



Ministry
of Defence

Defence Equipment and Support
Secretariat
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Ministry of Defence
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Email: DES SEC-PolSec LE-JSC-WPNS@mod.uk



Our Reference:
FOI2022/05676
Date:
6 July 2022

Dear ,

I am writing about your email of 20 May 2022, further to my response to FOI2022/04901 requesting clarification. You originally requested:

'Please can you provide copies of the following documents relating to CVR(T)(D) Spartan vehicles:

- 1. Operating information***
- 2. Repair manuals***
- 3. Illustrated spares catalogue'***

You refined your request as follows:

'Thanks, please could you let me have the Operating Instructions'

Your request has been handled in accordance with the Freedom of Information (FOI) Act 2000.

A search has been carried out of Ministry of Defence (MOD) records and it is confirmed that information related to your request is held. This is attached as follows:

- Army Equipment Support Publication (AESP) 2350-T-220-201 – Combat Vehicle, Reconnaissance, Full Tracked, CVR(T) (D), Common Items, Operating Information (Version 2, March 2006) (REDACTED)
- Army Equipment Support Publication (AESP) 2350-T-221-201 – Combat Vehicle, Reconnaissance, Full Tracked, CVR(T) (D), Operating Information (Version 2, July 2008) (REDACTED)

Some of the information you have requested falls within the scope of the absolute exemption provided for in Section 40 (personal data) and qualified exemptions Section 26 (Defence), Section 27 (International Relations) and Section 38 (Health and Safety) of the FOI Act and has been withheld.

Section 40(2) has been applied to personal information as governed by the General Data Protection Regulations (GDPR). Section 40 is an absolute exemption and there is therefore no requirement to consider the public interest in making a decision to withhold the information.

Defence Equipment & Support

Sections 26, 27 and 38 are qualified exemptions and subject to public interest testing which means that the information requested can only be withheld if the public interest in doing so outweighs the public interest in disclosure.

Section 26(1)(b), Section 27(1) and Section 38(1) have been applied to some of the information because it contains details which are operationally sensitive and would prejudice the capability and effectiveness of the Armed Forces, prejudice the relations between the United Kingdom and another state, and compromise the health and safety of Armed Forces personnel. The balance of public interest was found to be in favour of withholding the information under these exemptions I have set the level of prejudice against release of the exempted information at the higher level of 'would' rather than 'would be likely to'.

If you have any queries regarding the content of this letter, please contact this office in the first instance. If you wish to complain about the handling of your request, or the content of this response, you can request an independent internal review by contacting the Information Rights Compliance team, Ground Floor, MOD Main Building, Whitehall, SW1A 2HB (e-mail CIO-FOI-IR@mod.gov.uk). Please note that any request for an internal review should be made within 40 working days of the date of this response.

If you remain dissatisfied following an internal review, you may raise your complaint directly to the Information Commissioner under the provisions of Section 50 of the Freedom of Information Act. Please note that the Information Commissioner will not normally investigate your case until the MOD internal review process has been completed. The Information Commissioner can be contacted at: Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF. Further details of the role and powers of the Information Commissioner can be found on the Commissioner's website at <https://ico.org.uk/>.

Yours sincerely,

DE&S Secretariat



CONDITIONS OF RELEASE

- 1 ~~This information is released by the UK Government for Defence purposes only.~~
- 2 ~~This information must be afforded the same degree of protection as that afforded to information of an equivalent security marking originated by the recipient Government or as required by the recipient Government's security regulations.~~
- 3 ~~This information may be disclosed only within the Defence Department of the recipient Government, except as otherwise authorized by the Ministry of Defence (Army).~~
- 4 ~~This information may be subject to privately owned rights.~~

COMBAT VEHICLE, RECONNAISSANCE, FULL TRACKED, CVR(T) (D) COMMON ITEMS OPERATING INFORMATION

~~THIS DOCUMENT IS THE PROPERTY OF HER BRITANNIC MAJESTY'S GOVERNMENT, and is issued for the information of such persons only as need to know its contents in the course of their official duties. Any person finding this document should hand it to a British forces unit or to a police station for its safe return to the MINISTRY OF DEFENCE (Dsy (Pol)), MAIN BUILDING, WHITEHALL, LONDON SW1A 2HB with particulars of how and where found. THE UNAUTHORIZED RETENTION OR DESTRUCTION OF THIS DOCUMENT MAY BE AN OFFENCE UNDER THE OFFICIAL SECRETS ACTS OF 1911-1989. (When released to persons outside Government service, this document is issued on a personal basis and the recipient to whom it may be entrusted in confidence, within the provision of the Official Secrets Acts 1911-1989, is personally responsible for its safe custody and for seeing that its contents are disclosed only to authorized persons).~~

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UNITED KINGDOM MINISTRY OF DEFENCE AND ARMED FORCES

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AMENDMENT RECORD

Amdt No.	Incorporated By (Signature)	Date
1	INCORPORATED	10/06
2	INCORPORATED	04/07
3	INCORPORATED	10/07
4	INCORPORATED	07/08
5	INCORPORATED	11/08
6	INCORPORATED	11/10
7	INCORPORATED	06/12
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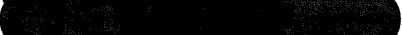
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OPERATING INFORMATION

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PREFACE**Sponsor: Refer to Table 1, Serial 1****File Ref: Pubs 2285****Publication Authority: Refer to Table 1, Serial 1****INTRODUCTION**

- 1 This document is based on the Scimitar vehicle. Where differences occur in the Samson, Sultan, Spartan and Samaritan variants, these are described in the relevant variant publication.
- 2 Users should forward any comments on this publication using the AESP Form 10 and the accompanying guidance which can be accessed and downloaded from the Joint Asset Management and Engineering Solutions (JAMES) Portal (via Hot Topics – Forms) or from Technical Documentation Online (TDOL) Viewer (Search: FORM10).
- 3 AESPs are issued under Defence Council Authority and where AESPs specify action to be taken, the AESP will of itself be sufficient authority for such action and also for the demanding of the necessary stores, subject to the provisions of Para 4 below.
- 4 The subject matter of this publication may be affected by Defence Instructions and Notices (DINs), Standing Operating Procedures (SOPs) or by local regulations. When any such instruction, order or regulation contradicts any portion of this publication it is to be taken as the overriding authority.
- 5 The installation of Bowman communications equipment may affect procedures contained in this publication. Refer to DAESP 5895-G-200-Series Bowman/CIP Communications System CIETP for information concerning any Bowman equipment fitted to CVR(T).

DISCLAIMER

The Second Edition of this publication is subject to General Condition Number 27 of the Design Services Contract LASS1A/0282 since it includes User information issued by VST-ATP without technical approval, prejudice or commitment by the vehicle Design Authority, BAE Systems Combat Vehicles (UK).

RELATED AND ASSOCIATED PUBLICATIONS

Related publications

6 The Octad for the subject equipment consists of the publications shown below. All references are prefixed with the first eight digits of this publication. The availability of the publications can be checked by reference to the relevant Group Index (see AESP 0100-A-001-013).

Category/Sub-category			Information Level			
			1 User/ Operator	2 Unit Maintenance	3 Field Maintenance	4 Base Maintenance
1	0	Purpose and Planning Information	101	*	*	*
	1	Equipment Support Policy Directives	111	*	*	*
2	0	Operating Information	201	*	*	*
	1	Aide-Memoire	211	*	*	*
	2	Training Aids	*	*	*	*
3		Technical Description	201	302	*	*
4	1	Installation Instructions	*	*	*	*
	2	Preparation for Special Environments	*	*	*	*
5	1	Failure Diagnosis	201	*	*	*
	2	Maintenance Instructions	201	522	523	524
	3	Inspection Standards	*	532	532	532
	4	Calibration Procedures	*	*	*	*
6		Maintenance Schedules	601	601	*	*
7	1	Illustrated Parts Catalogues	711	711	*	*
	2	Commercial Parts Lists	*	*	*	*
	3	Complete Equipment Schedule, Production	*	*	*	*
	4	Complete Equipment Schedule, Service Edition (Simple Equipment)	741	*	*	*
	5	Complete Equipment Schedule, Service Edition (Complex Equipment)	*	*	*	*
8	1	Modification Instructions	*	*	*	*
	2	General Instructions, Special Technical Instructions and Servicing Instructions	*	*	*	*
	3	Service Engineered Modification Instructions	*	*	*	*

*Category/Sub-category not published

Associated publications

<u>7 Reference</u>	<u>Title</u>
AESP 2350-T-210-811	Combat Vehicle Reconnaissance Tracked (CVR(T)) All Variants - Modification Instructions and Index
AESP 2350-T-210-812	Combat Vehicle Reconnaissance Tracked (CVR(T)) All Variants - Modification Instructions and Index
AESP 2350-T-210-821	Combat Vehicle Reconnaissance Tracked (CVR(T)) All Variants - General Instructions and Index
AESP 2815-K-101-Series	Engine Diesel Cummins B Series
AESP 0200-A-093-013	Land Equipment User Maintenance Standards
AESP 0200-A-221-013	Painting of Land Equipment
AESP 5825-E-100-Series	Tactical Navigation & Target Location System (TNTLS)
AESP 5855-C-115-Series	Battle Group Thermal Imaging System (BGTI) CVR(T) Scimitar
AESP 5855-D-110-Series	Enhanced - Sight Periscopic Infra-Red Equipment (E-SPIRE)
DAESP 5895-G-200-Series	Bowman/CIP Communications System CIETP
Army Code 13150 Annex 3	Ammunition and explosive regulations – first aid
Army Code 62226	Limitations in the use of missiles and ammunition for training
Army Code 62230	Limitations in the use of missiles and ammunition for training
Army Code 71276 (Mar 2001)	Standing orders for the Safety of Crews of AFV's
Army Code 31297	Complete Equipment Schedule, Radio Installation (UK)
HQ RAC Centre Bovington	Rescue of casualties from AFVs
AB 413	'A' vehicle record book

REFERENCE ORGANIZATIONS AND ADDRESSES

8 The organizations listed in Table 1 are referred to throughout this AESP.

TABLE 1 REFERENCE ORGANIZATIONS AND ADDRESSES

Serial (1)	Organization (2)	Address (3)
1	Vehicle Support Team – Armoured Tracks Portfolio (VST-ATP)	MoD Abbey Wood, Bristol, BS34 8JH [REDACTED]

WARNINGS

(1) **ASPHYXIATION HAZARD.** IF FLUOROKETONE (NOVEC 1230) EXTINGUISHERS HAVE BEEN USED INSIDE THE VEHICLE, PERSONNEL MUST NOT RE-ENTER UNTIL ALL FUMES HAVE DISPERSED.

(2) **PERSONNEL SAFETY.** FLUOROKETONE EXTINGUISHING AGENTS MAY DECOMPOSE UNDER CERTAIN FIRE CONDITIONS, PRODUCING CONSIDERABLE QUANTITIES OF FLUOROKETONE GAS. EXPOSURE TO LARGE DOSES OF FLUOROKETONE MAY BE HARMFUL IF INHALED. IF A CREW MEMBER SHOWS SYMPTOMS OF INHALATION, IMMEDIATELY EVACUATE TO AN AREA WITH FRESH AIR, AND INFORM MEDICAL SERVICES OF SUSPECTED EXPOSURE TO FLUOROKETONE.

(continued)

WARNINGS (continued)

- (3) **ASPHYXIATION HAZARD. DRY POWDER EXTINGUISHERS ARE NON-TOXIC. HOWEVER, THIS TYPE OF EXTINGUISHER IS NOT TO BE USED IN A CONFINED SPACE UNLESS IN AN EXTREME EMERGENCY.**
- (4) **PERSONNEL SAFETY. HYDROFLUOROCARBON (HFC) GAS EXTINGUISHING AGENTS MAY DECOMPOSE UNDER CERTAIN FIRE CONDITIONS, PRODUCING CONSIDERABLE QUANTITIES OF HYDROGEN FLUORIDE (HF) GAS. EXPOSURE TO LARGE DOSES OF HF CAN LEAD TO POTENTIALLY LETHAL RESPIRATORY FAILURE. IF A CREW MEMBER IS IN CLOSE PROXIMITY TO A FIRE TACKLED BY EXTINGUISHING AGENTS, IMMEDIATELY EVACUATE TO AN AREA WITH FRESH AIR, AND INFORM MEDICAL SERVICES OF SUSPECTED EXPOSURE TO HF.**
- (5) **PERSONAL INJURY. ENSURE THAT THE DOOR SPRING LOADED CATCH HAS ENGAGED PRIOR TO MOVING THE VEHICLE.**
- (6) **PHYSICAL INJURY. THE SEAT MUST BE PROPERLY SECURED IN POSITION BEFORE ATTEMPTING TO DRIVE THE VEHICLE.**
- (7) **PHYSICAL INJURY. ENSURE THAT BOTH LOCATING PINS ARE FULLY ENGAGED BEFORE COMMITTING THE FULL BODY WEIGHT ON THE SEAT.**
- (8) **LIMITED STEERING. THERE ARE NO LIMIT STOPS FOR SEAT MOVEMENT AND IF THE SEAT IS MOVED TOO FAR FORWARD, IT WILL INTERFERE WITH THE OPERATION OF THE STEERING LEVERS.**
- (9) **FIRE RISK. FLUID AL11 IS HIGHLY FLAMMABLE. THE PREPARATION OF THE FLUID FOR THE WINDSCREEN WASHERS IS TO BE CARRIED OUT IN THE OPEN AND AWAY FROM NAKED FLAME. MINIMUM PRECAUTION AFTER USE IS TO WASH THE AFFECTED SKIN AREAS WITH SOAP AND WATER.**
- (10) **DANGER TO LIFE AND LIMB. BEFORE PERSONNEL ARE ALLOWED UNDER THE VEHICLE, THE PARKING BRAKE MUST BE FULLY APPLIED AND THE VEHICLE SECURED AGAINST MOVEMENT AND THE ENGINE SWITCHED OFF.**
- (11) **RISK TO HEALTH. USED ENGINE OIL IS HARMFUL TO THE SKIN. ALWAYS USE A BARRIER CREAM BEFORE STARTING THIS TASK. ALWAYS WASH YOUR HANDS AFTERWARDS.**
- (12) **DANGER TO LIFE AND LIMB. DRIVER'S COMPARTMENT MUST BE MANNED THROUGHOUT THE ENGINE RUN PERIOD.**
- (13) **RISK TO HEALTH. ALL PERSONNEL IN IMMEDIATE VICINITY MUST WEAR EAR PROTECTORS WHEN ENGINE IS RUNNING.**
- (14) **DANGER TO LIFE AND LIMB. ALL TOOLS AND EQUIPMENT USED DURING MAINTENANCE MUST BE REMOVED FROM THE VEHICLE PRIOR TO STARTING ENGINE.**
- (15) **DANGER TO LIFE AND LIMB. ALL TOOLS AND EQUIPMENT USED DURING MAINTENANCE MUST BE REMOVED FROM THE ENGINE AND GEARBOX COMPARTMENT PRIOR TO STARTING ENGINE.**
- (16) **DANGER FROM SCALDING. DO NOT RELEASE THE COOLANT PRESSURE/FILLER WHILE THE ENGINE IS RUNNING OR IF THE TEMPERATURE OF THE HEADER TANK IS ABOVE HAND HOT.**

(continued)

WARNINGS (continued)

(17) **EYE PROTECTION. ANTI-FREEZE SOLUTION AL39 WILL BE EJECTED UNDER PRESSURE DURING BLEEDING OPERATION - PROTECT EYES WITH GOGGLES.**

(18) **TOXIC AND HAZARDOUS SUBSTANCE. FLUID AL39 IS BOTH TOXIC AND HAZARDOUS. REFER TO LOCAL UNIT PRECAUTIONS AND CURRENT DINS, FOR FULL SAFETY PROCEDURES. MINIMUM PRECAUTION AFTER USE IS TO WASH ANY AFFECTED SKIN AREAS WITH SOAP AND WATER.**

(19) **DANGER FROM SCALDING. TO AVOID SCALDING FROM HOT COOLANT, EYE PROTECTION AND PROTECTIVE GLOVES MUST BE WORN WHEN DRAINING COOLANT.**

(20) **FIRE RISK. A RISK OF FIRE AND/OR EXPLOSION EXISTS WHEN REFUELLING A VEHICLE FITTED WITH RUBBER PADDED TRACKS, BY EITHER PUMPS OR PLASTIC CONTAINERS, DUE TO THE PRESENCE OF STATIC ELECTRICITY. THIS RISK ALSO APPLIES WHEN REFUELLING OR DRAINING NEAR AN OPERATING RADAR SET OR OTHER HF TRANSMITTERS - THE HAZARD VARIES WITH THE POWER OF THE EQUIPMENT SO UNIT STANDING ORDERS MUST BE RIGOROUSLY APPLIED. THE VEHICLE MUST, THEREFORE, ALSO BE EARTHED WHEN CARRYING OUT REFUELLING OR FUEL TANK DRAINING OPERATIONS.**

(21) **FIRE RISK. WHEN WORKING ON THE FUEL SYSTEM ALL SWITCHES MUST BE IN THE OFF POSITION AND HATCHES AND COVERS OPENED TO DISPERSE FUMES. ALL NECESSARY FIRE PRECAUTIONS MUST BE STRICTLY APPLIED.**

(22) **RISK TO HEALTH. DIESEL FUEL IS CARCINOGENIC. USE BARRIER CREAM AND WEAR PROTECTIVE CLOTHING WHEN THERE IS A POTENTIAL RISK OF CONTACT WITH DIESEL FUEL.**

(23) **DANGER OF SCALDING FROM HOT OIL. PROTECTIVE GLOVES MUST BE WORN WHEN REMOVING THE GEARBOX OIL DRAIN PLUG.**

(24) **DANGER OF SCALDING FROM HOT OIL. PROTECTIVE GLOVES MUST BE WORN WHEN CHANGING OIL FILTERS.**

(25) **DANGER TO PERSONNEL. TRACK INSPECTION. WHEN CARRYING OUT THE FOLLOWING PROCEDURE, PERSONNEL MUST NOT TAKE UP POSITIONS WHERE THE DRIVER CANNOT SEE THEM. THE DRIVER MUST NOT MOVE THE VEHICLE IF A PERSON IS STANDING IN FRONT OF A TRACK OR IF A PERSON IS KNOWN TO BE IN THE VICINITY OF THE TRACK BUT NOT IN VIEW. THE COMMANDER MUST BE IN A POSITION TO BE ABLE TO CONTROL THE COMPLETE OPERATION.**

(26) **DANGER TO PERSONNEL. IT IS NOT A SAFE PRACTICE TO HAVE BOTH TRACKS REMOVED AT THE SAME TIME AS THE BRAKES WILL BE INEFFECTIVE. IF SUCH A PROCEDURE IS UNAVOIDABLE, SECURE THE VEHICLE BY CHOCKING ROAD WHEELS BEFORE 'BREAKING' THE SECOND TRACK.**

(27) **DANGER TO PERSONNEL. DO NOT TAKE RISKS WITH SAFETY; JACKING STRUT COLLAPSE CAN CAUSE SERIOUS INJURY.**

(continued)

WARNINGS (continued)

- (28) **DANGER TO PERSONNEL. DO NOT HOLD THE JACKING STRUT IN POSITION WHEN RAISING THE ROAD WHEEL.**
- (29) **DANGER TO PERSONNEL. ON TURRETED VEHICLES THE TURRET BATTERY MASTER SWITCHES MUST BE IN THE 'OFF' POSITION BEFORE CONNECTING THE INTER-VEHICLE LEAD, AND MUST REMAIN IN THE 'OFF' POSITION UNTIL AFTER THE LEAD HAS BEEN DISCONNECTED.**
- (30) **PERSONAL INJURY. DO NOT OPERATE THE STEERING LEVERS WITH THE ENGINE RUNNING AT IDLING SPEED AND THE TRANSMISSION IN NEUTRAL, AS THIS COULD CAUSE THE VEHICLE TO PIVOT.**
- (31) **FIRE RISK. WHEN USING FUELS OTHER THAN DIESEL (F-54) PLACE A PORTABLE FIRE EXTINGUISHER READY FOR USE CLOSE TO THE VEHICLE. A CREW MEMBER MUST STAND BY THE VEHICLE CLOSE TO THE EXTINGUISHER READY TO USE THE EXTINGUISHER.**
- (32) **FIRE RISK. ENSURE THAT ALL FUEL SPILLAGE IS CLEANED UP.**
- (33) **PERSONAL INJURY. DEEP FRYING MUST NOT BE ATTEMPTED.**
- (34) **PERSONAL INJURY. THE BASE OF THE WATER COMPARTMENT BECOMES RED HOT WHEN FRYING, DO NOT COOL BY POURING WATER INTO THE COMPARTMENT.**
- (35) **PERSONAL INJURY. CARE MUST BE TAKEN WHEN REFILLING WITH WATER SOON AFTER FRYING.**
- (36) **HEALTH HAZARD. THE BRAKE PADS MAY CONTAIN ASBESTOS. ENSURE THAT ADEQUATE PRECAUTIONS ARE TAKEN TO PREVENT POSSIBLE INHALATION OF ANY DUST.**
- (37) **HEALTH HAZARD. HYDRAULIC OIL IS BOTH TOXIC AND HAZARDOUS. AVOID SKIN CONTACT WITH OIL. APPLY BARRIER CREAM TO HANDS AND WEAR GLOVES BEFORE COMMENCING WORK ON THE HYDRAULIC SYSTEM.**
- (38) **PERSONAL INJURY. ALL PERSONNEL MUST WEAR EYE SHIELDS AND GLOVES WHEN WORKING WITH TOOLS THAT CAUSE METAL TO METAL CONTACT TO PROTECT EYES AND HANDS FROM METAL FRAGMENTS.**
- (39) **PHYSICAL INJURY. ENSURE THAT SAFETY HARNESSSES ARE WORN AND CORRECTLY ADJUSTED AT ALL TIMES WHEN THE VEHICLE IS IN MOTION.**
- (40) **WEIGHT HAZARD. ACCESS COVERS ARE HEAVY. SMALLER COVERS MAY BE RAISED BY ONE MAN. LARGER COVERS WILL REQUIRE ASSISTANCE OR MUST BE LIFTED USING SUITABLE LIFTING EQUIPMENT.**
- (41) **PHYSICAL INJURY. SUFFICIENT MANPOWER OR SUITABLE LIFTING EQUIPMENT MUST BE AVAILABLE PRIOR TO REMOVING THE TOP DECKS. A MINIMUM OF A VEHICLE COMMANDER MUST SUPERVISE THIS TASK.**
- (42) **PHYSICAL INJURY. DEPENDING UPON THE ANGLE BETWEEN THE VEHICLE AND GROUND SURFACE, WITH THE VEHICLE STATIONARY AND THE ENGINE IDLING, THE VEHICLE MAY MOVE IF EITHER THE DRIVER'S FOOTBRAKE OR THE PARKING BRAKE IS RELEASED.**

(continued)

WARNINGS (continued)

- (43) **HIGH CURRENT. AVOID THE RISK OF HIGH CURRENT SHORT CIRCUITS; TAKE EXTRA CARE WHEN UTILISING METAL ITEMS OR TOOLS NEAR THE BATTERIES.**
- (44) **HEAVY WEIGHTS. EACH BATTERY WEIGHS APPROXIMATELY 39 KG (86 LB). DUE CONSIDERATION MUST BE GIVEN TO JSP 375, LEAFLET 4, MANUAL HANDLING.**
- (45) **VEHICLE MOVEMENT. IF THE PARKING BRAKE FAILS TO HOLD THE VEHICLE, THE TRACKS MUST BE CHOCKED BEFORE THE ENGINE IS SWITCHED OFF.**
- (46) **FIRE RISK. WHEN BLEEDING THE FUEL SYSTEM, THE HULL AUTOMOTIVE MASTER SWITCH MUST BE IN THE ON POSITION. ALL NECESSARY FIRE PRECAUTIONS MUST BE STRICTLY APPLIED AND HATCHES AND COVERS OPENED TO DISPERSE FUMES.**
- (47) **ASBESTOS MATERIAL. ASBESTOS DUST IS INJURIOUS TO HEALTH WHEN INHALED. AIR LINES OR DRY BRUSHING ARE NOT TO BE USED TO CLEAN OFF DUST AROUND BRAKE PADS, BRAKE CALIPERS, DISCS AND SURROUNDING AREAS. IF ASBESTOS DUST IS INHALED SEEK MEDICAL ATTENTION IMMEDIATELY.**
- (48) **ASBESTOS MATERIAL. WHEN CLEANING OFF BRAKE DUST, THE MINIMUM PRECAUTIONS ARE TO WEAR A FACE MASK AND RUBBER GLOVES AND ALSO DAMPEN THE AREA.**
- (49) **LOSS OF CONTROL. DO NOT DRIVE THE VEHICLE WITH DEFECTIVE BRAKES.**
- (50) **PERSONAL INJURY. THE TRACK PULLING ROPE AND TRACK CLAMP MUST BE CHECKED BOTH BEFORE AND AFTER USE TO ENSURE THAT THEY ARE FREE FROM DAMAGE.**
- (51) **PERSONAL INJURY. GOGGLES AND PROTECTIVE GLOVES MUST BE WORN WHEN REMOVING OR REFITTING TRACKS, LINKS AND SPROCKETS OR WHENEVER USING TRACK TOOLS ON WHICH METAL-TO-METAL CONTACT OCCURS OR WHEN SPLINTERING MAY OCCUR.**
- (52) **PERSONAL INJURY. BEWARE OF SHARP EDGES IF IDLER WHEEL IS CHECKED WITH BARE HANDS.**
- (53) **PERSONAL HAZARD. WORK ON BATTERIES MUST BE CARRIED OUT BY QUALIFIED PERSONNEL ONLY.**
- (54) **HIGH CURRENT. TURN OFF BATTERY MASTER SWITCHES BEFORE UNDERTAKING ANY BATTERY MAINTENANCE.**
- (55) **ELECTROLYTE SPILLAGE. IF BATTERIES ARE DAMAGED, CARE MUST BE TAKEN TO PREVENT ELECTROLYTE COMING INTO CONTACT WITH SKIN OR CLOTHING. IF ELECTROLYTE GETS ONTO THE SKIN IT MUST BE WASHED OFF WITH SOAP UNDER COLD RUNNING WATER.**
- (56) **HIGH CURRENT. CABLES MUST NOT BE CONNECTED OR DISCONNECTED DURING THE OPERATION OF THE VEHICLE.**

(continued)

WARNINGS (continued)

(57) **FIRE HAZARD. DO NOT SMOKE OR ALLOW NAKED FLAMES IN THE VICINITY OF BATTERIES.**

(58) **HIGH CURRENT. AVOID THE RISK OF HIGH CURRENT SHORT CIRCUITS; TAKE EXTRA CARE WHEN UTILISING METAL ITEMS OR TOOLS NEAR BATTERIES.**

(59) **PHYSICAL INJURY. BEFORE MOVING THE VEHICLE ENSURE THAT THE DRIVER'S HATCH IS SECURED. SERIOUS INJURY CAN RESULT IF THE DRIVER'S HATCH SWINGS CLOSED WHEN MOVING THE VEHICLE WITH THE DRIVER IN THE 'HEAD UP' POSITION.**

(60) **VEHICLE CONTROL. THE COMMANDER OF THE TOWING/TOW STARTING OPERATION IS TO FULLY BRIEF ALL PERSONNEL ON CORRECT SYNCHRONISATION BETWEEN CONTROLLERS AND DRIVERS. SPECTATORS MUST ALSO BE KEPT WELL CLEAR OF THE TOWING/TOW STARTING AREA.**

(61) **PHYSICAL INJURY. WHEN REVERSING THE TOWING VEHICLE USE A LOW GEAR. THIS OPERATION MUST BE DONE AT LOW SPEED AND UNDER TIGHT CONTROL AND BE SUPERVISED BY THE COMMANDER OF THE TOWING VEHICLE.**

(62) **PHYSICAL INJURY. WHEN HANDLING THE TOW ROPES PERSONNEL ARE TO WEAR PROTECTIVE GLOVES.**

(63) **PHYSICAL INJURY. WHEN STARTING A VEHICLE BY TOWING, THE DRIVER OF THE CASUALTY VEHICLE MUST BE CLOSED DOWN.**

(64) **VEHICLE MOVEMENT. CARE SHOULD BE EXERCISED WHEN LEAVING THE DRIVER'S COMPARTMENT TO AVOID ACCIDENTALLY MOVING A STEERING LEVER IF THE ENGINE IS RUNNING. ACCIDENTALLY MOVING A STEERING LEVER CAN INITIATE AN UNPLANNED PARTIAL NEUTRAL TURN.**

(65) **VEHICLE MOVEMENT. WHEN THE PARKING BRAKE IS APPLIED, IF NEUTRAL IS NOT SELECTED THE VEHICLE CAN STILL ENGAGE GEAR WHEN THE ACCELERATOR IS DEPRESSED.**

(66) **LOSS OF CONTROL. IF CONDITIONS DICTATE THE USE OF BRAKING, THE BRAKES MUST BE APPLIED GENTLY, AS THE VEHICLE MAY TURN IN THE DIRECTION OF THE REMAINING FITTED TRACK.**

(67) [REDACTED]

(68) [REDACTED]

(69) **REDUCED CREW SURVIVABILITY. HARNESSSES MUST BE WORN CORRECTLY AT ALL TIMES. FAILURE TO WEAR THE HARNESSSES WILL COMPROMISE THE LEVEL OF PROTECTION.**

(continued)

WARNINGS (continued)

(70) [REDACTED]

(71) DANGER TO LIFE AND LIMB. DUE CONSIDERATION SHOULD BE GIVEN TO THE HIGHLY FLAMMABLE NATURE OF GASOLINE AND ITS VAPOUR. CARELESSNESS IN ITS USE MAY RESULT IN PAINFUL BURNS.

(72) [REDACTED]

(73) EARLY EXPLOSION. COVER MUST BE TAKEN WITHOUT DELAY, SINCE THE FIRE MAY CAUSE AN EARLY EXPLOSION OF THE AMMUNITION.

(74) RISK OF FIRE. RADIO BATTERY MASTER SWITCH SHOULD NOT BE SWITCHED ON WHEN RADIO BATTERIES ARE DISCONNECTED.

(75) CADMIUM PLATING. THE EQUIPMENT COVERED BY THIS PUBLICATION CONTAINS COMPONENTS INCORPORATING CADMIUM PLATED MATERIAL WHICH IS A POTENTIAL SAFETY HAZARD. THIS MATERIAL, IN ITSELF, IS SAFE EXCEPT IN CIRCUMSTANCES WHEN IT IS HEATED, CORRODED OR WORKED. POTENTIAL HAZARDS ARISE WHEN:

(75.1) CADMIUM PLATING MATERIAL OR COMPONENTS ARE FILED AND THE RESULTING DUST IS INHALED.

(75.2) TOXIC FUMES ARE INHALED WHEN CADMIUM IS HEATED.

(75.3) CADMIUM SALTS FORMING AS A RESULT OF CORROSION ARE ABSORBED INTO THE BODY TISSUES THROUGH SKIN, MOUTH, OR WOUND.

REFER TO JSP 515 FOR THE RELEVANT MSDS AND CONDUCT A RISK ASSESSMENT I.A.W. JSP 375, VOL 2, LEAFLET 5 OR AESP 0200-A-093-013 PRIOR TO ACTIVITIES.

(76) LETHAL VOLTAGES. DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. WHEN CARRYING OUT WORK ON ANY BOWMAN RADIO EQUIPMENT DURING FAILURE DIAGNOSTICS, REFER TO BOWMAN CIETP, DAESP 5895-G-200-SERIES.

(77) FIRE HAZARD. BOWMAN EQUIPMENT MAY CAUSE FLAMMABLE SUBSTANCES TO IGNITE AT REFUELLING POINT. BOWMAN SYSTEM MUST BE TURNED TO STANDBY DURING REFUELLING.

(78) PERSONNEL INJURY. BOWMAN ANTENNAS MAY TRANSMIT AT ANY TIME. SHOULD A CREW MEMBER GRAB AN ANTENNA WHILST TRANSMITTING THEY MAY SUFFER RF BURNS. UNDER NO CIRCUMSTANCES MUST AN ANTENNA BE TOUCHED WHEN FITTED TO THE VEHICLE UNLESS EQUIPMENT IS TURNED TO STANDBY.

(79) PERSONNEL INJURY. CARE MUST BE TAKEN WHILST MOVING THE VEHICLE WITH THE ANTENNAS FITTED. TOUCHING OF OVERHEAD CABLES MAY INDUCE HIGH VOLTAGES INTO THE VEHICLE CAUSING POSSIBLE ELECTROCUTION OF CREW MEMBERS.

(continued)

WARNINGS (continued)

(80) **PERSONNEL INJURY. WHEN CARRYING OUT ANY TYPE OF WORK ON A CVR(T) (BOWMAN) VEHICLE, ATTENTION MUST BE MADE TO THE VARIOUS SAFETY NOTICES WHICH ARE POSITIONED THROUGHOUT THE VEHICLE.**

(81) **RISK OF CRUSH INJURY. DO NOT WORK UNDER VEHICLE SUPPORTED ONLY BY JACKING STRUTS. VEHICLE MUST BE SECURELY SUPPORTED BY HULL STANDS OR SUITABLE SKIDDING.**

(82) **RISK OF CRUSH INJURY. VEHICLE MUST NOT BE SUPPORTED BY JACKING STRUTS FOR PROLONGED PERIODS. FAILURE OF TORSION BARS CAN OCCUR SUDDENLY, WHICH WILL SIGNIFICANTLY REDUCE GROUND CLEARANCE OR CAUSE VEHICLE MOVEMENT.** [REDACTED]

(83) **PERSONNEL INJURY. WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.**

(84) **SILICA. TOXIC SUBSTANCE. ANY ACCUMULATED SAND ON THE VEHICLE MAY CONTAIN SILICA DUST WHICH MUST BE REGARDED AS HAZARDOUS TO HEALTH. PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN TO PREVENT INHALATION OF DUST WHEN CLEANING OR WORKING ON THE VEHICLE. REMOVE ANY SAND AND DUST DEPOSITS FROM THE VEHICLE BEFORE COMMENCING WORK. ALL PERSONAL PROTECTIVE EQUIPMENT MUST BE CLEANED AFTER EACH USE IN A DESIGNATED AREA TO PREVENT THE RISK OF DUST INHALATION BY UNPROTECTED PERSONNEL.**

(85) **PERSONAL INJURY. WHEN CHECKING ASSEMBLIES FOR HIGH TEMPERATURE, APPROACH WITH CARE USING THE BACK OF THE HAND TO DETECT EXCESSIVE HEAT RADIATION.**

(86) **RISK OF DEATH OR SERIOUS INJURY. FAILURE TO OBSERVE AND FOLLOW THE ADDITIONAL INSTRUCTIONS MAY CAUSE FAILURE OF ONE OR MORE OF THE TOWING EYES ON THE RECOVERY VEHICLE AND OR THE CASUALTY VEHICLE. THIS COULD RESULT IN INJURIES TO PERSONNEL THAT COULD RESULT IN DEATH.**

(87) **RISK OF DEATH OR SERIOUS INJURY. DURING RECOVERY A SAFETY ZONE OF 25 TO 30 METRES MUST BE MAINTAINED AROUND THE CASUALTY AND RECOVERY VEHICLES, MEASURED FROM THE CENTRE POINT BETWEEN THE TWO VEHICLES.**

(88) **HAND INJURY. WEAR PROTECTIVE GLOVES WHEN HANDLING THE KERR. ANY SHARP OBJECTS EMBEDDED IN THE ROPE MAY CAUSE INJURY.**

(89) **DANGER OF DEATH OR INJURY. IF A VEHICLE IS INVOLVED IN A ROAD TRAFFIC ACCIDENT (RTA) OR A HEAVY IMPACT TO THE FRONT OF THE VEHICLE (HULL, TRACKS OR FINAL DRIVES) IT IS POSSIBLE THAT DAMAGE HAS OCCURRED TO COMPONENTS INSIDE THE FINAL DRIVE THAT CAN RESULT IN A LOSS OF CONTROL OF THE VEHICLE. THE VEHICLE MUST BE RECOVERED AND BOTH FINAL DRIVES MUST BE REPLACED. REPORT TO REME. THE SEFIT AND PLATFORM TEAMS MUST BE INFORMED.**

(continued)

WARNINGS (continued)

(90) **TOXIC AND HAZARDOUS SUBSTANCE - CERABOARD ALUMINOSILICATE FIBRES.** ALL VARIANT (EXCEPT SCIMITAR) ENGINE COMPARTMENT BULKHEAD INSULATION MAY CONTAIN ALUMINOSILICATE FIBRES WHICH ARE HARMFUL WHEN INHALED AND AN IRRITANT TO THE SKIN AND EYES. USE APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT WHEN CLEANING THE COMPARTMENT TO PREVENT INHALATION AND CONTACT WITH SKIN AND EYES.

(91) **RISK OF DEATH OR SERIOUS INJURY.** WHEN THE DRIVER IS IN THE HEADS OUT POSITION WITH HATCHES OPEN, THE TURRET MUST BE POSITIONED TO THE FRONT OF THE VEHICLE (12 O'CLOCK POSITION) AND THE TURRET LOCK ENGAGED. WHEN THE TURRET IS IN ALL POSITIONS OTHER THAN 12 O'CLOCK, THE DRIVER MUST BE IN THE HEADS IN POSITION WITH HATCHES CLOSED.

CAUTIONS

- (1) **EQUIPMENT DAMAGE.** Do not overfill engine with oil.
- (2) **EQUIPMENT DAMAGE.** If the transmission louvres are open, no air is drawn through the radiator or charge air cooler. Therefore, only limited running of the engine in this condition is possible. The engine must be stopped before high coolant temperatures occur.
- (3) **EQUIPMENT DAMAGE.** Do not over tighten the engine oil filter canister when fitting a new filter canister.
- (4) **EQUIPMENT DAMAGE.** Loose connections or damaged charge air cooler can cause damage to the turbocharger.
- (5) **EQUIPMENT DAMAGE.** The engine must not be run with the radiator in the raised position. Seek REME advice if required.
- (6) **EQUIPMENT DAMAGE.** Do not use a screwdriver or similar 'chisel edged' metal tool to refit the seals.
- (7) **EQUIPMENT DAMAGE.** Ensure that the driver's access aperture is covered before cleaning commences.
- (8) **EQUIPMENT DAMAGE.** Use only a low pressure water jet for cleaning matrices. Matrices may be damaged if compressed air or high pressure water jets are used.
- (9) **EQUIPMENT DAMAGE.** Care must be taken to avoid distorting the radiator core fins.
- (10) **EQUIPMENT DAMAGE.** Do not use tools when fitting filter cartridge. Over tightening will damage the cartridge or the filter head by distorting the screw threads.
- (11) **DAMAGE TO SEALS.** Avoid spilling oil onto the charge air cooler or radiator seals. Any spillage must be wiped off to preserve the rubber.
- (12) **EQUIPMENT DAMAGE.** The brake disc must not be used as a lever when pushing the piston back into the cylinder.

(continued)

CAUTIONS (continued)

(13) **EQUIPMENT DAMAGE.** Displacing the cylinder pistons could cause the reservoir level to rise and block the filler cap breather holes. Check for correct fluid level and that the breather holes are clear, wipe up any spilt fluid before driving.

(14) **EQUIPMENT DAMAGE.** The gases vented from a battery are highly inflammable, therefore, electrical connections must be maintained clean and tight to prevent ignition of gases. Before removing or replacing connectors, put the master battery switch to OFF and ensure that the vent block outlets are fitted with plastic tubing or plastic caps as appropriate. Do not attempt to remove or replace the positive connector with the negative (earth) cable connected. Freshly charged batteries must not be installed until all gassing has ceased. A naked light must never be used when examining a battery.

(15) 

(16) **EQUIPMENT DAMAGE.** When the system is not in use the scavenge outlet must be closed with the plug provided to prevent, during fording or washing down, the ingress of water damaging the fan motor.

(17) **EQUIPMENT DAMAGE.** The engine idling speed is never to exceed 750 rpm otherwise the clutch will become engaged.

(18) **EQUIPMENT DAMAGE.** Do not rapidly increase and decrease the engine revolutions immediately after starting.

(19) **TURBOCHARGER DAMAGE.** To avoid damage to the turbocharger, allow the engine to idle for 3-4 minutes to allow the turbocharger to slow and cool before stopping the engine. Only under operationally essential and circumstances of safety may the engine be switched off immediately prior to turbocharger run down and cool.

(20) **EQUIPMENT DAMAGE.** Pivot turns should be avoided on rough or heavy ground, as it places excessive strain on the transmission and may result in a track being thrown.

(21) **IMPROPER USE.** Do not make 'tea, coffee, soups etc' in the water compartment, as this heavy fluid will cause the drain tap to malfunction.

(22) **EQUIPMENT DAMAGE.** Under normal light conditions, the night vision periscope should not be switched on unless the training filter is fitted, or the image intensification tube may be damaged. If the periscope is used in daylight in an emergency, the diaphragm control must not be rotated past the first 'click' or damage to the image intensification tube may result.

(23) **ENGINE OVERHEATING.** Do not block deck louvres with stowed items.

(24) **EQUIPMENT DAMAGE.** Do not 'blip' the accelerator pedal before switching off the engine, as serious damage may be caused to the turbocharger.

(25) **ELECTRICAL ARCING.** Care must be exercised that the centre terminal of the inter-vehicle cable does not contact any metal parts once one end of the cable has been connected.

(continued)

CAUTIONS (continued)

- (26) **EQUIPMENT DAMAGE.** Power must not be turned off while the vehicle is in motion.
- (27) **EQUIPMENT DAMAGE.** Diesel fuel and solvent cleaners can damage rubber. All traces of cleaning solvents must be removed by wiping dry all cleaned surfaces.
- (28) **WATER LEVEL.** When boiling less than 1 litre (two pints) of water, the food container must be placed in the compartment.
- (29) **EQUIPMENT DAMAGE.** The radio master switch must be in the 'OFF' position before connecting or disconnecting any radio installation equipment.
- (30) **EQUIPMENT DAMAGE.** Do not change frequency on the set while the TUAAM is tuning or warming up or damage may occur within the antenna system.
- (31) **EQUIPMENT DAMAGE.** Care must be taken to refit the decks with the louvres the correct way round to prevent overheating.
- (32) **EQUIPMENT DAMAGE.** Do not over tighten the floor plate securing bolts. If over tightened, there is a possibility that they may shear off.
- (33) **VEHICLE CONTROL.** When fitting the steering lever bolts, always ensure that the correct size bolts are used and that they are fitted from the outside faces of the steering levers. Ensure both levers operate freely and there is no fouling.
- (34) **EQUIPMENT DAMAGE.** Use only Petrolatum Technical grease on battery posts; on no account must ordinary grease be used for this purpose.
- (35) **EQUIPMENT DAMAGE.** Methylated spirits, petrol or other cleaning agents should only be used by suitably qualified personnel, as excessive use of these can cause deterioration of the sealing and bonding materials.
- (36) **EQUIPMENT DAMAGE.** The air filter element must never be washed.
- (37) **EQUIPMENT DAMAGE.** When the radiator is in the raised position coolant flow through the trunnion glands is prevented, therefore, the engine must not be run with the radiator in the raised position.
- (38) **EQUIPMENT DAMAGE.** To avoid unnecessary damage, do not stand on the radiator, particularly when the radiator is in the raised position.
- (39) **EQUIPMENT DAMAGE.** Work on batteries must only be carried out by qualified personnel.
- (40) **EQUIPMENT DAMAGE.** Defective batteries must be replaced immediately. Do not run vehicles with known defective batteries. Report to REME.
- (41) **DISPOSAL OF DISCHARGED BATTERIES.** Batteries withdrawn from service must be properly disposed of through the normal recycling process.
- (42) **EQUIPMENT DAMAGE.** An over-tightened alternator drive belt can cause damage to the pulley bearings on the alternator drive system.

(continued)

CAUTIONS (continued)

(43) **AUTOMOTIVE DAMAGE.** It is possible, particularly on down gradients to exceed the specified maximum speed of the vehicle. The driver must ensure that the vehicle does not exceed the maximum speed as laid down in standing orders, to retain control of the vehicle and avoid damage to automotive components.

(44) **TRANSMISSION DAMAGE.** If a main brake failure occurs, the vehicle may be brought to a halt by progressive use of the parking brake. This, however, may cause damage to the transmission and is only to be used in an extreme emergency.

(45) **TRANSMISSION DAMAGE.** If the vehicle has not been brought to a halt and is still in motion, do not attempt to engage emergency gear.

(46) **EQUIPMENT DAMAGE.** Do not turn off the power while the vehicle is in motion.

(47) **EQUIPMENT DAMAGE.** Greater care should be taken when driving, manoeuvring, or crossing obstacles due to reduced ground clearance.

(48) **EQUIPMENT DAMAGE.** When being transported by Heavy Equipment Transporter, up armoured vehicles must be reversed onto the transporter.

(49) **EQUIPMENT DAMAGE.** During recovery operations, the recovering vehicle should be of an equal or greater weight than the casualty vehicle. Therefore an up-armoured vehicle should never be recovered by a single non up-armoured vehicle. Always use tandem towing methods if recovery has to be undertaken using non up armoured variants.

(50)



(51) **EQUIPMENT FAILURE.** CVR(T) Mk 1 vehicles have recovery eyes that are welded to the hull of the vehicle. Due to the age of the vehicle and these welds their integrity cannot be guaranteed.

(52) **EQUIPMENT FAILURE.** Under no circumstance should a sideward pull be carried out with KERR using the recovery lugs to straighten up a vehicle prior to normal recovery. The shear loads on the recovery lugs could potentially be too great for the lugs to withstand.

(53) **EQUIPMENT FAILURE.** Deviation from any Single or Combination of the factors given below could lead to a serious equipment failure.

(54) **EQUIPMENT DAMAGE.** The lifting eyes on the upper surfaces must not be used for recovery.

(55) **EQUIPMENT DAMAGE.** Do not steam clean or force dry the KERR with hot air.

(56) **EQUIPMENT DAMAGE.** Do not allow the KERR to come into contact with heat sources or acids.

~~OFFICIAL SENSITIVE~~

~~OFFICIAL SENSITIVE~~

CHAPTER 1
INTRODUCTION AND DATA
CONTENTS

Para

1	Introduction and Data
3	Engine
4	Air filtration unit
5	Fuel system
6	Cooling system
7	Bilge pump
8	Range of operation
9	Transmission
10	Controls
11	Suspension
12	Tracks
13	Brakes
14	Electrical system

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Annex

- A Introduction and data for up-armoured vehicles

INTRODUCTION AND DATA

1 The Scimitar is the fire support vehicle of the Combat Vehicle, Reconnaissance (Tracked) family and is the basic vehicle of the family, of which all the automotive components are common.

2 Full NBC protection is provided on all vehicles in the family, to protect the crews against bacteriological or chemical attack and from nuclear fall-out.

ENGINE

3

Type	Cummins B, 5.9 litre diesel, turbocharged, charge air cooled
Number of cylinders	6 in line
Maximum power (gross)	142 kW at 2600 rev/min (approx 190 bhp)
Maximum torque (gross)	610 Nm (450 lbf ft) at 1500 rev/min approx
Fuel Injection	Direct, in-line fuel injection pump
Lubrication	Wet sump
Cooling	Liquid, pump assisted, pressurized and thermostat controlled
Bore	102 mm (4.02 in)
Stroke	120 mm (4.72 in)
Displacement	5.88 litres (359 in ³)
Compression ratio	17.6:1
Firing order	1,5,3,6,2,4 (numbered from flywheel end)
Governed speed	Maximum no load 2900 rev/min Maximum power speed 2600 rev/min
Idling speed	700 rev/min
Starter motor	Flange mounted, axial engagement type with thermal trip
Fire detection system	Fire sensing wire fitted to engine

AIR FILTRATION UNIT

4

Two stage system	Stage 1: Cyclone pre-cleaner, Stage 2: Paper element
------------------------	--

FUEL SYSTEM

5

Fuel priming pump	Electric lift type
Fuel lift pump	Mechanical pump on engine
Fuel filter	Canister type

COOLING SYSTEM

6

Radiator	Single pass, trunnion mounted
Fan	Mixed flow, belt driven from transmission

BILGE PUMP

7

Hand operated	72 litres/min
---------------------	---------------

RANGE OF OPERATION

NOTE

Refer to Disclaimer, Preliminary pages, page (vi).

8

Endurance..... [REDACTED]

TRANSMISSION

9

Gearbox TN15D cross drive, hot shift type, providing seven speeds in each direction
 Final drive Single epicyclic reduction
 Steering..... Meritt system incorporated in gearbox
 Steering brakes..... Caliper discs, hydraulically operated
 Main brakes Caliper discs, hydraulically operated

TABLE 1 GEAR RATIOS

Gear	Final drive ratio	Overall Gear ratio
1	3.667	16.10
2	3.667	7.18
3	3.667	5.15
4	3.667	3.10
5	3.667	1.72
6	3.667	1.31
7	3.667	0.83

CONTROLS

10

Gear selector Foot operated, mechanical linkage
 Forward/reverse lever Hand operated, mechanical linkage
 Steering levers Hydraulically connected to steering brakes
 Parking brake..... Lever connected by cable to contracting bands round the main brake discs
 Foot brake pedal Hydraulically connected to main brakes
 Accelerator pedal Cable connection to fuel injection pump
 Cold starting device Thermostart (if fitted)

SUSPENSION

11

Type Transverse torsion bar, 5 units each side 0.58 m
(23 in) diameter, rubber tyred aluminium alloy
discs. Two on each suspension unit.
Shock absorbers Messier type on front and rear stations
Wheel deflection 0.20 m (8 in) bump, 0.10 m (4 in) rebound

TRACKS

12

Type Light steel links with rubber pads and bushes
Pitch 0.11 m (4.54 in)
Width 0.43 m (17 in)
Links per track (Nominal) 77-79 (Scimitar)
82-84 (Variants)

BRAKES

13

Main (hydraulic, disc) 60% retardation, 15.2 m (50 ft) stop from 48.3 km/h
(30 mile/h)
Parking (mechanical, band) Holds on 1 in 3 slope (34% slope)

ELECTRICAL SYSTEM

14

TABLE 2 LAMPS

Light	Volts	Watts	Type	NSN
Head	24	70/75		6240-99-995-1984
	24	50		6240-99-995-4441
	24	70/75		6240-99-659-8126
Registration plate, interior	28	5	SCC	6240-99-995-9813
Tail/stop	28	7/30	SBC Index	6240-99-995-3296
Turn, side	24	21	SCC	6240-12-173-4827
Generator Warning	28	1.12	MCC	6240-99-995-9118
Oil press warning	28	1.12	MCC	6240-99-995-9118
Temp warning	28	1.12	MCC	6240-99-995-9118
Flasher warning	28	1.12	MCC	6240-99-995-9118
Main beam warning	28	1.12	MCC	6240-99-995-9118
Driver's instrument panel	28	2.8	MES	6240-99-995-1297
Commander's map light	28	5	SCC	6240-99-995-9813
Spotlight	26	50	Pre-focus	6240-99-995-4508
Hazard switch warning	24	3	MCC	6240-12-121-2728
Central warning system	24	2.8	MCC	6240-99-995-1233
Amber flashing beacon	24	70	SCC	6240-99-995-2519

TABLE 3 CIRCUIT PROTECTION DEVICES

Location	Identification	Type and Rating	Circuit
Driver's instrument panel	Smoke	Ceramic Cartridge 10A	Not used
	Head	Ceramic Cartridge 15A	Headlights
	Heater	Ceramic Cartridge 10A	Heater motor
	Int Lts	Ceramic Cartridge 5A	Hull interior light
	Wiper periscope	Ceramic Cartridge 10A	Driver's periscope and image intensification sight
	Flasher	Ceramic Cartridge 5A	Turn lights
	Ins	Ceramic Cartridge 10A	IGN and OIL warning lights, panel lamps, battery and fuel gauge
	Cupola	Ceramic Cartridge 15A	Used on Spartan
	Side	Ceramic Cartridge 5A	Side lights
	Tail	Ceramic Cartridge 5A	Tail lights
	Con	Ceramic Cartridge 5A	Convoy light
	Radiac	Ceramic Cartridge 5A	Not used
	Fuse unit forward	-	Ceramic Cartridge 63A
Fuse unit rear	-	Ceramic Cartridge 32A	NBC Unit
Distribution Panel	F1	Ceramic Cartridge 15A	Not used
	F2	Ceramic Cartridge 15A	Not used
	F3	Ceramic Cartridge 15A	Not used
	F4	Ceramic Cartridge 10A	Inspection lamp sockets (dist panel)

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CHAPTER 2
FIRE FIGHTING EQUIPMENT
CONTENTS

Para

- 1 Description
- 3 Fire detection system
- 6 Fixed fire extinguisher (WARNING)
Operation of equipment
- 8 Fixed fire extinguisher
- 9 Portable fire extinguisher (fluoroketone) (WARNINGS)
- 10 Portable fire extinguisher (dry powder)
- 11 Action in the event of fire (WARNINGS)
Maintenance (WARNING)
- 13 Fixed extinguisher
- 17 Portable fire extinguisher (fluoroketone)
- 18 Portable fire extinguisher (dry powder)
- 19 Fire detection system

Fig

Page

1	Fire detection system engine compartment (typical)	2
2	Fixed fire extinguisher (typical)	3
3	Portable fire extinguisher (fluoroketone)	5
4	Portable fire extinguisher (dry powder)	6
5	Engine fire detection press to test switch box	10

DESCRIPTION

1 The Fire Fighting Equipment comprises portable fire extinguishers stowed on mounting brackets at various locations depending on the vehicle variant, an engine compartment fire detection system and a fixed fire extinguisher which is coupled to piping that is arranged to discharge into the engine compartment through three discharge nozzles.

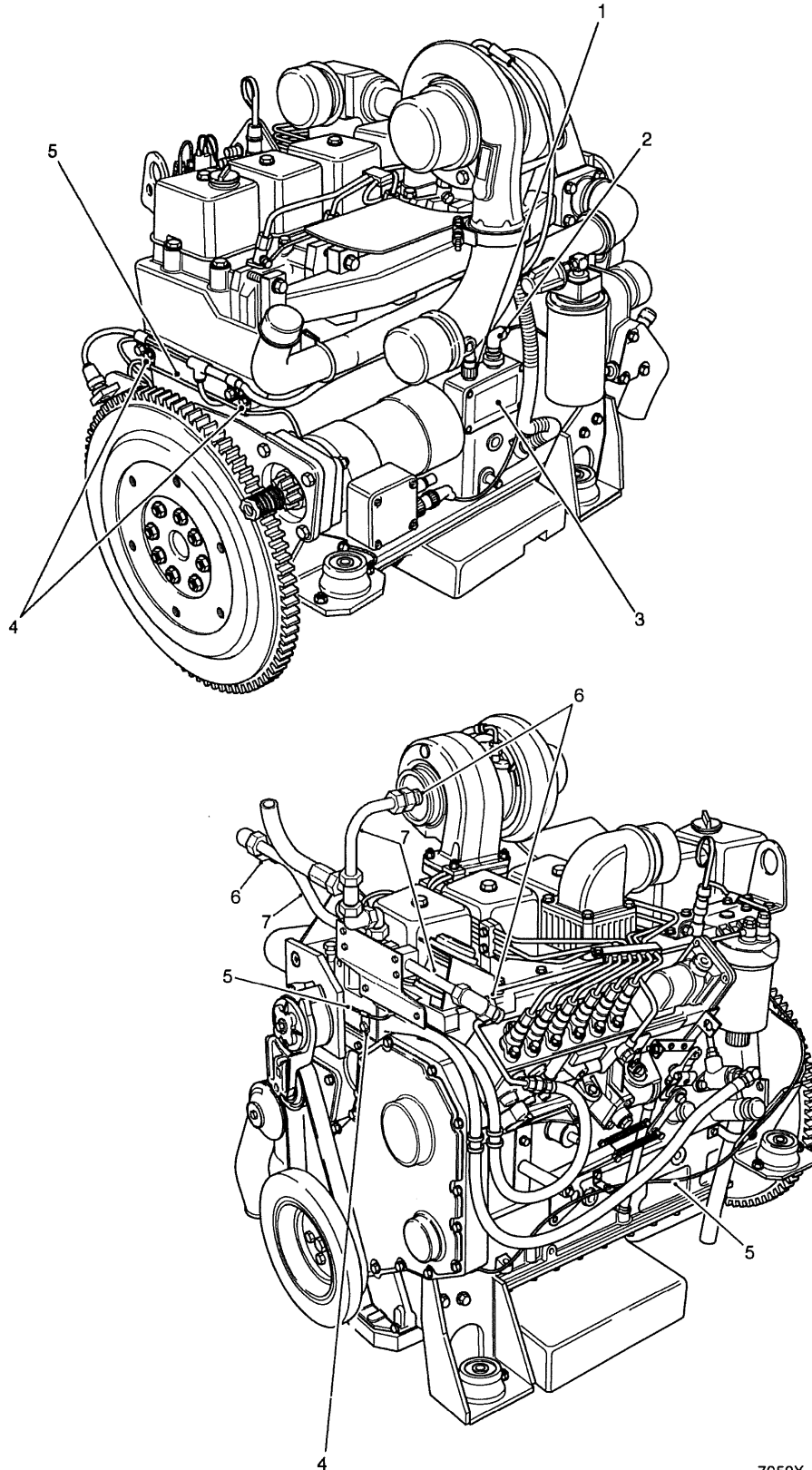
2 The fluoroketone (Novec 1230) fire extinguishers contain liquid, which discharges as a gas suitable for fighting all types of fire that may occur either inside or outside the vehicle. Externally mounted fire extinguishers are 2 kg Dry Powder Type.

FIRE DETECTION SYSTEM

3 The engine compartment automatic detection system (Fig 1) comprises a fire sensing wire connected to a fire warning horn and warning lamp. When a fire is detected the fire warning horn sounds and the red warning light flashes. The fire warning horn can be manually overridden but the warning lamp will remain illuminated until the sensing wire is renewed.

4 The fire sensing wire (Fig 1 (5)) is positioned around the engine with the fire detection junction box (3) located on the engine adjacent to the starter motor. The fire warning horn is mounted in the crew compartment, high up on the left hand side near the forward bulkhead. The warning lamp is mounted in the binnacle within the drivers view and the horn cancel switch is located on the fire horn relay box.

5 A press to test switch (Fig 5 (2)), mounted on the engine air filtration unit in the engine compartment, provides the means of testing the integrity of the fire detection system.



- | | | | |
|---|--|---|--------------------|
| 1 | Engine harness connector | 5 | Fire sensing wire |
| 2 | Press-to-test switch harness connector | 6 | Discharge nozzle |
| 3 | Fire detection junction box | 7 | Discharge pipework |
| 4 | Fire sensing wire securing clips (typical) | | |

Fig 1 Fire detection system engine compartment (typical)

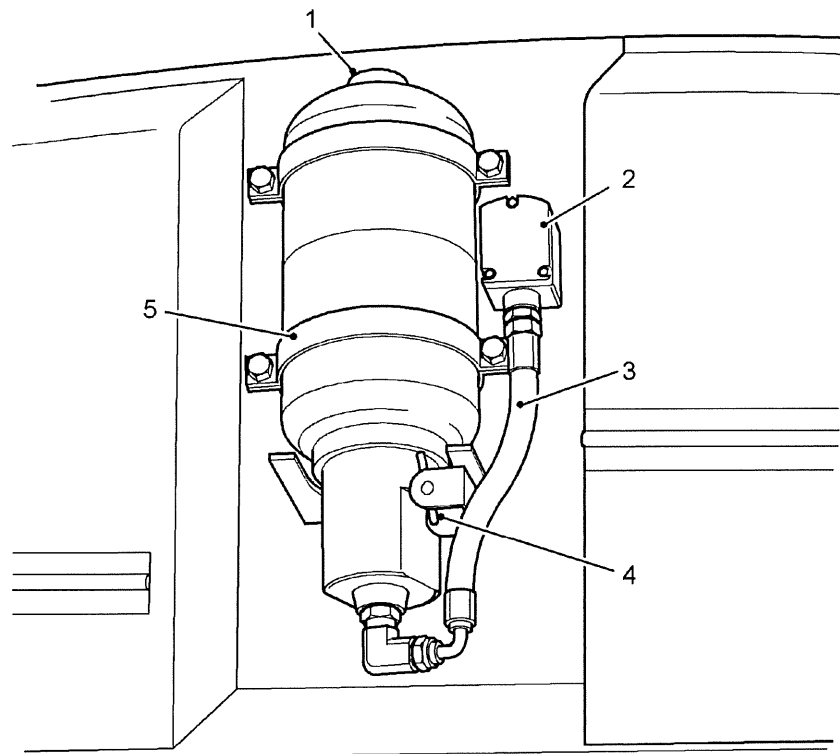
FIXED FIRE EXTINGUISHER

WARNING

PERSONNEL SAFETY. HYDROFLUOROCARBON (HFC) GAS EXTINGUISHING AGENTS MAY DECOMPOSE UNDER CERTAIN FIRE CONDITIONS, PRODUCING CONSIDERABLE QUANTITIES OF HYDROGEN FLUORIDE (HF) GAS. EXPOSURE TO LARGE DOSES OF HF CAN LEAD TO POTENTIALLY LETHAL RESPIRATORY FAILURE. IF A CREW MEMBER IS IN CLOSE PROXIMITY TO A FIRE TACKLED BY EXTINGUISHING AGENTS, IMMEDIATELY EVACUATE TO AN AREA WITH FRESH AIR, AND INFORM MEDICAL SERVICES OF SUSPECTED EXPOSURE TO HF.

6 The fixed fire extinguisher (Fig 2) is a FM200 type and is manually operated by means of a finger bar operated by means of an externally mounted pull handle.

7 A gauge on the end of the extinguisher bottle gives an indication of the charge status.



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- | | | | |
|---|-----------------|---|----------------|
| 1 | Contents gauge | 4 | Finger bar |
| 2 | Ballistic cover | 5 | Securing clamp |
| 3 | Discharge hose | | |

Fig 2 Fixed fire extinguisher (typical)

OPERATION OF EQUIPMENT**Fixed fire extinguisher**

8 The fixed fire extinguisher is manually operated from the outside of the vehicle, by means of a finger bar or T-handle. Distribution of the extinguisher contents is via pipework and flexible hoses to 3 off nozzle assemblies. Refer to variant AESP Category 201 for detailed operating instructions.

Portable fire extinguisher (fluoroketone)**WARNINGS**

(1) ASPHYXIATION HAZARD. IF FLUOROKETONE (NOVEC 1230) EXTINGUISHERS HAVE BEEN USED INSIDE THE VEHICLE, PERSONNEL MUST NOT RE-ENTER UNTIL ALL FUMES HAVE DISPERSED.

(2) PERSONNEL SAFETY. FLUOROKETONE EXTINGUISHING AGENTS MAY DECOMPOSE UNDER CERTAIN FIRE CONDITIONS, PRODUCING CONSIDERABLE QUANTITIES OF FLUOROKETONE GAS. EXPOSURE TO LARGE DOSES OF FLUOROKETONE MAY BE HARMFUL IF INHALED. IF A CREW MEMBER SHOWS SYMPTOMS OF INHALATION, IMMEDIATELY EVACUATE TO AN AREA WITH FRESH AIR, AND INFORM MEDICAL SERVICES OF SUSPECTED EXPOSURE TO FLUOROKETONE.

9 The portable fire extinguishers (fluoroketone) (Novec 1230) (Fig 3) must be held with the discharge head uppermost until either the fire is extinguished or the extinguisher is empty.

9.1 Remove the extinguisher (5) from its mounting bracket (1)

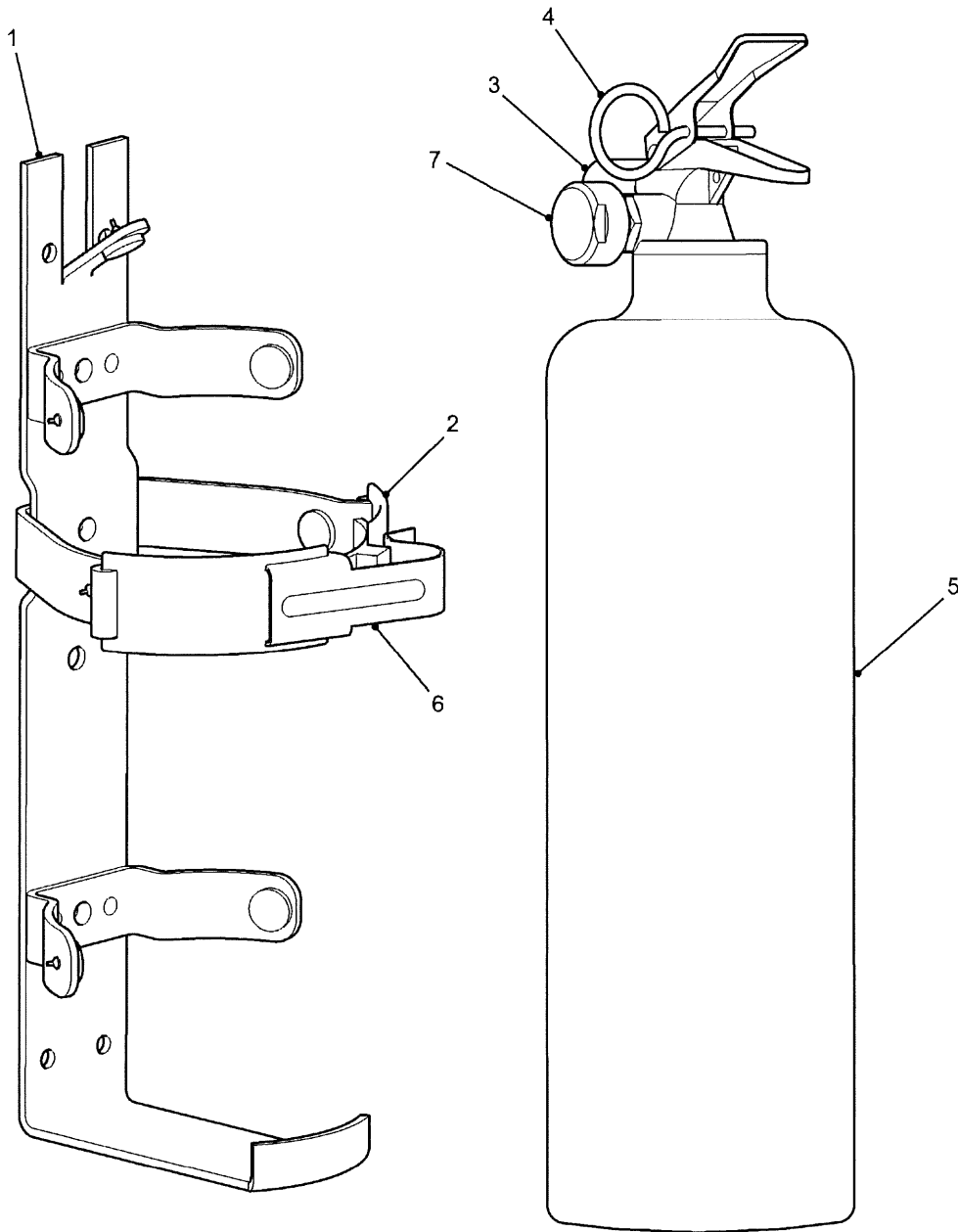
9.2 Remove the nozzle cover (3) and the safety pin (4).

9.3 Take up the most suitable position for fighting the fire before operating the extinguisher.

9.4 Operate the operating handle.

9.5 Direct the spray first at the seat of the nearest flames, sweeping from side to side and progressing the spray on the fire area leaving no flame behind it.

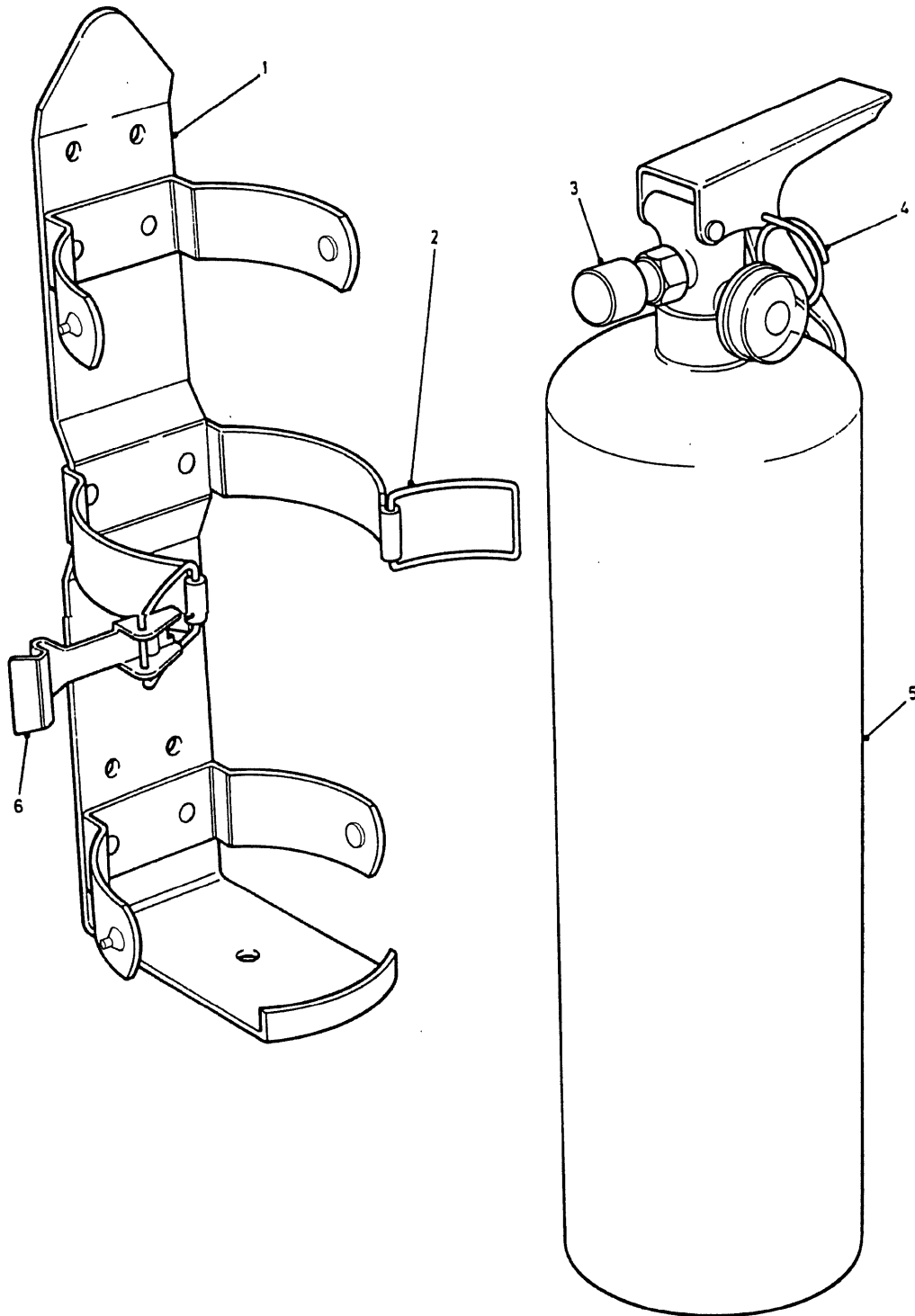
9.6 Replace a discharged extinguisher as soon as possible.



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|---|------------------------|---|----------------|
| 1 | Mounting bracket | 5 | Extinguisher |
| 2 | Strap | 6 | Catch |
| 3 | Discharge nozzle cover | 7 | Pressure gauge |
| 4 | Safety pin | | |

Fig 3 Portable fire extinguisher (fluoroketone)



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|---|------------------------|---|--------------|
| 1 | Mounting bracket | 4 | Safety pin |
| 2 | Strap | 5 | Extinguisher |
| 3 | Discharge nozzle cover | 6 | Catch |

Fig 4 Portable fire extinguisher (dry powder)

Portable fire extinguisher (dry powder)

10 The portable dry powder fire extinguisher (Fig 4) must be held with the discharge head uppermost until either the fire is extinguished or the extinguisher is empty.

- 10.1 Remove the extinguisher (5) from its mounting bracket (1)
- 10.2 Remove the nozzle cover (3) and the safety pin (4).
- 10.3 Take up the most suitable position for fighting the fire before operating the extinguisher.
- 10.4 Operate the operating handle.
- 10.5 Direct the spray first at the seat of the nearest flames, sweeping from side to side and progressing the spray on the fire area leaving no flame behind it.
- 10.6 Replace a discharged extinguisher as soon as possible.

ACTION IN THE EVENT OF FIRE

11 In all cases of fire:

WARNINGS

(1) **PERSONNEL SAFETY. IN THE EVENT OF A FIRE ENSURE ALL PERSONNEL ARE EVACUATED FROM THE VEHICLE AND THAT ALL NON-ESSENTIAL PERSONNEL ARE MOVED TO A SAFE AREA. NO ONE MUST RETURN TO THE VEHICLE UNTIL THE SENIOR PERSON PRESENT GIVES PERMISSION.**

(2) **ASPHYXIATION HAZARD. IF FLUOROKETONE (NOVEC 1230) EXTINGUISHERS HAVE BEEN USED INSIDE THE VEHICLE, PERSONNEL MUST NOT RE-ENTER UNTIL ALL FUMES HAVE DISPERSED.**

(3) **PERSONNEL SAFETY. FLUOROKETONE EXTINGUISHING AGENTS MAY DECOMPOSE UNDER CERTAIN FIRE CONDITIONS, PRODUCING CONSIDERABLE QUANTITIES OF FLUOROKETONE GAS. EXPOSURE TO LARGE DOSES OF FLUOROKETONE MAY BE HARMFUL IF INHALED. IF A CREW MEMBER SHOWS SYMPTOMS OF INHALATION, IMMEDIATELY EVACUATE TO AN AREA WITH FRESH AIR, AND INFORM MEDICAL SERVICES OF SUSPECTED EXPOSURE TO FLUOROKETONE.**

(4) **ASPHYXIATION HAZARD. DRY POWDER EXTINGUISHERS ARE NON-TOXIC. HOWEVER, THIS TYPE OF EXTINGUISHER IS NOT TO BE USED IN A CONFINED SPACE UNLESS IN AN EXTREME EMERGENCY.**

(5) **ASPHYXIATION HAZARD. THIS EQUIPMENT CONTAINS A FM200 FIRE SUPPRESSION SYSTEM. IF FM200 VAPOUR IS BREATHED IN IT CAN CAUSE SUFFOCATION. ANYONE WHO HAS INHALED FM200 VAPOUR SHOULD BE MOVED TO A PLACE OF FRESH AIR AND BE SUBJECTED TO MEDICAL ATTENTION.**

(6) **PERSONNEL SAFETY. HYDROFLUOROCARBON (HFC) GAS EXTINGUISHING AGENTS MAY DECOMPOSE UNDER CERTAIN FIRE CONDITIONS, PRODUCING CONSIDERABLE QUANTITIES OF HYDROGEN FLUORIDE (HF) GAS. EXPOSURE TO LARGE DOSES OF HF CAN LEAD TO POTENTIALLY LETHAL RESPIRATORY FAILURE. IF A CREW MEMBER IS IN CLOSE PROXIMITY TO A FIRE TACKLED BY EXTINGUISHING AGENTS, IMMEDIATELY EVACUATE TO AN AREA WITH FRESH AIR, AND INFORM MEDICAL SERVICES OF SUSPECTED EXPOSURE TO HF.**

- 11.1 Stop the vehicle and apply the parking brake.
- 11.2 Stop the engine and put the battery master switch to OFF.
- 11.3 Remove the portable extinguishers from the vehicle, evacuate the vehicle and close all hatches.
- 11.4 If the fire is in the engine compartment, operate the fixed fire extinguisher in accordance with the relevant variant operating instructions Category 201.

12 All fire fighting operations must be directed by the senior person present.

MAINTENANCE

WARNING

SILICA - TOXIC SUBSTANCE. BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.

Fixed extinguisher

- 13 The fixed extinguisher should be checked for weight periodically, this task will be carried out by a qualified REME technician.
- 14 The operator is to check the following points:
 - 14.1 The security and condition of unions, accessible piping and discharge nozzles.
 - 14.2 That the extinguisher is secured in its bracket and the bracket is secured to the hull.
 - 14.3 That the extinguisher contents gauge reading is above 24 bar at an ambient temperature of 20 deg C.
- 15 Any defect arising from the above mentioned checks, REPORT.
- 16 After the event of the fixed fire extinguisher discharging, report to REME.

Portable fire extinguisher (fluoroketone)

- 17 Check each portable fire extinguisher (fluoroketone) (Novec 1230) (Fig 3) as follows:
 - 17.1 Release the catch (6) from the strap (2) on the mounting bracket (1).
 - 17.2 Remove the extinguisher (5) from the mounting bracket (1).
 - 17.3 Shake the extinguisher (5) to ensure the presence of liquid contents.
 - 17.4 Check that the extinguisher (5) is fully charged by ensuring that the pressure gauge (7) needle is in the green zone. If the pressure needle is in the red zone, the extinguisher must be replaced.
 - 17.5 Inspect the extinguisher (5) as follows:
 - 17.5.1 Check that the tamper seal is intact.
 - 17.5.2 Check that the safety pin (4) is in position.
 - 17.5.3 Check that the operating handle is not bent or damaged.
 - 17.5.4 Check that the discharge nozzle is not obstructed.

- 17.5.5 Check that the discharge nozzle cover (3) is in position.
- 17.6 If a defect is identified at Sub-Para 17.5, replace the extinguisher (5).
- 17.7 Inspect the mounting bracket (1) for damage and replace if required.
- 17.8 Check the mounting bracket (1) is securely attached to the vehicle.
- 17.9 Install the extinguisher (5) to the mounting bracket (1) and secure with the strap (2) and catch (6).

Portable fire extinguisher (dry powder)

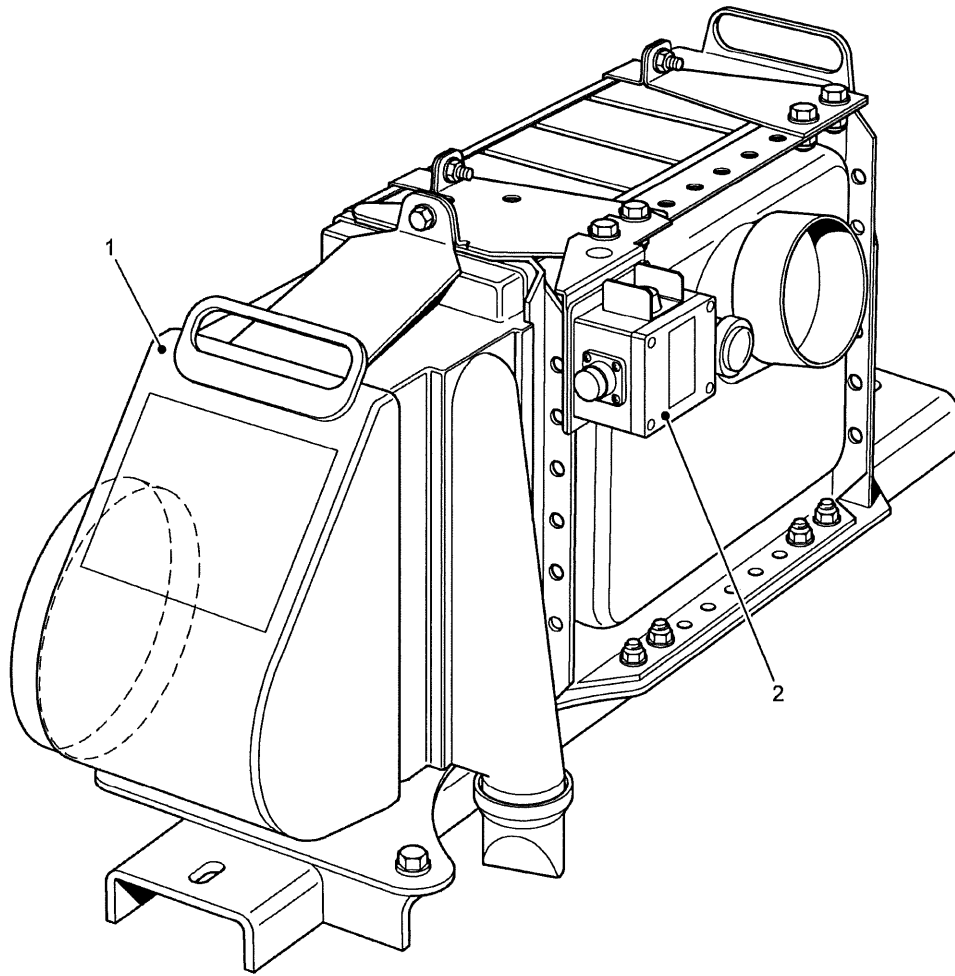
18 Check each portable extinguisher (dry powder) (Fig 4) as follows:

- 18.1 Remove extinguisher (5) from its mounting bracket (1) and inspect it for any damage. Check the instruction label is in place and legible.
- 18.2 Check that the extinguisher is fully charged by ensuring that the pressure gauge needle is in the green zone. Should the pressure needle be in the red zone the extinguisher must be renewed.
- 18.3 Place the extinguisher (5) close to the ear and turn it upside down. Listen for the dry powder falling smoothly. If you cannot hear the powder flow the extinguisher must be renewed.
- 18.4 Check that the tamper seal is intact.
- 18.5 Check that the safety pin (4) is in position.
- 18.6 Check that the operating handle is not bent or damaged.
- 18.7 Check that the discharge nozzle is not obstructed.

Fire detection system

19 Maintenance of the Fire Detection System must be carried out by a qualified REME technician. Crew members should however, check the following:

- 19.1 The fire sensing wire is in good condition.
- 19.2 The fire sensing wire is secured in the clips.
- 19.3 The fire sensing wire is clear of the structure, hoses, cables and pipes.
- 19.4 Operate press-to-test switch (if fitted) to check function of fire detection system.



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- 1 Air filtration unit (typical)
- 2 Engine fire detection press to test switch box (if fitted)

Fig 5 Engine fire detection press to test switch box

CHAPTER 3
HULL AND FITTINGS
CONTENTS


Para	
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3	Mounting and dismounting – weapons systems not activated
4	Mounting and dismounting – weapons systems activated
5	Mounting and dismounting by attachments to the vehicle
6	Top access covers (CAUTION)
8	To remove and refit top armour and decking
9	Removal (WARNINGS) (CAUTION)
10	Refitting (CAUTION)
11	Driver's seat
14	To position the seat for height (WARNING)
15	To move the seat forwards or backwards (WARNING)
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GENERAL DESCRIPTION

1

2 At the front of the hull is the transmission compartment. Behind the transmission compartment are the engine compartment on the right and the driving compartment on the left. To the rear of these is the fighting compartment; a further compartment at the rear of the hull houses an NBC pack. In addition to front and rear towing eyes the hull has four lifting and ten lashing eyes fitted.

WARNINGS

(1) **CADMIUM PLATING. THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.**

(2) **PERSONAL INJURY. WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS. ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.**

(3) **SILICA - TOXIC SUBSTANCE. BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.**

MOUNTING AND DISMOUNTING THE VEHICLE**NOTE**

Refer to Disclaimer, Preliminary pages.

Mounting and dismounting – weapons systems not activated

3 Crews must comply with the following procedures:

3.1 Only mount the vehicle from the front when authorised to do so by the vehicle commander.

3.2 Three points of contact must be maintained.

3.3 Care must be taken when moving to crew positions to avoid trip hazards.

3.4 Dismounting the vehicle is in reverse order to mounting.

3.5 At all times care must be exercised by the individual when moving on or around the vehicle.

3.6 On no account must crews jump on or off the vehicle.

Mounting and dismounting – weapons systems activated

- 4 Crews are to comply with the following procedures:
 - 4.1 Crews must obey all Range Standing Orders (if applicable), and only mount the vehicle when authorised to do so by the vehicle commander.
 - 4.2 Crews must not go forward of any loaded weapon systems; this may mean mounting and dismounting the vehicle from the rear.
 - 4.3 Three points of contact must be maintained.
 - 4.4 Care must be taken when moving to crew positions to avoid trip hazards.
 - 4.5 Dismounting the vehicle is in reverse order to mounting.
 - 4.6 At all times care must be exercised by the individual when moving on or around the vehicle.
 - 4.7 On no account must crews jump on or off the vehicle.

Mounting and dismounting by attachments to the vehicle

- 5 Crews and attachments must comply with the following procedures:
 - 5.1 All non-crewed attachments wishing to mount and dismount the vehicle must only do so on authorisation of the vehicle commander.
 - 5.2 The vehicle commander is responsible for ensuring all attachments are correctly briefed on how to mount and dismount the vehicle.

TOP ACCESS COVERS

CAUTION

ENGINE OVERHEATING. Do not block deck louvres with stowed items.

- 6 The transmission covers (Fig 1 (4)) are hinged to provide access to the transmission compartment and incorporate the air inlet louvres for the engine radiator and the charge air cooler. The covers can be secured in the closed position with hand nuts (5).
- 7 The engine access covers incorporate the air outlet louvres. Three of the covers are hinged and secured with hand nuts. The fourth cover is secured with screws. Short cables with a spring clip, attached to the hull, enable the engine and transmission compartment hinged covers to be secured safely in the open position.

NOTE

There are some differences in the configuration of the covers between vehicle variants.

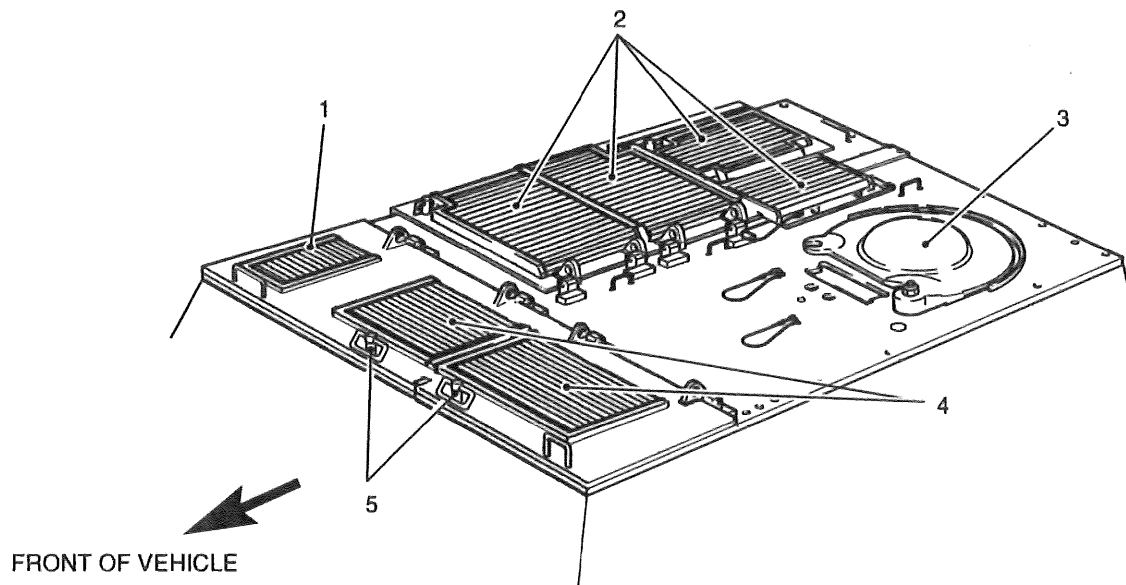
To remove and refit top armour and decking

NOTE

Refer to Disclaimer, Preliminary pages.

8 The crew must conduct the following preliminary tasks:

- 8.1 Position the vehicle on firm level ground.
- 8.2 Apply the parking brake and turn the hull master switch to OFF.
- 8.3 Traverse the turret to the three o'clock position (if applicable).



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|---|----------------------------|---|----------------------------------|
| 1 | Charge air cooler inlet | 4 | Transmission compartment louvres |
| 2 | Engine compartment louvres | 5 | Hand nuts (typical) |
| 3 | Driver's access door | | |

Fig 1 Engine and transmission covers

Removal

9 To remove the top armour and decking proceed as follows:

WARNINGS

(1) **WEIGHT HAZARD. ACCESS COVERS ARE HEAVY. SMALLER COVERS MAY BE RAISED BY ONE MAN. LARGER COVERS WILL REQUIRE ASSISTANCE OR MUST BE LIFTED USING SUITABLE LIFTING EQUIPMENT.**

(2) **PHYSICAL INJURY. SUFFICIENT MANPOWER OR SUITABLE LIFTING EQUIPMENT MUST BE AVAILABLE PRIOR TO REMOVING THE TOP DECKS. A MINIMUM OF A VEHICLE COMMANDER MUST SUPERVISE THIS TASK.**

CAUTION

EQUIPMENT DAMAGE. Before removing the decks on the CVR(T) vehicles the drivers Bowman box has to be removed, as follows:

- a. Ensure that BNAU is powered off.
- b. Disconnect all cables from BAIU.
- c. Ensure the ends of the disconnected cables are protected and secured away from deck.
- d. Remove the BAIU from its mounting and stow in a safe place. After refitting the deck, refit the BAIU and reconnect all cables.

9.1 Remove hinged engine air louvres from top armour.

9.2 Remove hinged transmission louvres.

9.3 Protect radiator.

9.4 Disconnect lead from the driver's periscope wiper motor and remove washer tube.

9.5 Remove driver's periscope.

9.6 Remove bolts securing top armour.

9.7 Carefully lift top armour, ensuring driver's periscope mounting is clear of the hull before armour is moved away from the hull.

9.8 Lay top armour down in a safe place, taking care not to damage any bracketry on the underside of the top armour.

Refitting

10 To replace the top armour and decking proceed as follows:

CAUTION

EQUIPMENT DAMAGE. Care must be taken to refit the decks with the louvres the correct way round to prevent overheating.

10.1 Replace and secure top armour. Torque the bolts to 82 Nm (61 lb ft).

- 10.2 Fit and connect driver's periscope.
- 10.3 Fit cable to periscope wiper and replace washer tube.
- 10.4 Remove radiator protection.
- 10.5 Refit hinged transmission louvres.
- 10.6 Refit hinged engine air louvres on top armour.

DRIVER'S SEAT

11 The driver's seat (Fig 2) can be adjusted to suit each individual driver's height and reach. It can be raised or lowered for 'opened up' or 'closed down' driving.

12 The padded backrest can be set at various angles between an upright and a reclined position. The backrest hinges are spring-loaded to the upright position. Elastic cords (1) attached to the seat frame and to the transverse bulkhead counterbalance the weight of the seat during height adjustment.

13 The backrest can be removed to provide improved access including the improved facility for the recovery of an injured driver.

To position the seat for height

WARNING

PHYSICAL INJURY. ENSURE THAT BOTH LOCATING PINS ARE FULLY ENGAGED BEFORE COMMITTING THE FULL BODY WEIGHT ON THE SEAT.

14 To position the seat for height, ease the weight of the body from the seat, then pull upwards the lower lever (9) at the front of the seat, to disengage two locating pins. Force the seat down by the weight of the body, or allow the seat to rise, due to the pull of the elastic cords. Release the lever and ensure that both locating pins fully engage in the new position before committing the full body weight in the seat.

To move the seat forwards or backwards

WARNING

LIMITED STEERING. THERE ARE NO LIMIT STOPS FOR SEAT MOVEMENT AND IF THE SEAT IS MOVED TOO FAR FORWARD, IT WILL PREVENT THE FULL MOVEMENT OF THE STEERING LEVERS.

15 To move the seat forwards or backwards, pull the upper of the two levers (6) at the front of the seat upwards and move the seat to the required position, release the handle and adjust the seat for the pins to engage in the nearest convenient holes.

To adjust the backrest

16 To adjust the backrest, press back against the backrest to take up the tension of the hinged springs and move the backrest release lever (10) backward to release the catch. Reposition the backrest as required, then release the lever and gradually ease the pressure from the backrest to permit the locating pins to re-engage.

To remove the backrest

17 To remove the backrest, grasp the seat removal strap (14) located at the back top centre of the backrest and pull upwards to clear the recline mechanism. Removal of backrest permits the emergency evacuation of the driver through the crew fighting compartment.

To refit the backrest

18 To refit the backrest ensure that there is no obstruction to the recline mechanism or the seat squab. Align the backrest supports with the recline mechanism and slide the backrest into position.

To remove the driver's seat

19 Remove the top armour and decking (refer to Para 8), and proceed as follows:

19.1 Remove the seat pan and cushion.

19.2 Remove the seat backrest.

19.3 Raise the seat to the 'head up' position, and ensure that it is locked.

19.4 Disconnect the two elastic cords from the hull attachment points.

19.5 Disconnect the two securing nuts from the front anchor brackets.

19.6 Disengage the seat guides from the anchor brackets.

19.7 Operate the height adjustment lever, to disengage the locking pins, and lift the seat out of the driver's compartment.

To refit the driver's seat

20 To refit the driver's seat, proceed as follows:

WARNINGS

(1) PHYSICAL INJURY. THE SEAT MUST BE PROPERLY SECURED IN POSITION BEFORE ATTEMPTING TO DRIVE THE VEHICLE.

(2) PHYSICAL INJURY. ENSURE THAT BOTH LOCATING PINS ARE FULLY ENGAGED BEFORE COMMITTING BODY WEIGHT ON THE SEAT.

(3) LIMITED STEERING. THERE ARE NO LIMIT STOPS FOR SEAT MOVEMENT AND IF THE SEAT IS MOVED TOO FAR FORWARD IT WILL PREVENT THE FULL MOVEMENT OF THE STEERING LEVERS.

20.1 Lower the driver's seat into the driver's compartment.

20.2 Operate the height adjustment lever to withdraw the locking pins.

20.3 Align the locking pins with upper recesses on the seat height locking bracket.

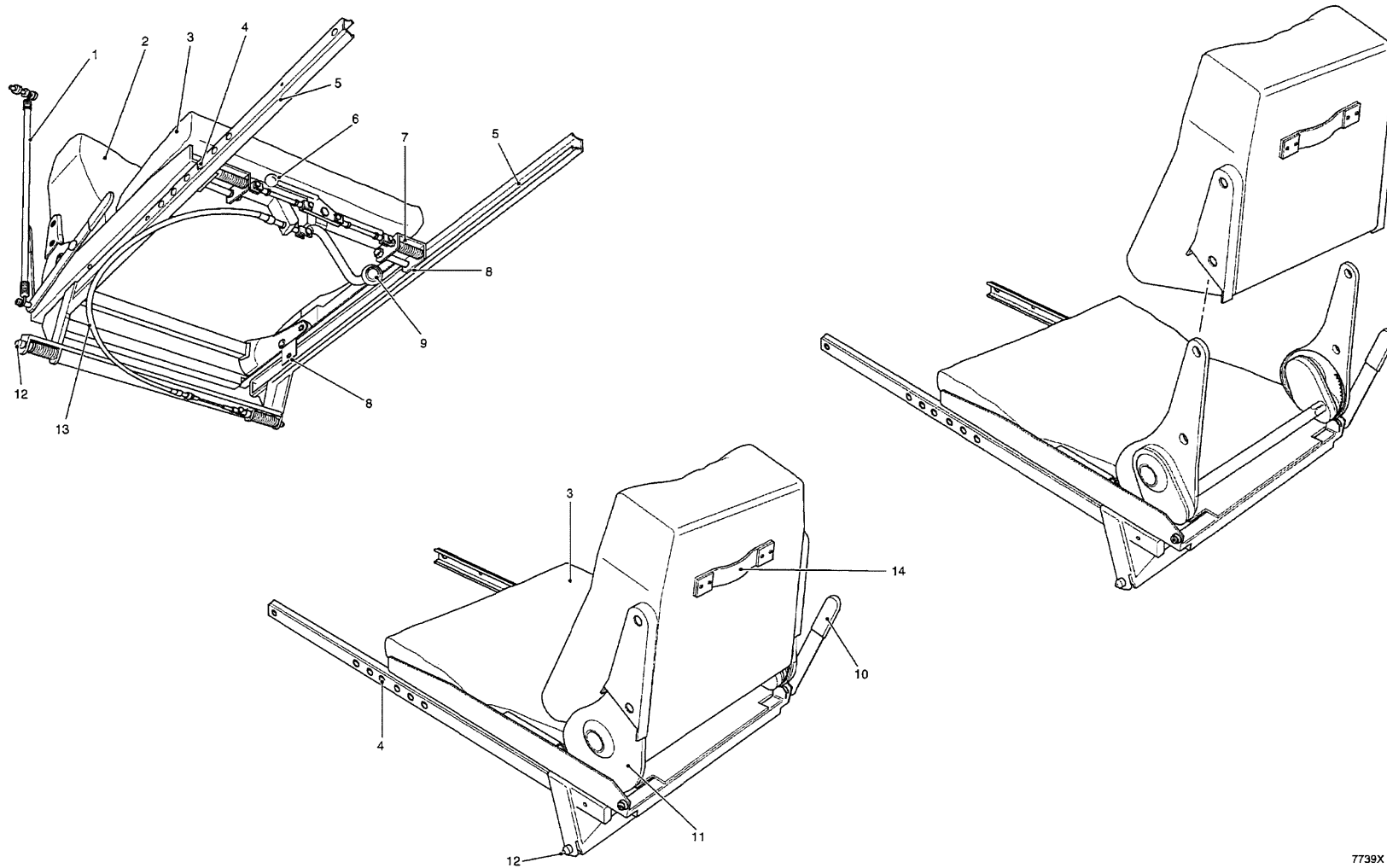
20.4 Release the height adjustment lever and ensure that both locking pins engage fully into the recesses.

- 20.5 Re-engage the seat guides onto the anchor brackets, and replace the securing nuts. Torque the M10 nyloc nuts to 49 Nm (36 lb ft).
- 20.6 Reconnect the two elastic cords to the hull attachment points.
- 20.7 Refit the seat backrest.
- 20.8 Refit the seat squab.
- 20.9 Refit the top armour as per Para 10.

User maintenance

20A Clean, check and lubricate the driver's seat mechanism as follows:

- 20A.1 Position the vehicle on firm level ground, apply the parking brake and ensure all battery master switches are in the off position.
- 20A.2 Adjust the driver's seat through the full range of movement for height, longitudinal, and backrest tilt position, Para's 14 to 16 refer. If movement is found to be restricted, thoroughly clean the mechanism with a lint free cloth until the full range of movement can be obtained.
- 20A.3 Lubricate the mechanism using oil, as specified in the Maintenance Schedule (Cat 601).



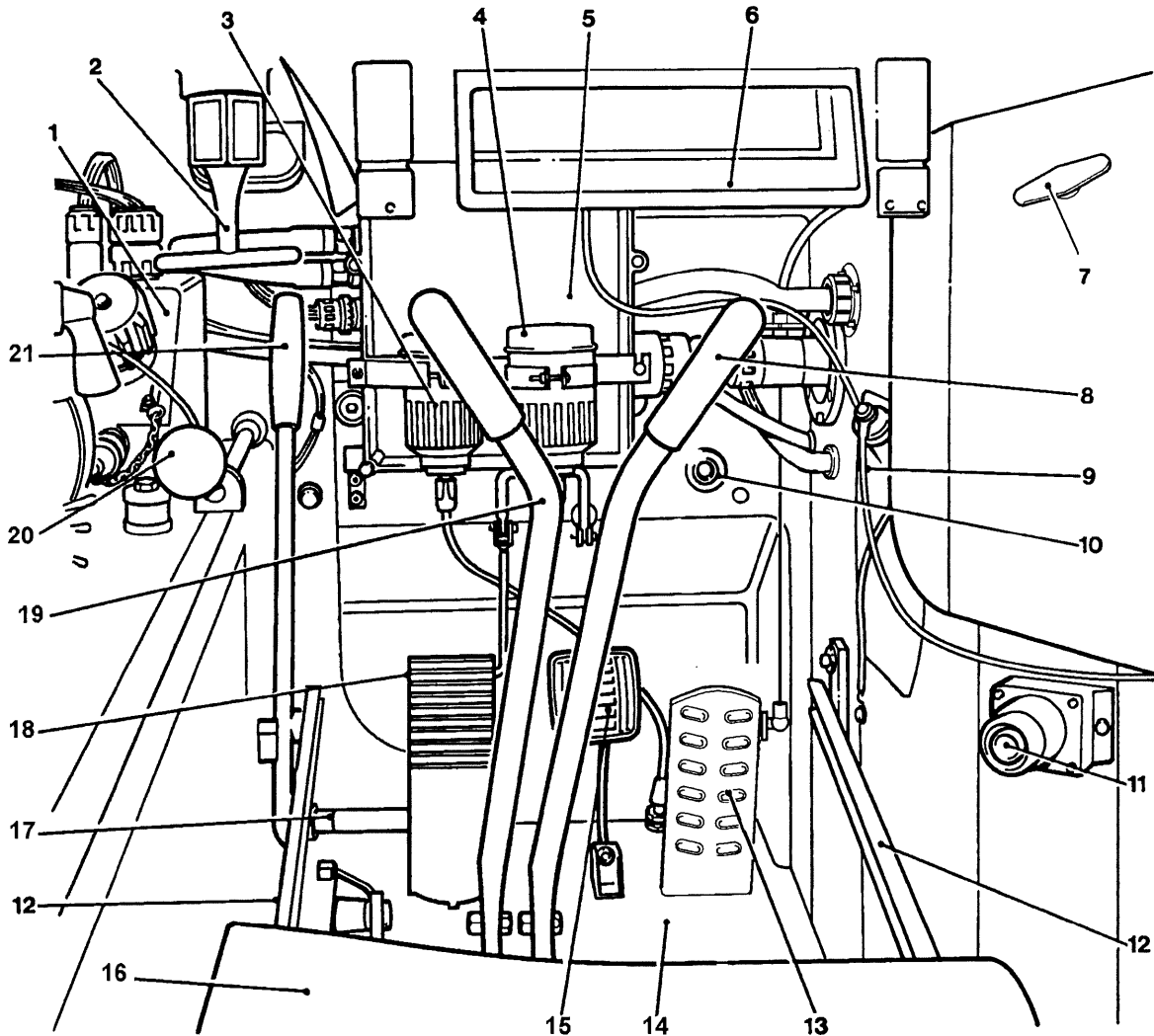
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|---|-------------------|----|-------------------------------|----|-------------------------|
| 1 | Elastic cord | 6 | Longitudinal adjustment lever | 11 | Backrest tilt mechanism |
| 2 | Backrest | 7 | Spring | 12 | Catch post |
| 3 | Seat squab | 8 | Guide roller | 13 | Control cable |
| 4 | Locating pin | 9 | Height adjustment lever | 14 | Seat removal strap |
| 5 | Seat support rail | 10 | Backrest release lever | | |

Fig 2 Driver's seat

DRIVER'S PERISCOPE DAY SIGHT

21 The driver's periscope (Fig 3 (6)) is fitted in the top armour plate forward of the driver's access door for use when the vehicle is closed down. An electrically operated screen wiper is fitted for cleaning the window in inclement weather. A switch on the driver's instrument panel controls the wiper. A manually operated bag type screen washer, with a single spray nozzle is also provided. The screen washer pump (11) is located to the right of the driver's seat.



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| 1 | Distribution panel | 12 | Seat guide rails |
| 2 | Driver's hatch pivot handle | 13 | Accelerator pedal |
| 3 | Steering brake reservoir | 14 | Floor plate |
| 4 | Main brake reservoir | 15 | Main brake pedal |
| 5 | Generator panel | 16 | Driver's seat |
| 6 | Driver's periscope | 17 | Gear change pedal pivot bar |
| 7 | Fuel cut-off control | 18 | Gear change pedal |
| 8 | Right steering lever | 19 | Left steering lever |
| 9 | Screen washer container | 20 | Transfer lever (forward/reverse) |
| 10 | Hull drain valve | 21 | Parking brake lever |
| 11 | Screen washer pump | | |

Fig 3 Driver's controls

To remove and refit the driver's periscope

22 To remove and refit the driver's periscope, proceed as follows:

22.1 Slacken the knurled nuts at the bottom of the supporting lugs.

22.2 Support the periscope, turn the supporting lugs clear and lower the periscope from its mounting.

22.3 Clean the inside of the periscope aperture and wipe with a soft clean cloth or soft tissue.

22.4 Any mud or dirt accumulated on the periscope glass surface must be cleaned off with clean water and not by wiping with a dry cloth or tissue, as this will leave scores. Cleaned surfaces should be dried with a clean soft tissue.

22.5 Refit the periscope in the reverse sequence, taking care not to damage the wiper blades.

[REDACTED]

23

[REDACTED]

24 The periscope can be used during daylight conditions, in conjunction with the filter assembly, by reducing the size of the diaphragm aperture to restrict the amount of light entering the instrument.

CAUTION

EQUIPMENT DAMAGE. Under normal light conditions, the night vision periscope should not be switched on unless the training filter is fitted, or the image intensification tube may be damaged. If the periscope is used in daylight in an emergency, the diaphragm control must not be rotated past the first 'click' or damage to the image intensification tube may result.

25 A device automatically protects the image intensifier tubes from damage in the event of excess illumination entering the periscope. Normal viewing will be restored within 5 seconds of the removal of the light source.

Power supplies

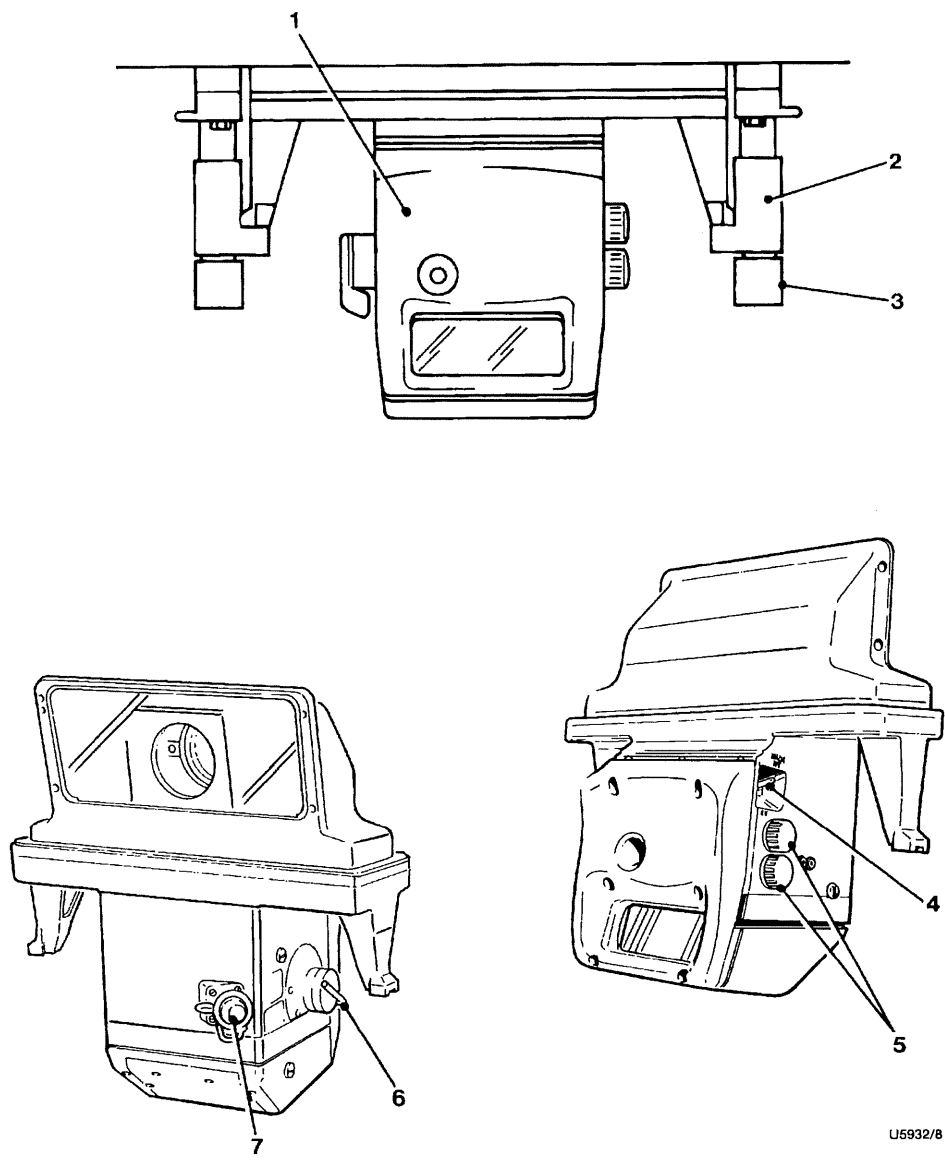
26 Power supply is made by connecting to the socket marked 24 V, on the rear of the periscope body. The circuit is protected by fuse F4 on the instrument panel.

Power supply and diaphragm aperture control

27 The rotary control is mounted to the left of the eyepiece and has two functions, to switch on the power supplies to the periscope and to operate the diaphragms. The control has a number of click stop settings.

Heater switch

28 The heater switch is mounted on the right hand side of the periscope. When in the ON position it supplies current to thermostatically controlled heater elements incorporated in the eyepieces to prevent misting.



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|---|----------------------|---|------------------------------|
| 1 | Brow pad | 5 | Fuses (2 off) |
| 2 | Retaining clamp | 6 | ON/OFF and diaphragm control |
| 3 | Knurled clamping nut | 7 | Power supply socket |
| 4 | Heater switch | | |

Fig 4 Driver's periscope night sight (Image Intensified periscope)

To fit the periscope

29 To fit the periscope, proceed as follows:

29.1 Remove the daylight periscope, see Para 22.

29.2 Ensure that power supply switch and heater switch are set to OFF.

29.3 Fit the periscope in the mounting.

29.4 Ensure that the battery master switch is OFF and connect the power supply cable between the periscope rear and the top socket located on the forward end of the instrument panel.

Operation

30 To operate the periscope, proceed as follows:

30.1 Turn the power supply switch clockwise to ON.

30.2 If required, put the heater switch to ON.

30.3 Rotate the power supply switch clockwise to adjust the light level entering the periscope for optimum viewing.

To remove the periscope

31 To remove the periscope, proceed as follows:

31.1 Put the power supply switch to OFF.

31.2 Remove all traces of mud, grit or sand from the top prism and mounting aperture.

31.3 Put the battery master switch to OFF.

31.4 Disconnect the power supply from the instrument.

31.5 Remove the periscope, see Para 22.

PERISCOPE MAINTENANCE

32 The periscope is a sealed instrument. Do not disturb the red painted screws on the body. A drying agent is injected into the periscope through these screw tappings on final assembly. Do not tamper with or strip in excess of that listed. Dirt or moisture entering the periscope will badly affects its performance.

33 Great care must be taken to avoid scratching the glass surface and lenses during cleaning and when fitting or removing the periscope.

CAUTION

EQUIPMENT DAMAGE. Methylated spirits, petrol or other cleaning agents should only be used by suitably qualified personnel, as excessive use of these can cause deterioration of the sealing and bonding materials.

34 The window of the periscope should be swabbed with plenty of clean water and a soft clean cloth or tissue in order to remove dirt and mud. A small quantity of detergent may be added to the water to assist in removing oil film and finger marks.

35 When visibility is poor, check that the glass surfaces are clean and free from mist; mist will give the effect of poor visibility.

To fill the screen washer bag

36 To fill the screen washer bag, proceed as follows:

36.1 Detach the bag from two support hooks and remove the stopper with tubing.

WARNING

FIRE RISK. FLUID AL11 IS HIGHLY INFLAMMABLE. THE PREPARATION OF THE FLUID FOR THE WINDSCREEN WASHERS IS TO BE CARRIED OUT IN THE OPEN AND AWAY FROM NAKED FLAME. MINIMUM PRECAUTION AFTER USE IS TO WASH THE AFFECTED SKIN AREAS WITH SOAP AND WATER.

36.2 Fill with clean water taking care that no dirt, oil or grease enters the bag. Where subzero temperature conditions are likely to prevail, a mixture of fluid AL11 and clean water should be used in the ratios shown in the Maintenance Schedule.

36.3 Refit the stopper with the tubing attached and rehang the bag.

BOTTOM ACCESS COVERS

37 Two cover plates fitted to the underside of the hull provide access to the lower of the engine and transmission compartments for such purposes as draining the lubrication and coolant systems. The access covers are drilled and tapped to accept extractor screws to facilitate removal of the covers.

HULL DRAIN VALVE

38 Later vehicles have a hull drain valve (Fig 5) fitted in the vehicle floor, in the transmission compartment, with a driver operated cable control.

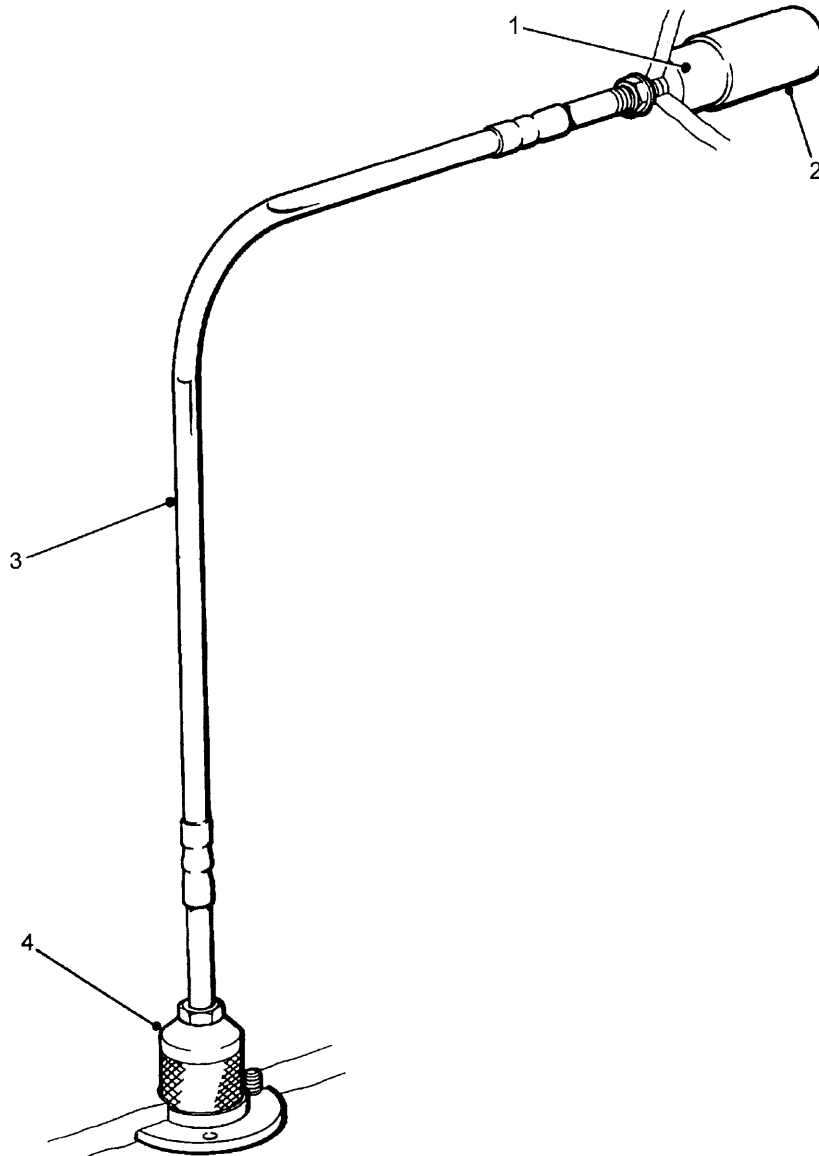
To operate the transmission compartment drain valve**NOTE**

39 To operate the transmission compartment drain valve, proceed as follows:

39.1 Using right foot, push in the spring-loaded control knob (2) in the driver's compartment.

39.2 Hold valve open until the compartment is drained, then release the control knob.

39.3 If tactically possible, check underneath the vehicle to ensure that the drain valve has closed correctly. An incorrectly closed drain valve will allow dirt and water to enter the transmission compartment when driving cross-country.



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- | | | | |
|---|--------------|---|---------------|
| 1 | Spring cup | 3 | Control cable |
| 2 | Control knob | 4 | Valve body |

Fig 5 Hull drain valve

FLOOR PLATE

40 The driver's compartment is fitted with a removable floor plate to enable maintenance tasks to be carried out. A hinged section of the floor plate provides access for cleaning of the area around the brake and steering master cylinders, without the need to remove the complete floor plate.

41 To open the hinged section, move the driver's seat fully rearwards and using a screwdriver, turn the two retainers anti-clockwise. Clean away any accumulated debris from the access plate and floor plate aperture before attempting to close and secure the hinged section.

To remove the drivers floor plate

42 To remove the driver's floor plate proceed as follows:

- 42.1 If operational circumstances allow, remove the top armour, decking and driver's seat.
- 42.2 Disconnect the accelerator linkage from the pedal.
- 42.3 Remove the two main brake pedal pad securing screws, and remove the brake pedal pad (and spacer if fitted).
- 42.4 Remove the four steering lever securing bolts, and remove the steering levers.
- 42.5 Remove the two bolts securing the gear change pedal to the hull, and raise pedal out of the way.
- 42.6 Remove the floor plate securing bolts.
- 42.7 Lift the floor plate over the steering lever bell cranks and the main brake pedal, and move clear of the master cylinders.

To refit the drivers floor plate

43 To refit the drivers floor plate proceed as follows:

- 43.1 Refit the floor plate over the steering lever bell cranks and main brake pedal.

CAUTION

EQUIPMENT DAMAGE. Do not over tighten the floor plate securing bolts. If over tightened, there is a possibility that they may shear off.

- 43.2 Refit the floor plate securing bolts.
- 43.3 Remount the gear change pedal to the hull wall.

CAUTION

VEHICLE CONTROL. When fitting the steering lever bolts, always ensure that the correct size bolts are used and that they are fitted from the outside faces of the steering levers. Ensure both levers operate freely and there is no fouling.

43.4 Replace the steering levers onto the bell cranks, and refit the steering lever securing bolts.

43.5 Refit the main brake pedal pad (and spacer if fitted). Ensure that the angle on the brake pedal pad slopes towards the accelerator pedal.

NOTE

The pedal must be fitted to the left hand side of the lever to prevent it interfering with the accelerator pedal operation.

43.6 Reconnect the accelerator linkage.

43.7 If necessary refit the driver's seat, top armour and decking.

HULL DRAIN PLUGS

NOTE



44 A drain plug is provided in the well of the driver's floor plate to permit drainage. The drain is unscrewed from under the vehicle, and the plug held captive by a pin through the stem of the plug.

45 Additionally thirteen further drain plugs, to improve hull drainage, are located through the hull lower vertical side plates, level with the wheel stations. Six positioned on the LH side of the vehicle and seven on the RH side of the vehicle.

NBC ACCESS DOOR

46 The NBC access door provides access to the unit filters and fan. It is hinged along its lower edge and in the open position is supported on the left by a wire stay, when closed it is secured by screws.

47 The door is fitted with an air inlet boss and an air outlet boss, which when the door is closed, are the inlet and outlet (scavenge) ports for the NBC unit. Connections to the unit are via short lengths of rubber hose, which are positioned on the inner side of the door to ensure ease of engagement/disengagement, with the unit when the door is being closed/opened.

48 An extension pipe is fitted to the air inlet boss.

Maintenance

49 To service the NBC access door, proceed as follows:

- 49.1 Remove the rear stowage bin to gain access to the NBC access door (Scimitar only).
- 49.2 Use an oilcan sparingly to lubricate the hinges, catches and guides.
- 49.3 Check the security of all seals, cover plates and hull attachment.
- 49.4 Replace the rear stowage bin (Scimitar only).

CHAPTER 4
ENGINE SYSTEMS
CONTENTS

Chapters

- 4-1 Engine
- 4-2 Engine lubrication system
- 4-3 Engine induction and exhaust system

UK RESTRICTED

UK RESTRICTED

CHAPTER 4-1

ENGINE

CONTENTS

Para

- 1 Introduction (WARNINGS)
Description
- 2 General
- 6 Cold start device (thermostart unit)
- 7 Starter motor
- 8 Alternator
- 9 Tachometer
- 11 User maintenance

Fig

Page

- 1 Engine general three-quarter view – coolant pump end (free end)..... 2
- 2 Engine general three quarter view – drive end..... 3

INTRODUCTION

WARNINGS

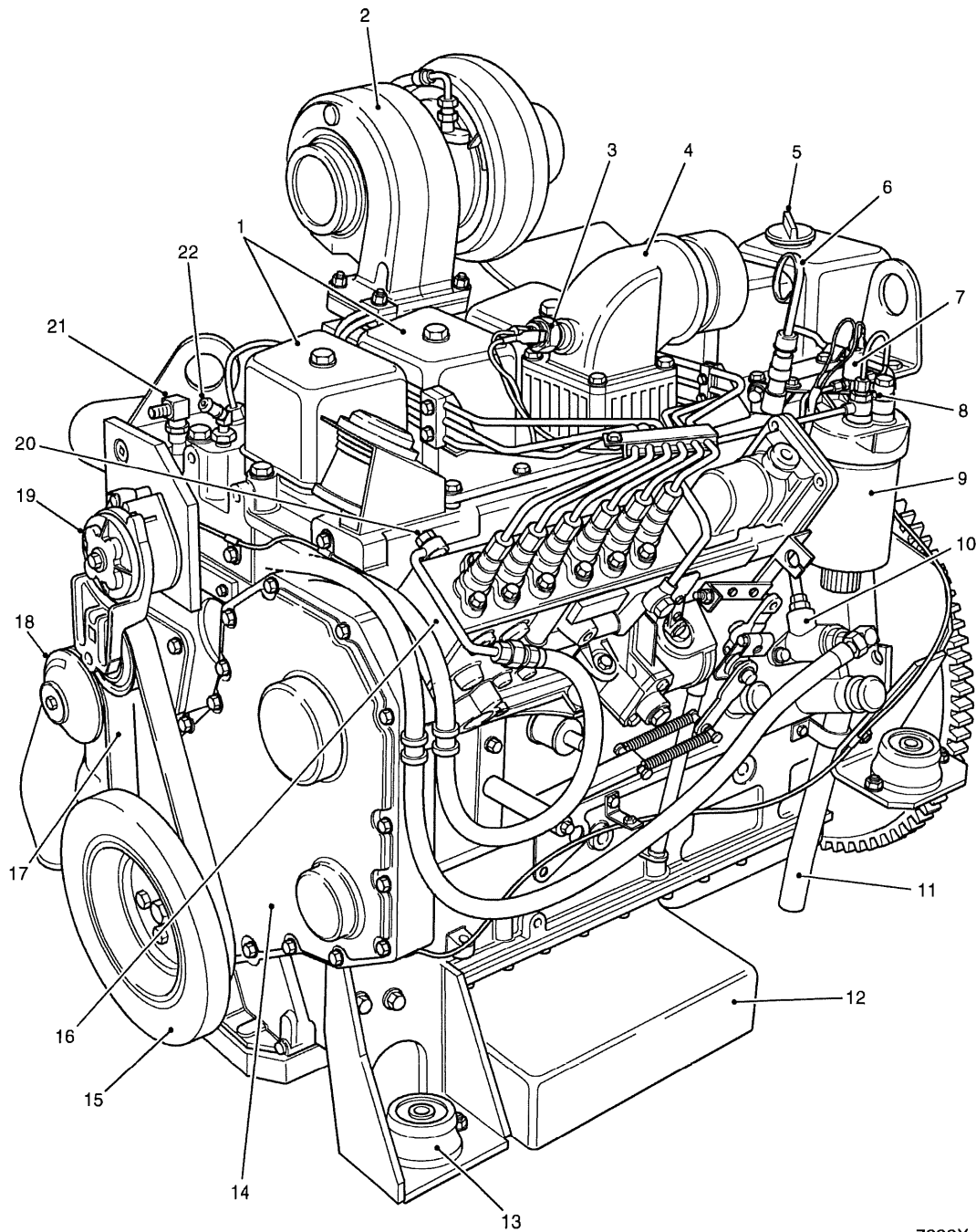
(1) **CADMIUM PLATING. THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.**

(2) **PERSONAL INJURY. WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS. ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.**

(3) **SILICA - TOXIC SUBSTANCE. BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.**

(4) **TOXIC AND HAZARDOUS SUBSTANCE - CERABOARD ALUMINOSILICATE FIBRES. ALL VARIANT (EXCEPT SCIMITAR) ENGINE COMPARTMENT BULKHEAD INSULATION MAY CONTAIN ALUMINOSILICATE FIBRES WHICH ARE HARMFUL WHEN INHALED AND AN IRRITANT TO THE SKIN AND EYES. USE APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT WHEN CLEANING THE COMPARTMENT TO PREVENT INHALATION AND CONTACT WITH SKIN AND EYES.**

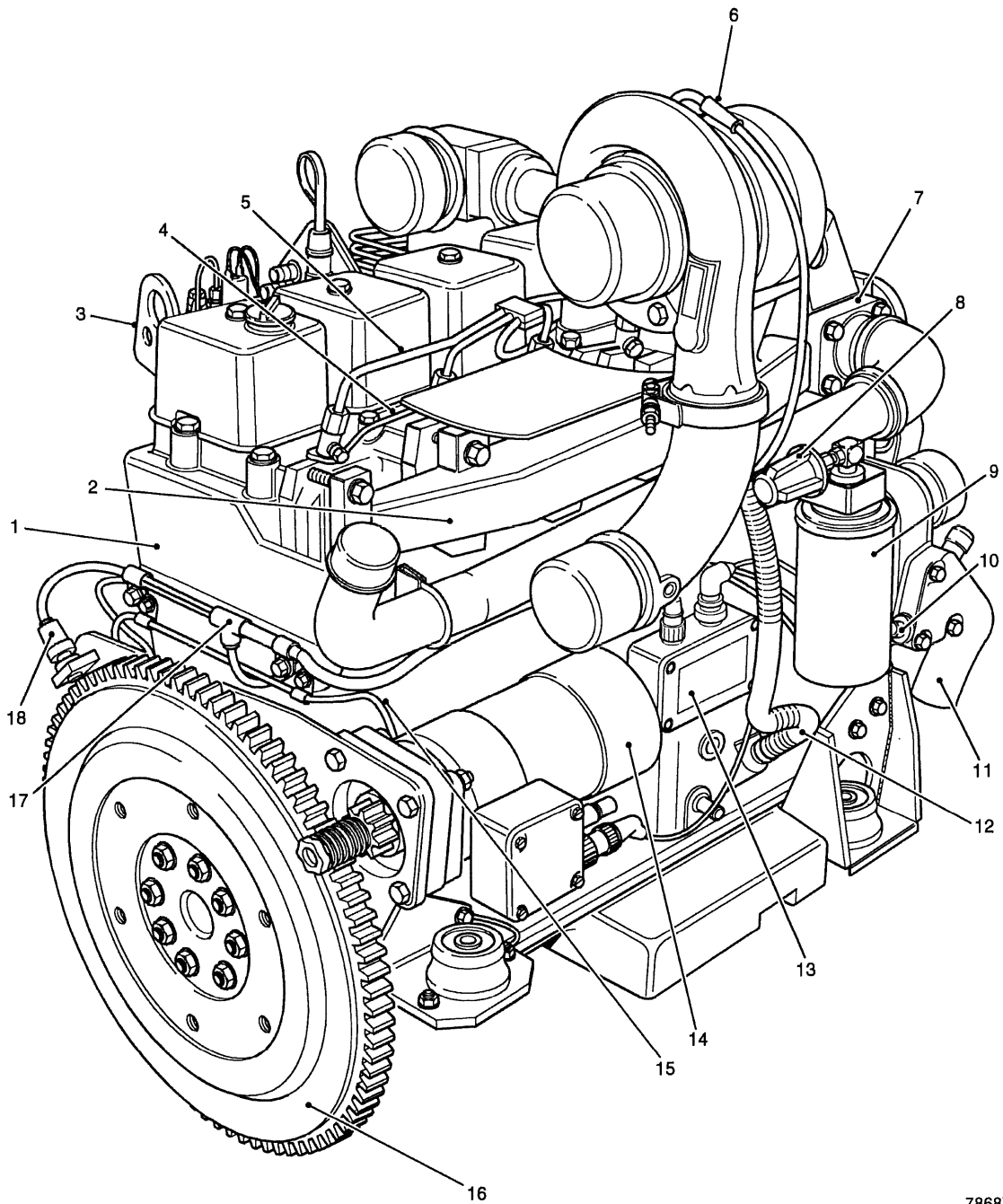
1 This chapter describes the engine fitted to the Combat Vehicle Reconnaissance (Tracked) (CVR(T)) diesel powered vehicles. For the purpose of this chapter, the coolant pump end of the engine is referred to as the front (free end) of the engine and the flywheel end as the rear (drive end). Left hand side and right hand side refer to the left and right sides of the engine looking at the front or coolant pump end.



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|----|---|----|--|
| 1 | Rocker covers | 12 | Oil sump |
| 2 | Turbocharger | 13 | Engine mounting |
| 3 | Thermostart unit (special to roll fit only) | 14 | Timing gear cover |
| 4 | Air inlet connection | 15 | Vibration damper and crankshaft pulley |
| 5 | Oil filler cap | 16 | Fuel injection pump |
| 6 | Oil dipstick | 17 | Coolant pump drive belt |
| 7 | Fuel control solenoid | 18 | Coolant pump |
| 8 | Fuel filter bleed screw | 19 | Belt tensioner |
| 9 | Fuel filter | 20 | Fuel injection pump bleed screw |
| 10 | Fuel lift pump | 21 | Heater connection |
| 11 | Crankcase breather | 22 | Constant bleed connection |

Fig 1 Engine general three-quarter view – coolant pump end (free end)



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- | | | | |
|---|------------------------------------|----|--------------------------------------|
| 1 | Cylinder head | 10 | Coolant drain tap |
| 2 | Exhaust manifold | 11 | Coolant inlet |
| 3 | Lifting bracket | 12 | Turbocharger lubrication return pipe |
| 4 | Fuel leak-off pipe | 13 | Fire sensing wire junction box |
| 5 | High-pressure fuel pipes | 14 | Starter motor |
| 6 | Turbocharger lubrication feed pipe | 15 | Fire sensing wire |
| 7 | Thermostat housing | 16 | Flywheel |
| 8 | Oil pressure switch | 17 | Engine wiring harness |
| 9 | Oil filter | 18 | Engine speed probe |

Fig 2 Engine general three-quarter view – drive end

DESCRIPTION

General

2 The engine (Figs 1 and 2) is an in line, six cylinder, liquid cooled, 5.9 litre, turbocharged, charge air cooled, direct injection, four stroke diesel.

3 The direct injection system consists of an injection pump, injectors, filters, lift pump and a cold start device, these assemblies, together with the engine lubrication system components, the turbocharger, starter motor, alternator and coolant pump are all described under relevant sub-chapter and chapter headings. The induction system filtration unit and the exhaust system are also described under relevant sub-chapter headings.

4 The engine is located to the rear of the transmission compartment on the right hand side of the vehicle. It is mounted on four flexible mounts, with the drive end towards the front of the vehicle.

5 One inlet and one exhaust valve are provided for each cylinder, operated through rocker gear, push rods and a camshaft. The valves are mounted vertically above the pistons.

NOTE

The engine on Samaritan vehicles is also fitted with a belt driven compressor for the air-cooling system

Cold start device (thermostart unit)

6 The cold start device assembly, consisting of a thermostart unit (Fig 1 (3)), fitted to the air inlet connection and a fuel control solenoid (7) mounted on top of the fuel filter, plus associated parts, is provided to facilitate engine starting in very cold conditions. Operation of the cold start device is by the thermostart/starter switch located on the driver's instrument panel. Cold starting instructions are given in Chap 12, Annex A.

Starter motor

7 The starter motor (Fig 2 (14)) is flange mounted to the side of the engine below the exhaust manifold and secured to the engine mounting plate by three bolts.

Alternator

8 The alternating current (ac) alternator is mounted on the engine compartment right sponson and is driven from the cooling fan pulley by a multi-groove belt.

Tachometer

9 The tachometer is fitted to ensure the engine is driven within its operating range and as an aid to gear changing. The tachometer is calibrated to give an indication of engine speed in Revolutions Per Minute (RPM).

10 Located within the face of the tachometer is a Liquid Crystal Display, (LCD) hours run meter, which is used to forecast and record maintenance tasks.

USER MAINTENANCE

11 User maintenance is limited to checking operation of the tachometer, as detailed in the Maintenance Schedule.

12 All other maintenance applicable to the engine systems is detailed in the relevant chapters or sub-chapters.

CHAPTER 4-2

LUBRICATION SYSTEM

CONTENTS

Para

- 1 Introduction
- 2 Oil cooler
- 4 Oil filter
- 5 Engine lubrication system
- User maintenance (WARNINGS)
- 13 Check engine oil level
- 15 Top up engine oil (CAUTION)
- 16 Drain engine oil (WARNINGS)
- 17 Fill engine with oil (WARNINGS) (CAUTIONS)
- 18 Renew engine oil filter (WARNINGS) (CAUTIONS)

Fig

Page

1	Oil filter	2
---	------------------	---

INTRODUCTION

1 The engine lubrication system is of the wet sump type with the oil pressure provided by a rotary pump driven from a gear in the timing gear case.

Oil cooler

2 The engine oil cooler utilises the engine coolant to cool the engine oil. The oil cooler is bolted to the side of the cylinder block behind the oil filter (Chap 4.1, Fig 2 (9)). The cooler element fits in a recess machined in the block where it is immersed in the flow of coolant from the coolant pump.

3 Oil enters the oil cooler element through a passage cast into the cooler cover.

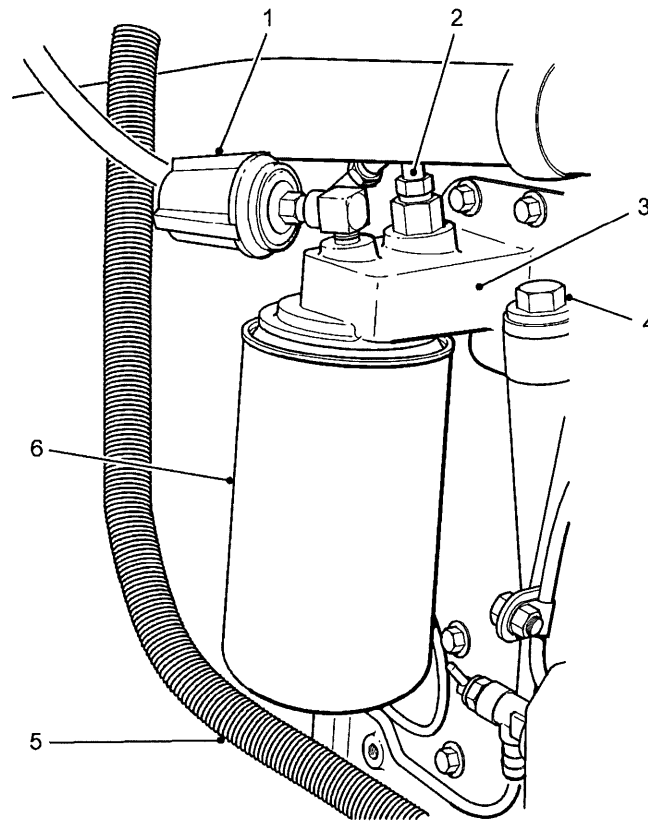
Oil filter

4 The oil filter is located on the side of the engine below the exhaust manifold. The oil filter canister (Fig 1 (6)) is of the replaceable 'screw on', full flow, self-sealing type incorporating a bypass valve in the filter head. The bypass valve ensures the passage of oil should the filter become blocked.

Engine lubrication system

5 Oil is held in a sump and drawn into the engine by means of the oil pump through a suction pipe.

6 The oil pump delivers oil to the Pressure Relief Valve (PRV), with excess oil being returned to the sump. Oil is then delivered to the oil cooler, where the oil transfers heat to the engine cooling system.



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1	Oil pressure switch	4	Oil pressure relief valve
2	Oil feed to turbocharger	5	Oil return from turbocharger
3	Filter head	6	Filter element canister

Fig 1 Oil filter

7 The oil is filtered through a 'screw on' type canister mounted on the side of the engine below the exhaust manifold. A filter bypass valve opens to maintain the supply of oil in the event of a blocked filter. Filtered oil is supplied directly to the main oil gallery.

8 From the main gallery, oil is transferred to the main bearings through individual cross-drillings. Internal passages in the crankshaft supply oil to the big end bearings.

9 Vertical drillings, one per cylinder, carry oil to lubricate the valve gear. This oil returns to the sump via the push rod tunnels.

10 Filtered oil is fed to the turbocharger bearings via a flexible hose from the oil filter head. A rigid pipe returns oil from the turbocharger via the crankcase to the sump.

11 A pressure switch activates a warning light on the driver's instrument panel when the oil pressure is below normal. The pressure switch is located on the oil filter head.

12 An oil filler cap (Chap 4-1, Fig 1 (5)) is located on the engine rocker box cover. The dipstick is located centrally on the injection side of the engine. Access to the sump drain plug necessitates the removal of a small access cover from the underside of the hull.

USER MAINTENANCE

WARNINGS

- (1) **CADMIUM PLATING.** THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.
- (2) **PERSONAL INJURY.** WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS. ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.
- (3) **SILICA - TOXIC SUBSTANCE.** BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.

Check engine oil level

- 13 Engine lubricating oil level should be checked when the engine is cold or when the engine has been stopped for a minimum of five minutes.
- 14 To check the engine oil level, proceed as follows:
 - 14.1 Position the vehicle on firm level ground and apply the parking brake.
 - 14.2 Release, open and secure the air outlet louvres.
 - 14.3 Withdraw the dipstick (Chap 4-1, Fig 1 (6)). Wipe with a clean, lint-free cloth.
 - 14.4 Re-insert dipstick into tube: push fully home and withdraw immediately. Note level of oil on dipstick.
 - 14.5 If level is below (H) high mark, top-up with oil as detailed in Para 15.
 - 14.6 Close and secure the air outlet louvres.

Top up engine oil

- 15 Top up engine oil as follows:
 - 15.1 Clean the area around the engine oil filler neck. Remove the engine oil filler cap (Chap 4-1, Fig 1 (5)).

CAUTION

EQUIPMENT DAMAGE. Do not overfill engine with oil.

- 15.2 Add clean, correct grade oil as specified in the Maintenance Schedule until (H) high mark on dipstick is reached.
- 15.3 Refit dipstick and engine oil filler cap (5).

Drain engine oil**WARNINGS**

(1) **DANGER TO LIFE AND LIMB. BEFORE PERSONNEL ARE ALLOWED UNDER THE VEHICLE, THE PARKING BRAKE MUST BE FULLY APPLIED AND THE VEHICLE SECURED AGAINST MOVEMENT AND THE ENGINE SWITCHED OFF.**

(2) **RISK TO HEALTH. USED ENGINE OIL IS HARMFUL TO THE SKIN. ALWAYS USE A BARRIER CREAM BEFORE STARTING THIS TASK. ALWAYS WASH YOUR HANDS AFTERWARDS.**

16 Engine lubricating oil should be drained when the engine is warm, using the following method.

16.1 Release, open and secure the air outlet louvres. Clean around the engine oil filler cap and remove (Chap 4-1, Fig 1 (5)).

16.2 Remove the engine oil drain access cover beneath the vehicle, utilising the two threaded extractor holes provided in the access cover to assist removal, as the cover is secured using a sealant gasket.

NOTE

16.3 Place a container of at least 20 litre (5 gal approximately) capacity, beneath the aperture.

16.4 Remove the sump drain plug and sealing washer; allow to drain for at least 30 minutes.

WARNING

DANGER OF SCALDING FROM HOT OIL. PROTECTIVE GLOVES MUST BE WORN WHEN REMOVING THE ENGINE OIL DRAIN PLUG.

NOTE

If the engine oil filter is also to be changed, proceed as in Sub-paras 19.1 to 19.14 before re-filling with oil.

16.5 Ensure that the drain plug and washer are serviceable.

16.6 Clean around the drain point. Refit plug and washer.

16.7 Recoat the engine oil drain access cover plate with sealant (Hylomar AS64352, NSN 8030-99-220-3407) and refit cover plate.

Fill engine with oil

17 Fill engine with oil as follows:

17.1 Ensure that the area around the filler neck is clean.

CAUTION

EQUIPMENT DAMAGE. Do not overfill engine with oil.

17.2 Add clean, correct grade oil as specified in Maintenance Schedule until (H) high mark on dipstick is reached. Allow five minutes for oil to drain into sump before checking level.

17.3 Refit dipstick and engine oil filler cap.

WARNINGS

(1) **DANGER TO LIFE AND LIMB. DRIVER'S COMPARTMENT MUST BE MANNED THROUGHOUT THE ENGINE RUN PERIOD.**

(2) **RISK TO HEALTH. ALL PERSONNEL IN IMMEDIATE VICINITY MUST WEAR EAR PROTECTORS WHEN ENGINE IS RUNNING.**

(3) **DANGER TO LIFE AND LIMB. ALL TOOLS AND EQUIPMENT USED DURING MAINTENANCE MUST BE REMOVED FROM THE VEHICLE PRIOR TO STARTING ENGINE.**

CAUTION

EQUIPMENT DAMAGE. If the transmission louvres are open, no air is drawn through the radiator or charge air cooler. Therefore, only limited running of the engine in this condition is possible. The engine must be stopped before high coolant temperatures occur.

17.4 Run the engine for five minutes. Check drain plug for leaks. Stop the engine. Re-check oil level as detailed in Para 14.

17.5 Refit and secure engine oil drain access cover beneath vehicle.

17.6 Release, lower and secure the air outlet louvres.

Renew engine oil filter

18 The engine oil filter is located on the left hand side of the engine (Chap 4-1, Fig 2 (9)) behind the engine access cover located in the driver's compartment.

19 Renew engine oil filter as follows:

19.1 Release, raise and secure the air outlet louvres.

19.2 Remove the rear most engine access cover from the driving compartment (firewall) side of the engine.

19.3 Drain the engine oil. Sub-paras 16.1 to 16.5 refer.

WARNING

RISK TO HEALTH. USED ENGINE OIL IS HARMFUL TO THE SKIN. ALWAYS USE A BARRIER CREAM BEFORE STARTING THIS TASK. ALWAYS WASH YOUR HANDS AFTERWARDS.

19.4 Using a strap wrench, unscrew oil filter canister (Fig 1 (6)). Take care not to spill the used engine oil as the canister is removed. Discard used canister and seal.

19.5 Clean sealing faces on filter head with lint-free cloth.

19.6 Fill (prime) filter element with clean engine oil.

CAUTION

EQUIPMENT DAMAGE. Do not overtighten the engine oil filter canister when fitting a new filter canister.

19.7 Smear sealing ring with clean engine oil and screw canister on to the filter head until sealing faces are in firm contact. Hand tighten a further 3/4 turn.

19.8 Refit oil drain plug. Sub-paras 16.5 and 16.6 refer.

NOTE

19.9 Fill engine to the correct level with oil. Sub-para 17.2 refers.

WARNINGS

(1) **DANGER TO LIFE AND LIMB. DRIVER'S COMPARTMENT MUST BE MANNED THROUGHOUT THE ENGINE RUN PERIOD.**

(2) **RISK TO HEALTH. ALL PERSONNEL IN IMMEDIATE VICINITY MUST WEAR EAR PROTECTORS WHEN ENGINE IS RUNNING.**

(3) **DANGER TO LIFE AND LIMB. ALL TOOLS AND EQUIPMENT USED DURING MAINTENANCE MUST BE REMOVED FROM THE ENGINE AND GEARBOX COMPARTMENT PRIOR TO STARTING ENGINE.**

CAUTION

EQUIPMENT DAMAGE. If the air inlet louvres are open, no air is drawn through the radiator or charge air cooler. Therefore, only limited running of the engine in this condition is possible. The engine must be stopped before high coolant temperatures occur.

19.10 Run the engine for five minutes. Check around sealing faces for leaks.

19.11 Stop the engine: allow oil to settle for a minimum of five minutes.

19.12 Refit and secure the engine access cover in the driving compartment (firewall) side of the engine.

19.13 Refit and secure the engine oil drain plug access cover, beneath the vehicle. Sub-para 16.7 refers.

CAUTION

EQUIPMENT DAMAGE. Do not overfill engine with oil.

19.14 Check the oil level as detailed in Para 14.

CHAPTER 4-3

ENGINE INDUCTION AND EXHAUST SYSTEM

CONTENTS

Para

- 1 Introduction
- 2 General description
- 4 Turbocharger (CAUTION)
- 5 Charge air cooler
- 7 Air filtration unit
- 10 Air restriction indicator
- 11 Air filter element
- 12 Gravity discharge valve
- 13 Exhaust system
- 13 User maintenance (WARNINGS)
- 15 Change air filter element (CAUTION)
- 17 Check charge air cooler (CAUTION)

Fig

Page

- | | | |
|---|------------------------------------|---|
| 1 | Induction system (typical)..... | 2 |
| 2 | Air filtration unit (typical)..... | 3 |
| 3 | Exhaust system (typical)..... | 4 |

INTRODUCTION

1 The engine air induction and exhaust systems are closely related and interdependent. The induction system ensures that sufficient quantities of filtered air, at the appropriate pressures and temperatures for combustion, are provided for the engine under all running and conditions.

GENERAL DESCRIPTION

2 Air for engine combustion is drawn into the induction system through an external armoured air inlet located on the front right hand side of the vehicle. The principle components of the induction system are an air cleaner (Fig 1(1)), one turbocharger (3), and a charge air cooler (6).

3 The exhaust gasses from the engine are used to drive the turbocharger.

Turbocharger

CAUTION

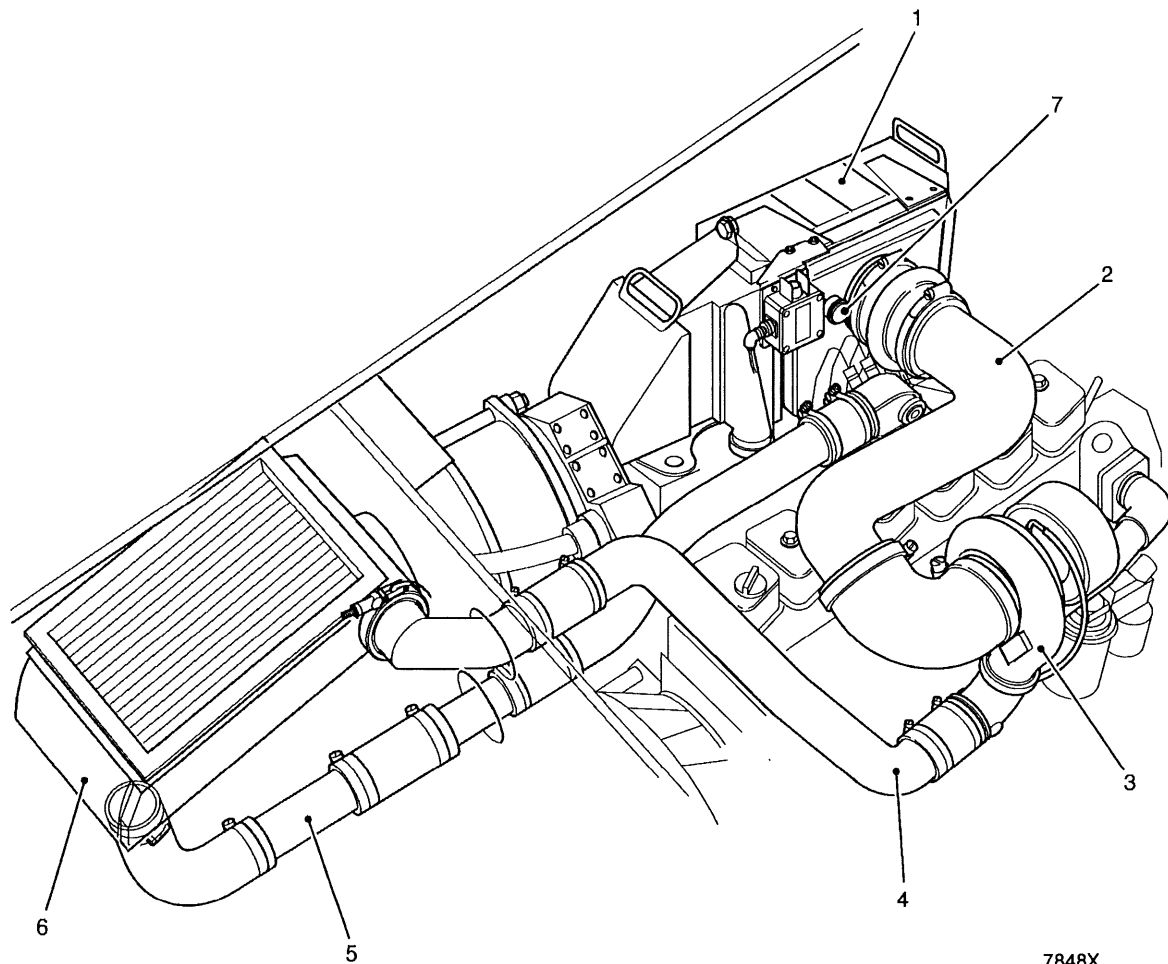
EQUIPMENT DAMAGE. To avoid damage to the engine, allow the engine to idle for 3-4 minutes to allow the turbocharger to slow and cool before stopping the engine.

4 The turbocharger (Fig 1(3)) is mounted on the engine exhaust manifold where it utilises waste energy from the exhaust gases to compress the incoming air. The turbocharger (3) compressor receives filtered air from the air filter via a pipe (2). Compressed air is then passed via pipework (4) to the charge air cooler (6) and fed into the air inlet connection via further pipework (5).

Charge air cooler

5 Charge air cooling is a method of cooling the compressed air between the turbocharger and the induction manifold, thus enabling more air to be forced into the induction manifold, resulting in higher volumetric efficiency and greater output from the engine. The charge air cooling system is shown in Fig 1.

6 The charge air cooler (Fig 1 (6)) is mounted on three brackets above the right hand sill of the vehicle in the transmission compartment directly below the air inlet louvres cover.



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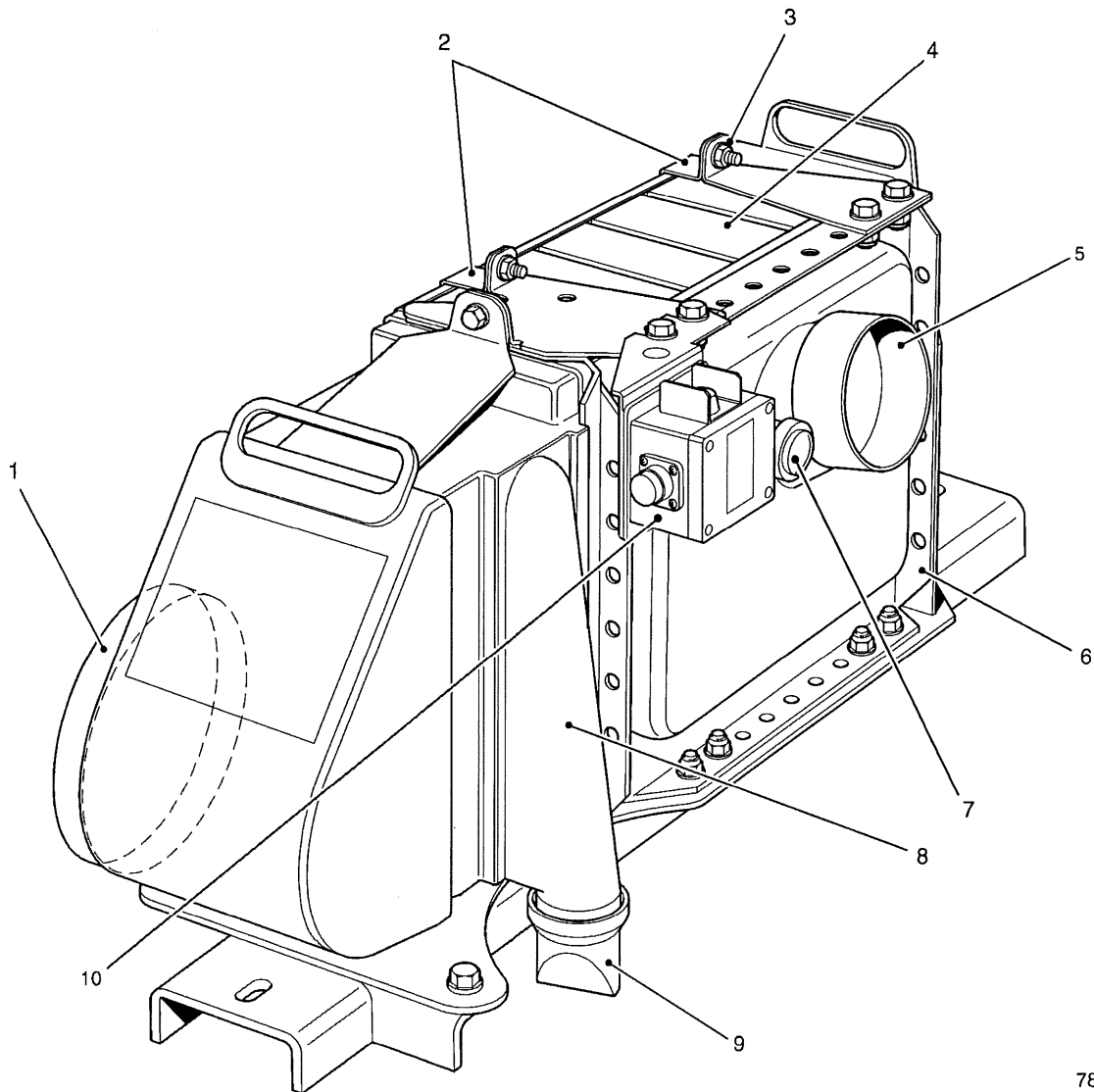
- | | | | |
|---|--|---|---|
| 1 | Air filtration unit | 5 | Pipework - charge air cooler to induction manifold connection |
| 2 | Pipework- air filter to turbocharger | 6 | Charge air cooler |
| 3 | Turbocharger | 7 | Air restriction indicator |
| 4 | Pipework - turbocharger to charge air cooler | | |

Fig 1 Induction system (typical)

Air filtration unit

7 The engine air filtration unit (Fig 2) is located within the engine compartment on the right hand sponson.

8 The two stage filtration unit comprises a pre-cleaner (8) with a gravity discharge valve (9), fabricated metal casing (6) and filter element (4). Retaining straps (painted white (2)) secured with four screws and nuts, provide access to the removable filter element.



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- | | | | | | |
|---|------------------------------------|---|---------------------------|----|--|
| 1 | Air intake | 5 | Air outlet | 9 | Gravity discharge valve |
| 2 | Filter element retaining straps | 6 | Casing | 10 | Engine fire detection
press-to-test switchbox |
| 3 | Filter element retaining strap nut | 7 | Air restriction indicator | | |
| 4 | Filter element | 8 | Pre-cleaner | | |

Fig 2 Air filtration unit (typical)

9 Incoming air is drawn through the external armoured air inlet and is ducted through the vehicle hull to the intake (1), which is connected to an aperture on the inside of the hull. A grille is fitted to the armoured air inlet to prevent the ingress of debris, leaves etc.

NOTE

The air outlet (5) on Samson, Samaritan, Spartan and Sultan is different to that shown in Fig 2.

Air restriction indicator

10 An air restriction indicator (Fig 2 (7)) is provided on the front face of the element casing. A scale indicates restriction in the induction system. The air filter element should be changed when the indicator shows a continuous reading of 25 in. WG during normal running. When the element has been changed, the indicator is to be reset by pressing the button at the front of the indicator.

Air filter element

11 The pleated paper air filter element (4) is secured to the filter housing by top fitting retaining plates. The filter element cannot be cleaned and must be replaced if unserviceable.

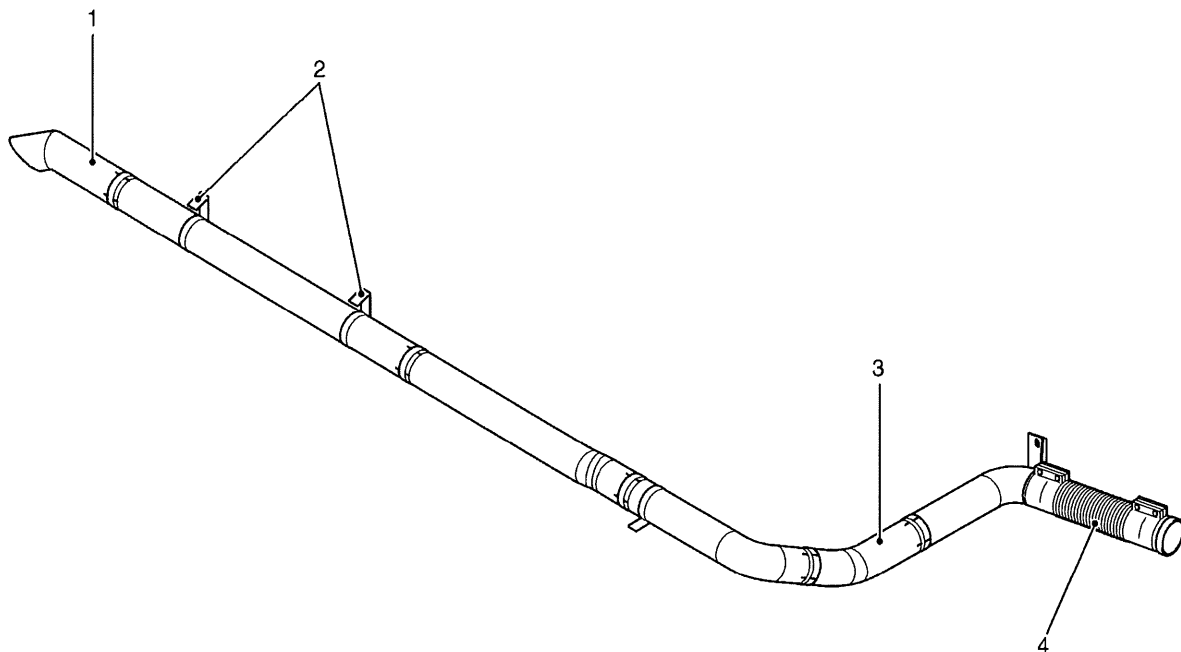
Gravity discharge valve

12 The gravity discharge valve (9), fitted to the pre-cleaner, allows dust and debris removed by the pre-cleaner to be discharged from the filtration unit. The discharge valve is normally open when the engine is not running, but is held closed by suction when the engine is running.

EXHAUST SYSTEM

13 The typical exhaust system is shown in Fig 3. The exhaust manifold feeds exhaust gases to the turbocharger, which is mounted directly on to the manifold. The turbocharger turbine is rotated at extremely high speed using some of the energy of the exhaust gases.

14 The exhaust pipe connects to the turbocharger outlet via a flexible section (4) and front pipe (3) and routed under the coolant header tank, through the hull plate, and along the outside of the hull towards the rear of the vehicle. The exhaust pipe carries exhaust gases from the turbocharger and discharges them away from the vehicle. No silencer is fitted; the exhaust is discharged directly to atmosphere.



- | | | | |
|---|--------------------------------|---|--------------------------------|
| 1 | External exhaust pipe assembly | 3 | Internal exhaust pipe assembly |
| 2 | Mounting brackets | 4 | Flexible exhaust pipe section |

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Fig 3 Exhaust system (typical)

USER MAINTENANCE

WARNINGS

(1) **CADMIUM PLATING. THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.**

(2) **PERSONAL INJURY. WHEN CARRYING OUT ANY REPAIRS OR MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.**

(3) **SILICA - TOXIC SUBSTANCE. BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.**

Change air filter element

15 The air filter element is housed within the casing (Fig 2 (6)) of the air filtration unit. The Maintenance Schedule, the air restriction indicator, or excessive loss of engine power accompanied by black exhaust smoke will indicate the need for renewal of the element.

16 Change air filter element as follows:

16.1 Position the vehicle on firm level ground, apply the parking brake ensuring that the engine is stopped and all master switches are in the OFF position.

16.2 Release, raise and secure the air outlet louvres.

16.3 Disconnect the pipework to the turbocharger.

16.4 Disconnect the fire detection test system harness from the press-to-test switch box (10).

16.5 Remove the two bolts securing the air filtration unit assembly to the sponson adaptor plate. Remove the air filtration unit complete.

16.6 Remove the two air filter element retaining straps (2) which are painted white by first removing the four securing nuts and screws. Remove the element.

CAUTION

EQUIPMENT DAMAGE. The air filter element must never be washed.

16.7 The air filter element is of the pleated paper type and must be discarded if unserviceable. Clean out the air filtration unit body, hull ducting aperture and check the seal for serviceability. Fit a new element in reverse order to the removal procedure.

NOTE

Care must be taken to ensure sealing part of element is correctly located in housing before securing straps.

Check charge air cooler**CAUTION**

EQUIPMENT DAMAGE. Loose connections or damaged charge air cooler can cause damage to the turbocharger.

17 A routine check of the charge air cooler (Fig 1(6)) should be carried out to ensure that the matrix is not damaged or blocked with an accumulation of debris. The crew are restricted to removing debris by use of the engine brush with the charge air cooler in place. Checking the seals as detailed in Chapter 5 is also a crew responsibility. If the debris cannot be removed or the matrix is damaged this must be reported to an Advanced driver or REME who will remove and replace the charge air cooler. Once the charge air cooler is removed the crew can proceed as detailed in Chapter 5.

CHAPTER 5

COOLING SYSTEM

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- 9 Air circulation
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- 12 Radiator (CAUTIONS)
- 13 Coolant – check/top-up (WARNINGS)
- 14 Coolant – drain and refill (WARNINGS) (CAUTION)
- Radiator and charge air cooler seals
- 15 To check
- 16 To renew (CAUTION)
- 17 Radiator and charge air cooler – external cleaning (CAUTIONS)
- 18 Cooling fan drive belt
- 19 Coolant pump drive belt – visual examination
- 20 Check condition of fan, fan mounting and tensioner

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INTRODUCTION

1 The cooling system comprises a coolant pump, header tank (Fig 1 (1)) with combined pressure/filler cap (13), belt driven fan (4), radiator (5), engine oil cooler (8), transmission oil heat exchanger (7) and thermostat. A coolant warning light is provided on the driver's instrument panel.

COOLANT CIRCULATION

2 The coolant pump (Fig 1 (14)) is mounted on a machined surface on the cylinder block and is driven by a drive belt from the crankshaft pulley. The pump impeller is located in a recess machined in the cylinder block and circulates coolant through internal passages.

3 When the engine is running, the coolant pump circulates coolant through the engine and radiator.

4 Coolant is drawn in through the coolant inlet by the coolant pump and passes into the engine oil cooler (8) cavity of the cylinder block.

5 The coolant then circulates around the cylinders and across the block by internal galleries, to the fuel injection pump side of the engine.

6 Coolant flows up into the cylinder head, across the valve bridges and down the exhaust manifold side of the engine. The coolant provides cooling for the injectors as it flows across the cylinder head towards the thermostat housing (3).

7 When the engine is below operating temperature, the thermostat is closed preventing coolant flow from the engine to the radiator.

8 When operating temperature is reached the thermostat is fully open, allowing full coolant flow to circulate through the radiator and gearbox oil heat exchanger before returning to the inlet side of the coolant pump.

AIR CIRCULATION

9 The belt driven fan draws air from the transmission compartment and discharges it into the engine compartment. The extraction of air from the transmission compartment causes a reduction of air pressure in the compartment, drawing fresh cooling air in through the transmission louvres.

10 The air forced into the engine compartment escapes to atmosphere through the air outlet louvres, which form the engine compartment access cover.

11 The radiator and charge air cooler matrices are fitted with sealing strips, which fit against the underside of the air inlet louvres and ensure that the air drawn into the compartment passes through the matrices.

USER MAINTENANCE

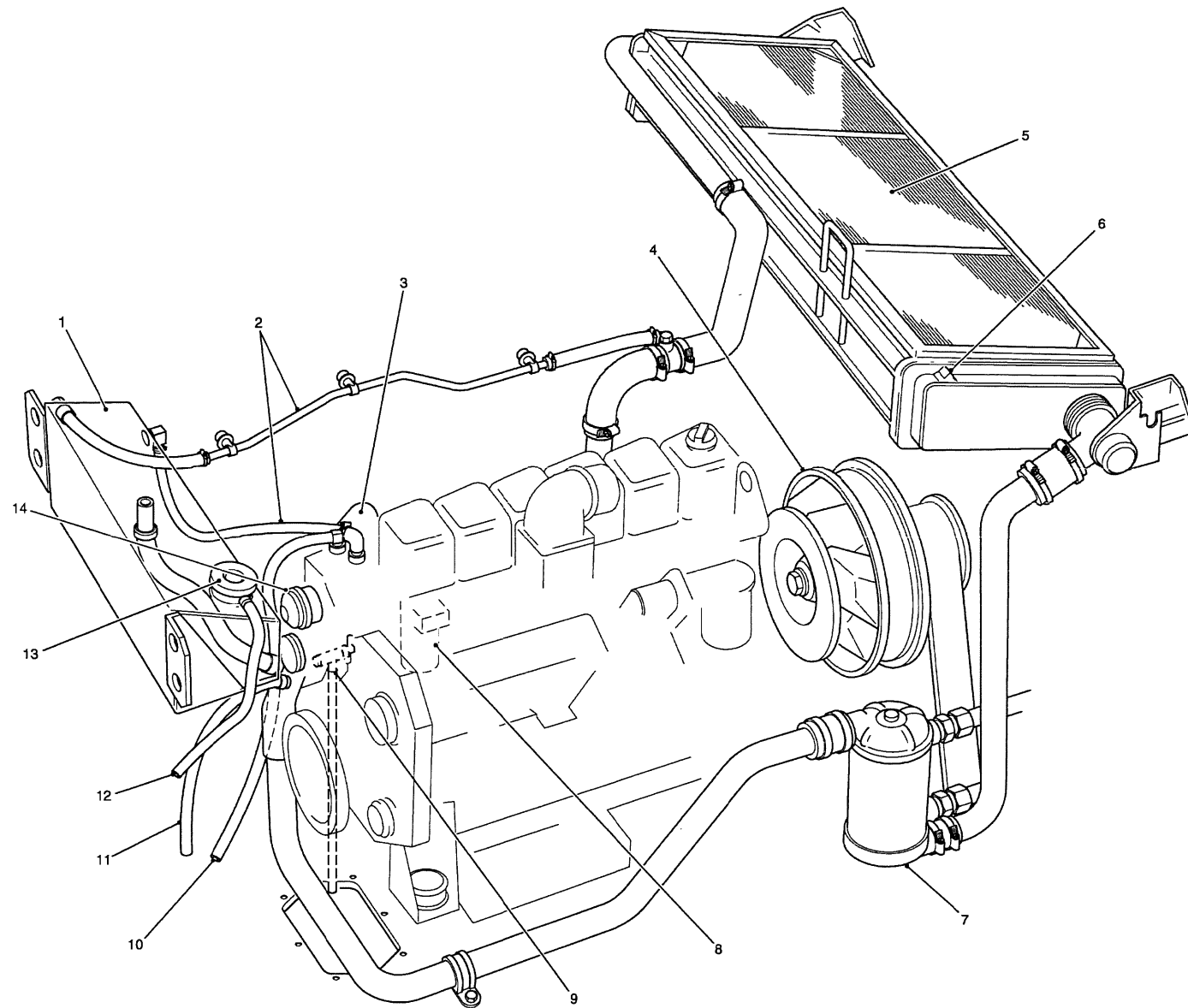
WARNINGS

(1) **CADMIUM PLATING. THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.**

(2) **PERSONAL INJURY. WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.**

(3) **SILICA - TOXIC SUBSTANCE. BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.**

(4) **TOXIC AND HAZARDOUS SUBSTANCE - CERABOARD ALUMINOSILICATE FIBRES. ALL VARIANT (EXCEPT SCIMITAR) ENGINE COMPARTMENT BULKHEAD INSULATION MAY CONTAIN ALUMINOSILICATE FIBRES WHICH ARE HARMFUL WHEN INHALED AND AN IRRITANT TO THE SKIN AND EYES. USE APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT WHEN CLEANING THE COMPARTMENT TO PREVENT INHALATION AND CONTACT WITH SKIN AND EYES.**



- 1 Coolant header tank
- 2 Constant bleed connection
- 3 Thermostat housing
- 4 Fan
- 5 Radiator
- 6 Bleed screw
- 7 Transmission oil heat exchanger
- 8 Engine oil cooler
- 9 Coolant drain tap
- 10 Heater connection hose (supply)
- 11 Heater connection hose (return)
- 12 Overflow pipe
- 13 Combined pressure/filler cap
- 14 Coolant pump

Fig 1 Cooling system

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Radiator**CAUTIONS**

- (1) **EQUIPMENT DAMAGE.** When the radiator is in the raised position coolant flow through the trunnion glands is prevented, therefore, the engine must not be run with the radiator in the raised position.
- (2) **EQUIPMENT DAMAGE.** If the transmission louvres are removed or open, no air is drawn through the radiator or charge air cooler. Therefore, only limited running of the engine in this condition is possible. The engine must be stopped before high coolant temperatures occur.
- (3) **EQUIPMENT DAMAGE.** To avoid unnecessary damage, do not stand on the radiator, particularly when the radiator is in the raised position.

12 Check that the radiator matrix is clean and undamaged and that there are no leaks at the glands in the trunnion blocks. Report any leaks.

Coolant – check/top-up

13 To check and top-up the cooling system, proceed as follows:

- 13.1 Park on a level surface ensuring that the parking brake is applied and all battery master switches are in the OFF position.
- 13.2 Release, raise and secure the air outlet louvres.

WARNINGS

- (1) **DANGER FROM SCALDING. DO NOT RELEASE THE COOLANT PRESSURE/FILLER CAP WHILST THE ENGINE IS RUNNING OR IF THE TEMPERATURE OF THE HEADER TANK IS ABOVE HAND HOT.**
- (2) **EYE PROTECTION. ANTI-FREEZE SOLUTION AL39 WILL BE EJECTED UNDER PRESSURE DURING BLEEDING OPERATION - PROTECT EYES WITH GOGGLES.**
- (3) **TOXIC AND HAZARDOUS SUBSTANCE. FLUID AL39 IS BOTH TOXIC AND HAZARDOUS. REFER TO LOCAL UNIT PRECAUTIONS AND CURRENT DINS, FOR FULL SAFETY PROCEDURES. MINIMUM PRECAUTION AFTER USE IS TO WASH ANY AFFECTED SKIN AREAS WITH SOAP AND WATER.**

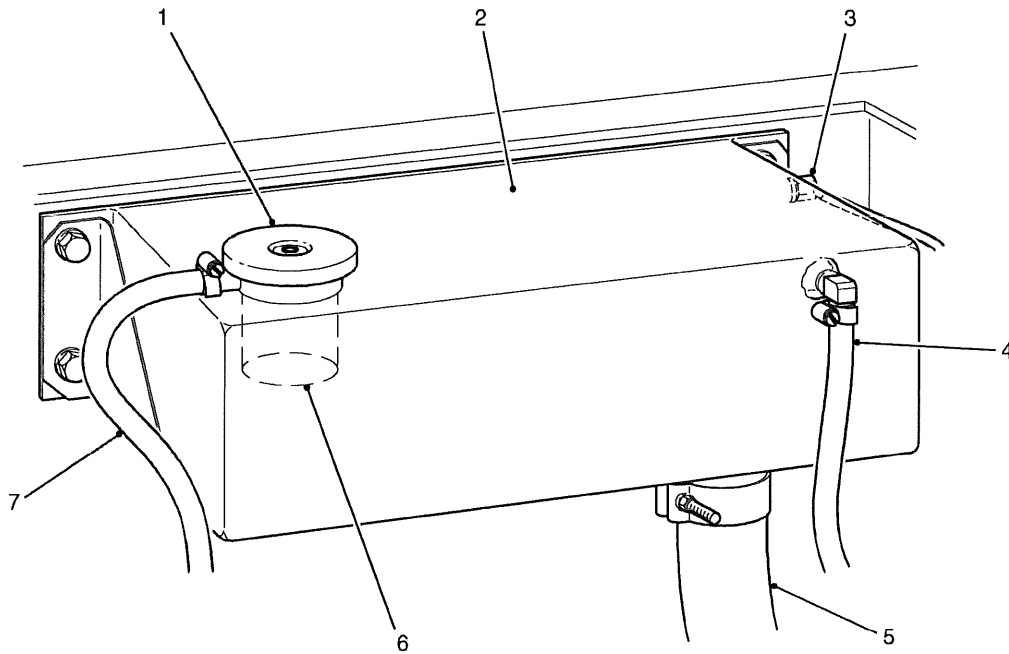
13.3 After ensuring that the temperature of the header tank is below hand hot, slowly loosen the header tank pressure/filler cap Fig 2 (1) to allow any minor pressure in the system to be released/vented. If pressure in the header tank is excessive, re-tighten and allow more time for the system to cool. Remove the cap.

13.4 Using the correct coolant mixture (refer to the Maintenance Schedule) top up coolant to the bottom of the filler neck in header tank.

NOTE

If coolant level is excessively low, check cooling system for leaks.

- 13.5 Check condition of filler cap sealing washer.
- 13.6 Fit the pressure/filler cap.
- 13.7 Lower and secure the air outlet louvres.



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- | | | | |
|---|------------------------------|---|-------------------|
| 1 | Combined pressure/filler cap | 5 | Outlet connection |
| 2 | Coolant header tank | 6 | Filler neck |
| 3 | Constant bleed connection | 7 | Overflow pipe |
| 4 | Constant bleed connection | | |

Fig 2 Coolant header tank

Coolant – drain and refill

NOTE



14 To drain and refill the system, proceed as follows:

14.1 Park on a level surface ensuring that the parking brake is applied and the vehicle master switch is in the OFF position.

14.2 Release, raise and secure the air outlet louvres.

NOTE

Draining the coolant must only be carried out with the radiator in the lowered position, as otherwise coolant will remain in the radiator.

14.3 Clean area around coolant pressure/filler cap.

WARNING

DANGER FROM SCALDING. DO NOT RELEASE THE COOLANT PRESSURE/FILLER CAP WHILE THE ENGINE IS RUNNING OR IF THE TEMPERATURE OF THE HEADER TANK IS ABOVE HAND HOT. GOGGLES SHOULD BE WORN.

14.4 After ensuring that the temperature of the header tank is below hand hot, slowly loosen the header tank pressure/filler cap Fig 2 (1) to allow any minor pressure in the system to be released/vented. If pressure in the header tank is excessive, re-tighten and allow more time for the system to cool. Remove the cap.

14.5 Remove the hull access plate on the underside of the vehicle.

14.6 Place a clean container of 27 litres capacity beneath the hull access aperture on the underside of the vehicle.

14.7 Remove the rear most engine access cover in the firewall.

WARNING

DANGER FROM SCALDING. TO AVOID SCALDING FROM HOT COOLANT, EYE PROTECTION AND PROTECTIVE GLOVES MUST BE WORN WHEN DRAINING COOLANT.

14.8 Clean the area around the coolant drain tap and ensure that the drain pipe is securely attached to the coolant drain tap. Unscrew the coolant drain tap. Allow coolant to drain.

14.9 Ensure that the coolant has ceased to drain. Remove the container from the underside of the vehicle and safely dispose of the drained coolant in conjunction with local standing orders.

WARNING

TOXIC AND HAZARDOUS SUBSTANCE. FLUID AL39 IS BOTH TOXIC AND HAZARDOUS. REFER TO LOCAL UNIT PRECAUTIONS AND CURRENT DINS, FOR FULL SAFETY PROCEDURES. MINIMUM PRECAUTION AFTER USE IS TO WASH ANY AFFECTED SKIN AREAS WITH SOAP AND WATER.

14.10 Check that the drain tap and connections are in good condition. Renew if required.

14.11 Close the coolant drain tap.

14.12 Add coolant of the correct strength (see Maintenance Schedule) until level is at the bottom of the filler neck, on the header tank. Check that the pressure/filler cap sealing washer is clean and in good condition. Refit the pressure/filler cap.

WARNINGS

(1) **DANGER TO LIFE AND LIMB. DRIVER'S COMPARTMENT MUST BE MANNED THROUGHOUT THE ENGINE RUN PERIOD.**

(2) **DANGER TO PERSONNEL. ALL PERSONNEL IN IMMEDIATE VICINITY MUST WEAR EAR PROTECTORS WHEN ENGINE IS RUNNING.**

(3) **DANGER TO LIFE AND LIMB. ALL TOOLS AND EQUIPMENT USED DURING MAINTENANCE MUST BE REMOVED FROM ENGINE AND GEARBOX COMPARTMENTS PRIOR TO STARTING ENGINE.**

CAUTION

EQUIPMENT DAMAGE. If the transmission louvres are open, no air is drawn through the radiator or charge air cooler. Therefore, only limited running of the engine in this condition is possible. The engine must be stopped before high coolant temperatures occur.

14.13 Run the engine until the outlet from the radiator is warm, to allow trapped air to escape.

WARNING

DANGER FROM SCALDING. DO NOT RELEASE THE COOLANT PRESSURE/FILLER CAP WHILE THE ENGINE IS RUNNING OR BEFORE SUFFICIENT TIME HAS BEEN ALLOWED FOR THE COOLANT TEMPERATURE TO COOL, OTHERWISE SEVERE SCALDING CAN RESULT.

14.14 Switch off the engine by operating the engine fuel cut-off control, allow the system to cool then check coolant level and top up, if necessary, as detailed in Sub-paras 13.3 to 13.7.

14.15 Lower and secure the air inlet louvres.

14.16 Refit the hull access plate on the underside of the vehicle, using sealant (NSN 8030-99-220-3407) on the mating faces.

RADIATOR AND CHARGE AIR COOLER SEALS

To check

15 To check radiator and charge air cooler seals proceed as follows:

15.1 Ensure the vehicle is parked on level ground and the parking brake is applied.

15.2 Ensure the vehicle master switch is in the OFF position.

15.3 Release, raise and secure the transmission louvres.

15.4 Check that the neoprene seals (Fig 3 (3)) are of uniform section, free from splits or cracks and evidence of permanent distortion.

To renew

16 To renew the radiator and charge air cooler seals proceed as follows:

CAUTION

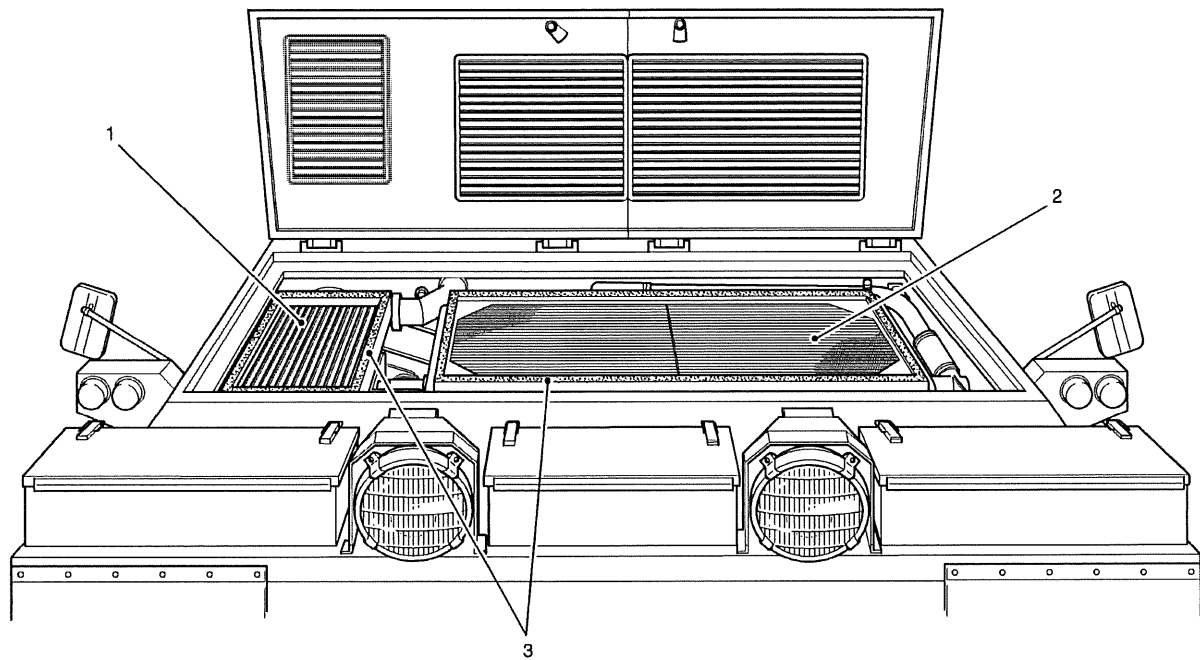
EQUIPMENT DAMAGE. Do not use a screwdriver or similar 'chisel edged' metal tool to refit the seals.

16.1 Pull off the old seal and discard.

16.2 Ensure all seating faces are clean and dry.

16.3 Fit a new length of (self-adhesive) seal, by pressing carefully into position. After fitting, lightly smear the top surface of the seal with petroleum jelly to prevent adhesion to the transmission louvres.

16.4 Lower and secure the transmission louvres.



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- | | | | |
|---|-------------------|---|-------|
| 1 | Charge air cooler | 3 | Seals |
| 2 | Radiator assembly | | |

Fig 3 Radiator and charge air cooler seals

RADIATOR AND CHARGE AIR COOLER – EXTERNAL CLEANING

- 17 To clean the radiator and charge air cooler, proceed as follows:
- 17.1 Ensure the vehicle is parked on firm level ground, with the parking brake applied.
 - 17.2 Ensure the vehicle master switch is in the OFF position.
 - 17.3 Release, raise and secure the transmission louvres.
 - 17.4 Release and raise the radiator. Remove the charge air cooler (Advanced driver/REME task), ensuring that blanking plates are fitted to the induction hose ends.
 - 17.5 Visually inspect matrices for signs of leakage or impact damage. Check for blockage by mud, leaves, insects or other debris. If deposits are excessive, the matrices must be cleaned.

CAUTIONS

- (1) **EQUIPMENT DAMAGE.** Ensure that the driver's access aperture is covered before cleaning commences.
 - (2) **EQUIPMENT DAMAGE.** Use only a low pressure water jet for cleaning matrices. Matrices may be damaged if compressed air or high pressure water jets are used.
 - (3) **EQUIPMENT DAMAGE.** Care must be taken to avoid distorting the core fins.
- 17.6 Before use of the water jet, remove the hull access cover in the underside of the hull, to allow for drainage.
- 17.7 Hose the upper side of the matrix to soften any persistent dirt, then hose from the underside to remove the dirt and debris.
- 17.8 Carefully straighten any distorted fins.
- 17.9 Fit the hull access cover in the underside of the hull, using sealant (NSN 8030-99-220-3407) on the mating faces. Refit the charge air cooler, lower and secure the radiator.
- 17.10 Lower and secure the transmission louvres.
- 17.11 If the debris cannot be removed by the above method, report to REME.

COOLING FAN DRIVE BELT

- 18 To check the cooling fan drive belt, proceed as follows:
- 18.1 Ensure the vehicle is parked on firm level ground, apply the parking brake and set the battery master switch to OFF. Raise and secure transmission louvres.
 - 18.2 Check the cooling fan drive belt for wear using the following criteria. If a replacement is considered necessary, report to REME.
 - 18.2.1 Cracking at roots of teeth.
 - 18.2.2 Excessive wear of land area between teeth, i.e. belt cord material exposed.
 - 18.2.3 Damage caused by sharp objects and lubricant contamination.
 - 18.2.4 Excessive side wear. The nominal width of a new drive belt is 50 mm (2 in.). Minimum allowable width is 45 mm (1.8 in.).
 - 18.3 Check tension of drive belt. Total free play must not exceed 14 mm (9/16 in.). The measurement is to be taken on the free run (the untensioned side) of the belt at mid point between pulleys. If the drive belt requires adjusting, report to Advanced driver/REME.

NOTE

- Replacement of the cooling fan drive belt is an Advanced driver/REME task.
- 18.4 Lower and secure the transmission louvres.

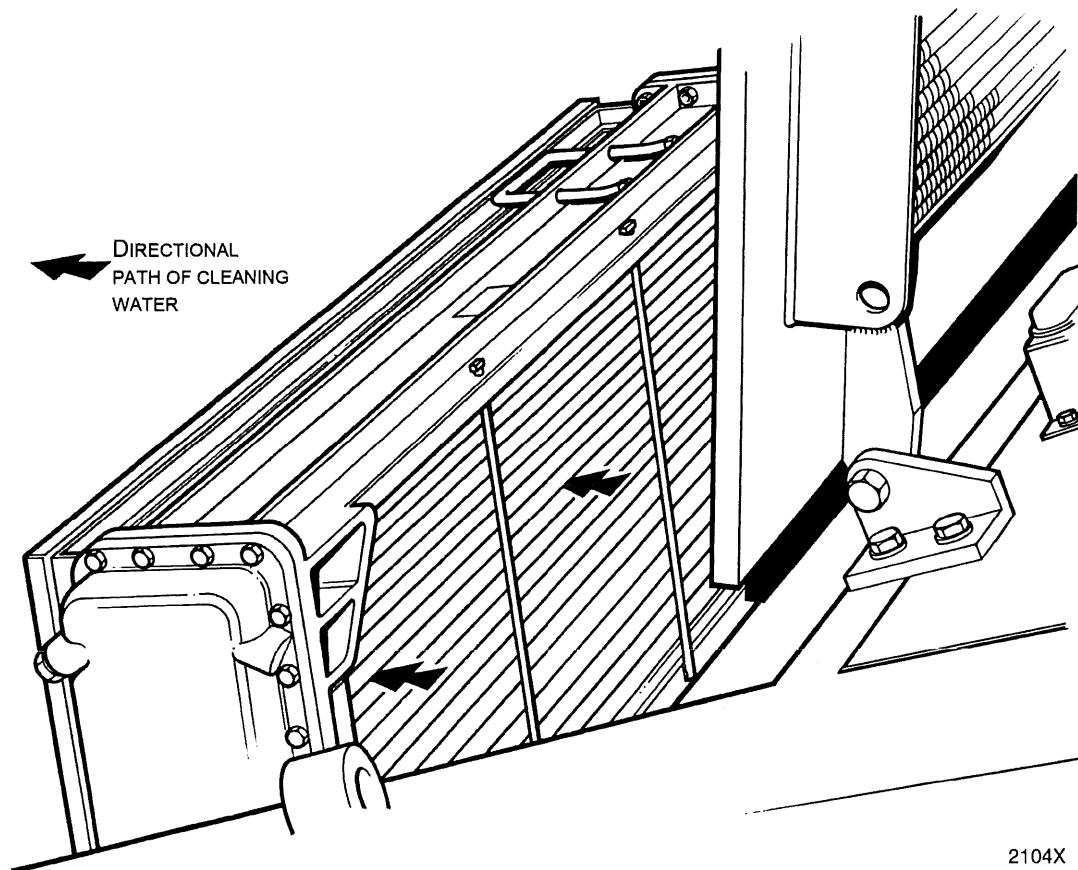


Fig 4 Radiator and charge air cooler cleaning

Coolant pump drive belt – visual examination

19 To examine the coolant pump drive belt, proceed as follows:

19.1 Set the battery master switch to OFF, raise and secure the air outlet louvres.

19.2 Examine the coolant pump drive belt for wear, using the following criteria. If belt replacement is necessary, report to REME.

19.2.1 Any cracking.

19.2.2 Fraying caused by excessive cracking (minimal cracking is acceptable).

19.2.3 Any signs of impact damage and lubricant contamination.

19.2.4 Visually check condition of belt tensioner.

19.3 Lower and secure the air outlet louvres.

NOTE

Replacement of the coolant pump drive belt is a REME task.

Check condition of fan, fan mounting and tensioner

20 A check (see Maintenance Schedule) for security and condition must be carried out. If in doubt, report to REME.

CHAPTER 6
FUEL SYSTEM
CONTENTS

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	Description
2	Filler pipe and cap
3	Strainer
4	Breather
6	Fuel tank
7	Electric fuel priming pump
8	System fuel filter
9	Fuel lift pump
10	Engine fuel filter
11	Fuel injection pump
14	Fuel injectors
15	Accelerator pedal
16	User maintenance (WARNINGS)
17	Drain the system and engine fuel filter of water (WARNING)
18	Renew engine fuel filter (WARNING) (CAUTION)
19	Bleed the fuel system
22	Renew the system fuel filter (WARNING)
23	Clean the electric fuel priming pump filter (WARNING)
24	Clean fuel filler gauze strainer (WARNING)
25	Refuelling (WARNING)
26	Cold start device (thermostart unit)
27	Accelerator linkage
28	Stop lever linkage
29	Fuel tank breather cut-off valve

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3	Engine fuel filter (thermostart system fitted).....	6
4	Electric fuel priming pump filter.....	8

INTRODUCTION

1 The fuel system (Fig 1) comprises a vehicle mounted fuel tank, electric priming pump, system fuel filter and fuel tap (if fitted), engine mounted lift pump, engine fuel filter, a six cylinder injection pump, a mechanical stop mechanism, six injectors and a cold start device which, if fitted, is located in the air inlet connection as an aid to engine starting in very cold conditions. A fuel gauge on the driver's instrument panel indicates the amount of fuel available in the fuel tank. Additionally, a fuel tank gauge is mounted near the fuel gauge sender unit (all variants), which indicates litres to fill.

DESCRIPTION

Filler pipe and cap

2 The filler pipe, with its screw clamp type filler cap, is connected to the left rear of the tank and extends upwards to an aperture in the hull roof plate. The aperture is closed by a cover plate, which is secured by a hinged padlock bar.

Strainer

3 Fuel is filtered through a gauze strainer situated in the filler pipe assembly.

Breather

4 The filler cap housing has two side vents - one above the filler cap level, the other below. The upper vent is connected by a pipe to a small hole in the hull rear plate for drainage purposes; the lower vent is the end of a breather tube, which extends downwards inside the filler tube to the fuel tank interior.

5 The fuel tank breather vent is connected by a pipe to an external breather located in the top of the hull to the right underneath the turret. Any fuel, which may enter the breather pipe whenever the vehicle is operating at extreme angles, is prevented from escaping by a needle valve placed between the pipe and the external breather.

Fuel tank

6 The Scimitar fuel tank is an integral part of the hull and is formed in the rear of the fighting compartment. It is lined with a flexible synthetic rubber bag, which is attached to the tank walls by press studs. Other variants have fabricated steel tanks. Refer to relevant variant AESP for details.

Electric fuel priming pump

7 An electric fuel priming pump (5) is incorporated into the fuel system to assist in priming and bleeding operations and is not necessary for normal operation. The pump operates continuously when the master switch and the ignition switch are turned on. The priming pump incorporates a gauze filter and is protected by a fuse mounted on the driver's instrument panel.

System fuel filter

8 The system fuel filter (3) is a disposable canister type and is mounted above the right hand sponson in the rear right hand side of the fighting compartment. Any trapped water may be drained as required using the drain tap located at the base of the canister.

Fuel lift pump

9 The fuel lift pump is fitted to the engine below and to the rear of the fuel injection pump and is operated by an eccentric cam on the camshaft. The lift pump, (Chap 4.1, Fig 1(10)) draws fuel from the tank through the system fuel filter and fuel tap (if fitted) and delivers it to the engine fuel filter. A hand priming pump incorporated in the lift pump facilitates bleeding the fuel system if the electric fuel priming pump is inoperative.

Engine fuel filter

10 The engine fuel filter fitted on the side of the engine to the rear of the fuel injection pump and cleans the fuel before it is routed to the fuel injection pump. The filter construction is identical to the system fuel filter.

Fuel injection pump

11 The fuel injection pump (Chap 4.1, Fig 1 (16)) is mounted on the timing gear case and supported on a bracket bolted to the side of the engine. The pump is lubricated by engine oil.

12 Speed control is maintained by a mechanical flyweight governor and gives accurate control of engine speed under all load conditions. An automatic advance device is fitted to give automatic variation of the commencement of injection.

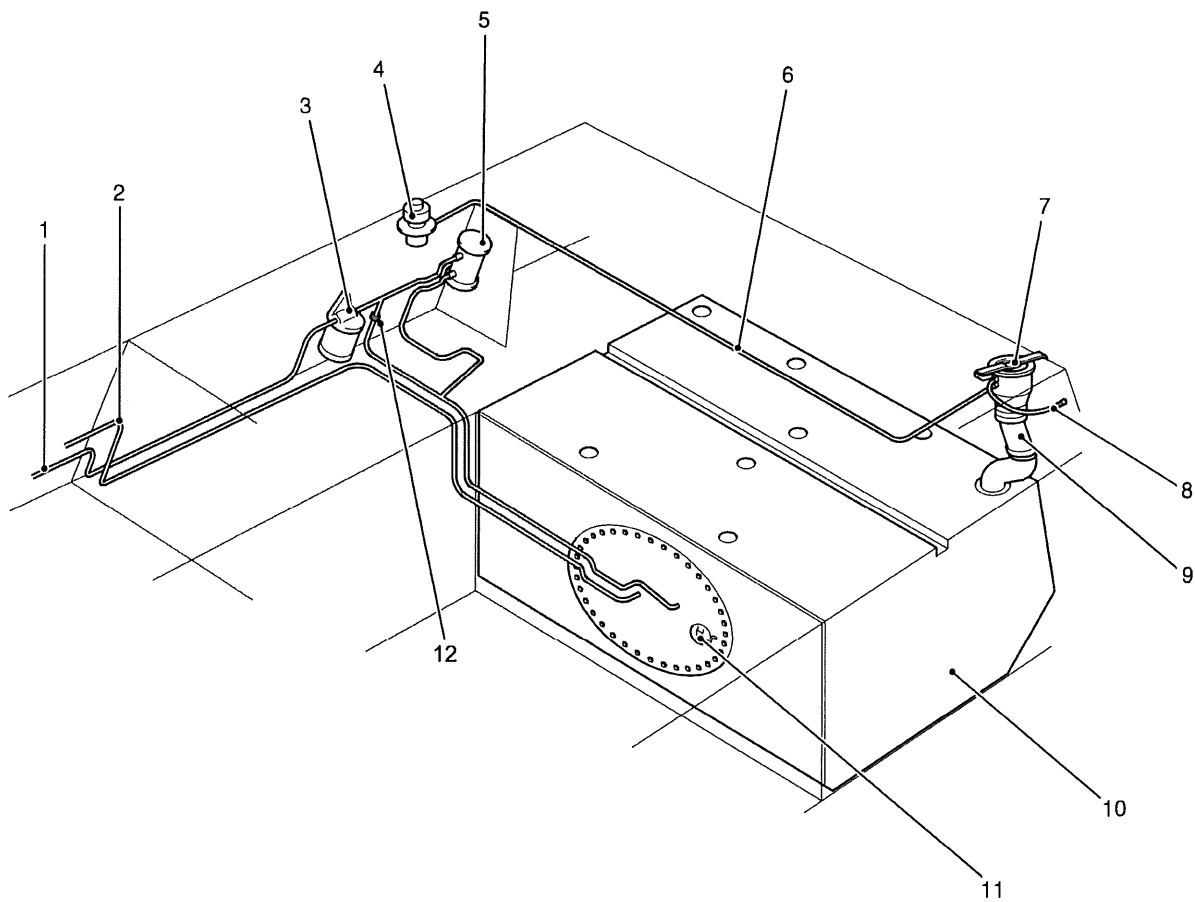
13 A fuel cut-off mechanism, fitted to the fuel injector pump, is operated by the engine stop cable 'T' handle in the driver's compartment.

Fuel injectors

14 The fuel injectors deliver the fuel to the engine combustion chamber. The injectors are also fitted with leak off (spill) connections to return natural leakage (this leakage being a feature of most diesel injection systems) with excess fuel from the fuel injection pump, via fuel filter head, for recirculation to the fuel tank via a fuel return pipe.

Accelerator pedal

15 The accelerator pedal is connected by a cable and associated linkage to the fuel control lever mounted on the fuel injection pump.



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- | | | | |
|---|-------------------------------|----|---------------------------------|
| 1 | Fuel injection pump feed pipe | 7 | Filler access cover |
| 2 | Engine fuel return pipe | 8 | Drain tube |
| 3 | System fuel filter | 9 | Filler hose |
| 4 | Breather assembly | 10 | Fuel tank |
| 5 | Electric fuel priming pump | 11 | Dual fuel gauge and sender unit |
| 6 | Breather tube | 12 | Non return valve |

Fig 1 Fuel system

USER MAINTENANCE**WARNINGS**

(1) **FIRE RISK.** A RISK OF FIRE AND/OR EXPLOSION EXISTS WHEN REFUELLING A VEHICLE FITTED WITH RUBBER PADDED TRACKS, BY EITHER PUMPS OR PLASTIC CONTAINERS, DUE TO THE PRESENCE OF STATIC ELECTRICITY. THIS RISK ALSO APPLIES WHEN REFUELLING OR DRAINING NEAR AN OPERATING RADAR SET OR OTHER HF TRANSMITTERS - THE HAZARD VARIES WITH THE POWER OF THE EQUIPMENT SO UNIT STANDING ORDERS MUST BE RIGOROUSLY APPLIED. THE VEHICLE MUST, THEREFORE, ALSO BE EARTHED WHEN CARRYING OUT REFUELLING OR FUEL TANK DRAINING OPERATIONS.

(2) **FIRE RISK.** WHEN WORKING ON THE FUEL SYSTEM ALL SWITCHES MUST BE IN THE OFF POSITION AND HATCHES AND COVERS OPENED TO DISPERSE FUMES. ALL NECESSARY FIRE PRECAUTIONS MUST BE STRICTLY APPLIED.

(3) **CADMIUM PLATING.** THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.

(4) **PERSONAL INJURY.** WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.

(5) **SILICA - TOXIC SUBSTANCE.** BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.

16 The following operations detail the procedures for carrying out the maintenance tasks applicable to the fuel system.

Drain the system and engine fuel filter of water

17 To drain the fuel filter of water (Fig 2 and Fig 3) proceed as follows:

WARNING

RISK TO HEALTH. DIESEL FUEL IS CARCINOGENIC. USE BARRIER CREAM AND WEAR PROTECTIVE CLOTHING WHEN THERE IS A POTENTIAL RISK OF CONTACT WITH DIESEL FUEL.

17.1 Position a container below the filter then loosen the drain tap (5) in the base of the unit.

17.2 When water-free fuel flows from the filter, tighten the drain tap.

17.3 Dispose of the waste safely in conjunction with local standing orders.

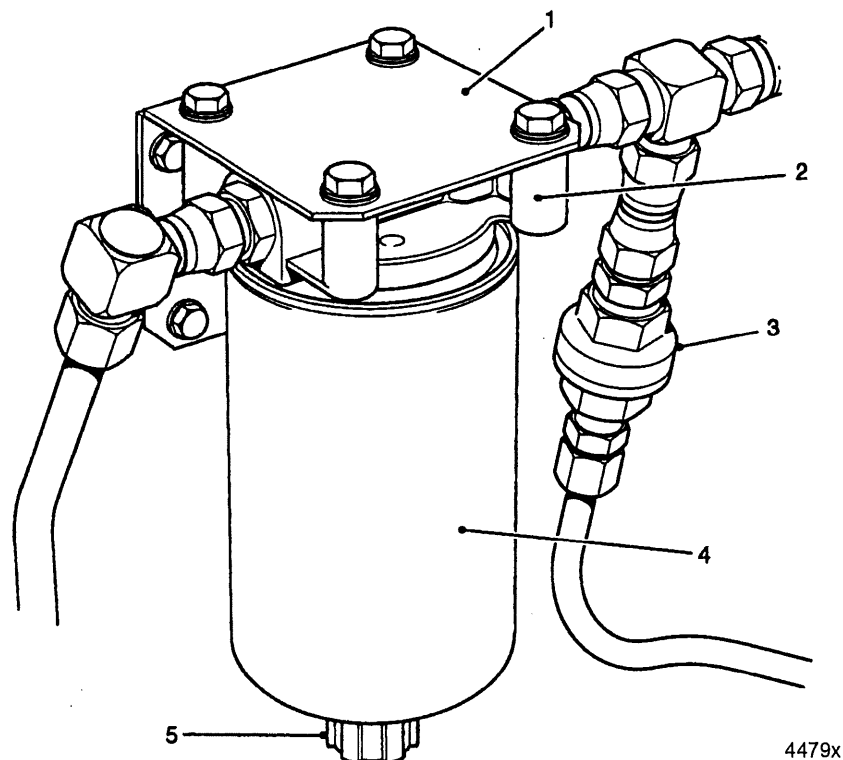
Renew engine fuel filter

18 Renew engine fuel filter as follows:

WARNING

RISK TO HEALTH. DIESEL FUEL IS CARCINOGENIC. USE BARRIER CREAM AND WEAR PROTECTIVE CLOTHING WHEN THERE IS A POTENTIAL RISK OF CONTACT WITH DIESEL FUEL.

18.1 Position the vehicle on firm level ground, apply the parking brake and ensure all battery master switches are in the off position.



- | | | | |
|---|------------------|---|-----------------|
| 1 | Mounting bracket | 4 | Filter canister |
| 2 | Filter head | 5 | Drain tap |
| 3 | Non-return valve | | |

Fig 2 System fuel filter

18.2 Raise and secure air outlet louvres.

NOTE

Due to restricted space in the engine compartment it may be difficult to fit and use the filter removal tool. The air filtration unit can be removed, (Chap 4.3 refers) to gain greater access.

18.3 Thoroughly clean the exterior of the filter assembly.

18.4 Unscrew filter canister (Fig 3 (4)) from filter head (1) taking care not to spill the contents.

18.5 Clean sealing face of filter head with clean lint-free cloth.

18.6 Fit new O-ring seal (3) to top of new filter canister and lubricate seal with clean diesel.

18.7 Fill new filter canister with clean fuel.

CAUTION

EQUIPMENT DAMAGE. Do not use tools when fitting filter canister. Over tightening will damage the cartridge or the filter head by distorting the screw threads.

18.8 Screw filter canister onto filter head. Tighten by hand until sealing faces are in firm contact. Hand tighten a further 3/4 turn.

18.9 Proceed to bleed the fuel system as detailed in Para 21. Once the engine is running check the fuel system for leaks. If a fuel leak cannot be rectified report to REME.

18.10 Close and secure air outlet louvres.

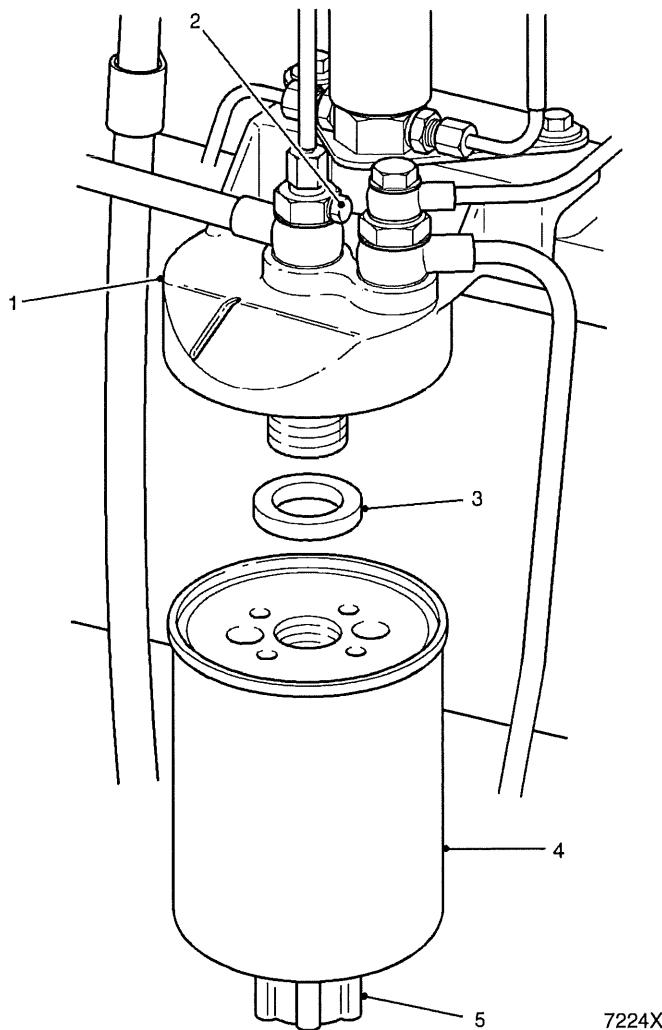
Bleed the fuel system

19 Any air must be vented and the system primed with fuel whenever any disconnection in the fuel system has taken place or when the system has been emptied of fuel.

20 No attempt must be made to start the engine until the fuel system has been bled.

21 Bleed the fuel system as follows:

21.1 Loosen the bleed screw (Fig 3 (2)) on the fuel filter outlet banjo bolt.



- | | | | |
|---|-------------|---|------------------|
| 1 | Filter head | 4 | Filter cartridge |
| 2 | Bleed screw | 5 | Drain tap |
| 3 | O-ring seal | | |

Fig 3 Engine fuel filter (thermostart system fitted)

21.2 Operate the electric fuel priming pump by turning on the vehicle master switch and engine ignition switch. When air-free fuel flows from the bleed screw on the fuel filter, tighten screw. If battery power is not available, the manual priming pump may be used (if accessible) to bleed the system.

21.3 Set and hold thermostart/starter switch to START position to crank engine until it starts.

NOTE

Engine may have to be cranked longer than for normal starting to allow the injection pump to self-bleed.

21.4 Run engine until it will run and idle smoothly. As the engine is running check the fuel system for leaks.

Renew the system fuel filter

22 Renew the system fuel filter as follows:

WARNING

RISK TO HEALTH. DIESEL FUEL IS CARCINOGENIC. USE BARRIER CREAM AND WEAR PROTECTIVE CLOTHING WHEN THERE IS A POTENTIAL RISK OF CONTACT WITH DIESEL FUEL.

22.1 Position the vehicle on firm level ground, apply the parking brake and ensure all battery master switches are in the off position.

22.2 Dependant upon the variant, stowage netting may have to be removed to gain access to the filter.

22.3 Renew the filter canister as detailed in Sub-paras 18.3 to 18.8.

22.4 Proceed to bleed the fuel system as detailed in Para 21. Once the engine is running check the fuel system for leaks. If a fuel leak cannot be rectified, report to REME.

Clean the electric fuel priming pump filter

23 Some electric fuel priming pumps are fitted with a removable filter, which should be cleaned at the intervals specified in the Maintenance Schedule. Clean the electric fuel priming pump filter as follows:

23.1 Position the vehicle on firm level ground, apply the parking brake and ensure all battery master switches are in the off position.

WARNING

RISK TO HEALTH. DIESEL FUEL IS CARCINOGENIC. USE BARRIER CREAM AND WEAR PROTECTIVE CLOTHING WHEN THERE IS A POTENTIAL RISK OF CONTACT WITH DIESEL FUEL.

23.2 Using a flat blade screwdriver, turn the fuel isolation tap to the off position (not required on Scimitar).

23.3 Pack cloth under the pump end cover to soak up any fuel that may be spilt.

23.4 Remove the bayonet-fitting end cover (Fig 4 (1)) (if too tight a spanner may be used) from the pump body (4) and withdraw the small circular gauze filter (3).

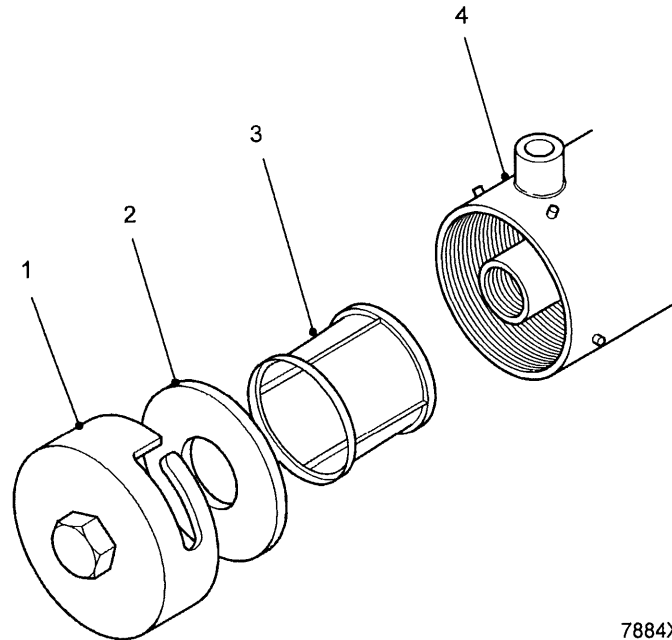
23.5 Wash the gauze filter (3) in clean diesel and clean the interior of the cover.

23.6 Check that the gauze filter is not damaged and that the rubber gasket (2) located within the pump end cover (1) is serviceable. Refit the gauze filter.

23.7 Refit and secure the pump end cover (1) and remove the cloth.

23.8 Using a flat blade screwdriver, turn the fuel isolation tap to the on position (not required on Scimitar) and set battery master switches to ON.

23.9 Proceed to bleed the fuel system as detailed in Para 21. With the ignition switch set to ON, check the electric fuel priming pump for leaks. If a fuel leak cannot be rectified report to REME.



1	Pump end cover	3	Gauze filter
2	Rubber gasket	4	Pump body

Fig 4 Electric fuel priming pump filter

Clean fuel filler gauze strainer

24 Clean the fuel filler gauze strainer as follows:

24.1 Position the vehicle on firm level ground, apply the parking brake and ensure all battery master switches are in the off position.

WARNING

RISK TO HEALTH. DIESEL FUEL IS CARCINOGENIC. USE BARRIER CREAM AND WEAR PROTECTIVE CLOTHING WHEN THERE IS A POTENTIAL RISK OF CONTACT WITH DIESEL FUEL.

24.2 Open up the cover plate and unscrew the filler cap.

- 24.3 Remove the circlip, which secures the filler cap captive chain, and place the whole assembly in a clean dry safe place.
- 24.4 Lift the strainer out of the filler neck and wash it in clean diesel.
- 24.5 Check the strainer is not damaged and replace it into the filler neck.
- 24.6 Replace the circlip into its recess in the filler neck and tighten the filler cap.
- 24.7 Close and secure the cover plate.

Refuelling

NOTE

It is recommended that fuel tanks be filled to maximum to reduce contamination by condensation.

- 25 Fill the fuel tank, as follows:

- 25.1 Position the vehicle on firm level ground, apply the parking brake and stop the engine.

WARNING

FIRE RISK. A RISK OF FIRE AND/OR EXPLOSION EXISTS WHEN REFUELLING A VEHICLE FITTED WITH RUBBER PADDED TRACKS, BY EITHER PUMPS OR PLASTIC CONTAINERS, DUE TO THE PRESENCE OF STATIC ELECTRICITY. THIS RISK ALSO APPLIES WHEN REFUELLING OR DRAINING NEAR AN OPERATING RADAR SET OR OTHER HF TRANSMITTERS - THE HAZARD VARIES WITH THE POWER OF THE EQUIPMENT SO UNIT STANDING ORDERS MUST BE RIGOROUSLY APPLIED. THE VEHICLE MUST, THEREFORE, ALSO BE EARTHED WHEN CARRYING OUT REFUELLING OR FUEL TANK DRAINING OPERATIONS.

- 25.2 Ensure that the vehicle is earthed before proceeding.
 - 25.3 Position the turret if necessary, to facilitate access to the filler pipe.
 - 25.4 Unlock and lift the filler cover plate, unscrew the winged clamp screw to remove the filler cap and add fuel until the fuel gauge indicates that the tank is full. If time permits also check the gauge mounted near the fuel gauge sender unit. The filler neck incorporates a strainer to prevent ingress of foreign matter.
 - 25.5 Replace the filler cap and secure the filler cover plate.

Cold start device (thermostart unit)

26 The cold start device is a special to role fit only and is installed in the air inlet connection with the fuel control solenoid mounted above the fuel filter to facilitate engine starting in very cold conditions. The device requires no maintenance. Operation of the cold start device is by means of the thermostart/starter switch located on the driver's instrument panel. Cold starting instructions are given in Chap 12, Annex A.

Accelerator linkage

27 Clean, check and lubricate the accelerator linkage as follows:

27.1 Position the vehicle on firm level ground, apply the parking brake and ensure all battery master switches are in the off position.

27.2 Clean the accelerator cable and linkage with a lint free cloth.

27.3 Check the condition of the cable and linkage, report any damage to REME.

27.4 Using oil as specified in the Maintenance Schedule (Cat 601), lubricate all joints in the accelerator linkage cable.

Stop lever linkage

28 Clean, check and lubricate the stop lever linkage as follows:

28.1 Position the vehicle on firm level ground, apply the parking brake and ensure all battery master switches are in the off position.

28.2 Clean the stop lever linkage with a lint free cloth.

28.3 Check the condition of the linkage, report any damage to REME.

28.4 Using oil as specified in the Maintenance Schedule (Cat 601), lubricate all joints in the stop lever linkage.

Fuel tank breather cut-off valve

29 Clean, check and lubricate the stop lever linkage as follows:

29.1 Position the vehicle on firm level ground, apply the parking brake and ensure all battery master switches are in the off position.

29.2 Locate the external portion of the fuel tank breather (Fig 1 (6)) and trace the breather pipe to its open end outside the vehicle hull.

29.3 Examine the end of the pipe for blockages or evidence of fuel leakage. Report any faults to REME.

CHAPTER 7
TRANSMISSION, FINAL DRIVES, AND BRAKING SYSTEMS

CONTENTS

Chapters

- 7-1 Gearbox and steering
- 7-2 Main and parking brakes
- 7-3 Final drives

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CHAPTER 7-1

GEARBOX AND STEERING

CONTENTS

Para

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	Operation of controls
7	Gear Change Pedal (GCP)
8	Forward/reverse control (Transfer lever)
9	Steering
13	Applying the steering levers (WARNING) (CAUTION)
15	User maintenance (WARNINGS)
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17	To change the gearbox oil (WARNINGS) (CAUTION)
18	To remove and replace the gearbox oil filter element (WARNINGS) (CAUTION)
19	Gearbox breather
	Main drive coupling
20	Examination
21	Steering lever and interlock lubrication
22	To check and top-up the steering brake reservoir (WARNING)
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25	To bleed the steering brakes (WARNINGS) (CAUTION)
26	Steering brake pads
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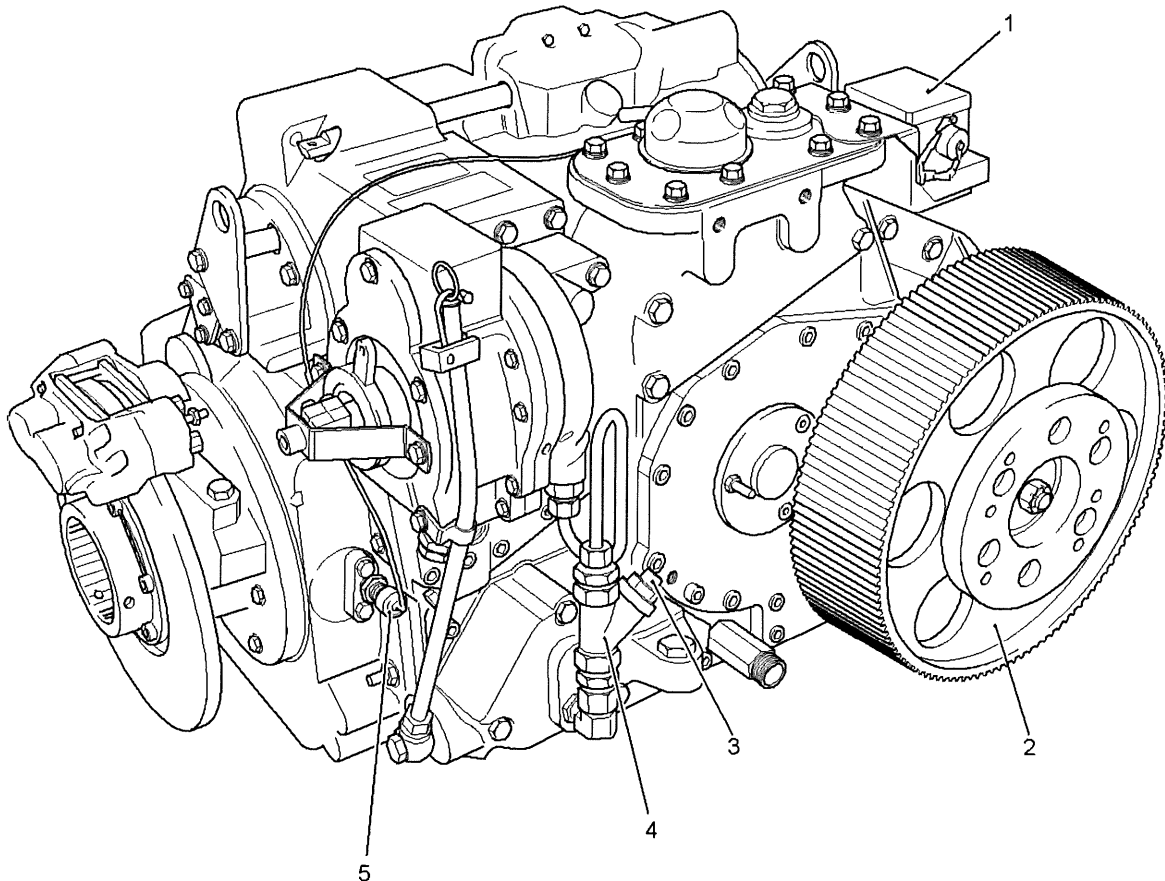
1	General view of TN15E gearbox	2
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3	Transmission	4
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GEARBOX

INTRODUCTION

1 The gearbox fitted to the vehicle may be either a TN15D or an updated version, designated TN15E. The gearboxes are colour coded for identification; the TN15D gearbox has the top cover painted yellow and the TN15E top cover is painted blue. The TN15E gearbox is the preferred fit.

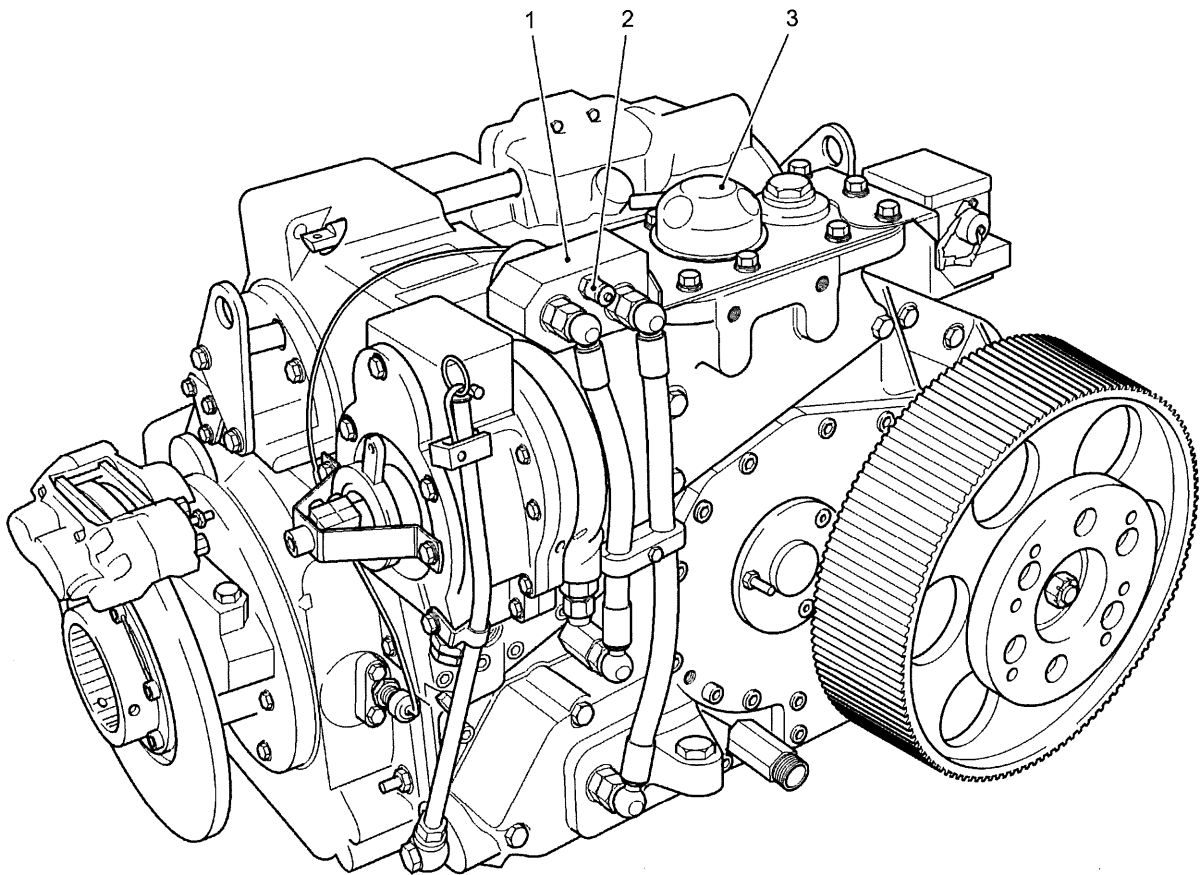
2 The TN15E (Fig 1) has updated internal components, an additional external bypass oil strainer assembly with oil pressure test point and a gearbox usage monitor. TN15E gearboxes fitted to vehicles held by BATUS only may have a repositioned bypass oil strainer assembly and replacement breather (Fig 2). The centrifugal clutch assembly is the same as that fitted to the TN15D.



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- | | | | |
|---|-------------------------------|---|----------------------|
| 1 | Gearbox usage monitor | 4 | By-pass oil strainer |
| 2 | Cooling fan drive belt pulley | 5 | Sensor unit |
| 3 | Oil pressure test point | | |

Fig 1 General view of TN15E gearbox



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- 1 Strainer manifold assembly
- 2 Oil pressure test point
- 3 Breather

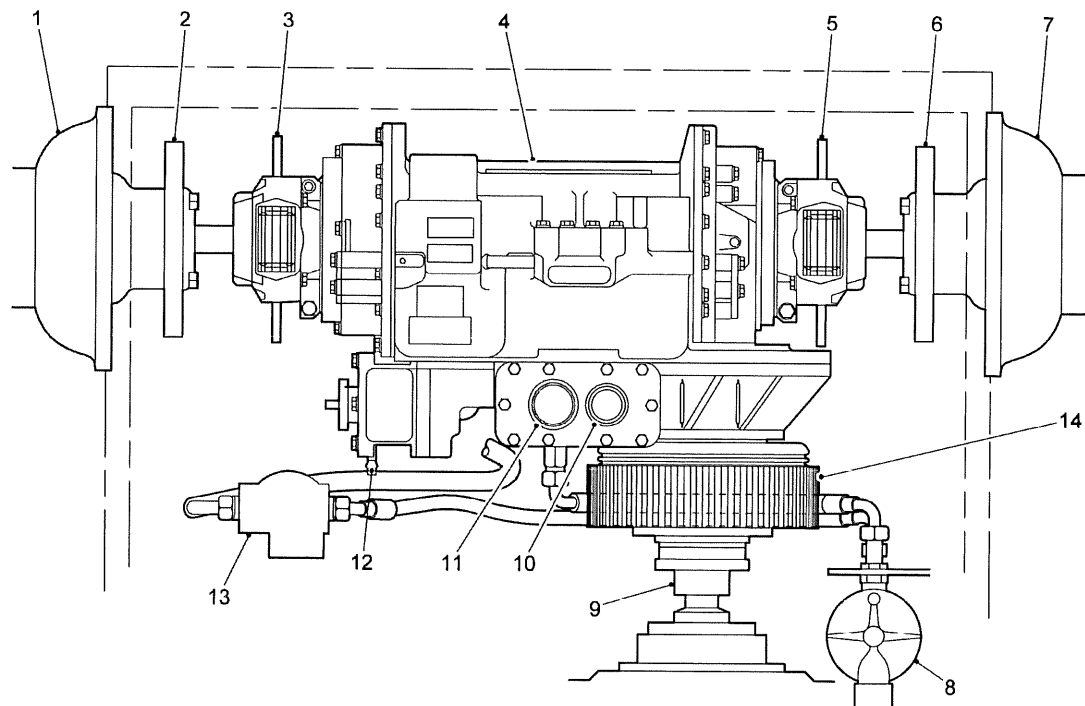
Fig 2 General view of TN15E gearbox (BATUS only)

DESCRIPTION

3 The gearbox combines the Wilson epicyclic gear train system with Merritt steering principles to permit seven-speed operation (forward or reverse) and steering. It is coupled to the engine by the main drive coupling; drive to the gear train system is via a centrifugal clutch incorporated in the gearbox input coupling. The clutch engages when the engine speed is increased above 750 rev/min.

4 A free wheel device, also incorporated in the gearbox input coupling, ensures positive drive back to the engine when tow-starting.

5 The gearbox drive control mechanisms are linked mechanically to a foot-operated gear change pedal and a hand-operated forward/reverse control (transfer lever) in the driving compartment. A gear position indicator, fitted to the driver's instrument panel and coupled to the gearbox by a flexible drive shaft, indicates which gear is engaged (E denotes extra low gear). The steering function is dependent upon the braking of either of two discs incorporated in the gearbox output trains.



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1	Final drive LH	8	Gearbox oil heat exchanger
2	Main/parking brake disc LH	9	Main drive coupling
3	Steering brake disc LH	10	Gearbox filler plug
4	Gearbox	11	Gearbox breather
5	Steering brake disc RH	12	Gearbox oil dipstick
6	Main/parking brake disc RH	13	Gearbox oil filter
7	Final drive RH	14	Centrifugal clutch

Fig 3 Transmission

6 The gearbox lubrication system is pressurised to promote the circulation of oil through the heat exchanger (Chap 4). A full flow gearbox oil filter (Fig 3 (13)), fitted with a disposable filter element, is mounted on the transmission compartment bulkhead. Should the gearbox oil filter become blocked, both of the two filter warning lights mounted on the side of the driver's instrument panel will illuminate, indicating that the gearbox oil filter requires attention. The gearbox (4) incorporates a dipstick (12) for checking the oil level, a filler plug (10) and breather (11), which are accessible in the transmission compartment, and a magnetic drain plug, which is accessible beneath the vehicle.

OPERATION OF CONTROLS

Gear Change Pedal (GCP)

7 The GCP (Chap 3, Fig 3 (18)) is a centre pivot, rocking type pedal, which is pushed down with the heel of the foot for higher and pushed forward with the toe of the foot for lower gears. The gear position indicator located on the driver's instrument panel, will indicate when a particular pedal movement has effected the required change; the pedal must then be released so that it can take up a position in readiness for the next change.

Forward/reverse control (Transfer lever)

8 The forward/reverse control (transfer lever) (Chap 3, Fig 3 (20)) has two identified positions FWD forward and REV reverse drive. Neutral midway between the two is unmarked. Operation of the transfer lever must only be made when the vehicle is stationary with clutch disengaged. Neutral can be selected and held, clutch engaged, i.e., silent watch conditions.

Steering

9 The steering levers (Chap 3, Fig 3 (8), (19)) provide for manual, unassisted operation of the steering brakes; each is linked to its respective master cylinder via an interlock mechanism, which, by preventing simultaneous operation of the levers, safeguards against possible damage to the gearbox.

10 There are two steering brake discs; one is incorporated in the gearbox LH output shaft as in Fig 3 (3) and the other (5) is similarly incorporated in the RH output shaft. TN15D transmissions are fitted with solid discs, whereas TN15E type are fitted with scalloped discs. The steering brake operating mechanisms are similar, each steering brake caliper comprises an operating cylinder to exert inward pressures on the steering brake pads (Fig 6 (4)) when the hydraulic system is pressurised. This occurs when either steering lever is operated to actuate the master cylinder. The pressure in the feed pipe is transmitted to each steering brake caliper operating cylinder.

11 The hydraulic system incorporates a bleed valve (Fig 6 (5)) in each caliper. The system is charged from the reservoir (Chap 3, Fig 3 (3)).

12 The steering brake pads are of the replaceable type and are retained in position by locking pins (Fig 6 (16)) and spring clips.

Applying the steering levers

WARNING

PERSONAL INJURY. DO NOT OPERATE THE STEERING LEVERS WITH THE ENGINE RUNNING AT IDLING SPEED AND THE TRANSMISSION IN NEUTRAL, AS THIS COULD CAUSE THE VEHICLE TO PIVOT.

CAUTION

EQUIPMENT DAMAGE. Pivot turns should be avoided on rough or heavy ground as it places excessive strain on the transmission and may result in a track being thrown.

13 When making a turn, the appropriate steering lever should be pulled back hard to lock the disc. It will be found, when turning on the move, that the turning circle will depend on the gear selected (Chap 12, Fig 2) i.e. the higher the gear, the greater the turning circle. When steering in lower gears a tighter turning circle can be achieved. Steering whilst changing gear on roads should not be attempted as this may cause the vehicle to violently change course.

14 Due to the rubber pads on the tracks, extra driver care is required when steering on smooth wet roads.

USER MAINTENANCE**WARNINGS**

(1) **CADMIUM PLATING. THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.**

(2) **PERSONAL INJURY. WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.**

(3) **SILICA - TOXIC SUBSTANCE. BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.**

15 Use oil, as specified in the Maintenance Schedule, to lubricate all joints in the gear change and forward/reverse control linkages.

To check and top up the gearbox oil level

16 To check and top up the gearbox oil level, proceed as follows:

16.1 Position the vehicle on firm, level ground and apply the parking brake.

16.2 Stop the engine, set all battery master switches to OFF. Position the main armament to clear the transmission louvres, if applicable and wait a few minutes to allow the oil to settle. Release, raise and secure the transmission louvres and raise the radiator.

CAUTION

DAMAGE TO SEALS. Avoid spilling oil onto the charge air cooler or radiator seals. Any spillage must be wiped off to preserve the rubber.

16.3 Release retaining clip and withdraw the dipstick (Fig 3 (12)). Wipe clean using a lint-free cloth. Re-insert the dipstick to its full depth, then withdraw it again and check the oil level. Refit the dipstick and secure with retaining clip.

NOTE

The dipstick has two marks, a minimum (low mark) and a maximum (high mark). The oil level should be kept at the high mark.

16.4 If the level is low, clean around and remove the gearbox filler plug (10) and slowly add oil (as specified in the Maintenance Schedule) until the level settles to the high mark on the dipstick.

16.5 Replace the filler plug. Lower the radiator. Release, lower and secure the transmission louvres.

To change the gearbox oil

17 Changing the gearbox oil should be carried out when the vehicle has been run and the oil is still warm.

WARNING

DANGER TO LIFE AND LIMB. BEFORE PERSONNEL ARE ALLOWED UNDER THE VEHICLE, THE PARKING BRAKE MUST BE FULLY APPLIED AND THE VEHICLE SECURED AGAINST MOVEMENT AND THE ENGINE SWITCHED OFF.

17.1 Position the vehicle on firm level ground.

17.2 Stop the engine and set all battery master switches to OFF. Apply the parking brake.

17.3 Position the main armament clear of the transmission louvres, if applicable.

17.4 Release, raise and secure the transmission louvres.

17.5 From underneath the vehicle, remove access cover from the transmission compartment floor, utilising the two threaded extractor holes provided in the access cover to assist removal, as the cover is secured using a sealant gasket.

NOTE

WARNING

DANGER OF SCALDING FROM HOT OIL. PROTECTIVE GLOVES MUST BE WORN WHEN REMOVING THE GEARBOX OIL DRAIN PLUG.

17.6 Position a container of approximately 12.5 litres capacity beneath the access hole to receive the gearbox oil. Remove the drain plug.

17.7 Allow the oil to drain. While the oil is draining, examine the magnetic drain plug. If metal particles are present, report to REME.

17.8 Clean the plug, check that the plug-sealing gasket is serviceable, replace and tighten the plug.

17.9 Raise the radiator.

17.10 Locate the oil filter (Fig 3 (13)) situated on the transverse bulkhead.

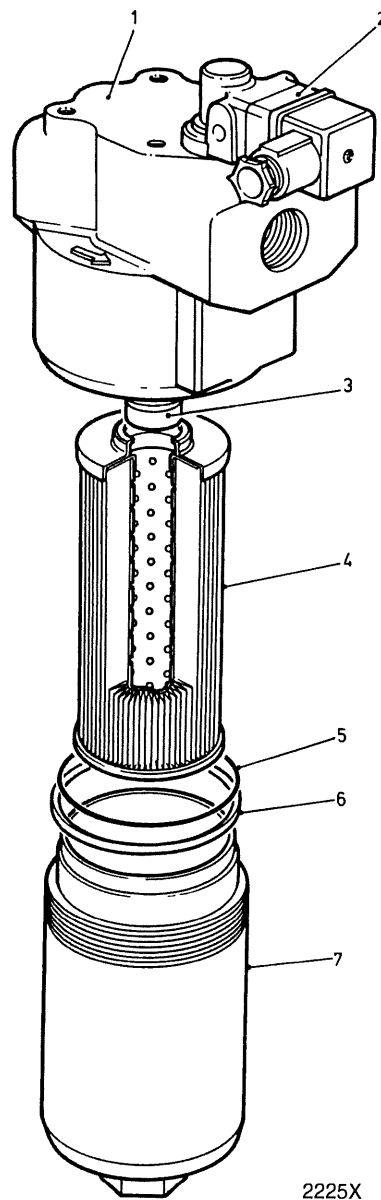
17.11 Unscrew the filter bowl (Fig 4 (7)) using a crowfoot wrench (9CVT 5120-01-628-8265) and suitable extension.

17.12 Empty the oil from the bowl. Remove and discard the filter element (4) and sealing ring (5), retaining the backing ring (6).

17.13 Wipe out the filter bowl thoroughly with a lint-free cloth, refit backing ring (6) and fit a new sealing ring (5).

17.14 Smear new sealing ring with oil, half fill bowl (7) with clean oil as specified in the Maintenance Schedule.

17.15 Push a new filter element (4) onto element adaptor (3) and refit bowl onto the filter head (1).



- | | | | |
|---|---------------------------|---|--------------|
| 1 | Filter head | 5 | Sealing ring |
| 2 | Filter restriction switch | 6 | Backing ring |
| 3 | Element adaptor | 7 | Bowl |
| 4 | Filter element | | |

Fig 4 Gearbox oil filter

17.16 Screw the filter bowl onto the filter head (1); tighten to the torque figure detailed in the Maintenance Schedule.

17.17 Remove the gearbox filler plug (Fig 3 (10)) and add approximately 12.5 litres of oil (as specified in the Maintenance Schedule) until the high level mark on the gearbox oil dipstick (12) is reached. Replace the filler plug.

WARNINGS

- (1) **DANGER TO LIFE AND LIMB. DRIVER'S COMPARTMENT MUST BE MANNED THROUGHOUT THE ENGINE RUN PERIOD.**
- (2) **DANGER OF HEARING DAMAGE. ALL PERSONNEL IN IMMEDIATE VICINITY MUST WEAR EAR PROTECTORS WHEN ENGINE IS RUNNING.**
- (3) **DANGER TO LIFE AND LIMB. ALL TOOLS AND EQUIPMENT USED DURING MAINTENANCE MUST BE REMOVED FROM THE ENGINE AND GEARBOX COMPARTMENTS PRIOR TO STARTING.**

CAUTION

EQUIPMENT DAMAGE. The engine must not be run with the radiator in the raised position. Seek REME advice if required.

17.18 Lower the radiator.

NOTE

Refer to Chap 12 for engine starting/stopping procedures.

17.19 Run the engine for at least one minute, at idling speed, to allow main oil pump to fill gearbox heat exchanger and filter, and check for leaks at the filter and drain plug.

17.20 Stop the engine, set all battery master switches to OFF, and allow the oil to settle for at least five minutes.

17.21 Raise the radiator, re-check the oil level with the gearbox dipstick and add further oil if necessary.

17.22 Lower the radiator. Lower and secure the transmission louvres.

17.23 Refit the hull access plate on the underside of the vehicle, using sealant (NSN 8030-99-220-3407) on the mating faces.

NOTE

If a leak in the gearbox is found or suspected report to REME.

To remove and replace the gearbox oil filter element

WARNING

DANGER OF SCALDING FROM HOT OIL. PROTECTIVE GLOVES MUST BE WORN WHEN CHANGING OIL FILTERS.

18 To change the gearbox oil filter element, without changing the oil, i.e. if the filter warning lights come on, proceed as follows:

- 18.1 Position the vehicle on firm level ground and apply the parking brake.
- 18.2 Stop the engine and set all battery master switches to OFF.
- 18.3 Position the main armament clear of the transmission louvres.
- 18.4 Release, raise and secure the transmission louvres and raise the radiator.
- 18.5 Replace the filter as detailed in Sub-paras 17.10 to 17.16.

WARNINGS

- (1) **DANGER TO LIFE AND LIMB. DRIVER'S COMPARTMENT MUST BE MANNED THROUGHOUT THE ENGINE RUN PERIOD.**
- (2) **DANGER OF HEARING DAMAGE. ALL PERSONNEL IN IMMEDIATE VICINITY MUST WEAR EAR PROTECTORS WHEN ENGINE IS RUNNING.**
- (3) **DANGER TO LIFE AND LIMB. ALL TOOLS AND EQUIPMENT USED DURING MAINTENANCE MUST BE REMOVED FROM THE ENGINE AND GEARBOX COMPARTMENTS PRIOR TO STARTING.**

CAUTION

EQUIPMENT DAMAGE. The engine must not be run with the radiator in the raised position. Seek REME advice if required.

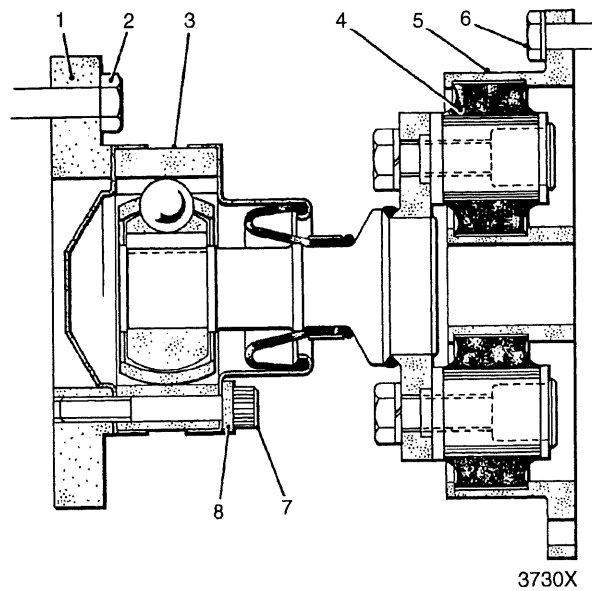
- 18.6 Lower the radiator during the engine run up period.
- 18.7 Run the engine for one minute at idling speed to allow filter to be filled. Raise the radiator and check for leaks at the filter bowl.
- 18.8 Check the gearbox oil level with the dipstick and top up if necessary as detailed in Para 16.
- 18.9 Lower the radiator and transmission louvres and secure.

Gearbox breather

- 19 To clean the gearbox breather proceed as follows:
 - 19.1 Set all battery master switches to **OFF** and apply the parking brake.
 - 19.2 Position the main armament clear of the transmission louvres.
 - 19.3 Release, raise and secure the transmission louvres and raise the radiator.
 - 19.4 Locate and remove the gearbox breather (Fig 3 (11)) and wash in an approved solvent. Shake the breather dry and wipe away excess solvent with clean soft cloth.
 - 19.5 When dry, oil the breather lightly with clean engine oil and refit the breather.
 - 19.6 Lower the radiator and transmission louvres and secure.

Main drive couplingExamination

- 20 To carry out an examination of the main drive coupling (Fig 5), proceed as follows:
 - 20.1 Thoroughly clean all components. Examine the main drive coupling for damage, wear and serviceability, it must be renewed if any of the following conditions are found, report to REME:
 - 20.1.1 Radial play (up and down or sideways movement as opposed to backlash) can be felt in the constant velocity joint (3).
 - 20.1.2 Rubber boot is damaged.



- | | | | |
|---|-----------------------------------|---|--|
| 1 | Coupling/gearbox adaptor | 5 | Engine flywheel coupling |
| 2 | Adaptor/gearbox bolts and washers | 6 | Coupling/flywheel mounting bolts and washers |
| 3 | Constant velocity joint | 7 | Cap head screws (coupling to adaptor) |
| 4 | Flexible coupling | 8 | Locking plate |

Fig 5 Main drive coupling

20.1.3 Grease is escaping from joint.

20.1.4 Excessive noise.

20.2 Visually inspect for signs of bolt slackness. And block deterioration in flexible coupling (4). The difference between cracks and creases may prove difficult to establish. If in doubt, report to REME.

Steering lever and interlock lubrication

21 Using an oil can, lubricate the lever pivots and link pins.

To check and top-up the steering brake reservoir

WARNING

HEALTH HAZARD. HYDRAULIC OIL IS BOTH TOXIC AND HAZARDOUS. AVOID SKIN CONTACT WITH OIL. APPLY BARRIER CREAM TO HANDS AND WEAR GLOVES BEFORE COMMENCING WORK ON THE HYDRAULIC SYSTEM.

22 Check that the fluid level in the steering brake reservoir (Chap 3, Fig 3 (3)) is up to the high mark, i.e. a line of blue or green dots. Check that the filler cap breather holes are clear and that the cap seal is serviceable. Top-up if necessary with hydraulic brake fluid as specified in the Maintenance Schedule.

Bleeding the steering brakes

23 When air enters into the components or pipes of the hydraulic system, the action of the steering brakes will become spongy due to the compressibility of the air, so reducing efficiency. Provision for bleeding is made at each steering brake operating cylinder by a bleed valve (Fig 6 (5)) on each caliper housing.

24 It is unlikely that the system will need bleeding unless some part has been renewed or a leak develops. A leak is indicated by the need for an unusually large quantity of fluid to top-up the supply reservoir. The pipes and components must be thoroughly inspected to locate the leak, which must be rectified before bleeding the system. If leaks appear to be coming from the brake operating cylinders, REPORT.

To bleed the steering brakes

25 When bleeding the steering brakes the vehicle should be positioned on firm, level ground, the parking brake applied and the engine switched off. A supply of fresh, clean steering brake fluid must be available for topping-up during the operations detailed below. Fluid, which has been bled from the system, must not be re-used. The fresh fluid should be added slowly to avoid aerating the system. The procedure, which is the same for both steering brakes, is as follows:

25.1 Check that there is free play in the push rod of each master cylinder. This will be indicated by free movement of 25 to 30 mm (1 to 1 3/16 in.) at the top of each steering lever grip.

25.2 Release, raise and secure the transmission louvres and raise the radiator.

WARNING

HEALTH HAZARD. HYDRAULIC OIL IS BOTH TOXIC AND HAZARDOUS. AVOID SKIN CONTACT WITH OIL. APPLY BARRIER CREAM TO HANDS AND WEAR GLOVES BEFORE COMMENCING WORK ON THE HYDRAULIC SYSTEM.

25.3 Clean the appropriate bleed valve (5) (right or left steering brake) and attach a bleed tube. The free end of the tube should be immersed in a quantity of steering brake fluid in a plastic container.

25.4 Slacken the bleed valve one half turn, instruct an assistant to sit in the driver's seat and to slowly and continuously operate the appropriate steering lever (the left lever operates the right steering brake and the right steering lever operates the left steering brake) until the fluid expelled is free from air bubbles. Tighten the bleed valve.

WARNING

PERSONAL INJURY. DO NOT OPERATE THE STEERING LEVERS WITH THE ENGINE RUNNING AT IDLING SPEED AND THE TRANSMISSION IN NEUTRAL, AS THIS COULD CAUSE THE VEHICLE TO PIVOT.

CAUTION

EQUIPMENT DAMAGE. Pivot turns should be avoided on rough or heavy ground as it places excessive strain on the transmission and may result in a track being thrown.

25.5 Top up the system and check the steering. Instant response to the application of either steering lever must be obtained.

- 25.6 Lower and secure the radiator and transmission louvres.
- 25.7 Report to REME for inspection.

Steering brake pads

26 The steering brake pads (Fig 6 (4)) should be removed for inspection or renewal. Pads must be renewed when the lining has worn down to 3 mm (1/8 in.) thickness (overall thickness including backing plate of 9 mm).

NOTE

The steering brake pads must always be replaced in complete sets of four pads (LH and RH sides)

To change the steering brake pads

- 27 To change the steering brake pads, proceed as follows:
 - 27.1 When changing the steering brake pads, the vehicle should be positioned on firm, level ground, the parking brake applied and the engine switched off.
 - 27.2 Release, raise and secure the transmission louvres and raise the radiator.

WARNINGS

(1) **ASBESTOS MATERIAL. ASBESTOS DUST IS INJURIOUS TO HEALTH WHEN INHALED. AIR LINES OR DRY BRUSHING ARE NOT TO BE USED TO CLEAN OFF DUST AROUND BRAKE PADS, BRAKE CALIPERS AND DISCS AND THE SURROUNDING AREA. IF ASBESTOS DUST IS INHALED SEEK MEDICAL ATTENTION IMMEDIATELY.**

(2) **ASBESTOS MATERIAL. WHEN CLEANING OFF BRAKE LINING DUST, THE MINIMUM PRECAUTIONS ARE TO WEAR A FACE MASK AND RUBBER GLOVES AND ALSO DAMPEN THE AREA.**

- 27.3 Remove spring clips and withdraw the locking pins (16) from the brake callipers.
- 27.4 Withdraw one brake pad (leaving the opposite pad in position).

WARNING

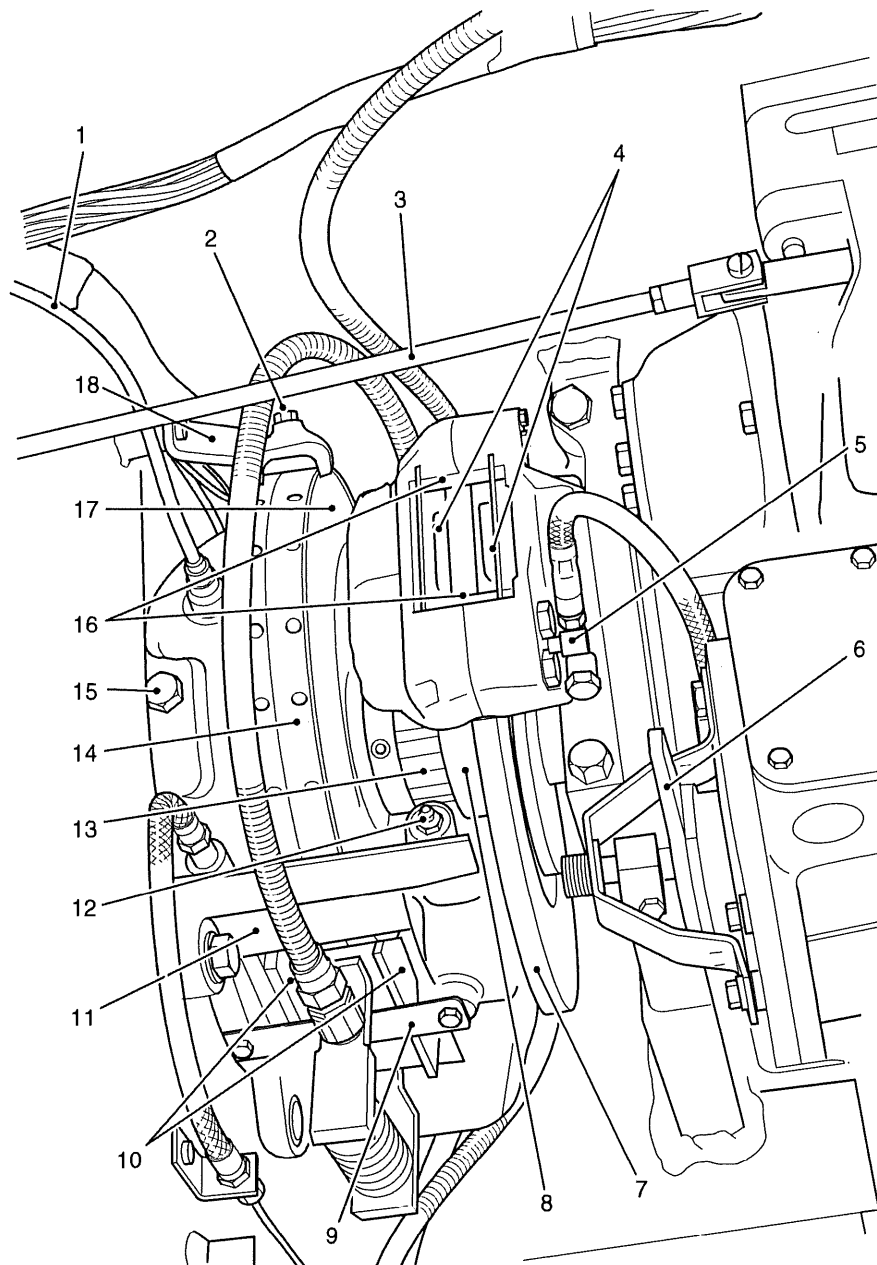
HEALTH HAZARD. HYDRAULIC OIL IS BOTH TOXIC AND HAZARDOUS. AVOID SKIN CONTACT WITH OIL. APPLY BARRIER CREAM TO HANDS AND WEAR GLOVES BEFORE COMMENCING WORK ON THE HYDRAULIC SYSTEM.

- 27.5 Clean the exposed part of the pad operating piston with a soft clean cloth and a little brake fluid. Check disc for signs of damage.

CAUTION

EQUIPMENT DAMAGE. Displacing the cylinder pistons could cause the reservoir level to rise and block the filler cap breather holes. Check for correct fluid level and that the breather holes are clear. Wipe up any spilt fluid before driving.

- 27.6 Clean and remove cap from steering hydraulic oil reservoir.



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|----|--------------------------------------|----|--|
| 1 | Speedometer cable | 11 | Main brake calliper |
| 2 | Centring screw | 12 | Main brake bleed valve |
| 3 | Gearbox forward/reverse selector rod | 13 | Final drive coupling shaft (shown disengaged from gearbox output coupling) |
| 4 | Steering brake pads | 14 | Parking brake band |
| 5 | Steering brake bleed valve | 15 | Breather |
| 6 | Gear change selector lever | 16 | Steering brake pads locking pins |
| 7 | Steering brake disc | 17 | Main brake disc |
| 8 | Gearbox output coupling | 18 | Steady bracket |
| 9 | Main brake pads restraining plate | | |
| 10 | Main brake pads | | |

Fig 6 Transmission compartment (left side)

- 27.7 Push the piston back into its cylinder (do not lever against the brake disc); fit a new pad.
- 27.8 Proceed as in Sub-paras 27.3 to 27.5 until both sets of brake pads are changed.
- 27.9 Replace the locking pins and secure with the spring clips.
- 27.10 Check that the pads are free to operate in the assemblies.
- 27.11 Lower the radiator and release, lower and secure the transmission louvres.

WARNING

PERSONAL INJURY. DO NOT OPERATE THE STEERING LEVERS WITH THE ENGINE RUNNING AT IDLING SPEED AND THE TRANSMISSION IN NEUTRAL, AS THIS COULD CAUSE THE VEHICLE TO PIVOT.

CAUTION

EQUIPMENT DAMAGE. Pivot turns should be avoided on rough or heavy ground, as it places excessive strain on the transmission and may result in a track being thrown.

- 27.12 Report to REME for inspection.
- 27.13 Test the steering brakes while running the vehicle. Instant and positive response to the controls must be obtained.

~~OFFICIAL SENSITIVE~~

~~OFFICIAL SENSITIVE~~

CHAPTER 7-2

MAIN AND PARKING BRAKES

CONTENTS

Para

- 1 Description
- 2 Main brakes
- 5 Parking brakes
- Operation of controls
- 7 Applying the main brakes
- 8 Applying the parking brakes
- 9 Releasing the parking brakes
- User maintenance (WARNINGS)
- 10 Brake pedal pivot
- 11 To check and top-up the main brake reservoir (WARNING)
- 12 Bleeding the main brakes (WARNINGS)
- 14 Main brake pads (WARNINGS)
- 15 To change the main brake pads (WARNINGS) (CAUTIONS)
- 16 Parking brake adjustment
- 17 To clean and lubricate the parking brake mechanism

Fig

Page

- 1 Parking and main brake (left side) 6

DESCRIPTION

1 The system utilises disc brakes in an arrangement as in Fig 1. The main brakes are hydraulically operated and controlled by a pedal, the parking brakes are cable operated and controlled by a hand operated lever.

MAIN BRAKES

2 There are two brake discs, one is incorporated in the left drive as in Fig 1, and the other is similarly incorporated in the right drive. The brake operating mechanisms are similar, each brake calliper (Fig 1 (17)) comprises an operating cylinder to exert inward pressures on the main brake pads (7) when the hydraulic system is pressurised. This occurs when the brake pedal (22) is depressed to actuate the brake master cylinder (26) the pressure in the feed pipe (25) is transmitted to each brake operating cylinder via a tee-piece.

3 The hydraulic system incorporates a bleed valve (13) in each brake line and a stop light switch (20) for operation of the stoplights. The system is charged via the reservoir (Chap 3, Fig 3 (4)).

4 The brake pads are of the replaceable type and are retained in position by a retaining plate (16).

PARKING BRAKES

5 The parking brakes comprise brake bands (9), which tighten around the brake discs (12) when the parking brake lever (2) is applied. Movement of the parking brake lever, (via a ratchet wheel (28) and a lever pawl (29)) pulls the inner cable which, runs through the brake operating cable assemblies (23). This action will tighten the parking brake bands around the brake disc. Once the parking brake is fully applied a second locking pawl (3) locks the brakes in the ON position. The pawls are forced by springs to engage the ratchet wheel teeth and only disengage when the lever is pushed forward. Brake band release springs (6) ensure the bands return to the OFF position when the parking brake is released.

6 The compensator (24) ensures an equal pull on the brake bands so that an equal braking force is applied to each disc.

OPERATION OF CONTROLS

Applying the main brakes

7 To apply the main brakes, with the vehicle in motion, depress the pedal (22) and the vehicle will decelerate (slow) at a rate, which is directly proportional to pedal pressure. When released, the pedal will be restored to the 'brake off' position by a spring.

Applying the parking brakes

8 The parking brake should not be applied (except in an emergency) if the vehicle is in motion. When parking the vehicle, pull back on the lever (2) until the stop (1) is reached, then move the lever forward to enable further pulling back, ensuring that the lever is not pushed too far forward or it will release the parking brake. Repeat this forward and backwards movement of the lever until the brake is fully on.

Releasing the parking brakes

9 To release the parking brakes, push the lever firmly against the forward stop to release the parking brakes.

USER MAINTENANCE

WARNINGS

(1) **CADMIUM PLATING. THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.**

(2) **PERSONAL INJURY. WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.**

(3) **SILICA - TOXIC SUBSTANCE. BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.**

Brake pedal pivot

10 Using an oil can, lubricate brake pedal pivot.

To check and top-up the main brake reservoir

WARNING

HEALTH HAZARD. HYDRAULIC OIL IS BOTH TOXIC AND HAZARDOUS. AVOID SKIN CONTACT WITH OIL. APPLY BARRIER CREAM TO HANDS AND WEAR GLOVES BEFORE COMMENCING WORK ON THE HYDRAULIC SYSTEM.

11 Check that the fluid level in the reservoir (Chap 3, Fig 3 (4)) is up to the high mark, i.e. a line of blue or green dots. Check that the filler cap breather holes are clear and that the cap seal is serviceable. Top-up if necessary with hydraulic fluid as specified in the Maintenance Schedule.

Bleeding the main brakes

12 It is unlikely that the system will need bleeding unless some part has been renewed or a leak develops. A leak is indicated by the need for an unusually large quantity of fluid to top-up the supply reservoir. The pipes and components must be thoroughly inspected to locate the leak, which must be rectified before bleeding the system. If leaks appear to be coming from the brake operating cylinders, report to REME.

13 Throughout the operation the reservoir must be kept topped-up with clean hydraulic fluid of the correct grade. Do not use fluid which has been bled from the system. Fresh fluid should be added slowly to avoid aerating the system. Ensure that the vehicle is placed on firm level ground, the parking brake applied and the engine switched off.

13.1 Check that the footbrake pedal has perceptible free movement. This should be approximately 13 mm (0.5 in.).

13.2 Release, raise and secure the transmission louvres and raise the radiator.

13.3 Clean the bleed valves and attach a bleed tube to the right brake valve.

WARNING

HEALTH HAZARD. HYDRAULIC OIL IS BOTH TOXIC AND HAZARDOUS. AVOID SKIN CONTACT WITH OIL. APPLY BARRIER CREAM TO HANDS AND WEAR GLOVES BEFORE COMMENCING WORK ON THE HYDRAULIC SYSTEM.

13.4 Insert the other end of the tube into a plastic container containing a sufficient quantity of brake fluid to cover the open end of the tube.

13.5 Slacken the bleed valve one half turn and instruct an assistant (positioned in the driver's seat) to slowly and continuously operate the brake pedal until the fluid expelled through the tube is free from air bubbles, then tighten the bleed valve.

13.6 Remove the tube, attach it to the left brake valve and proceed as in Sub-paras 13.4 and 13.5.

13.7 Remove the bleed tube and plastic container, lower the radiator and release, lower and secure the transmission louvres.

13.8 Report to REME for inspection.

WARNING

LOSS OF CONTROL. DO NOT DRIVE THE VEHICLE WITH DEFECTIVE BRAKES.

13.9 Check that the reservoir fluid level is correct, and then test the brakes. Instant and positive response to the application of the brake pedal must be obtained.

Main brake pads**WARNINGS**

(1) **ASBESTOS MATERIAL. ASBESTOS DUST IS INJURIOUS TO HEALTH WHEN INHALED. AIR LINES OR DRY BRUSHING ARE NOT TO BE USED TO CLEAN OFF DUST AROUND BRAKE PADS, BRAKE CALIPERS, DISCS AND SURROUNDING AREAS. IF ASBESTOS DUST IS INHALED SEEK MEDICAL ATTENTION IMMEDIATELY.**

(2) **ASBESTOS MATERIAL. WHEN CLEANING OFF BRAKE LINING DUST, THE MINIMUM PRECAUTIONS ARE TO WEAR A FACE MASK AND RUBBER GLOVES AND ALSO DAMPEN THE AREA.**

14 The main brake pads (Fig 1 (7)) should be removed for inspection or renewal. Pads must be renewed when the lining has worn down to 3 mm (1/8 in.) thickness (overall thickness, including backing plate, 9 mm (3/8 in.)).

To change the main brake pads

15 To change the main brake pads, proceed as follows:

15.1 Raise and secure the transmission louvres and raise the radiator.

WARNING

ASBESTOS MATERIAL. WHEN CLEANING OFF BRAKE LINING DUST, THE MINIMUM PRECAUTIONS ARE TO WEAR A FACE MASK AND RUBBER GLOVES AND ALSO DAMPEN THE AREA.

15.2 Remove the retaining plate (16) from either brake calliper and withdraw one main brake pad (7), leaving the opposite pad in position.

WARNING

HEALTH HAZARD. HYDRAULIC OIL IS BOTH TOXIC AND HAZARDOUS. AVOID SKIN CONTACT WITH OIL. APPLY BARRIER CREAM TO HANDS AND WEAR GLOVES BEFORE COMMENCING WORK ON THE HYDRAULIC SYSTEM.

15.3 Clean the exposed part of the operating piston with a soft clean cloth and a little brake fluid. Check discs for damage.

CAUTIONS

(1) **EQUIPMENT DAMAGE.** The brake disc must not be used as a lever when pushing the piston back into the cylinder.

(2) **EQUIPMENT DAMAGE.** Displacing the cylinder pistons could cause the reservoir level to rise and block the filler cap breather holes. Check for correct fluid level and that the breather holes are clear, wipe up any spilt fluid before driving.

15.4 Push the piston back into its cylinder (do not lever against the brake disc) and fit a new pad.

15.5 Repeat the operation until all brake pads are changed. Refit the pad retaining plates.

15.6 Lower the radiator and release, lower and secure the transmission louvres.

15.7 Report to REME for inspection.

WARNING

LOSS OF CONTROL. DO NOT DRIVE THE VEHICLE WITH DEFECTIVE BRAKES.

15.8 Test the vehicle on a road run and ensure that the brakes operate correctly.

Parking brake adjustment

16 The parking brake adjustment is set when the brake bands are fitted and as the brake is only used when the vehicle and brake discs are stationary, subsequent adjustment due to wear is not necessary.

To clean and lubricate the parking brake mechanism

17 To clean and lubricate the parking brake mechanism, proceed as follows:

17.1 Place the vehicle on firm level ground, chock the tracks front and rear (see Chap 8) so the vehicle cannot move and switch off the engine.

17.2 Release the parking brake and expose as much of the cables as possible.

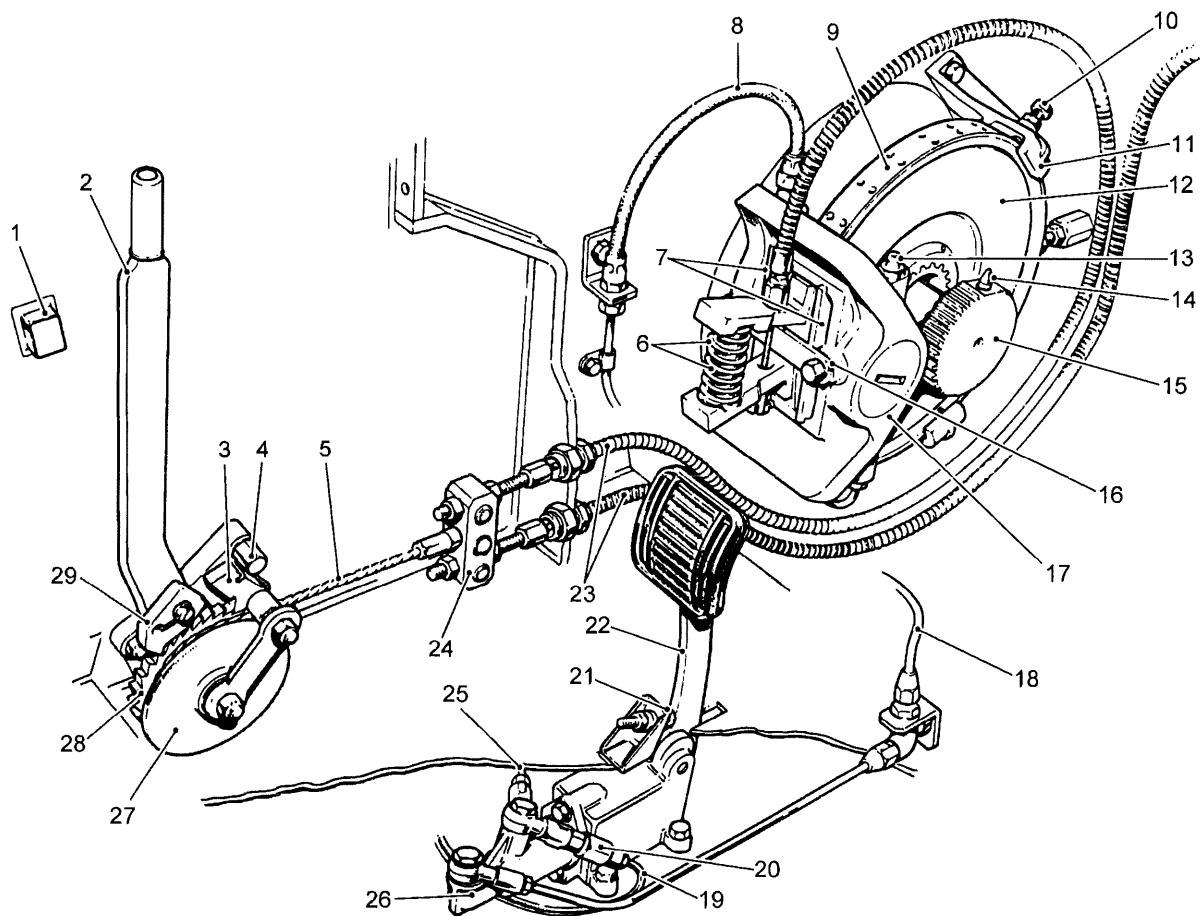
17.3 Wipe the cable with a clean rag, which has been lightly oiled, check for broken strands, if there are any, report to REME.

17.4 Check the compensator cable connections for security and sparingly lubricate the pins.

17.5 Operate the brake lever a number of times to work in the lubricant.

17.6 Wipe off any surplus lubricant.

17.7 Apply the parking brake and remove the chocks.



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1	Lever stop	16	Main brake pads retaining plate
2	Brake lever	17	Main brake calliper
3	Locking pawl	18	Down pipe from fluid reservoir
4	Pawl stop	19	Stop light switch lead
5	Brake cable	20	Stop light switch
6	Brake release springs	21	Pedal return stop
7	Main brake pads	22	Main brake pedal
8	Brake hose	23	Cable assemblies
9	Parking brake band	24	Compensator
10	Centring and adjuster screw	25	Brake pressure feed pipe
11	Steady bracket	26	Brake master cylinder
12	Brake disc	27	Cable drum
13	Bleed valve	28	Ratchet wheel
14	Spring-loaded locating plunger	29	Lever pawl
15	Final drive coupling shaft		

Fig 1 Parking and main brake (left side)

CHAPTER 7-3
FINAL DRIVES
CONTENTS

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- 1 Description (WARNING)
- 6 Speedometer
- 7 Disengaging the drive from the gearbox
- 8 Re-engaging the drive from the gearbox
- User maintenance (WARNINGS)
- 9 General
- 11 To check and top-up the oil levels
- 12 To check the final drive for overheating
- 13 To clean the final drive breather
- 14 To change the oil in a final drive

Fig

Page

- 1 Transmission compartment (left side)..... 2

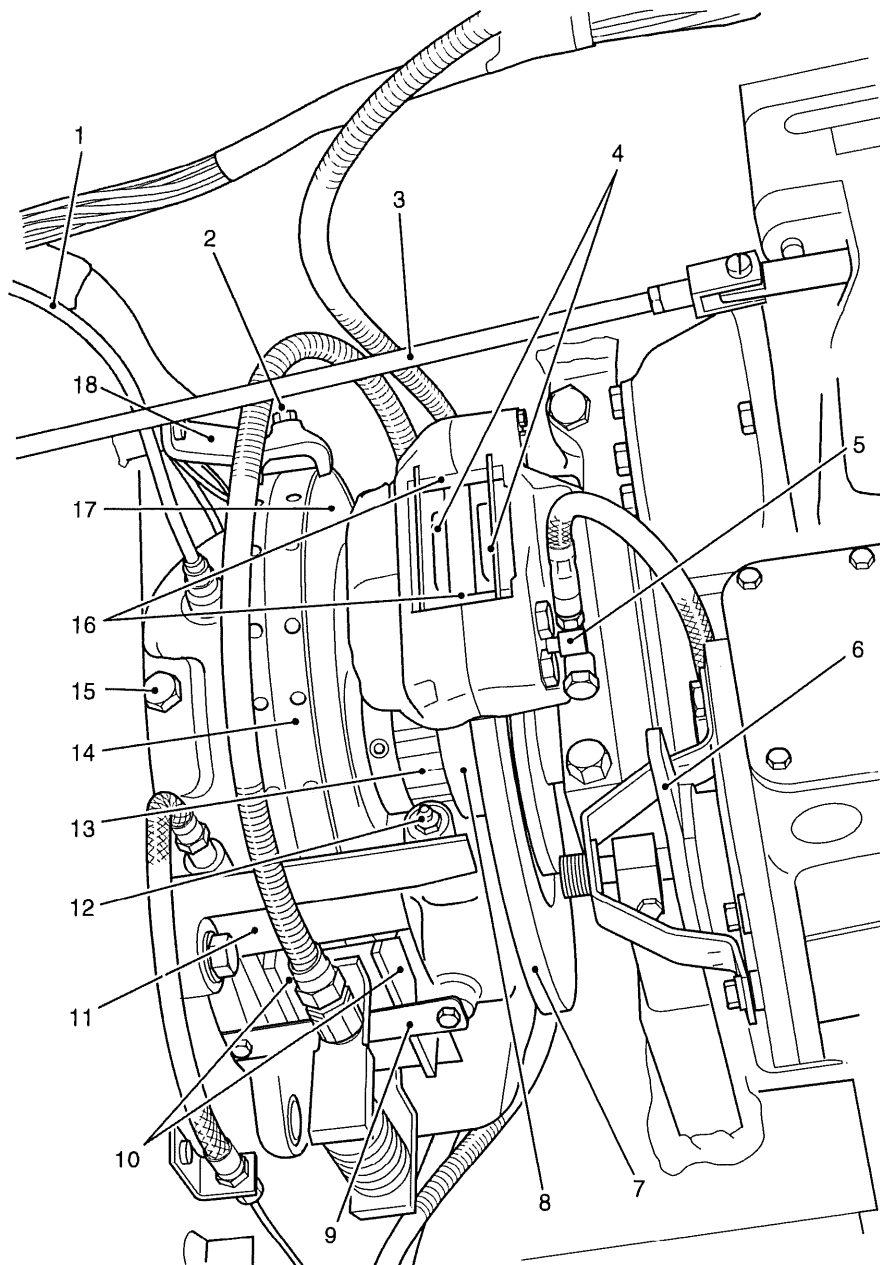
DESCRIPTION

- 1 The final drives are incorporated in the transmission to impart an increased torque, reduced speed drive to the drive sprockets, relative to the gearbox drive. The drives are mounted in corresponding positions in the hull left and right side plates with their input couplings inside the transmission compartment in line with the gearbox output drive.
- 2 Each final drive consists of a single epicyclic reduction gear, which is lubricated by oil contained in the drive casing. Three screw type plugs, fitted in the final drive casing, outboard of the hull plate, are for draining and replenishing of the oil; a breather (Fig 1 (15)) is also incorporated in the inner casing.
- 3 An auxiliary drive from the left final drive is connected to the speedometer on the instrument panel via the speedometer drive cable (1).

WARNING

DANGER OF DEATH OR INJURY. IF A VEHICLE IS INVOLVED IN A ROAD TRAFFIC ACCIDENT (RTA) OR A HEAVY IMPACT TO THE FRONT OF THE VEHICLE (HULL, TRACKS OR FINAL DRIVES) IT IS POSSIBLE THAT DAMAGE HAS OCCURRED TO COMPONENTS INSIDE THE FINAL DRIVE THAT CAN RESULT IN A LOSS OF CONTROL OF THE VEHICLE. THE VEHICLE MUST BE RECOVERED AND BOTH FINAL DRIVES MUST BE REPLACED. REPORT TO REME. THE SEFIT AND PLATFORM TEAMS MUST BE INFORMED.

- 4 The final drives are coupled to the gearbox by splined shafts. Each shaft incorporates, at the gearbox end, a spring-loaded locating plunger, which locates in a hole in the periphery of the gearbox output drive coupling (8) when the shaft is fully engaged. The shaft is thus retained in mesh by the spring-loaded plunger - a method that facilitates disconnecting of the gearbox prior to its removal, or in an emergency when the vehicle has to be towed while having a defective gearbox (e.g. seized drive).



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- | | | | |
|----|--------------------------------------|----|--|
| 1 | Speedometer cable | 11 | Main brake calliper |
| 2 | Centring screw | 12 | Main brake bleed valve |
| 3 | Gearbox forward/reverse selector rod | 13 | Final drive coupling shaft shown disengaged from gearbox output coupling |
| 4 | Steering brake pads | 14 | Parking brake band |
| 5 | Steering brake bleed valve | 15 | Breather |
| 6 | Gear change selector lever | 16 | Steering brake pads locking pins |
| 7 | Steering brake disc | 17 | Main brake disc |
| 8 | Gearbox output coupling | 18 | Steady bracket |
| 9 | Main brake pads restraining plate | | |
| 10 | Main brake pads | | |

Fig 1 Transmission compartment (left side)

NOTE

Although it is not necessary to disengage the drives from the gearbox for towing when the gearbox is not at fault, always ensure (except when tow-starting) that the drive is in the 'neutral' position. However, towing under these conditions must be undertaken by REME and must not be over distances in excess of [REDACTED] and the towing speed must not exceed [REDACTED]

5 End caps fitted to the hub centres protect the projecting ends of splined propeller shafts. An internally threaded hole is machined into the splined end of the propeller shaft. This allows the fitting of a bolt to enable the final drives to be disengaged and engaged.

Speedometer

6 The speedometer is graduated at 10 mile per hour intervals and is located on the driver's instrument panel. It also incorporates a total mileage recorder and a trip recorder. Use of the speedometer is shown in Chapter 9.

Disengaging the drive from the gearbox

7 Disengaging the drive from the gearbox is a two-man operation and the procedure is as follows:

- 7.1 Position the vehicle on firm, level ground and apply the parking brake.
- 7.2 Raise and secure the transmission louvres.
- 7.3 Raise the radiator and check that the spring loaded plunger is accessible. If it is not accessible the vehicle will have to be moved to gain access.

NOTE

If the vehicle has to be moved to gain access to the spring loaded plunger the transmission louvres and radiator must be checked for security to prevent them falling.

- 7.4 Stop the engine, set all battery master switches to OFF and apply the parking brake.
- 7.5 Remove and stow the end cap from the centre of each drive sprocket.
- 7.6 Locate the spring-loaded plunger in either of the gearbox couplings. Depress the plunger and pull outwards on the propeller shaft to disengage the drive. Proceed in a similar manner to withdraw the other drive shaft from the gearbox coupling.

NOTE

If it is difficult to withdraw a drive shaft when the plunger is fully depressed, because the propeller shaft end cannot be gripped properly, a 3/8 UNF bolt screwed in the end of the shaft will facilitate this task.

- 7.7 If the vehicle is to be towed, close the transmission louvres.

Re-engaging the drive from the gearbox

8 Re-engaging the drive from the gearbox is a two-man operation and the procedure is as follows:

- 8.1 Set all battery master switches to OFF and apply the parking brake.
- 8.2 Open and secure the transmission louvres, and raise the radiator.
- 8.3 Position a gearbox drive coupling so that a hole in its periphery is aligned with the spring-loaded plunger in the respective final drive coupling shaft.
- 8.4 Depress the spring-loaded plunger inwards to permit the final drive coupling shaft to engage the gearbox drive coupling, at the same time as a member of the crew pushes the splined end of the propeller shaft. Check that the plunger locates correctly to retain the shaft.

NOTE

Final drive coupling shaft may require lifting internally to facilitate fitting.

- 8.5 Repeat Sub-paras 8.3 and 8.4 to reconnect the other final drive.
- 8.6 Refit the end caps to the sprocket hub centres, lower the radiator and close the transmission louvres.

USER MAINTENANCE**WARNINGS**

(1) **CADMIUM PLATING. THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.**

(2) **PERSONAL INJURY. WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.**

(3) **SILICA - TOXIC SUBSTANCE. BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.**

General

9 Inspect for oil leaks both inside and outside the transmission compartment, with particular attention to the presence of oil on the main brake discs. Report any oil leaks.

10 When a replacement final drive or associated component has been fitted, the securing screws or nuts must be checked for tightness for the next three days that the vehicle is operated. Torque the screws to XXXXXXXXXX

To check and top-up the oil levels

- 11 To check and top-up the oil levels, proceed as follows:
 - 11.1 Position the vehicle on firm level ground and apply the parking brake.
 - 11.2 Stop the engine, set all battery master switches to OFF and wait at least one minute for the oil to settle.
 - 11.3 Clean the area around a filler plug (3 or 9 o'clock position) and remove the plug with washer.
 - 11.4 Check that the oil is covering the threads at the filler plug - add oil if necessary. The condition of the oil is also to be checked. If the oil is contaminated the final drive will need to be drained and flushed and then re-filled.
 - 11.5 Check the washer and plug for serviceability. Replace and tighten the plug.
 - 11.6 Repeat Sub-paras 11.1 to 11.5 for the other final drive.

To check the final drive for overheating

- 12 To check the final drive for overheating proceed as follows:
 - 12.1 Position the vehicle on firm level ground and apply the parking brake.
 - 12.2 Stop the engine, set all battery master switches to OFF.

WARNING

PERSONAL INJURY. WHEN CHECKING ASSEMBLIES FOR HIGH TEMPERATURE, APPROACH WITH CARE USING THE BACK OF THE HAND TO DETECT EXCESSIVE HEAT RADIATION.

- 12.3 Using the back of the hand check both final drive outboard casings for excessive heat.
- 12.4 If excessive heat is detected proceed to check the oil level in accordance with Sub-paras 11.3 to 11.6.
- 12.5 If the oil level is correct then report to REME.

To clean the final drive breather

- 13 To clean the final drive breather proceed as follows:
 - 13.1 Position the vehicle on firm level ground and apply the parking brake.
 - 13.2 Stop the engine, set all battery master switches to OFF.
 - 13.3 Open and secure the transmission louvres and raise the radiator.
 - 13.4 Remove the clip that secures the breather pipe to the side of the transmission compartment.
 - 13.5 Unscrew the union that secures the breather pipe to the final drive inboard casing and remove the breather pipe complete.
 - 13.6 Using a piece of D10 telephone cable as a 'pullthrough' clean the breather pipe.
 - 13.7 Replace the breather pipe and tighten the union to the inboard casing.

- 13.8 Re-secure the breather pipe to the side of the transmission compartment.
- 13.9 Repeat Sub-paras 13.4 to 13.8 for the other breather pipe.
- 13.10 Lower and secure the radiator and close and secure the transmission louvres.

To change the oil in a final drive

14 Changing the oil in a final drive should be carried out after the vehicle has been run and the oil is warm. Proceed as follows:

- 14.1 Position the vehicle on firm level ground and apply the parking brake.
- 14.2 Stop the engine and set all battery master switches to OFF.
- 14.3 Clean the area around a filler plug and the drain plug. Remove the filler plug with washer.
- 14.4 Position a container under the drain plug and remove the plug.
- 14.5 When the oil has completely drained, check the drain plug and washer for serviceability. A check should also be made of the drained oil to ensure it contains no metal particles. If metal particles are present, report to REME. Refit and secure the plug.
- 14.6 Add oil as specified in the Maintenance Schedule, when it settles to the required level (i.e. threads of the filler hole), check the plug and washer for serviceability. Refit and secure the plug.

CHAPTER 8

SUSPENSION, TRACKS AND SPROCKETS

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	SPROCKETS, TRACKS AND TRACK ADJUSTERS
	Description
1	Sprockets
3	Tracks
5	Track adjusters
	User maintenance (WARNINGS)
6	General
7	Chocking the vehicle
8	Use of torque wrench
9	To check idler hub oil level
10	To check the idler hub for overheating (WARNING)
11	To lubricate the track idler wheel axle and tensioner pivot bracket (WARNING)
	Inspection of tracks 'Routine Maintenance' (WARNINGS)
12	General
14	Check of track - during use
15	Check of track - after use
16	To check track tension
17	To adjust track tension
18	To remove a track
19	To move the vehicle with one track removed
20	To remove a track link
22	To check an idler wheel for rim rock
23	To check a sprocket hub for rim rock
24	To check idler wheel wear (WARNING)
25	To change an idler wheel
26	To change the sprocket rings or track support wheels
27	To refit a track
28	Examination of tracks - track off
	Condemnation criteria
29	Track link
30	Track set
	SUSPENSION
33	Description
34	Suspension units
37	Suspension dampers
	User maintenance
38	General
39	To check road wheels for condition and hubs for overheating (WARNING)
40	To check and top-up a wheel hub
41	To raise road wheels using the jacking strut (WARNINGS)
42	To lower road wheels from the jacking strut (WARNING)

(continued)

CONTENTS (continued)

Para

- 43 To remove and replace the road wheels
 44 To check road wheels for rim rock
 45 To lubricate an axle arm bearing
 46 To lubricate the suspension damper (Messier) lower link arm bush

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2	Track link	4
3	Chocking the vehicle	5
4	Track tension	9
5	Idler wheel wear indicator chamfer	12
6	Tracks – method of joining	15
7	Track faults	17
8	Front suspension (left)	18
9	Road wheel	20
10	Wear strip and retaining rivets	21
11	Root of the wheel	21
12	Correct positioning of jacking strut	23
13	Rear suspension (left)	25/26

SPROCKETS, TRACKS AND TRACK ADJUSTERS

DESCRIPTION

Sprockets

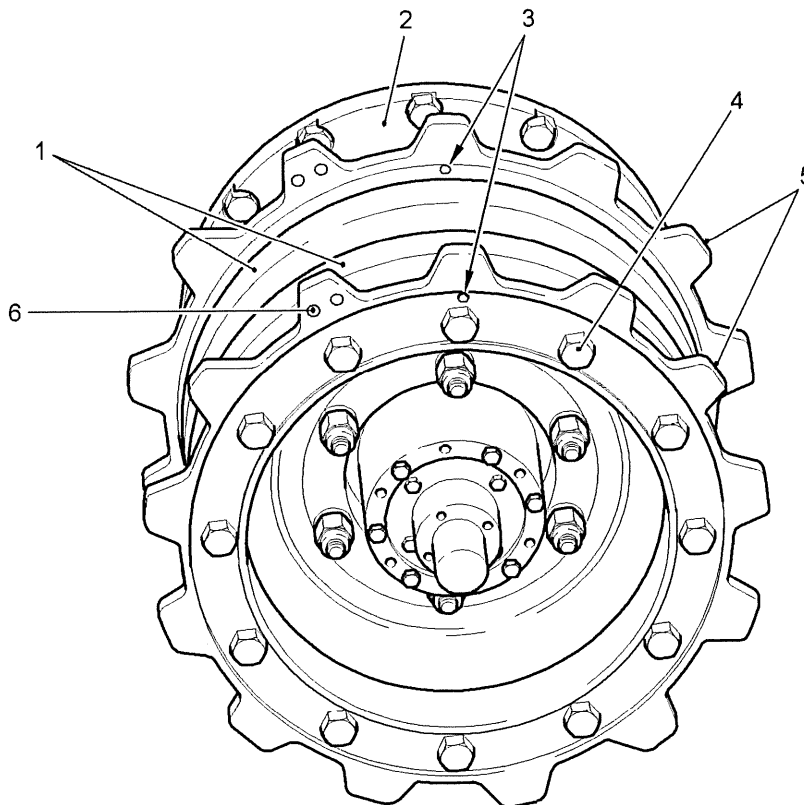
1 Each sprocket is an assembly of two sprocket rings and two support wheels as in Fig 1. The sprocket rings (5) are bolted to the track support wheels (1), which in turn are bolted to a final drive hub, the support wheels have bonded rubber tyres to reduce the noise level.

2 Datum holes (3) are provided on each sprocket ring to facilitate correct alignment of each pair of sprocket rings. Wear indicators (6) are machined onto one side of each of two teeth, to provide a visible means of monitoring tooth wear. When wear on the marked teeth completely removes the adjacent wear indicator, the pair of sprocket rings must be reversed or renewed.

Tracks

3 The tracks comprise track links and track pins as in Fig 2. The track links have bonded rubber pads (2) for silent operation and are hinged by the track's pins (6) via resilient bushes (5). The track pins are hexagonal in section and locate in similarly shaped metal insert in the resilient bushes, an arrangement that greatly prolongs track pin life due to the absence of frictional wear. The number of track links on a new track will depend on the variant however, Scimitar is 79 links dropping to 77 over the life of the track.

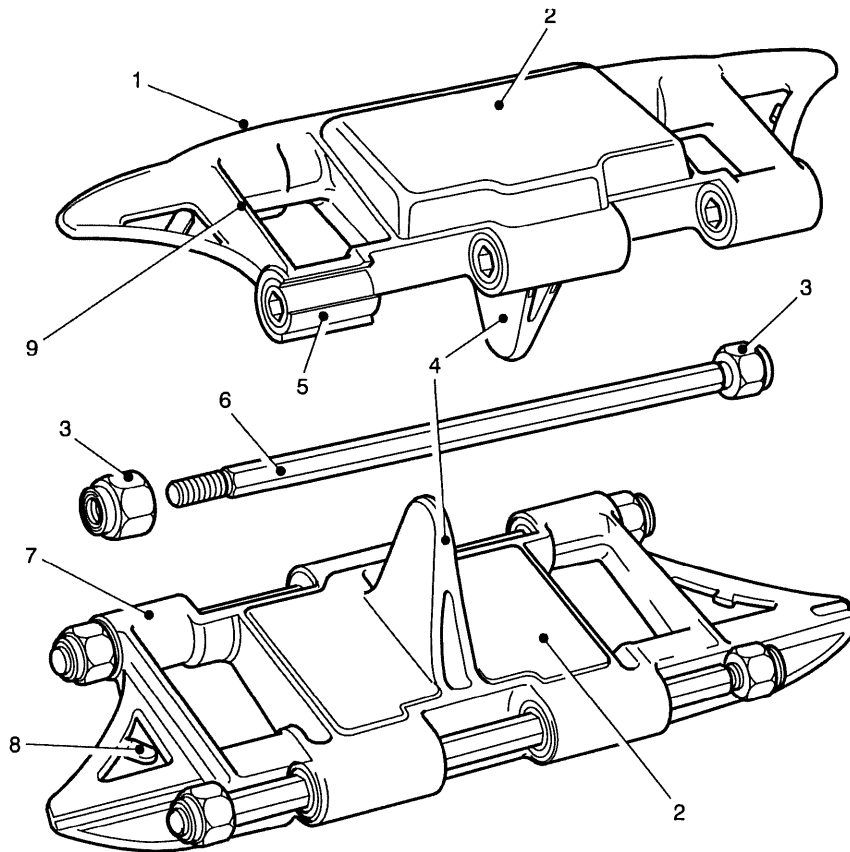
4 The horn (4) on each track link passes between each pair of wheel tyres to centralise the track when it is in motion.



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1	Track support wheels	4	Sprocket ring securing bolt
2	Final drive outer casing	5	Sprocket ring
3	Datum holes	6	Wear indicators

Fig 1 Sprocket rings and track support wheels



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1	Spud	6	Track pin
2	Rubber pad	7	Link
3	Nut	8	Test pieces (one normally removed)
4	Horn	9	Datum surface (track tension)
5	Resilient bush		

Fig 2 Track link

Track adjusters

5 The tracks are adjusted to their correct tension by movement of the rear-fitted idler wheels in an arrangement as in Fig 13. The hydraulic ram (10) exerts force on the cranked idler axle (3) sufficient to maintain the correct track tension. The hydraulic ram plunger (1) extends (to increase track tension) when grease is injected via the charging valve (7) or retracts (to decrease track tension) when grease is released via the pressure relief screw (6). Extension of the hydraulic ram plunger is limited by axle stop (2); a similar stop (11) is incorporated to prevent ram drop, if for some reason (e.g. loss of grease) the hydraulic ram fails to exert pressure on the cranked idler axle (3).

USER MAINTENANCE**WARNINGS**

(1) **CADMIUM PLATING. THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.**

(2) **PERSONAL INJURY. WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.**

WARNINGS (continued)

(3) **SILICA - TOXIC SUBSTANCE. BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.**

(4) **PERSONAL INJURY. WHEN CHECKING ASSEMBLIES FOR HIGH TEMPERATURE, APPROACH WITH CARE USING THE BACK OF THE HAND TO DETECT EXCESSIVE HEAT RADIATION.**

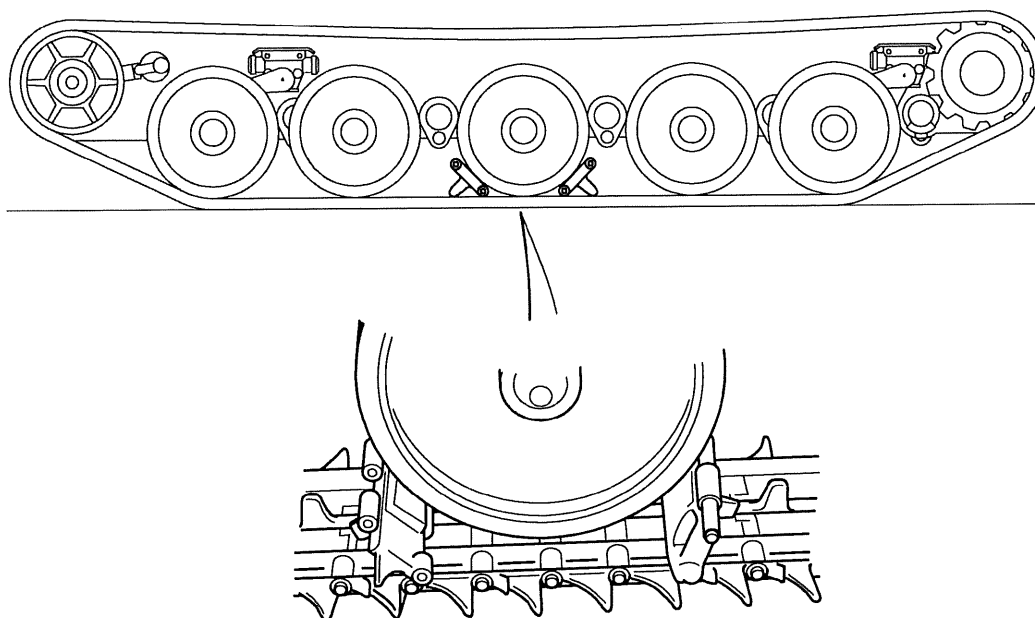
General

6 The sprocket support wheel and nuts, sprocket ring bolts, idler wheel nuts and track pin nuts must be checked for tightness, using the appropriate torque wrench, refer to variant CES Chap 2-2-1. Checking of the track tensioner mounting bolts by the crew is by a visual check. The securing nuts of any component newly fitted, should be checked for tightness on receipt and at least once daily for the next three days that the vehicle is operated.

Chocking the vehicle

7 To secure the vehicle against unwanted movement during maintenance, use the following chocking method:

7.1 Place two spare track links, horn downwards, on the lower track run, one in front and one behind the centre road wheel as shown in Fig 3.



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Fig 3 Chocking the vehicle

Use of torque wrench

8 A torque wrench is provided as part of the CES to check and tighten the track pin nuts, idler wheel nuts, road wheel nuts, sprocket support wheel nuts and sprocket ring bolts to the correct torque setting as specified in Cat 601. Apply the correct setting to the adjustable torque wrench (Cat 601) and apply a steady pressure until the wrench 'breaks' indicating correct loading.

To check idler hub oil level

- 9 To check the idler hub oil level, proceed as follows:
- 9.1 Position the vehicle so that the filler/level plug (Fig 13 (9)) is at the 2 or 10 o'clock position, stop the engine and apply the parking brake.
 - 9.2 Clean the area around the plug and remove the plug.
 - 9.3 Add oil until, after settling, the oil level is on the threads of the plug hole.
 - 9.4 Check the sealing washer on the plug, renew if necessary.
 - 9.5 Replace and tighten the plug, clean off any surplus oil.

To check the idler hub for overheating

- 10 To check the idler hub for overheating, proceed as follows:
- 10.1 Position the vehicle on firm level ground, stop the engine and apply the parking brake.

WARNING

PERSONAL INJURY. WHEN CHECKING ASSEMBLIES FOR HIGH TEMPERATURE, APPROACH WITH CARE USING THE BACK OF THE HAND TO DETECT EXCESSIVE HEAT RADIATION.

- 10.2 Using the back of the hand check both idler hubs for excessive heat.
- 10.3 If excessive heat is detected, proceed to check the oil level as detailed in Para 9.
- 10.4 If the oil level is correct, then report to REME.

To lubricate the track idler wheel axle arm and tensioner pivot bracket

- 11 To lubricate the track idler wheel axle arm and tensioner pivot brackets, proceed as follows:

- 11.1 Position the vehicle on firm level, stop the engine and apply the parking brake.

WARNING

DANGER TO LIFE AND LIMB. BEFORE PERSONNEL ARE ALLOWED UNDER THE VEHICLE, THE PARKING BRAKE MUST BE FULLY APPLIED AND THE VEHICLE SECURED AGAINST MOVEMENT AND THE ENGINE SWITCHED OFF.

- 11.2 Clean around lubricators (Fig 13 (19)) on the idler wheel axle arm and tensioner pivot bracket to remove any dirt.
- 11.3 Using a grease gun pump anti-seize compound (as specified in Cat 601) into each lubricator until anti-seize compound appears as follows:
 - 11.3.1 Around the circlip of the tensioner pivot bracket.
 - 11.3.2 At the surface of the idler wheel axle arm where it pivots on the hull mounted bracket.

- 11.4 Wipe away excess anti-seize compound.
- 11.5 Repeat Sub-paras 11.2 to 11.4 for the other side.

INSPECTION OF TRACKS 'ROUTINE MAINTENANCE'

WARNINGS

- (1) **DANGER TO PERSONNEL. WHEN CARRYING OUT THE FOLLOWING PROCEDURE, PERSONNEL MUST NOT TAKE UP POSITIONS WHERE THE DRIVER CANNOT SEE THEM. THE DRIVER MUST NOT MOVE THE VEHICLE IF A PERSON IS STANDING IN FRONT OF A TRACK OR IF A PERSON IS KNOWN TO BE IN THE VICINITY OF THE TRACK BUT NOT IN VIEW. THE COMMANDER IS TO BE IN A POSITION TO BE ABLE TO CONTROL THE COMPLETE OPERATION.**
- (2) **DANGER TO LIFE AND LIMB. BEFORE PERSONNEL ARE ALLOWED UNDER THE VEHICLE, THE PARKING BRAKE MUST BE FULLY APPLIED AND THE VEHICLE SECURED AGAINST MOVEMENT AND THE ENGINE SWITCHED OFF.**
- (3) **RISK TO HEALTH. ALL PERSONNEL IN IMMEDIATE VICINITY MUST WEAR EAR PROTECTORS WHEN ENGINE IS RUNNING.**
- (4) **DANGER TO PERSONNEL. IT IS NOT A SAFE PRACTICE TO HAVE BOTH TRACKS REMOVED AT THE SAME TIME AS THE BRAKES WILL BE INEFFECTIVE. IF SUCH A PROCEDURE IS UNAVOIDABLE, SECURE THE VEHICLE BY CHOCKING ROAD WHEELS BEFORE 'BREAKING' THE SECOND TRACK.**
- (5) **PERSONAL INJURY. THE TRACK PULLING ROPE AND TRACK CLAMP MUST BE CHECKED BOTH BEFORE AND AFTER USE TO ENSURE THAT THEY ARE FREE FROM DAMAGE.**
- (6) **PERSONAL INJURY. GOGGLES AND PROTECTIVE GLOVES MUST BE WORN WHEN REMOVING OR REFITTING TRACKS, LINKS AND SPROCKETS OR WHENEVER USING TRACK TOOLS ON WHICH METAL TO METAL CONTACT OCCURS OR WHEN SPLINTERING MAY OCCUR.**

General

12 The track is to be checked or inspected as part of routine maintenance activities, daily (during and after use). All checks/inspections are to take place with the track fitted and correctly tensioned.

13 Any track links that are replaced should be recorded in the AB 413 Section 2C. The following information is required:

- 13.1 Date of failure.
- 13.2 Current track mileage.
- 13.3 Reason for replacement.

Check of track - during use

14 During use carry out a static visual check for track component security.

Check of track -after use

15 The procedure for inspecting the tracks after use is as follows:

15.1 Mark one link on each side of the track to indicate when the tracks have made one complete revolution

15.2 Two members of the crew should take up positions at the front of the vehicle, facing the inside of each track. One member of the crew will have to act as overall commander.

15.3 While the vehicle is being driven slowly in reverse, inspect the inner sides of the track for damaged links, cracks, faulty pins, nuts, damaged or loose rubber pads or bushes. Any damage or faults should be marked and rectified after the inspection.

15.4 Take up positions at the sides of the vehicle facing the outer sides of the tracks. Do not stand in front of the vehicle. One member of the crew will have to act as overall commander.

15.5 While the vehicle is being driven slowly forward, inspect the outer sides of the tracks as for the inner sides (Sub-para 15.3).

15.6 Rectify all faults found during the inspection. If the fault cannot be rectified report to REME.

To check track tension

16 Track tension (Fig 4) is determined by measuring the vertical distance, taken on the centre line of the centre road wheel (2), between the underside of the hull sponson (1) and the top metal edge of a track link (datum surface Fig 2 (9)).

16.1 Distance 'A' is as follows:

16.2 FV107 Scimitar - 135-155 mm.

16.2.1 All other variants FV102-106 inc - 120-145 mm.



16.4 Position the vehicle on level ground.

16.5 Drive the vehicle slowly forward at least one vehicle's length, this allows slack to be positioned on the top run of the track and let it come to rest without applying the main, parking or steering brakes.

16.6 Chock one track, refer to Para 7.

16.7 Stop the engine and set all battery master switches to OFF.

16.8 Check that the clearance between the specified points on both tracks is as detailed in Sub-paras 16.1 or 16.2 as applicable.

16.9 If tension is incorrect proceed as detailed Para 17.

- 18.2 Start the engine and set the controls in preparation for reverse neutral turn.
- 18.3 Run the engine at a speed sufficient only to engage the clutch and, by light applications of the appropriate steering lever, gather all the slack under the sprocket, e.g. if the right track is to be removed, gently apply the right steering lever; as soon as the vehicle starts to move apply the main brake (release steering lever) to prevent the sprocket turning back. Apply the parking brake and release the main brake.
- 18.4 Stop the engine and set all battery master switches to OFF.
- 18.5 Select a track pin to the front of the road wheel and remove the outer nut.
- 18.6 Lightly tap out the track pin using the track pin removal tool and nylon hammer (if the pin is tight, use the track pin extractor tool). Remove the tool.
- 18.7 Attach the track pulling rope to the track.
- 18.8 Start the engine, ensure reverse is engaged and select second gear. Release the parking brake and reverse slowly until the track is clear of the sprocket. Apply the appropriate steering lever to move rearwards once the track is clear of the sprocket.
- 18.9 Use the track pulling rope to control and maintain tension on the track to prevent the track horns causing damage to the messier suspension damper and lift it clear of the track tensioner ram until the track is lying flat on the ground.
- 18.10 Stop the vehicle, apply the parking brake and stop the engine. Chock the vehicle, refer to Para 7.
- 18.11 Set all battery master switches to OFF.

To move the vehicle with one track removed

19 To move the vehicle with one track removed, start the engine and engage lowest gear (E) forward or reverse drive. Release the parking brake run the engine at a speed just sufficient to engage the clutch and apply either steering brake. If the lever on the trackless side is applied, the vehicle will move quickly, if the other lever is applied, the vehicle will move slowly. There will also be drive to the disengaged sprocket whichever lever is applied and it will rotate accordingly.

To remove a track link

- 20 To remove a track link, proceed as follows:
 - 20.1 Position the link to be removed between the sprocket and the first road wheel.
 - 20.2 Stop the engine, apply the parking brake and set all master switches to OFF.
 - 20.3 Proceed as detailed in Sub-paras 18.1 to 18.4.
 - 20.4 Remove the outer nuts from both pins, which connect the link that is to be removed.
 - 20.5 Lightly tap out the track pins, starting with the pin nearest the sprocket, using the track pin removal tool and nylon hammer. Once the first pin has been removed, the link will now be lying on the ground. Remove the second track pin (if the pins are tight, use the track pin extractor tool).

20.6 Once the second pin has been removed, remove the link. If a replacement link is required replace a new link using the dummy track drift pin to provisionally line up the bushes. The link is to be joined to the portion of track just forward of the first road wheel.

20.7 Ensure the correct angular placement (Fig 6 (b)) of the bushes by raising or lowering the link by hand.

20.8 Feed in the track pin while withdrawing the dummy track drift pin, and secure the track pin nut.

20.9 Bring the track ends together, using the track clamp, and insert the dummy track drift pin to provisionally line up the bushes.

21 Proceed as detailed in Sub-paras 27.9 to 27.11 to join the track.

To check an idler wheel for rim rock

22 Check idler wheels for rim rock each time the track is removed. Proceed as follows:

22.1 Check that the wheel rotates freely. Report any tight spots.

22.2 Grip the wheel top and bottom and apply a rocking motion. There should be slight rim rock.

22.3 Repeat Sub-para 22.2 with the wheel rotated to different position. Report excessive rim rock.

To check a sprocket hub for rim rock

23 Check sprocket hubs for rim rock each time the track is removed. Proceed as follows:

23.1 Chock the road wheels (Para 7) and release the parking brake.

23.2 Check that the sprocket rotates without undue tight spots. If in doubt – report to REME.

23.3 Grip a sprocket ring top and bottom and apply a rocking motion. There should be slight rock.

23.4 Repeat Sub-para 23.3 with the sprocket rotated to different positions. Report excessive rim rock.

To check idler wheel wear

24 Check idler wheel for wear as follows:

WARNING

PERSONAL INJURY. BEWARE OF SHARP EDGES IF IDLER WHEEL IS CHECKED WITH BARE HANDS.

24.1 A wear indicator chamfer, is machined onto the inner circumferences of the idler wheels, refer to Fig 5.

24.2 When the chamfered area on the outer idler wheel is worn away, the wheel is no longer serviceable for use as an outer idler wheel.

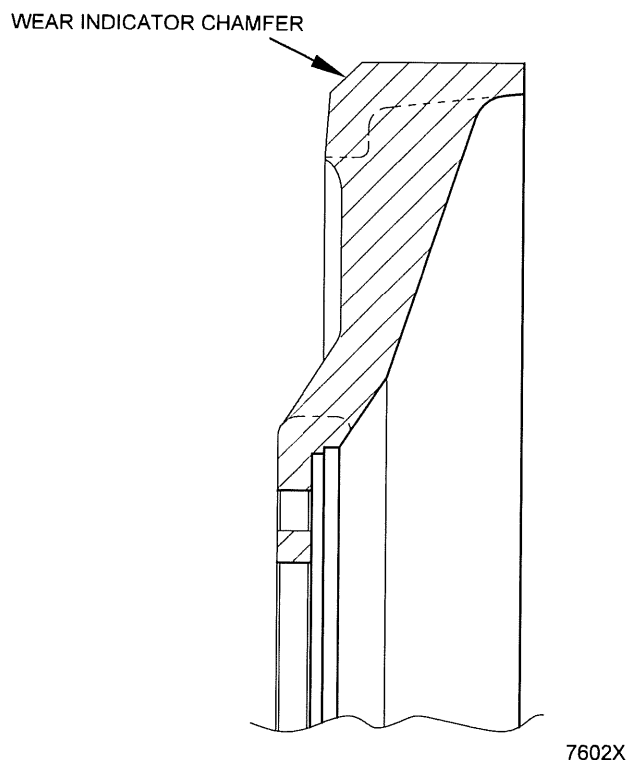


Fig 5 Idler wheel wear indicator chamfer

24.3 Check the inner idler wheel wear indicator chamfer. If the chamfer is present, the inner idler wheel is to be exchanged with the outer idler wheel.

24.4 If the inner wheel is also worn, change the inner and outer idler wheels as a pair.

NOTE

The inner idler wheel may have a groove worn on the running surface. This is acceptable and the wheel should be considered serviceable.

To change an idler wheel

25 When changing an idler wheel, slacken the wheel securing bolts and then remove the track as detailed in Para 18, then proceed as follows:

25.1 Unscrew the idler wheel nuts and remove the idler wheels from the hub. Check that the locking plate that prevents the idler wheel securing bolts from rotating is fitted and serviceable.

25.2 Clean all mating surfaces.

25.3 If there is a spacer fitted between the inner idler wheel and the idler wheel hub:

25.3.1 Remove and discard the spacer.

25.3.2 Replace the securing bolts (AESP 2350-T-220-711, Chap 2-7-7).

- 25.4 Refit and torque tighten the wheel nuts.
- 25.5 Refit the track as detailed in Para 27.
- 25.6 Adjust track tension as detailed in Para 17.
- 25.7 Carry out subsequent checks on nut security as detailed in Para 6.

To change the sprocket rings or track support wheels

26 To change the sprocket rings or track support wheels, proceed as for track removal (Para 18 to 18.7), until the track has been lifted clear of the sprocket. Proceed as follows:

- 26.1 Remove the nuts, bolts and washers securing the sprockets to the hub (the sprocket can now be separated into two identical wheel and sprocket ring sub-assemblies).
- 26.2 Remove the sprocket from the hub (noting locations of spacers and shims).
- 26.3 Remove the bolts and washers securing the sprocket rings to the wheels, change wheels/rings as necessary. Reassemble the rings to the wheels and secure the bolts using the torque wrench.

NOTE

The sprocket rings **MUST** be assembled to the wheels as in Fig 1 (i.e. the datum holes (4) must line up with a wheel fixing hole and the wheel centre). It is, therefore, possible to misalign sprocket teeth if the rings are assembled haphazardly.

- 26.4 Assemble the sprocket on the hub (ensuring mating surfaces are clean and that spacers and shims are correctly located), refit the bolts, nuts and washers and secure the nuts using the torque wrench.
- 26.5 Refit the track as detailed in Sub-paras 27.6 to 27.11.
- 26.6 Carry out subsequent checks on nut security as detailed in Para 6.

To refit a track

27 To refit a track, proceed as follows:

27.1 Drive the vehicle onto the track as detailed in Para 19. Position the vehicle with approximately 2 metres of track behind the rear road wheel.

NOTE

If a new track is to be fitted, lay the new track end to end with the old one (ensure it is the correct way about), and drive on to the new track as detailed in Para 19.

- 27.2 Lift the track as far as possible over the idler wheel.
- 27.3 Attach the track pulling rope to the end link and position a member of the crew to the front, and clear of the vehicle to take the strain on the rope. This is to prevent the track horns damaging the messier suspension damper.
- 27.4 Move the vehicle slowly forward (Para 19) while the track is pulled along the top of the road wheels.
- 27.5 Gather track on top of the road wheels, just before the front suspension damper unit. Ensure the track is lifted clear of the cowl (when lifting track clear of the cowl, stop the vehicle and apply the parking brake).

27.6 Once the track is clear of the cowl, restart the vehicle and lift the end of the track over the sprocket, by using the track pulling rope, and feed it over the sprocket as the vehicle is being driven forward. Continue until there is sufficient track between the sprocket and the first road wheel to affect a join.

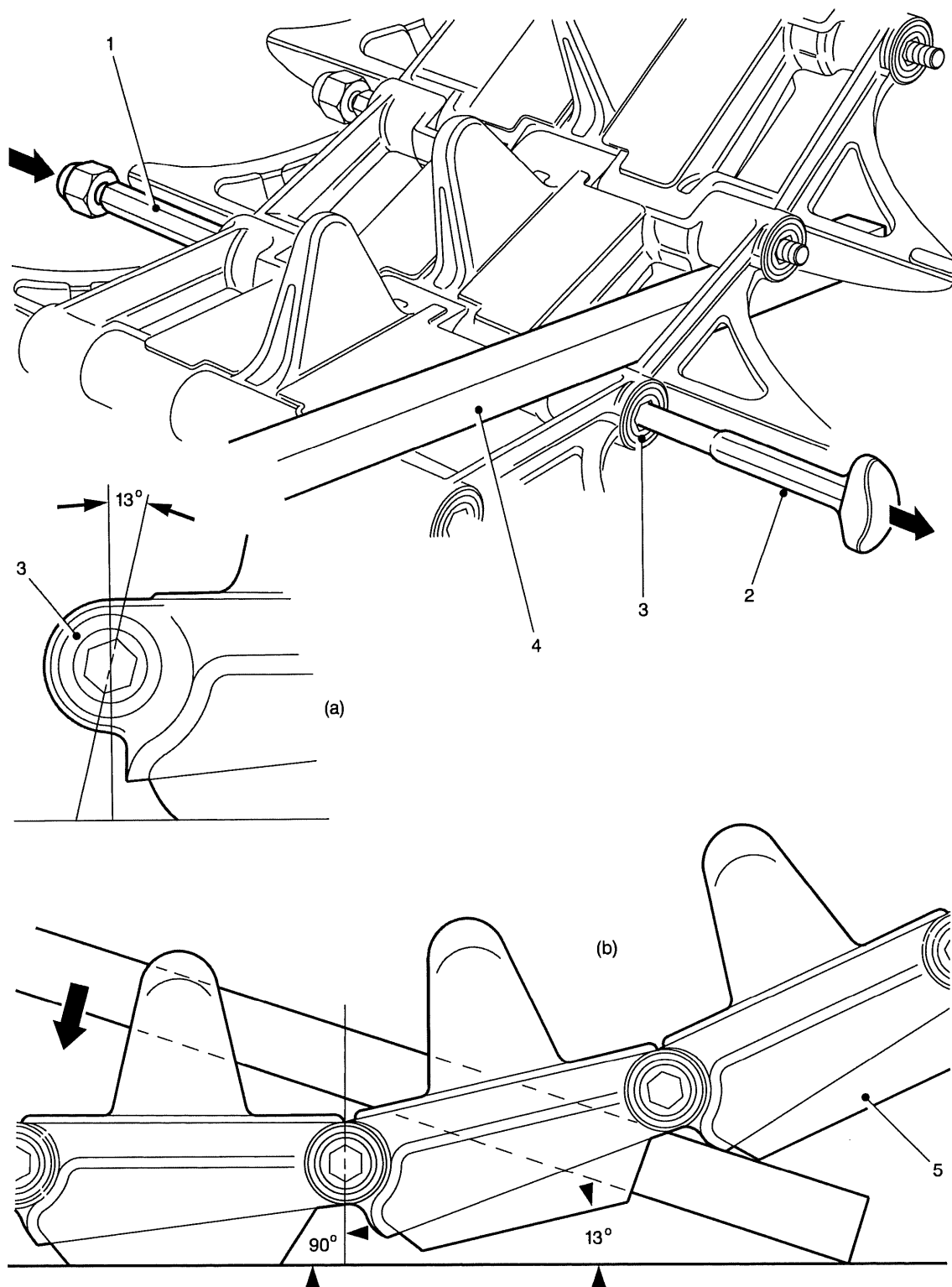
27.7 Stop the vehicle, apply the parking brake, stop the engine and set all battery master switches to OFF.

27.8 Remove the track pulling rope. Bring the track ends together, using the track clamp, and insert the dummy track drift pin to provisionally line up the bushes.

27.9 Position a crowbar as in (Fig 6) to obtain the correct angular displacement between the links to be joined. (The hexagonal bush inserts are aligned when the pad surface of the forward link is inclined at an angle of 13 degrees as in Fig 6 (b)).

27.10 Feed in the track pin while withdrawing the dummy track drift pin, fit and secure the track pin nut. Mark the track pin nut to identify it so that it can be checked for tightness as detailed in Para 6.

27.11 Adjust track tension (Para 16). If fitting a new track, move the vehicle approximately two lengths before checking the specified clearance.



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- | | |
|--|--|
| <ul style="list-style-type: none"> 1 Track pin (hexagonal) 2 Drift 3 Resilient bush 4 Crow bar 5 Rubber pad | <ul style="list-style-type: none"> (a) Position (relative to vertical) of hexagonal hole on two lug side of link (b) Position (relative to vertical) of hexagonal hole on three lug side of link |
|--|--|

Fig 6 Tracks - method of joining

Examination of tracks - track off

28 A track off examination is carried out as stated in Cat 601 and at any time when doubt exists as to the condition and serviceability of the tracks. To examine the tracks, proceed as follows:

28.1 Before removing the track, check track pitch (stretching) over 10 links as follows:

28.1.1 Position the vehicle on firm level ground, apply the parking brake and put all master switches to OFF.

28.1.2 Measure the track between pin centres over 10 links. This measurement should be made on that part of the track under the road wheels on firm level ground.

28.1.3 If the measurement exceeds the figure in Cat 601, report to REME.

28.2 Break one track and run the vehicle clear of the track (Paras 18 and 19).

28.3 Inspect the track for cracks, missing pads, bent pins, lug and bush failure (Fig 7).

28.4 Use torque wrench to tighten up all track pin nuts to the approved torque figures. Ensure that there is an equal number of threads exposed beyond the nuts on each end of the pin as specified in Cat 601.

CONDEMNATION CRITERIA**Track link**

29 Track and track links to be assessed as follows in accordance with Fig 7:

29.1 Pin movement (walking). In service bush movement may allow sideways movement of the pin. This is acceptable until the limit is reached when less than 8 mm or more than 22 mm of pin extends beyond the outer edge of the lug.

29.2 Bushes. A bush with rubber extruding is acceptable providing there are no signs of tearing or break-up. A bush is unacceptable when it can be rotated within the lug.

29.3 Links with gaps and metal-to-metal contact due to sideways movements only are serviceable.

29.4 Pins must be concentric with all five lugs. Uneven gaps between lugs and adjoining links caused by bent pins are unacceptable.

29.5 Links are replaced when:

29.5.1 Cracks are apparent in lugs and/or adjacent to them.

29.5.2 Cracks extend to the mid point between lug and horn.

NOTE

Links with cracked or broken wings are serviceable.

29.5.3 The sprocket drive area is worn through to expose the rubber bush.

29.5.4 Rubber pads are missing.

NOTE

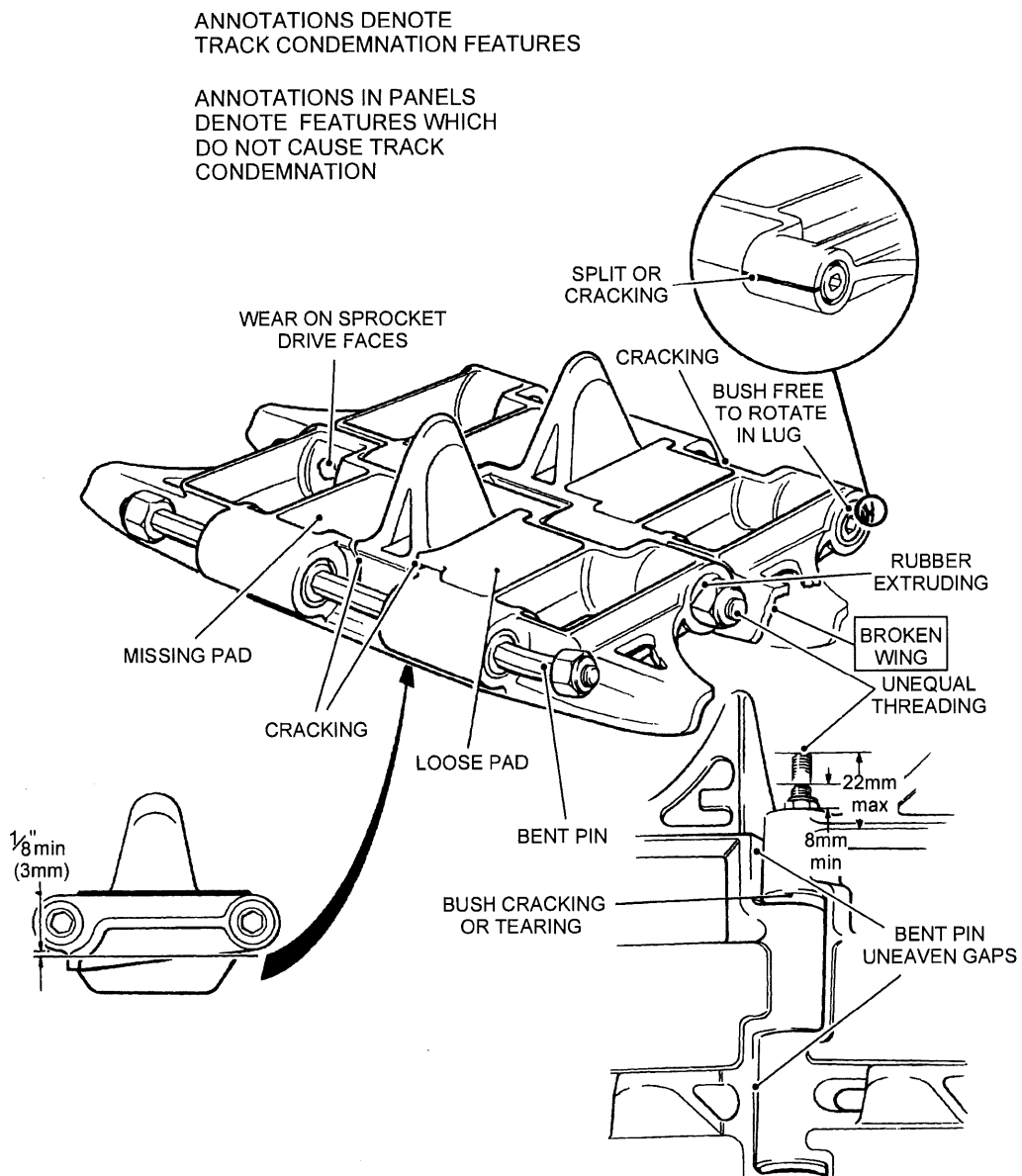
Links with rubber pads worn down to the metal grouser (spud) are technically serviceable. The technical consideration may be overridden to comply with local traffic regulations.

29.6 If a link is removed/replaced, it must be recorded in Section 2C of the AB 413s.

Track set

30 Track wear: Tracks are condemned when a cumulative total of 15 links (Section 2C of AB 413s) have been replaced as a consequence of general wear.

31 Tracks stretching: Pitch between pins over 10 links (see Para 28), must not exceed the figure given in Cat 601.



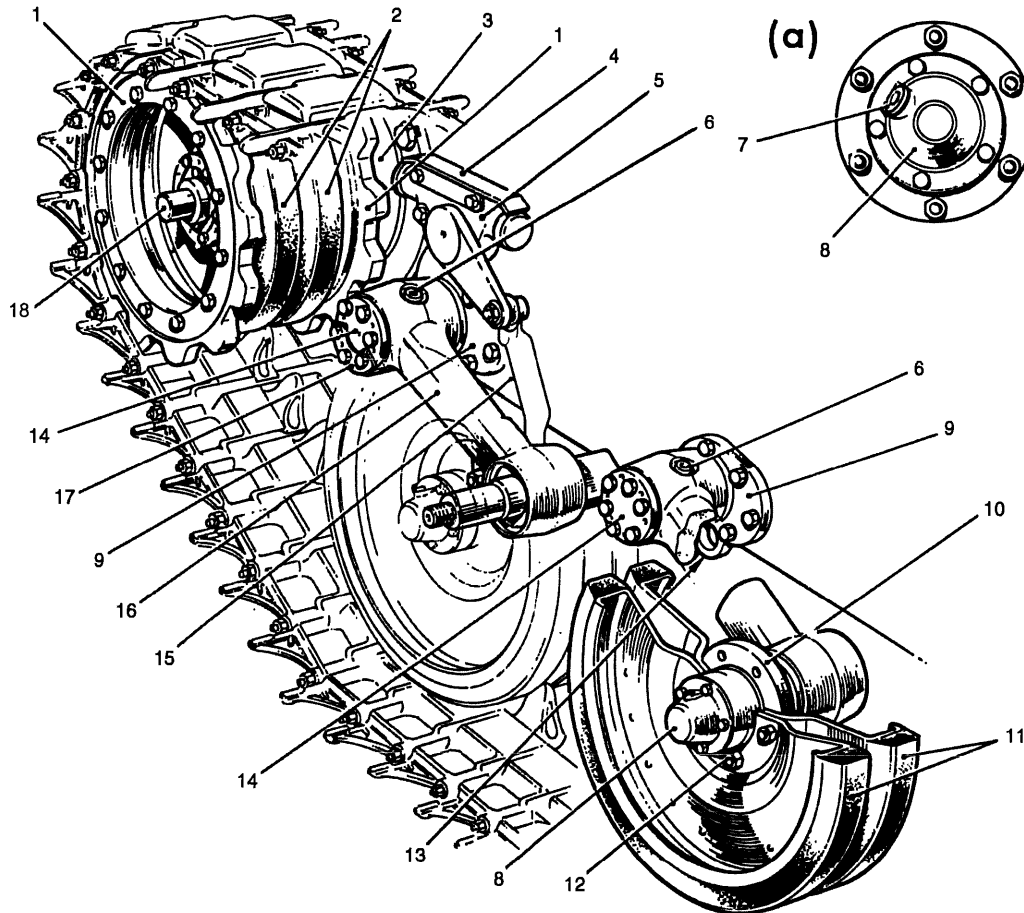
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Fig 7 Track faults

32 Reporting and recording:

32.1 Manufacturer's symbols, embossed on the link wing, are required when reporting defects.

32.2 Details of track history, including dates of examinations, findings and action taken, are to be recorded in Section 2C of the AB 413s.



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1	Drive sprocket	10	Road wheel hub
2	Track support wheels	11	Road wheels
3	Final drive outer casing	12	Wheel nuts
4	Damper guard	13	Lashing eye
5	Suspension damper	14	Torsion bar
6	Axle arm bearing filler plug	15	Suspension damper link arm
7	Road wheel hub filler/level plug (shown in 10 o/c filling position)	16	Axle arm (front station)
8	Hub cap	17	Axle arm shield
9	Axle arm and torsion bar anchor bracket	18	Drive shaft end cap

Fig 8 Front suspension (left)

SUSPENSION

DESCRIPTION

33 The vehicle is supported on ten transverse torsion bar suspension units, five on each side. The axle arm of each unit is fitted in the trailing position.

Suspension units

34 Each unit has a pair of rubber-tyred road wheels (Fig 8 (11)) bolted to a hub (10), which rotates on adjustable taper roller bearings mounted to a stub axle fitted to the end of an axle arm (16).

35 The axle arm pivots on a bracket (9) under the control of a flange-fitted torsion bar (14). The torsion bar extends across the hull to the opposite suspension unit where it is anchored in a splined housing on the inner side of the respective axle arm pivot bracket.

36 All road wheels are interchangeable, a jacking strut as an aid to wheel changing is included in the vehicle kit.

Suspension dampers

37 Hydraulic, Messier type suspension dampers (Fig 8 (5)) are fitted to the front and rear suspension units.

USER MAINTENANCE

General

38 The road wheel nuts must be checked for the correct torque setting as specified in Cat 601. The securing nuts of any component newly fitted, should be checked for tightness on receipt and at least once daily for the next three days that the vehicle is operated.

To check road wheels for condition and hubs for overheating

39 To check road wheels (Fig 9) for condition and hubs for overheating, proceed as follows:

39.1 Remove embedded stones from the tyres and check for excessive tyre wear (i.e. tyres on rear wheels may be found to have greatest wear due to stones being thrown by the tracks) – interchange/change wheels as necessary (Para 43) to ensure an equal rate of tyre wear overall.

39.2 Position the vehicle on firm level ground, apply the parking brake and stop the engine.

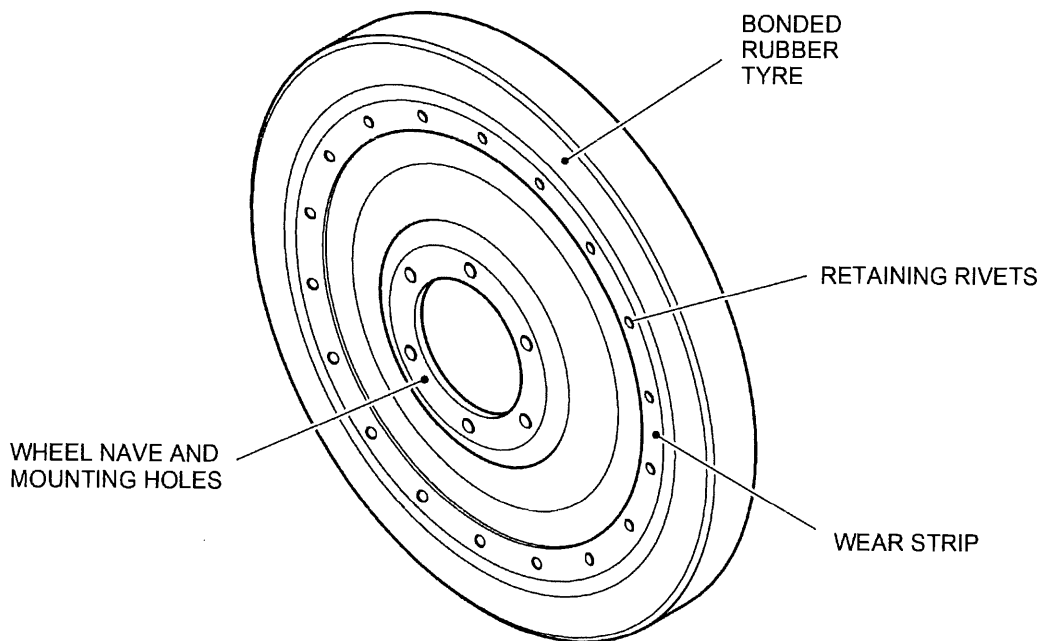
WARNING

PERSONAL INJURY. WHEN CHECKING ASSEMBLIES FOR HIGH TEMPERATURE, APPROACH WITH CARE USING THE BACK OF THE HAND TO DETECT EXCESSIVE HEAT RADIATION.

39.3 Using the back of the hand check all road wheel hubs for excessive heat.

39.4 If excessive heat is detected, proceed to check the oil level as detailed in Para 40.

39.5 If the oil level is correct, report to REME.



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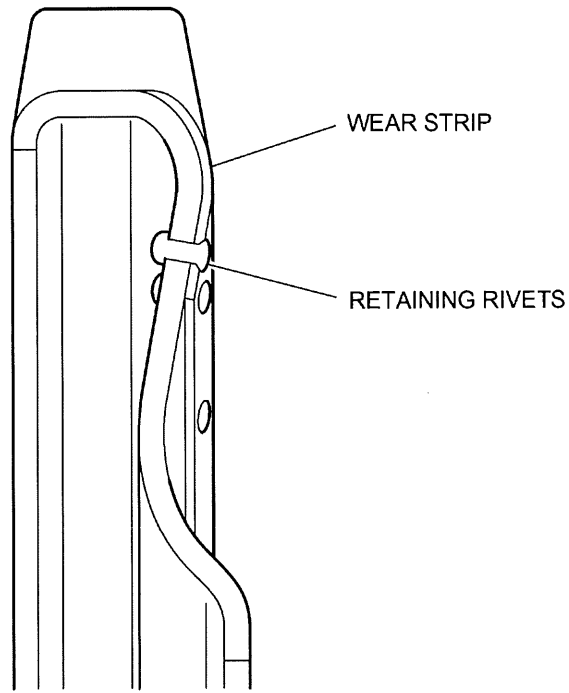
Fig 9 Road wheel

- 39.6 Check both sides of each wheel.
- 39.7 Replace any wheels that are distorted or dented.
- 39.8 Check the road wheel tyre around the complete circumference of the wheel. Remove any embedded stones where possible that are likely to cause splits leading to loss of tyre.
- 39.9 Check the road wheel tyre condition. Tyres must be free from major defects i.e. loss of large sections of tyre or signs of bonding failure.
- 39.10 Wear strip retaining rivets. Check the wear strip retaining rivets (Fig 10). Condemnation criteria: NO WEAR ALLOWED AT ALL ON RIVETS.
- 39.11 No separation between tyre and wheel is permissible.
- 39.12 Road wheel. Check the nave of the wheel around the mounting holes (6-off). Condemnation criteria is any deformation or cracks visible around mounting holes.
- 39.13 Check the root of the wheel all around the circumference for any cracks. Condemnation criteria is any cracks visible in the root of the wheel (Fig 11).

To check and top-up a wheel hub

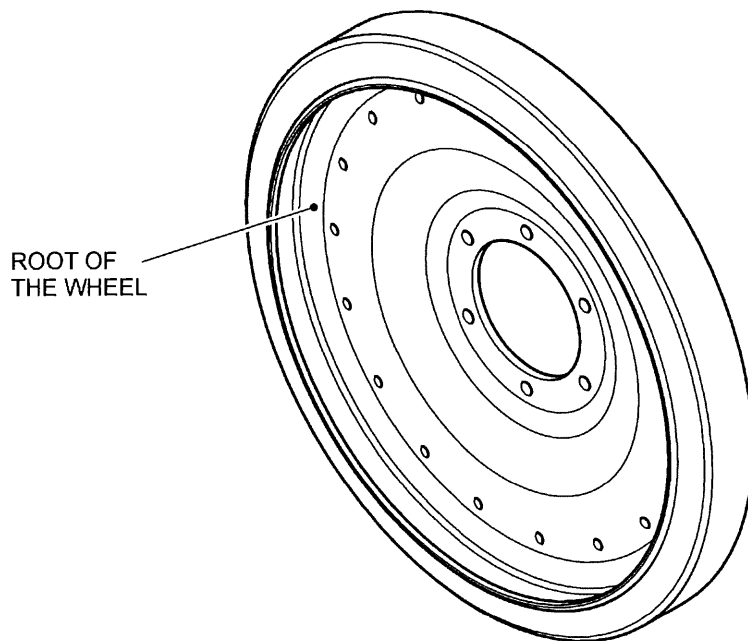
- 40 To check and top-up a wheel hub, proceed as follows:
- 40.1 Position the vehicle so that the filler/level plug (Fig 8 (7)) is at the 2 or 10 o'clock position, apply the parking brake and stop the engine.
- 40.2 Clean the area around the plug and remove the plug.
- 40.3 Check the oil level and check oil for contamination. If contamination is present the oil will require changing, report to REME. If the oil level is low, add oil until, after settling, the oil level is on the threads of the plug hole.

- 40.4 Check the sealing washer on the plug, renew if necessary.
- 40.5 Replace and tighten the plug, clean off any surplus oil.



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Fig 10 Wear strip and retaining rivets



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Fig 11 Root of the wheel

To raise road wheels using the jacking strut**WARNINGS**

- (1) **DANGER TO PERSONNEL. DO NOT TAKE RISKS WITH SAFETY; JACKING STRUT COLLAPSE CAN CAUSE SERIOUS INJURY.**
- (2) **DANGER TO PERSONNEL. DO NOT HOLD THE JACKING STRUT IN POSITION WHEN RAISING THE ROAD WHEEL.**
- (3) **RISK OF CRUSH INJURY. DO NOT WORK UNDER VEHICLE SUPPORTED ONLY BY JACKING STRUTS. VEHICLE MUST BE SECURELY SUPPORTED BY HULL STANDS OR SUITABLE SKIDDING.**
- (4) **RISK OF CRUSH INJURY. VEHICLE MUST NOT BE SUPPORTED BY JACKING STRUTS FOR PROLONGED PERIODS. FAILURE OF TORSION BARS CAN OCCUR SUDDENLY, WHICH WILL SIGNIFICANTLY REDUCE GROUND CLEARANCE OR CAUSE VEHICLE MOVEMENT. THIS RISK IS INCREASED ON UP-ARMoured VEHICLES.**

41 To raise road wheels using the jacking strut (Fig 12), position the vehicle on firm level ground, apply the parking brake, stop the engine and proceed as follows:

WARNING

DANGER TO LIFE AND LIMB. BEFORE PERSONNEL ARE ALLOWED UNDER THE VEHICLE, THE PARKING BRAKE MUST BE FULLY APPLIED AND THE VEHICLE SECURED AGAINST MOVEMENT AND THE ENGINE SWITCHED OFF.

- 41.1 Go under the vehicle and position the strut between the wheel hub and a track link to the rear of the wheel hub. The smallest end should be located on the track link and the strut allowed to lean with its extended edge resting on the axle arm (Fig 12).
- 41.2 Move from under the vehicle.
- 41.3 Move the vehicle carefully in reverse using lowest gear (E), to bring the strut vertical. Apply the parking brake and stop the engine.

To lower road wheels from the jacking strut

42 To lower road wheels from the jacking strut (Fig 12), proceed as follows:

- 42.1 Move the vehicle in lowest gear (E), forward until the strut is free. Apply the parking brake and stop the engine.

WARNING

DANGER TO LIFE AND LIMB. BEFORE PERSONNEL ARE ALLOWED UNDER THE VEHICLE, THE PARKING BRAKE MUST BE FULLY APPLIED AND THE VEHICLE SECURED AGAINST MOVEMENT AND THE ENGINE SWITCHED OFF.

- 42.2 Go under the vehicle and retrieve the strut.

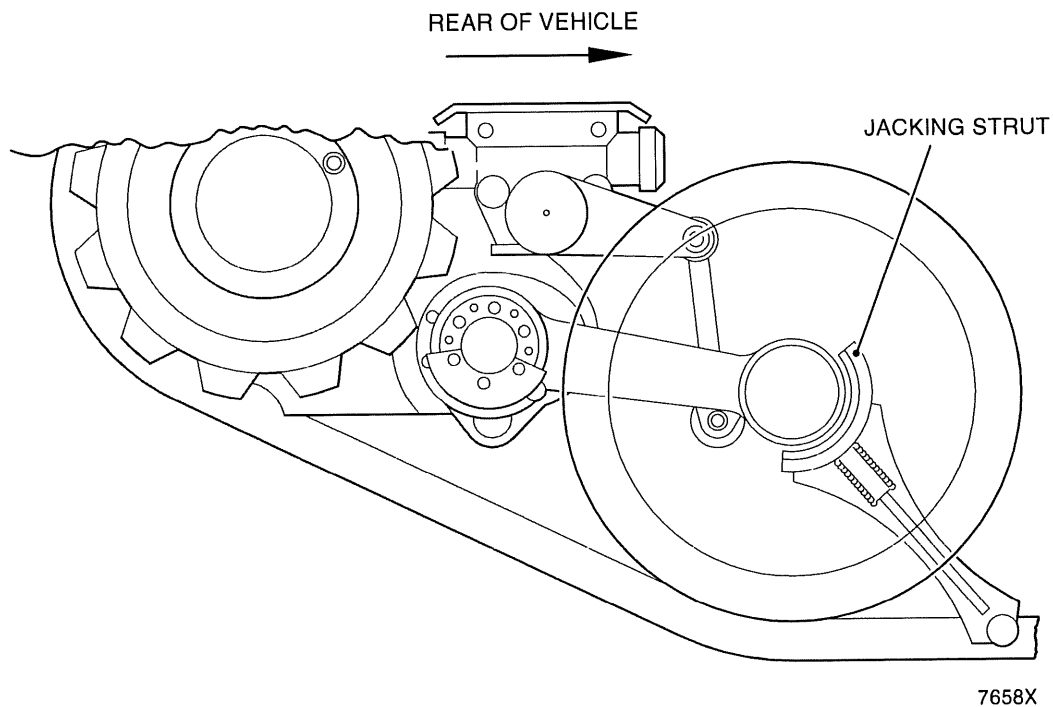


Fig 12 Correct positioning of jacking strut

To remove and replace the road wheels

43 To remove and replace the road wheels, proceed as follows:

43.1 Slightly slacken the wheel nuts and then raise the wheels (Para 41).

43.2 Unscrew and remove the wheel nuts. Remove the wheels (note location of shim/packing piece).

43.3 Refit the wheels; first ensuring mating surfaces are clean and shim/packing piece is correctly located.

43.4 Apply a smear of grease to the wheel securing nuts and bolts, refit them (with washers) and tighten the nuts in diagonal sequence using the torque wrench.

NOTE

Wheel nuts, having self-locking inserts, tend to lose their tenacity after being removed a few times; suspect nuts (i.e. those not stiff on threads) should be discarded and new nuts fitted.

43.5 Lower the road wheels (Para 42).

43.6 Complete tightening of the wheel nuts (tighten nuts in diagonal sequence) and carry out subsequent checks as described in Para 6.

To check road wheels for rim rock

44 Checks on rim rock are to be carried out as specified in Cat 601 and when wheels are raised during a wheel change operation. Proceed as follows:

- 44.1 Raise the road wheel (Para 41).
- 44.2 Check that the wheels rotate freely.
- 44.3 Grip a wheel on opposite sides and apply a rocking motion - only very slight movement should be present.
- 44.4 Check rim rock with the wheel rotated to different positions; if excessive rim rock is suspected or if there are tight spots to prevent the wheel from rotating freely, report to REME.
- 44.5 Lower the road wheel (Para 42) and repeat Sub-paras 44.1 to 44.4 for all the other wheel stations.

To lubricate an axle arm bearing

45 The axle arm bearings are filled with oil via a filler plug (Fig 8 (6)). To lubricate the axle arm bearing, proceed as follows:

- 45.1 Position the vehicle on firm level ground, stop the engine and apply the parking brake.
- 45.2 Clean the area around the plug and remove the plug.
- 45.3 Check the oil level, the level should be to the level of the plug hole. If the oil level is low, add oil until it is at the correct level.

NOTE

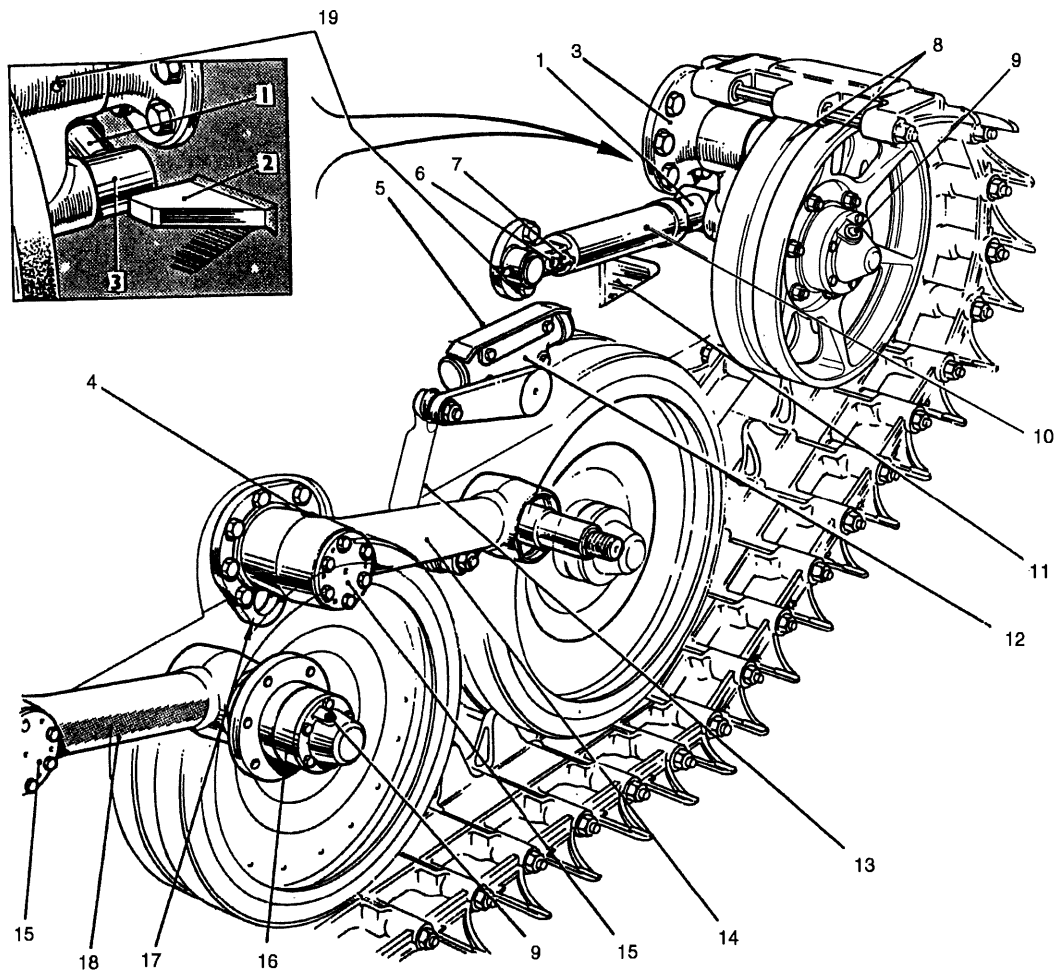
When topping up the axle arms, allow time for the oil to settle to its correct level before refitting the plug.

- 45.4 Check the sealing washer on the plug, renew if necessary.
- 45.5 Replace and tighten the plug, clean off any surplus oil.
- 45.6 Repeat Sub-paras 45.1 to 45.5 for the remainder of the axle arms.

To lubricate the suspension damper (Messier) lower link arm bush

46 Some types of the suspension dampers may require grease gun lubrication as stated in Cat 601. To lubricate the suspension damper (Messier) lower link arm bush, proceed as follows:

- 46.1 Position the vehicle on firm level ground, apply the parking brake and put all master switches to OFF.
- 46.2 Wipe away any dirt from around the lubricator.
- 46.3 Using a grease gun, inject grease (Cat 601) into the lubricator until grease appears around the area of the ball joint.
- 46.4 Wipe away excess grease and repeat Sub-paras 46.2 to 46.3 for the opposite damper.



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- | | | | |
|----|---------------------------------|----|---|
| 1 | Hydraulic ram plunger | 11 | Ram stop |
| 2 | Axle stop | 12 | Suspension damper |
| 3 | Cranked idler axle | 13 | Suspension damper link arm |
| 4 | Axle arm bearing filler plug | 14 | Axle arm (rear station) |
| 5 | Damper guard | 15 | Torsion bar |
| 6 | Pressure relief screw | 16 | Road wheel hub |
| 7 | Charging valve | 17 | Lashing eye (axle arm and torsion bar anchor bracket) |
| 8 | Track adjuster idler wheel | 18 | Axle arm (intermediate station) |
| 9 | Filler/level plug | 19 | Lubricators |
| 10 | Hydraulic ram (track tensioner) | | |

Fig 13 Rear suspension (left)

~~OFFICIAL SENSITIVE~~

~~OFFICIAL SENSITIVE~~

CHAPTER 9
ELECTRICAL SYSTEM
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(continued)

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ELECTRICAL INSTALLATION

GENERAL

- 1 The vehicle is wired to a 24 volt system, two sets of batteries (one each for the hull and turret services) are provided, each set consisting of two identical 12 volt batteries housed separately in fibre glass containers and connected in series. A battery master switch associated with each set of batteries provides for independent control, in addition the hull installation includes an inter-vehicle starting socket to accept the supply from an external 24 volt battery system should the hull batteries be in a discharged condition. An indicator circuit is also incorporated to give visual warning should there be an incorrect connection (i.e. reversed polarity) of the hull, turret or external battery systems.
- 2 A distribution panel and a driver's instrument panel provide control and distribution of power for hull services. For turret services a turret supply box is provided.
- 3 Certain parts of the hull circuits (principally light current services) utilise the hull as in a negative earth return system, whereas the wiring throughout the turret is typical of an all-insulated return system.
- 4 A rotary base junction provides for electrical continuity between hull and turret common services (i.e. intercommunication network and battery charging).
- 5 The turret installation includes gun firing circuits for both the main and auxiliary armaments and power supplies for the radio communication equipment and Battle Group Thermal Imaging (BGTI) system (when fitted).
- 6 For details of the vehicle generating system, see Paras 102 to 108.

BATTERIES

CAUTION

EQUIPMENT DAMAGE. The gases vented from a battery are highly inflammable, therefore, electrical connections must be maintained clean and tight to prevent ignition of gases. Before removing or replacing connectors, put the battery switch to OFF and ensure that the vent block outlets are fitted with plastic tubing or plastic caps as appropriate. Do not attempt to remove or replace the positive connector with the negative (earth) cable connected. Freshly charged batteries must not be installed until all gassing has ceased. A naked light must never be used when examining a battery.

NOTE

The following information is based on the sealed lead acid (Low Maintenance) battery. Should any vehicle be found to be fitted with the non-sealed battery, the user is to refer to AESP 6140-A-100-013 BATTERIES-ALL TYPES for technical and maintenance support.

7 The batteries are of the sealed (low maintenance), 12 volt, lead-acid type with a capacity rating of 110 Ah. They are located two in the forward part of the fighting compartment base (hull batteries) and two on the turret basket floor (turret batteries).

7A Battery terminals are of the standard polarised type for use with split-clamp connectors, the larger terminal being fitted with a red plastic collar to identify it as the positive.

Battery vents and breathers

7B The battery cells are vented by means of a common vent block at the top of the battery.

7C The vent block has two outlets suitable for the attachment of plastic tubing, where one outlet only is utilised, the other is sealed by a plastic cap. Plastic tubing is used in conjunction with each of the hull and turret battery vent systems to provide for breathing of the batteries and the safe release of cell gases via breathers fitted on the vehicle exterior.

7D The externally fitted breathers each incorporate a flame trap to prevent damage to batteries should escaping gases ignite and are located one for the hull batteries below and forward of the engine compartment access covers, and for the turret batteries to the right of the stowage bin at the rear of the turret.

User Maintenance

7E For each breather assembly on the vehicle, release the screw and washer, and remove the external battery breather cover from the flame trap retainer.

7F Clear any accumulated debris from the cross-drilled hole in the flame trap retainer.

7G Ensure that the underside of the cover is clean, then replace and secure the cover with the screw and washer removed at Sub-para 7E.

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8 Both sets of batteries are charged simultaneously when the vehicle alternator is 'on line'; it is not necessary for the turret battery master switch to be ON to ensure charging of the turret batteries.

DISTRIBUTION PANEL

9 The distribution panel No. 10 (Fig 1) is located in the driver's compartment on the hull sponson adjacent to the forward and reverse lever. On the Mk 3 version, Skt 14 (8) has been upgraded to provide a heavy duty power supply for ancillary systems which may be fitted to the vehicle.

Battery master switch

10 A semi-rotary battery master switch (1) with positions identified ON-OFF. In the OFF position the switch isolates the batteries from all circuits.

Inter-vehicle starting socket

11 The inter-vehicle starting socket (11) permits a heavy current connection (via the battery master switch) between the hull batteries and a similar external battery system (see Chapter 12). When not in use the socket must be covered by the captive screw-on cap.

Inspection lamp socket

12 The inspection lamp socket (14) is provided for the connection of an inspection lamp. The socket is 'live' when the hull master switch is ON and should be covered by the captive screw on cap (13) when not in use.

Fuses

13 Four fuses of the type described in Para 29 are fitted on the edge of the panel, which is towards the front of the vehicle. They are positioned in a row and identified consecutively F1 to F4 in the direction of the left side plate. For details of circuits protected see Chapter 1.

Relays

14 Inside the panel are three relays which are incorporated in the battery supply line as isolating switches, one for the NBC fan, one for the cooking vessel and one for the engine starter control circuit.

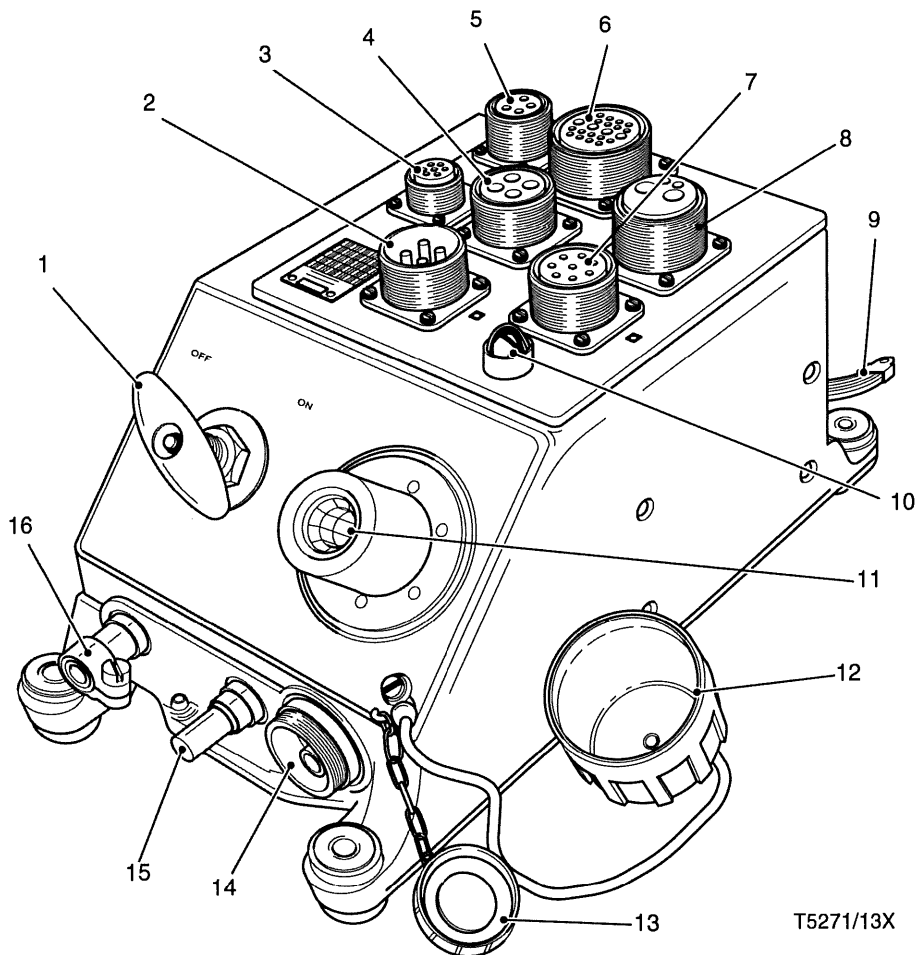
15 The purpose of the NBC fan and cooking vessel relays is to isolate the respective circuits when the vehicle alternator is not 'on line' (an arrangement which prevents excessive drainage of the hull batteries), while the starter control relay, in conjunction with a thermal switch in the starter, 'opens' the starter circuit when the starter overheats.

Battery indicator light

16 The battery indicator light (10) is incorporated in a (12v) charging system protection circuit, which under normal operations will glow dimly (half brilliance). The circuit operates to protect the charging system in the event of:

- 16.1 Reversed battery connections (reverse polarity).
- 16.2 Battery leads disconnected and earthing.
- 16.3 Earth fault in battery positive leads.

17 The battery indicator light will glow brightly (full brilliance) to indicate that the supply voltage (i.e. from the hull, turret or external batteries) is of the reverse polarity. Reverse polarity in respect of the external battery supply (inter-vehicle starting) would be indicated immediately on its application via the inter-vehicle starting socket (i.e. master switch OFF). Whereas, a similar fault in respect of the hull or turret battery conditions would not be indicated until the hull battery master switch had been put to ON; in any case, the cause should be investigated and remedial action taken.



- | | | | |
|---|--|----|---|
| 1 | Battery master switch | 9 | Earthing strap |
| 2 | Plug 10 - Turret/radio battery supply | 10 | Reverse battery warning light |
| 3 | Socket 8 - Starter and engine services | 11 | Intervehicle starting socket |
| 4 | Socket 11 - Cooking vessel supply | 12 | Protective cover for intervehicle starting socket |
| 5 | Socket 9 - NBC supply | 13 | Protective cover for inspection socket |
| 6 | Socket 12 - Positive supplies to instrument panel and engine condition signals (oil, temp and tacho) | 14 | Socket 1 - Inspection lamp socket |
| 7 | Socket 13 - Fused RBJ supply (if used) | 15 | Plug 6 - Hull battery positive |
| 8 | Socket 14 - Air cooling/Ancillary supply (if used) | 16 | Socket 5 - Hull battery negative |

Fig 1 Distribution panel

CENTRAL WARNING SYSTEM

18 The Central Warning System operates through a cluster of three lights mounted in a binnacle located on the front left side of the vehicle facing the driver.

19 The system makes use of a fire sensing wire system and several electrical circuits to actuate the necessary lights to indicate a fire or engine malfunction in the engine compartment.

Warning lights

20 The cluster of lights consists of three separate coloured lenses, red, amber and green.

21 The red light flashes intermittently to warn of fire in the engine compartment at the same time a sustained sound is produced by a fire warning horn.

22 A cancel button on the fire horn relay switches off the fire warning horn.

23 The amber light flashes intermittently to warn of an engine malfunction. To determine whether the fault is in the coolant or lubrication the particular warning light on the driver's instrument panel has to be referred to.

24 The green light is redundant on the diesel version of each variant.

Annunciator

25 An annunciator is fitted on the LH side near the front bulkhead plate. Its purpose is to detect fault-indicating signals and energise the fire horn relay.

Relay

26 A relay is mounted on the turret side of the bulkhead behind the driver; it is fitted with a switch to enable the fire warning horn to be cancelled out. The relay is also fitted with a protective fuse.

Fire warning horn

27 A fire warning horn is fitted in the crew compartment. The horn is adjacent to the relay and sounds only to give warning of fire in the engine compartment.

DRIVER'S INSTRUMENT PANEL

28 The instrument panel (Fig 2) is located to the left of the driver's compartment on the hull sponson. The following components are incorporated.

Fuses

29 Twelve fuse units (1) at the top of the instrument panel provide protection for the various circuits as identified by markings on the panel adjacent to the fuse holders. The units are identical in appearance and each accommodates a single cartridge fuse, but the fuse ratings are varied to match each circuit loading (see Chap 1 for details of circuit and fuse ratings). A further fuse unit (27) mounted on top of the instrument panel provides protection for the electric fuel pump.

30 Spare fuses are carried in the cylindrical container (16) located on the left at the bottom of the panel.

Engine thermostart/starter switch

31 The engine thermostart/starter switch (20) is used when starting the engine. The HEAT position is used to energise the thermostart (special to role use only when fitted) and the START position is used to turn the engine over to start. Both positions are spring loaded to return to the central OFF/RUN position when released.

Engine ignition switch

32 The engine ignition switch (26) is a rotary type switch, located in the centre of the lighting switch. When switched to the ON position, it energises the electrical system to enable the vehicle to be started. It also allows current to be fed to certain controls and components (e.g. warning lights on the drivers instrument panel and the electric fuel priming pump).

Lighting switch

33 The lighting switch (25) is semi-rotary in operation, having six positions.

34 For selective operation of the external lighting under normal conditions the IR switch (24) must be at NORMAL and the convoy light changeover switch (18) must be at CON NOR. Under IR/BLACKOUT conditions (see Para 36) the switch has no application. The identifying marks at each position signify (as shown) which of the various external lights (excluding the turnlights and stoplights) can be selected. The switch positions are identified by the markings listed below:

ANTICLOCKWISE from OFF position,

T - tail lights and registration plate light,

S & T - sidelights, tail lights and registration plate light,

H - headlights, sidelights, tail lights and registration plate light,

CLOCKWISE from OFF position,

C - convoy light only,

C & S - convoy light and sidelights

IR lighting switch

35 The IR lighting switch (24) is no longer used.

Convoy light changeover switch

36 The convoy light changeover switch (18) is a two-way lever operated switch. It can be put to either of two positions, i.e. CON IR or CON NOR for operation of the convoy light under IR/BLACKOUT or NORMAL lighting conditions.

Driver's periscope wiper switch

37 The driver's periscope wiper switch (22) is a pull (ON) push (OFF) type to control the periscope wiper motor.

Instrument light dimmer control

38 The dimmer control (19) is rotatable between two positions marked DIM and BRIGHT, to provide means of varying the brilliance of the panel instrument lights (see Paras 63 and 64).

Tachometer

39 The tachometer (2) provides an aid to ensuring that the engine is operated in the most efficient speed range and does not exceed the safe maximum speed of 2600 rev/min. It also facilitates the correct setting of engine idling speed (see Chap 1).

40 The tachometer is an electrical instrument whose operation is dependent upon electrical impulses derived from a speed probe aligned with the engine flywheel. The instrument reading is in direct proportion to the frequency of the impulses, which in turn is dependent upon engine speed.

41 The operation of the tachometer is also covered in Chapter 4.1. Para 9.

Turnlight switch

42 The turnlight switch (4) is a three position, lever operated, self-cancelling type switch.

43 Left or right turnlights are selected by moving the lever to the L or R position as appropriate, the self-cancelling period is approximately 10 seconds.

Turnlight warning light

44 The warning light (5) flashes, when the turnlight switch is operated, to indicate that the turnlights are operating.

Hazard warning switch

45 The hazard warning light switch (3) is a press button type being wired into the turn light circuit such that when the switch is operated, flashing of each of the four turn lights occurs simultaneously.

46 A warning light incorporated in the switch button also flashes to indicate that the hazard warning system is in operation.

47 The hazard warning circuit is not dependent on the vehicle engine operation, as is the turnlight circuit. However it should be noted that this hazards warning circuit is not operable during blackout conditions.

Press to test switch (temperature warning light)

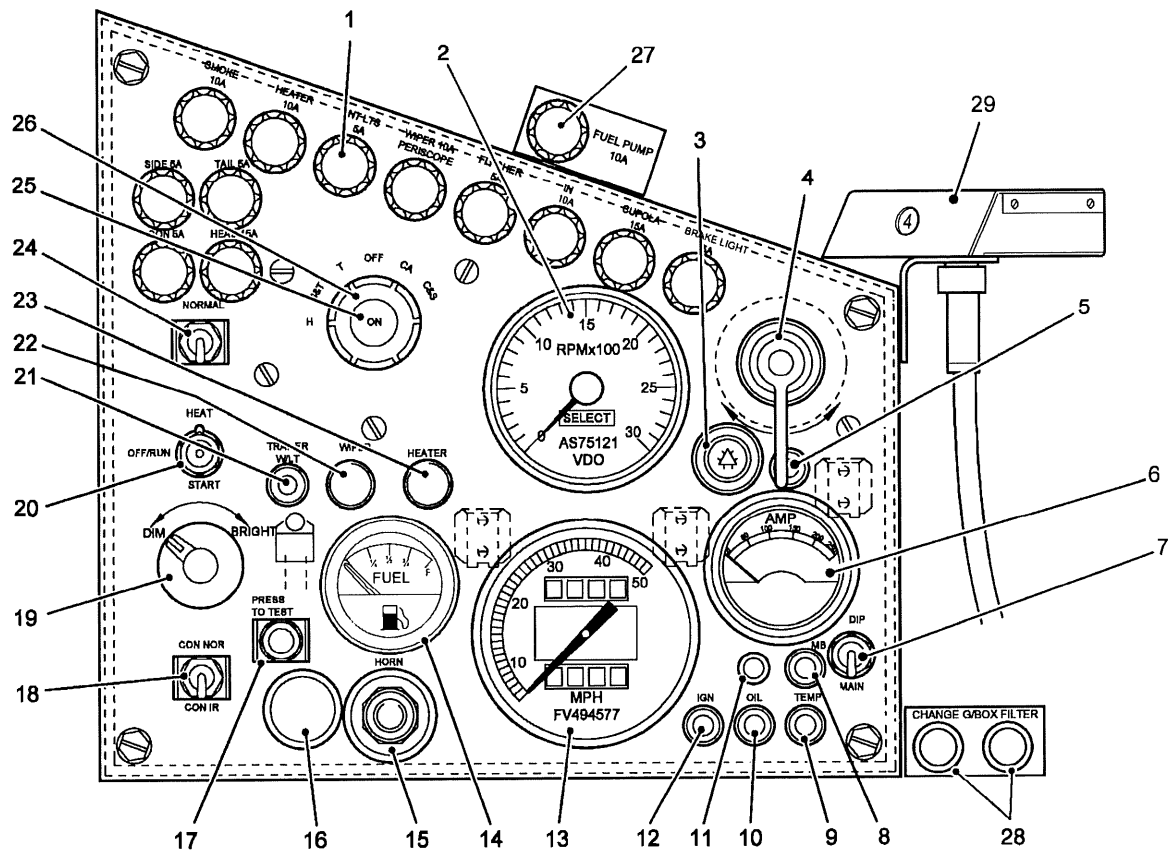
48 The switch (17) is a press button type, providing a means of testing the red and the amber light in the Central Warning System.

Alternator warning light

49 The alternator warning light (12) on the DIP glows and the amber light of the Central Warning System flashes when the engine ignition switch is set to on. Both lights should extinguish when the engine is started indicating an output from the alternator. If the alternator warning light continues to glow and amber warning light continues to flash while the engine is running there is no alternator output.

Oil pressure warning light

50 The oil pressure warning light (10) on the DIP glows and the amber light of the Central Warning System flashes when the engine ignition switch is set to on. Both lights should extinguish when the engine is started, indicating there is a regular oil pressure level; should the oil pressure warning light continue to glow and amber warning light continues to flash while the engine is running there is low oil pressure.



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- | | |
|-------------------------------------|--|
| 1 Fuse unit (typical 12 off) | 16 Spare fuse container |
| 2 Tachometer | 17 Press to test switch (for temp warning light) |
| 3 Hazard warning light switch | 18 Convoy light changeover switch |
| 4 Turnlight switch | 19 Instrument light dimmer control |
| 5 Turnlight warning light | 20 Thermostart/starter switch |
| 6 Ammeter | 21 Trailer warning light (not used) |
| 7 Headlight dipswitch | 22 Driver's periscope wiper switch |
| 8 Main beam warning light | 23 Heater switch |
| 9 Coolant temperature warning light | 24 IR lighting switch |
| 10 Oil pressure warning light | 25 Ignition switch |
| 11 Speedometer trip set reset knob | 26 Lighting switch |
| 12 Alternator warning light (IGN) | 27 Fuel pump fuse |
| 13 Speedometer | 28 Gearbox filter warning lights |
| 14 Fuel gauge | 29 Gear indicator (Scimitar position) |
| 15 Horn pushbutton switch | |

Fig 2 Driver's instrument panel

Engine temperature warning light

51 The coolant temperature warning light (9) on the DIP glows and the amber light of the Central Warning System flashes when the engine ignition switch is set to on. Both lights should extinguish when the engine is started; should the engine temperature warning light continue to glow and amber light continues to flash while the engine is running, the engine is overheating, the engine should be stopped and the cause investigated.

Ammeter

52 The ammeter (6) is an instrument calibrated 0 to 250A for measurement of current in the alternator output line. This will be at a maximum (140A) when both hull and turret services are heavily loaded and/or when the batteries are in a low state of charge.

Headlight dipswitch

53 The headlight dipswitch (7) is a two-way, toggle switch provided for dipping the headlight beams.

Headlight main beam warning light

54 The headlight main beam warning light (8) has a blue lens fitted and it glows when the headlights are in use and the dipswitch is at MAIN. When the headlight beams are dipped the light is extinguished.

Speedometer

55 The speedometer (13) provides a direct reading of vehicle speed. Two apertures in the speedometer face indicate the total mileage travelled (lower aperture) and the mileage travelled during a specific exercise or manoeuvre (upper aperture). A speedometer trip reset knob (11), permits resetting of the digits to zero.

56 The speedometer is mechanically driven from the left hand final drive by an enclosed, flexible drive shaft.

Fuel gauge

57 The fuel gauge (14) is operative only when the master switch and the engine ignition switch are set to on. The circuit is protected by a fuse (see Chap 1).

Horn pushbutton switch

58 The horn pushbutton switch (15) is identified HORN; the horn circuit is not fused, being dependent only on the master switch. A guard fitted to the horn button prevents accidental operation.

Heater switch

59 The heater switch (23) is identical to the driver's periscope wiper switch (see Para 37) and is connected to control the blower motor in the heater unit. The circuit is energised via the engine ignition switch.

Socket outlets

60 Four socket outlets are fitted to the panel sides.

61 Three are arranged in a single column on the side facing towards the front of the vehicle, the other socket is located on the opposite side and is not used. The three outlets in column provide for connection of services as shown below:

61.1 Top outlet - driver's night sight/Tactical Navigation and Target Location System - (TNTLS - TFOG) (only vehicles fitted with ESPIRE i.e. not BGTI).

61.2 Centre outlet - driver's periscope wiper.

61.3 Bottom outlet - monitoring of the low oil pressure and engine temperature warning systems.

62 When not in use the socket outlets should be fitted with a plastic cover.

Instrument lights

63 There are six instrument lights, five are located inside the instrument panel and one is incorporated in the gear indicator (29) to illuminate the scale.

64 The five internally fitted lights are of the clip-in lampholder type, three are retained by brackets secured to the inside of the panel cover, one is embodied in the tachometer housing and the other in the fuel gauge housing.

Flasher unit

65 Located inside the instrument panel, the flasher unit is connected into the turn light and hazard warning light circuits.

66 The unit is sealed and hence requires to be replaced in the event of a malfunction.

HEAVY DUTY FUSE UNITS

67 There are two identical units, both are mounted side by side on the hull plate forward of the driver's instrument panel.

68 Each unit comprises a removable ceramic cartridge fuse. That fitted to the rearmost unit protects the NBC circuit; the other fuse protects the cooking vessel circuit (see Chapter 1 for details of fuse ratings).

HEATER UNIT

69 Located in the fighting compartment above the hull batteries, the heater unit provides for heating the driving and fighting compartments. The heat is taken from the engine coolant as it flows through the unit radiator; a motor driven blower incorporated in the unit then distributes the heated air. Also provided are air outlet adaptors, which can be repositioned to vary the direction of air, flow as required. A hand-operated valve cock, located to the lower left end of the heat unit, controls coolant flow through the heater unit.

70 The blower motor is controlled by the switch identified HEATER on the driver's instrument panel; the circuit, which is energised only when the engine ignition switch is set to on, is protected by the fuse identified HEATER 10A.

INTERIOR LIGHTS

71 Five interior lights (three in the hull, two in the turret) are provided. Those in the hull are located - one in the rear of the driving compartment and one in each rear corner of the fighting compartment. The turret interior lights are located - one on the left turret wall for the commander and one on the right turret wall for the gunner.

72 The lights are identical, each being individually controlled by a combined switch and dimmer control incorporated in its base.

73 Circuit protection for the hull interior lights is provided by a fuse identified INT LTS on the driver's instrument panel, and for the turret interior lights by the fuse identified F6 on the turret supply box.

74 For lamp details and fuse ratings, see Chapter 1.

EXTERIOR LIGHTS

75 The exterior lights comprise two headlights, two sidelights, two stop/tail-lights, a registration plate light, a convoy light, and four turnlights, which are also the hazard warning lights. IR lights are not provided.

76 The lights are controlled by switches on the driver's instrument panel. The circuits (excluding the hazard warning light circuit) are protected by the fuse identified LIGHTS, which is also on the driver's instrument panel.

Headlights

77 These are identical units fitted with a removeable glass lens. Removal of the lens allows access to the twin filament bulbs which allow 'main' or 'dipped' beam operation as required.

78 The headlight mounting bolt is of a resilient type in which a rubber bush is utilised as a means to isolate the sealed beam unit from possible hull vibration.

Sidelights, turnlights and tail/stoplights

79 These are the same general construction each having a screw-in type glass lens which is white for the sidelights, red for the stop/tail-lights and amber for the turnlights. The stop/tail-lights are each fitted with a double contact lampholder with staggered slots to ensure correct fitting of the appropriate lamp, the other lights have identical single contact lampholders fitted. All lampholders are provided with an earthing terminal.

80 For details of lamps fitted, see Chapter 1.

Registration plate light and convoy light

81 The registration plate light and the convoy light are identical. One is positioned beneath the rear towing eye as appropriate for the convoy light, the other is fitted to the right of the convoy light where it provides for illumination of the vehicle registration number.

82 The lights are of the masked type which allows an adjustable light setting. Each light comprises a clear glass lens and a cover, which has an adjustable light shield to provide for the selection of normal, or subdued lighting as required. The lamps are of the same type as those in the sidelights, for full details see Chapter 1.

To adjust a light shield

83 To adjust a light shield, proceed as follows:

83.1 Press inwards on the end of the shield and turn it to the fully clockwise or anti-clockwise position as appropriate.

83.2 Release the shield to permit it to be retained in position by an internally fitted spring.

Amber flashing beacon

84 The amber-flashing beacon is a rotating reflector type incorporating a drive motor. A mounting bracket located on the turret/cupola provides for mounting the beacon when required. Power connection to the light is made through the spotlight connection socket, via a switch on the cupola services switch box labelled SPOT, the circuit is protected by a 7 amp fuse located directly above the switch.

ACCESSORIES

Horn

85 An electric horn of waterproof construction located to the left in the transmission compartment is operated by the push button identified HORN on the driver's instrument panel. The circuit is not fused.

Oil pressure switch

86 The oil pressure switch operates to extinguish both the oil pressure warning light on the driver's instrument panel and the amber light on the Central Warning System when the engine oil pressure exceeds the minimum safe working value. It is fitted to the head of the engine oil filter.

Engine temperature switch

87 The engine temperature switch operates to illuminate the engine temperature warning light on the driver's instrument panel when the coolant overheats. It screws into the engine and is provided with a single push-on type terminal for connection with the warning light.

STARTER

88 The starter is fitted to the flywheel housing on the left side of the engine.

89 It has two main terminals for battery positive and battery negative connections, a solenoid switch is incorporated. The switch is controlled by the driver's start switch with the exception that if the motor is hot, due to its being overloaded, a thermal switch embedded in the yoke will open to 'break' the control circuit. The thermal switch will, as the motor cools, self-reset to restore the control circuit to normal.

90 The control circuit, which plugs into a terminal box at the side of the starter, also includes a switch (on gearbox) to prevent starter operation if a gear is selected.

USER MAINTENANCE**WARNINGS**

- (1) **CADMIUM PLATING.** THIS EQUIPMENT CONTAINS CADMIUM PLATED MATERIAL. REFER TO THE CADMIUM PLATING WARNING IN THE PRELIMINARY PAGES.
- (2) **PERSONAL INJURY.** WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.
- (3) **SILICA - TOXIC SUBSTANCE.** BEFORE WORKING ON THE VEHICLE, REFER TO THE SILICA WARNING IN THE PRELIMINARY PAGES.

To check security and cleanliness of batteries

91 To check the security and cleanliness of batteries, proceed as follows:

WARNINGS

- (1) **PERSONNEL HAZARD.** WORK ON BATTERIES MUST BE CARRIED OUT BY QUALIFIED PERSONNEL ONLY.
- (2) **HIGH CURRENT.** TURN OFF BATTERY MASTER SWITCHES BEFORE UNDERTAKING ANY BATTERY MAINTENANCE.
- (3) **ELECTROLYTE SPILLAGE.** IF BATTERIES ARE DAMAGED, CARE MUST BE TAKEN TO PREVENT ELECTROLYTE COMING INTO CONTACT WITH SKIN OR CLOTHING. IF ELECTROLYTE GETS ONTO THE SKIN IT MUST BE WASHED OFF WITH SOAP UNDER COLD RUNNING WATER.
- (4) **HIGH CURRENT.** CABLES MUST NOT BE CONNECTED OR DISCONNECTED DURING THE OPERATION OF THE VEHICLE.
- (5) **FIRE HAZARD.** DO NOT SMOKE OR ALLOW NAKED FLAMES IN THE VICINITY OF BATTERIES.
- (6) **HIGH CURRENT.** AVOID THE RISK OF HIGH CURRENT SHORT CIRCUITS; TAKE EXTRA CARE WHEN UTILISING METAL ITEMS OR TOOLS NEAR THE BATTERIES.
- (7) **RISK OF FIRE.** RADIO BATTERY MASTER SWITCH SHOULD NOT BE SWITCHED ON WHEN RADIO BATTERIES ARE DISCONNECTED.

CAUTIONS

- (1) **EQUIPMENT DAMAGE.** Work on batteries must be carried out by qualified personnel only.
- (2) **EQUIPMENT DAMAGE.** Defective batteries must be replaced immediately. Do not run vehicles with known defective batteries. Report to REME.
- (3) **DISPOSAL OF DISCHARGED BATTERIES.** Batteries withdrawn from service must be properly disposed of through the normal recycling process.

91.1 Put both battery master switches to OFF.

91.2 Check the security of the battery and battery securing clamps.

91.3 Ensure that cable connectors are clean and free from grease and firmly secured to the battery posts.

91.4 Examine for signs of damage including cracked, split or overheated/distorted case, loose or burnt away terminals and corrosion.

91.5 To correct any faults or to clean the batteries thoroughly the batteries will have to be removed, refer to REME.

To change a fuse

92 To change a cartridge fuse, proceed as follows:

92.1 Set all master switches to OFF.

92.2 Unscrew and remove the appropriate fuse cap with the fuse attached.

92.3 Remove the fuse and refit a new one (see Chap 1).

92.4 Insert the cap and fuse in the respective holder and tighten the cap (finger tight).

92.5 Check the system operates correctly. If the fuse blows, report to REME.

To change the battery indicator light lamp

93 To change the battery indicator light lamp, proceed as follows:

93.1 Set all master switches to OFF.

93.2 Unscrew and remove the red lens.

93.3 Remove and replace the lamp (see Chap 1 for type).

93.4 Refit the red lens.

93.5 Check the system operates correctly. If the lamp blows, report to REME.

To change a warning light on the Central Warning System

94 To change a warning light, proceed as follows:

94.1 Set the battery master switches to OFF.

94.2 Unscrew the lens, remove lens and withdraw lamp.

94.3 Fit new lamp and replace lens.

94.4 Check the system operates correctly. If the lamp blows, report to REME.

To replace the lamp in the hazard warning switch

95 To replace the lamp in the hazard warning switch, proceed as follows:

95.1 Set the battery master switches to OFF.

95.2 Unscrew the switch button to obtain access to the lamp.

95.3 Remove the bayonet capped lamp and fit a replacement (type as specified in Chap 1).

95.4 Replace the switch button and operate the switch to test the lamp. If the lamp blows report to REME.

To renew a warning light lamp on the driver's instrument panel

96 To renew a warning light lamp, proceed as follows:

- 96.1 Set the battery master switches to OFF.
- 96.2 Gently ease out the lamp holder from the instrument panel.
- 96.3 Withdraw the lampholder from the sleeve of the appropriate warning light and remove the bayonet capped lamp.
- 96.4 Refit a new lamp (type as in Chap 1) and reinsert the lampholder in the sleeve.
- 96.5 Replace and secure the lampholder in the instrument panel.
- 96.6 Check the system operates correctly. If the lamp blows, report to REME.

To renew an internally fitted instrument light lamp

97 To renew an internally fitted instrument light lamp, proceed as follows:

- 97.1 Set the battery master switches to OFF.
- 97.2 Gently ease out the lampholder from the instrument panel.
- 97.3 Locate and withdraw the appropriate lampholder and remove the screw capped lamp.
- 97.4 Refit a new lamp (type as in Chap 1) and reinsert the lampholder into its housing.
- 97.5 Replace and secure the panel front with care so as not to trap the internal wiring or dislocate the seal.
- 97.6 Check the system operates correctly. If the lamp blows, report to REME.

To renew a heavy duty fuse unit

98 To renew a fuse, proceed as follows:

- 98.1 Set the battery master switches to OFF.
- 98.2 Remove the fuse and carrier by pulling outwards on the carrier.
- 98.3 Unscrew two screws to withdraw the old fuse from the carrier, insert and secure a spare fuse.
- 98.4 Replace the carrier in the holder and push it fully inwards to ensure good electrical contact.
- 98.5 Check the system operates correctly. If the fuse blows, report to REME.

To change a headlight bulb

99 To change a headlight bulb proceed as follows:

- 99.1 Set the battery master switches to OFF.
- 99.2 Set the lighting switch on the drivers instrument panel to OFF.
- 99.3 Remove the headlight lens by removing the securing screws.

- 99.4 Press and twist the lamp anti-clockwise to remove it from the lamp holder.
- 99.5 Fit a new lamp of the correct rating (see Chapter 1).
- 99.6 Replace and secure the lens.
- 99.7 Check operation of the headlight. If it blows, report to REME.

To change a sidelight, turnlight and tail/stop light lamp

100 To change a lamp, proceed as follows:

- 100.1 Set the battery master switches to OFF.
- 100.2 Set the lighting switch on the drivers instrument panel to OFF.
- 100.3 Unscrew and remove the appropriate light lens.
- 100.4 Press and twist the lamp anti-clockwise to detach it from the holder.
- 100.5 Fit a new lamp (if a stop/tail ensure that the pins mate correctly with the staggered slots in the lampholder).
- 100.6 Replace the lens, ensure the threads are correctly engaged and tighten.
- 100.7 Check operation of the lamp, if it blows report to REME.

To change a registration plate and convoy light lamp

101 To change a lamp, proceed as follows:

- 101.1 Set the battery master switches to OFF.
- 101.2 Set the lighting switch on the driver's instrument panel to OFF.
- 101.3 Unscrew and remove the three screws that the secure the cover to the light unit.
- 101.4 Withdraw the cover with care to ensure retention of the glass lens.
- 101.5 Remove the old lamp and fit a new one.
- 101.6 Check that the cover gasket is intact and refit the cover with the light aperture facing downwards.
- 101.7 Check operation of the lamp, if it blows report to REME.

GENERATING SYSTEM

General

102 The system comprises an alternating current (a.c.) alternator, a generator panel, two 'alternator only' relays and an alternator warning light in circuit with the amber light of the Central Warning System. The alternator is capable of sustaining the more heavily rated loads (i.e. NBC, fan and cooking vessel loads) while maintaining the hull and turret batteries in a charged condition. A transistorised voltage regulator within the alternator panel controls system voltage. Current control is dependent upon a self-regulating characteristic of the alternator; the circuit is not fused.

Alternator

103 The alternator is mounted on the right sponson of the engine compartment where it is driven by a belt and pulley coupling with the gearbox input shaft. It is of the self-excited type incorporating a 3-phase alternator and silicon diodes to provide the rated output of 140 amps. The alternator is water-proofed and ventilated by a fan fitted to the rotor shaft inside the casing.

Generator panel

104 The generator panel is secured to the driver's/transmission compartment bulkhead via four resilient mounts. It is a sealed unit incorporating a voltage regulator, battery relay, radio interference suppression network and other electronic components associated with the generating system control.

105 Connections to the panel are via plug and socket connectors.

Relays

106 There are two relays in the distribution panel which function to energise the NBC fan and cooking vessel circuits when the generating system is operative.

Alternator warning light

107 The alternator warning light (Fig 2 (12)) and the amber light of the Central Warning System will glow when energised via the engine ignition switch. An output voltage from the alternator equal to the battery voltage will cause the lights to extinguish. The light should remain extinguished at all engine speeds in excess of 650 rev/min to signify that the alternator is functioning.

Alternator drive

108 The alternator is driven (at approximately 3 x engine speed) by the belt and pulley system shown in Fig 3. The internally toothed belt (11) transmits drive to the cooling fan, which in turn transmits drive to the alternator via the multi-vee belt (4). The alternator drive belt is tensioned by a pulley (2), which rotates about a stub axle incorporated in an adjustable bracket.

GENERATING SYSTEM USER MAINTENANCE

109 The alternator and drive belt tensioner bearings are of the pre-lubricated, sealed type requiring no attention between routine overhauls. The alternator drive belt must be checked periodically in accordance with the Maintenance Schedule, but can be visually checked when the opportunity arises, for example when the air inlet louvres have been raised for checks on radiator or transmission. Refer to Para 111 for examination criteria. Check the security of the screw-type harness connectors to the generator panel; retighten (by hand) if necessary.

To charge the batteries using the vehicle alternator

110 To charge the batteries using the vehicles alternator proceed as follows:

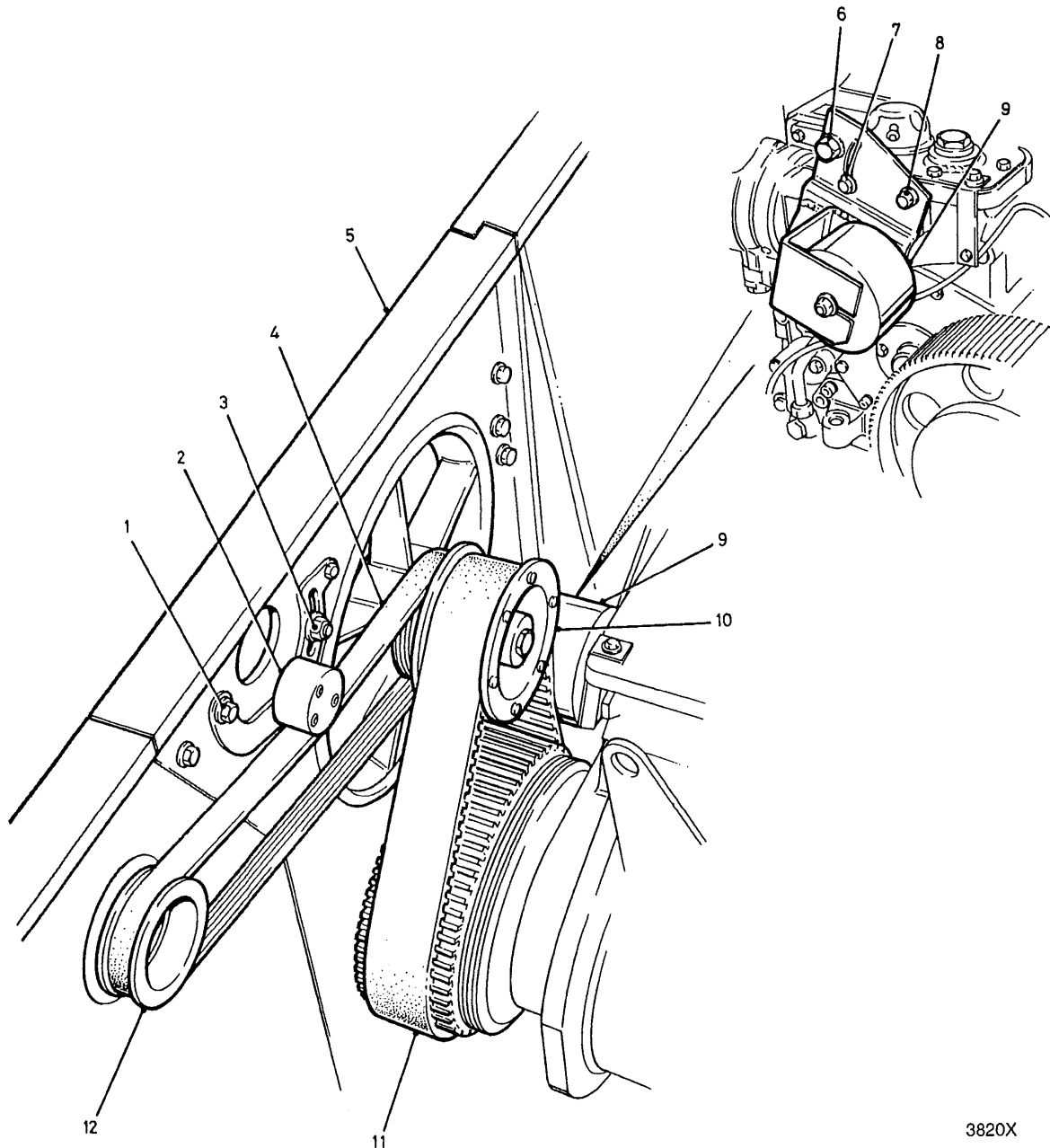
110.1 Put the vehicle master switch to 'ON'.

110.2 Start the engine (Chapter 12).

110.3 The alternator should come 'on line' over 650 rpm, extinguishing the alternator warning light and indicating a charge on the ammeter. However it may necessary (first start of the day) to increase the engine speed until the alternator warning light goes out and a charge is indicated on the ammeter.

110.4 Check periodically to see if the required charging rate requires adjustment of the engine speed.

110.5 After charging is complete stop the engine and put the vehicle master switch to OFF.



- | | | | |
|---|--|----|--------------------------------------|
| 1 | Pivot bolt (alternator belt) | 7 | Cooling fan belt adjusting nut |
| 2 | Tensioning pulley (alternator belt) | 8 | Pivot bolt (cooling fan belt) |
| 3 | Adjusting nut (alternator belt) | 9 | Tensioning pulley (cooling fan belt) |
| 4 | Alternator drive belt (multi vee belt) | 10 | Cooling fan belt retaining flange |
| 5 | Bulkhead section | 11 | Fan drive belt (toothed belt) |
| 6 | Welded hexagon head | 12 | Alternator drive pulley |

Fig 3 Alternator drive system

Alternator drive belt – visual examination

111 To examine the alternator drive belt, proceed as follows:

111.1 Position the vehicle on firm level ground, apply the parking brake and set the battery master switches to OFF. Raise and secure the transmission louvres and raise the radiator.

111.2 Examine the alternator drive belt (Fig 3 (4)) using the following criteria. If replacement is necessary report to Advanced driver or REME.

111.2.1 Any cracking along the length of the belt at the roots of grooves.

111.2.2 Fraying caused by excessive cracking across the width of the belt (minimal cracking is acceptable).

111.2.3 Any damage caused by lubricants, or impact by foreign objects.

NOTE

Replacement of the alternator drive belt is an Advanced driver/REME task.

111.3 Lower and secure the transmission louvres.

To check the alternator drive belt tension

112 On the longest run (bottom run) of the alternator drive belt check that the free play (deflection) is approximately 13 mm (0.5 inches). If the free play is incorrect the belt will require adjustment.

To adjust the alternator belt tension

113 To adjust the alternator belt tension proceed as follows:

113.1 Position the vehicle on firm level ground, apply the parking brake and set the battery master switches to OFF.

113.2 Raise and secure the transmission louvres and raise the radiator.

113.3 Slacken the pivot bolt (Fig 3 (1)), do not undo fully.

113.4 Slacken the adjusting nut (3) enough to enable the adjusting bracket to move.

113.5 To tighten the belt, apply gentle downward pressure on the bracket. This will press down on the belt applying tension. Once the belt has an overall deflection of approximately 13 mm (0.5 inches) tighten up on the adjusting nut then the pivot bolt.

CAUTION

EQUIPMENT DAMAGE. An over-tightened alternator drive belt can cause damage to the pulley bearings on the alternator drive system.

113.6 To reduce tension on a belt that is too tight, lift upward on the bracket and proceed as Sub-para 113.5.

113.7 Once the adjusting nut and pivot bolt are tight, re-check belt tension (Para 112) to confirm.

NOTE

If the correct tension cannot be achieved report to an Advanced driver or REME to replace the belt.

113.8 Lower the radiator and close and secure the transmission louvres.

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CHAPTER 11
RADIO AND INTERCOMMUNICATION
CONTENTS

Para

- 1 General
- 2 Suppression of electrical interference to radio services

GENERAL

1 For operating information on the installed radio and communications equipment, refer to DAESP 5895-G-200 Series Bowman/CIP Communications System CIETP.

SUPPRESSION OF ELECTRICAL INTERFERENCE TO RADIO SERVICES

2 The operation of VHF radio sets calls for a high standard of vehicle suppression if interference is to be effectively suppressed and full use of sets obtained. Efficient servicing of the electrical system is, therefore essential and it must be remembered that although a vehicle is not carrying a radio set, it can cause interference to nearby radio sets. The important points are as follows:

- 2.1 Make sure that there is no intermittent contact on any fuse, switch or terminal.
- 2.2 Keep all connections and mating surfaces clean and free from paint, corrosion and lubricants.
- 2.3 Keep all bonding strips and earth braids free from corrosion, paint or dirt and ensure that they are properly secured.
- 2.4 Do not paint under bonding strips or other parts intended to be in electrical contact.
- 2.5 Ensure that the cable screening is not corroded or frayed and that it is properly earthed at both ends. Metal-to-metal contact must be maintained throughout all screened circuits.
- 2.6 Ensure that all components, covers and brackets are firmly secured.
- 2.7 Do not interfere with the vehicle wiring or make improvised connections.
- 2.8 Do not remove any suppression equipment fitted.
- 2.9 Refrain from using any switch unnecessarily.
- 2.10 Report immediately any defect, which may affect the standard of suppression of the vehicle.

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CHAPTER 12

VEHICLE OPERATION

CONTENTS

Para

- 1 Introduction
- Normal engine starting procedure
- 2 Engine pre-starting checks
- 3 Engine starting procedure (to -10 deg C) (CAUTION)
- Driving
- 4 Normal driving from rest (WARNINGS)
- 5 Cross-country driving
- 6 Road driving (CAUTION)
- 7 Engine stopping procedure (WARNING) (CAUTIONS)
- 8 Emergency starting using another vehicle (WARNING) (CAUTION)
- 10 Starting the vehicle by towing (WARNINGS) (CAUTIONS)
- 11 Vehicle towing
- 13 Steering in forward and reverse gears
- 14 Steering in neutral (WARNING) (CAUTION)
- Braking (WARNING)
- 15 Normal braking
- 16 Emergency braking
- 17 Leaving the driver's compartment (WARNINGS)
- 18 Action in the event of failure
- 19 Loss of steering
- 20 Loss of track (WARNING)
- 21 Loss of brakes (CAUTION)
- 22 Loss of track tension
- 24 Loss of drive (WARNING) (CAUTIONS)
- 25 Mini pipe fascine
- 26 Nylon Kinetic Energy Recovery Rope (KERR) (WARNINGS) (CAUTIONS)
- Maintenance and inspection
- 37 Maintenance (CAUTIONS)
- 41 Inspection (WARNING)
- 51 Service life of the KERR
- 52 Evacuation of casualties
- 53 Medical aspects of rescue
- 56 Action in an emergency
- 57 Rescue priorities



(continued)

CONTENTS (continued)

Para

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4	Minimum distance between towing eyes and apex of towing attachment	14
5	Safety zone	15

6

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Annex

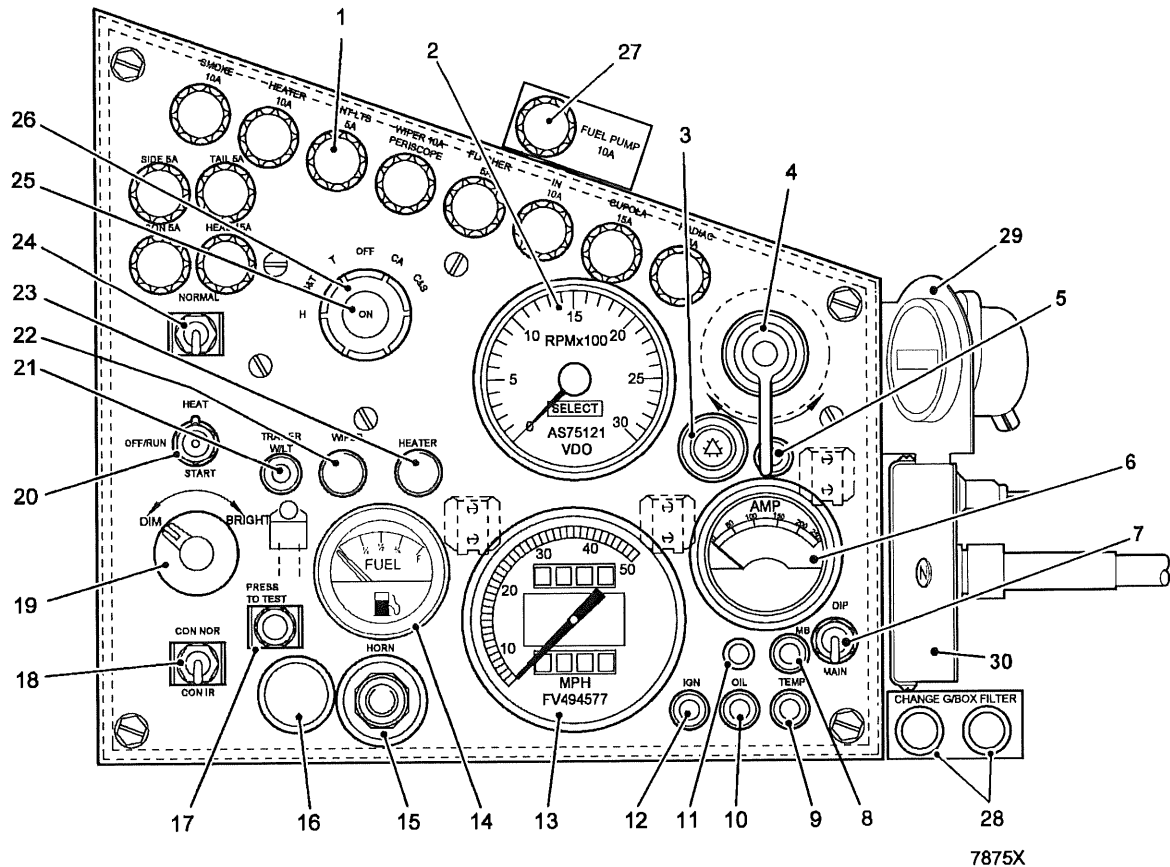
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Vehicle operation cold environments (-10 deg C and below)

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INTRODUCTION

1 This chapter details the basic crew operating procedures for vehicle operation of CVR(T) Diesel vehicles.



- | | | | |
|----|-----------------------------------|----|---|
| 1 | Fuse unit (typical 12 off) | 16 | Spare fuse container |
| 2 | Tachometer | 17 | Press to test switch (for temp warning light) |
| 3 | Hazard warning light switch | 18 | Convoy light changeover switch |
| 4 | Turnlight switch | 19 | Instrument light dimmer control |
| 5 | Turnlight warning light | 20 | Thermostart/starter switch |
| 6 | Ammeter | 21 | Trailer warning light (not used) |
| 7 | Headlight dipswitch | 22 | Driver's periscope wiper switch |
| 8 | Main beam warning light | 23 | Heater switch |
| 9 | Coolant temperature warning light | 24 | [REDACTED] |
| 10 | Oil pressure warning light | 25 | Ignition switch |
| 11 | Speedometer trip set reset knob | 26 | Lighting switch |
| 12 | Alternator warning light (IGN) | 27 | Fuel pump fuse |
| 13 | Speedometer | 28 | Gearbox filter warning lights |
| 14 | Fuel gauge | 29 | Hour meter (Samson only) |
| 15 | Horn pushbutton switch | 30 | Gear indicator (Variants position) |

Fig 1 Driver's Instrument panel

NORMAL ENGINE STARTING PROCEDURE**Engine pre-starting checks**

- 2 The following checks should be made before the engine is started:
 - 2.1 Check that the vehicle has had the correct daily maintenance carried out as detailed by the Maintenance Schedule.
 - 2.2 Check that the area around the vehicle is clear of personnel and equipment.
 - 2.3 Check the security of the driver's hatch and that it is locked in position.
 - 2.4 Ensure that the parking brake is applied.
 - 2.5 Ensure that the hull battery master switch is set to OFF.
 - 2.6 If necessary adjust the driver's seat and rear view mirrors.
 - 2.7 Check that both steering levers are fully forward.
 - 2.8 Check that the gear change pedal (GCP) is in neutral.
 - 2.9 Check there is no obstruction or fouling to the accelerator pedal.

Engine starting procedure (to - 10 deg C)

- 3 To start the engine proceed as follows:
 - 3.1 Place the forward/reverse (transfer) lever (Chap 3, Fig 3 (20)) in the appropriate position for the required direction of travel.
 - 3.2 Using the foot operated gear change control pedal (GCP) (18), check that neutral position is selected. The gear position indicator (Fig 1 (29)) located on the driver's instrument panel will show N (no further downward movement of pedal using toe of the foot).
 - 3.3 Ensure that the fuel cut-off control (Chap 3, Fig 3 (7)) is pushed fully home.
 - 3.4 Turn the battery master switch to the ON position and place the ignition switch (Fig 1 (25)) in the ON position.
 - 3.5 Check that the oil pressure warning light (10) and the alternator warning light (12) on the driver's instrument panel glow.
 - 3.6 Check that the amber warning light of the central warning system (located in the binnacle mounted on top of the LH side and turn light) flashes. The binnacle lights should extinguish when the engine is running.
 - 3.7 Check that the fuel gauge (14) indicates sufficient fuel.
 - 3.8 If an engine thermostart is fitted, place the engine thermostart/starter switch (20) to the HEAT position to operate the electrically heated element and hold in that position for approximately 10 seconds. Move the switch down to the START position to engage the starter motor, as soon as the engine fires release the switch (it is spring loaded to the central OFF/RUN position). If the engine fails to start ensure that the flywheel and starter pinion have stopped rotating before attempting to re-engage the starter motor.

CAUTION

EQUIPMENT DAMAGE. Do not rapidly increase and decrease the engine revolutions immediately after starting.

3.9 With the engine idling observe that the oil pressure (10) and alternator warning light (12) go out and that a charge rate is shown on the ammeter (6) (it may be necessary to slightly increase engine speed). The battery indicator light on the distribution panel should glow faintly. Check the gearbox filter warning lights (28) are not illuminated, if they are, do not move the vehicle, replace the oil filter.

3.10 Increase engine speed to check operation of the tachometer (2) and then allow the engine speed to drop to idling and using the tachometer, check the idling speed is approximately 700 rpm. The engine should run smoothly.

DRIVING

NOTE

Driving techniques are Operational Information - see Disclaimer, Preliminary Pages, Page (vi).

Normal driving from rest

4 To move off from rest, proceed as follows:

WARNINGS

(1) **PHYSICAL INJURY. ENSURE THAT SAFETY HARNESSSES ARE WORN AND CORRECTLY ADJUSTED AT ALL TIMES WHEN THE VEHICLE IS IN MOTION.**

(2) **PHYSICAL INJURY. DEPENDING UPON THE ANGLE BETWEEN THE VEHICLE AND GROUND SURFACE, WITH THE VEHICLE STATIONARY AND THE ENGINE IDLING, THE VEHICLE MAY MOVE IF EITHER THE DRIVER'S FOOTBRAKE OR THE PARKING BRAKE IS RELEASED.**

(3) **PHYSICAL INJURY. BEFORE MOVING THE VEHICLE ENSURE THAT THE DRIVER'S HATCH IS SECURED. SERIOUS INJURY CAN RESULT IF THE DRIVER'S HATCH SWINGS CLOSED WHEN MOVING THE VEHICLE WITH THE DRIVER IN THE 'HEAD UP' POSITION.**

4.1 Using the transfer lever, select forward or reverse as required.

4.2 With the engine running at idling speed, select E (tight manoeuvres) or 2nd gear with the gear change pedal.

NOTE

Gear selection will depend on the initial manoeuvre, type of terrain or the commander's verbal commands.

4.3 Simultaneously release the parking brake and progressively press the accelerator pedal.

4.4 Accelerate away changing to the next highest gears as necessary, ensuring that the engine does not overspeed, or labour in any of the gears, avoiding if possible, the application of steering until sufficient power output is developed by the engine to maintain steer without a reduction in engine speed.

NOTE

The centrifugal clutch should be completely disengaged with the engine idling at 700 – 750 rpm. The clutch should start to take up the drive at 900 rpm. Where possible, the engine speed should be maintained at a minimum of 1500 rpm by selecting the appropriate gear to suit the road speed – this ensures that the centrifugal clutch is positively engaged and minimises wear to the friction linings.

Cross-country driving

5 The following factors are to be considered when driving the vehicle across country (off-road driving):

5.1 Adjust the speed of the vehicle as necessary to suit the terrain, by use of an appropriate gear to maintain optimum engine speeds (as per Sub-para 4.4).

5.2 Ensure that the necessary gear down-changes are made prior to negotiating steep ascents, obstacles or descents.

5.3 Gears may need to be held to maintain maximum engine torque when climbing long gradients.

Road driving

6 The following factors are to be considered when driving the vehicle on the road:

CAUTION

AUTOMOTIVE DAMAGE. It is possible particularly on down gradients to exceed the specified maximum speed of the vehicle. The driver must ensure that the vehicle does not exceed the maximum speed as laid down in standing orders, to retain control of the vehicle and avoid damage to automotive components.

6.1 Under normal conditions only gears in the range 2 - 7 are required on the road. 'E' can be used when negotiating tight corners or junctions.

6.2 'E' reverse gear only is to be used to reverse the vehicle on the public highway.

6.3 If constant steering corrections must be made in the same direction to maintain the vehicle driving in a straight line (where the road surface is flat and level, without camber etc.), a fault should be suspected and reported to REME at the earliest opportunity.

ENGINE STOPPING PROCEDURE

7 To stop the engine proceed as follows:

WARNING

VEHICLE MOVEMENT. IF THE PARKING BRAKE FAILS TO HOLD THE VEHICLE, THE TRACKS MUST BE CHOCKED BEFORE THE ENGINE IS SWITCHED OFF.

7.1 Bring the vehicle to a halt and apply the parking brake.

7.2 Select neutral gear with the gear change pedal and check that the gear position indicator shows N.

7.3 Allow the engine to slow down to its normal idling speed.

CAUTIONS

(1) **EQUIPMENT DAMAGE.** Do not 'blip' the accelerator pedal before switching off the engine, as serious damage may be caused to the turbocharger.

(2) **EQUIPMENT DAMAGE.** To avoid damage to the turbocharger, allow the engine to idle for 3-4 minutes to allow the turbocharger to slow and cool before stopping the engine. Only under operationally essential and circumstances of safety may the engine be switched off immediately prior to turbocharger run down and cool.

(3) **EQUIPMENT DAMAGE.** Power must not be turned off while the vehicle is in motion.

7.4 Pull and hold the fuel cut-off control until the engine has stopped. When the engine has stopped, release the control and allow it to return to the fully in position.

7.5 Ensure that the alternator warning light, oil pressure warning light and amber light on the central warning system illuminate.

7.6 Move the ignition switch to the OFF position to extinguish the warning lights.

EMERGENCY STARTING USING ANOTHER VEHICLE

8 If the vehicle cannot be started because the batteries are insufficiently charged, the batteries on a second vehicle can be used as a slave.

9 To start the vehicle using another vehicle, proceed as follows:

WARNING

DANGER TO PERSONNEL. ON TURRETED VEHICLES THE TURRET BATTERY MASTER SWITCHES MUST BE IN THE 'OFF' POSITION BEFORE CONNECTING THE INTER-VEHICLE LEAD, AND MUST REMAIN IN THE 'OFF' POSITION UNTIL AFTER THE LEAD HAS BEEN DISCONNECTED.

CAUTION

EQUIPMENT DAMAGE. Care must be exercised that the centre terminal of the inter-vehicle cable does not contact any metal parts once one end of the cable has been connected.

9.1 Set all battery master switches on both vehicles to OFF and connect the inter-vehicle connecting lead (stowed item) to the respective inter-vehicle starting sockets on the distribution panels.

9.2 Set the hull battery master switch on the 'slave' vehicle to ON.

9.3 Start the 'slave' vehicle and run the engine at a fast idling speed, ensuring that the alternator warning light is extinguished indicating the alternator is 'on line'.

9.4 Carry out engine pre-starting checks (Para 2).

9.5 Set the hull battery master switch on the casualty vehicle to ON and check that the battery indicator light does not glow. If the light does glow it indicates a fault (see Chapter 9), investigate and if necessary report to REME.

9.6 Start the engine in the normal way (Para 3) and run the engine at a fast idling speed.

9.7 On the slave vehicle reduce the engine to the normal idling speed. Operate the relevant controls to stop the engine (Para 7). Set all battery master switches to OFF and disconnect the inter-vehicle connecting lead.

9.8 On the casualty vehicle reduce the engine to the normal idling speed, disconnect and stow the inter-vehicle connecting lead. Replace the inter-vehicle starting socket covers.

STARTING THE VEHICLE BY TOWING

NOTE

Refer to Disclaimer, Preliminary Pages, Page (vi).

WARNINGS

(1) **VEHICLE CONTROL. THE COMMANDER OF THE TOWING/TOW STARTING OPERATION IS TO FULLY BRIEF ALL PERSONNEL ON CORRECT SYNCHRONISATION BETWEEN CONTROLLERS AND DRIVERS. SPECTATORS MUST ALSO BE KEPT WELL CLEAR OF THE TOWING/TOW STARTING AREA.**

(2) **PHYSICAL INJURY. WHEN REVERSING THE TOWING VEHICLE USE A LOW GEAR. THIS OPERATION MUST BE DONE AT LOW SPEED AND UNDER TIGHT CONTROL AND BE SUPERVISED BY THE COMMANDER OF THE TOWING VEHICLE.**

(3) **PHYSICAL INJURY. WHEN HANDLING THE TOW ROPES PERSONNEL ARE TO WEAR PROTECTIVE GLOVES.**

(4) **PHYSICAL INJURY. WHEN STARTING A VEHICLE BY TOWING, THE DRIVER OF THE CASUALTY VEHICLE MUST BE CLOSED DOWN.**

CAUTIONS

(1) **EQUIPMENT DAMAGE. No vehicle is to be used to tow a vehicle of a heavier class.**

(2) **EQUIPMENT DAMAGE. All towing equipment must be inspected prior to tow starting to ensure it is serviceable.**

10 To start the vehicle by towing proceed as follows:

10.1 Attach the tow-ropes to the casualty vehicle.

10.2 On the casualty vehicle, set the controls for normal starting (Para 3), set all the master switches to ON and check that the ignition switch is in the ON position.

10.3 Engage fourth gear and forward drive in the casualty vehicle.

10.4 Engage first or second gear and forward drive in the towing vehicle.

WARNING

PHYSICAL INJURY. WHEN STARTING A VEHICLE BY TOWING, THE DRIVER OF THE CASUALTY VEHICLE MUST BE CLOSED DOWN.

10.5 With the casualty vehicle closed down, release the parking brake on the casualty vehicle and commence towing. When the engine starts, a signal to the towing vehicle should be made, change down to neutral, give the signal to cease towing, the towed vehicle should gently apply the brakes bringing both vehicles to a halt, apply the parking brake on both vehicles.

10.6 Remove, inspect and stow the towropes.

NOTE

Do not continue towing if the engine does not start readily.

VEHICLE TOWING

11 An 'A' frame is always to be used for towing. When being towed, the forward/reverse linkage and gear control pedal must be in the neutral position. Towing speed must not exceed [REDACTED]. Towing operations are to be supervised by qualified personnel.

12 The vehicle is not to be towed further than [REDACTED] with the gearbox couplings connected. The final drive input shafts must be disconnected before attempting to tow a vehicle with a seized gearbox (refer to Chapter 7.3).

STEERING IN FORWARD AND REVERSE GEARS

13 When steering in either forward or reverse gear, the vehicle will turn to the side on which the steering lever is operated (see Fig 2).

Steering in neutral

WARNING

PERSONAL INJURY. DO NOT OPERATE THE STEERING LEVERS WITH THE ENGINE RUNNING AT IDLING SPEED AND THE TRANSMISSION IN NEUTRAL, AS THIS COULD CAUSE THE VEHICLE TO PIVOT.

CAUTION

EQUIPMENT DAMAGE. Pivot turns should be avoided on rough or heavy ground, as it places excessive strain on the transmission and may result in a track being thrown.

14 With the engine running above idling speed and no gear engaged, the vehicle can be steered. On hard level ground the vehicle will pivot about its centre with one track going forward and the other going backward, (as in Fig 2). If, however, the ground is uneven, the drive may be distributed unevenly, so that one track might stop and the vehicle be driven by the other. Steering in neutral should be avoided on rough or heavy ground; it puts excessive strain on the transmission and may result in a track being 'thrown'.

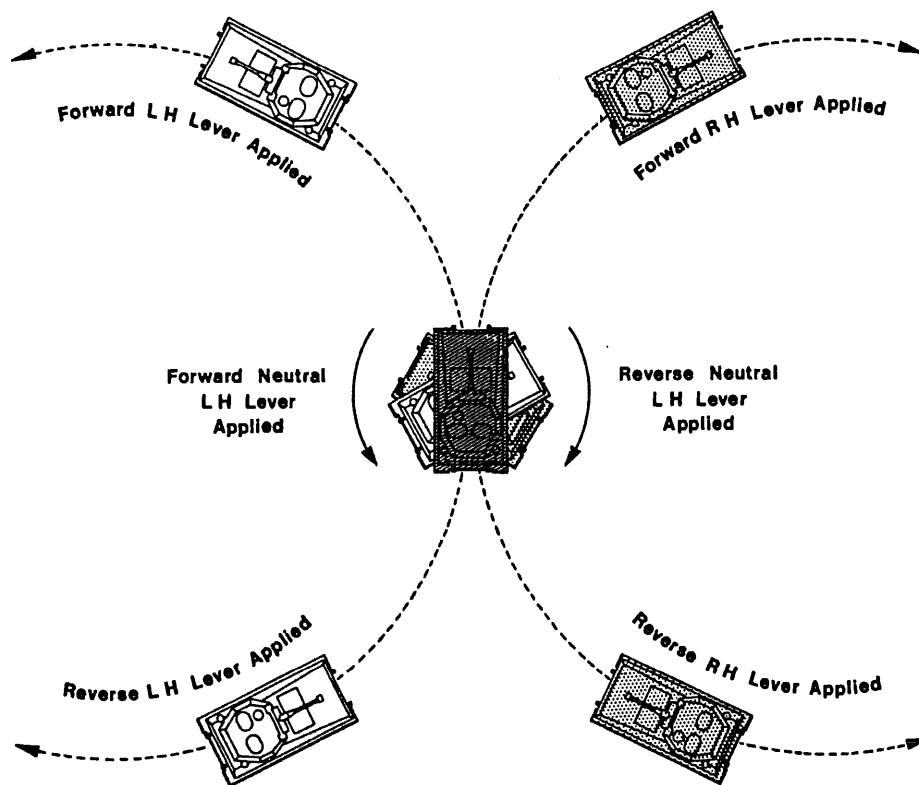
BRAKING

WARNING

MOVEMENT OF THE VEHICLE. DEPENDENT UPON THE GRADIENT, WITH THE VEHICLE STATIONARY AND THE ENGINE IDLING, THE VEHICLE MAY MOVE IF EITHER THE DRIVERS FOOTBRAKE OR PARKING BRAKE IS RELEASED.

Normal braking

15 Lift the right foot from the accelerator pedal and allow the vehicle to slow down and come to a rest. Operate the footbrake pedal as necessary, avoiding steering and braking at the same time.



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Fig 2 Steering operation

Emergency braking

16 If an emergency stop is required, depress the footbrake pedal progressively and firmly, and hold in the fully braked position until the vehicle has come to a halt.. Maintain footbrake pressure, apply the parking brake and using the gear change pedal select neutral. Release the footbrake.

LEAVING THE DRIVER'S COMPARTMENT**WARNINGS**

(1) **VEHICLE MOVEMENT. CARE SHOULD BE EXERCISED WHEN LEAVING THE DRIVER'S COMPARTMENT TO AVOID ACCIDENTALLY MOVING A STEERING LEVER IF THE ENGINE IS RUNNING. ACCIDENTALLY MOVING A STEERING LEVER CAN INITIATE AN UNPLANNED PARTIAL NEUTRAL TURN.**

(2) **VEHICLE MOVEMENT. WHEN THE PARKING BRAKE IS APPLIED, IF NEUTRAL IS NOT SELECTED THE VEHICLE CAN STILL ENGAGE GEAR WHEN THE ACCELERATOR IS DEPRESSED.**

17 Prior to leaving the driver's compartment, ensure the following:

- 17.1 The parking brake is applied.
- 17.2 The gear change pedal and transfer lever are set to the neutral position.

ACTION IN THE EVENT OF FAILURE

NOTE

Refer to Disclaimer, Preliminary Pages, Page (vi).

18 If the driver experiences a failure or a warning light illuminates, the first action is to report the failure to the vehicle commander. The vehicle commander will assess the overall/tactical situation and decide the course of action.

Loss of steering

19 If loss of steering occurs, bring the vehicle to a halt by braking gently. Avoid violent braking to prevent tracks locking. Apply the parking brake, engage neutral gear, release foot brake and investigate fault or report to REME.

Loss of track

WARNING

LOSS OF CONTROL. IF CONDITIONS DICTATE THE USE OF BRAKING, THE BRAKES MUST BE APPLIED GENTLY, AS THE VEHICLE MAY TURN IN THE DIRECTION OF THE REMAINING FITTED TRACK.

20 If a track becomes completely detached from the vehicle while on the move, allow the vehicle to come to a halt using the transmission down change of gears. Avoid application of the foot brake or parking brake, if possible.

Loss of brakes

CAUTION

TRANSMISSION DAMAGE. If a main brake failure occurs, the vehicle may be brought to a halt by progressive use of the parking brake. This, however, may cause damage to the transmission and is only to be used in an extreme emergency.

21 If a failure of the foot operated main brake occurs, bring the vehicle to a halt by means of the parking brake.

Loss of track tension

22 If a track becomes slack while the vehicle is in motion, allow the vehicle to slow down and bring gently to a halt.

NOTE

The vehicle may turn in the direction of the tightest track while slowing down.

23 Adjust track tension as detailed in Chap 8. Do not drive the vehicle with tracks that are incorrectly adjusted.

Loss of drive**WARNING**

VEHICLE MOVEMENT. IF THE PARKING BRAKE FAILS TO HOLD THE VEHICLE, THE TRACKS MUST BE CHOCKED BEFORE SWITCHING OFF THE ENGINE.

CAUTIONS

(1) TRANSMISSION DAMAGE. If the vehicle has not been brought to a halt and is still in motion, do not attempt to engage emergency gear.

(2) EQUIPMENT DAMAGE. Do not turn off the power while the vehicle is in motion.

24 If a loss of drive occurs while the vehicle is in motion and the engine is running normally, proceed as follows:

24.1 Maintain engine speed to retain steering capability.

24.2 Bring the vehicle to a halt and apply the parking brake.

24.3 Select neutral gear by means of the gear change pedal.

24.4 If further vehicle movement is required, engage emergency (E) gear using the gear change pedal and release the parking brake.

24.5 If no drive can be achieved when the emergency gear is selected, the loss of drive may be caused by an external transmission fault, such as final drive or drive shaft failure.

24.6 If no emergency drive can be obtained, apply the parking brake, select neutral gear and investigate fault, or report to REME.

MINI PIPE FASCINE

25 For information regarding the mini pipe fascine, refer to AESP 5680-C-100.

NYLON KINETIC ENERGY RECOVERY ROPE (KERR)

26 All recovery procedures should be carried out as directed by the REME Recovery Manual AESP 0200-A-308-013 and the All Arms Equipment Recovery Manual AESP 0200-A-307-013. Instructions regarding recovery using a Kinetic Energy Recovery Rope (KERR) are to be followed, but modified by the additional instructions given here.

WARNING

RISK OF DEATH OR SERIOUS INJURY. FAILURE TO OBSERVE AND FOLLOW THE ADDITIONAL INSTRUCTIONS MAY CAUSE FAILURE OF ONE OR MORE OF THE TOWING EYES ON THE RECOVERY VEHICLE AND OR THE CASUALTY VEHICLE. THIS COULD RESULT IN INJURIES TO PERSONNEL THAT COULD RESULT IN DEATH.

CAUTIONS

(1) **EQUIPMENT FAILURE.** CVR(T) Mk1 vehicles have recovery eyes that are welded to the hull of the vehicle. Due to the age of the vehicle and these welds their integrity cannot be guaranteed.

(2) **EQUIPMENT FAILURE.** Under no circumstance should a sideward pull be carried out with KERR using the recovery lugs to straighten up a vehicle prior to normal recovery. The shear loads on the recovery lugs could potentially be too great for the lugs to withstand.

(3) **EQUIPMENT FAILURE.** Deviation from any Single or Combination of the factors given below could lead to a serious equipment failure.

27 The following factors must be observed:

27.1 The recovery vehicle must always be on an axis parallel to the centre line of the casualty vehicle

27.2 Limit the speed of the CVR(T) Mk 2 recovery vehicle to [REDACTED] as detailed in Tables 2 to 5.

27.3 Limit the gear selection CVR(T) Mk 2 recovery vehicle to 3rd gear maximum as detailed in Tables 2 to 5.

27.4 Maximum run up length of 8 metres before KERR starts to take the load, applicable when a Mk 2 vehicle is being used as the recovery vehicle.

27.5 Slings or an 'A' frame, detailed in Table 1, are to be used to help spread the loads between the recovery lugs.

27.6 The centrally mounted towing pintle assembly (FV969723), fitted to Samson Mk 1, Samson Mk 2 and Scimitar Mk 2 vehicles, is not to be used in conjunction with the KERR system.

TABLE 1 EQUIPMENT TO BE USED

Item No.	Description	Part No.	NSN
1	Marlow Kinetic Energy Rope	WJA004	4020-99-832-0800
2	'A' Frame Tow Bar Assembly	FV840744	2590-99-834-8694
3	Twin Tow Bar Assembly	FV840676	2590-99-835-9677

28 Visually inspect the recovery lugs to be used on the recovery and casualty vehicles for signs of damage, weld cracking (Mk 1 vehicles), and security. If any damage or cracks are found or suspected, or the lugs are not secure, recover the vehicle using other methods.

29 The vehicles are to be connected as shown in Fig 3, using one of either Table 1 Item 2 or Table 1, Item 3, attached to the vehicle being used for the recovery and the vehicle being recovered.



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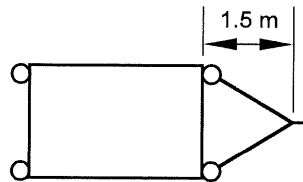
Fig 3 Connection of the vehicles

CAUTION

EQUIPMENT DAMAGE. The lifting eyes on the upper surfaces must not be used for recovery.

30 The towing/recovery eyes only are to be used (on the lower hull).

31 The distance between the vehicle and the apex formed by the two sides of the 'A' frame tow bar or the twin tow bar must not be less than 1.5 metres as shown in Fig 4.



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Fig 4 Minimum distance between towing eyes and apex of towing attachment

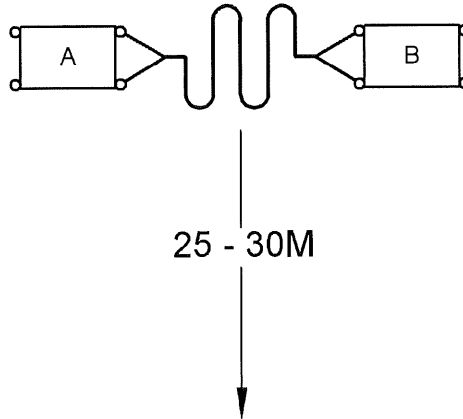
32 The KERR Table 1, Item 1 is to be connected between the 'A' frame tow bar or the twin tow bar on each vehicle.

33 When the recovery vehicle is a Mk 2 vehicle, position the recovery vehicle so that there is a maximum of 8 metres slack in the KERR.

WARNING

RISK OF DEATH OR SERIOUS INJURY. DURING RECOVERY A SAFETY ZONE OF 25 TO 30 METRES MUST BE MAINTAINED AROUND THE CASUALTY AND RECOVERY VEHICLES, MEASURED FROM THE CENTRE POINT BETWEEN THE TWO VEHICLES.

34 During the recovery, all personnel outside the vehicle should maintain a position 25 to 30 metres away perpendicular to the recovery direction. Refer to Fig 5.



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Fig 5 Safety zone

35 Carry out the recovery procedure i.a.w. the Publications referenced in Para 26.

36 Tables 2, 3, 4 and 5 detail the configuration of recovery points on both Mk 1 and Mk 2 recovery and casualty vehicles. The tables also detail any limitations associated with a particular configuration.

TABLE 2 FRONT RECOVERY POINTS TO FRONT RECOVERY POINTS ON CASUALTY

		Recovery Vehicle	
		CVR(T) Mk 1 ██████████	CVR(T) Mk 2 ██████████
Casualty Vehicle	CVR(T) Mk 1		Recovery using KERR is not recommended, see note below.
	Scimitar	FV2227806	
	Spartan	FV2228001	
	Sultan	FV2256302	
	Samaritan	FV2257061	
	Samson	FV2257064	
	CVR(T) Mk 2		✓
	Scimitar	FV2310770	
	Spartan	FV2308480	
	Sultan	FV2309100	
Samaritan	FV2309110		
Samson	FV2309120		

NOTE

Table 2 limitations. When recovering a Mk 1 casualty vehicle, it is not recommended to use KERR on a Mk 2 recovery vehicle. If using Mk 2 as a recovery vehicle, limit speed to ██████████ and use a maximum of 3rd gear with a maximum of 8 metres of slack in the KERR.

TABLE 3 REAR RECOVERY POINTS TO REAR RECOVERY POINTS ON CASUALTY

		Recovery Vehicle	
		CVR(T) LEP Diesel ██████████	CVR(T) Mk 2 ██████████
Casualty Vehicle	LEP(D) Scimitar (Core BOM)	✓	Recovery using KERR is not recommended, see note below.
	Scimitar FV2227806		
	Spartan FV2228001		
	Sultan FV2256302		
	Samaritan FV2257061		
	Samson FV2257064		
	CVR(T) Mk 2 (TES)	✓	Recovery using KERR is not recommended, see note below.
	Scimitar 2 FV2310770		
	Spartan FV2308480		
	Sultan FV2309100		
Samaritan FV2309110			
Samson FV2309120			

NOTE

Table 3 limitations. It is not recommended to use KERR on a Mk 2 recovery vehicle. If using Mk 2 as a recovery vehicle, limit speed to ██████████ and use a maximum of 3rd gear with a maximum of 8 metres of slack in the KERR.

TABLE 4 REAR RECOVERY POINTS TO FRONT RECOVERY POINTS ON CASUALTY

		Recovery Vehicle	
		CVR(T) LEP Diesel ██████████	CVR(T) Mk 2 ██████████
Casualty Vehicle	LEP(D) Scimitar (Core BOM)	✓	Recovery using KERR is not recommended, see note below.
	Scimitar FV2227806		
	Spartan FV2228001		
	Sultan FV2256302		
	Samaritan FV2257061		
	Samson FV2257064		
	CVR(T) Mk 2 (TES)	✓	Recovery using KERR is not recommended, see note below.
	Scimitar 2 FV2310770		
	Spartan FV2308480		
	Sultan FV2309100		
Samaritan FV2309110			
Samson FV2309120			

NOTE

Table 4 limitations. It is not recommended to use KERR on a Mk 2 recovery vehicle. If using Mk 2 as a recovery vehicle, limit speed to ██████████ and use a maximum of 3rd gear with a maximum of 8 metres of slack in the KERR.

TABLE 5 FRONT RECOVERY POINTS TO REAR RECOVERY POINTS ON CASUALTY

		Recovery Vehicle		
		CVR(T) LEP Diesel	CVR(T) Mk 2	
Casualty Vehicle	LEP(D) Scimitar (Core BOM)		✓	Recovery using KERR is not recommended, see note below.
	Scimitar	FV2227806		
	Spartan	FV2228001		
	Sultan	FV2256302		
	Samaritan	FV2257061		
	Samson	FV2257064		
	CVR(T) Mk 2 (TES)		✓	Recovery using KERR is not recommended, see note below.
	Scimitar 2	FV2310770		
	Spartan	FV2308480		
	Sultan	FV2309100		
Samaritan	FV2309110			
Samson	FV2309120			

NOTE

Table 5 limitations. It is not recommended to use KERR on a Mk 2 recovery vehicle. If using Mk 2 as a recovery vehicle, limit speed to [REDACTED] and use a maximum of 3rd gear with a maximum of 8 metres of slack in the KERR.

MAINTENANCE AND INSPECTION

Maintenance

CAUTION

EQUIPMENT DAMAGE. Do not allow the KERR to come into contact with heat sources or acids.

37 To prevent damage to the KERR in use or storage, it must not be placed:

- 37.1 On or near hot exhaust or exhaust pipes.
- 37.2 On or near sulphuric battery acid or other acids.
- 37.3 Near an open flame or other heat sources.

38 The KERR will function in the following environmental conditions:

- 38.1 Sun or heat up to 90°C (200°F).
- 38.2 Ice, snow and cold.
- 38.3 All petroleum, oil, lubricant (POL) environments.

39 Remove any obvious foreign bodies in the weave.

CAUTION

EQUIPMENT DAMAGE. Do not steam clean or force dry the KERR with hot air.

40 The KERR may be cleaned using water or soap and water and air dried.

Inspection**WARNING**

HAND INJURY. WEAR PROTECTIVE GLOVES WHEN HANDLING THE KERR. ANY SHARP OBJECTS EMBEDDED IN THE ROPE MAY CAUSE INJURY.

41 An initial inspection of the KERR should be made on first issue, to ensure there is no damage, or if so, to gauge the condition against future damage in the field.

42 Carry out a full inspection after each recovery operation.

43 Not all the KE developed in the KERR recovery process will be transferred to the casualty vehicle. Some of it is converted into friction heat within the KERR itself. The KERR gives a 'signal' in those instances where excessive energy may have developed. Heat build-up within the KERR can cause a melting and welding of the nylon fibres between strands and plaits.

44 The inspection for this condition is as follows:

44.1 Separate the strands of the rope with fingers.

44.2 Run fingers up and down between strands to check that the strands are free from each other and not heat welded together.

44.3 Repeat this at several points along the length of the rope. Pay particular attention to the area about two metres from the splice on each end.

44.4 If one or more strand to strand welds are found during this inspection of the KERR, it has most likely been over stressed and should be discarded.

45 The ground over which the KERR will be dragged can cause minor pulls in the outer yarns. These small tufts do not affect the performance of the KERR.

46 Check the KERR for cuts in the outer yarns and strands due to dragging over sharp or jagged objects. A few small cuts over the length of the KERR do not appear to degrade the strength or usefulness of the KERR. However, an increasing number of cuts and their depth, especially in concentrated areas, may be cause for discarding and replacing the KERR.

47 As a guide, the following parameters for inspecting the KERR may be useful until further experience is gained. The KERR should be replaced if:

47.1 More than three quarters of the strands in one plait in one location are severed.

47.2 More than 20 cuts each of two strands or more in its plait over the length of the KERR.

47.3 Two or more cuts along the KERR length, each of which has at least half the strands severed in its plait.

48 Check the KERR eye shroud for rips or tears. If rips or tears are present, move the shroud around the eye to utilize a non-torn area. The shroud is only a protective shield, for the KERR and has no load bearing function. The KERR will work just as well without it, but may wear out faster.

49 Check the eye splices. Each pull on the KERR tends to tighten the splices. The binding at the end of each plait may be displaced as the tension pulls the end of the plait into the splice. If the binding is missing, re-whip the end of the plait or tape it.

50 The KERR length will be longer after a recovery (note the original specified assembly length is 13.7 m). If a permanent set of 600 mm to 900 mm extra is evident, after a two or three week period, the KERR should be replaced.

Service life of the KERR

51 The KERR has no fixed service lifetime. If inspection after each recovery use shows no damage, within the levels defined, then it may continue to be used.

EVACUATION OF CASUALTIES

NOTE

Medical Aspects, Emergency Action, Evacuation and Rescue drills are Operational Information – refer to Disclaimer, Preliminary Pages, Page (vi).

52 The following procedures for evacuation of casualties from CVR(T) are based on the Scimitar and Spartan variants. All crew members operating the other variants must be fully conversant with the correct procedure for operating the access hatches/doors as laid down in the relevant variant Category 201.

MEDICAL ASPECTS OF RESCUE

53 The ability to perform prompt and effective first aid, particularly that aimed at the maintenance of breathing and control of bleeding is an essential requirement of all soldiers.

54 First aid, by definition, is the application of simple precautions pending the arrival of professional help. Remember that professional help may not be readily at hand. The person on the spot must therefore always act decisively, accepting any risks in making his decision.

55 The casualty's helmet must remain on throughout rescue operations and if possible the crew must support the casualty's head at all times.

Action in an emergency

56 The main points to look for and the priority of action are as follows:

56.1 Are you or the casualty in danger?

56.1.1 Remove the danger. Move the casualty only if absolutely necessary.

56.2 Check for consciousness:

56.2.1 A - Open the Airway.

56.2.2 B - Check for Breathing.

56.2.3 C - Check for Circulation (pulse).

56.2.4 D - Check for Disabilities i.e. breaks and burns etc.

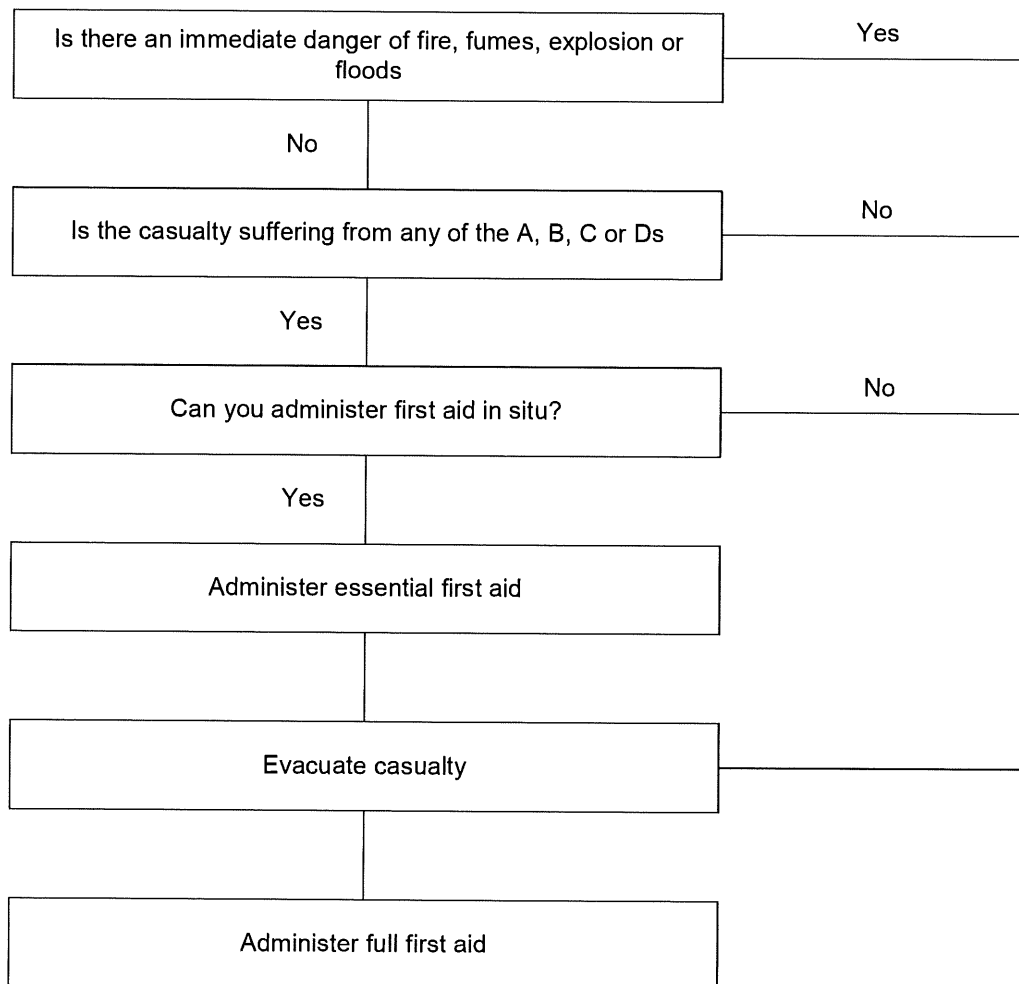
Rescue priorities

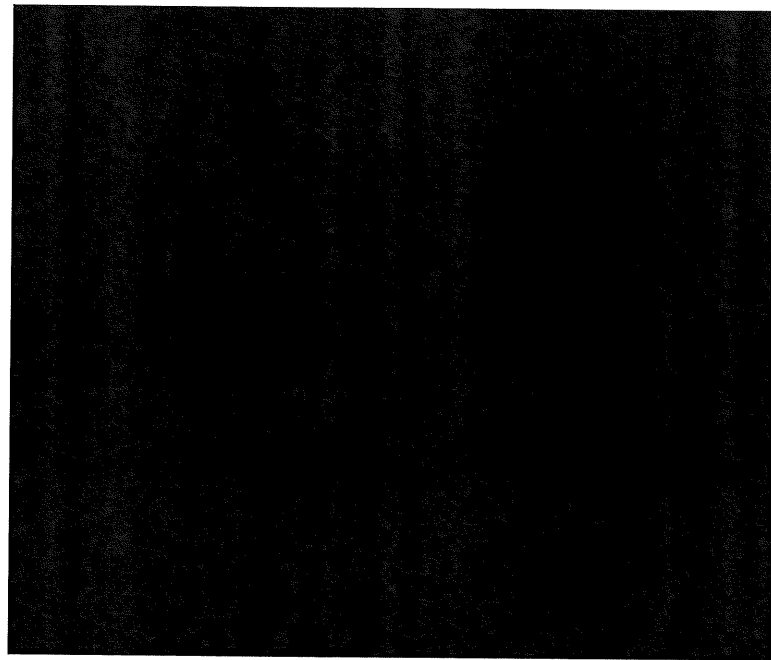
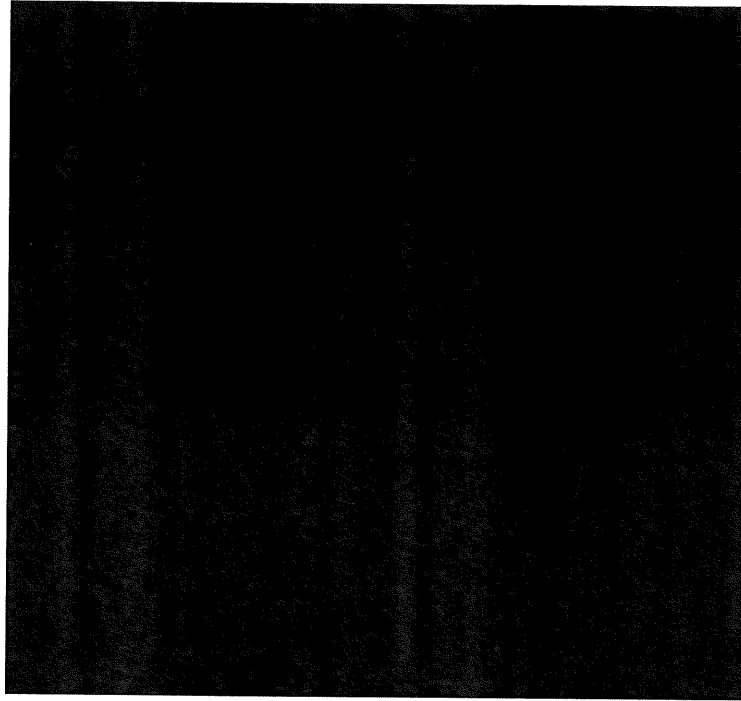
57 Whilst, as a general rule, first aid is most efficiently applied outside a vehicle, there are important exceptions. There are also rare occasions when first aid hardly matters at all initially. Table 6 shows the decisions to be made at the start of the rescue, by the senior active crewman.

58 Under active service conditions, or where there is immediate danger of fire, fumes or flood, the casualty must be evacuated from the vehicle to a place of safety where medical attention can be provided. An injured man in a sitting position may quickly die under certain circumstances, and as a general rule he should be in the recovery position as soon as possible. While the casualty is in a sitting or upright position his head must, at all times, be supported and held up to ensure that he can breath freely.

59 Where there is no immediate danger from enemy action, fire, flood or fumes, priority must be given to administering first aid and sending for skilled medical personnel. Breathing should be restored, bleeding arrested and the casualty treated for shock. Only if the casualty is in physical danger, as from a burning vehicle, should he be evacuated before medical attention arrives.

TABLE 6 EVACUATION DECISIONS





[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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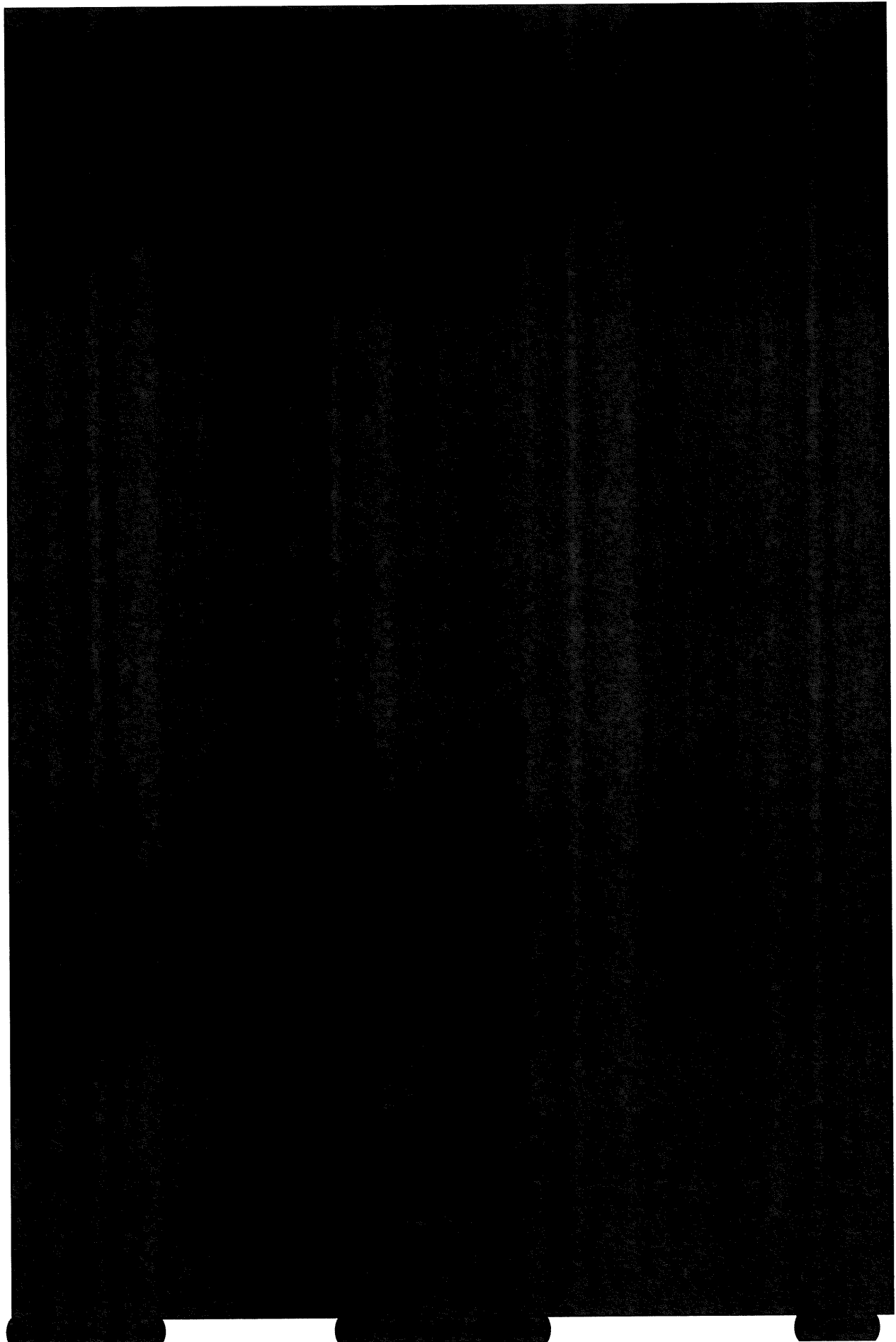
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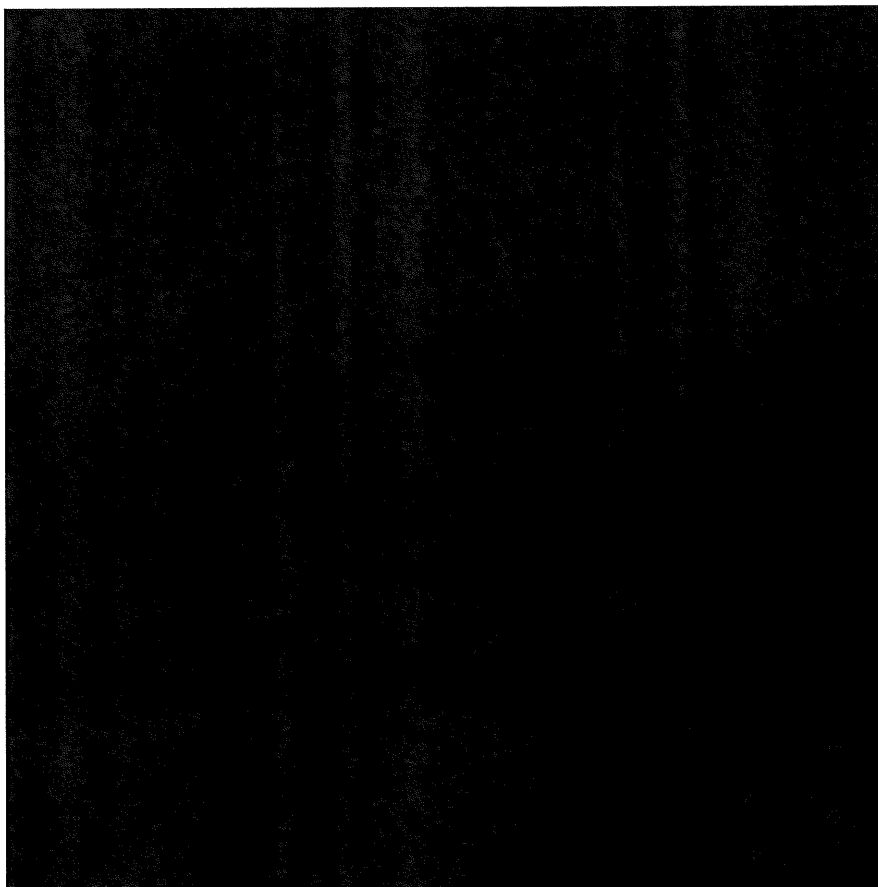
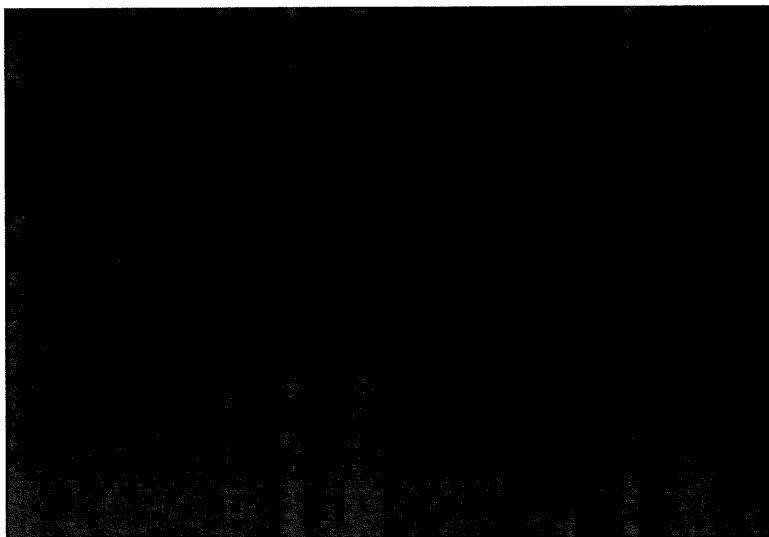
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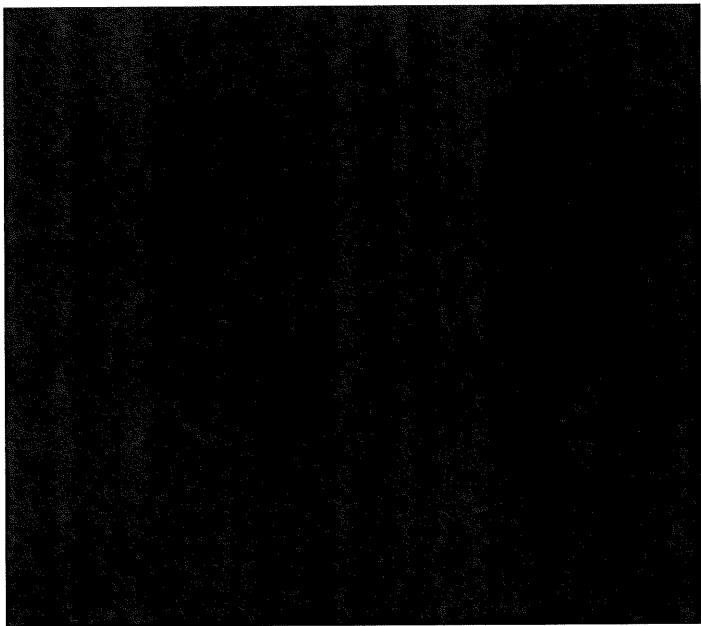
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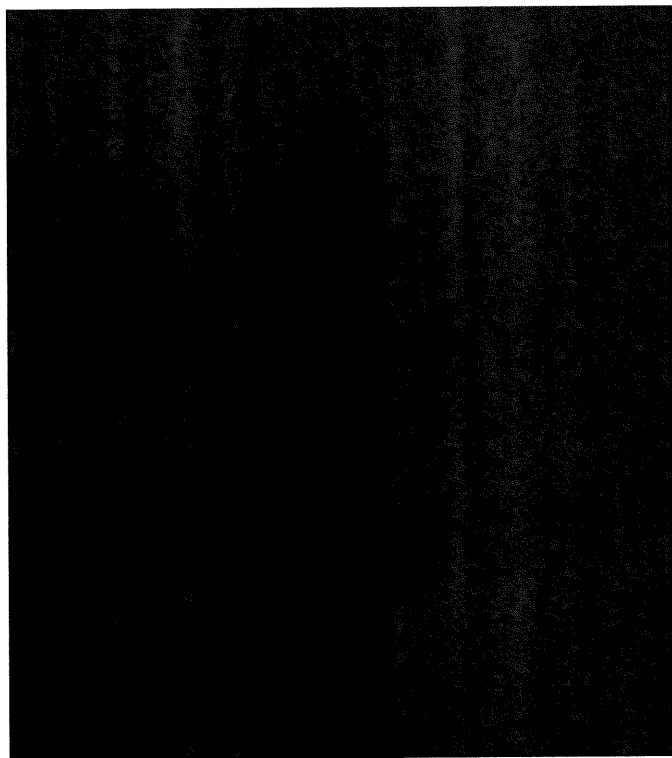
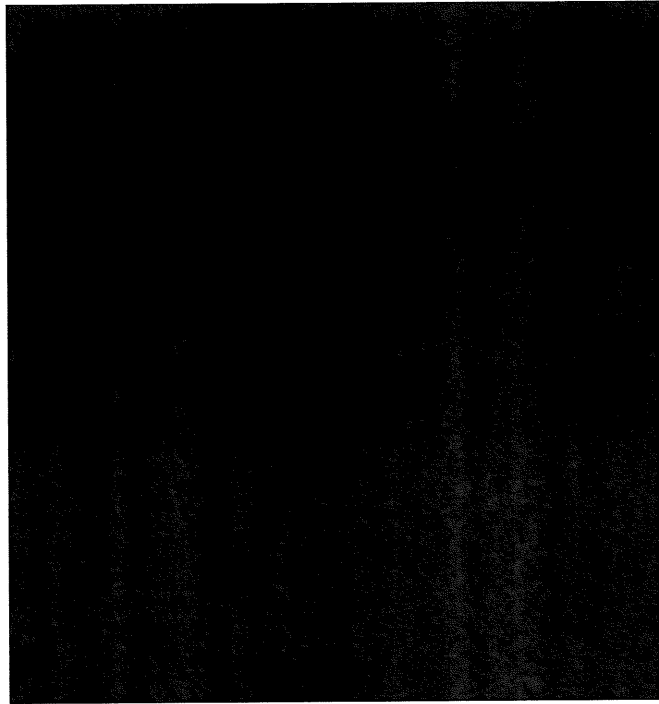
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CHAPTER 12 ANNEX A

VEHICLE OPERATION

COLD ENVIRONMENTS (MINUS 10 DEGREES C AND BELOW)

CONTENTS

Para

- 1 Introduction
- 5 Lubrication system
- 7 Fuel system (WARNINGS)
- 8 Cold starting procedure (single vehicle) (WARNING)
- 9 Cold starting procedure (two vehicles) (WARNING)

INTRODUCTION

1 This annex details the crew operating procedures for vehicle operation of the CVR(T) Diesel vehicles in cold environments (minus 10 degrees C and below).

NOTE

Engines prepared for operation in cold environments should be fitted with a thermostart unit (Cold Start Kit) to assist with engine starting at temperatures below minus 10 degrees C.

2 To enable the vehicle lubrication and fuel systems to function correctly at sub-zero temperatures the normal lubricant and fuel are to be replaced with alternatives suitable for operation in cold environments. Refer to Maintenance Schedule, AESP 2350-T-220-601.

3 Due to the climatic effect on the vehicle batteries, the highest maintenance standards must be maintained to ensure maximum reliability.

4 An additional heavy duty battery lead (portable IVC adapter) is provided as part of the Cold Start Kit to facilitate single vehicle starting.

LUBRICATION SYSTEM

5 Refer to the Maintenance Schedule for the correct engine oil for cold environments.

6 Change the engine oil and filter, refer to Chap 4.

FUEL SYSTEM

7 To change the fuel type from Diesel (F-54) to AVTUR proceed as follows:

WARNINGS

(1) FIRE RISK. WHEN USING FUELS OTHER THAN DIESEL (F-54) PLACE A PORTABLE FIRE EXTINGUISHER READY FOR USE CLOSE TO THE VEHICLE. A CREW MEMBER MUST STAND BY THE VEHICLE CLOSE TO THE EXTINGUISHER READY TO USE THE EXTINGUISHER.

(2) FIRE RISK. WHEN WORKING ON THE FUEL SYSTEM ALL SWITCHES MUST BE IN THE OFF POSITION AND HATCHES AND COVERS OPENED TO DISPERSE FUMES. ALL NECESSARY FIRE PRECAUTIONS MUST BE STRICTLY APPLIED.

(3) RISK TO HEALTH. DIESEL FUEL IS CARCINOGENIC. USE BARRIER CREAM AND WEAR PROTECTIVE CLOTHING WHEN THERE IS A POTENTIAL RISK OF CONTACT WITH DIESEL FUEL. IF SPLASHED INTO EYES WASH OUT FULLY WITH WATER AND SEEK MEDICAL ATTENTION.

7.1 Drain the fuel tank with REME assistance.

WARNING

FIRE RISK. ENSURE THAT ALL FUEL SPILLAGE IS CLEANED UP.

7.2 Renew the engine fuel filter cartridge, as detailed in Chap 6.

7.3 Renew the system fuel filter as detailed in Chap 6.

7.4 Fill fuel tank with AVTUR.

WARNING

FIRE RISK. WHEN BLEEDING THE FUEL SYSTEM, THE AUTOMOTIVE MASTER SWITCH MUST BE IN THE ON POSITION. ALL NECESSARY FIRE PRECAUTIONS MUST BE STRICTLY APPLIED AND HATCHES AND COVERS OPENED TO DISPERSE FUMES.

7.5 Prepare for fuel spillage. Starting at the system fuel filter, open bleed screws and operate electric fuel pump or engine priming pump until AVTUR issues from bleed screws. Once the fuel lines are free of air the fuel system is primed.

7.6 Close all bleed screws.

7.7 Disconnect electrical cable from thermostart unit and insulate cable connector to prevent possible short circuit.

7.8 Disconnect fuel supply pipe from thermostart unit and direct the open end of the pipe into a suitable container to collect fuel.

7.9 Set master switch and engine ignition switch to ON position and hold thermostart/starter switch in HEAT position to purge residual diesel from the fuel pipe.

7.10 When AVTUR issues from the fuel pipe, release the thermostart/starter switch and set master switch and engine ignition switch to OFF.

7.11 Re-connect fuel pipe to thermostart unit.

7.12 Remove temporary insulation and connect electrical cable to thermostart unit.

COLD STARTING PROCEDURE (SINGLE VEHICLE)

8 The portable IVC adapter, supplied as part of the Cold Start Kit, allows the turret or radio batteries to be used to boost the vehicle batteries for engine starting. To start the vehicle proceed as follows:

8.1 Ensure that all battery master switches are set to OFF.

WARNING

DANGER TO PERSONNEL. ON TURRETED VEHICLES THE TURRET BATTERY MASTER SWITCHES MUST BE IN THE 'OFF' POSITION BEFORE CONNECTING THE INTER-VEHICLE LEAD, AND MUST REMAIN IN THE 'OFF' POSITION UNTIL AFTER THE LEAD HAS BEEN DISCONNECTED.

- 8.2 Connect the portable IVC adapter to the turret or radio batteries (depending on variant).
- 8.3 Connect the IVC cable between the portable IVC adapter and the vehicle IVC socket.
- 8.4 Set the vehicle master switch to ON.
- 8.5 If the vehicle is fitted with a thermostart device proceed as follows:
 - 8.5.1 Set engine ignition switch to the ON position.
 - 8.5.2 Initiate the cold start sequence by holding the thermostart/starter switch in the HEAT position for 35 seconds.
 - 8.5.3 Move the thermostart/starter switch to the START position and operate the starter for 20 seconds. Allow the thermostart/starter switch to return to the central OFF/RUN position as soon as the engine starts.
 - 8.5.4 If the vehicle does not start, repeat Sub-paras 8.5.1 to 8.5.3 until the engine starts.

NOTE

If the thermal cut out relay in the starter motor operates, wait for at least 30 minutes before next attempt to start.

- 8.6 When the engine has been started, disconnect and stow the IVC cable and portable IVC adapter.

COLD STARTING PROCEDURE (TWO VEHICLES)

9 The cold starting procedure is different depending upon how many vehicles are in the location. If there is only a single vehicle, carry out the procedure as detailed in Para 8, otherwise proceed as detailed below.

- 9.1 Ensure that all battery master switches in both vehicles are set to OFF.

WARNING

DANGER TO PERSONNEL. ON TURRETED VEHICLES THE TURRET BATTERY MASTER SWITCHES MUST BE IN THE OFF POSITION BEFORE CONNECTING THE INTER-VEHICLE LEAD, AND MUST REMAIN IN THE 'OFF' POSITION UNTIL AFTER THE LEAD HAS BEEN DISCONNECTED.

- 9.2 Connect the inter-vehicle cable to the inter-vehicle electrical sockets on both vehicles.
- 9.3 Set the starting vehicle master switch to ON.
- 9.4 If the casualty vehicle is fitted with a thermostart device proceed as follows:
 - 9.4.1 Set engine ignition switch to the ON position.
 - 9.4.2 Initiate the cold start sequence by holding the thermostart/starter switch in the HEAT position for 35 seconds.
 - 9.4.3 Move the thermostart/starter switch to the START position and operate the starter for 20 seconds. Allow the thermostart/starter switch to return to the central OFF/RUN position as soon as the engine starts.

9.4.4 If the vehicle does not start, repeat Sub-paras 9.4.1 to 9.4.3 until the engine starts.

NOTE

If the thermal cut-out relay in the starter motor operates, wait for at least 30 minutes before next attempt to start.

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CHAPTER 14
COOKING VESSEL

CONTENTS

Para

- 1 Description
- 5 Water compartment
- 8 Lid
- Operation
- 10 Boiling (CAUTION)
- 11 Making beverages (CAUTION)
- 12 Heating composite rations – decanted
- 13 Heating composite rations – undecanted
- 14 Frying (WARNINGS)
- 17 User maintenance
 - Cleaning
- 18 Food container
- 19 Water compartment
- 20 Drain tap
- 21 Lid
- 22 Fault finding (if the vessel fails to heat up)

Fig

Page

- 1 Cooking vessel..... 4

DESCRIPTION

1 The cooking vessel (Fig 1) is located in the fighting/crew compartment. It is supplied with power from the hull battery and vehicle generating systems via a cable harness (and a fuse, Chap 9) when the alternator is 'on-line'. The harness incorporates a free socket which engages with the connector (12); when not in use the socket is stowed in a clip on the engine/crew compartment bulkhead.

2 The vessel can provide hot water for beverages, shaving, washing, etc. and at the same time heat up tinned or decanted foods. It can also be used for frying.

3 The cooking vessel comprises a stainless steel water compartment (14), a removable stainless steel food container (8) and a lid (3). The water compartment and the lid are insulated to reduce heat loss and to minimise the possibility of accidental burns and scalds.

4 The vessel must always be stowed securely to prevent damage when travelling over rough ground or uneven surfaces.

Water compartment

5 The water compartment contains a heating element and a thermostat, it is also fitted with a drain tap (11). The heating element is incorporated within the base of the compartment and must not be disturbed as interference can render it unserviceable.

6 The thermostat is fitted as a safety device to prevent the vessel overheating.

7 The drain tap has a push button operated valve which can be dismantled for cleaning. Dismantling does not require any special tools.

Lid

8 The lid is provided with catches (4) and hooks (15) as a means of securing it to the water compartment; the catches engage with posts (10) and the hooks locate in the toggle clips (13). If required, the hooks can also be used (as illustrated) to lift the food container.

9 When the lid is secured to the water compartment, a leak-proof joint is effected by a non-toxic seal (9) while the domed vent (1) provides an outlet for steam. The vent must be kept clear at all times.

OPERATION

Boiling

CAUTION

WATER LEVEL. When boiling less than 1 litre (two pints) of water, the food container must be placed in the compartment.

10 To boil, remove the lid and lift out the inner food container. Pour the required amount of water into the water compartment but DO NOT FILL ABOVE THE 4 LITRE (7 PINT) LEVEL LINE. Replace and secure the lid, engage the cable socket with the electrical connector (12), start the engine, allowing it to idle to bring the alternator 'on-line'. When the water boils, stop the engine and disengage the cable socket.

Making beverages

CAUTION

IMPROPER USE. Do not make tea, coffee, soups etc in the water compartment, as these fluids will cause the drain tap to malfunction.

11 To make beverages, place tea, coffee, cocoa or soup powder, etc. into the food container (the capacity of the container is approximately 2.5 litres (4.5 pints), position the container under the tap and draw off the hot water by pressing the tap push button.

Heating composite rations - decanted

12 To heat decanted composite rations, proceed as follows:

12.1 Remove the lid and lift out the food container.

12.2 Pour approx 1 litre (2 pints) of water into the water compartment, **DO NOT FILL ABOVE THE 1 LITRE (2 PINT) LEVEL.**

12.3 Pour the contents of up to five tins of composite rations into the food container, replace the container in the vessel, replace and secure the lid.

12.4 Engage the cable socket to the connector and run the engine at idle speed for approximately 25 minutes.

12.5 Stop the engine and disengage the socket.

12.6 Remove the lid and (use the lid hooks if necessary) lift out the food container.

NOTE

Food left in the container will remain hot for up to four hours. The hot water remaining in the container can be used for beverages, if required.

Heating composite rations - undecanted

13 To heat undecanted composite rations, proceed as in the preceding paragraph but place up to three tins of composite rations, with TOPS PIERCED, in the inner container. When heated, remove the composite ration tins, open them carefully and serve.

Frying

WARNINGS

(1) PERSONAL INJURY. DEEP FRYING MUST NOT BE ATTEMPTED.

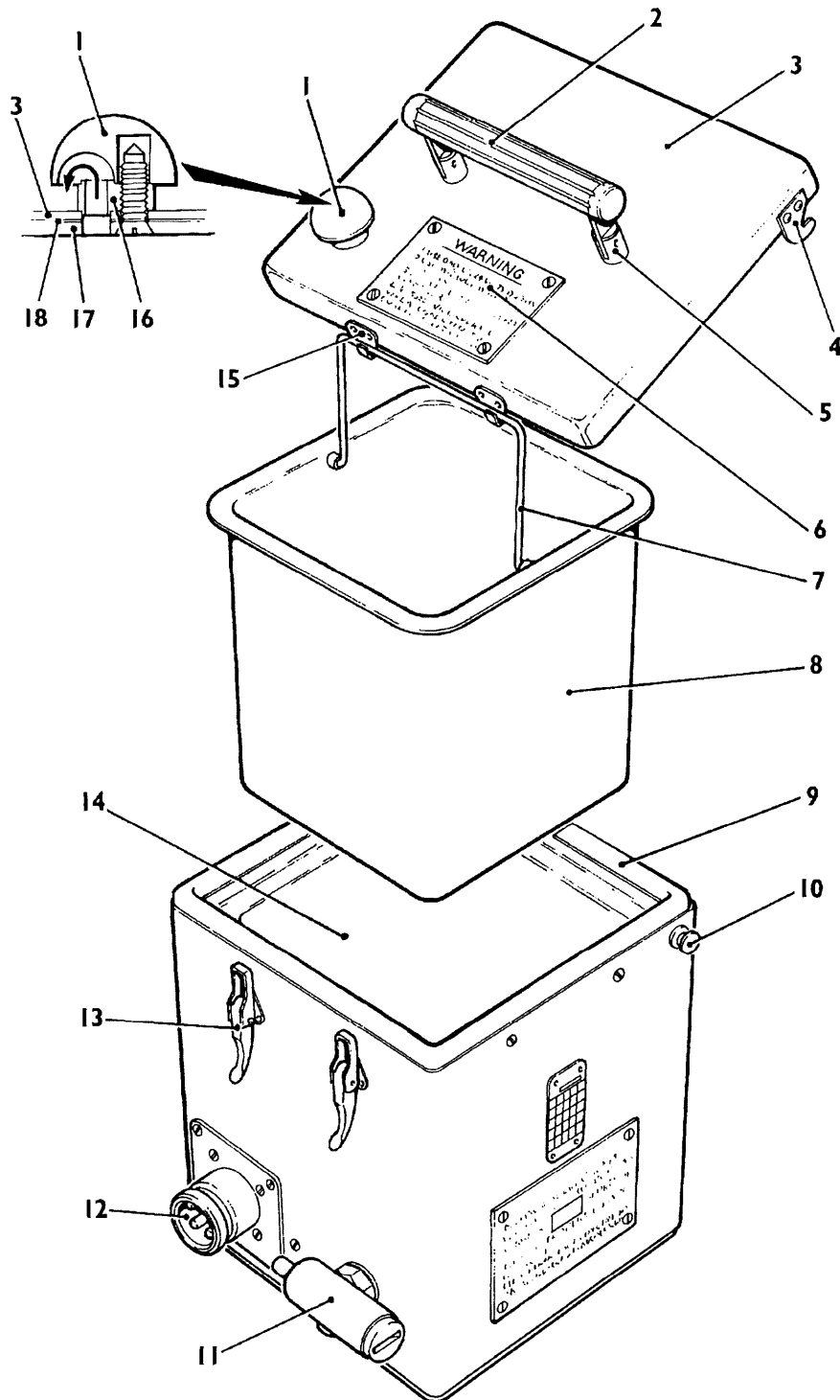
(2) PERSONAL INJURY. THE BASE OF THE WATER COMPARTMENT BECOMES RED HOT WHEN FRYING, DO NOT COOL BY POURING WATER INTO THE COMPARTMENT.

(3) PERSONAL INJURY. CARE MUST BE TAKEN WHEN REFILLING WITH WATER SOON AFTER FRYING.

14 Remove the lid and food container, drain off the food container and ensure that the water compartment is clean.

15 Place a small quantity of cooking fat in the bottom of the food container and replace the container.

16 Engage the cable socket to the plug and run the engine at fast idle to bring the alternator 'on-line'. At the first indication of blue smoke arising from the melted fat, place food for frying (sausages, bacon, eggs, etc.) into the hot fat and fry until cooked. Stop the engine and unplug the cable. Lift out the container and serve the food.



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Fig 1 Cooking vessel

KEY TO FIG 1

1	Vent	7	Food container lifting handle	13	Quick release toggle clip
2	Lifting handle	8	Food container	14	Water compartment
3	Insulated lid	9	Seal	15	Fixing and lifting hooks
4	Lid securing catch	10	Catch post	16	Spacer
5	Hinge support	11	Drain tap	17	Plastic lining
6	Warning plate	12	Electrical connector	18	Gasket

USER MAINTENANCE

17 Operation of the boiling vessel is to be checked at the intervals specified in the Maintenance Schedule.

Cleaning

Food container

18 Remove and clean the food container by scouring, rinse, drain and wipe dry.

Water compartment

19 Clean the water compartment by scouring, rinse, drain and wipe dry. Alternatively cleaning can be effected using boiling water to which soda or detergent has been added and running the water off through the drain tap; the compartment and tap must be rinsed thoroughly before use.

Drain tap

20 Clean the drain tap as follows:

- 20.1 Unscrew the slotted end stop using a coin or suitable implement.
- 20.2 Remove the spring.
- 20.3 Remove valve plunger assembly.
- 20.4 Clean all parts, dry off and reassemble in reverse sequence.

Lid

21 Clean the lid parts as follows:

- 21.1 Remove the vent cap and spacer (16) by unscrewing the countersunk retaining screw.
- 21.2 Unscrew the remaining two countersunk screws, which secure the handle (2) from the inner face of the lid.
- 21.3 Dismantle the lid and clean.
- 21.4 Reassemble in reverse sequence ensuring that the vent apertures align and the sealing gasket (18) seats correctly.

Fault finding (if the vessel fails to heat up)

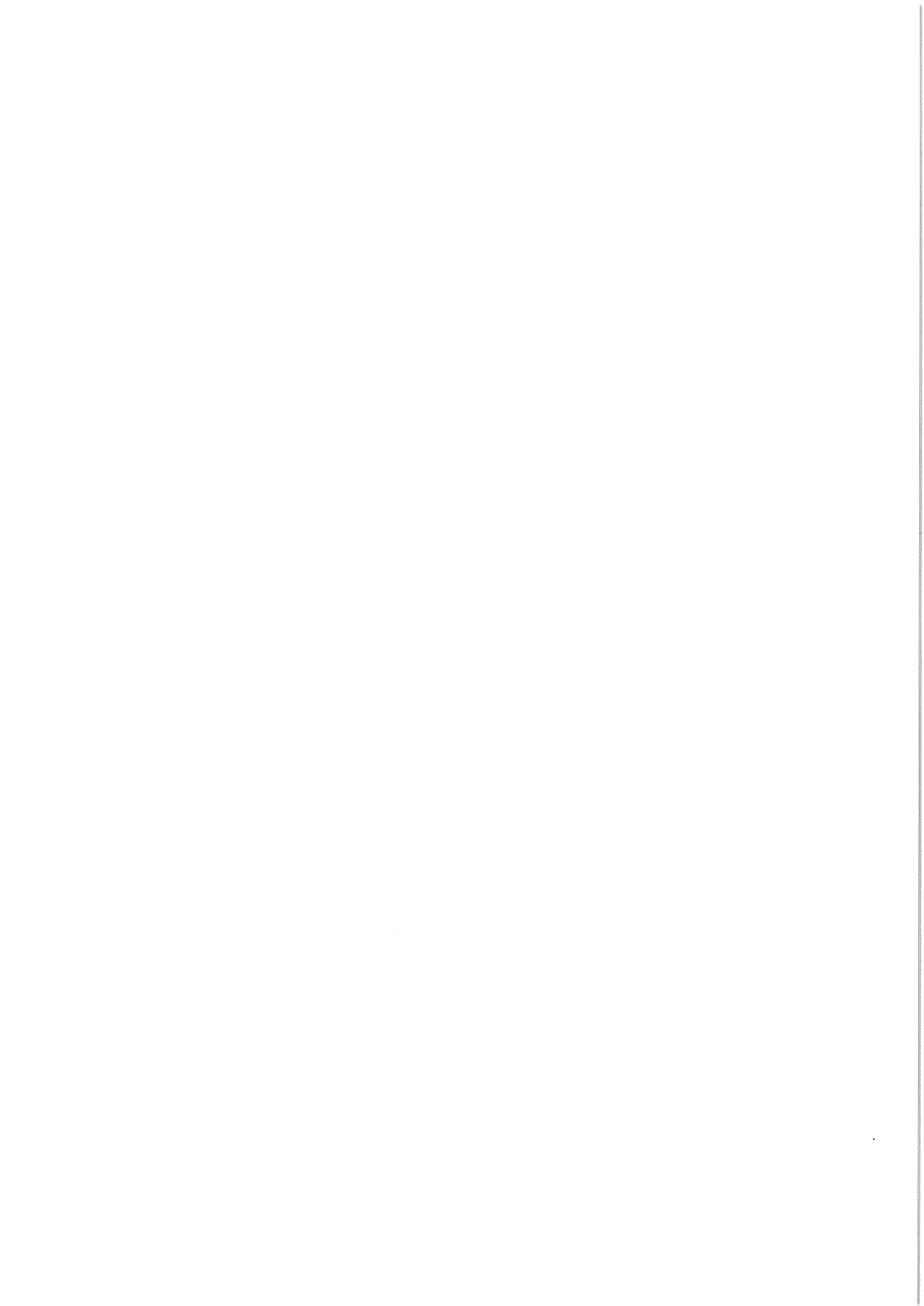
22 If the vessel fails to heat up, check the following:

22.1 Alternator is 'on line'. If the alternator warning light (see Chap 9) glows when the engine is running, report to REME.

22.2 The heavy duty fuse (see Chap 9).

22.3 The cable socket and connector are fully engaged.

23 If the vessel still fails to heat up, report to REME.



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**COMBAT VEHICLE RECONNAISSANCE,
FULL TRACKED, CVR(T) (D) - SPARTAN
OPERATING INFORMATION**

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Amdt No.	Incorporated By (Signature)	Date
1	INCORPORATED	11/08
2	INCORPORATED	11/10
3	INCORPORATED	03/13
4	INCORPORATED	10/13
5	INCORPORATED	09/14
6	INCORPORATED	07/15
7	INCORPORATED	12/16
8	INCORPORATED	07/17
9	INCORPORATED	01/18
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PREFACE

Sponsor: Refer to Table 1, Serial 1
File ref: Pubs 2285
Publication Authority: Refer to Table 1, Serial 1

INTRODUCTION

1 Users should forward any comments on this publication using the AESP Form 10 and the accompanying guidance which can be accessed and downloaded from the Joint Asset Management and Engineering Solutions (JAMES) Portal (via Hot Topics – Forms) or from Technical Documentation Online (TDOL) Viewer (Search: FORM10).

2 AESPs are issued under Defence Council authority and where AESPs specify action to be taken, the AESP will of itself be sufficient authority for such action and also for the demanding of the necessary stores, subject to the provisions of Para 3 below.

3 The subject matter of this publication may be affected by Defence Instructions and Notices (DINs), Standing Operating Procedures (SOPs) or by local regulations. When any such instruction, order or regulation contradicts any portion of this publication it is to be taken as the overriding authority.

4 The installation of Bowman communications equipment may affect procedures contained in this publication. Refer to DAESP 5895-G-200-Series (CIETP) for information concerning any Bowman equipment fitted to CVR(T).

RELATED AND ASSOCIATED PUBLICATIONS

Related publications

5 The Octad for the subject equipment consists of the publications below. All references are prefixed with the first eight digits of this publication. The availability of the publications can be checked by reference to the relevant Group Index (see AESP 0100-A-001-013).

Category/Sub-category			Information Level			
			1 User/ Operator	2 Unit Maintenance	3 Field Maintenance	4 Base Maintenance
1	0	Purpose and Planning Information	*	*	*	*
	1	Equipment Support Policy Directives	*	*	*	*
2	0	Operating Information	201	*	*	*
	1	Aide-Memoire	*	*	*	*
	2	Training Aids	*	*	*	*
3		Technical Description	201	302	*	*
4	1	Installation Instructions	*	*	*	*
	2	Preparation for Special Environments	*	*	*	*
5	1	Failure Diagnosis	201	*	*	*
	2	Maintenance Instructions	201	522	523	*
	3	Inspection Standards	*	532	532	532
	4	Calibration Procedures	*	*	*	*
6		Maintenance Schedules	*	*	*	*
7	1	Illustrated Parts Catalogues	711	*	*	*
	2	Commercial Parts Lists	*	*	*	*
	3	Complete Equipment Schedule, Production	*	*	*	*
	4	Complete Equipment Schedule, Service Edition (Simple Equipment)	741	*	*	*
	5	Complete Equipment Schedule, Service Edition (Complex Equipment)	*	*	*	*
8	1	Modification Instructions	*	*	*	*
	2	General Instructions, Special Technical Instructions and Servicing Instructions	*	*	*	*
	3	Service Engineered Modification Instructions	*	*	*	*

*Category/Sub-category not published

Associated publications

6	<u>Reference</u>	<u>Title</u>
	AESP 2350-T-210-811	Combat Vehicle Reconnaissance Tracked (CVR(T)) All Variants - Modification Instructions and Index
	AESP 2350-T-210-812	Combat Vehicle Reconnaissance Tracked (CVR(T)) All Variants - Modification Instructions and Index
	AESP 2350-T-210-821	Combat Vehicle Reconnaissance Tracked (CVR(T)) All Variants - General Instructions and Index
	AESP 2350-T-220-Series	Combat Vehicle Reconnaissance Tracked (CVR(T)) Diesel Common Items
	AESP 1005-N-510-201	General Purpose Machine gun 7.62 mm L37A1 Operating Information
	AESP 1005-N-510-741	General Purpose Machine Gun 7.62 mm L37A1 Complete Equipment Schedule
	DAESP 5895-G-200-Series Army Code No. 14608 Army Code No. 61182	Bowman / CIP Communications System CIETP User Handbook, Radar No 14, Mk 1 (ZB298) Provisional User Handbook, Sight Unit, Image Intensified, L3A1 and L7A1
	EMER Instruments S302/62	Sight periscopic, AV, No. 62, Mk 1

REFERENCE ORGANIZATIONS AND ADDRESSES

7 The organizations listed in Table 1 are referred to throughout this AESP.

TABLE 1 REFERENCE ORGANIZATIONS AND ADDRESSES

Serial (1)	Organization (2)	Address (3)
1	Vehicle Support Team – Armoured Tracks Portfolio (VST-ATP)	MoD Abbey Wood, Bristol, BS34 8JH Tel: [REDACTED]

WARNINGS

(1) **DRY CELL BATTERIES.** THE BATTERIES USED IN THIS EQUIPMENT ARE CAPABLE OF GENERATING TOXIC GASES AT HIGH PRESSURE AND MAY BURST IF THEY ARE SUBJECTED TO: EXCESSIVE HEAT, PROLONGED SHORT CIRCUITING, OR BEING DISCHARGED WELL BEYOND THEIR OPERATING LIFE. DISCHARGED BATTERIES MUST BE PROMPTLY REMOVED FROM THE EQUIPMENT AND RETURNED TO UNIT STORES. THEY MUST NOT BE BURIED, PLACED ON A FIRE, OR IN ANY RECEPTACLE FOR OTHER RUBBISH. EVERY PRECAUTION MUST BE TAKEN AGAINST ACCIDENTAL SHORT CIRCUIT, AND NO ATTEMPT IS TO BE MADE TO OPEN THE BATTERIES.

(2) **TOXIC FUMES.** THE FUMES GIVEN OFF ARE LIABLE TO BE DANGEROUS ESPECIALLY IN A CONFINED SPACE.

(3) **PRESSURISED CONTAINER.** DO NOT INTERFERE WITH THE FRANGIBLE SEAL IN THE HEAD OF A REPLACEMENT CHARGED CONTAINER.

(4) **RF HAZARD.** IT IS POTENTIALLY DANGEROUS TO LOAD OR UNLOAD SMOKE GRENADE DISCHARGERS WITHIN TWO METRES OF SOME RADIO ANTENNAS WHEN TRANSMITTING ON SOME FREQUENCIES. THEREFORE, CREWS SHOULD ENSURE THAT RADIOS DO NOT TRANSMIT WHEN LOADING OR UNLOADING SMOKE GRENADE DISCHARGERS.

(5) **DANGER TO LIFE AND LIMB.** THE FM200 GAS IN THE BOTTLE IS UNDER HIGH PRESSURE. THERE IS THE POTENTIAL FOR SERIOUS INJURY IF THE BOTTLE IS DISCHARGED WHILST NOT SECURED WITHIN ITS BRACKET. ENSURE THE ANTI-RECOIL PLUG IS FITTED AT ALL TIMES WHEN THE BOTTLE IS NOT SECURED IN ITS BRACKET.

(6) **DANGER TO LIFE AND LIMB.** THE FM200 GAS IN THE BOTTLE IS UNDER HIGH PRESSURE. AT ALL TIMES HANDLE THE BOTTLE AND FITTINGS WITH EXTREME CARE, ESPECIALLY WHEN THE BOTTLE IS NOT SECURED DOWN. EXERCISE THE SAME CARE EVEN IF THE READING ON THE BOTTLE PRESSURE GAUGE INDICATES EMPTY.

(7) **ASPHYXIATION HAZARD.** IF FM200 VAPOUR IS BREATHED IT CAN CAUSE DIZZINESS AND SUFFOCATION. ANYONE WHO HAS INHALED FM200 VAPOUR SHOULD BE MOVED TO A PLACE OF FRESH AIR AND BE SUBJECTED TO MEDICAL ATTENTION.

(8) **PERSONNEL SAFETY.** HYDROFLUOROCARBON (HFC) GAS EXTINGUISHING AGENTS MAY DECOMPOSE UNDER CERTAIN FIRE CONDITIONS, PRODUCING CONSIDERABLE QUANTITIES OF HYDROGEN FLUORIDE (HF) GAS. EXPOSURE TO LARGE DOSES OF HF CAN LEAD TO POTENTIALLY LETHAL RESPIRATORY FAILURE. IF A CREW MEMBER IS IN CLOSE PROXIMITY TO A FIRE TACKLED BY EXTINGUISHING AGENTS, IMMEDIATELY EVACUATE TO AN AREA WITH FRESH AIR, AND INFORM MEDICAL SERVICES OF SUSPECTED EXPOSURE TO HF.

(9) **LETHAL VOLTAGES.** DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. WHEN CARRYING OUT WORK ON ANY BOWMAN RADIO EQUIPMENT DURING FAILURE DIAGNOSTICS, REFER TO BOWMAN CIETP, DAESP 5895-G-200-SERIES.

(10) **FIRE HAZARD.** BOWMAN EQUIPMENT MAY CAUSE FLAMMABLE SUBSTANCES TO IGNITE AT REFUELLING POINT. BOWMAN SYSTEM MUST BE TURNED TO STANDBY DURING REFUELLING.

(continued)

WARNINGS (continued)

(11) **PERSONNEL INJURY.** BOWMAN ANTENNAS MAY TRANSMIT AT ANY TIME. SHOULD A CREWMEMBER GRAB AN ANTENNA WHILST TRANSMITTING THEY MAY SUFFER RF BURNS. UNDER NO CIRCUMSTANCES MUST AN ANTENNA BE TOUCHED WHEN FITTED TO THE VEHICLE UNLESS EQUIPMENT IS TURNED TO STANDBY.

(12) **PERSONNEL INJURY.** CARE MUST BE TAKEN WHILST MOVING THE VEHICLE WITH THE ANTENNAS FITTED. TOUCHING OF OVERHEAD CABLES MAY INDUCE HIGH VOLTAGES INTO THE VEHICLE CAUSING POSSIBLE ELECTROCUTION OF CREW MEMBERS.

(13) **PERSONNEL INJURY.** WHEN CARRYING OUT ANY TYPE OF WORK ON A CVR(T) (BOWMAN) VEHICLE, ATTENTION MUST BE MADE TO THE VARIOUS SAFETY NOTICES WHICH ARE POSITIONED THROUGHOUT THE VEHICLE.

(14) **PERSONAL INJURY.** WHEN CARRYING OUT REPAIRS AND MAINTENANCE, THERE MAY BE A RISK OF SHARP EDGES AND METAL SPLINTERS, ENSURE WHEN CARRYING OUT THESE TASKS THAT CARE IS TAKEN, AND ADEQUATE PROTECTIVE EQUIPMENT IS USED.

(15) **SILICA. TOXIC SUBSTANCE.** ANY ACCUMULATED SAND ON THE VEHICLE MAY CONTAIN SILICA DUST WHICH MUST BE REGARDED AS HAZARDOUS TO HEALTH. PERSONAL PROTECTIVE EQUIPMENT MUST BE WORN TO PREVENT INHALATION OF DUST WHEN CLEANING OR WORKING ON THE VEHICLE. REMOVE ANY SAND AND DUST DEPOSITS FROM THE VEHICLE BEFORE COMMENCING WORK. ALL PERSONAL PROTECTIVE EQUIPMENT MUST BE CLEANED AFTER EACH USE IN A DESIGNATED AREA TO PREVENT THE RISK OF DUST INHALATION BY UNPROTECTED PERSONNEL.

(16) **DANGER TO LIFE.** IF THE REAR DOOR LOCKS ARE ENGAGED, INGRESS AND EGRESS TO THE REAR OF THE VEHICLE ARE SEVERELY IMPEDED IN THE EVENT OF EMERGENCY OR ROLL OVER.

(17) **TOXIC AND HAZARDOUS SUBSTANCE - CERABOARD ALUMINOSILICATE FIBRES.** ALL VARIANT (EXCEPT SCIMITAR) ENGINE COMPARTMENT BULKHEAD INSULATION MAY CONTAIN ALUMINOSILICATE FIBRES WHICH ARE HARMFUL WHEN INHALED AND AN IRRITANT TO THE SKIN AND EYES. USE APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT WHEN CLEANING THE COMPARTMENT TO PREVENT INHALATION AND CONTACT WITH SKIN AND EYES.

CAUTIONS

(1) **IMAGE INTENSIFIER.** The photo-cathode of the image intensifier tube (IIT) may be damaged if bright light either natural or artificial is allowed to enter the objective system with the iris open. The iris must be kept closed when the equipment is not in use.

(2) **TRACK DAMAGE.** Due to manufacturing tolerances the total number of vehicle track links per side can vary on issue. It is important to refer to AB 413 before track condemnation is decided.

(continued)

CAUTIONS (continued)

(3) EQUIPMENT DAMAGE. The FM200 gas in the bottle is under high pressure. There is the potential for serious damage to surrounding equipment, both inside and outside the vehicle, if the FM200 gas is discharged and the bottle is not secured down. At all times handle the bottle with extreme care, exercise the same care even if the reading on the bottle pressure gauge shows empty.

(4) EQUIPMENT DAMAGE BY INADVERTENT OPERATION. The pull cable inside the vehicle is sensitive to movement and can be mistaken for a cable harness. Even a very small displacement of the pull cable can cause the FM200 bottle to discharge.

~~OFFICIAL SENSITIVE~~

~~OFFICIAL SENSITIVE~~

CHAPTER 1

INTRODUCTION AND DATA

CONTENTS

Para

1	Introduction and data
9	Manpower requirements
10	Physical data (standard vehicle)
11	Performance
12	Vision
13	Fuel consumption
14	Capacities
15	Armament
16	Smoke protection
17	Cupola, MG
18	Communications
19	Electrical system

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3	Vehicle dimensions (standard vehicle).....	5

INTRODUCTION AND DATA (Figs 1 and 2)

1 The Spartan (Figs 1 and 2) is primarily designed as a Reconnaissance and Armoured Personnel Carrier (APC) to accommodate an assault section of seven men, a driver, vehicle commander/gunner, and in the personnel compartment, five infantrymen, (section commander and four men).

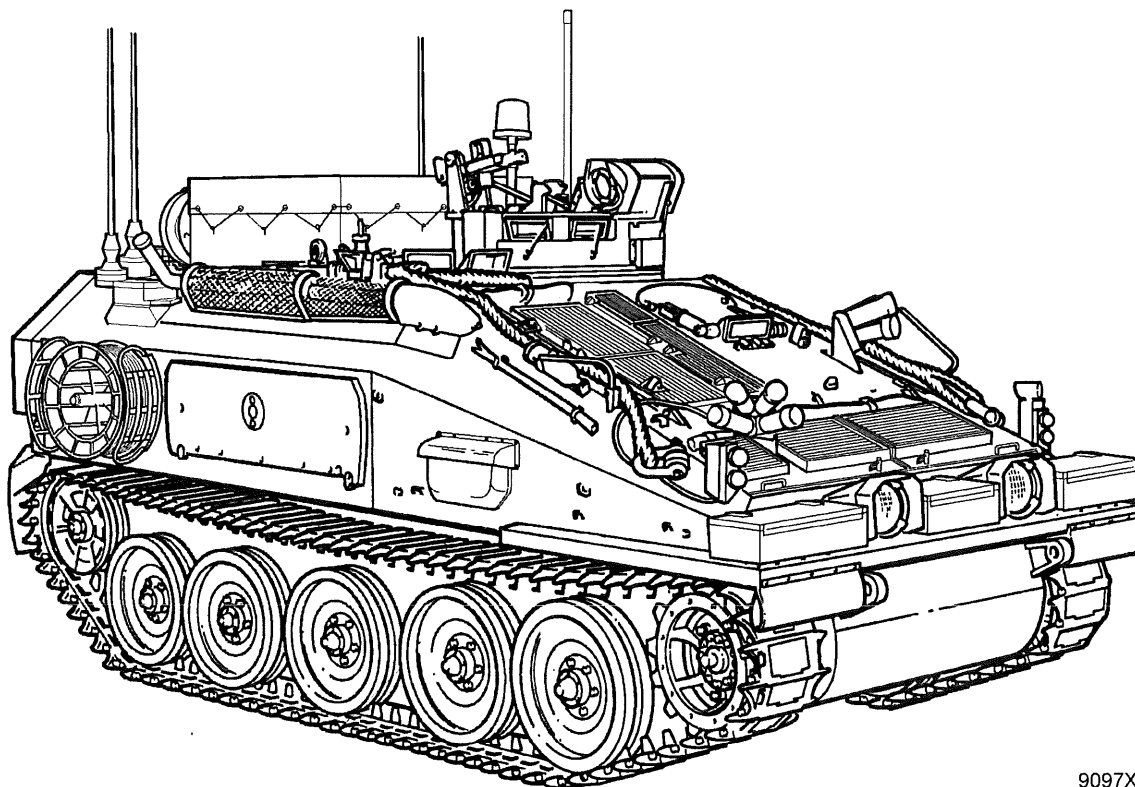
2 Accordingly its hull is of a different shape from that of the basic vehicle (Scimitar)

3 Provision is made for the stowage of full equipment and weapons plus a variety of other stores; in addition, built-in facilities enable various radio installations and other operational equipment to be fitted as required.

4 Spartan is armed with a 7.62 mm GPMG mounted externally, on a fully rotating vision cupola in the vehicle roof. The cupola provides the vehicle commander with an all-round observation facility, enabling him also to arm and fire the GPMG from within the 'shut-down' vehicle. Providing a roof stowage bin is not fitted, firepower can be increased by partly opening the large rectangular hatch in the hull roof to permit the use of personal weapons over the vehicle sides;

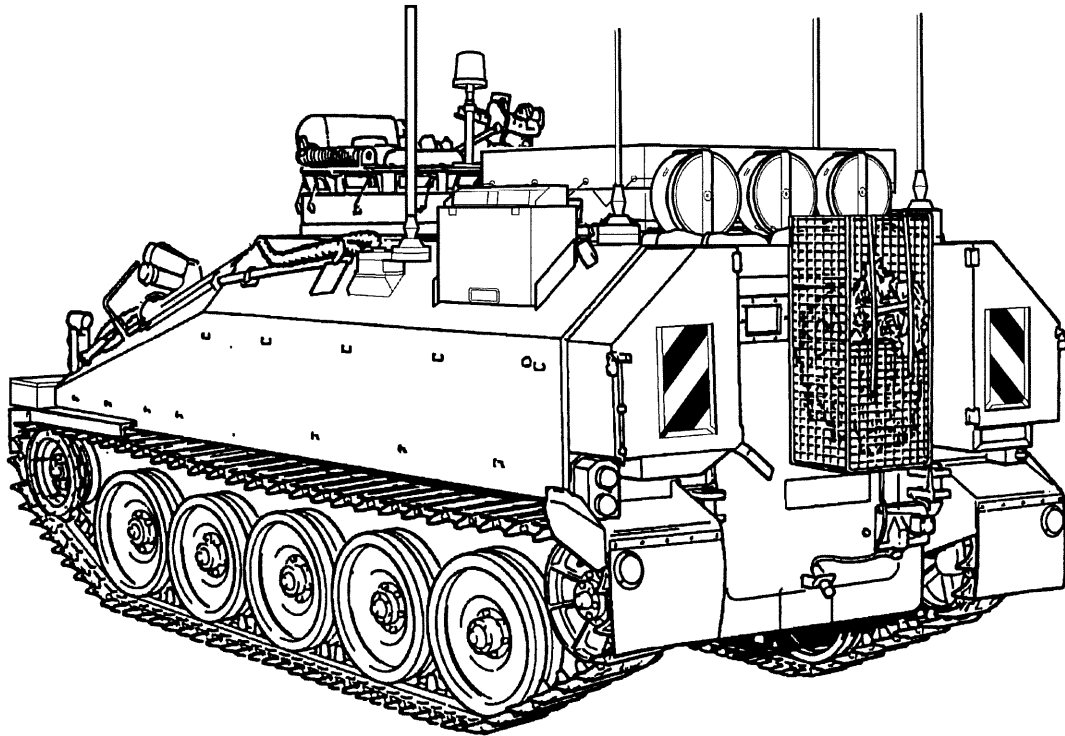
Smoke grenade dischargers are included and are positioned on the front sloping plates.

5 A door at the rear of the vehicle provides an entrance/exit facility for personnel. There are also two individual hatches - one in the vehicle commander's vision cupola, and one above the section commander's position - in the personnel compartment.



9097X

Fig 1 Three-quarter, front, left view of vehicle



9098X

Fig 2 Three-quarter, rear, right view of vehicle

6 Vision equipment includes a laminated glass vision block located in the rear door for the use of personnel; provision is also made for installing RADAR detection equipment when an extension of ground surveillance capability is required.

7 Spartan is longer than the Scimitar necessitating longer tracks and an increase in the number of track links.

8 The vehicle suspension differs from the Scimitar vehicle, but only by the increased spacing between the road wheels on either side of the centre road wheel.


MANPOWER REQUIREMENTS

9

Crew 7 men (driver, vehicle commander/gunner, section
..... commander and four men)

PHYSICAL DATA (Standard Vehicle) (Fig 3)

10




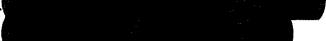
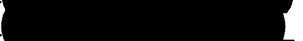


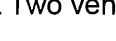
Length overall 4.89 m (16 ft)
 Height (over MG mounting) 2.24 m (7 ft 4 inches)
 Height (to top of hull) 2.083 m (6 ft 10 inches)
 Width overall 2.211 m (7 ft 3 inches)
 Width over tracks 2.134 m (7 ft 0 inches)
 Track centres 1.7 m (5 ft 7 inches)
 Length of track on ground 2.801 m (9 ft 2 inches)
 Number of links 82-84 per side
 Fully laden weight 

NOTE

For physical data relating to up-armoured vehicles refer to AESP 2350-T-220-201 Chapter 1, Annex A.

PERFORMANCE

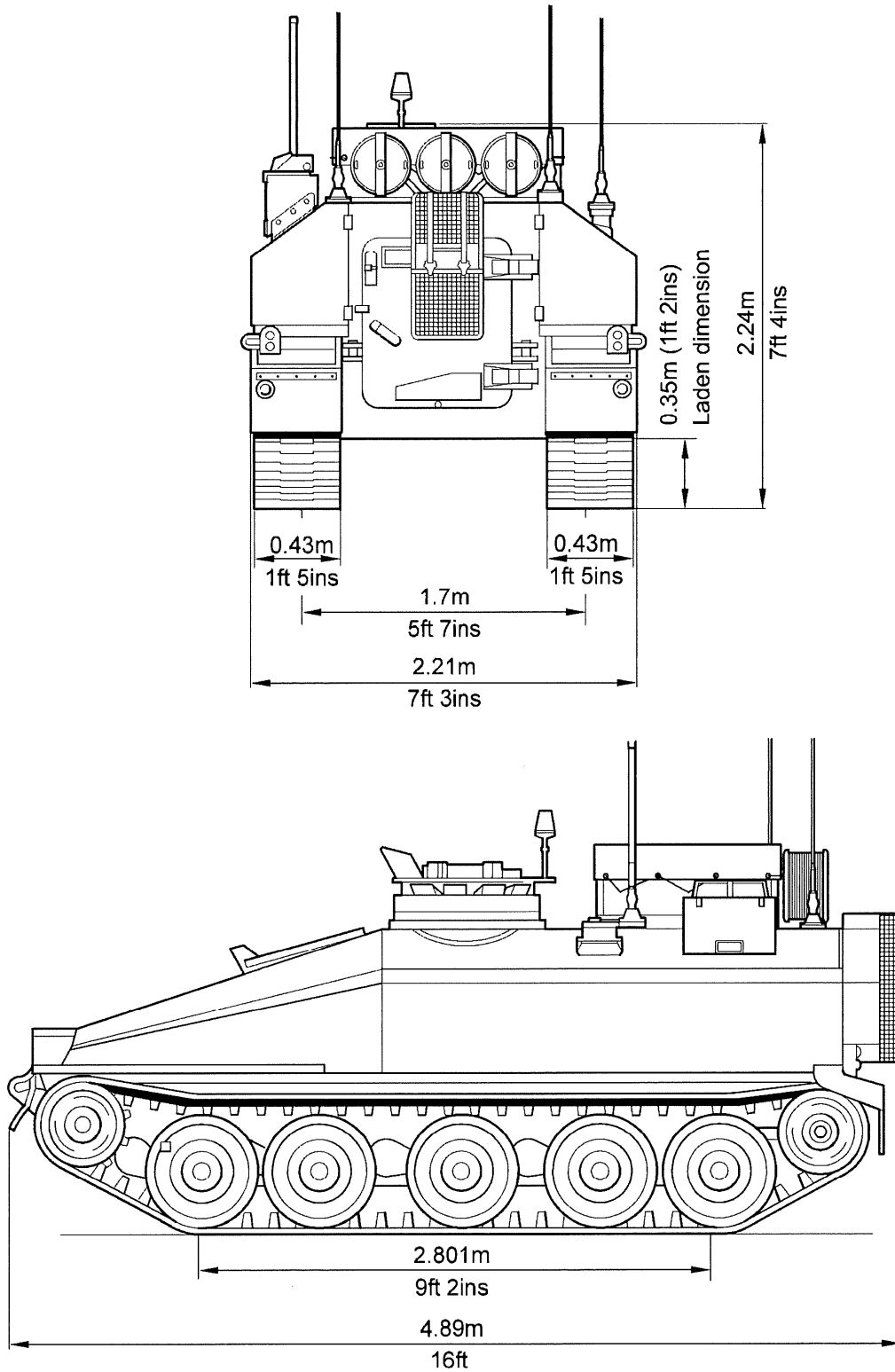
11

Road speed (max allowed) 80 km/h (50 mile/h)
 Acceleration through gears
 (1) Diesel 0-48 km/h (0-30 mile/h) in <24 seconds
 (2) AVTUR 0-48 km/h (0-30 mile/h) in <30 seconds
 Ground clearance 0.35 m (1 ft 2 inches)
 Vertical obstacle 
 Trench crossing 
 Angle of approach 
 Angle of departure 
 Angle of tilt 
 Fording 
 Ground pressure 
 Bridge classification 
 Airportability Two vehicles per C 130 aircraft

VISION

12

Vehicle commander Cupola vision, AV No. 16 Mk 1, with 8 vision Periscopes,
 AV No. 42 Mk 1 and Sight Periscope AV No. 62
 Night Sight Sight Unit AV No. 63 L3A1 (when fitted to Sight AV No. 62
 the sight designation is changed to Sight AV No. 64)
 Section commander Three Periscopes AV No. 43, Mk 3
 Driver 'Head out' for opened-up driving. Single wide-angle
 Periscope AV No. 44, Mk 2 for closed driving.
 Night Sight Periscope AV II L5A1
 Personnel One laminated glass vision block in rear door



9620X

Fig 3 Vehicle dimensions (standard vehicle)

FUEL CONSUMPTION

13

Fully laden battlefield mission 1.90 km/litre
 Range 733 km



CAPACITIES

14

	Litres	Imperial	USA
Fuel tank	386	85 gal	102 gal

ARMAMENT

15

Armament..... Cupola mounted 7.62 mm L37A1 GPMG
 Ammunition 7.62 mm GPMG 2000 rounds
 Smoke grenades 
 Grenades 



SMOKE PROTECTION

16

Smoke dischargers 2 multi-barrel smoke dischargers mounted
 on front sloping plates
 Coverage 711 mils (40 degrees) each discharger

CUPOLA, MG

17

Type No. 16, Mk 1
 Traverse 6400 mils (360 degrees)
 Elevation 
 Depression 

COMMUNICATIONS

18

Bowman communications installation:

Vehicle user data terminal	(VUDT)
User control device - commander	(UCD - CMDR)
User control device	(UCD - LROG)
Bowman management data terminal (Cat H)	(BMDT (H))
User control device – signal officer 1	(UCD SO1)
Band pass filter 2	(BPF2)
User switch box	(USB LOG)
High frequency 1, HF mounted (role) radio high power	(HF1 (HMOP))
User control device extension cable	(UCD-XC)
Low pass filter	(LPF)
Ethernet extension cable	(NET-XC)
Power extension cable	(PWR-XC)
Vehicle interface panel - full function local area	(VIP (FFLA))
Global positioning system – antenna	(GPSA)
Bowman network access unit 2	(BNAU - 2)

Power distribution unit	(PDU)
Bowman audio interface unit	(BAIU)
Band pass filter 1 or High pass filter	(BPF1) or (HPF)
Advanced digital radio + B	(ADR+B)
Advanced digital radio + A	(ADR+A)
High capacity data radio	(HCDR)
Global positioning system - automatic positioning locator Q	(GPS APLQ)
Headquarters kit	(HQ KIT (HF))

Radio Power supply [REDACTED]

ELECTRICAL SYSTEM

19

Generator No 12, Mk 3..... 8 inches diameter 3 phase alternator with integral
rectifying diodes

Generator 140 amperes at 28.5 volts at 3000-10000 rev/min

System voltage..... 28.5 volts ± 0.25 volts - normal
27.0 volts ± 0.25 volts - tropical

Batteries (automotive) [REDACTED]

Distribution and charging system DC nominal, 24-volt system with negative pole earth.
Conventional earth return circuits where appropriate.
Heavy discharge circuits; battery and engine starter
use return cables at 200 A rating.
Two sets of batteries are fitted; one set for automotive
purposes and the second set for radio purposes. Each
set has its own isolating switch. Both banks of batteries
are float charged in parallel from the vehicle generator
at 28.5 volts.

TABLE 1 LAMPS

Serial	NSN	Light	Volts	Watts	Type	Qty
1	6240-99-995-9182	Gen indicator light on, Radio Distribution box	28	1.1	Midget flange	As req'd
2	6220-99-823-8832	Spotlight	28	100	Sealed beam	As req'd
3	6240-99-995-1233	Fire warning	24	3	MCC fitting	As req'd
4	6240-99-995-9182	GPMG warning	28	1.1	Midget flange	As req'd

TABLE 2 CIRCUIT PROTECTIVE DEVICES

Serial	Circuit	Ident.	Type and Rating	Location	Qty
1	Smoke dischargers	Smoke	Cartridge 10A	Driver's instrument panel	As Req'd
2	Commander's map light	INT LTS	Cartridge 5A		As Req'd
3	Cupola periscope wipers, sight graticule and heater, spotlight and MG	Cupola	Cartridge 15A		As Req'd
4	Radio services	Load fuse	Link 100A	Radio Distr Box	As Req'd
5	Gen indicator light	5A	Cartridge 5A	Cupola services switch box	As Req'd
6	GPMG firing circuit	10 AMP	Cartridge 10A		As Req'd
7	Spotlight circuit	7 AMP	Cartridge 7A		As Req'd
8	Wiper circuit	3 AMP	Cartridge 3A		As Req'd
9	Commander's sight circuit	2 AMP	Cartridge 2A		As Req'd
10	Wipers	Wiper reset	Circuit breaker 2A		As Req'd

CHAPTER 2

HULL AND FITTINGS

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Para

1	General
2	Driver's compartment
3	Driver's access hatch door
7	To open the hatch door
8	To close the hatch door
9	Section commander's hatch door
11	Roof hatch doors
14	To open the hatch doors
15	To close the hatch doors
16	Rear door
18	To clamp the door closed (WARNING)
20	Vehicle commander's hatch
22	Vehicle commander's seat
23	To adjust seat height
24	Personnel seats
	[REDACTED]
	[REDACTED]
	[REDACTED]
	[REDACTED]
	[REDACTED]
	[REDACTED]
	[REDACTED]
	[REDACTED]
36	Vision block - rear door
37	To change a vision block
38	Multi-barrelled smoke dischargers (WARNING)
39	Towing, lifting and recovery attachments
40	Maintenance
41	Bowman communication equipment

Fig

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10	Location of Bowman communication equipment - Spartan, Sheet 1.....	17
11	Location of Bowman communication equipment - Spartan, Sheet 2.....	18

GENERAL (Fig 1)

1 [REDACTED] with the front compartment layout as per the Scimitar vehicle, but from the driver rearwards a personnel compartment with a cupola mounted in its roof. The engine compartment louvres (Fig 1 (5)), transmission compartment louvres (12), and the charge air cooler intake louvre (17) are fitted with wire mesh guards to prevent the ingress of spent cartridge cases, leaves and debris. Roll-up type canvas covers (11) are also provided to prevent entry of snow/rain into the compartments when the vehicle is parked. Stowage facilities are provided by boxes fitted to the roof plate, the hull rear plate and a wire cage on the rear door for a camouflage net. Provision is made for two bins to be fitted to the roof plate, two bins to be fitted to the LH hull side plate and one bin to be fitted to the RH hull side plate, for stowage of JAVELIN GW equipment items. Also, provision is made for the ADAD SIA stowage kit to be fitted externally on the rear door in lieu of the fitted fire extinguisher stowage. [REDACTED]

DRIVER'S COMPARTMENT

2 The increased height of the hull provides the driver with a greater head clearance for closed-down driving.

DRIVER'S ACCESS HATCH DOOR (Fig 2)

3 The driver's hatch door (Fig 2 (2)) is hinged on its front edge. The inside surface is padded (14) and strap (15) is fitted to facilitate handling.

4 The weight of the hatch door is counterbalanced by a spring equilibrator (4).

5 The hatch door is secured in the open position by a spring-loaded catch (10), and in the closed position by a catch (5) and locking handle (6) located in the roof plate.

6 A hasp (1) and eye (9) are provided to padlock the hatch door when required. A rain deflector strip (8) above the hatchway directs water away.

To open the hatch door

7 To open the hatch door, pull downwards on the strap (15) and turn the locking handle (6) until the catch (5) is clear of the hatch door. Allow the hatch door to rise under the influence of the equilibrator, and then push the hatch door fully open until it is held by the spring-loaded catch (10).

7A Luminescent tape has been positioned on the internal handle of the driver's hatch as a visual aid for the driver when exiting in both normal and emergency circumstances ('battened down' closed hatch position).

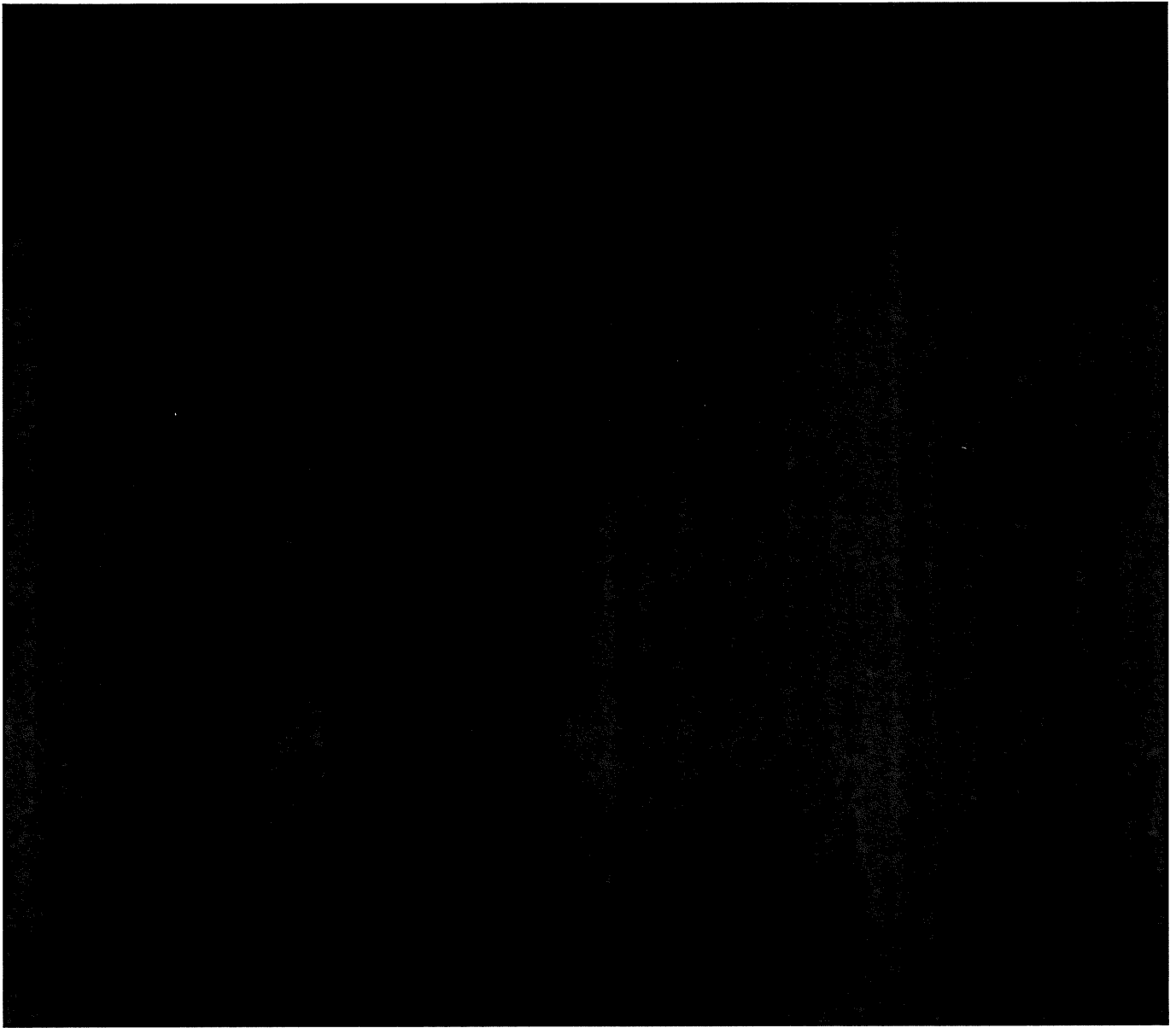
To close the hatch door

8 To close the hatch door, grasp the hatch door strap, release the catch (12) and pull the hatch door until closed. Turn the locking handle until the catch (5) engages the edge of the hatch door.

[REDACTED]

[REDACTED]

[REDACTED]



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

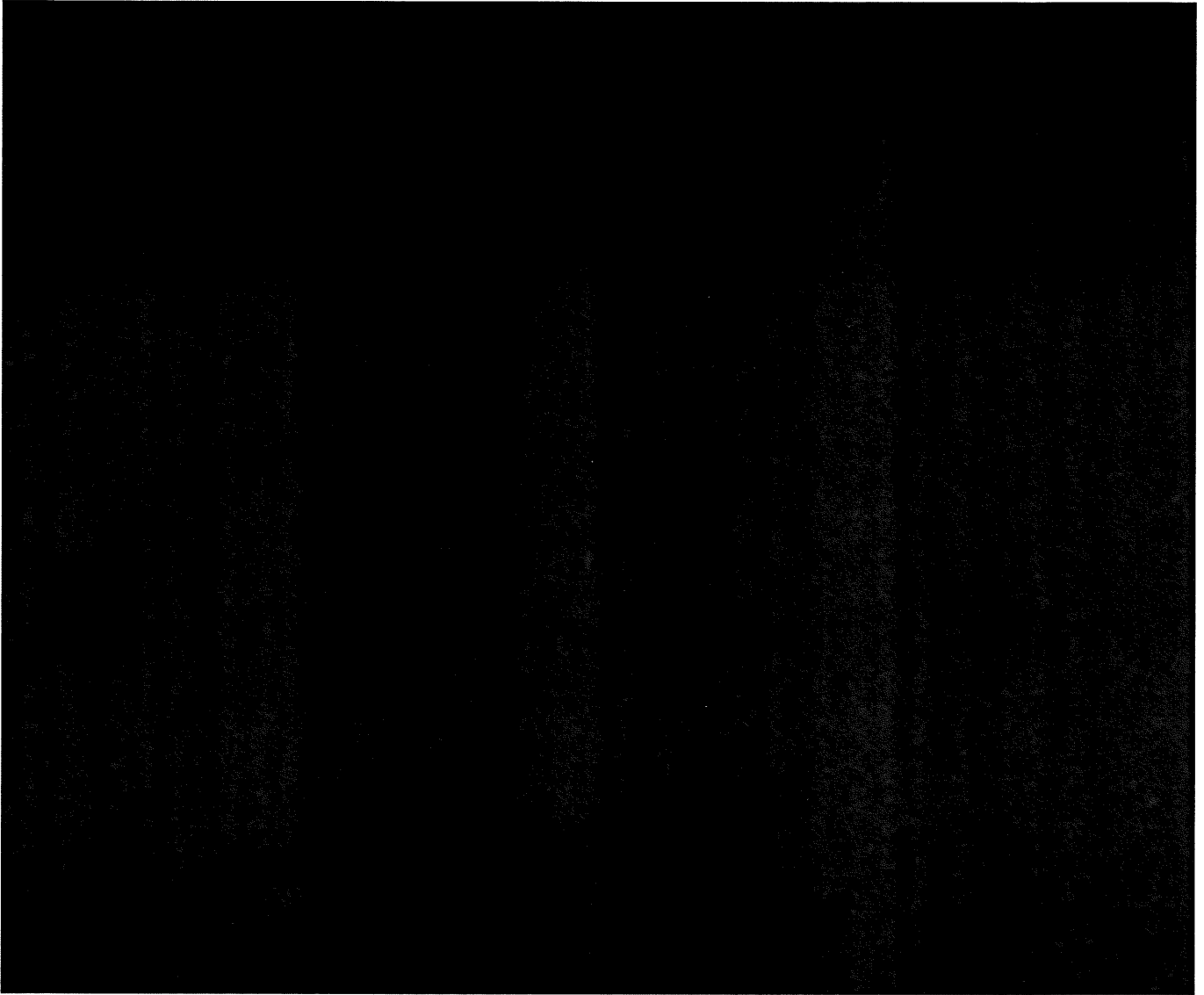
[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



[REDACTED] [REDACTED] [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

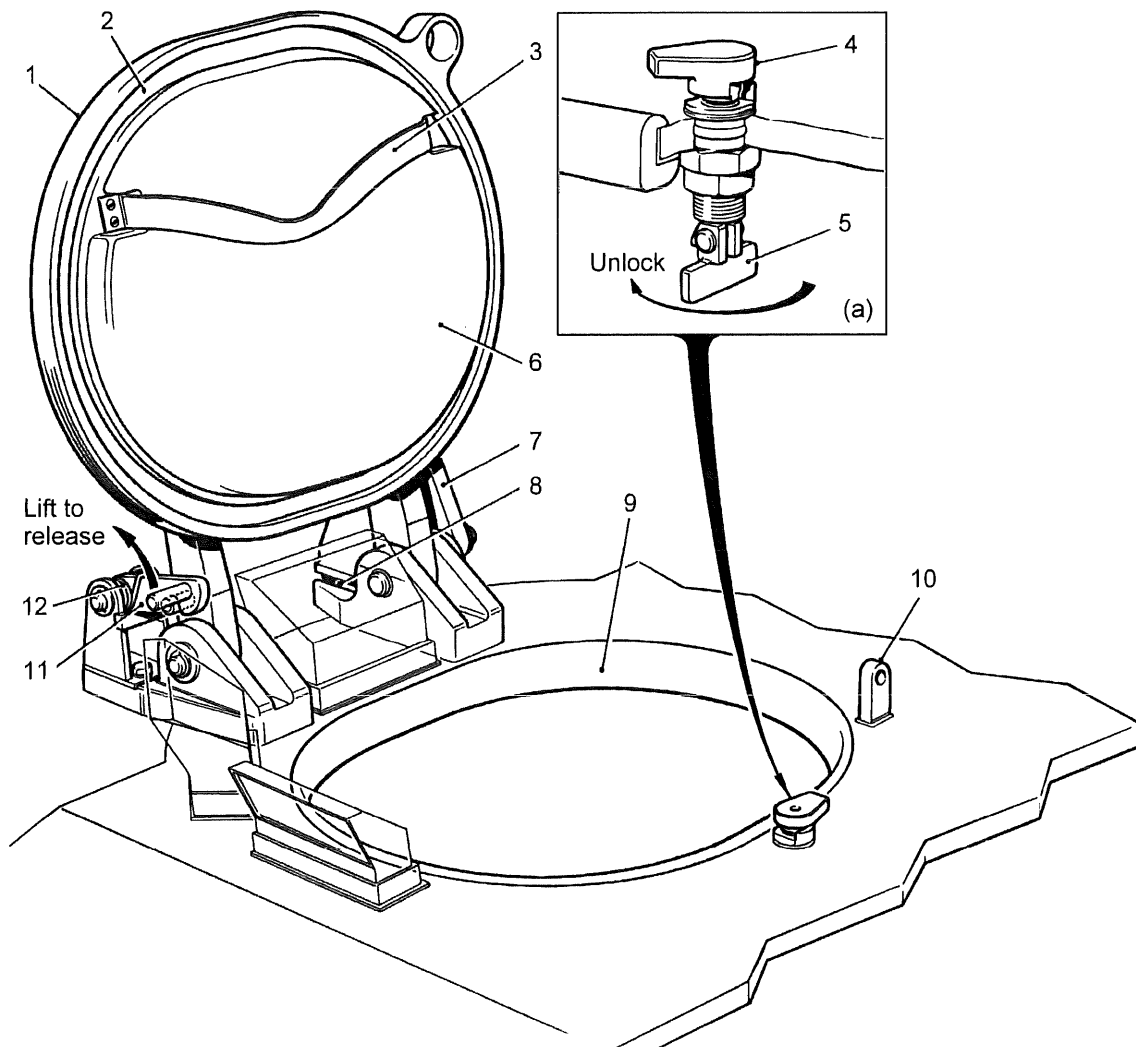
[REDACTED]

SECTION COMMANDER'S HATCH DOOR (Fig 3)

9 The section commander's hatch door (Fig 3 (1)), situated in the hull immediately above his seat, is similar to the driver's hatch door. For details of description and operation, refer to Paras 3 to 8.

9A Luminescent tape has been positioned on the internal handle of the commander's hatch as a visual aid for the commander when exiting in both normal and emergency circumstances ('battened down' closed hatch position).

10 A stop bracket is fitted to hold the hatch door vertical and so prevent the hatch door overhanging the side of the vehicle.



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Fig 3 Section commander's hatch

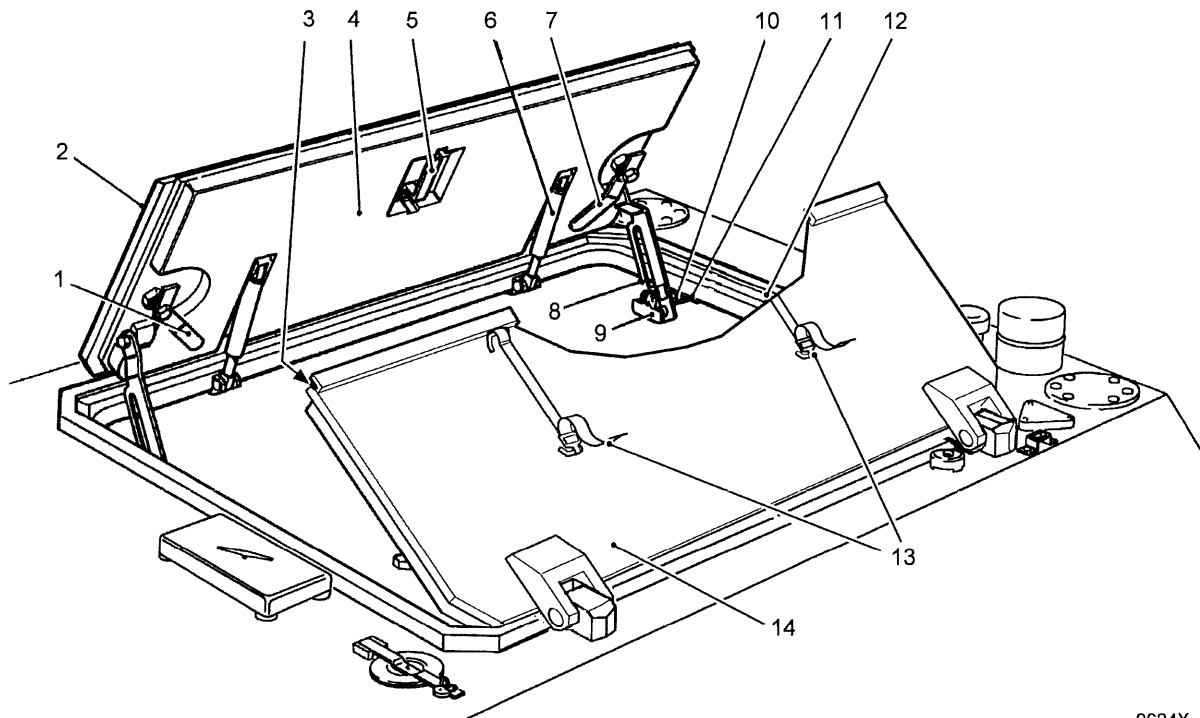
ROOF HATCH DOORS (Figs 1 and 4)**NOTE**

With the roof stowage bin located above the roof hatch doors, the external stowage bin will need to be removed before the roof hatch doors can be used.

11 The two hatch doors (Fig 1 (3)) are hinged to open upwards and are padded on the inner side. Each hatch door is fitted with gas filled damper struts and is provided with stays, which retain the hatch door in the fully open, or any intermediate position.

12 The hatch door hinges are arranged to form a weapon slit between the roof plate and the hatch door edge when the hatch door is open.

13 The hatch doors are retained in the closed position by two locking handles (Fig 4 (1 and 7)) on each hatch door. The left hatch door overlaps the right; therefore, the left hatch door must be opened first and closed last. A handle (5) is provided for pulling the hatch door down against the dampers (6).



9624X

1	Lever handle	6	Gas spring (dampers)	11	Catch plate
2	Right door	7	Lever handle	12	Sealing strip
3	Sealing strip	8	Hatch door stay	13	Stowage securing straps
4	Padding and insulation	9	Stay catch	14	Left door
5	Handle	10	Block, finger lock		

Fig 4 Roof hatch doors

To open the hatch doors (Fig 4)

14 To open the hatch doors, proceed as follows:

14.1 Turn the locking handles of the left hatch door until the locking tongues are clear of the roof plate.

14.2 Lift the locking handles and allow the hatch door to rise under pressure of the dampers, and then push the hatch door open to the desired position.

14.3 Secure by turning the stay catches (Fig 4 (9)) down to lock the stay.

14.4 Open the right hatch door in a similar manner.

To close the hatch doors (Fig 4)

15 To close the hatch doors, proceed as follows:

15.1 Grasp the handle (Fig 4 (5)) on the right hatch door.

15.2 Release the stay catch (9), pull the hatch door down.

15.3 Secure with the locking handles (1 and 7) against the underside of the roof plate.

15.4 Repeat for the left hatch door, re-check security.

REAR DOOR (Figs 5 and 6)

16 The rear door (Fig 5 (2)) is [REDACTED] insulated on the inside and hinged to open outwards. A vision block (3) in the top of the door can be blacked-out by a spring-loaded shutter. The shutter being retained in the open position by a spring and eye arrangement fitted each side of the shutter.

17 The door can be secured in the closed position, from both inside or outside, by a lever operated locking handle (19). Six rotatable catches (Fig 6 (12)), positioned around the inside of the door, clamp it closed. A 'blackout switch' (7), located near the locking handle tongue, is operated when the door is opened to extinguish any interior lights, which may be switched on. The circuit to the door mounted registration plate (Fig 5 (17)) and convoy light (18) is completed by a plunger type switch (Fig 6 (1)) when the door is closed.

To clamp the door closed (Fig 6)

WARNING

DANGER TO LIFE. IF THE REAR DOOR LOCKS ARE ENGAGED, INGRESS AND EGRESS TO THE REAR OF THE VEHICLE ARE SEVERELY IMPEDED IN THE EVENT OF EMERGENCY OR ROLL OVER.

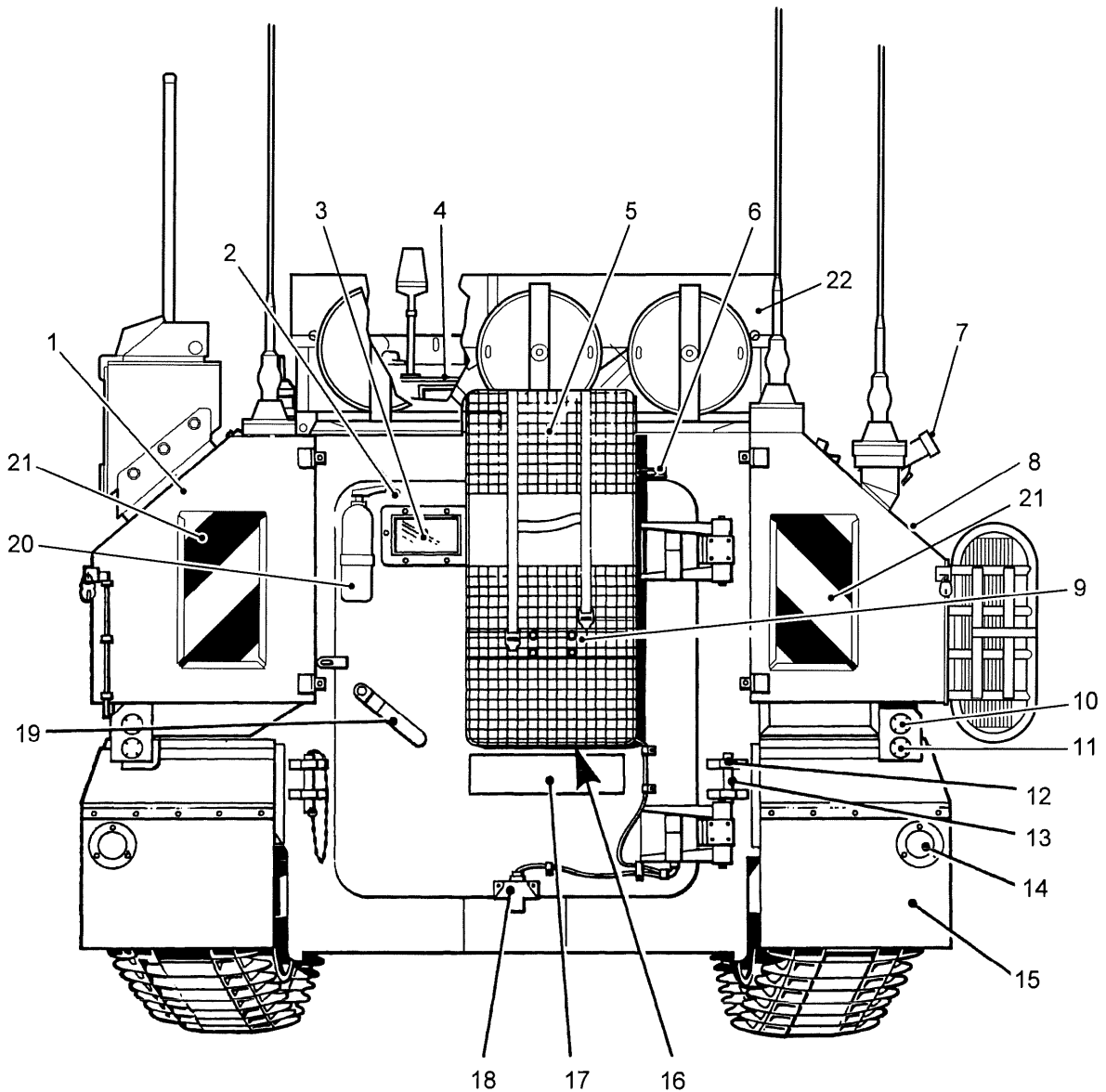
18 To clamp the door closed, close the door, secure the door handle (Fig 6 (8)) and proceed as follows:

18.1 Slacken the six rotatable door catches (12), rotate the tongue of each catch to engage door clamping blocks (9).

18.2 Hand tighten the catches, clamping the door.

19 To release the door unscrew each catch and rotate them to engage pads on door, then hand tighten catches.

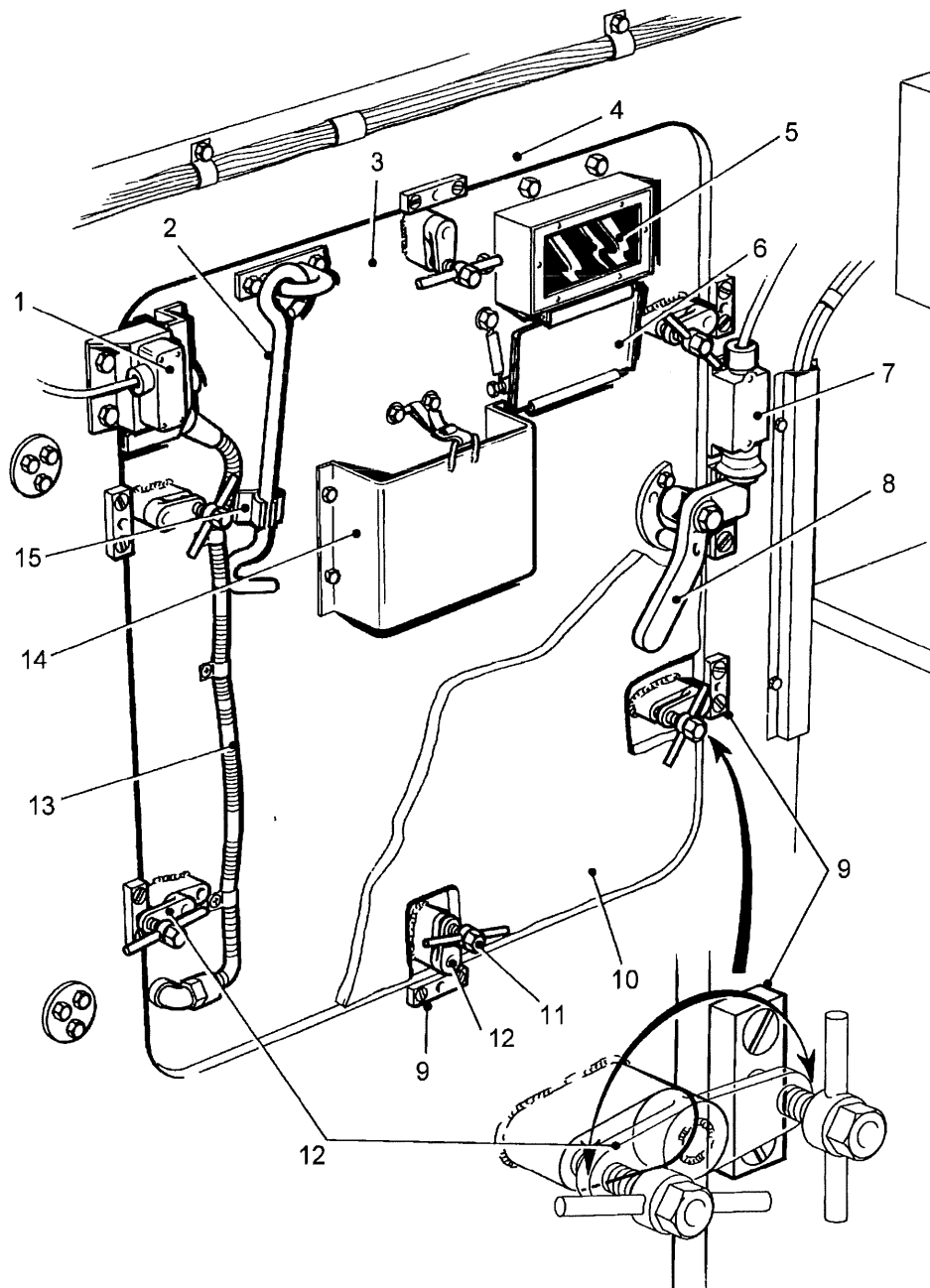
19A Luminescent tape has been positioned on the internal handle of the rear door as a visual aid for the crew when exiting in both normal and emergency circumstances (closed door position).



9625X

- | | | |
|------------------------------|--|-----------------------------|
| 1 Stowage bin | 9 Telephone cable, drum mounting holes | 16 Registration plate light |
| 2 Rear door | 10 Turn light | 17 Registration plate |
| 3 Vision block | 11 Rear light | 18 Convoy light |
| 4 Cupola | 12 Towbar bracket | 19 Door handle |
| 5 Camouflage net stowage bin | 13 Towbar retaining pin | 20 Extinguisher |
| 6 Staple | 14 Reflector | 21 Rear marker plate |
| 7 Exhaust | 15 Mudflap | 22 Roof stowage bin |
| 8 Stowage bin | | |

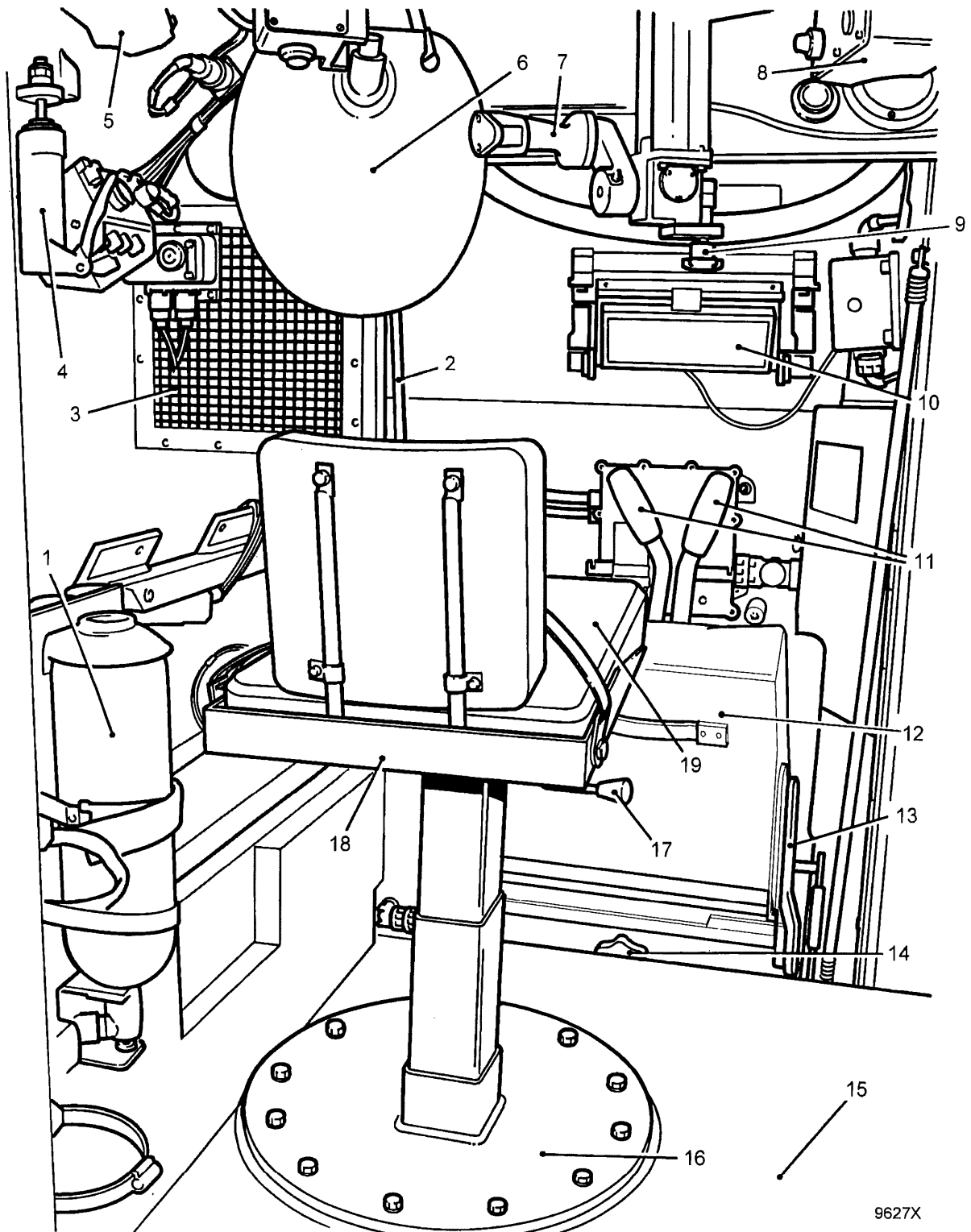
Fig 5 Rear view of vehicle



9626X

- | | | | | | |
|---|---|----|-----------------|----|-----------------------|
| 1 | Electrical control box and plunger switch | 6 | Flap (blackout) | 11 | Clamp screw |
| 2 | Stay | 7 | Blackout switch | 12 | Rotatable catch |
| 3 | Door | 8 | Door handle | 13 | Electric cable |
| 4 | Hull rear plate | 9 | Clamping block | 14 | First aid stowage bin |
| 5 | Vision block | 10 | Padding | 15 | Clip |

Fig 6 Rear door (interior view)



9627X

Fig 7 Vehicle commander's and driver's seating positions, (looking forward)

KEY TO FIG 7

1	Fire extinguisher	8	Cupola electrical services control box	14	Fuel tap
2	Elasticated cords			15	Fuel tank
3	Heater grille	9	Lock	16	Baseplate
4	Cupola traverse handle	10	Driver's periscope	17	Height adjustment lever
5	Wiper drive motor	11	Steering levers	18	Seat frame
6	Screen washing fluid bag	12	Driver's seat	19	Vehicle commander's seat
7	Elevating gear handle	13	Backrest release lever		

VEHICLE COMMANDER'S HATCH

20 See Chap 3 – Cupola.

VEHICLE COMMANDER'S SEAT (Figs 7 and 7A)

22 The vehicle commander's seat (Fig 7 (19)) is positioned on the left of the personnel compartment directly behind driver's seat. It is a pedestal type seat, which is secured by its base plate to the reinforced top plate of the vehicle fuel tank. The seat can be swivelled round, adjusted for height and for forward and backward movements. A helical compression spring fitted in the seat column assists the lifting of the seat. The seat squab and backrest are padded with PVC covered foam rubber. A 2-point seat belt is provided. A seat belt cutter (Fig 7A) is fitted to the waist/lap strap.

To adjust seat height

23 To adjust the seat height, proceed as follows:

23.1 Pull the height adjustment lever handle (Fig 7 (17)) upwards to disengage the catch.

23.2 Use body weight to control seat movement to the desired height.

23.3 Release the handle and ensure that the catch is fully engaged before committing the full body weight to the seat.

PERSONNEL SEATS (Figs 7A and 8)

24 The section commander/radio operator's seat faces forward immediately below his hatch door to the right of the vehicle commander.

25 The seat (Fig 8) comprises a seat pad mounted on the vehicle fuel tank (18). It provides for one other crew member sitting back to back with the section commander. The seat backrest (22) is padded on both sides and positioned between the two seated members.

26 The backrest is mounted on a single post which slots into a support tube bolted to the hull lower right side plate. It can be positioned midway between the two seats or stowed in a forward or a backward position against the stowage bin situated over the track sill plate.

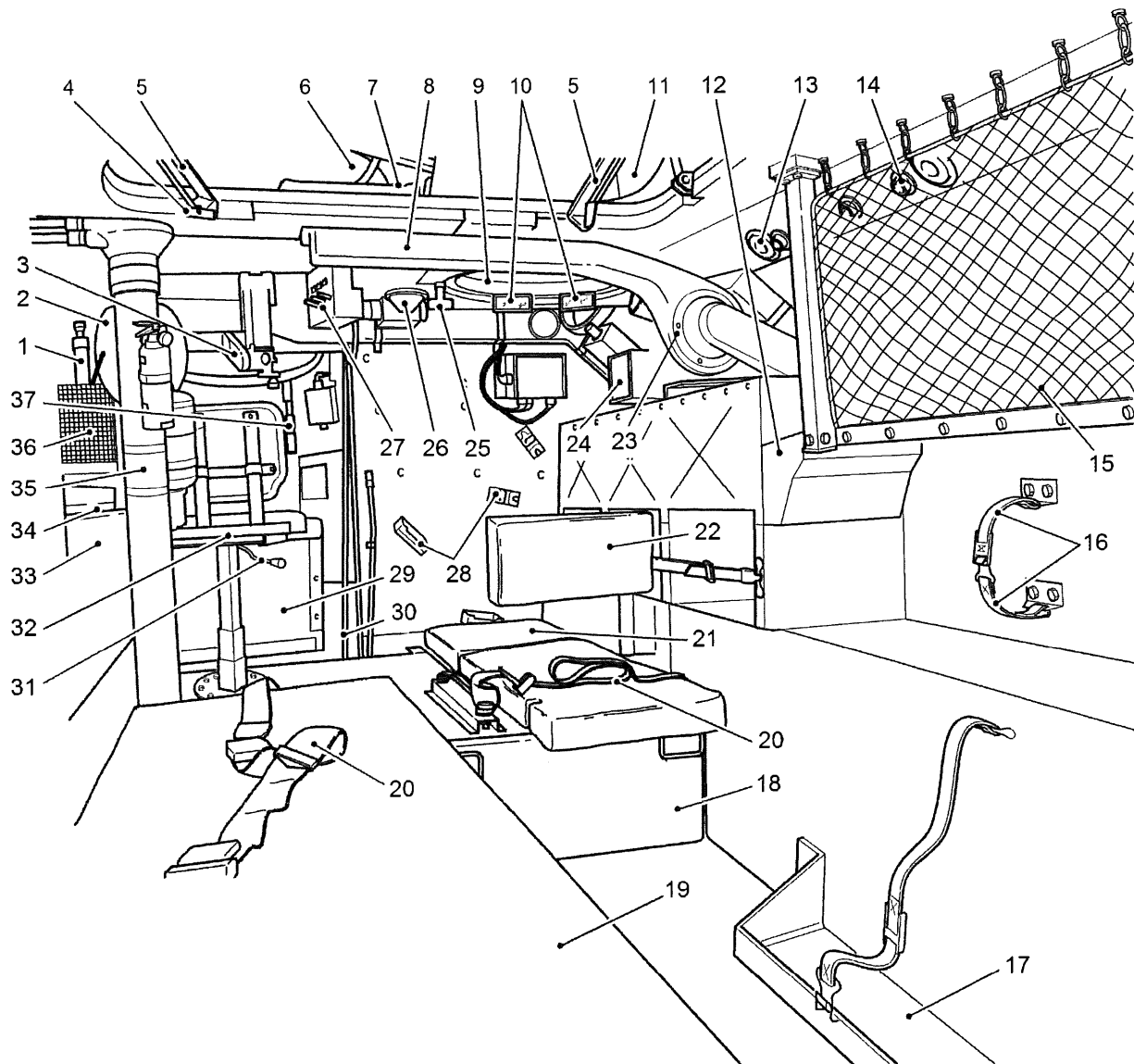
27 Three other persons can be seated side by side on a hinged padded board seat (19), under which, part of the fuel tank, batteries and stowage are located. They all face inwards towards the right side, with a padded backrest (33) behind them along the left lower side plate. The stowage bin cover forms the hinged backrest.

28 All the seats are provided with seat belts (20). A seat belt cutter (Fig 7A) is fitted to each waist/lap strap.



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Fig 7A Seat belt cutter (2-point seat belt) (Pictorial Representation Only)



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- | | | |
|-----------------------------------|-----------------------------|-----------------------------|
| 1 Cupola traverse handle | 13 Air diffusers | 26 Compartment light |
| 2 Screen washer bag | 14 Mask connections | 27 Cupola services box |
| 3 Elevating gear handle | 15 Stowage net | 28 Small arms brackets |
| 4 Catch | | 29 Driver's seat |
| 5 Door stay | 17 Water container stowage | 30 Elasticated cords |
| 6 Cupola | 18 Fuel tank | 31 Height adjustment lever |
| 7 NBC air inlet duct valve | 19 Personnel seats | 32 Vehicle commander's seat |
| 8 NBC air intake ducting | 20 Seat belts | 33 Personnel seat backrest |
| 9 Section commander's hatch | 21 Section commander's seat | 34 Stowage bin |
| 10 Section commander's periscopes | 22 Double sided backrest | 35 Fuel tank filler tube |
| 11 Roof hatch door | 23 NBC fan | 36 Heater grille |
| 12 Sight stowage, driver's | 24 NBC control panel | 37 Driver's periscope |
| | 25 Catch | |

Fig 8 Personnel compartment, view looking forward

DRIVER'S DAY PERISCOPE/NIGHT SIGHT (Figs 8 and 9)

29 The driver's day periscope/night sight (Fig 9 (6 and 4)) are common to all CVR(T) Diesel vehicles, see AESP 2350-T-220-201, Chap 3. A mounting bracket (Fig 8 (12)) for stowing either a day periscope or night sight is provided in the personnel compartment.

To remove and replace driver's periscope or sight

30 See AESP 2350-T-220-201, Chap 3.

VEHICLE COMMANDER'S COMBINED DAY/NIGHT SIGHT

31 [REDACTED]

PERISCOPES (Fig 9)

32 Fig 9 shows the position of the various periscopes, sights and the vision block, incorporated in the hull. All periscopes are provided with blackout blinds.

Vehicle commander's periscopes

33 See Chap 3 - Cupola.

Section commander's periscopes (Fig 9)

34 The section commander has three Periscopes No. 43, Mk 3 (Fig 9 (7)), [REDACTED]

[REDACTED] The section commander's periscopes are secured to the underside of the roof plate by two screws.

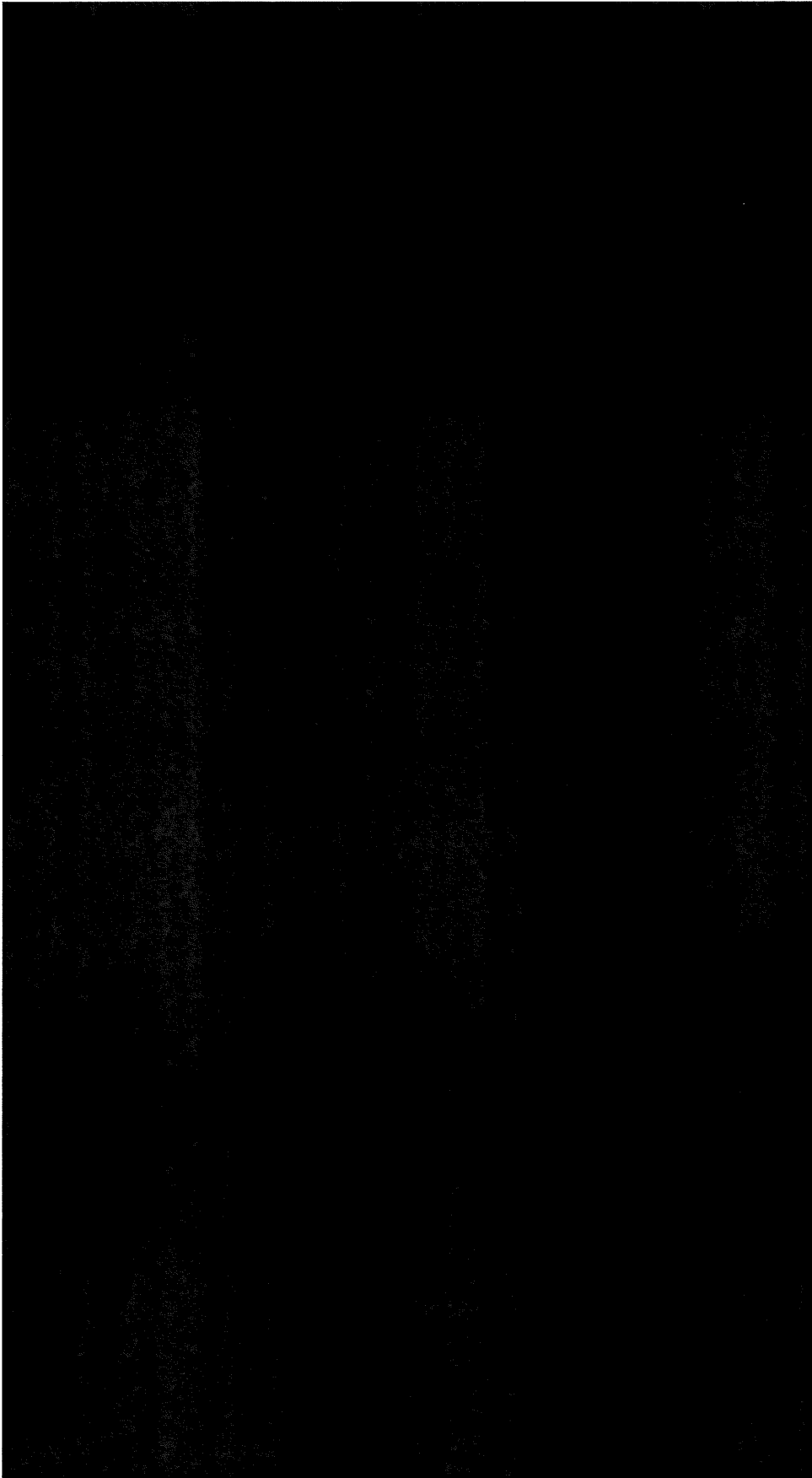
To remove and replace a section commander's periscope

35 To remove and replace a section commander's periscope, proceed as follows:

- 35.1 Remove the two securing screws, withdraw the periscope.
- 35.2 Clean the inside of the periscope aperture.
- 35.3 Clean the periscope glass surfaces as detailed in Chap 3 - Cupola.
- 35.4 Ensure that the sealing gasket is serviceable before replacing the periscope into its aperture.
- 35.5 Replace the securing screws, do not overtighten.

[REDACTED]

[REDACTED]



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

VISION BLOCK - REAR DOOR (Fig 9)

36 The vision block (Fig 9 (2)) is fitted to the top left hand corner of the rear door, see also Para 16.


To change a vision block

37 To change a vision block, proceed as follows:

- 37.1 Remove the six screws securing the block.
- 37.2 Ease the block out of the mounting.
- 37.3 Inspect the condition of the seal and replace if necessary.
- 37.4 Replace the vision block and tighten the screws evenly.

MULTI-BARRELLED SMOKE DISCHARGERS (Fig 1)**WARNING**

RF HAZARD. IT IS POTENTIALLY DANGEROUS TO LOAD OR UNLOAD SMOKE GRENADE DISCHARGERS WITHIN TWO METRES OF SOME RADIO ANTENNAS WHEN TRANSMITTING ON SOME FREQUENCIES. THEREFORE, CREWS SHOULD ENSURE THAT RADIOS DO NOT TRANSMIT WHEN LOADING OR UNLOADING SMOKE GRENADE DISCHARGERS.

38 A pair of four-barrelled smoke dischargers (Fig 1 (10)) are located one on either side of the forward hull roof plates. 

TOWING, LIFTING AND RECOVERY ATTACHMENTS (Figs 1 and 5)

39 Four lifting eyes are fitted for air portability or parachute dropping. Towing eyes (Fig 1 (16)), one each side of the front are provided for recovery purposes and eyes with pins (Fig 5 (12 and 13)) are provided on either side of the rear door for the lifting of a towing attachment or recovery equipment.

MAINTENANCE

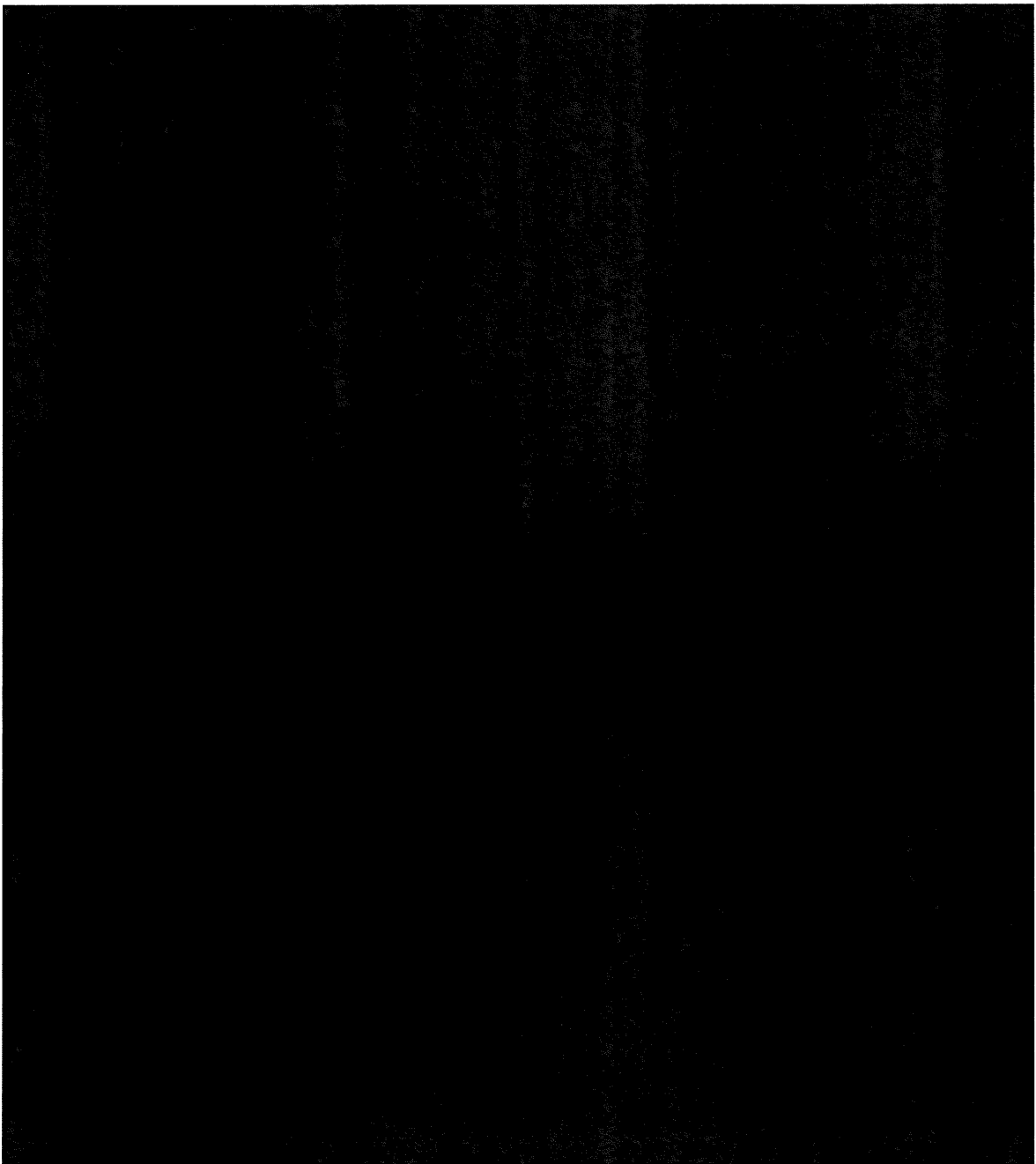
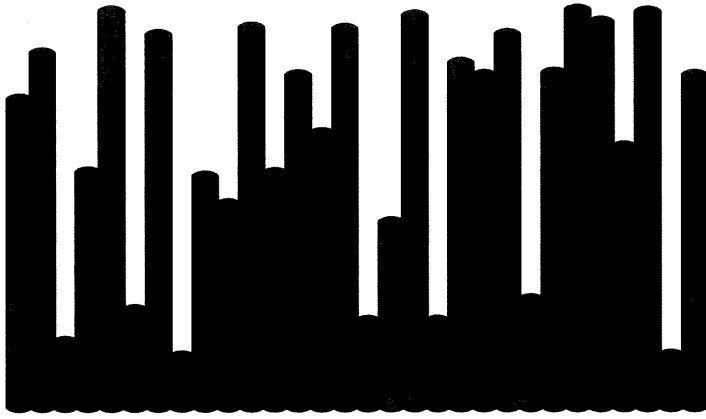
40 To maintain the hull and its fittings, proceed as follows:

- 40.1 Use an oil can sparingly to lubricate all hinges, catches and guides.
- 40.2 Check the serviceability and security of all seals, cover plates and hull attachments.
- 40.3 Check that wire mesh guards are clear of debris and that canvas covers are serviceable.

BOWMAN COMMUNICATION EQUIPMENT (Figs 10 and 11)

41 The Bowman equipment installed in Spartan is shown in Figs 10 and 11.

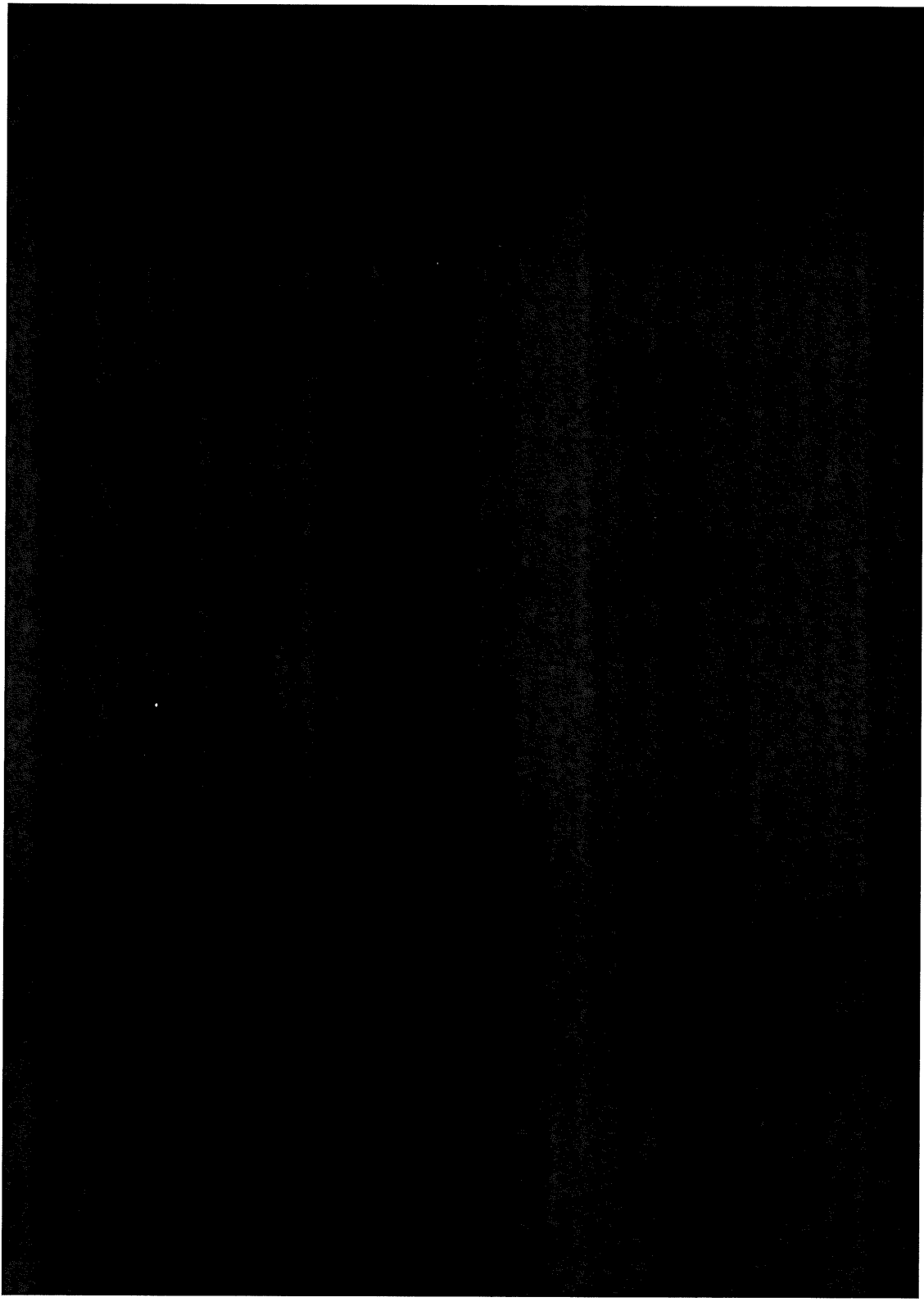
42 The layout is representative only and reference should be made to DAESP 5895-G-200-Series (CIETP) for operating information on any installed Bowman system or component.



[REDACTED]

[REDACTED]

[REDACTED]



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

CHAPTER 3

CUPOLA

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5	To traverse the cupola
6	To slew the cupola
7	Maintaining the cupola
8	[REDACTED]
12	Sight unit, image intensified, L3A1 (CAUTION)
16	To fit the sight unit
17	To remove the sight unit
18	Maintenance
19	Cleaning
20	To change the battery (WARNING)
21	Vehicle commander's periscopes
24	To remove and replace a periscope
25	Cupola hatch door
27	GPMG mounting and elevating gear
33	GPMG firing interrupter systems
35	GPMG firing manually
36	Cupola services switch box
40	To reset a circuit breaker
41	Switch box fuses
42	To change a fuse
43	To change the spotlight sealed beam unit

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4	Fitting the sight unit into the No. 62 sight	6
5	Fitting the battery.....	8
6	Cupola No. 16, Mk 1 (external view)	10
7	Cupola services switch box.....	12

GENERAL (Figs 1 and 6)

1 The vision cupola AV No. 16 Mk 1 (Figs 1 and 6) is mounted on the personnel compartment roof to the rear of the driver's position. It provides a mount for the rotating amber warning light (Fig 6 (19)), [REDACTED] and a GPMG mounting and spotlight (12). The GPMG can be loaded, cocked and fired from within the cupola.

2 The cupola can be traversed 6,400 mils (360 degrees) by a hand operated gear. The traverse gear being engaged by the operation of a trigger (Fig 1 (11)) integral with the traverse handle (12). With the trigger released the gears are out of mesh and the cupola can be slewed by hand. The traverse handle can be parked by engaging the trigger plunger with the traverse gear casing parking point (14). A traverse lock (13) retains the cupola in any position.

3 [REDACTED] All movements of the mount are transmitted to the sight objective mirror and spotlight. The mount can be locked in any position in elevation.

4 The sight and periscopes are provided with a wiper and washer jet. The washer jets are supplied with water from a bag type reservoir via manually operated plunger type pump.

TO TRAVERSE THE CUPOLA (Fig 1)

5 Ensure that there is no obstruction to prevent the cupola from turning, then:

5.1 Unscrew the cupola traverse lock (Fig 1 (13)).

5.2 Grasp the traversing handle (12) simultaneously depressing the release trigger (11) and rotate the handle in the required direction.

5.3 Screw up the cupola traverse lock as required.

TO SLEW THE CUPOLA (Fig 1)

6 To slew the cupola, proceed as follows:

6.1 Unscrew the cupola traverse lock (Fig 1 (13)).

6.2 Depress release trigger (11) and turn traversing handle to parking point (14) and release trigger.

6.3 Grasp both the traversing (12) and elevating gear handles (6) and manually rotate the cupola in the required direction.

6.4 Screw up the cupola traverse lock as required.

MAINTAINING THE CUPOLA

7 The cupola ring wire bearing, elevation and traverse gearboxes are packed with lubricant on assembly and should not require lubrication in service.

[REDACTED]

[REDACTED]

9

[REDACTED]

10

[REDACTED]

11

[REDACTED]

[REDACTED]

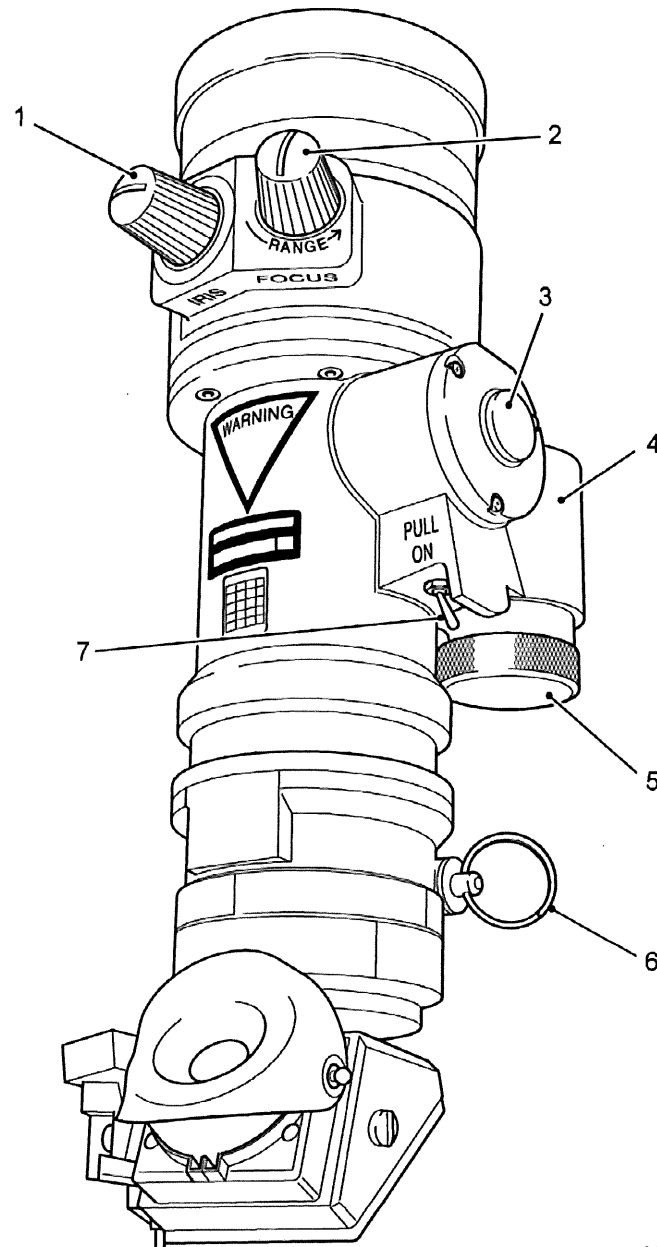
[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



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- | | | | |
|---|----------------------|---|-----------------------|
| 1 | Iris shutter control | 5 | Knurled screw cap |
| 2 | Focus control | 6 | Spring-loaded plunger |
| 3 | Inverter | 7 | Power supply switch |
| 4 | Battery compartment | | |

Fig 2 Sight unit No.63, Image Intensified, L3A1

SIGHT UNIT NO.63, IMAGE INTENSIFIED, L3A1 (Figs 2 and 3)**CAUTION**

IMAGE INTENSIFIER. The photo-cathode of the image intensifier tube (IIT) may be damaged if bright light either natural or artificial is allowed to enter the objective system with the iris open. The iris must be kept closed when the equipment is not in use.

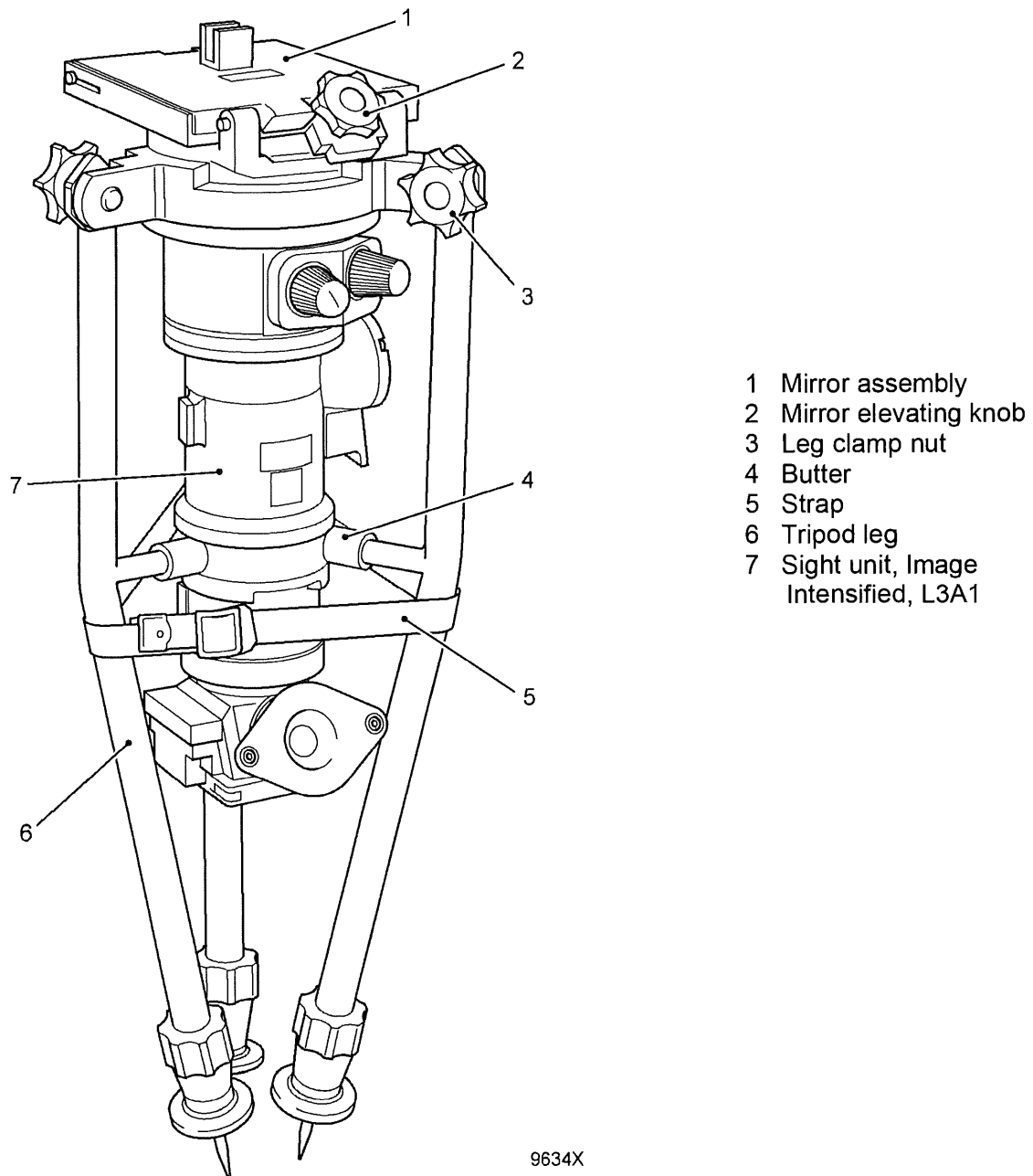
12 The Sight Unit (Fig 2) enables crews to survey battle areas and direct the fire of the GPMG at night without the use of artificial light.

13

14

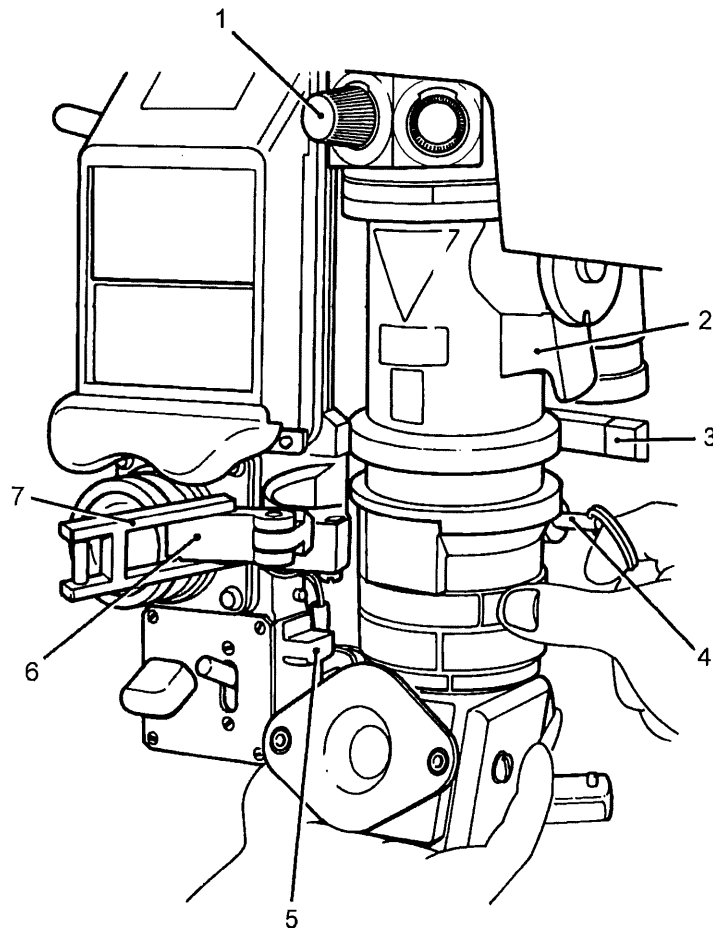
Under very dark conditions less current is used and so the battery life may be prolonged but the battery performance may deteriorate slightly under extremely cold conditions.

15 The sight unit may also be tripod mounted and used away from the vehicle (Fig 3).



9634X

Fig 3 Tripod fire control instrument (in carrying position)



9635X

- | | | | |
|---|-----------------------|---|------------------------|
| 1 | Iris shutter control | 5 | Eyepiece heater socket |
| 2 | Power supply switch | 6 | Lever |
| 3 | Rear clamp arm hook | 7 | Hook joint |
| 4 | Spring-loaded plunger | | |

Fig 4 Fitting the sight unit into the No. 62 sight

To fit the sight unit (Fig 4)

16 To fit the sight unit, with the battery fitted, see that the power supply switch (Fig 4 (2)) is OFF, and that the Iris control (1) is in the SHUT position.

16.1 Pull the front end of the lever (6) towards you.

16.2 Disengage the hook joint (7) and swing the front section of the clamp to the left.

16.3 Push the rear arm of the clamp (3) back against the wall of the cupola and remove the mirror periscope if fitted.

16.4 Remove the protective caps, one from the front objective lens and one from the heater plug.

16.5 Take the sight unit in the right hand, supporting it near the battery housing. With the left hand holding the bottom of the eyepiece, position the sight unit slightly below and on the right of the day sight.

- 16.6 Guide the objective assembly into the collar at top of the day sight, ensuring at the same time that the eyepiece heater plug is in line with its own socket (5).
- 16.7 Pull out the plunger (4) and keeping the plunger spring compressed push the sight unit up until the eyepiece heater plug has engaged with its socket - release the plunger.
- 16.8 Keep the left hand under the eyepiece supporting the sight until sure the plunger is correctly located in the day sight, and test for security by pulling down on the sight unit.
- 16.9 Draw both arms of the clamp to the sight unit, pulling the lever (6) out to the right.
- 16.10 Engage the hook joint (7) of the front clamp over the hook of the rear arm (3) and pull the lever (6) to the left to lock the clamp.
- 16.11 Press the two eyeguard lugs back on to the two studs to expose the eyepiece lens.

To remove the sight unit

- 17 To remove the sight unit, proceed as follows:
 - 17.1 Switch the sight OFF.
 - 17.2 Check that the iris control knob is at OFF, i.e. fully clockwise.
 - 17.3 Place the left hand under the eyepiece. Release the clamp lever and hook joint and undo the clamp.
 - 17.4 Pull the plunger ring and disengage the plunger.
 - 17.5 Allow the left hand to take the weight of the sight. Feed the sight down and clear of the day sight.
 - 17.6 Replace the objective lens protective cap and the heater plug protective cap.
 - 17.7 Remove battery and return it to Unit Store.

Maintenance

- 18 When maintaining the sight unit, as with all optics, great care must be taken not to scratch glass or lens surfaces. No attempt should be made to wipe off mud or grit in a dry state.

Cleaning

- 19 To clean the sight unit, proceed as follows:
 - 19.1 Rinse the front objective lens glass with plenty of clean water until it is free of mud or grit.
 - 19.2 Dust may be removed by a soft brush.
 - 19.3 Soap or detergent may be used to remove greasy smears or stains, (DO NOT use a petroleum spirit) then wipe with a damp leather or tissue taking care not to trap abrasive matter between the leather and the glass.
 - 19.4 Clean and dry all surfaces, other than glass, with a brush or dry cloth.
 - 19.5 Breathing on the eyepiece and drying with a clean dry cloth or tissue can assist cleaning of the eyepiece lens.

To change the battery (Fig 5)

WARNING

DRY CELL BATTERIES. THE BATTERIES USED IN THIS EQUIPMENT ARE CAPABLE OF GENERATING TOXIC GASES AT HIGH PRESSURE AND MAY BURST IF THEY ARE SUBJECTED TO: EXCESSIVE HEAT, PROLONGED SHORT CIRCUITING, OR BEING DISCHARGED WELL BEYOND THEIR OPERATING LIFE. DISCHARGED BATTERIES MUST BE PROMPTLY REMOVED FROM THE EQUIPMENT AND RETURNED TO UNIT STORES. THEY MUST NOT BE BURIED, PLACED ON A FIRE, OR IN ANY RECEPTACLE FOR OTHER RUBBISH. EVERY PRECAUTION MUST BE TAKEN AGAINST ACCIDENTAL SHORT CIRCUIT, AND NO ATTEMPT IS TO BE MADE TO OPEN THE BATTERIES.

20 To change the battery, proceed as follows:

20.1 Check that the power supply toggle switch (Fig 5 (1)) is at OFF and the iris control to the SHUT position.

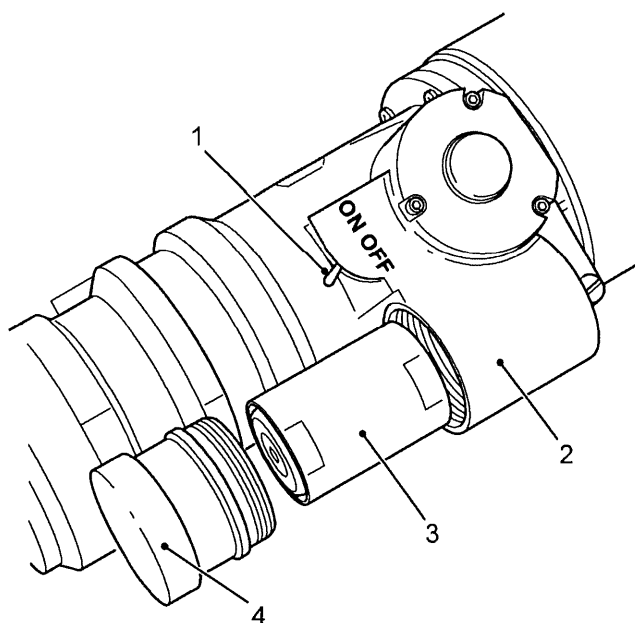
20.2 Unscrew the battery compartment knurled cap (4) and remove old battery.

20.3 Check that the compartment and cap threads are clean and dry.

20.4 Insert new battery ensuring that the positive end, indicated by a slight raised boss, is inserted first.

20.5 Screw the knurled cap fully home.

20.6 Return the old battery to Unit Stores because of the hazardous nature of this type of battery.



9636X

- | | | | |
|---|---------------------|---|-------------------|
| 1 | Power supply switch | 3 | Battery |
| 2 | Battery compartment | 4 | Knurled screw cap |

Fig 5 Fitting the battery

VEHICLE COMMANDER'S PERISCOPES (Fig 1)

21

22 The sight and periscopes are each provided with an individual wiper arm and washer jet, the wiper being driven from a common flexible shaft powered by the single electric wiper motor (1). The washer jets are supplied with water from a bag type reservoir (10) via the washer button/pump (15).

23 Inside the cupola each periscope can be masked by a roller type blackout blind (7), by looping it over the emergent ocular and affixing it to a catch.

To remove and replace a periscope

24 To remove and replace a periscope, proceed as follows:

24.1 Move the wiper away from the periscope.

24.2 Slacken the bolts retaining the clamping plates.

24.3 Support the periscope, rotate the clamping plates clear of the periscope flanges. Lower the periscope.

24.4 Clean the inside of the periscope aperture; and also clean the periscope.

24.5 For replacing: check the periscope seal for serviceability and follow instructions in reverse order.

CUPOLA HATCH DOOR (Fig 6)

25 The vehicle commander's hatch door (Fig 6 (7)) is spring assisted, and can be locked or unlocked from inside the vehicle only; by turning locking handles (8) onto lugs in the hull casing. The door can be retained in the open position by the engagement of the door catch (9) with the doorstop arm, giving two different open positions.

26 A rubber seal (6) affixed to the door groove ensures a perfect seal when the door is closed. A flap type NBC pressure relief valve (5) fitted to the door relieves pressure build up, which occurs when the vehicle is operated 'closed-down'.

GPMG MOUNTING AND ELEVATING GEAR (Figs 1, 6 and 7)

27 The machine gun mounting provides the mount for the GPMG and spotlight and is mechanically linked to the commander's sight objective prism giving synchronised movements in elevation/depression for MG sighting and target illuminance.

28 The GPMG is positioned in guide slots at the rear and secured at the front by a captive quick release pin (Fig 6 (3)). The front GPMG mounting bracket (2) can be adjusted to align the GPMG in azimuth.

29 The GPMG is fired electrically, the circuit being controlled by a switch on the cupola services switch box (Fig 7) and the firing trigger being located on the elevating gear operating handle.

[REDACTED]

[REDACTED]

[REDACTED]



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

30 A small spring-loaded plunger is mounted on the left of the cradle in alignment with the GPMG safety catch button. This plunger provides the means of putting the mounted GPMG from 'safe' to 'fire' (the GPMG 'push to fire' button is inaccessible when the GPMG is mounted).

31 The GPMG is cocked by a flexible cable routed by a system of pulleys to a sliding block; which contacts the GPMG mounted cocking handle (Fig 1 (4)) protruding from a slot in the cupola casing wall, adjacent to the GPMG ammunition stowage compartment.

32 A nut and screw type elevating gear is operated by an elevating handle (Fig 1 (6)) through a set of bevel gears and universal coupling and can elevate and depress the mount as stated in Para 3. A hand nut on the bottom face of the elevating gear bevel box can be turned to lock the mount to permit the GPMG to be fired on a fixed line of elevation etc.

GPMG firing interrupter systems

33 The electrically fired GPMG receives its belt type ammunition from within the cupola via a feed slot in the top plate. This slot has a rubber plug, to keep out the rain and is stored in a bracket below the GPMG mount.

34 A cutout device operates before the ammunition container is emptied to enable a new ammo-belt to be clipped to the trailing last cartridge and firing continued. To overcome the hazard of 'shooting-away' the radio aerials radar masts etc. an interrupter mechanism is provided to cutout the electrical firing circuit at the required locations on the cupola 6,400 mil (360 degrees) traverse.

NOTE

The magazine door must be shut to complete the electrical firing circuit.

GPMG firing manually

35 The GPMG can be fired manually by depressing the trigger of the GPMG pistol grip but this action necessitates operating the GPMG from outside.

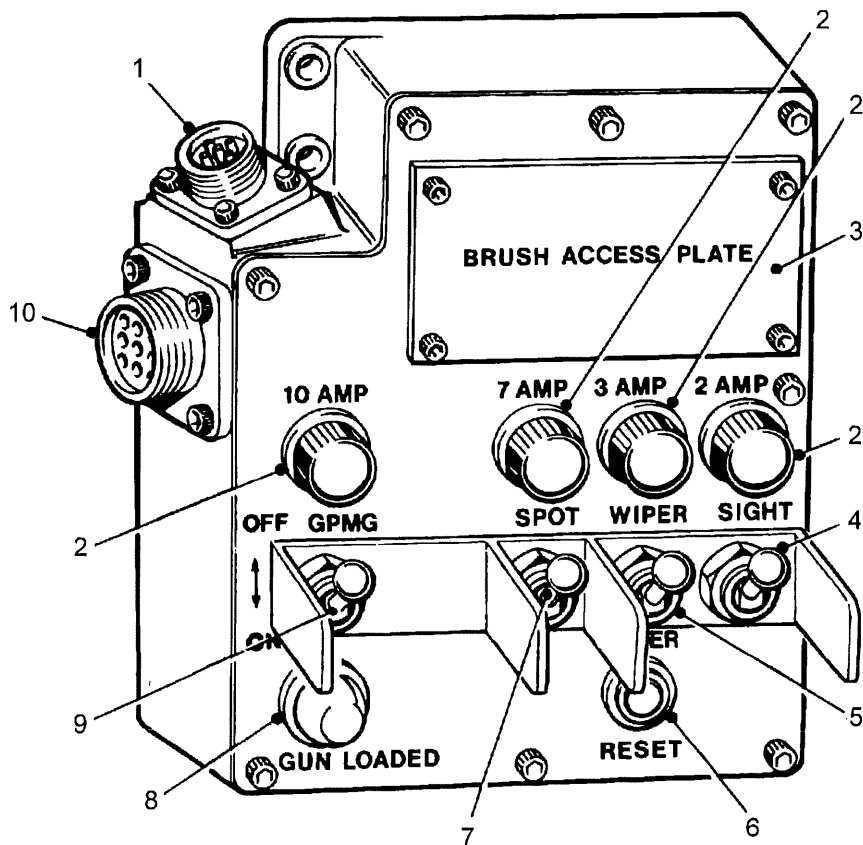
CUPOLA SERVICES SWITCH BOX (Fig 7)

36 The cupola services switch box (Fig 7) mounted on the cupola wall adjacent to the GPMG ammo-magazine provides the mounting facility for the entire cupola electrical services controls. Four ON-OFF toggle switches are provided for: GPMG (9), spotlight (7), wiper system (5) and commander's sight (4) circuits.

37 Each switched circuit has its own cartridge type fuse (2) mounted above the switch. In addition the GPMG circuit has a red warning lamp (8), which illuminates when the switch is put to ON confirming that the ammo-belt is completing contact via the micro-switch and that the circuit is made and ready for firing.

38 An overload/reset button (6) circuit breaker is incorporated to safeguard the wiper circuit from a current surge should a wiper arm encounter an obstruction.

39 Two electrical connections (1 and 10) mounted on the side of the switchbox provide points for the output cables, which connect with the commander's sight and GPMG electrical firing gear.



9638X

1	Plug connection	5	Wiper switch	8	GPMG warning light
2	Fuses	6	Wiper reset button (circuit breaker)	9	GPMG switch
3	Brush access plate	7	Spotlight	10	Socket connection
4	Commander's sight				

Fig 7 Cupola services switch box

To reset a circuit breaker

40 The white collar on the reset button (6) stem shows only when the circuit breaker is in the tripped (fault) condition. To reset the circuit breaker, proceed as follows:

- 40.1 Switch off the circuit.
- 40.2 Press the button in until it remains in.
- 40.3 Switch on the circuit. If the circuit breaker trips again check for obstruction, if it cannot be remedied. Report problem to REME.

Switch box fuses

41 All the electrical circuits in the cupola are protected by a 15 amp fuse marked 'CUPOLA' on the driver's instrument panel, see Chapter 1. Individual circuits are protected by fuses (2) in the switch box, (see Chapter 1).

To change a fuse

42 To change a fuse, proceed as stated in AESP 2350-T-220-201.

TO CHANGE THE SPOTLIGHT SEALED BEAM UNIT

43 To change the spotlight sealed beam unit, proceed as follows:

43.1 Remove the screws securing the sealed beam unit rim.

43.2 Carefully remove the rim and seal.

43.3 Lift out and unplug the sealed beam unit.

43.4 Replace with a new unit.

43.5 Examine the seal for serviceability and replace if necessary. Refit the seal.

43.6 Screw up the light rim evenly, sufficient to secure the sealed beam unit and provide a watertight seal.

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CHAPTER 4

FIRE FIGHTING EQUIPMENT

CONTENTS

Para

- 1 General
- 2 Fixed fire extinguisher
- 3 To operate the fixed fire extinguisher (WARNINGS)
- 4 Maintenance

Fig

Page

- 1 Fixed fire extinguisher 2

GENERAL

1 Portable fire extinguishers are provided in addition to the fixed fire extinguisher, which serves the engine compartment.

FIXED FIRE EXTINGUISHER (Fig 1)

2 The fixed fire extinguisher (Fig 1) is a manually operated FM200 type extinguisher mounted internally on the fuel tank filler pipe and is operated by means of an operating cable connected to an externally mounted T handle located on the front sloping side plate. The extinguisher is connected by flexible hose and piping to three discharge nozzles in the engine compartment.

To operate the fixed fire extinguisher

WARNINGS

(1) **PERSONNEL SAFETY. IN THE EVENT OF A FIRE ENSURE ALL PERSONNEL ARE EVACUATED FROM THE VEHICLE AND THAT ALL NON-ESSENTIAL PERSONNEL ARE MOVED TO A SAFE AREA. NO ONE MUST RETURN TO THE VEHICLE UNTIL THE SENIOR PERSON PRESENT GIVES THE ALL CLEAR.**

(2) **ASPHYXIATION HAZARD. THIS EQUIPMENT CONTAINS A FM200 FIRE SUPPRESSION SYSTEM. IF FM200 VAPOUR IS BREATHED IT CAN CAUSE SUFFOCATION. ANYONE WHO HAS INHALED FM200 VAPOUR SHOULD BE MOVED TO A PLACE OF FRESH AIR AND BE SUBJECTED TO MEDICAL ATTENTION.**

(3) **PERSONNEL SAFETY. HYDROFLUOROCARBON (HFC) GAS EXTINGUISHING AGENTS MAY DECOMPOSE UNDER CERTAIN FIRE CONDITIONS, PRODUCING CONSIDERABLE QUANTITIES OF HYDROGEN FLUORIDE (HF) GAS. EXPOSURE TO LARGE DOSES OF HF CAN LEAD TO POTENTIALLY LETHAL RESPIRATORY FAILURE. IF A CREW MEMBER IS IN CLOSE PROXIMITY TO A FIRE TACKLED BY EXTINGUISHING AGENTS, IMMEDIATELY EVACUATE TO AN AREA WITH FRESH AIR, AND INFORM MEDICAL SERVICES OF SUSPECTED EXPOSURE TO HF.**

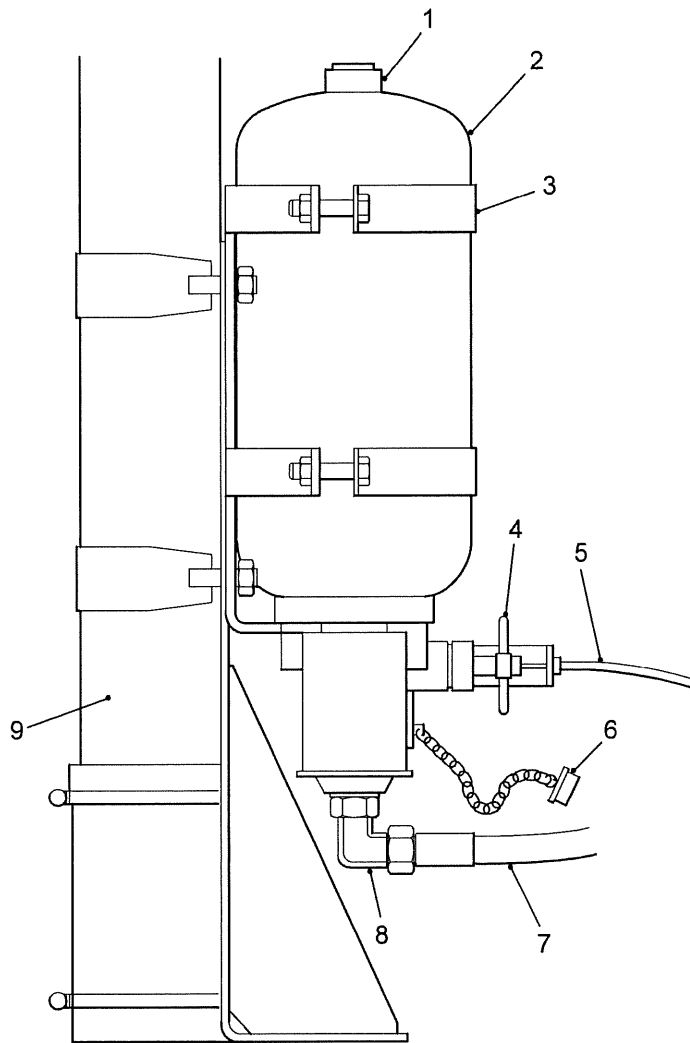
3 The fixed fire extinguisher should be operated in the following manner if the RED warning light comes on or the fire warning horn sounds:

- 3.1 Stop the vehicle and apply the parking brake.
- 3.2 Stop the engine.
- 3.3 Set the battery master switch to OFF.
- 3.4 Vacate the vehicle.
- 3.5 All fire fighting operations must be directed by the senior person present.
- 3.6 Locate the pull handle in the assembly tube on the outside of the vehicle hull. Operate by turning the pull handle 90 deg anti-clockwise and pull out.
- 3.7 Do not return to the vehicle until the senior person present gives permission.
- 3.8 The discharged gas cylinder must be replaced with a serviceable unit. Report to REME.

Maintenance

4 The charge status of the fixed extinguisher is to be checked periodically, see AESP 2350-T-220-601. If the contents gauge reading is below 24 bar at 20 deg C, the extinguisher should be replaced. Check:

- 4.1 The security and condition of unions, accessible piping and discharge nozzles.
- 4.2 That the extinguisher is secure in its bracket and the bracket secure to the hull.
- 4.3 Operate press-to-test switch, located on the air filtration unit, to check function of the fire detection system.



- 1 Contents gauge
- 2 Extinguisher bottle
- 3 Securing strap
- 4 Finger bar
- 5 Operating cable
- 6 Anti-recoil cap
- 7 Discharge hose
- 8 Elbow union
- 9 Fuel tank filler pipe

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Fig 1 Fixed fire extinguisher

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CHAPTER 5

FUEL SYSTEM

CONTENTS

Para

- 1 General
- 4 Maintenance
- 5 Fuel pump
- 6 To clean fuel pump filter
- 7 System fuel filter
- 8 To renew the system fuel filter
- 9 To fill the fuel tank
- 10 Air filtration unit

Fig

Page

- | | | |
|---|--------------------------------|-----|
| 1 | Fuel pump, tap and filter..... | 2 |
| 2 | Air filtration unit..... | 3/4 |

GENERAL (Fig 1)

1 The fuel system has a fabricated steel fuel tank (Fig 1 (1)) positioned on the floor at the left front of the personnel compartment. The tank is removable and is of sufficient rigid welded construction to accommodate the weight of the personnel, their seats and the vehicle commander's pedestal seat, which is mounted on a removable inspection plate base.

2 The tank is connected to and filled from a filler cap situated on the hull roof to the rear of the cupola. The lower of two pipes connected to the filler neck, terminates in a combined vent and valve on the left side of the personnel compartment roof, and the upper allows spillage or water to drain away via the upper left side plate.

3 A fuel isolation tap (5), system fuel filter (4) and electric fuel priming pump (6) are located on the front wall of the tank to the rear of the driver's seat. On later production models the fuel pump is positioned horizontally below the intermediate mounting bracket and associated fuel pipes concealed below the front edge of the fuel tank to reduce vulnerability.

MAINTENANCE

4 Before any maintenance, ensure that driver's seat is moved forward and that the fuel tap is turned to OFF. Refer to AESP 2350-T-220-201, Chap 6.

Fuel pump

5 Refer to AESP 2350-T-220-201, Chap 6.

To clean fuel pump filter

6 Refer to AESP 2350-T-220-522, Chap 2.

System fuel filter

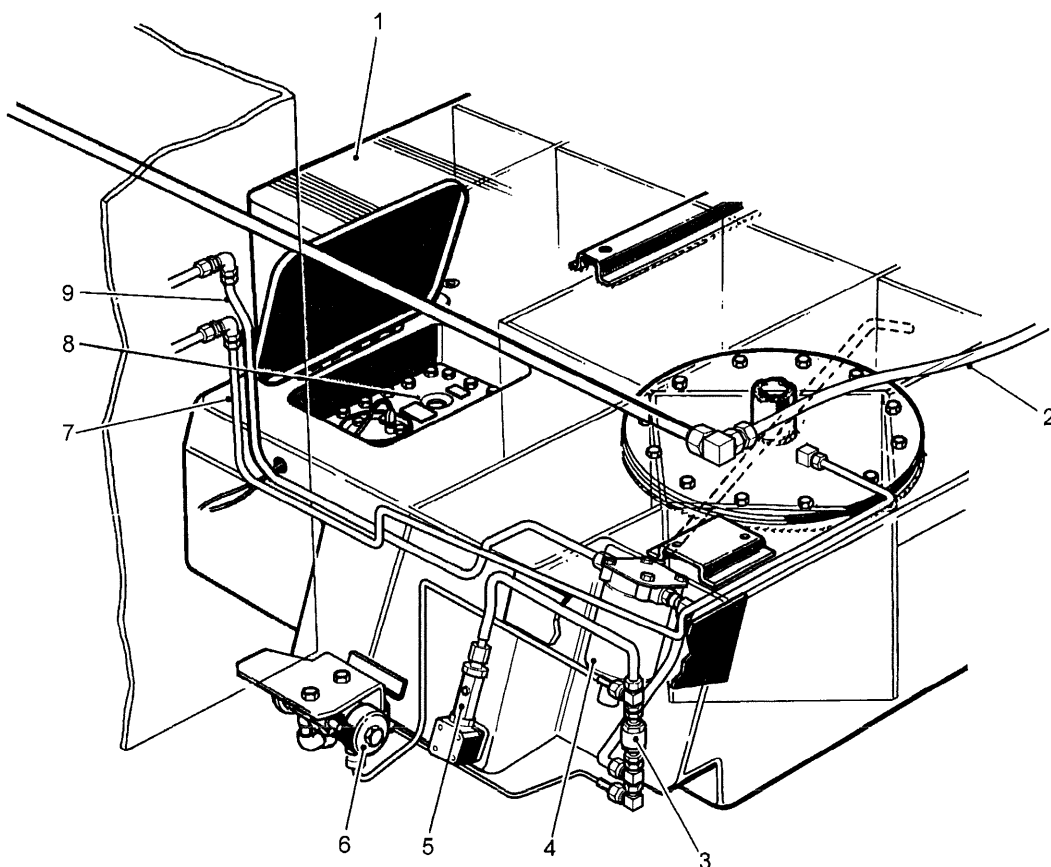
7 Refer to AESP 2350-T-220-201, Chap 6.

To renew the system fuel filter

8 Refer to AESP 2350-T-220-201, Chap 6.

To fill the fuel tank

9 Refer to AESP 2350-T-220-201, Chap 6.



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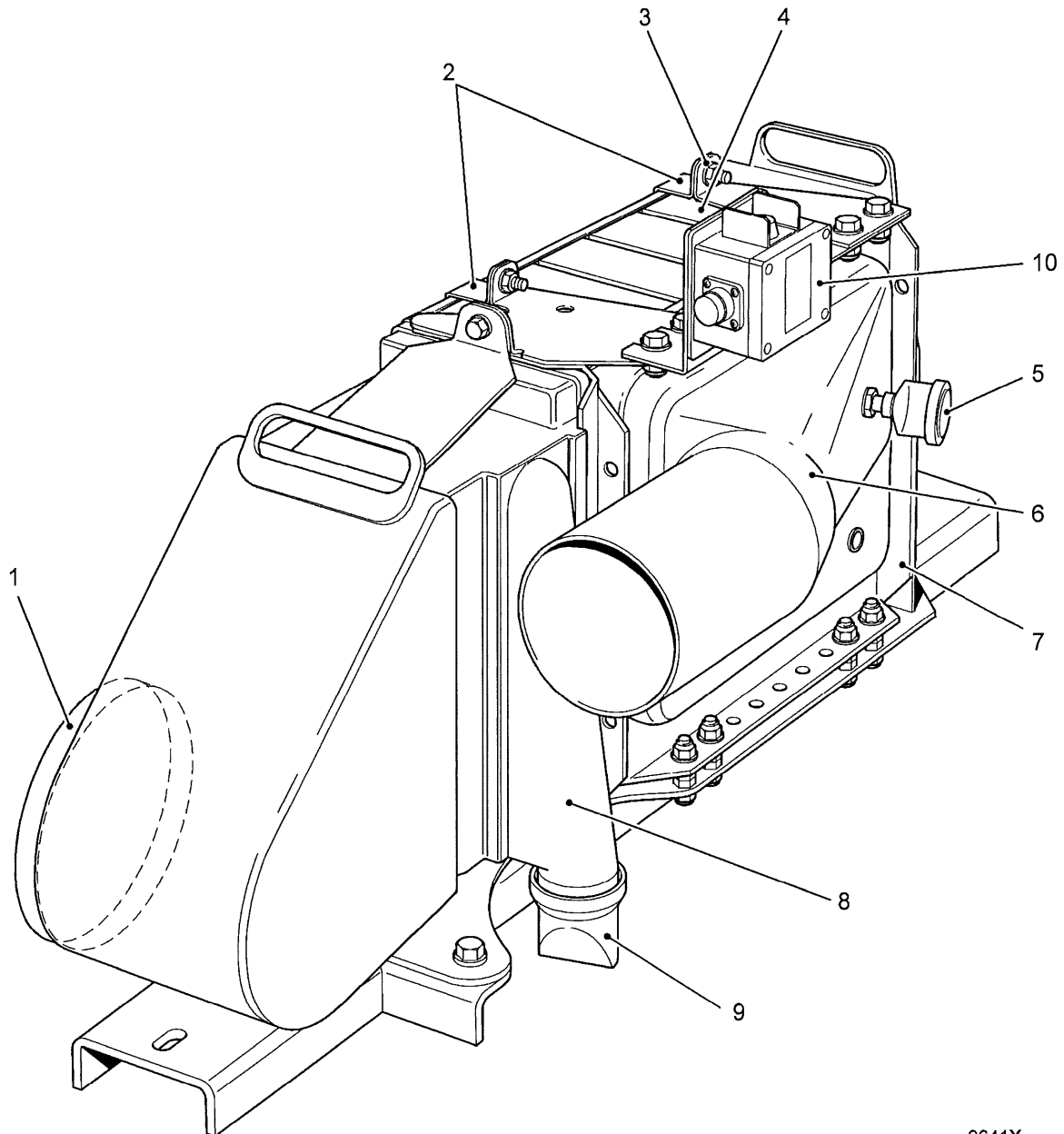
1	Fuel tank	6	Electric fuel priming pump
2	Internal breather pipe	7	Fuel return pipe
3	Non-return valve	8	Dual fuel gauge
4	System fuel filter	9	Fuel feed pipe, filter to bulkhead
5	Fuel isolation tap		

Fig 1 Fuel pump, tap and filter

AIR FILTRATION UNIT (Fig 2)

10 This air filtration unit fitted in Spartan is similar in operation to that fitted in Scimitar. The casing (Fig 2 (7)) is enlarged and the air outlet (6) is extended and rotated 90 degrees towards the front of the vehicle. An air restriction indicator (5) is incorporated in the casing to show when the filter element (4) needs replacement.

11 For maintenance procedures refer to AESP 2350-T-220-201 Chap 4.



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|--------------------------------------|-----------------------------|--|
| 1 Air intake | 5 Air restriction indicator | 9 Gravity discharge valve |
| 2 Filter element retaining straps | 6 Air outlet | 10 Engine fire detection press to test switchbox |
| 3 Filter element retaining strap nut | 7 Casing | |
| 4 Filter element | 8 Pre-cleaner | |

Fig 2 Air filtration unit

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CHAPTER 6

ELECTRICAL SYSTEM

CONTENTS

Para

1	General
3	Batteries
5	Maintenance
6	Smoke dischargers firing control buttons
8	Convoy and registration plate lights
9	Rear door contacts check
10	Interior lights
11	Heater unit
12	Junction box
13	Radio distribution box
14	Radio battery master switch
15	Load fuse
16	To change a load fuse
17	Generator warning light
18	To change a generator warning lamp (Radio Distribution Box)
19	To check the warning light fuse
20	External charge switch
21	External charge terminals
22	Operation of controls
23	To charge the radio batteries from the vehicle generator, with the vehicle stationary
24	To charge the radio batteries from a charging set
25	To charge external batteries
26	Commander's map light

Fig

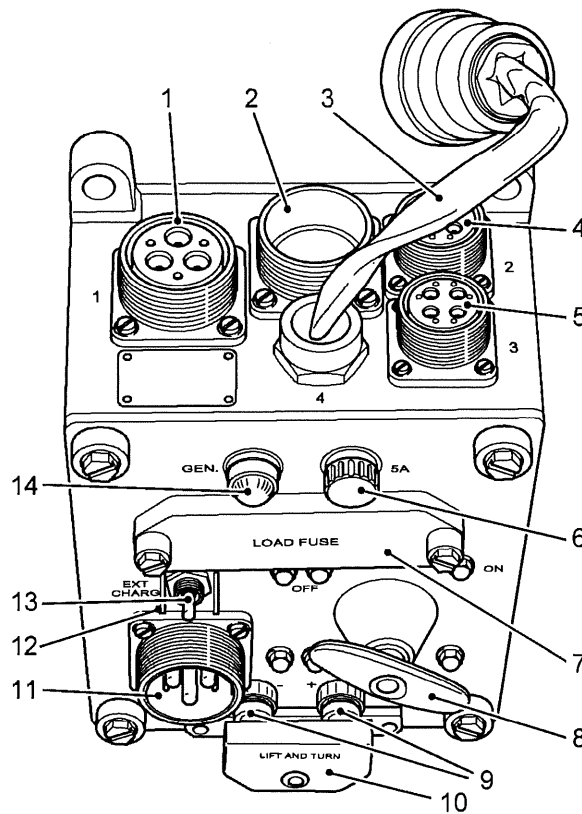
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1	Radio distribution box No. 1, Mk 1	2
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GENERAL (Fig 1)

1 The Spartan is wired with a 24 volt system, and has two sets of batteries, one set for automotive systems and the other for the radio installation.

2 A distribution panel and a driver's instrument panel as per the Scimitar vehicle provide control and distribution of power for hull services. For the cupola services a cupola switch box is provided. For radio services the radio distribution box (Fig 1) is provided, fitted to the left side of the rear wall of the personnel department.



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|---|--|----|---------------------------------------|
| 1 | Socket No. 1 – generator panel or external link connection | 8 | Radio battery master switch |
| 2 | Dummy housing for external link | 9 | Terminals for charging set harness |
| 3 | External link | 10 | Terminal cover |
| 4 | Socket No. 2 – radio junction box connection | 11 | Plug No. 6 – external battery harness |
| 5 | Socket No. 3 – radio junction box connection | 12 | Switchboard |
| 6 | Warning light fuse | 13 | External charge switch |
| 7 | Load fuse cover | 14 | Generator warning light |

Fig 1 Radio distribution box No. 1, Mk 1

BATTERIES (Fig 1)

3 The automotive batteries are located in the driver's compartment and the radio batteries under the rear seats in the personnel compartment, see also AESP 2350-T-220-201, Chap 9.

4 Each set of batteries is controlled by a separate master switch, the automotive batteries by a switch on the distribution box and the radio batteries by the master switch (Fig 1 (8)) on the radio distribution box. The radio battery master switch must be put to ON when the vehicle is in use, to ensure a supply to the radio and for the batteries to receive a charge from the vehicle's generating system.

Maintenance

5 For maintaining the batteries, access can be gained by releasing the clamping bars and sliding the battery boxes out far enough to complete maintenance, see AESP 2350-T-220-201, Chap 9. The clamping bar for the automotive batteries is secured by locknuts on the pillars supporting the instrument panel base; and that of the radio batteries, by hand nuts. On completion of maintenance, push the batteries fully home making sure that the clamping bars are secure.

SMOKE DISCHARGERS FIRING CONTROL BUTTONS

6 The Smoke Discharger's circuit through the automotive battery master and is protected by the fuse marked 'SMOKE' on the driver's instrument panel (see Chap 1).

7 The firing buttons are located to the left of the vehicle commander's position near the heater air intake grille (Chap 2, Fig 7 (3)). The vehicle commander can fire a stick of four or a salvo of eight grenades, as required.

CONVOY AND REGISTRATION PLATE LIGHTS

8 The convoy (Chap 2, Fig 5 (18)) and registration plate lights (16) are fitted to the rear door and the circuit is completed when the door is closed, by a plunger type switch (Chap 2, Fig 6 (1)) meeting contacts adjacent to the door upper hinge.

REAR DOOR CONTACTS CHECK

9 To check the rear door contacts, proceed as follows:

9.1 Check the security of the plunger switch, contact plate and wiring.

9.2 See that the contacts are clean and lightly smeared with grease.

9.3 Check the free operation of the spring-loaded plungers.

9.4 See that the plungers correctly engage the contact plate.

9.5 Check that the lights illuminate, when the lighting switch is put to ON and the rear door is closed, and that the lights extinguish when the door is opened.

INTERIOR LIGHTS

10 There are five interior lights (Chap 2, Fig 8 (10)), four in the personnel compartment and one in the driver's compartment. An overriding 'blackout' switch (Chap 2, Fig 6 (7)), operated by the tongue of the rear door handle (8), extinguishes any interior lights when the door is opened, see AESP 2350-T-220-201, Chap 9.

HEATER UNIT

11 The heater unit is located in the bulkhead to the left of the driver's position. The ON/OFF valve is positioned on the opposite bulkhead and the switch on the driver's instrument panel, see AESP 2350-T-220-201, Chap 9.

JUNCTION BOX

12 A junction box is fitted to the personnel compartment roof to the rear of the engine compartment bulkhead. The box provides a socket for the connection of the cooking vessel lead, a second socket is provided as a charging facility for radar batteries, when fitted.

RADIO DISTRIBUTION BOX (Fig 1)

13 The radio distribution box (Fig 1) is provided as a connection point for the radio batteries. It also controls the supply to the radio circuits, facilitates the charging of the radio batteries from the vehicle generator (or from an external source) and the charging of external batteries from the vehicle's generator. Incorporated in the box is a radio battery switch, load fuse etc.

Radio battery master switch

14 The radio battery master switch (8) is similar to automotive battery master switch, and when in the ON position, operates to connect the radio batteries to the radio junction boxes and to the vehicle generator for charging purposes.

Load fuse

15 A load fuse of the link type is fitted under the cover (7), it is rated at 100 A and is connected in the supply to the radio junction boxes.

To change a load fuse

16 To change a load fuse, proceed as follows:

16.1 Put the radio master switch to OFF.

16.2 Remove the load fuse cover (7).

16.3 Slacken the fuse link securing nuts and withdraw the fuse.

16.4 Ensure that the contact surfaces of the fuse link securing terminals are clean and free from burns.

16.5 Fit the new fuse link and replace the cover.

16.6 Put the radio master switch to ON and check the circuit, if the fuse blows again, REPORT.

Generator warning light

17 The generator warning light (Fig 1 (14)) is fitted with a 28 V 1.1 W midget flange lamp and a red lens. The lamp will glow when the master switch is put to ON and will go OFF when the batteries are being charged. The warning light circuit is protected by the adjacent 5A fuse (6); failure of the fuse will not affect the charging system, see AESP 2350-T-220-201, Chap 9.

To change a generator warning lamp (Radio Distribution Box)

- 18 To change a generator warning lamp, proceed as follows:
- 18.1 If practical, put the master switch to OFF.
 - 18.2 Unscrew the lens and remove the lamp.
 - 18.3 Replace with a lamp of the correct type, replace the lens.
 - 18.4 Test the circuit, if the lamp does not glow, check the warning light fuse (6).

To check the warning light fuse

- 19 Proceed as per AESP 2350-T-220-201, Chap 9.

External charge switch

20 The external charge switch (13) is of the toggle type and is connected in the generator warning light circuit. In the OFF position the switch connects the warning light to the radio battery positive line and in the ON position connects the light to the external batteries (when connected). The switch is provided with a spring-loaded cover to prevent accidental operation.

NOTE

When not charging external batteries the switch must always be at the OFF position. At the ON position the warning light is inoperative and the radio batteries disconnected from the generator.

External charge terminals

21 The external charge terminals are located under the cover (10) marked 'LIFT AND TURN' and are provided for the connection of an external charging set. The cover must always be repositioned to cover the terminals.

Operation of controls

22 For normal operation the radio batteries will receive a charge, providing the radio battery master switch (8) is put to 'ON' and the vehicle's generator is 'outputting'.

To charge the radio batteries from the vehicle generator, with the vehicle stationary

- 23 To charge the radio batteries from the vehicle generator, with the vehicle stationary, proceed as follows:
- 23.1 Put both master switches to ON.
 - 23.2 Start the engine.
 - 23.3 Increase the engine speed sufficiently to extinguish the generator warning light and to permit a charge to be indicated on the ammeter.
 - 23.4 Set the engine speed hand control.
 - 23.5 Periodically check to see if the required charging rate can be obtained with a reduced engine speed.

NOTE

After charging, reset the engine speed with the hand control to idling speed.

To charge the radio batteries from a charging set

24 To change the radio batteries from a charging set, proceed as follows:

- 24.1 Put both battery master switches and the 'EXT CHARGE' switch (13) on the radio distribution box to OFF.
- 24.2 Disconnect the generator panel cable from socket (1) on the radio distribution box.
- 24.3 Remove the plug on the external link (3) from the dummy housing (2) on the box and replace it with the cable already removed at Sub-para 24.2.
- 24.4 Fit the plug of the external link to socket (1).
- 24.5 Lift the spring-loaded captive cover (10) from the two terminals on the face of the box designated 'GEN SET' and turn it through 180 degrees to obtain access to the terminals (9).
- 24.6 Connect the charging set to the terminals ensuring that the positive lead is connected to the positive (+) terminal. Replace the insulated cover over the terminals.
- 24.7 Start the charging set.
- 24.8 Turn the radio distribution box battery switch (8) to ON.
- 24.9 After charging, restore the system to normal in the reverse order to that outlined above.

NOTE

The GEN light on the radio distribution box is not affected by the charging set.

To charge external batteries

25 To charge external batteries, proceed as follows:

- 25.1 Stop the engine, if running.
- 25.2 Put the radio battery master switch (8) and the external charge switch (13) on the radio distribution box to OFF.
- 25.3 Connect the external battery harness to the external and fit into plug No. 6 (11) on the box.
- 25.4 Put the external charge switch (13) to ON.
- 25.5 Put the engine switch ON and check that the GEN light (14) glows.
- 25.6 Start the engine and check that light goes out. Adjust the engine speed.
- 25.7 After charging put the external charge switch to its OFF position and reset engine speed to idling.

COMMANDER'S MAP LIGHT

26 If the commander's map light is fitted, refer to AESP 2350-T-220-201, Chap 9.

CHAPTER 7

SPROCKETS, TRACKS AND TRACK ADJUSTERS

CONTENTS

Para

- 1 General (CAUTION)

GENERAL

CAUTION

TRACK DAMAGE. Due to manufacturing tolerances the total number of vehicle track links per side can vary on issue. It is important to refer to AB 413 before track condemnation is decided.

1 The Spartan tracks are longer than the Scimitar vehicle, necessitating more links, due to the hull being of a greater length; to compensate for this, there is increased spacing between the centre wheels and the wheels either side of the centre wheels. In all other respects the sprockets, tracks and track adjusters are the same and AESP 2350-T-220-201, Chap 8 should be referred to.

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CHAPTER 8

SUSPENSION

CONTENTS

Para

1 General

GENERAL

1 All aspects of Spartan suspension are the same as for the Scimitar, except that there is increased space between the road wheels on either side of the centre road wheel; due to the Spartan hull being of greater length, refer to AESP 2350-T-220-201, Chap 8.

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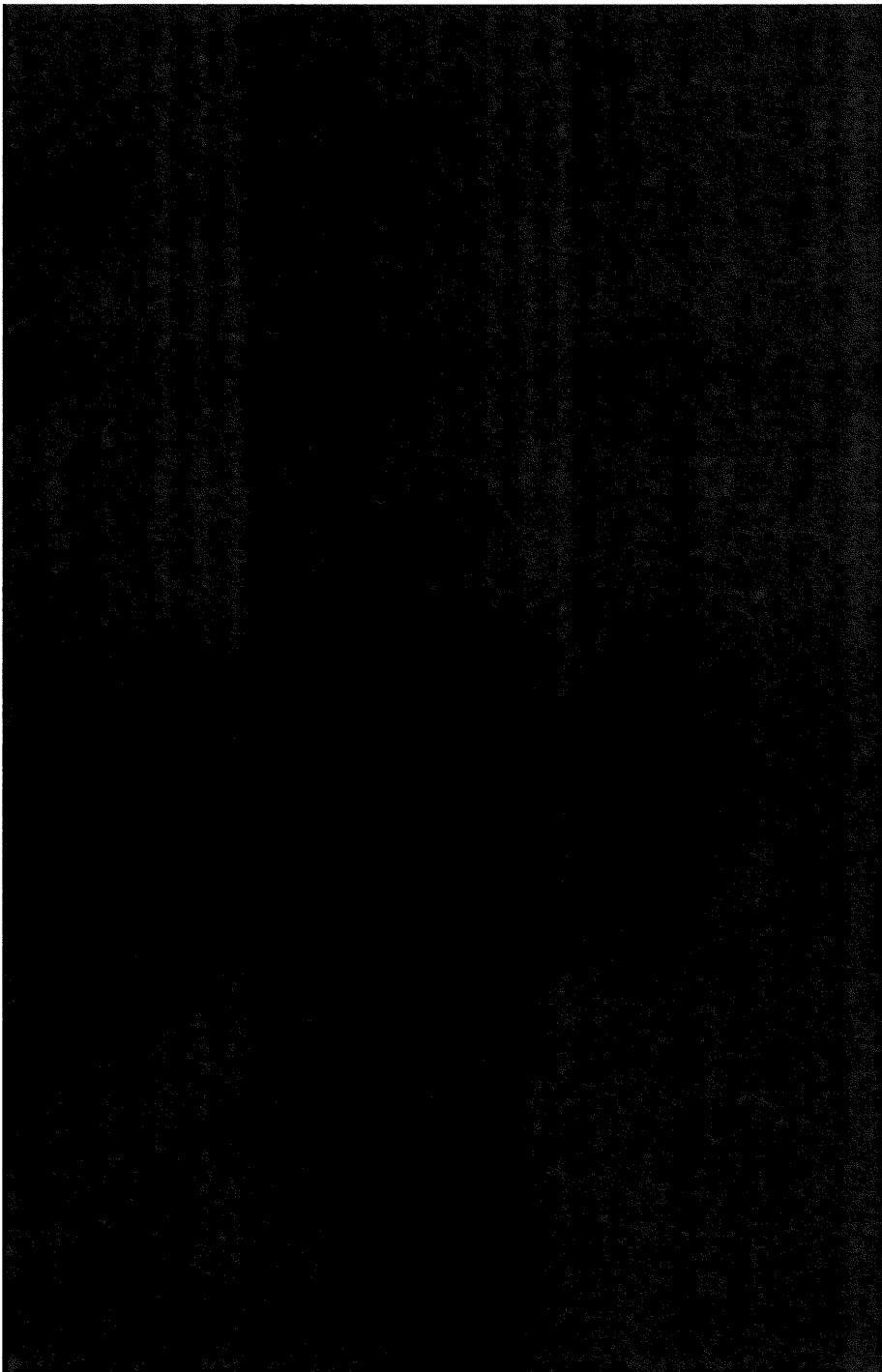
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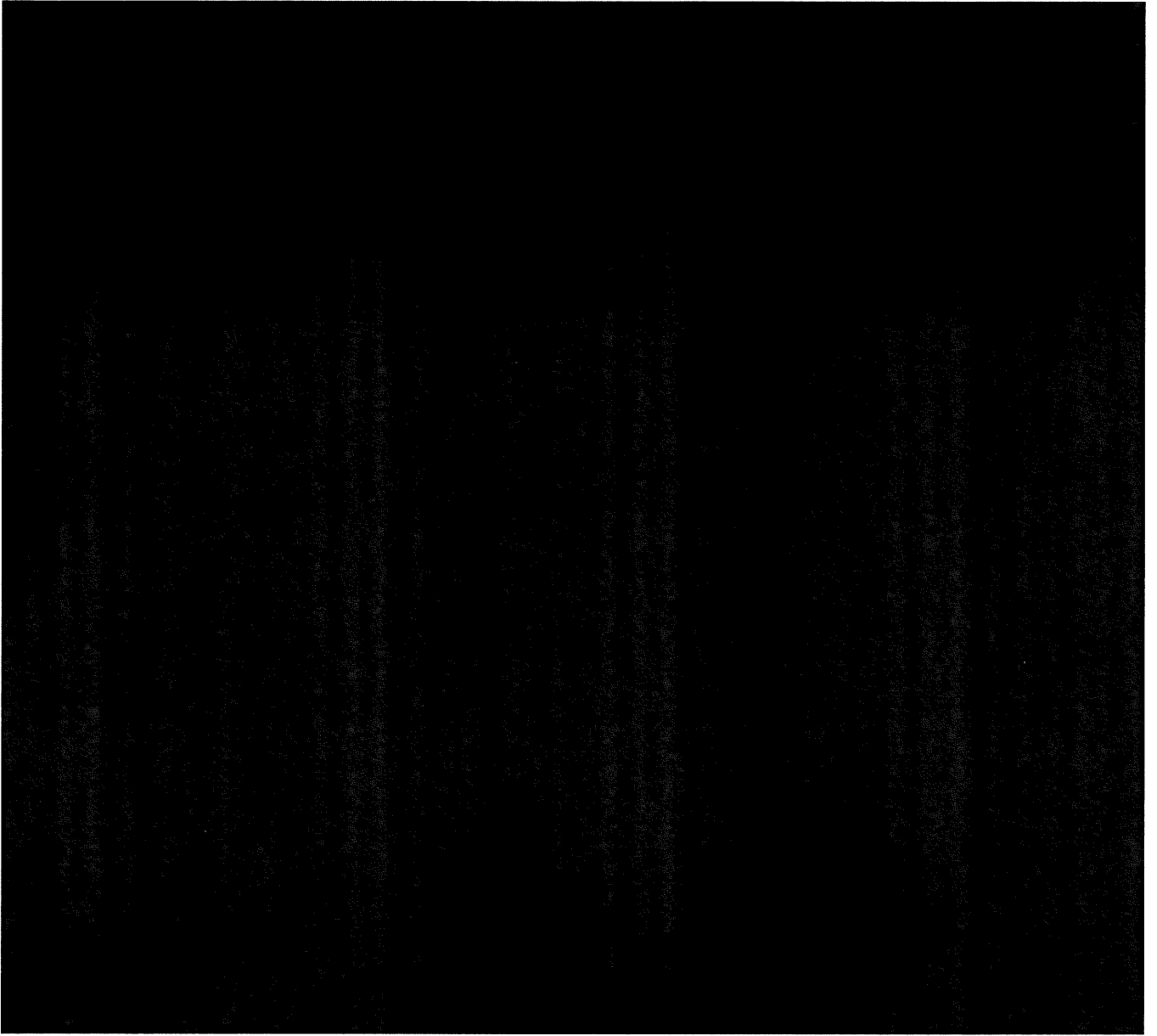
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CHAPTER 10

STOWAGE SKETCHES

CONTENTS

Para

1 General
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Fig

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1	Stowage sketch – Exterior, front right side.....	2
2	Stowage sketch – Exterior, rear left side.....	3/4

GENERAL

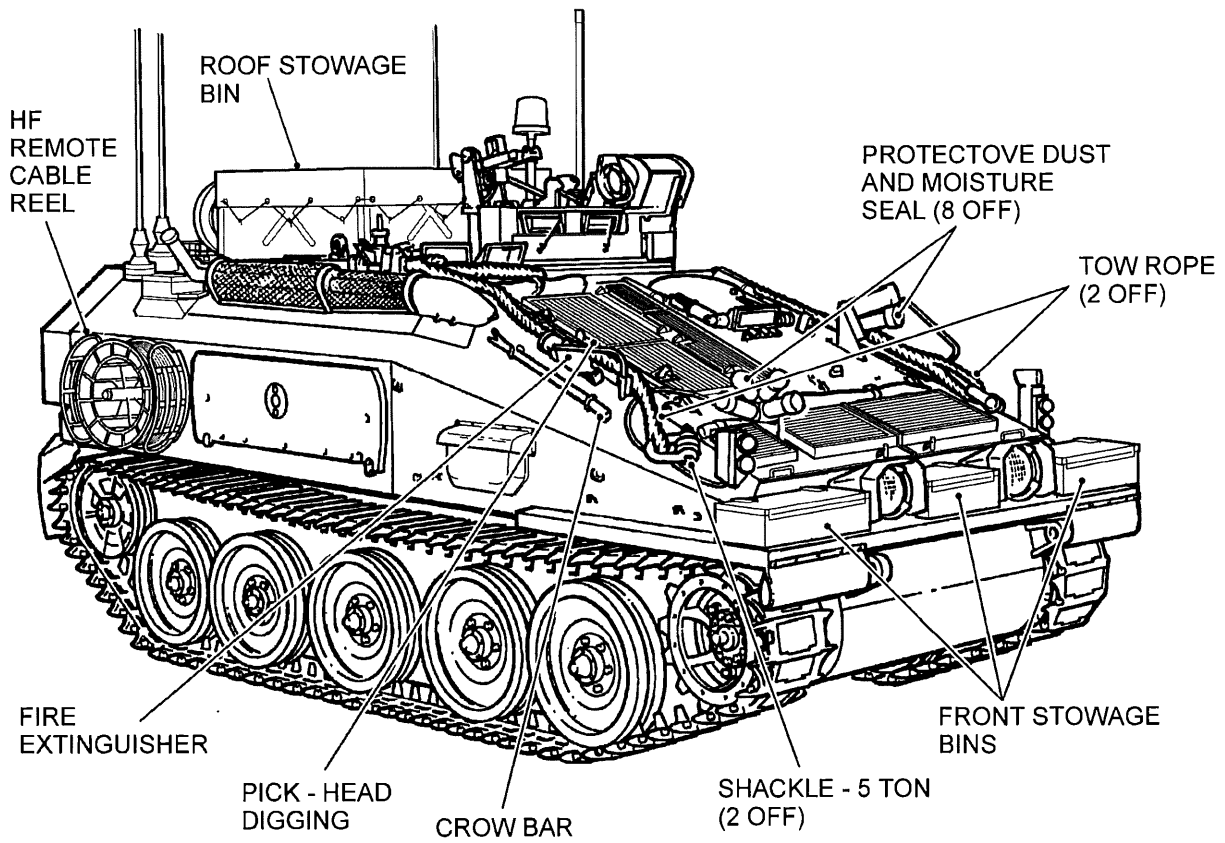
1 Refer to AESP 2350-T-221-741, Complete Equipment Schedule for the lists of fitted and stowed items, tools, cleaning kits and other equipment.

NOTE

Ration packs. No fixed bracketry has been designed for the stowage of ration packs; it has been left for the individual units to decide on the final method of stowage dependant on the form of ration supplies.

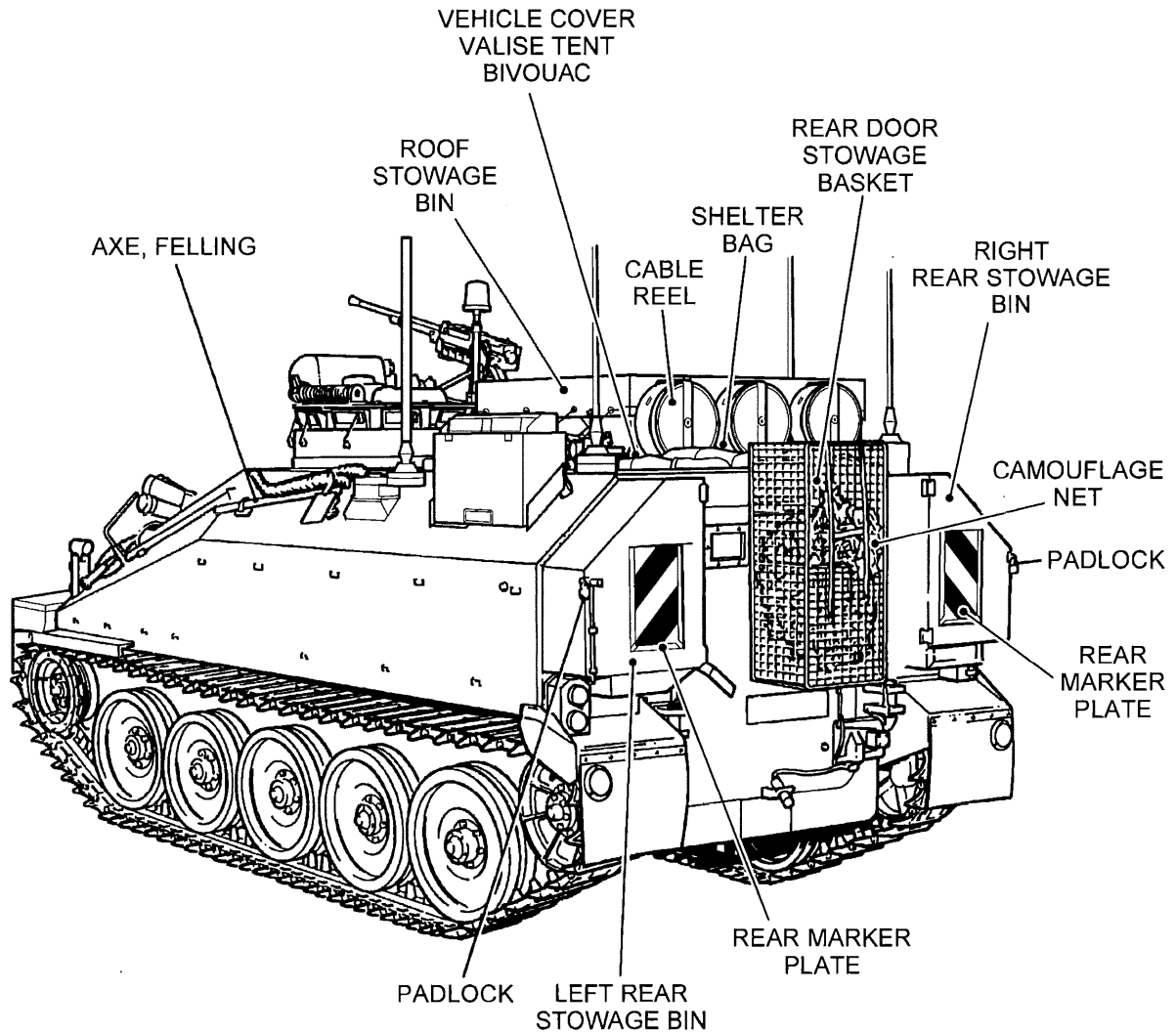
2 The location of some equipment stowed on or within the vehicle has been affected by the installation of Bowman and the stowage of associated equipment. The stowage location of some items may also be different in vehicles fitted with an alternative Bowman system layout and equipped for different roles.

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Fig 1 Stowage sketch - Exterior, front right side



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Fig 2 Stowage sketch - Exterior, rear left side

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