radiator, transmission oil cooler and inter-cooler cores for any material that may cause obstruction to normal air flow (clean if required).
16. Check the cab fire extinguisher is fully charged and correctly stowed.
17. Check all cabin and body fittings, seats and seat belts, windscreen, driving mirrors, door windows, hinges, catches and latches and stowed items for operation and security.
18. Check light lenses, driving mirrors and windows for cleanliness.

19. Check the operation of the air conditioner and heater; inspect the return air filter (replace/clean as necessary).

20. Inspect the vehicle for any damage, fuel, lubricant and coolant leaks and loose or missing parts.

21. Report any malfunctions and/or damage and any servicing due.

22. Ensure that the vehicle is left in a clean condition, correctly parked with the park brake engaged, the transmission in neutral and the fwd/rev selector in the fwd position.

Table 3-2 Weekly Task - Air Conditioning System

The following operation is to be carried out weekly by the driver/operator:

1. Run the air conditioning system for a minimum period of five (5) minutes.

Table 3-3 Fortnightly Tasks - Cab/Chassis

The following operations are to be carried out by the driver/operator:

1. The fortnightly servicing includes all of the operations listed in the daily and weekly tasks (refer to Tables 3-1 and 3-2) and the following operations:

2. Check the electrolyte level in both batteries, top-up if necessary. Examine the battery terminals for cleanliness, security, and that they are lubricated. Check for leaks and security, clean outside of batteries if required.
Table 3-4 Monthly Tasks - Cab/Chassis

The following operations are to be carried out by the driver/operator:

1. The monthly servicing tasks include all of the operations listed in daily, weekly and fortnightly tasks (refer to Tables 3-1, 3-2 and 3-3) and the following operations.

2. Check the engine air filter, clean according to the indicator: replace the filter after five cleanings: replace the filter if it has any holes in it.

3. Check the cooling fan viscous coupling control spring. Clean if required.

4. Check the compressed air system for correct function and leaks. Open the drain valves on air tanks. If condensation discharges at the drain valves replace the dehumidifier element.

5. Check the front suspension and steering linkage for damage or wear.

6. Check the condition of the front winch rope guide tube and report any defects.

7. Inspect the externally mounted fire extinguisher mounts for security. Tighten if required.

8. Lubricate the front rope window guide rollers.

9. Lubricate the rear recovery platform to chassis mounting pin.

10. Check the operation of all lights and report any defects.

11. Check the condition of the tyres; retorque the wheel nuts.
Periodic Servicing - Recovery Unit

Introduction

3.43. The driver/operator is responsible for

a. Carrying out the daily, and monthly servicing and tasks in the minor and major services to the recovery unit as indicated.

b. Carrying out the daily and monthly inspections on the recovery unit.

c. Checking the periodic servicing list for the recovery unit and reporting each service as it becomes due.

3.44. Recovery unit servicing is to be carried out at the following intervals:

a. **Daily Tasks.** Daily tasks are listed in Table 3-5 and are carried out to ensure the recovery unit is fit for operation.

b. **Monthly Tasks.** Tasks to be performed monthly are listed in Table 3-6 and are carried out to ensure the recovery unit is in a serviceable condition.

c. **Minor Service.** A minor service is to be carried out every 12 months or 10,000 km of vehicle operation after the last major service, whichever occurs first. Refer to EMEI Vehicle D 399.

d. **Major Service.** A major service is to be carried out every 24 months or 20,000 km of vehicle operation after last major service, whichever occurs first. Refer to EMEI Vehicle D 399.

e. **Alternate Major Service.** An alternate major service is to be carried out every 48 months or 40,000 km of operation after the last major service. Refer to EMEI Vehicle D 399.

Special Requirements

3.45. During the early life of the recovery unit the working parts settle down, with the result that various clearances and adjustments need to be corrected. Operators should report problems for rectification at the earliest opportunity.
Table 3-5 Daily Tasks - Recovery Unit

The following operations are to be carried out daily by the driver/operator:

1. Check for any visible damage of towing unit and lifting equipment. Repair or replace any defective parts.
2. Check for oil leaks. Tighten connections and repair any defective parts.
3. Check the oil level in the hydraulic tank (top up if required).
4. Lubricate the folding boom pivot pin (2 nipples), the T-bar pivot pin (1 nipple) and the T-bar yoke (1 nipple).
5. Lubricate the main boom lock pins and the extension boom lock pin (3 nipples).
6. Lubricate the rear sheaves and fairleads (4 nipples).
7. Check the condition and security of the fire extinguishers stowed at the front of the recovery platform (2).

Table 3-6 Monthly Tasks - Recovery Unit

The following operations are to be performed by the driver/operator:

1. Carry out daily servicing tasks. Refer to Table 3-5.
2. Lubricate all fittings as per the lubrication guide. Refer to Section 3.
3. Check for loose bolts, pipes or hose clamps, etc. Tighten if required.
4. Clean/inspect the main boom cylinder rod wipers.
5. Clean/lubricate the quadrant slides and locking pin mounting holes.
6. Clean/oil the upper ball joint on the winch flat rating device.
7. Inspect the rope guide wear inserts, replace if required.
8. Remove and inspect the T-bar yoke for cracks and excessive wear.
9. Clean/lubricate the directional control valve cable clevis pins.
10. Clean/inspect the towbar mounting clamps, screws, and towbar stop blocks.
11. Pull out the winch ropes. Inspect for broken wires, kinks and other damage. Clean off any rust or mud and lubricate the ropes. Rewind each winch rope. Refer to Chapter 2, Section 2
12. Clean/inspect front, second, main and rear subframe structure mountings to cab/chassis
13. Clean/lubricate cabinet door locks and hinges.
Periodic Servicing - Crane

Introduction

3.46. The driver/operator is responsible for carrying out the daily, weekly, monthly servicing and tasks in the minor and major services as indicated. All other tasks are to be carried out by a qualified mechanic. The driver/operator is to check the periodic servicing list and report each servicing as it becomes due. Crane servicing is to be carried out at the following intervals:

a. **Daily Tasks.** Daily tasks are listed in Table 3-7 and are carried out to ensure the crane is fit for operation.

b. **Weekly Tasks.** Tasks that are to be performed weekly are listed in Table 3-8 and are carried out to ensure the crane is in a serviceable condition.

c. **Monthly Tasks.** Tasks that are to be performed monthly are listed in Table 3-9 and are carried out to ensure the crane is in a serviceable condition.

d. **Minor Service.** A minor service is to be carried out every 12 months of vehicle operation. Refer to EMEI Vehicle D 399.

e. **Major Service.** A major service is to be carried out every 24 months of vehicle operation. Refer to EMEI Vehicle D 399.

f. **Alternate Major Service.** An alternate major service is to be carried out every 48 months or 40,000 km of operation after the last major service. Refer to EMEI Vehicle D 399.

Special Requirements

3.47. During the early life of the crane the working parts settle down, with the result that various clearances and adjustments need to be corrected. Operators should report problems for rectification at the earliest opportunity.
Table 3-7 Daily Tasks - Crane

The following operations are to be carried out daily by the driver/operator:

1. Check the hydraulic oil level (top up if required).
2. Inspect for oil leaks at hose and pipe connections and tighten if required.
3. Check load carrying parts such as hooks, hook attachments, chains, pulleys, swivels, lines, clips, cables, and other tools used for lifting are in a serviceable condition.
4. Check that the crane controls automatically go back to neutral when released.
5. Check that the crane has suffered no other damage which could affect its safe operation.

Table 3-8 Weekly Tasks - Crane

The following operations are to be carried out weekly by the driver/operator:

1. Lubricate the stabiliser ram leg end.
2. Check for hydraulic leaks and report if any.
3. Check the hydraulic oil level, top up if required.
4. Lubricate the control levers.
Table 3-9 Monthly Tasks - Crane

The following operations are to be carried out monthly by the driver/operator:

1. Lubricate the stabiliser ram leg end.
2. Lubricate the support column.
3. Lubricate the slewing rack.
4. Lubricate the main boom pivot.
5. Lubricate the main and outer boom cylinder and link pivots.
6. Lubricate the outer boom pivot.
7. Lubricate the boom extension cylinder guide parts.
8. Lubricate the boom extension guide blocks.
9. Inspect and lubricate the cargo hook and shackle.
10. Lubricate the control levers.
11. Check the hydraulic oil reservoir level (top up if required).
12. Check pipelines and hoses for chafing, leaks and security of connections.
13. Operate the crane and inspect for leaks, correct operation, and serviceability of hoses.
SECTION 3
LUBRICATION

Introduction

3.50. This section details the lubricants and fluids required for servicing and illustrates the location of various lubrication and oil drainage/refill points around the MRV.

3.51. Parade and periodic servicing must be carried out in accordance with EMEI Vehicle A 029, EMEI Vehicle D 399, and as detailed in Sections 1 and 2 of this Chapter. If servicing cannot be performed when it is due, the fact is to reported immediately.

Lubricants and Fluids

3.52. Lubricants and fluids required for servicing the recovery vehicle are listed in Table 3-10 however, refer to EMEI Vehicle D 399 for the approved list of lubricants.
<table>
<thead>
<tr>
<th>Item</th>
<th>Location</th>
<th>Lubricant</th>
<th>Capacity (litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Engine (incl filter)</td>
<td>OMD-115</td>
<td>14.5</td>
</tr>
<tr>
<td>2.</td>
<td>Transmission</td>
<td>Castrol Syntrans 75W/85</td>
<td>12</td>
</tr>
<tr>
<td>3.</td>
<td>Splitter Box</td>
<td>Castrol Syntrans 75W/85</td>
<td>2.8</td>
</tr>
<tr>
<td>4.</td>
<td>Front, intermediate and rear differentials</td>
<td>OEP-220</td>
<td>2.5</td>
</tr>
<tr>
<td>5.</td>
<td>Front, intermediate and rear wheel hubs</td>
<td>OEP-220</td>
<td>0.6</td>
</tr>
<tr>
<td>6.</td>
<td>Power Divider</td>
<td>OEP-220</td>
<td>3.5</td>
</tr>
<tr>
<td>7.</td>
<td>Power steering system</td>
<td>OX-47 Grade 10</td>
<td>3.2</td>
</tr>
<tr>
<td>8.</td>
<td>Brake system</td>
<td>OX(AUST)-8</td>
<td>1.0</td>
</tr>
<tr>
<td>9.</td>
<td>Clutch system</td>
<td>OX(AUST)-8</td>
<td>0.2</td>
</tr>
<tr>
<td>10.</td>
<td>Cooling system</td>
<td>50/50 water and inhibitor mix: Castrol Anti-Freeze DB, or BP Coolant 007/400F</td>
<td>20</td>
</tr>
<tr>
<td>11.</td>
<td>Fuel tank</td>
<td>Automotive Distillate</td>
<td>302</td>
</tr>
<tr>
<td>12.</td>
<td>Battery terminals</td>
<td>PX-7</td>
<td>As req</td>
</tr>
<tr>
<td>13.</td>
<td>Windscreen washer reservoir</td>
<td>Water</td>
<td>9.0</td>
</tr>
<tr>
<td>14.</td>
<td>Grease nipples</td>
<td>Shell Retinax LX2</td>
<td>As req</td>
</tr>
<tr>
<td>15.</td>
<td>Recovery system hydraulic oil</td>
<td>Tellus 68 (5°C – 42°C) max oil temp 80°C OR: OM 33 (-6°C – 25°C) max oil temp 60°C</td>
<td>135</td>
</tr>
<tr>
<td>16.</td>
<td>Winch ropes</td>
<td>Grease – Wire Rope Lubricant</td>
<td>As req</td>
</tr>
</tbody>
</table>
Service and Lubrication Points - Cab/Chassis (Fig 3-8)

3.53. The servicing points pertaining to the cab/chassis are as follows:

a. Coolant expansion tank;
b. Coolant pump/alternator drive belt;
c. Fan drive belt;
d. Steering pump drive belt;
e. Air compressor drive belt;
f. Engine oil filler cap;
g. Batteries;
h. Steering system reservoir;
i. Main transmission level and filler plug;
j. Power take-off;
k. Splitter box level and drain plugs;
l. Brake master cylinders;
m. Steering linkage lubrication points;
o. Inter-axle differential (power divider) drain and filler plugs;
p. Intermediate and rear differential level and drain plugs;
q. Intermediate and rear wheel hub drive level and drain plugs;
r. Front differential level and drain plugs;
s. Front wheel hub drive level and filler plugs;
t. Inter-axle to rear differential drive shaft universal joints;
u. Windscreen washer reservoir;
w. Engine dipstick;
x. Engine oil filter;
y. Engine throttle linkage lubrication;
z. Compressed air reservoirs;
aa. Dehumidifier element;
ab. Engine brake linkage lubrication; and
ac. Fire extinguishers.

Figure 3-8 Service and Lubrication Points - Cab/Chassis
3.54. **Engine Oil Level Check.** The engine oil level must be checked at the start and the finish of each day of operation and at the Halt Parade Service. The engine oil dipstick (Fig 3-9) is located on the right hand side of the engine. Check the engine oil level as follows:

a. Park the vehicle on level ground, stop the engine and wait for at least three minutes.

b. Remove the dipstick and wipe it with a clean cloth.

c. Replace the dipstick ensuring that it is pushed fully home. Remove the dipstick and check the oil level. The oil level must be between the ADD and FULL marks on the dipstick.

**NOTE**

When pouring engine oil into the filler (Fig 3-9), do not spill oil on the engine.

d. The engine oil filler cap (Fig 3-9) is located rearwards of the dipstick. Top-up the engine oil if necessary; do not overfill. Refer to Table 3-1 for approved lubricants.

![Figure 3-9 Engine Dipstick and Filler](image-url)
Engine Oil and Filter Change Procedure

NOTE

The engine oil filter (Fig 3-10) is located at the lower right hand side of the engine.

3.55. Run the engine until the engine coolant reaches normal operating temperature then shut down the engine. Remove the sump plug and drain all the engine oil. Discard the oil and the sealing washer from the sump plug. Clean off any dirt and metal particles adhering to the sump plug. Fit a new sealing washer on the drain plug and install the drain plug. Torque the drain plug to 80-90 Nm.

3.56. Remove the oil filter bowl drain plug and drain all oil from the assembly into a suitable container. Discard the drain plug sealing washer and the oil. Remove the retaining bolt securing the oil filter bowl to the filter head. Discard the sealing washer on the bolt and remove the oil filter bowl and the filter element from the filter head. Discard the filter element.

3.57. Remove and discard the O-ring from the groove in the filter head. Clean and inspect the oil filter head and the oil filter bowl for cracks. Replace the filter bowl if it is damaged.

NOTE

Ensure that the oil filter bowl O-ring is not twisted in the filter head groove.

3.58. Lightly lubricate the new O-ring with clean engine oil and fit the O-ring into the groove in the oil filter head. Insert a new filter element into the oil filter bowl and position the filter bowl against the O-ring in the filter head. Fit a new sealing washer to the filter bowl retaining bolt. Install the bolt and torque the retaining bolt to 40 - 45 Nm.

3.59. Fit the filter bowl drain plug with a new sealing washer and install the plug. Torque the drain plug to 17 Nm.

3.60. Fill the engine with the correct quantity of the recommended lubricant. Do not overfill. Check the level on the dipstick, then run the engine at low idle speed for a brief period to allow the engine oil pressure to build up to operating pressure and check for oil leaks around the filter head area. Stop the engine and check the oil level on the dipstick, top-up if required.
3.61. **Splitter Transmission.** The splitter transmission oil filler/level plug is located at the upper left of the rear of the splitter box transmission housing and the drain plug on the bottom of the housing (Fig 3-11). The splitter transmission is vented via the common ventilation filter. Fill the splitter transmission with the recommended lubricant to the bottom of the filler/level hole. Tighten the filler plug securely.

3.62. **Main Transmission Group.** A common oil filler/level plug (for the main transmission, transfer case and working gear group) is located at the upper centre of the rear of the housing (Fig 3-12). The transmission is
vented via the common ventilation filter. Fill the transmission with the recommended lubricant to the bottom of the filler/level hole. Tighten the filler plug securely.

![Transmission Filler/Level Plug](image)

**Figure 3-12 Transmission Filler/Level Plug**

**3.63.** The main transmission group has three oil drain plugs, all of which must be removed to completely drain the oil. The drain plug for the main transmission is located on the bottom right hand side of the transmission housing. The transfer case drain plug is located on the front lower side of the transfer case housing right hand. The drain plug for the working gear group is located on the lower right hand side of the working gear group housing (Fig 3-13).

![Transmission Group Drain Plugs](image)

**Figure 3-13 Transmission Group Drain Plugs**
**Clutch Reservoir**

3.64. The clutch reservoir is located on the firewall in the engine compartment behind the air cleaner. To check the level remove the reservoir cap and ensure that the fluid level is up to the level marked on the reservoir. If required, top up with clean brake fluid (OX(Aust) 8).

**Power Divider and Axles**

3.65. **Power Divider.** The power divider oil filler/level plug is located halfway up the left-hand side of the power divider whilst the drain plug is located on the bottom of the housing (Fig 3-14). The power divider is vented via the common ventilation filter. Fill the power divider with the recommended lubricant to the bottom of the fill hole. Tighten the level/filler plug securely.

3.66. **Intermediate Axle.** The intermediate axle oil filler/level plug is located adjacent to the torque tube/drive shaft mounting and the drain plug is on the bottom of the differential housing (Fig 3-14). The intermediate axle is vented via the common ventilation filter. Fill the intermediate axle with the recommended lubricant to the bottom of the fill hole. Tighten the filler plug securely.

![Figure 3-14 Power Divider and Intermediate Axle Oil Filler/Level and Drain Plugs](image-url)
3.67. **Rear Axle.** The rear axle oil filler/level plug is located adjacent to the right hand axle housing and the drain plug on the bottom of the differential housing. (Fig 3-15). The rear axle is vented via the common ventilation filter. Fill the rear axle with the recommended lubricant to the bottom of the fill hole. Tighten the filler plug securely.

![Figure 3-15 Rear Axle Housing Oil Filler/Level and Drain Plug](image)

3.68. **Front Axle.** The front axle oil filler/level plug is located adjacent to the torque tube/drive shaft mounting and the drain plug is on the bottom of the differential housing (Fig 3-16). The front axle is vented via the common ventilation filter. Fill the front axle with the recommended lubricant to the bottom of the fill hole. Tighten the filler plug securely.

![Figure 3-16 Front Axle Housing Oil Filler/Level and Drain Plug](image)
3.69. **Propeller Shafts.** The propeller shaft connecting the rear axle to the interaxle drive is fitted with grease nipples at both universal joints.

3.70. **Reduction Hub Drives.** The wheel reduction hub drive housing oil filler/level plugs, are located just below the axle entry points (Figs 3-17 and 3-18). Fill the reduction hub drives with the recommended lubricant to the bottom of the fill hole. Tighten the filler plug securely.

Figure 3-17 Rear Axle Reduction Hub Drain and Filler/Level Plugs

Figure 3-18 Front Axle Reduction Hub Drain and Filler/Level Plugs
Steering System

3.71. **Steering Hydraulic Reservoir.** The steering system hydraulic fluid reservoir with filter is mounted above the front left-hand wheel in the engine compartment. Ensure the reservoir lid and vent hose plug are clean before removing. The oil level is checked by removing the vent hose plug which has a dipstick attached. The reservoir is filled by unscrewing the lid and adding oil (OX-47 Grade 10) to the prescribed mark on the dipstick (Fig 3-19). The reservoir is vented via the common ventilation filter.

![Figure 3-19 Steering Hydraulic Reservoir](image)

Brake System

3.72. **Brake Master Cylinders.** Dual hydraulic brake master cylinders (Fig 3-20) are mounted on the vehicle chassis immediately forward of the left hand intermediate wheel. Check the fluid in the brake reservoirs against the level marked on each reservoir. Top up with clean brake fluid (OX (Aust) 8) if required. To remove the reservoir cap first unscrew the smaller cap securing the wiring harness, disconnect the harness then remove the cap.

![Figure 3-20 Brake Master Cylinders](image)
Service and Lubrication Points - Recovery Unit (Fig 3-21)

3.73. The service and lubrication points pertaining to the recovery unit are as follows:

a. Hydraulic system;
b. Hydraulic tank filter;
c. Pipes and hoses;
d. Winch system oil filters;
e. Winch ropes;
f. Winch flat rating device and pressure rollers;
g. Main boom lifting cylinder upper and lower pins;
h. Main boom crosshead support pins;
i. Main boom and main boom side stay pivots;
j. Folding boom linkage, hinge pins and lock;
k. Extension boom cylinder pins and lock;
l. T-bar yoke and bearing;
m. Earth anchor legs: upper and lower pins;
n. Rope sheaves and deflector roller - front winching;
o. Recovery platform mounts; and
p. Cabinet door locks and hinges.

Figure 3-21 - Service and Lubrication Points - Recovery Unit
Service and Lubrication Points - Crane (Fig 3-22)

3.74. The service and lubrication points pertaining to the crane are as follows:

a. Crane hydraulic oil filter,
b. Control levers,
c. Crane base,
d. Support column and bearing,
e. Extension boom guide blocks,
f. Boom extension cylinder guide parts,
g. Cargo hook and shackle,
h. Stabiliser cylinders,
i. Slewing rack and cylinder mountings,
j. Main boom pivot, cylinder and link pivots,
k. Outer boom pivot, cylinder and link pivots,
l. Extension boom pivot,
m. Stabiliser leg pivots and leg ends, and
n. Hydraulic hoses and connections.
SECTION 4
FAULT FINDING

Introduction

3.75. When a fault occurs commence checking known failure modes or components that from operator experience point to the area at fault. Check the easy to get at items first (e.g. without raising the cab). After that, proceed to the more complex items. This method may save a considerable amount of time in the long term.

3.76. Before consulting the fault finding tables check the following items:
   a. Batteries fully charged.
   b. All electrical connections clean and tight.
   c. Starter motor in good condition.
   d. Correct fuel in the tank and the system primed.
   e. Lubricating oil at the correct level and not contaminated.
   f. No restrictions in the air intake system, and the air cleaner element not clogged.
   g. Engine coolant at correct level, water pump operating, belts correctly adjusted and radiator cores clean.
   h. All fuel line connections tight and not leaking.
   i. All gauges, indicating and warning lights operating.

Fault Finding Tables

3.77. The fault finding tables indicate some of the probable causes for the symptoms shown. The causes listed are common and as such, should be examined prior to major overhaul work. The following areas are covered in the fault finding tables.
   a. Engine (Refer to Table 3-11).
   b. Drive lines (Refer to Table 3-12).
   c. Steering, brakes and suspension (Refer to Table 3-13).
   d. Electrical (Refer to Table 3-14).
   e. Air conditioning (Refer to Table 3-15).
   f. Recovery unit hydraulics (Refer to Table 3-16).
   g. Crane (Refer to Table 3-17).
### Table 3-11 - Engine Faults and Probable Causes

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>PROBABLE CAUSES CODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check probable causes codes listed below against the code amplification list.</td>
<td></td>
</tr>
</tbody>
</table>

#### ENGINE WILL NOT START

- Fuel delivery normal
  - 1a, 1b, 5, 8, 10b, 11, 19, 1d
- Fuel delivery low or no fuel
  - 1b, 1c, 3, 4, 15

#### ENGINE STARTS, ERRATIC Firing ON ALL CYLINDERS

- Fuel delivery low
  - 1a, 1c, 2, 3, 4
- Adequate fuel delivery
- Erratic at idling speed only
  - 1b
- Erratic at idle and high speed
  - 1b, 5, 9, 15, 18, 20

#### ENGINE MISSING ON ONE OR MORE CYLINDERS

- Missing at idle speed only
  - 5, 8, 9, 10b, 18
- Missing at idle and high speed
  - 5, 6, 9, 15, 16, 18, 20, 21
- No exhaust smoke
  - 1a, 1c, 2, 3, 4, 8a, 9, 10, 15, 16
- Blow-by at crankcase breather
  - 17, 21

#### ENGINE STALLS FREQUENTLY

- Low or no fuel delivery
  - 1c, 2, 3, 4
- Fuel delivery adequate
- No exhaust smoke
  - 5, 6b, 10, 11
- Black exhaust smoke
  - 5, 9, 11, 14, 15

#### ENGINE SURGES ERRATICALLY

- Engine will not reach no load governed rpm
  - 1a, 2, 3, 5, 6a, 10, 11, 20

#### ENGINE OVERSPEEDS

- No exhaust smoke
  - 3, 5, 6, 9, 10a, 11a, 11c, 11d
- Black or brown exhaust smoke
  - 3, 5, 9, 14, 15, 16, 17, 18, 21, 14e
- Blue or white exhaust smoke
  - 14, 15, 16, 17, 21, 30

#### ENGINE OVERHEATS

- Fuel delivery normal
  - 1a, 1b, 1c, 1d, 2, 5, 8, 11, 16, 24, 25, 32
- Fuel delivery low or no fuel
  - 1a, 1b, 5, 8, 10b, 11, 16, 24, 25, 32

#### EXCESSIVE FUEL CONSUMPTION

- Fuel delivery normal
  - 6a, 10b, 11, 14d
- Fuel delivery low or no fuel
  - 5, 6a, 10, 11, 14a

#### CODE AMPLIFICATION LIST - ENGINE PROBABLE CAUSES

<table>
<thead>
<tr>
<th>FUEL SYSTEM</th>
<th>LUBRICATION SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Fuel shut-off valve closed, or partly closed.</td>
<td>12. Restriction in oil galleries or faulty gauge</td>
</tr>
<tr>
<td>1b. Air intake system blocked, or partly blocked.</td>
<td>13. Pressure relief valve stuck or faulty</td>
</tr>
<tr>
<td>1c. Fuel tank vent blocked, or partly blocked.</td>
<td>14. Turbocharger passing oil</td>
</tr>
<tr>
<td>1d. Injector pump stop lever sticking.</td>
<td>14b. Restriction or blockage in air intake line</td>
</tr>
<tr>
<td>2. Fuel pump inoperative or leaking.</td>
<td>14c. Low turbocharger r.p.m.</td>
</tr>
<tr>
<td>3a. Air leaks or restriction on suction side.</td>
<td>14d. Binding turbocharger impeller</td>
</tr>
<tr>
<td>3b. Fuel filters clogged.</td>
<td>14e. Intercooler or intercooler hoses leaking</td>
</tr>
<tr>
<td>4. Injection pump relief valve leaking, stuck open or closed.</td>
<td>15a. Incorrect valve clearance camshaft or lifters worn</td>
</tr>
<tr>
<td>5a. Injection pump relief valve leaking, stuck open or closed.</td>
<td>15b. Broken or weak valve springs</td>
</tr>
<tr>
<td>5c. Low turbocharger r.p.m.</td>
<td>15c. Worn or binding valve guides</td>
</tr>
<tr>
<td>6a. Incorrect setting of governor or high speed stop.</td>
<td>15d. Valves sticking or burnt, poor seat contact</td>
</tr>
<tr>
<td>6b. Incorrect setting of governor idle speed.</td>
<td>15a. Leaking cylinder head gasket</td>
</tr>
<tr>
<td>7. Fuel return line blocked or partly blocked.</td>
<td>16a. Leaking gaskets and seals</td>
</tr>
<tr>
<td>8. Delivery valve stuck or leaking.</td>
<td>16b. Delivery valve stuck or leaking.</td>
</tr>
<tr>
<td>9a. Faulty nozzle spray, leaking or opening pressure setting incorrect.</td>
<td>17a. Piston rings sticking or worn</td>
</tr>
<tr>
<td>9b. Nozzle cap nut improperly torqued.</td>
<td>17b. Piston rings broken or incorrectly fitted</td>
</tr>
<tr>
<td>9c. Nozzle valve(s) stuck.</td>
<td>18. Poor compression (see low compression)</td>
</tr>
<tr>
<td>9d. Bunt or broken spindle or pipe.</td>
<td>19. Blocked crankcase breather or pipe</td>
</tr>
<tr>
<td>9e. Nozzle incorrectly installed in cylinder head.</td>
<td>20. Blow-by</td>
</tr>
<tr>
<td>10a. Injection pump piston stuck.</td>
<td>22. Excessive clearance in main or connecting rod bearings</td>
</tr>
<tr>
<td>10b. Injection pump piston stuck.</td>
<td>23. Coolant leak into combustion chamber, cracked head gasket</td>
</tr>
<tr>
<td>10c. Injection pump piston stuck.</td>
<td>24. Alternator not charging</td>
</tr>
<tr>
<td>11a. Governor throttle shaft linkage binding, or sticking governor parts.</td>
<td>25. No air pressure</td>
</tr>
<tr>
<td>11c. Governor drive assembly binding</td>
<td>27. Viscous fan faulty</td>
</tr>
<tr>
<td>11d. Broken or weak timing springs</td>
<td>28. Thermostat faulty</td>
</tr>
<tr>
<td>12. Cooling pump belt broken or loose.</td>
<td>29. Coolant pump belt broken or loose</td>
</tr>
<tr>
<td>30. Coolant pump faulty.</td>
<td>31. Coolant level low</td>
</tr>
<tr>
<td>31. Cooling filler faulty.</td>
<td>32. Faulty relay</td>
</tr>
</tbody>
</table>

231/(232 blank)
### Table 3-12 - Drive Line Faults and Probable Causes

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>PROBABLE CAUSES CODES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLUTCH SYMPTOMS</strong></td>
<td></td>
</tr>
<tr>
<td>Clutch slipping under load</td>
<td>1</td>
</tr>
<tr>
<td>Clutch grabbing on engaging</td>
<td>1a, 1d, 1e</td>
</tr>
<tr>
<td>Clutch dragging during gear change</td>
<td>1b, 1e</td>
</tr>
<tr>
<td><strong>TRANSMISSION PROBLEMS</strong></td>
<td></td>
</tr>
<tr>
<td>Shift shift action</td>
<td>1a, 2a, 2b, 2c, 2d, 3, 7</td>
</tr>
<tr>
<td>Jumping out of gear</td>
<td>2a, 2d, 2e, 2f, 2g, 2h, 3, 2c, 2d, 2f</td>
</tr>
<tr>
<td>Noisy when driving</td>
<td>2b, 2c, 2h</td>
</tr>
<tr>
<td>Oil leaks</td>
<td>3</td>
</tr>
<tr>
<td><strong>NOISY PROPELLER SHAFTS</strong></td>
<td>4</td>
</tr>
<tr>
<td><strong>AXLE PROBLEMS</strong></td>
<td></td>
</tr>
<tr>
<td>Both sides won't drive</td>
<td>1a, 1b, 2b</td>
</tr>
<tr>
<td>Rear axle won't drive</td>
<td>2a, 4a, 4f, 4g, 6e, 5c</td>
</tr>
<tr>
<td>Front axle won't drive</td>
<td>3a, 4e, 4d, 6b, 6c</td>
</tr>
<tr>
<td>Differential lock inoperative</td>
<td>3d, 5e</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CODE AMPLIFICATION - DRIVE LINE PROBABLE CAUSES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLUTCH</strong></td>
<td>5</td>
</tr>
<tr>
<td>1a. Sticking actuating mechanism.</td>
<td>2a. Loose bolts on gear lever.</td>
</tr>
<tr>
<td>1b. Worn or damaged clutch plate.</td>
<td>2b. Gearstick damper faulty.</td>
</tr>
<tr>
<td>1c. Worn or damaged throw-out bearing.</td>
<td>3a. Loose housing covers or attachments.</td>
</tr>
<tr>
<td>1d. Clutch housing not firmly bolted to engine.</td>
<td>3b. Worn or damaged shift seals and gaskets.</td>
</tr>
<tr>
<td>1e. Warped or damaged pressure plate.</td>
<td>3c. Blocked or partly blocked breather line.</td>
</tr>
<tr>
<td>1f. Torsional vibration being transmitted by clutch.</td>
<td></td>
</tr>
<tr>
<td><strong>PROPELLER SHAFTS</strong></td>
<td></td>
</tr>
<tr>
<td>1g. Bell housing filled with oil.</td>
<td>4a. Damaged universal joints.</td>
</tr>
<tr>
<td>1h. Clutch hydraulics faulty.</td>
<td>4b. Worn or damaged torque ball assembly.</td>
</tr>
<tr>
<td><strong>MAIN TRANSMISSION</strong></td>
<td>4c. Unbalanced propeller shaft.</td>
</tr>
<tr>
<td>2a. Incorrect shift adjustment.</td>
<td>4d. Worn or damaged splines.</td>
</tr>
<tr>
<td>2b. Incorrect oil level.</td>
<td>4e. Power divider broken.</td>
</tr>
<tr>
<td>2c. Incorrect oil in transmission.</td>
<td>4f. Half shaft broken.</td>
</tr>
<tr>
<td>2d. Sticking shift fingers.</td>
<td></td>
</tr>
<tr>
<td><strong>AXLE ASSEMBLIES</strong></td>
<td></td>
</tr>
<tr>
<td>2e. Weak or broken detent springs.</td>
<td>5a. Parking brakes not releasing.</td>
</tr>
<tr>
<td>2f. Bent or broken shift forks.</td>
<td>5b. Damaged differential gears.</td>
</tr>
<tr>
<td>2g. Broken snap rings on gear shafts.</td>
<td>5c. Damaged hub drive gears.</td>
</tr>
<tr>
<td>2h. Worn or damaged bearings.</td>
<td>5d. Differential lock control malfunction.</td>
</tr>
<tr>
<td>2i. Sticking shift valve</td>
<td>5e. Diff lock gears broken.</td>
</tr>
</tbody>
</table>

### Table 3-13 - Steering, Brake and Suspension Faults and Probable Causes

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>PROBABLE CAUSES CODES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEERING</strong></td>
<td></td>
</tr>
<tr>
<td>Vehicle pulls to one side</td>
<td>1a, 1b, 1c</td>
</tr>
<tr>
<td>Wandering or weaving</td>
<td>1a, 1d, 1g, 1m</td>
</tr>
<tr>
<td>Not tracking straight</td>
<td>1a, 1f, 4</td>
</tr>
<tr>
<td>Hard steering</td>
<td>1a, 1f, 1o, 1p, 1q</td>
</tr>
<tr>
<td>Wheel vibration</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>1d, 1g, 1h, 1i, 4a, 5a, 5b, 5c</td>
</tr>
<tr>
<td>At speed</td>
<td>1a, 1h, 1i, 1l, 1m, 4a, 4b, 5b, 5c</td>
</tr>
<tr>
<td><strong>BRAKES</strong></td>
<td></td>
</tr>
<tr>
<td>No brakes</td>
<td>2a, 2b, 2h</td>
</tr>
<tr>
<td>Slow brake application</td>
<td>2a, 2c</td>
</tr>
<tr>
<td>Uneven braking</td>
<td>1a, 1c, 2c, 2h</td>
</tr>
<tr>
<td><strong>LOW AIR PRESSURE</strong></td>
<td>3</td>
</tr>
<tr>
<td><strong>SUSPENSION</strong></td>
<td></td>
</tr>
<tr>
<td>Bottoming out</td>
<td>1k, 4</td>
</tr>
<tr>
<td>Not tracking straight</td>
<td>1d, 1f, 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CODE AMPLIFICATION - STEERING, BRAKE AND SUSPENSION PROBABLE CAUSES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEERING</strong></td>
<td></td>
</tr>
<tr>
<td>1a. Unequal toe pressures.</td>
<td>2a. Lack of hydraulic fluid.</td>
</tr>
<tr>
<td>1b. Dragging brakes.</td>
<td>2b. Defective brake valve.</td>
</tr>
<tr>
<td>1c. Sticking parking brake.</td>
<td>2c. Crimped hydraulic lines.</td>
</tr>
<tr>
<td>1d. Incorrect wheel alignment.</td>
<td>2d. Faulty tow-dependent valve.</td>
</tr>
<tr>
<td>1e. Power boost inoperative.</td>
<td></td>
</tr>
<tr>
<td>1f. Twisted axle.</td>
<td>3a. System leaking badly.</td>
</tr>
<tr>
<td>1g. Loose king pin or bearing.</td>
<td>3b. Reservoir drain valve stuck open.</td>
</tr>
<tr>
<td>1h. Worn or damaged ball joints.</td>
<td>3c. Regulator incorrectly set.</td>
</tr>
<tr>
<td>1i. Loose steering arms.</td>
<td>3d. Governor incorrectly set.</td>
</tr>
<tr>
<td>1j. Unbalanced wheels.</td>
<td></td>
</tr>
<tr>
<td>1k. Faulty absorbers.</td>
<td>4a. Damaged or broken spring.</td>
</tr>
<tr>
<td>1l. Worn wheel bearings.</td>
<td>4b. Damaged or broken axle shaft.</td>
</tr>
<tr>
<td>1m. Steering box worn.</td>
<td>4c. Twisted chassis.</td>
</tr>
<tr>
<td>1n. Sticking shift valve.</td>
<td>4d. Torque rods damaged.</td>
</tr>
<tr>
<td>1o. Steering column universal seized.</td>
<td></td>
</tr>
<tr>
<td>1p. Drive belt loose or broken.</td>
<td>5a. Low brake pressure.</td>
</tr>
<tr>
<td>1q. No oil.</td>
<td>5b. Mud in brakes.</td>
</tr>
<tr>
<td>1r. Damaged tires.</td>
<td></td>
</tr>
</tbody>
</table>

233/(234 blank)
Table 3-14 - Electrical Faults and Probable Causes

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>PROBABLE CAUSES CODES</th>
<th>CODE AMPLIFICATION - ELECTRICAL PROBABLE CAUSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check probable cause codes listed below against the probable causes listed in code amplification list.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery not charging</td>
<td>1a, 1b, 1c, 1d, 1e, 1f</td>
<td>1a. Faulty alternator belt drive.</td>
</tr>
<tr>
<td>No power available</td>
<td>1g, 1h, 1i, 1j</td>
<td>1b. Faulty alternator.</td>
</tr>
<tr>
<td>Poor or flickering lights</td>
<td>1k, 1l, 1m, 1n</td>
<td>1c. Faulty rectifier.</td>
</tr>
<tr>
<td>Rapid battery discharge</td>
<td>1o, 1p, 1r</td>
<td>1d. Faulty regulator.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1e. Incorrect battery electrode level.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1f. Ignition switch left in ON position.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1g. Too many devices on at once.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1h. Faulty battery.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1i. Incorrect battery electrolyte level.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1j. Intermittent short or broken wire.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1k. Ignition switch not properly adjusted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1l. Faulty starter motor-short circuit.</td>
</tr>
</tbody>
</table>

Table 3-15 - Air Conditioning System Faults and Probable Causes

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>PROBABLE CAUSES CODES</th>
<th>CODE AMPLIFICATION - AIR CONDITIONING SYSTEM PROBABLE CAUSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check probable cause codes listed below against the probable causes listed in code amplification list.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System produces no cooling, compressor operative</td>
<td>1a to 1j</td>
<td>1a. System low on refrigerant.</td>
</tr>
<tr>
<td>System produces no cooling, compressor inoperative</td>
<td>2a to 2e</td>
<td>1b. System low on refrigerant.</td>
</tr>
<tr>
<td>System only partially cools</td>
<td>2f to 3a, 1a, 1b, 1c, 1d, 1e</td>
<td>1c. System low on refrigerant.</td>
</tr>
<tr>
<td>System code intermittently</td>
<td>4a to 4h, 4i</td>
<td>1d. System low on refrigerant.</td>
</tr>
<tr>
<td>System excessively noisy</td>
<td>5a to 5c, 5d, 5e, 5f, 5g, 5h, 5i</td>
<td>1e. System low on refrigerant.</td>
</tr>
<tr>
<td>Warm air being discharged from air conditioner</td>
<td>5j, 5k, 5l</td>
<td>1f. System low on refrigerant.</td>
</tr>
<tr>
<td>Insufficient air</td>
<td>6a, 6b, 6c, 6d</td>
<td>1g. System low on refrigerant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2a. System low on refrigerant.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2b. Complete loss of charge, LP switch open.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2c. Compressor clutch coil burnt out.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2d. Thermostat inactive due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2e. Thermostat adjusted too low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2f. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2g. thermostat adjusted too low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2h. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2i. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2j. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2k. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2l. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2m. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2n. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2o. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2p. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2q. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2r. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2s. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2t. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2u. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2v. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2w. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2x. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2y. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2z. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3a. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3b. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3c. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3d. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3e. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3f. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3g. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3h. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3i. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3j. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3k. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3l. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3m. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3n. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3o. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3p. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3q. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3r. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3s. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3t. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3u. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3v. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3w. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3x. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3y. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3z. Thermostat not functioning due to tripped circuit breaker.</td>
</tr>
</tbody>
</table>

235/236 blank
### Table 3-16 - Recovery Unit Hydraulics Faults and Probable Causes

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>PROBABLE CAUSES CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check probable causes codes listed below against the code amplification list</td>
<td></td>
</tr>
<tr>
<td>Hydraulic circuit maximum pressure low</td>
<td>1a, 1b, 4a</td>
</tr>
<tr>
<td>Switch is noisy</td>
<td>1a, 1b, 1d, 2a, 2c, 5c</td>
</tr>
<tr>
<td>Hydraulic system losing oil</td>
<td>3a, 3b</td>
</tr>
<tr>
<td>Hydraulically actuated function swaps under load</td>
<td>2a, 4b, 5c</td>
</tr>
<tr>
<td>Hydraulic function does not operate</td>
<td>1b, 1b, 2a, 3a, 4b, 4c, 4a, 4f</td>
</tr>
<tr>
<td>Winch will not pull in at correct capacity</td>
<td>1b, 1a, 4a, 4d, 5c, 5c, 5a, 5a</td>
</tr>
<tr>
<td>Winch will not wind out</td>
<td>4a, 5b, 5c</td>
</tr>
<tr>
<td>Hydraulic function is noisy when operated</td>
<td>1a, 1b, 2b, 3a, 4b, 5c, 5a, 5c, 5a</td>
</tr>
<tr>
<td>Filters clog rapidly</td>
<td>1a, 1b, 2b, 3a, 4a, 4b, 5b, 5a, 5c</td>
</tr>
</tbody>
</table>

### CODE AMPLIFICATION - CRANE FAULTS PROBABLE CAUSES

<table>
<thead>
<tr>
<th>PROBABLE CAUSES CODE</th>
<th>CODE AMPLIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Pump worn.</td>
<td>6b. Counterbalance valve unserviceable</td>
</tr>
<tr>
<td>1b. Pump damaged.</td>
<td>4c. Counterbalance valve incorrectly set</td>
</tr>
<tr>
<td>1c. Pump drive faulty.</td>
<td>4d. Sequence valve incorrectly set</td>
</tr>
<tr>
<td>1d. Pump running too fast.</td>
<td>4e. Winch torque control requires calibration</td>
</tr>
<tr>
<td>2a. Suction line ball valve not fully open.</td>
<td>4f. Hydraulic throttle valve incorrectly set or blocked</td>
</tr>
<tr>
<td>2b. Hydraulic oil level low.</td>
<td>5a. Cylinder seats worn or damaged</td>
</tr>
<tr>
<td>2c. Air in hydraulic system.</td>
<td>5b. Winch motor faulty</td>
</tr>
<tr>
<td>2d. Tank filler/breather faulty.</td>
<td>5c. Directional control valve or control cable faulty</td>
</tr>
<tr>
<td>2e. Incorrect oil viscosity.</td>
<td>5d. Hydraulic lines incorrectly connected</td>
</tr>
<tr>
<td>3a. Hydraulic connection leaking.</td>
<td>6a. Electrical fault</td>
</tr>
<tr>
<td>3b. Gauge hydraulic line fractured.</td>
<td>7a. Hydraulic oil unserviceable</td>
</tr>
<tr>
<td>4a. Main relief valve faulty.</td>
<td>8a. Mechanical fault</td>
</tr>
<tr>
<td>4b. Counterbalance valve unserviceable</td>
<td></td>
</tr>
<tr>
<td>4c. Counterbalance valve incorrectly set</td>
<td></td>
</tr>
<tr>
<td>4d. Sequence valve incorrectly set</td>
<td></td>
</tr>
<tr>
<td>4e. Winch torque control requires calibration</td>
<td></td>
</tr>
<tr>
<td>4f. Hydraulic throttle valve incorrectly set or blocked</td>
<td></td>
</tr>
<tr>
<td>5a. Cylinder seats worn or damaged</td>
<td></td>
</tr>
<tr>
<td>5b. Winch motor faulty</td>
<td></td>
</tr>
<tr>
<td>5c. Directional control valve or control cable faulty</td>
<td></td>
</tr>
<tr>
<td>5d. Hydraulic lines incorrectly connected</td>
<td></td>
</tr>
<tr>
<td>6a. Electrical fault</td>
<td></td>
</tr>
<tr>
<td>7a. Hydraulic oil unserviceable</td>
<td></td>
</tr>
<tr>
<td>8a. Mechanical fault</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3-17 - Crane System Faults and Probable Causes

<table>
<thead>
<tr>
<th>SYMPTOMS</th>
<th>PROBABLE CAUSES CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check probable causes codes listed below against the code amplification list</td>
<td></td>
</tr>
<tr>
<td>No oil flow or pressure.</td>
<td>1, 2, 9</td>
</tr>
<tr>
<td>Excessive oil pressure.</td>
<td>3, 9</td>
</tr>
<tr>
<td>No crane movements with control operation.</td>
<td>6, 15</td>
</tr>
<tr>
<td>Erratic crane movement.</td>
<td>4, 10</td>
</tr>
<tr>
<td>Oil pump noisy.</td>
<td>1, 4, 8, 11</td>
</tr>
<tr>
<td>Oil pressure.</td>
<td>1, 3, 5, 9, 13</td>
</tr>
<tr>
<td>Pump overheated.</td>
<td>1, 4, 12, 14</td>
</tr>
<tr>
<td>Erratic of pressure.</td>
<td>4, 5</td>
</tr>
<tr>
<td>Excessive of pressure.</td>
<td>9, 15</td>
</tr>
<tr>
<td>Low oil pressure.</td>
<td>1, 2, 6, 7</td>
</tr>
</tbody>
</table>

### CODE AMPLIFICATION - CRANE FAULTS PROBABLE CAUSES

<table>
<thead>
<tr>
<th>PROBABLE CAUSES CODE</th>
<th>CODE AMPLIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pump worn or damaged.</td>
<td>9. Oil viscosity too low.</td>
</tr>
<tr>
<td>2. Excessive oil leaks.</td>
<td>10. Lack of lubrication</td>
</tr>
<tr>
<td>5. Contaminated oil.</td>
<td>13. Oil pressure too high.</td>
</tr>
<tr>
<td>7. Low oil pressure.</td>
<td>15. Flow control valve faulty or incorrectly adjusted.</td>
</tr>
<tr>
<td>8. Oil viscosity too high.</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 4

WARRANTY

SECTION 1 - WARRANTY AND REPAIR
SECTION 1
WARRANTY AND REPAIR

Warranty Provisions

4.1. DaimlerChrysler Australia/Pacific Pty. Ltd. (The Contractor) warrants that all precautions, which are usual and reasonable, have been taken to ensure the quality of materials and workmanship in the U2450L Unimog.

4.2. Should any defect or fault develop within 48 months or 40000km, whichever occurs first, after acceptance of supplies by the Commonwealth and upon examination by the Contractor or one of their authorised distributors or dealers, such defect or fault be found to be due to defective material or workmanship, the contractor undertakes to repair or exchange or to have repaired or exchanged such defective or faulty part or parts free of charge. This warranty is given on condition that the vehicle is operated and maintained in accordance with the user handbook and relevant EMEI.

4.3. The foregoing warranty does not cover normal wear and tear resulting from regular usage nor does it cover defects or faults arising out of misuse, or neglect; and shall not apply to vehicles that have been altered without the Contractor’s approval.

4.4. The Contractor’s liability in all other circumstances shall, wherever permitted by law, be limited to the replacement of any defective or faulty part or parts or the payment of the cost of such repair or replacement as appropriate.

4.5. All claims against the foregoing warranty shall be made by presenting the vehicle, with the vehicle’s GM 120 and a contractor’s claim for warranty to the nearest authorised contractor’s representative or in accordance with the current instructions in respect of warranty administration between the Contractor and the Commonwealth.

Warranty Rights

4.6. The warranty coverage of 48 months or 40,000 kilometres, whichever occurs first, applies to the entire vehicle with the exception of tyres and tubes. Warranty service provided by DaimlerChrysler Australia/Pacific Pty Ltd will cover the total cost of the work performed, including labour and parts, to rectify any items of defective materials or workmanship within the warranty period.
4.7. Tyres and tubes are excluded from the DaimlerChrysler Australia/Pacific Pty Ltd warranty as they are warranted by the tyre manufacturer.

Special Provisions

4.8. The warranty will not apply where failure arises from:

a. The vehicle not being maintained in accordance with the User Handbook or EMEI manuals.

b. Incorrect tuning, adjustments or maintenance operations that are associated with periodic servicing operations.

c. The use of incorrect lubricants, oils or fuels.

d. EMEI storage procedures not being effectively applied.

e. Misuse or neglect of the vehicle.

f. A change to the vehicle specifications without the prior approval of DaimlerChrysler Australia/Pacific Pty Ltd.

g. The specified gross vehicle weight or gross combined weight being exceeded.

h. The fitting of non-genuine parts, and where it is mutually agreed as a contributing factor.

i. The use of equipment not normally or reasonably associated with the operation of supplies.

j. Supplies that have been altered in form or function without consultation with and approval of the Contractor.

k. Any part or parts from which the identification marks or numbers have been altered or removed by the Commonwealth.

l. Repairs which involved or resulted from either direct or indirect use of non-genuine parts.

m. Parts or equipment which have not been supplied by the Contractor or by a supplier approved by the Contractor and any problems which may arise, either directly or indirectly, from the fitment of such equipment.

n. The consequences of the supplies having been repaired by a non-approved repairer. For the purpose of this clause approved repairer shall include Army vehicle maintenance personnel.
4.9. Neither DaimlerChrysler Australia/Pacific Pty Ltd nor its authorized Dealers shall be responsible for any consequential loss suffered as a result of, or arising out of, or in connection with, any defective workmanship or materials.

4.10. DaimlerChrysler Australia/Pacific Pty Ltd reserve the right to inspect and test any parts considered defective, or inspect those items subject to environmental deterioration, prior to accepting a claim. This specifically applies to paint, soft trim or glass repairs/replacements.

4.11. Where a part is to be provided for a Vehicle at a greater distance than forty (40) kilometres from a representative of the Contractor, the part or parts shall be delivered to the designated unit or address nominated by the Project Authority. Installation of the part(s) shall be by the Contractor's nominated representative or if such representative is not available by Army tradespersons (after approval has been granted by the Contractor) at cost to the Contractor and at the Contractor's standard warranty repair time and prevailing warranty labour rate.

4.12. For further details on warranty conditions, refer to Electrical and Mechanical Engineering Instructions Vehicle A 119-24.

Application of Warranty

4.13. The application of the warranty will be by repair or replacement of the defective component at no cost to the Commonwealth.

4.14. Provision is made for warranty repairs to be carried out by DaimlerChrysler Australia/Pacific Pty Ltd authorized dealers.

4.15. However, if for reasons of distance, location etc., it is not practical to have the necessary repairs carried out by a DaimlerChrysler Australia/Pacific Pty Ltd authorized dealer, then an Army tradesperson is approved to carry out the repair. This procedure should be adopted in the case of emergency or essential repairs only (e.g. for safety, prevention of further damage or an operational requirement).

4.16. In such circumstances, DaimlerChrysler Australia/Pacific Pty Ltd will reimburse the Army for parts used at cost and labour at standard repair times and the prevailing DaimlerChrysler Australia/Pacific Pty Ltd dealer warranty hourly labour rate.

4.17. The information required to be documented by the Army unit in such circumstances is:

   a. Identify the vehicle by Army registration number.
   b. Identify the vehicle by chassis number.
   c. Identify the engine number.
d. Date vehicle entered service (if known).
e. Current odometer reading.

f. Nature of failure (brief explanation).
g. Nature of repair necessary.
h. Part replaced by designation and part number.
i. Time taken or Standard Repair Time (SRT) and EMEFIX number (refer to EMEI VEH A 119-24).
j. If parts were procured through a DaimlerChrysler Australia/Pacific Pty Ltd dealer, then documentation identifying purchase and price paid.
k. DaimlerChrysler Australia/Pacific Pty Ltd Authority Number (if applicable).

4.18. The procedure for submitting a claim to DaimlerChrysler Australia/Pacific Pty Ltd to obtain reimbursement is defined in EMEI VEH A 119-24.

Prior Consultation

4.19. Where a vehicle is presented to an authorised DaimlerChrysler Australia/Pacific Pty Ltd dealer for warranty repairs, the Unit is not to be further involved as the dealer has adequate authority, and the necessary procedures, to obtain authority from the Regional Fleet Manager in the case of major repairs.

4.20. In circumstances where the Army are themselves undertaking a warranty repair, this may proceed without authority provided the estimated total material and labour cost is less than $500. If the cost is estimated to be in excess of $500, then the appropriate DaimlerChrysler Australia/Pacific Pty Ltd Regional Office listed in Table 4-1 should be contacted for authority and guidance.

4.21. The person making the contact should have the following information available:

a. Vehicle chassis and Army registration number.
b. Date in service (if known).
c. Current odometer reading.
d. Knowledge of the problem encountered.
Obtaining Warranty Service

4.22. While any authorised Dealer may carry out warranty repairs or replacements, the primary responsibility for performing warranty repairs and replacements rests with DaimlerChrysler Australia/Pacific Pty Ltd.

Warranty Procedures

4.23. Vehicles having defects or malfunctions considered warrantable are to be processed in accordance with the procedures listed in EMEI VEH A 119-24.

Recording of Repairs

4.24. Details of all repairs carried out under warranty are to be recorded in the Record Book for Service Equipment GM 120.

Reporting of Defects

4.25. All defects, which occur during the warranty period, are to be reported using the RODUM in accordance with ALI POL7-10.

Replacement Parts and Accessories during Vehicle Warranty

4.26. Parts fitted under the terms of this warranty are covered for the remaining part of the new vehicle warranty. No warranty will apply if non-genuine or non-approved parts are used.

List of Agents

4.27. Table 4-1 details the DaimlerChrysler Australia/Pacific Pty Ltd Regional Offices and a directory of Unimog service centres throughout Australia. This list was correct at the time of printing.
Table 4-1 DaimlerChrysler Australia/Pacific Pty Ltd Dealers

Queensland

Regional Office: Brisbane (Rocklea)
DaimlerChrysler Commercial Vehicles
1699 Ipswich Rd, Rocklea 4106
Tel: (07) 3275 8711, Fax: (07) 3275 8770

Metropolitan
Brisbane (Rocklea)
DaimlerChrysler Commercial Vehicles
1699 Ipswich Rd, Rocklea 4106
Tel: (07) 3275 8711 (BH)
(07) 3275 8745 (AH)
015 596 144 (AH)
Fax: (07) 3275 8770

Regional
Cairns
Trucks North Pty Ltd
Cnr Bunda St and Hartley St, Cairns 4870
Tel: (07) 4031 6318 (BH)
0412 587 809 (AH)
0412 779 479 (AH)
(07) 4075 8393 (AH)
Fax: (07) 4051 4831

Mackay
Central Coast Truck Sales Pty Ltd
33 Victoria St, Mackay 4740
Tel: (07) 4951 4066 (BH)
018 185 574 (AH)
0408 775 062 (AH)
Fax: (07) 4951 1966

Nambour (Woombye)
Ray Grace Truck Centre
Bruce Highway, Woombye 4559
Tel: (07) 5442 1911 (BH)
(07) 5445 9871 (AH)
019 342 654 (AH)
Fax: (07) 5442 1595

Toowoomba
Westco Truck Sales (Qld)
9 Carrington Rd,
Toowoomba 4350
Tel: (07) 4634 3811 (BH)
(07) 4634 3811 (AH)
Service: 015 134 205 (AH)
Fax: (07) 4634 6622
Queensland (Continued)

Townsville
Trucks North (Qld) Pty Ltd
593 Ingham Rd,
Mount St John 4814
Tel:  (07) 4774 5366 (BH)
     0417 794 932 (AH)
     (07) 4778 6361 (AH)
     (07) 4774 1627 (AH)
Fax:  (07) 4774 5928

Northern Territory

Regional Office: Melbourne (Mulgrave)
DaimlerChrysler Australia/Pacific Pty Ltd – Southern Region
Lexia Place, Mulgrave 3170
Tel:   (03) 9566 9266
Fax:   (03) 9566 9323

Metropolitan

Darwin
Western Motors
1143 Stuart Highway,
Berrimah 0828
Tel:  (08) 8924 9100 (BH)
     (08) 8924 9150 (AH)
Fax:  (08) 8924 9101

Alice Springs
Western Diesel Pty Ltd
275 North Stuart Highway,
Alice Springs 0871
Tel:  (08) 8952 1377 (BH)
     (08) 8952 5919 (AH)
     0418 802 681 (AH)
Fax:  (08) 8953 0822

New South Wales

Regional Office: Sydney (Milperra)
DaimlerChrysler Australia/Pacific Pty Ltd – New South Wales Region
75 Ashford Avenue, Milperra 2214
Tel: (02) 9774 0777, Fax: (02) 9774 0723
New South Wales (Continued)

Metropolitan

Milperra
DaimlerChrysler Commercial Vehicles
90-104 Ashford Avenue,
Milperra 2214 (Approx May 2001
relocating to Decker Place
Huntingwood)
Tel (24 hr service):
(02) 9774 0777
0417 292 470
Fax: (02) 9774 1535

Regional

Albury
Southend Truck & Trailer Pty Ltd
Cnr Hume Highway and
Thurgoona Drive, Lavington
2641
Tel: (02) 6025 2566 (BH)
(02) 6021 6252 (AH)
(02) 6021 6724 (AH)
Fax: (02) 6025 8852

Gosford West
Atchison Truck Repairs Pty Ltd
1 Bowen Crescent,
Gosford West 2250
Tel: (02) 4324 5358 (BH)
(02) 4324 3790 (AH)
Fax: (02) 4324 7401

Kempsey South
Mavin & McNamara Pty Ltd
Lot 5, Woolford Crescent,
Kempsey South 2440
Tel: (02) 6562 6211 (BH)
(02) 6562 4776 (AH)
(02) 6565 4525 (AH)
Fax: (02) 6562 6487

Lismore South
Southside Agencies (Lismore)
Pty Ltd
Cnr Krauss Avenue & Three
Chain Rd,
Lismore South 2480
Tel: (02) 6621 7474 (BH)
(02) 6624 1915 (AH)
(02) 6624 8530 (AH)
Fax: (02) 6621 9193
New South Wales (Continued)

Newcastle (Thornton)
DaimlerChrysler Commercial Vehicles
2 Glenwood Drive,
Thornton 2322
Tel:  (02) 4966 8062 (BH)
      0409 992 497 (AH)
Fax:  (02) 4966 8604

Orange
West Orange Motors Pty Ltd
32 Forbes Rd,
Orange 2800
Tel:  (02) 6362 2988 (BH)
      018 288 883 (AH)
Fax:  (02) 6361 3815

Queanbeyan (Canberra)
Intermotors Pty Ltd
156 Uriarra Rd,
Queanbeyan 2620
Tel:  (02) 6297 2888 (BH)
      0418 624 815 (AH)
      0419 447 061 (AH)
Fax:  (02) 6297 5606
Parts: 018 620 578

Victoria

Regional Office: Melbourne (Mulgrave)
DaimlerChrysler Australia/Pacific Pty Ltd – Southern Region
Lexia Place, Mulgrave 3170
Tel:  (03) 9566 9266, Fax:  (03) 9566 9323

Metropolitan

Footscray - Melbourne West
DaimlerChrysler Commercial Vehicles
2-10 Appleton Dock Rd,
Footscray 3011
Tel:  (03) 9687 2800 (24 hour)
Fax:  (03) 9687 5800
Parts:  (03) 9687 2939

Regional

Mildura
Mildura Truck Centre
1055 Benetook Avenue,
Mildura 3500
Tel:  (03) 5021 2122 (BH)
      (03) 5022 1052 (AH)
      (03) 5022 1110 (AH)
      (03) 5032 2573 (AH)
Fax:  (03) 5022 2897
Victoria (Continued)

Somerton - Melbourne North
DaimlerChrysler Commercial Vehicles
24-38 Hume Highway,
Somerton 3062
Tel:  (03) 9305 4152 (BH)
     014 407 530 (AH)
Fax:  (03) 9305 3553

South Australia

Regional Office: Melbourne (Mulgrave)
DaimlerChrysler Australia/Pacific Pty Ltd – Southern Region
Lexia Place, Mulgrave 3170
Tel: (03) 9566 9266, Fax: (03) 9566 9323

Metropolitan

Adelaide - Angle Park
DaimlerChrysler Commercial Vehicles
526 Grand Junction Rd,
Angle Park 5010
Tel:  (08) 8268 5555 (BH)
     (08) 8256 9693 (AH)
     (08) 8262 3948 (AH)
     (08) 8336 3829 (AH)
Fax:  (08) 8445 6914
Parts Fax:  (08) 8347 4580

Regional

Port Augusta
Butlers Mechanical Services
2 Woodcock St,
Port Augusta 5700
Tel:  (08) 8642 2188 (BH)
     (08) 8642 6389 (AH)
     (08) 8642 3346 (AH)
Fax:  (08) 8642 4498

Port Lincoln
Duns Bros.
Cnr Blackman Place & Porter St,
Port Lincoln 5606
Tel:  (08) 8682 1495 (BH)
     (08) 8682 4132 (AH)
     (08) 8682 1263 (AH)
Western Australia

Regional Office: Perth (Belmont)
DaimlerChrysler Australia/Pacific Pty Ltd – Western Australian Region
Unit 1, 112 Belgravia St, Belmont 6104
Tel (24 hr service): (08) 9479 6888, Fax: (08) 9479 5155

Metropolitan

Bentley
Diesel Motors
1089-1091 Albany Highway,
Bentley 6102
Tel: (08) 9311 7344 (BH)
(08) 9311 7344 (AH)
Fax: (08) 9458 1252

Regional

Albany
Northcott Auto Engineering
173 Chester Pass Rd,
Albany 6330
Tel: (08) 9841 3203 (BH)
(08) 9841 5913 (AH)
Fax: (08) 9841 3937

Tasmania

Regional Office: Melbourne (Mulgrave)
DaimlerChrysler Australia/Pacific Pty Ltd – Southern Region
Lexia Place, Mulgrave 3170
Tel: (03) 9566 9266 Fax: (03) 9566 9323

Metropolitan

Hobart
Midland Truck and Bus Repairs
11 Midland Highway,
Brighton 7030
Tel: (03) 6268 0722 (BH)
(03) 6263 5810 (AH)
Fax: (03) 6268 0723

Regional

Launceston
C and I Transport Repairs
430 Hobart Rd,
Youngtown 7250
Tel: (03) 6344 7944 (BH)
(03) 6393 6394 (AH)
Fax: (03) 6344 7955
## INDEX

<table>
<thead>
<tr>
<th>A</th>
<th>Para</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerator pedal linkage</td>
<td>1.72</td>
</tr>
<tr>
<td>Accessories</td>
<td>1.33</td>
</tr>
<tr>
<td>Air cleaner</td>
<td>1.3, 1.51</td>
</tr>
<tr>
<td>Air conditioner compressor</td>
<td>1.130</td>
</tr>
<tr>
<td>Air conditioner condenser</td>
<td>1.131</td>
</tr>
<tr>
<td>Air conditioner evaporator</td>
<td>1.132</td>
</tr>
<tr>
<td>Air conditioner</td>
<td>1.131</td>
</tr>
<tr>
<td>Air filter indicator light</td>
<td>1.126</td>
</tr>
<tr>
<td>All wheel drive and power divider control switch</td>
<td>1.125</td>
</tr>
<tr>
<td>All wheel drive/front axle drive engaged indicator light</td>
<td>1.126</td>
</tr>
<tr>
<td>Alternator charge indicator warning light</td>
<td>1.126</td>
</tr>
<tr>
<td>Alternator</td>
<td>1.90</td>
</tr>
<tr>
<td>Application of warranty</td>
<td>4.13</td>
</tr>
<tr>
<td>Approach and departure angles</td>
<td>1.43</td>
</tr>
<tr>
<td>Attaching the towing pintle to the MRV</td>
<td>2.83</td>
</tr>
<tr>
<td>Audio kit</td>
<td>1.25, 1.101, 1.171</td>
</tr>
<tr>
<td>Auxiliary start socket</td>
<td>1.93</td>
</tr>
<tr>
<td>Auxiliary transmission (working gear group)</td>
<td>1.58</td>
</tr>
<tr>
<td>Auxiliary transmission (working gear group) selector switch</td>
<td>1.83</td>
</tr>
<tr>
<td>Auxiliary wire rope stowage</td>
<td>1.153</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>Para</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery installation</td>
<td>2.33</td>
</tr>
<tr>
<td>Battery mains switch</td>
<td>1.92</td>
</tr>
<tr>
<td>Battery removal</td>
<td>2.32</td>
</tr>
<tr>
<td>Before starting the engine</td>
<td>2.5</td>
</tr>
<tr>
<td>Before starting</td>
<td>2.4</td>
</tr>
<tr>
<td>Blackout lights</td>
<td>1.99</td>
</tr>
<tr>
<td>Bonnet release</td>
<td>1.143</td>
</tr>
<tr>
<td>Boom head anchor points</td>
<td>2.70</td>
</tr>
<tr>
<td>Boom stowed positions</td>
<td>2.75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C</th>
<th>Para</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabin and fittings</td>
<td>1.134</td>
</tr>
<tr>
<td>Cabin lighting</td>
<td>1.100</td>
</tr>
<tr>
<td>Cabin seat belts</td>
<td>1.136</td>
</tr>
<tr>
<td>Cabin seats</td>
<td>1.135</td>
</tr>
<tr>
<td>Cabin</td>
<td>1.134</td>
</tr>
<tr>
<td>Camouflage nets stowage</td>
<td>1.151</td>
</tr>
<tr>
<td>Capacities</td>
<td>1.36</td>
</tr>
<tr>
<td>Central tyre inflation system (CTIS)</td>
<td>1.23, 1.127, 1.167, 2.35</td>
</tr>
<tr>
<td>Centre of gravity plate</td>
<td>1.158</td>
</tr>
<tr>
<td>Changing a wheel</td>
<td>2.26</td>
</tr>
<tr>
<td>Changing from reeving to the front to reeving to the rear</td>
<td>2.97</td>
</tr>
<tr>
<td>Chassis and body fittings</td>
<td>1.141</td>
</tr>
<tr>
<td>Chassis</td>
<td>1.20, 1.62</td>
</tr>
<tr>
<td>Circuit breakers</td>
<td>1.91, 2.34</td>
</tr>
<tr>
<td>Climatic controls</td>
<td>1.133</td>
</tr>
<tr>
<td>Climbing bars</td>
<td>1.142</td>
</tr>
<tr>
<td>Clutch pedal</td>
<td>1.7, 1.75</td>
</tr>
<tr>
<td>Clutch reservoir</td>
<td>3.64</td>
</tr>
<tr>
<td>Clutch</td>
<td>1.7, 2.19</td>
</tr>
<tr>
<td>Communications</td>
<td>1.102</td>
</tr>
<tr>
<td>Connecting a trailer/casualty to the MRV</td>
<td>2.81</td>
</tr>
<tr>
<td>Construction</td>
<td>1.141</td>
</tr>
<tr>
<td>Control panel differential lock control switch</td>
<td>1.88</td>
</tr>
</tbody>
</table>
INDEX

<table>
<thead>
<tr>
<th>Para</th>
<th>Controls........................................... 1.72</th>
</tr>
</thead>
<tbody>
<tr>
<td>Para</td>
<td>Cool mode ........................................ 1.133</td>
</tr>
<tr>
<td>Para</td>
<td>Coolant expansion tank coolant level check ... 3.16</td>
</tr>
<tr>
<td>Para</td>
<td>Coolant temperature gauge ..................... 1.117</td>
</tr>
<tr>
<td>Para</td>
<td>Cooling system .................................... 1.5</td>
</tr>
<tr>
<td>Para</td>
<td>Crane control levers .............................. 1.169</td>
</tr>
<tr>
<td>Para</td>
<td>Crane hydraulic systems controls ................ 1.169</td>
</tr>
<tr>
<td>Para</td>
<td>Crane operation ................................... 2.104</td>
</tr>
<tr>
<td>Para</td>
<td>Crane .............................................. 1.32, 1.168</td>
</tr>
<tr>
<td>Para</td>
<td>Cross country driving ............................. 2.11</td>
</tr>
</tbody>
</table>

**D**

<table>
<thead>
<tr>
<th>Para</th>
<th>Daily servicing .................................... 3.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Para</td>
<td>Data Summary ...................................... 1.1</td>
</tr>
<tr>
<td>Para</td>
<td>Demist mode ........................................ 1.133</td>
</tr>
<tr>
<td>Para</td>
<td>Diesel engine exhaust smoke emission control .. 1.54</td>
</tr>
<tr>
<td>Para</td>
<td>Differential locks ................................ 1.61</td>
</tr>
<tr>
<td>Para</td>
<td>Dimensions .......................................... 1.35</td>
</tr>
<tr>
<td>Para</td>
<td>Disconnecting the casualty ........................ 2.62</td>
</tr>
<tr>
<td>Para</td>
<td>Drivelines and axles ................................ 1.60</td>
</tr>
<tr>
<td>Para</td>
<td>Driving procedures ................................... 2.9</td>
</tr>
<tr>
<td>Para</td>
<td>Dual air pressure gauge ............................. 1.116</td>
</tr>
</tbody>
</table>

**E**

<table>
<thead>
<tr>
<th>Para</th>
<th>Earth anchor emergency retract procedure ........ 2.68</th>
</tr>
</thead>
<tbody>
<tr>
<td>Para</td>
<td>Earth anchor leg reeving point limitations ........ 2.72</td>
</tr>
<tr>
<td>Para</td>
<td>Earth anchor leg reeving points .................... 2.71</td>
</tr>
<tr>
<td>Para</td>
<td>Earth anchor operation ................................ 2.67</td>
</tr>
<tr>
<td>Para</td>
<td>Earth anchors ........................................ 1.31, 1.163, 2.64</td>
</tr>
<tr>
<td>Para</td>
<td>Electrical system .................................... 1.24, 1.89</td>
</tr>
<tr>
<td>Para</td>
<td>Electrical trailer connection socket ............... 1.149</td>
</tr>
</tbody>
</table>

**F**

<table>
<thead>
<tr>
<th>Para</th>
<th>Emergency park brake release ...................... 2.31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Para</td>
<td>Emergency procedures .............................. 2.21</td>
</tr>
<tr>
<td>Para</td>
<td>Emergency towing points ........................... 2.72</td>
</tr>
<tr>
<td>Para</td>
<td>Engaging/disengaging the PTO ...................... 2.8</td>
</tr>
<tr>
<td>Para</td>
<td>Engine brake/service brake switch ................ 1.122</td>
</tr>
<tr>
<td>Para</td>
<td>Engine cooling ....................................... 1.52</td>
</tr>
<tr>
<td>Para</td>
<td>Engine oil and filter change procedure ............ 3.55</td>
</tr>
<tr>
<td>Para</td>
<td>Engine oil level check .............................. 3.18, 3.54</td>
</tr>
<tr>
<td>Para</td>
<td>Engine starter ....................................... 1.6</td>
</tr>
<tr>
<td>Para</td>
<td>Engine temperature ................................ 2.17</td>
</tr>
<tr>
<td>Para</td>
<td>Exhaust brake ...................................... 1.66, 1.67</td>
</tr>
<tr>
<td>Para</td>
<td>Extending the extension boom ....................... 2.53</td>
</tr>
<tr>
<td>Para</td>
<td>Fairleads ............................................ 1.30</td>
</tr>
<tr>
<td>Para</td>
<td>Fault finding tables ................................ 3.77</td>
</tr>
<tr>
<td>Para</td>
<td>Fire extinguishers ................................... 1.145</td>
</tr>
<tr>
<td>Para</td>
<td>Fire .................................................. 2.22</td>
</tr>
<tr>
<td>Para</td>
<td>First parade service ................................ 3.4</td>
</tr>
<tr>
<td>Para</td>
<td>Fitting of Adapter, Unimog Rear .................... 2.78</td>
</tr>
<tr>
<td>Para</td>
<td>Flat batteries ....................................... 2.23</td>
</tr>
<tr>
<td>Para</td>
<td>Flat towing .......................................... 2.81</td>
</tr>
<tr>
<td>Para</td>
<td>Flat tyre ............................................. 2.24</td>
</tr>
<tr>
<td>Para</td>
<td>Folding boom and extension boom ................... 2.52</td>
</tr>
<tr>
<td>Para</td>
<td>Foot Brake pedal ..................................... 1.76</td>
</tr>
<tr>
<td>Para</td>
<td>Foot Brake ........................................... 1.68</td>
</tr>
<tr>
<td>Para</td>
<td>Fording depth ....................................... 1.37</td>
</tr>
<tr>
<td>Para</td>
<td>Fording .............................................. 2.12</td>
</tr>
<tr>
<td>Para</td>
<td>Forward/reverse selector lever ...................... 1.78</td>
</tr>
</tbody>
</table>
Free spooling ........................................ 2.59
Front axle differential lock indicator light .......... 1.126
Front axle .................................. 1.11, 3.68
Front self recovery and front winching .............. 2.93
Front suspension .................................. 1.14
Front winch components layout ....................... 2.93
Front winching controls ................................ 2.94
Front winching anchor points .......................... 2.74
Front winching .................................... 2.50
Fuel filter and priming pump.......................... 3.21
Fuel gauge ........................................ 1.118
Fuel lift pump and pre-filter .......................... 3.20
Fuel system ...................................... 1.4, 1.53, 3.19
Fuel tank filler cap .................................. 3.19
Gear changing .................................... 2.20
Gear selector lever .................................. 1.79
Gear shift gate position indicator ...................... 1.80
General ........................................ 1.1
Good driving habits .................................. 2.17
GPS power supply sockets .. 1.120
Ground clearance ................................... 1.39
Halt parade service ................................ 3.13
Hand throttle ...................................... 1.74
Hazard warning light switch .......................... 1.123
Headlight adjustment control 1.111
Headlight beam control ................................ 1.106
Headlight flasher control ............................. 1.107
Headlight high beam indicator light .................... 1.126
Heat mode ........................................ 1.133
Heating, cooling and ventilation ....................... 1.128
Horn control ..................................... 1.108
Horn ........................................ 1.97
Hydraulic system .................................. 1.27, 1.161
Ignition switch .................................... 1.103
Increasing boom height to gain winching advantage ...... 2.88
Indicator control combination switch .................. 1.104
Inflate/deflate intermediate and rear axle tyres ......... 2.37, 2.38
Inflate/deflate front and rear axle tyres ................ 2.39
Inflate/deflate front axle tyres ....................... 2.35, 2.36
Inflating a tyre from an external source ................ 2.40
Instrument light switch and dimmer control .......... 1.126
Instrument panel all wheel drive and power divider control switch .................................. 1.87
Instrument panel bulb replacement ..................... 1.126
Instrument panel .................................. 1.113
Instruments ........................................ 2.18
Inter-axle differential lock indicator light ............ 1.126
Intermediate rear axle ................................ 1.12, 3.67
Introduction .................................... 1.44
Last parade service ................................ 3.14
Layout and operation of controls ....................... 2.46
Lift towing ....................................... 2.79
Lifting a load ..................................... 2.107
Lifting and towing gear ................................ 1.160
Lifting the casualty ................................ 2.79
### INDEX

<table>
<thead>
<tr>
<th>Para</th>
<th>Para</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting system ..</td>
<td>1.98</td>
</tr>
<tr>
<td>List of agents ..</td>
<td>4.27</td>
</tr>
<tr>
<td>Low brake fluid/differential pressure warning light ..</td>
<td>1.126</td>
</tr>
<tr>
<td>Lowering a load in an emergency ..</td>
<td>2.63</td>
</tr>
<tr>
<td>Lowering the folding boom ..</td>
<td>2.52</td>
</tr>
<tr>
<td>Lowering the stabilisers ..</td>
<td>2.105</td>
</tr>
<tr>
<td>Lubricants and fluids ..</td>
<td>3.37, 3.52</td>
</tr>
<tr>
<td>Lubrication ..</td>
<td>1.48</td>
</tr>
<tr>
<td>Main boom operation ..</td>
<td>2.51</td>
</tr>
<tr>
<td>Main boom static lifting ..</td>
<td>2.85</td>
</tr>
<tr>
<td>Main boom ..</td>
<td>2.51</td>
</tr>
<tr>
<td>Main features ..</td>
<td>1.45</td>
</tr>
<tr>
<td>Main transmission group ..</td>
<td>3.62</td>
</tr>
<tr>
<td>Main transmission ..</td>
<td>1.57</td>
</tr>
<tr>
<td>Main/masked light switch ..</td>
<td>1.126</td>
</tr>
<tr>
<td>Maximum fleet angles ..</td>
<td>2.95</td>
</tr>
<tr>
<td>Moving off slippery road conditions and rough terrain ..</td>
<td>2.10</td>
</tr>
<tr>
<td>Moving off and running ..</td>
<td>3.12</td>
</tr>
<tr>
<td>Moving off – normal conditions ..</td>
<td>2.9</td>
</tr>
<tr>
<td>MRV loading onto C-130 aircraft ..</td>
<td>2.41</td>
</tr>
<tr>
<td>MRV to MRV towing preparation – Option 1 ..</td>
<td>2.29</td>
</tr>
<tr>
<td>MRV to MRV towing preparation – Option 2 ..</td>
<td>2.30</td>
</tr>
<tr>
<td>Normal lights ..</td>
<td>1.98</td>
</tr>
<tr>
<td>Normal operation ..</td>
<td>2.3</td>
</tr>
<tr>
<td>Observation hatch ..</td>
<td>1.139</td>
</tr>
<tr>
<td>Obtaining warranty service ..</td>
<td>4.22</td>
</tr>
<tr>
<td>Oil cooler ..</td>
<td>1.50</td>
</tr>
<tr>
<td>Oil filter ..</td>
<td>1.49</td>
</tr>
<tr>
<td>Oil pressure gauge ..</td>
<td>1.119</td>
</tr>
<tr>
<td>Opening the bonnet and grille for servicing access ..</td>
<td>3.15</td>
</tr>
<tr>
<td>Operating in darkness ..</td>
<td>2.113</td>
</tr>
<tr>
<td>Operation of winches ..</td>
<td>2.58</td>
</tr>
<tr>
<td>Operational and logistic concept ..</td>
<td>1.46</td>
</tr>
<tr>
<td>Operator check procedures ..</td>
<td>3.16</td>
</tr>
<tr>
<td>Overload protection system ..</td>
<td>2.108</td>
</tr>
<tr>
<td>Park brake ..</td>
<td>1.69</td>
</tr>
<tr>
<td>Park brake indicator light ..</td>
<td>1.126</td>
</tr>
<tr>
<td>Park brake lever ..</td>
<td>1.82</td>
</tr>
<tr>
<td>Parking ..</td>
<td>2.14</td>
</tr>
<tr>
<td>Paying out/winching in under power using the control panel ..</td>
<td>2.60</td>
</tr>
<tr>
<td>Paying out/winching in under power using the remote control unit ..</td>
<td>2.61</td>
</tr>
<tr>
<td>Performance ..</td>
<td>1.34</td>
</tr>
<tr>
<td>Periodic servicing - crane ..</td>
<td>3.46</td>
</tr>
<tr>
<td>Periodic servicing - recovery unit ..</td>
<td>3.43</td>
</tr>
<tr>
<td>Periodic servicing - cab/chassis ..</td>
<td>3.38</td>
</tr>
<tr>
<td>Personal equipment stowage ..</td>
<td>1.154</td>
</tr>
<tr>
<td>Pintle hook ..</td>
<td>2.73</td>
</tr>
<tr>
<td>POL stowage ..</td>
<td>1.146</td>
</tr>
<tr>
<td>Power divider and axles ..</td>
<td>3.65</td>
</tr>
<tr>
<td>Power divider ..</td>
<td>3.65</td>
</tr>
<tr>
<td>Precautions during use ..</td>
<td>2.44, 2.65</td>
</tr>
<tr>
<td>Precautions during winching ..</td>
<td>2.57</td>
</tr>
<tr>
<td>Precautions prior to and during use ..</td>
<td>2.99, 2.100</td>
</tr>
<tr>
<td>Precautions prior to use ..</td>
<td>2.43, 2.64, 2.69, 2.86</td>
</tr>
<tr>
<td>Precautions prior to winching ..</td>
<td>2.56</td>
</tr>
</tbody>
</table>
INDEX

<table>
<thead>
<tr>
<th>Para</th>
<th>Para</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-operational check</td>
<td>2.1</td>
</tr>
<tr>
<td>Preparation for recovery</td>
<td>2.45</td>
</tr>
<tr>
<td>Priming the fuel system</td>
<td>3.22</td>
</tr>
<tr>
<td>Prior consultation</td>
<td>4.19</td>
</tr>
<tr>
<td>Prior to moving off</td>
<td>2.112</td>
</tr>
<tr>
<td>Propeller shafts</td>
<td>1.16, 3.69</td>
</tr>
<tr>
<td>PTO engaged indicator light</td>
<td>1.126</td>
</tr>
<tr>
<td>PTO selector switch</td>
<td>1.84</td>
</tr>
<tr>
<td>PTO</td>
<td>1.10</td>
</tr>
<tr>
<td>Radiator core and hoses</td>
<td>3.17</td>
</tr>
<tr>
<td>Raising the folding boom</td>
<td>2.55</td>
</tr>
<tr>
<td>Rear axle differential lock indicator light</td>
<td>1.126</td>
</tr>
<tr>
<td>Rear axle</td>
<td>1.13, 3.67</td>
</tr>
<tr>
<td>Rear self recovery</td>
<td>2.98</td>
</tr>
<tr>
<td>Rear view mirrors</td>
<td>1.138</td>
</tr>
<tr>
<td>Rear winching</td>
<td>2.86</td>
</tr>
<tr>
<td>Recording of repairs</td>
<td>4.24</td>
</tr>
<tr>
<td>Recovery and towing hydraulic systems controls</td>
<td>1.164</td>
</tr>
<tr>
<td>Recovery boom</td>
<td>1.28</td>
</tr>
<tr>
<td>Recovery equipment and controls</td>
<td>1.160</td>
</tr>
<tr>
<td>Recovery system operation</td>
<td>2.43</td>
</tr>
<tr>
<td>Recovery unit lighting</td>
<td>1.170</td>
</tr>
<tr>
<td>Reduction hub drives</td>
<td>3.70</td>
</tr>
<tr>
<td>Reieving to the front of the MRV</td>
<td>2.96</td>
</tr>
<tr>
<td>Releasing a load</td>
<td>2.109</td>
</tr>
<tr>
<td>Releasing the load</td>
<td>2.80</td>
</tr>
<tr>
<td>Remote control</td>
<td>2.48</td>
</tr>
<tr>
<td>Remote control function switch</td>
<td>2.49</td>
</tr>
<tr>
<td>Removing the towing pintle from the MRV</td>
<td>2.84</td>
</tr>
<tr>
<td>Replacement parts and accessories during vehicle warranty</td>
<td>4.26</td>
</tr>
<tr>
<td>Replacing a winch rope</td>
<td>2.101</td>
</tr>
<tr>
<td>Reporting of defects</td>
<td>4.25</td>
</tr>
<tr>
<td>Retracting the extension boom</td>
<td>2.54</td>
</tr>
<tr>
<td>Rims</td>
<td>1.22</td>
</tr>
<tr>
<td>Rotating beacon indicator light</td>
<td>1.126</td>
</tr>
<tr>
<td>Running-in</td>
<td>2.2</td>
</tr>
<tr>
<td>Safety precautions</td>
<td>2.102</td>
</tr>
<tr>
<td>Self recovery and driving</td>
<td>2.99</td>
</tr>
<tr>
<td>Service and lubrication points - cab/chassis</td>
<td>3.53</td>
</tr>
<tr>
<td>Service and lubrication points - crane</td>
<td>3.74</td>
</tr>
<tr>
<td>Service and lubrication points - recovery unit</td>
<td>3.73</td>
</tr>
<tr>
<td>Servicing data decal</td>
<td>1.159</td>
</tr>
<tr>
<td>Shipping volume</td>
<td>1.42</td>
</tr>
<tr>
<td>Shutting down the engine</td>
<td>2.7</td>
</tr>
<tr>
<td>Side step</td>
<td>1.147</td>
</tr>
<tr>
<td>Side winching layouts</td>
<td>2.91</td>
</tr>
<tr>
<td>Side winching</td>
<td>2.89</td>
</tr>
<tr>
<td>Six-wheel work brake indicator light</td>
<td>1.126</td>
</tr>
<tr>
<td>Six-wheel work brake</td>
<td>1.71, 1.165, 2.15</td>
</tr>
<tr>
<td>Six-wheel work brake switch</td>
<td>1.121</td>
</tr>
<tr>
<td>Slinging and tie-down points</td>
<td>1.41</td>
</tr>
<tr>
<td>Soil conditions</td>
<td>2.66</td>
</tr>
<tr>
<td>Spare wheel stowage</td>
<td>1.152</td>
</tr>
<tr>
<td>Special provisions</td>
<td>4.8</td>
</tr>
<tr>
<td>Speed limiter malfunction and overspeed indicator light</td>
<td>1.126</td>
</tr>
<tr>
<td>Speed limiting device</td>
<td>1.73</td>
</tr>
<tr>
<td>Speedometer</td>
<td>1.114</td>
</tr>
<tr>
<td>Splitter transmission</td>
<td>1.8, 1.56, 3.61</td>
</tr>
</tbody>
</table>
## INDEX

<table>
<thead>
<tr>
<th>Para</th>
<th>Para</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R</strong></td>
<td><strong>R</strong></td>
</tr>
<tr>
<td>Splitter transmission selector lever</td>
<td>1.81</td>
</tr>
<tr>
<td>Stabilised pull</td>
<td>2.89</td>
</tr>
<tr>
<td>Stabiliser control lever</td>
<td>1.169</td>
</tr>
<tr>
<td>Start the MRV</td>
<td>3.11</td>
</tr>
<tr>
<td>Starter motor</td>
<td>1.94</td>
</tr>
<tr>
<td>Starting the engine (hot or cold)</td>
<td>2.6</td>
</tr>
<tr>
<td>Static lifting</td>
<td>2.85</td>
</tr>
<tr>
<td>Steering hydraulic reservoir</td>
<td>3.71</td>
</tr>
<tr>
<td>Steering system</td>
<td>1.17, 1.65, 3.71</td>
</tr>
<tr>
<td>Steering wheel/column</td>
<td>1.85</td>
</tr>
<tr>
<td>Stowage</td>
<td>1.144</td>
</tr>
<tr>
<td>Stowing the crane</td>
<td>2.110</td>
</tr>
<tr>
<td>Stowing the spare wheel</td>
<td>2.27</td>
</tr>
<tr>
<td>Stowing the stabilisers</td>
<td>2.110</td>
</tr>
<tr>
<td>Suspension</td>
<td>1.63</td>
</tr>
<tr>
<td>Switches</td>
<td>1.103</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>T</strong></th>
<th><strong>W</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachometer</td>
<td>1.115</td>
</tr>
<tr>
<td>Tackle attachment points</td>
<td>2.68</td>
</tr>
<tr>
<td>Tools</td>
<td>1.172</td>
</tr>
<tr>
<td>Towing a casualty MRV</td>
<td>2.28</td>
</tr>
<tr>
<td>Towing a trailer</td>
<td>2.16</td>
</tr>
<tr>
<td>Towing attachments</td>
<td>2.77</td>
</tr>
<tr>
<td>Towing pintle</td>
<td>2.82</td>
</tr>
<tr>
<td>Towing precautions</td>
<td>2.76</td>
</tr>
<tr>
<td>Towing</td>
<td>2.28, 2.76</td>
</tr>
<tr>
<td>Trailer brake lever</td>
<td>1.77</td>
</tr>
<tr>
<td>Trailer brake system</td>
<td>1.19</td>
</tr>
<tr>
<td>Trailer brake</td>
<td>1.70</td>
</tr>
<tr>
<td>Trailer turn signal indicator light</td>
<td>1.126</td>
</tr>
<tr>
<td>Transfer case</td>
<td>1.59</td>
</tr>
<tr>
<td>Transmission</td>
<td>1.9, 1.57</td>
</tr>
<tr>
<td>Transportability</td>
<td>1.40</td>
</tr>
<tr>
<td>Travelling empty</td>
<td>2.75</td>
</tr>
<tr>
<td>Turn indicator control</td>
<td>1.105</td>
</tr>
<tr>
<td>Turn signal indicator light</td>
<td>1.126</td>
</tr>
<tr>
<td>Tyre inflation point</td>
<td>1.150</td>
</tr>
<tr>
<td>Tyres</td>
<td>1.21</td>
</tr>
<tr>
<td><strong>U</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td>Unit formation signs</td>
<td>1.156</td>
</tr>
<tr>
<td>Unloading effect (front of MRV lifting off ground)</td>
<td>2.87</td>
</tr>
<tr>
<td>Unstabilised pull</td>
<td>2.90</td>
</tr>
<tr>
<td>Unstowing the crane</td>
<td>2.106</td>
</tr>
<tr>
<td><strong>V</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td>Vehicle mounted recovery/towing controls</td>
<td>2.46</td>
</tr>
<tr>
<td>Vehicle nomenclature plate</td>
<td>1.157</td>
</tr>
<tr>
<td>Vehicle washing</td>
<td>2.42</td>
</tr>
<tr>
<td>Vent mode</td>
<td>1.133</td>
</tr>
<tr>
<td><strong>W</strong></td>
<td><strong>W</strong></td>
</tr>
<tr>
<td>Warning beacon switch</td>
<td>1.124</td>
</tr>
<tr>
<td>Warning/indicator light cluster</td>
<td>1.126</td>
</tr>
<tr>
<td>Warranty procedures</td>
<td>4.23</td>
</tr>
<tr>
<td>Warranty provisions</td>
<td>4.1</td>
</tr>
<tr>
<td>Warranty rights</td>
<td>4.6</td>
</tr>
<tr>
<td>Weapon clips and butt boxes</td>
<td>1.140</td>
</tr>
<tr>
<td>Winch pressure/tension gauges</td>
<td>2.47</td>
</tr>
<tr>
<td>Winch ropes</td>
<td>2.101</td>
</tr>
<tr>
<td>Winches</td>
<td>1.29, 1.162, 2.56</td>
</tr>
<tr>
<td>Winching and driving simultaneously</td>
<td>2.100</td>
</tr>
<tr>
<td>Windows</td>
<td>1.137</td>
</tr>
<tr>
<td>Windscreen washer control</td>
<td>1.110</td>
</tr>
<tr>
<td>Windscreen washers</td>
<td>1.96</td>
</tr>
<tr>
<td>Windscreen wiper control</td>
<td>1.109</td>
</tr>
<tr>
<td>Windscreen wipers</td>
<td>1.95</td>
</tr>
</tbody>
</table>