Ministry of Defence

Defence Equipment and Support
Secretariat
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Ministry of Defence
Abbey Wood
Bristol BS34 8JH

Email: DES SEC-PolSec LE-JSC-WPNS@mod.uk

[redacted]

Our Reference:
FOI2022/07532
Date:
10 August 2022

Dear [redacted]

I am writing about your email of 22 June 2022 requesting the following information:

'Please could you provide me with copies of the following AESP's for the Combat Engineer Tractor FV180.
2350-T-310-201
2350-T-310-601'

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-310-201 –Tractor, Combat Engineer, Tracked, Operating Information (2nd Edition dated June 2003)

- Army Equipment Support Publication (AESP) 2350-T-310-601 – Tractor, Combat Engineer, Tracked, Maintenance Schedules, (2nd edition dated June 2003)

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.

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 other states, 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.

TRACTOR, COMBAT ENGINEER, TRACKED

OPERATING INFORMATION

REPRINTED INCORPORATING AMDTS 1-3

BY COMMAND OF THE DEFENCE COUNCIL

[redacted]

Ministry of Defence
Issued by
DEFENCE LOGISTICS ORGANISATION
ENGINEER SYSTEMS SUPPORT

AMENDMENT RECORD

Amdt No.	Incorporated by (Signature)	Date
1	INCORPORATED	
2	[redacted]	30/11/06
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PRELIMINARY MATERIAL

OPERATING INFORMATION

Chapter

PREFACE

Sponsor: ESS IPT
Publication Authority: TES TI Andover

INTRODUCTION

1 Service users should forward any comments concerning this Publication through the channels prescribed in Army Equipment Support Publication (AESP) 0100-P-011-013. An AESP Form 10 is provided at the end of this publication; it should be photocopied and used for forwarding comments on this AESP.

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 Council Instructions (DCIs), Standard Operating Procedures (SOPs) or by local regulations. When any such Instruction, Order or Regulation contradicts any portion of this publication they are to be taken as the overriding authority.

RELATED AND ASSOCIATED PUBLICATIONS

Related publications

4 The Octad for the subject equipment consists of all the categories detailed opposite. 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 (refer to 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	101	101	101
	1	Equipment Support Policy Directive	111	111	111	111
2	0	Operating Information	201	*	*	*
	1	Aide Memoire	211	*	*	*
	2	Training Aids	*	*	*	*
3		Technical Description	201	302	302	302
4	1	Installation Instructions	411	*	*	*
	2	Preparation for Special Environments	*	*	*	*
5	1	Failure Diagnosis	201	512	512	512
	2	Maintenance Instructions	201	522	522	522
	3	Inspection Standards	*	532	532	532
	4	Calibration Procedures	*	*	*	*
6		Maintenance Schedules	601	*	*	*
7	1	Illustrated Parts Catalogues	711	711	711	711
	2	Commercial Parts Lists	*	*	*	*
	3	Complete Equipment Schedule, Production	*	*	*	*
	4	Complete Equipment Schedule, Service Edition (Simple Equipment)	741	741	741	741
	5	Complete Equipment Schedule, Service Edition (Complex Equipment)	*	*	*	*
8	1	Modification Instructions	811	811	811	811
	2	General Instructions, Special Technical Instructions and Servicing Instructions	821	821	821	821
	3	Service Engineered Modification Instructions (RAF only)	*	*	*	*

* Category/sub-category not published

Associated Publications

5 The following associated publications should be read in conjunction with this publication:

Reference	Title
ACN 62030 Pamphlet 1	Hazardous Stores Safety Data Sheet
ACN 71140	REME Recovery Manual 1995
AESP 0200-A-194-013	Policy directive for the implementation of the Montreal Protocol applied for Fire Extinguishers and Refrigerants
AESP 0200-A-201-013	Welding, Cutting and Brazing
AESP 0200-A-221-013	Painting of Service Equipment
AESP 4210-E-110-201	Extinguishers, Fire, General Service (Hand Held)
AESP 6140-A-100-013	Secondary Lead Acid Batteries
Army Code 22492	Technical Folder
Army Code 31143	Auxiliary Lifting Equipment
Army Code 34607	Tractor, Combat Engineer, Tracked
Army Code 61393	User Handbook for UK/VRC-353 Radio Set
Army Code 61423	User Handbook for Radio Installation UK/VRC-353 (SVIC No. CE/3 with CLANSMAN Harness in Combat Engineer Tractor (FV 180))
Army Code 61883	User Handbook for Periscope, Armoured Vehicle Image Intensified ((AVII)) L7A1 in Variants)
Army Code 63723	Health and Safety Management in the Equipment Support Organisation and ES/REME Units
Army Code 70959	All Arms Training Standing Orders for Crews of Armoured Fighting Vehicles
JSP 71	Movement Diagrams
JSP 359	Catalogue of Hazardous Stores
MEVII	Field Engineering Part II All Arms Pamphlet No. 5
MEVII	Part III Pamphlet No. 4
Pocket book No. 5C	Engineer Construction Plant - 1961

LIST OF ABBREVIATIONS

6 The following abbreviations are used in this publication:

AC	Army Code
ac	alternating current
ACN	Army Code Number
AESP	Army Equipment Support Publication
AFV	Armoured Fighting Vehicle
CB (*)	Crew Box (No.)
CB	Circuit Breaker
CES	Complete Equipment Schedule
CET	Combat Engineer Tractor
CTC	Carbon tetrachloride
CWL	Central Warning Light
dc	direct current
DCI	Defence Council Instruction
eng	engine
FV	Fighting Vehicle
galls	gallons
gen	generator
GIC	Garbarit International de Chargement
hyd	hydraulic
IB	Interconnecting Box
JSP	Joint Service Publication
MEV	Military Engineering Volume
MoD	Ministry of Defence
NBC	Nuclear, Biological and Chemical
OMC	Override Master Control
rev/min	revolutions per minute

RJB	Radio Junction Box
SOP	Standard Operating Procedure
SWG	Standard Wire Gauge
SWR	Steel Wire Rope

WARNINGS

7 The following WARNINGS are applicable to the equipment:

(1) TOXIC HAZARD. FUMES GIVEN OFF BY FIRES AND FIRE EXTINGUISHERS CAN BE TOXIC. ALWAYS EVACUATE ALL PERSONNEL FROM THE VEHICLE BEFORE ATTEMPTING TO EXTINGUISH A FIRE. NEVER FIGHT THE FIRE FROM WITHIN THE VEHICLE UNLESS THE SOURCE OF THE FIRE CANNOT BE REACHED FROM OUTSIDE THE VEHICLE. WHEN THE FIRE HAS BEEN EXTINGUISHED, THOROUGHLY VENTILATE THE VEHICLE BEFORE RE-ENTERING.

(2) PERSONNEL INJURY. IN THE EVENT OF AN ENGINE FIRE DO NOT OPERATE EXTINGUISHER(S) UNTIL THE ENGINE HAS BEEN STOPPED AND THE COOLING FAN IS STATIONARY.

(3) PERSONNEL INJURY. ENSURE THAT THE EMERGENCY EXIT DOOR LOCKING CATCH IS IN THE OFF POSITION BEFORE OPERATING THE VEHICLE. FAILURE TO DO SO COULD PREVENT RESCUE FROM OUTSIDE THE VEHICLE.

(4) PERSONNEL INJURY. BEFORE USING THE VEHICLE IN THE DEEP WADING MODE, ENSURE THAT THE HINGE PINS ARE REMOVED.

(5) PERSONNEL INJURY. HARD APPLICATION OF THE BRAKE PEDAL WILL RESULT IN THE VEHICLE STOPPING ABRUPTLY, RESULTING IN POSSIBLE INJURY TO THE CREW.

(6) PERSONNEL INJURY. THE SEATS ARE MOUNTED ON SPRING-LOADED LINKAGES, DESIGNED TO COUNTERACT THE WEIGHT OF A CREW MEMBER. DO NOT OPERATE THE HEIGHT ADJUSTMENT HANDLES WITH THE SEATS UNOCCUPIED, THIS COULD CAUSE SERIOUS DAMAGE OR INJURY TO PERSONNEL.

(7) PERSONNEL INJURY. BEFORE DRIVING OFF, THE CREW MEMBER IN CONTROL MUST ENSURE THAT HIS LOCKING PIN IS WITHDRAWN AND THAT THE LOCKING PIN IN THE OPPOSITE CREW POSITION IS IN PLACE.

(8) PERSONNEL INJURY. FLUID AL 11 IS HIGHLY FLAMMABLE. THE PREPARATION OF THE FLUID FOR WINDSCREEN WASHERS IS TO BE CARRIED OUT IN THE OPEN AND AWAY FROM NAKED FLAME. MINIMUM PRECAUTION AFTER CONTAMINATION IS TO WASH THE AFFECTED SKIN AREAS WITH SOAP AND WATER.

(9) TOXIC HAZARD. FLUID AL 39 IS BOTH TOXIC AND HAZARDOUS - REFER TO LOCAL UNIT PRECAUTIONS AND CURRENT DCIs FOR FULL SAFETY PROCEDURES. MINIMUM PRECAUTION AFTER USE IS TO WASH THE AFFECTED SKIN AREAS WITH SOAP AND WATER.

(10) PERSONNEL INJURY. DO NOT REMOVE HEADER TANK FILLER CAP BEFORE TEMPERATURE HAS FALLEN BELOW 93 DEGREES C (200 DEGREES F).

(11) PERSONNEL INJURY. ENSURE THAT THE EMERGENCY GEAR SELECTOR LEVER IS IN NEUTRAL BEFORE OPERATING THE STARTER MOTOR. THERE IS NO ELECTRICAL INTERLOCK ON THIS CONTROL LEVER.

(12) PERSONNEL INJURY. THE VEHICLE MUST REMAIN STATIONARY DURING WINCHING OPERATIONS, EXCEPT DURING SELF-RECOVERY.

(13) PERSONNEL INJURY. THE NBC SYSTEM IS TO BE SWITCHED ON WHENEVER THE VEHICLE AIR COOLING SYSTEM IS OPERATED CLOSED DOWN.

(14) PERSONNEL INJURY. DO NOT SMOKE IN A REFRIGERANT CONTAMINANT ATMOSPHERE OR WHEN WORKING ON ANY EQUIPMENT CONTAINING REFRIGERANT. SMOKING WILL CAUSE ISCEON 49 (R413a) TO BREAK DOWN INTO HYDROCHLORIC ACID (HYDROFLUORIC ACID AND PHOSGENE).

(15) ENVIRONMENTAL HAZARD. IT IS ILLEGAL UNDER THE ENVIROMENTAL PROTECTION ACT 1990 TO WILFULLY DISPOSE OF REFRIGERANTS BY VENTING REFRIGERANTS INTO THE ATMOSPHERE. ONLY COMPETENT PERSONNEL WITH A SPECIALIST KNOWLEDGE OF REFRIGERANT SYSTEMS, HOLDING A CURRENT REFRIGERANT HANDLING CERTIFICATE, ARE TO BE ALLOWED TO WORK ON ANY REFRIGERANT SYSTEM. ALWAYS REPORT ANY SUSPECT LEAKS TO REME AS SOON AS POSSIBLE.

(16) PERSONNEL INJURY. REFRIGERANTS ARE NON-TOXIC BUT DISPLACE AIR AND WILL CAUSE ASPHYXIA IN CONFINED SPACES BY THE ACCUMULATION OF HEAVIER THAN AIR REFRIGERANT IN THE LOWEST REGION OF AN ENCLOSED SPACE. ENSURE ADEQUATE VENTILATION AT ALL TIMES WHEN WORKING ON INSTALLATIONS CONTAINING REFRIGERANTS. IF A LEAK IS SUSPECTED THE AREA MUST BE WELL VENTILATED BEFORE ANY INVESTIGATORY WORK IS UNDERTAKEN.

(17) PERSONNEL INJURY. DO NOT SMOKE IN A REFRIGERANT CONTAMINATED ATMOSPHERE AS THE SUBSTANCE WILL BREAK DOWN INTO HYDROCHLORIC ACID, HYDROFLUORIC ACID AND PHOSGENE.

(18) PERSONNEL INJURY. REFRIGERANT CONTACT WITH EYES AND SKIN. ALWAYS WEAR SAFETY GOGGLES, GLOVES AND PROTECTIVE CLOTHING WHEN HANDLING REFRIGERANTS. IF REFRIGERANT CONTACTS EYES DO NOT RUB EYES, SPLASH EYES WITH COLD WATER AND SEEK IMMEDIATE MEDICAL ATTENTION. IF REFRIGERANT CONTACTS SKIN, WASH OFF WITH COLD WATER. IF INJURY TO SKIN OCCURS TREAT AS FROSTBITE, SEEK IMMEDIATE MEDICAL ATTENTION.

(19) PERSONNEL INJURY. IF A LEAK IN THE REFRIGERATION SYSTEM IS SUSPECTED IT IS TO BE INVESTIGATED BY A QUALIFIED REME TRADESMAN AS SOON AS POSSIBLE. UNTIL SUCH AN INVESTIGATION HAS BEEN CARRIED OUT, THE SYSTEM IS TO BE SWITCHED OFF. THE WORK AREA MUST BE WELL VENTILATED.

(20) PERSONNEL INJURY. WHEN HEATING WATER OR TINNED FOOD, DO NOT OPEN THE COOKING VESSEL CONTAINER LID WHEN THE VEHICLE IS IN MOTION.

(21) PERSONNEL INJURY. CARE MUST BE TAKEN WHEN REMOVING HOT TINS FROM THE COOKING VESSEL INNER CONTAINER.

(22) PERSONNEL INJURY. DEEP FRYING USING THE COOKING VESSEL MUST NOT BE ATTEMPTED.

(23) PERSONNEL INJURY. NEVER ATTEMPT TO FRY FOOD, USING THE COOKING VESSEL, WHILST THE VEHICLE IS IN MOTION.

(24) PERSONNEL INJURY. THE BASE OF THE COOKING VESSEL WATER COMPARTMENT BECOMES RED HOT WHEN FRYING. DO NOT COOL BY POURING WATER INTO THE COMPARTMENT.

(25) PERSONNEL INJURY. CARE MUST BE TAKEN WHEN REFILLING THE COOKING VESSEL WITH WATER SOON AFTER FRYING.

(26) PERSONNEL INJURY. A RISK OF FIRE AND/OR EXPLOSION EXISTS WHEN REFUELLING VEHICLES FITTED WITH RUBBER PADDED TRACKS AND RUBBER TYRES, BY EITHER PUMPS OR PLASTIC CONTAINERS, DUE TO THE PRESENCE OF STATIC ELECTRICITY. THE VEHICLE MUST BE EARTHED WHEN CARRYING OUT REFUELLING OR FUEL TANK DRAINING OPERATIONS.

(27) PERSONNEL INJURY. REFUELLING MUST NOT TAKE PLACE NEAR RADAR EQUIPMENT. SAFE DISTANCE WILL VARY BETWEEN 2 AND 175 METRES DEPENDING ON RADAR EQUIPMENT. VEHICLE CREWS ARE TO CHECK WITH RADAR OPERATORS BEFORE REFUELLING (REFER TO AC 63723).

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

(29) PERSONNEL INJURY. GREAT CARE MUST BE TAKEN AT ALL TIMES TO ENSURE THE SAFETY OF PERSONNEL, WHEN WORKING ON OR BENEATH THE BUCKET LINKAGE.

(30) PERSONNEL INJURY. THE EMERGENCY BRAKE CONTROL IS NOT TO BE USED AS A PARKING BRAKE.

(31) PERSONNEL INJURY. THE TUBE ASSEMBLIES MUST BE FITTED TO THE PISTON RODS OF THE BOOM LIFTING RAMS WHEN PERSONNEL ARE WORKING ON OR BENEATH THE BUCKET LINKAGE.

(32) PERSONNEL INJURY. TO PREVENT INADVERTENT OPERATION OF THE SMOKE GRENADE DISCHARGERS AND SUBSEQUENT DANGER TO PERSONNEL, THE LOADING/UNLOADING OF THE DISCHARGERS SHOULD ONLY BE CARRIED OUT WITH THE FUSE F34 REMOVED.

(33) PERSONNEL INJURY. THE HANDLING OF L5A4, L7A1 AND L8A1 SMOKE GRENADES IS POTENTIALLY DANGEROUS WITHIN TWO METRES OF CLANSMAN RADIO ANTENNAE WHEN TRANSMITTING. DO NOT USE RADIOS TO TRANSMIT WHEN LOADING OR UNLOADING SMOKE GRENADE DISCHARGERS.

(34) PERSONNEL INJURY. IN THE EVENT OF A MISFIRE IN ANY SMOKE GRENADE DISCHARGER BARREL, WAIT FIVE MINUTES BEFORE UNLOADING, AND THEN THROW THE GRENADE CLEAR OF THE VEHICLE.

(35) PERSONNEL INJURY. CLUTCH/BRAKE (SKID STEER) MODE OF STEERING MUST NEVER BE USED FOR HIGH SPEED CROSS-COUNTRY DRIVING OR WHEN DRIVING ON THE ROAD. THE STEERING ACTION IN THIS MODE IS VIOLENT IF USED AT SPEED AND MAY CAUSE INJURY TO THE CREW AND DAMAGE TO THE VEHICLE.

(36) PERSONNEL INJURY. DO NOT ALLOW THE VEHICLE TO FREE WHEEL IN NEUTRAL AS CONTROL OF THE VEHICLE BECOMES DIFFICULT ONCE MOMENTUM HAS BUILT UP.

(37) PERSONNEL INJURY. DURING WINCH OPERATIONS RIGOROUS PRECAUTIONS MUST BE TAKEN TO ENSURE SAFETY OF ALL PERSONNEL PRESENT.

(38) PERSONNEL INJURY. TO SAFEGUARD THE CREW MEMBERS, THE CREW COMPARTMENT ACCESS DOORS SHOULD BE CLOSED DURING HEAVY WINCHING OPERATIONS.

(39) PERSONNEL INJURY. THE WINCH HOLDING BRAKE MUST ALWAYS BE APPLIED WHEN WINCHING IN. THIS WILL PREVENT THE LOAD SLIPPING BACK, POSSIBLY OUT OF CONTROL.

(40) PERSONNEL INJURY. IF ANY EVIDENCE OF EXCESSIVE WEAR, FRAYING, KINKING OR OTHER DAMAGE IS PRESENT, THE WINCH ROPE MUST NOT BE USED FOR LIFTING OR WINCHING.

(41) PERSONNEL INJURY. DURING LIFTING OPERATIONS RIGOROUS PRECAUTIONS MUST BE TAKEN TO ENSURE THE SAFETY OF ALL PERSONNEL INVOLVED. ANY PERSONS NOT DIRECTLY INVOLVED SHOULD BE CLEARED FROM THE AREA OF OPERATION.

(42) PERSONNEL INJURY. ALWAYS USE APPROVED PALLET LIFTING EQUIPMENT, FOR EXAMPLE, SPREADER BEAMS - DO NOT IMPROVISE.

(43) PERSONNEL INJURY. THE VEHICLE MUST BE STATIONARY WHEN USING THE AUXILIARY LIFTING ATTACHMENT.

(44) PERSONNEL INJURY. LOW GEAR SHOULD ALWAYS BE USED FOR LIFTING OPERATIONS TO ENSURE MAXIMUM CONTROL OF THE LOAD.

(45) PERSONNEL INJURY. CLEANING AGENTS CONTAINING PETROL OR OIL DERIVATIVES MUST NOT BE USED FOR CLEANING THE COOKING VESSEL UNDER ANY CIRCUMSTANCES. THEY MAY CAUSE SILICONE SEALS TO SWELL. SEALS THAT HAVE SWOLLEN ARE TOXIC. SEALS THAT BECOME CONTAMINATED MUST BE CHANGED BEFORE THE VESSEL IS USED AGAIN.

(46) PERSONNEL INJURY. ANY SERVICING TASK ON THE RUNNING GEAR WHICH INVOLVES MOVING THE VEHICLE MUST BE UNDERTAKEN WITH AT LEAST THREE PERSONS PRESENT, DEPLOYED AS FOLLOWS:

(1) A SUITABLY QUALIFIED DRIVER IN THE VEHICLE.

(2) ONE PERSON TO DIRECT THE DRIVER, POSITIONED IN FULL VIEW OF THE DRIVER AND PERSONNEL CARRYING OUT THE TASK.

(3) THE PERSON(S) ENGAGED DIRECTLY ON THE TASK IN HAND.

(47) PERSONNEL INJURY. IT IS NOT A SAFE PRACTICE TO HAVE BOTH TRACKS REMOVED FROM THE VEHICLE AT THE SAME TIME, UNDER SUCH CIRCUMSTANCES THE VEHICLE BRAKES WILL NOT BE EFFECTIVE. SHOULD HOWEVER THIS PROCEDURE BE UNAVOIDABLE, SOME MEANS OF SECURING THE VEHICLE, SUCH AS SCOTCHING THE ROADWHEELS, MUST BE USED BEFORE BREAKING THE SECOND TRACK.

(48) PERSONNEL INJURY. PROTECTIVE GLOVES MUST BE WORN WHENEVER THE WINCH ROPE IS HANDLED.

(49) PERSONNEL INJURY. SAFETY GOGGLES MUST BE WORN BY PERSONNEL WHILST USING THE CABLE CUTTER.

(50) PERSONNEL INJURY. WHEN THREADING THE ROPE BY HAND ONTO THE CAPSTAN BULLWHEELS THE WINCH MUST BE STATIONARY AND THE ENGINE STOPPED. KEEP HANDS CLEAR OF THE BULLWHEELS WHEN THE WINCH IS IN OPERATION.

(51) PERSONNEL INJURY. DUE CONSIDERATION SHOULD BE GIVEN TO THE HIGHLY FLAMMABLE NATURE OF GASOLINE AND ITS VAPOUR. CARELESSNESS IN ITS USE MAY RESULT IN PAINFUL BURNS.

[redacted]

(53) PERSONNEL INJURY. BCF FIRE EXTINGUISHERS CONTAIN HALON 1211. HALON IS HARMFUL BY INHALATION AND IS AN IRRITANT TO SKIN AND EYES. IN HIGH CONCENTRATIONS THE VAPOUR CAN CAUSE SUFFOCATION. ANYONE WHO HAS INHALED HALON OR HAD IT IN CONTACT WITH THEIR EYES OR SKIN IS TO RECEIVE IMMEDIATE MEDICAL ATTENTION.

(54) PERSONNEL INJURY. DO NOT DIRECT A DRY POWDER FIRE EXTINGUISHER AT INDIVIDUALS, EXCEPT TO EXTINGUISH A CLOTHING FIRE IF SMOTHERING IS UNSUCCESSFUL.

(55) PERSONNEL INJURY. DO NOT USE A DRY POWDER FIRE EXTINGUISHER ON METAL AND GAS FIRES DUE TO RISK OF EXPLOSION.

(56) PERSONNEL INJURY. THE INTER-VEHICLE CONNECTING SOCKET IS LIVE WHEN THE BATTERY MASTER SWITCH IS ON. THE SOCKET COVER MUST ALWAYS BE FITTED DURING NORMAL OPERATIONS.

(57) PERSONNEL INJURY. THE GASES RELEASED 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, TURN THE BATTERY SWITCH TO OFF. 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.

(58) PERSONNEL INJURY. TO PREVENT INJURY TO PERSONNEL ENSURE THAT THE REFRIGERANT SYSTEM IS COMPLETELY DEPRESSURISED BEFORE REMOVING ANY COMPONENT NOT EQUIPPED WITH SELF-SEALING COUPLINGS.

(59) PERSONNEL HAZARD. WHEN PRESSURE TESTING REFRIGERANT PIPEWORK OR ANY LRU THE AREA OF THE TEST MUST BE SAFE IN THAT, SHOULD A FAILURE OCCUR PERSONNEL AND EQUIPMENT ARE PROTECTED FROM FLYING DEBRIS.

(60) PERSONNEL INJURY. FM-200 FIRE EXTINGUISHING AGENT IS HARMFUL BY INHALATION AND IS AN IRRITANT TO SKIN AND EYES. IN HIGH CONCENTRATIONS THE VAPOUR CAN CAUSE SUFFOCATION. ANYONE WHO HAS INHALED FM-200 OR HAD IT IN CONTACT WITH THEIR EYES OR SKIN IS TO RECEIVE IMMEDIATE MEDICAL ATTENTION.

CAUTIONS

8 The following CAUTIONS are applicable to the equipment:

(1) EQUIPMENT DAMAGE. To prevent hull distortion all external engine/transmission hatches are to be in place prior to vehicle movement.

(2) EQUIPMENT DAMAGE. Do not use forced air, petrol or other solvents to clean NBC filter elements. Such action will shorten the life of the filter elements.

(3) EQUIPMENT DAMAGE. Before attempting to move the vehicle, the position of the driver/operator select switch should be checked to ensure that the appropriate control position is selected.

(4) EQUIPMENT DAMAGE. Should the fault indicator warning lighting illuminate, switch off the periscope as soon as possible and report the fault to REME.

(5) EQUIPMENT DAMAGE. Do not disturb the red painted screws on the periscope body; the periscope is hermetically sealed. Do not tamper with or strip in excess of that instructed. Dirt or moisture entering the periscope will badly affect its performance.

[redacted]

(7) EQUIPMENT DAMAGE. Do not immediately switch the engine off when it reaches maximum operating temperature or when the temperature warning light illuminates.

(8) EQUIPMENT DAMAGE. Switch off the compressor immediately if excessive vibration or unusual noise occurs.

(9) EQUIPMENT DAMAGE. When the cooking vessel is in use, connection and disconnection of the harness must not be made at the sockets until the cooker switch is turned to the OFF position. When the cooking operation is completed, the harness should be disconnected and stowed. DO NOT stand the vessel on damp surfaces - especially when the vessel is hot.

(10) EQUIPMENT DAMAGE. Do not fill the cooking vessel above the 7 pint level line engraved within the water compartment.

(11) EQUIPMENT DAMAGE. Tea and other beverages must not be made in the cooking vessel water compartment as the drain tap will become blocked.

(12) EQUIPMENT DAMAGE. If the turbocharger is to operate efficiently and not sustain serious damage, the turbocharger operating procedures MUST be rigorously applied. Failure to do so will shorten the life of the turbocharger and may render the vehicle inoperative.

(13) EQUIPMENT DAMAGE. On no account must the transmission disconnect clutch lever be operated with the engine running.

(14) EQUIPMENT DAMAGE. The cold start pump should not be operated unless the engine is being rotated by the starter motor. Severe damage may be caused if cold start fluid is pumped into the induction manifold of a stationary engine.

(15) EQUIPMENT DAMAGE. To avoid causing damage to the turbocharger bearings, they are to be primed before starting the engine when the engine has not been run for a week or more or a replacement turbocharger or engine have been fitted.

(16) EQUIPMENT DAMAGE. The coolant level must not be allowed to fall below the bottom of the header tank or air may be drawn into the system and bleeding will be necessary.

(17) EQUIPMENT DAMAGE. When emergency gears are not in use the emergency gear selector lever must be pinned back into the neutral position.

(18) EQUIPMENT DAMAGE. When the vehicle is stationary do not attempt to engage any gear if the engine speed exceeds 1000 rev/min. This could result in damage to the torque converter.

(19) EQUIPMENT DAMAGE. With the engine running, the torque converter and gearbox oil pump will continue to circulate oil through the heat exchanger. The engine must NOT be stopped in an attempt to cool the oil, as this will stop the oil flow and may aggravate the situation.

(20) EQUIPMENT DAMAGE. The emergency brake must not be used as a parking brake by leaving the lever in the ON (rearmost) position. In time, air will leak away and the brakes will release.

(21) EQUIPMENT DAMAGE. When the external air coupling is not in use, a suitable dummy coupling should be attached to prevent the entry of foreign matter and damage to the sealing surfaces.

(22) EQUIPMENT DAMAGE. Before starting any earth moving task using the bucket, ensure that no shackles or loose attachments are fitted to anchorage points inside or outside the bucket. Such items are liable to jam and cause damage.

(23) EQUIPMENT DAMAGE. Do not attempt to lower the bucket or operate the crowd/dump control lever while the travelling locks are in place.

(24) EQUIPMENT DAMAGE. Do not attempt to push any load when the tie bars are fitted to the bucket mechanism in the level position, as damage will be caused to the boom arm and bucket linkages.

(25) EQUIPMENT DAMAGE. When bucket control levers are not in use ensure that the locking lever is fitted.

(26) EQUIPMENT DAMAGE. In order to ensure that the bucket is held securely in a safe position, locking devices are provided and MUST be fitted at all times to the bucket operating mechanism when the vehicle is travelling on the road or being transported or when the bucket is not in use.

(27) EQUIPMENT DAMAGE. Do not move the driver/operator select switch or either forward/reverse lever when the vehicle is in motion.

(28) EQUIPMENT DAMAGE. At the start of each working day with the vehicle stationary and the engine running, select 1st and 2nd gears sequentially holding each gear for at least 3 seconds, repeating 20 times for each gear.

(29) EQUIPMENT DAMAGE. When selecting forward/reverse, the engine must be allowed to idle to enable the correct engagement to take place within the transfer gearbox.

(30) EQUIPMENT DAMAGE. Do not allow the vehicle to freewheel in neutral as damage to the gearbox may occur.

(31) EQUIPMENT DAMAGE. Irrespective of the gear that is engaged, the gear lever MUST NOT be moved into neutral until the vehicle is at rest and the parking brake has been applied. Allowing the vehicle to freewheel may result in damage to the gearbox.

(32) EQUIPMENT DAMAGE. Access to the NBC unit should be limited to essential maintenance to prevent damage to the seal.

(33) EQUIPMENT DAMAGE. The disconnect pedal must not be operated when the engine speed is above normal idling speed.

(34) EQUIPMENT DAMAGE. After every hour digging, select 1st and 2nd gears sequentially holding each gear for at least 3 seconds, repeating 10 times for each gear.

(35) EQUIPMENT DAMAGE. When paying out, ensure that the red painted section of the rope does not come past the fixed pulley.

(36) EQUIPMENT DAMAGE. DO NOT attempt to use the general service tow hook or the plant tow hook as a means of anchoring the winch rope when using the snatch block. The tow hooks are not designed to accept the loads which may be involved in winching operations.

(37) EQUIPMENT DAMAGE. Failure to fit the tie bars may result in damage to the crowd ram hydraulics.

(38) EQUIPMENT DAMAGE. Before raising the bucket to its full height check that sufficient slack rope is available. Failure to do this can result in jamming at the jib pulley and damage to the hook attachment clamps, pulley and top stay.

(39) EQUIPMENT DAMAGE. The NBC fan must not be switched on with the cowl closed or damage from overheating will result.

(40) EQUIPMENT DAMAGE. The generator diodes are sensitive to voltage changes and high temperatures. It is, therefore, essential that precautions are taken to avoid irreparable damage to the generator when carrying out any servicing or maintenance.

(41) EQUIPMENT DAMAGE. The battery must never be disconnected whilst the generator is running. The battery polarity and voltage must be checked before connecting into the system. Reversed polarity, no matter how brief, will cause immediate and permanent damage to the diodes.

(42) EQUIPMENT DAMAGE. If it is necessary at any time to disconnect a lead from the generating system, it is essential that the engine is shut down first.

(43) EQUIPMENT DAMAGE. When a generating system lead is disconnected it should be identified in relation to its terminal to facilitate accurate reconnection.

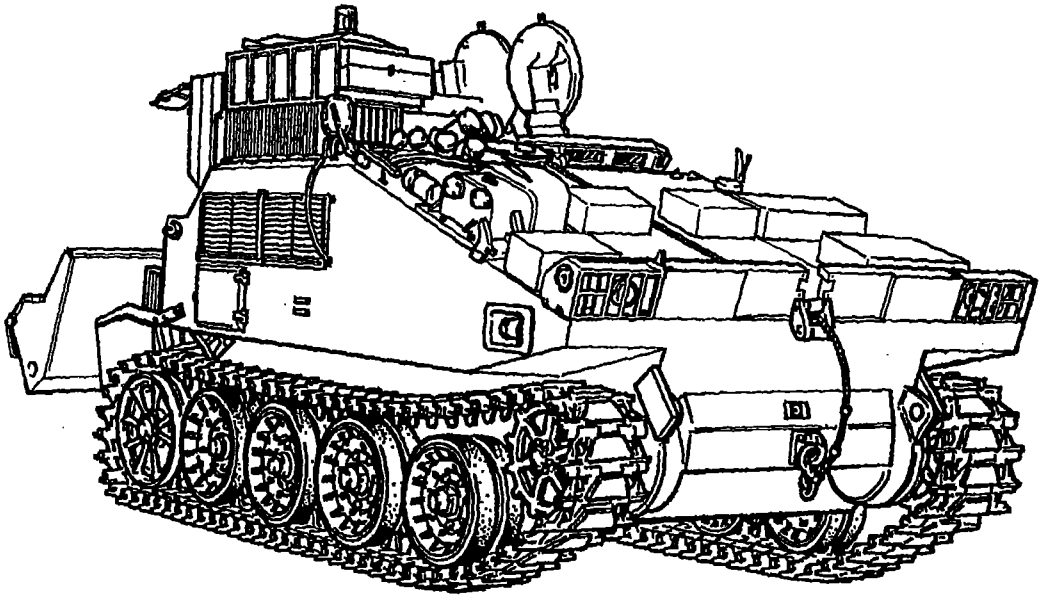
(44) EQUIPMENT DAMAGE. If using electric welding to repair the vehicle it is essential that the batteries and the generator unit are first disconnected from the vehicle circuit.

(45) EQUIPMENT DAMAGE. Any electric voltage inputs, either ac or dc, to the vehicle will necessitate the batteries or generating unit being disconnected. The exception to this rule is the use of the inter-vehicle starting socket.

(46) EQUIPMENT DAMAGE. When handling a new rotary beacon lamp, avoid touching the transparent lamp surface.

(47) EQUIPMENT DAMAGE. All work carried out on the hydraulic system must be undertaken in the CLEANEST possible conditions. Dirt entering the system can cause damage and possible failure of components.

(49) EQUIPMENT DAMAGE. When operating in sub-zero conditions, the batteries must be kept fully charged or the electrolyte may freeze and cause subsequent damage to the cells.



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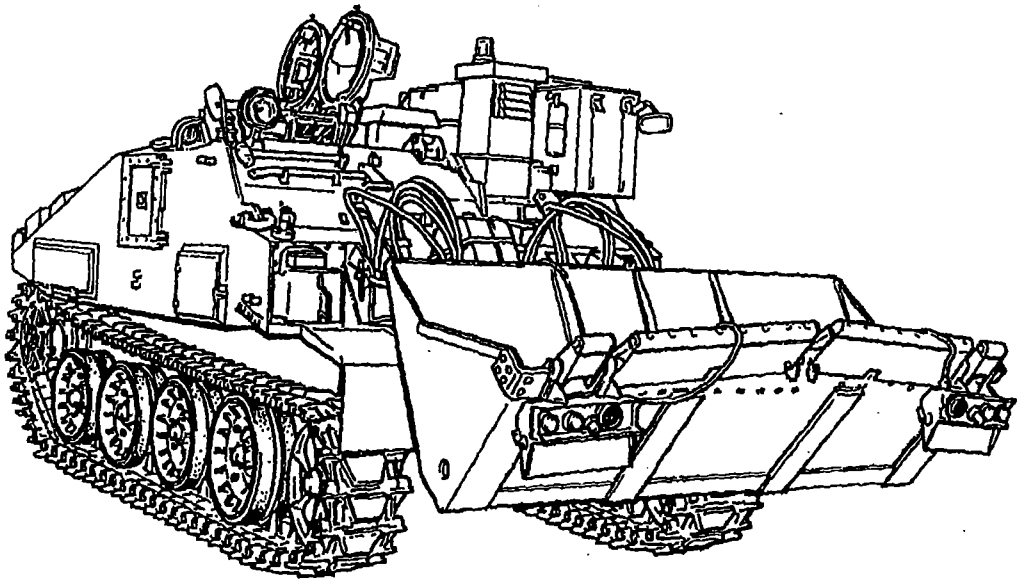

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Frontispiece

CHAPTER 1

GENERAL DESCRIPTION

CONTENTS

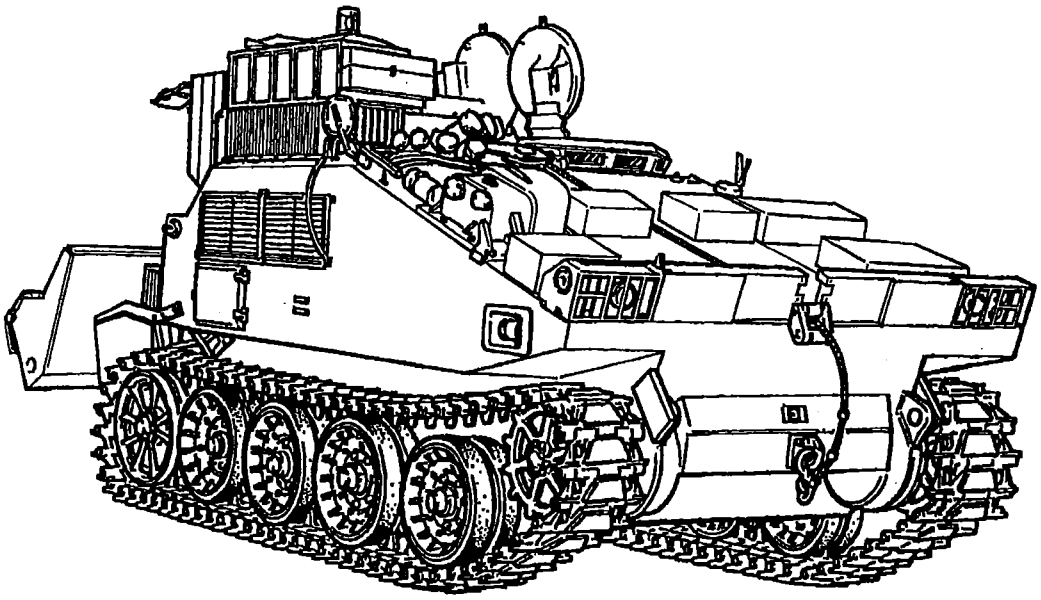

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Fig 1 Combat engine tractor - 3/4 view (right front)

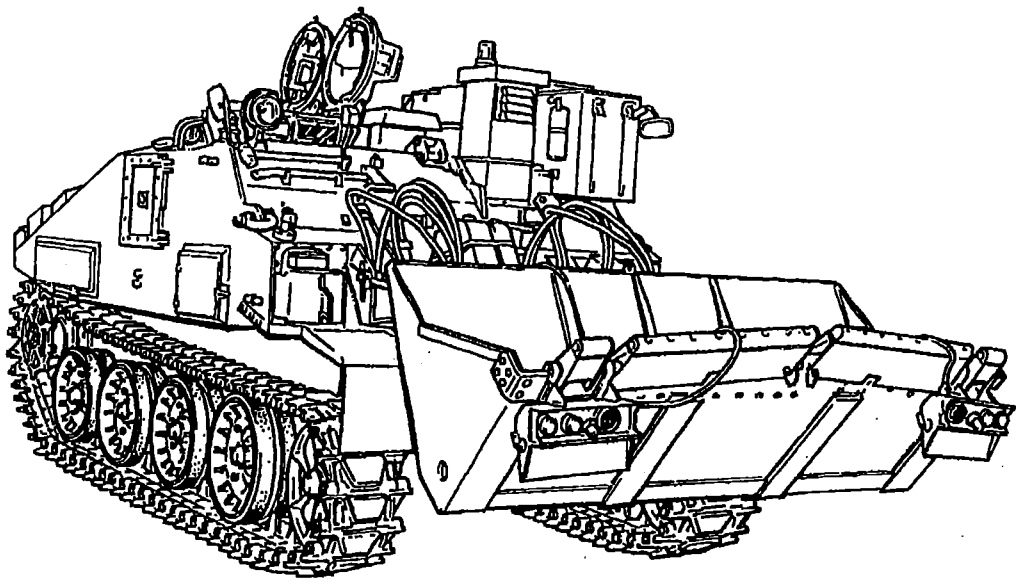

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Fig 2 Combat engineer tractor - 3/4 view (left rear)

INTRODUCTION

1 The Combat Engineer Tractor (CET) (Figs 1 and 2) is an armoured tracked vehicle intended to provide Engineer units with a versatile purpose built vehicle, for use in forward combat areas and it has been designed as a highly mobile earth mover and support vehicle capable of maintaining station with armoured fighting vehicles, under conditions of conventional and Nuclear, Biological and Chemical (NBC) attack.

[redacted]

3 The principle tasks of the CET are:

3.1 The construction and improvement of cross country routes, including the clearance of obstacles and debris, filling craters and laying prefabricated trackway.

3.2 To assist fighting vehicles in the crossing of obstacles, by winching and towing.

3.3 To dig tank protection ' slots' and gun pits in the battle area.

3.4 To improve routes, particularly at river crossings, constructing entry and exit ramps and providing assistance to amphibious or wading vehicles.

3.5 By means of various ancillary equipments, provide mechanical assistance during bridging and other engineering operations.

4 The CET is manned by a crew of two, seated in tandem. One man, the driver, faces forwards and controls the vehicle during road and cross country travel. The other man, the operator, faces rearwards and controls the earthmoving operations. Either crewman, when not in control of the vehicle, can change his seating position to face the direction of travel and act as commander, observer and radio operator. Both men may operate from either a 'head out' or 'closed down' position, depending on the circumstances prevailing.

5 Four basic modes of vehicle operation are possible.

5.1 Driven in the forward direction, the CET is a highly mobile road and cross country vehicle. The CET is driven by a conventional Rolls Royce diesel engine rated at 239 kW (320 horsepower). The engine transmits power to the tracks via a TN 26, manually controlled, gearbox and torque converter, steer unit and final drives. A transfer gearbox mounted on the main gearbox provides power to drive the water propulsion units (this capability no longer exists), hydraulic pumps and other ancillary services.

5.2 Driven in reverse, it functions as an effective earth moving tractor using a rear mounted hydraulically operated bucket, which is designed for shovelling. In addition, it may be used for towing or, with the appropriate attachments, used to provide lifting or pushing facilities.

5.3 The vehicle can deep wade and work, without preparation, in water to a depth of 1.8m (6 feet).

5.4 Using the vehicle winch, the CET can assist other vehicles at river crossings and perform normal recovery duties, within its capacity.

6 All of the main automotive controls, ie steering, brakes and accelerator, are provided at each crew position. Both steering and brake controls are air operated. The air supply is provided by a compressor on the engine which charges the appropriate reservoirs.

PHYSICAL DATA

Tractor

7	Crew	2	(Driver and operator)
	Battle weight	[redacted]	
	Military load classification		
	Nominal ground pressure		

Dimensions

8	Length overall	7.3 m	(23 ft 11-1/2 in.)
	Width - Hull	2.87 m	(9 ft 5 in.)
	- Bucket	2.93 m	(9 ft 7 in.)
	Height overall*	2.83 m	(9 ft 3-1/2 in.)
	Height overall (travelling mode)	2.87 m	(9ft 5 in.)
	Ground clearance	[redacted]	
	Wading depth	1.8 m	(6 ft (with 4.5 tonnes (10000 lb) remaining on tracks)

NOTE

Dimensions annotated* are based on a battle weight of [redacted]

Performance

9	Maximum road speed	56 km/h	(34 mile/h)
	Range on road	340 km	(210 miles)
	Maximum tractive effort	133 kN	(30000 lbf)
	Turning circle (between walls):		
	skid steer	[redacted]	
	differential steer		
	Vertical obstacle		
	Earth moving performance:		
	banked whilst digging an AFV pit including the construction parapet	180 m^3/h	(235.4 yds^3/h)
	loose whilst moving from stockpile and carrying over 50 m (54.7 yds)	200 m^3/h	(261.6 yds^3/h)
	Break-out force at bucket cutting edge	71.170 kN	(16000 lbf)

Engine

10	Type		Rolls Royce C6TFR
	Number of cylinders		Six (in line)
	Piston displacement		12.17 litres (742.64 in.³)
	Bore		130.17 mm (5.125 in.)
	Stroke		152.4 mm (6.000 in.)
	Compression ratio		14 : 1
	Aspiration		Turbocharged
	Firing order		1, 4, 2, 6, 3, 5
	Maximum power (at 2100 rev/min)		239 kW (320 hp)
	Maximum governed speed		2140 rev/min
	Idling speed		600 to 650 rev/min
	Injection pump		Simms Majormec, in line multi-plunger
	Lubrication		
		Type	Wet sump, integral oil pump
		Oil pressure Minimum	1.05 kgf/cm² (15 lbf/in.²)
		Maximum	3.87 kgf/cm² (55 lbf/in.²)
		Normal	2.10 kgf/cm² (30 lbf/in.²)

Cooling

11	Type		Liquid, pressurised to 69 kN/m² (10 lbf/in.²)
	Radiators		Two - air cooled by fans on land - water cooled when deep wading
	Fans		Two - 380 mm (15 in.) diameter mounted above radiators
	Fan drive		Hydrostatic: variation speed, thermostatically controlled from coolant temperature

Air cleaner

12	Type		Two stage dry type

Starting

13	Type		Electric starter motor

Transfer gearbox

14	Ratio		1 :1.68 overdrive
	Number of power take-offs		Six
	Cold start disconnect		Dog clutch
	Water propulsion unit drive E		Synchromesh clutch (this capability no longer exists)

Main gearbox

15	Type		TN 26 Mk III manually controlled power shift providing four speed in each direction of travel		
	Torque converter		Schneider 330 mm (13 in.) diameter		
	Gear ratios:	First	Forward 3.52 : 1	Reverse	7.35 : 1
		Second	2.22 : 1		4.75 : 1
		Third	3.25 : 1		3.25 : 1
		Fourth	1.00 : 1		2.14 : 1

Steer unit

16	Type	.....	Rolls Royce CGS 312. Two modes of operation - clutch brake steer and controlled differential, manually selected from crew compartment
	Ratio	.....	2.07 : 1

Final drives

17	Type	.....	Single reduction, spur gears
	Ratio	.....	3.857 : 1

Sprockets

18	Type	.....	Doublic ring - replaceable
	Number of teeth	.....	12

Suspension

19	Type	.....	Transverse torsion bar (5 stations per side)
	Dampers	.....	Hydraulic double acting cylinders on front and rear stations
	Damper lock-out	.....	Air actuated hydraulic lock controlled from crew compartment. Incorporated on rear wheel stations only

Wheel deflection

20	To bump	.....	203 mm (8 in.)
	To rebound	.....	102 mm (4 in.)

Tracks

21	Type	.....	Cast steel links with single horn, rubber bushes and road pads
	Pitch	.....	152 mm (6 in.)
	Width	.....	508 mm (20 in.)
	Number of Links per track		
	right track	.....	77
	left track	.....	76
	Length of track in contact with ground		
	right track	.....	3.76 m (12 ft 4 in.)
	left track	.....	3.66 m (12 ft 0 in.)

Brakes

22	Main brakes	.....	Air operated, contracting bands in steer unit
	Parking brake	.....	Mechanically operated pawl and ratchet device retains main brakes in the ON position

Electrical system

23	Voltage	.....	24 volts (nominal)
	Generator		
	Type	.....	AC 140 203 mm (8 in.) 3 phase alternator with integral rectifying diodes
	Output	.....	140A at 28V at 1800/10000 rev/min
	Batteries		
	Number	.....	Four
	Type	.....	Lead acid (UK6TN) MF 12V, rated at 110 Ah (connected series/parallel giving a total capacity of 220 Ah

NBC system

24	Type	.....	No. 5, Mk 1 mounted in a sealed compartment in front of crew compartment. NBC pack used additionally to provide ventilation of the crew compartment while operating closed down

Vision equipment

25	Vision blocks	.....	Ten vision blocks fitted in cupola. Full washing and wiping facilities provided for three blocks at each driving position
	Night vision periscope	.....	One [redacted] provided for use in either crew hatch. Each crew hatch is fitted with a window having full washing, wiping and heating facilities

Smoke protection

26	Smoke grenade dischargers	.....	Two, four-barrelled, fitted to right front glacis plate

Bucket

27	Type	.....	Light alloy construction with steel cutting edges and teeth. Hydraulically operated mechanism for raise/lower/float and for dump/crowd
	Capacity: Struck (SAE)	.....	1.53 m^3 (2 yd^3)
	Heaped (SAE)	.....	1.91 m^3 (2-1/2 yd^3)
	Maximum lift height (with bucket floor level)	.....	1.83 m (6 ft)
	Maximum depth (below track level with bucket floor level)	.....	102 mm (4 in.)
	Crowd and dump angles	.....	45 degrees crowd 60 degrees dump
	Lifting capacity	.....	67.5 kN (15000 lbf)

Winch

28	Type	Plumett CA 80, 2 speed hydraulically driven capstan type	
	Maximum pull, low gear	80 kN	(17000 lbf)
	Maximum pull, high gear	30 kN	(6500 lbf)
	Maximum speed, low gear	40 m/min	(130 ft/min)
	Maximum speed, high gear	113 m/min	(370 ft/min)
	Rope: diameter	16 mm	(0.630 in.)
	length	113 m	(370 ft)
	usable length	91.4 m	(300 ft)

Tow hooks

29	General service	Pull not to exceed 5 tons
	Plant (detachable)	Pull not to exceed 10 tons

ENVIRONMENTAL DATA

30	Temperature range	Temperature/humidity category of A3-C1 (only to -25 °C)

TRANSPORTATION DATA

31 Refer to JSP 71 Part 3 or Chap 3 of this publication.

TABLE 1 CAPACITIES

System/Assembly (1)	Metric (Litre) (2)	Imperial (Gals) (3)
Engine lubrication system (sump)	38	8.25
Cooling system	73	16
Gearbox/transfer gearbox	57	12.5
Steer unit	73	16
Final drives (each)	9	2
Wheel hubs: stations 1-4	1.7	3 pints
stations 5	1.1	2 pints
Bevel boxes (each)	1	1.75 pints
Propulsion unit (each)	0.3	0.5 pints
Winch gearbox	15	3.4
Earth moving hydraulics	82	18
Fan pack hydraulics	48	10.5
Dampers (each)	2.25	4 pints
Fuel tanks: No. 1 tank	243	53
No. 2 tank	177	39
Total fuel capacity (including collector tank)	436	96

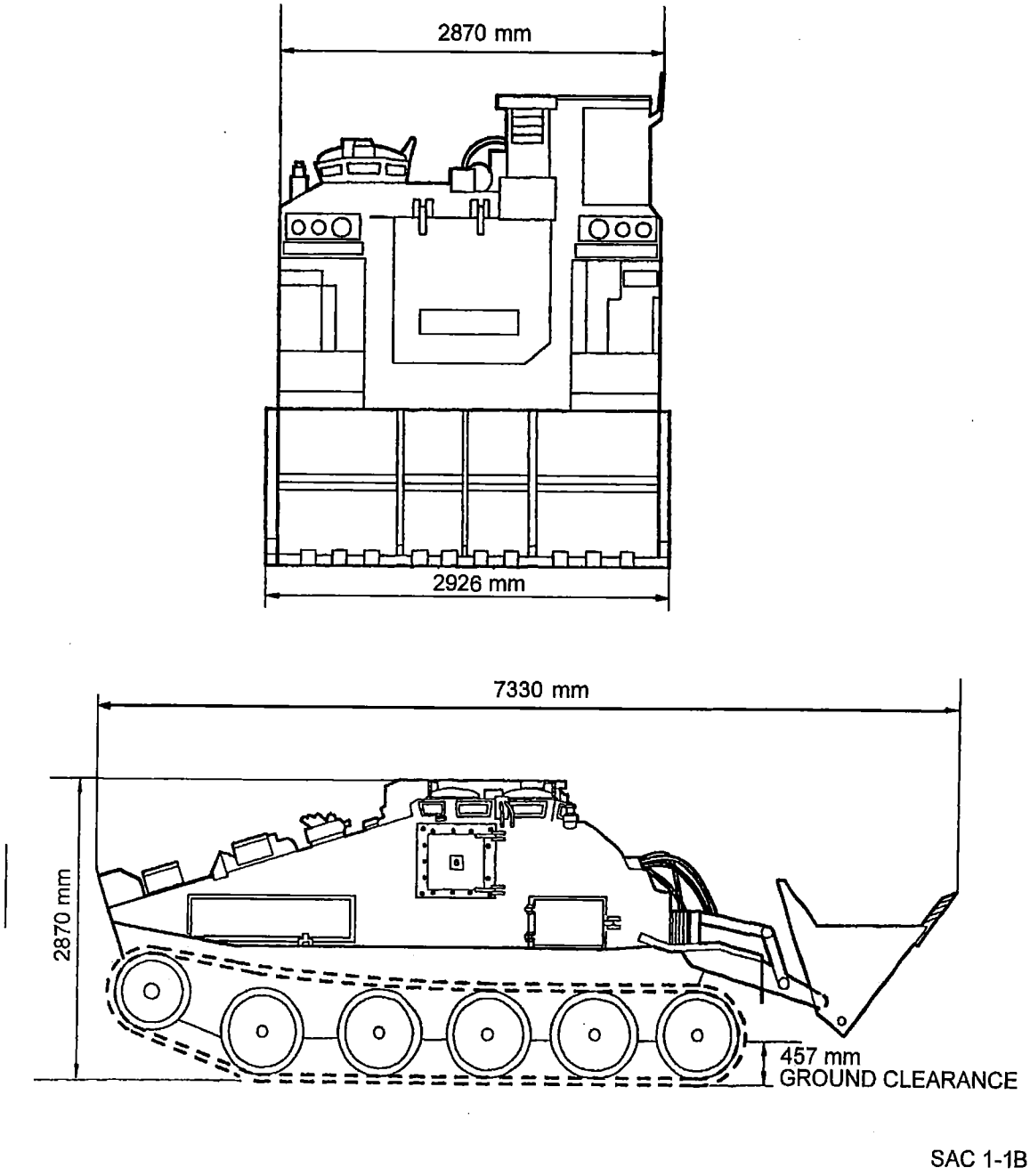


Fig 3 Vehicle dimensions (travelling mode)

CHAPTER 2-0

OPERATING INSTRUCTIONS - LIST OF CHAPTERS

Para

LIST OF CHAPTERS

1 This chapter is divided into the following sub-chapters:

1.1	Chapter 2-1	Hull and crew compartment
1.2	Chapter 2-2	Engine
1.3	Chapter 2-3	Fuel system
1.4	Chapter 2-4	Transmission, steer unit and final drives
1.5	Chapter 2-5	Brakes and air system
1.6	Chapter 2-6	Running gear
1.7	Chapter 2-7	Electrical equipment
1.8	Chapter 2-8	Earth moving and winch equipment
1.9	Chapter 2-9	Smoke grenade dischargers
1.10	Chapter 2-10	Demolition equipment
1.11	Chapter 2-11	Vehicle operation

CHAPTER 2-1

HULL AND CREW COMPARTMENT - LIST OF CHAPTERS

Para

LIST OF CHAPTERS

1 This chapter is divided into the following sub-chapters:

1.1	Chapter 2-1-1	Fire fighting equipment
1.2	Chapter 2-1-2	Hull
1.3	Chapter 2-1-3	Crew compartment
1.4	Chapter 2-1-4	Vision equipment
1.5	Chapter 2-1-5	Radio and intercommunications
1.6	Chapter 2-1-6	NBC system
1.7	Chapter 2-1-7	Air cooling system

CHAPTER 2-1-1

FIRE FIGHTING EQUIPMENT

CONTENTS

GENERAL DESCRIPTION

1 Hand held and fixed fire extinguishers, of the BCF vaporising liquid type and dry powder type are provided on the vehicle. Operating instructions are clearly marked on all extinguishers. The fixed system includes four extinguishers to combat fires in the engine/transmission compartments. An alarm system is fitted which will give audible and visual warning in the event of overheating or fire occurring in the area of the engine/transmission compartments.

HAND HELD FIRE EXTINGUISHERS

2 There are four hand held extinguishers (refer to Figs 1 and 2) provided on the vehicle. One inside and three outside the vehicle, and are located as follows:

2.1 One (1.5 kg BCF) inside the crew compartment, below the hand control levers, on the operator's right (Fig 7 (19)).

2.2 One (2 kg Dry Powder) on each side of the vehicle, on the glacis plate.

2.3 One (2 kg Dry Powder) on the rear stowage bin.

Operation

WARNING

TOXIC HAZARD. FUMES GIVEN OFF BY FIRES AND FIRE EXTINGUISHERS CAN BE TOXIC. ALWAYS EVACUATE ALL PERSONNEL FROM THE VEHICLE BEFORE ATTEMPTING TO EXTINGUISH A FIRE. NEVER FIGHT THE FIRE FROM WITHIN THE VEHICLE UNLESS THE SOURCE OF THE FIRE CANNOT BE REACHED FROM OUTSIDE THE VEHICLE. WHEN THE FIRE HAS BEEN EXTINGUISHED, THOROUGHLY VENTILATE THE VEHICLE BEFORE RE-ENTERING.

<u>BCF fire extinguisher</u>

WARNING

PERSONNEL INJURY. BCF FIRE EXTINGUISHERS CONTAIN HALON 1211. HALON IS HARMFUL BY INHALATION AND IS AN IRRITANT TO SKIN AND EYES. IN HIGH CONCENTRATIONS THE VAPOUR CAN CAUSE SUFFOCATION. ANYONE WHO HAS INHALED HALON OR HAD IT IN CONTACT WITH THEIR EYES OR SKIN IS TO RECEIVE IMMEDIATE MEDICAL ATTENTION.

3 To operate a BCF fire extinguisher, proceed as follows:

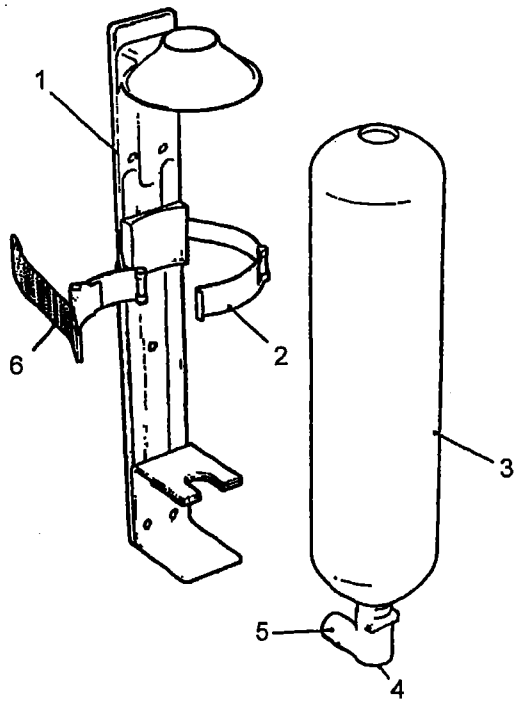
3.1 The extinguisher (refer to Fig 1) must be held with the striker head (4) downwards.

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

3.3 Strike the striker head on a hard surface.

3.4 From a safe position, as near to the fire as possible, direct the spray first at the base of the nearest flames, sweeping from side to side and progressing the spray over the fire area, leaving no flame behind.

3.5 During the whole operation the extinguisher must be held head downward until empty. The extinguisher may be tilted through an angle of up to 45 degrees out of vertical. The rate of discharge cannot be controlled, once discharge is started it will continue until the extinguisher is completely empty.



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1 Mounting bracket
2 Catch
3 Extinguisher
4 Striker head
5 Discharge nozzle
6 Strap

Fig 1 Hand held BCF fire extinguisher

3.6 When discharged, retain the empty container, in accordance with unit SOPs and obtain a replacement as soon as possible.

3.7 Refer to AESP 0200-A-194-013 for full details of the dangers of HALON, first aid measures to be taken and method of obtaining a replacement fire extinguisher.

Dry powder fire extinguishers

WARNINGS

(1) PERSONNEL INJURY. DO NOT DIRECT A DRY POWDER FIRE EXTINGUISHER AT INDIVIDUALS, EXCEPT TO EXTINGUISH A CLOTHING FIRE IF SMOTHERING IS UNSUCCESSFUL.

(2) PERSONNEL INJURY. DO NOT USE A DRY POWDER FIRE EXTINGUISHER ON METAL AND GAS FIRES DUE TO RISK OF EXPLOSION.

4 To operate a dry powder fire extinguisher, proceed as follows:

4.1 Remove the extinguisher from the mounting bracket by pulling and releasing the securing catch.

4.2 Remove nozzle cover (Fig 2 (1)) and safety pin (4).

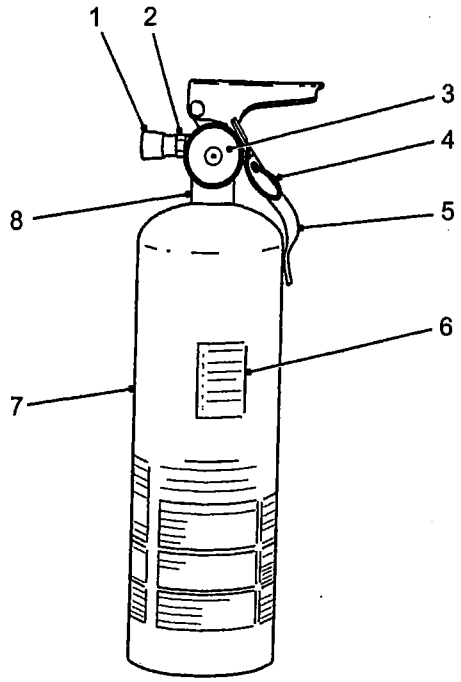
4.3 Hold the extinguisher with the extinguisher head (8) uppermost, direct nozzle towards the base of the fire and squeeze the operating handle (5).

4.4 When discharged, retain the empty container and obtain a replacement as soon as possible.

NOTES

(1) When in use, the fire extinguisher must be held with the extinguisher head uppermost until either fire is extinguished or the extinguisher is empty.

(2) The extinguishers can be tilted up to 45 degrees from the vertical position.



SAC 2-1

1	Nozzle cover	5	Operating handle
2	Discharge nozzle	6	Inspection record card
3	Gauge	7	Cylinder
4	Safety pin	8	Extinguisher head

Fig 2 Hand held dry powder fire extinguisher

Servicing and maintenance

BCF fire extinguishers

5 To service and maintain BCF fire extinguishers, proceed as follows:

5.1 Remove the extinguisher from its bracket (Fig 1 (1)) and inspect for damage.

5.2 Check that the extinguisher is charged by applying thumb pressure to the pressure checking disc at the base of the extinguisher. If the disc remains indented and does not reassert itself assume that the extinguisher has become discharged and obtain a replacement.

5.3 Check that the discharge nozzle (5) is not obstructed.

5.4 Check the mounting bracket for serviceability before replacing the extinguisher.

NOTE

The extinguishers are sealed and the discharge heads cannot be unscrewed.

Dry powder fire extinguishers

6 To service and maintain dry powder fire extinguishers, proceed as follows:

6.1 Remove the extinguishers from their brackets and inspect for damage.

6.2 Check that each extinguisher is fully charged by ensuring that the pointer on the gauge (Fig 2 (3)) is in the high side of the green sector.

6.3 Remove the nozzle cover (1) and check that the discharge nozzle (2) is not obstructed. Replace the cover.

6.4 Check the mounting bracket for serviceability before replacing extinguishers.

7 Refer to AESP 4210-E-110-201 for full details of the use, maintenance and inspection of hand held dry powder extinguishers.

NOTES

(1) The externally located hand held fire extinguishers (Fig 2) are of a different type to the one fitted internally (Fig 1).

(2) They are not interchangeable.

(3) Operating instructions are marked on each extinguisher.

FIXED FIRE EXTINGUISHER SYSTEM

8 The fixed fire extinguisher system consists of four cylinders, each containing 3.0 Kg of FM-200, mounted by their discharge heads on a common manifold located to the front left of the transmission compartment. The cylinders are held, in pairs, by a securing plate fitted over the tops of the cylinders. Each plate is clamped by two through bolts fixed in the mounting bracket. The securing plate allows access to a pressure indicator at the top of each cylinder.

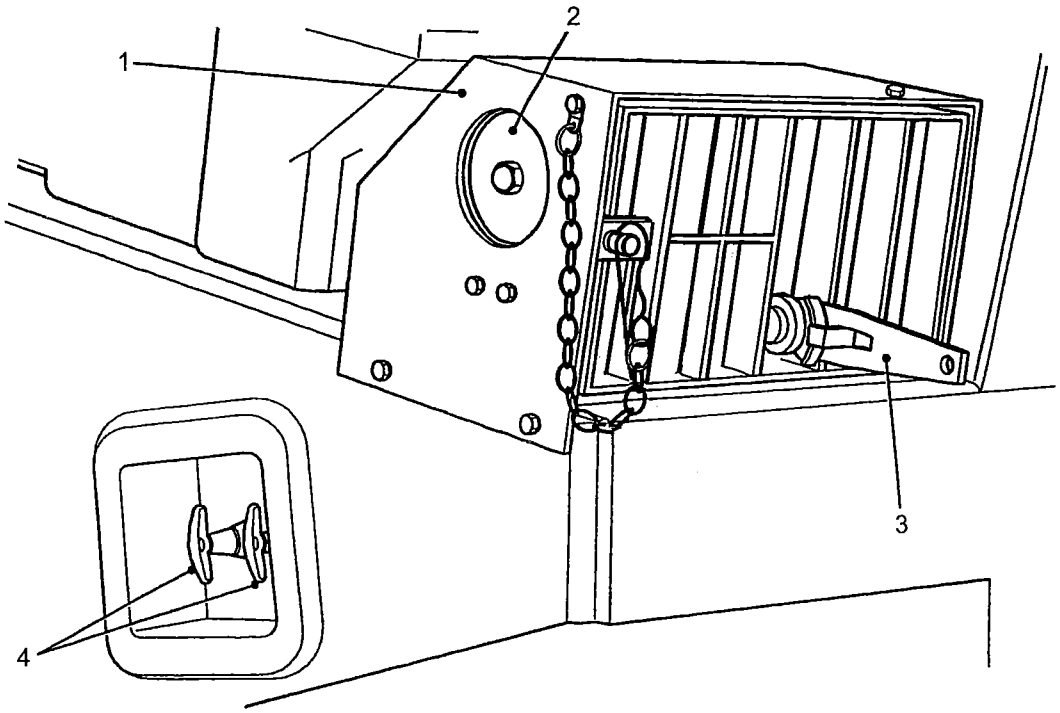
9 The manifold is connected to piping which is fixed round the engine and transmission compartments. The piping is drilled with a series of holes so that the discharged FM-200 is spread evenly throughout the compartments.

Operation

10 The fixed extinguisher system is operated manually by means of a cable operated mechanism. Discharge of the cylinders (refer to Fig 4) can be effected from either outside the vehicle or from the crew compartment. Two operating handles (Fig 6 (21)) are positioned in front of the driver and two operating handles (Fig 3 (4)) on the exterior of the hull, on the front right side.

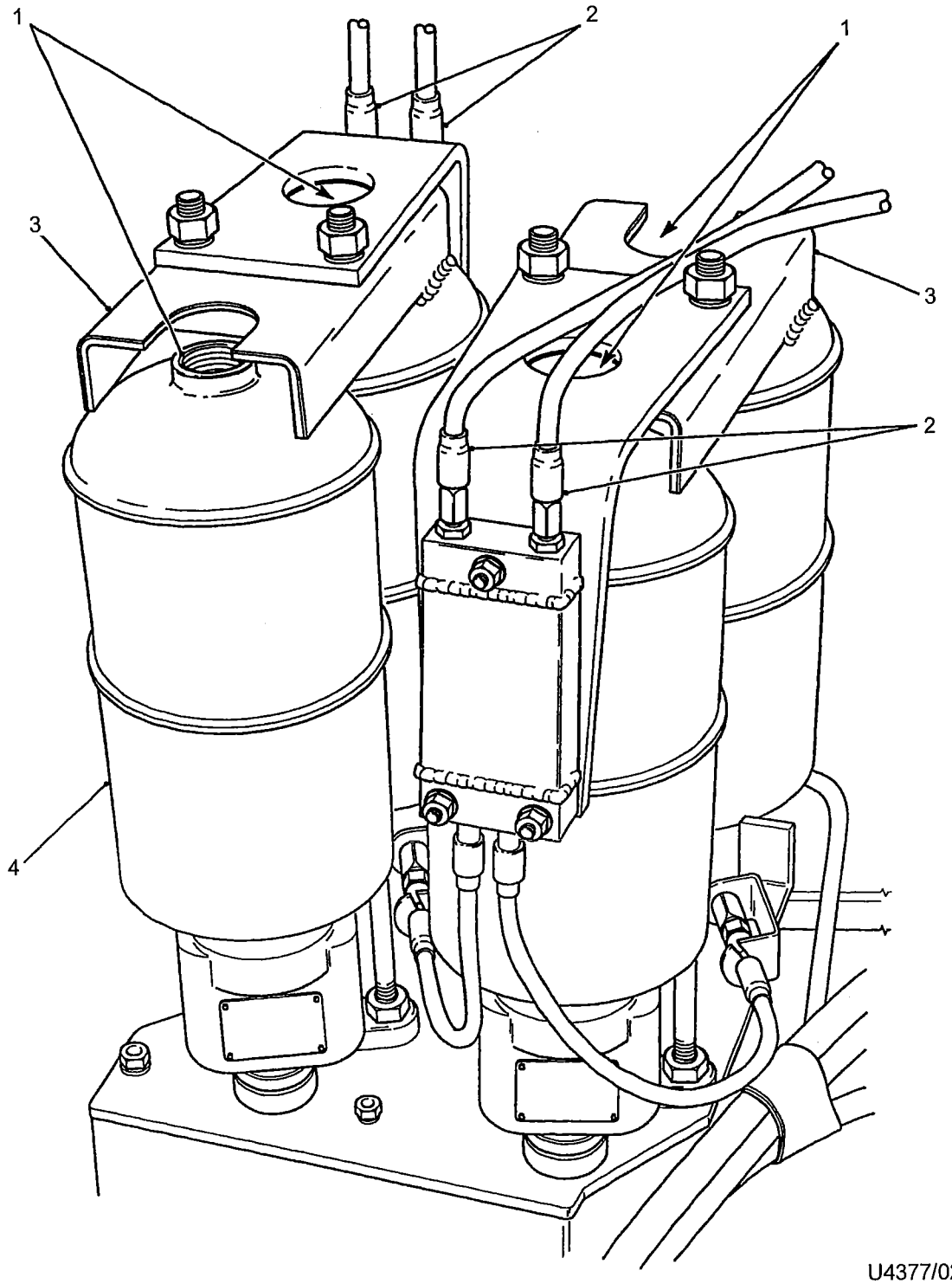
11 Pulling either of the red painted operating handles will discharge one pair of cylinders; one discharging into the engine compartment and one into the transmission compartment. The rate of flow from a cylinder cannot be controlled and once the seal is broken the cylinder will discharge completely. If the fire persists after one pair of cylinders has been operated, the other pair should be discharged.

12 Discharged cylinders must be replaced with charged ones as soon as possible.



1 Front right light bracket
2 Road warning horn
3 External air connection
4 Fixed extinguisher operating handles

Fig 3 Extinguisher external operating handles



1 Test disc/pressure gauge
2 Control cables
3 Securing bracket
4 FM-200 cylinders (4 position)

Fig 4 Fixed extinguisher cylinders

Servicing and maintenance

Extinguishers fitted with a gauge

13 To service and maintain extinguishers fitted with a gauge, proceed as follows:

13.1 Check that each extinguisher is fully charged by ensuring that the pointer on the gauge (Fig 4 (1)) is in the high side of the green sector. If the pointer on the gauge is reading low then the cylinder must be exchanged, report to REME.

13.2 Check that the cylinders are secure in their mounting.

13.3 Check the control cables (2) are correctly connected.

Extinguishers fitted with a pressure disc

14 To service and maintain extinguishers fitted with a pressure disc, proceed as follows:

14.1 Check that each extinguisher cylinder is fully charged by applying thumb pressure to the pressure checking disc (Fig 4 (1)) on top of the cylinder. The disc may be pressed in but it must reassert itself under cylinder pressure. If the disc remains indented the cylinder must be exchanged, report to REME.

14.2 Check that the cylinders are secure in their mounting.

14.3 Check that the control cables (2) are correctly connected.

14.4 The fixed extinguishers must only be charged by a qualified tradesman.

ALARM SYSTEM

15 The basic components of the alarm system are a sensing element loop, a firewire control box (Fig 7 (39)) with test switch, a warning horn (4), a flasher unit and a warning light (24).

16 In the event of overheating or fire in the engine or transmission compartments, the sensing element loop will cause the alarm system to operate. The warning horn will sound, the warning light will flash and a buzz will be heard in the connected headphones of the crew.

17 The firewire control box (Fig 7 (39)) and (Fig 5 (2)) is mounted on the compartment wall at the front left of the operator. A test switch (1), fitted to the box enables the continuity and insulation resistance of the sensing loop, and the integrity of the control box and warning light to be verified. The system will not signal a warning if a short circuit occurs or if a fault develops in the power supply or control unit. Therefore, it is essential that the system be tested regularly as laid down in the Maintenance Schedule (Cat 601) and in accordance with Para 19.

Operation

18 The warning light is controlled by the battery master switch but the warning horn will operate irrespective of the position of the master switch position, i.e ON or OFF.

Servicing and maintenance

To check the alarm system

19 To check the alarm system, proceed as follows:

19.1 Ensure that the battery master switch is in the ON position.

19.2 Connect the headphones to the radio crew boxes.

19.3 Move the firewire test switch (1) to the test position and check that:

19.3.1 The warning horn sounds.

19.3.2 A buzz is heard in all connected headphones.

19.3.3 The warning light flashes.

19.4 Release the test switch.

19.5 If the warning signals fail to operate, carry out basic fault finding, if the system still fails to operate report to REME.

19.6 If the warning signals continue to function after releasing the test switch, withdraw the fuses identified F2 and F3, which are located in the distribution panel (Fig 6 (11)), and report to REME.

To change a warning lamp

20 The warning light (Fig 7 (24)) is fitted with a 26V, 24W SCC lamp. To change a warning lamp, proceed as follows:

20.1 Set the battery master switch to OFF.

20.2 Remove the protective guard.

20.3 Unscrew the domed lens from the light.

20.4 Remove the bayonet fixing lamp from its holder.

20.5 Check that the spring-loaded contact is serviceable, then fit a new lamp.

20.6 Screw on the domed lens, taking care that the threads are correctly engaged and remain properly engaged.

20.7 Test the light and if satisfactory refit the protective guard.

ACTION IN THE EVENT OF FIRE

WARNING

PERSONNEL INJURY. IN THE EVENT OF AN ENGINE FIRE DO NOT OPERATE EXTINGUISHER(S) UNTIL THE ENGINE HAS BEEN STOPPED AND THE COOLING FAN IS STATIONARY.

21 In the event of fire:

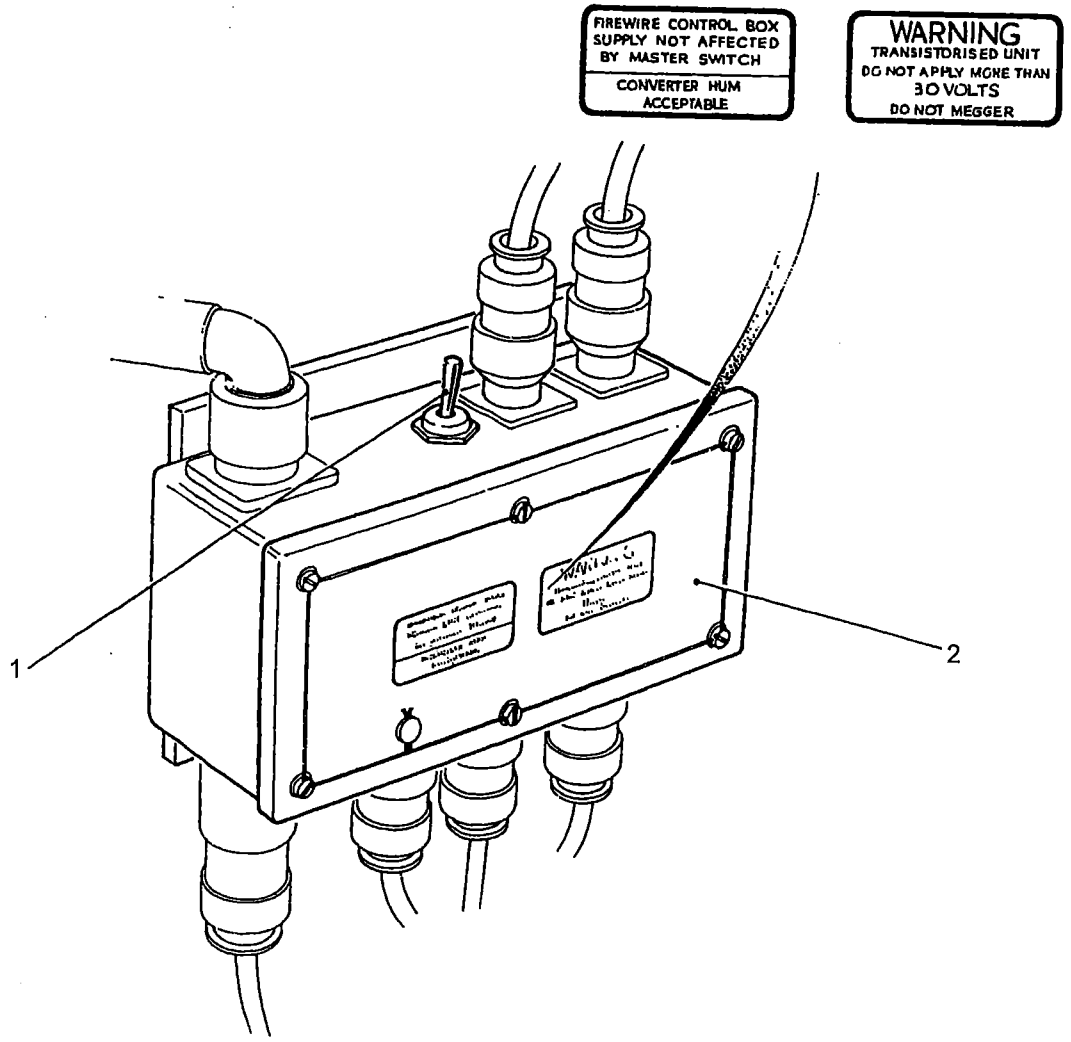
21.1 Stop the vehicle.

21.2 Stop the engine.

21.3 Set the battery master switch to OFF.

21.4 Evacuate the vehicle and close all the hatches.

22 The vehicle commander will take charge of the fire fighting and direct operations according to the nature of the fire.



1 Test switch 2 Control box

Fig 5 Firewire control box

External fires and crew compartment fires

WARNING

PERSONNEL INJURY. DO NOT DIRECT A DRY POWDER FIRE EXTINGUISHER AT INDIVIDUALS, EXCEPT TO EXTINGUISH A CLOTHING FIRE IF SMOTHERING IS UNSUCCESSFUL.

23 Use a hand held fire extinguisher.

24 For a fire in the crew compartment open one hatch, discharge one of the extinguishers into the compartment, then close the hatch. Wait for 10 minutes before re-opening unless the fire is seen to persist. In this case discharge a second extinguisher and close the hatch.

Engine or transmission compartment fires

25 If the warning system operates or flames or smoke are seen in either compartment, discharge one pair of cylinders. If, after cylinders have discharged, the fire persists, discharge the second pair of cylinders.

26 If no warning is given but flames or smoke are seen, stop the vehicle, set the battery master switch to OFF and investigate carefully. If investigation is impracticable or if smoke persists or increases, discharge one pair of cylinders, allowing adequate time for flames to be stifled, before opening each of the compartment covers to investigate. If flames persist, discharge the second pair of cylinders, close hatch covers and wait for the flames to be stifled.

NOTES

(1) Before discharging the cylinders, consideration should be given to the possible cause of smoke. Allowances should be made for smoke from surplus oil, new engine paintwork, and other 'normal' vapour, thereby avoiding premature operation.

(2) DO NOT, at any time, discharge fire fighting cylinders when the engine is running, as the ventilation fan in the bulkhead wall will drive all the fire fighting gas out of the exhaust ducts and thereby nullify its effect.

(3) When the fire has been extinguished and the vehicle has cooled, open all access covers and hatches to remove fumes, and allow to ventilate for at least 30 minutes.

(4) Ensure a discharged extinguisher is replaced as soon as possible.

1 Diffuser box
2 Python harness aperture
3 Interior light
4 Driver's instrument panel
5 Inspection light socket
6 Driver's road warning instrument panel
7 Steering column
8 Speedometer panel
9 'Trip' reset knob
10 Battery master switch
11 Distribution panel
12 Air restriction indicator
13 Emergency brake lever
14 Flooding valve
15 Engine stop control
16 Transmission disconnect clutch lever
17 Height adjuster, driver's seat
18 Accelerator pedal
19 Cold starting aid pump handle
20 Brake pedal
21 Fire extinguisher operating handles
22 Night sight stowage
23 Gear selector switch-box
24 Winch gear change lever
25 Pay-out/winch-in control lever
26 High speed pay-out/winch-in control lever
27 Driver/operator select switch
28 Junction box
29 Demolition microswitch
30 Demolition terminals
31 Heated clothing switch-box
32 Inter-vehicle socket
33 Emergency door release handle
34 Crew box - 2 radio

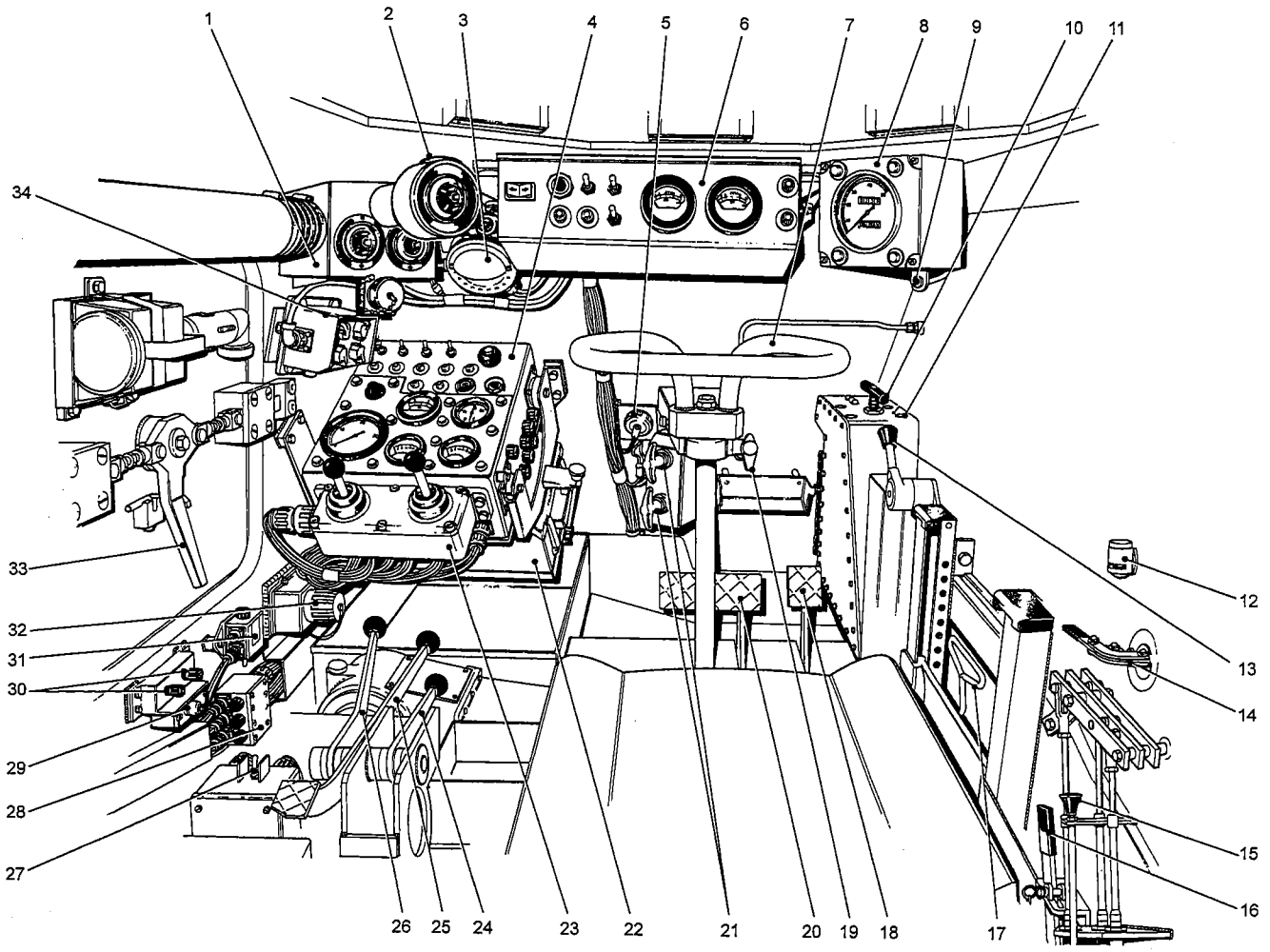
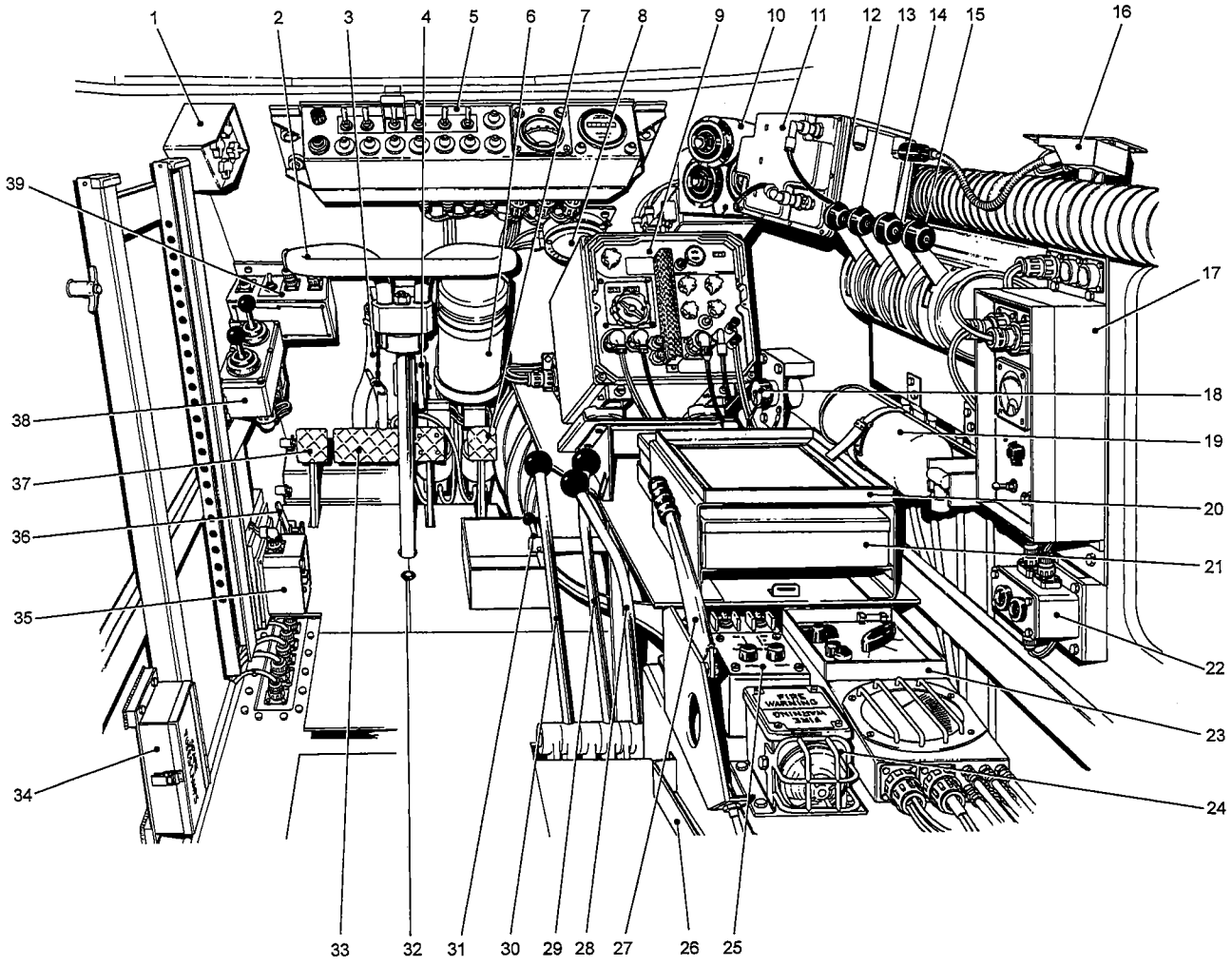


Fig 6 Controls and instruments (crew compartment - front)



1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spares box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnect pedal
38 Gear selector switch-box
39 Firewire control box

Fig 7 Controls and instruments (crew compartment - rear)

CHAPTER 2-1-2

HULL

CONTENTS

GENERAL DESCRIPTION

1 The hull is an all welded construction of armoured aluminium alloy, which affords all round protection for the crew and essential vehicle components against small arms fire and shell splinters. It is designed to enable the vehicle to carry out a number of tasks, including earth moving, tank slot and river bank preparation.

2 The hull is divided into three main sections - the engine compartment, transmission compartment and crew compartment.

3 The rear section of the hull forms the engine compartment and the front section forms the transmission compartment. The crew compartment is situated on the left side of the hull and provides accommodation for a two-man crew.

4 Removable and hinged access covers are provided on the top side of the hull. The covers allow access to the engine and transmission compartments, NBC installation, fuel filler and stowed items.

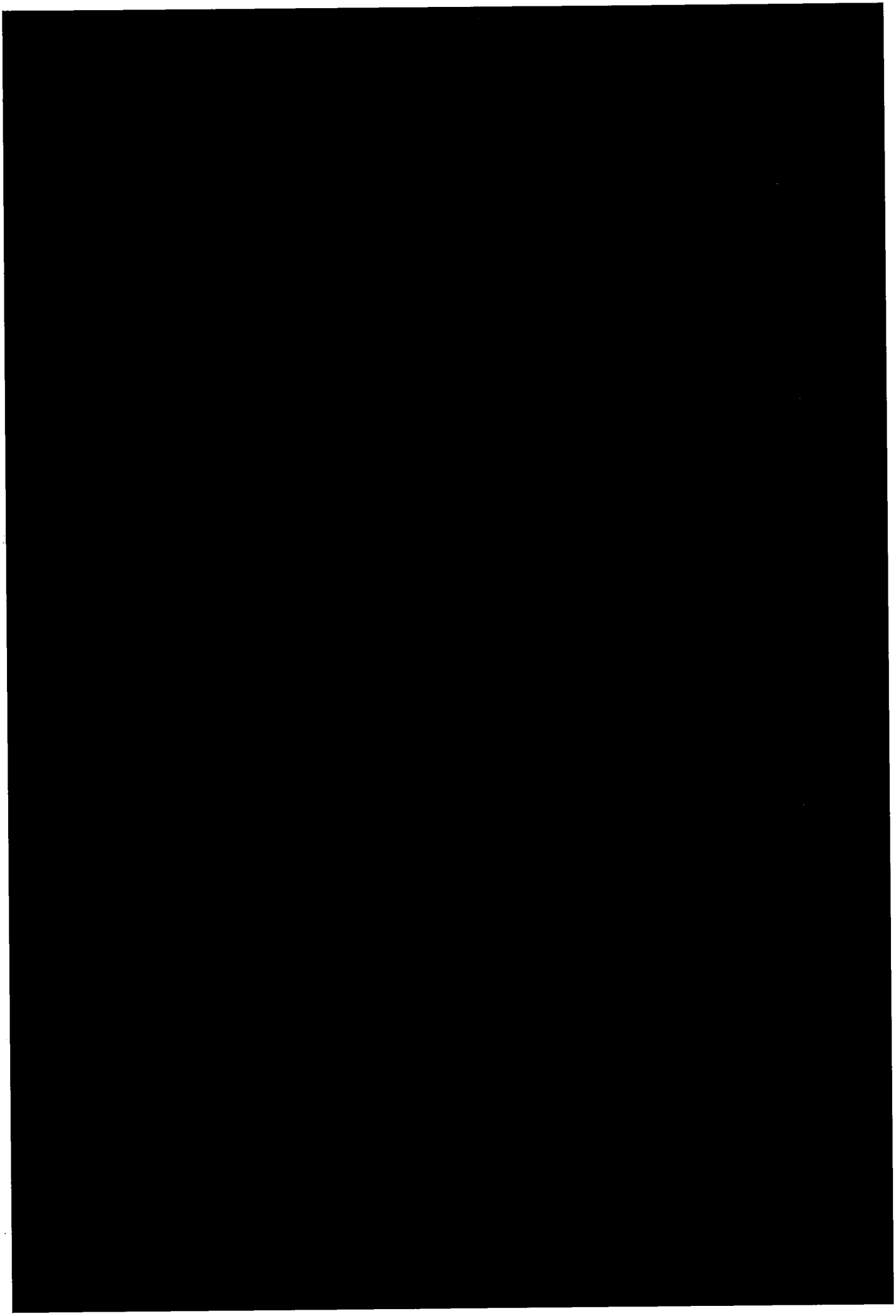
5 Mounted on the rear of the hull is a hydraulically operated bucket, used mainly for earth moving or as an earth anchor when winching.

6 A partially enclosed hydraulic winch is fitted on the forward right side glacis plate. The winch is used for recovery purposes and for use with ancillary equipment. Also mounted on the hull are the necessary pulleys and fairleads for use with the winch.

7 Four lifting/recovery eyes, two at the front and two at the rear are an integral part of the hull structure. Provision is made at the front of the hull for two tow hooks, one permanent and one detachable.

KEY TO FIG 1

1 Front stowage bins
2 Winch
3 Air intake cowl
4 Access panel
5 Access cover plates
6 Stowage basket
7 Stowage box
8 Rear stowage bin
9 Bilge pump outlet (rear)
10 Engine compartment roof plate
11 Engine compartment lower access panel
12 Drain plug
13 Emergency exit door
14 [redacted]
15 Exhaust cowl
16 Fairlead
17 Smoke grenade stowage box
18 Engine compartment access door
19 Operator's access hatch
20 Driver's access hatch
21 Python aperture cover plate
22 NBC air intake cowl
23 Stowage compartment door
24 Transmission compartment lower access panel
25 General service tow hook
26 Fire extinguisher operating handles
27 Transmission compartment upper access panel
28 Bilge pump outlet (front)
29 Smoke discharger mounting
30 Fuel filler access cover
31 Radiator intake louvres
32 Radiator outlet louvres



ACCESS COVERS

General

CAUTION

EQUIPMENT DAMAGE. To prevent hull distortion, all external engine/transmission hatches are to be in place prior to vehicle movement.

Engine compartment

8 The engine compartment is enclosed by a two piece cover, comprising a roof plate (Fig 1 (10)) and a hinged lower access panel (11). Both sections are bolted in place on rubber seals.

9 The roof plate contains a rectangular hinged access door (18) to allow limited access to the engine, an access panel (4) and a small oval cover plate (5) covering the coolant filler.

10 The hinged lower panel is secured by seventeen bolts. The panel may be retained in the open position by inserting a quick release pin in the additional holes provided in the right side hinge.

Transmission compartment

11 The transmission compartment is enclosed by a two piece detachable panel, which forms the centre section of the forward glacis plate.

12 The lower access panel (24) is bolted in place, on a rubber seal and carries two of the front stowage bins (1).

13 The upper access panel (27) is a hinged panel opening forward. The panel closes on a rubber seal and is secured by ten budget locks. With the panel raised, access is afforded to the batteries, hydraulic oil tank, gearbox filler, winch gearbox, various filters, fixed fire extinguisher bottles, ACU, belt adjustment and the fan pack.

NBC unit

CAUTION

EQUIPMENT DAMAGE. Access to the NBC unit should be limited to essential maintenance to prevent damage to the seal.

14 [redacted]

15 [redacted]

Fuel filler

16 Access to the fuel filler is by way of the hinged access cover (30), on the right of the glacis plate. The cover opens forward and is held closed by a spring-loaded plunger, which is released when the cover is lifted by the handle provided. A drilled lug is fitted to enable a padlock to be used.

Maintenance

17 Keep all door seals and hatch openings clean and free from debris.

18 Using a suitable oil can lightly oil all hinges and catches. Apply grease via a suitable grease gun, to each lubricating nipple on the access cover budget locks.

STOWAGE COMPARTMENT

General

NOTE

Compartment should be vented regularly to prevent condensation and possible rotting of the cloth type equipment.

19 A stowage compartment is provided within the hull above the NCB unit. The compartment is sealed to enable items of equipment to be stowed free from contamination under NBC conditions.

20 Access to the stowage compartment is by means of a hinged door, (Fig 1 (23)) and (Fig 2 (4)), in the glacis plate. A rubber seal (1) is fixed to the underside of the door, which is secured by a central latch. The locking handle (8) is turned to position the latch (3) under the sides of hatch opening. The wing nut (5) is used to tighten the door against the seal. Provision is made to enable a padlock to be used to immobilise the locking handle (8).

Operation

<u>To open the stowage compartment door</u>

21 To open the stowage compartment door, proceed as follows:

21.1 Turn the wing nut (5) anti-clockwise as far as it will go.

21.2 Unlock the door by turning the handle (8) anti-clockwise until latch (3) contacts its stop.

21.3 Lift and open the door towards the front of the vehicle.

<u>To close the stowage compartment door</u>

22 To close the stowage compartment, proceed as follows:

22.1 Pull rearwards and lower the door (4) into position on the glacis plate. Ensure that it is correctly sealed.

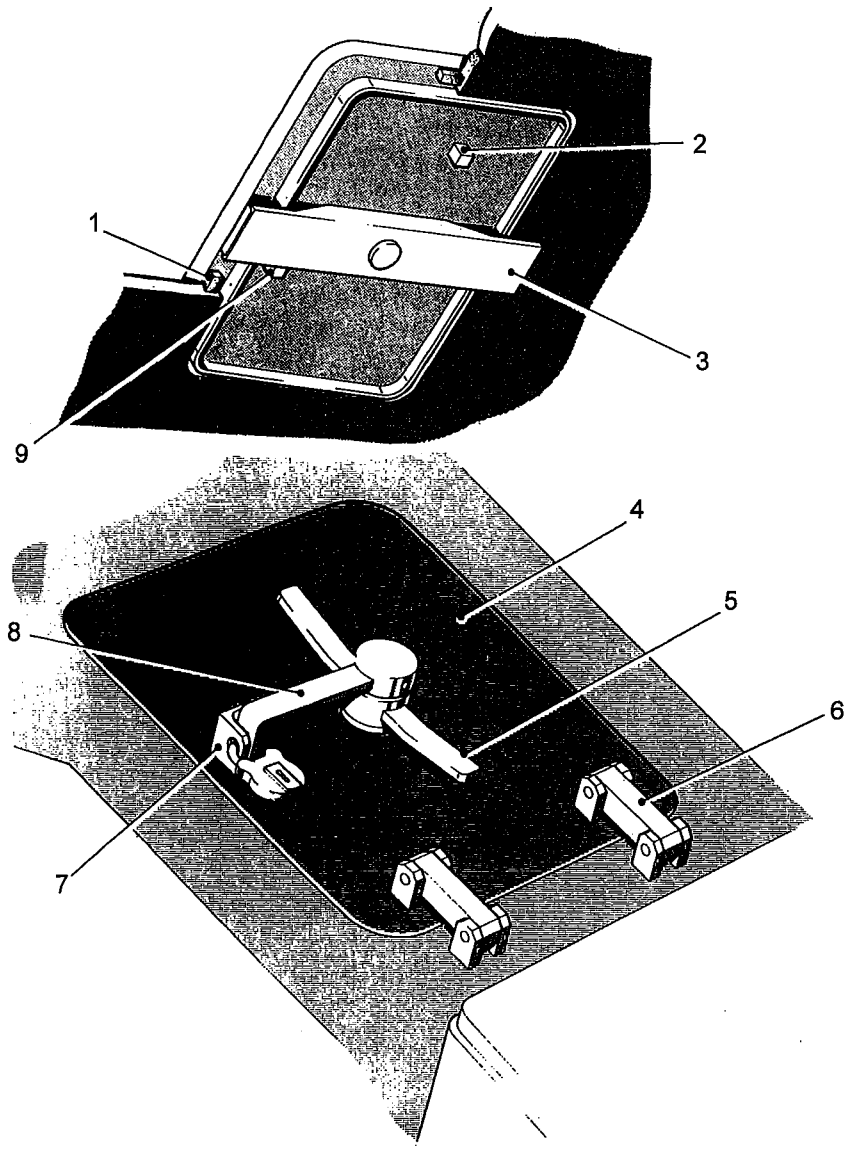
22.2 Turn the locking handle (8) clockwise until the latch (3) contacts its stop (9).

22.3 Turn the wing nut (5) clockwise to tighten the door.

Maintenance

23 Keep all door seals and hatch openings clean and free from debris.

24 Using a suitable oil can lightly oil all hinges and the latch mechanisms.



1	Seal	4	Door	7	Padlock lug
2	Stop (fully open)	5	Wing nut	8	Locking handle
3	Latch	6	Hinges	9	Stop (fully closed)

Fig 2 Stowage compartment door

STOWAGE BINS

Front stowage bins

25 Five stowage bins (Fig 1 (1)) are fitted on the front cover of the vehicle. Three adjacent to the winch. Two are mounted on the transmission compartment panel and one on the left side of the glacis plate. Two are mounted rear of the headlights, one on the left and one on the right.

Rear stowage bins

26 A large vertical bin (8) is located on the right rear of the hull adjacent to the engine cooling louvres.

Stowage basket

27 A rectangular basket (6) constructed of metal mesh is fitted on the right of the hull above the engine cooling louvres. Attached to the sides of the basket are stowage facilities for smoke grenades and other equipment.

TOW HOOKS

General service tow hook

28 A general service tow hook (Fig 1 (25)) is permanently fitted on the front of the hull below the winch fairlead. The hook is intended for general towing purposes.

Plant tow hook

29 A detachable 'bolt on' plant tow hook (Fig 3 (3)) is provided. The mounting face (6) for the tow hook is on the front of the hull. The hook is used for towing engineering plant which has a low drawbar height, or where the general service hook is otherwise unsuitable. To reduce drag on the muddy banks of rivers when winching out, the hook should be removed and stowed in the appropriate place on the bucket. A blanking plate (5) is provided to protect the mounting face and bolt holes.

To fit the plant tow hook

30 To fit the plant tow hook, proceed as follows:

30.1 Undo the four securing bolts (4) and remove the blanking plate.

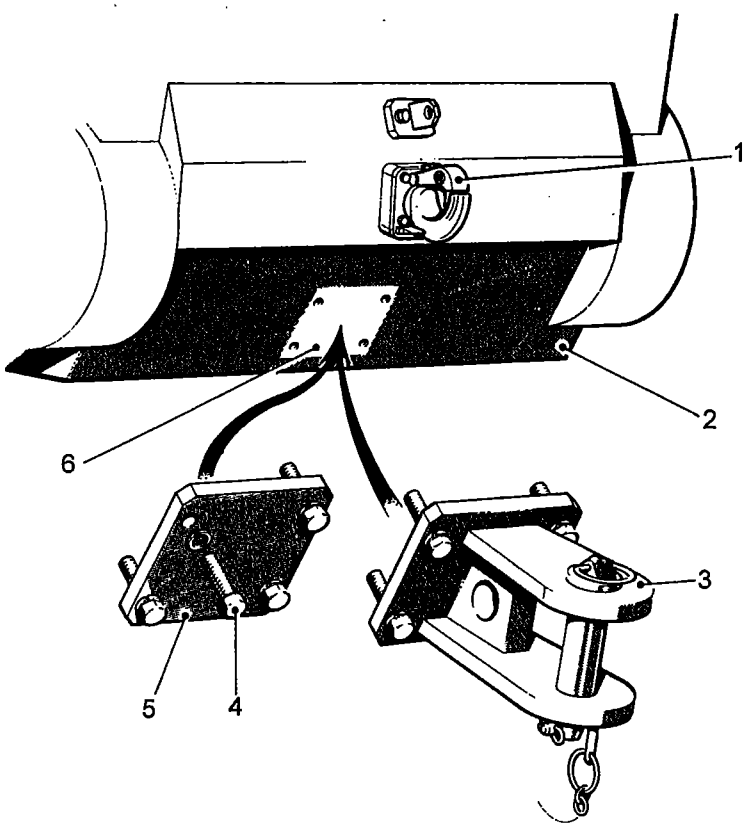
30.2 Remove tow hook from bucket and bolt the tow hook in position, ensuring that all four bolts are fully tightened.

30.3 Stow the blanking plate on the bucket in place of the tow hook.

HULL DRAIN PLUGS

31 To enable the hull to be drained of excess water and/or sludge, a threaded drain plug (Fig 1 (12)) is provided in the lower portion of the hull heel plate at the rear end of the vehicle.

32 The hexagon headed plug is provided with a retaining device to prevent its loss while the hull is being drained.



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1	General service tow hook	4	Securing bolts
2	Toe plate	5	Blanking plate
3	Plant tow hook	6	Mounting face

Fig 3 Towing hooks

CHAPTER 2-1-3

CREW COMPARTMENT

CONTENTS

GENERAL DESCRIPTION

1 The crew compartment is located on the left side of the vehicle and provides accommodation for a crew of two, seated back to back. A forward facing position is provided for the driver and a rearward position for the operator. The compartment is designed to enable the vehicle to be operated, in most of its various roles, fully closed down, under NBC and combat conditions.

2 Housed in the compartment are the seats, vehicle controls and instrument panels, and the controls necessary for the operation of the vehicle during winching and earth moving operations.

CREW ACCESS HATCHES

3 Each crew member has a separate access, which is closed by a cast steel access hatch. The access hatches (Fig 1) are pivoted on spring-assisted hinges and open towards the centre of the vehicle. A heated sight window (1) and a wiper is installed in each door to enable an L21 night vision sight to be used, in the mounting (8) provided.

4 The hatches are held in the open position by the retaining plungers (3) which locate in holes in the hinge brackets (2). On closing, the release handle (5) withdraws the plungers and allows the hatch to be pulled down. The handle (7) operates the latch (6) to lock the hatch in the closed position. A release hexagon (13) is provided to allow the latch to be operated from the outside, by using the emergency key (10). The hasp (12) allows a padlock to be used for security purposes. Each hatch is padded to afford protection to the crew and is sealed by a rubber seal (9).

Operation

<u>To open an access hatch</u>

5 To open an access hatch, proceed as follows:

5.1 Turn the handle (7) towards the inner wall of the compartment until the latch (6) disengages from the catch-plate. The hatch will open slightly due to the action of the torsion spring (4).

5.2 Push the hatch upwards, towards the centre of the vehicle, until the retaining plungers (3) locate in the hinge brackets (2).

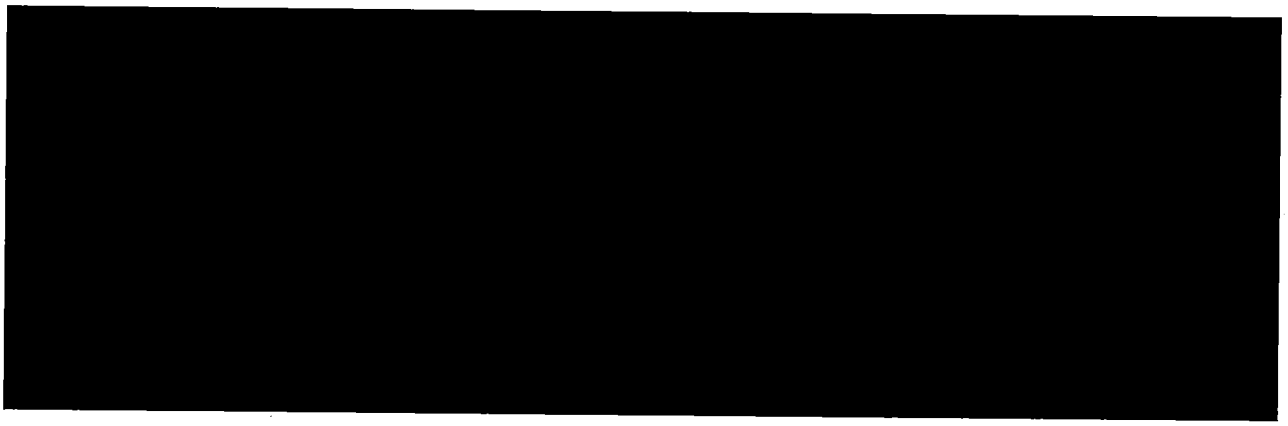
5.3 Ensure that the hatch is securely held.

<u>To close an access hatch</u>

6 To close an access hatch, proceed as follows:

6.1 Pull down the hatch by means of the release handle (5), and close.

6.2 Lock the hatch by turning the handle (7) until the latch (6) fully engages its catch plate.

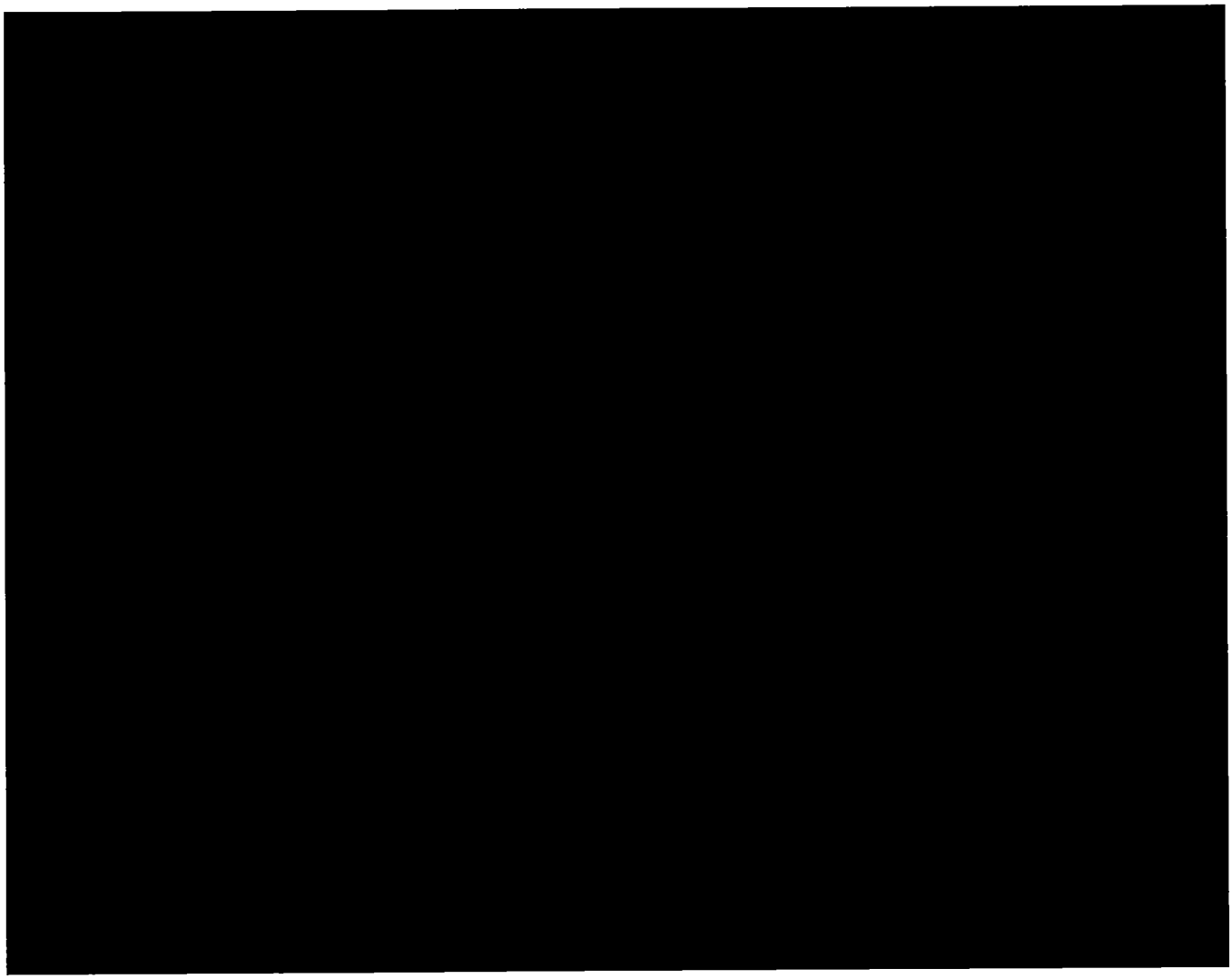


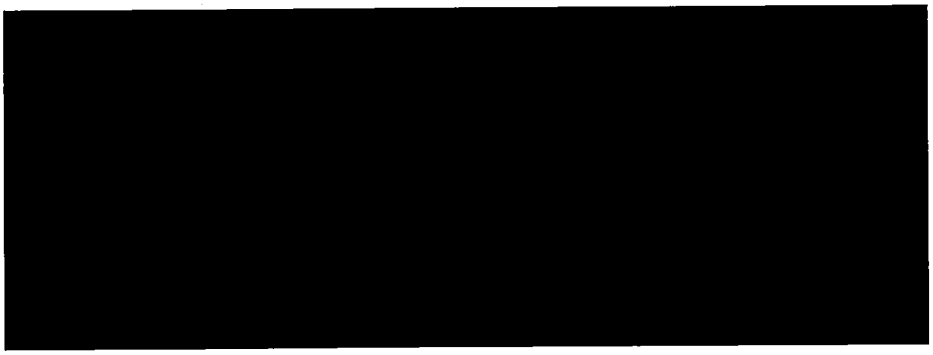
Maintenance

8 Keep hatch seals and hatch openings clean and free from debris.

9 Using an oil can, lightly oil the hinge pins, latches and release mechanism.

10 Use a grease gun to lubricate the plungers.





EMERGENCY EXIT DOOR

WARNINGS

(1) PERSONNEL INJURY. ENSURE THAT THE EMERGENCY EXIT DOOR LOCKING CATCH IS IN THE OFF POSITION BEFORE OPERATING THE VEHICLE. FAILURE TO DO SO COULD PREVENT RESCUE FROM OUTSIDE THE VEHICLE.

(2) PERSONNEL INJURY. BEFORE USING THE VEHICLE IN THE DEEP WADING MODE, ENSURE THAT THE HINGE PINS ARE REMOVED.

11 The emergency exit door (Fig 2) must only be used if an emergency requiring a rapid exit from the vehicle arises. A release mechanism (6), operated by a central release handle (9), holds the door in place, against the seal (3). Removable hinge pins (1) are provided to enable the door to be jettisoned completely if required. A locking catch is released by lifting the catch (10) and turning it parallel to the surface of the door.

12 Stowage facilities for a hand lamp (12) and a torch (4) are fitted to the inside of the door.

Operation

To open the emergency exit door

13 To open the emergency exit door, proceed as follows:

13.1 Ensure that the locking catch (10) is OFF.

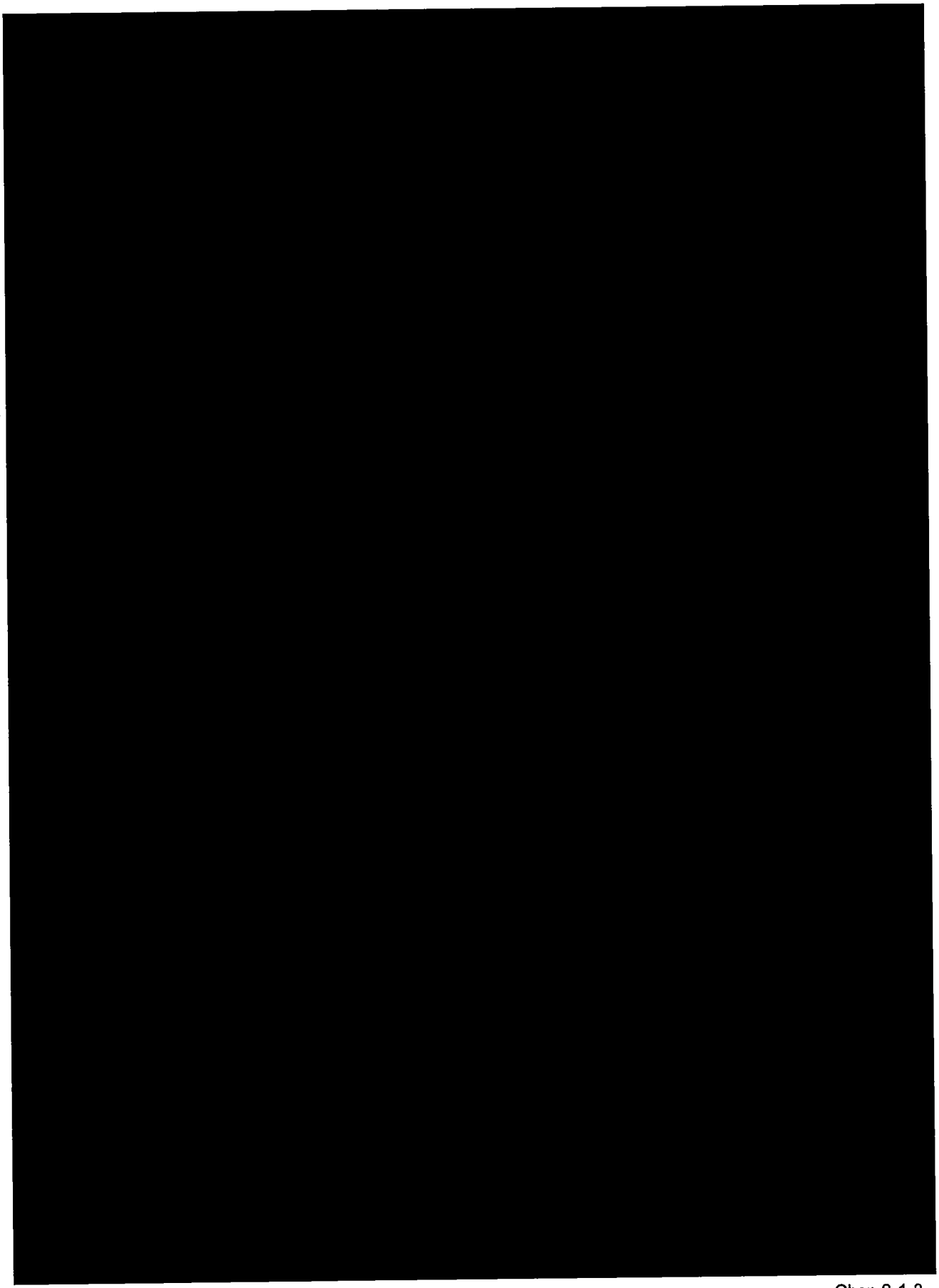
13.2 Turn the release handle (9) clockwise and push the door (2) outwards.

[redacted]

Maintenance

15 Keep the door seals clean and free from debris.

16 Lightly oil the door release mechanism.



CREW SEATS

WARNING

PERSONNEL INJURY. THE SEATS ARE MOUNTED ON SPRING-LOADED LINKAGES, DESIGNED TO COUNTERACT THE WEIGHT OF A CREW MEMBER. DO NOT OPERATE THE HEIGHT ADJUSTMENT HANDLES WITH THE SEATS UNOCCUPIED, THIS COULD CAUSE SERIOUS DAMAGE OR INJURY TO PERSONNEL.

17 The crew seats are located one under each access hatch in the crew compartment. The seats (refer to Fig 3) are attached to vertical rails fixed to the inner compartment wall.

18 Each seat is adjustable for height and backward or forward setting. The vertical mounting rails (1) and spring-loaded linkages (6) provide adjustment for height. The seat in the operator's position has rails giving a considerably greater range of adjustment than that of the driver.

19 The position of each backrest (2) can be changed, to either end of the seat cushions, to enable the driver to face the rear during long earth moving operations and the operator to face forward while the vehicle is on the road.

Operation

To position a seat for height

20 The height of the seat is adjusted as follows:

20.1 Ensure that the access hatches are properly secured in the open position.

20.2 Move the spring-loaded release handle (13) towards the front of the vehicle and set the seat to the correct height. Easing the weight of the body on or off the seat will assist movement.

20.3 Release the handle. Ensure that the locking mechanism is fully engaged.

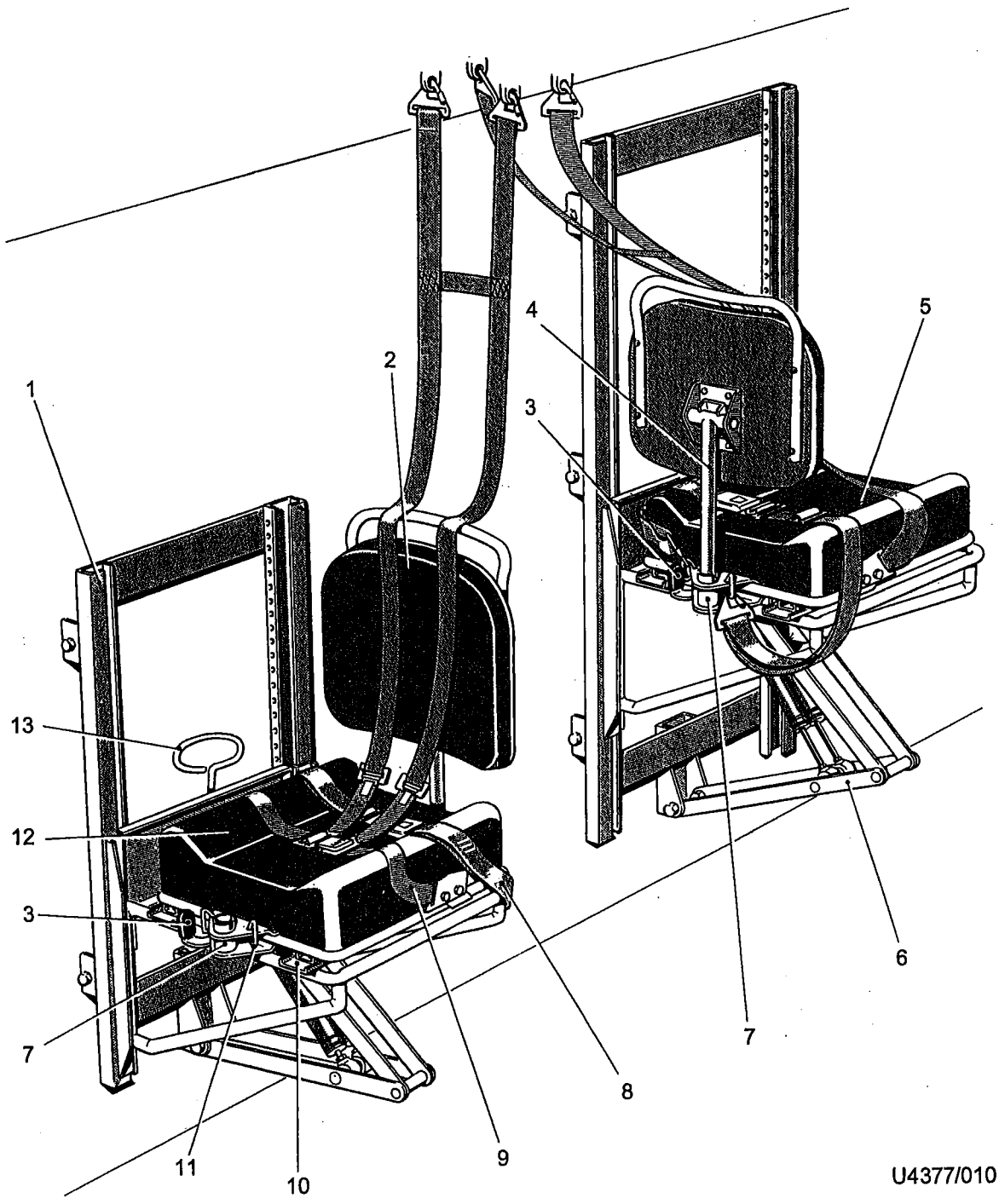
To move the seat backward or forward

21 The seat may be moved backward or forward as follows:

21.1 Move the adjusting lever (3), located at both ends of each seat cushion (5) and (12) to the right of the body to disengage the locking mechanism from the guide rails.

21.2 Slide the seat to the required position and then release the lever.

21.3 Ensure that the locking mechanism fully engages the guide rail.



1	Mounting rails	8	Lap strap
2	Backrest	9	Harness
3	Adjusting lever (horizontal movement)	10	Guide rails
4	Backrest pillar	11	D-rings
5	Operator's seat cushion	12	Driver's seat cushion
6	Spring-loaded linkage	13	Release handle (vertical movement)
7	Backrest locating socket		

Fig 3 Crew seats

To change the position of a backrest

22 The position of a backrest may be changed as follows:

22.1 Lift the backrest upwards until the pillar (4) clears the locating socket (7).

22.2 Turn the backrest round to face the required direction and insert the pillar in the locating socket at the opposite end of the seat cushion and push fully home. Identical locating sockets are provided at each end of the seat cushions (5) and (12).

Maintenance

23 Using an oil can, sparingly lubricate the seat runners, pivot pins and other moving parts.

SEAT BELTS

24 Each crew seat is provided with two separate seat belts, a full harness for cross country and a lap strap for road use.

25 The full harness (9) is attached to the seat frame at its lower end and to a lug on the cupola roof at the top end. A quick release fastener is fitted at the centre and buckles permit the length to be adjusted.

NOTE

After adjusting the seat height it will be necessary to adjust the harness accordingly.

26 The lap strap (8) may be attached to D-rings (11) at either end of the seat cushion, thus enabling it to be used when the crew member is facing in either direction. A quick release device is fitted at the centre of the belt and two buckles provide length adjustment.

FLOOR PLATES

27 A false floor, consisting of nine separate detachable plates, is mounted on brackets above the compartment bottom. The plates have a 'tread plate' surface and protect the various control mechanisms beneath the floor. Each floor plate is secured by a small number of countersunk screws.

DRAIN VALVE

28 A screw down type of drain valve (Fig 6 (32)) is fitted below the floor plates near the operator's feet. The valve enables excess water to be drained from the compartment to the hull.

Operation

29 The valve is opened or closed by applying a spanner to the valve spindle. To open the valve turn the spindle anti-clockwise.

FLOODING VALVE

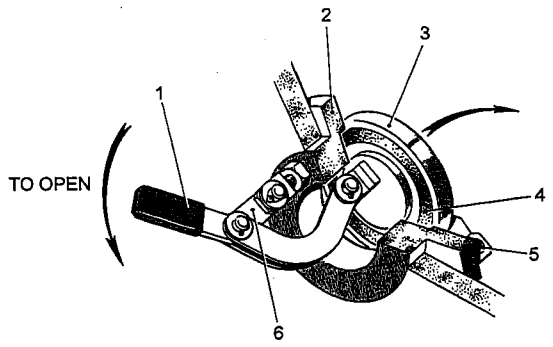
30 To enable the crew compartment to be flooded in an emergency, a flooding valve (Fig 4) and (Fig 5 (14)) is provided, on the inner compartment wall adjacent to the driver's air restriction indicator.

31 The valve is lever operated, with an over centre toggle action. When the valve is opened water is allowed free passage between the crew compartment and the hull.

Operation

32 The operating lever (Fig 4 (1)) is pulled outwards to unlock the valve and further movement progressively opens the valve disc (3), against the pressure of incoming water, thus allowing a controlled flow.

33 To close the valve fully, the lever is pushed to the closed position, parallel to the compartment wall.



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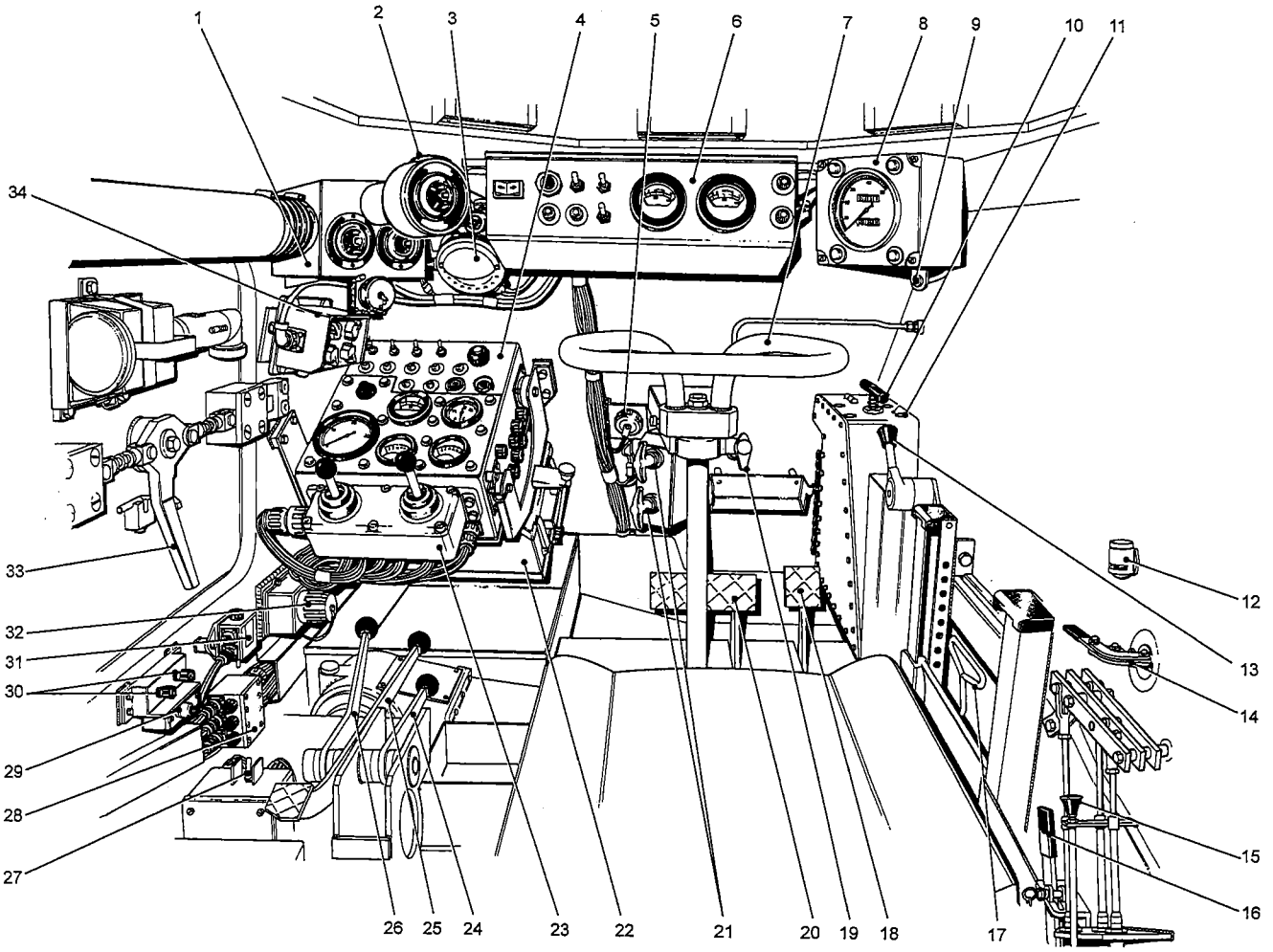
1 Operating lever
2 Valve body
3 Valve disc
4 Seal
5 Pivot pin
6 Toggle mechanism

Fig 4 Flooding valve



1 Diffuser box
2 Python harness aperture
3 Interior light
4 Driver's instrument panel
5 Inspection light socket
6 Driver's road warning instrument panel
7 Steering column
8 Speedometer panel
9 'Trip' reset knob
10 Battery master switch
11 Distribution panel
12 Air restriction indicator
13 Emergency brake lever
14 Flooding valve
15 Engine stop control
16 Transmission disconnect clutch lever
17 Height adjuster, driver's seat
18 Accelerator pedal
19 Cold starting aid pump handle
20 Brake pedal
21 Fire extinguisher operating handles
22 Night sight stowage
23 Gear selector switch-box
24 Winch gear change lever
25 Pay-out/winch-in control lever
26 High speed pay-out/winch-in control lever
27 Driver/operator select switch
28 Junction box
29 Demolition microswitch
30 Demolition terminals
31 Heated clothing switch-box
32 Inter-vehicle socket
33 Emergency door release handle
34 Crew box - 2 radio

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Fig 5 Controls and instruments (crew compartment - front)

1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spare box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnect pedal
38 Gear selector switch-box
39 Firewire control box

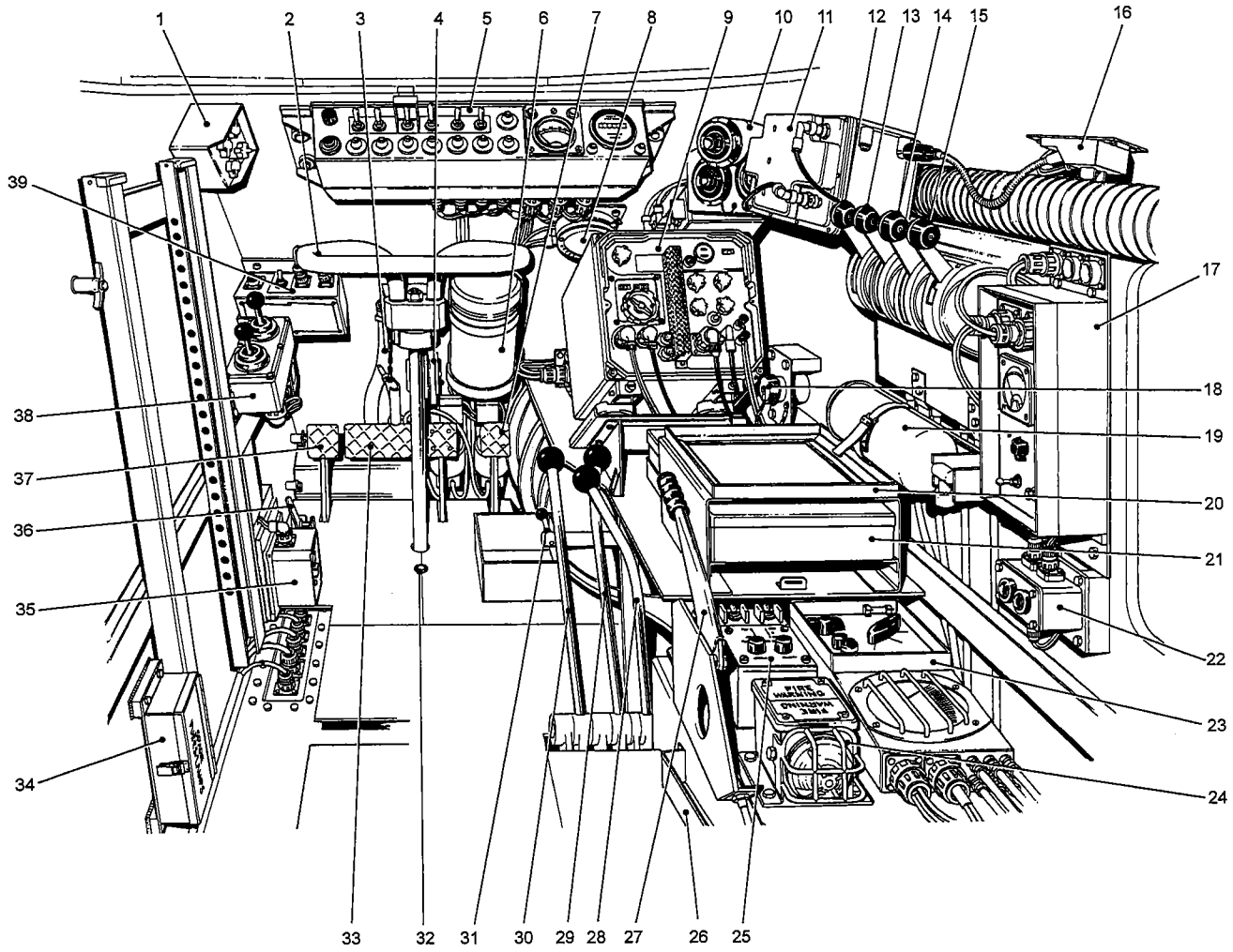


Fig 6 Controls and instruments (crew compartment - rear)

CHAPTER 2-1-4

VISION EQUIPMENT

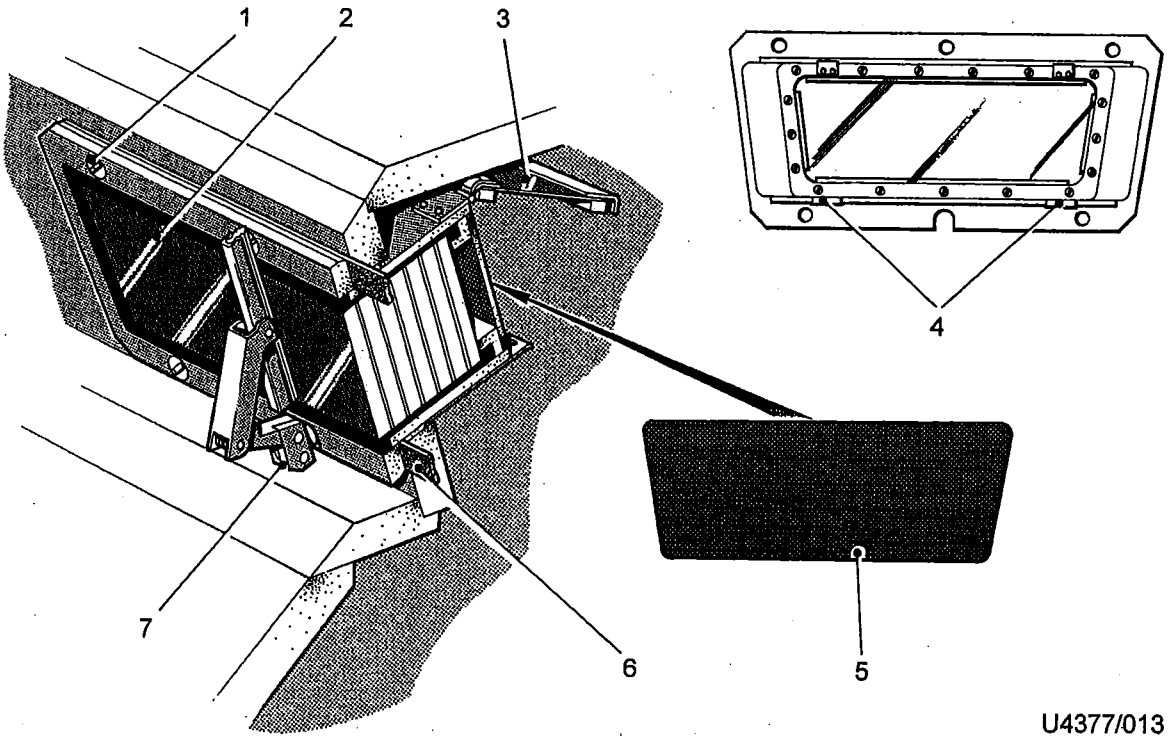
CONTENTS

GENERAL DESCRIPTION

1 Both crew positions share a common cupola, which affords all round vision by means of ten vision blocks.

2 Provision is made in each crew access hatch for the installation of an image intensified night vision periscope. An identical periscope mounting is fitted in each hatch, containing the necessary electrical connections. Each periscope window has a heating element and a wiper. One night vision periscope is carried on the vehicle and when not in use, by either crew member, is stowed beneath the driver's instrument panel.

3 An electrically operated wiper and washer system operates on three vision blocks at each end of the cupola and both periscope windows. The electrical circuits are fitted with radio suppression filters. Each circuit is protected by a fuse; for details of type, rating and location refer to Chap 2-7.



1	Retaining screws (5 position)	5	Blackout screen
2	Vision block assembly	6	Seal
3	Perspex screen	7	Wiper arm
4	Spring clip		

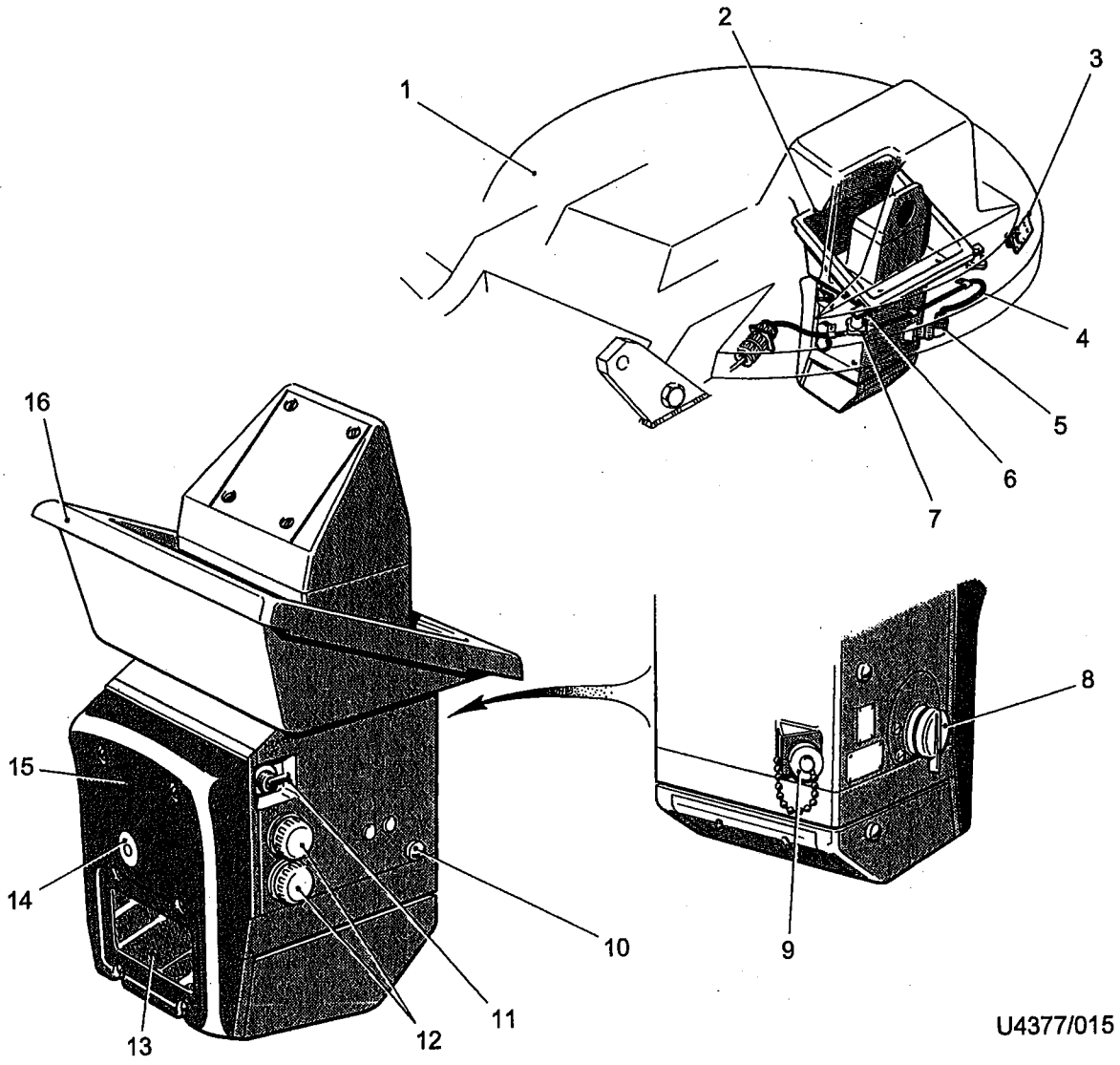
Fig 1 Vision block

VISION BLOCKS

4 Each of the ten vision blocks (refer to Fig 1) is a self contained removable unit of laminated glass, sealed for Nuclear, Biological and Chemical (NBC) protection. The blocks are retained in the cupola by countersunk screws and may be removed from outside the vehicle.

5 A hinged perspex screen (3) is fitted on the inside of each block to afford some protection from splinters should the glass be shattered. The screen is hinged to open upwards and is normally held closed by the spring clips (4).

6 The vision blocks are 'blacked out' by inserting blackout screens (5) behind each perspex screen. When not in use, the ten blackout screens are stowed in the rack provided below the winch brake lever.



1	Access hatch	10	Sealing screws (evacuation) (4 positions)
2	Locating slot	11	Heater control switch
3	Dummy socket	12	Fuses
4	Supply lead	13	Eyepiece window
5	Connecting plug	14	Warning light
6	Clamp (2 positions)	15	Brow pad
7	Handnut (2 positions)	16	Mounting tongue
8	Control switch (diaphragm)		
9	Supply socket		

Fig 2 Night vision periscope

Maintenance

7 The external surfaces of the vision blocks should be kept clean and free from dried-on mud. Under no circumstances should dried-on dirt or mud be scraped or rubbed off. Always wash off any such debris with water and dry the surface with a soft cloth.

NIGHT VISION PERISCOPE

9 The instrument is connected to the vehicle electrical system via a supply socket (9) at the rear of the periscope. Two fuses (12) protect the internal circuits and a warning light (14) illuminates red if a short circuit occurs.

Operation

Controls

CAUTIONS

(1) EQUIPMENT DAMAGE. Should the fault indicator warning light illuminate, switch off the periscope as soon as possible and report the fault to REME.

(2) EQUIPMENT DAMAGE. Do not disturb the red painted screws on the body; the periscope is hermetically sealed. Do not tamper with or strip in excess of that instructed. Dirt or moisture entering the periscope will badly affect its performance.

10 The main ON-OFF and diaphragm control switch (8) is situated on the left side of the instrument. As the knob is rotated a number of operating positions may be selected, each indicated by a 'click'. Rotating the knob anti-clockwise, the first 'click' turns the instrument ON, connecting the internal circuits to the vehicle electrical supply. The second 'click' introduces a dark filter and selects an aperture suitable for daylight conditions. Further rotation of the knob progressively opens the diaphragm aperture allowing more light to enter the instrument in poor lighting conditions.

11 The heater control switch (11) is a toggle type which is located on the right side of the instrument. This switch controls a heating element in the eyepiece which will prevent misting of the eyepiece window. The switch has two positions, the upper position for OFF and the lower position for ON.

12 The red warning light, located in the brow pad (15), will illuminate if a short circuit occurs within the instrument. This indicates that the tube is operating on a secondary circuit and will do so only for a limited time. When the light illuminates, switch off the instrument as soon as possible and report to REME.

To fit the night vision periscope

13 To fit the night vision periscope, proceed as follows:

13.1 Remove the blanking plate from the periscope mounting by slackening the handnuts (7) and turning the clamps (6) to clear the plate. Lift blanking plate clear of the locating slot (2).

13.2 Carefully lift the periscope into the mounting, engaging the mounting tongue (16) on the periscope bracket into the locating slot.

13.3 Turn the clamps to engage the periscope bracket and tighten the handnuts.

13.4 Remove the connecting plug (5) from its dummy socket (3) and connect to the periscope supply socket (9).

To remove the night vision periscope

14 To remove the night vision periscope, proceed as follows:

14.1 Ensure that the control switch (8) is in the OFF position.

14.2 Disconnect the electrical supply lead (4), replacing the blanking cap in the supply socket. Attach the supply lead connecting plug to the dummy socket.

14.3 Support the periscope. Slacken the handnuts and turn the clamps sideways to clear the periscope bracket.

14.4 Carefully move the periscope down, and forward to clear the locating slot.

14.5 Stow in bin provided beneath the driver's instrument panel.

NOTE

Replace the periscope aperture blanking plate whenever the night vision periscope is removed. This is a necessary part of the armour protection and blackout.

WIPER SYSTEM

15 An independent wiper system is provided for each crew position, controlled by its own electrical circuit. The wiper system for each crew member comprises a single wiper blade for the night vision periscope window (Fig 3 (2)) and three wipers for the end vision blocks (9) of the cupola. Each set of three vision block wipers has its own electric motor. The motors (1) and (11) are located one on either side of the cupola.

Operation

Controls

16 Switches, identified OFF - WIPE - WIPE/WASH, control the wipers at each crew position. The driver's switch is located on the road warning instrument panel (Fig 4) and the operator's on the operator's instrument panel (Fig 5).

17 Putting the three position switch to the WIPE position brings the vision block wipers and the night vision periscope wiper into operation for the appropriate crew member.

18 Selection of the WIPE/WASH position of the switch actuates the wipers and the washers simultaneously.

NOTE

The wipers alone must not be operated if the periscope windows or vision blocks are covered with dirt or mud. Under these conditions the wipers and washers must be operated together.

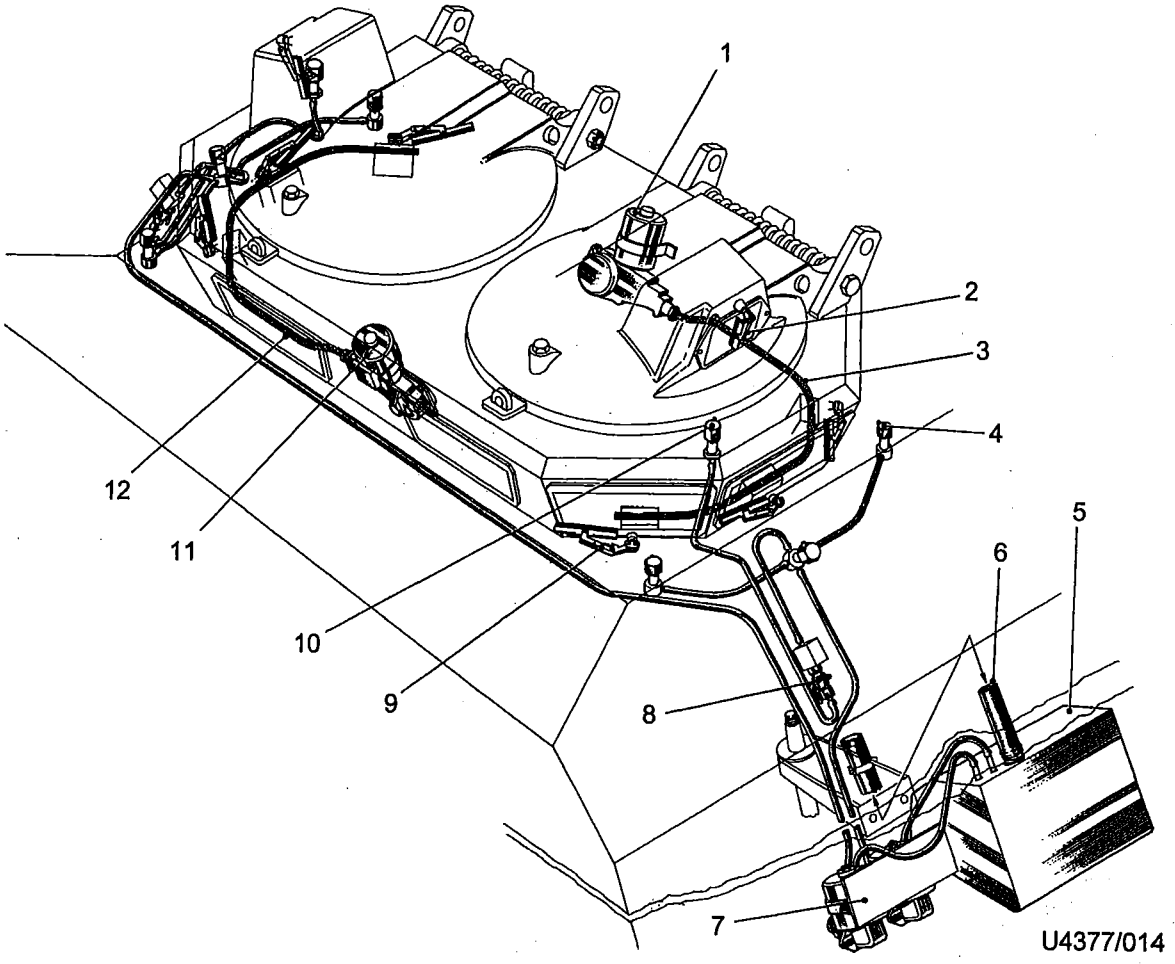
Maintenance

19 Check the condition of the wiper blades to ensure that the blade is not worn to the level of the metal backing. If the blades are badly worn, it is possible that the surfaces of the vision blocks or windows may be scratched. Badly worn blades should be replaced as soon as practicable.

WASHER SYSTEM

20 The washer system enables a jet of water to be sprayed onto the periscope windows and vision blocks, in conjunction with the wiper system. The washer at each crew position is operated independently of the other, having a separate electrical circuit and pump.

21 The pumps (Fig 3 (7)) and a washer fluid reservoir (5) are mounted on the rear wall of the crew compartment at floor level. Water is delivered by the pumps to jets on the exterior of the hull. Four jets are provided for each crew position, three washer jets (4) for the vision blocks and one washer jet (4) for the night vision periscope window.



1 Wiper motor, operator's vision blocks
2 Night vision periscope window wiper (2 positions)
3 Flexible drive, operator's vision block wipers
4 Washer jets, vision blocks (6 positions)
5 Washer fluid reservoir
6 Reservoir filler tube
7 Washer pumps
8 Control cock, night vision periscope washer (2 positions)
9 Wipers, vision blocks (6 positions)
10 Washer jets, night vision periscope windows (2 positions)
11 Wiper motor, driver's vision blocks
12 Flexible drive, driver's vision block wipers

Fig 3 Layout of wiper and washer system

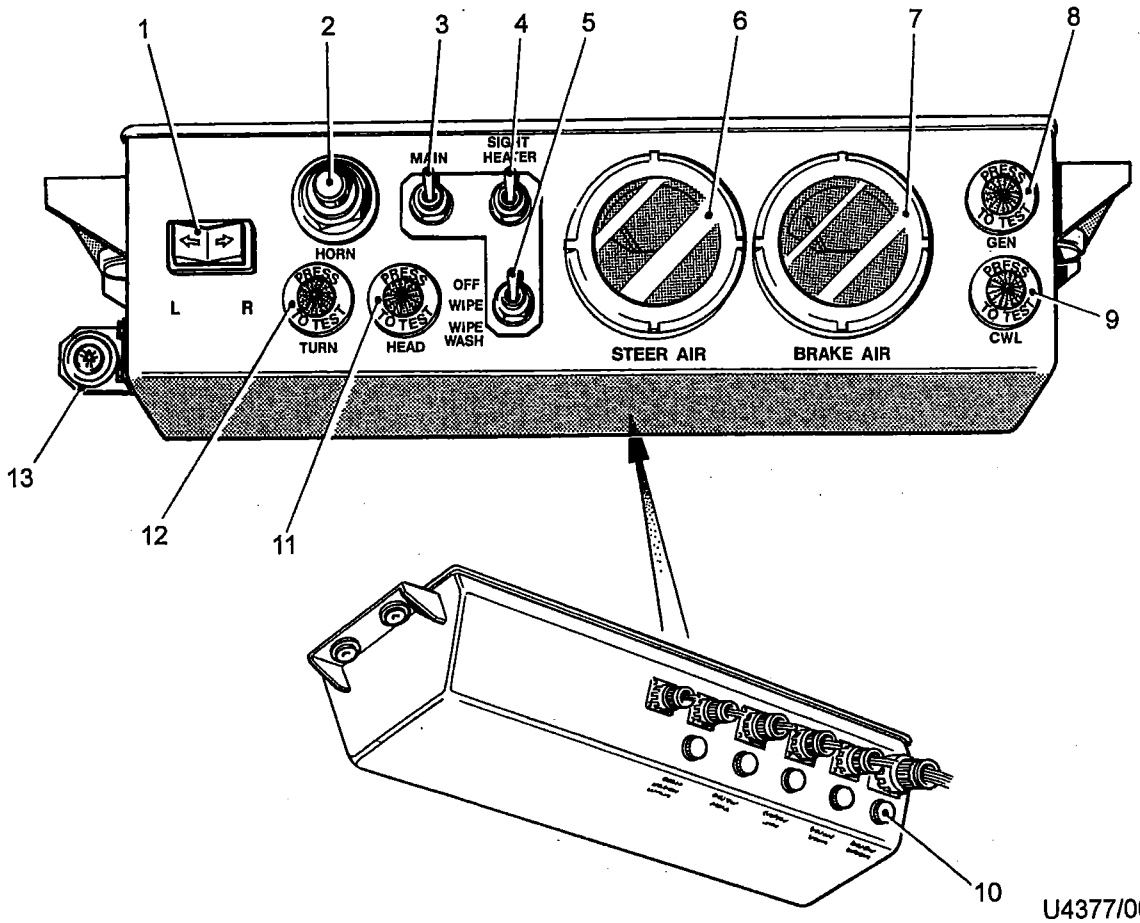
22 A small control cock (8) is provided on the compartment wall in front of each crew position, which enables the water supply to the night vision periscope window jet to be cut off when not required.

23 The reservoir is filled via a flexible plastic filler tube located adjacent to the operator's steering column.

Operation

24 The washers are controlled by the switches detailed in Para 16.

25 To operate the washers, move the switch at the appropriate crew position to the WIPE/WASH position and hold against its return spring. When the switch is released it will return to the WIPE position.

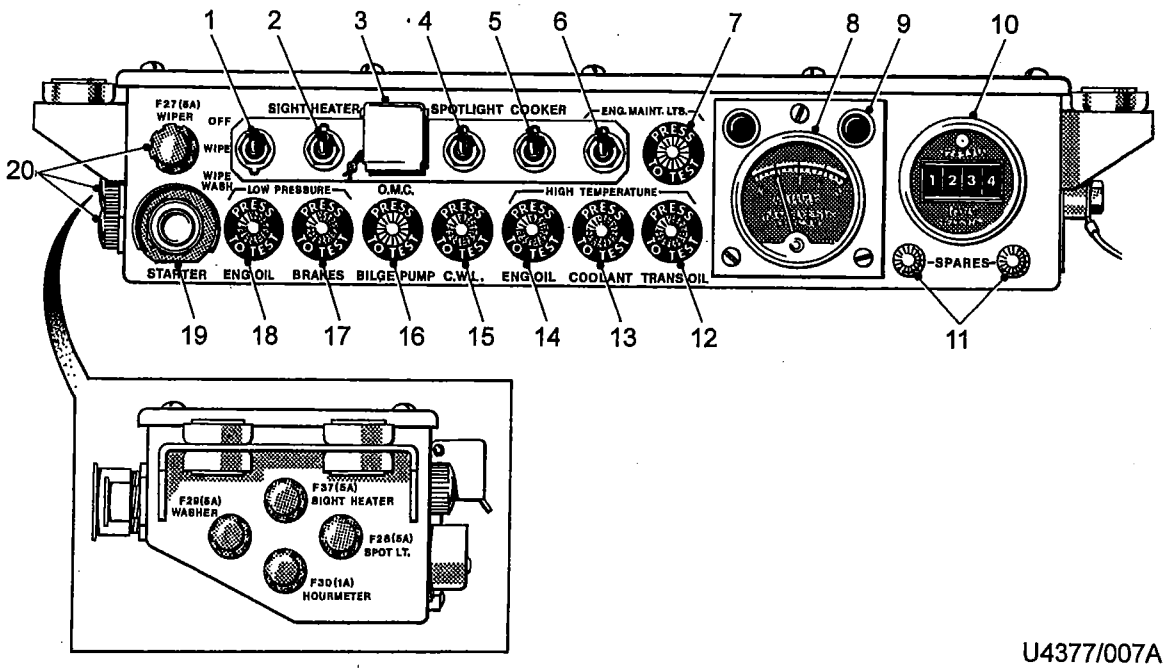


U4377/006B

1 Turnlight switch
2 Horn pushbutton
3 Headlight dipswitch
4 Sight heater switch
5 Wipe/wash switch
6 Steer air pressure gauge
7 Brake air pressure gauge
8 Generator warning light
9 Central warning light
10 Fuses: F12, F18, F19, F36, and F38
11 Main beam warning light
12 Turnlight warning light
13 Hazard warning light switch

Fig 4 Driver's road warning instrument panel

26 The small control cock (Fig 3 (8)) fitted in front of each crew member has two positions. The ON position, with the handle in-line with the connecting pipe, enables the washer system to work on the vision blocks and the night vision periscope window. In the OFF position, with the handle at 90 degrees to the pipe, the supply to the night vision periscope window jet is cut off.



U4377/007A

1	Wipe/wash switch	11	Spare warning light lenses
2	Sight heater switch	12	Transmission oil temperature warning light
3	Override master control switch	13	Coolant temperature warning light
4	Spotlight switch	14	Engine oil temperature warning light
5	Cooker switch	15	Central warning light
6	Engine maintenance light switch	16	Bilge pump warning light
7	Maintenance light warning light	17	Brake low pressure warning light
8	Ammeter	18	Engine low oil pressure warning light
9	Panel lights (2 positions)	19	Starter button
10	Hourmeter	20	Fuses: F27, F28, F29, F30 and F37

Fig 5 Operator's instrument panel

WARNING

PERSONNEL INJURY. FLUID AL 11 IS HIGHLY FLAMMABLE. THE PREPARATION OF FLUID FOR WINDSCREEN WASHERS IS TO BE CARRIED OUT IN THE OPEN AND AWAY FROM NAKED FLAME. MINIMUM PRECAUTION AFTER CONTAMINATION IS TO WASH THE AFFECTED SKIN AREAS WITH SOAP AND WATER.

27 To fill the water reservoir, proceed as follows:

27.1 Remove the reservoir filler tube from its clip on the operator's steering column bracket.

27.2 Fill the reservoir carefully with clean water, checking the level at intervals to prevent overflowing. The reservoir should be filled until the fluid level just appears at the bottom of the transparent filler tube. Care should be taken to ensure that oil, dirt or grease does not enter the reservoir.

27.3 Replace the filler tube in the retaining clip.

NOTE

During frost precaution periods add AL 11 to the water in the proportion of one part AL 11 to two parts water.

CHAPTER 2-1-5

RADIO AND INTERCOMMUNICATIONS

CONTENTS

GENERAL DESCRIPTION

1 The vehicle is equipped with a Clansman UK/VRC-353 radio and the associated Clansman radio control harness. The radio control harness forms an interconnected system of control and junction boxes which permit the single radio to be used from either crew position, with comprehensive provision for intercommunication (refer to Fig 1 for block wiring diagram).

2 Intercommunication between other similar installations and remote control of the radio is possible via an external terminal box and land line.

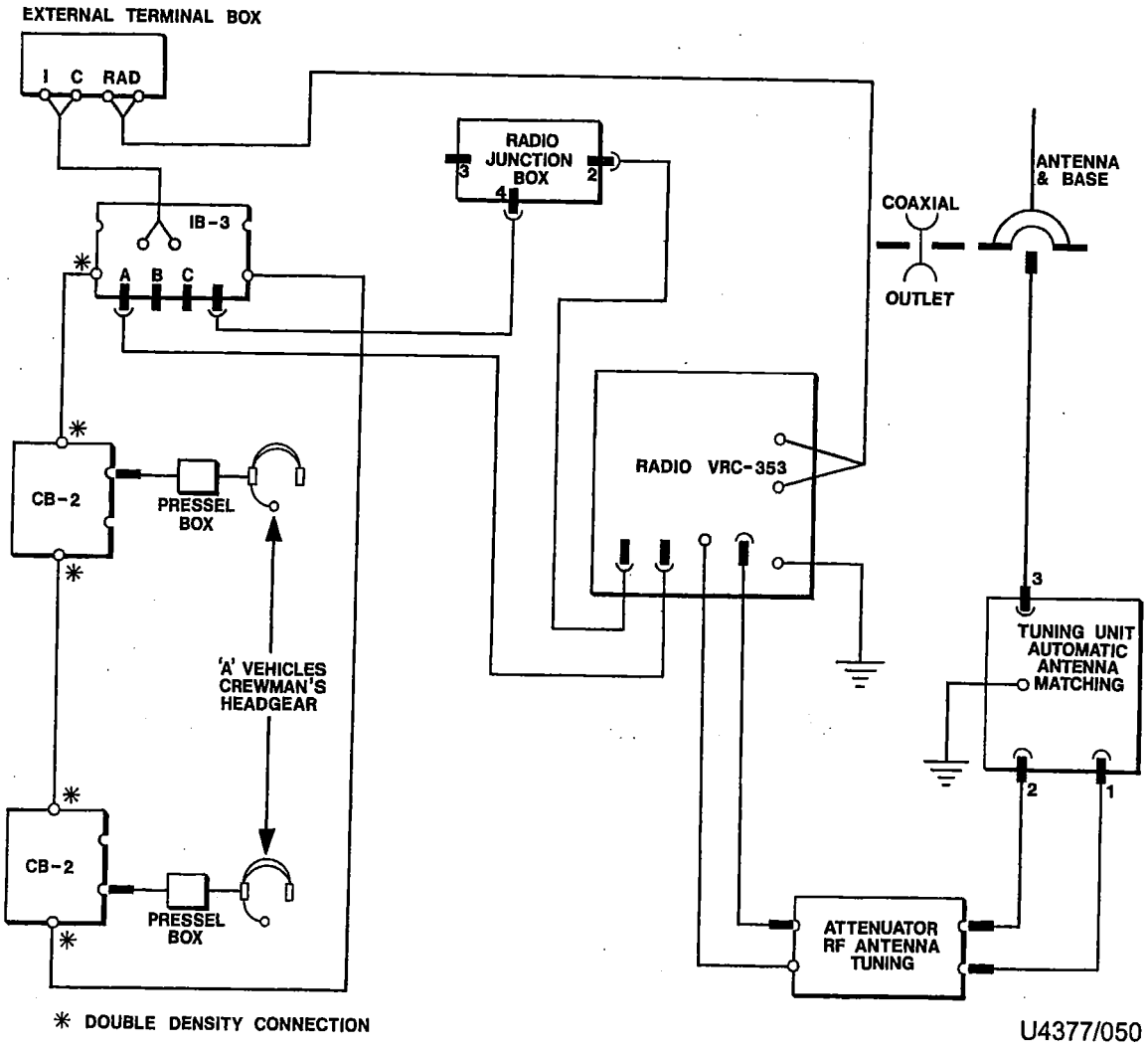
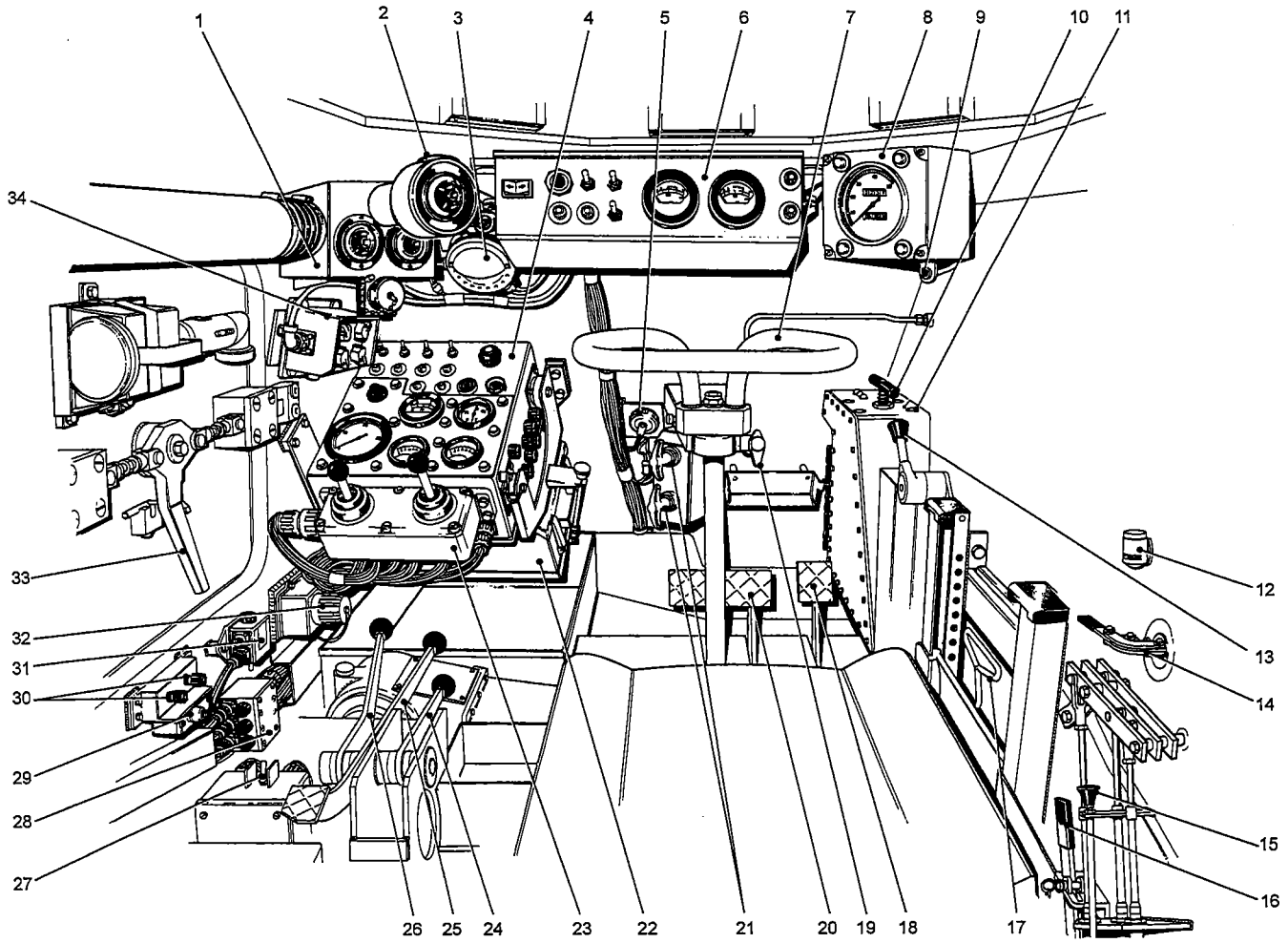


Fig 1 Block wiring diagram - radio

3 The operation of the radio and intercommunication system is described in the User Handbook: Radio Installation UK/VRC-353 with Clansman Harness in CET (FV180) Army Code No. 61423.

4 The radio set is mounted on a sloping carrier located adjacent to the crew compartment outer wall, at the operator's position. Power to operate the installation is drawn from the Radio Junction Box (RJB) located behind the radio mounting. The radio and intercommunications system is only operational when the battery master switch is in the ON position.



1 Diffuser box
2 Python harness aperture
3 Interior light
4 Driver's instrument panel
5 Inspection light socket
6 Driver's road warning instrument panel
7 Steering column
8 Speedometer panel
9 'Trip' reset knob
10 Battery master switch
11 Distribution panel
12 Air restriction indicator
13 Emergency brake lever
14 Flooding valve
15 Engine stop control
16 Transmission disconnect clutch lever
17 Height adjuster, driver's seat
18 Accelerator pedal
19 Cold starting aid pump handle
20 Brake pedal
21 Fire extinguisher operating handles
22 Night sight stowage
23 Gear selector switch-box
24 Winch gear change lever
25 Pay-out/winch-in control
26 High speed pay-out/winch-in control
27 Driver/operator select switch
28 Junction box
29 Demolition microswitch
30 Demolition terminals
31 Heated clothing switch-box
32 Inter-vehicle socket
33 Emergency door release handle
34 Crew box - 2 radio

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Fig 2 Controls and instruments (crew compartment - front)

1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spares box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnect pedal
38 Gear selector switch-box
39 Firewire control box

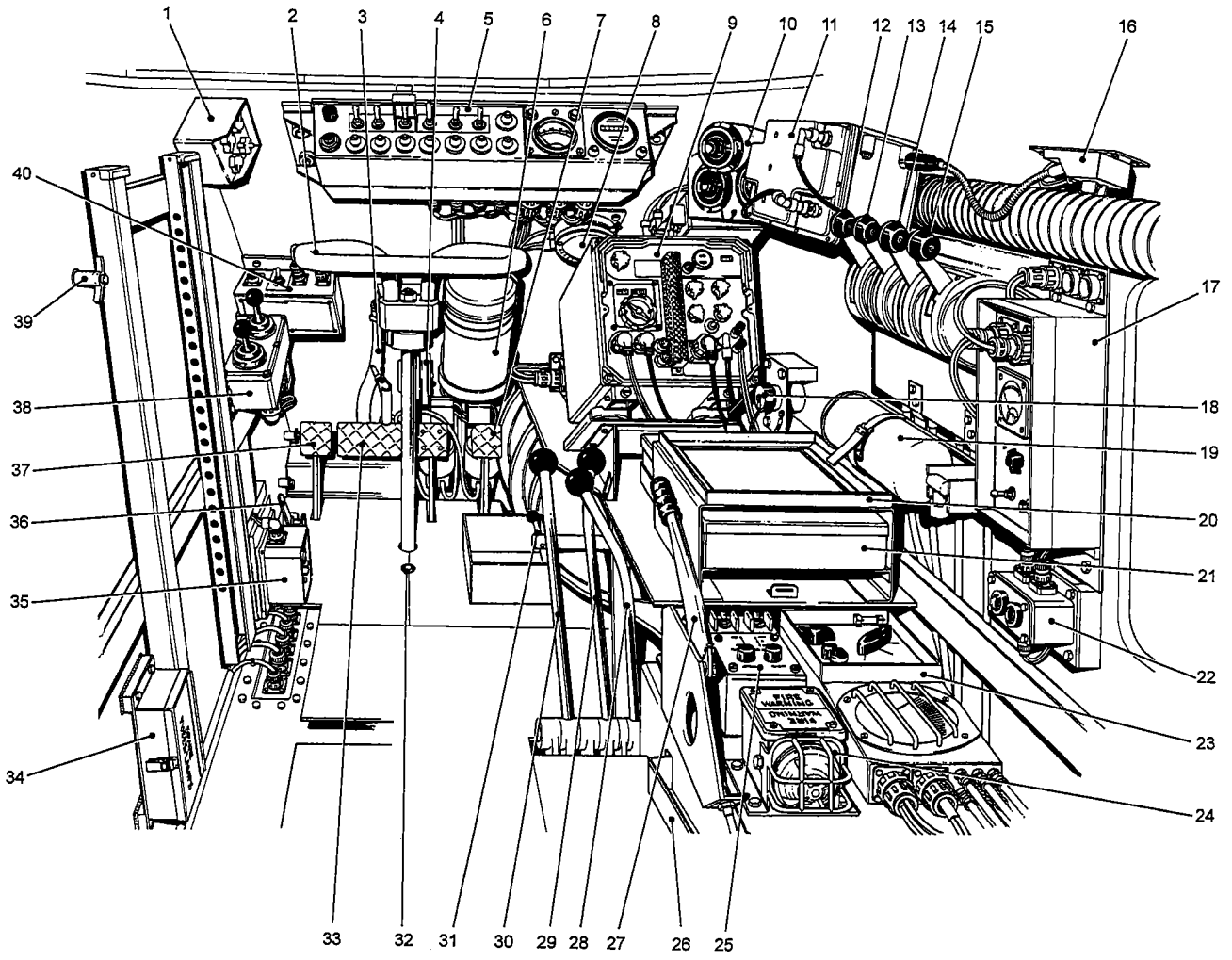

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Fig 3 Controls and instruments (crew compartment - rear)

CREW BOX 2 RADIO

5 A Crew Box 2 Radio (CB-2) (Fig 2 (34)) and (Fig 3 (1)) is fitted at each crew position, one located on the driver's left and one on the left of the operator. Each box provides the respective crew member with the necessary radio and intercommunication controls and a connection for the 'A' vehicle crewman's headgear.

INTERCONNECTING BOX 3 RADIO

6 The Interconnecting Box 3 Radio (IB-3) box (Fig 3 (35)), located on the operator's left, near the compartment floor, acts as a junction and control box. The unit houses the intercommunications amplifier and the system main ON-OFF switch.

AUDIO EQUIPMENT

7 An 'A' vehicle crewman's helmet, incorporating earphones, a pressel switch unit and a boom microphone is used at each crew position during normal operations.

8 When a respirator Anti-gas No. S10 is being worn, the boom microphone is replaced by a microphone fitted over the respirator voice tube.

9 For use with the remote facility, a handset is provided which may be connected to the external remote connections via IB-3 or the radio set.

10 For information on the above items of equipment, refer to the relevant associated publications.

EXTERNAL TERMINAL BOX

11 A terminal box, containing two pairs of screw terminals, is mounted inside the front left light box. One pair of terminals provide a connection to the vehicle intercommunication system and the second pair are for use with the radio remote control circuit.

CABLE REEL

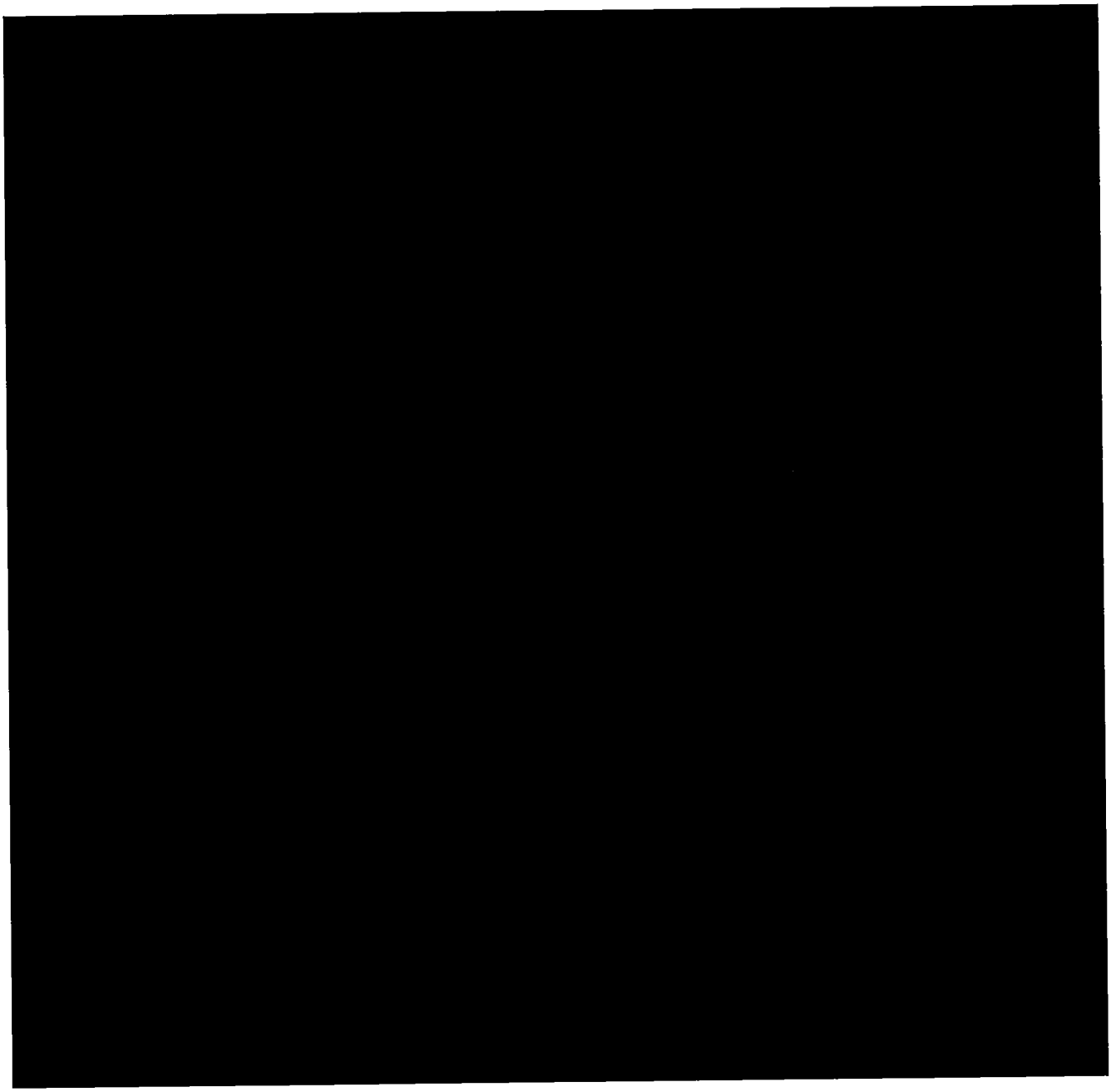
12 A cable, for use with the external terminal box and remote use facilities, is stored on a reel located at the rear of the vehicle.

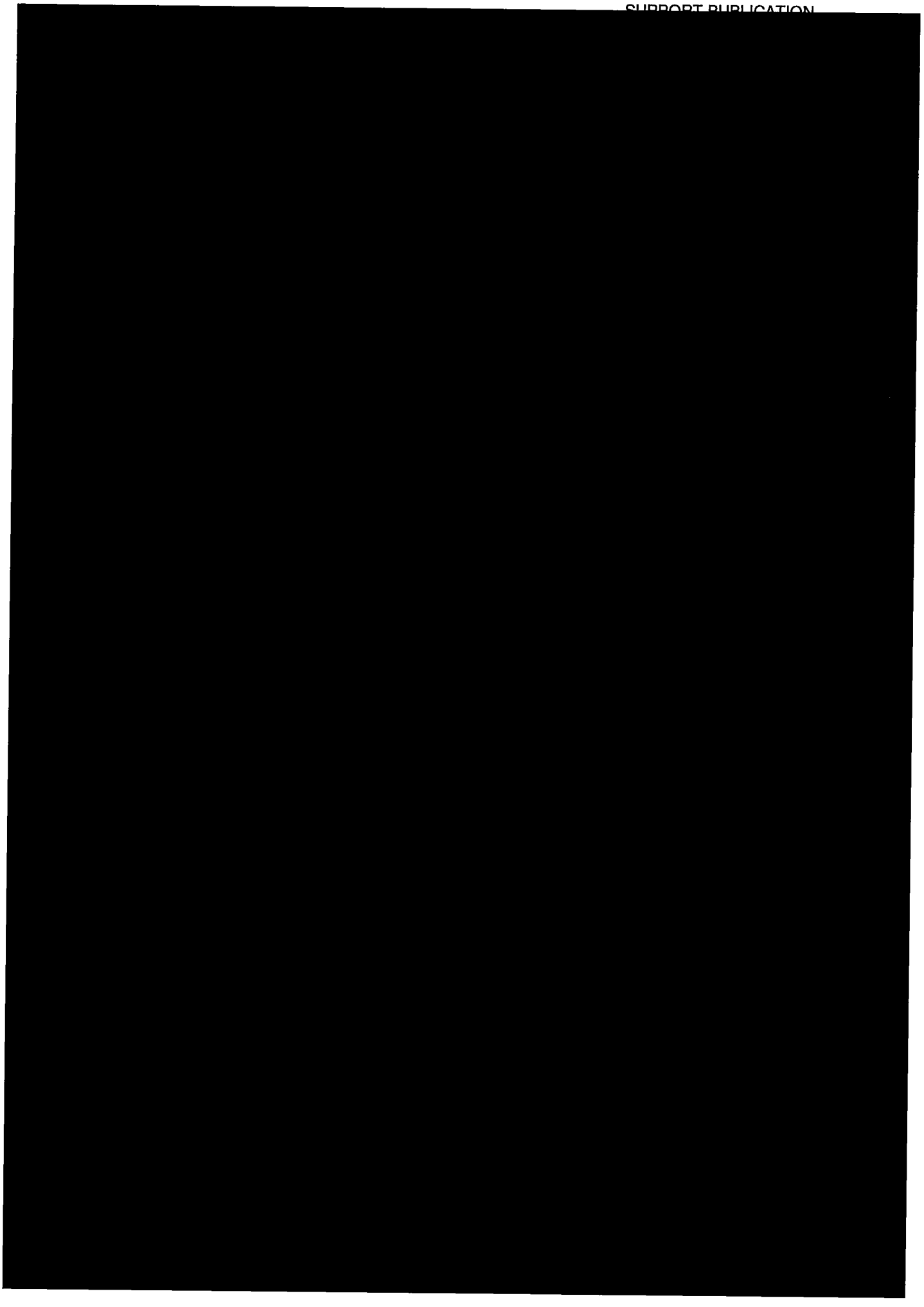
RADIO ANTENNA

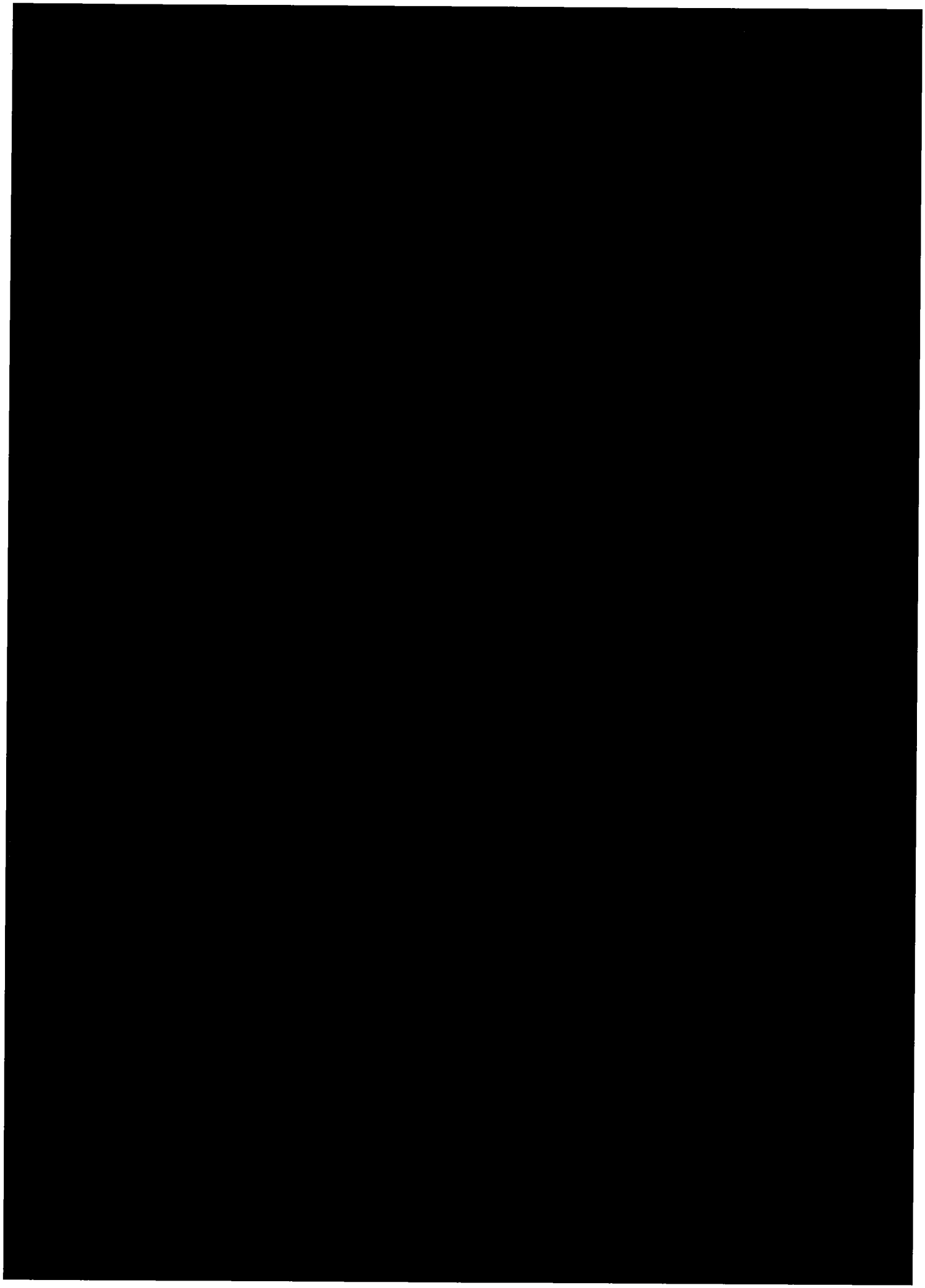
13 The radio system is provided with an antenna and its associated tuning units.

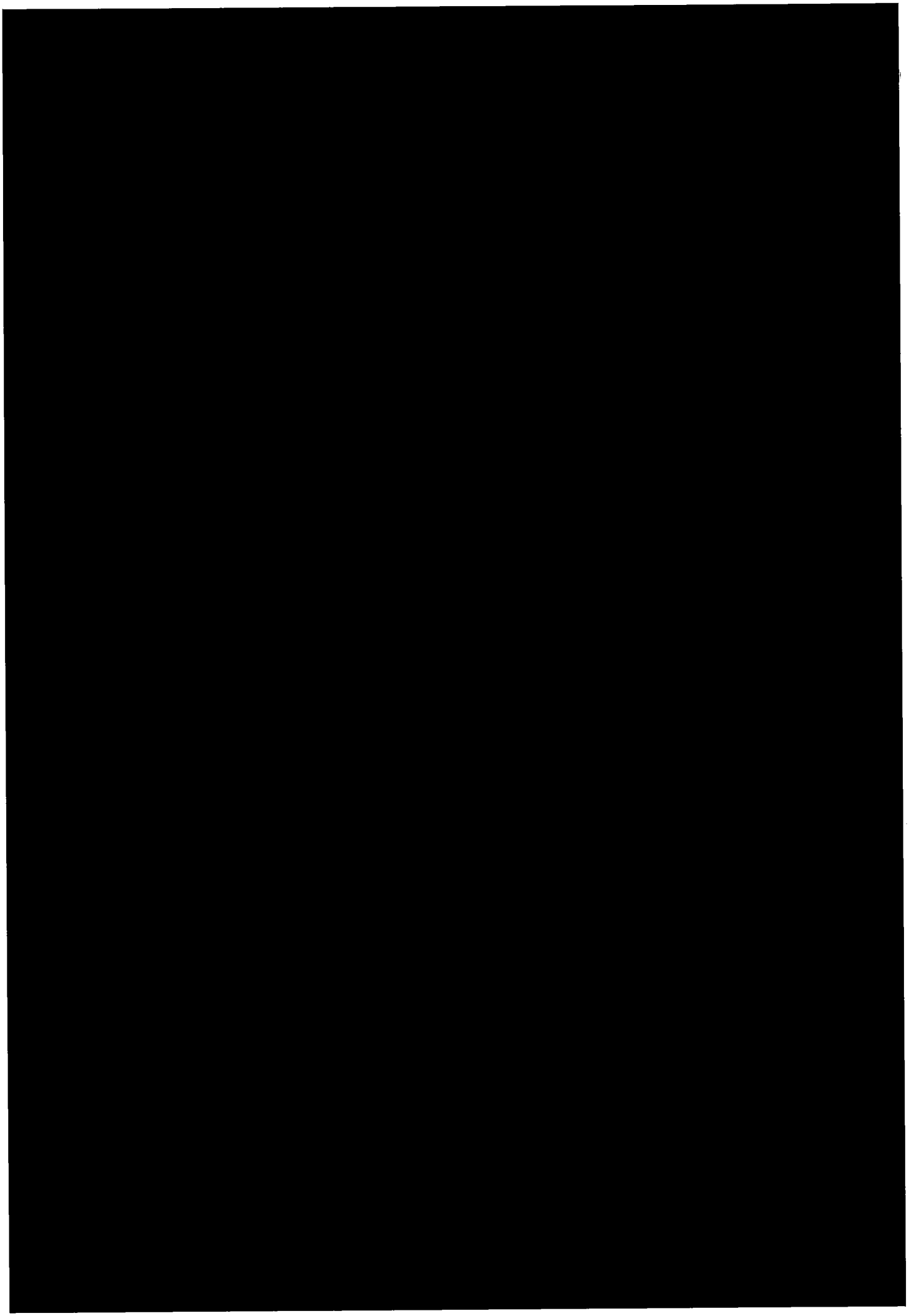
14 The antenna is mounted in a base located on the rear roof plate.

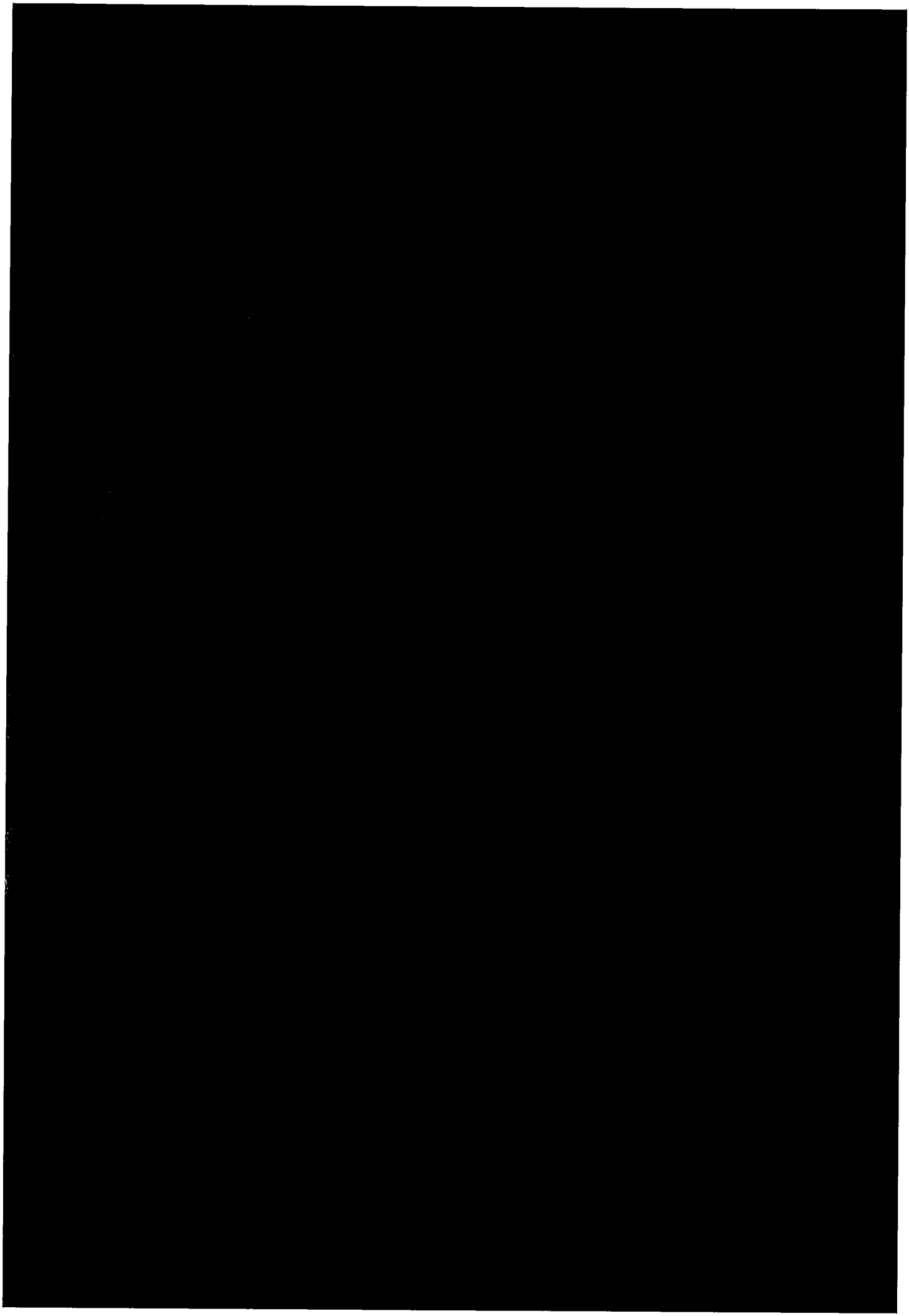
15 A coaxial outlet connection is fitted in the crew compartment roof to enable a remote antenna to be utilised via a suitable cable.

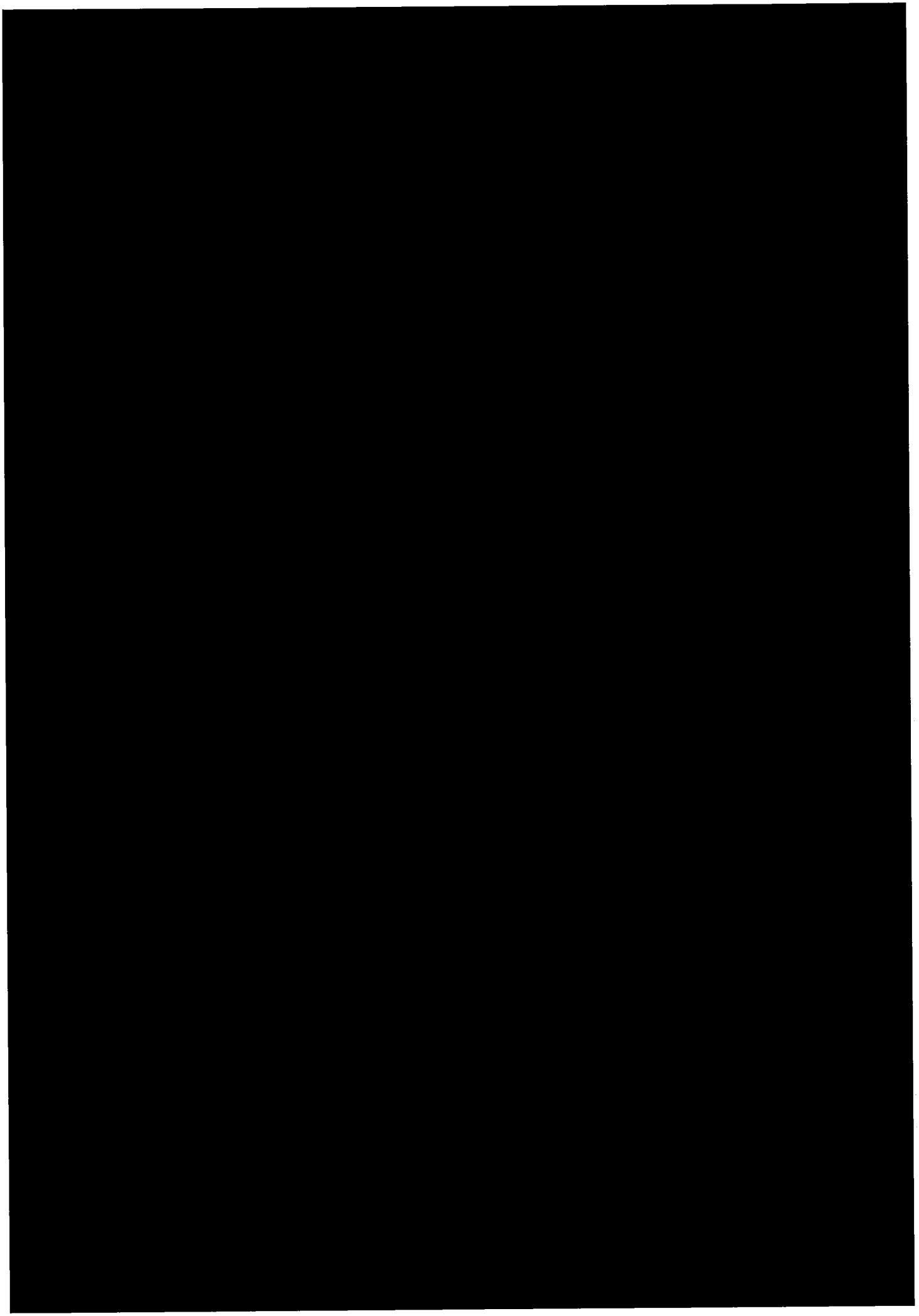


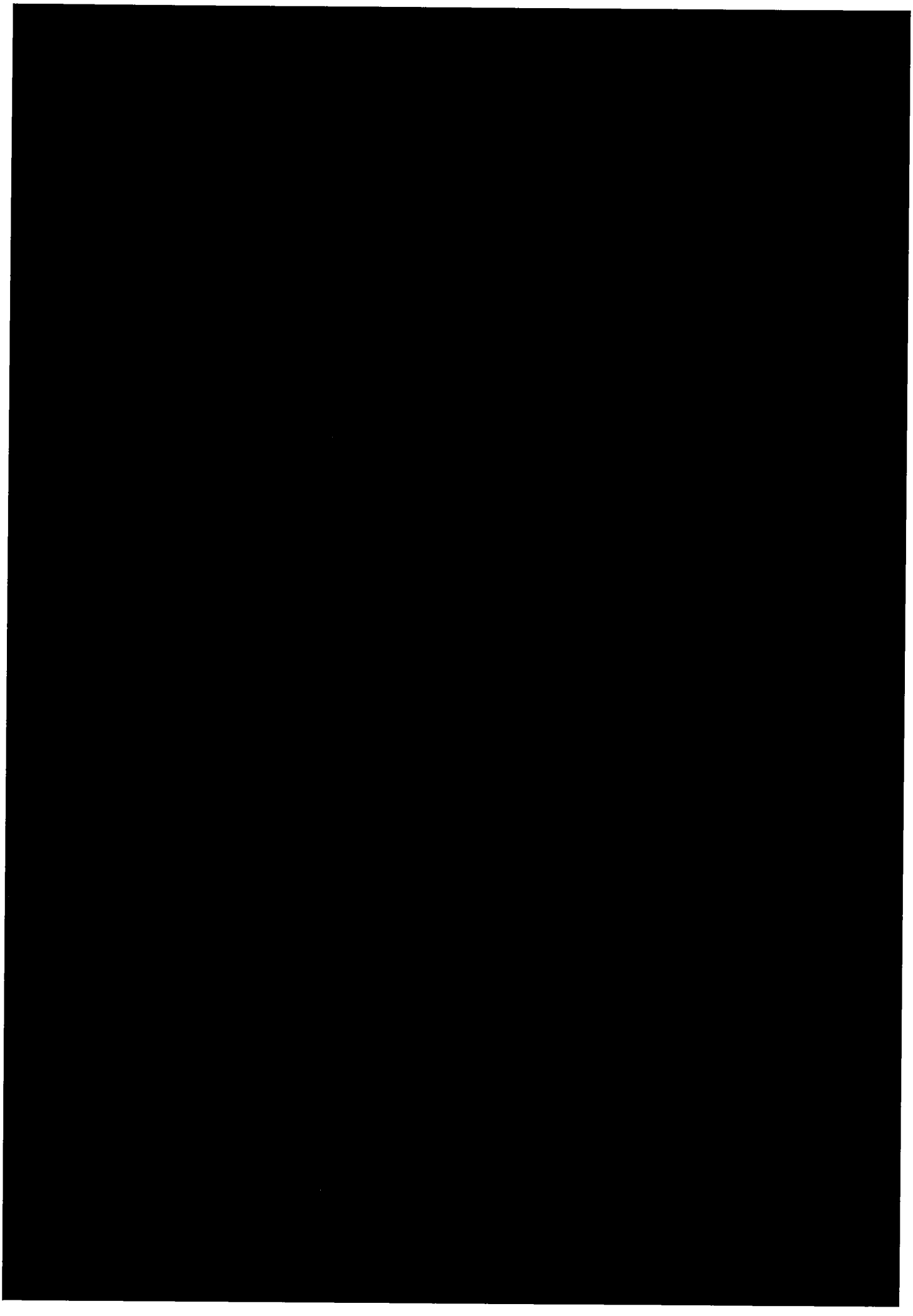


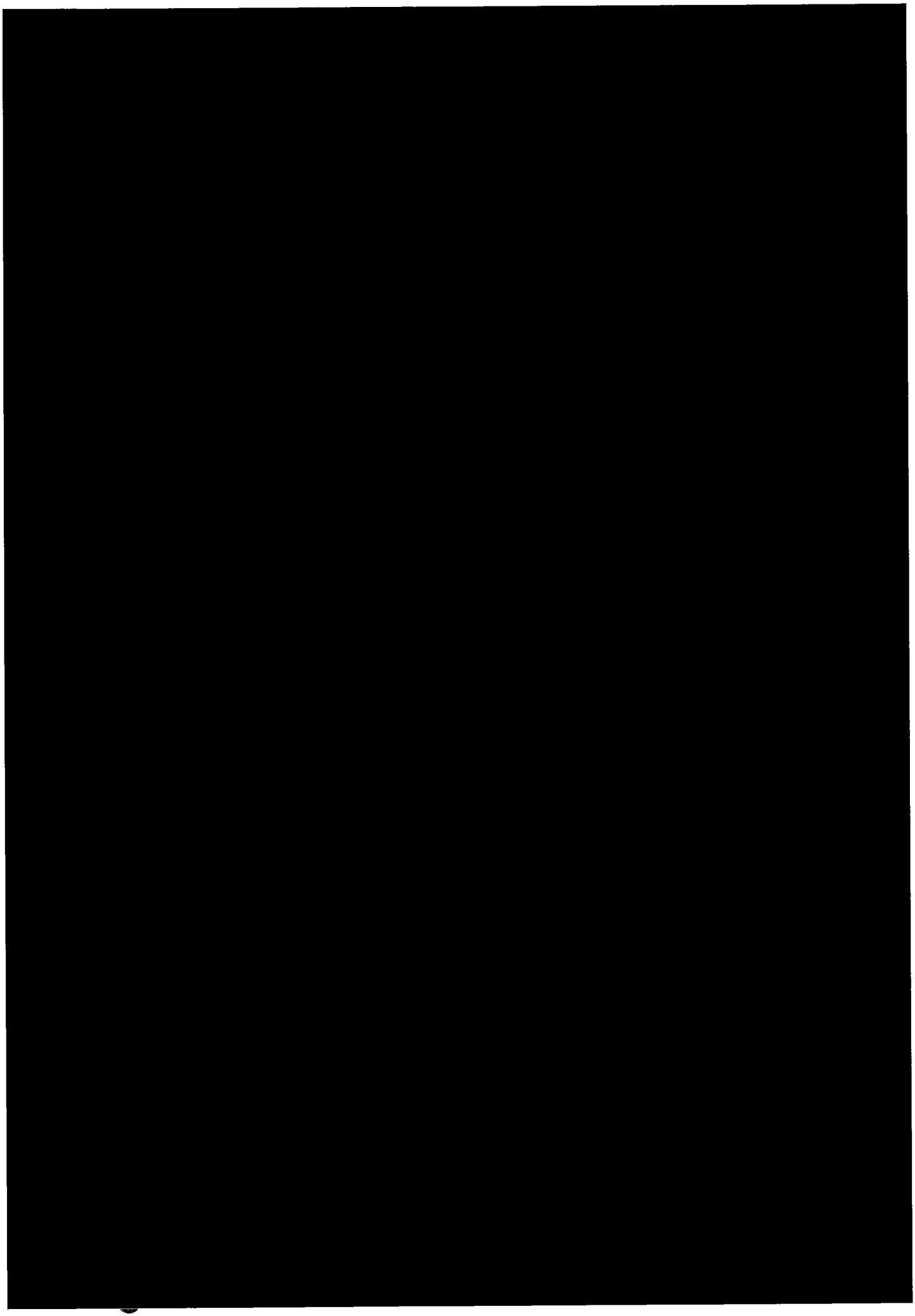


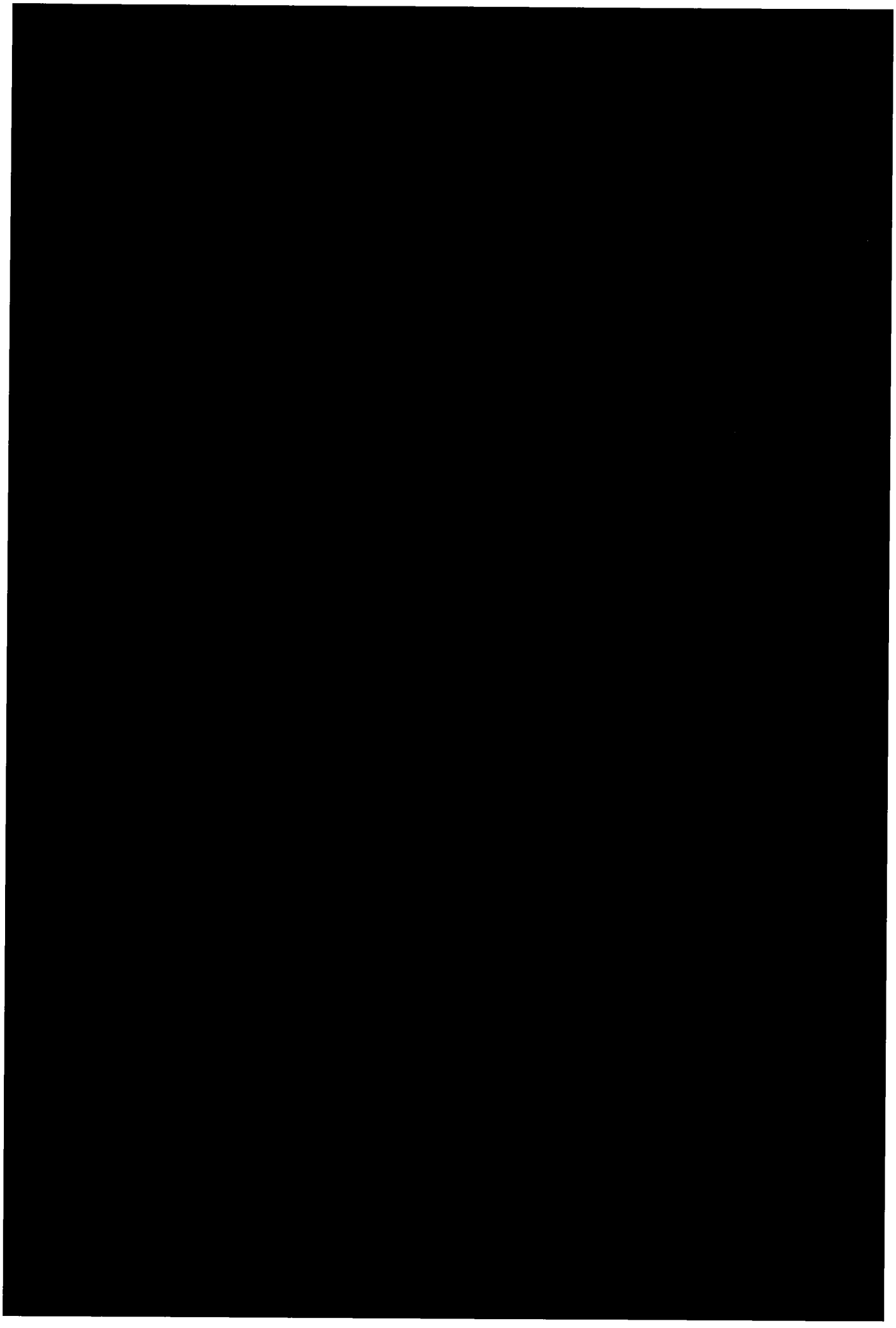


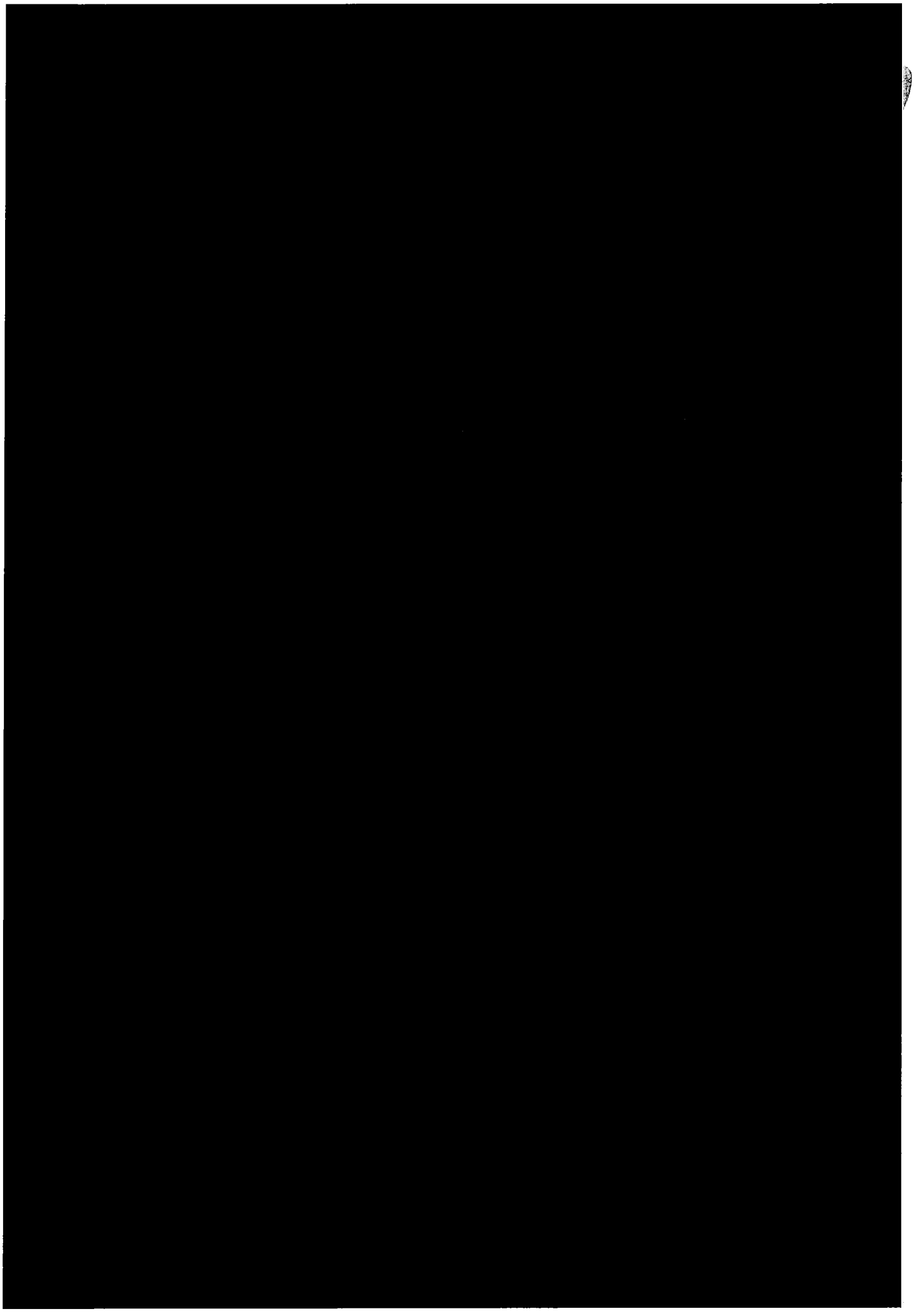


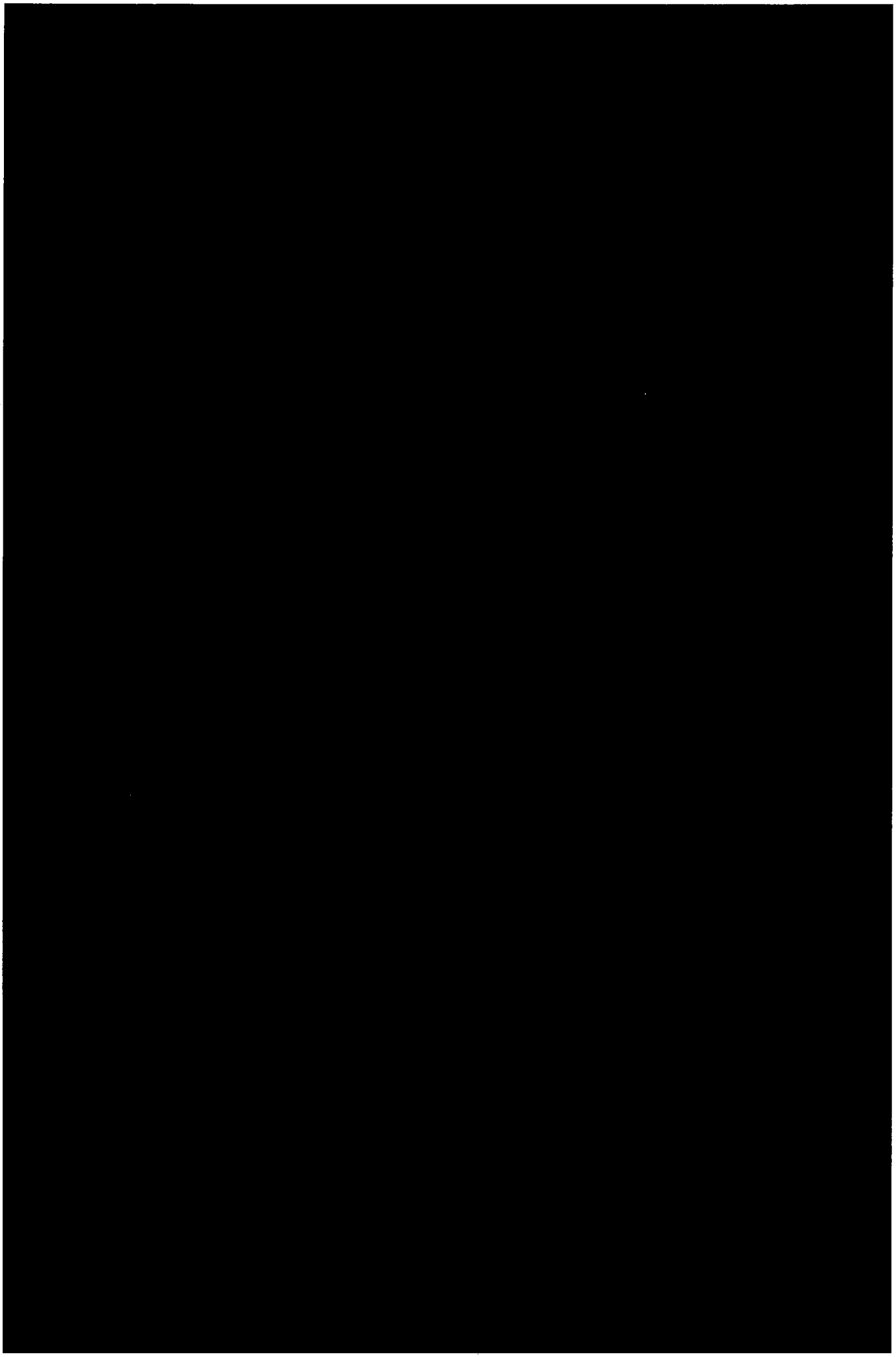


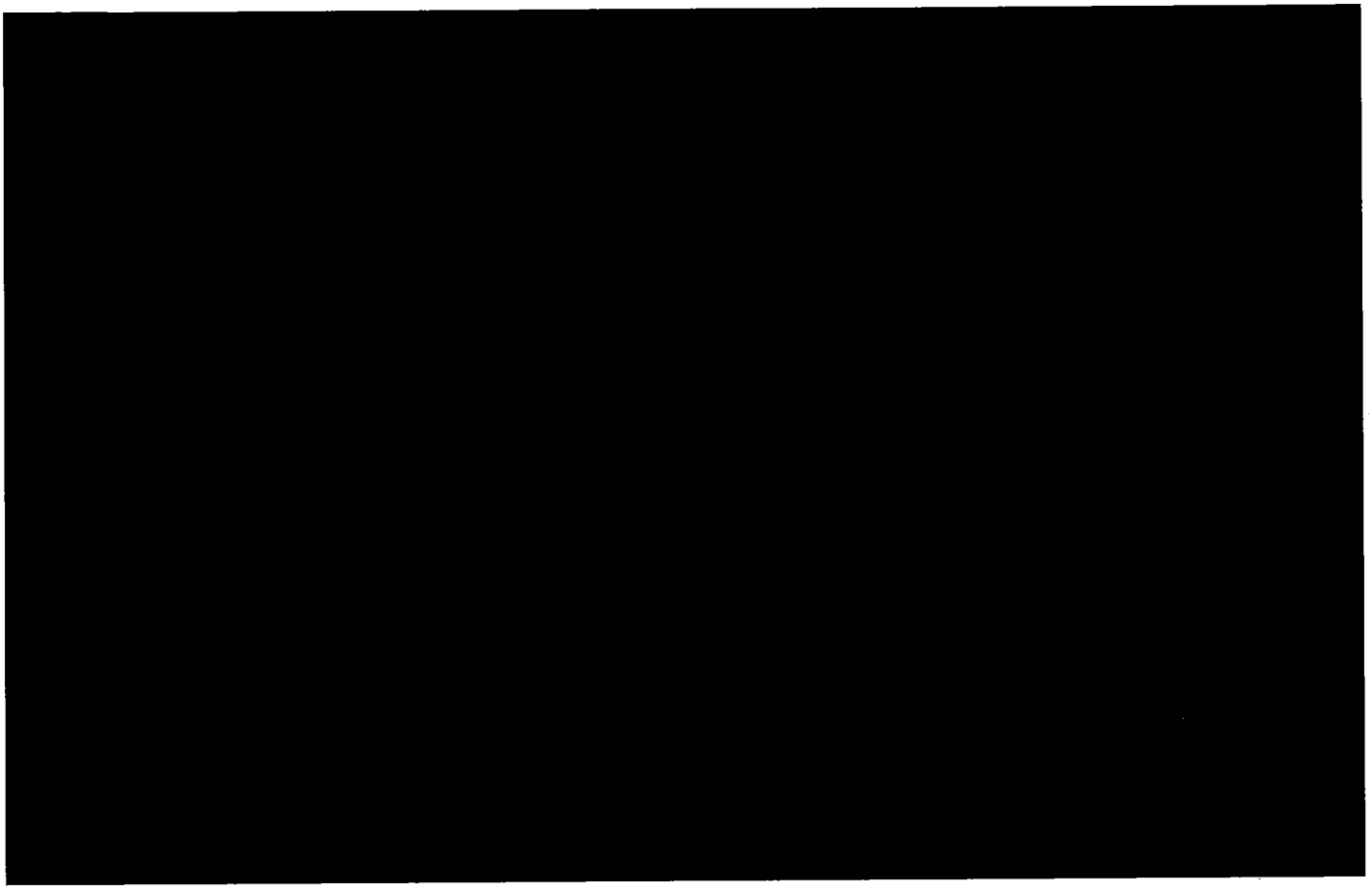












CHAPTER 2-1-7

AIR COOLING SYSTEM

CONTENTS

GENERAL DESCRIPTION

WARNINGS

(1) ENVIRONMENTAL HAZARD. IT IS ILLEGAL UNDER THE ENVIRONMENTAL PROTECTION ACT 1990 TO WILFULLY DISPOSE OF REFRIGERANTS BY VENTING REFRIGERANTS INTO THE ATMOSPHERE. ONLY COMPETENT PERSONNEL WITH A SPECIALIST KNOWLEDGE OF REFRIGERANT SYSTEMS, HOLDING A CURRENT REFRIGERANT HANDLING CERTIFICATE, ARE TO BE ALLOWED TO WORK ON ANY REFRIGERANT SYSTEM. ALWAYS REPORT ANY SUSPECT LEAKS TO REME AS SOON AS POSSIBLE.

(2) PERSONNEL INJURY. REFRIGERANTS ARE NON-TOXIC BUT DISPLACE AIR AND WILL CAUSE ASPHYXIA IN CONFINED SPACES BY THE ACCUMULATION OF HEAVIER THAN AIR REFRIGERANT IN THE LOWEST REGION OF AN ENCLOSED SPACE. ENSURE ADEQUATE VENTILATION AT ALL TIMES WHEN WORKING ON INSTALLATIONS CONTAINING REFRIGERANTS. IF A LEAK IS SUSPECTED THE AREA MUST BE WELL VENTILATED BEFORE ANY INVESTIGATORY WORK IS UNDERTAKEN.

(3) PERSONNEL INJURY. REFRIGERANT CONTACT WITH EYES AND SKIN. ALWAYS WEAR SAFETY GOGGLES, GLOVES AND PROTECTIVE CLOTHING WHEN HANDLING REFRIGERANTS. IF REFRIGERANT CONTACTS EYES DO NOT RUB EYES, SPLASH EYES WITH COLD WATER AND SEEK IMMEDIATE MEDICAL ATTENTION. IF REFRIGERANT CONTACTS SKIN, WASH OFF WITH COLD WATER. IF INJURY TO SKIN OCCURS TREAT AS FROSTBITE, SEEK IMMEDIATE MEDICAL ATTENTION.

(4) PERSONNEL INJURY. DO NOT SMOKE IN A REFRIGERANT CONTAMINANT ATMOSPHERE OR WHEN WORKING ON ANY EQUIPMENT CONTAINING REFRIGERANT. SMOKING WILL CAUSE ISCEON 49 (R413a) TO BREAK DOWN INTO HYDROCHLORIC ACID (HYDROFLUORIC ACID AND PHOSGENE).

(5) PERSONNEL INJURY. IF A LEAK IN THE REFRIGERATION SYSTEM IS SUSPECTED, IT IS TO BE INVESTIGATED BY A QUALIFIED REME TRADESMAN AS SOON AS POSSIBLE. UNTIL SUCH AN INVESTIGATION HAS BEEN CARRIED OUT, THE SYSTEM IS TO BE SWITCHED OFF. THE WORK AREA MUST BE WELL VENTILATED.

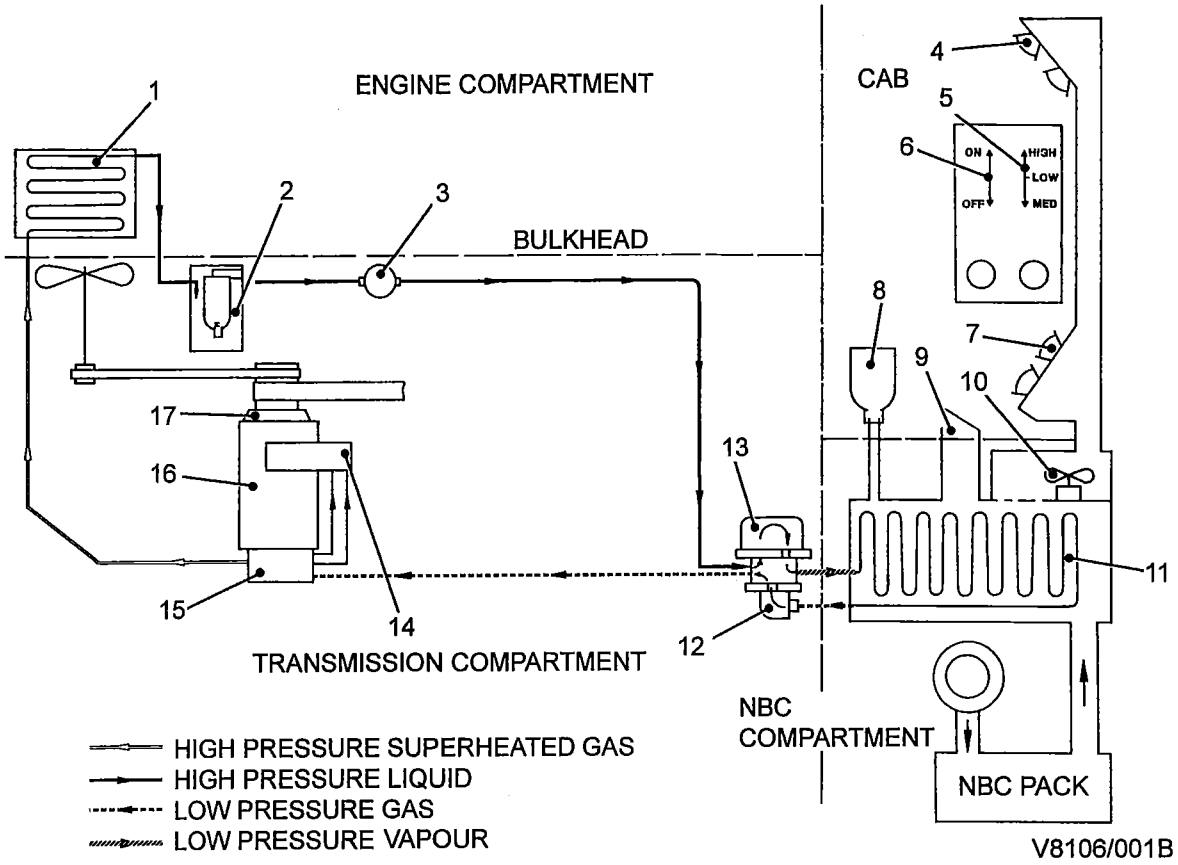
(6) PERSONNEL INJURY. THE NBC SYSTEM IS TO BE SWITCHED ON WHENEVER THE VEHICLE AIR COOLING SYSTEM IS OPERATED CLOSED DOWN.

(7) PERSONNEL INJURY. TO PREVENT INJURY TO PERSONNEL ENSURE THAT THE REFRIGERANT SYSTEM IS COMPLETELY DEPRESSURISED BEFORE REMOVING ANY COMPONENT NOT EQUIPED WITH SELF-SEALING COUPLINGS.

(8) PERSONNEL HAZARD. WHEN PRESSURE TESTING REFRIGERANT PIPEWORK OR ANY LRU THE AREA OF THE TEST MUST BE SAFE IN THAT, SHOULD A FAILURE OCCUR PERSONNEL AND EQUIPMENT ARE PROTECTED FROM FLYING DEBRIS.

CAUTIONS

(1) EQUIPMENT DAMAGE. Switch off the compressor immediately if excessive vibration or unusual noise occurs.



1	Condenser	10	Evaporator fan
2	Filter drier unit	11	Evaporator unit
3	Sight glass	12	Suction throttling valve
4	Diffuser outlet (operator)	13	Thermostatic expansion valve
5	Control box	14	High and low pressure cut-outs
6	ON/OFF fan	15	Connection block
7	Diffuser outlet (driver)	16	Compressor
8	Condensate bottle	17	Compressor clutch
9	Flap valve		

Fig 1 Air cooling system - schematic layout

1 The air cooling system (Fig 1) fitted to the Combat Engineer Tractor (CET), provides cool, clean, filtered air to the crew. The system is designed to operate in an ambient temperature of up to 125 degrees F (52 degrees C).

2 The system cools air within the vehicle, controlling the temperature to create a comfortable environment for the crew. Air is drawn into the vehicle through the flap valve (9) and the NBC pack. Ducting provides each crew member with a supply of filtered conditioned air via spherical diffuser outlets (4) and (7). Each diffuser outlet can be adjusted to control the volume and direction of airflow.

3 The system comprises a compressor (16), mounted on the transfer gearbox, a condenser (1), filter drier unit (2), sight glass (3), thermostatic expansion valve (13), evaporator and suction throttling valve (12). It is operated by a control box (5) mounted in the crew compartment, adjacent to the Nuclear, Biological and Chemical (NBC) control box. A relay incorporated in the control box ensures that the system cannot switch ON if the engine revolutions are too low (below 650 rev/min) to put the generator 'on line'. A delay is incorporated to hold the compressor clutch (17) on should the engine speed drop below 650 rev/min momentarily.

4 The refrigerant used in the system is Iceon 49 to which has been added a dye to assist in the locating of leaks. A round sight glass allows the condition of the refrigerant to be seen and the level assessed.

COMPRESSOR

5 The compressor is located on top of the transfer gearbox, adjacent to the fan pack filler and dipstick. It is driven by the transfer gearbox through a magnetic compressor clutch providing the engine is running at a speed sufficient to bring the generator 'on line'. A limiting pressure switch (14) is collocated with the compressor which cuts off the electrical supply from the compressor clutch if the system overheats. The system is then effectively 'shut down'.

CONDENSER AND FILTER DRIER UNIT

6 The condenser is vertically mounted and located in the engine compartment, on the bulkhead along side the engine air cleaner. The condenser removes heat from the refrigerant and condenses the cooled vaporised refrigerant prior to it entering the filter drier unit. The filter drier contains a desiccant which absorbs water in the refrigerant and also extracts any other contamination. This ensures a liquid flow of refrigerant to the evaporator.

EVAPORATOR AND CONDENSATE BOTTLE

7 The evaporator unit (11) is mounted in the NBC compartment and draws air from both the flap valve and, in closed down conditions, the NBC pack. A circulating evaporator fan (10) passes air over the evaporator matrix, and subsequently cools the air which passes to the crew compartment. Moisture from the air condenses on the matrix and is collected in a plastic condensate bottle (8).

OPERATING CONTROLS

8 The air cooling system control box (Fig 2) is mounted in the crew compartment below the hand controls, between the NBC control box and the fire detection warning light. Two switches mounted on the air cooling control box allow for control of the system.

9 The ON/OFF switch (1) enables electrical current to pass to the magnetic compressor clutch which in turn takes up drive from the transfer gearbox. The switch also enables power to the evaporator fan (Fig 1 (10)) which passes air over the evaporator matrix, thus cooling the air passed to the crew compartment. In the OFF position the air cooling system will be shut down.

10 The fan speed selector switch (Fig 2 (2)) controls the speed of the air evaporator fan. It is a three position toggle switch marked MED, LOW and HIGH.

OPERATION

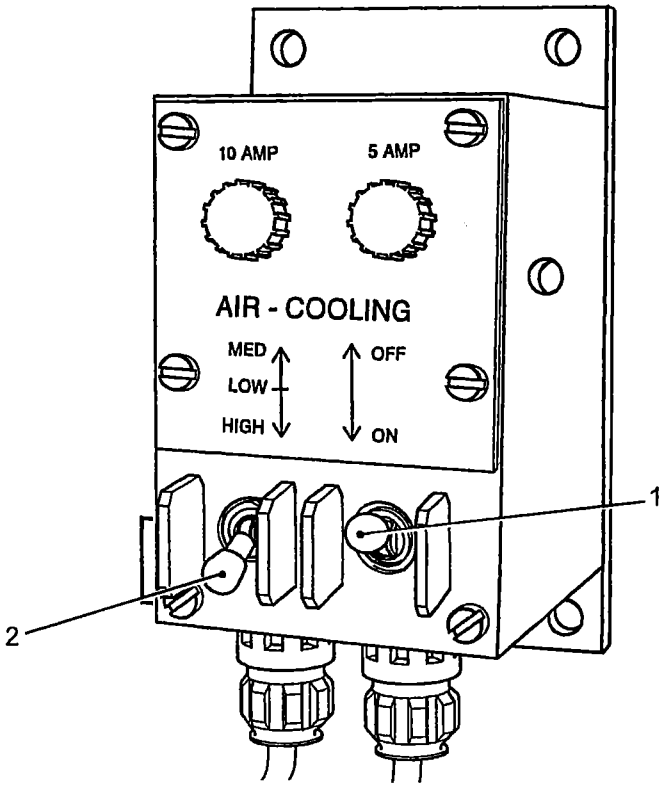
11 To provide recirculation of dust free conditioned air within the crew compartment, operate the air cooling system as follows:

11.1 Set the vehicle battery master switch to the ON position.

11.2 Start and run the engine at fast idle speed to bring the generator on line. Set the hand operated accelerator control to maintain engine speed to keep the generator on line.

11.3 Set the air cooling switch to ON and select the desired flow rate on the fan speed selector switch.

11.4 Open and adjust outlet diffusers as required.



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1 ON/OFF switch
2 Fan speed selector switch

Fig 2 Air cooling system control box

MAINTENANCE

12 Maintenance at this level is restricted to a visual check of sight glass (Fig 1 (3)) to establish refrigerant condition. Refer to Table 1 for condition and actions.

TABLE 1 REFRIGERANT CONDITION AND ACTIONS

Serial (1)	Sight Glass (2)	Remarks (3)
1	Clear	Serviceable - no action
2	Bubbles appear	Refrigerant low - report to REME
3	Streaked appearance	Compressor oil circulating - report to REME
4	Cloudy appearance	Desiccant break down - report to REME

CHAPTER 2-2

ENGINE

CONTENTS

(continued)

CONTENTS (continued)

ENGINE

General

1 The engine is a Rolls Royce C6TFR (Cylinder 6, Turbo, Ferrous, RH Build) high speed, compression ignition engine. It embodies six vertical in-line cylinders, operating on a four stroke cycle, and is turbocharged with direct fuel injection.

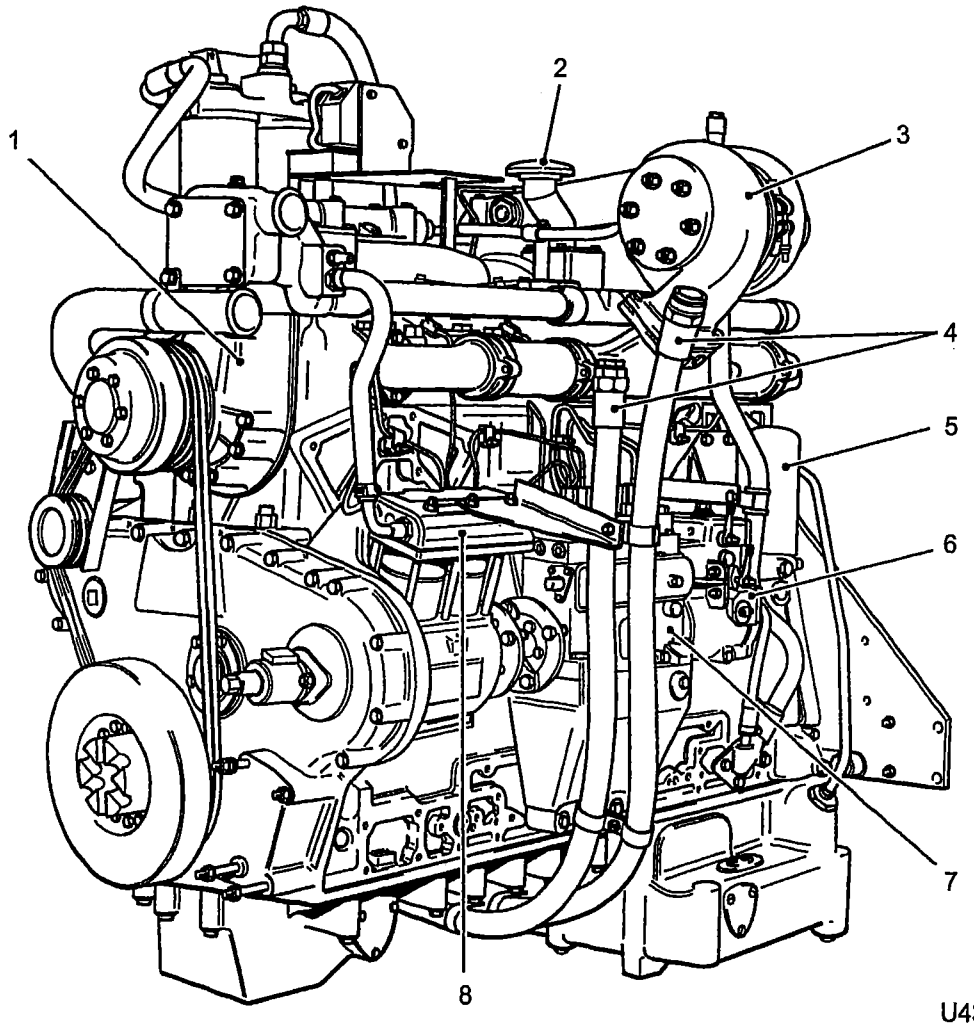
2 The engine is situated in the rearmost compartment and is located in the hull on four flexible mounts. Access to the engine is by means of the hinged lower access plate (Fig 3 (11)) and the hinged door (18)) in the roof plate.

3 Engine cooling is effected by means of a liquid coolant circulated through a heat exchanger and radiators by a belt driven pump (Fig 1 (1)).

4 A twin cylinder air compressor (Fig 1 (8)) is mounted on the engine to supply air to operate the main brakes, steer unit actuators and suspension damper locking mechanism.

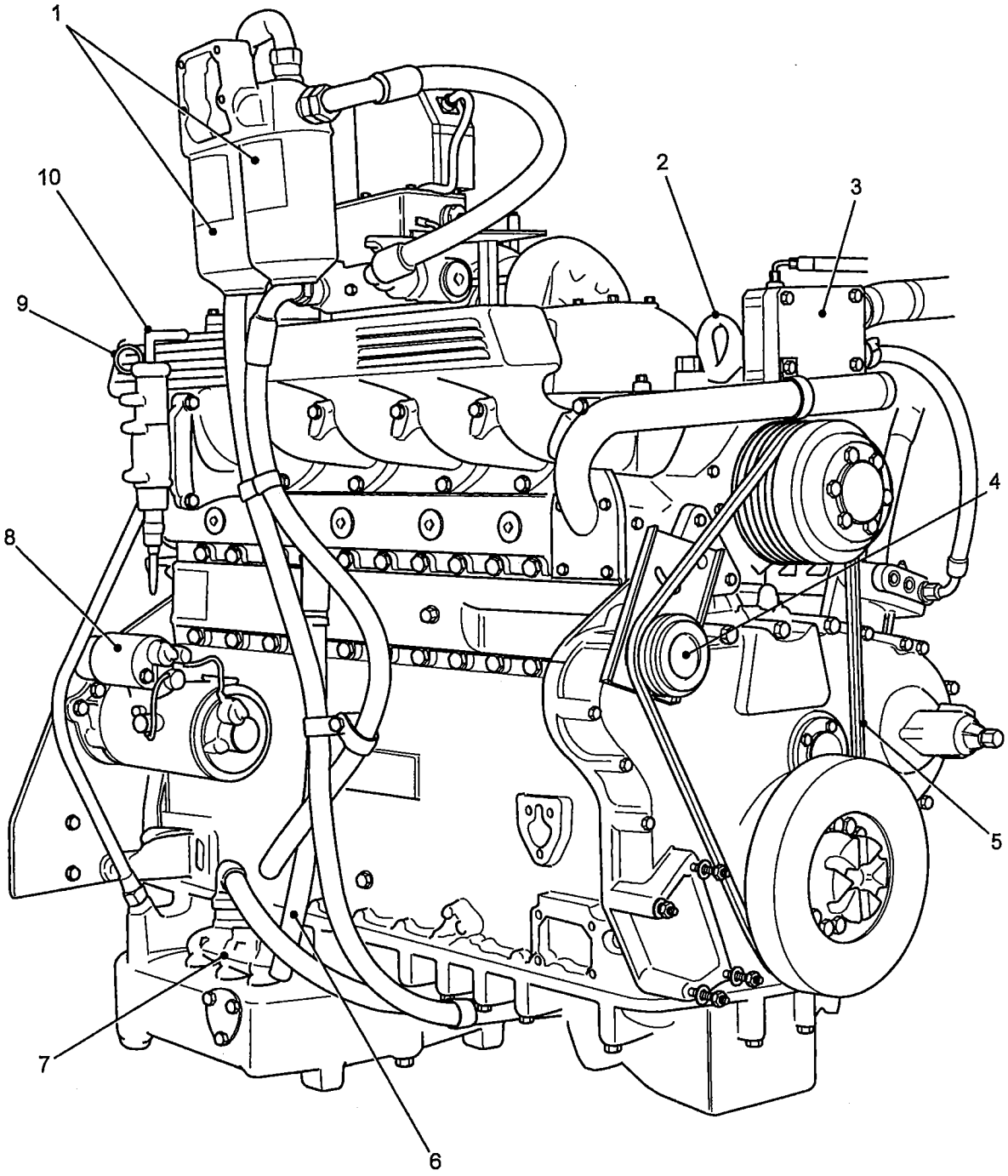
5 The engine is started by an electric starter motor (Fig 2 (8)) which can be operated from either driving position.

6 To assist starting in conditions of extreme cold the engine can be disconnected from all loads by disengaging a dog clutch in the transfer gearbox.



1	Coolant pump	5	Main fuel filter
2	Oil filler	6	Governor
3	Turbocharger	7	Fuel injection pump
4	Oil hoses to heat exchanger	8	Air compressor

Fig 1 Engine, right, rear



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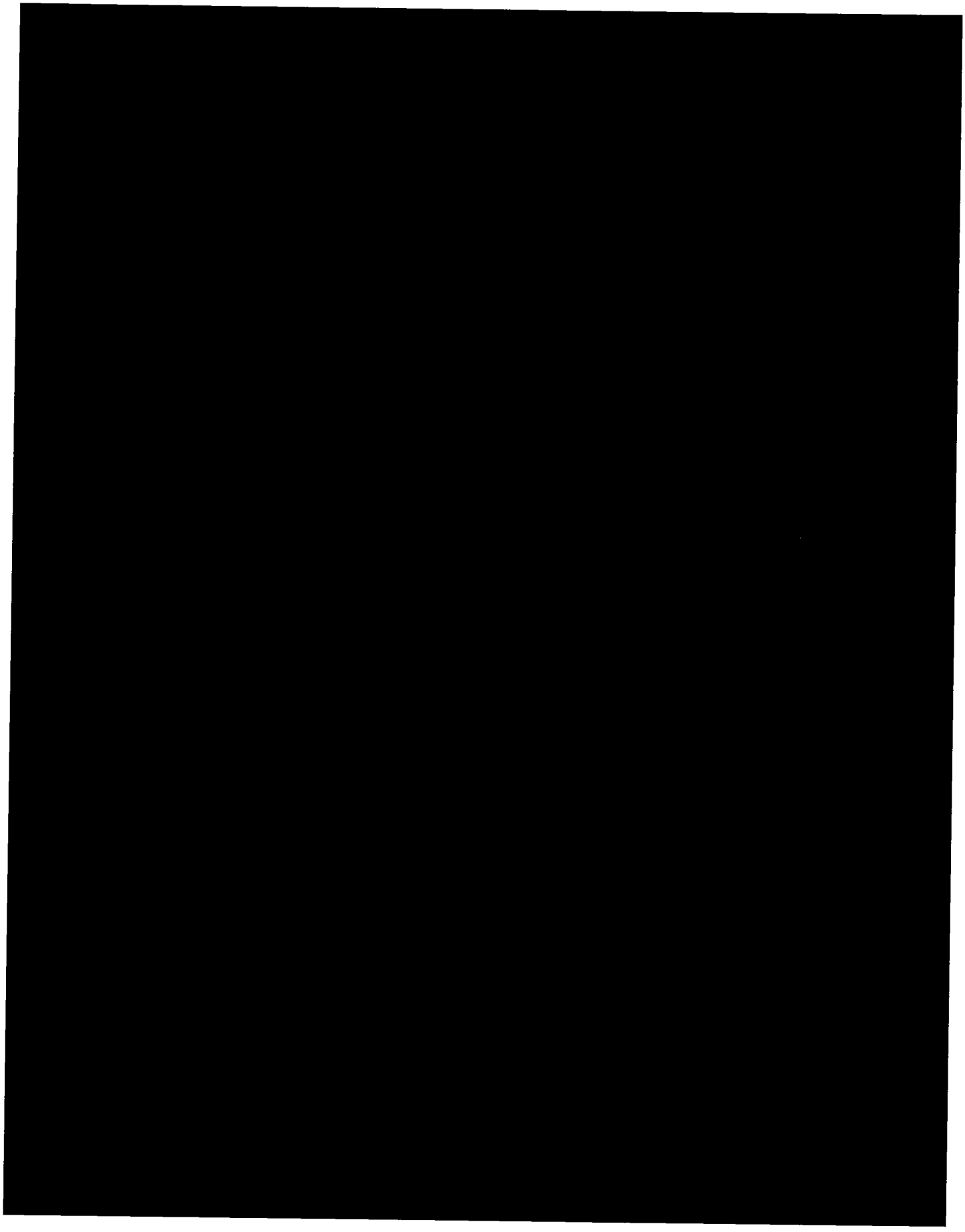
1	Oil filters	6	Crankcase breather
2	Lifting eye	7	Relief valve
3	Thermostat housing	8	Starter motor
4	Coolant pump belt tensioner	9	Dipstick
5	Coolant pump belts	10	Sump pump

Fig 2 Engine, left, rear



KEY TO FIG 3

1 Front stowage bins
2 Winch
3 Air intake cowl
4 Access panel
5 Access cover plates
6 Stowage basket
7 Stowage box
8 Rear stowage bin
9 Bilge pump outlet (rear) panel
10 Engine compartment roof plate
11 Engine compartment lower access panel
12 Drain plug access panel
13 Emergency exit door
[redacted]
15 Exhaust cowl
16 Fairlead
17 Smoke grenade stowage box
18 Engine compartment access door
19 Operator's access hatch
20 Driver's access hatch
21 Python aperture cover plate
22 NBC air intake cowl
23 Stowage compartment door
24 Transmission compartment access
25 General service tow hook
26 Fire extinguisher operating handles
27 Transmission compartment upper
28 Bilge pump outlet (front)
29 Smoke discharger mounting
30 Fuel filler access cover
31 Radiator intake louvres
32 Radiator Outlet Louvres

EXHAUST SYSTEM

General

7 The exhaust gases from the engine are utilised to drive the turbocharger. The gases, leaving the turbocharger outlet, pass to atmosphere through an outlet on the hull roof plate.

8 The exhaust system is provided with flexible couplings, of the metallic bellows type, to allow for movement between the engine and the hull.

9 The exhaust outlet is contained within an armoured rectangular cowl (Fig 3 (15)), which also provides an exit for the engine and transmission compartments ventilation air. To prevent rain and debris entering the exhaust outlet, a louvred cover is fitted over the outlet.

Turbocharger

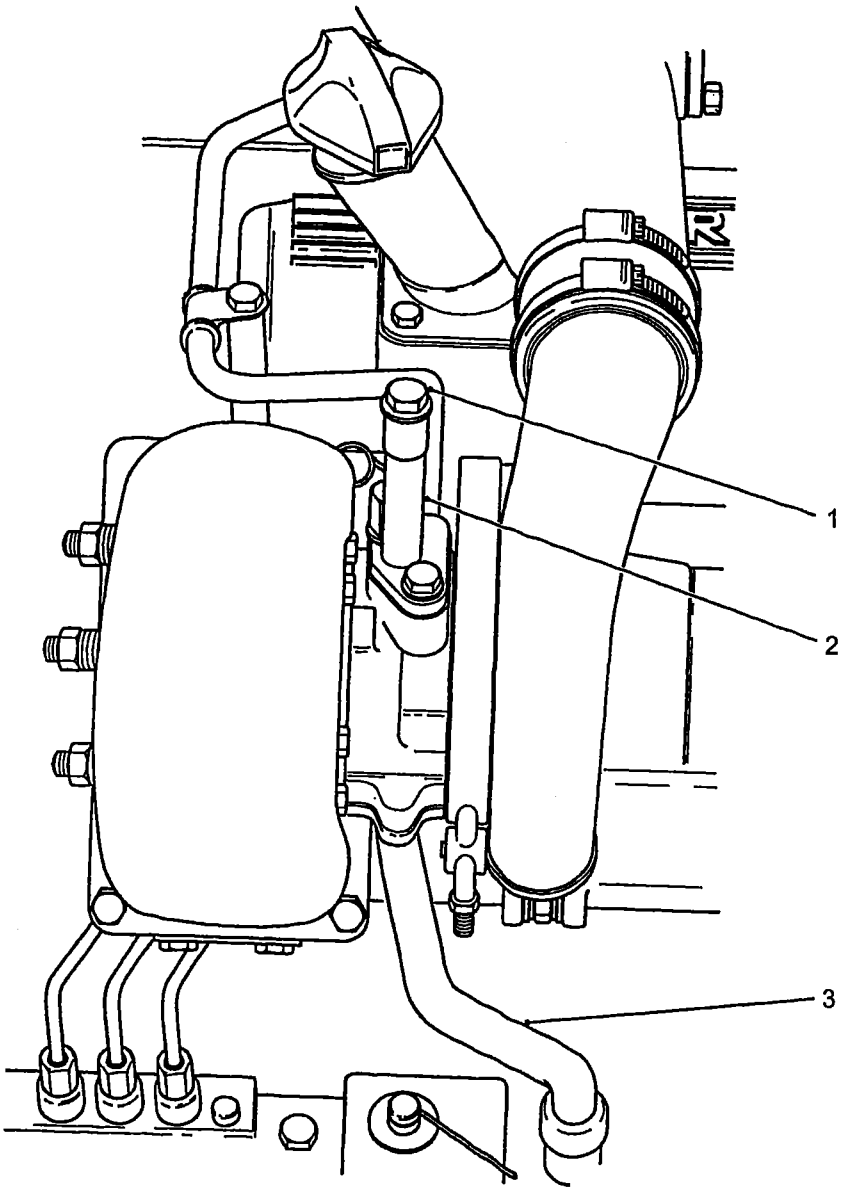
10 The turbocharger (Fig 4) is a turbine driven compressor which increases the mass airflow to the engine cylinders. Both turbine and compressor are carried on the opposite ends of a common shaft which rotates in fully floating bearings. The bearings are pressure lubricated by an oil supply from the engine lubrication system. The oil is then returned to the crankcase via a drain tube (3).

11 The turbocharger is simple in principle and construction, but it is a precision built component which operates at very high speeds. Its life and efficiency is dependant on correct operation and efficient servicing.

LUBRICATION SYSTEM

General

12 The engine lubrication system works on the wet sump principle. Oil from the sump is circulated by an integral engine oil pump to lubricate the major engine components, including the fuel injection pump, turbocharger and compressor. Filtration and cooling of the oil is carried out by means of externally mounted filters and a heat exchanger.



1 Filler plug
2 Filler tube
3 Drain tube (to sump)

Fig 4 Turbocharger

13 A dipstick (Fig 5 (4)), fitted on the left side of the engine, indicates the correct oil level in the sump and an oil filler (1) is located on the rocker cover.

14 To facilitate the removal of oil from the sump, during servicing or repair, a hand operated sump pump (2) is provided, permanently connected to the engine sump by means of a pipe. The pump is located adjacent to the dipstick and has a threaded outlet connection (3) to enable a flexible discharge hose to be attached when in use.

15 Access to the dipstick, oil filler and sump pump is by means of the hinged access door (Fig 3 (18)) in the roof plate.

16 The engine oil filter (Fig 6) is a twin full flow unit, having expendable paper elements, which is located on the engine compartment left wall. When the engine is started from cold, or if the elements are clogged, a relief valve in the filter header/bracket (3) will open at a differential pressure of 1.05 kg/cm^2 (15 lbf/in.^{2}) and allow the oil to bypass the filter and pass directly to the engine.

17 Cooling of the lubricating oil is effected by a portion of the main heat exchanger. The heat exchanger is located on the right side of the engine compartment and utilises coolant from the engine cooling system.

18 A pressure relief valve (Fig 2 (7)), mounted externally on the sump, will open when the oil pressure exceeds 4.2 kg/cm^2 (60 lbf/in.^{2}). Oil will then be diverted back into the sump.

Instruments

Oil pressure gauge

19 An oil pressure gauge (Fig 7 (16)), graduated 0 to 100 lbf/in.^{2} and 0 to 7 kgf/cm^2, is located on the driver's instrument panel. The gauge indicates the oil pressure present in the engine lubrication system.

20 The gauge should be observed frequently to check that oil pressures are not abnormally high or low. This is particularly important during starting up, and if a Central Warning Light (CWL) illuminates during vehicle operation. Oil pressures at normal working temperatures are:

20.1	Minimum	1.05 kgf/cm^2	(15 lbf/in.^{2}).
20.2	Normal	2.10 kgf/cm^2	(30 lbf/in.^{2}).
20.3	Maximum	3.87 kgf/cm^2	(55 lbf/in.^{2}).

21 If the pressure reading consistently deviates from the above parameters, stop the vehicle and investigate.

Low oil pressure warning light

22 An engine low oil pressure warning light (Fig 8 (18)) is located on the operator's instrument panel. The light is identified ENG OIL (under the caption LOW PRESSURE) and illuminates red if the oil pressure drops below 0.7 kgf/cm^2 (10 lbf/in.^{2}). The light is of the 'press to test' type.

NOTE

The low oil pressure warning light will illuminate when the battery master switch is switched to ON and will remain illuminated until the engine is started and oil pressure builds up.

23 If the warning light illuminates during normal vehicle operation, stop the engine and investigate immediately. The engine should not be restarted until the cause has been located and rectified.

High oil temperature warning light

24 A high temperature warning light (Fig 8 (14)) is located on the operator's instrument panel. The light is identified ENG OIL (under the caption HIGH TEMPERATURE) and illuminates green if the engine oil temperature exceeds 120 degrees C (248 degrees F). The light is of the 'press to test' type.

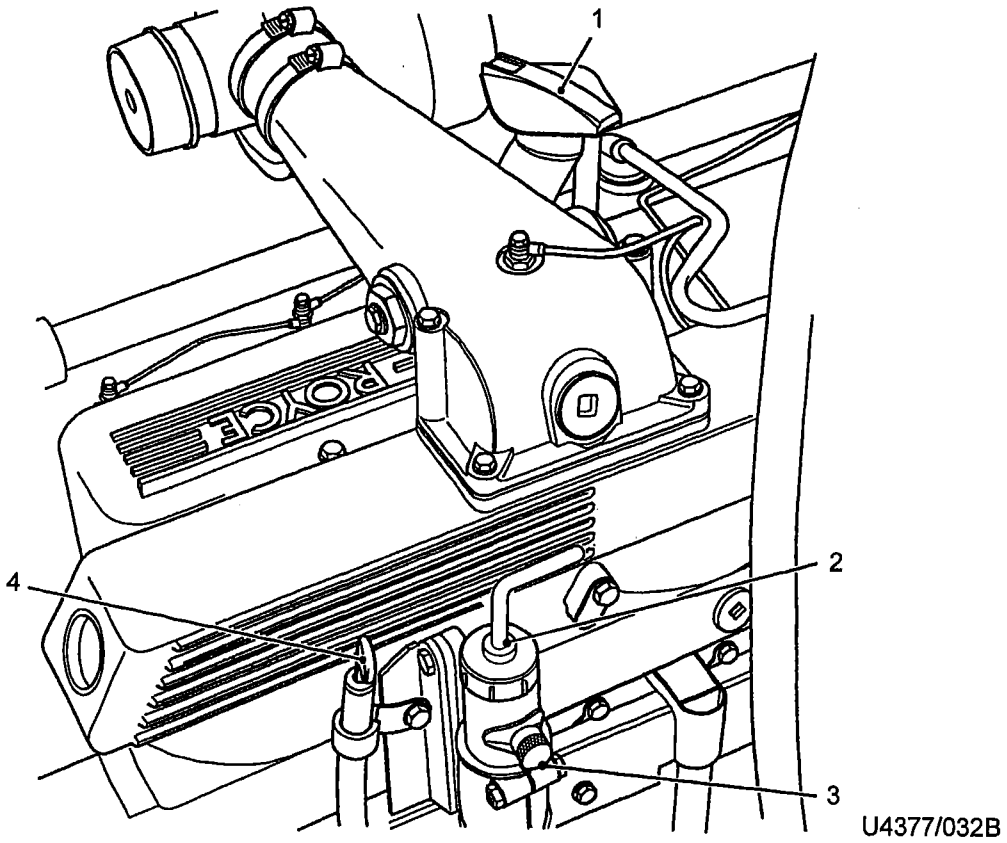
25 If the warning light illuminates, stop the vehicle as soon as possible. Check that oil pressure gauge readings and coolant temperatures are normal. If the oil pressure readings are acceptable, allow the engine to idle and the oil to cool. If the warning light remains illuminated report to REME.

Central warning lights

26 The external and internal CWL will illuminate if either of the two following lubrication system warning lights are activated:

26.1 Low oil pressure.

26.2 High oil temperature.



1 Oil filler
2 Sump pump
3 Outlet connection
4 Dipstick

Fig 5 Oil filler, dipstick and sump pump

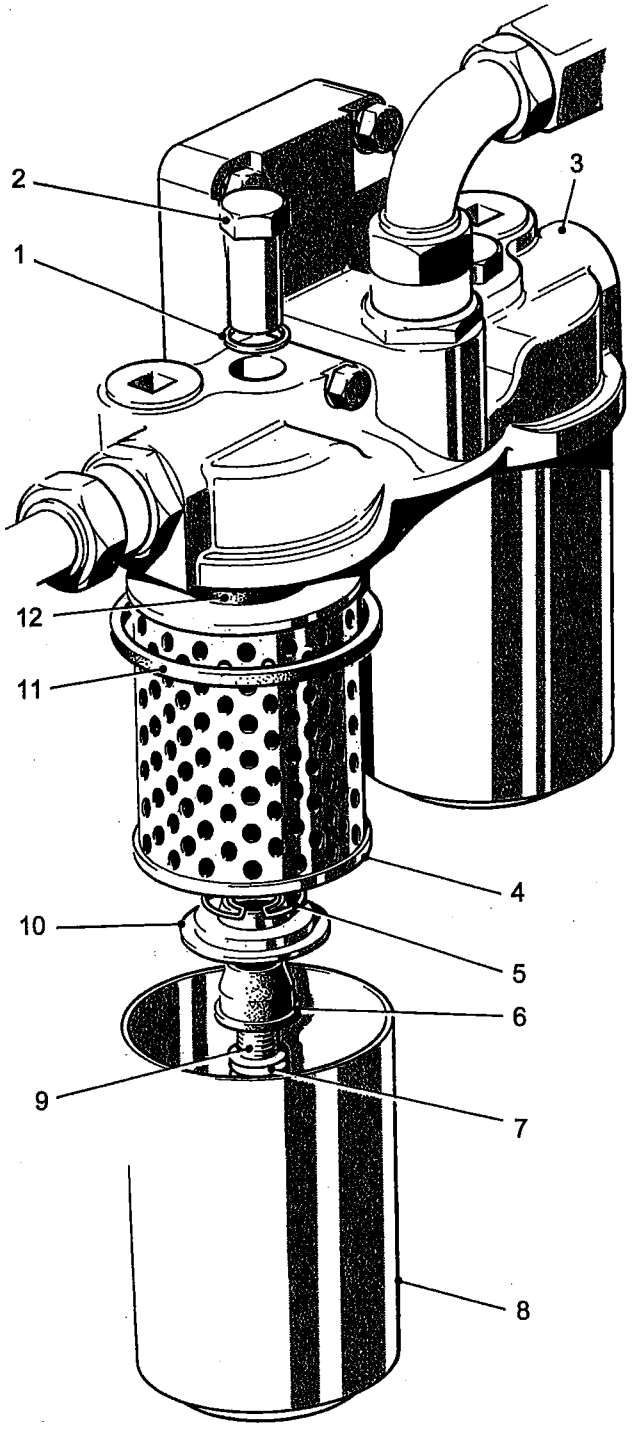
27 If a CWL illuminates, the warning lights and instruments must be checked immediately in order to locate the system at fault.

NOTES

(1) The CWLs will illuminate when the battery master switch is set to ON and will remain illuminated until the engine is started and oil pressure builds up.

(2) The CWL system covers nine warning conditions in all, if the CWLs illuminate it is important that the system at fault is located quickly, by means of the normal warning lights and instruments.

28 The CWL system is described in greater detail in Chap 2-7 (Electrical Equipment).



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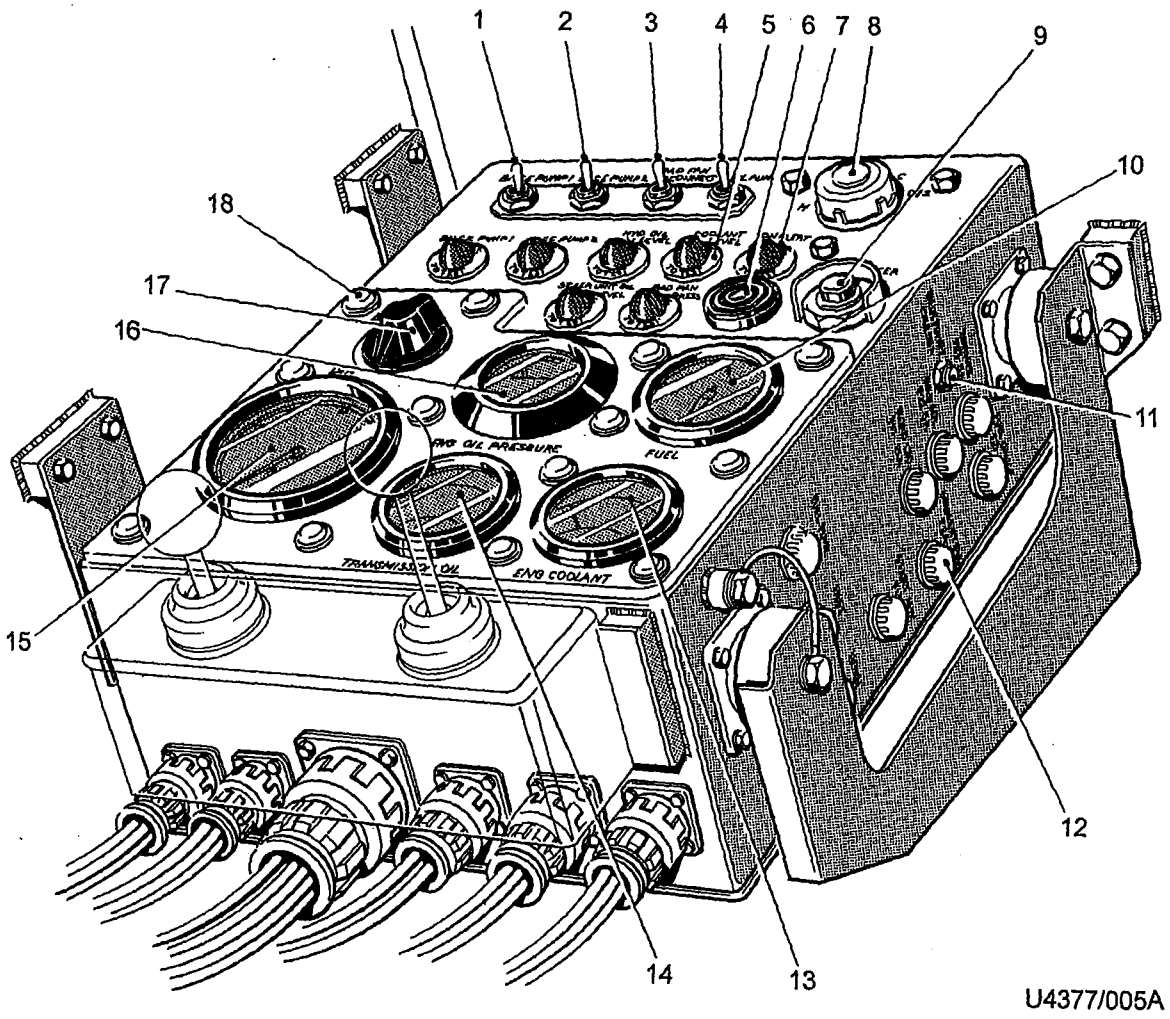
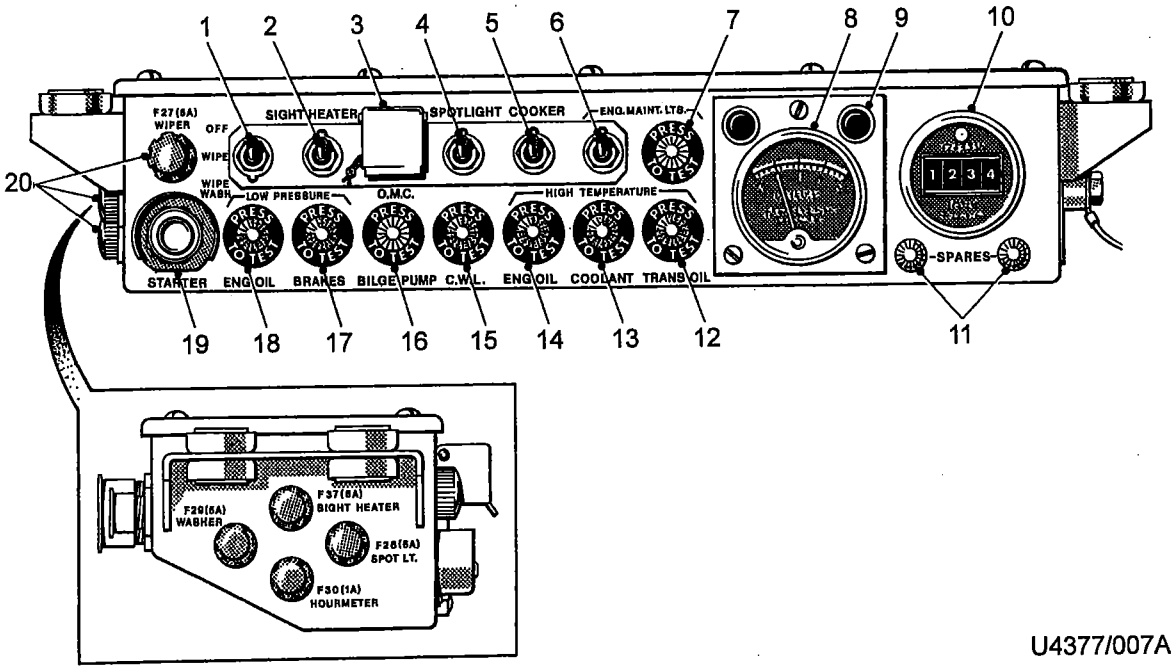
1	Washer	7	Spring
2	Nut	8	Filter bowl
3	Header/bracket	9	Centre stud
4	Element	10	Support plate
5	Spring clip	11	Top seal
6	Base seal	12	Seal

Fig 6 Engine oil filter



1 Bilge pump 1 switch
2 Bilge pump 2 switch
3 Radiator fan disconnect switch
4 Fuel pump switch
5 Warning lights:
  Bilge pumps 1 and 2
  Hydraulic oil level
  Coolant level
  Steer unit low oil level
  Radiator fan boost pressure
6 Sonalert horn
7 Sonalert light
8 Light switch
9 Starter button
10 Fuel gauge
11 Circuit breaker, No. 2 bilge pump
12 Fuses: F13, F14, F16, F17, F20, F21, F22, F23 and F24
13 Engine coolant temperature gauge
14 Transmission oil temperature gauge
15 Tachometer
16 Engine oil pressure gauge
17 Dimmer switch
18 Panel lights (14 positions)

Fig 7 Driver's instrument panel



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1 Wipe/wash switch
2 Sight heater switch
3 Override master control switch
4 Spotlight switch
5 Cooker switch
6 Engine maintenance light switch
7 Maintenance light warning light
8 Ammeter
9 Panel lights (2 positions)
10 Hourmeter
11 Spare warning light lenses
12 Transmission oil temperature warning light
13 Coolant temperature warning light
14 Engine oil temperature warning light
15 Central warning light
16 Bilge pump warning light
17 Brake low pressure warning light
18 Engine low oil pressure warning light
19 Starter button
20 Fuses: F27, F28, F29, F30 and F37

Fig 8 Operator's instrument panel

COOLING

General

29 The engine cooling system consists of a header tank, a belt driven coolant pump, a thermostat, two radiators, a heat exchanger pack and the necessary pipework. Two fans driven by a hydraulic fan pack, provide a flow of cooling air through the radiators.

30 Coolant is circulated in the system by the pump, passing through the heat exchangers and radiators. A sliding element sleeve type thermostat restricts circulation until working temperatures are reached.

31 During normal operation, the radiators are air cooled by the airflow generated by the fans. When the vehicle is deep wading, the fans are stopped by means of a switch on the driver's instrument panel and the radiators become immersed in water, which freely enters the radiator compartment.

32 The heat exchanger provides a means of exchanging heat between the coolant and the various lubricating and hydraulic oils, thus maintaining a uniform temperature below the maximum working limit of the oils.

Header tank

CAUTION

EQUIPMENT DAMAGE. The coolant level must not be allowed to fall below the bottom of the header tank or air may be drawn into the system and bleeding will be necessary.

33 The header tank is located on the right wall of the engine compartment. The tank provides the means of filling and topping-up the cooling system and also acts as an expansion chamber.

34 A filler cap (Fig 9 (2)), fitted in the top of the header tank, is accessible through the oval cover plate (1) on the vehicle roof. A pressure/vacuum relief valve, contained in a housing (5) on the tank top, maintains the system at a pressure of 69 kN/m^2 (10 $lbf/in.^2$). This increases the boiling point of the system to make it more efficient. Any excess coolant released by the relief valve drains into the hull via the overflow pipe (7).

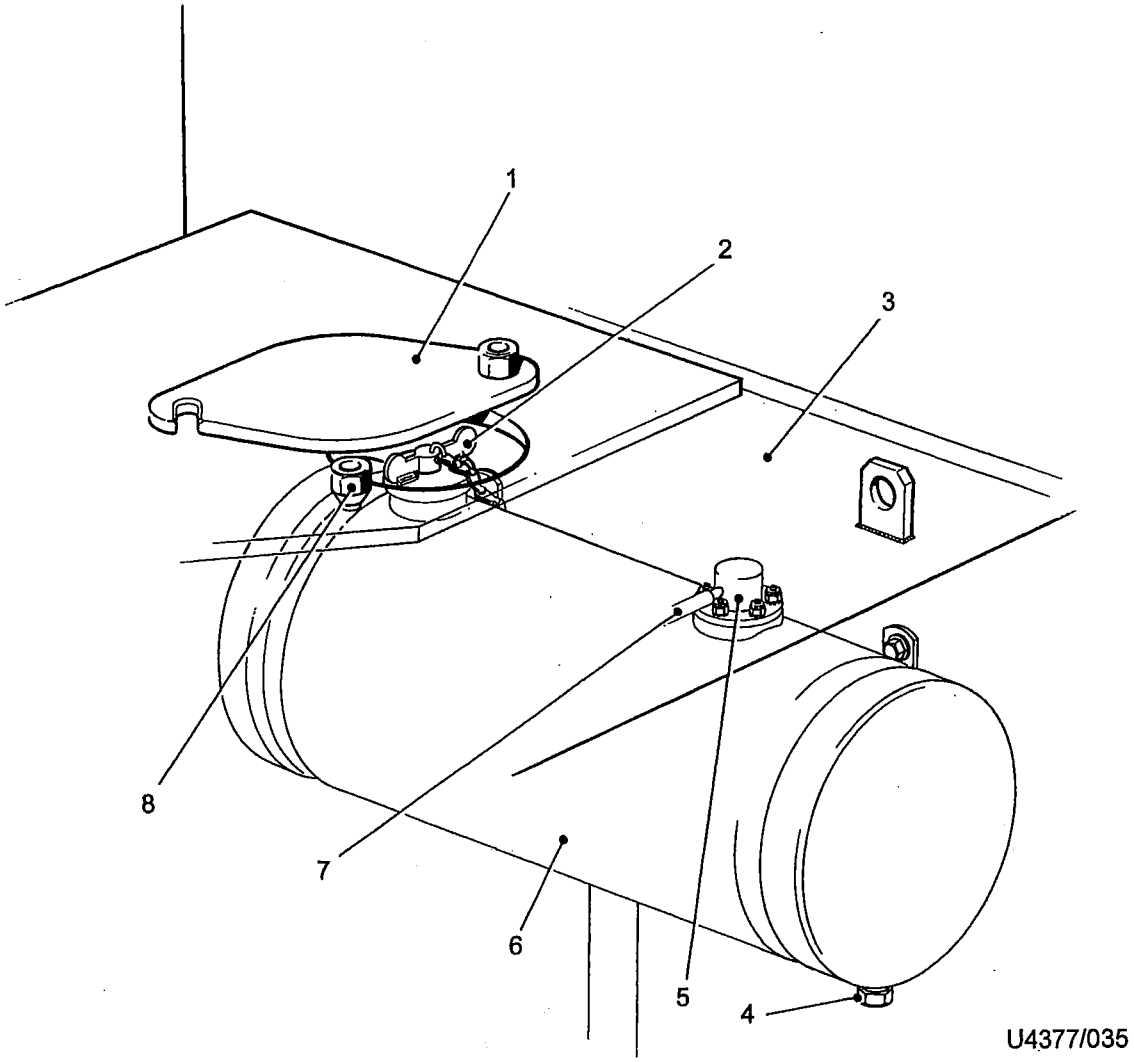
35 A sender unit is fitted into the header tank, which operates in conjunction with the coolant low level warning light.

Coolant pump and thermostat

36 The coolant pump (Fig 1 (1)) is mounted on the rear of the engine and is driven by a twin vee belt (Fig 2 (5)) from the engine crankshaft. The pump assists the circulation of coolant through the heat exchanger and radiators.

37 Adjustment of the drive belts is by means of the coolant pump belt tensioner (4). This task and that of replacing belts, must only be undertaken by a qualified tradesman.

38 The thermostat is a non-adjustable unit, located in a housing (3) above the coolant pump. Below normal operating temperatures, the thermostat allows coolant to circulate around the engine water jacket only. When normal operating temperatures are reached, the thermostat progressively opens and the coolant is free to circulate through the radiators.



1	Cover plate	5	Pressure/vacuum relief valve housing
2	Filler cap	6	Header tank
3	Roof plate	7	Overflow pipe
4	Drain plug	8	Cover plate securing nuts

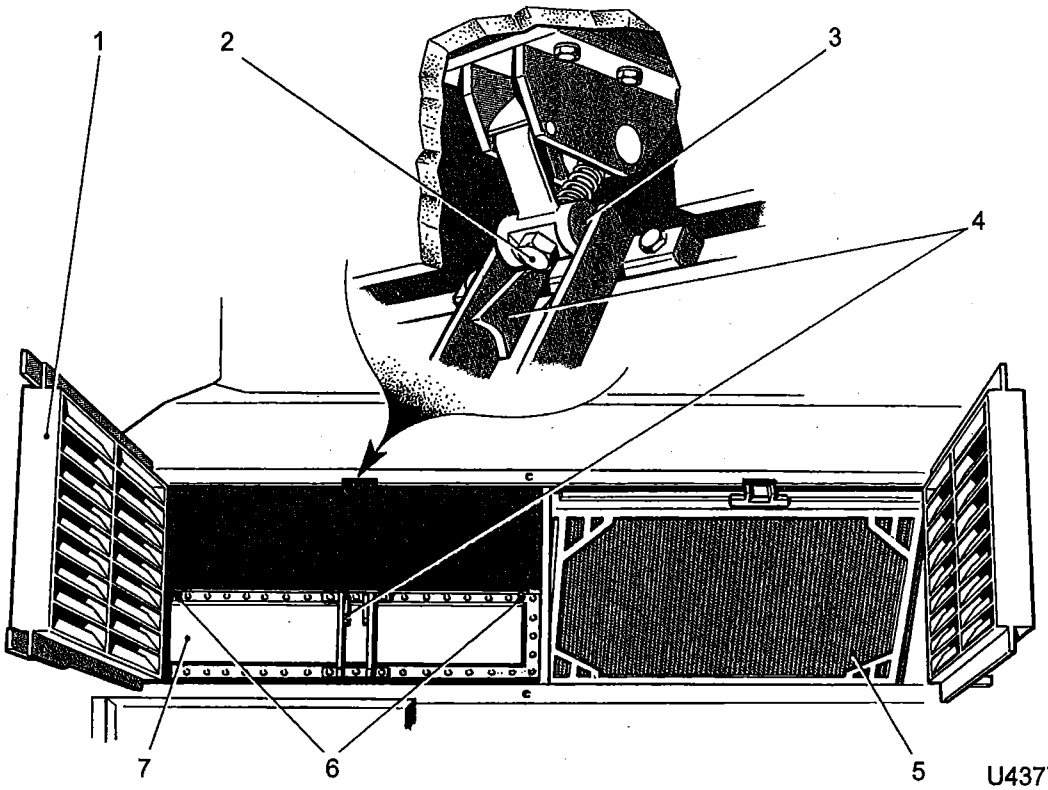
Fig 9 Coolant filler and header tank

Heat exchanger

39 The heat exchanger consists of two units located on a common mounting on the right of the engine compartment. Each of the two portions is sub-divided and the unit provides cooling for the following services; gearbox oil, main hydraulic oil, engine oil, steer unit oil and fan pack hydraulic oil.

Radiators

40 The two radiators (Fig 10) are located in a compartment on the right side of the hull, immediately beneath the fan outlet louvres. Air is drawn in through the radiator intake louvres (Fig 3 (31)) and up through the radiators by the two main cooling fans.



1	Radiator intake louvres	5	Radiator (in operating position)
2	Securing bolt	6	Bleed screws
3	Locking catch	7	Radiator (in lowered position)
4	Securing lugs		

Fig 10 Radiators

41 The radiators are positioned at an angle of 35 degrees from the horizontal and are trunnion mounted. Each radiator may be hinged down, on to the compartment bottom, for maintenance purposes and to allow access to the fans.

42 Both radiators are fitted with bleed screws (Fig 10 (6)) to enable any air trapped in the system to be vented. This will be necessary if the system is drained and refilled or if the coolant level has been allowed to drop below the level of the header tank bottom.

Cooling fans

43 Two cooling fans are located above the radiators. Each fan rotates about a vertical axis and is driven by its own hydraulic motor.

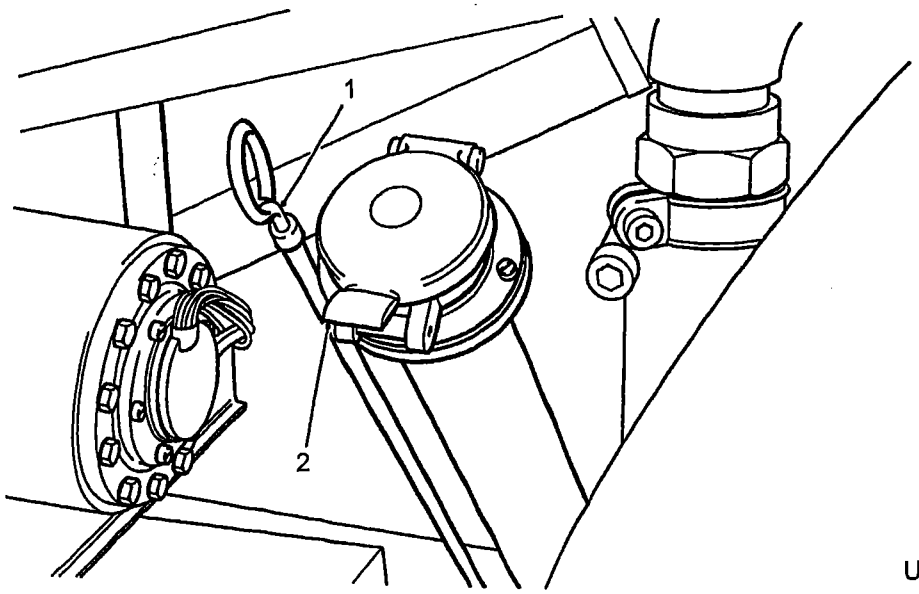
44 The speed of rotation of the fans is varied automatically, by a thermostatically operated control unit within the fan pack, and is dependent on coolant temperature. The fans start to rotate when the coolant temperature reaches 81 degrees C (178 degrees F) and reach their maximum speed of 4000 rev/min at 103 degrees C (217 degrees F).

Fan hydraulic pack

45 The fan hydraulic pack supplies a controlled flow of hydraulic fluid to the fan motors. The pack is a self contained unit mounted on the hull floor and driven by the transfer gearbox via a flexible coupling.

46 Output to the fan motors is controlled by an integral thermostatic control unit which is connected to a sensitive thermo-probe in the coolant system.

47 The fan hydraulic pack contains its own fluid reservoir. A filler cap (Fig 11 (2)) and dipstick (1) are provided to enable the fluid level to be checked and maintained. Access to the fan pack is by means of the transmission compartment upper access cover (Fig 3 (27)). If failure of the hydraulic pack occurs a manual override is fitted to the rear left-hand side of the reservoir. This will bring the fans to maximum speed regardless of the temperature.



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1 Dipstick
2 Filler cap

Fig 11 Fan pack filler and dipstick

Controls and instruments

Radiator fans disconnect switch

48 To enable the fans to be stopped during deep wading, a disconnect switch is provided. The switch (Fig 7 (3)) is located on the driver's instrument panel. Moving the switch down activates a solenoid in the fan hydraulic pack, thus stopping the fans.

NOTE

Before starting the engine for normal land use, the radiator fans disconnect switch must be put to its uppermost 'off' position, to allow the radiator fans to run.

49 The disconnect solenoid electrical circuit is protected by a fuse, for rating and location refer to Chap 2-7 (Electrical Equipment).

Coolant temperature gauge

50 The temperature gauge (Fig 7 (13)), located on the driver's instrument panel, is graduated -4 degrees F to +30 degrees F. The reading obtained, when multiplied by 10, indicates the coolant temperature.

51 The operating temperature will vary according to the conditions encountered, but the maximum temperature must no exceed 116 degrees C (240 degrees F). The temperature warning light will indicate that the maximum temperature has been reached (refer to Para 54).

WARNING

PERSONNEL INJURY. DO NOT REMOVE HEADER TANK FILLER CAP BEFORE TEMPERATURE HAS FALLEN BELOW 93 DEGREES (200 DEGREES F).

CAUTION

EQUIPMENT DAMAGE. Do not immediately switch the engine off when it reaches maximum operating temperature or when the temperature warning light illuminates.

52 If the gauge indicates a temperature above this figure, indicated by the temperature warning light, stop the vehicle as soon as possible. DO NOT switch the engine off immediately. Allow the engine to idle, observing the temperature gauge at the same time. Idling of the engine should cause the temperature to drop. If the temperature continues to rise, stop the engine and investigate to ascertain the cause. DO NOT attempt to remove the coolant filler cap.

53 If no apparent cause can be found, eg broken coolant pump belts, or the fault persists, report to REME.

Coolant temperature warning light

54 A high temperature warning light (Fig 8 (13)) is located on the operator's instrument panel, identified COOLANT (under the caption HIGH TEMPERATURE). The light, which is a 'press to test' type with a green lens, will illuminate when the coolant temperature exceeds 116 degrees C (240 degrees F).

WARNING

PERSONNEL INJURY. DO NOT REMOVE HEADER TANK FILLER CAP BEFORE TEMPERATURE HAS FALLEN BELOW 93 DEGREES C (200 DEGREES F).

CAUTION

EQUIPMENT DAMAGE. Do not immediately switch the engine off when it reaches maximum operating temperature or when the temperature warning light illuminates.

55 If the coolant temperature warning light illuminates, stop the vehicle as soon as possible. DO NOT switch the engine off immediately. Allow the engine to idle, observing the temperature gauge (Fig 7 (13)) at the same time. Idling of the engine should cause the temperature to drop. If the temperature continues to rise, stop the engine and investigate to ascertain the cause. DO NOT attempt to remove the coolant filler cap. If no apparent cause can be found, eg broken coolant pump belts, or the fault persists, report to REME.

Coolant low level warning light

WARNING

PERSONNEL INJURY. DO NOT REMOVE HEADER TANK FILLER CAP BEFORE TEMPERATURE HAS FALLEN BELOW 93 DEGREES C (200 DEGREES F).

56 A warning light (Fig 7 (5)) on the driver's instrument panel, identified COOLANT LOW LEVEL, will illuminate if the header tank coolant level falls dangerously low. The light has a red lens and is of the 'press to test' type.

57 If the coolant low level warning light illuminates, stop the vehicle and allow to cool. Do NOT attempt to remove the filler cap to top up the header tank until the system has cooled down and a check has been made to ensure the system is free from leaks.

Radiator fan boost pressure warning light

58 A warning light located on the driver's instrument panel, identified RAD FAN BOOST PRESS will illuminate if the fan pack hydraulic boost pressure falls below an acceptable limit. The light has a red lens and is of the 'press to test' type.

59 If the light illuminates, stop the vehicle as soon as possible, stop the engine and check the fan pack oil level. If the oil level is correct or after topping up the light remains illuminated report to REME.

Central warning lights

60 The external and internal CWL will illuminate if any of the following cooling system warning lights are activated:

60.1 Coolant high temperature.

60.2 Coolant low level.

60.3 Radiator fan boost pressure.

61 If a CWL illuminates, the warning lights and instruments must be checked immediately in order to locate the system at fault.

NOTES

(1) The CWLs will illuminate when the battery master switch is set to ON and will remain illuminated until the engine is started and oil pressure builds up.

(2) The CWL system covers nine warning conditions in all; if the CWLs illuminate it is important that the system at fault is located quickly, by means of the normal warning lights and instruments.

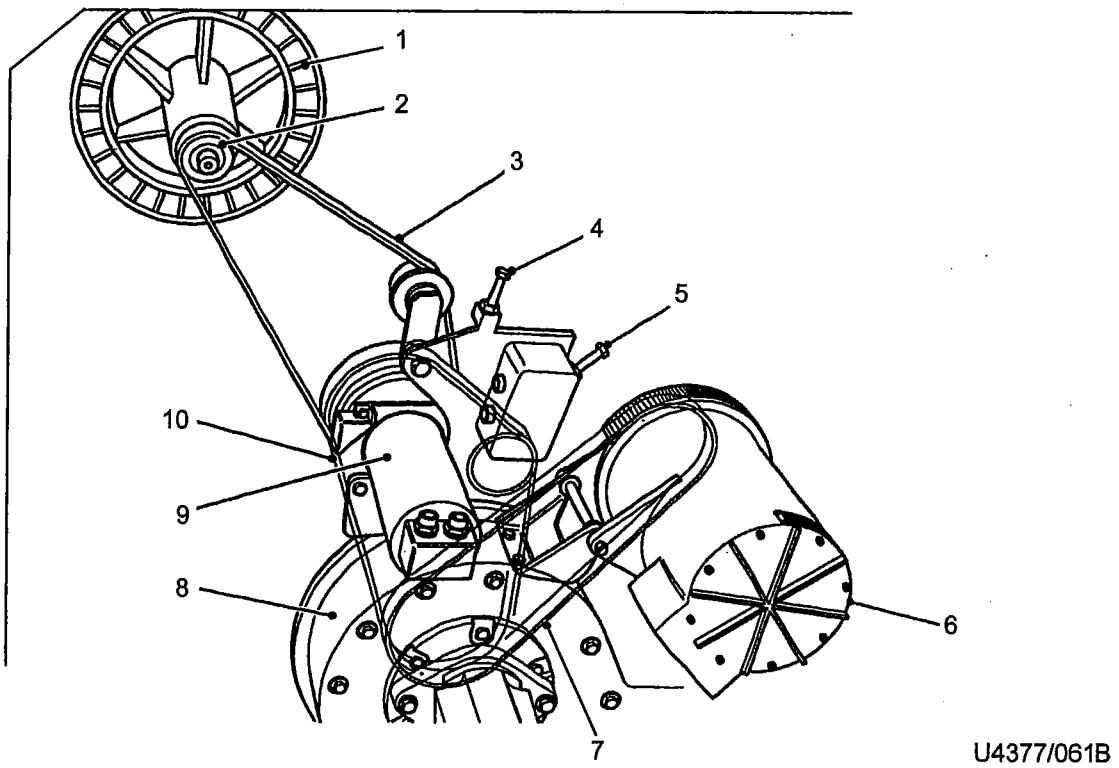
62 The CWL system is detailed in Chap 2-7 (Electrical Equipment).

ENGINE AND TRANSMISSION COMPARTMENT VENTILATION

General

63 The engine and transmission compartments are ventilated by a flow of air, created by an auxiliary fan. The fan is mounted on the engine/transmission compartment bulkhead and draws air in through the armoured intake cowl (Fig 3 (3)) on the hull roof plate. Air drawn in by the fan is directed into the transmission compartment, thus causing a flow of air through into the engine compartment via the bottom of the bulkhead. The ventilation airflow leaves the vehicle via an air passage surrounding the engine exhaust pipe, within the armoured exhaust cowl (15).

64 The ventilation fan (Fig 12 (1)) is located in the transmission compartment and is driven by a multi-vee drive belt (3), from a pulley on the air cooling system compressor (9). A ventilation fan belt adjuster (4) mounted on the compressor mounting plate provides a means of adjusting the belt tension.



1	Ventilation fan	6	Generator
2	Ventilation fan pulley	7	Generator drive belt
3	Ventilation fan drive belt	8	Transfer gearbox
4	Ventilation fan belt adjuster	9	Compressor
5	Compressor drive belt adjuster	10	Compressor drive belt

Fig 12 Generator and ventilation fan drive belts

MAINTENANCE

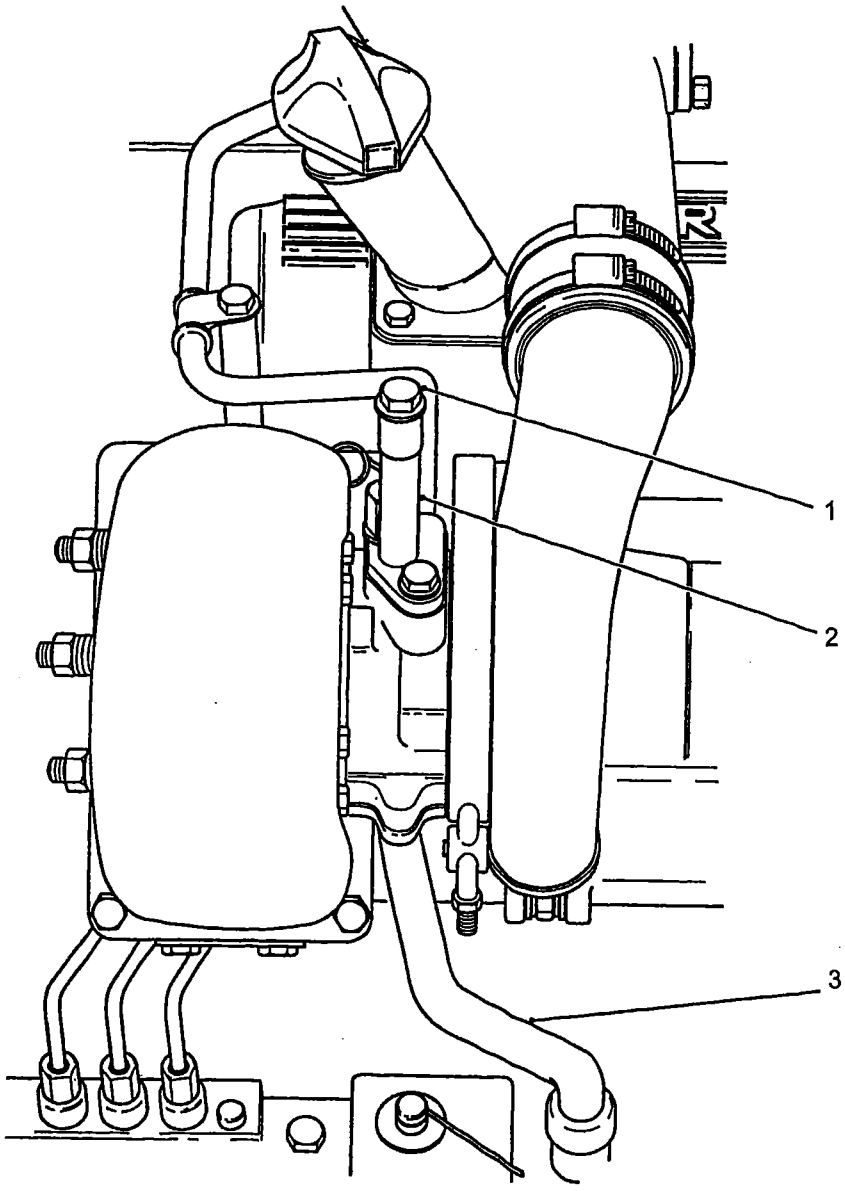
Exhaust system

65 Periodic checks (refer to Cat 601) should be made to ensure that:

65.1 There is no leakage of exhaust gases from gaskets or couplings.

65.2 The outlet cap is free and closes properly.

65.3 There is no blockage or restriction in the system.



1 Filler plug
2 Filler tube
3 Drain tube (to sump)

Fig 13 Turbocharger

NOTE

Overheating and loss of power will result if back pressure occurs due to a restriction, or if a leakage develops between the engine exhaust manifold and the turbocharger turbine.

Turbocharger

General

66 Particular attention should be paid to the regular servicing of the air cleaner (refer to Chap 2-3) ensuring that there are no leaks in the induction and exhaust systems.

67 The turbocharger oil feed and drain pipes should be inspected regularly for leaks or damage.

CAUTION

EQUIPMENT DAMAGE. If the turbocharger is to operate efficiently and not sustain serious damage, the turbocharger operating procedures MUST be rigorously applied. Failure to do so will shorten the life of the turbocharger and may render the vehicle inoperative.

68 The following operating procedures must be rigorously observed:

68.1 If the engine has not been run for a week or more, or if a replacement turbocharger or engine has been fitted, prime the turbocharger bearings with oil as detailed in Para 69.

68.2 Before stopping the engine allow the turbocharger to cool down by running the engine at 800 rev/min for 3 minutes.

68.3 The accelerator MUST NOT be 'blipped' before stopping the engine as this will cause the turbocharger to speed up, with a subsequent rise in temperature. The turbocharger will continue to 'freewheel' after the engine has stopped, without lubrication oil pressure, thus resulting in a much reduced bearing life.

68.4 If an excessively high pitched whine is heard from the turbocharger, the engine should be stopped as soon as possible. The whine may be an indication of bearing failure.

To prime the turbocharger bearings

CAUTION

EQUIPMENT DAMAGE. To avoid causing damage to the turbocharger bearings, they are to be primed before starting the engine when the engine has not been run for a week or more or a replacement turbocharger or engine have been fitted.

69 To prime the turbocharger bearings, proceed as follows:

69.1 Open the engine compartment access door (Fig 3 (18)).

69.2 Clean the area around the filler plug (Fig 13 (1)) and unscrew the plug from the filler tube (2).

69.3 Pour in 0.2 litre (3/4 pint) of clean engine oil, or sufficient oil to cause an overflow at the filler tube. Replace and tighten the plug. Clean any spillage around the filler and turbocharger.

69.4 Close and secure the access door.

Lubrication system

70 The lubrication system must be checked for leaks on all servicing parades. If the system develops a persistent leak, it must be reported to REME.

To check the oil level and top-up

71 To check and top-up the oil level, proceed as follows:

71.1 Ensure that the vehicle is on firm level ground. Check the dipstick (Fig 14 (4)) to ensure that oil is present. Start the engine.

71.2 Allow the engine to run at idling speed for five minutes at normal operating temperature. Stop the engine.

71.3 Open the engine compartment access door (Fig 3 (18)).

71.4 Withdraw the dipstick (Fig 14 (4)), wipe it clean and re-insert it into the dipstick tube. Ensure that it is pushed firmly home.

71.5 Withdraw the dipstick and observe the oil level. The level should be between the upper and lower marks.

71.6 If the level is low, clean the area around the oil filler cap (1). Open the filler cap and add oil to bring the level to the upper mark on the dipstick. The amount of oil needed to bring the level from the low to the high mark is approximately 1.42 litres (2-1/2 pints). Pause periodically during filling and check the oil level with the dipstick. Do NOT fill above the upper mark on the dipstick. Close the filler cap.

71.7 Run the engine for 5 minutes at idling speed, stop the engine, check the oil lever and top-up if necessary.

71.8 After filling, ensure that the filler cap is securely closed and remove all traces of oil from the filler neck and cap to avoid attracting dirt.

71.9 Close and secure the access door.

To change the engine oil

72 To change the engine oil, proceed as follows:

72.1 This servicing task should be carried out when the oil is hot after the engine has been running. If the oil is cold, run the engine until the correct operating temperature is reached.

72.2 Position the vehicle on firm level ground. Stop the engine.

72.3 Open and secure the engine compartment access door (Fig 3 (18)) and the lower access panel (11).

72.4 Attach a flexible hose to the sump pump threaded outlet connection (Fig 14 (3)). Operate handle of the sump pump (2) and pump out the oil into suitable containers.

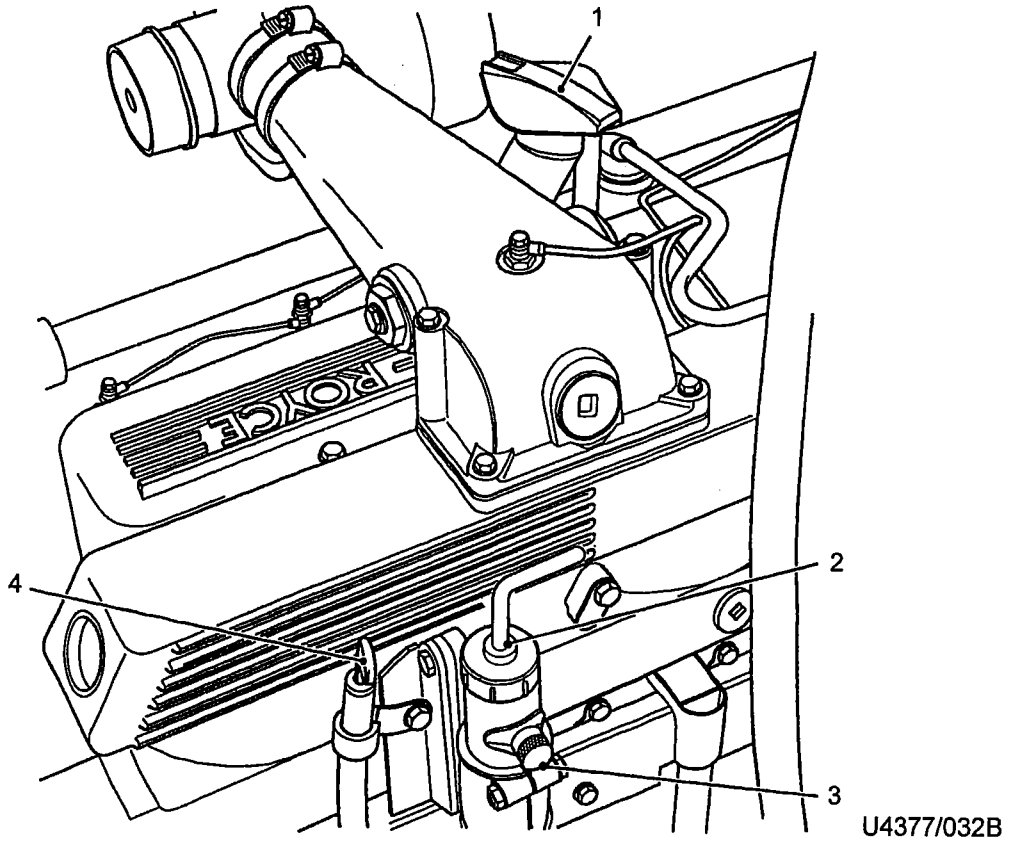
72.5 When as much oil as possible has been pumped out, remove the flexible hose from the pump connection.

72.6 Change the oil filter elements. Refill the system via the oil filler cap (1). Refer to the Cat 601 for the correct grade and quantity of oil.

72.7 Run the engine until the correct operating temperature is reached. Check that the oil pressure gauge readings are steady at the correct figure.

72.8 Stop the engine, check for leaks, check oil level and top-up if necessary.

72.9 Close and secure access door and panel.



1	Oil filler cap	3	Outlet connection
2	Sump pump	4	Dipstick

Fig 14 Oil filler, dipstick and sump pump

To change the filter elements

73 To change the filter elements, proceed as follows:

73.1 Slacken the filter bowl retaining nut (Fig 15 (2)). Hold the filter bowl (8) with one hand and remove the retaining nut and washer (1). Carefully lower the bowl from the header/bracket (3).

73.2 Pour off the oil from the bowl and discard the filter element (4) and sealing ring (11).

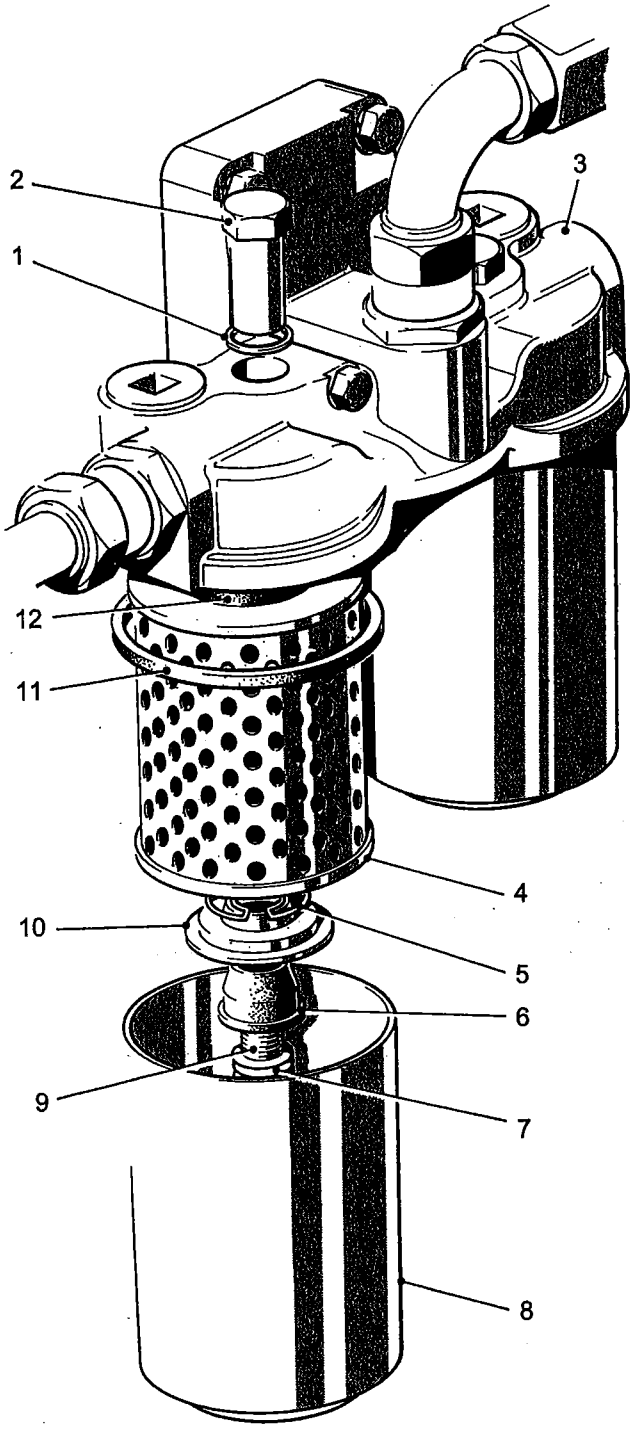
73.3 Clean the filter bowl internally and externally. Inspect for cracks or damage.

73.4 Replace internal fittings and fit a new element and sealing ring. Ensure that the sealing ring is correctly located in its groove and the new element has been primed with fresh oil.

73.5 Locate the filter bowl on the header/bracket, replace the retaining nut and washer. Tighten the retaining nut, taking care to avoid over tightening.

73.6 Repeat operations in Paras 73.1 to 73.5 for the other filter elements.

73.7 Run the engine and carry out checks as detailed in Paras 72.7 and 72.8 paying particular attention to detecting any leakage from the filter bowls.



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1	Washer	7	Spring
2	Nut	8	Filter bowl
3	Header/bracket	9	Centre stud
4	Element	10	Support plate
5	Spring clip	11	Top sealing ring
6	Base seal	12	Seal

Fig 15 Engine oil filter

To test the warning light lamps

74 To test the warning light lamps, proceed as follows:

74.1 Set the battery master switch to ON.

74.2 The low oil pressure warning light (Fig 16 (18)), should illuminate, indicating that there is no oil pressure.

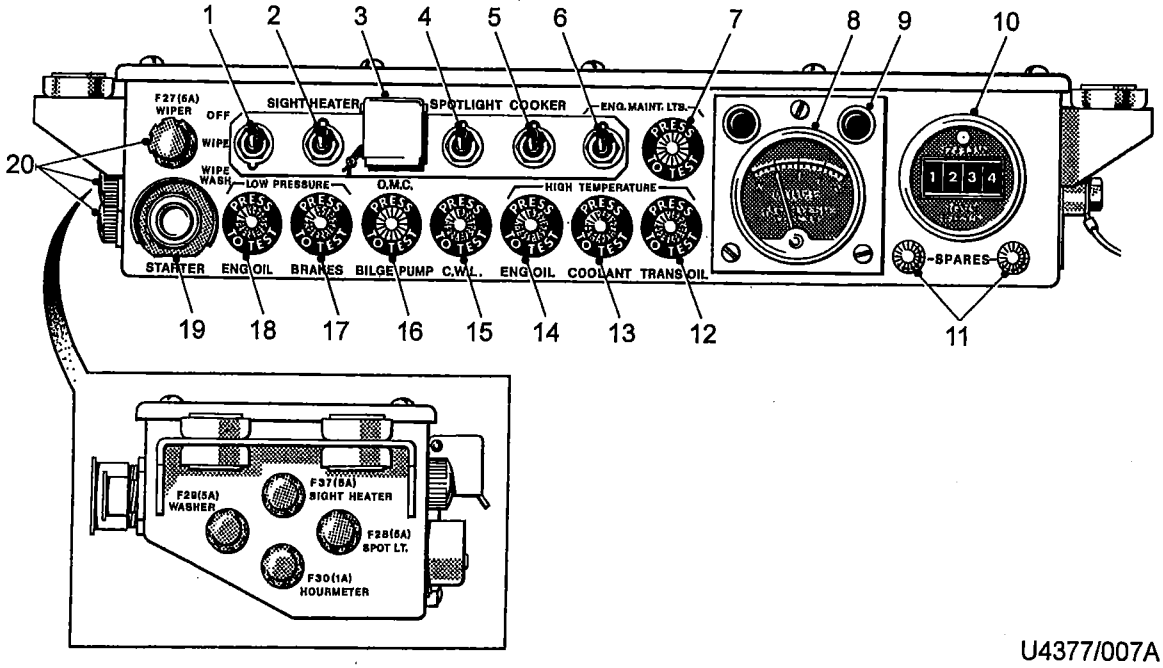
74.3 Press the lens of the oil temperature warning light (14), it should illuminate.

74.4 Start the engine and the low oil pressure warning light will extinguish. Press the lens of the low oil pressure warning light and it should illuminate.

74.5 If the lamps do not illuminate as described, stop the engine and check the lamps and fuses. For details of fuse rating and location - refer to Chap 2-7 (Electrical Equipment).

NOTE

Continued failure of the oil system warning lights must be reported to REME.



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1	Wipe/wash switch	11	Spare warning light lenses
2	Sight heater switch	12	Transmission oil temperature warning light
3	Override master control switch	13	Coolant temperature warning light
4	Spotlight switch	14	Engine oil temperature warning light
5	Cooker switch	15	Central warning light
6	Engine maintenance light switch	16	Bilge pump warning light
7	Maintenance light warning light	17	Brake low pressure warning light
8	Ammeter	18	Engine low oil pressure warning light
9	Panel lights (2 positions)	19	Starter button
10	Hourmeter	20	Fuses: F27, F28, F29, F30 and F37

Fig 16 Operator's instrument panel

Engine cooling system

75 During routine maintenance, and as detailed in the Cat 601, the following checks should be made:

75.1 Ensure that the radiator air intake louvres and matrices are clean and free from debris.

75.2 Check for coolant leaks, particularly from the hoses and radiator trunnion block glands.

75.3 Check visually the condition of hoses, clips and coolant pump belts. If the pump belts are excessively slack or damaged - report to REME.

75.4 Check the fan hydraulic motors for oil leaks. If oil stains appear on the matrix of either radiator, it may indicate an oil leak from a fan motor. Any such leaks must be reported to REME.

To check the coolant level

WARNINGS

(1) PERSONNEL INJURY. DO NOT REMOVE THE HEADER TANK FILLER CAP BEFORE TEMPERATURE HAS FALLEN BELOW 93 DEGREES C (200 DEGREES F).

(2) PERSONNEL INJURY. AL 39 IS BOTH TOXIC AND HAZARDOUS - REFER TO LOCAL UNIT PRECAUTIONS AND CURRENT DCIs FOR FULL SAFETY PROCEDURES. MINIMUM PRECAUTION AFTER USE IS TO WASH THE EFFECTED SKIN AREAS WITH SOAP AND WATER.

76 As the system is sealed and will become pressurized, the filler cap should not be removed when the engine is hot or even warm, if it can be avoided.

77 Access to the header tank filler is via the oval cover plate (Fig 17 (1)). To check the coolant level, proceed as follows:

77.1 Slacken the cover plate securing nuts (8), swing the cover plate on one side.

77.2 Carefully remove the filler cap (2).

77.3 When the system is filled correctly, the level of the coolant will be just below the edge of the filler opening.

77.4 If the level is correct, replace the filler cap and close and secure the cover.

To fill or top-up the system

78 To fill or top-up the system, proceed as follows:

78.1 Open the filler access cover plate as detailed in Para 77.1.

78.2 Remove the filler cap.

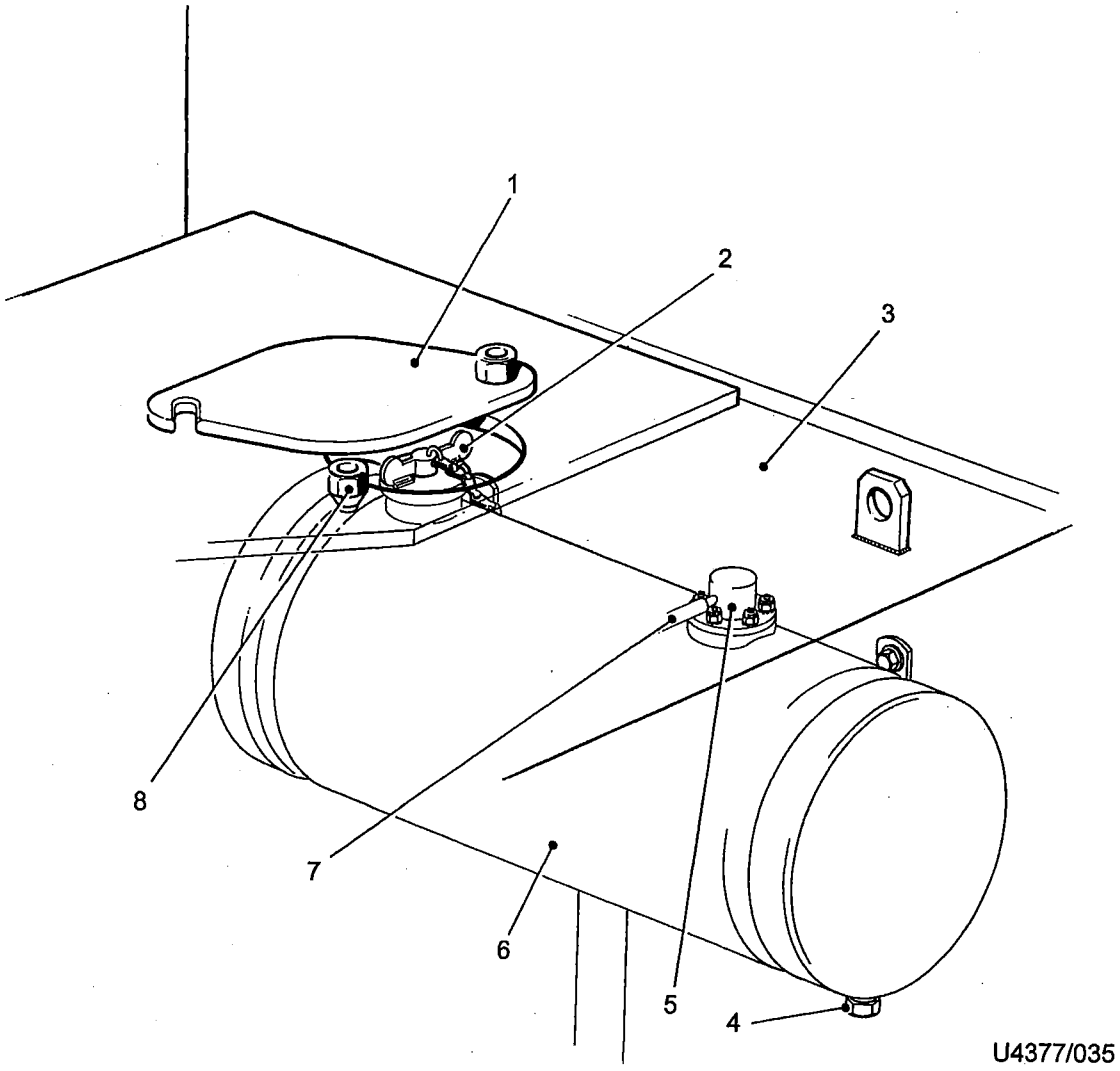
78.3 Check the coolant level in the header tank. If the coolant is cold, top-up with an AL 39 and water mix until the level is just below the filler hole.

78.4 If the system has been drained, or if the coolant level has dropped below the bottom of the header tank, the system must be filled and bled as detailed in Para 81.

78.5 Replace the filler cap, close and secure the access cover plate.

78.6 Run the engine until the coolant temperature reaches not more than 50 degrees C (122 degrees F) as shown in the driver's instrument panel. Stop the engine and carefully remove the filler cap and re-check the level. Top-up as necessary.

78.7 Replace the filler cap, close and secure the access cover.



1	Cover plate	5	Relief valve housing
2	Filler cap	6	Header tank
3	Roof plate	7	Overflow pipe
4	Drain plug	8	Cover plate securing nuts

Fig 17 Coolant filler and header tank

To lower a radiator

79 To lower a radiator, proceed as follows:

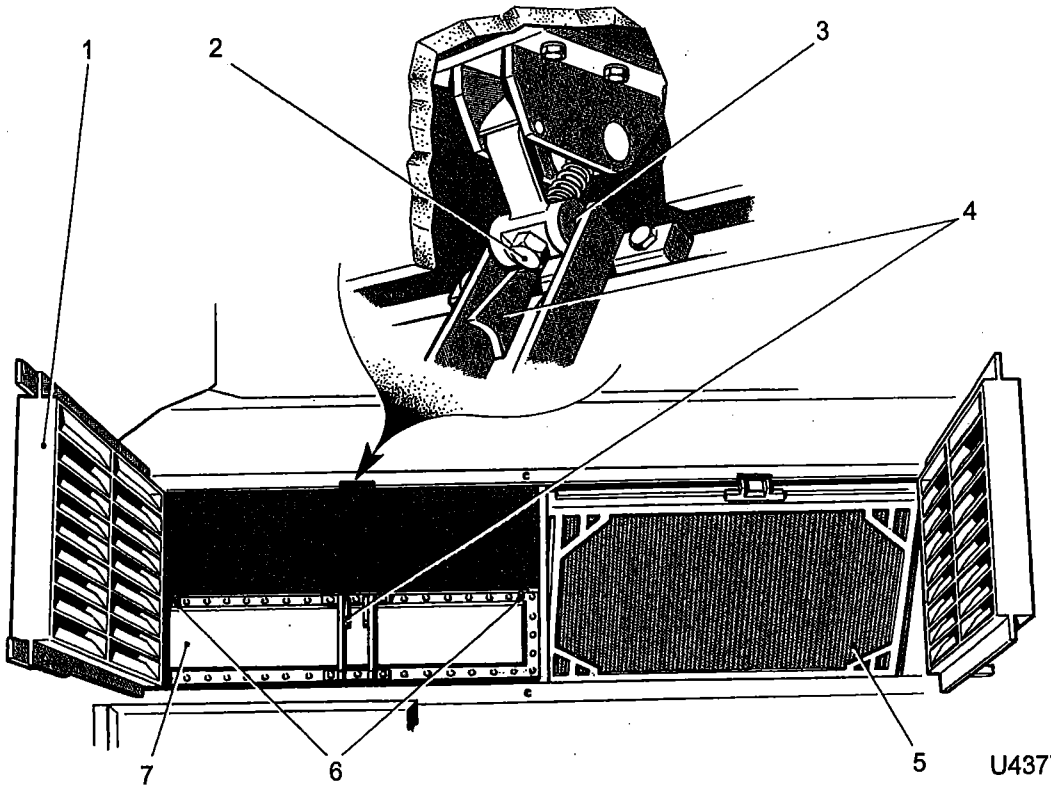
79.1 Remove the two securing bolts and open both radiator louvres (Fig 18 (1)).

79.2 Using a 19 mm socket and extension, slacken fully the radiator locking catch securing bolt (2). Remove all debris from the floor of the compartment.

79.3 Push the radiator firmly upwards and disengage the locking catch (3) from the radiator securing lugs (4), using a screwdriver or similar implement.

79.4 Lower the radiator carefully to the horizontal position.

79.5 Secure radiator louvres.



1 Radiator louvres
2 Securing bolt
3 Locking catch
4 Securing lugs
5 Radiator (in open position)
6 Bleed screws
7 Radiator (in lowered position)

Fig 18 Radiators

To raise a radiator

80 To raise a radiator, proceed as follows:

80.1 Lift the radiator upwards into its working position and engage the locking catch.

80.2 Ensure that the catch is fully engaged behind the radiator securing lugs, and tighten the securing bolt.

80.3 Close the louvres, replace and tighten the securing bolts.

To bleed the coolant system

81 To bleed the coolant system, proceed as follows.

81.1 Lower both radiators to the horizontal position as detailed in Para 79.

81.2 Fill the system via the header tank filler until the header tank is full. Fill slowly giving the coolant time to circulate.

81.3 Slacken the radiator bleed screws (Fig 18 (6)) and allow the coolant to flow until the stream of liquid is completely free of air bubbles.

NOTE

It is essential to ensure that the header tank is kept full during the bleeding operation. If the level is allowed to fall below the bottom of the header tank, air may be drawn into the system.

81.4 Tighten the bleed screws.

81.5 Raise and secure the radiators as detailed in Para 80.

To drain the coolant

82 To drain the coolant, proceed as follows:

82.1 Position the vehicle on firm level ground.

82.2 Run the engine until a coolant temperature of not more than 50 degrees C (122 degrees F) has been attained, this should be sufficient to open the thermostat to afford improved draining. Stop the engine and set the battery master switch to OFF.

82.3 Open the coolant filler access cover plate (Fig 17 (1)), and remove the filler cap (2).

82.4 Open and secure the engine compartment lower access panel (Fig 3 (11)).

82.5 Remove the drain hose (Fig 19 (2)) from its retaining spring clip (3) on the engine compartment rear bulkhead. Position the hose so that the drain plug (5) is outside the vehicle.

82.6 Place a suitable container beneath the hose and remove the drain plug. Some care will be necessary in order to remove the drain plug without damage to the hose. Two spanners must be used, to hold the adaptor (4) and unscrew the drain plug (5). Allow the system to drain fully.

NOTES

(1) Draining may be assisted by opening the bleed screws on both radiators and supporting the radiators as near to their operating position as possible.

(2) Complete draining of the coolant system is not possible by normal means. When the amount of fluid drained is compared with the system total capacity some discrepancy is inevitable.

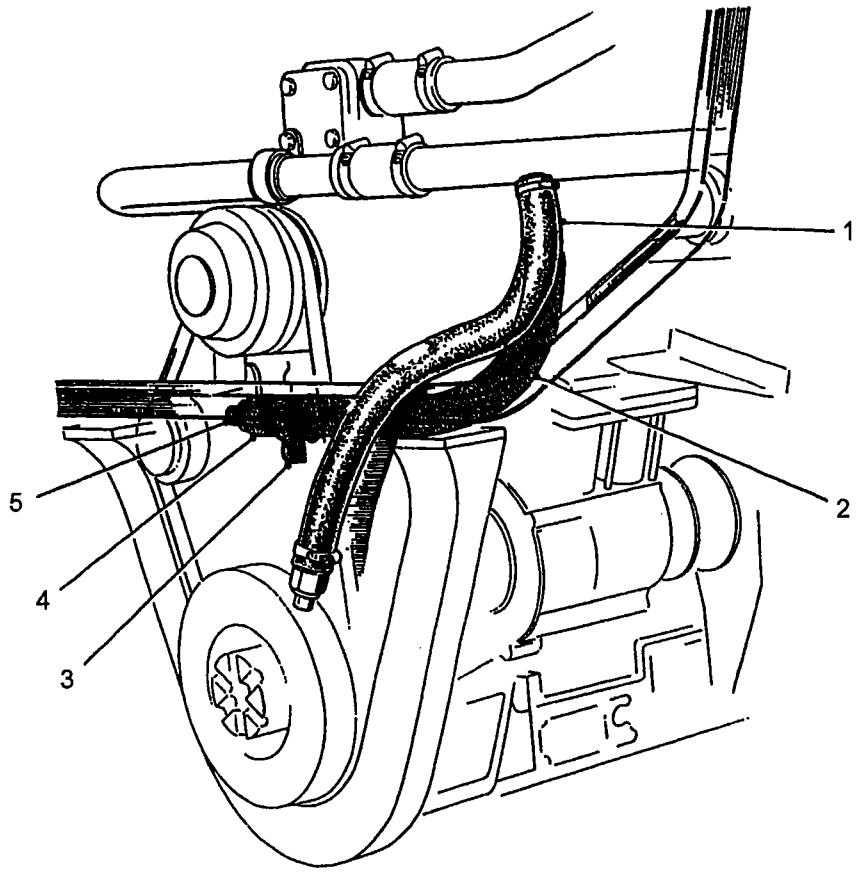
82.7 Replace and tighten the drain plug. Return the drain hose to its stowed position in the spring clip (3). Tighten radiator bleed screws, secure radiators, close and secure lower access panel.

To check and top-up the fan pack oil level

83 To check and top-up the fan pack oil level, proceed as follows:

83.1 Open the transmission compartment upper access panel (Fig 3 (27)).

83.2 Remove the dipstick (Fig 20 (1)), wipe it clean and re-insert it in the dipstick tube.



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1 Drain hose (draining position)
2 Drain hose (stowed position)
3 Spring clip
4 Adaptor
5 Drain plug

Fig 19 Coolant drain hose

83.3 Withdraw the dipstick and observe the oil level. The level should be between the upper and lower marks on the dipsticks.

83.4 If the level is low, clean the area around the filler cap (2). Open the filler cap and add oil of the correct grade (refer to Cat 601) to bring the level to the upper mark on the dipstick. Do not overfill. Close the filler cap.

83.5 Close and secure the access panel.

To test the warning light lamps

84 To test the warning light lamps, proceed as follows:

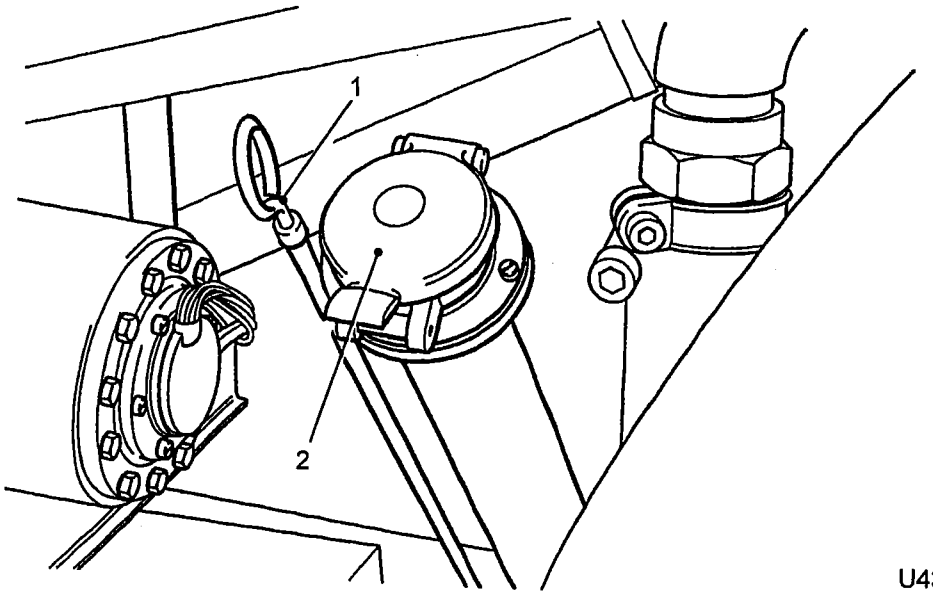
84.1 Set the battery master switch to ON.

84.2 Press to test the lens of each coolant system warning light, the lamps should illuminate.

84.3 If the lamps do not illuminate, check the lamps and fuses. For details of fuse rating and location refer to Chap 2-7 (Electrical Equipment).

NOTE

Continued failure of any coolant system warning light must be reported to REME.



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1 Dipstick
2 Filler cap

Fig 20 Fan pack filler and dipstick

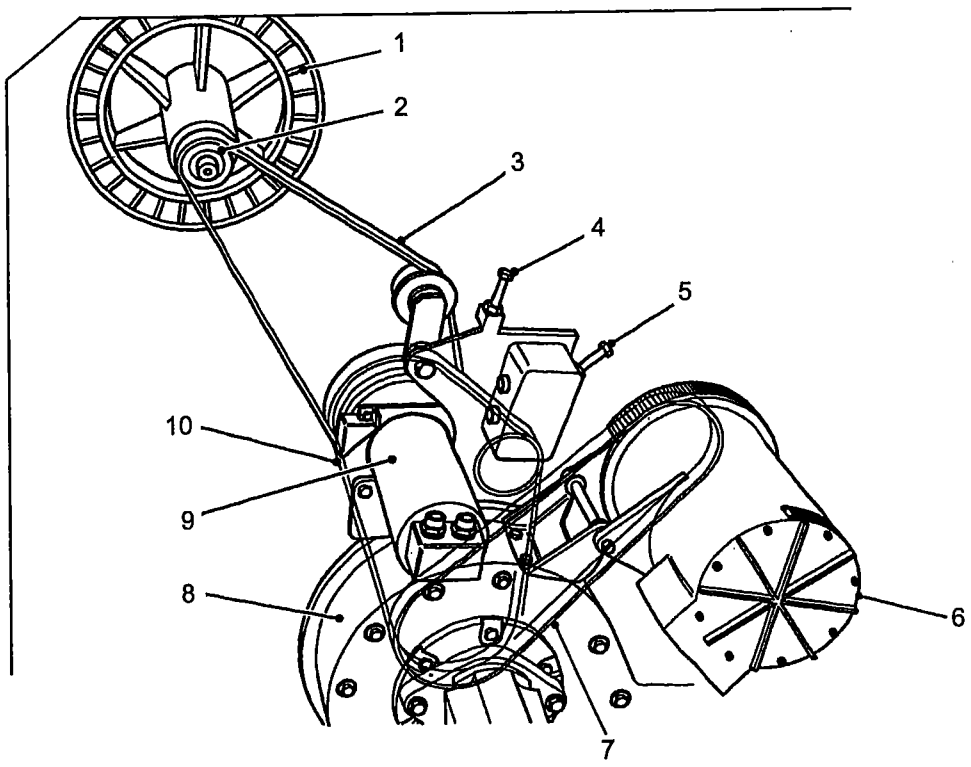
Engine and transmission compartment ventilation

85 The engine and transmission compartments are ventilated by a fan (Fig 21 (1)) located in the transmission compartment. The fan drive belt (3) can be accessed via the transmission compartment upper access panel (Fig 3 (27)).

86 Inspect the ventilation fan drive belt (Fig 21 (3)) for tension, cracks or any other damage. The correct tension of the drive belt should be 12 mm (1/2 in.) deflection at the mid point of the longest belt run. If the belt is unduly slack or damaged report to REME.

NOTE

Under no circumstances should the engine be run for long periods with the transmission and engine compartment access panels and doors open, as this will disrupt the internal airflow within the hull.



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1	Ventilation fan	6	Generator
2	Ventilation fan pulley	7	Generator drive belt
3	Ventilation fan drive belt	8	Transfer gearbox
4	Ventilation fan belt adjuster	9	Compressor
5	Compressor drive belt adjuster	10	Compressor drive belt

Fig 21 Generator and ventilation fan drive belts

CHAPTER 2-3

AIR INTAKE AND FUEL SYSTEM

CONTENTS

AIR INTAKE

General description

1 Air necessary for both engine operation and ventilation of the engine compartment and the ACU matrix is drawn through an armoured air intake cowl (Fig 1 (3)) on the engine compartment roof plate. The air for engine operation passes through a two-stage dry type air cleaner (Fig 2) and is then ducted to the turbocharger intake.

Air cleaner

2 The air cleaner contains cyclone vanes (9), in the lower position, which impart a swirling motion to the incoming air. The motion causes the larger particles of dust in the air to strike the walls of the cyclone tubes (10) and fall into the dust chamber (11). Any dust remaining in the air is removed by a replaceable element (15) contained in the upper portion of the cleaner body.

3 Dust falling into the air cleaner dust chamber passes through a rubber dust valve (12) into the engine compartment, to be dispersed by the ventilation air flow. The dust valve allows the dust to pass, by the action of gravity but will not allow air to be drawn in.

Air cleaner restriction indicator

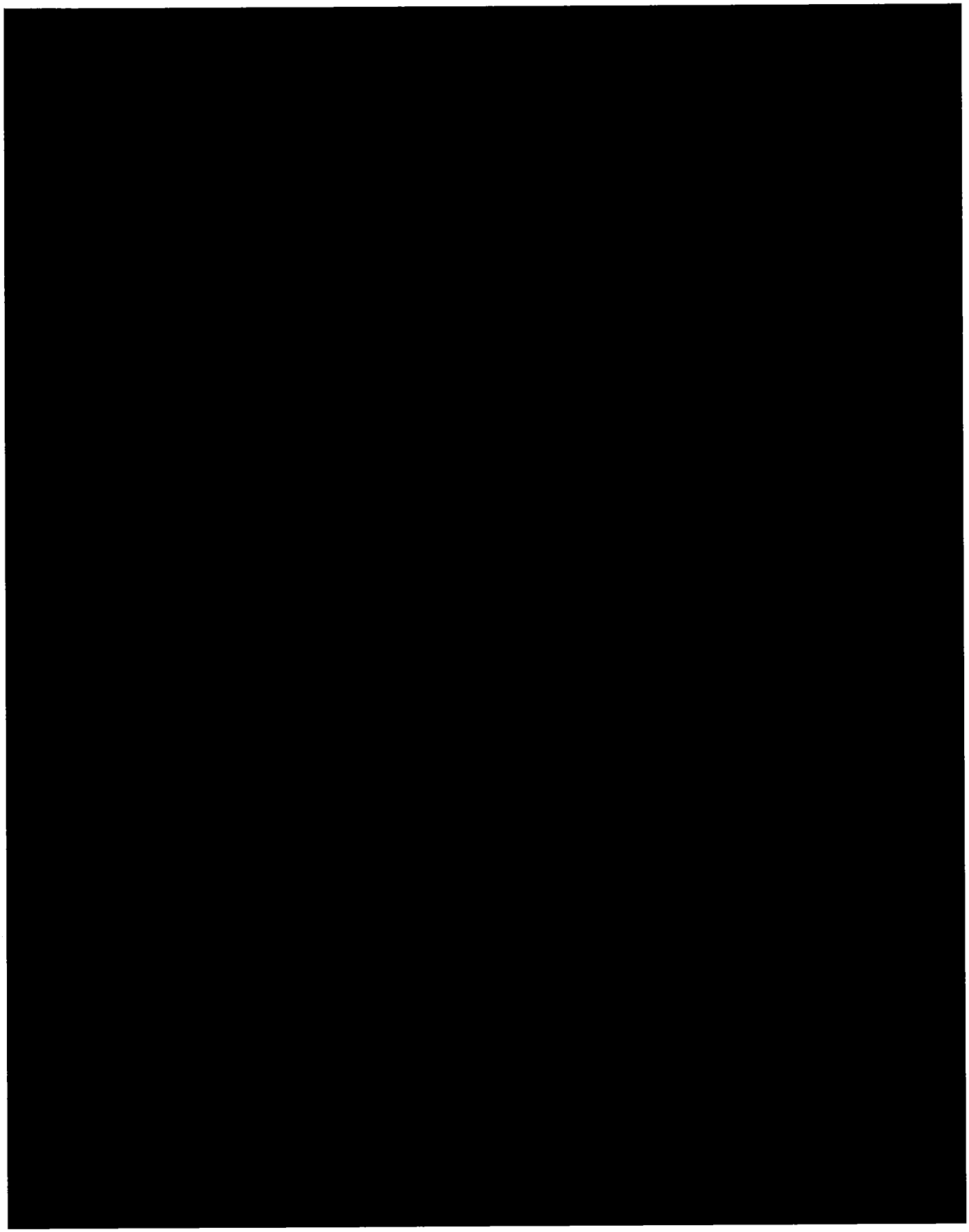
4 A restriction indicator (Fig 3) located on the crew compartment inner wall, adjacent to the driver's right side, gives a visual indication of the state of cleanliness of the filter element.

5 When the element is in good condition the transparent window (1) of the indicator will remain clear. If the element becomes clogged, a red signal will appear in the window.

6 To reset the indicator, press the reset button (2) in the base of the unit.

KEY TO FIG 1

1 Front stowage bins
2 Winch
3 Air intake cowl
4 Access panel
5 Access cover plates
6 Stowage basket
7 Stowage box
8 Rear stowage bin
9 Bilge pump outlet (rear)
10 Engine compartment roof plate
11 Engine compartment lower access panel
12 Drain plug
13 Emergency exit door
[redacted]
15 Exhaust cowl
16 Fairlead
17 Smoke grenade stowage box
18 Engine compartment access door
19 Operator's access hatch
20 Driver's access hatch
21 Python aperture cover plate
22 NBC air intake cowl
23 Stowage compartment door
24 Transmission compartment access panel
25 General service tow hook
26 Fire extinguisher operating handles
27 Transmission compartment upper access panel
28 Bilge pump outlet (front)
29 Smoke discharger mounting
30 Fuel filler access cover
31 Radiator intake louvres
32 Radiator outlet louvres



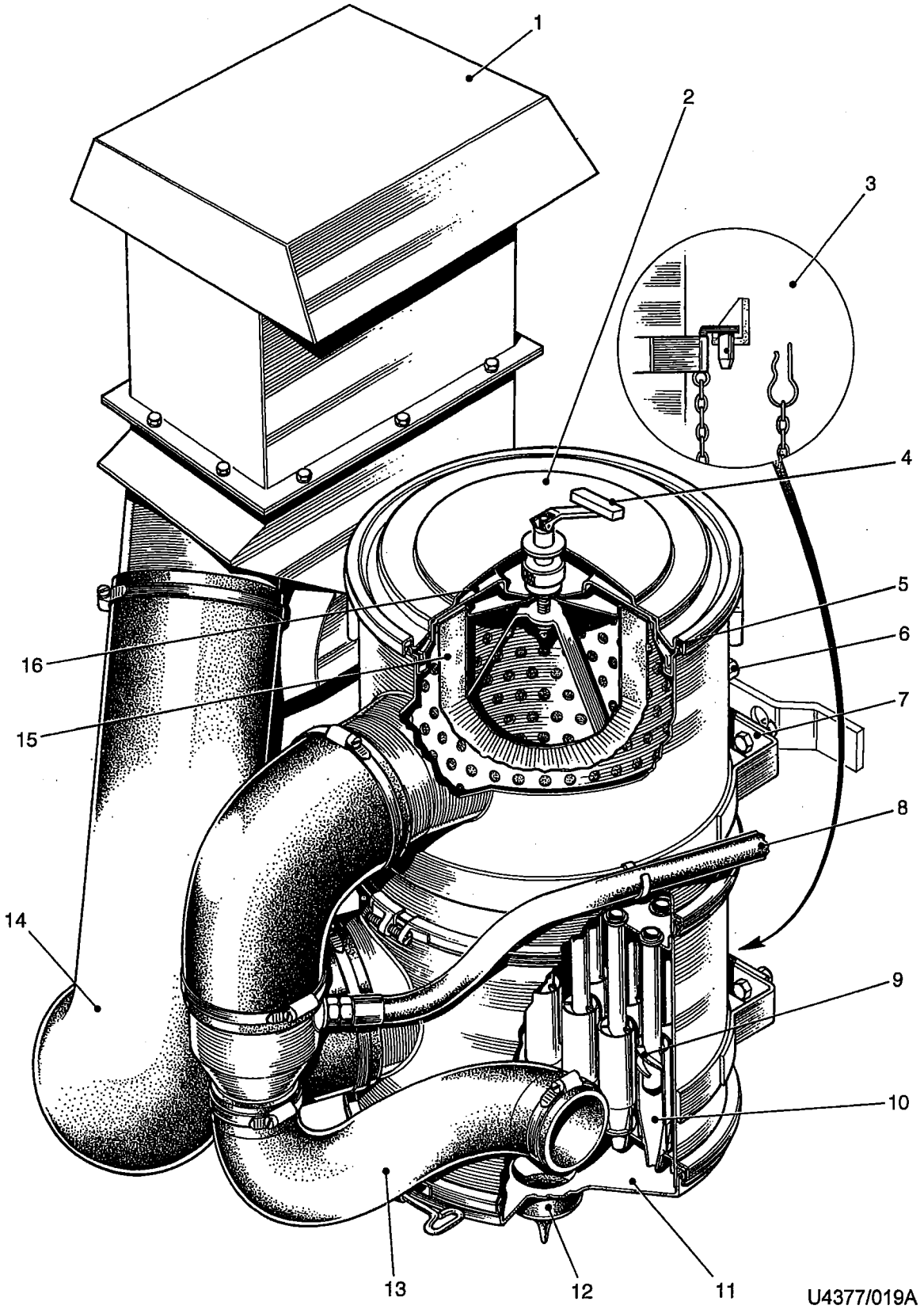
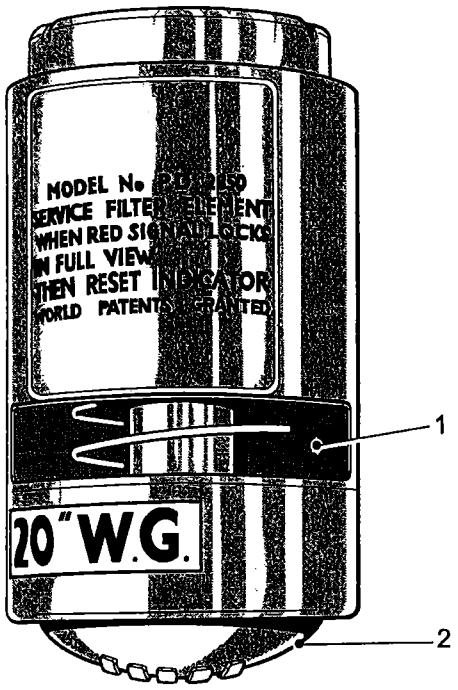


Fig 2 Engine air cleaner

KEY TO FIG 2

1 Intake cowl
2 Outer cover
3 Air cleaner retaining pin and clip
4 Clamping lever
5 Gasket
6 Restriction indicator connection
7 Upper mounting bracket
8 Air compressor clean air connection
9 Cyclone vanes
10 Cyclone tubes
11 Dust chamber
12 Dust valve
13 Clean air to turbocharger
14 Air intake
15 Element
16 Inner cover



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1 Window
2 Reset button

Fig 3 Air cleaner restriction indicator

Maintenance

General

7 Access to the air cleaner is by means of an access panel (Fig 1 (4)) bolted to the engine compartment roof plate (10).

8 Servicing includes visual inspection of hoses for cracks or damage and ensuring that all connections are tight and in good condition. When completing servicing tasks on the air cleaner, check that the dust valve (Fig 2 (12)) is in place and has not been damaged.

To remove the air filter element

9 To remove the air filter element, proceed as follows:

9.1 Remove any dust or dirt from the exterior of the air cleaner, unscrew the clamping lever (4) and remove the outlet cover (2) with its gasket (5).

9.2 Carefully withdraw the inner cover (16) and filter element (15). Care should be taken to prevent dust falling into the air cleaner body.

9.3 If the element is to be renewed, the inner cover and gasket must be removed. The inner cover is easily removed from the element at temperatures above 16 degrees C (60 degrees F). The cover must NOT be prised off.

9.4 If the element is only to be cleaned it is not necessary to remove it from the inner cover.

To clean the air filter element

10 To clean the air filter element, proceed as follows:

10.1 Apply dry, clean compressed air NOT exceeding 7 kg/cm^2 (100 $lbf/in.^2$) up and down the pleats on the outside to remove as much dust as possible.

10.2 Soak the element in detergent solution at approximately 50 degrees C (120 degrees F) for at least 10 minutes. Gently agitate the element to flush out dirt.

10.3 Rinse the element in clean water and allow to dry. Do not dry in an oven; a fan or air draught may be used.

10.4 Inspect the element for damage by placing a bright light inside the element and looking for light showing through any holes. Pin holes or the slightest rupture will render the element unfit for use.

NOTE

IMPORTANT: The element must be renewed after a maximum of six cleanings.

To replace the air filter element

11 To replace the air filter element, proceed as follows:

11.1 Reassemble the element and inner cover.

11.2 Lower the inner cover and element into position in the body of the air cleaner.

11.3 Replace the outer cover, ensuring that the gasket (5) is in place and in good condition. Screw in the clamping lever until the cover is secure on the air cleaner.

11.4 Reset the restriction indicator (Fig 3) by pushing in the reset button (2).

NOTE

If after cleaning the air filter element, the restriction indicator still shows red - report to REME.

FUEL SYSTEM

General description

12 Fuel for the engine fuel system (Fig 4) is supplied from two main tanks, located within the hull, which have a total usable fuel capacity of 436 litres (96 gallons). Both tanks are connected in normal operation to a collector tank located near the hull floor. The main filler is on the glacis plate, protected by a hinged access cover (Fig 1 (30)) and enables both tanks to be filled via No. 1 fuel tank (Fig 4 (1)). An emergency filler is provided in the No. 2 fuel tank (12) for use if No. 1 fuel tank is damaged.

13 To enable a damaged fuel tank to be isolated, or to assist with maintenance tasks, a four position isolating valve (15) is provided, which will allow any combination of tanks to be used.

14 The fuel supply to the engine is drawn from the collector tank (18) by an electrically driven fuel pump (6), via a primary suction filter (13). The pump delivers fuel to the main fuel filter (10) mounted on the engine and then to the fuel injection pump.

15 A pressure relief valve, integral with the engine fuel filter, ensures that delivery pressure to the fuel injection pump does not exceed a predetermined value. Any return flow (spill) from the relief valve passes into the No. 1 fuel tank during normal running. If either No. 1 or 2 fuel tank is damaged the fuel spill can be returned to the undamaged tank by operating the fuel spill isolating valve (8).

16 To vent liquid away from the filler neck a bung is located in the tubular surround, also an earth connection point (2) is located in front of the filler assembly.

Fuel fillers

17 The main fuel filler on the glacis plate is designed to enable the tanks to be filled by means of a hose, or from jerry cans. The filler cap, located beneath the armoured filler access cover (Fig 4 (3)), is of the quick release toggle action type. To prevent the entry of large particles of dirt into the fuel tanks, a gauze strainer is fitted inside the filler neck. With the filler cap (4) open the strainer may be lifted out for cleaning.

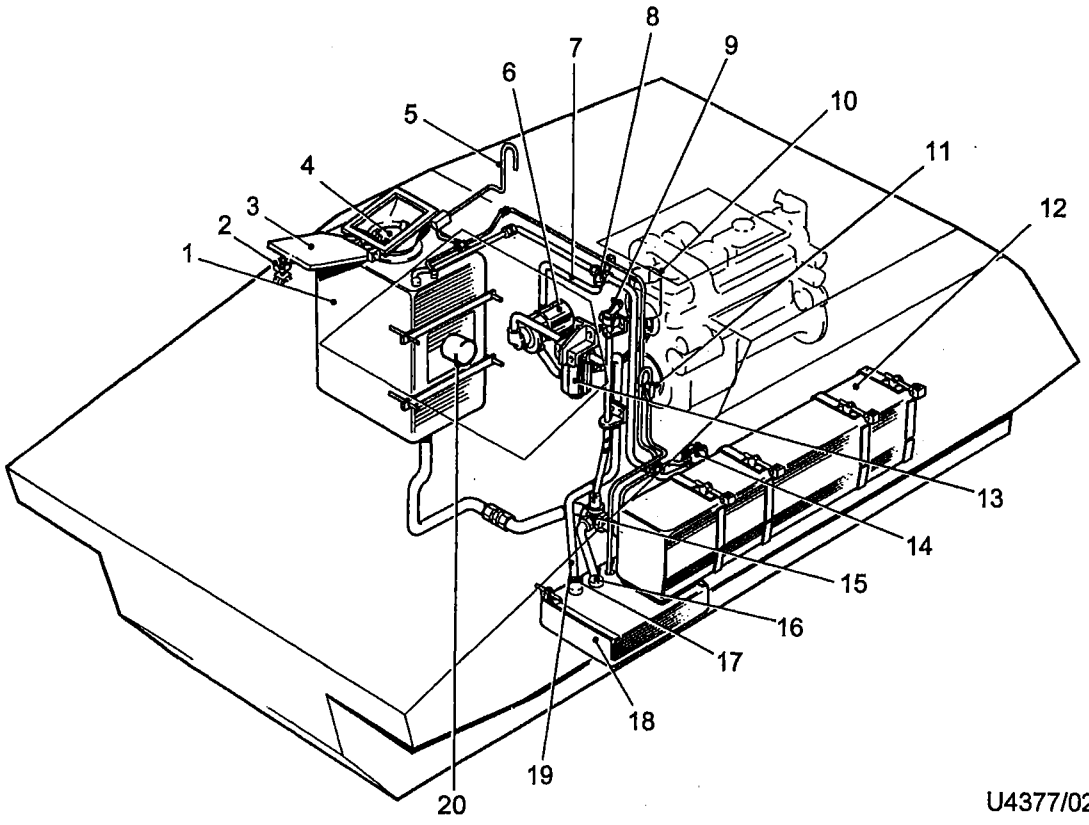
18 An emergency filler (14) is provided in the No. 2 fuel tank (12) for use if the No. 1 fuel tank (1) is out of use due to damage. The filler is located low in the front left corner of the engine compartment. The cap for this filler is a threaded female type, with an internal sealing ring, and must be kept firmly tightened and locked with wire. A strainer of the 'lift out' type is provided in the filler neck.

Fuel tanks

19 The No. 1 fuel tank (Fig 4 (1)) is located on the right side of the hull in the transmission compartment. The top surface of the tank carries the main fuel filler. A fuel gauge sender unit (20) is fitted in the innermost side plate and a drain plug on the bottom edge.

20 The No. 2 fuel tank (12) is mounted on the left side of the hull beneath the crew compartment, extending into both the engine and transmission compartments. The emergency filler (14) is located on the top corner of the tank in the engine compartment. Beneath the filler tube is a fuel gauge sender unit and on the bottom edge, a drain plug.

21 The collector tank (18) is located in the transmission compartment beneath the No. 2 fuel tank. All fuel for the engine fuel system is drawn from this tank, which is interconnected to both main fuel tanks via the fuel tank isolating valve (15). Fuel for the engine is taken from a level half way up the collecter tank to allow any water and sediment to accumulate in the bottom. A drain valve (11) is provided on the bulkhead, with a suitable siphon pipe, to enable any such deposits to be periodically drained.



1	No. 1 fuel tank	11	Water/sediment drain valve and siphon pipe
2	Earth connection point	12	No. 2 fuel tank
3	Filler access cover	13	Primary suction filter
4	Filler cap	14	Emergency filler
5	Vent pipe outlet	15	Fuel tank isolating valve
6	Electric fuel pump	16	Inlet connection to collector tank
7	Spill pipe, from engine	17	Non-return valve
8	Fuel spill isolating valve	18	Collector tank
9	Fuel tank isolating valve, operating lever	19	Fuel supply to electric fuel pump
10	Main fuel filter	20	No. 1 fuel tank sender unit

Fig 4 Layout of fuel system

22 All three tanks are connected by a vent pipe, to assist with tank 'breathing' during fuel transfer. The pipe has no valves and has an outlet (5) to atmosphere on the exterior of the hull, adjacent to the engine cooling louvres.

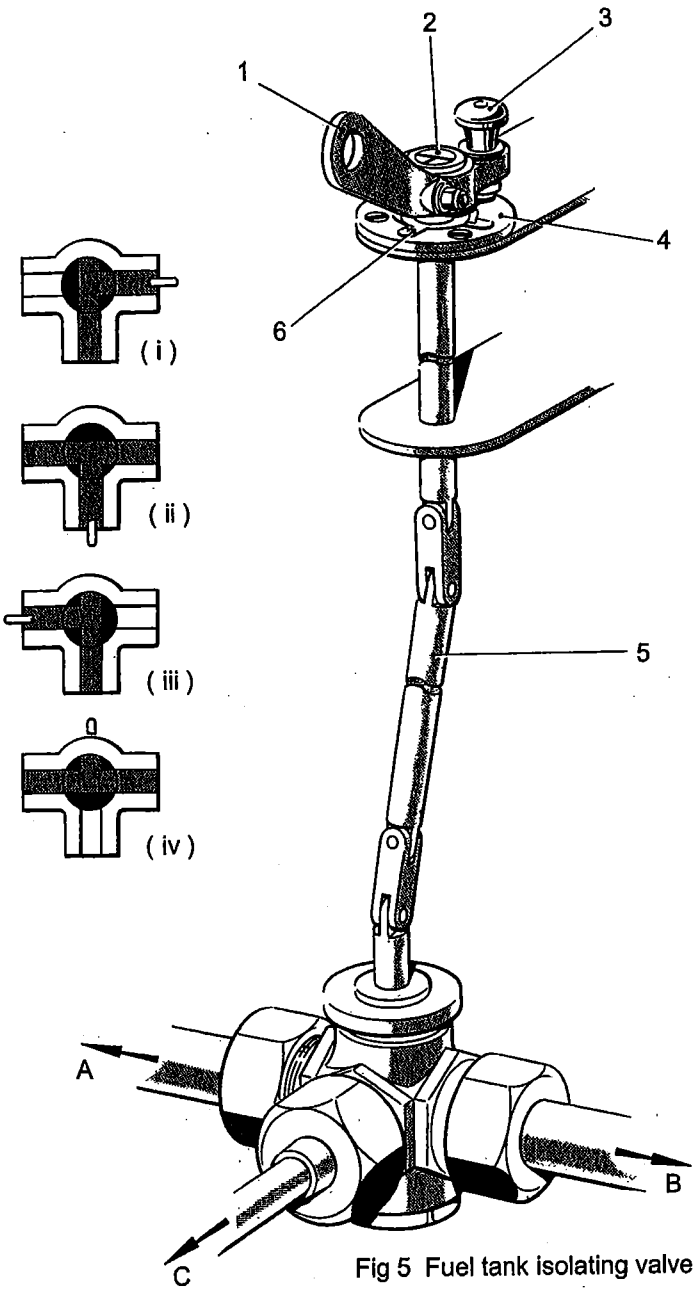
NOTE

Fuel starvation may only occur when the fuel tanks are no more than one-third full under the following conditions:

(1) Prolonged operations on steep gradients (both up and down).

(2) When dozing deep slots when the entrance slot becomes steep.

(3) When travelling along a transverse slope for a prolonged period.



1 Lever
2 Flow identification marking
3 Plunger
4 Index plate
5 Operating shaft
6 Locating slots

A Flow to No. 1 fuel tank
B Flow to No. 2 fuel tank
C Flow to collector tank

(i) No. 1 fuel tank isolated
(ii) Flow to all tanks
(iii) No. 2 fuel tank isolated
(iv) Collector tank isolated

Fig 5 Fuel tank isolating valve

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Fuel tank isolating valve

23 The fuel tank isolating valve (Fig 4 (15)) is a four position valve located low in the transmission compartment adjacent to the collector tank. The valve is operated remotely by a lever (Fig 5 (1)), on the transmission/engine compartment bulkhead, which is accessible with the transmission compartment upper access panel open (Fig 1 (27)).

24 A marking (Fig 5 (2)) on the valve lever indicates the valve flow pattern and (Fig 5 (i), (ii), (iii) and (iv) shows the operating positions. Any single tank may be isolated as required by selecting the correct valve position.

25 To change the position of the valve, the plunger (3) is lifted, the lever turned to the desired position and the plunger released. Ensure that the correct locating slot (6) is fully engaged by the plunger.

NOTE

For normal operation of the vehicle and filling of the fuel tanks, the 'flow to all tanks' (Fig 5 (ii)) position must be used.

Fuel pump

26 An electrically driven fuel pump (Fig 4 (6)) is located on the bulkhead between the engine and transmission compartments. The pump is the sole means of supplying fuel to the fuel injection pump. Fuel is drawn from the collecting tank via a primary suction filter (13). A non-return valve in the collecting tank pipe connection prevents fuel running back into the tank when the pump is switched off. A small gauze strainer is fitted within the valve assembly.

27 The fuel pump is controlled by a switch (Fig 8 (4)), identified FUEL PUMP on the driver's instrument panel. The circuit is protected by a fuse, for location and rating, refer to Chap 2-7 (Electrical Equipment).

Primary fuel filter

28 The primary suction filter (Fig 4 (13)) is located in the transmission compartment on the bulkhead adjacent to the electric fuel pump (6). All fuel drawn from the collector tank passes through the filter before entering the pump.

29 The filter has a detachable bowl, enclosing a wire wound element. The element is removed for cleaning during routine servicing. Should the filter element become completely clogged, a by-pass valve in the filter header will open allowing fuel to by-pass the element.

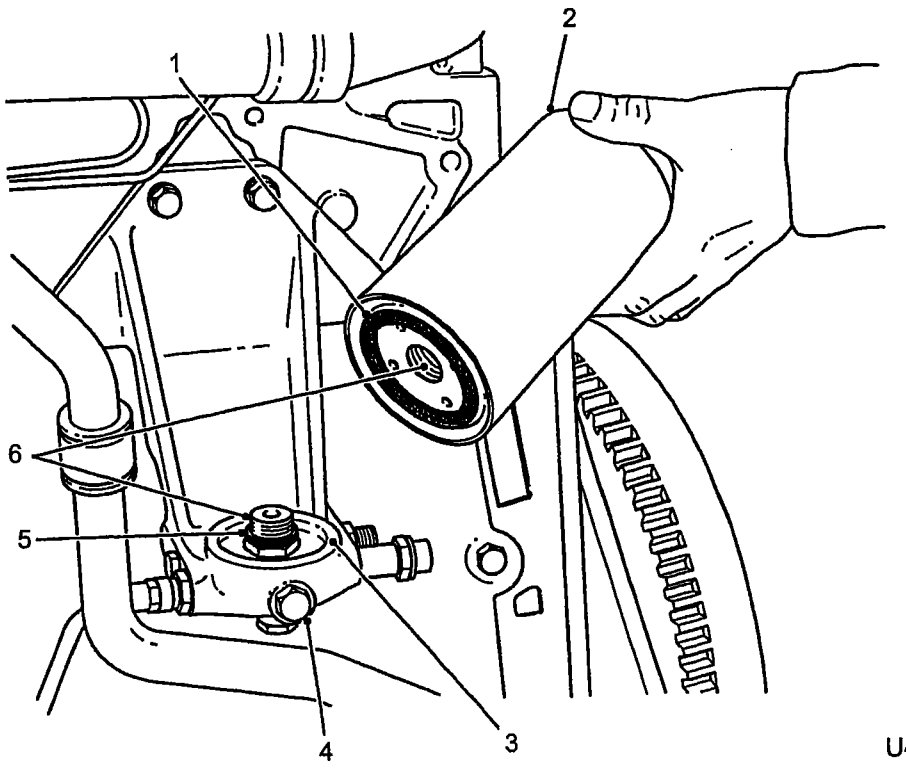
Main fuel filter

30 The main fuel filter (Fig 4 (10)) is an expendable 'screw-on' canister, carried on a header bracket which is bolted to the right side of the engine. All fuel supplied to the fuel injection pump passes through the filter.

31 Screwed into the filter header bracket (Fig 6 (3)) is a pressure relief valve, drain plug (4) and the engine spill return connection. The pressure relief valve maintains fuel feed pressure to the fuel injection pump at a predetermined value. Surplus fuel from the relief valve and the spill connection is returned to the fuel tanks via the fuel spill isolating valve (Fig 4 (8)).

Fuel injection pump

32 The fuel injection pump (Fig 9 (1)) is an in-line multi plunger type unit, mounted on the right side of the engine, which delivers fuel to the injectors at high pressure. The pump is driven in tandem with the air compressor and embodies a mechanical governor. Lubrication of the unit is provided by oil fed from the engine lubrication system.



1	Seal (bonded to element)	4	Drain plug
2	Element	5	Seal
3	Header bracket	6	Locating threads

Fig 6 Main fuel filter

Fuel spill isolating valve

33 During normal running all fuel spill from the engine is returned to the No. 1 fuel tank. If this tank is damaged and out of use the fuel spill isolating valve (Fig 7) and (Fig 4 (8)) may be used to divert the flow to No. 2 fuel tank.

34 The valve is located on the engine compartment bulkhead and is accessible from the hinged access cover (Fig 1 (30)) in the roof plate. There are three positions which may be selected as shown in Fig 7. When the fuel tanks are being filled at a high flow rate it is an advantage to select the 'all tanks' mode (i) which will improve tank 'breathing'.

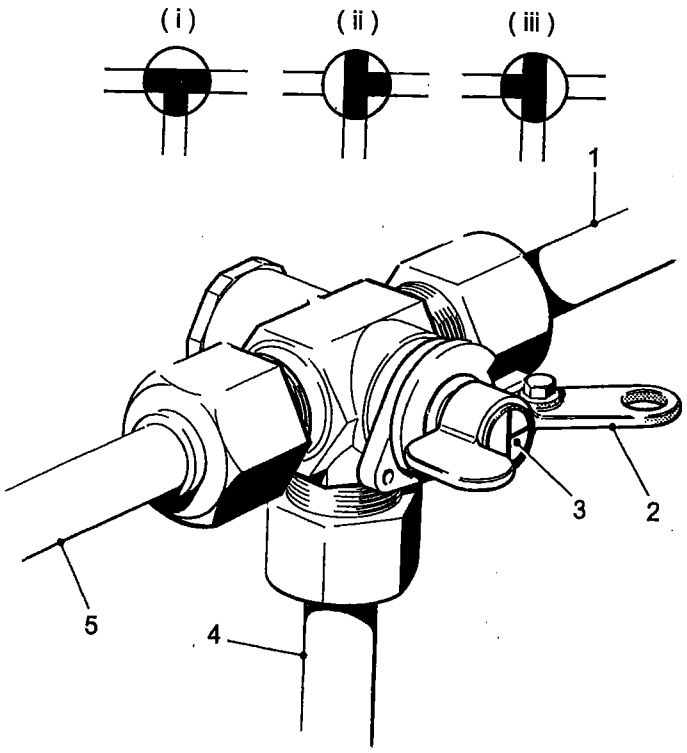
Controls and instruments

Fuel pump switch

35 A two position switch (Fig 8 (4)), identified FUEL PUMP, on the driver's instrument panel controls the operation of the fuel pump. When the switch is moved to the ON position, towards the driver, the fuel pump will operate. The battery master switch must also be ON.

NOTE

The fuel pump switch MUST be in the ON position before the engine is started. If the engine is run without the pump operating, it will be starved of fuel and it may be necessary to bleed the fuel system.



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1	Pipe to No. 1 fuel tank	(i)	Flow to 'all tanks'
2	Operating lever	(ii)	Flow to No. 1 fuel tank NORMAL
3	Flow identification marking	(iii)	Flow to No. 2 fuel tank
4	Pipe to engine fuel spill line		
5	Pipe to No. 2 fuel tank		

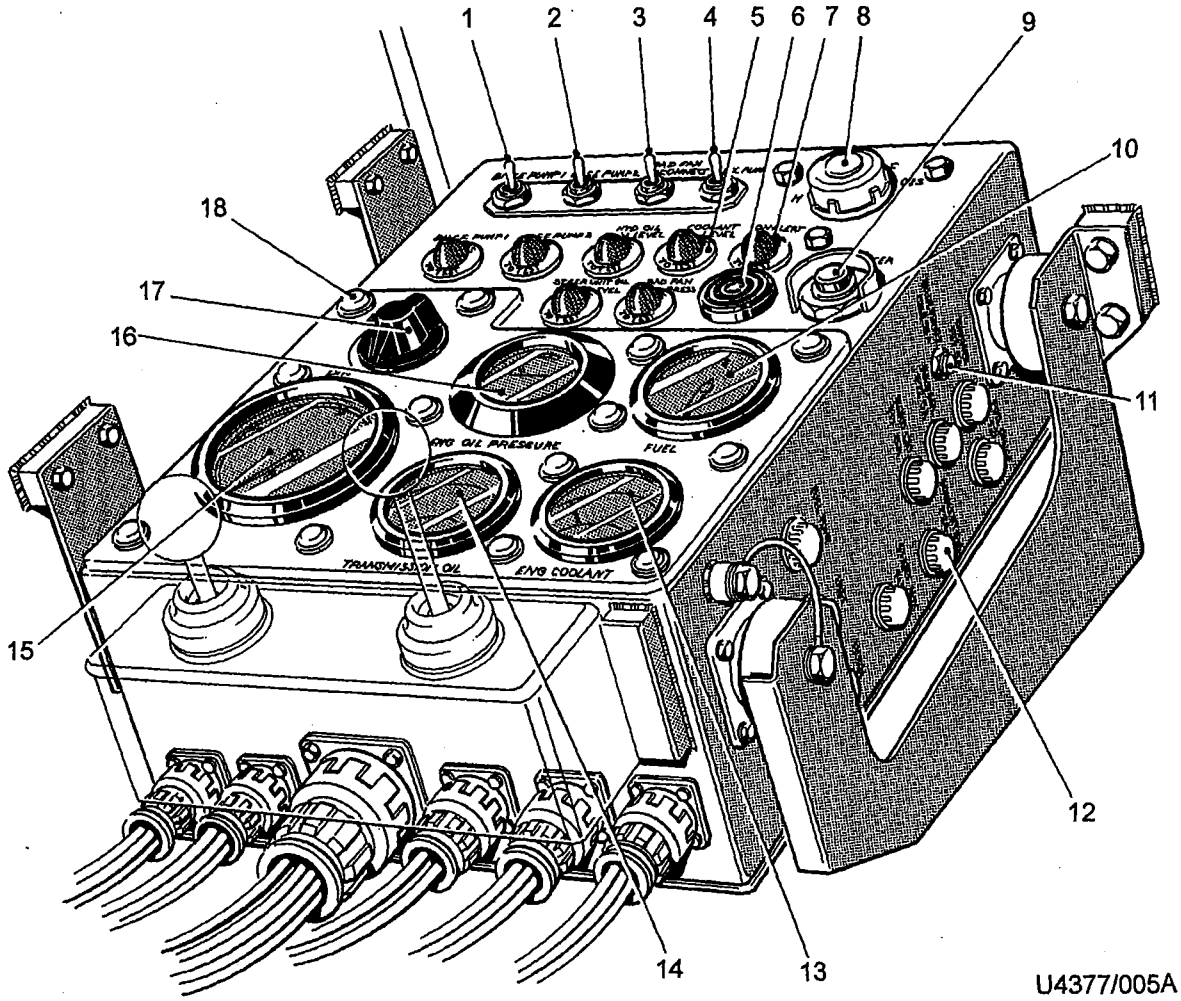
Fig 7 Fuel spill isolating valve

Fuel gauge

36 The fuel gauge (10), located on the driver's instrument panel, is graduated 0, 1/4, 1/2, 3/4 and F. The gauge indicates the total amount of fuel remaining in ALL tanks. In normal circumstances, both fuel tanks feed the fuel system at the same time. As the No. 1 fuel tank is higher than No. 2 fuel tank, it empties first. As No. 1 fuel tank empties the gauge reading drops from Full to 1/2, whilst the gauge reading from 1/2 to 0 shows the emptying of No. 2 fuel tank. The gauge will not start registering No. 2 fuel tank until No. 1 fuel tank is completely empty and in the following circumstances the gauge readings will be false:

36.1 No. 1 fuel tank isolated. When No. 1 fuel tank is isolated the gauge will show a constant reading between Full and 1/2 depending on the contents of No. 1 fuel tank. This constant reading will not show any use of fuel from No. 2 fuel tank.

36.2 No. 2 tank isolated. If No. 2 fuel tank is isolated the fuel gauge will show a reading of between Full and 1/2 as the contents of No. 1 fuel tank are used. The crewman must note in this case that the reading will always show half a tank too much.



1 Bilge pump 1 switch
2 Bilge pump 2 switch
3 Radiator fan disconnect switch
4 Fuel pump switch
5 Warning lights:
- Bilge pumps 1 and 2
- Hydraulic oil level
- Coolant level
- Steer unit low oil level
- Radiator fan boost pressure

6 Sonalert horn
7 Sonalert light
8 Light switch
9 Starter button
10 Fuel gauge
11 Circuit breaker, No. 2 bilge pump
12 Fuses F13, F14, F16, F17, F20, F21, F22, F23 and F24
13 Engine coolant temperature gauge
14 Transmission oil temperature gauge
15 Tachometer
16 Engine oil pressure gauge
17 Dimmer switch
18 Panel lights (14 positions)

Fig 8 Driver's instrument panel

37 The fuel gauge system is arranged so that a reserve of approximately 45 litres (10 gallons) remains when the gauge reads '0'.

38 The fuel gauge electrical system is protected by a fuse, for rating and location refer to Chap 2-7 (Electrical Equipment).

Accelerator pedals

39 An accelerator pedal is provided in each of the crew positions (Fig 10 (18)) and (Fig 11 (7)). The pedals control the speed of the engine by a mechanical linkage to the engine governor speed control lever (Fig 9 (6)). Each pedal operates independently but the driver's pedal will override that of the operator.

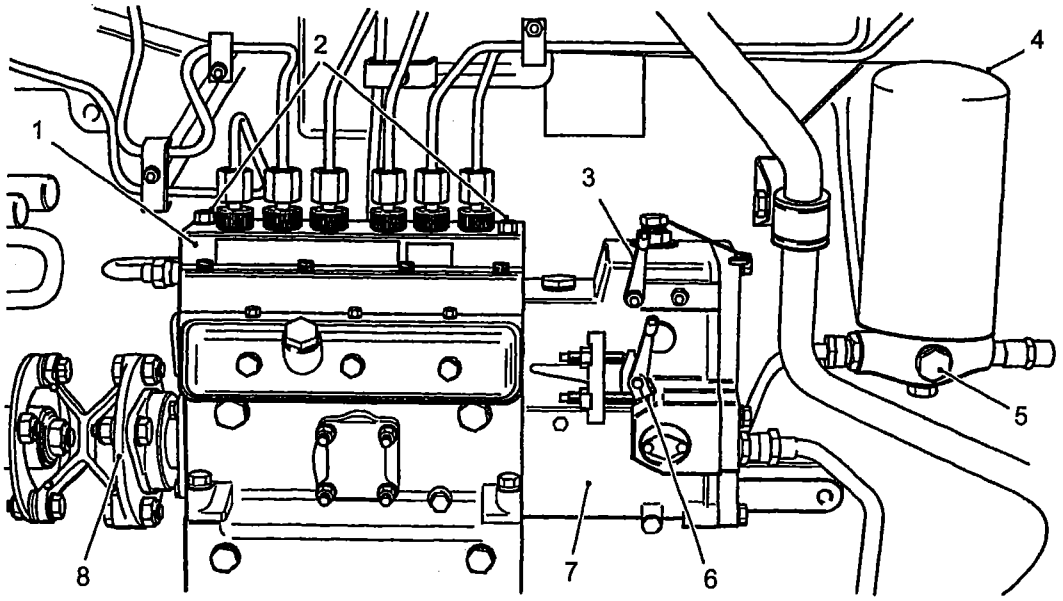
Hand operated accelerator control

40 A hand operated accelerator control (Fig 11 (12)), in the form of a lever, is located on the outer wall of the crew compartment. The lever is used to set a steady engine speed for winching or battery charging when stationary.

41 The lever has a ratchet action. To increase engine speed, the lever must be moved sideways to clear the 'gate' and downwards until the required engine speed is reached. To decrease engine speed the lever must be moved sideways to clear the ratchet before it can be moved upwards. When idling and not in use the lever must be returned to the uppermost 'gate' position.

Engine stop control

42 The engine stop control (Fig 10 (15)) is located on the crew compartment inner wall. Pulling the knob upwards, stops the engine, by moving the control rack of the fuel injection pump to a neutral 'no fuel' position. A control cable connects the knob to the stop control lever (Fig 9 (3)) on the pump casing.



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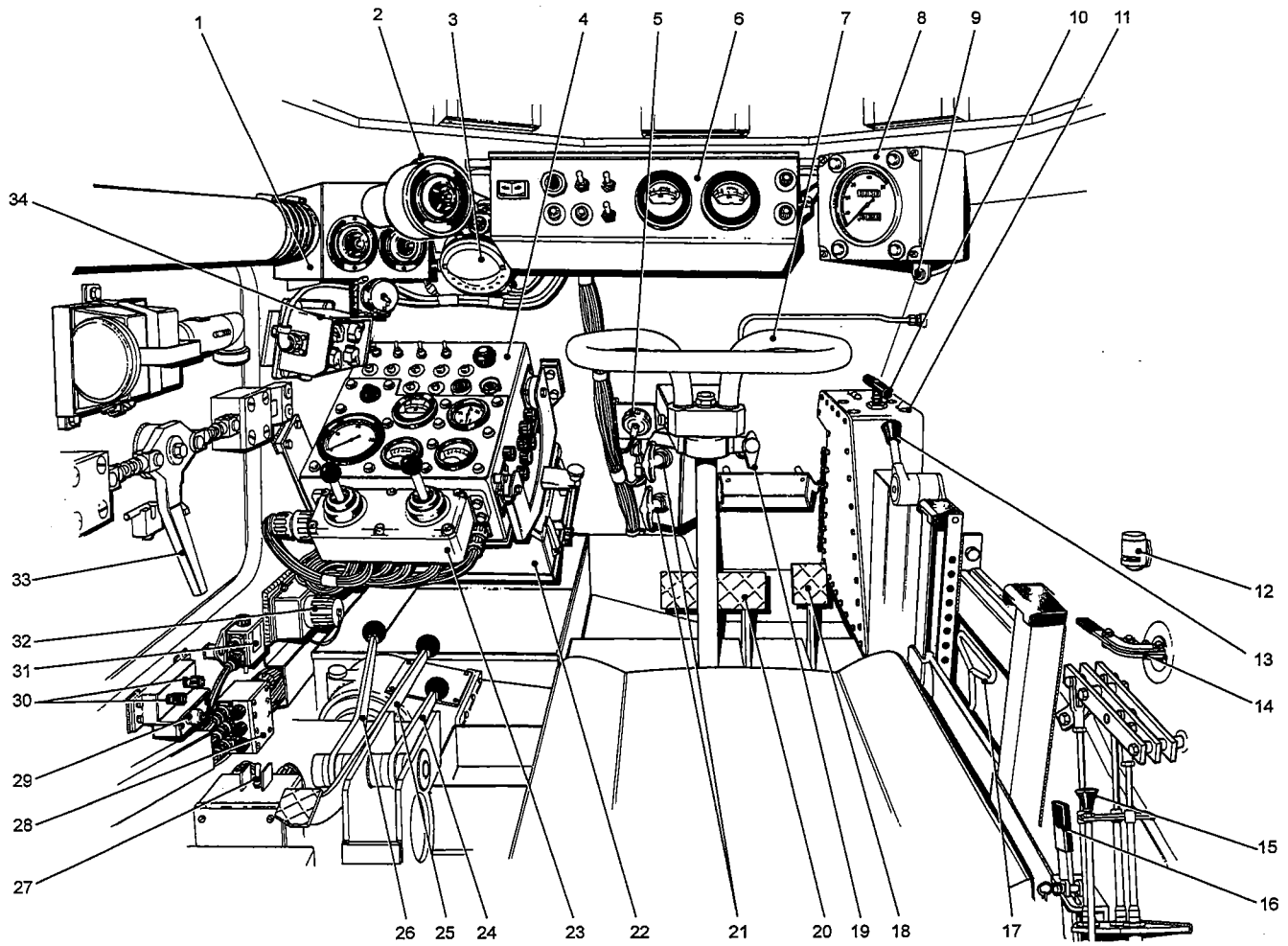
1 Fuel injection pump
2 Vent screws
3 Stop control lever
4 Main fuel filter
5 Drain plug
6 Speed control lever
7 Governor housing
8 Drive coupling

Fig 9 Fuel injection pump, governor and filter



1 Diffuser box
2 Python harness aperture
3 Interior light
4 Driver's instrument panel
5 Inspection light socket
6 Driver's road warning instrument panel
7 Steering column
8 Speedometer panel
9 'Trip' reset knob
10 Battery master switch
11 Distribution panel
12 Air restriction indicator
13 Emergency brake lever
14 Flooding valve
15 Engine stop control
16 Transmission disconnect clutch lever
17 Height adjuster, driver's seat
18 Accelerator pedal
19 Cold starting aid pump handle
20 Brake pedal
21 Fire extinguisher operating handles
22 Night sight stowage
23 Gear selector switch-box
24 Winch gear change lever
25 Pay-out/winch-in control lever
26 High speed pay-out/winch-in control lever
27 Driver/operator select switch
28 Junction box
29 Demolition microswitch
30 Demolition terminals
31 Heated clothing switch-box
32 Inter-vehicle socket
33 Emergency door release handle
34 Crew box - 2 radio

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Fig 10 Controls and instruments (crew compartment - front)

1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spare box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnect pedal
38 Gear selector switch-box
39 Firewire control box

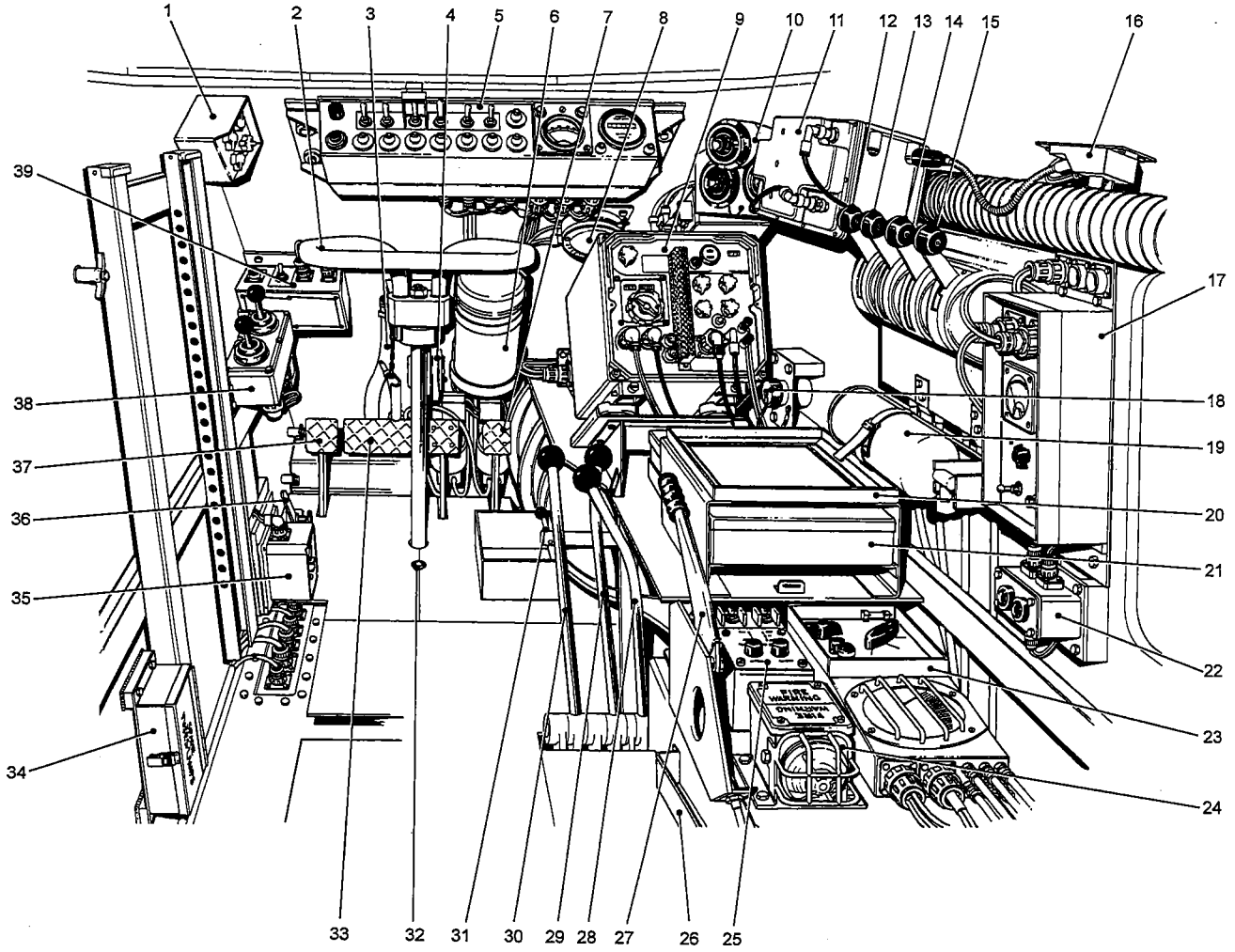

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Fig 11 Controls and instruments (crew compartment - rear)

Maintenance

43 When working on the fuel system all switches must be in their OFF positions and access panels and hatches opened to disperse fumes. If a fuel connection is broken, for removal of components, spillage must be kept to a minimum.

To fill the system

WARNINGS

(1) PERSONNEL INJURY. REFUELLING MUST NOT TAKE PLACE NEAR RADAR EQUIPMENT. SAFE DISTANCE WILL VARY BETWEEN 2 AND 175 METRES DEPENDING ON RADAR EQUIPMENT. VEHICLE CREWS ARE TO CHECK WITH RADAR OPERATORS BEFORE REFUELLING (REFER TO AC 63723).

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

(3) PERSONNEL INJURY. A RISK OF FIRE AND/OR EXPLOSION EXISTS WHEN REFUELLING VEHICLES FITTED WITH RUBBER PADDED TRACKS AND RUBBER TYRES, BY EITHER PUMPS OR PLASTIC CONTAINERS, DUE TO THE PRESENCE OF STATIC ELECTRICITY. THE VEHICLE MUST BE EARTHED WHEN CARRYING OUT REFUELLING OR FUEL TANK DRAINING OPERATIONS.

44 If the tanks are empty the fuel gauge should be checked for a zero reading. If not correct - report to REME. To fill the system, proceed as follows:

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

44.2 Earth the vehicle. Drive an earth spike into the ground and attach the cable to the earthing connector on the vehicle, which is located on the front right glacis plate. If an earthing spike is not available, wedge a steel bar between the track and the ground. Should the effectiveness of the 'earth' be in doubt, due to dry soil conditions, the area surrounding the spike or bar should be watered. If the bucket is free it should be lowered teeth first until the bucket makes good contact with the ground.

44.3 Check the positions of the fuel tank isolating valve (refer to Fig 5) and the fuel spill isolating valve (refer to Fig 7). Provided both tanks are undamaged and in use, both valves should be set to the 'all tanks' position.

44.4 Clean the area around the filler access cover (Fig 4 (3)).

44.5 Open the filler access cover by pulling the handle forwards, towards the front of the vehicle, thus disengaging the catch. Lower the cover onto the glacis plate. Vent any liquid from the filler neck, and clean the area around the filler cap (4).

44.6 Open the filler cap, check that the gauze strainer is in place and then pour in fuel as required. If the tanks have been filled completely, check the fuel gauge. If the gauge does not read full - report to REME.

44.7 Close the filler cap and access cover.

NOTE

Do not overfill the system, as excess fuel seeping out will attract dirt or water and thereby contaminate the fuel; it is also a fire risk.

45 All normal filling of the system is via the main filler/cap. In an emergency, if the No. 2 fuel tank (12) is damaged and has been isolated, No. 1 fuel tank (1) can still be filled in the normal way. If No. 1 fuel tank is isolated, No. 2 fuel tank may be filled by means of the emergency filler (14).

To fill the No. 2 fuel tank

46 The No. 2 fuel tank filler must only be used in an emergency. To fill the No. 2 fuel tank, proceed as follows:

46.1 Open the transmission compartment upper access panel (Fig 1 (27)) and move the fuel tank isolating valve to the appropriate position, (Fig 5 (i)).

46.2 Open the hinged engine compartment access door (Fig 1 (18)) and put the fuel spill isolating valve to the isolated position (Fig 7 (iii)).

46.3 Remove the locking wire from the emergency filler cap (Fig 4 (14)), unscrew and remove the cap.

46.4 Add fuel as required but do not overfill, when the tank is full, replace, tighten and secure the cap with locking wire. Check that the fuel gauge reads 1/2 full.

NOTE

When No. 2 fuel tank is full the fuel gauge will read 1/2 full only when the No. 1 fuel tank is empty.

46.5 Close and secure access panel and door.

To isolate a fuel tank

47 To isolate a fuel tank, proceed as follows:

47.1 Open the engine and transmission access door and panel as previously detailed.

47.2 Move the fuel tank isolating valve (15) to the appropriate position, as shown in Fig 5.

47.3 Move the fuel spill isolating valve (8) to the appropriate position, as shown in Fig 7.

47.4 Close and secure access panel and door.

To clean a filler strainer

48 To clean a filler strainer, proceed as follows:

48.1 Lift fuel filler access cover Fig 4 (3)).

48.2 Open the filler cap (4).

48.3 Lift out strainer, from filler neck.

48.4 Wash strainer in clean fuel or paraffin and replace.

To clean the primary filter

49 To clean the primary filter, proceed as follows:

49.1 Stop the engine. Check that the battery master switch and fuel pump switches are OFF.

49.2 Open the transmission compartment upper access panel (Fig 1 (27)).

49.3 Place a suitable receptacle beneath the filter to collect as much fuel spillage as possible.

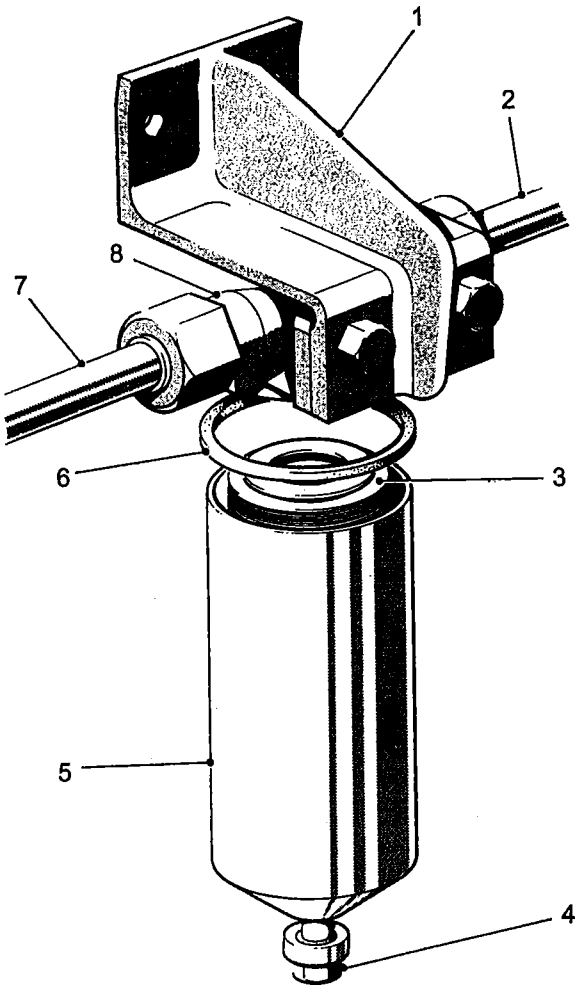
49.4 Unscrew the centre bolt (Fig 12 (4)), remove the filter bowl (5) and element (3).

49.5 Clean the element by washing in clean paraffin, using a soft brush. Also ensure that the filter bowl is clean. Do not use compressed air.

49.6 Check the condition of the sealing ring (6) and replace if necessary.

49.7 Replace the element and bowl, tighten the centre bolt.

49.8 Switch on the battery master switch and fuel pump. Check for leaks. If no leaks are apparent, switch off fuel pump and battery master switch, close and secure access panel.



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1 Mounting bracket
2 Inlet from collector tank
3 Element
4 Centre bolt
5 Filter bowl
6 Sealing ring
7 Outlet to electric fuel pump
8 Filter header

Fig 12 Primary fuel filter

To change the main fuel filter element

50 To change the main fuel filter element, proceed as follows:

50.1 Stop the engine. Check that the battery master switch and fuel pump switches are OFF.

50.2 Open the engine compartment lower access panel (Fig 1 (11)) and secure.

50.3 Place a suitable receptacle beneath the filter header/bracket (Fig 13 (3)). Remove the drain plug (4) and allow the filter to empty.

50.4 Unscrew and discard the filter element canister (2). Only hand pressure should be necessary.

50.5 Clean the contact faces and fit a new seal (5).

50.6 Screw on a new element canister until the joint faces are just in contact. Then tighten by hand for a maximum of another 3/4 turn. DO NOT over tighten.

50.7 Replace and tighten the drain plug.

50.8 Switch on the battery master switch and fuel pump. Check for leaks. If no leaks are apparent, switch off fuel pump and battery master switch, close and secure the access panel.

To drain sediment from the collector tank

51 To drain sediment from the collector tank, proceed as follows:

51.1 Ensure the vehicle is standing on firm ground.

NOTE

The system must be full and allowed to stand over night to obtain the best results.

51.2 Open the transmission compartment upper access panel (Fig 1 (27)).

51.3 Place a suitable receptacle beneath the siphon pipe of the water drain valve (Fig 4 (11)).

51.4 Remove the locking wire from the sediment drain valve. Move the valve hand upwards until liquid flows from the siphon pipe. Allow flow to continue until clean fuel can be detected free from water or sediment.

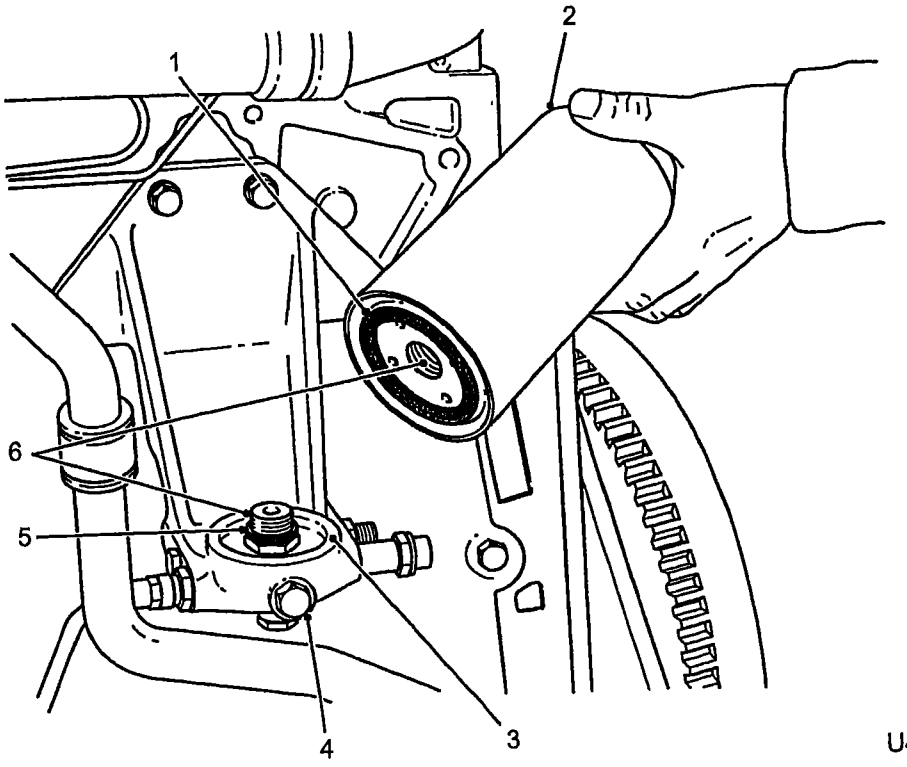
NOTE

This can be a time consuming process.

51.5 Close the valve and secure with locking wire. Close and secure access panel.

Fuel system venting

52 On all production vehicles venting the fuel system, after repairs or running out of fuel, is unnecessary. If air is introduced into the system it will be automatically purged when the electric fuel pump is started.



1	Seal (bonded to element)	4	Drain plug
2	Element canister	5	Seal
3	Header/bracket	6	Locating threads

Fig 13 Main fuel filter

CHAPTER 2-4

TRANSMISSION, STEER UNIT AND FINAL DRIVES

CONTENTS

(continued)

CONTENTS (continued)

TRANSFER GEARBOX

General description

1 The transfer gearbox provides the means of driving a number of items of ancillary equipment. It is bolted to the rear of the main gearbox and for purposes of lubrication and mounting forms an integral part of that unit. A shaft and two flexible couplings connect the transfer gearbox to the engine.

2 The transfer gearbox drives, by means of conventional spur gears, the following items:

2.1 Generator drive pulley.

2.2 Cooling fan hydraulic pack, via a flexible coupling.

2.3 Hydraulic pumps, for winch and earth moving equipment.

2.4 Steer unit hydraulic pumps.

2.5 Ventilation fan drive pulley and Air Cooling Unit (ACU) pump.

2.6 Tachometer electrical sender unit.

2.7 Propulsion units via a splitter gearbox (this capability no longer exists).

3 The drive shaft from the engine also transmits power to the torque converter and main gearbox, by a dog clutch, located within the transfer gearbox casing. The dog clutch enables the engine to be disconnected from all loads when starting in conditions of extreme cold. Use of the disconnect clutch control is detailed in Chap 2-8-2.

4 A second clutch in the transfer gearbox controls the output to the propulsion units, splitter gearbox and drive. The clutch is of the synchromesh type which allows the propulsion units to be engaged or disengaged while the engine is running (this capability no longer exists).

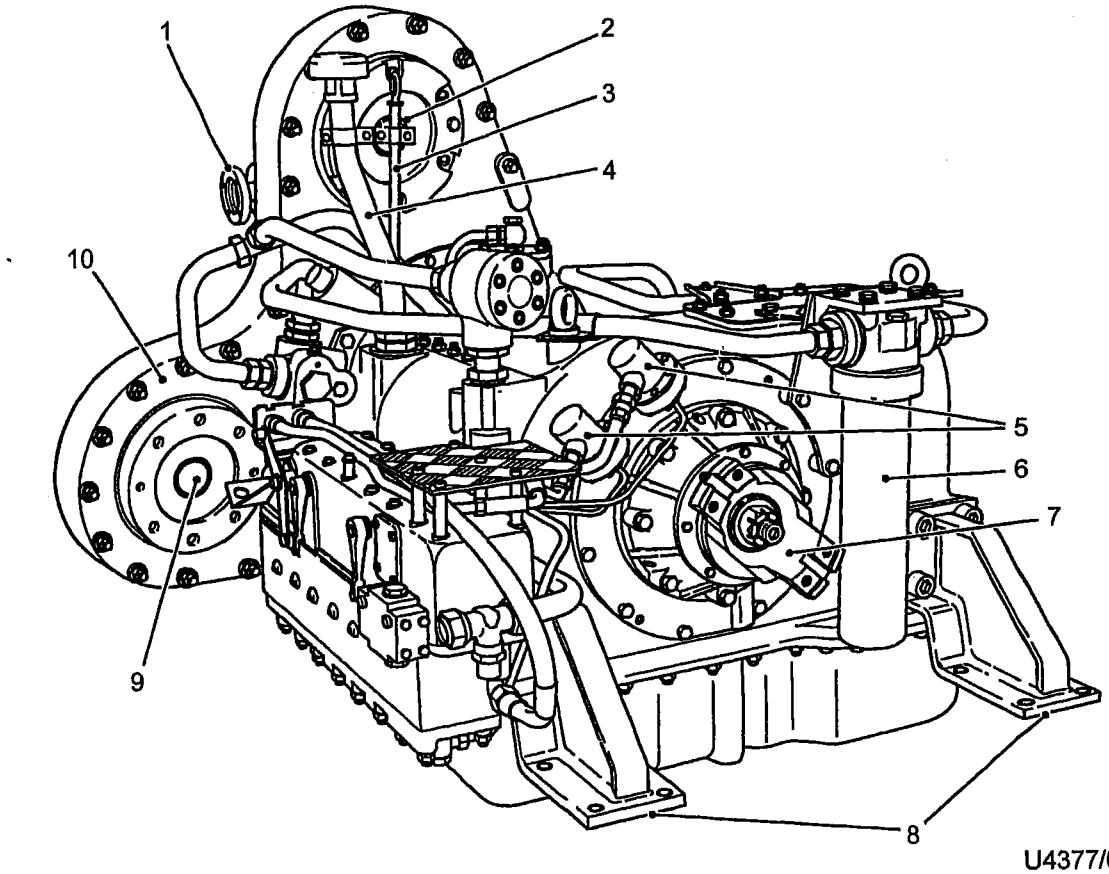
GEARBOX AND TORQUE CONVERTER

General description

5 The gearbox (Fig 1), designated TN 26, comprises a torque converter and an epicyclic gear train. The unit is located in the transmission compartment and provides the means of transmitting power to the steer unit and final drives. The gearbox is coupled to the engine by the transfer gearbox (10) which is bolted to the rear of the unit.

6 The epicyclic gear train enables four forward and four reverse gears to be manually selected, using an electro-hydraulic mechanism. Each crew position is provided with a gear selector switch-box which gives full control of the four gears in forward and reverse. A changeover switch ensures that control is restricted to only one crew position at a time. When the vehicle is travelling rearwards (bucket first) speed of advance in all gears is half that available when travelling forward.

7 The fluid operated torque converter is incorporated within the gearbox casing. A 'lock-up' facility is provided which automatically locks the torque converter when 3rd and 4th gears are selected, from the driver's control position only. When 'locked-up' the fluid drive is eliminated by a mechanical clutch, giving a positive drive for cross-country and road driving.



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1	Propulsion unit drive (right)	6	Oil filter
2	Hydraulic pump drive	7	Drive coupling (to steer unit)
3	Dipstick tube	8	Mounting brackets
4	Hose to oil filler	9	Steer oil pump drive
5	Pressure switches	10	Transfer gearbox

Fig 1 Gearbox and transfer gearbox

Gearbox

8 The gearbox is of the epicyclic type in which gear ratios are engaged by means of brakes or clutches. The three intermediate gears (1st, 2nd and 3rd) and reverse gear are controlled by applying brake bands to the appropriate rotating elements of the gear train. Fourth gear is a direct drive obtained by use of a clutch. The brake bands and clutches are actuated by oil pressure from the gearbox oil system and controlled by electrically operated solenoid valves.

9 When a gear is selected by moving a gear lever at either crew position, an electrical circuit is completed, thus energizing the appropriate solenoid valves. The solenoid valves control the flow of high pressure oil to pistons which activate the brakes or clutch for the gear required.

10 The principle oil systems are used in the gearbox, one high pressure at 12.65 kgf/cm^2 (180 lbf/in.^{2}) and one low pressure at 2.11 kgf/cm^2 (30 lbf/in.^{2}). The high pressure system operates the brake bands and clutches. The low pressure system supplies oil to the torque converter and lubricates the gears and bearings in both the gearbox and transfer gearbox. Both oil systems are supplied by a pump, located within the unit, which draws oil from the gearcase sump. Pressures are controlled by relief valves in each system.

11 Oil from the torque converter passes, via hoses, through a section of the main heat exchanger to be cooled, before returning to the gearbox lubrication system.

12 The gearbox oil is filtered by a filter (Fig 1 (6)), containing a removable element, mounted vertically on the gearbox casing. Oil passes through the filter, from the pump, at the higher of the two system pressures.

13 A mechanical linkage on the gearbox valve block is connected to the emergency gear engagement lever (Fig 3 (36)), in the crew compartment. The mechanism enables four solenoids to be operated mechanically, in case of an electrical failure, giving control of one forward and one reverse gear.

Torque converter

14 The torque converter is a three element fluid type utilising the gearbox low pressure oil supply. At stall, the unit gives a torque multiplication of 3:1.

15 Incorporated in the torque converter is a multi-plate clutch which provides the 'lock-up' facility. The clutch is oil operated and is automatically engaged by the gear control electrical circuits. 'Lock-up' only takes place in 3rd and 4th gears when the vehicle is travelling forward, under the control of the driver. No 'lock-up' takes place when gears are selected from the operator's position.

Gearbox control circuits

16 When the battery master switch (Fig 2 (10)) is in the ON position the gearbox solenoid valve circuits are energised.

17 The circuits are controlled by the operation of the control levers on the gear selector switch-boxes at either crew position and the driver/operator select switch. A fuse protects the gear control circuits, for rating and location, refer to Chap 2-7 (Electrical Equipment).

Controls and instruments

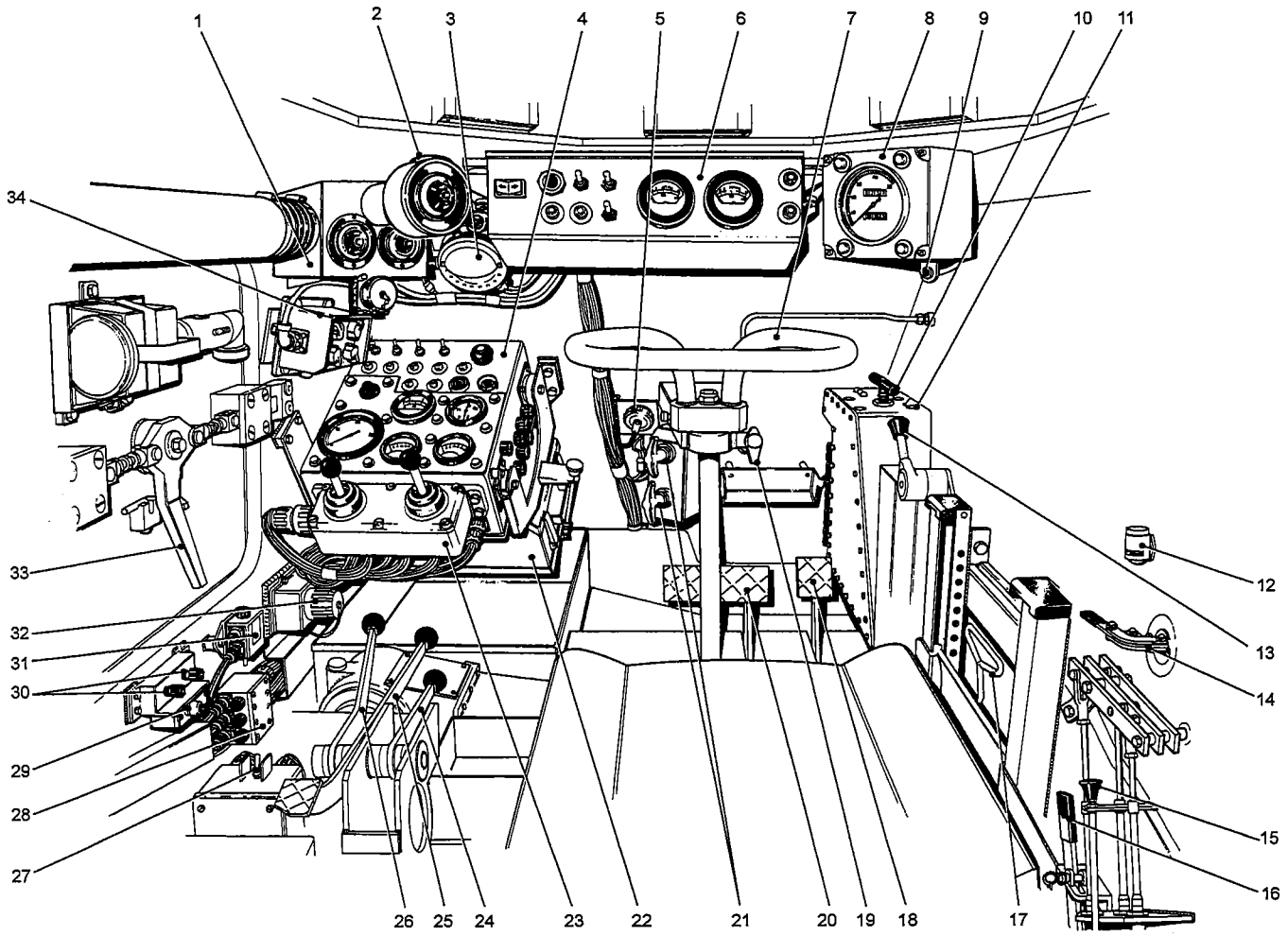
Driver/operator select switch

CAUTION

EQUIPMENT DAMAGE. Before attempting to move the vehicle, the position of the driver/operator select switch should be checked to ensure that the appropriate control position is selected.

18 The driver/operator select switch (Fig 2 (27)) and (Fig 4 (5)) ensures that the control of gears is only operative at one crew position at a time. The switch has two positions, identified E OPS and ROAD DVR, and is located on the gear change junction box to the driver's left.

19 When either crew member takes over control of the vehicle, the driver/operator select switch must be moved to the correct position to bring the appropriate gear selector switch-box into use.



1 Diffuser box
2 Python harness aperture
3 Interior light
4 Driver's instrument panel
5 Inspection light socket
6 Driver's road warning instrument panel
7 Steering column
8 Speedometer panel
9 'Trip' reset knob
10 Battery master switch
11 Distribution panel
12 Air restriction indicator
13 Emergency brake lever
14 Flooding valve
15 Engine stop control
16 Transmission disconnect clutch lever
17 Height adjuster, driver's seat
18 Accelerator pedal
19 Cold starting aid pump handle
20 Brake pedal
21 Fire extinguisher operating handles
22 Night sight stowage
23 Gear selector switch-box
24 Winch gear change lever
25 Pay-out/winch-in control lever
26 High speed pay-out/winch-in control lever
27 Driver/operator select switch
28 Junction box
29 Demolition microswitch
30 Demolition terminals
31 Heated clothing switch-box
32 Inter-vehicle socket
33 Emergency door release handle
34 Crew box - 2 radio

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Fig 2 Controls and instruments (crew compartment - front)

1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spares box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnect pedal
38 Gear selector switch-box
39 Firewire control box

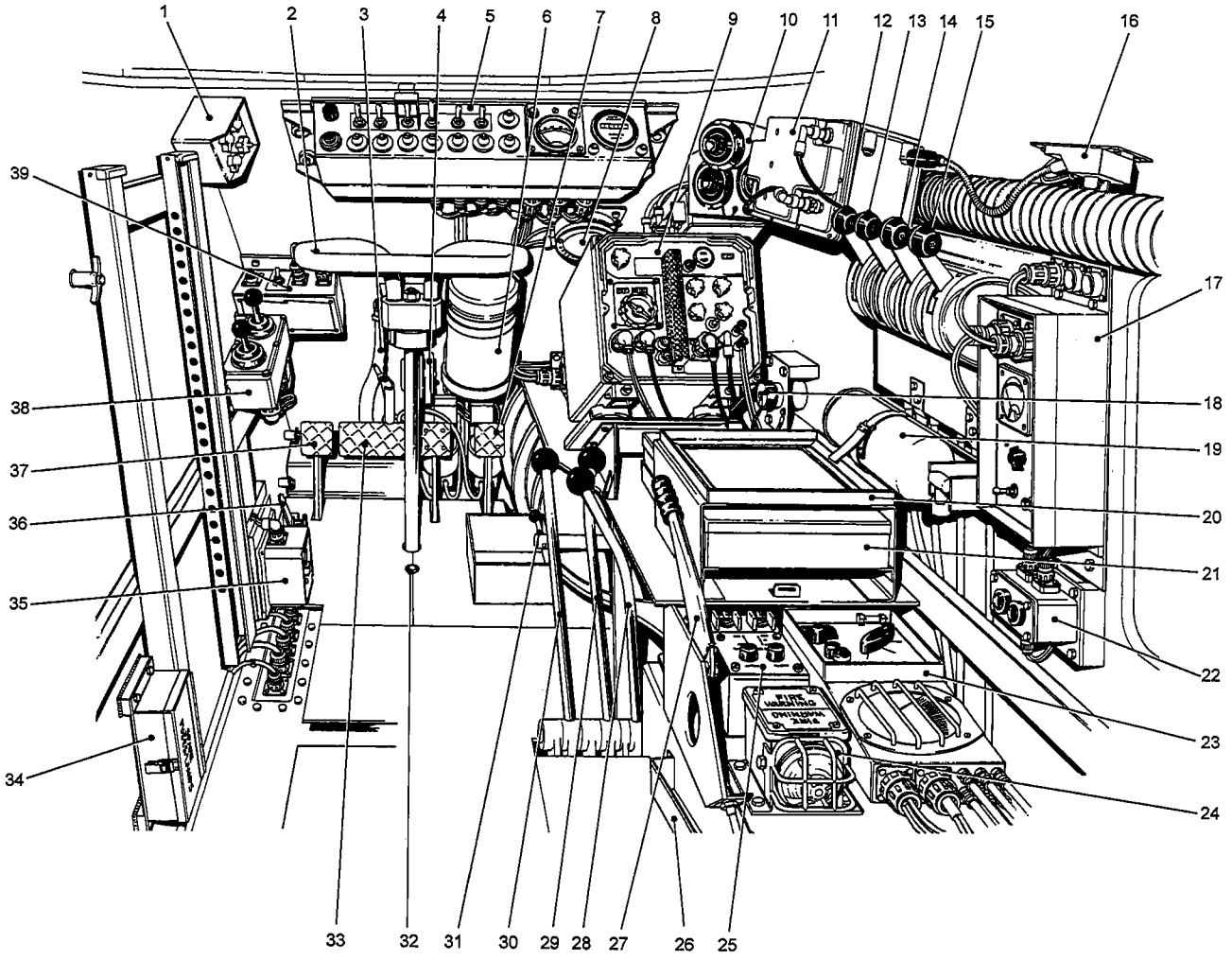


Fig 3 Controls and instruments (crew compartment - rear)

Driver's gear selector switch-box

CAUTION

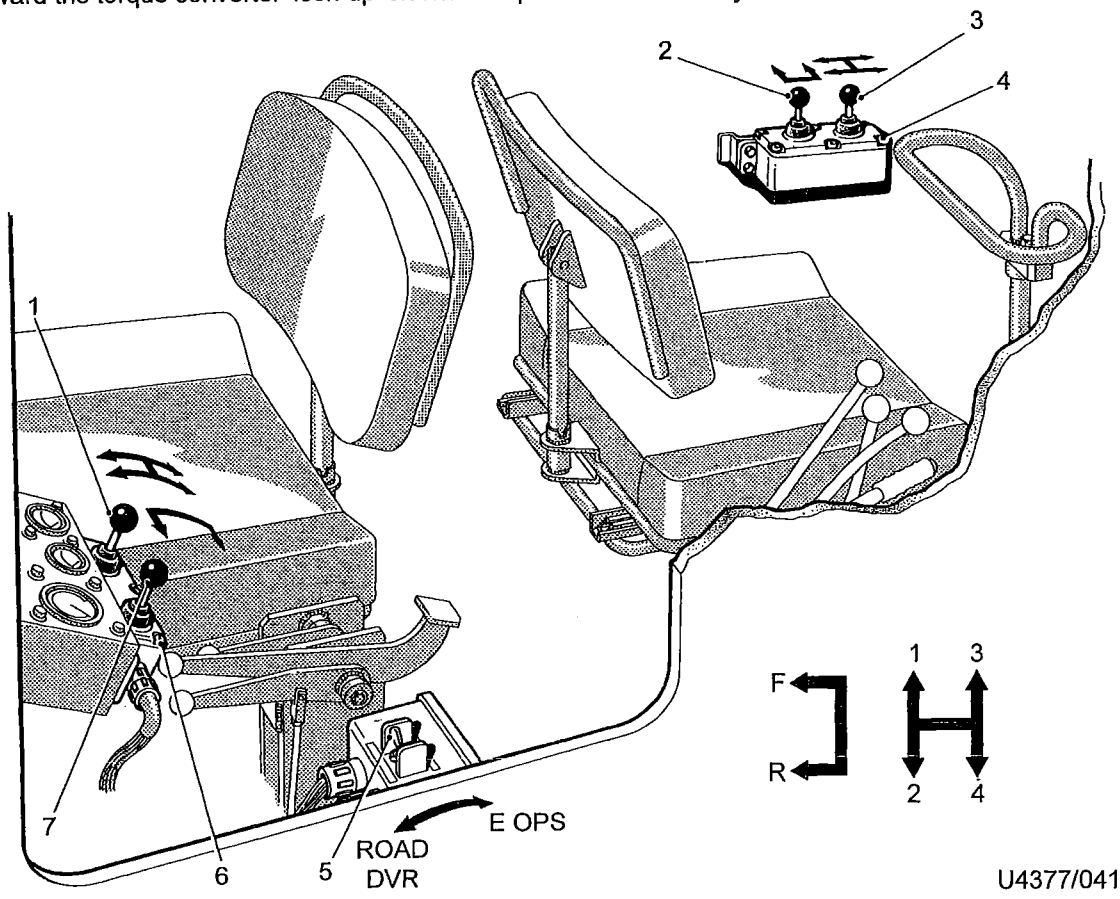
EQUIPMENT DAMAGE. When the vehicle is stationary do not attempt to engage any gear if the engine speed exceeds 1000 rev/min. This could result in damage to the torque converter.

20 The driver's gear selector switch-box (Fig 2 (23)) and (Fig 4 (6)) is located on the lower edge of the driver's instrument panel. Two levers on the top surface of the box actuate switches controlling the gear selection electrical circuits.

21 The left lever is the forward/reverse lever (7) and it controls the forward and reverse movement of the vehicle. The lever has a central neutral position and is moved in the required direction of travel. When the lever is moved to the forward or reverse positions, it must be pushed to the left to obtain full engagement (refer to Fig 4).

22 The gear selector lever (1) on the right of the selector switch controls the engagement of the four gears. The lever moves in a four position 'gate' and has a central neutral position (refer to Fig 4).

23 The selector lever mechanism prevents a direct gearchange from 4th into any gear except 3rd. When 3rd and 4th gears are engaged from the driver's selector switch-box and the vehicle is travelling forward the torque converter 'lock-up' clutch will operate automatically.



1 Driver's gear selector lever
2 Operator's Forward/Reverse lever
3 Operator's gear selector lever
4 Operator's gear selector switch-box
5 Driver/operator select switch
6 Driver's gear selector switch-box
7 Driver's Forward/Reverse lever

Fig 4 Gear selection controls

Operator's gear selector switch-box

24 The operator's gear selector switch-box (Fig 3 (38)) and (Fig 4 (4)) is located on the crew compartment inner wall to the operator's left. Two gear control levers (2) and (3) are provided, which operate in the same manner as those on the driver's selector switch-box. Only the layout differs (refer to Fig 4).

25 Torque converter 'lock-up' does not occur in any gear selected by the operator.

NOTE

When the operator is in control of vehicle movement, reverse speeds (for the operator in the earth moving role) are half that of forward speeds.

Emergency gear selector lever

CAUTION

EQUIPMENT DAMAGE. When emergency gears are not in use the emergency gear selector lever must be pinned back into the neutral position.

26 The emergency gear selector lever (Fig 3 (36)) is located near the floor on the inner compartment wall. In the event of an electrical failure the lever may be used to engage one forward and one reverse gear manually.

27 Operation of the lever actuates the appropriate solenoid valves in the gearbox mechanically, giving control of 2nd gear forward or 3rd gear reverse as required.

28 A quick release pin is provided to retain the lever in the neutral position. The lever is moved in the required direction of travel to engage either forward or reverse.

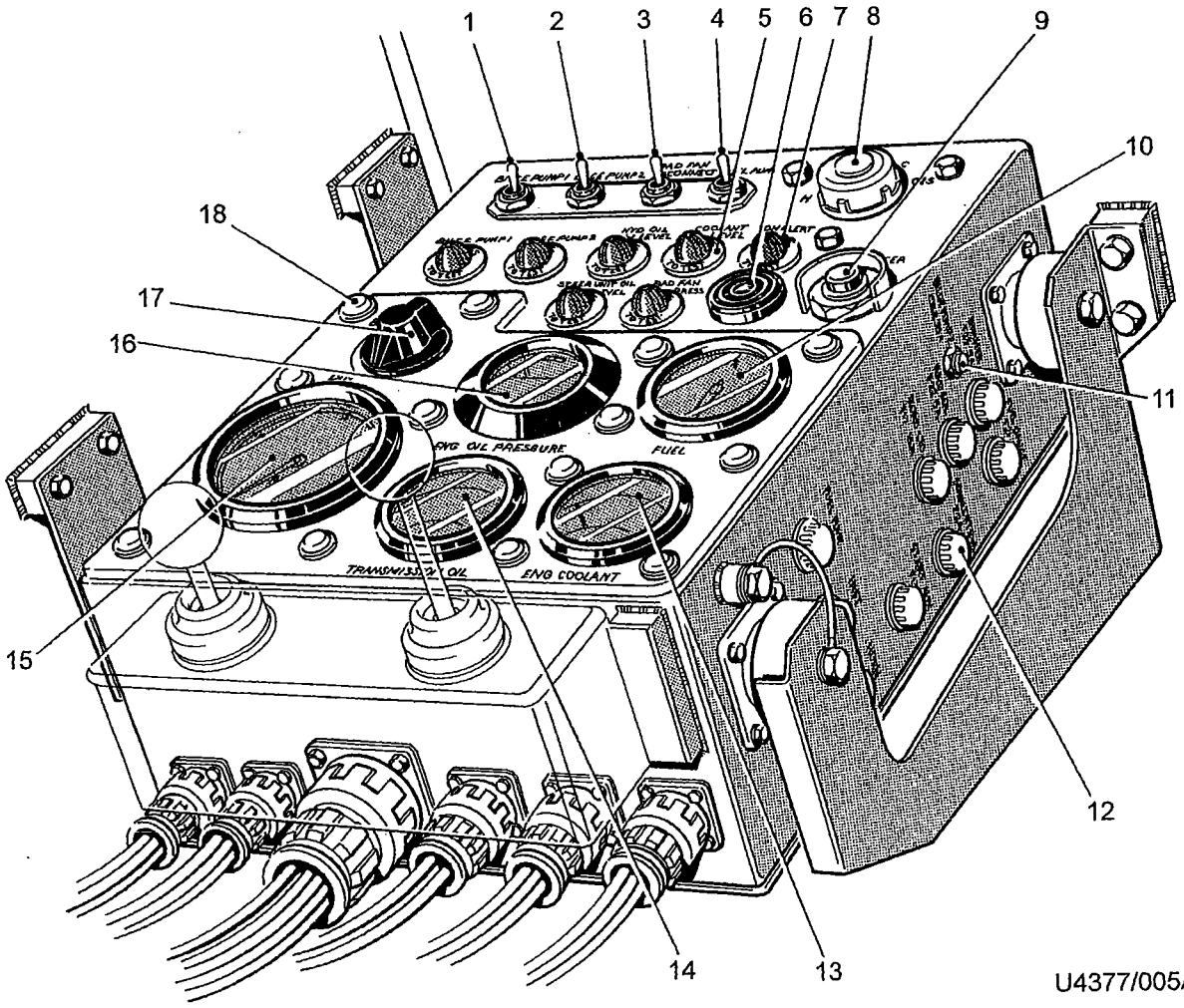
29 Before engaging a gear using the emergency lever, ensure that all electrical gear selectors are in their neutral positions.

Gear change operation

30 Instructions for gear changing and vehicle movement are contained in Chap 2-11-1 (Driving and Towing).

Transmission oil temperature gauge

31 The transmission oil temperature gauge (Fig 5 (14)), identified 'TRANSMISSION OIL' and located on the driver's instrument panel, indicates the temperature of the gearbox/torque converter oil. The gauge is graduated -4 degrees F to +30 degrees F and the figures must be multiplied by 10 to obtain the oil temperature.



1 Bilge pump 1 switch
2 Bilge pump 2 switch
3 Radiator fan disconnect switch
4 Fuel pump switch
5 Warning lights:
Bilge pumps 1 and 2
Hydraulic oil level
Coolant level
Steer unit low oil level
Radiator fan boost pressure
6 Sonalert horn
7 Sonalert light
8 Light switch
9 Starter button
10 Fuel gauge
11 Circuit breaker, No. 2 bilge pump
12 Fuses: F13, F14, F16, F17, F20, F21, F22, F23 and F24
13 Engine coolant temperature gauge
14 Transmission oil temperature gauge
15 Tachometer
16 Engine oil pressure gauge
17 Dimmer switch
18 Panel lights (14 positions)

Fig 5 Driver's instrument panel

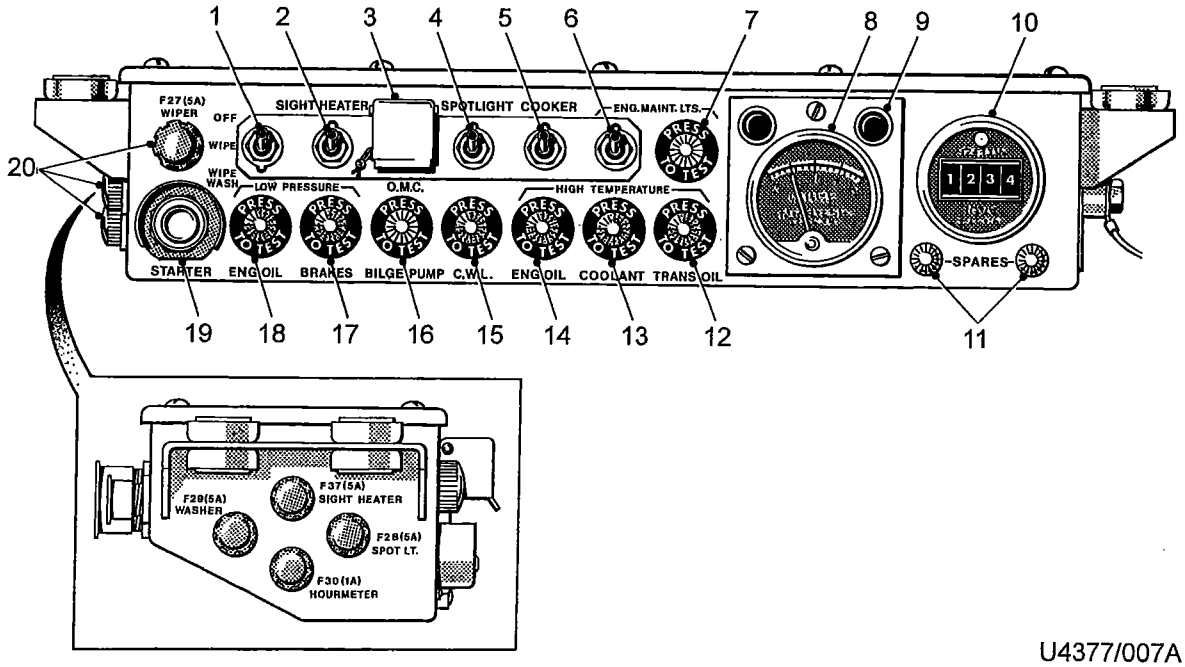
32 The normal operating temperature is between 82 degrees C (180 degrees F) and 121 degrees C (250 degrees F). A maximum figure of 140 degrees C (284 degrees F) must not be exceeded.

Transmission oil temperature warning light

CAUTION

EQUIPMENT DAMAGE. With the engine running, the torque converter and gearbox oil pump will continue to circulate oil through the heat exchanger. The engine must NOT be stopped in an attempt to cool the oil, as this will stop the oil flow and may aggravate the situation.

33 A transmission oil temperature warning light (Fig 6 (12)) is located on the operator's instrument panel, identified TRANS OIL (under the HIGH TEMPERATURE caption).



U4377/007A

1 Wipe/wash switch
2 Sight heater switch
3 Override master control switch
4 Spotlight switch
5 Cooker switch
6 Engine maintenance light switch
7 Maintenance light warning light
8 Ammeter
9 Panel lights (2 positions)
10 Hourmeter
11 Spare warning light lenses
12 Transmission oil temperature warning light
13 Coolant temperature warning light
14 Engine oil temperature warning light
15 Central warning light
16 Bilge pump warning light
17 Brake low pressure warning light
18 Engine low oil pressure warning light
19 Starter button
20 Fuses: F27, F28, F29, F30 and F37

Fig 6 Operator's instrument panel

34 The light, which has a green lens, will illuminate when the gearbox oil temperature exceeds 140 degrees C (284 degrees F). The light has a 'press to test' facility.

NOTE: The transmission oil temperature probe is fitted in the pipework on the exhaust side of the torque converter. The position of this probe gives the temperature of the oil leaving the torque converter and not the bulk oil within the transmission. During operation in 1st gear, if the light is illuminated it will be due to the slip across the torque converter. Reducing the engine speed should cause the light to extinguish.

35 If the transmission oil temperature warning light illuminates when the operator is earth moving, towing or travelling over undulating terrain in a gear other than 1st, a lower gear should be selected and the warning light observed carefully. The use of a lower gear will tend to cool the oil and the light should extinguish.

36 If the warning light illuminates when the operator is performing tasks in 1st gear, reduce the engine speed and the light should be extinguished. If the light is extinguished it is safe to continue with the task, if the light illuminates again repeat the procedure. If the light fails to extinguish, set the engine speed at idle and check the coolant temperature gauge (Fig 5 (13)) on the driver's instrument panel. If the temperature reading is abnormally high, and there is no apparent cooling system fault, allow the engine to idle until the temperature returns to normal.

37 In all cases the fact that the transmission oil has overheated should be reported.

Central warning light

38 The external and internal Central Warning Lights (CWL) will illuminate if the transmission oil temperature warning light is activated.

39 If a CWL illuminates, the warning lights and instruments must be checked immediately in order to locate the system at fault.

NOTES

(1) The CWLs will illuminate when the battery master switch is set to ON and will continue to be illuminated until the engine is started and oil pressure builds up.

(2) The CWL system covers nine warning conditions in all, if the CWLs illuminate it is important that the system at fault is located quickly, by means of the normal warning lights and instruments.

40 The CWL system is detailed in Chap 2-7 (Electrical Equipment).

MAINTENANCE

Transfer gearbox

41 For servicing purposes the transfer gearbox forms part of the main gearbox and requires no individual attention, other than visual checks. Ensure that all drive couplings are secure and free from damage and check for oil leaks. Any damage to couplings or serious oil leaks must be reported as soon as possible to REME.

Gearbox

General

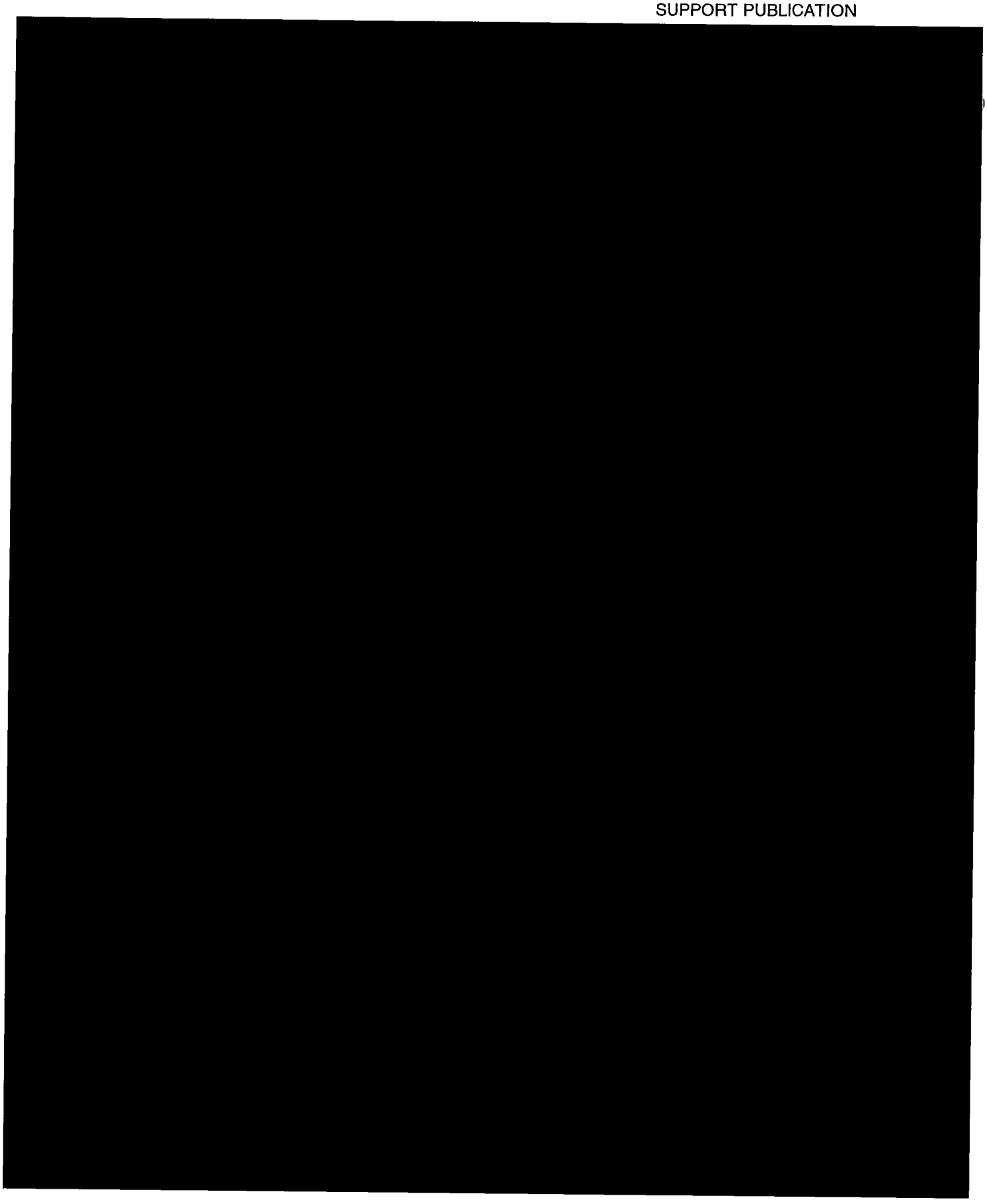
42 As part of routine maintenance the gearbox assembly should be inspected for oil leaks and to ensure that it is secure on its mountings.

To check and top-up the gearbox oil

43 Before checking the gearbox oil it is necessary to run the engine for at least 3 minutes to allow any oil which has drained from the torque converter into the gearbox to be replenished and then wait 2 minutes for the level to stabilise. A preliminary check should be made however to ensure that oil is present before starting up, then proceed as follows:

43.1 Position the vehicle on firm level ground and stop the engine.

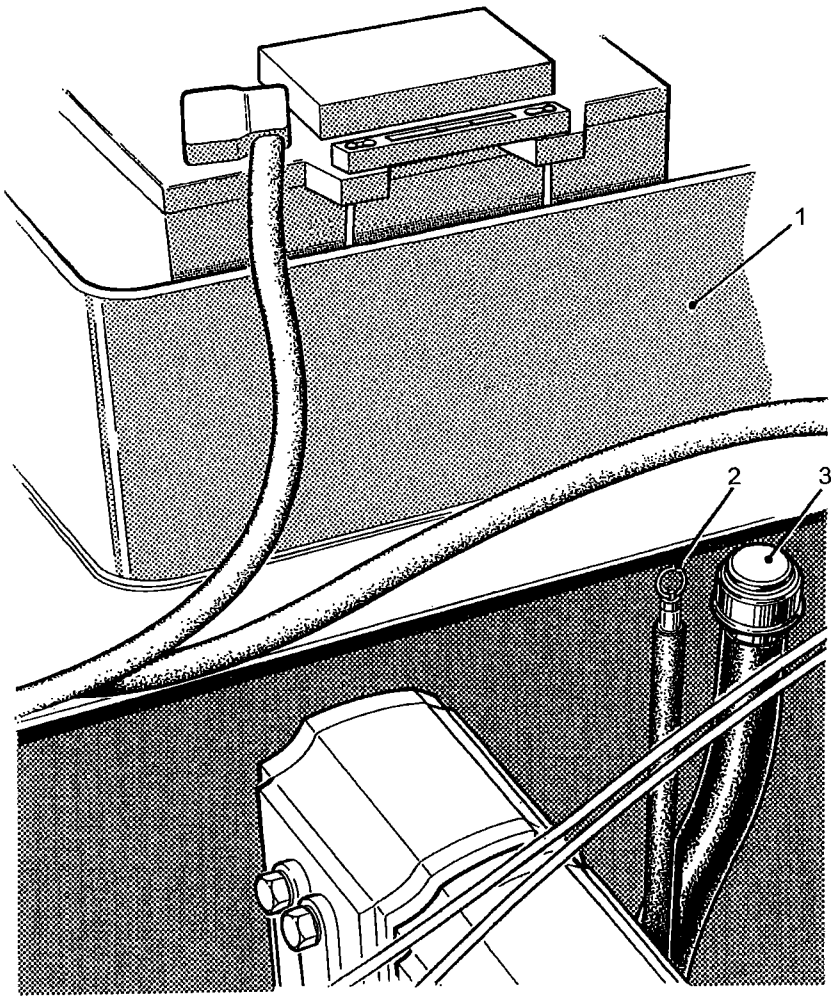
43.2 Open the transmission compartment upper access panel (Fig 7 (27)).



KEY TO FIG 7

1 Front stowage bins
2 Winch
3 Air intake cowl
4 Access panel
5 Access cover plates
6 Stowage basket
7 Stowage box
8 Rear stowage bin
9 Bilge pump outlet (rear)
10 Engine compartment roof plate
11 Engine compartment lower access panel
12 Drain plug
13 Emergency exit door
14 [redacted]
15 Exhaust cowl
16 Fairlead
17 Smoke grenade stowage box
18 Engine compartment access door
19 Operator's access door
20 Driver's access door
21 Python aperture cover plate
22 NBC air intake cowl
23 Stowage compartment door
24 Transmission compartment lower access panel
25 General service tow hook
26 Fire extinguisher operating handles
27 Transmission compartment upper access panel
28 Bilge pump outlet (front)
29 Smoke discharger mounting
30 Fuel filler access cover
31 Radiator intake louvres
32 Radiator outlet louvres

43.3 Remove the dipstick (Fig 8 (2)), wipe it clean and re-insert it in the dipstick tube.



1 Battery box
2 Dipstick
3 Filler cap

Fig 8 Gearbox filler and dipstick

43.4 Withdraw dipstick and observe oil level. The dipstick is marked FILL and FULL. If the oil level is not up to the FULL mark, add oil to bring it up to the correct level.

43.5 If it is necessary to add oil, clean the area around the filler cap (3). Remove the cap and add oil of the correct grade (refer to Cat 601) until the level reaches the FULL mark on the dipstick. DO NOT OVERFILL.

43.6 Replace the dipstick and filler cap, close and secure the access panel.

NOTE

The dipstick is a long flat strip which must be correctly orientated to enable it to follow the contour of the dipstick tube.

To remove, clean and replace the gearbox filter element

44 To remove, clean and replace the gearbox filter element, proceed as follows:

WARNINGS

(1) PERSONNEL INJURY. DURING LIFTING OPERATIONS RIGOROUS PRECAUTIONS MUST BE TAKEN TO ENSURE THE SAFETY OF ALL PERSONNEL INVOLVED. ANY PERSONS NOT DIRECTLY INVOLVED SHOULD BE CLEARED FROM THE AREA OF OPERATION.

(2) PERSONNEL INJURY. ALWAYS USE APPROVED PALLET LIFTING EQUIPMENT, FOR EXAMPLE, SPREADER BEAMS - DO NOT IMPROVISE.

44.1 Remove the transmission compartment upper access panel (Fig 7 (27)) and transmission compartment access panel (24).

44.2 Clean the outside of the oil filter assembly (Fig 1 (6)) and place rag under the filter bowl, or take similar precautions to contain any oil spillage over the gearbox casing.

44.3 Unscrew the filter bowl (Fig 9 (4)) and carefully remove the filter bowl complete with the filter element (3).

44.4 Clean the filter bowl internally and externally.

44.5 Ensure that the top seal is in place and is in good condition.

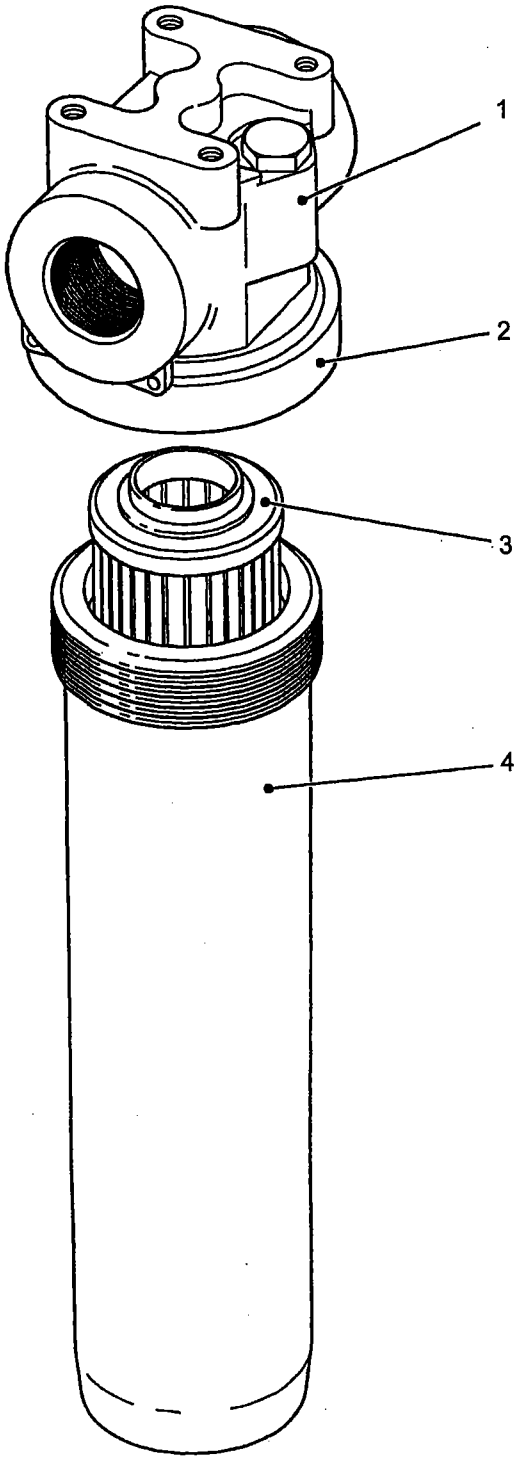
44.6 Fit a new element into the bowl. Locate the bowl on to the header bracket (1) ensuring that the bowl is centralised. Tighten the collar with sufficient force to ensure that the bowl is tight and no leaks occur. DO NOT overtighten.

44.7 Top-up gearbox oil to the correct level.

44.8 Run the engine to bring the oil to its normal working temperature. Stop the engine, re-check the oil level and add oil as necessary.

44.9 Check for oil leaks.

44.10 Refit and secure the two access panels (24) and (27).



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1 Filter header bracket
2 Seal housing
3 Filter element
4 Filter bowl

Fig 9 Gearbox oil filter

Draining the gearbox oil

45 Draining or changing the gearbox oil will not normally be necessary. To carry out this task necessitates the gearbox being removed from the vehicle and is NOT a User task.

STEER UNIT

General description

46 The steer unit is mounted at the front of the transmission compartment, connected to the gearbox by a flexible drive coupling (Fig 1 (7)) and to the final drives by muff type couplings. The unit comprises a crown wheel and pinion, a differential gear train and the necessary clutches and brakes to provide directional control of the vehicle.

47 A steering column at each crew position controls the action of the steer unit. Two modes of steering are available. A changeover lever in the crew compartment enables the appropriate mode to be selected to suit the role of the vehicle. The modes are:

47.1 Controlled differential: For high mobility role.

47.2 Clutch/brake: For tight turning and skid steering.

48 The steering controls in the crew compartment actuate the steer unit via a pneumatic system. Movement of the steering columns causes air valves to be operated, thus directing air to the steer unit brakes or clutches in the required sequence. The steering brakes are totally air operated but the steer unit clutches are operated hydraulically under the control of the pneumatic system.

49 All steering functions are performed by the sequential operation of four contracting band brakes and four multi-plates located within the steer unit.

50 When the controlled differential mode of steering is in use, the appropriate clutches are engaged allowing the steer unit differential gear train to operate. Steering then takes place by controlling the output of the differential by the means of brakes, thus varying the speed of the tracks in relation to each other.

51 In the clutch/brake mode of steering the steer unit differential does not operate. When a steering column is moved in a given direction, a clutch is disengaged and a brake applied, stopping the drive to the track on the inside of the intended turn. Drive to the opposite track is uninterrupted.

Steer unit hydraulic system

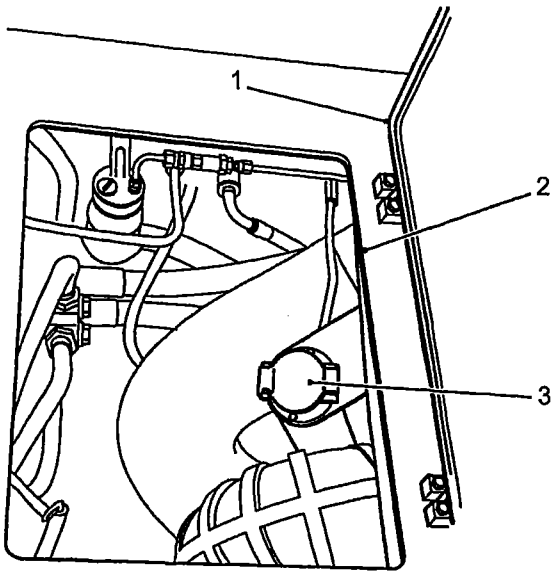
52 The steer unit has its own hydraulic system, which provides hydraulic pressure to operate the clutches and a supply of oil for lubricating and cooling purposes. The system comprises an oil reservoir, a twin element filter, two pumps and the necessary pipework.

53 The two pumps form a tandem unit which is mounted on and driven by the transfer gearbox. One pump supplies oil under pressure to the steer unit, through the filters located on the right side of the transmission compartment. A scavenge pump returns oil from the steer unit sump, through a section of the main heat exchanger, to the reservoir.

54 The reservoir is a separate tank located on the right side of the engine compartment in front of the heat exchanger. The reservoir is filled by means of a filler (Fig 10 (3)) located inside the engine compartment access cover (1) on the roof plate. The filler is connected to the reservoir by a tube and also incorporates a flexible dipstick which is used to check the oil level in the reservoir.

Steer unit air system

55 The steer unit air system is detailed in Chap 2-5 (Brakes and Air System).



U4377/046A

1 Access cover
2 Access hatch (engine compartment)
3 Steer unit oil filler

Fig 10 Steer unit oil filler

Controls and instruments

Steering column

CAUTION

EQUIPMENT DAMAGE. Before driving off, the crew member in control must ensure that his column locking pin is withdrawn and that the locking pin in the opposite crew position is in place.

56 A steering column (Fig 11) is provided at each crew position. Each column can be operated independently. A locking pin (1), attached to a captive chain on each column support bracket (4), must be inserted in the column, when not in use, to prevent accidental interference.

57 The tiller (2) is used to control the direction of travel by rotating it about its column (3). When the crew member in control is facing the direction of travel, the column is moved clockwise to turn the vehicle to the right and anti-clockwise to make a turn to the left.

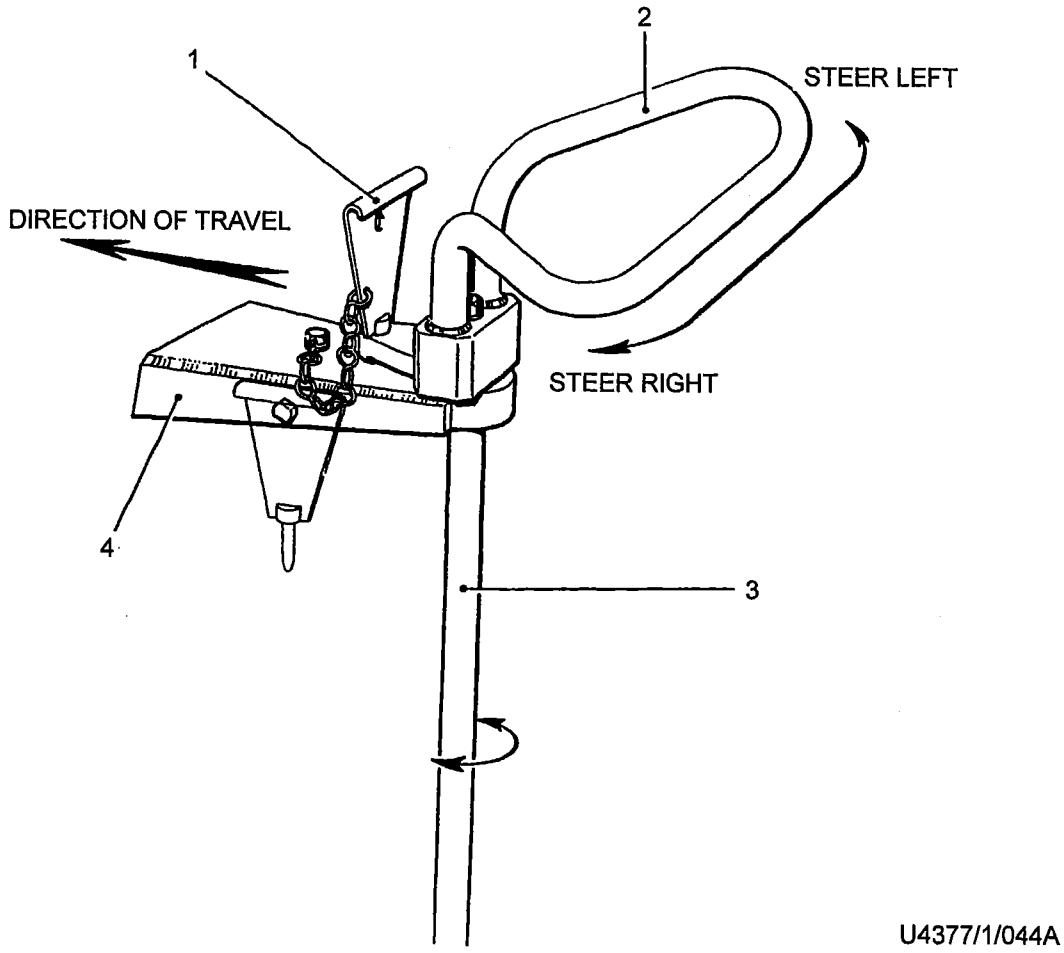
Steer changeover lever

58 The steer changeover lever (Fig 3 (13)) and (Fig 12 (2)), located on the compartment outer wall, enables the steering mode of operation to be changed at will.

59 The lever has two positions, the uppermost identified ROAD DRIVE, selects the controlled differential mode of steering. The lower position, identified SKID STEER, selects the clutch/brake mode.

Steer air pressure gauge

60 The steer air pressure gauge (Fig 13 (6)), located on the driver's road warning instrument panel, indicates the air pressure present in the steer air reservoir. The gauge is graduated 0-11 kgf/cm^2 (0-160 lbf/in.^{2}) and will only operate when the battery master switch is ON.



1 Locking pin (shown in position)
2 Tiller
3 Column
4 Support bracket

Fig 11 Steering column

61 The vehicle must not be operated until a pressure reading of 5.6 kgf/cm^2 (80 lbf/in.^{2}) is obtained.

NOTE

If the vehicle has been left standing it may be necessary to run the engine for several minutes to allow air pressure to build up before moving off. The steering controls may not function if the required minimum pressure gauge reading of 5.6 kgf/cm^2 (80 lbf/in.^{2}) is not present.

Steer unit low oil level warning light

62 A warning light (Fig 5 (5)) on the driver's instrument panel will illuminate when the oil level in the steer oil reservoir becomes unacceptably low. The light has a red lens and is of the 'press to test' type.

63 If the warning light illuminates during vehicle operation the vehicle should be stopped as soon as possible. A check should be made to ensure that no serious oil leaks have occurred before topping up the reservoir. If a serious leak is discovered or if the warning light remains illuminated report to REME.

Central warning light

64 The external and internal (CWL) will illuminate if the steer unit low oil level warning light is activated.

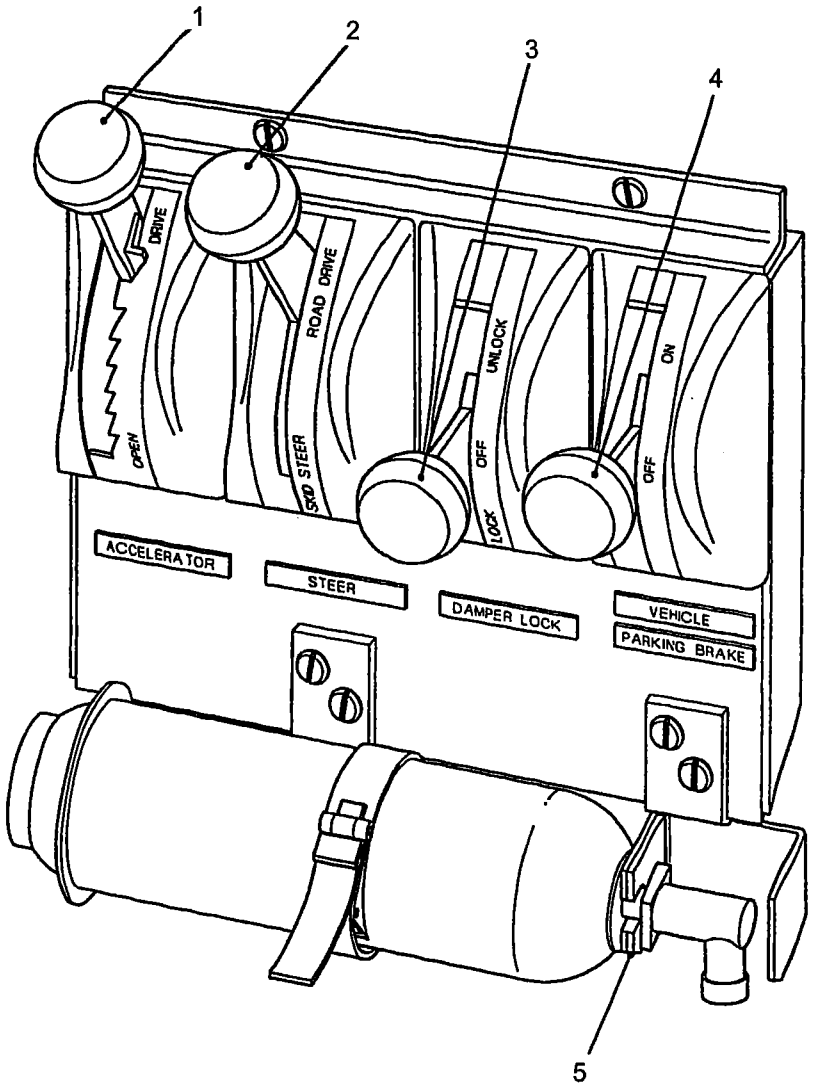
65 If a CWL illuminates, the warning lights and instruments must be checked immediately in order to locate the system at fault.

NOTES

(1) The CWLs will illuminate when the battery master switch is set to ON and will continue to remain illuminated until the engine is started and oil pressure builds up.

(2) The CWL system covers nine warning conditions in all, if the CWLs illuminate it is important that the system at fault is located quickly, by means of the normal warning lights and instruments.

66 The CWL system is detailed in Chap 2-7 (Electrical Equipment).



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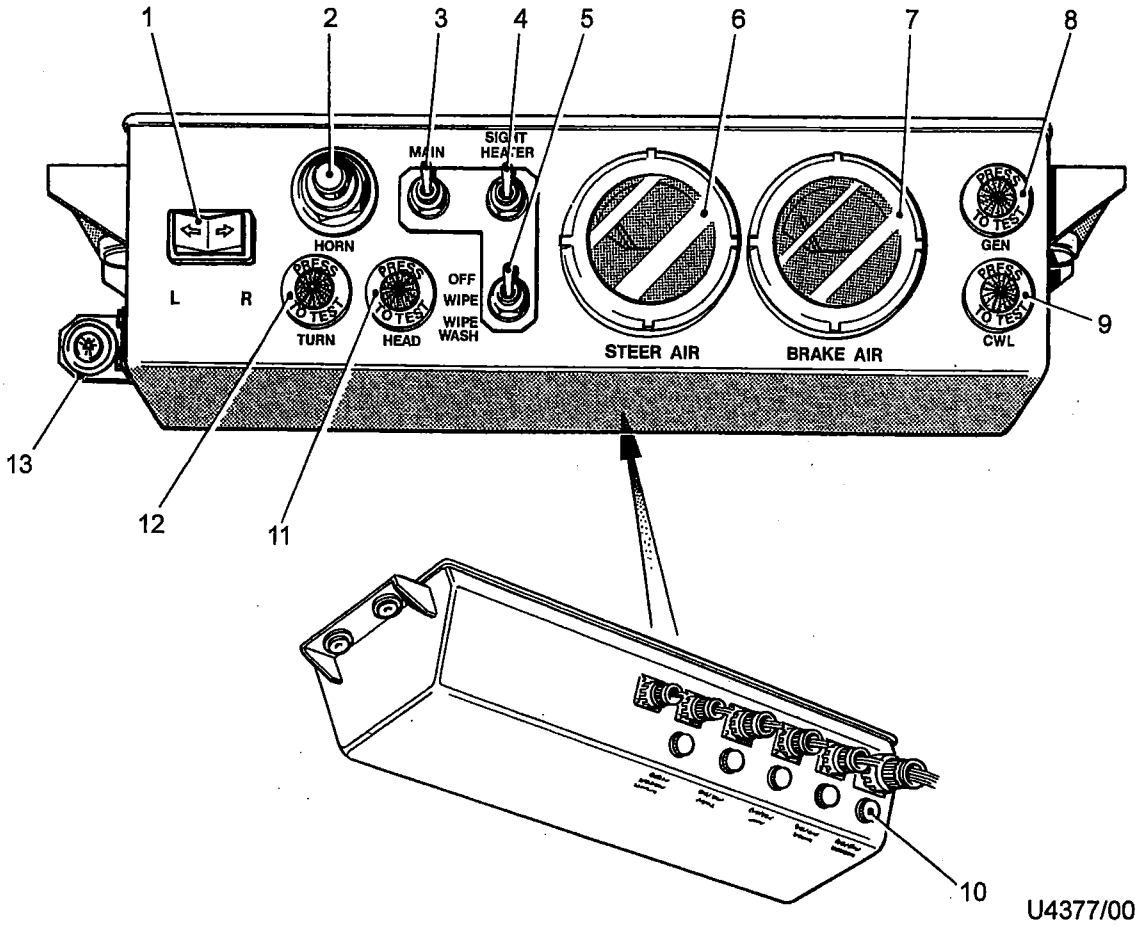
1 Hand operated accelerator
2 Steer changeover lever
3 Suspension lock control lever
4 Parking brake lever
5 Fire extinguisher stowage

Fig 12 Hand controls



1	Turnlight switch	8	Generator warning light
2	Horn pushbutton	9	Central warning light
3	Headlight dipswitch	10	Fuses: F12, F18, F19, F36 and F38
4	Sight heater switch	11	Main beam warning light
5	Wipe/wash switch	12	Turnlight warning light
6	Steer air pressure gauge	13	Hazard warning light switch
7	Brake air pressure gauge		

Fig 13 Driver's road warning instrument panel

Maintenance

General

67 Inspect for oil leaks from the steer unit and the associated pipework. Check security of the steer unit mountings and gearbox/steer unit coupling.

68 In accordance with the Cat 601, lubricate as follows:

68.1 Apply a grease gun to the lubricating nipples on the gearbox/steer unit coupling (Fig 14 (9)) and each of the eight actuator arm pivot pins (5) and (8).

68.2 Using an oil can sparingly, lubricate the eight clevis pins (4) on the brake actuators and the parking brake pawl (2) mechanisms.

To check and top-up the steer unit oil level

69 Before an accurate check on the steer unit reservoir oil level can be made, it is necessary to run the engine for at least five minutes. Prior to starting, check the steer unit low oil level warning light on the driver's instrument panel (with the battery master switch ON. If the steer unit low oil level warning light illuminates do not start up, check for external leaks, and refill oil until the low oil level warning light extinguishes. If any oil is present on the dipstick, run for 5 minutes before checking the level and topping up. After running the engine, proceed as follows:

69.1 Position the vehicle on firm level ground and stop the engine.

69.2 Open the access door (Fig 15 (1)) on the vehicle roof plate.

69.3 Open the filler cap (3) and withdraw the dipstick, which is located in the filler.

69.4 Wipe the dipstick and replace it in the filler tube ensuring that it is pushed fully home. Withdraw the dipstick and observe the oil level. If the oil level is below the FILL mark add oil of the correct grade. **DO NOT FILL TO THE FULL MARK OR ABOVE.** For correct grade of oil refer to Cat 601.

69.5 Replace the dipstick in the filler tube and close the filler cap.

69.6 Close and secure the access door.

To replace steer unit oil filter elements

70 The steer unit oil filter is located on the right side of the transmission compartment beneath the battery tray. The filter has two elements, the instructions which follow apply to both. Filter elements should be replaced at the intervals specified in the Cat 601. To replace steer unit oil filter elements, proceed as follows:

WARNINGS

(1) PERSONNEL INJURY. DURING LIFTING OPERATIONS RIGOROUS PRECAUTIONS MUST BE TAKEN TO ENSURE THE SAFETY OF ALL PERSONNEL INVOLVED. ANY PERSONS NOT DIRECTLY INVOLVED SHOULD BE CLEARED FROM THE AREA OF OPERATION.

(2) PERSONNEL INJURY. ALWAYS USE APPROVED PALLET LIFTING EQUIPMENT, FOR EXAMPLE, SPREADER BEAMS - DO NOT IMPROVISE.

70.1 Stop the engine. Remove the transmission compartment upper access panel (Fig 7 (27)) and transmission compartment access panel (24).

70.2 Clean the area around each filter bowl. Place rag or suitable container beneath the filter bowls to contain any oil spillage, or as much as possible.

70.3 Unscrew the centre bolt (Fig 16 (4)) and carefully remove the filter bowl (5) complete with the element (8).

70.4 Discard the element, clean the filter bowl and its components thoroughly. Remove the seal (3) from the groove in the filter head (1).

70.5 Fit a new seal, making sure that it is correctly located in the groove.

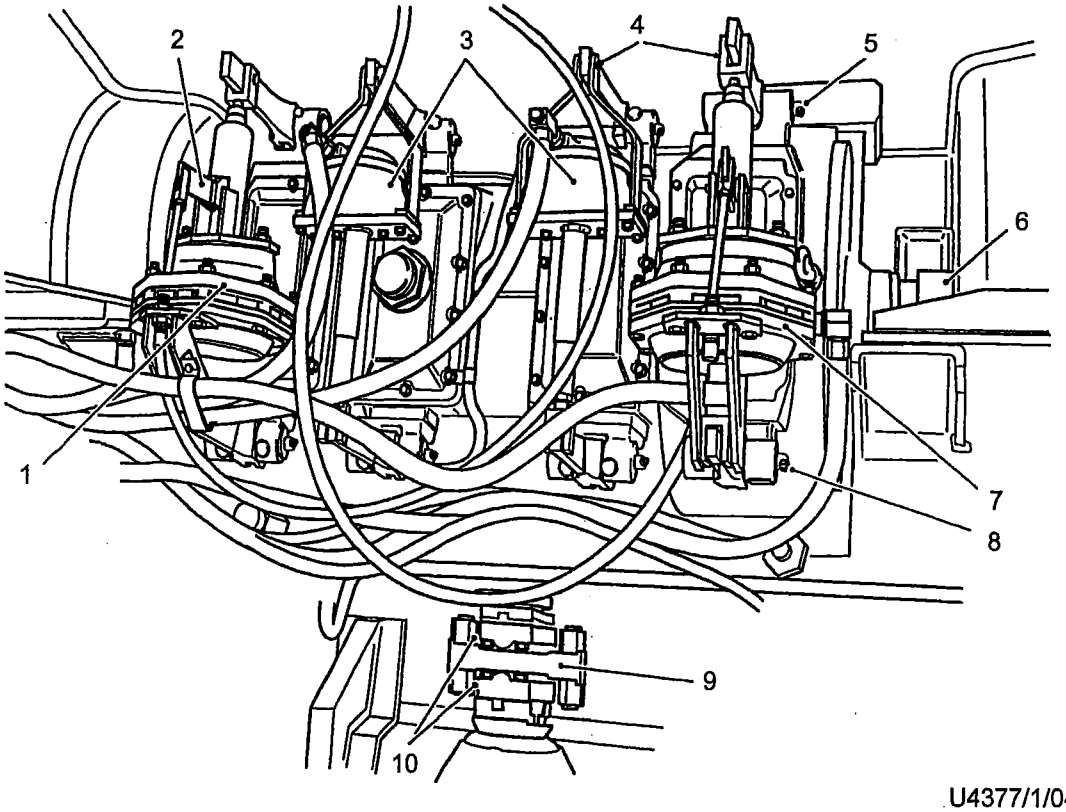
70.6 Place a new filter element in the filter bowl. Position the bowl on to the filter head making sure that it is central. Tighten the centre bolt with sufficient force to ensure that the bowl is tight and no leaks occur. DO NOT overtighten.

70.7 Top-up the steer unit oil reservoir to the correct level.

70.8 Run the engine for at least 5 minutes. Stop the engine, re-check the oil level and add oil as necessary.

70.9 Check for oil leaks.

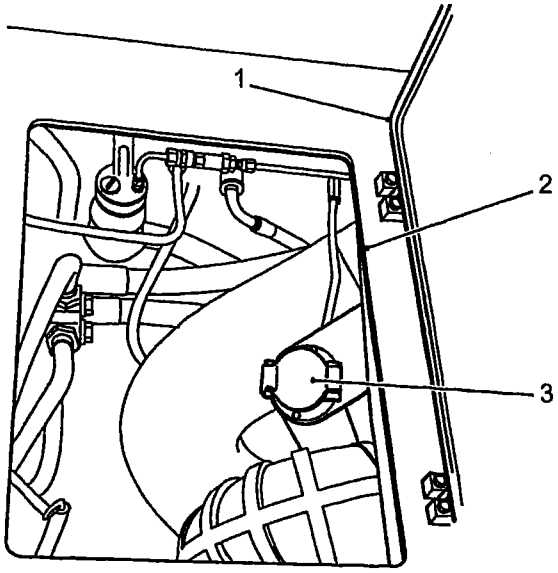
70.10 Refit and secure the two access panels (24) and (27).



U4377/1/043A

1 Steer/main brake actuators
2 Parking brake pawl
3 Steering brake actuators
4 Actuator clevis pins (8 positions)
5 Pivot pin (4 positions)
6 Muff coupling
7 Steer/main brake actuators
8 Actuator arm pivot pins (4 positions)
9 Gearbox/steer unit coupling
10 Coupling lubricating nipples

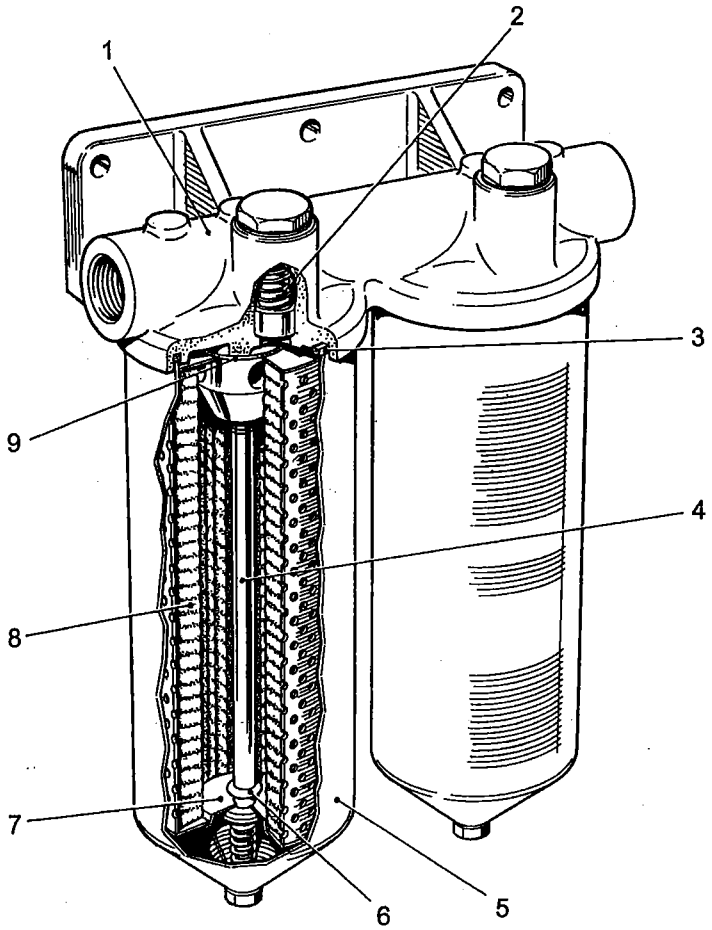
Fig 14 Steer unit and brake actuators



U4377/046A

1 Access door
2 Access hatch (engine compartment)
3 Steer unit oil filler cap

Fig 15 Steer unit oil filler



1 Filter head
2 Relief valve
3 Seal
4 Centre bolt
5 Filter bowl
6 Circlip
7 Guide plate
8 Filter element
9 Sealing ring

U4264/048A

Fig 16 Steer unit oil filter

To drain the steer unit oil

71 Draining or changing the steer unit oil will normally be necessary during 400 hours maintenance. For maintenance periods refer to Cat 601. This is a REME task and must not be undertaken by the User.

FINAL DRIVES

General description

72 The drive from the gearbox is transmitted, through the steer unit, to the two final drives. Each final drive comprises a conventional single reduction gear train contained within an oil tight gearcase. The final drive units are bolted onto the hull at the front of the vehicles, one on each side.

73 The input gear of each final drive is driven, by a sliding coupling, covered by a muff coupling, from the steer unit and the output flange provides a mounting for the track sprockets. The left and right final drives are similar in construction, except for a speedometer drive take-off which is fitted on the left unit only.

74 Each gear case forms an integral oil bath which provides lubrication for the gear train and its associated bearings. A filler/level plug, a drain plug and a breather is fitted to each unit.

Maintenance

To check each final drive oil level

75 To check each final drive oil level, proceed as follows:

75.1 Position the vehicle on firm level ground.

75.2 Clean the area around the filler plug (Fig 17 (1)), remove the plug and check that the oil is level with the bottom of the hole.

75.3 If necessary add oil until the correct level is reached.

75.4 Clean and check washer for serviceability, screw in and tighten the filler plug. Check for leaks.

75.5 Repeat sub-Paras 75.1 to 75.4 for the other final drive.

To change the oil in each final drive

76 To change the oil in each final drive, proceed as follows:

76.1 Run the vehicle to warm the oil to assist draining.

76.2 Position the vehicle on firm level ground.

76.3 Clean the area around the filler plug and the drain plug (3). Place a clean receptacle under the drain plug.

76.4 Remove the filler plug and the drain plug. Allow the oil to drain completely.

76.5 When all the oil has drained clean and replace the drain plug.

76.6 Fill with the correct grade of oil until oil flows from the filler hole.

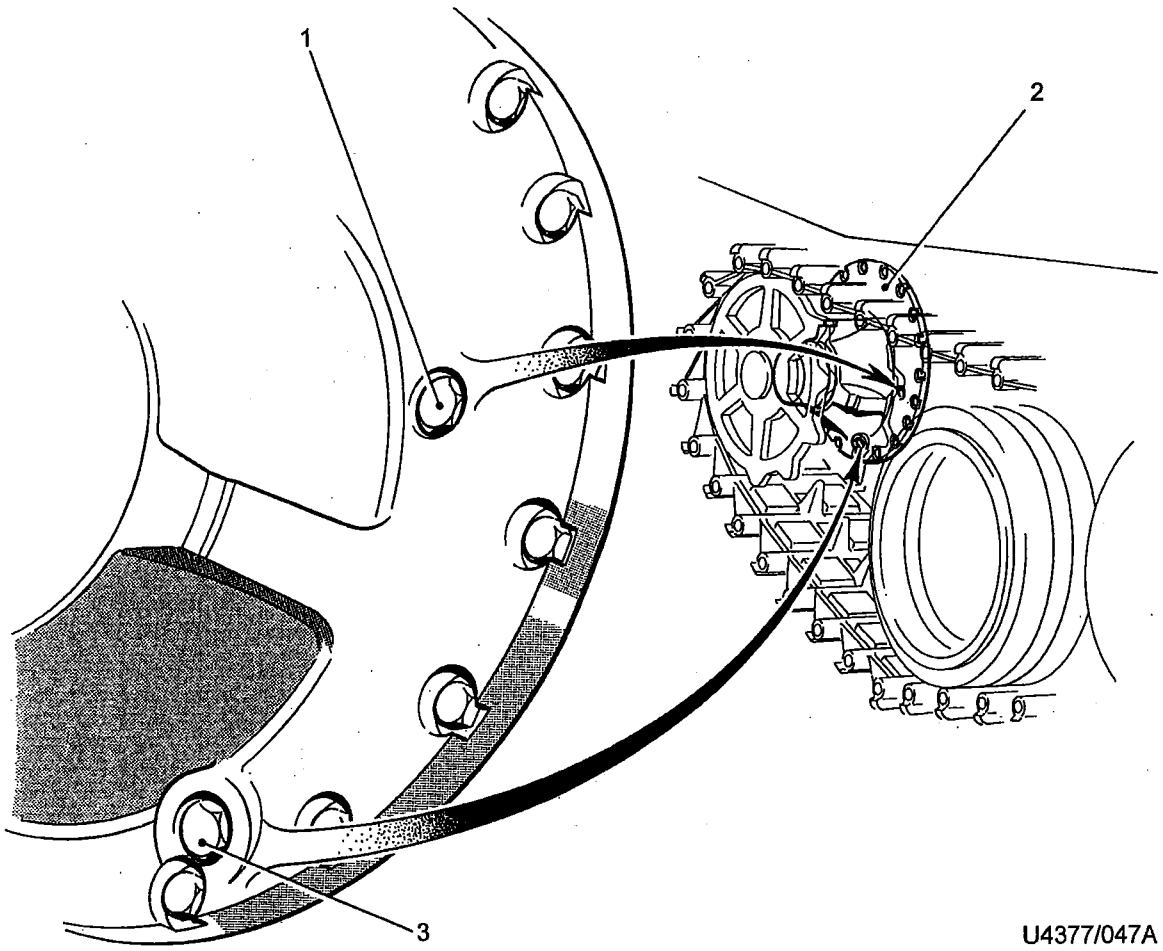
76.7 Clean and replace the filler plug and washer.

76.8 Check for leaks.

NOTES

(1) If a final drive oil level is checked and found to be abnormally high, this may be due to a defective seal, allowing water to enter the gearcase. Action must be taken, if contamination is found, to change the oil and report the defect to REME.

(2) Any water contamination found during a routine oil change must be reported to REME.



1 Filler plug
2 Final drive casing
3 Drain plug

Fig 17 Final drive (left-hand)

CHAPTER 2-5

BRAKES AND AIR SYSTEM

CONTENTS

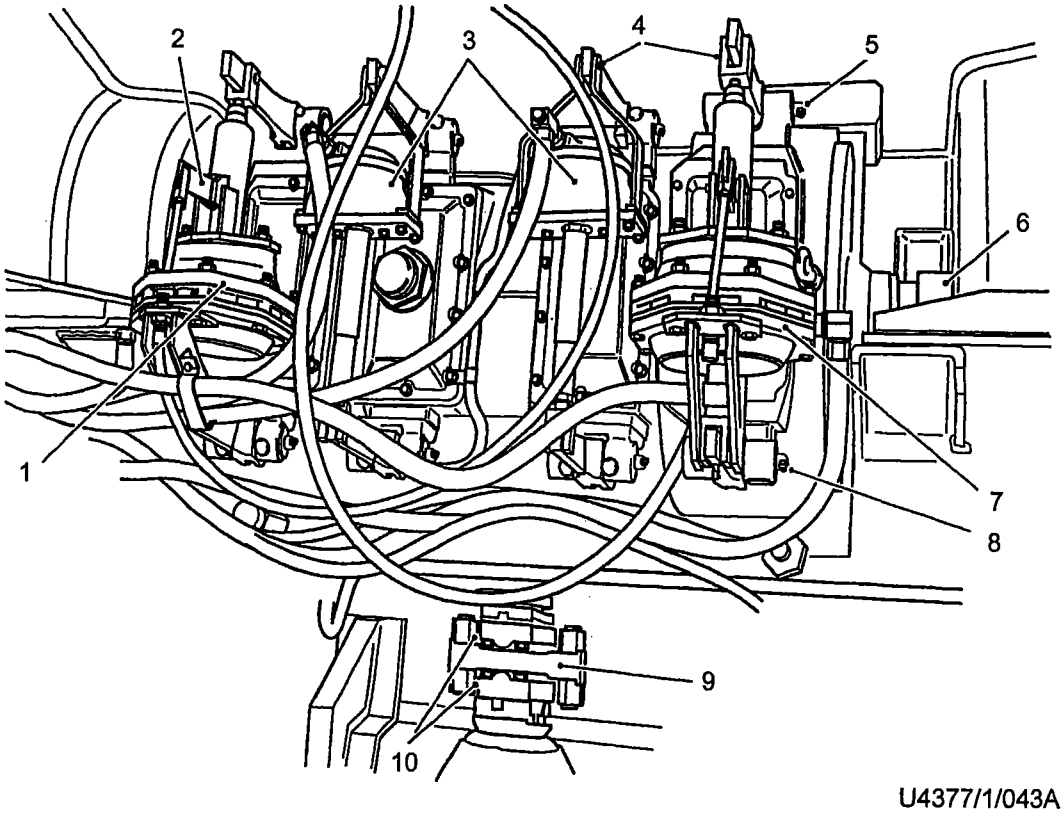
BRAKES

General description

1 Main vehicle braking is provided by utilising two of the brakes in the steer unit. The brakes are arranged to perform a dual function, to provide braking effect for steering in the clutch/brake mode and main braking for vehicle retardation. To achieve this dual function, each of the main brakes actuators (Fig 1 (1) and (7)) has two separate operating diaphragms, one controlled by the steer air system and the other by the brake air system.

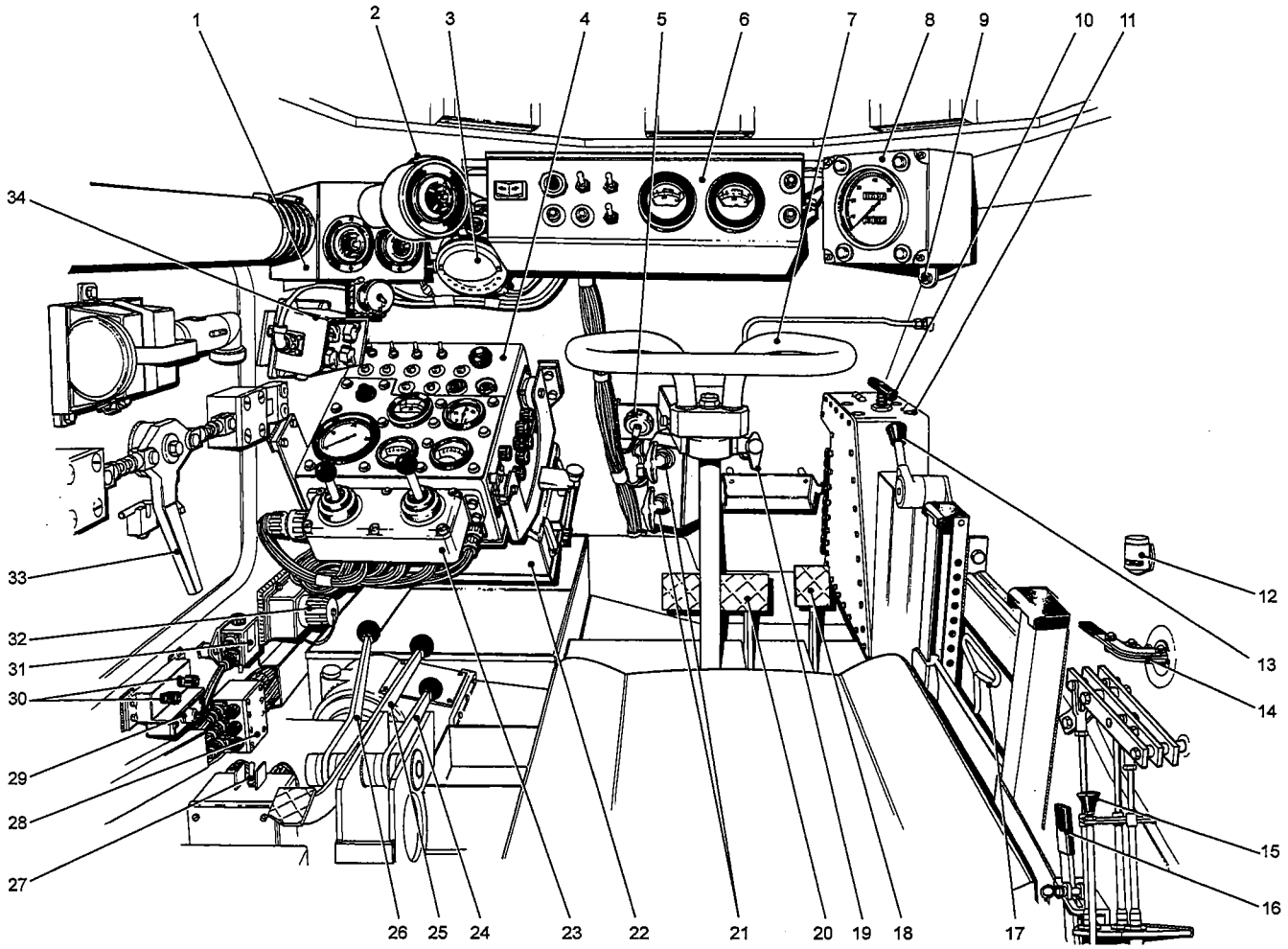
2 Main braking is controlled by foot pedals, one at each crew position. When pressure is applied to a pedal both main brake actuators are operated simultaneously, thus giving straight line braking. All brake controls, with the exception of the parking brake, are air operated. The brake air system is an independent circuit, for normal braking, having its own air reservoir. The reservoir enables a reserve of air pressure to be retained, when the engine is stopped, for limited use of the brake.

3 Emergency braking is possible in the event of a brake air system failure by means of a hand operated valve. When the valve is operated, air is diverted from the steer air system to operate both main brake actuators.



1 Steer/main brake actuators
2 Parking brake pawl
3 Steering brake actuators
4 Actuator clevis pin (8 positions)
5 Pivot pin lubrication nipples (4 positions)
6 Muff coupling
7 Steer/main brake actuators
8 Actuator arm lubrication nipples (4 positions)
9 Gearbox/steer unit coupling
10 Coupling lubrication nipples

Fig 1 Steer unit and brake actuators



1 Diffuser box
2 Python harness aperture
3 Interior light
4 Driver's instrument panel
5 Inspection light socket
6 Driver's road warning instrument panel
7 Steering column
8 Speedometer panel
9 'Trip' reset knob
10 Battery master switch
11 Distribution panel
12 Air restriction indicator
13 Emergency brake lever
14 Flooding valve
15 Engine stop control
16 Transmission disconnect clutch lever
17 Height adjuster, driver's seat
18 Accelerator pedal
19 Cold starting aid pump handle
20 Brake pedal
21 Fire extinguisher operating handles
22 Night sight stowage
23 Gear selector switch-box
24 Winch gear change lever
25 Pay out/winch in control lever
26 High speed pay out/winch in control lever
27 Driver/operator select switch
28 Junction box
29 Demolition microswitch
30 Demolition terminals
31 Heated clothing switch-box
32 Inter-vehicle socket
33 Emergency door release handle
34 Crew box - 2 radio

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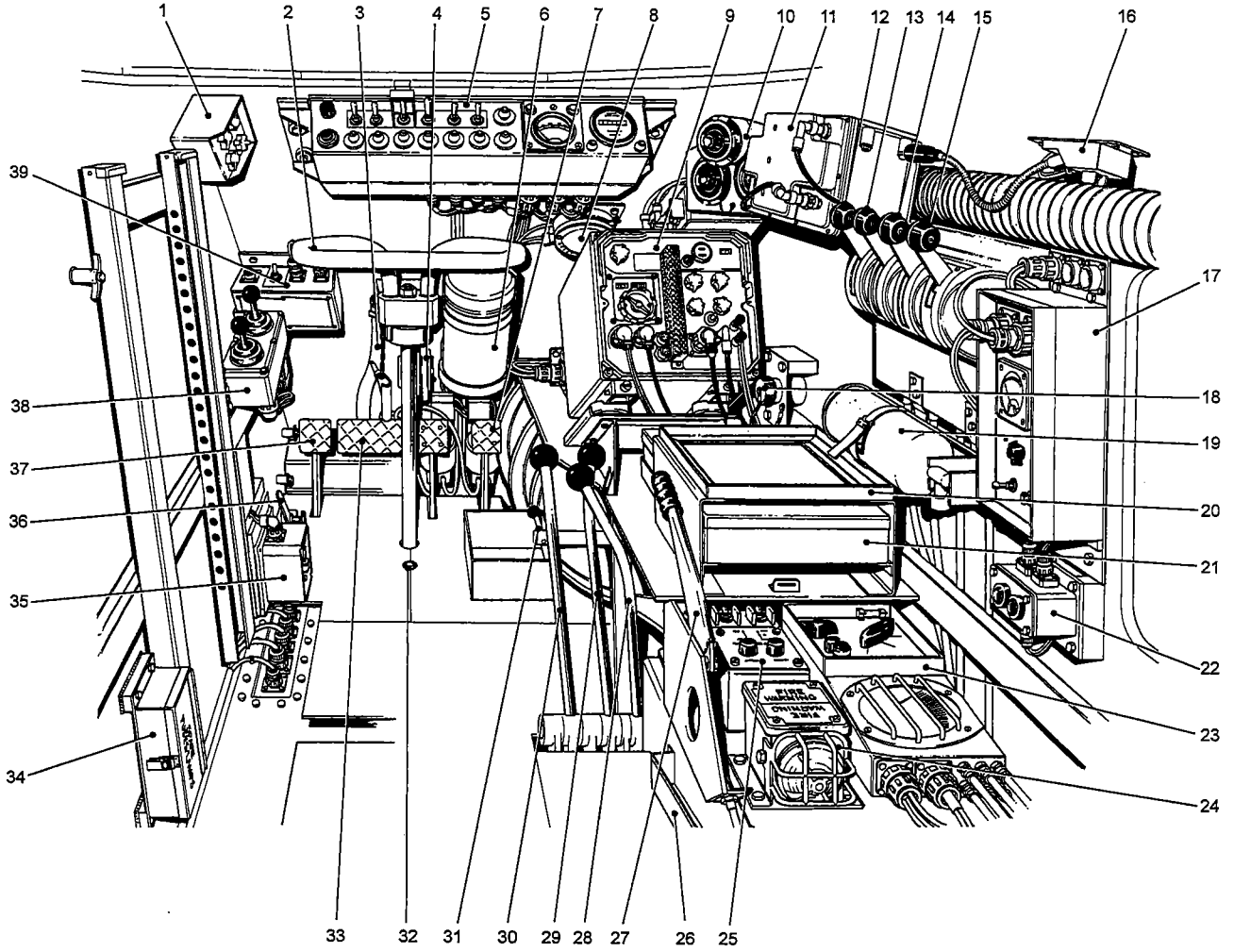
Fig 2 Controls and instruments (crew compartment - front)

1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spares box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnector pedal
38 Gear selector switch-box
39 Firewire control box



U4377/028B

Fig 3 Controls and instruments (crew compartment - rear)

4 The vehicle air system is described in greater detail later in Paras 21 to 34.

5 The parking brake consists of a mechanical ratchet device which enables the main brake actuators to be 'locked on' once they have been applied. A lever (Fig 3 (15)) in the crew compartment controls the parking brake ratchets, via a cable.

6 The operator's disconnect pedal (37) is connected mechanically to the main brake valve. When the disconnect pedal is depressed to its fullest extent the main brakes are applied. The pedal is only used during earth moving operations and its purpose is detailed in Chap 2-8-2 (Earth Moving Equipment).

Controls and Instruments

Brake pedals

WARNING

PERSONNEL INJURY. HARD APPLICATION OF THE BRAKE PEDAL WILL RESULT IN THE VEHICLE STOPPING ABRUPTLY, RESULTING IN POSSIBLE INJURY TO THE CREW.

7 The brake pedals (Fig 2 (20)) and (Fig 3 (33)) are linked mechanically beneath the crew compartment floor. When a pedal is depressed, the main brake air valve is actuated and the brakes progressively applied.

Emergency brake lever

CAUTION

EQUIPMENT DAMAGE. The emergency brake must not be used as a parking brake by leaving the lever in the 'ON' (rearmost) position. In time, air will leak away and the brakes will release.

8 The emergency brake lever (Fig 2 (13)) is located on the driver's right. If damage or a fault occurs in the main brake air system emergency braking is possible, providing the steer system reservoir is undamaged and pressurised. When the emergency brake lever is operated, air from the steer air reservoir is applied direct to the main brake actuators.

9 The normal OFF position for the lever is forward, moving the lever back towards the rear of the vehicle will progressively apply the brakes.

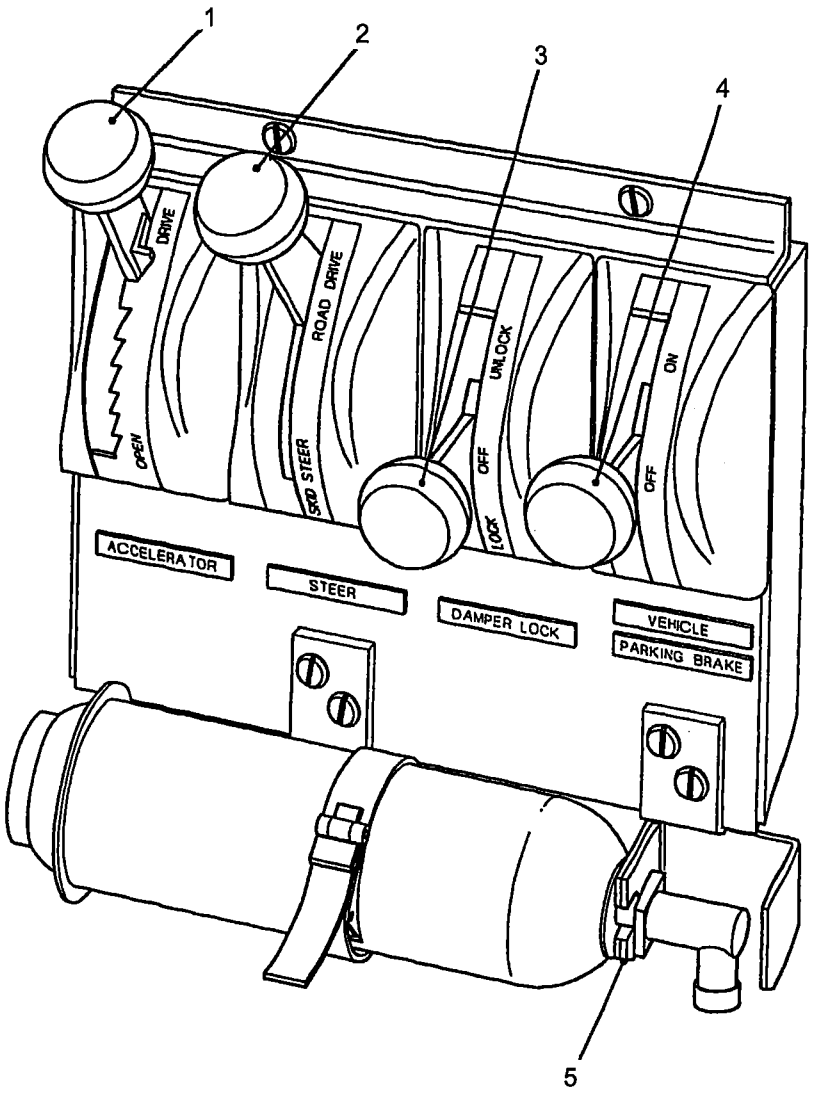
Parking brake lever

10 The parking brake lever (Fig 3 (15)) and (Fig 4 (4)) is located on the outer wall of the crew compartment and can be reached from either seat. This control cannot be used to slow or stop the vehicle; its function is to mechanically lock the main brake actuators ON when the vehicle is stationary.

11 When the parking brake lever is moved upwards to the ON position, ratchet pawls (Fig 1 (2)) are released by the control cables to engage teeth on the actuator plungers. The ratchet pawls will then prevent the actuator plungers from returning to their OFF positions after the footbrake has been operated. When the lever is moved to the OFF (lower) position, the pawls will be withdrawn, allowing the actuators to operate normally. Pressure must be applied to the foot brake pedal before attempting to release the parking brake.

Brake air pressure gauge

12 The brake air pressure gauge (Fig 5 (7)), located on the driver's road warning instrument panel, indicates the air pressure present in the brake air reservoir. The gauge is graduated 0-11 kgf/cm^2 (0-160 lbf/in.^{2}) and will operate only when the battery master switch is ON.



U4377/1/045A

1 Hand operated accelerator
2 Steering changeover lever
3 Suspension lock control lever
4 Parking brake lever
5 Fire extinguisher stowage

Fig 4 Hand controls

13 The vehicle must not be operated until a pressure reading of 4.2 kgf/cm^2 (60 lbf/in.^{2}) is obtained.

NOTE

If the vehicle has been left standing it may be necessary to run the engine for several minutes to allow air pressure to build up before moving off. The brakes may not function if the required minimum pressure gauge reading of 4.2 kgf/cm^2 (60 lbf/in.^{2}) is not present.

Brake low pressure warning light

14 The brake low pressure warning light (Fig 6 (17)) on the operator's instrument panel will illuminate when the brake air pressure falls dangerously low. The light, which has a red lens, is identified BRAKES under the LOW PRESSURE caption and is the 'press to test' type.

15 If the brake low pressure warning light illuminates during vehicle operation the vehicle should be brought to a halt as soon as possible using the emergency brake, if necessary. In an extreme emergency the vehicle can be driven in this condition providing the steer air pressure gauge reading remains normal. All such brake system failures must be reported to REME immediately.

Central warning light

16 The external and internal Central Warning Lights (CWL) will illuminate if the brake air low pressure warning light is activated.

NOTE

When operating in convoy only the internal CWL will operate in the event of the brake air low pressure activation.

17 If a CWL illuminates, the warning lights and instruments must be checked immediately in order to locate the system at fault.

NOTES

(1) The CWLs will illuminate when the battery master switch is switched to ON and will remain illuminated until the engine is started and oil pressure builds up.

(2) The CWL system covers nine warning conditions in all, if the CWLs illuminate, it is important that the system at fault is located quickly, by means of the normal warning lights and instruments.

18 The CWL system is detailed in Chap 2-7 (Electrical Equipment).

Operation

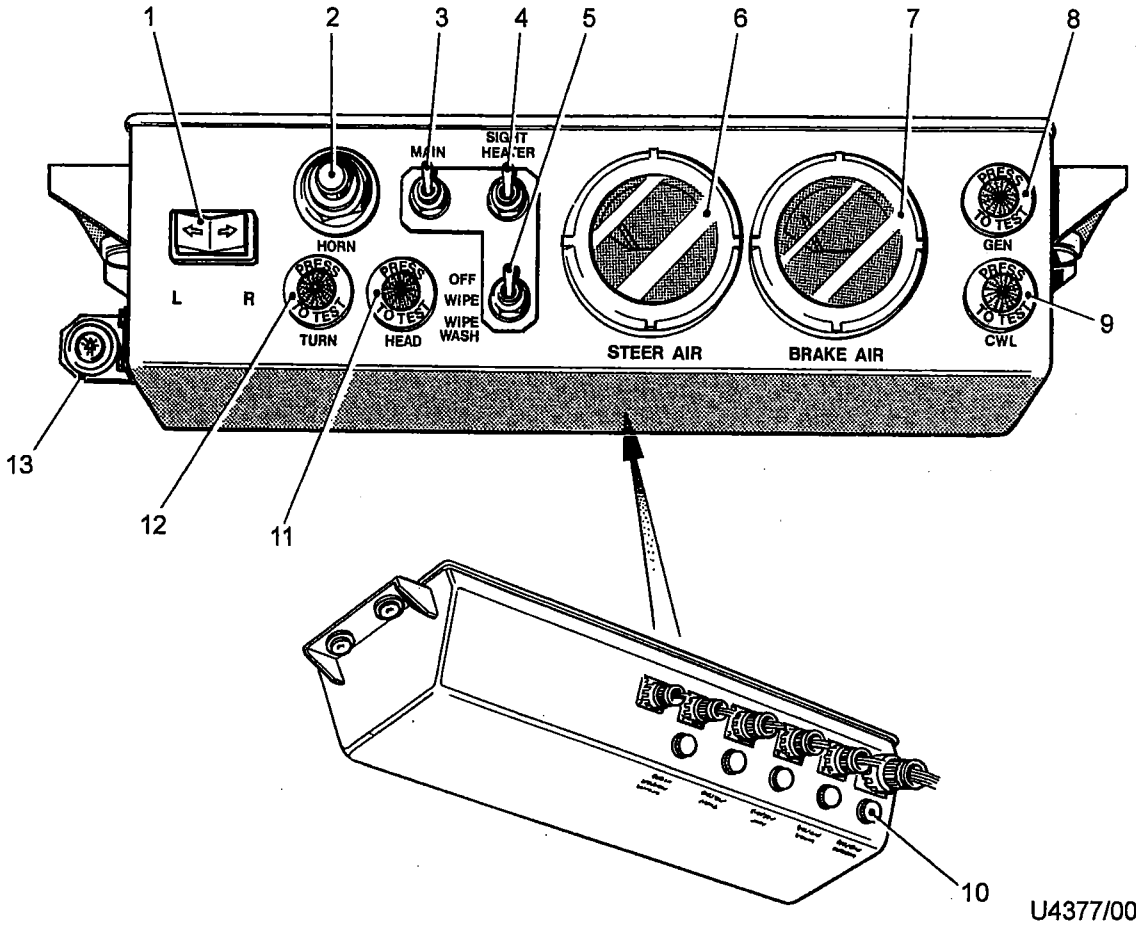
To apply the parking brake

19 To apply the parking brake, proceed as follows:

19.1 Apply half pressure to either footbrake pedal.

19.2 Move the parking brake lever upwards until it engages in the 'gate' marked ON.

19.3 Release the brake pedal.



1	Turnlight switch	8	Generator warning light
2	Horn pushbutton	9	Central warning light
3	Headlight dip switch	10	Fuses: F12, F18, F19, F36 and F38
4	Sight heater switch	11	Main beam warning light
5	Wipe/wash switch	12	Turnlight warning light
6	Steer air pressure gauge	13	Hazard warning light switch
7	Brake air pressure gauge		

Fig 5 Driver's road warning instrument panel

To release the parking brake

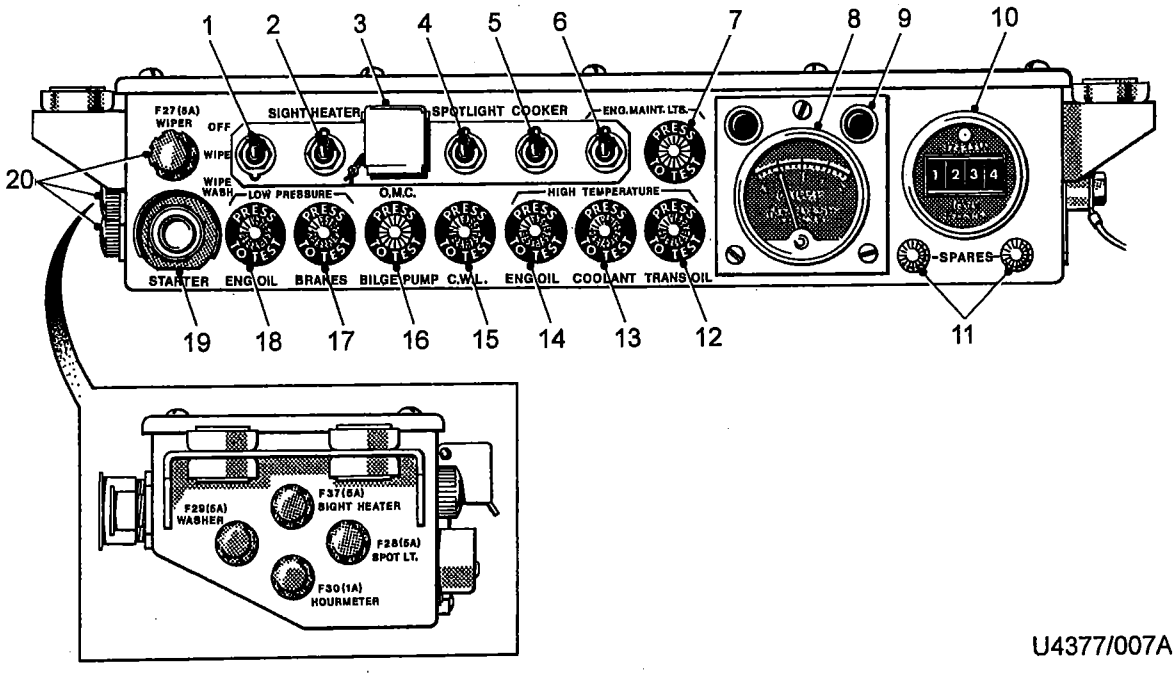
20 To release the parking brake, proceed as follows:

20.1 Apply full pressure to either footbrake pedal.

20.2 Move the parking brake lever downwards into the 'gate' marked OFF.

NOTE

It will only be possible to apply or release the parking brake if normal braking air pressure is available. If it is necessary to release the parking brake when the engine cannot be started and no air pressure exists in the reservoir (i.e. for towing purposes) an external air supply will be required.



U4377/007A

1 Wipe/wash switch
2 Sight heater switch
3 Override master control switch
4 Spotlight switch
5 Cooker switch
6 Engine maintenance light switch
7 Maintenance light warning light
8 Ammeter
9 Panel lights (2 positions)
10 Hourmeter
11 Spare warning light lenses
12 Transmission oil temperature warning light
13 Coolant temperature warning light
14 Engine oil temperature warning light
15 Central warning light
16 Bilge pump warning light
17 Brake low pressure warning light
18 Engine low oil pressure warning light
19 Starter button
20 Fuses: F27, F28, F29, F30 and F37

Fig 6 Operator's instrument panel

AIR SYSTEM

General description

21 Air pressure is required to operate the main brakes, steer unit actuators and suspension lockout valves in the hydraulic dampers. The air pressure system consists of a compressor, unloader valve, water separator tank, two reservoirs and the necessary pipework. One reservoir supplies air pressure for braking and the second for all other purposes.

22 The controls and instruments appertaining to the air system are detailed in the steering, brake or suspension sections of this publication, as appropriate.

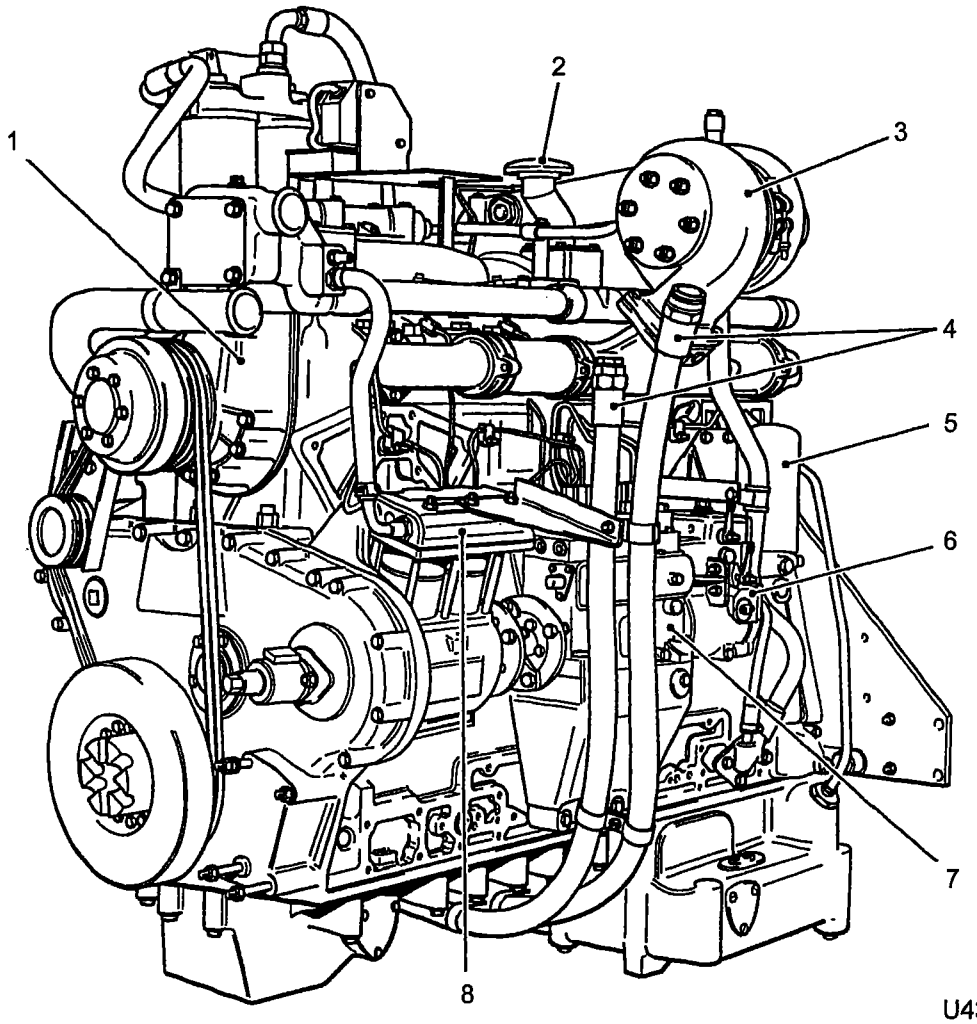
23 An external coupling enables the reservoirs to be charged from a remote source of air pressure. The same coupling may be used to supply air to ancillary equipment.

Compressor

24 The air compressor (Fig 7 (8)) is a twin cylinder unit mounted on, and driven from, the engine timing case. Clean air is drawn in by the compressor from a connection on the engine air cleaner.

Alcohol evaporator

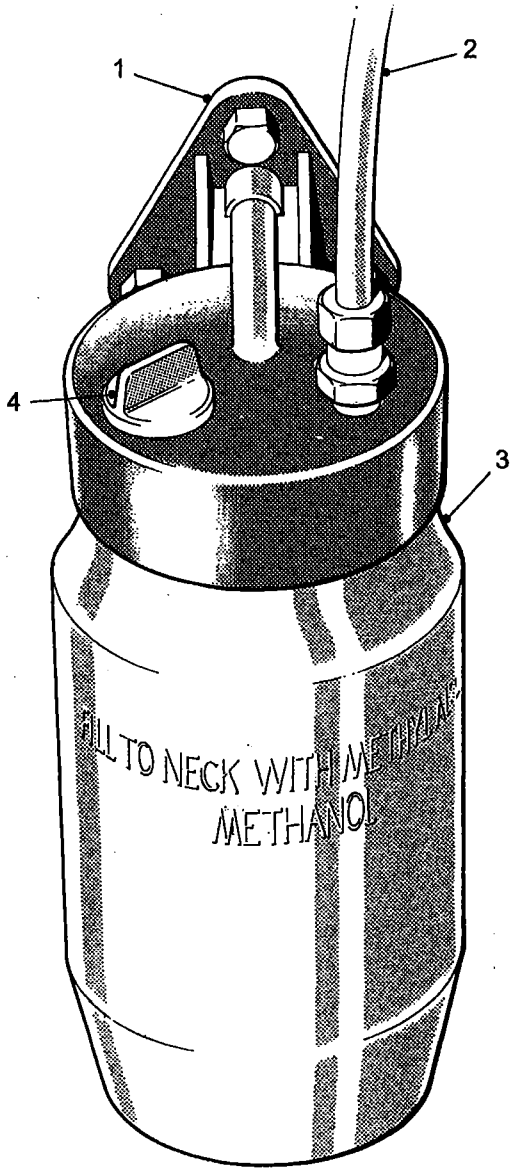
25 To protect the air system in conditions of extreme cold, below 0 degrees C (32 degrees F), an alcohol evaporator is provided. This device introduces alcohol vapour into the system to act as an antifreeze agent.



1 Coolant pump
2 Oil filler
3 Turbocharger
4 Oil hoses to heat exchanger
5 Main fuel filter
6 Governor
7 Fuel injection pump
8 Air compressor

Fig 7 Engine, right, rear

26 The alcohol evaporator (Fig 8) is located inside the engine compartment access cover on the engine/transmission compartment bulkhead. The unit has a detachable reservoir (3) and a filler plug (4). The reservoir should be filled, only when conditions of extreme cold are anticipated, with Methyl Alcohol (Methanol). There are no controls and the evaporator will operate without attention while the compressor is running, providing the reservoir contains sufficient fluid.



U4377/048

1 Mounting bracket
2 Pipe to air system
3 Reservoir
4 Filler plug

Fig 8 Alcohol evaporator

Unloader valve

27 The air supply from the compressor is controlled to give a maximum system pressure of 7 kgf/cm^2 (100 lbf/in.^{2}) by an unloader valve. The valve is located on the right side of the engine compartment adjacent to the air reservoirs and does not require any attention from the user.

Water separator tank and air reservoirs

28 Air from the unloader valve passes through a water separator tank into two reservoirs. The separator tank is designed to automatically rid the system of unwanted moisture. The tank incorporates an automatic drain valve and a safety valve which is set at 11 kgf/cm^2 (160 lbf/in.^{2}).

29 The separator tank outlet is connected to both air reservoirs. One reservoir provides a supply of air for the main braking system; and the other air to operate the steering, disconnect control, suspension lock and emergency brake. Both reservoirs are located, with the separator tank, on the right side of the engine compartment below the heat exchangers.

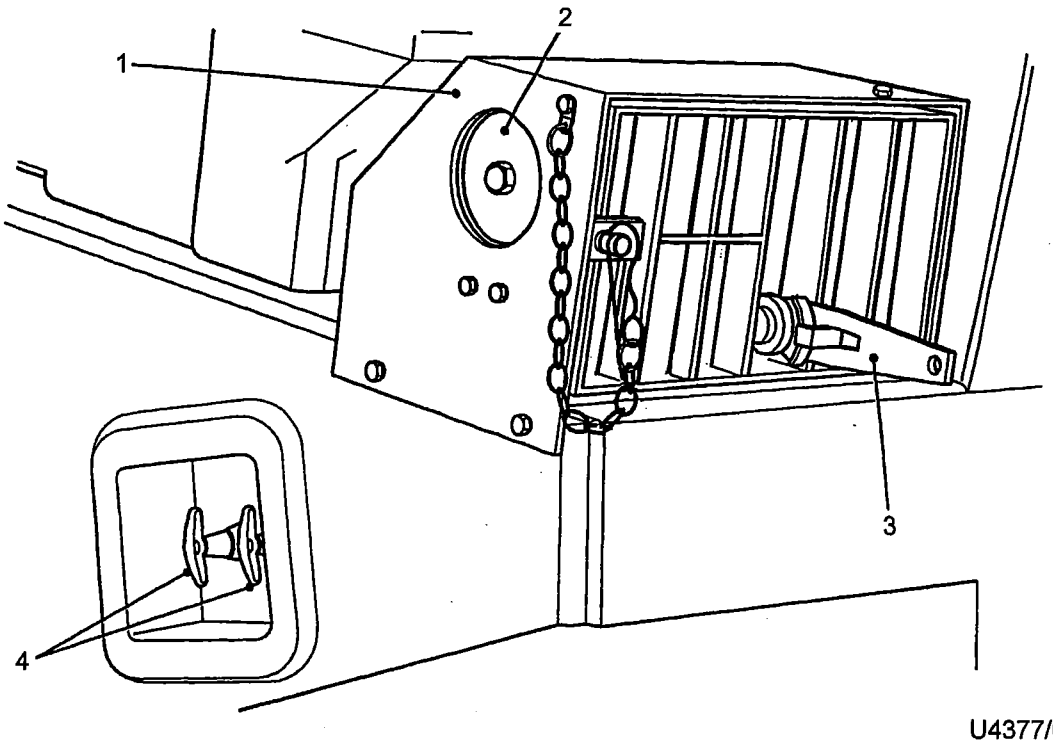
30 Each reservoir has an integral non-return valve fitted to the inlet connection, to prevent a reverse flow of air when the compressor is not running. Manual drain cocks are fitted to both reservoirs, to supplement the automatic drain valve in the water separator, but are not used during normal routine servicing.

External air connection

CAUTION

EQUIPMENT DAMAGE. When the external air coupling is not in use, a suitable dummy coupling should be attached to prevent the entry of foreign matter and damage to the sealing surfaces.

31 The external air connection (Fig 9 (3)) is a quick acting 'palm' type coupling located in the front right light box (1). The coupling is connected to the air system via a coupling cock, non-return valve and a pressure protection valve.



U4377/017B

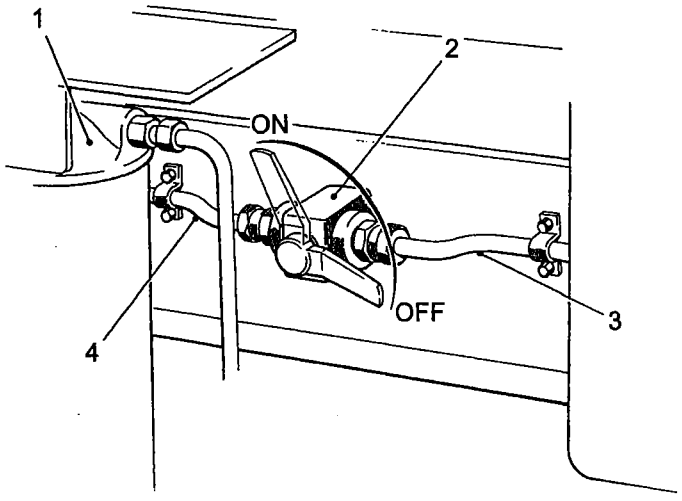
1 Front right light box
2 Road warning horn
3 External air connection
4 Fixed fire extinguisher operating handles

Fig 9 External air connection

32 To enable the external air connection to be isolated when not in use, a two position coupling cock (Fig 10 (2)) is fitted. The cock is located on the right side of the transmission compartment beneath the battery tray.

33 When charging the reservoirs from an external source, air flows through the coupling, non-return valve and coupling cock direct to both reservoirs. With the reservoirs charged in this way sufficient air pressure will be available for limited use of the brakes and/or steering.

34 The external air connection may be used to provide air to operate other equipment, i.e. to release the air brakes on a road trailer while towing. Air pressure is only available at the coupling when the engine is running, no air is drawn from the reservoirs for external use. Air flow to the coupling is restricted by the pressure protection valve until a predetermined minimum useable pressure is built up.



1 Steer unit oil filters
2 Coupling cock
3 Pipe from air reservoirs
4 Pipe to external air connection

Fig 10 External air connection ON-OFF cock

Operation

<u>To charge the air system from an external source</u>

35 To charge the air system from an external source, proceed as follows:

35.1 Ensure that the air supply source is equipped with a suitable hose having the correct 'palm' type coupling. Connect the supply hose to the external air connection (Fig 9 (3)).

35.2 Open the transmission compartment upper access panel. Move the coupling cock operating handle to the ON position, as shown in Fig 10.

35.3 Turn on the external air supply.

35.4 Providing the vehicle batteries are charged, and the battery master switch is set to ON it is possible to monitor the level of air pressure in the reservoirs by referring to the brake and steer pressure gauges (Fig 5 (6) and (7)).

35.5 Turn off the external air supply when a pressure of approximately 7 kgf/cm^2 (100 lbf/in.^{2}) is reached.

35.6 Move the coupling cock operating handle to the OFF position.

35.7 Close and secure the access panel.

35.8 Uncouple the hose and replace the dummy coupling.

Using the external air supply to operate ancillary equipment

36 When using the vehicle air system to operate ancillary equipment, via the external air connection, the following precautions should be observed:

36.1 Check that any connecting hose used has a compatible 'palm' type coupling.

36.2 Do not turn coupling cock (Fig 10 (2)) to ON until the connecting hose is in place.

36.3 Do not attempt to disconnect any connecting hose until the coupling cock is turned OFF and any pressure in the line is released.

36.4 Remember that air pressure is not available at the external air connection until the engine is running and the coupling cock is in the ON position. It may be necessary to run the engine for a few minutes to allow pressure to build up sufficiently to operate the pressure protection valve and flow to the external connection.

Maintenance

To service the alcohol evaporator

37 The alcohol evaporator operates automatically once filled with fluid. Correct functioning of the unit is indicated by the presence of air bubbles in the reservoir when the compressor is running. If no bubbles are apparent, check for leaks, paying particular attention to the gaskets on the filler plug and the reservoir joint.

NOTE

The reservoir should only be filled with Methyl Alcohol (Methanol) when protection against freezing is actually required.

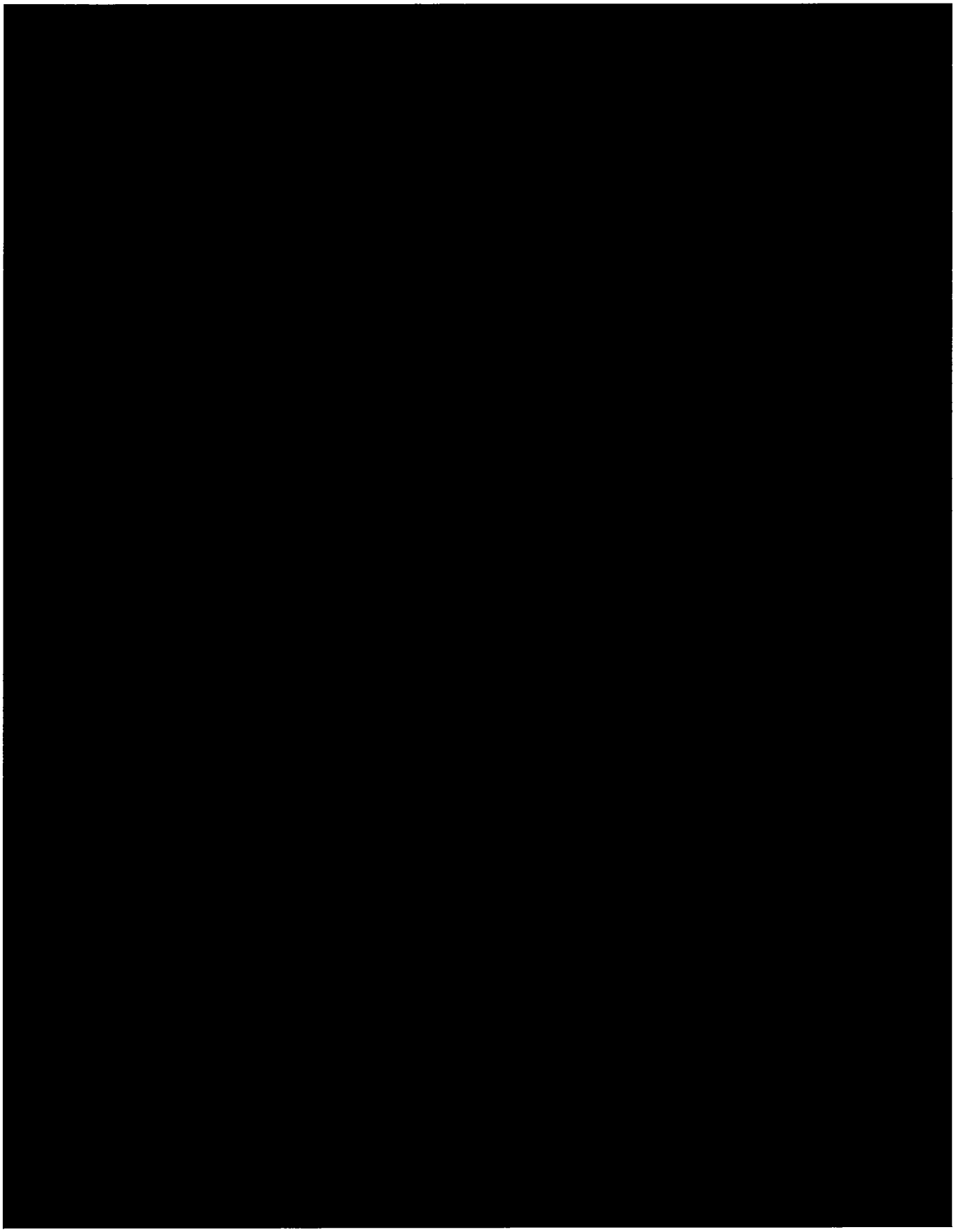
38 The alcohol reservoir may be cleaned and filled as follows:

38.1 Stop the engine. Open the engine compartment access door (Fig 11 (18)).

38.2 Unscrew the reservoir (Fig 8 (3)) from the evaporator body.

KEY TO FIG 11

1 Front stowage boxes
2 Winch
3 Air intake cowl
4 Access panel
5 Access cover plates
6 Stowage basket
7 Stowage box
8 Rear stowage bin
9 Bilge pump outlet (rear)
10 Engine compartment roof plate
11 Engine compartment lower access panel
12 Drain plug
13 Emergency exit door
14 [redacted]
15 Exhaust cowl
16 Fairlead
17 Smoke grenade stowage box
18 Engine compartment access door
19 Operator's access door
20 Driver's access door
21 Python aperture cover plate
22 NBC air intake cowl
23 Stowage compartment door
24 Transmission compartment lower access panel
25 General service tow hook
26 Fire extinguisher operating handles
27 Transmission compartment upper access panel
28 Bilge pump outlet (front)
29 Smoke discharger mounting
30 Fuel filler access cover
31 Radiator intake louvres
32 Radiator outlet louvres



38.3 Clean the reservoir internally and externally. Inspect the reservoir for cracks or damage which may cause a leak.

38.4 Check that the gaskets on the filler plug and reservoir are in good condition. Replace the reservoir.

38.5 Remove the filler plug (4) and fill the reservoir with Methyl Alcohol (Methanol) to the level of the reservoir neck.

38.6 Replace the filler plug. Close and secure the access door.

CHAPTER 2-6

RUNNING GEAR

CONTENTS

SUSPENSION AND ROADWHEELS

General description

1 The vehicle is supported on each side by five independently sprung roadwheels. Each roadwheel assembly is mounted on an axle arm which pivots in bearings fitted to the hull sides. A torsion bar attached to each axle arm provides the necessary spring action.

2 The axle arms at the extreme front and rear of the vehicle (wheel stations 1 and 5) are attached to hydraulic dampers, located inside the hull. The dampers fitted to the rear station (station 5) are provided with a locking device, which may be operated from the crew compartment, to enable the rear suspension members to be locked rigidly when required.

SUSPENSION

Description

Torsion bars and axle arms

3 The torsion bars (Fig 1 (4)), which support the weight of the vehicle through torsional resistance (i.e. the twisting action of the bars caused by up and down movement of the axle arms), act as springs to cushion the vehicle against ground shocks.

4 Each axle arm (6) is pivoted in bearings located in a housing (3) on the hull side. The axle arm is attached by means of splines to one end of a torsion bar (4). The torsion bar extends across the hull floor with its opposite end secured in an anchorage (5) on the hull.

5 On the front four stations of the suspension (wheel stations 1 to 4) the axle arms are fitted with a stub axle on which the wheel hubs (7) are located. Each rear axle arm (12) (station 5) carries a cranked axle (16) and a track tensioning arm (11) to allow the roadwheel to be moved in relation to the axle arm for track adjustment. The rear station roadwheels (17) are located on the cranked axles by means of integral non-detachable hubs.

6 The axle arm pivoting bearings are lubricated by means of a nipple (1) and a breather (2) located on the bearing housing. Oil is applied to the nipple by means of a suitable lubricating gun. The breather prevents over pressurizing and damage to the bearing housing seals.

7 Rebound pads (14) are fitted inside the rear hull to absorb any excessive travel of the rear suspension units. Bump stops on the outside of the forward hull prevent the front (station 1) suspension from being damaged when travelling forwards over rough ground.

Hydraulic dampers

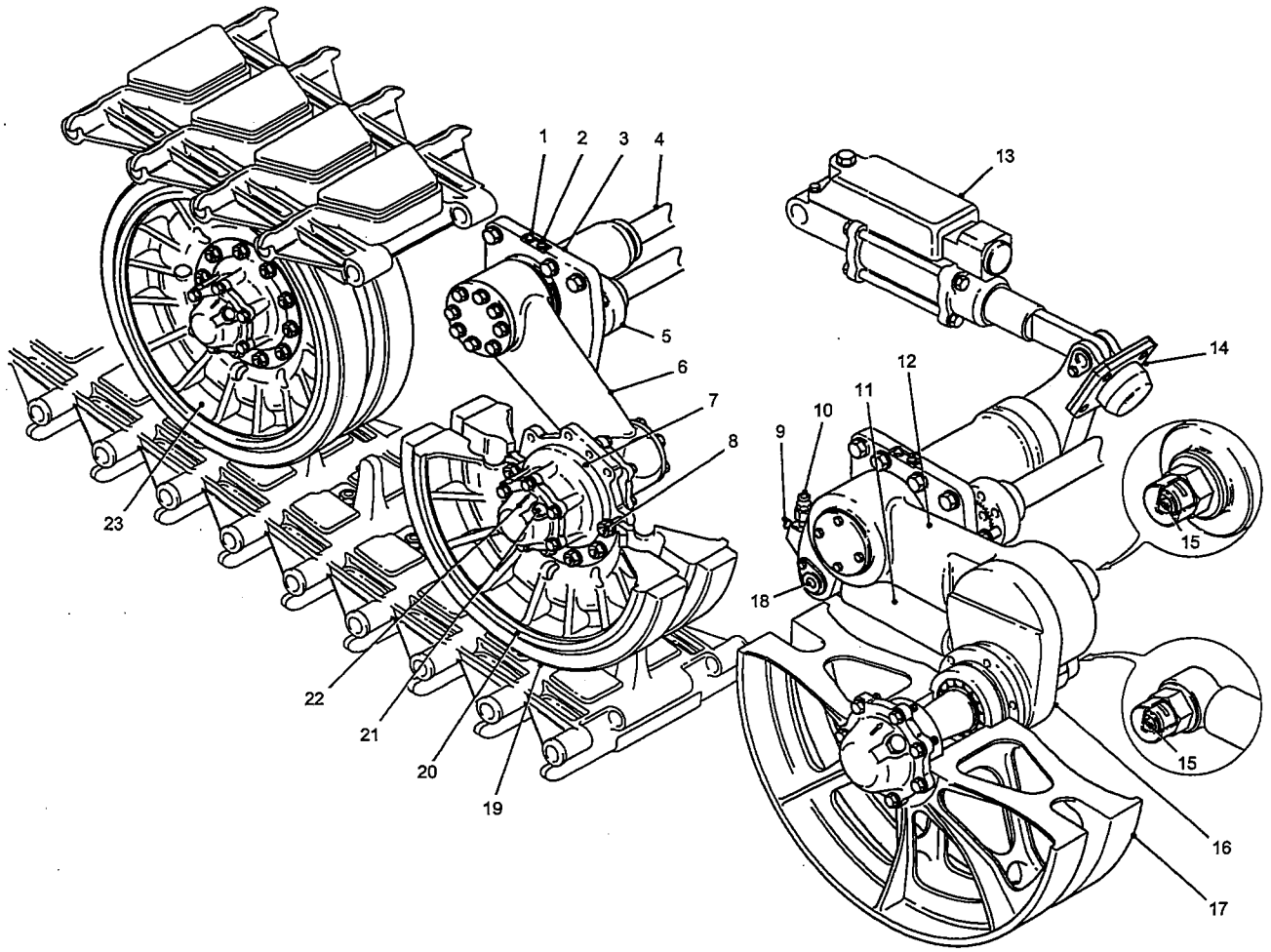
8 Four hydraulic dampers (13) are fitted to control the movement of the axle arms at the front and rear stations (wheel stations 1 and 5). Two damper units are fitted to each station, one attached to each axle arm. The dampers are connected to a link which is splined to the axle arm shaft, inboard of the pivot bearing housing.

9 Each damper is a self-contained unit having its own integral oil reservoir. The damping effect provided by the unit is achieved by the transfer of oil from one portion of the damper to another, controlled automatically by integral valves.

10 The rear dampers are provided with an air operated locking device. When the suspension lock control lever is operated, upward movement of the rear axle arms and roadwheels is prevented.

Suspension lock control lever

11 The suspension rear station damper lock is controlled by a lever (Fig 2 (14)) and (Fig 3 (3)) located on the crew compartment outer wall.



1 Pivot lubricating nipple
2 Breather
3 Pivot bearing housing
4 Torsion bar
5 Torsion bar anchorage
6 Axle arms (Stations 1-4)
7 Wheel hubs
8 Roadwheel nuts
9 Vent screw (track adjuster)
10 Pressurizing nipple (track adjuster)
11 Tensioning arm (track adjuster)
12 Axle arm (station 5)
13 Damper (left rear)
14 Rebound pad
15 Lubricating nipple (track adjuster)
16 Cranked axle
17 Rear station roadwheels (station 5)
18 Lubricating nipple (track adjuster)
19 Tyre
20 Wheel disc
21 Filler/level plug
22 Reference arrow
23 Roadwheel

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Fig 1 Suspension

1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spares box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnect pedal
38 Gear selector switch-box
39 Firewire control box

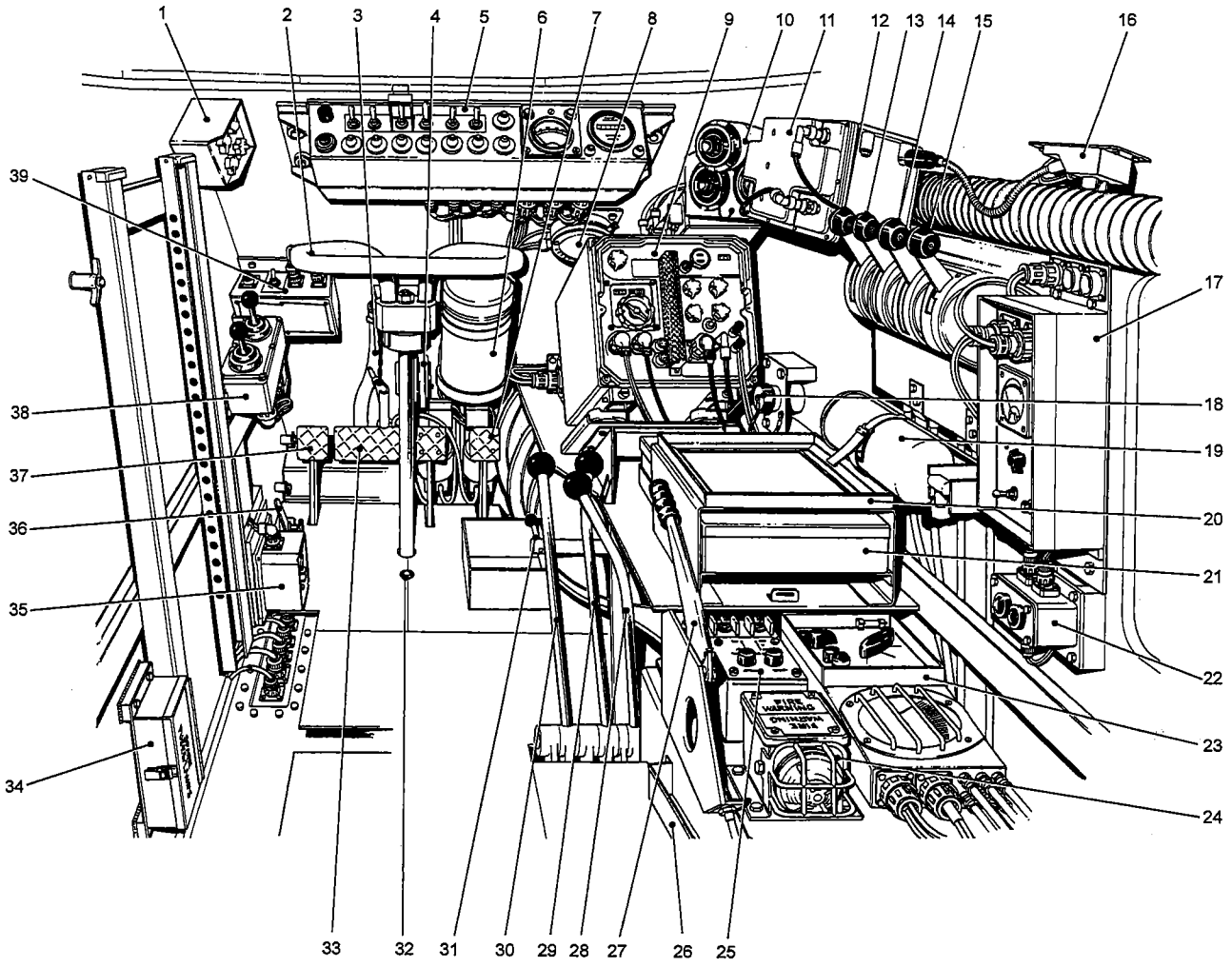

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Fig 2 Controls and instruments (crew compartment - rear)

12 When the lever is operated, valves in the rear dampers are actuated by air pressure and the dampers are hydraulically locked. Locking the rear dampers will be necessary when the vehicle is engaged in earth moving operations, trackway laying/recovery, fascine operations, and using the auxiliary lifting attachment.

Operation

To lock the rear suspension

13 To lock the rear suspension, proceed as follows:

13.1 Check that there is sufficient air pressure in the steer air reservoir to operate the lock control mechanism. The steer air pressure gauge should read at least 5.6 kgf/cm^2 (80 lbf/in.^{2}).

13.2 Move the control lever down to the position marked LOCK.

13.3 Wait a few seconds for the mechanism to operate. Return the lever to the central OFF position.

To unlock the rear suspension

14 To unlock the rear suspension, proceed as follows:

14.1 Check that there is sufficient air pressure available, as per Para 13.1.

14.2 Move the control lever up to the position marked UNLOCK.

14.3 Wait a few seconds for the mechanism to operate. Return the lever to the OFF position.

NOTE

The suspension lock control lever must always be returned to the OFF position after use, to prevent any chance of air leaking into the damper hydraulic oil. Therefore, if the vehicle has been standing, the procedure for locking or unlocking should be carried out before use, to ensure that the required mode of damper operation is in use.

Maintenance

WARNING

PERSONNEL INJURY. ANY SERVICING TASK ON THE RUNNING GEAR WHICH INVOLVES MOVING THE VEHICLE MUST BE UNDERTAKEN WITH AT LEAST THREE PERSONS PRESENT, AND DEPLOYED AS FOLLOWS:

(1) A SUITABLY QUALIFIED DRIVER IN THE VEHICLE.

(2) ONE PERSON TO DIRECT THE DRIVER, POSITIONED IN FULL VIEW OF THE DRIVER AND PERSONNEL CARRYING OUT THE TASK.

(3) THE PERSON(S) ENGAGED DIRECTLY ON THE TASK IN HAND.

To lubricate the axle arm pivot bearings

15 To lubricate the axle arm pivot bearings, proceed as follows:

15.1 Clean the area around the lubricating nipple (Fig 1 (1)) and breather (2).

15.2 Using an oil gun, inject oil into the nipple until excess oil appears at the breather. For the time interval and correct grade of oil, refer to the Cat 601.

15.3 If oil does not emit from the breather, or if leakage is detected around the axle arm, a seal may be defective, report to REME.

15.4 Repeat the above instructions for each suspension unit, on both sides of the vehicle.

To lubricate the track adjusting mechanism

16 The track adjusting mechanism, on each rear axle arm, is lubricated by means of three lubricating nipples. Two of the nipples (15) face inwards, towards the hull, and are protected by moulded plastic caps. To lubricate the track adjusting mechanism, proceed as follows:

16.1 Remove the plastic caps by carefully prising them off.

16.2 Wipe clean all three lubricating nipples (15) and (18) and apply a grease gun to each in turn.

16.3 Refit the plastic caps by pushing them into place.

16.4 Repeat Paras 16.1 to 16.3 on both rear axle arms.

Checking the damper oil level

17 The dampers (13) should be topped-up with oil of the correct grade, to a level just below the filler plug hole. Refer to the Cat 601 for servicing intervals and correct grade of oil.

NOTE

The rear dampers will only be accessible when the engine is removed and this is not a User task.

Checking the suspension lock

18 If a fault is suspected, it is possible to check the rear suspension damper locking mechanism for correct operation as follows:

18.1 Operate the suspension lock control lever in the crew compartment to select the UNLOCK condition.

18.2 Drive the vehicle so that the rear wheels (station 5) overhang a baulk of timber or a low ramp. Stop the vehicle.

18.3 Set the control lever to the LOCK position.

18.4 Reverse off the obstacle and stop the vehicle.

18.5 Check the positions that the rear roadwheels have assumed. If the locking mechanism is working correctly both rear wheels will remain extended, downwards in relation to the hull tending to relieve the load on the other rear wheel stations (3 and 4). If one or both wheels have returned to a normal level attitude, a fault is present and should be reported to REME.

ROADWHEELS

Description

19 Two types of roadwheel are fitted. Rubber tyre wheels on the intermediate stations (wheel stations 1, 2, 3 and 4) and steel spoked wheels, without tyres, on the rear station (station 5).

20 Each of the intermediate roadwheels (Fig 1 (23)) consists of a pair of aluminium alloy discs (20) fitted with bonded rubber tyres. Both discs are mounted on a common hub (7) and secured by studs and nuts (8).

21 The wheel discs may be removed from the hub for repair or replacement but must be treated as a pair. A worn wheel disc must not be installed with a new disc on the same hub.

22 The rear station roadwheels (17) (station 5) are fabricated steel wheels designed to withstand earth moving operations and resist jamming by debris without damage to the wheels or tracks.

23 Each rear wheel is a one piece item, having an integral hub. The wheels cannot, therefore be removed without dismantling the hub bearings and this is NOT a User task.

24 Lubrication of all wheel bearings is by means of an oil bath in each hub. A combined filler and level plug (21) is fitted in each hub cap with a reference arrow (22) to show the correct position of the wheel when servicing the hubs.

Maintenance

WARNING

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(1) A SUITABLY QUALIFIED DRIVER IN THE VEHICLE.

(2) ONE PERSON TO DIRECT THE DRIVER, POSITIONED IN FULL VIEW OF THE DRIVER AND PERSONNEL CARRYING OUT THE TASK.

(3) THE PERSON(S) ENGAGED DIRECTLY ON THE TASK IN HAND.

To check serviceability

25 To check the serviceability of roadwheels, proceed as follows:

25.1 Check all wheel nuts (Fig 1 (8)) for security, using a torque wrench set to 204 Nm (150 lbf ft).

25.2 Inspect all wheel hubs (7) for oil leaks and signs of overheating.

25.3 Check roadwheel tyres (19) for wear and damage. Remove any stones embedded in the tyres and wipe off oil or grease.

25.4 Inspect roadwheel discs (20) (stations 1-4) and wheel spokes of roadwheels (17) (station 5) for signs of cracking or other damage.

26 All serious leaks, overheating or damage found during routine servicing must be reported to REME.

To check and top-up hub oil level

27 To check and top-up hub oil level, proceed as follows:

27.1 Move the vehicle so that the reference arrow (22) on the hub is pointing upward.

27.2 Clean the area around the filler/level plug (21).

27.3 Remove the filler/level plug and add oil, as necessary, to bring the level up to the plug threads in the hub. For correct grade of oil refer to the Cat 601.

27.4 Clean plug and washer, check that each is serviceable, replace and tighten.

27.5 Repeat the operations detailed in Paras 27.1 to 27.4, for each hub, on all ten wheels.

To change the roadwheel discs

28 The roadwheel discs are interchangeable from inside to outside, on either side of the vehicle. it is important, however, to keep part worn discs as a pair. A new disc must NOT be fitted to the same hub as a worn component, always change BOTH discs as a pair.

29 To change a pair of discs, proceed as follows:

29.1 Ensure that any protruding threads on the wheel nut studs are clean and free from paint.

29.2 Slacken each wheel nut (Fig 1 (8)), on the wheel to be changed, not more than one turn.

29.3 Remove the track off the side to be worked on, as detailed in Para 49.

29.4 Raise the wheel requiring the maintenance.

29.5 Remove the wheel nuts.

29.6 Remove the wheel discs (20). It may be necessary to lift the inner disc clear of the track horns.

29.7 Fit new or an interchanged pair of wheel discs.

29.8 Check condition of wheel nuts, any damaged nuts must be replaced with new ones.

29.9 Fit the wheel nuts and secure the wheel discs to the hub.

29.10 Lower the wheel.

29.11 Tighten the wheel nuts, using a torque wrench, to 204 Nm (150 lbf ft).

29.12 Refit the track, as detailed in Para 50.

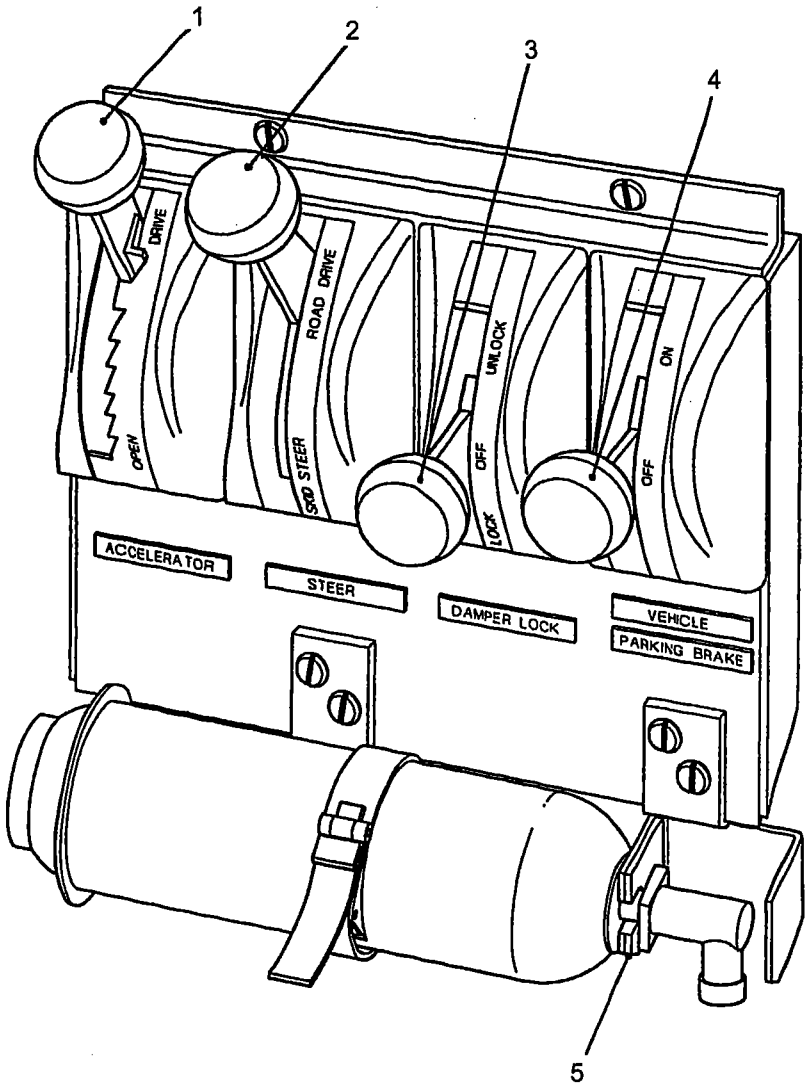
To check the roadwheels for rim rock

30 Checks on the roadwheels for rim rock is to be carried out when wheels are raised during a wheel change operation and when wheel discs are changed. To check the roadwheels for rim rock, proceed as follows:

30.1 Check that the wheels rotate freely and there are no tight spots.

30.2 Grip a wheel on opposite sides and apply a rocking motion. There should be no discernible movement.

30.3 Check rim rock with the wheel rotated to different positions. If any discernible rim rock or tight spots are suspected, report to REME.



U4377/1/045A

1 Hand operated accelerator
2 Steering changeover lever
3 Suspension lock control lever
4 Parking brake lever
5 Fire extinguisher stowage

Fig 3 Hand controls

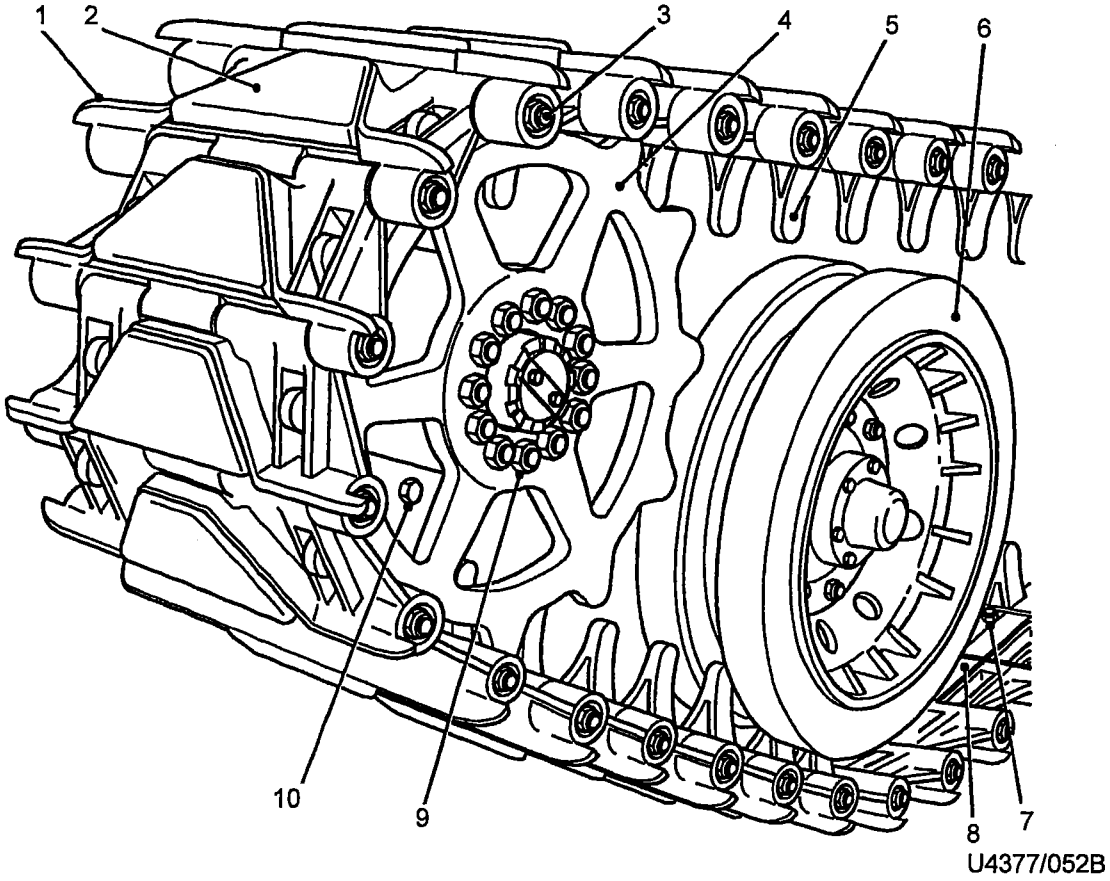
SPROCKETS AND TRACKS

General description

Sprockets

31 The tracks are driven by sprocket rings (Fig 4) mounted on final drive assemblies. Each assembly comprises a hub to which two sprocket rings are bolted.

32 The sprocket rings can be removed from the hubs without the need to remove the hub from the final drive.



1	Spud	6	Roadwheel (station 1)
2	Track pad	7	Track pad retaining nuts
3	Track pin nut	8	Roadwheel pads
4	Outer sprocket ring	9	Outer sprocket ring nuts
5	Horn	10	Inner sprocket ring nuts

Fig 4 Sprocket and track

Tracks

33 Each live track consists of a series of cast steel links pinned together by pins and rubber bonded bushes. When the track is assembled the track pins are located in the bushes held within the journals in such a manner as to give the track a natural tendency to curl inwards when removed from the vehicle.

34 The track pins are threaded at each end and fitted with self-locking nuts (Fig 4 (3)) which are tightened to 238 Nm (175 lbf ft) using a torque wrench.

35 The inner face of each track link has two rubber roadwheel pads (8) moulded into the surface, one on either side of the horn (5). The pads form the surface on which the roadwheels travel, and the horns ensure that the track remains in line with the wheels.

36 The outer surface of the track link has a protruding steel spud (1) and a replaceable rubber track pad (2).

37 Each track pad is secured to the link by an integral stud and self-locking nut (7).

38 When new, the right track has 77 links and the left 76 links. During the life of the track, it will be necessary to remove one or two links from each track in order to maintain a range of track tension adjustment.

39 Adjustment for track tension is by means of an eccentric cranked axle (Fig 1 (16)) on each rear axle arm. A grease filled tensioning arm (11) is provided to turn the axle, thus varying the wheelbase by a small amount.

40 A pressurizing nipple (10) and vent screw (9) on the tensioning arm enable a grease gun to be used to provide the necessary pressure to carry out track adjustment.

Maintenance

WARNING

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(1) A SUITABLE QUALIFIED DRIVER IN THE VEHICLE.

(2) ONE PERSON TO DIRECT THE DRIVER, POSITIONED IN FULL VIEW OF THE DRIVER AND PERSONNEL CARRYING OUT THE TASK.

(3) THE PERSON(S) ENGAGED DIRECTLY ON THE TASK IN HAND.

To check the security of sprocket ring nuts

41 The inner and outer sprocket ring nuts are of different sizes and must be checked for tightness, in accordance with the Cat 601, using a torque wrench set as follows:

41.1 Inner sprocket ring nuts - 95 Nm (70 lbf ft).

41.2 Outer sprocket ring nuts - 339 Nm (250 lbf ft).

To change the sprocket rings

42 To change the sprocket rings, proceed as follows:

42.1 Disconnect the track (refer to Para 49) and move it clear of the sprocket assembly.

42.2 Remove the outer sprocket ring nuts (Fig 4 (9)) and washers.

42.3 Lift off the outer sprocket ring (4).

42.4 Remove the inner sprocket ring nuts (10) and washers.

42.5 Lift off the inner sprocket ring.

42.6 Reassemble the new sprocket rings in reverse order. Ensure that all sprocket nuts are tightened, using a torque wrench set to the correct values.

Track inspection

43 To inspect the track, proceed as follows:

43.1 Ensure that the personnel carrying out the task are properly deployed and that the person controlling the operation is within sight of the driver at all times. Check that the path behind the vehicle is clear of obstructions.

43.2 With the person carrying out the inspection standing at the front of the vehicle, facing the inside of one track, slowly move the vehicle in reverse.

NOTE

During the track inspection a special watch should be kept for cosmetic cracks appearing on the surfaces of the track links, and roadwheel pads that are missing or loose. ANY DAMAGE OR CRACKS found must be reported to REME.

43.3 While the vehicle is being driven, slowly in reverse, inspect the track links for damage or cracks, and for faulty pins, nuts or rubber pads. Stop the vehicle as necessary and remove any embedded stones or oil and grease from the rubber pads. Both track pads (2) and roadwheel pads (8) should be checked.

43.4 When the complete length of the track has been checked, stop the vehicle.

43.5 With the person inspecting stationed outside the track at the front of the vehicle, drive slowly forward and repeat the process, concentrating on the outside features of the same track.

43.6 Stop the vehicle when the complete length of the track has been checked.

43.7 Repeat Paras 43.1 to 43.6 for the other track.

To check the security of track pin nuts

44 It is important that the nuts at both ends of the track pins are kept correctly tightened. Using a similar procedure to that detailed for track inspection, check each track pin nut (3) on the inside and outside of the track. Use a torque wrench set to 238 Nm (175 lbf ft).

To check the security of track pads

45 When new tracks, track links or track pads are fitted, the pads are liable, after supporting the weight of the vehicle, to bed down and loosen. It is therefore, necessary to check the nuts frequently for tightness during the first 80 km (50 miles) after fitting (refer to Para 46 for torque setting).

To fit a new track pad

46 To fit a new track pad, proceed as follows:

46.1 Move the vehicle until the pad to be changed is in an accessible position. This is between the sprocket and the front roadwheel.

46.2 Remove the retaining nut (7) from the pad to be removed. Tap and lever off the pad (2).

46.3 Thoroughly clean the track link so that the new pad will make proper contact with the face of the link.

46.4 Fit a new pad, ensuring that it fits properly on the mating surfaces.

46.5 Fit a new nut and tighten with a torque wrench set at 204 Nm (150 lbf ft).

46.6 During the first 80 km (50 miles), periodically check that the nut is tight, using the torque wrench set to 204 Nm (150 lb ft).

NOTE

If every track pad is to be replaced at one time, it may be less time consuming to remove the track and position it on its side and work on it clear of the vehicle.

To adjust track tension

47 The track tension is correct when the slack at the top of the track just allows the track to touch the top of the third roadwheel tyre. Check the tension with the vehicle on a flat surface with the parking brake OFF. If the track is excessively slack, proceed as follows:

47.1 If possible position the vehicle on firm level ground.

47.2 Clean the area around the nipple (Fig 1 (10)) and connect a grease gun. Slacken the hexagonal adaptor below the nipple to allow the cylinder to be pressurized.

47.3 Operate the grease gun until the top of the track only just touches the top of the third roadwheel tyre.

47.4 Tighten the adaptor. Remove the grease gun.

To slacken a track

48 If the track is to be disconnected or the jacking strut is to be used, it will be necessary to fully slacken the track. To slacken a track, proceed as follows:

48.1 Clean the area around the vent screw (9).

48.2 Slacken the vent screw using a spanner. Do not remove the screw completely. The weight of the track will cause the tensioning arm (11) to contract, forcing grease from the nipple at a considerable rate. It is desirable to collect as much of the overflowing grease as possible in a suitable container to reduce contamination of the track.

48.3 When the track is sufficiently slack, tighten the vent screw.

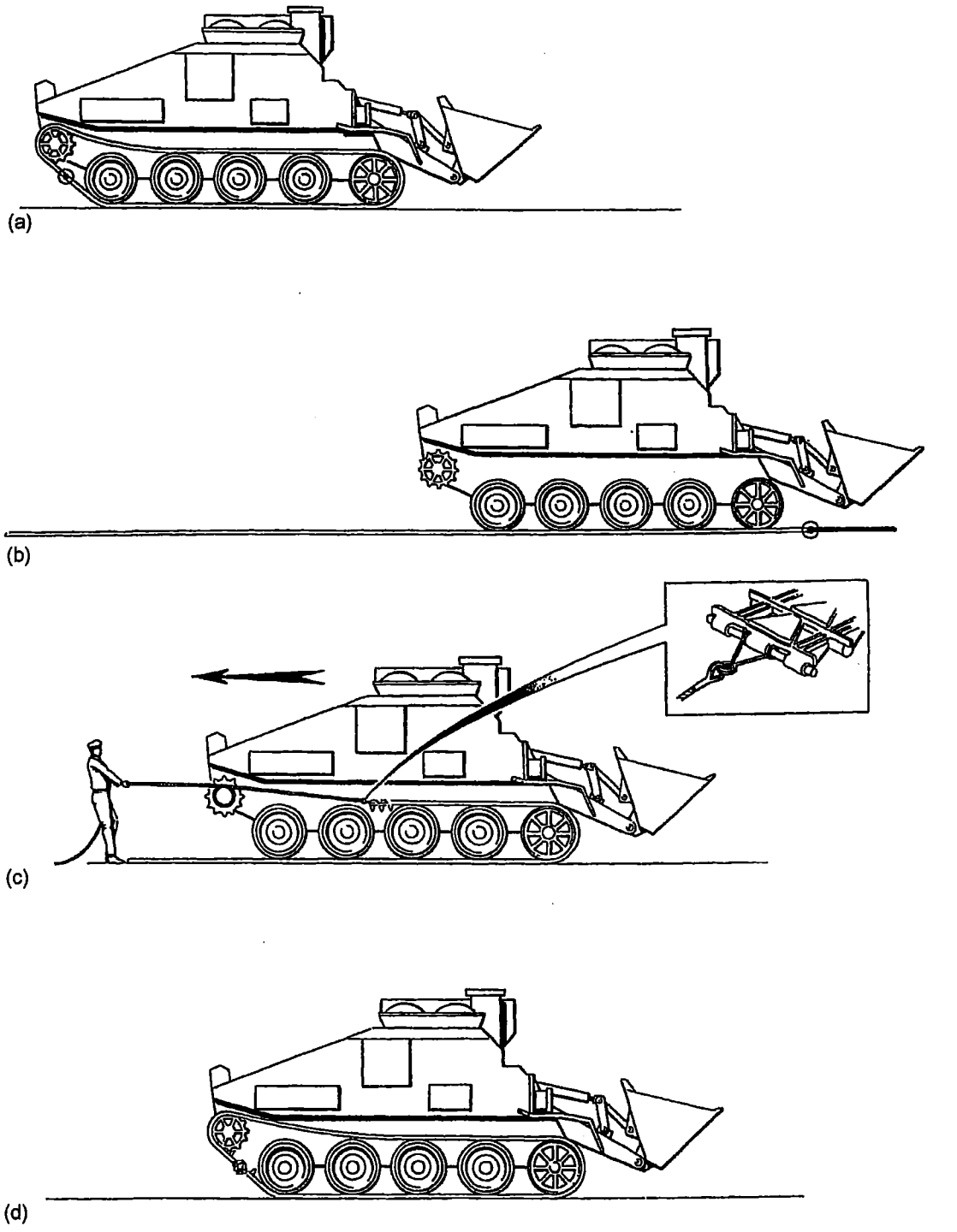
To disconnect a track

49 To disconnect a track, proceed as follows:

49.1 If possible, position the vehicle on firm level ground and ensure that the track pin to be removed is positioned between the sprocket and front roadwheel, (refer to Fig 5 (a)).

49.2 If the track is to be removed, ensure that there is sufficient space behind the vehicle to allow the top run of the track to lie flat on the ground.

49.3 If a small section of damaged links is to be removed, this should be positioned under the front roadwheel so that the links are readily accessible when the vehicle is moved backwards.



(a) Position for removing track pin
(b) Track disconnected, connected to new track
(c) Replacing track using a track rope
(d) Position for rejoining track (Note slack built up below sprocket).

Fig 5 Removing and replacing a track

49.4 Slacken the track.

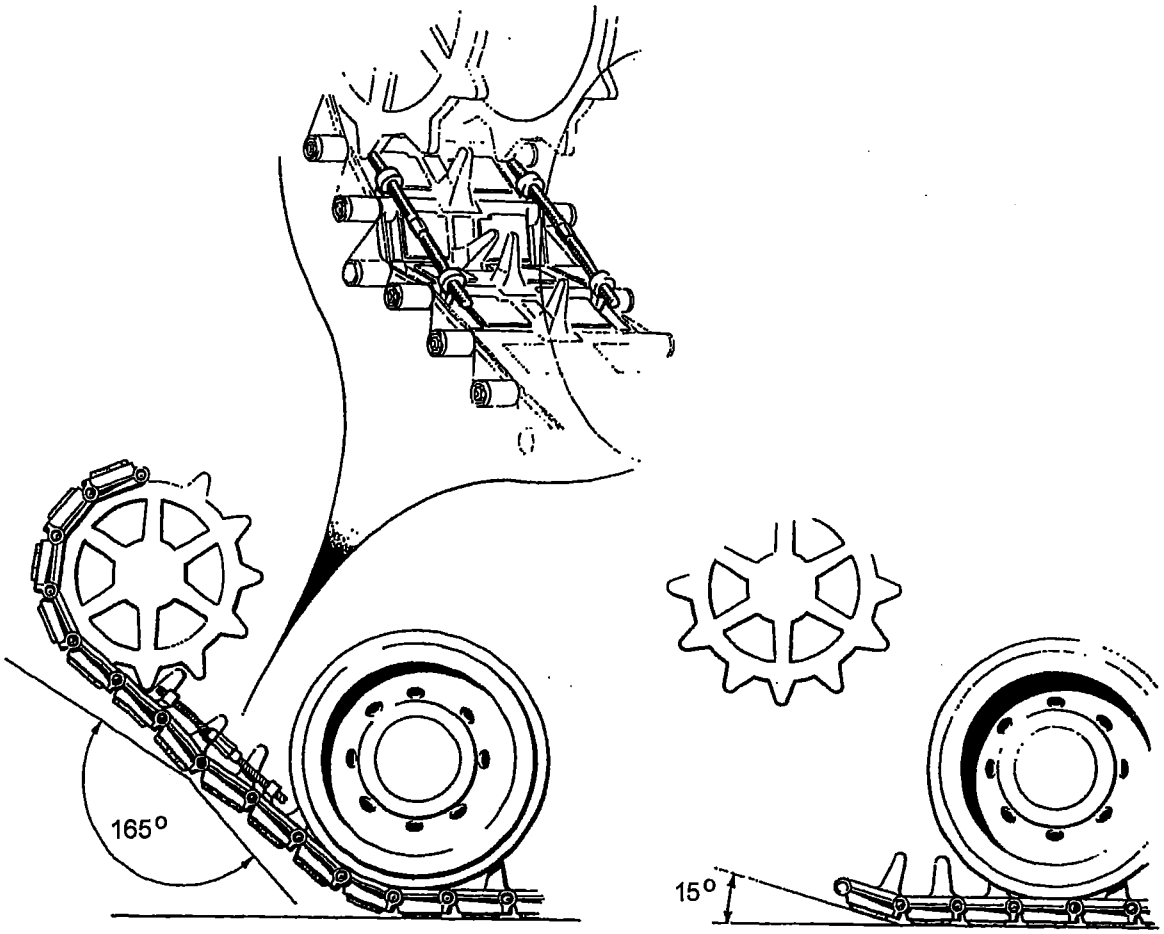
49.5 Select SKID steer and drive the vehicle forward so that the track gathers under the sprocket ahead of the front roadwheel. As soon as the vehicle tends to move apply the main brakes and operate the parking brake.

49.6 Fit a track clamp on each side of the track, between the sprocket and front roadwheel (refer to Fig 6 (a)). Locate the clamp jaws in the sprocket holes of the track links either side of the track pin to be removed. Tighten the clamps just enough to remove the tension from the track pin.

49.7 Remove the track pin nut (Fig 4 (3)).

49.8 Drive out the track pin using a suitable drift.

49.9 After removal of the pin, slacken and remove the clamps and lower the end of the track to the ground.



(a) Correct angle of track links before joining a complete track
(b) Correct angle of a single new link before inserting the track pin

Fig 6 Joining a track

To connect a track

50 To connect a track, proceed as follows:

50.1 Before attempting to connect a track, ensure that as much slack as possible exists between the sprocket and the front roadwheel as detailed in Para 49.5 (refer to Fig 5 (d)).

50.2 Attach a track clamp on each side of the track, between the sprocket and front roadwheel. Locate the clamp jaws in the sprocket holes of the track links either side of the ones to be connected. Tighten the clamps until the track pin holes can be lined up.

50.3 Insert a headless pin into the track pin holes to ensure that they are in line. Continue to tighten the clamps until the links to be connected form an angle of 165 degrees as shown in Fig 6.

50.4 Insert a track pin into the pin hole. Ensure that the flats of the pin coincide with those of the track link bush holes. Carefully drive the pin through the links.

50.5 Fit the track pin nut and tighten with a torque wrench to 238 Nm (175 lbf ft).

50.6 Remove the track clamps.

50.7 Adjust the track tension as detailed in Para 47.

To change a single track link

51 To change a single track link, proceed as follows:

51.1 Position the vehicle to disconnect the track, as shown in Fig 5 (a).

51.2 Disconnect the track, as detailed in Para 49, adjacent to the defective link so that when the track pin is removed the defective link will lie on the ground.

51.3 Remove the track pin nuts and drive out the pin connecting the defective link to the track and remove link.

51.4 Locate a new track link on the track at ground level, with the track pin holes in line.

51.5 Raise the free end of the new link to an angle of 15 degrees (from the ground) as shown in Fig 6 (b) and insert the track pin. Ensure that the flats of the pin coincide with those of the track link bush holes. Carefully drive the pin through the links.

51.6 Connect the track, as detailed in Para 50.

51.7 Refit track pin nuts on both track pins and tighten with a torque wrench to 238 Nm (175 lbf ft).

To remove/replace a complete track

WARNING

PERSONNEL INJURY. IT IS NOT SAFE PRACTICE TO HAVE BOTH TRACKS REMOVED FROM THE VEHICLE AT THE SAME TIME, UNDER SUCH CIRCUMSTANCES THE VEHICLE BRAKES WILL NOT BE EFFECTIVE. SHOULD HOWEVER THIS PROCEDURE BE UNAVOIDABLE, SOME MEANS OF SECURING THE VEHICLE, SUCH AS SCOTCHING THE ROADWHEELS, MUST BE USED BEFORE BREAKING THE SECOND TRACK.

52 To remove/replace a complete track, proceed as follows:

52.1 Position the vehicle on firm level ground and disconnect the track, as detailed in Para 49.

52.2 Reverse the vehicle until all of the track is flat on the ground. Stop the vehicle before the rear roadwheel (station 5) reaches the end (refer to Fig 5 (b)).

52.3 Lay out the new track, temporarily pinning the end of the old track.

52.4 Reverse the vehicle slowly and stop when the rear roadwheel (station 5) is a few links from the free end of the new track.

52.5 Remove temporary pin and discard the old track.

52.6 Attach a track rope to the end of the new track, behind the rear roadwheel. Take the loose end of the rope forward making one or two turns around the sprocket hub. Do not exceed two turns.

NOTE

On no account must the rope be attached to the sprocket teeth. At all times the rope must be free to slip when tension on the loose end is released.

52.7 Slowly and carefully drive the vehicle forward keeping the rope taut, using the rotating hub as a capstan winch (refer to Fig 5 (c)).

52.8 When the track has passed over the sprocket, stop the vehicle and remove the track rope.

52.9 Continue to drive the vehicle until all possible slack is below the sprocket in a position to connect the track (refer to Fig 5 (d)).

52.10 Connect the track, as detailed in Para 50.

CHAPTER 2-7

ELECTRICAL EQUIPMENT

CONTENTS

(continued)

CONTENTS (continued)

(continued)

CONTENTS (continued)

GENERAL

Description

1 The vehicle is wired on a 24V negative earth return system with the major electrical assemblies provided with an insulated return.

2 A set of four batteries is provided, charged by a generator driven from the transfer gearbox. The generating system is detailed in Para 15.

3 Connections to most major components are made by plugs and sockets and all cables and harnesses are identified by cable markers. Circuit breakers and fuses are used to protect the electrical system; for ratings and locations of fuses and circuit breakers, refer to Tables 1 and 2.

Suppression of electrical interference to radio services

4 The use of VHF radio sets calls for a high standard of vehicle suppression if interference is to be effectively suppressed and full advantage of the sets obtained. Good servicing of the electrical system is, therefore, essential and it must be remembered that interference can also be caused to nearby radio sets. Important points are:

4.1 Make sure there is no intermittent contact on any fuse, switch or terminal.

4.2 Keep all connections and mating surfaces clean and free from paint, corrosion and lubricants.

4.3 Keep all bonding strips and earth braids free from corrosion, paint and dirt and ensure that they are firmly secured.

4.4 Do not paint under bonding strips or other parts intended to be in electrical contact.

4.5 Ensure that all cable screening is continuous, not corroded or frayed and is properly earthed at both ends. Metal to metal contact must be maintained throughout all screened circuits.

4.6 Ensure that all covers, components and brackets are firmly secured.

4.7 Do not interfere with vehicle wiring or make improvised connections.

4.8 Do not remove any suppression equipment that has been fitted.

4.9 Refrain from using any switch unnecessarily.

4.10 Report immediately any defect which may affect the standard of suppression of the vehicle.

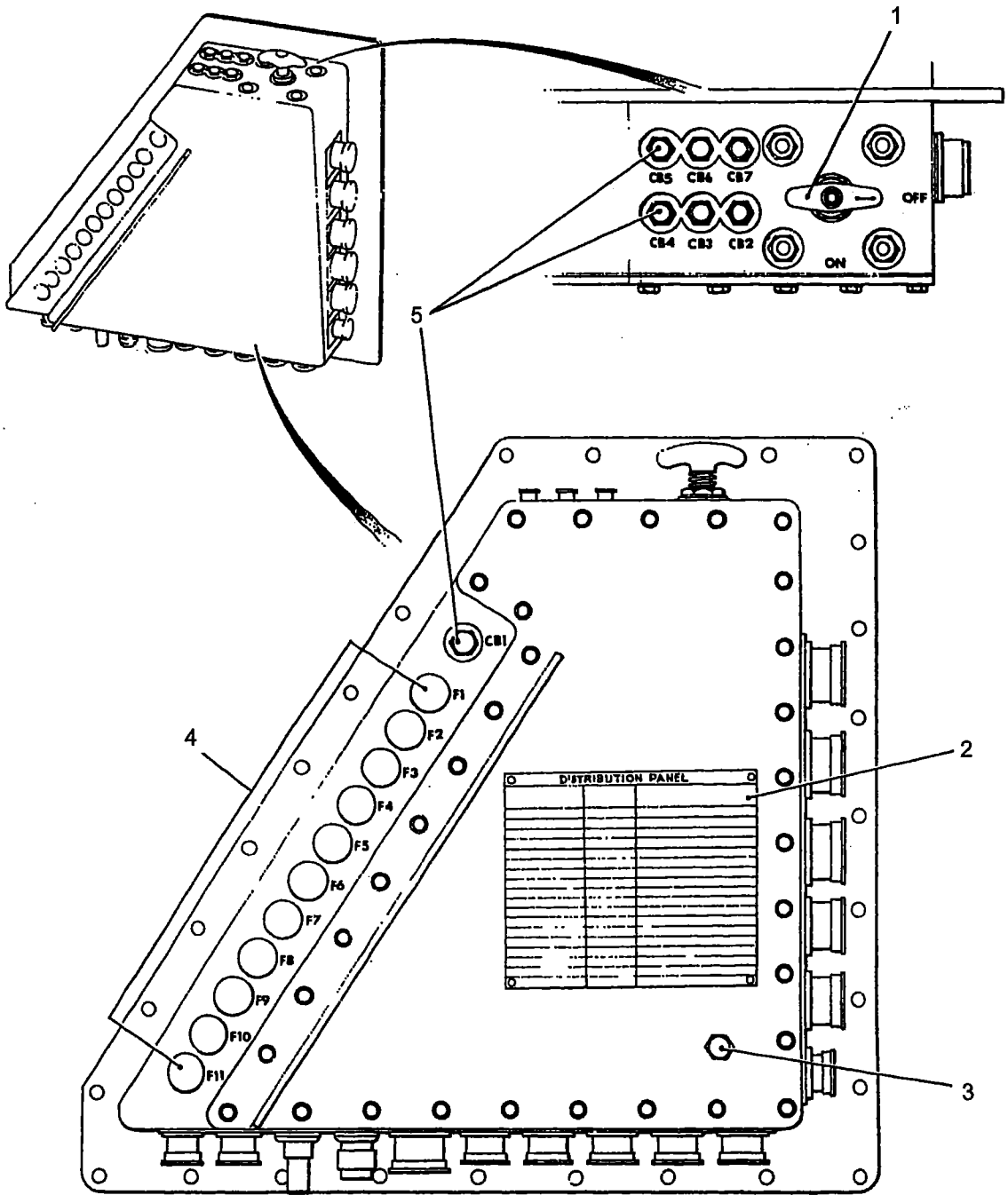
BATTERIES AND DISTRIBUTION PANEL

Batteries

Description

5 Four 12V 6 TNMF maintenance free batteries are fitted, each with a capacity rating of 110 Ah. The batteries are housed, in pairs, in glass fibre containers positioned on a mounting shelf in the transmission compartment. The batteries are connected in series/parallel to give a 24V supply with a total rating of 220 Ah.

6 The battery connectors are of the standard split clamp type and each is enclosed by a rubber cover. To prevent inadvertent reversing of the connections the battery terminal posts are of different diameters with the positive terminal encircled by a red collar.



U4294/017

1 Battery master switch
2 Fuse and circuit breaker identification plate
3 Pressure test point
4 Fuses (F1 - F11)
5 Circuit breakers (CB1 - CB7)

Fig 1 Distribution panel

7 To permit the escape of gases generated during charging, the cells of each battery are vented via a common vent block at the top of the battery.

Distribution panel

Description

8 The distribution panel (Fig 1) is located in the crew compartment to the front right of the driver. The panel provides the means of distributing power from the batteries to the major electrical systems.

9 On the outer surfaces of the distribution panel are located the battery master switch (1), fuses (4) and circuit breakers (5).

Battery master switch

10 The battery master switch is a semi-rotary switch with two positions identified ON-OFF. In the OFF position the switch isolates the batteries from all circuits except the fire warning horn.

Circuit breakers

11 Seven circuit breakers are incorporated in the distribution panel and are numbered CB1 to CB7. For details of rating and circuits protected, refer to Table 1.

Fuses

12 Eleven fuses are fitted, in holders, in the panel. The fuses are positioned in a single row and are numbered consecutively from top to bottom, F1 to F11. For details of type, rating and circuits protected, refer to Table 2.

Relays

13 Inside the panel are four relays, which are incorporated in the battery supply line as isolating switches, one for the Nuclear, Biological and Chemical (NBC) fan, one for the cooking vessel, one for the engine starter control circuit and one for the No. 1 bilge pump.

14 The purpose of the NBC fan and cooking vessel relays is to isolate the respective circuits when the engine is not running and the generator is not 'on line'. This prevents excessive drainage of the batteries.

GENERATING SYSTEM

Description

15 The generating system comprises an alternating current (ac) generator (with internal rectification), a generator panel, two 'generator only' relays and a generator warning light. The generator is capable of sustaining the more heavily rated loads imposed on the system (ie NBC fan and cooking vessel) while maintaining the vehicle batteries in a charged condition. System voltage is controlled by a voltage regulator within the generator panel.

Generator

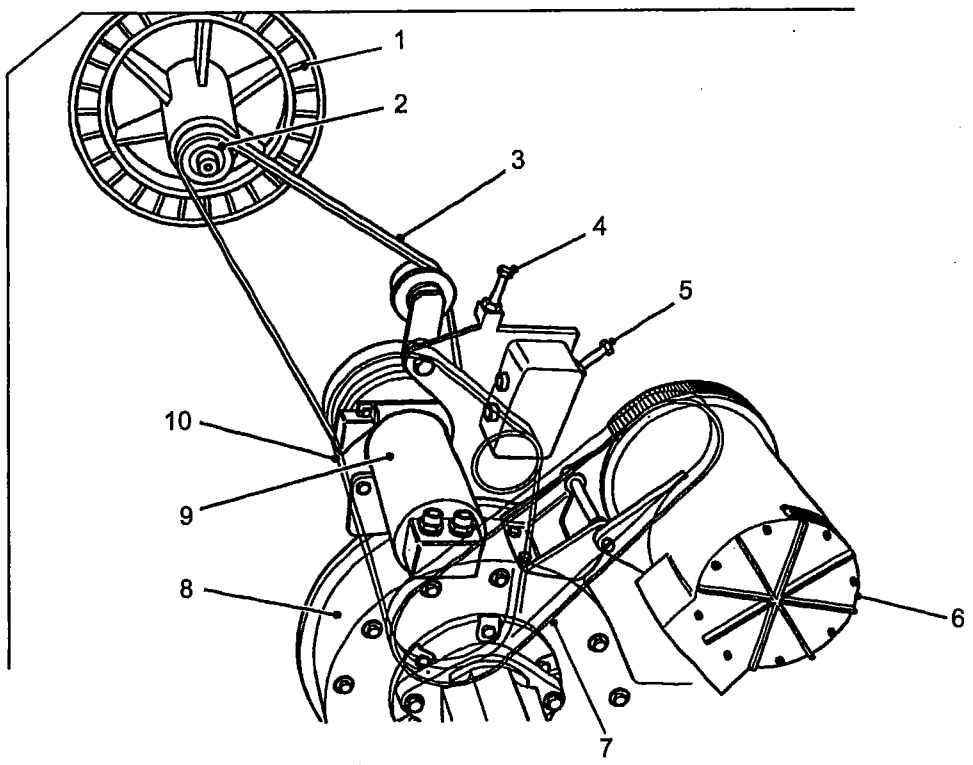
16 The generator (Fig 2 (6)) is mounted on, and driven from, the transfer gearbox (8), the drive being provided by a multi-vee belt and pulleys. The generator comprises a 3 phase alternator, with a built-in silicon diode rectification system, giving a 140A (maximum) output at 28V dc (nominal). The generator field cut-off circuit is protected by a 5A fuse, F1, which is located on the distribution panel.

Generator panel

17 The generator panel is mounted, in the transmission compartment, on the crew compartment front wall. It is a sealed unit incorporating a voltage regulator, charging relays, radio interference suppression network and other electronic components associated with the generating system control.

Relays

18 Two of the relays, located in the distribution panel (Fig 1), ensure that the NBC fan and cooling vessel circuits are only operative when the engine is running and the generator system is 'on line'.



1	Ventilation fan	6	Generator
2	Ventilation fan pulley	7	Generator drive belt
3	Ventilation fan drive belt	8	Transfer gearbox
4	Ventilation fan belt adjuster	9	Compressor
5	Compressor drive belt adjuster	10	Compressor drive belt

Fig 2 Generator and ventilation fan drive belts

Controls and instruments

Generator warning light

19 The generator warning light (Fig 3 (8)) is located on the driver's road warning instrument panel and is identified GEN. When the battery master switch is switched to ON the warning light, which is fitted with a red lens, will illuminate and remain illuminated until the generator output voltage exceeds that of the batteries, or the battery master switch is set to OFF.

20 The light should remain extinguished on all engine speeds in excess of 650 rev/min to indicate that the generator is operating correctly.

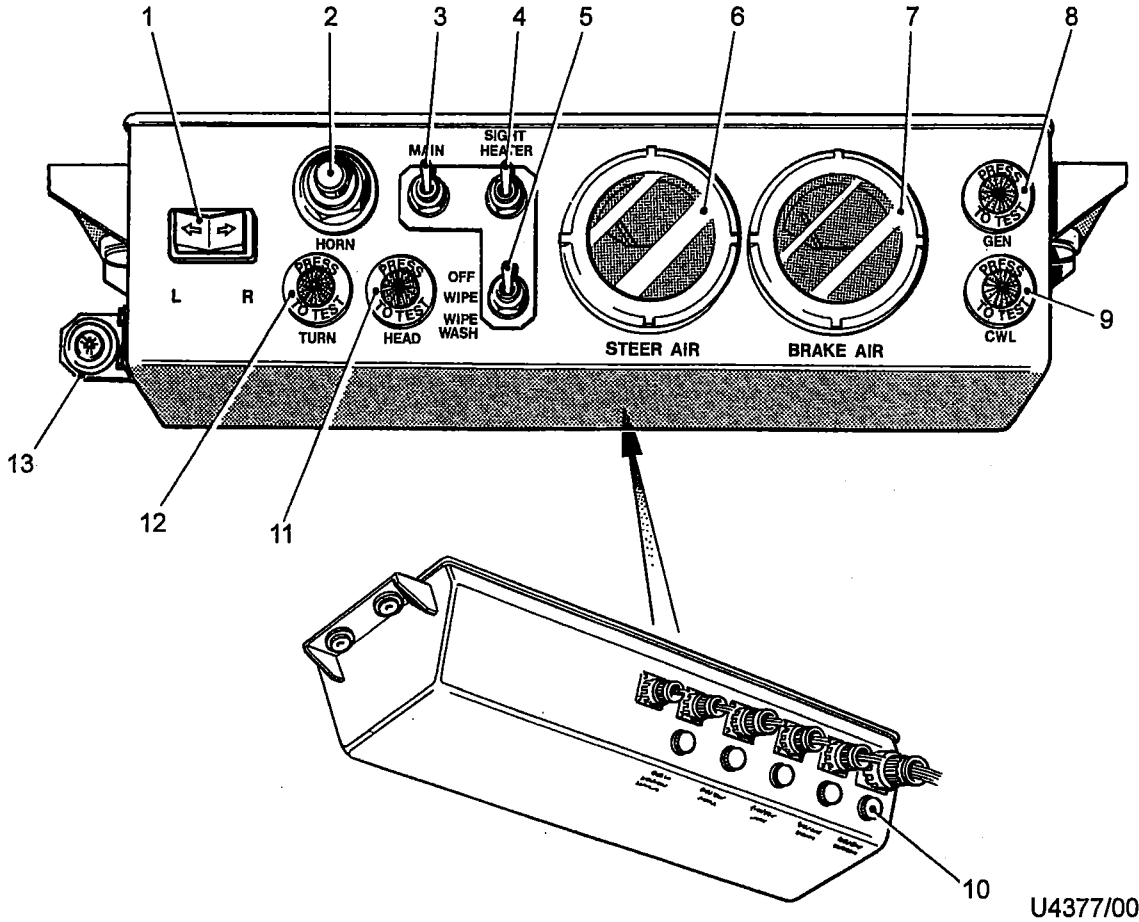
Ammeter

21 The ammeter (Fig 4 (8)) is located on the operator's instrument panel and is calibrated 0 to 250A. The ammeter measures the current in the generator output line and will give a maximum reading, 140A, when there is a heavy loading on the batteries or if the batteries are in a low state of charge.

Override master control switch

22 The switch (3), identified OMC on the operator's instrument panel, is an Override Master Control (OMC) switch. When the switch is operated, power from the batteries is made available to operate the NBC system, in the event of a generator or engine failure.

23 A hinged cover is fitted to the OMC switch to prevent accidental operation. The switch MUST ONLY be used in operational conditions.



1 Turnlight switch
2 Horn pushbutton
3 Headlight dipswitch
4 Sight heater switch
5 Wipe/wash switch
6 Steer air pressure gauge
7 Brake air pressure gauge
8 Generator warning light
9 Central warning light
10 Fuses: F12, F18, F19, F36 and F38
11 Main beam warning light
12 Turnlight warning light
13 Hazard warning light switch

Fig 3 Driver's road warning instrument panel

LIGHTING

Exterior lighting

Description

24 The exterior lights comprise two headlights, two sidelights, two tail/stop lights, registration plate lights, turnlights, a convoy light, a spotlight, a rotary beacon and detachable rear lights for the bucket. The lights are controlled by switches in the crew compartment.

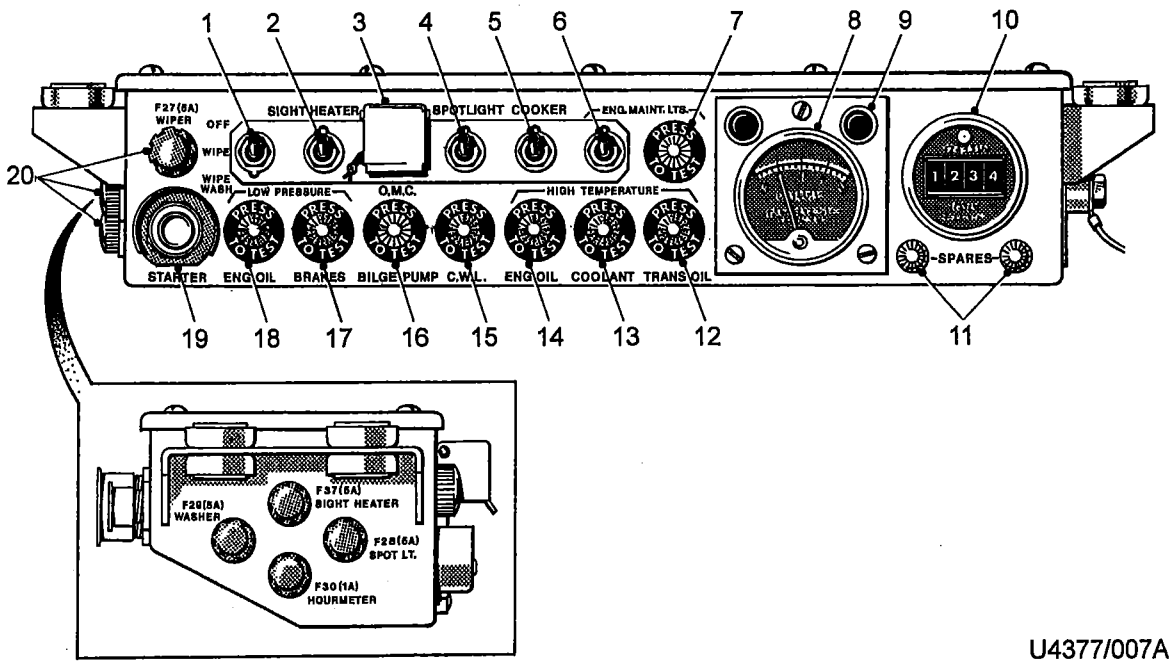
25 In addition to the normal road lighting and spotlight on the exterior of the vehicle, central warning lights are fitted in positions which make them visible to the crew members when driving 'head out'.

Headlights

26 The headlights (Fig 5 (5)) are mounted in a protective sheet metal light box, one on either side of the glacis plate. Hinged shutters (6) are fitted to protect the front lights when the vehicle is deep wading.

27 The headlights incorporate sealed beam units (15) of the twin filament type giving 'main' or 'dipped' beam operation. The sealed beam units are connected to the headlight circuit by means of a socket connector (14) inside the lamp body.

28 Alignment of the headlights is accomplished by means of the clamp bolt (11), for lateral adjustment, or the pivot bolts (8) and sealed beam unit tilt adjusting screw (13).



U4377/007A

1 Wipe/wash switch
2 Sight heater switch
3 Override master control switch
4 Spotlight switch
5 Cooker switch
6 Engine maintenance light switch
7 Maintenance light warning light
8 Ammeter
9 Panel lights (2 positions)
10 Hourmeter
11 Spare warning light lenses
12 Transmission oil temperature warning light
13 Coolant temperature warning light
14 Engine oil temperature warning light
15 Central warning light
16 Bilge pump warning light
17 Brake low pressure warning light
18 Engine low oil pressure warning light
19 Starter button
20 Fuses: F27, F28, F29, F30 and F37

Fig 4 Operator's instrument panel

Sidelights and tail/stop lights

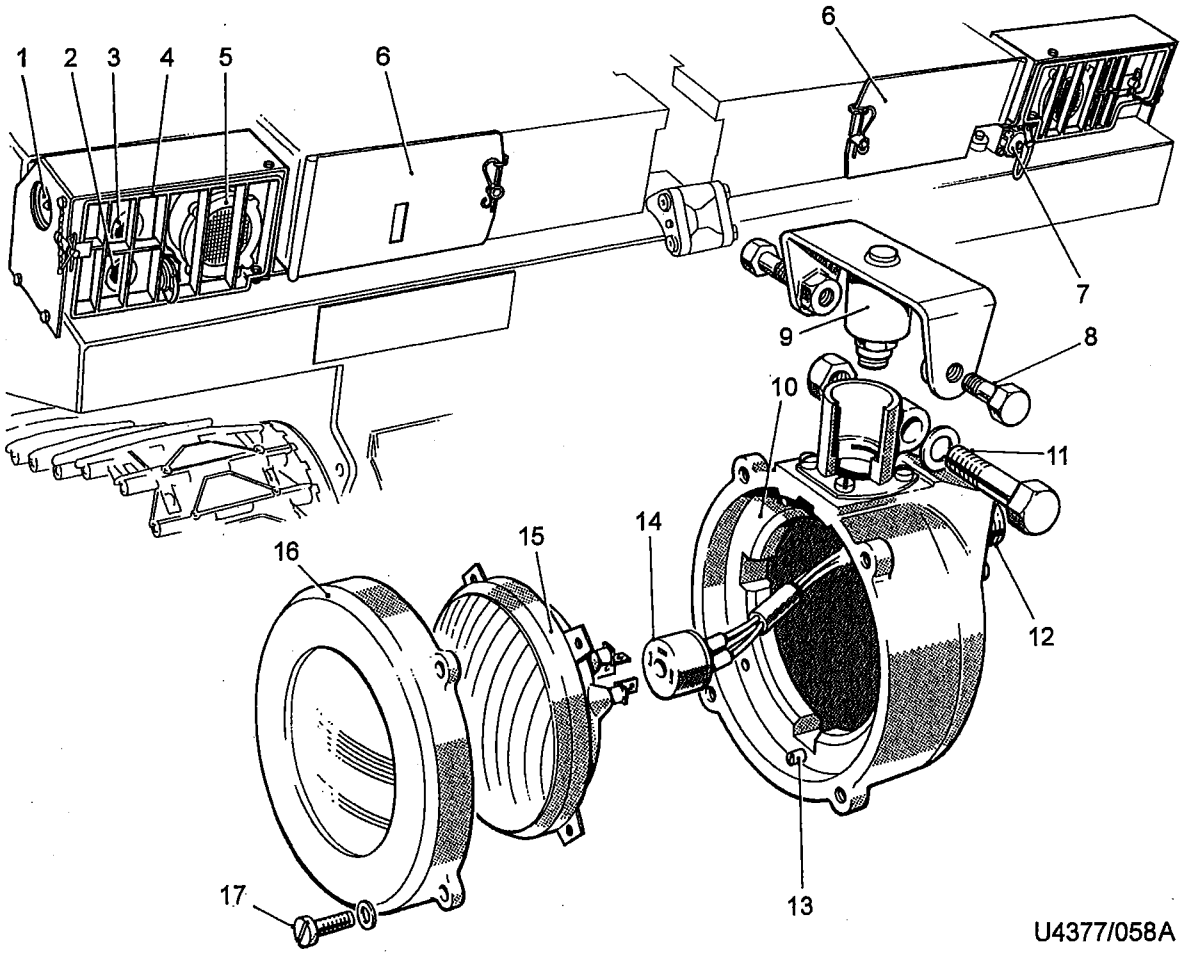
29 The sidelights (2) are mounted in the front light boxes, adjacent to the headlights. Two tail/stop lights are mounted in the rear hull lighting boxes (Fig 6 (3) and (12)). All of the four lights are of the same general construction, with screw-in lenses, as shown in Fig 7.

30 The lampholders (Fig 7 (1)) in each type of light differ only in that the tail/stop lights are fitted with double contacts suitable for the two filament tail/stop light lamps.

Turnlights

31 Two types of turnlights (Fig 7) are fitted to the vehicle. The front and rear turnlights are of the same construction as the sidelights but with amber lenses and different lamps. Two turnlights are fitted at the front of the vehicle, one in each light box and two at the rear, one in each rear light box.

32 A pair of turnlights (Fig 8) are also fitted on the sides of the vehicle, one adjacent to the cupola and one ahead of the engine cooling louvres. Each light comprises a single lampholder and lamp with a double sided amber lens, retained by a circular clamping ring.



1	Horn	10	Seating plate
2	Sidelight	11	Clamp bolt
3	Turnlight	12	Fixed connector
4	Grille	13	Tilt adjusting screw
5	Headlight	14	Socket connector
6	Shutters	15	Sealed beam unit
7	Trailer lighting socket	16	Rim
8	Pivot bolts	17	Rim retaining screw
9	Mounting stem		

Fig 5 Front lights

33 When the turnlight switch in the crew compartment is operated, all three turnlights on the appropriate side of the vehicle flash simultaneously.

Hazard warning lights

34 Hazard warning lights are incorporated into the turnlight lighting circuit. The hazard warning lights are separately controlled by a switch (Fig 3 (13)) on the driver's road warning instrument panel. This circuit is not isolated in convoy mode.

Rear lighting boxes (hull mounted)

35 Two lighting boxes (Fig 6 (3) and (12)), located on the rear of the hull, one on each side, provide a mounting for the rear turnlights, tail/stop lights, reflectors and registration plate lights.

36 Both rear lighting boxes are fitted with a registration plate (17), hinged beneath the lower edge. The plates may be raised to obscure the registration number, by slackening the wing bolts and folding the plate upwards.

37 The hull mounted lighting boxes are both designed to be demountable. In order that the vehicle meets the requirements of relevant road traffic regulations, while travelling on public roads, both lighting boxes must be transferred to the bucket.

38 To enable the lighting boxes to be easily fitted to the bucket, 'bolt on' attachment brackets (2) are provided, which when attached to the lighting boxes allow them to be fitted to the bucket cutting edge. The lighting boxes are normally bolted to the hull and the attachment brackets stowed.

39 When the lighting boxes are fitted to the bucket, connection is made to the lighting circuits by means of a detachable harness (13), one for each unit, and using the same connector points on the rear lighting hull connectors (8) and (11).

Auxiliary lights

NOTE

Only by transferring the rear hull lighting boxes to the bucket edge, at the correct height, can relevant lighting regulations be satisfied. Auxiliary light units (14) and (16) are provided for use on operations, where use of the rear lighting boxes on the buckets is not acceptable, and marker lights are required when carrying trackway.

40 Connection to the lighting circuits is by means of the same harnesses used for the hull lighting boxes, when they are transferred to the bucket, but connected to adjacent full connector points. Auxiliary lights are attached to the bucket in the same way as the rear lighting boxes.

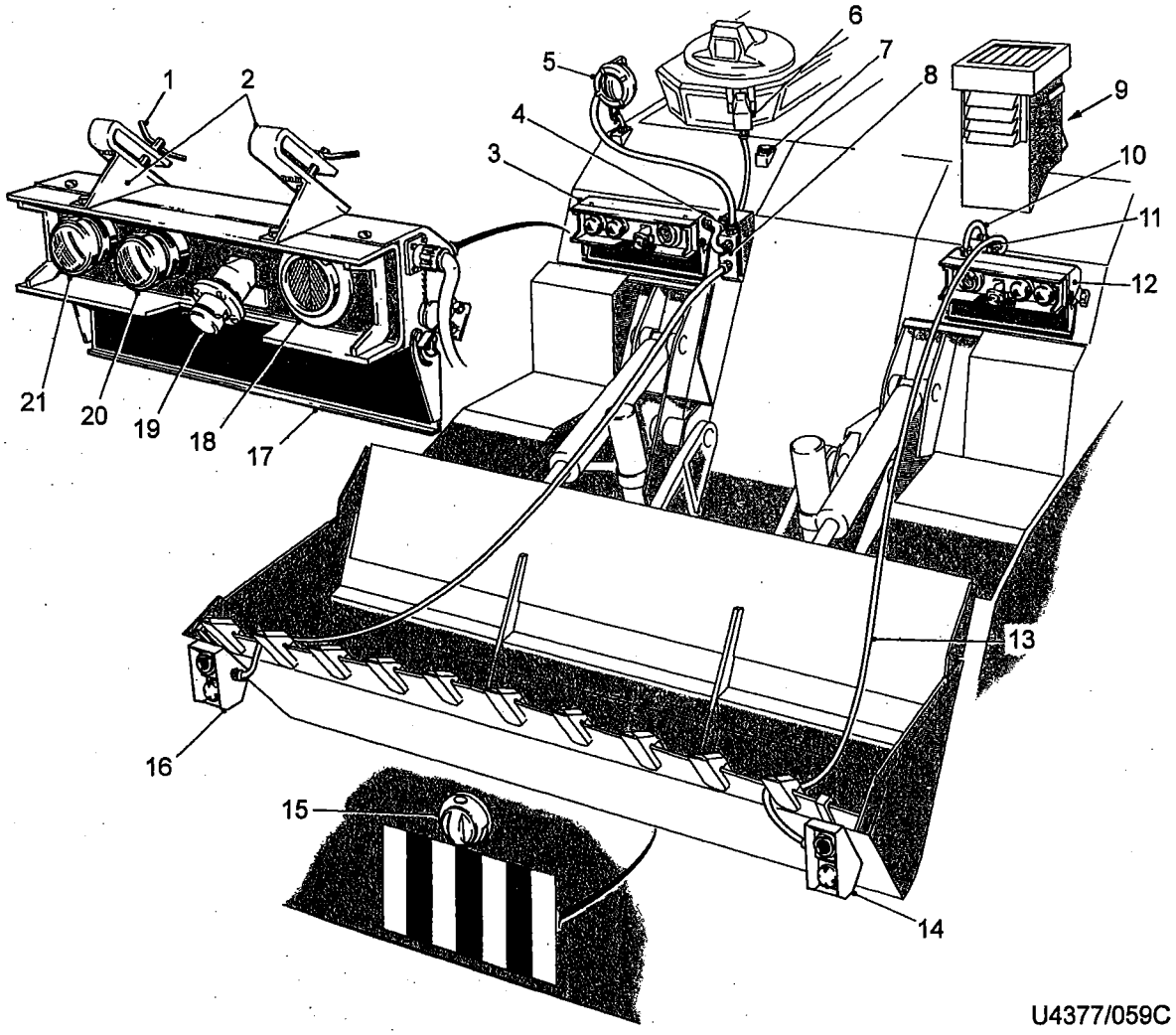
41 To fit rear lighting boxes to the bucket. To remove the rear lighting boxes from the hull and fit them to the bucket, for use on public roads, proceed as follows:

41.1 With the vehicle on level ground, position the bucket so that the side edges are parallel to and approximately 1.2 metres (4 feet) from the ground. If the bucket travelling locks are fitted, the correct position is automatically achieved.

41.2 Set the light switch (Fig 13 (8)) to the OFF position.

41.3 Unbolt both lighting boxes from their positions on the rear brackets.

41.4 Locate each lighting box on the cutting edge of the bucket, one on each side. The boxes are secured by wing bolts (Fig 6 (1)) which pass through the brackets and holes in the bucket edge. Tighten the wing bolts hand tight.



1	Wing bolt	12	Rear lighting box (right)
2	Attachment brackets	13	Detachable harness
3	Rear lighting box (left)	14	Auxiliary light unit
4	Spotlight connector point	15	Convoy light
5	Spotlight	16	Auxiliary light unit
6	Central warning light (operator's)	17	Registration plate
7	Spotlight mounting	18	Reflector
8	Rear lighting hull connector	19	Registration plate light
9	Auxiliary light unit stowage	20	Tail/stop light
10	Short harness	21	Turnlight
11	Rear lighting hull connector		

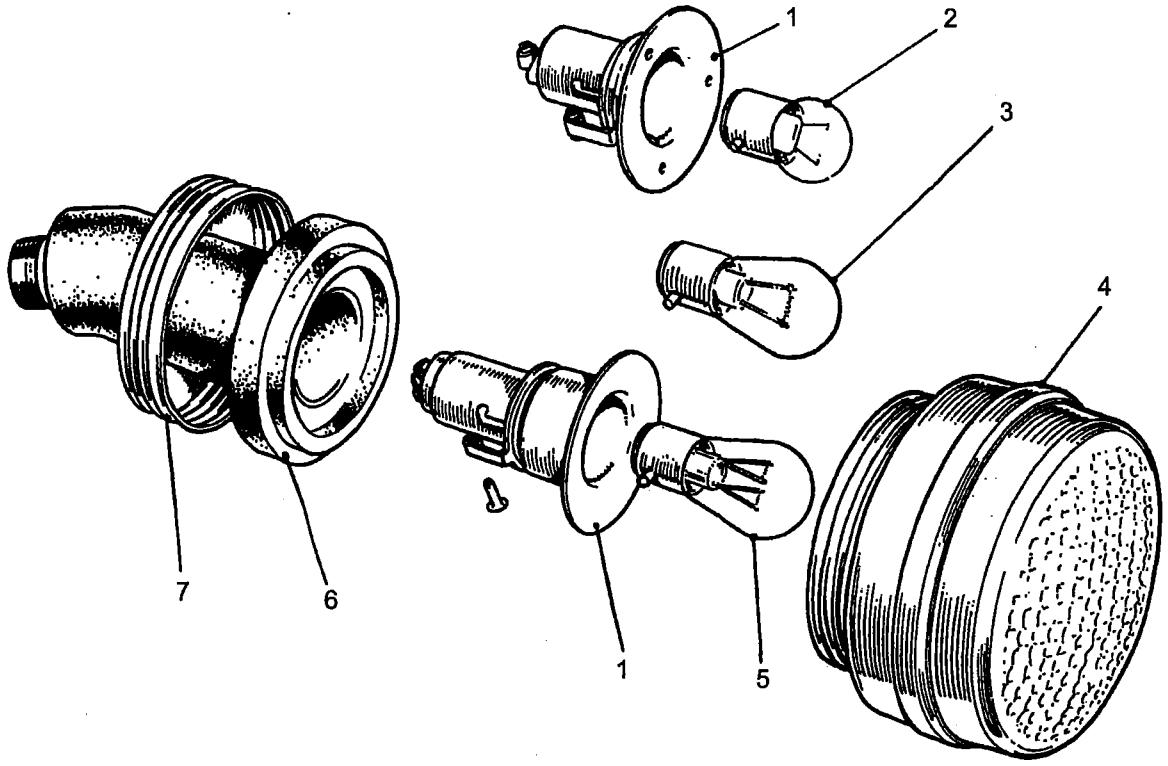
Fig 6 Rear lighting

41.5 Connect a detachable harness (13) to each lighting box, and their normal hull connector points.

41.6 Check that the lights are operative.

NOTE

With the bucket set as detailed in Para 41.1 the lighting will conform to the legal height requirements for rear lighting.



1	Lampholders	5	Stop/tail lights
2	Sidelight lamp	6	Cover
3	Turnlight lamp	7	Locking ring
4	Lens		

Fig 7 Sidelight, turnlight and stop/tail lights

42 To remove rear lighting boxes from the bucket. For normal use when the vehicle is not used on public roads, the rear lighting boxes are mounted on the rear of the hull. To re-install the lighting boxes in this position the procedure is the reverse of that detailed in Para 41.

Registration plate lights

43 A registration plate light (Fig 9) is fitted to each rear lighting box (Fig 6 (3) and (12)) in order to provide illumination for the registration plates (17). Each light has a clear glass lens (Fig 9 (13)) and an adjustable outer lens shield (14).

Convoy light

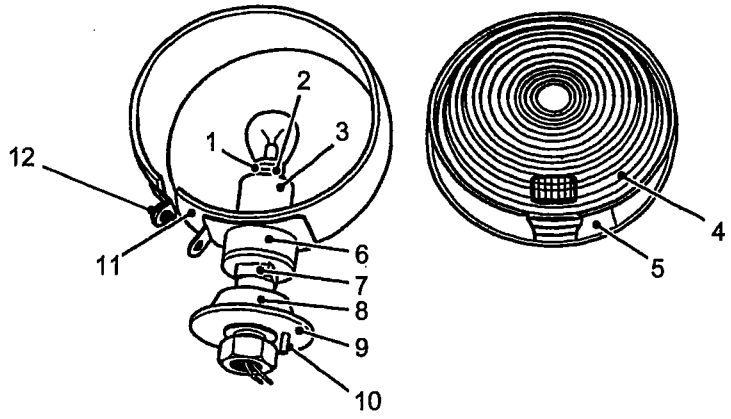
44 A convoy light is fitted to the hull, low on the heel plate, at the rear of the vehicle. The convoy light (Fig 10) is an assembly consisting of a body, lamp-holder, screw cap and polystyrene lens.

45 When the convoy light is in operation, a beam of light is directed downwards onto the painted markings on the hull, through the lens (14). A small red lens (1) is also illuminated at the top of the lamp.

Trailer lighting connection

46 In order to provide lighting facilities for a trailer, when towing with the front mounted tow hooks, a lighting socket (Fig 5 (7)) is provided at the front of the vehicle.

47 The socket is located adjacent to the left front lighting box and is a standard NATO connector, giving facilities for tail/stop, turn and convoy lights.



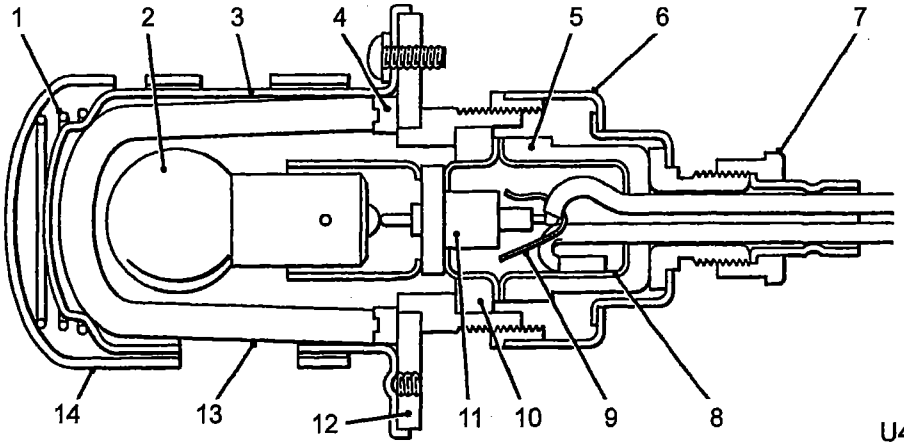
U4264/085A

1	Eyelet for each connection	5	Lens securing tape	9	Seating washer
2	Adaptor tube	6	Clamping ring bracket	10	Locating dowel
3	Rubber holder	7	Stem	11	Lens clamping ring
4	Lens	8	Pedestal washer	12	Retaining screw

Fig 8 Turnlight

Spotlight

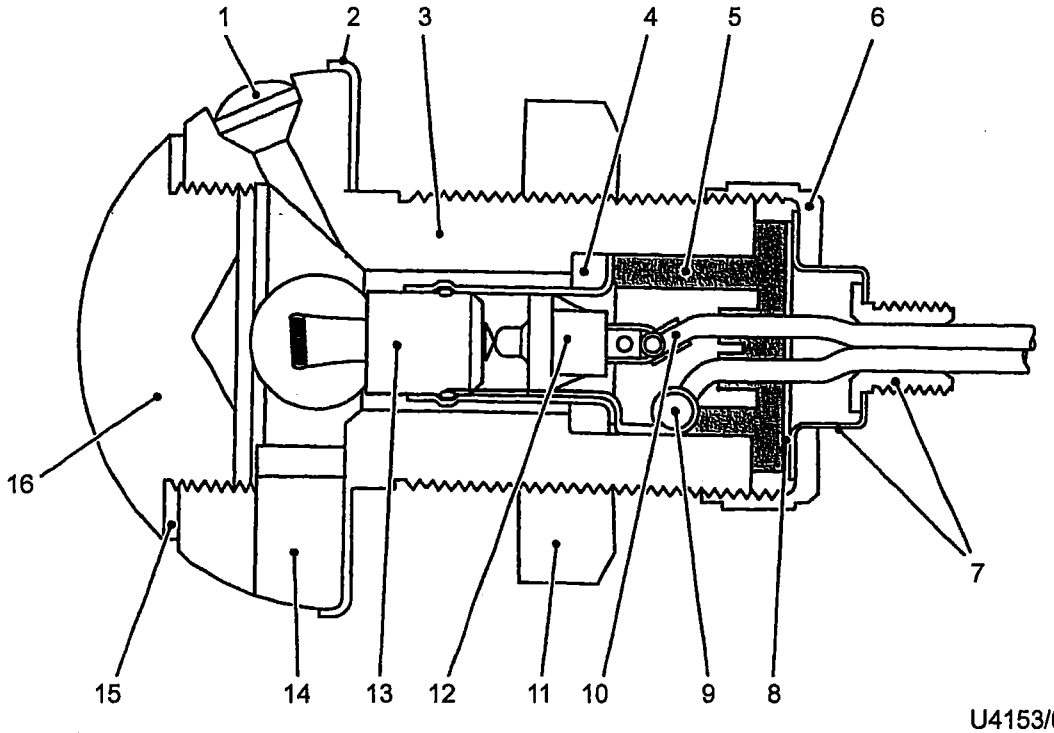
48 The spotlight (Fig 11) may be mounted on any one of four mounting points on the vehicle roof. Two mounting points at the rear of the hull enable the spotlight to be controlled and used by the operator and two further points, near the front of the cupola, enable it to be fitted in reach of the driver.



U4201/020A

1	Light shield spring	8	Negative connection cup
2	Lamp	9	Terminal cover
3	Front cover	10	Front rubber mounting
4	Gasket	11	Lampholder
5	Rear rubber mounting	12	Backplate
6	Locking ring	13	Lens
7	Cable bush nut	14	Lens shield

Fig 9 Registration plate light



U4153/075A

1	Convoy lens (red)	9	Negative connection
2	Backplate	10	Positive connection
3	Body	11	Securing nut
4	Lampholder mounting bush	12	Lampholder plunger
5	Rubber sleeve	13	Lamp
6	Locking ring	14	Polystyrene lens
7	Cable ferrule	15	Gasket
8	Spring tension washer	16	Cap

Fig 10 Convoy light

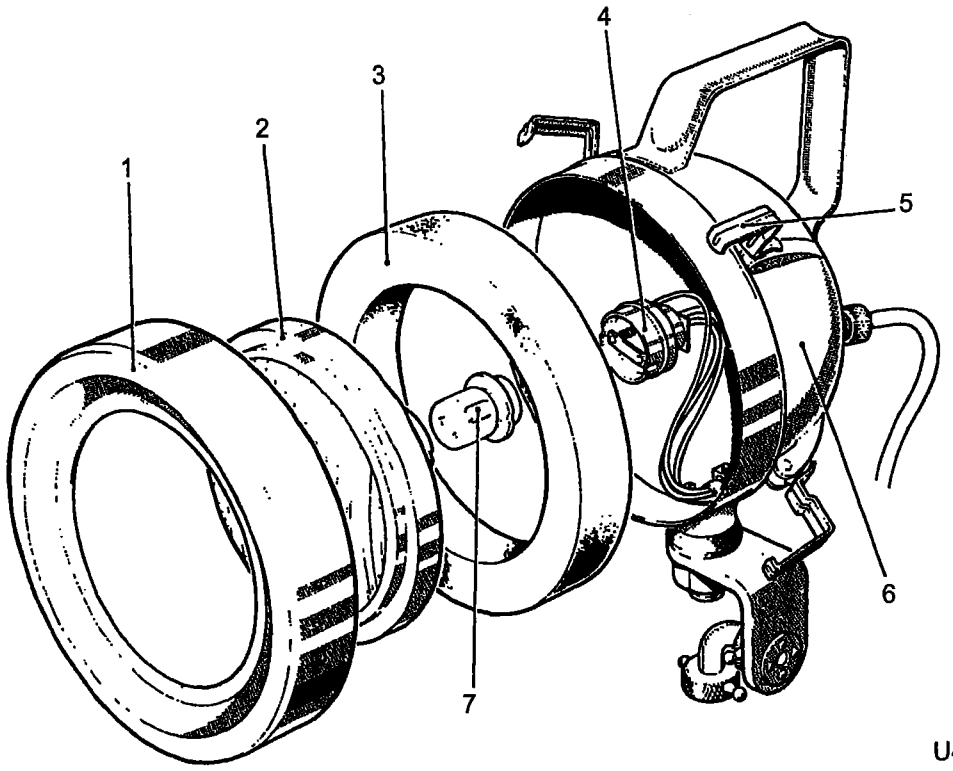
49 The spotlight is connected to the internal electrical system via a hull connector point (Fig 6 (4)) and a flexible harness. Power to the light is controlled by a switch (Fig 4 (4)) on the operator's instrument panel and/or by a switch on the spotlight casing. The spotlight mountings must be protected when not in use, with the screw caps provided.

Rotary beacon

50 For vehicles operating overseas, provision may be made for an orange rotating beacon to be fitted on the upper edge of the stowage basket. When the beacon is fitted the spotlight socket is used as a source of power. An additional socket in the beacon wiring is provided to enable the spotlight to remain in use.

Central warning lights

51 The primary purpose of the Central Warning Light (CWL) system is to give prompt warning to the driver or operator when driving 'head out' or 'closed down', of possible fault conditions. At the driver's position the central warning light (Fig 12 (6)) is a shielded warning light mounted on the glacis plate, in the normal field of vision when road driving. The operator's central warning light (1) is mounted on the right rear edge of the cupola and is visible when earth moving.



1	Rim	5	Clamp
2	Lens	6	Body
3	Seal	7	Lamp
4	Lampholder		

Fig 11 Spotlight

52 Both warning lights are designed to be seen only from within the field of vision of the appropriate crew member but are extinguished when the main light switch (Fig 13 (8)) is set to the 'convoy' position.

53 The external central warning lights are supplemented by two conventional warning lights, identified CWL, one on the driver's road warning instrument panel (Fig 3 (9)) and one on the operator's instrument panel (Fig 4 (15)). All four CWLs, internal and external, have red lenses.

54 The central warning lights will illuminate when a warning condition exists on any one of the following sensor circuits:

54.1 Engine low oil pressure.

54.2 Engine high oil temperature.

54.3 Engine cooling high temperature.

54.4 Transmission oil high temperature.

54.5 Brakes low air pressure.

54.6 Fan pack boost pressure low.

54.7 Hydraulic oil level low.

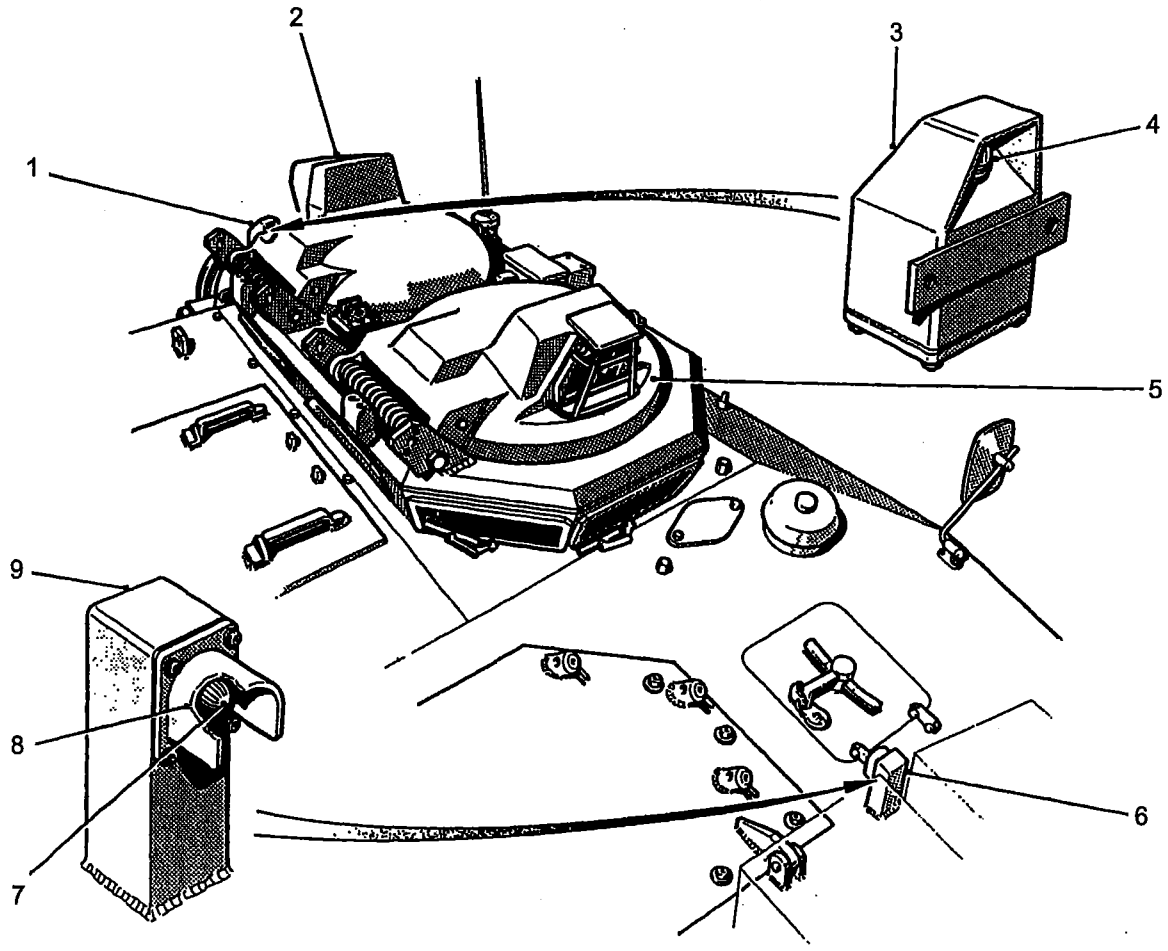
54.8 Steer unit oil level low.

54.9 Coolant level low.

55 When the battery master switch is set to ON the CWLs will illuminate until the engine is started and oil pressure builds up.

NOTE

During the engine start up procedure it is important that individual systems are monitored by means of the normal instruments and warning lights in the crew compartment.



1 Operator's central warning light
2 Operator's access hatch
3 Housing
4 Lamp and lens
5 Driver's access hatch
6 Driver's central warning light
7 Lamp and lens
8 Hood
9 Support bracket

Fig 12 External central warning lights

56 If a CWL illuminates during normal vehicle operation: Stop the vehicle and identify the system at fault by means of the normal instruments and warning lights, as quickly as possible. Take appropriate action, depending on the system fault.

NOTE

Internal CWL will illuminate when the brakes are applied.

Controls and instruments

57 All lighting circuits are dependent upon the battery master switch being set to ON before becoming operative.

Light switch

58 The light switch (Fig 13 (8)) is located on the driver's instrument panel and is semi-rotary in operation. The switch has six positions and each position has an identifying mark which signifies which of the external lights can be selected. The positions are:

58.1 Anti-clockwise from the OFF position:

T - Taillights only.
S - Side, tail and registration lights.
H - Head, side, tail and registration lights.

58.2 Clockwise from the OFF position:

C - Convoy light only.
C & S - Convoy and sidelights only.

Headlight dipswitch

59 Headlight dipping is controlled by a toggle headlight dipswitch (Fig 3 (3)), located on the driver's road warning instrument panel. The switch has a two way action, for the selection of main beam or dipped headlights. When the switch is in the uppermost position, identified MAIN, both headlight main beam filaments are in use.

Main beam warning light

60 The main beam warning light (11), located beneath the headlight dipswitch, is fitted with a blue lens. The light will illuminate when the headlights are in use and the dipswitch is in the MAIN position. When the headlight beams are dipped, the light is extinguished.

Turnlight switch

61 The turnlight switch (1) is a three position pushbutton operated switch, with a central OFF position. The left or right turnlights are selected by pressing the pushbutton to the required L or R positions.

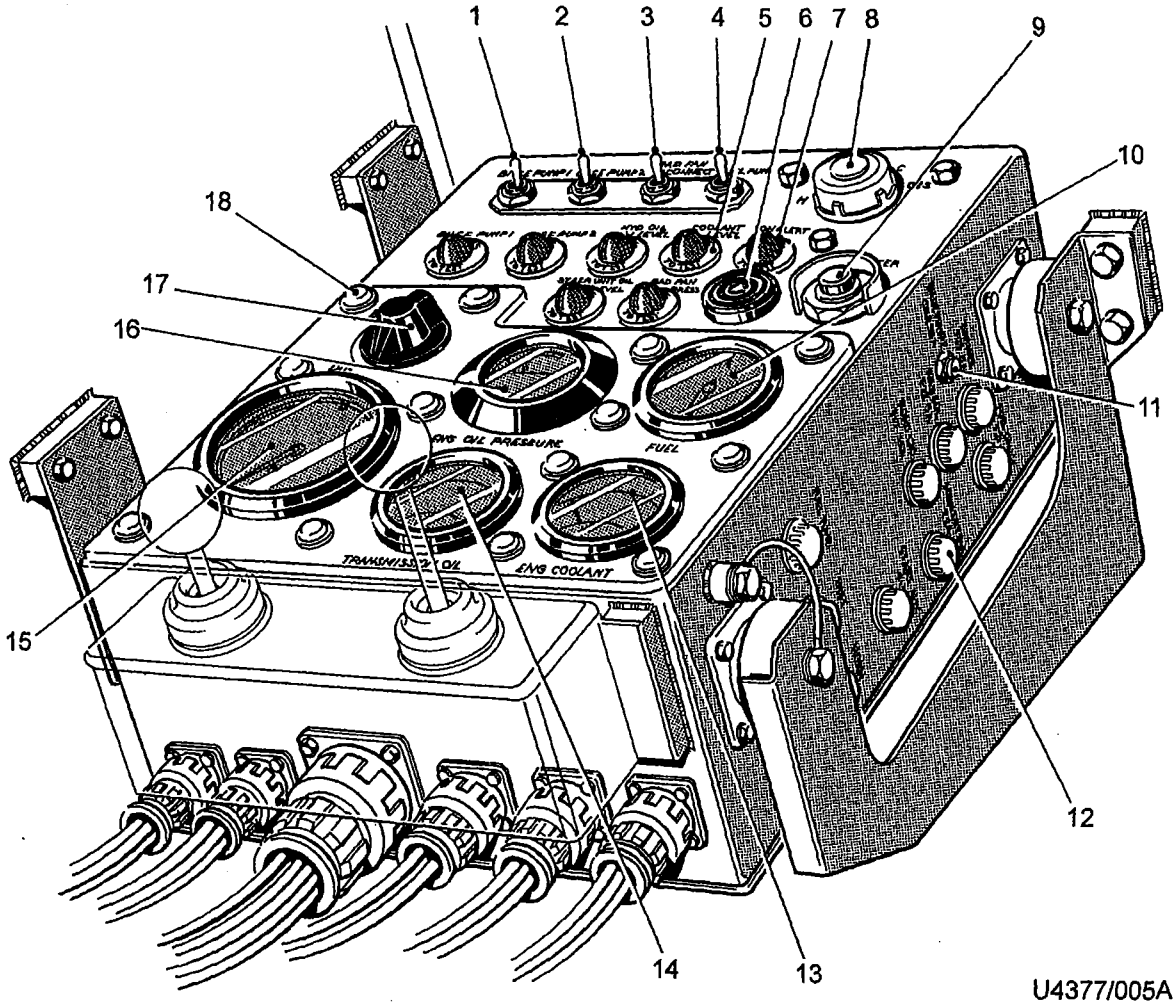
Turnlight warning light

62 The turnlight warning light (12), to the right of the turnlight switch, has a green lens and will flash when the turnlight switch is at the L or R positions, indicating that the turnlights are operating.

63 The flasher circuit is protected by a fuse. For location and rating refer to Table 2.

Spotlight switch

64 The spotlight electrical circuit is controlled by the toggle switch (Fig 4 (4)), located on the operator's instrument panel. When the switch is ON, in its lower position, the spotlight circuit becomes 'live'. The spotlight may then be controlled by a switch on the light body.



1 Bilge pump 1 switch
2 Bilge pump 2 switch
3 Radiator fan disconnect switch
4 Fuel pump switch
5 Warning lights:
  Bilge pumps 1 and 2
  Hydraulic oil level
  Coolant level
  Steer unit low oil level
  Radiator fan boost pressure
6 Sonalert horn
7 Sonalert light
8 Light switch
9 Starter button
10 Fuel gauge
11 Circuit breaker, No. 2 bilge pump
12 Fuses: F13, F14, F16, F17, F20, F21, F22, F23 and F24
13 Engine coolant temperature gauge
14 Transmission oil temperature gauge
15 Tachometer
16 Engine oil pressure gauge
17 Dimmer switch
18 Panel lights (14 positions)

Fig 13 Driver's instrument panel

Interior lighting - crew compartment

Interior lights

65 Two interior lights are fitted in the crew compartment. One light (Fig 14 (3)) is located above the driver's instrument panel and one light (Fig 15 (8)) beneath the operator's instrument panel.

66 Each light is controlled by a combined switch and dimmer, incorporated in its base. The interior light circuit for the crew compartment is protected by a fuse in the radio junction box, for rating refer to Table 2.

Inspection light socket

67 An inspection light socket (Fig 14 (5)) is provided, to the left of the driver's steering column, to enable an inspection light to be used in the crew compartment. When not in use, the socket must be protected by the screw-on cap provided.

Map reading light

68 The map reading light (Fig 15 (16)) is located on the crew compartment outer wall. The light has a flexible stem and is controlled by a switch and dimmer on the light mounting base.

Interior lighting - engine and transmission compartments

Maintenance lights

69 Two lights are provided to illuminate the engine and transmission compartments, for maintenance purposes. In the engine compartment the light is located on the engine/crew compartment bulkhead above the hydraulic pipes. The transmission compartment light is located on the engine/transmission compartment bulkhead adjacent to the ventilation fan. Each light is fitted with a protective guard and an integral switch.

70 The circuits for both lights are controlled by a switch (Fig 4 (6)) on the operator's instrument panel. When the switch is moved down, to the ON position, the warning light (7), adjacent to the switch will illuminate. The switch also controls power to the engine and transmission compartment inspection light sockets.

Inspection light sockets

71 Two inspection light sockets enable an inspection light to be used in the engine and transmission compartments. The socket in the engine compartment is integral with the engine junction box which is mounted on the engine above the inlet manifold. The socket is located on the rear surface of the junction box and is provided with a screw-on protective cap.

72 The transmission compartment inspection light socket is located adjacent to the maintenance light detailed in Para 69.

73 Power is only available at the inspection light sockets when the engine maintenance light switch is set to its ON position.

Spares

74 Twelve midget panel lamps, twenty fuses and twelve lenses are provided and are carried in a spares box (Fig 15 (34)), which is located on the inner wall of the crew compartment.

ELECTRICAL ANCILLARIES

General

75 In addition to the normal vehicle automotive electrical system, power is supplied to a number of ancillary services, which include the NBC unit, bilge pumps, radio, night vision periscope, cooking vessel, smoke dischargers and the demolition firing circuits. All of the services mentioned are detailed in the relevant chapters of this publication. The services detailed in this section are those which are not covered elsewhere.

Road warning horn

76 An electric horn (Fig 5 (1)), of waterproof construction, is located on the outer side of the right front light box.

77 The horn is operated by a pushbutton switch (Fig 3 (2)) on the driver's road warning instrument panel. The horn circuit is protected by a fuse, for location and rating refer to Table 2.

Inter-vehicle socket

WARNING

PERSONNEL INJURY. THE INTER-VEHICLE CONNECTING SOCKET IS LIVE.

78 In the event of the vehicle batteries being in a discharged state, provision is made for an external connection to another vehicle or 24V negative earth external source. Such a connection is made using the inter-vehicle socket (Fig 14 (32)), located on the left wall of the crew compartment beneath the sill of the emergency exit door.

79 Connection to an alternative supply is by means of the inter-vehicle cable, which is stowed on the vehicle. The cable may be used for starting and charging purposes, or to enable ancillary equipment to be used, ie radio, lighting, etc.

NOTES

(1) When connecting or disconnecting the inter-vehicle cable to another vehicle, the battery master switches of both vehicles must be in the OFF position.

(2) When the connection has been made both battery master switches must be in the ON position to obtain power.

80 When the inter-vehicle connecting socket is not in use it must be protected by the screw-on cap provided.

Heated clothing switch-boxes

81 A heated clothing switch-box is fitted at each crew position. The driver's heated clothing switch-box (Fig 14 (31)) is located beneath the sill of the emergency exit door and the operator's beneath the gear selector switch-box (Fig 15 (38)).

82 Each switch-box has a socket, into which the heated clothing harness is plugged, a toggle switch and a fuse. The switch controls the power supply to the socket and the fuse provides protection for the individual clothing circuit. Further fuses in the distribution panel provide additional protection for the heating clothing electrical system. For fuse ratings and location refer to Table 2.

1 Diffuser box
2 Python harness aperture
3 Interior light
4 Driver's instrument panel
5 Inspection light socket
6 Driver's road warning instrument panel
7 Steering column
8 Speedometer panel
9 'Trip' reset knob
10 Battery master switch
11 Distribution panel
12 Air restriction indicator
13 Emergency brake lever
14 Flooding valve
15 Engine stop control
16 Transmission clutch disconnect lever
17 Height adjuster, driver's seat
18 Accelerator pedal
19 Cold starting aid pump handle
20 Brake pedal
21 Fire extinguisher operating handles
22 Night sight stowage
23 Gear selector switch-box
24 Winch gear change lever
25 Pay-out/winch-in control lever
26 High speed pay-out/winch-in control lever
27 Driver/operator select switch
28 Junction box
29 Demolition microswitch
30 Demolition terminals
31 Heated clothing switch-box
32 Inter-vehicle socket
33 Emergency door release handle
34 Crew box - 2 radio

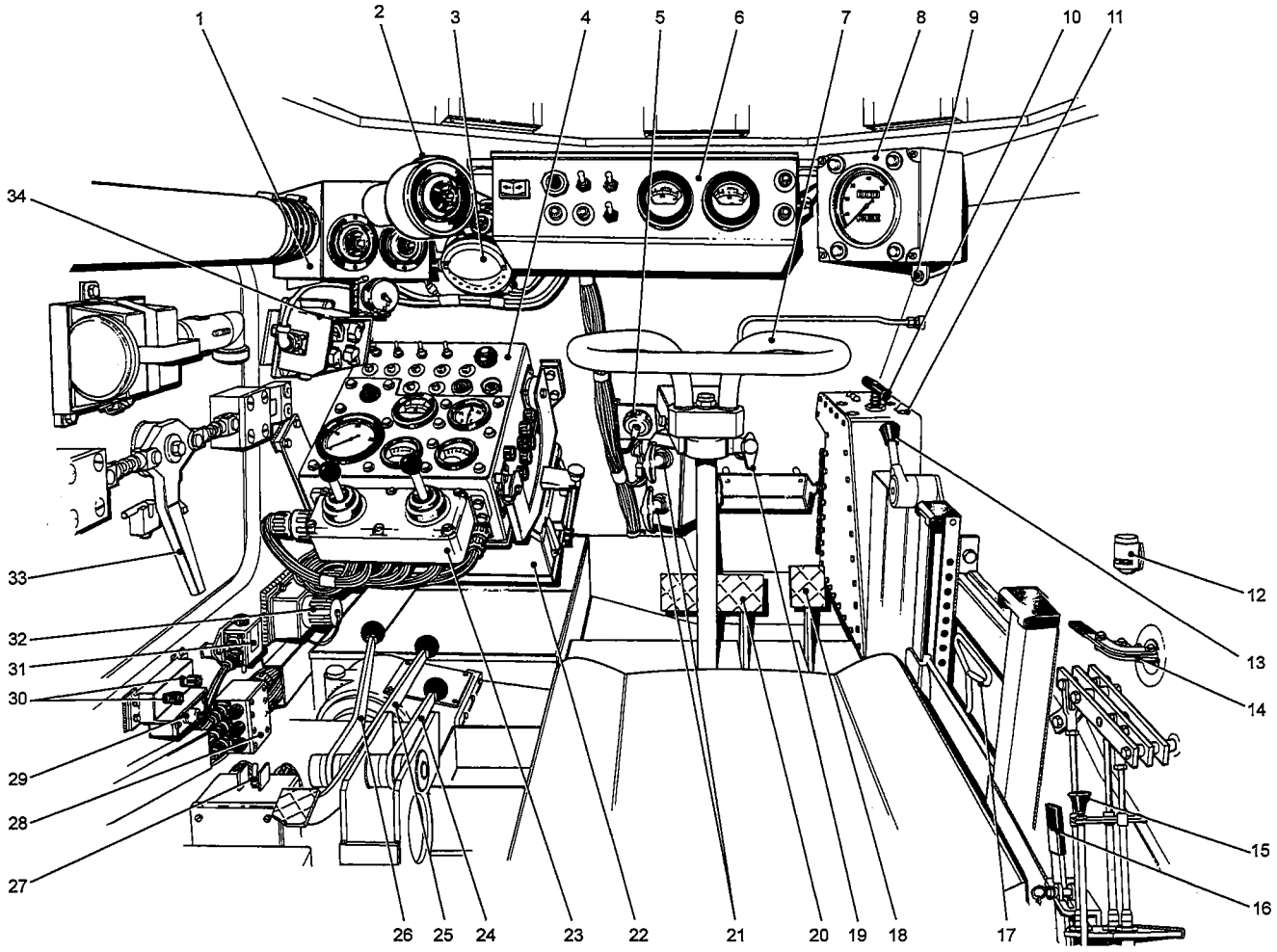


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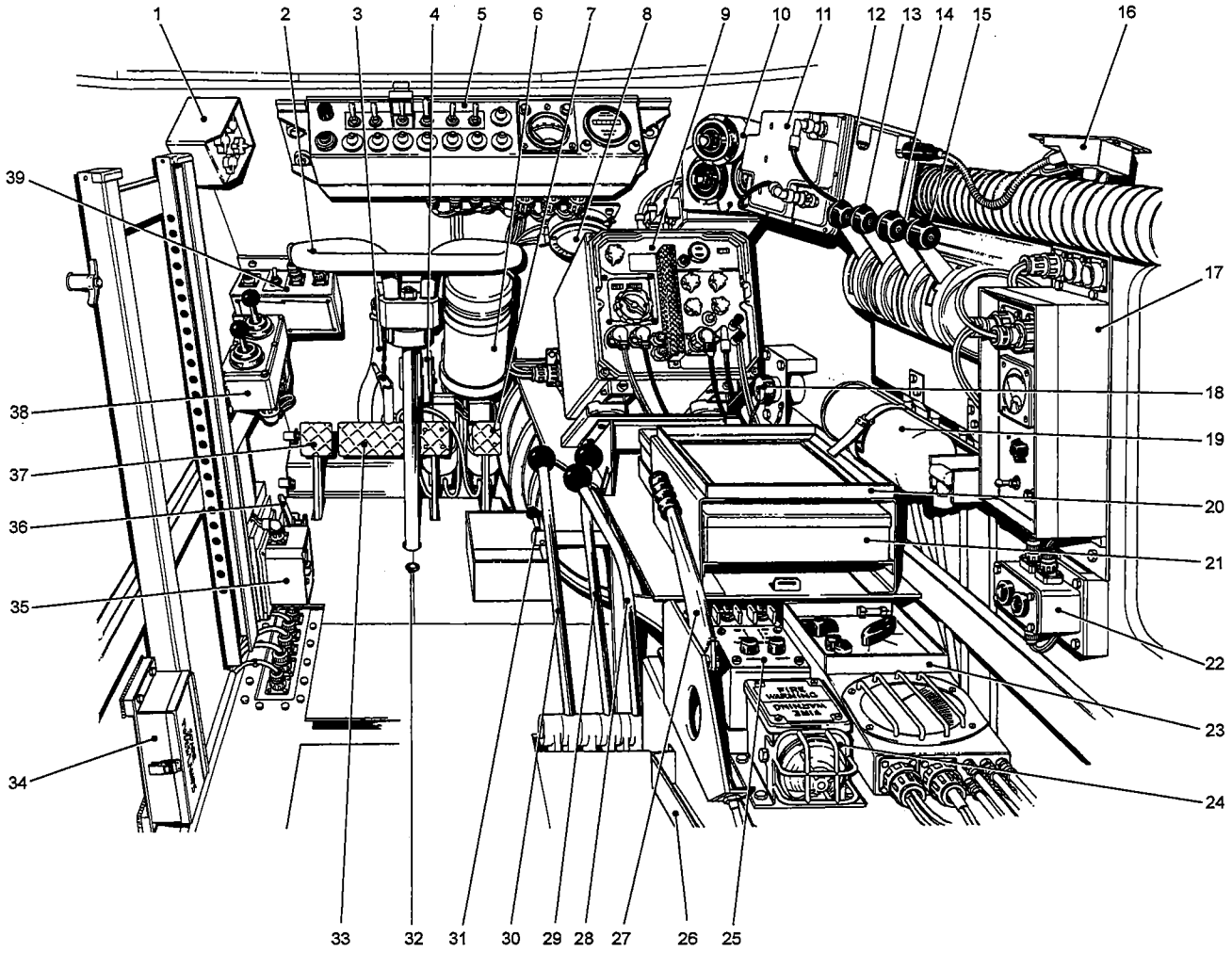
Fig 14 Controls and instruments (crew compartment - front)



1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spares box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnect pedal
38 Gear selector switch-box
39 Firewire control box

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Fig 15 Controls and instruments (crew compartment - rear)

Fuse/junction box

83 A combined fuse/junction box (Fig 14 (28)), located beneath the sill of the emergency exit door, contains connections and fuses for the smoke discharger firing circuit and the night vision periscope electrical supply. For details of fuse ratings refer to Table 2 and/or see information plate on the vehicle.

TABLE 1 CIRCUIT BREAKERS

Identification (1)	Rating (2)	Location (3)	Circuit Protected (4)
CB 1	15A	Distribution panel	Starter solenoid
CB 2	50A	Distribution panel	Cooking vessel
CB 3	50A	Distribution panel	NBC
CB 4	35A	Distribution panel	Bilge pump No. 1
CB 5	35A	Distribution panel	Radio supply, maintenance lights and inspection sockets
CB 6	50A	Distribution panel	Driver's instrument panel Driver's road warning panel
CB 7	50A	Distribution panel	Operator's instrument panel
CB 8	35A	Driver's instrument panel	Bilge pump No. 2

TABLE 2 FUSES

Identification (1)	Rating (2)	Location (3)	Circuit Protected (4)
F 1	5A	Distribution panel	Generator field cut-off
F 2	15A	Distribution panel	Firewire (battery feed)
F 3	15A	Distribution panel	Firewire (switched)
F 4	10A	Distribution panel	Heater suit - driver
F 5	10A	Distribution panel	Heater suit - operator
F 6	15A	Distribution panel	Junction box (image intensifier and smoke grenade dischargers)
F 7	10A	Distribution panel	Demolition charge
F 8	5A	Distribution panel	Gear change
F 9	15A	Distribution panel	Air cooling system
F 10	10A	Distribution panel	Maintenance lights and inspection light socket engine/transmission compartments
F 11	5A	Distribution panel	NBC and cooking vessel relay coils
F 12	5A	Driver's road warning panel	Turnlights
F 13	2A	Driver's instrument panel	Starter relay
F 14	10A	Driver's instrument panel	Road horn

(continued)

TABLE 2 FUSES (continued)

Identification (1)	Rating (2)	Location (3)	Circuit Protected (4)
F 15	-	-	(Not in use)
F 16	10A	Driver's instrument panel	Fuel pump supply and No. 2 bilge pump
F 17	15A	Driver's instrument panel	Road lighting
F 18	5A	Driver's road warning panel	Washer (driver)
F 19	5A	Driver's road warning panel	Wiper (driver)
F 20	2A	Driver's instrument panel	Instruments (driver)
F 21	2A	Driver's instrument panel	Fuel gauging (instruments and relay box)
F 22	5A	Driver's instrument panel	Radiator fans solenoid disconnected and No. 1 bilge pump
F 23	5A	Driver's instrument panel	Dimmed positive supply (all warning lights etc)
F 24	1A	Driver's instrument panel	Sonalert
F 25	2A	Driver's heated clothing switch-box	Heated suit (driver)
F 26	2A	Operator's heated clothing switch-box	Heated suit (operator)
F 27	5A	Operator's instrument panel	Wiper (operator)
F 28	5A	Operator's instrument panel	Spotlight (and rotary beacon)
F 29	5A	Operator's instrument panel	Washer (operator)
F 30	1A	Operator's instrument panel	Hourmeter
F 31	10A	Radio junction box	Interior lights and inspection light socket (crew compartment)
F 32	10A	Junction box	Night vision periscope (operator)
F 33	10A	Junction box	Night vision periscope (driver)
F 34	10A	Junction box	Smoke grenade dischargers
F 35	5A	NBC control box	NBC scavenge fan
F 36	2A	Driver's road warning panel	Instruments - driver's road warning panel
F 37	5A	Operator's instrument panel	Heated window (operator)
F 38	5A	Driver's road warning panel	Heated window (driver)
F 39	7A	Test/fire box	Demolition circuits

Cooking vessel

84 The portable cooking vessel is provided for boiling water for beverages, shaving, washing etc and at the same time heating up tinned or decanted foods. The vessel can also be used for frying.

85 Power is supplied, via a socket on the outer crew compartment wall adjacent to the cooker stowage tray, when the engine is running and the generator is 'on line'. A cooker ON-OFF switch (Fig 4 (5)) on the operator's instrument panel controls the electrical supply to the socket. The electrical circuit is protected by a 50A circuit breaker located on the distribution panel.

86 To prevent damage to the vessel when travelling over rough ground or uneven surfaces, it must be securely stowed in the tray provided (Fig 15 (20)).

87 The vessel comprises a stainless steel water compartment (Fig 16 (14)), a removable stainless steel inner food container (8) and a removable lid (3). The water compartment and the lid are insulated to reduce heat loss and to reduce the possiblity of accidental burns and scalds.

Water compartment

88 The water compartment, which contains the heating element and a thermostat, is fitted with a drain tap (11). The heating element is located in the base of the compartment, and must not be disturbed. The thermostat is fitted to prevent the vessel overheating. The drain tap has a pushbutton operated valve which can be dismantled for cleaning.

Lid

89 The lid is fitted with hinge clips (4) at the rear and fixing and lifting hooks (15) at the front. The hinge clips engage with hinge pins (10) located at the corner of the water compartment, the out-turned hooks engage with the quick release toggle clips (13). The lid also accommodates a safety vent cap (1), a folding lifting handle (2) and sealing gasket (18).

90 When closed, the lid forms a water tight seal and the vent cap is necessary to allow the steam to escape. The vent must be kept clear at all times.

91 The front fixing and lifting hooks can be used, as illustrated, when removing the inner food container during cooking operations.

Operation

CAUTIONS

(1) EQUIPMENT DAMAGE. When the cooking vessel is in use, connection and disconnection of the harness must not be made at the sockets until the cooker switch is turned to the OFF position. When the cooking operation is completed, the harness should be disconnected and stowed. DO NOT stand the vessel on damp surfaces - especially when the vessel is hot.

(2) EQUIPMENT DAMAGE. Do not fill the cooking vessel above the 7 pint level line engraved within the water compartment.

92 The cooking vessel can only be used when the engine is running and the generator is charging. The hand operated accelerator control should be set so that the engine runs at fast idle speed - approximately 1000 rev/min and the generator warning light is extinguished.

93 Boiling. Release the toggle clips, remove the lid and lift out the inner food container. Pour the required measure of water into the container but DO NOT FILL ABOVE THE 7 PINT LEVEL LINE ENGRAVED WITHIN THE WATER COMPARTMENT. Replace the lid, fasten the toggle clips and engage the harness plug to the socket on the compartment wall and then to the connector (Fig 16 (12)) on the cooking vessel. Turn the cooker switch on the operator's instrument panel (Fig 4 (5)) down to the ON position.

CAUTION

EQUIPMENT DAMAGE. Tea and other beverages must not be made in the cooking vessel water container as the drain tap will become blocked.

94 Making beverages. Place tea, coffee, cocoa or soup powder etc, into a suitable container. Boil the water, switch off and disconnect the plug. Position a suitable container under the tap and draw off water by pressing the tap pushbutton.

NOTE

The food container capacity is four and a half pints (approximately).

WARNING

PERSONNEL INJURY. WHEN HEATING WATER OR TINNED FOOD, DO NOT OPEN THE COOKING VESSEL CONTAINER LID WHEN THE VEHICLE IS IN MOTION.

95 Heating composite rations - decanted. Release the toggle clips, remove the lid and lift out the inner foods container. Measure two pints of water into the water compartment - DO NOT EXCEED THE TWO PINT LEVEL. Pour the contents of up to five tins of composite rations into the food container, replace the container in the vessel, then replace and secure the lid. Engage the harness plug to the socket, turn the cooker switch (Fig 4 (5)) down to the ON position and leave for approximately 25 minutes, for the food to heat. Switch off and disconnect the harness, then using the out-turned clip hooks on the lid to engage the inner container folding handle, lift the container out.

NOTE

Food left in the vessel will remain hot for up to 4 hours. The boiling water remaining in the water compartment can be used for beverages or washing etc.

WARNING

PERSONNEL INJURY. CARE MUST BE TAKEN WHEN REMOVING HOT TINS FROM THE COOKING VESSEL INNER CONTAINER.

96 Heating composite rations - undecanted. Proceed as in Para 12, but place up to three tins of composite rations, with TOPS PIERCED, into the inner container. When heated, remove the composite ration tins, open them carefully and serve.

WARNINGS

(1) PERSONNEL INJURY. DEEP FRYING USING THE COOKING VESSEL MUST NOT BE ATTEMPTED.

(2) PERSONNEL INJURY. NEVER ATTEMPT TO FRY FOOD, USING THE COOKING VESSEL, WHILST THE VEHICLE IS IN MOTION.

(3) PERSONNEL INJURY. THE BASE OF THE COOKING VESSEL WATER COMPARTMENT BECOMES RED HOT WHEN FRYING. DO NOT COOL BY POURING WATER INTO THE COMPARTMENT.

(4) DANGER OF SCALDING. CARE MUST BE TAKEN WHEN REFILLING THE COOKING VESSEL WITH WATER SOON AFTER FRYING.

97 Frying. Remove the lid and inner container, drain off the inner container and ensure that the water compartment is clean. Place a small quantity of cooking fat in the bottom of the inner food container and replace the container.

98 Connect one end of the harness to the distribution panel socket and then connect the other end to the cooking vessel. Set the cooker switch (Fig 4 (5)) on the operator's instrument panel down to the ON position. At the first indication of blue smoke arising from the melted fat, place food for frying into the hot fat and fry until cooked. Switch off and then unplug and stow the harness. Lift out the container and serve the food.

Cleaning

WARNING

PERSONNEL INJURY. CLEANING AGENTS CONTAINING PETROL OR OIL DERIVATIVES MUST NOT BE USED FOR CLEANING THE COOKING VESSEL UNDER ANY CIRCUMSTANCES. THEY MAY CAUSE SILICONE SEALS TO SWELL. SEALS THAT HAVE SWOLLEN ARE TOXIC. SEALS THAT BECOME CONTAMINATED MUST BE CHANGED BEFORE THE VESSEL IS USED AGAIN.

99 Inner food container. Remove and clean by scouring, then rinse, drain and wipe dry.

100 Water compartment. Clean by scouring, then rinse, drain and wipe dry. Alternatively, cleaning can be affected 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.

101 Drain tap. To clean the drain tap, proceed as follows:

101.1 Using a coin or suitable implement, unscrew and remove the end plug from the tap.

101.2 Remove the spring and valve plunger assembly.

101.3 Clean all parts, dry off and assemble.

102 Lid. To clean the lid, proceed as follows:

102.1 Remove the vent cap (Fig 16 (1)) and spacer (16) by unscrewing the countersunk retaining screw.

102.2 Unscrew the remaining two countersunk screws, which secures the lifting handle (2), from the inner face of the lid (3).

102.3 Dismantle the lid and clean.

102.4 Re-assemble in reverse sequence, ensuring that the vent apertures align and the sealing gasket (18) seats correctly.

Cooking vessel fails to heat

103 If the cooking vessel fails to heat, carry out the following checks:

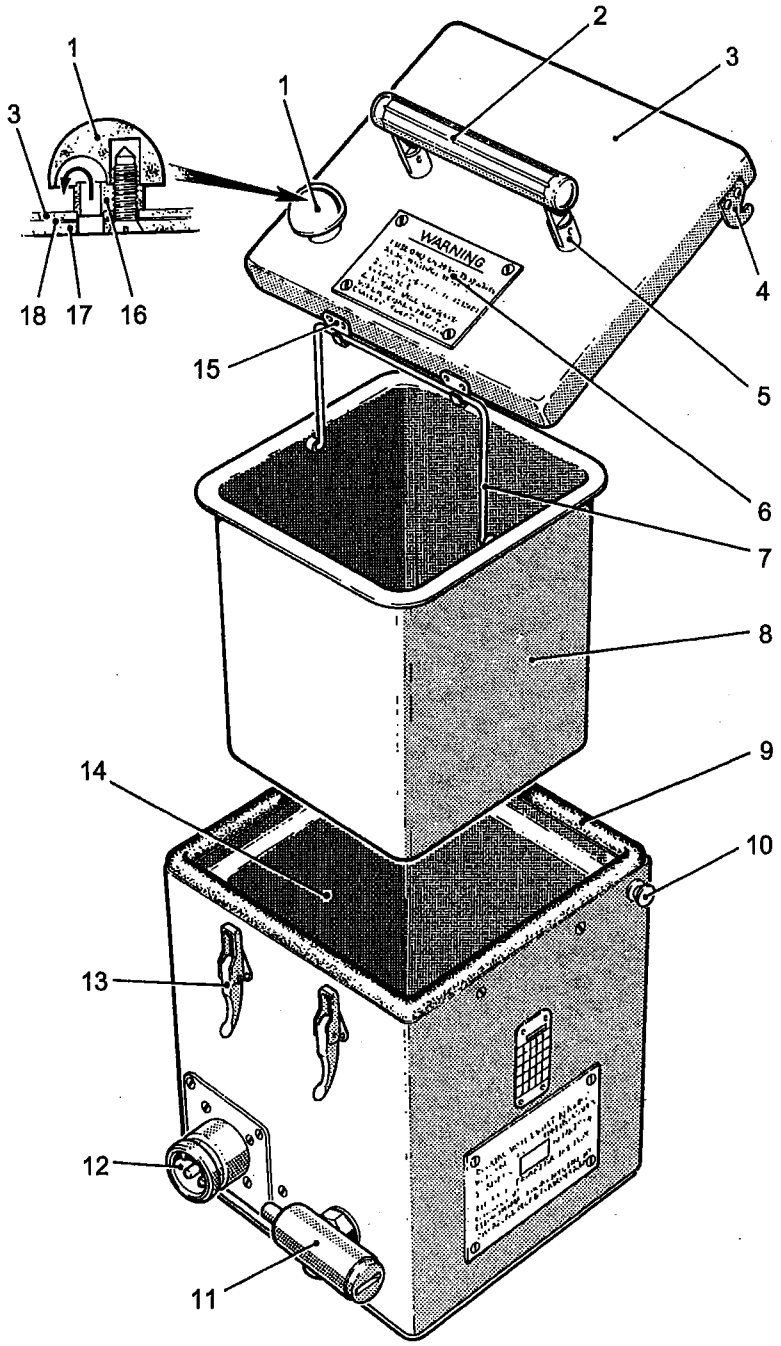
103.1 Check the generator is running and charging.

103.2 Check that the cable connections are fully secured.

103.3 Check that the cooker switch is switched to ON.

103.4 Check that the circuit breaker on the distribution panel is not 'tripped', i.e. white collar showing.

103.5 If the cooling vessel still does not heat, report to REME.



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1	Vent cap	10	Hinge pins
2	Lifting handle	11	Drain tap
3	Insulated lid	12	Electrical connector
4	Hinge clips	13	Toggle clip
5	Handle support	14	Water compartment
6	Warning plate	15	Fixing and lifting hooks
7	Food container lifting handles	16	Spacer
8	Food container	17	Plastic lining
9	Seal	18	Gasket

Fig 16 Cooking vessel

MAINTENANCE

Batteries

CAUTION

EQUIPMENT DAMAGE. When operating in sub-zero conditions, the batteries must be kept fully charged or the electrolyte may freeze and cause subsequent damage to the cells.

To check the batteries

NOTE

The batteries fitted to CET are of the maintenance free type. Battery maintenance is restricted to cleaning and greasing of terminals.

104 To check the batteries, proceed as follows:

104.1 Set the battery master switch to OFF.

104.2 Open and secure the transmission compartment upper access panel (Fig 17 (27)).

104.3 Check the security of the battery clamping bars (Fig 18 (2)).

104.4 Ensure that all cable connectors (3) are firmly secured to the terminal posts.

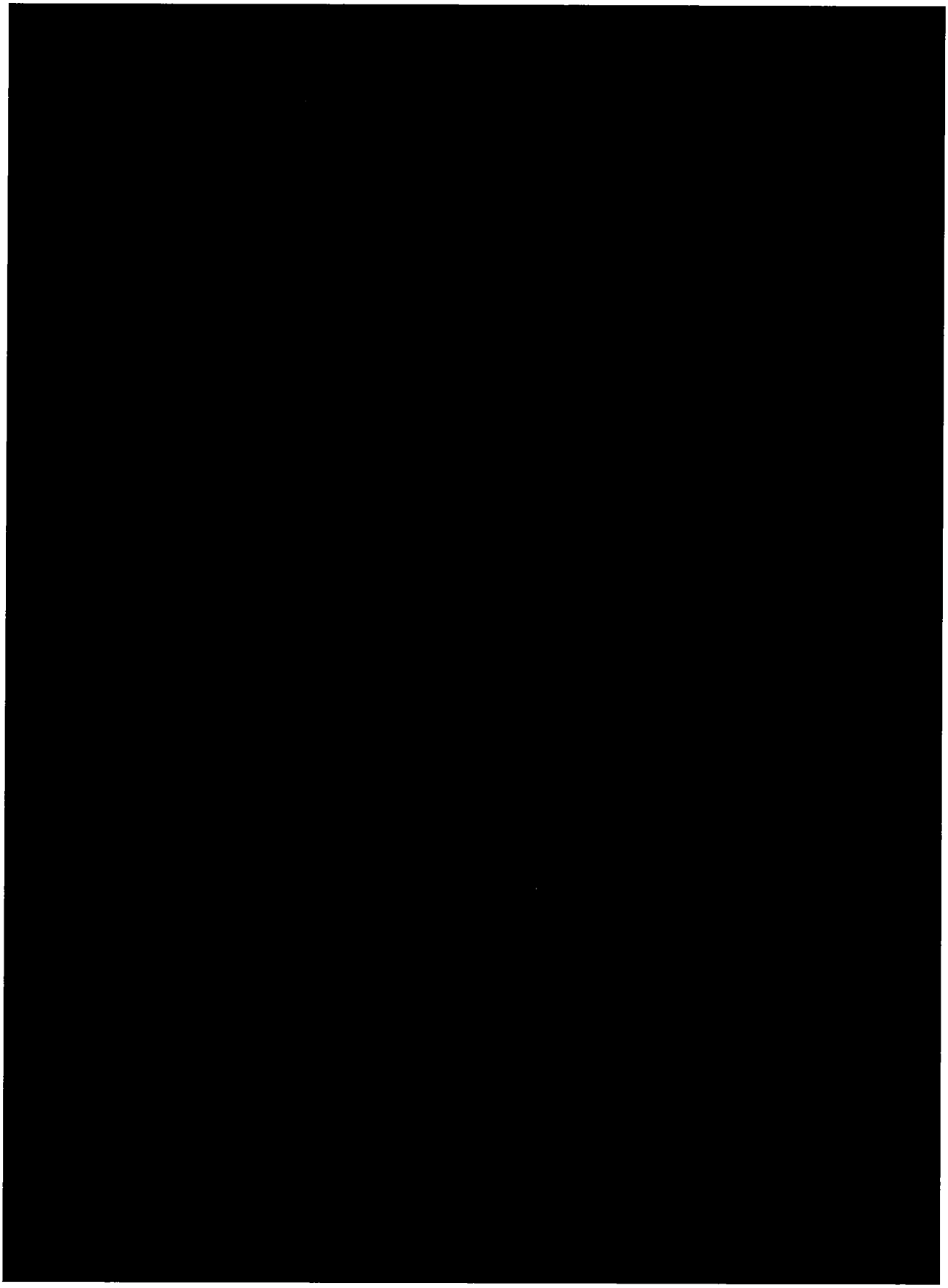
WARNING

PERSONNEL INJURY. THE GASES RELEASED 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, TURN THE BATTERY SWITCH TO OFF. 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.

104.5 Examine for signs of corrosion around the bottom of each connector. If corrosion is visible, carefully lift the connector cover, then disconnect the connector from its post. Scrape away the corrosion and wash the connector and post with hot water, or an ammonia or soda solution to neutralize the acid, replace the connectors - positive terminal first.

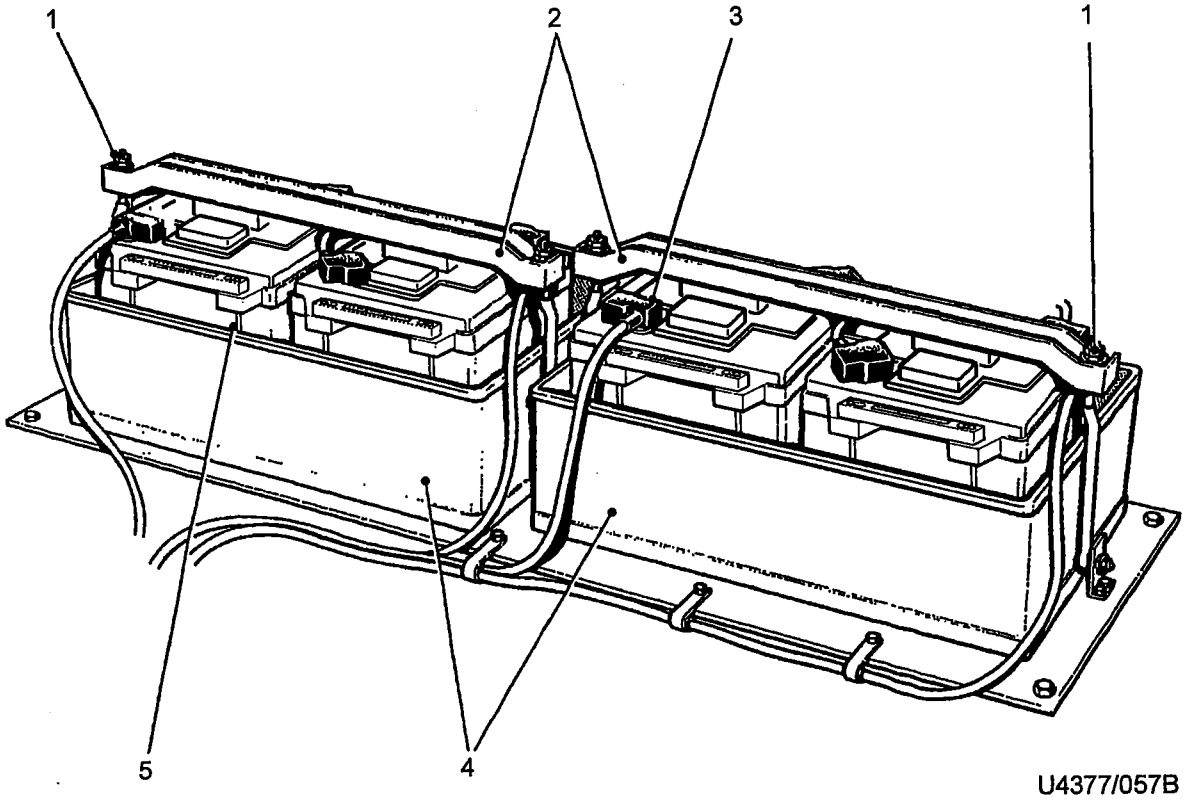
KEY TO FIG 17

1 Front stowage bins
2 Winch
3 Air intake cowl
4 Access panel
5 Access cover plates
6 Stowage basket
7 Stowage box
8 Rear stowage bin
9 Bilge pump outlet (rear)
10 Engine compartment roof plate
11 Engine compartment lower access panel
12 Drain plug
13 Emergency exit door
[redacted]
15 Exhaust cowl
16 Fairlead
17 Smoke grenade stowage box
18 Engine compartment access door
19 Operator's access door
20 Driver's access door
21 Python aperture cover plate
22 NBC air intake cowl
23 Stowage compartment door
24 Transmission compartment lower access panel
25 General service tow hook
26 Fire extinguisher operating handles
27 Transmission compartment upper access panel
28 Bilge pump outlet (front)
29 Smoke discharger mounting
30 Fuel filler access cover
31 Radiator intake louvres
32 Radiator outlet louvres



104.6 Coat the connectors and terminal posts with the approved protective grease (refer to Cat 601). On no account must ordinary grease be used for this purpose.

104.7 Close and secure the access panel.



1 Securing nuts
2 Clamping bars
3 Cable connector (8 positions)
4 Battery containers
5 Batteries (4 positions)

Fig 18 Battery installation

Distribution panel

105 User servicing of the distribution panel is limited to resetting the circuit breakers, replacing fuses, checking harnesses for damage and the plugs and sockets for security.

To reset a circuit breaker

106 If a circuit breaker has tripped, a white collar will show on the stem, to reset a circuit breaker, proceed as follows:

106.1 Set the battery master switch to OFF and push in the circuit breaker.

106.2 Set the battery master switch to ON and test the circuit. If the circuit breaker trips again, report to REME.

To change a fuse

107 To change a fuse, proceed as follows:

107.1 Set the battery master switch to OFF.

107.2 Unscrew the appropriate fuseholder and withdraw the fuse from the holder.

107.3 Fit a new fuse of the correct rating, as detailed in Table 2, into the fuseholder.

107.4 Screw the fuseholder into the distribution panel.

107.5 Set the battery master switch to ON and test the circuit. If the fuse blows again, report to REME.

Generator system

CAUTIONS

(1) EQUIPMENT DAMAGE. The generator diodes are sensitive to voltage changes and high temperatures. It is, therefore, essential that precautions are taken to avoid irreparable damage to the generator when carrying out any servicing or maintenance.

(2) EQUIPMENT DAMAGE. The battery must never be disconnected whilst the generator is running. The battery polarity and voltage must be checked before connecting into the system. Reverse polarity, no matter how brief, will cause immediate and permanent damage to the diodes.

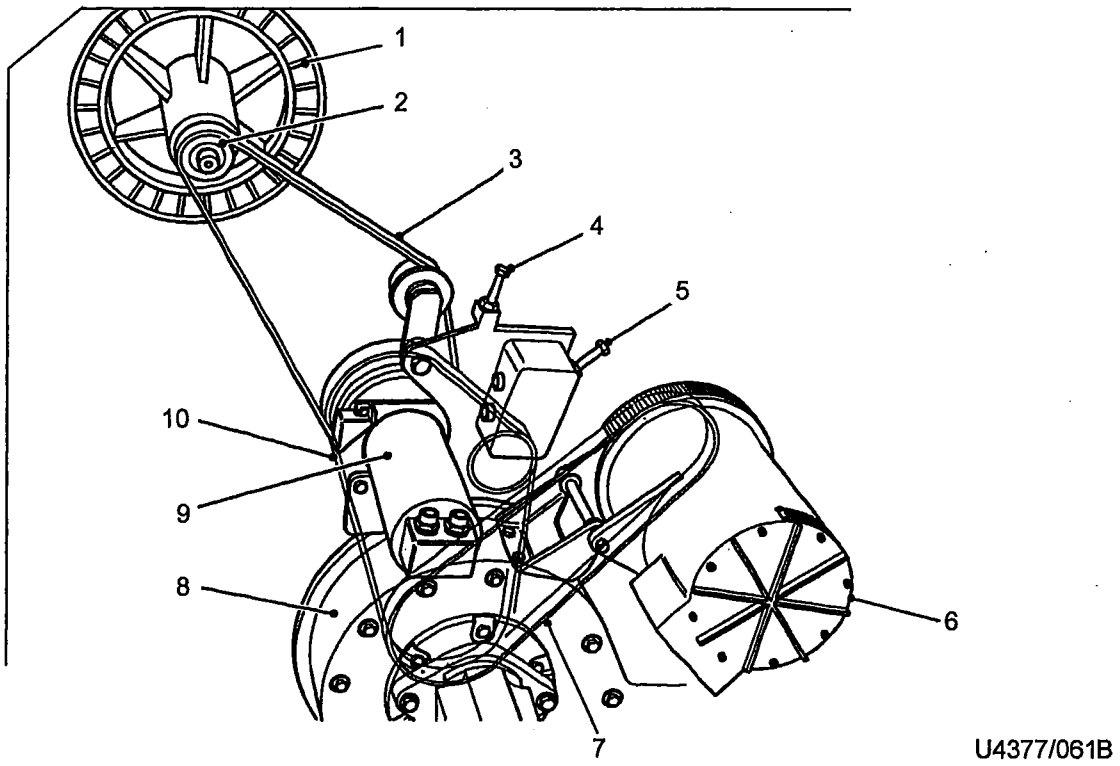
(3) EQUIPMENT DAMAGE. If it is necessary at any time to disconnect a lead from the generating system, it is essential that the engine is shut down first.

(4) EQUIPMENT DAMAGE. When a generating system lead is disconnected it should be identified in relation to its terminal to facilitate accurate reconnection.

(5) EQUIPMENT DAMAGE. If using electric welding to repair the vehicle it is essential that the batteries and the generator unit are first disconnected from the vehicle circuit.

(6) EQUIPMENT DAMAGE. Any electric voltage inputs, either ac or dc, to the vehicle will necessitate the batteries or generating unit being disconnected. The exception to this rule is the use of the inter-vehicle starting socket.

108 Servicing of the generator system is restricted to a visual check on the generator drive belt (Fig 19 (7)) and the security of the harness connectors, for belt tension refer to Chap 2-2. If the drive belt is found to be damaged or worn, report to REME.



1	Ventilation fan	6	Generator
2	Ventilation fan pulley	7	Generator drive belt
3	Ventilation fan drive belt	8	Transfer gearbox
4	Ventilation fan belt adjuster	9	Compressor
5	Compressor drive belt adjuster	10	Compressor drive belt

Fig 19 Generator and ventilation fan drive belts

Lighting

To check alignment of the headlights

109 To check the alignment of the headlights, proceed as follows:

109.1 Position the vehicle on firm level ground with its front edge parallel to, and 6 metres (20 ft) from a wall or similarly suitable screen.

109.2 Raise the bucket so that it is clear of the ground, to prevent the front of the vehicle being forced down.

109.3 Fix a point on the screen which is on the line of sight when looking from the rear of the vehicle along the outer edge of either track guard and mark this as a datum.

109.4 Find the vertical and horizontal distances between the headlight centre and the track guard edge (datum) and reproduce these on the screen to enable the marking of two positions which are 'straight ahead' projections of the headlight centres.

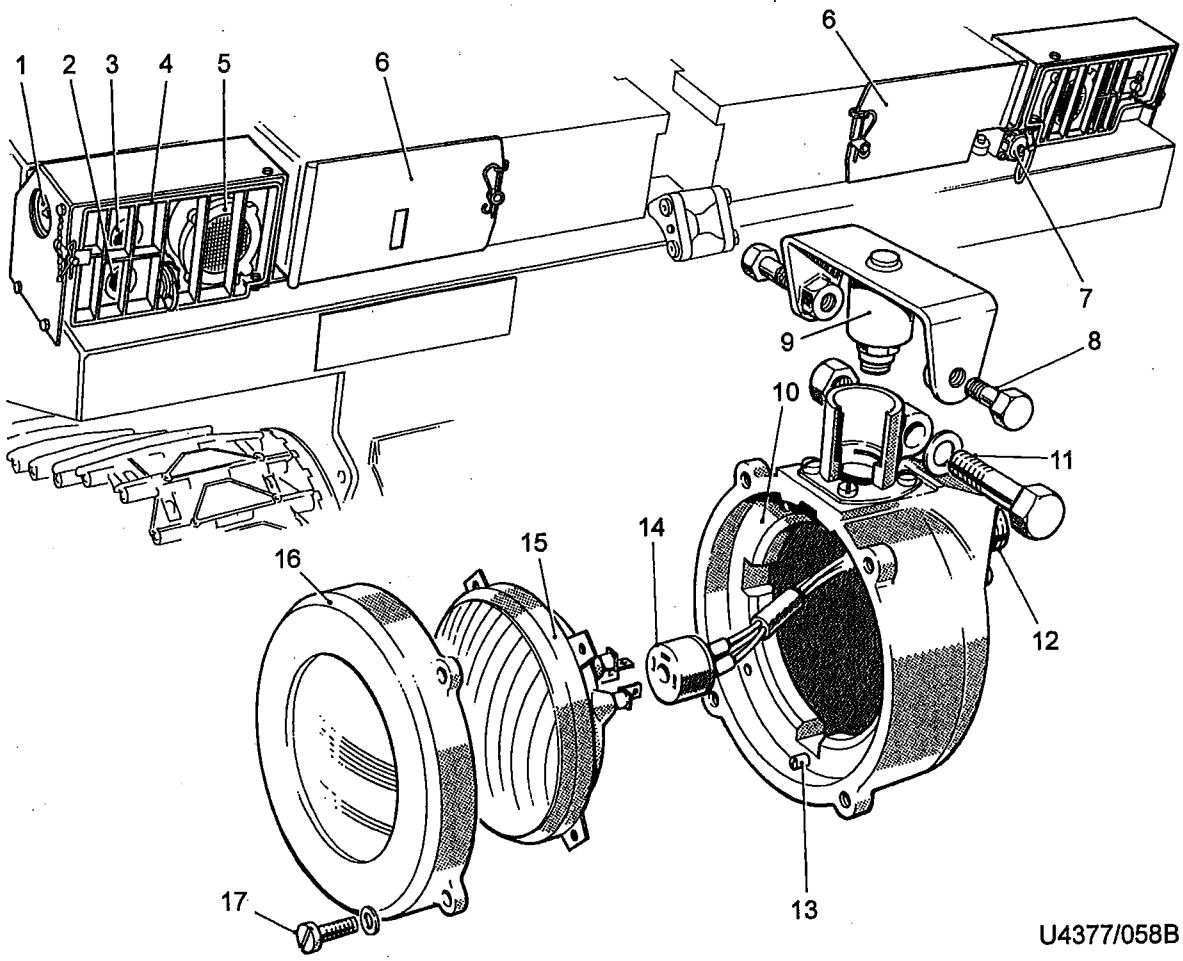
109.5 Switch on the headlights, as for main beam operation, and check that each concentrated area of light appears to be centred on its respective mark on the screen.

To align the headlights

110 To align the headlights, proceed as follows:

110.1 Unscrew the four retaining screws (Fig 20 (17)) to enable the rim (16) to be removed from the appropriate headlight.

110.2 Slacken the headlight mounting clamp bolt (11) and reposition the headlight to correct for any lateral misalignment. Tighten the clamp bolt.



1	Horn	10	Seating plate
2	Sidelight	11	Clamp bolt
3	Turnlight	12	Fixing connector
4	Grille	13	Tilt adjusting screw
5	Headlight	14	Socket connector
6	Shutters	15	Sealed beam unit
7	Trailer lighting socket	16	Rim
8	Pivot bolts	17	Rim retaining screw
9	Mounting stem		

Fig 20 Front lights

110.3 Locate and turn the tilt adjusting screws (13) as appropriate for raising or lowering the headlight beam, refit the rim. If insufficient adjustment is available by this means, slacken the pivot bolts (8) and reposition the lamp body.

110.4 Re-check the alignment of the headlights.

To change a sealed beam unit

111 To change a sealed beam unit, proceed as follows:

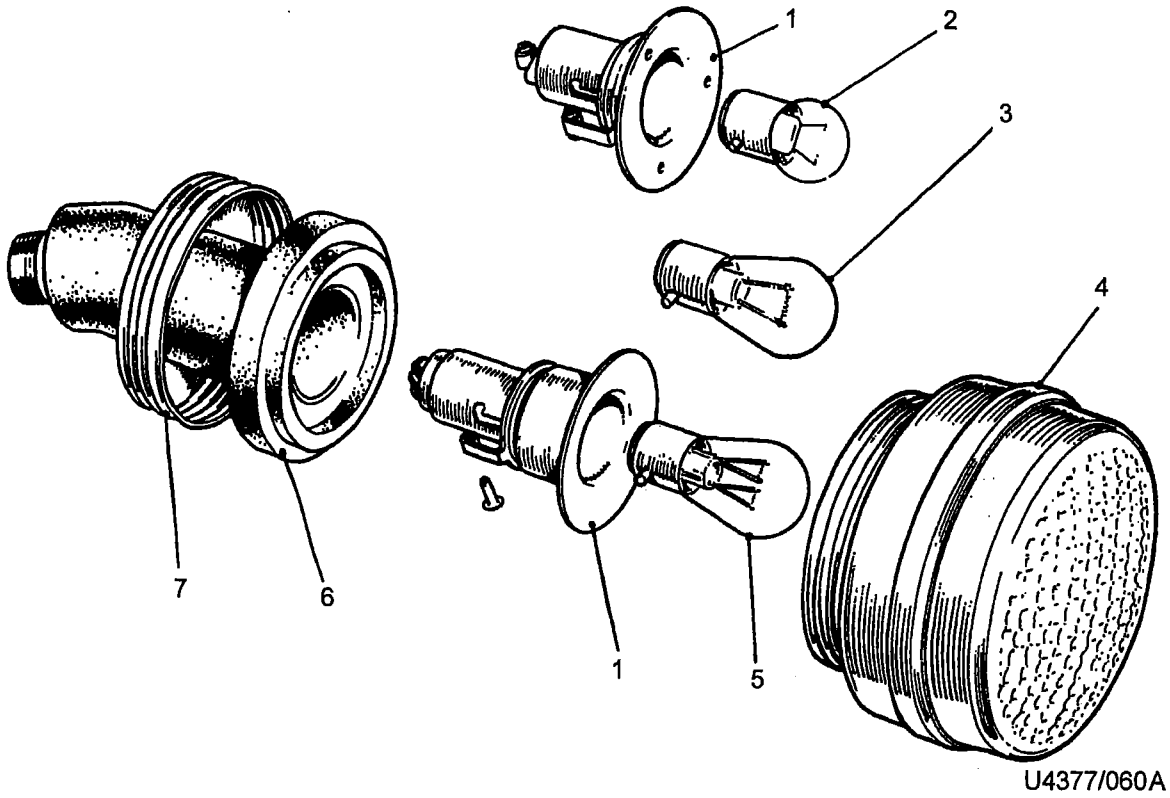
111.1 Set the lighting switch to the OFF position and set the battery master switch to OFF. Unscrew the four retaining screws (17) to remove the rim and lens assembly.

111.2 Remove the four screws and withdraw the sealed beam unit retaining rim.

111.3 Withdraw the sealed beam unit (15) and disengage the socket connector (14) from the rear.

111.4 Plug in the replacement sealed beam unit, note the inscription TOP on the glass and position the unit in the seating plate (10) accordingly, refit and secure the retaining rim.

111.5 Check that the seal fitted in the face of the rim and lens is serviceable, reposition the rim and lens on the headlight body (with the word TOP, on the lens, uppermost), engage and tighten the four retaining screws.



1 Lamp holders
2 Sidelight lamp
3 Turnlight lamp
4 Lens
5 Tail/stop lamp
6 Cover
7 Locking ring

Fig 21 Sidelight, turnlight and tail/stop lights

To change a sidelight, turnlight or tail/stop light lamp

112 To change a sidelight, turnlight or tail/stop light lamp, proceed as follows:

112.1 Set the lighting switch to the OFF position and set the battery master switch OFF.

112.2 Unscrew and remove the lens (Fig 21 (4)).

112.3 Push the lamp into its holder (1) and twist the lamp in an anti-clockwise direction to detach it from the holder.

112.4 Fit a new lamp. If fitting a tail/stop lamp, ensure that the pins mate correctly with the staggered slots in the lamp holder and test.

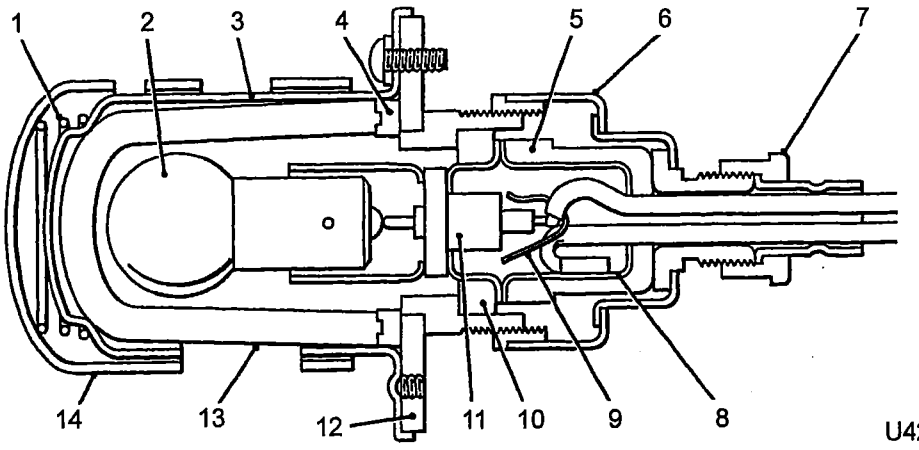
112.5 Replace the lens ensuring that the threads are correctly engaged and fully tighten.

To change a registration plate light lamp

113 To change a registration plate light lamp, proceed as follows:

113.1 Set the lighting switch to the OFF position.

113.2 Unscrew and remove the three screws securing the front cover (Fig 22 (3)) to the backplate (12).



1	Light shield spring	8	Negative connection cup
2	Lamp	9	Terminal cover
3	Front cover	10	Front rubber mounting
4	Gasket	11	Lamp holder
5	Rear rubber mounting	12	Backplate
6	Locking ring	13	Lens
7	Cable bush nut	14	Light shield

Fig 22 Registration plate light

113.3 Remove the front cover and lens (13).

113.4 Remove the lamp (2), check that the centre spring-loaded contact is in good condition, then fit a new lamp.

113.5 Assemble the light, ensuring that the lens is firmly seated on the gasket (4).

113.6 Test the light.

To change a convoy light lamp

114 To change a convoy light lamp, proceed as follows:

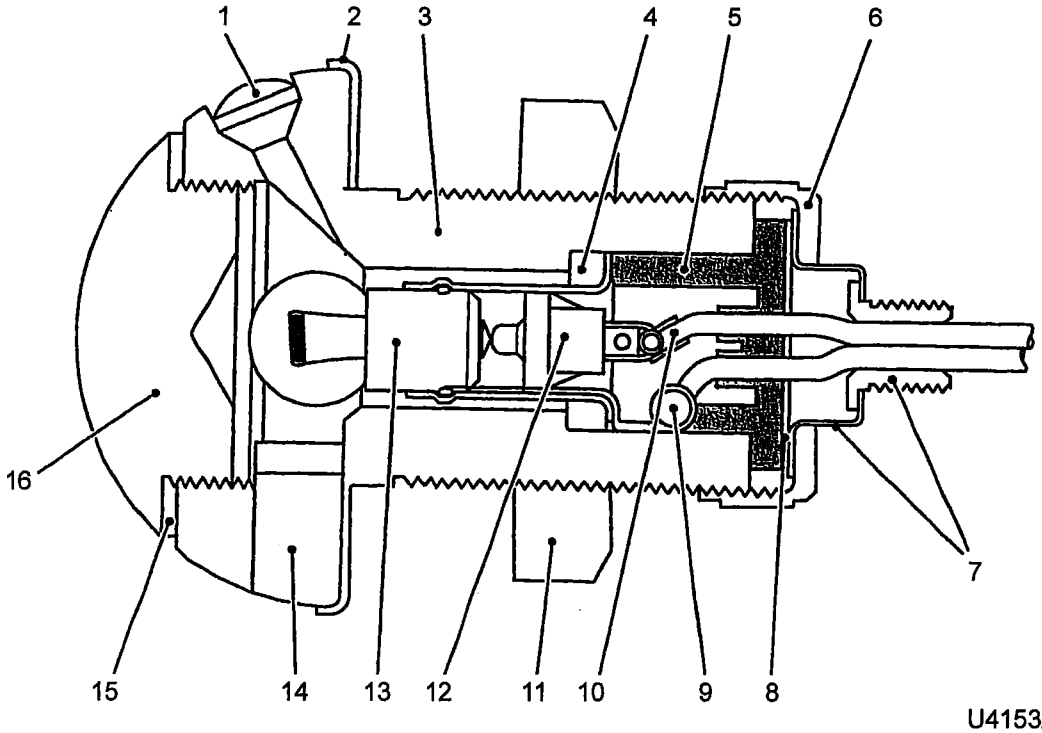
114.1 Set the lighting switch to the OFF position.

114.2 Remove the cap (Fig 23 (16)).

114.3 Remove the lamp (13), check that the centre spring-loaded contact is in good condition, then fit a new lamp and test.

114.4 Refit the cap, making sure that the gasket (15) is in place.

114.5 Test the light.



1	Convoy lens	9	Negative connection
2	Backplate	10	Positive connection
3	Body	11	Securing nut
4	Lamp holder mounting bush	12	Lamp holder plunger
5	Rubber sleeve	13	Lamp
6	Locking ring	14	Polystyrene lens
7	Cable ferrule	15	Gasket
8	Spring tension washer	16	Cap

Fig 23 Convoy light

To change a (side mounted) turnlight lamp

115 To change a (side mounted) turnlight lamp, proceed as follows:

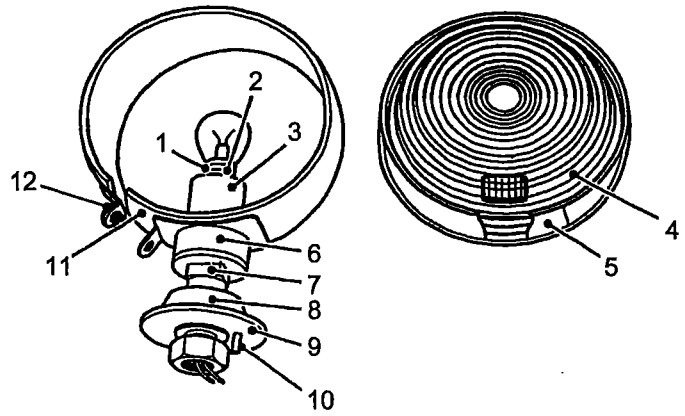
115.1 Set the turnlight switch to the OFF position.

115.2 Remove the rim securing screw (refer to Fig 24).

115.3 Ease the lens (4) away from the light body and sideways out of the clamping ring to gain access to the lamp.

115.4 Remove the lamp.

115.5 Fit a new lamp, reassemble the light and test.



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1	Eyelet for each connection	7	Stem
2	Adaptor tube	8	Pedestal washer
3	Rubber holder	9	Seating washer
4	Lens	10	Locating dowel
5	Lens securing tape	11	Lens clamping ring
6	Clamping ring bracket	12	Retaining screw

Fig 24 Turnlight

To change a spotlight lamp

116 To change a spotlight lamp, proceed as follows:

116.1 Set the spotlight switch to the OFF position.

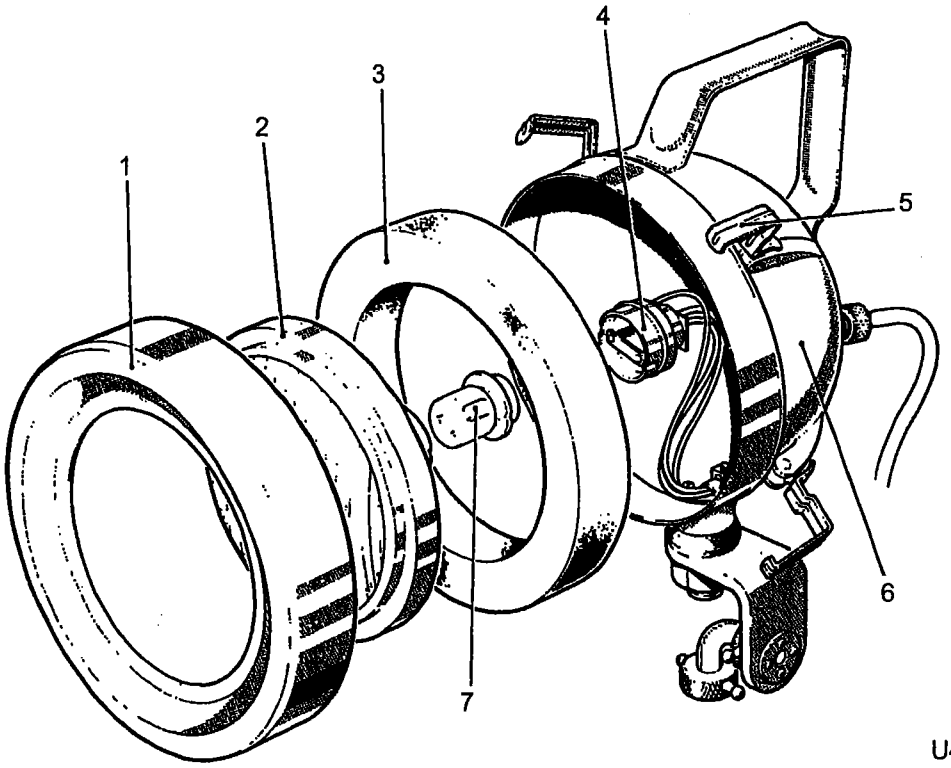
116.2 Release the clamps (Fig 25 (5)) securing the rim (1) to the body (6).

116.3 Withdraw the rim sufficiently to obtain access to the body interior.

116.4 Detach the bayonet fitting lamp holder (4) from the reflector lens (2) and remove the defective lamp (7).

116.5 Carefully reposition a new lamp within the reflector lens housing and refit the lamp holder.

116.6 Refit and secure the rim.



1	Rim	5	Clamp
2	Lens	6	Body
3	Seal	7	Lamp
4	Lamp holder		

Fig 25 Spotlight

To change a rotary beacon light lamp

CAUTION

EQUIPMENT DAMAGE. When handling a new rotary beacon lamp, avoid touching the transparent lamp surface.

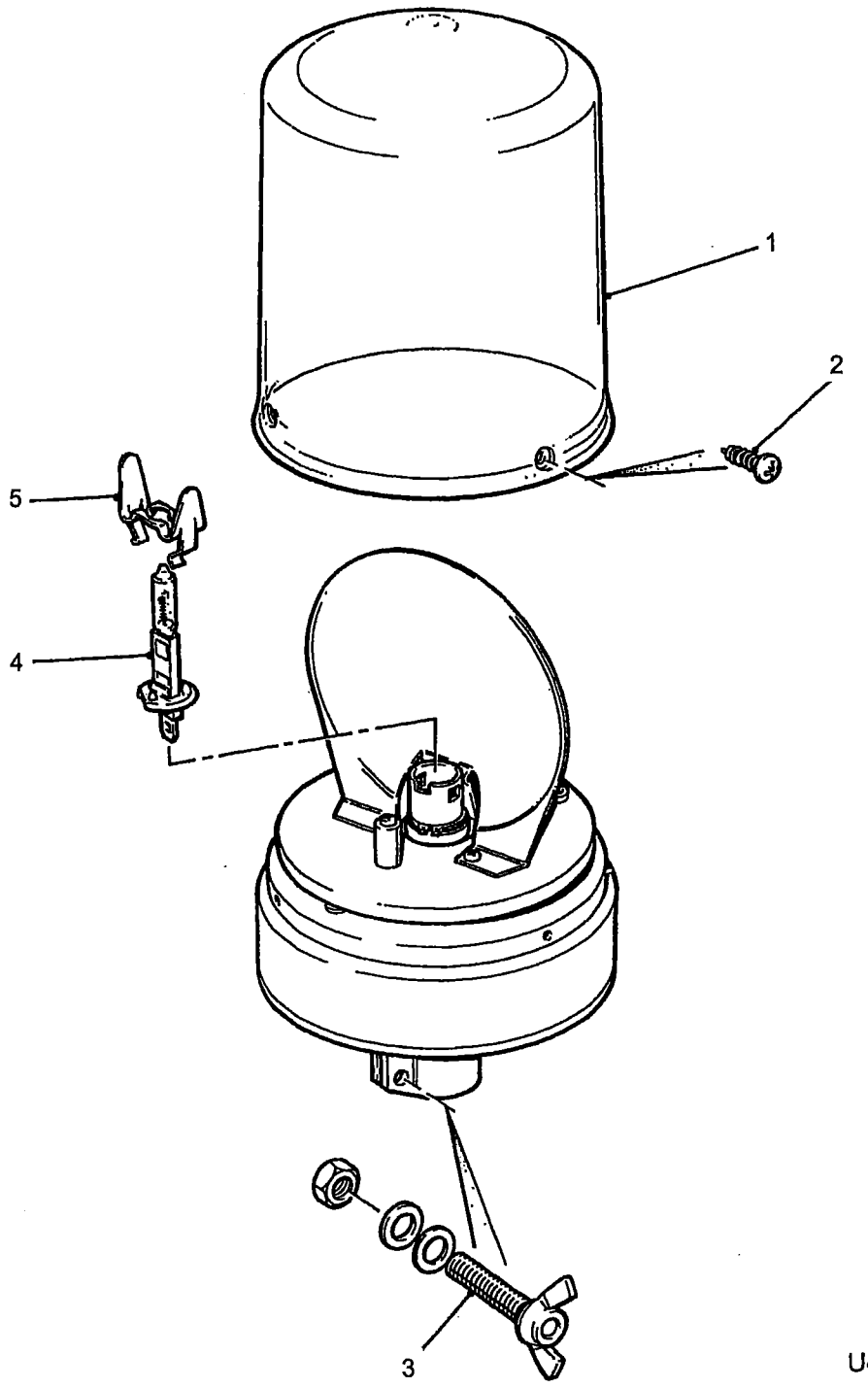
117 To change a rotary beacon light lamp (Fig 26 (4)), proceed as follows:

117.1 Remove and retain the securing screws (2) and lens cover (1).

117.2 Squeeze retaining clip (5) spring arms together and carefully lift over lamp and away from the reflector.

117.3 Remove old lamp, replace with a new one and test.

117.4 Refit retaining clip and lens cover.



1 Lens cover
2 Securing screws
3 Mounting clamp screw
4 Lamp
5 Retaining clip

Fig 26 Rotary beacon light

CHAPTER 2-8

EARTH MOVING AND WINCH EQUIPMENT - LIST OF CHAPTERS

CONTENTS

LIST OF CHAPTERS

1 This chapter is divided into the following sub-chapters:

1.1	Chapter 2-8-1	Hydraulic system
1.2	Chapter 2-8-2	Earth moving equipment
1.3	Chapter 2-8-3	Winch equipment

CHAPTER 2-8-1

HYDRAULIC SYSTEMS

CONTENTS

DESCRIPTION

General

1 The hydraulic system provides the motive power necessary to operate and control the bucket and winch. System pressure is supplied by a tandem pump unit mounted on, and driven by, the transfer gearbox.

NOTE

The cooling system fans are also hydraulically driven but have their own closed circuit hydraulic system, which is detailed in Chap 2-2.

2 The system includes an oil reservoir, a pump unit, filters, heat exchanger, control valves and the necessary pipework. Oil is supplied at the appropriate working pressures to the winch hydraulic motor and the bucket operating rams.

Reservoir

3 The hydraulic oil reservoir is located low in the left side of the hull. A filler and dipstick are provided, which are accessible from inside the transmission compartment (refer to Chap 2-4).

4 The reservoir has a capacity of 82 litres (18 gallons). It is fitted with an integral suction filter on each of the two outlets. A breather pipe, open to atmosphere above the vehicle roof plate, provides the necessary venting for the reservoir.

Pump unit

5 The pump unit is a tandem arrangement of two separate gear type pumps on a common mounting. The pumps are driven by the transfer gearbox and operate continuously while the engine is running. Therefore when no hydraulic equipment is in use, the oil circulates through the system and is returned directly to the reservoir.

6 Each pump performs a different function in the system. The inner pump provides oil, at a nominal pressure of 206.8 bar (3000 lbf/in.^{2}), to operate the bucket mechanism and to enable the winch to be used at half power. The outer pump supplies oil, at a nominal pressure of 172 bar (2500 lbf/in.^{2}), exclusively to the winch motor but only when full power control is operated. (refer to Chap 2-8-3).

Filter

7 The main hydraulic system filters consists of a twin bowl unit having replaceable elements. The unit is located in the front left corner of the engine compartment, on the engine/transmission compartment bulkhead.

8 All of the oil circulated and returned to the reservoir by the outer hydraulic pump passes through the filter unit.

Heat exchanger

9 Control of the hydraulic oil temperature is assisted by passing a proportion of the oil through a section of the vehicle heat exchanger pack. By this means the oil temperature is maintained at a similar level to the coolant and other fluids.

10 All of the oil circulated, and returned to the reservoir by the inner hydraulic pump passes through the heat exchanger pack. For details of the cooling system refer to Chap 2-2.

Control valves

11 The valves, which control all of the hydraulic system functions, are situated within a single valve block, located in the engine compartment, on the engine/crew compartment bulkhead.

12 The valve block contains four spool valves, each of which is connected mechanically to the appropriate bucket or winch control lever in the crew compartment. Three of the spool valves are connected to the output from the inner hydraulic pump and control the raise/lower and crowd/dump action of the bucket, and the winch. The fourth spool valve controls the flow from the outer pump and hence the action of the winch when the full power control is used.

13 Also contained within the valve block are the necessary relief and pressure control valves. The action of these components is fully automatic, requiring no action by the user.

MAINTENANCE

CAUTION

EQUIPMENT DAMAGE. All work carried out on the hydraulic system must be undertaken in the CLEANEST possible conditions. Dirt entering the system can cause damage and possible failure of components.

To check and top-up the hydraulic oil

14 To check and top-up the hydraulic oil, proceed as follows:

14.1 Position the vehicle on firm, level ground, apply the parking brake, stop the engine and ensure that the bucket is at rest on the ground or secured in the travelling position.

14.2 Open the dipstick cover plate in the transmission compartment upper access panel.

14.3 Remove the dipstick (Fig 1 (3)) wipe it clean and re-insert it in the dipstick tube.

14.4 Withdraw the dipstick and observe the oil level. The dipstick is marked FILL and FULL. If the oil level is not up to the FULL mark, add oil to bring the level correct.

14.5 If it is necessary to add oil, clean the area around the filler cap (2). Open the cap and add oil of the correct grade until the level reaches the FULL mark on the dipstick. DO NOT OVERFILL.

14.6 Replace the dipstick and close the filler cap.

14.7 Operate the bucket mechanism and then re-check the oil level. Care should be taken to ensure that the bucket is returned to the same position and attitude before re-checking, in order to allow for the varying displacement of the rams.

14.8 Close and secure the transmission compartment upper access panel.

To replace the hydraulic oil filters

15 The hydraulic oil filter (Fig 2) is located in the engine compartment, on the engine/transmission compartment bulkhead. The filter has two elements, the following instructions apply to both. To replace the hydraulic oil filters, proceed as follows:

15.1 Stop the engine and ensure that the bucket is at rest on the ground or secured in the travelling position.

15.2 Open the engine compartment access door.

15.3 Clean the area around each filter bowl (5). Place rag or a suitable container beneath the filter bowls to contain any oil spillage as much as possible.

15.4 Unscrew the centre bolt (4) and carefully remove the filter bowl (5) complete with the filter element (8).

15.5 Discard the filter element, clean the filter bowl and its components thoroughly. Remove the seal (3) from the groove in the filter head.

15.6 Fit a new seal, making sure that it is correctly located in the groove.

15.7 Place a new filter element in the filter bowl. Position the bowl on the filter head (1) making sure that it is central. Tighten the centre bolt with sufficient force to ensure that the bowl is tight and no leaks occur. DO NOT OVERTIGHTEN.

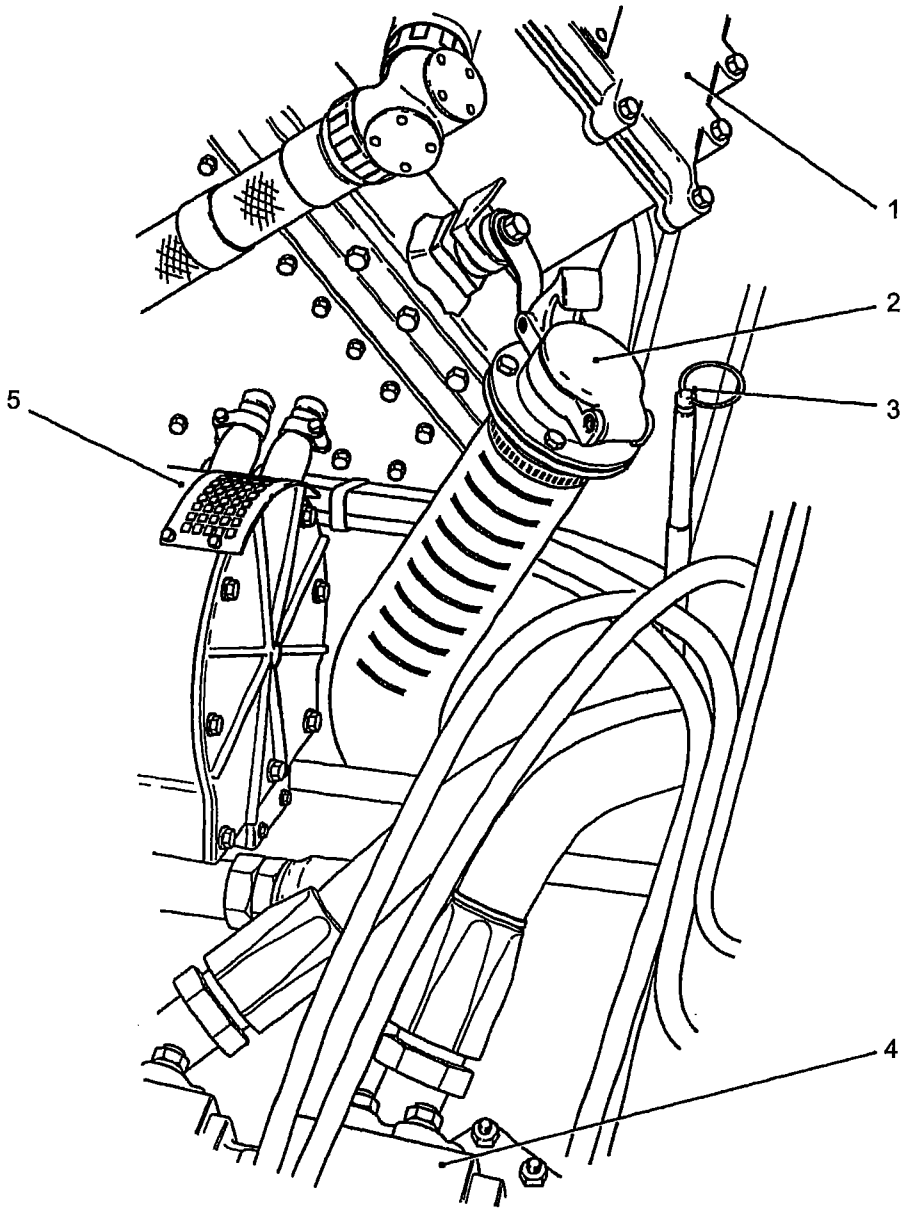
15.8 Top up the hydraulic oil reservoir to the correct level.

15.9 Start the engine and operate the bucket.

15.10 Check for oil leaks. Stop the engine.

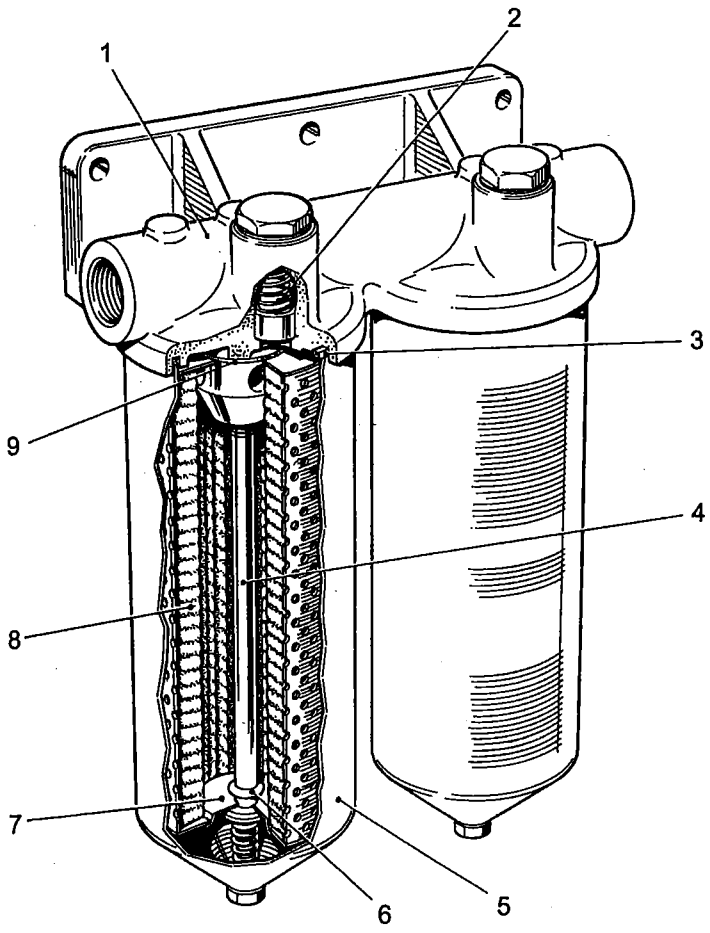
15.11 Re-check oil level and top-up as necessary.

15.12 Close and secure the access panel.



1 Generator panel
2 Hydraulic oil filler cap
3 Dipstick
4 Hydraulic pumps
5 Generator

Fig 1 Hydraulic oil filler and dipstick



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1	Filter head	6	Circlip
2	Relief valve	7	Guide plate
3	Seal	8	Filter element
4	Centre bolt	9	Sealing ring
5	Filter bowl		

Fig 2 Hydraulic oil filter

Draining the hydraulic oil

16 Draining the hydraulic oil will only normally be carried out during major overhauls and is NOT a User task.

CHAPTER 2-8-2

EARTH MOVING EQUIPMENT

CONTENTS

GENERAL DESCRIPTION

1 The bucket is located on the rear of the vehicle, with its associated boom, linkage and hydraulic operating rams - (refer to Fig 1). The primary purpose of the bucket is to enable the vehicle to perform loading, and general earth moving tasks. In addition, it has the following ancillary functions:

1.1 The bucket is used as an earth anchor, during heavy winching operations from the rear. Fixing points in the bucket may be used to attach a snatch block, or a winch rope, if the vehicle is used as an anchor during recovery operations, working in conjunction with a heavy recovery vehicle.

1.2 Facilities are provided on the bucket to enable attachments to be used for trackway laying, lifting and pushing.

2 The bucket is attached to the vehicle by a boom which is located in pivots on the rear of the hull. Four hydraulic rams and a linkage provide the means of operating and controlling the bucket. Two levers in the operator's driving position control the hydraulic rams, giving a lift, lower, float, crowd and dump action.

3 Hydraulic power is supplied by a pump which is driven continuously by the transfer gearbox. The hydraulic system also provides power to operate the winch.

BUCKET

4 The bucket (Fig 1 (1)) is a welded construction fabricated from light alloy plate. Steel reinforcing strips (17) are rivetted to the lower cutting edge and sides to increase resistance to wear and damage. Ten replaceable cast steel teeth (18) are fitted to the cutting edge to improve the earth moving performance under difficult soil conditions. Guards are provided to cover the teeth when the vehicle is travelling on public roads or when using the auxiliary lifting attachment to prevent damaging the load being lifted.

5 The internal strengthening ribs (19) are drilled to provide anchorage points (21) and (20) for the auxiliary lifting attachment and to enable a snatch block or winch rope to be attached. When the bucket is used as an earth anchor, for heavy recovery purposes, the anchorage points (20) are designed to withstand a pull of 30480 kgf (30 tonf).

6 A lug (16) on the upper edge of the bucket is used during trackway laying operations.

7 A number of holes are drilled in the bucket edge, between the teeth (18). They are used to secure the rear lighting equipment, when this is located on the bucket for road use, refer to Chap 2-7 (Electrical Equipment).

KEY TO FIG 1

1	Bucket	12	Track link
2	Sleeve	13	Plant tow hook
3	Indicator rod	14	Stowage box
4	Reference mark/band	15	Bridge lifting lug
5	Crowd rams	16	Trackway lug
6	Lift rams	17	Steel reinforcing strips
7	Lubrication nipples	18	Teeth
8	Radius arms	19	Strengthening ribs
9	Boom	20	Recovery anchorage points
10	Crowbar stowage	21	Lifting attachment anchorage points
11	Snatch block	22	Links

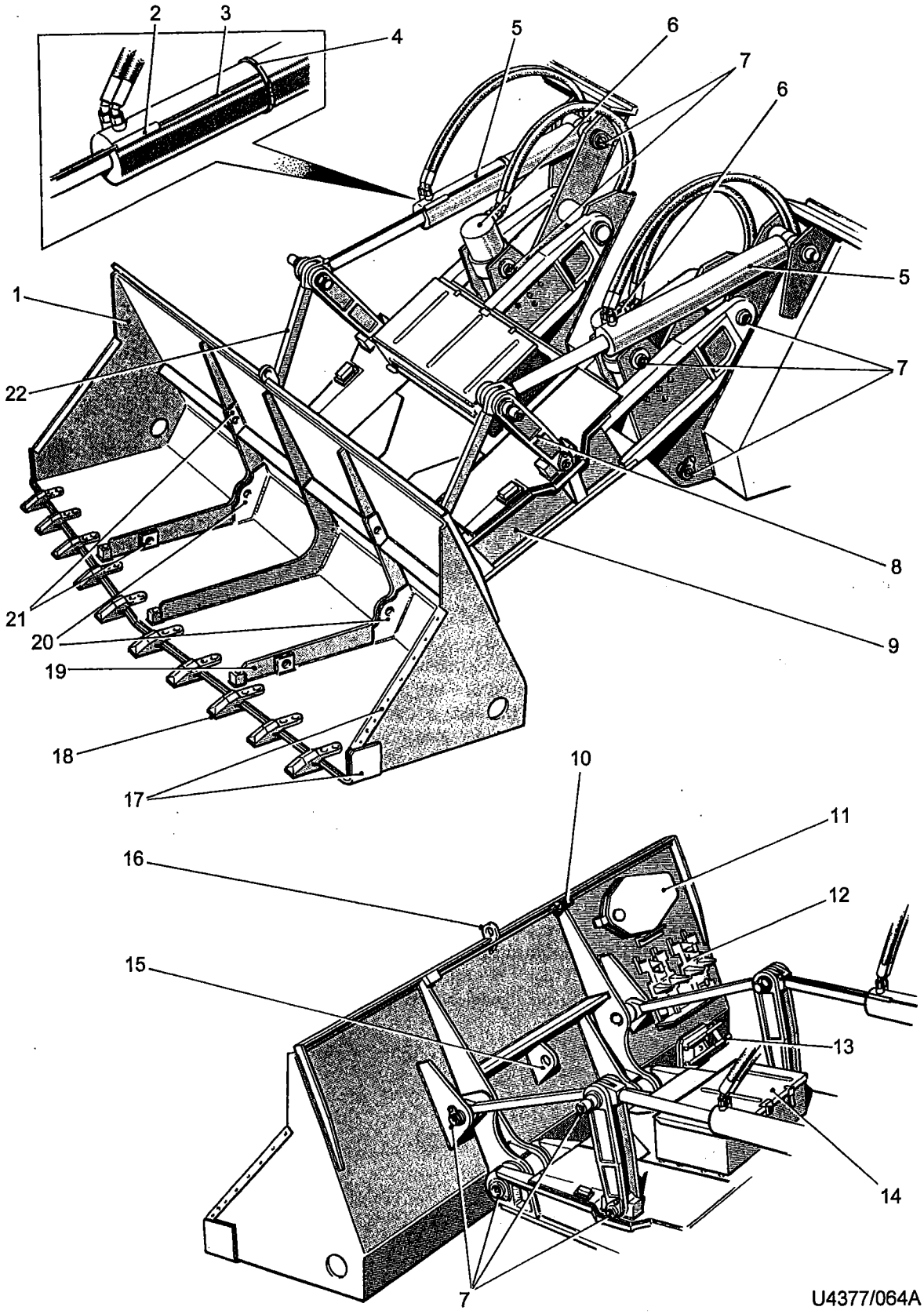


Fig 1 Bucket and boom layout

BOOM AND OPERATING MECHANISM

8 The boom (Fig 1 (9)) is a welded light alloy structure which forms the main supporting member of the bucket operating mechanism. On it are located the bearing bushes and mountings for the bucket (1), radius arms (8) and the main hydraulic lift rams (6).

9 The main lifting effort is supplied by the two main rams which are anchored in trunnions on the boom and strong points on the vehicle hull.

10 Crowd and dump action of the bucket is controlled by the crowd rams (5), which transmit motion to the bucket, via the links (22) and radius arms. In order that the bucket will maintain a given attitude throughout the lifting range, the mechanism follows an almost parallel action. An indicator rod (3) is fitted to give a visual indication to the operator when the bucket floor is parallel to the ground (refer to Paras 27 to 29).

11 Lubrication of the bucket operating mechanism is by means of lubricating nipples in each of the various pivot pins and trunnions.

STOWAGE

12 The boom and bucket are used as locations for the stowage of certain items of equipment.

13 On the forward, left surface of the bucket are fittings which secure a snatch block (Fig 1 (11)), spare track links (12) and the plant tow hook (13).

14 A large rectangular stowage box (14) is fitted on the centre portion of the boom, adjacent to facilities for stowing a pick and handle.

CONTROLS AND INSTRUMENTS

CAUTIONS

(1) EQUIPMENT DAMAGE. Do not attempt to lower the bucket or operate the crowd/dump control lever while the travelling locks are in place.

(2) EQUIPMENT DAMAGE. Do not attempt to push any load when the tie bars are fitted to the bucket mechanism in the level position, as damage will be caused to the boom arm and bucket linkages.

(3) EQUIPMENT DAMAGE. When bucket control levers are not in use ensure that the locking lever is fitted.

15 All bucket movements are controlled by two levers and one locking handle located on the operator's right hand side. The bucket and its controls are operative at all times, when the engine is running. The speed of the engine will determine the speed of bucket operation. A locking bar is provided to prevent accidental lower/dump operations.

Bucket raise/lower control lever

16 The outer lever (Fig 2 (4)) controls the raising and lowering of the bucket and boom. The lever has three operating positions: raise, lower and float. The lever is retained by a detent in the 'float' position but returns automatically to the neutral hold position when released from 'raise' and 'lower'.

17 To raise the bucket, the lever is moved upwards and held, until the bucket reaches the desired height, when it is released. To lower the bucket, the lever is moved downwards to its first position; the bucket will then lower and continue to do so until the lever is released.

18 The bucket may be caused to 'float' by moving the lever downwards, past the 'lower' position, to its fullest extent. In this condition, the bucket , once at ground level, will follow the contours of the ground, unaffected by the hydraulic system.

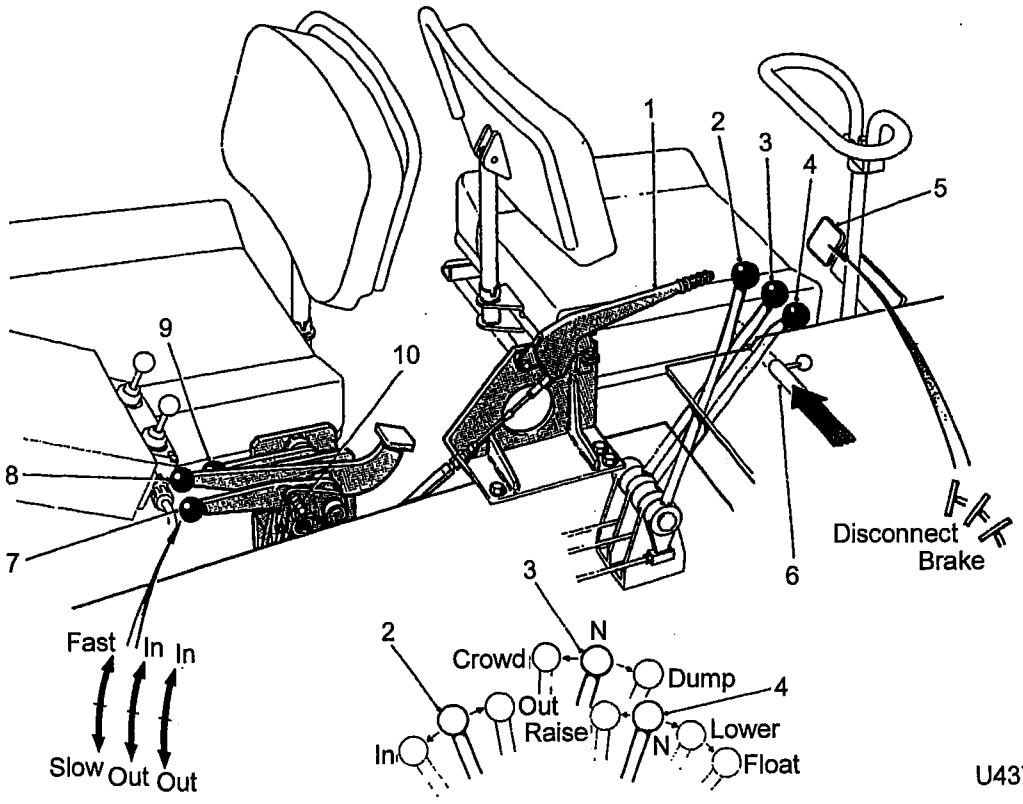
Bucket crowd/dump control lever

19 The lever (3), adjacent to the operator's seat, controls the 'crowd' and 'dump' action of the bucket. This causes the bucket to pivot about its bearings on the outer end of the boom.

20 The lever has two operating positions 'crowd' and 'dump', and when released, automatically returns to a neutral hold position.

21 When the lever is moved upwards the bucket will move towards the 'crowd' (tilted upwards) position.

22 Moving the lever downwards will cause the bucket to move downwards to the 'dump' position. When the bucket is in its fully 'dumped' position, the bucket floor slopes downwards away from the vehicle, thus releasing any spoil contained within.



1 Holding brake lever
2 Operator's winch-in/pay-out control lever
3 Bucket crowd/dump control lever
4 Bucket raise/lower control lever
5 Disconnect pedal
6 Locking lever
7 High speed winch-in/pay-out control lever
8 Driver's winch-in/pay-out control lever
9 Gear change lever
10 Locking pin

Fig 2 Bucket and winch controls

Locking lever

23 A locking lever (6), has a horizontal sliding action. When the locked position is in use, the shank of the lever prevents the bucket controls being inadvertently moved to the 'lower' or 'dump' positions.

24 To bring the lock into use, the lever is moved horizontally towards the operator's seat and locked in position by rotating the handle clockwise about the shank.

Disconnect pedal

25 The disconnect pedal (5) is located in the operator's position to the left of the brake pedal. Initial movement of the pedal disconnects the drive to the tracks by temporarily disengaging both steering clutches. Further pedal movement actuates the main brakes. When the pedal is released, drive to the tracks is resumed.

26 The effect, when earth moving, is to allow the engine speed to rise, making more power available to 'lift' or 'crowd' the bucket. If the pedal is fully depressed, the action of the brakes will prevent the vehicle 'running back' while the drive is disconnected.

Bucket level indicator

27 The bucket level indicator (refer to Fig 1) is located on the left crowd ram (5). The purpose of this device is to assist the operator to judge when the bucket floor is parallel with the ground, during certain earth moving and loading operations.

28 The indicator comprises of an indicator rod (3), attached to the crowd ram piston, which slides through a sleeve (2) mounted on the ram cylinder. As the crowd ram extends or contracts, depending on the attitude of the bucket, the indicator rod also moves in relation to a reference mark/band (4) on the ram cylinder.

29 When the end of the indicator rod reaches a position adjacent to the reference mark/band, the bucket floor is level.

Hydraulic oil low level warning light

30 A warning light (Fig 3 (5)), located on the driver's instrument panel, identified HYD OIL LOW LEVEL, will illuminate if the level of oil in the reservoir falls dangerously low. The light has a red lens and is of the 'press to test' type.

31 If the hydraulic oil low level warning light illuminates, stop operations immediately. Check the oil level in the reservoir and top-up as necessary. Inspect pipework and hoses for any signs of leakage. If a leak is found or if the fault recurs it must be reported to REME.

Central warning lights

32 The external and internal Central Warning Lights (CWL) will illuminate if the hydraulic oil low level warning light is activated.

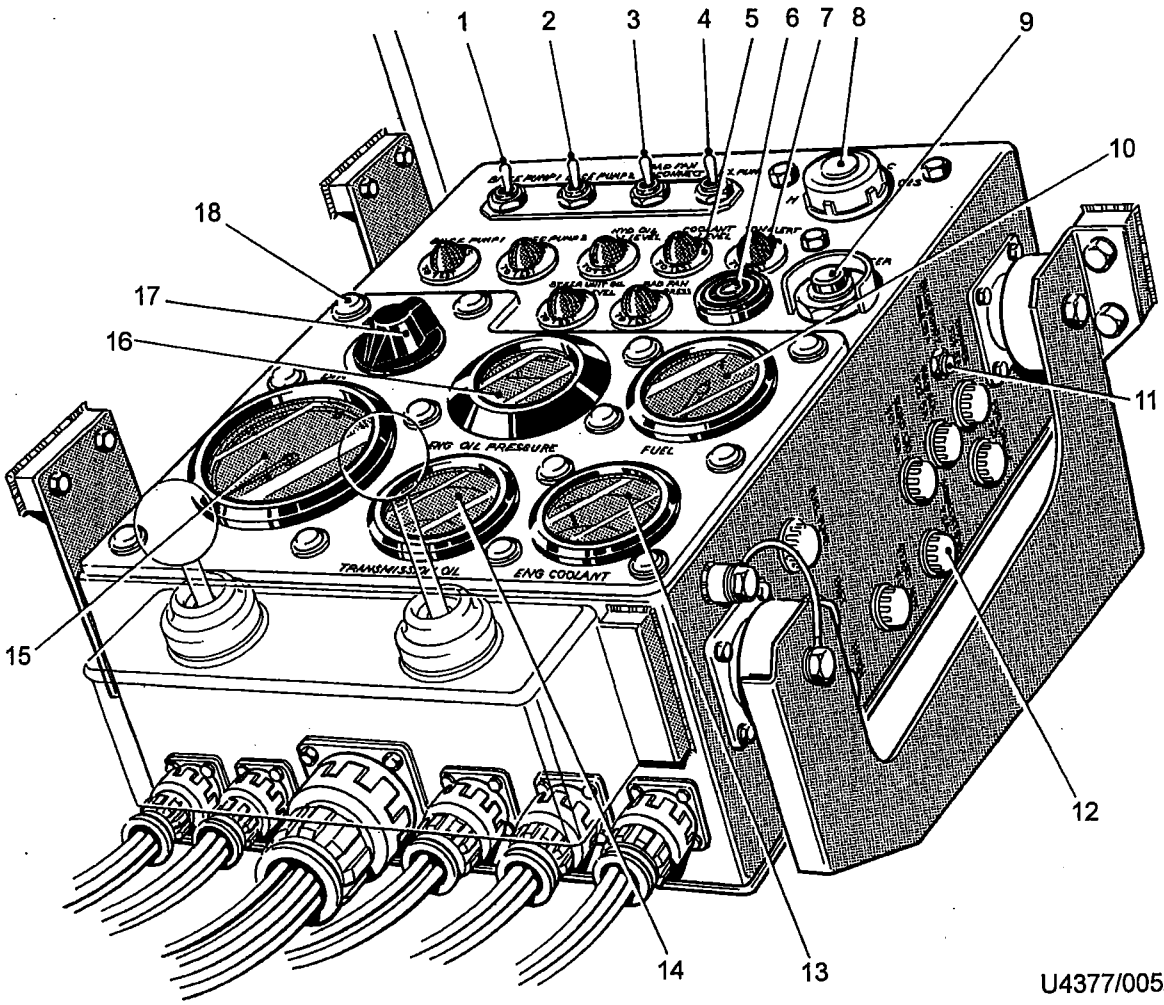
33 If a CWL illuminates, the warning lights and instruments must be checked immediately in order to locate the system at fault.

NOTES

(1) The CWLs will illuminate when the battery master switch is set to ON and will remain illuminated until the engine is started and oil pressure builds up.

(2) The CWL system covers nine warning conditions in all, if the CWLs illuminate it is important that the system at fault is located quickly, by means of the normal warning lights and instruments.

34 The CWL system is detailed in Chap 2-7 (Electrical Equipment).



1 Bilge pump 1 switch
2 Bilge pump 2 switch
3 Radiator fan disconnect switch
4 Fuel pump switch
5 Warning lights
  Bilge pumps 1 and 2
  Hydraulic oil level
  Coolant level
  Steer unit low oil level
  Radiator fan boost pressure
6 Sonalert horn
7 Sonalert light
8 Light switch
9 Starter button
10 Fuel gauge
11 Circuit breaker, No. 2 bilge pump
12 Fuses: F13, F14, F16, F17, F20, F21, F22, F23, and F24
13 Engine coolant temperature gauge
14 Transmission oil temperature gauge
15 Tachometer
16 Engine oil pressure gauge
17 Dimmer switch
18 Panel lights (14 positions)

Fig 3 Driver's instrument panel

BUCKET TRAVELLING LOCKS

CAUTION

EQUIPMENT DAMAGE. In order to ensure that the bucket is held securely in a safe position, locking devices are provided and MUST be fitted at all times to the bucket operating mechanism when the vehicle is travelling on the road or being transported or when the bucket is not in use.

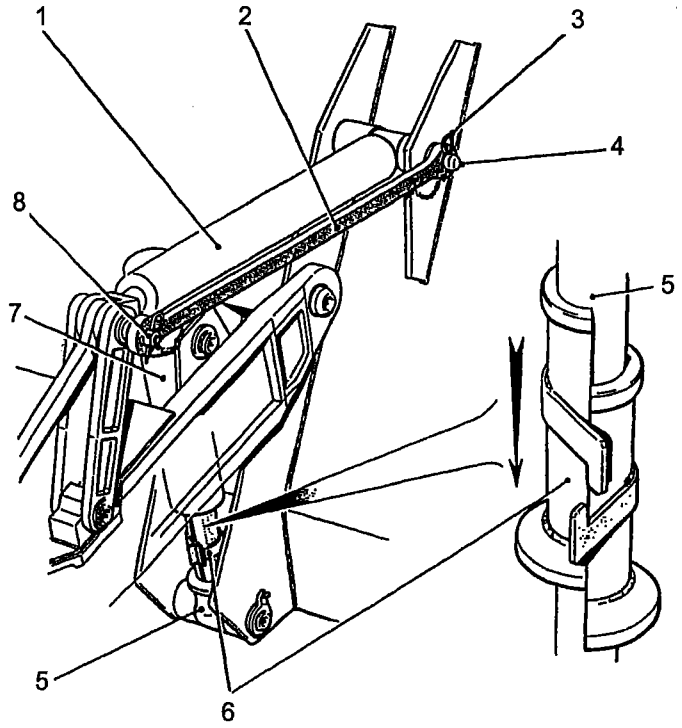
35 A pair of tie bars (Fig 4 (2)) are provided as travelling locks for the crowd ram (1). When fitted to the crowd ram pivot pins (4) and (8) they prevent any movement of the bucket from the fully crowded position. Each tie bar is fitted with two captive R type spring pins (3), used to retain the bars in place on the crowd ram pivot pins.

WARNING

PERSONNEL INJURY. THE TUBE ASSEMBLIES MUST BE FITTED TO THE PISTON RODS OF THE BOOM LIFTING RAMS WHEN PERSONNEL ARE WORKING ON OR BENEATH THE BUCKET LINKAGE.

36 Tube assemblies (6) are placed in position on each lift ram piston rod (5) to ensure that the bucket is prevented from sinking below a safe travelling height.

37 When not in use, the travelling locks are stowed on the vehicle.



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1	Crowd ram (right)	5	Piston rod (lift ram)
2	Tie bar	6	Tube assemblies
3	Spring pins (R-clip)	7	Lift ram (left)
4	Extended pivot pin	8	Extended pivot pin

Fig 4 Bucket travelling locks

OPERATION

CAUTION

EQUIPMENT DAMAGE. Before starting any earth moving task using the bucket, ensure that no shackles or loose attachments are fitted to anchorage points inside or outside the bucket. Such items are liable to jam and cause damage.

Preparations for earth moving

38 It is assumed that prior to starting earth moving operations, daily servicing and pre-start checks will have been carried out and that the engine is running satisfactorily. In order to prevent unnecessary damage to the vehicle or inconvenience to the crew, the following preparations should also be made before starting work:

38.1 Check that the propulsion unit intake grille covers are closed and secure (this capability no longer exists).

38.2 Remove the lighting equipment from the bucket and fit, or stow, it correctly on the vehicle.

38.3 Remove and stow the travelling locks from the lift and crowd rams.

38.4 Check that no shackles, chains or slings are attached to lugs and fittings on the bucket or rear hull.

38.5 Check that items stowed on the bucket stowage points are secure.

38.6 Close and secure the front light shutters.

38.7 Lock out the suspension.

Locking the suspension

39 Depending on the type of earth moving operation to be undertaken, it may be advantageous to lock the suspension dampers. This will prevent the suspension at the rear (bucket end) of the vehicle being depressed when the bucket becomes full, an important consideration when loading or digging.

40 On dozing and levelling tasks more positive and accurate control of bucket height will be possible with the suspension locked. It must be remembered, however, that only the rear suspension members (Station 5) will be locked rigid; some deflection will still occur at the other stations.

Mode of steering

41 When earth moving is in progress the mode of steering used will vary with the type of task. The clutch/brake steering mode will prove an advantage when working in confined areas. For the 'cut and carry' type of digging task, which involves lengthy movements to dump spoil, controlled differential steering will prove to be more convenient and less violent.

EARTH MOVING OPERATIONS

To lock the rear suspension

42 To lock the rear suspension, proceed as follows:

42.1 Check that there is sufficient air pressure in the steer air reservoir to operate the lock control mechanism. The steer air pressure gauge should read at least 5.6 kgf/cm^2 (80 lbf/in.^{2}).

42.2 Move the control lever down to the position marked LOCK.

42.3 Wait a few seconds for the mechanism to operate. Return the lever to the central OFF position.

To unlock the rear suspension

43 To unlock the rear suspension, proceed as follows:

43.1 Check that there is sufficient air pressure available, as detailed in sub-Para 42.1.

43.2 Move the control lever up to the position marked UNLOCK.

43.3 Wait a few seconds for the mechanism to operate. Return the lever to the OFF position.

NOTE

The suspension lock control lever must always be returned to the OFF position after use, to prevent any chance of air leaking into the damper hydraulic oil. Therefore, if the vehicle has been standing, the procedure for locking or unlocking should be carried out before use, to ensure that the required mode of damper operation is in use.

Use of the bucket controls

44 The earth moving bucket controls are similar in operation to those found in conventional engineering plant. Movement of the bucket is controlled by two levers (Fig 2 (3) and (4)) situated by the operator's seat.

45 The bucket and its controls are operative at all times, providing the engine is running. When not in use, the levers must be restrained by means of the locking lever (6) to prevent the bucket being inadvertently lowered or dumped.

46 Both control levers will return to neutral and bucket motion will cease when the levers are released. The controls operate as follows:

46.1	To lower the bucket	- Move the raise/lower control lever downwards.
46.2	To raise the bucket	- Move the raise/lower control lever upwards.
46.3	To cause the bucket to 'float'	- Move the raise lower control lever downwards to its fullest extent.
46.4	To 'crowd' the bucket	- Move the crowd/dump control lever upwards.
46.5	To 'dump' the bucket	- Move the crowd/dump control lever downwards.

47 The full extent of bucket movement available is shown in Fig 5. It may be necessary for the operator to refer to the bucket level indicator, fitted to the left crowd ram, in order to judge when the bucket floor is parallel with the ground.

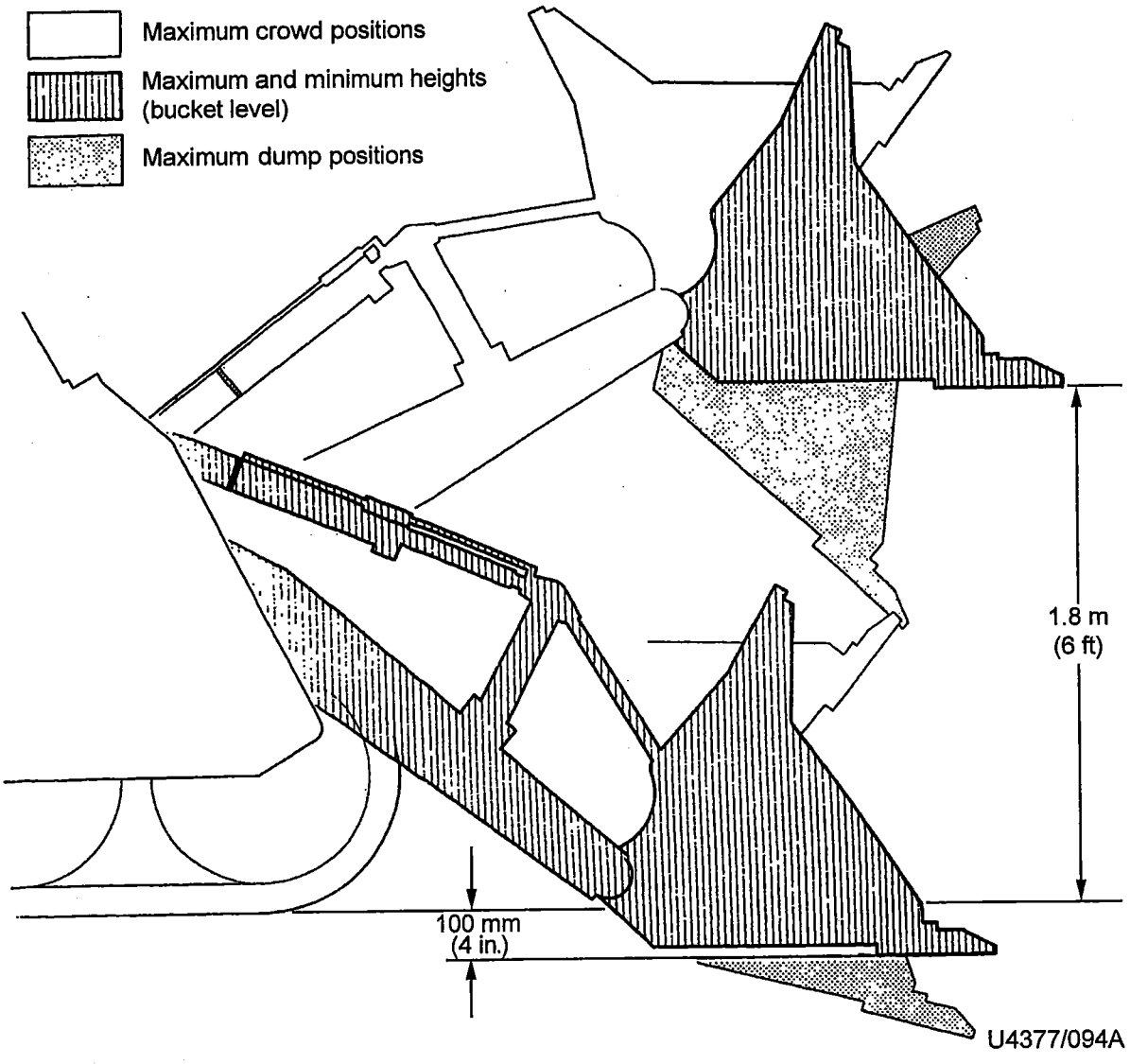


Fig 5 Limits of bucket movement

Use of the disconnect pedal

CAUTION

EQUIPMENT DAMAGE. The disconnect pedal must not be operated when the engine speed is above normal idling speed.

48 When digging and loading, the engine speed will decrease rapidly as the bucket is driven into the soil and becomes fully loaded, the vehicle will tend to stall. This will result in a loss of hydraulic power and difficulty in crowding or raising the bucket. To overcome this, the disconnect pedal (Fig 2 (5)) is used.

49 As the vehicle slows and engine speed decreases the pedal is depressed, temporarily disconnecting the drive to the tracks, thus allowing the engine to speed up. Hydraulic power is restored, and when the loaded bucket has 'broken free' the pedal is released.

50 If the vehicle tends to 'run back' when the pedal is depressed, applying further pressure will operate the main brakes and keep the vehicle stationary.

To position the bucket locks

51 To position the bucket locks, proceed as follows:

51.1 Stop the vehicle and apply the parking brake.

51.2 Raise the bucket to its full height. Put the bucket controls locking lever to the locked position.

51.3 Reach under the boom and fit a tube assembly to each lift ram piston rod. The tube assemblies are assembled by putting one half in position on the ram and sliding the second half into place, ensuring that the interlocking lugs are fully engaged and flange uppermost (refer to Fig 4).

51.4 Lower the bucket until the ram cylinders contact the tube assemblies. Operate the crowd/dump control to move the bucket to the fully crowded position. Stop the engine and apply the bucket control lock.

51.5 Attach one tie bar to each crowd ram. The holes in each end of the bar are located on the extended pivot pins (4) and (8). When the bars are in place they are secured by inserting the R-clips into the holes provided.

To remove the bucket locks

WARNING

PERSONNEL INJURY. GREAT CARE MUST BE TAKEN AT ALL TIMES TO ENSURE THE SAFETY OF PERSONNEL, WHEN WORKING ON OR BENEATH THE BUCKET LINKAGE.

52 To remove the bucket locks, proceed at follows:

52.1 Stop the vehicle and apply the parking brake.

52.2 Remove the crowd ram tie bars.

52.3 Raise the bucket to its full height, using the raise/lower control lever. Apply the bucket control lock.

52.4 Reach under the boom and remove the tube assemblies.

52.5 Stow the tie bars and tube assemblies.

High temperature warnings

53 While earth moving operations are in progress, it is important to ensure that the CWL are correctly monitored, in order to detect in good time any overheating or other fault which may occur. If the CWL illuminates, carry out the correct procedure immediately to identify the fault and act accordingly (refer to Chap 2-11-1 Table 2).

Earth moving tasks

CAUTION

EQUIPMENT DAMAGE. After every hour digging, select 1st and 2nd gears sequentially holding each gear for at least 3 seconds, repeating 10 times for each gear.

54 The CET may be employed on the following tasks, using the hydraulically operated bucket:

54.1 General earth moving and dozing.

54.2 Loading and shovelling.

54.3 Rubble clearance.

54.4 Tree and scrub clearance.

54.5 Tactical battlefield tasks - digging protection slots for tanks and other armour vehicles etc.

54.6 Constructing river entry and exit ramps.

55 Detailed instructions for most of these operations are to be found in the 'Royal Engineers Supplementary Pocket Book, No. 5c - Engineer Construction Plant - 1961'. The observations which follow, contain information directly related to the operation of CET only.

Loading, shovelling and digging

56 Loading and shovelling is performed in a similar manner as with conventional plant of a similar capacity. Some consideration must be given, however, to the limited maximum bucket height and reduced visibility.

57 The maximum bucket height will not be sufficient to safely load many of the larger tipper lorries or dumpers. If this type of operation is necessary, some prior preparation will be necessary, either to build an earth ramp for the CET to climb or alternatively dig a slot to accommodate the vehicle being loaded. The latter method affords better visibility for the vehicle operator when loading is in progress.

58 When carrying out operations which involve frequent cycles of backwards and forwards vehicle movement, problems of restricted visibility can be overcome if the crew work efficiently as a team. With the crew members seated back to back, the operator will drive the vehicle rearwards and operate the bucket, but for any forward movement of any distance the driver takes over their respective position, which is particularly important when working 'closed down' under battlefield conditions. It is essential to adopt a rigid discipline when using this method of working, to ensure that the changeover of gear and steering controls is properly carried out, each time control of the vehicle is handed over from one crew member to the other.

Rubble clearance

59 The CET can be used to clear or load rubble and blowdown debris providing that a number of elementary precautions are observed.

60 The main bucket structure is fabricated from aluminium alloy; it is necessary therefore to ensure that it is not overstressed. Great care should be exercised when attempting to lift concrete or break partly demolished brickwork.

61 When rubble clearance operations are in progress, frequent inspection of tracks and roadwheels should be made. If accumulations of rubble become trapped in the roadwheels or tracks, damage could be caused or a track thrown.

MAINTENANCE

62 The bucket, boom and associated linkages may be subject to damage, especially when the vehicle is working in difficult conditions, i.e. clearing debris or rubble. Therefore, frequent visual inspections are necessary.

63 Inspect the bucket for cracks and distortion in the aluminium alloy structure and for loose reinforcing strips. Any such cracks or damage must be reported to REME. Loose bucket teeth must be re-tightened and any missing bolts replaced. Failure to keep the teeth secure will result in damage to the mounting holes in the bucket.

Lubrication

64 The bucket and boom operating linkage pivot points must be lubricated at the intervals indicated in the Cat 601. A grease gun must be applied to each of the eighteen lubricating nipples (Fig 1 (7)) (nine on each side of the vehicle).

NOTE

If the crowd ram travelling tie bar (Fig 4 (2)) is in position, the rearmost crowd ram pivot pin (8) lubricating nipple is obscured by the R-clip (3). It is necessary to remove the pin to gain access to the lubricating nipple.

CHAPTER 2-8-3

WINCH EQUIPMENT

CONTENTS

GENERAL DESCRIPTION

1 The vehicle is fitted with a two speed capstan type winch (Fig 1), designated Plumett CA 80. The winch is mounted on the right front glacis plate, with only the capstan housing and rope guard protruding. A wire rope of 16 mm (0.63 inch) diameter, with a usable length of 91.4 metres (300 feet) is fitted to the winch. The rope passes from the exterior of the vehicle around the capstan bullwheels and onto a storage drum within the hull. A cable cutter is provided and can be mounted above the rear corner of the hull structure.

2 The winch is driven by a hydraulic motor which is supplied with fluid under pressure by the tandem hydraulic pumps mounted on the transfer gearbox. Two pumps are fitted to enable the winch to be operated simultaneously with the bucket or to make full hydraulic power available for winching. Levers in the crew compartment control the output from the hydraulic pumps. For details of the hydraulic system refer to Chap 2-8-1.

3 All winch controls are positioned in the crew compartment. The main control levers are located to the left of the driver and the winch holding brake and a duplicate 'winch-in'/'pay-out' lever in the operator's position. This arrangement allows operations to be conducted from the position affording the best field of vision.

4 The winch operates in conjunction with a system of pulleys and fairleads, enabling the winch rope to be used to exert a pull from the front or rear of the vehicle. If the winch rope is used over the rear of the vehicle, when operating in a recovery role to assist amphibious vehicles, the bucket can be used as an earth anchor.

5 A number of the subsidiary roles performed by the vehicle require the used of the winch. These include trackway laying, winching ferries and use of the auxiliary lifting attachment.

6 The normal maximum winch pull of 80 kN (17000 lbf) may be increased when necessary by using the snatch block, which is normally stowed on the exterior of the bucket.

WINCH

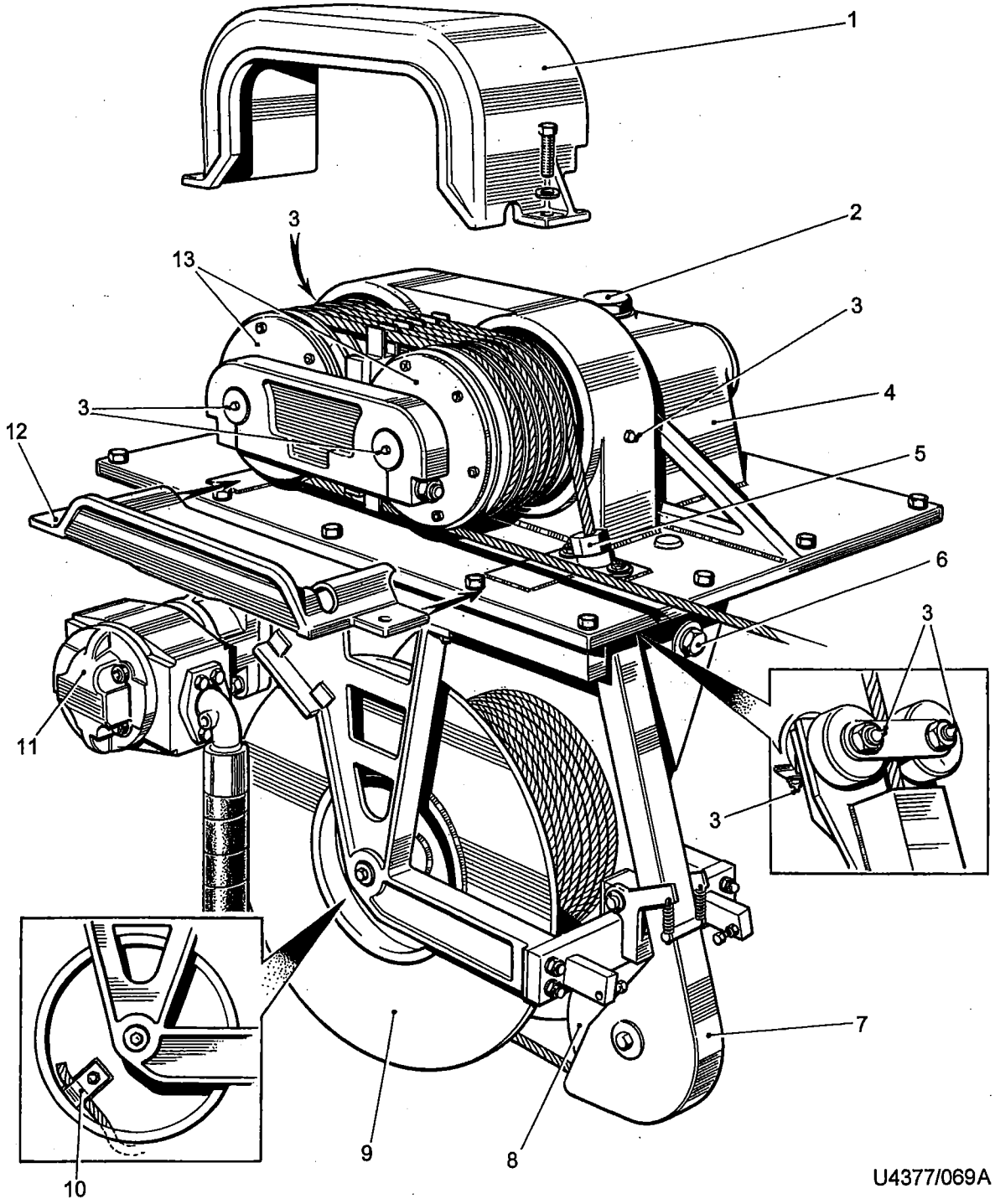
7 The main feature of the capstan winch is a pair of multi-grooved bullwheels (Fig 1 (13)) which transmit power to the steel wire rope at a constant rate, regardless of the length of rope present on the storage drum (9). The bullwheels are driven by a dual rotation hydraulic motor (11), via a two speed gearbox (4).

8 When the rope is in place it enters the winch beneath the upper rope guard (1) and passes five times around the two bullwheels. The rope then passes down through the rope seal (5), through the laying on arm (7), round the guide pulley (8) and onto the rope storage drum as shown in Fig 2.

9 When the winch controls are set to 'winch-in', the gearbox drives the bullwheels and the storage drum at the speed selected. The storage drum rotates at a rate which, in conjunction with a slipping clutch, imposes a preset load on the drum end of the rope, thus causing the rope to grip the bullwheels and be driven by them.

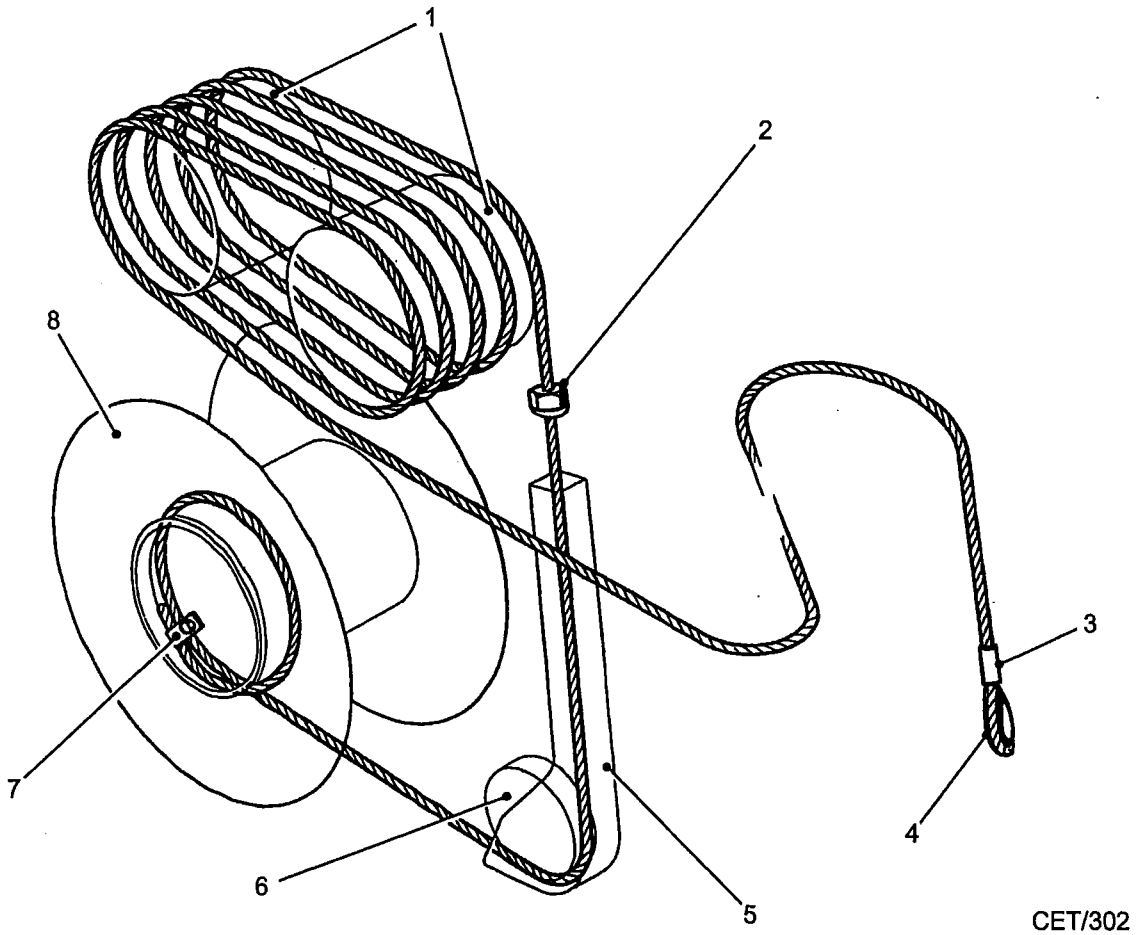
10 To 'pay-out', the winch motor is reversed and a small load must be applied manually to the 'free' end of the rope. This ensures that there is sufficient friction, between the rope and the rotating bullwheels, to pull the rope off the storage drum. A slipping clutch in the storage drum drive ensures that the rope tension, between the bullwheels and the storage drum, remains constant both when winching in and paying out.

11 A mechanically actuated drum brake is fitted to the winch gearbox. The brake incorporates a sprag clutch and provides the means of holding the load on the winch, and preventing a load slipping back, while winching is in progress. The brake is of the internal expanding type, controlled by a mechanical linkage, from a lever in the crew compartment.



1	Upper rope guard	8	Guide pulley
2	Filler plug	9	Storage drum
3	Lubrication nipples	10	Rope clamp
4	Gearbox	11	Hydraulic motor
5	Rope seal	12	Lower rope guard
6	Gearbox level plug	13	Bullwheels
7	Laying on arm		

Fig 1 Winch



1	Bullwheels	5	Laying on arm
2	Rope seal	6	Guide pulley
3	Ferrule	7	Rope clamp
4	Thimble	8	Storage drum

Fig 2 Winch rope schematic diagram

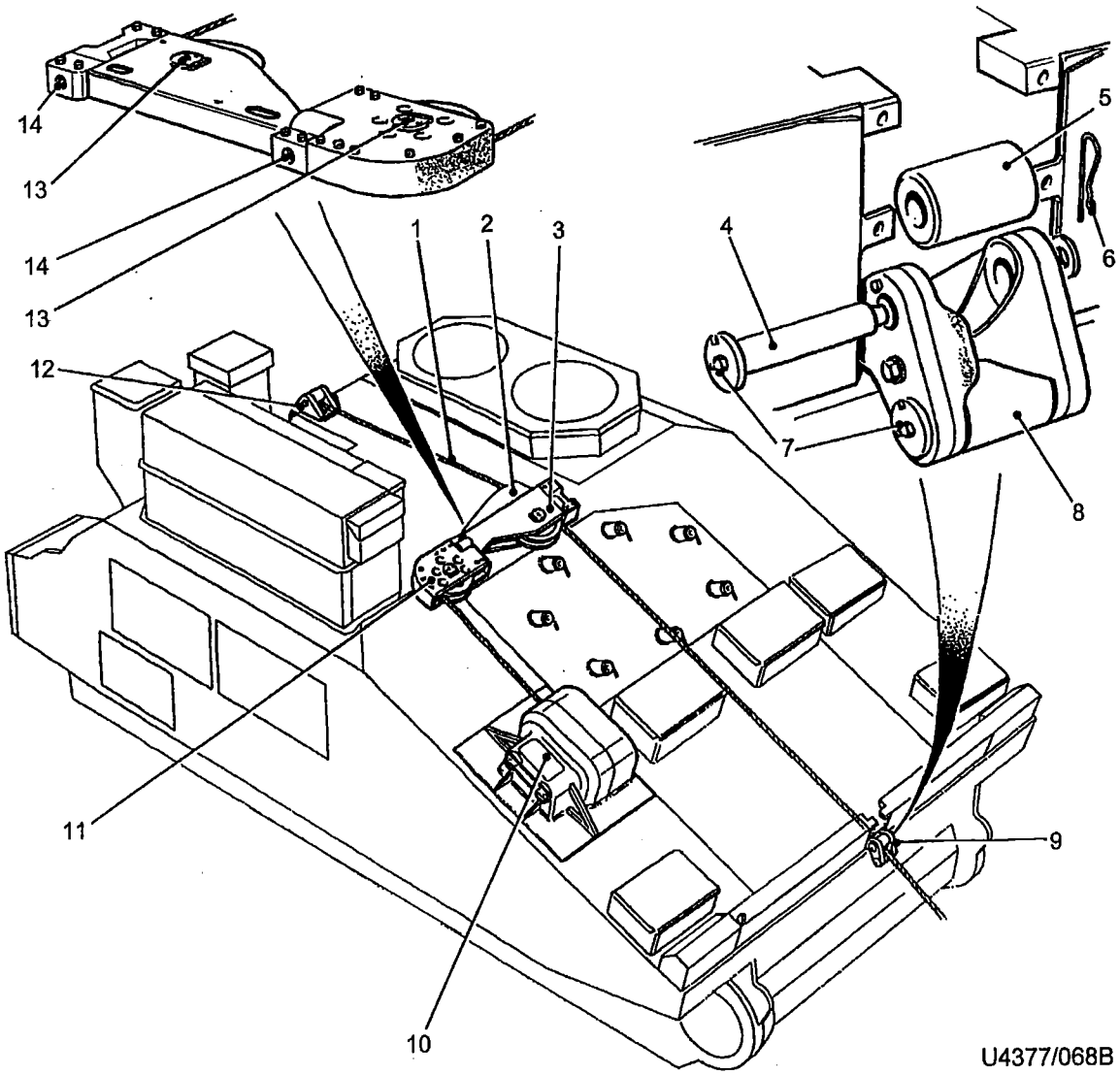
12 The winch gearbox contains a train of spur gears which connect the output shaft of the hydraulic motor to the capstan bullwheels. The gearbox also provides a drive to the storage drum via a chain and sprockets. The input shaft of the gearbox drives the two gear trains, of different ratios, either of which may be selected by a mechanically controlled dog clutch. This arrangement enables a high or low gear to be selected by means of a lever in the crew compartment. A neutral (no drive) position is selected when the dog clutch is totally disengaged.

13 Winching speed is dependent on engine speed and the winch gear selected. The maximum winching speeds are as follows:

13.1 High gear - 113 m/min (370.7 ft/min).

13.2 Low gear - 40 m/min (131.2 ft/min).

14 Lubrication of the winch is by means of an integral oil bath and lubricating nipples (Fig 1 (3)) on the various internal and external parts.



1 Winch rope (in rear position)
2 'Flop over pulley' (in rear position)
3 'Flop over pulley'
4 Spindle
5 Top roller
6 Retaining pin
7 Lubrication nipples
8 Bottom roller
9 Front fairlead
10 Winch
11 Fixed pulley assembly
12 Rear fairlead
13 Lubrication nipples (pulley spindles)
14 Lubrication nipples (pivot pins)

Fig 3 Winch pulley and fairleads

PULLEY ASSEMBLY AND FAIRLEADS

15 The pulley assembly (Fig 3) is mounted at the forward end of the hull roof plate. The assembly comprises two separate pulleys each with its own spindle and bearings. One pulley (11) is fixed rigidly to the hull and the other pulley (3) is in a hinged 'flop-over' mounting.

16 The winch rope is threaded through the pulley assembly at all times. Direction of pull, over the front or rear of the vehicle is changed by moving the 'flop-over' pulley to the front or rear positions and inserting the rope in the appropriate fairlead (9) or (12).

17 Both pulley spindles, and the 'flop-over' pulley pivots, are fitted with lubrication nipples (13) and (14).

18 The fairleads, located at each end of the vehicle hull, guide the winch rope at the front or rear as required. The fairleads are identical in construction and the top roller (5) of each is removable. To remove a fairlead roller, pull out the spring retaining pin (6), remove the roller spindle (4) and lift out the roller.

19 Both the spindles of the top and bottom roller (8) are fitted with lubrication nipples (7).

CONTROLS

Holding brake lever

WARNING

PERSONNEL INJURY. THE WINCH HOLDING BRAKE MUST ALWAYS BE APPLIED WHEN WINCHING IN. THIS WILL PREVENT THE LOAD SLIPPING BACK, POSSIBLY OUT OF CONTROL.

20 The winch holding brake lever (Fig 5 (27)) and (Fig 6 (1)) is located at the operator's position. The lever is connected by a cable to the brake operating mechanism. A ratchet enables the lever to be held in the 'on' (uppermost) position. The ratchet is released, to free the brake, by pressing the button at the end of the lever.

Gear change lever

21 The winch gear change lever (Fig 4 (24)) and (Fig 6 (9)) is located to the left of the driver's seat. The lever, which has three positive positions, HIGH RATIO, NEUTRAL and LOW RATIO, mechanically controls the gear ratio of the winch gearbox, to give fast or slow winch rope movement. The HIGH RATIO gear is used only for light loads and fast rope recovery.

22 The lever is moved upwards for high speed and downwards for low, with a central neutral position.

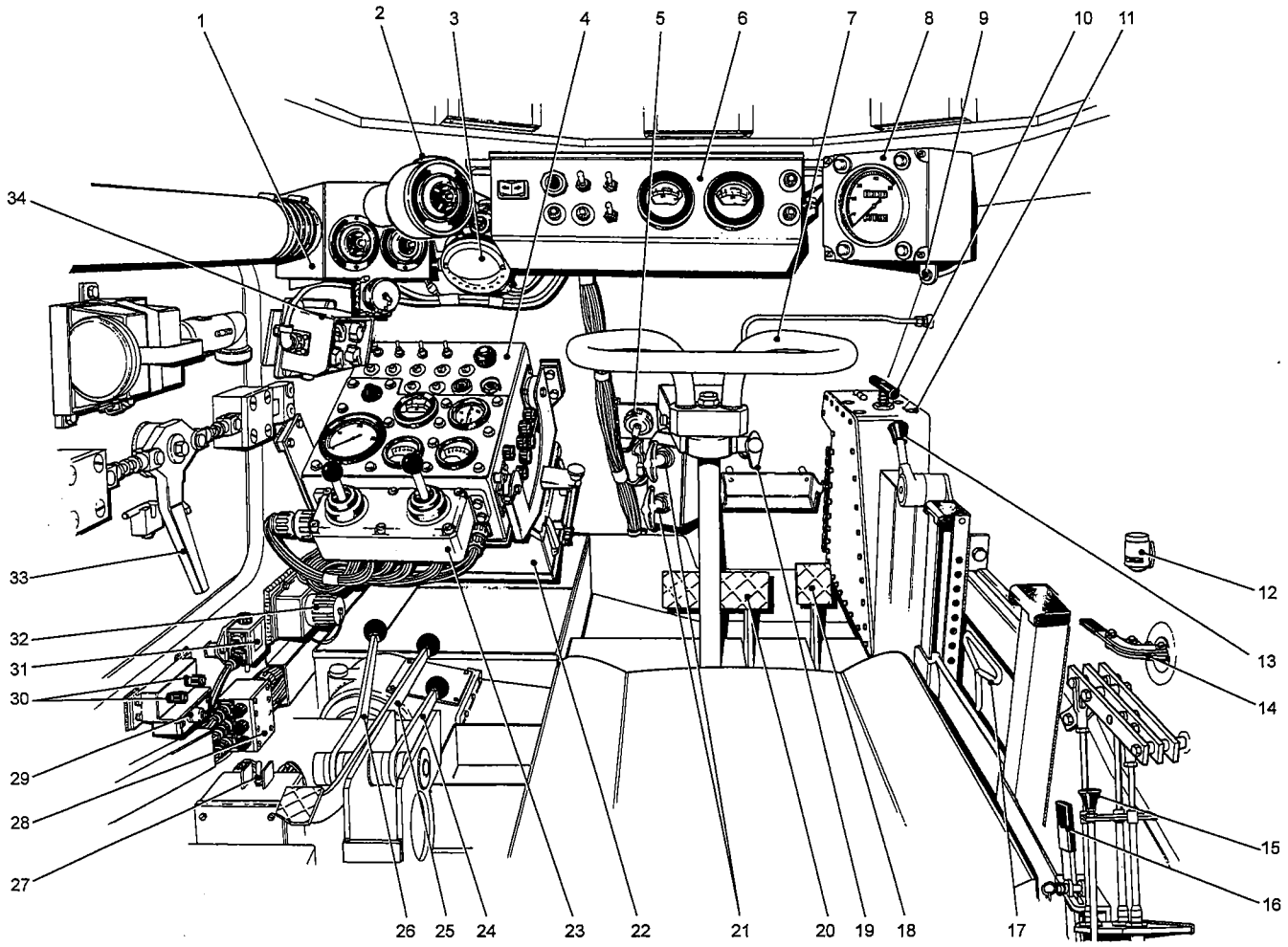
Driver's winch-in/pay-out control lever

23 The driver's winch-in/pay-out control lever (Fig 4 (25)) and (Fig 6 (8)) is the centre lever of the driver's winch controls. It is connected to a spool valve in the hydraulic system which controls the direction of rotation of the winch hydraulic motor.

24 The lever has a progressive action with a central neutral position. Upward movement of the lever selects the winch-in direction and downward movement, pay-out.

NOTE

The winch will only operate if the bucket controls are both in the neutral or float positions. If winching is necessary while the bucket is in use, the high speed winch-in/pay-out control lever (7) must be used (refer to Para 26).



1 Diffuser box
2 Python harness aperture
3 Interior light
4 Driver's instrument panel
5 Inspection light socket
6 Driver's road warning instrument panel
7 Steering column
8 Speedometer panel
9 'Trip' reset knob
10 Battery master switch
11 Distribution panel
12 Air restriction indicator
13 Emergency brake lever
14 Flooding valve
15 Engine stop control
16 Transmission disconnect clutch lever
17 Height adjuster, driver's seat
18 Accelerator pedal
19 Cold starting aid pump handle
20 Brake pedal
21 Fire extinguisher operating handles
22 Night sight stowage
23 Gear selector switch-box
24 Winch gear change lever
25 Pay-out/winch-in control lever
26 High speed pay-out/winch-in control lever
27 Driver/operator select switch
28 Junction box
29 Demolition microswitch
30 Demolition terminals
31 Heated clothing switch-box
32 Inter-vehicle socket
33 Emergency door release handle
34 Crew box - 2 radio

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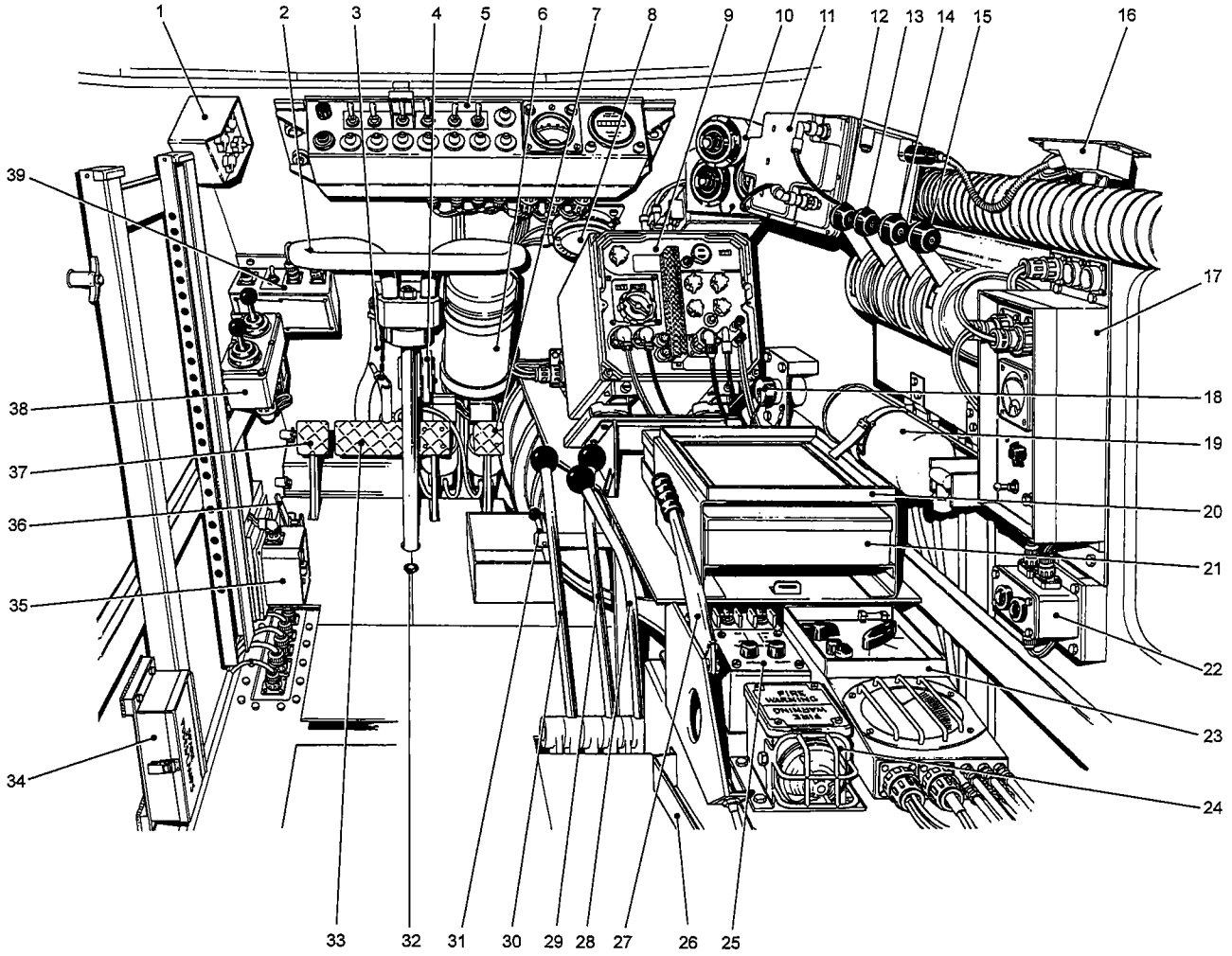
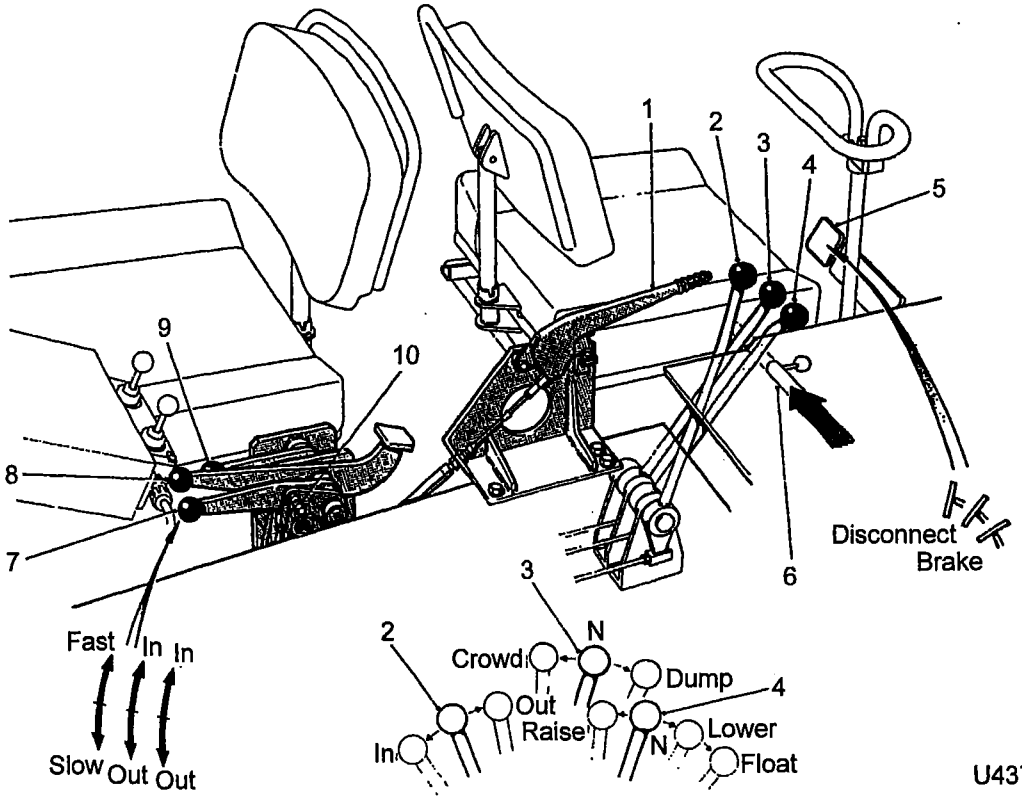
Fig 4 Controls and instruments (crew compartment - front)



1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spares box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnect pedal
38 Gear selector switch-box
39 Firewire control box

Fig 5 Controls and instruments (crew compartment - rear)



1 Holding brake lever
2 Operator's winch-in/pay-out control lever
3 Bucket crowd/dump control lever
4 Bucket raise/lower control lever
5 Disconnect pedal
6 Locking lever
7 High speed winch-in/pay-out control lever
8 Driver's winch-in/pay-out control lever
9 Gear change lever
10 Locking pin

Fig 6 Bucket and winch controls

25 A control lever (Fig 5 (28)) and (Fig 6 (2)), located adjacent to the bucket controls, allows the operator to control the winch direction when winching over the rear of the vehicle, trackway laying or lifting is in progress. The lever is connected mechanically to the driver's winch-in/pay-out control lever (8) and has the same operating characteristics.

High speed winch-in/pay-out control lever

26 The lever (Fig 4 (26)) and (Fig 6 (7)), located on the left of the driver's winch controls is the high speed winch-in/pay-out control lever. It is connected mechanically to a spool valve in the hydraulic system which enables the output from the secondary portion of the tandem hydraulic pump to be used for winching.

27 The lever has three positions, and the same operating characteristics as the driver's winch-in/ pay-out control lever. The effect of using the control can be twofold:

27.1 If the lever is operated while the bucket controls are in use, winching is possible but at only half normal speed and power.

27.2 When used simultaneously, with the driver's winch-in/pay-out control lever (8), full power, high speed winching is possible, utilizing both portions of the hydraulic pump.

Locking pin

28 A quick release locking pin (10) is provided to prevent accidental movement of the driver's winch-in/pay-out control levers. When not in use, the pin is inserted in the holes provided, thus locking the levers to the supporting pedestal.

OPERATION

Preparations for winching

WARNINGS

(1) PERSONNEL INJURY. IF ANY EVIDENCE OF EXCESSIVE WEAR, FRAYING, KINKING OR OTHER DAMAGE IS PRESENT, THE WINCH ROPE MUST NOT BE USED FOR LIFTING OR WINCHING.

(2) PERSONNEL INJURY. PROTECTIVE GLOVES MUST BE WORN WHENEVER THE WINCH ROPE IS HANDLED.

29 Before winch operations begin, the following preparations should be made:

29.1 Check the condition of the winch rope.

29.2 If fitted, check that the quick release hook is correctly fitted to the winch rope and that the securing clamps are tight.

29.3 Arrange the winch rope for front or rear operation as required (refer to Paras 36 to 38 and 39 to 41).

29.4 Check that the fairlead rollers in use are properly assembled and the spindles secured.

To operate the winch

WARNINGS

(1) PERSONNEL INJURY. DURING WINCH OPERATIONS RIGOROUS PRECAUTIONS MUST BE TAKEN TO ENSURE SAFETY OF ALL PERSONNEL PRESENT.

(2) PERSONNEL INJURY. TO SAFEGUARD THE CREW MEMBERS, THE CREW COMPARTMENT ACCESS DOORS SHOULD BE CLOSED DURING HEAVY WINCHING OPERATIONS.

30 When operating the winch, a clear method of signalling should be used for all changes of procedure, i.e. stopping, starting and changes of direction. If necessary, a crewman should be stationed outside the vehicle in view of the operator, to conduct operations.

NOTE

Before using the winch, remove the locking pin (Fig 6 (10)) from the control levers (7) and (8). Always ensure that the pin is put back into position when winching operations have been completed.

To pay out slack rope

CAUTION

EQUIPMENT DAMAGE. When paying out, ensure that the red painted section of the rope does not come past the fixed pulley.

31 To pay out slack rope, proceed as follows:

31.1 Start the engine.

31.2 Select HIGH gear, by moving the winch gear change lever (9) upwards.

31.3 Release the holding brake lever (1).

WARNING

PERSONNEL INJURY. PROTECTIVE GLOVES MUST BE WORN WHENEVER THE WINCH ROPE IS HANDLED.

31.4 Apply tension to the rope, by pulling out by hand.

31.5 Move the driver's winch-in/pay-out control lever (8), or alternatively the operator's control lever (2), downwards to the pay-out position.

31.6 Rope will pay out provided some tension is maintained. Speed of operation is controlled by adjusting the speed of the engine and the use of the high speed winch-in/pay-out control lever (7).

31.7 When sufficient rope is payed out, return the winch-in/pay-out control lever to its central position.

To winch in

WARNING

PERSONNEL INJURY. THE WINCH HOLDING BRAKE MUST ALWAYS BE APPLIED WHEN WINCHING IN. THIS WILL PREVENT THE LOAD SLIPPING BACK, POSSIBLY OUT OF CONTROL.

32 To winch in, proceed as follows:

32.1 Ensure that the winch rope is properly secured to the anchorage point or object to be winched.

32.2 Start the engine.

32.3 Select HIGH or LOW gear, using the gear change lever (9), to suit the task in hand.

NOTE

High gear should be used only for very light loads and fast rope recovery. Low gear should always be used for recovery or self-recovery.

32.4 Apply the holding brake lever (1).

32.5 Slowly move the winch-in/pay-out control lever (8) upwards to the winch-in position, to take up the slack rope.

32.6 Increase engine speed to suit the load and required rope speed.

32.7 Stop winching as necessary by reducing engine speed and moving the control lever to the central position.

To pay out (with a load attached)

CAUTION

EQUIPMENT DAMAGE. When paying out, ensure that the red painted section of the rope does not come past the fixed pulley.

33 To pay out (with a load attached), proceed as follows:

33.1 Start the engine.

33.2 Select HIGH or LOW gear, using the gear change lever (9), to suit the task in hand.

NOTE

High gear should be used only for very light loads. Low gear should always be used for recovery or self-recovery.

33.3 Release the holding brake lever (1).

33.4 Move the winch-in/pay-out control lever (8) downwards to the pay out position. Operate the lever carefully in conjunction with the holding brake lever to control the movement of the load.

33.5 Adjust the speed of the engine to control the pay-out speed.

33.6 When paying out is complete, move the winch-in/pay-out control lever to the central position and apply the holding brake lever.

To use the high speed winch-in/pay-out control lever

34 The high speed winch-in/pay-out control lever operates in the same way as the driver's winch control lever. The control lever brings the output from the secondary hydraulic pump into use and may be used in either of the following ways:

34.1 If the lever is operated while the bucket controls are in use, winching in is possible but at only half normal speed and power.

34.2 When used simultaneously, with the driver's winch-in/pay-out control lever, full power, high speed winching is possible, utilizing both portions of the hydraulic pump.

Winching operations

WARNING

PERSONNEL INJURY. THE VEHICLE MUST REMAIN STATIONARY DURING WINCHING OPERATIONS, EXCEPT DURING SELF-RECOVERY.

35 The winch may be employed in any of the following modes:

35.1 Winching from the front - for recovery, self-recovery and general winching.

35.2 Winching from the rear - for recovery or self-recovery and general winching, with or without using the bucket as an earth anchor.

35.3 Winching from the front - for self assistance in difficult terrain.

35.4 As motive power for the auxiliary lifting attachment.

35.5 To assist in handling and releasing trackway during trackway laying operations.

Winching from the front of the vehicle

CAUTION

EQUIPMENT DAMAGE. DO NOT attempt to use the general service tow hook or the plant tow hook as a means of anchoring the winch rope when using the snatch block. The tow hooks are not designed to accept the loads which may be involved in winching operations.

36 Winching from the front of the vehicle may be used for recovery of other vehicles, self assistance or other straight forward winching tasks. When used in this mode the winch rope is routed down the glacis plate and through the front fairlead as shown in Fig 7 (a).

37 A straight pull of up to 80 kN (17000 lbf) may be applied using this configuration. The pull available can be doubled by using the snatch block, carried on the vehicle. When the snatch block is in use, the rope end should be attached (in conjunction with an 8-1/2 ton bow/D-shackle) to one of the recovery eyes on the front of the vehicle.

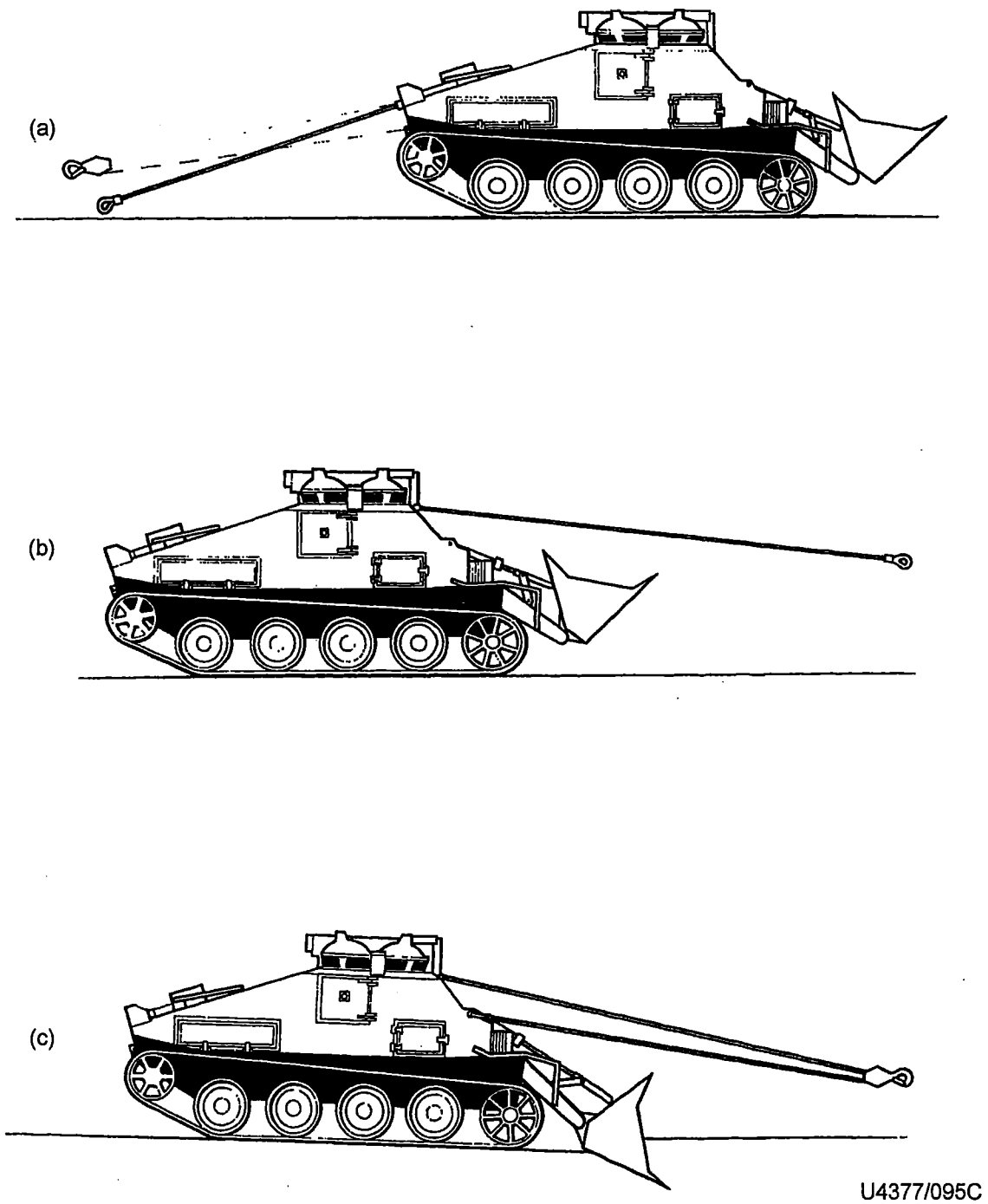
38 If a heavy stationary pull is required, such as for a recovery task, anchoring the vehicle may prove to be the main limitation. For this type of work a pull from the rear, using the bucket as an earth anchor is more suitable.

Winching from the rear of the vehicle

39 When winching from the rear of the vehicle as shown in Fig 7 (b), the winch rope is routed over the roof plate and through the rear fairlead. By this means a straight pull of 80 kN (17000 lbf) is possible.

40 For heavy loads, such as vehicle recovery, the snatch block may be used to double the available pull. When the snatch block is in use, the end of the winch rope should be secured to one of the anchorage points inside the bucket.

41 When undertaking a heavy pull, using the snatch block from the rear of the vehicle, as shown in Fig 7 (c) it may be an advantage to use the bucket as an earth anchor.



(a) Winching from the front of the vehicle, with or without a snatch block

(b) Winching over the rear of the vehicle (straight pull)

(c) Winching over the rear of the vehicle using a snatch block and the bucket as an earth anchor

Fig 7 Winching operations

To use the bucket as an earth anchor

42 To use the bucket as an earth anchor, the following preparations should be made:

42.1 Prepare the winching site by dozing a wedge-shaped hole the full width of the bucket. The depth should increase from 0 to 1 ft (0 to 305 mm) with the deep end nearest to the casualty or subject to be winched.

42.2 Drive the vehicle into the hole until the bucket is adjacent to the 1 ft (305 mm) step.

42.3 Position the bucket in the fully dumped attitude and at the lowest possible height. The aim should be to bury the bucket as low as possible in the end of the prepared winch pit.

42.4 Lock the suspension.

42.5 Set up the winch rope and snatch block securing the rope end to a rear lifting/recovery eye, as shown in Fig 7 (c).

43 If the vehicle is used as an earth anchor, to assist a heavy recovery vehicle (ARRV or similar), the procedures detailed in Paras 42.1 to 42.2 are used. With the bucket buried in this way, a load of up to 30480 kgf (30 tonf) can be applied to the anchorage points on the interior of the bucket, providing a suitable adaptor attachment is used.

Specialized winching operations

44 The use of the winch when it is used with the trackway laying, or auxiliary lifting attachment is detailed in Chaps 2-11-2 and 2-11-3.

MAINTENANCE

Winch rope

WARNINGS

(1) PERSONNEL INJURY. IF ANY EVIDENCE OF EXCESSIVE WEAR, FRAYING, KINKING OR OTHER DAMAGE IS PRESENT, THE WINCH ROPE MUST NOT BE USED FOR LIFTING OR WINCHING.

(2) PERSONNEL INJURY. PROTECTIVE GLOVES MUST BE WORN WHENEVER THE WINCH ROPE IS HANDLED.

45 The winch rope should be examined for signs of excessive wear, fraying, kinking or other damage and then cleaned and lubricated after use. Any damage found must be reported to REME and if necessary the rope cut as detailed in Para 56.

NOTE

Solvents must NOT be used to clean the rope.

46 When cleaning and examining the winch rope, protective gloves must be worn.

Lubrication points

47 There are a number of lubricating nipples on the winch, pulleys and fairleads. A grease gun should be applied to all lubricating nipples at intervals specified in the Cat 601.

48 Lubricating nipples (Fig 1 (3)) are provided for the winch bullwheels, rope guide rollers and laying on gear pivots.

49 Lubricating nipples (Fig 3 (7), (13) and (14)) are also located on the pulley assembly and fairleads.

50 The clevis pins in the winch gear change linkage should be lubricated by applying oil from an oil can sparingly to each pivot. These points are accessible only from inside the transmission compartment.

To check and top-up winch gearbox oil level

51 To check and top-up winch gearbox oil level, proceed as follows:

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

51.2 Open the transmission compartment upper access panel.

51.3 Clean the area around the winch gearbox filler plugs (Fig 1 (2)) and level plug.

51.4 Remove the gearbox level plug and washer. The oil should be level with the bottom of the hole.

51.5 If it is necessary to add oil, remove the filler plug and add oil (refer to Cat 601) until it flows from the level plug hole.

51.6 Replace and tighten the filler and level plugs and wipe off any surplus oil.

Draining the winch gearbox oil

52 Draining or changing the gearbox oil will not normally be necessary. To carry out the task necessitates the winch being removed from the vehicle and this is NOT a User task.

To remove the winch rope

WARNING

PERSONNEL INJURY. PROTECTIVE GLOVES MUST BE WORN WHENEVER THE WINCH ROPE IS HANDLED.

53 To remove the winch rope, proceed as follows:

53.1 Position the vehicle in such a manner that there is adequate space to work safely around the rear of the vehicle. Check that the parking brake is correctly applied.

53.2 Open the transmission compartment upper access panel.

53.3 Remove the rope clamp (Fig 1 (10)) from the storage drum (9). Close the access panel.

53.4 Remove the top and bottom rope guards (1) and (12).

53.5 Operate the winch over the rear of the vehicle, to pay out slowly, while the rope is pulled out by hand. If possible, the rope should be stored on a suitable drum. The last 22.86 m (75 feet) of rope should be painted red, this is an indication to the operator of approaching the end of the winch rope.

53.6 When only a few turns of rope remain on the storage drum, stop the winch and check that the rope end is free and not jammed. Continue to pay out slowly until the rope can be pulled completely clear of the winch and pulley assembly.

To fit a winch rope

WARNINGS

(1) PERSONNEL INJURY. WHEN THREADING THE ROPE BY HAND ON TO THE CAPSTAN BULLWHEELS, THE WINCH MUST BE STATIONARY AND THE ENGINE STOPPED. KEEP HANDS CLEAR OF THE BULLWHEELS WHEN THE WINCH IS IN OPERATION.

(2) PERSONNEL INJURY. PROTECTIVE GLOVES MUST BE WORN WHENEVER THE WINCH ROPE IS HANDLED.

54 To fit the winch rope, proceed as follows:

54.1 Remove the rope guards (Fig 1 (1) and (12)) and rope clamp (10).

54.2 Check one end of the winch rope is painted red for a length of 22.86 m (75 feet).

54.3 Thread the red painted end of the rope through the pulleys (Fig 3 (3) and (11)) and down the glacis plate to enter the winch beneath the bullwheels as shown in Fig 2.

54.4 Continue to thread the rope around the bullwheels until the rope occupies the grooves as shown in Fig 2. It will assist considerably if plenty of slack rope can be maintained between the winch and the pulley assembly and around the bullwheels.

54.5 When the bullwheels are correctly threaded, continue to work the rope end down through the rope seal (2) and laying on arm (5), around the guide pulley (6) and on to the storage drum (8).

54.6 Bring the end of the rope through the aperture in the storage drum. Fit and secure the rope clamp (7). Ensure that at least 60 mm (2-3/8 in.) of rope protrudes beyond the clamp.

54.7 Operate the winch, to winch in slowly. Continue to winch in until unpainted rope appears at the fixed pulley (Fig 3 (11)). Stop the winch.

54.8 Check that the rope is correctly wound on the storage drum.

NOTE

When the rope is wound in until the red painted section terminates at the fixed pulley on the glacis plate, there must be at least thirteen turns (one complete layer) of rope neatly wound onto the storage drum. The correct functioning of the laying on gear depends on this first layer of rope being accurately placed. It is necessary to assist the first 13 turns by keeping the guide close to the rope already on the drum.

54.9 Refit the rope guards (Fig 1 (1) and (12)) and secure the transmission compartment access panel. Continue to 'winch-in' until only sufficient rope is left to enable the shackles to be fitted and the winch rope to be connected to the general service tow hook.

Emergency repair to winch rope

WARNING

PERSONNEL INJURY. PROTECTIVE GLOVES MUST BE WORN WHENEVER THE WINCH ROPE IS HANDLED.

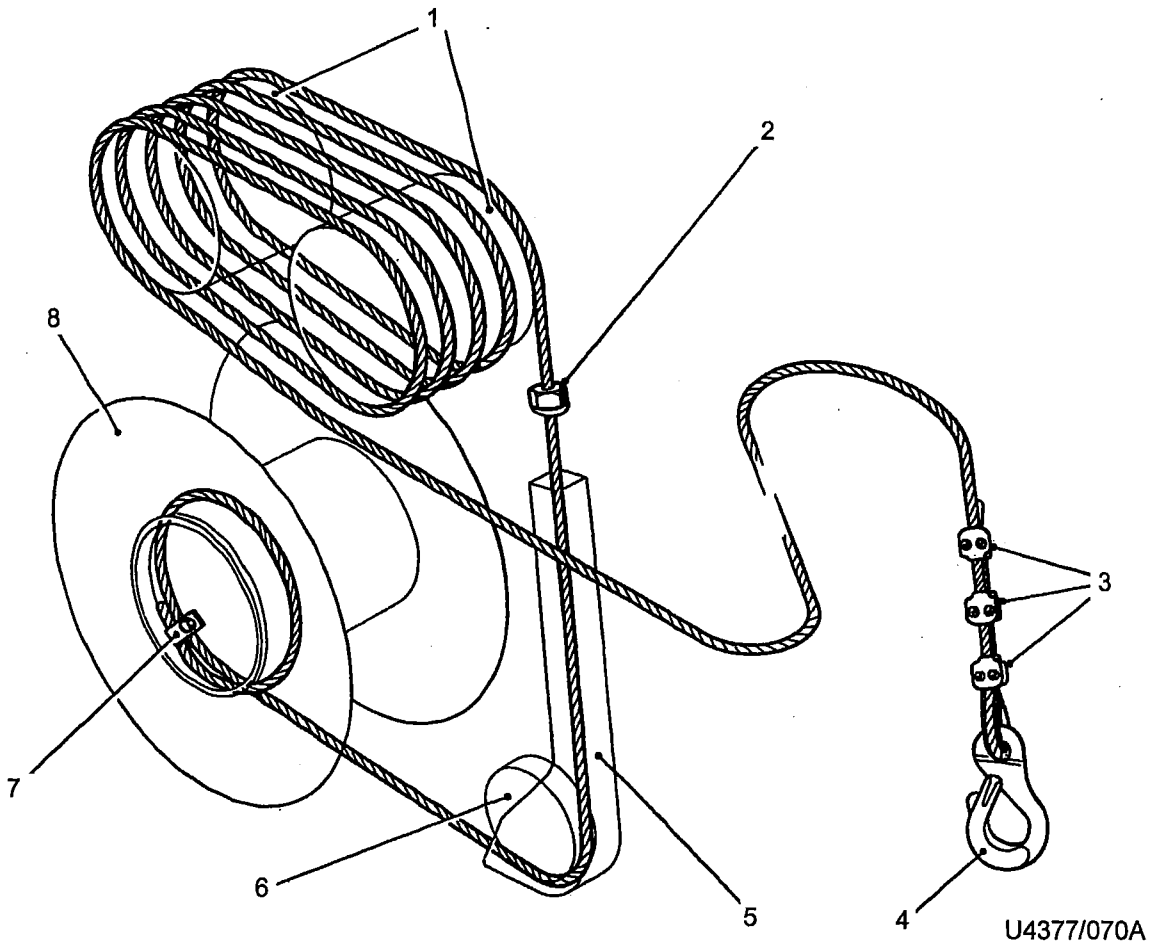
55 The winch rope may be repaired, in an emergency, but must be replaced at the earliest opportunity. As part of the CES, (refer to Cat 741) an 8 tonne Norvan safety hook (Fig 8 (4)) and six clamps (3) are provided for this purpose. To repair a winch rope, proceed as follows:

55.1 Check that the winch rope is correctly routed through the pulley assembly on the glacis plate.

55.2 Ensure that the rope end is in good condition and correctly whipped.

55.3 Thread approximately 400 mm (16 in.) of rope through the hook eye, around the thimble, and bend the rope end back alongside the rope.

55.4 Fit an iron grip clamp (3) as near as possible to the hook eye and thimble and tighten the clamp.



1 Bullwheels
2 Rope seal
3 Clamps
4 Safety hook
5 Laying on arm
6 Guide pulley
7 Rope clamp
8 Storage drum

Fig 8 Emergency repair to winch rope

55.5 Fit a second and third iron grip clamp (3) at approximately 100 mm (4 in.) spacings, and tighten.

55.6 Check the operation of the hook to ensure that it opens and closes correctly.

55.7 Check the iron grip clamps for tightness before any winching operations.

Use of the cable cutter

WARNINGS

(1) PERSONNEL INJURY. PROTECTIVE GLOVES MUST BE WORN WHENEVER THE WINCH ROPE IS HANDLED.

(2) PERSONNEL INJURY. SAFETY GOGGLES MUST BE WORN BY PERSONNEL WHILST USING THE CABLE CUTTER.

56 To use the cable cutter, proceed as follows:

56.1 Ensure that the cable cutter (Fig 9) is securely mounted on the vehicle and that the cutting edge of the blade is not damaged.

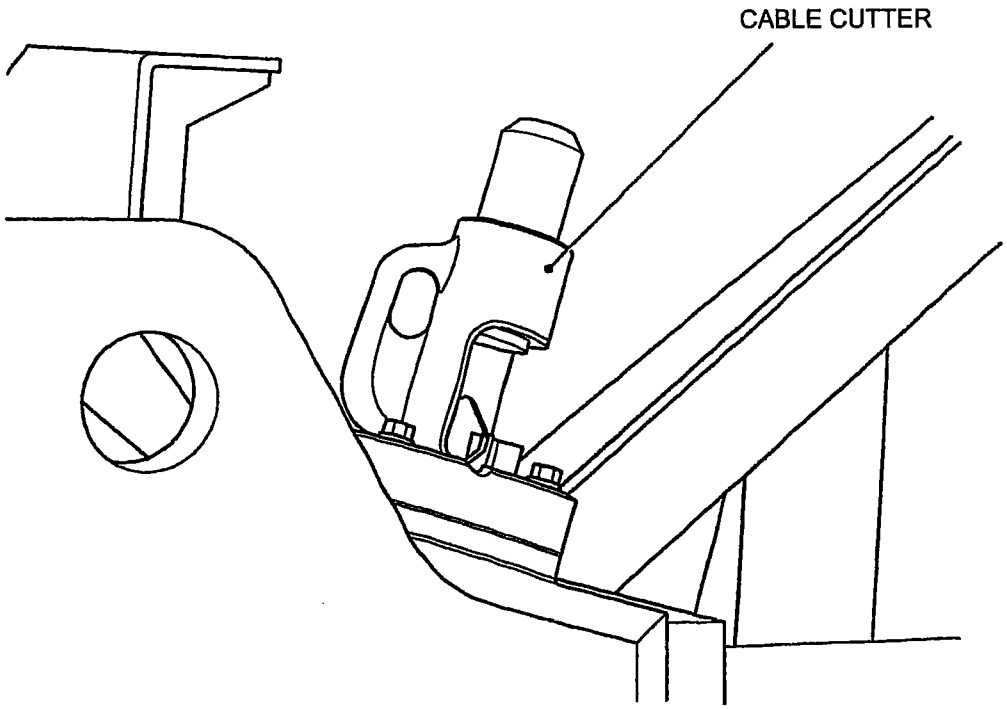


Fig 9 Cable cutter

56.2 Bind the rope with plastic tape or string either side of the point where it is to be cut.

56.3 Lift the cutting blade and position the rope underneath so that the blade will cut between the two bound parts of the rope.

56.4 Strike the cable cutter with the sledge hammer and check that the blade has cut through the rope. If the rope is not cut through repeat the operation until it is.

56.5 Measure the length of rope to be discarded and record it in the AB 413, Sect 8, Winch.

NOTE

The winch rope must be condemned when its length is reduced to 87.5 m (287 ft) or if there are any severe kinks in it.

CHAPTER 2-9

SMOKE GRENADE DISCHARGERS

CONTENTS

DESCRIPTION

General

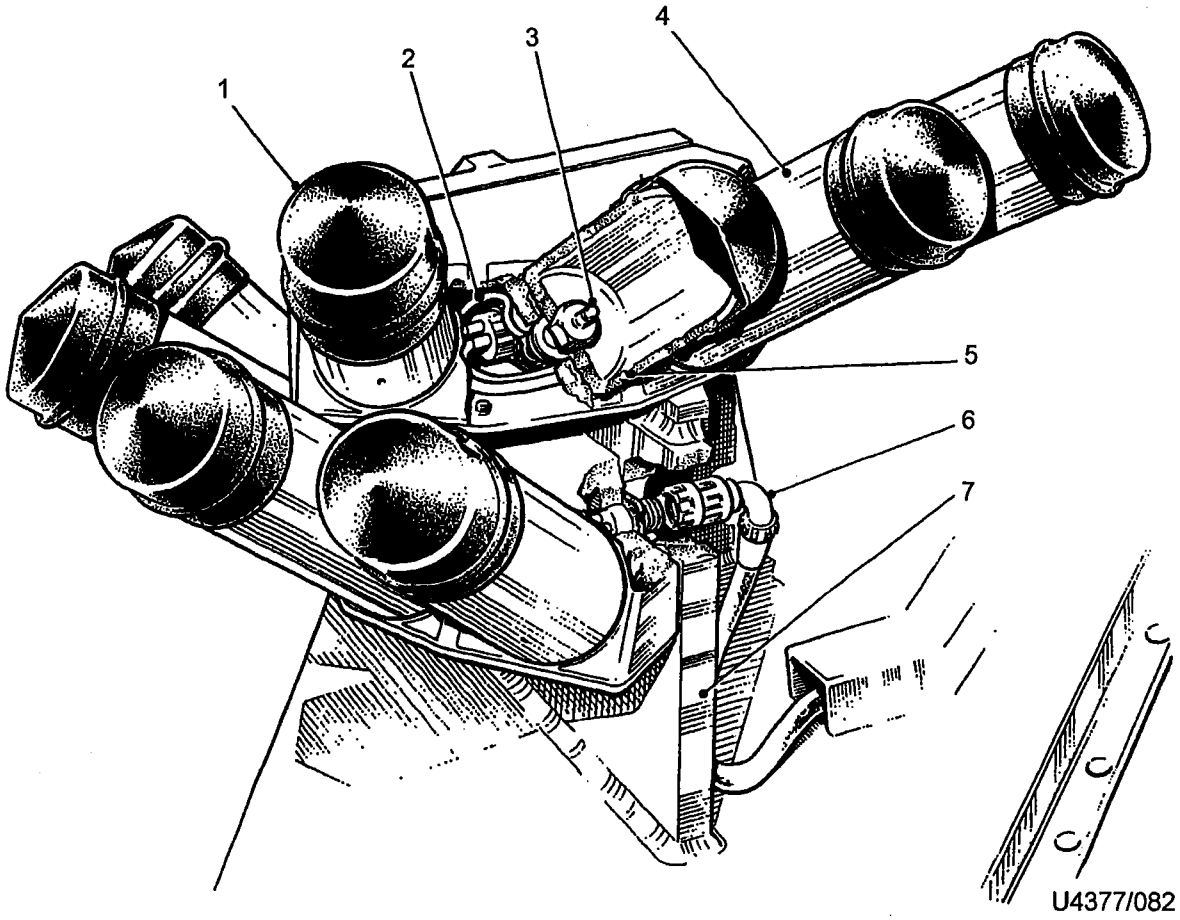
1 Two smoke grenade dischargers (Fig 1) are fitted on a single mounting, located on the right glacis plate. The dischargers enable smoke grenades to be projected in a pre-determined pattern to provide a defensive smoke screen.

2 Each discharger has four barrels (4) and is electrically fired from within the crew compartment. The firing switches enable one or both dischargers to be fired as required.

3 The barrels are each fitted with a single pin plug (3) which forms part of the electrical connection, when the self-projecting grenade is in place. The grenade contains the socket portion of the electrical connection, a fuse and a propelling charge.

4 A drain hole (5) is provided at the lower end of each barrel to allow any water which enters the barrel to drain away.

5 Protective covers (1) are fitted to each barrel when the dischargers are not in use.



1	Protective covers	5	Drain hole
2	Internal wiring	6	Connector (right discharger)
3	Plug	7	Mouting bracket
4	Barrels		

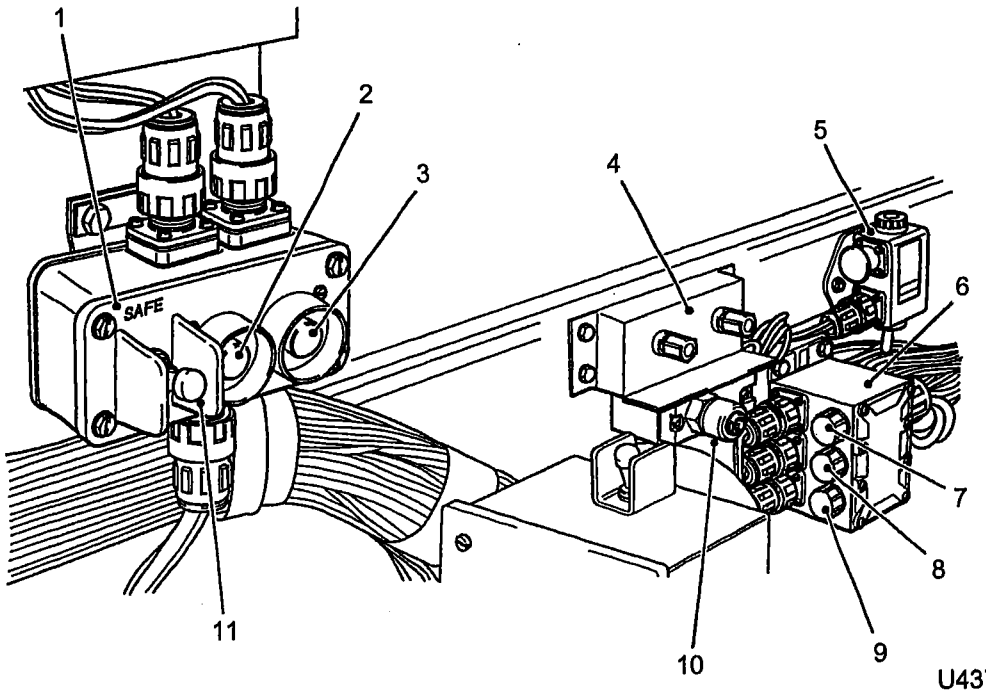
Fig 1 Smoke grenade dischargers

Circuit protection

6 The smoke grenade discharger firing circuit is protected by a fuse (F34) (Fig 2 (9)) located in the fuse/junction box (6). The junction box also accommodates fuses for the night vision periscope circuits and is itself protected by a fuse (F6) in the main distribution panel. For fuse ratings refer to Chap 2-7 (Electrical Equipment).

Controls

7 The smoke grenade dischargers are fired electrically by operating pushbuttons in conjunction with the SAFE/ARM toggle switch (Fig 2 (11)) on the switch-box (1). The switch-box is located on the crew compartment outer wall. Two firing buttons (2) and (3) are provided, one for each discharger. When a firing button is pressed, the electrical circuit is completed and all four grenades, from the selected discharger, are fired simultaneously.



1 Smoke grenade discharger switch-box
2 Firing button (right discharger)
3 Firing button (left discharger)
4 Demolition terminals (internal)
5 Heated clothing switch-box
6 Fuse/junction box
7 Fuse (F33)
8 Fuse (F32)
9 Fuse (F34)
10 Demolition microswitch
11 Toggle switch (SAFE/ARM)

Fig 2 Smoke grenade discharger firing switches

OPERATION

To load the dischargers

WARNINGS

(1) PERSONNEL INJURY. TO PREVENT INADVERTENT OPERATION OF THE SMOKE GRENADE DISCHARGERS AND SUBSEQUENT DANGER TO PERSONNEL, THE LOADING/UNLOADING OF THE DISCHARGERS SHOULD ONLY BE CARRIED OUT WITH THE FUSE F34 REMOVED.

(2) PERSONNEL INJURY. THE HANDLING OF L5A4, L7A1 AND L8A1 SMOKE GRENADES IS POTENTIALLY DANGEROUS WITHIN TWO METRES OF CLANSMAN RADIO ANTENNAE WHEN TRANSMITTING. DO NOT USE RADIOS TO TRANSMIT WHEN LOADING OR UNLOADING SMOKE GRENADE DISCHARGERS.

8 To load the dischargers, proceed as follows:

8.1 Remove the fuse (F34) (Fig 2 (9)) from the fuse/junction box.

8.2 Remove and stow the protective covers (Fig 1 (1)).

8.3 Check that the plug (3) contacts are clean. Insert a grenade in each barrel and press in to ensure that a good contact is made between plug and socket. Load the grenades from the bottom of the dischargers to the top, whilst standing behind the dischargers.

8.4 Replace the fuse (F34).

To fire the grenades

WARNING

PERSONNEL INJURY. IN THE EVENT OF A MISFIRE IN ANY SMOKE GRENADE DISCHARGER BARREL, WAIT TEN MINUTES BEFORE UNLOADING, AND THEN THROW THE GRENADE CLEAR OF THE VEHICLE.

9 To fire the grenades, proceed as follows:

9.1 Check that the fuse (F34) (Fig 2 (9)) is correctly located in the fuse/junction box (6) and set the battery master switch to ON. Arm the circuit by operating the SAFE/ARM toggle switch (11).

9.2 Press one or both firing buttons (2) or (3) as required.

To unload the dischargers

WARNINGS

(1) PERSONNEL INJURY. TO PREVENT INADVERTENT OPERATION OF THE SMOKE GRENADE DISCHARGERS AND SUBSEQUENT DANGER TO PERSONNEL, THE LOADING/UNLOADING OF THE DISCHARGERS SHOULD ONLY BE CARRIED OUT WITH THE FUSE F34 REMOVED.

(2) PERSONNEL INJURY. THE HANDLING OF L5A4, L7A1 AND L8A1 SMOKE GRENADES IS POTENTIALLY DANGEROUS WITHIN TWO METRES OF CLANSMAN RADIO ANTENNAE WHEN TRANSMITTING. DO NOT USE RADIOS TO TRANSMIT WHEN LOADING OR UNLOADING SMOKE GRENADE DISCHARGERS.

10 To unload the dischargers, proceed as follows:

10.1 Set the battery switch to OFF and remove fuse (F34) (Fig 2 (9)) from the fuse/junction box (6).

10.2 Working from behind the barrels withdraw the grenades and stow them in the grenade stowage box at the rear of the stowage basket.

10.3 Ensure that the discharger barrels are clean. Fit the protective covers (Fig 1 (1)).

10.4 Replace the fuse (F34).

Misfire action

WARNING

PERSONNEL INJURY. IN THE EVENT OF A MISFIRE IN ANY SMOKE GRENADE DISCHARGER BARREL, WAIT TEN MINUTES BEFORE UNLOADING, AND THEN THROW THE GRENADE CLEAR OF THE VEHICLE.

11 In the event of a misfire, carry out the following action:

11.1 Wait ten minutes after the first attempt to fire, then withdraw the grenade from the discharger barrel.

11.2 Test the electrical circuit. If the circuit is correct, treat the grenade as a misfire and deal with it in accordance with Standard Operating Procedures (SOPs).

11.3 If the circuit is faulty, report to REME. The grenade may be reloaded and fired from a different discharger barrel if required.

MAINTENANCE

To test the firing circuits

12 To test the firing circuits, proceed as follows:

12.1 Check that the dischargers are unloaded.

12.2 Set the battery master switch to ON.

12.3 Check that the fuse (F34) (Fig 2 (9)) is correctly located.

12.4 Earth a 24V lamp using a 12 in. extension or a large screwdriver against the side of the barrel (Fig 1 (4)). When the appropriate firing button is pressed the lamp should illuminate.

12.5 Should the lamp fail to illuminate, check the following:

12.5.1 Fuse (F34) on the fuse /junction box and fuse (F6) on the distribution panel.

12.5.2 The security of the connector (6) at the base of the discharger bracket.

12.5.3 If the lamp still fails to illuminate report to REME.

12.6 Repeat Paras 12.1 to 12.5 for each barrel.

12.7 Fit the protective covers (1) on completion of the test.

To clean the smoke grenade dischargers

13 To clean the smoke grenade dischargers, proceed as follows:

13.1 After firing, remove deposits of foil from the discharger barrels (Fig 1 (4)) and plugs (3).

13.2 Clean and lightly oil each barrel and check that the drain holes (5) are clear.

13.3 Replace the covers (1).

CHAPTER 2-10

DEMOLITION EQUIPMENT

CONTENTS

DESCRIPTION

General

1 Facilities are provided on the vehicle to enable demolition charges to be fired electrically from within the crew compartment. Demolition charges and circuits are tested, primed and fired by using the test/fire box (Fig 1 (10)).

2 The demolition circuit comprises of two sets of terminals, wired in parallel, a microswitch and the necessary harness components. When in use the circuit is connected to the test/fire box in place of the rocket anchor firing circuit. (This capability no longer exists). The demolition circuit is shown in Fig 2.

3 Demolition charge firing leads may be connected to the firing circuit via terminals inside the crew compartment or externally on the cupola roof, whichever proves most convenient.

NOTE

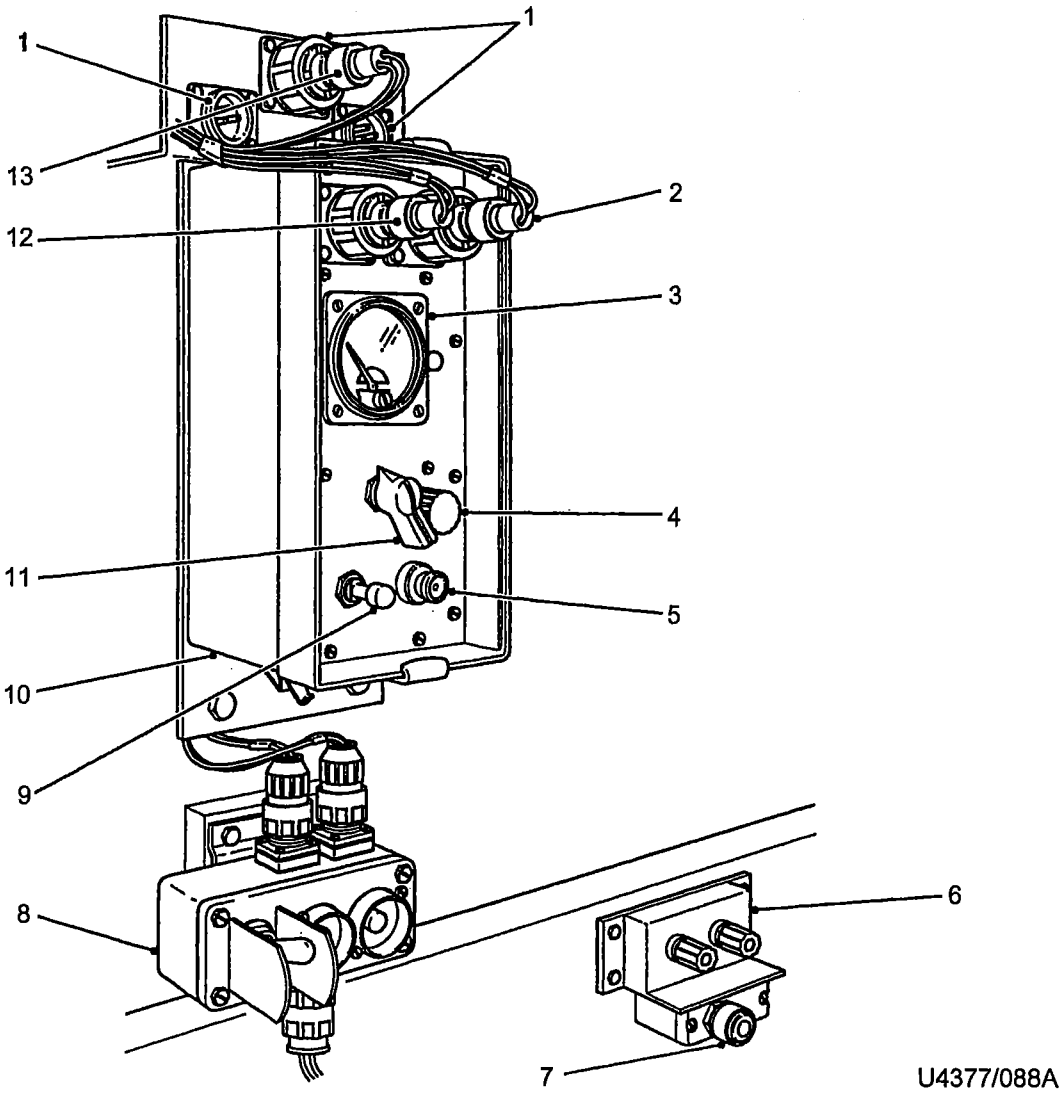
This Chapter of the AESP describes only the vehicle mounted equipment and does NOT include the Operating Instructions for setting up demolition circuits or firing charges.

Test/fire box

4 The test/fire box (Fig 1 (10)) is used to test and fire demolition charges. The box is located on the crew compartment outer wall, secured by two wing nuts. The test/fire box has the following functions:

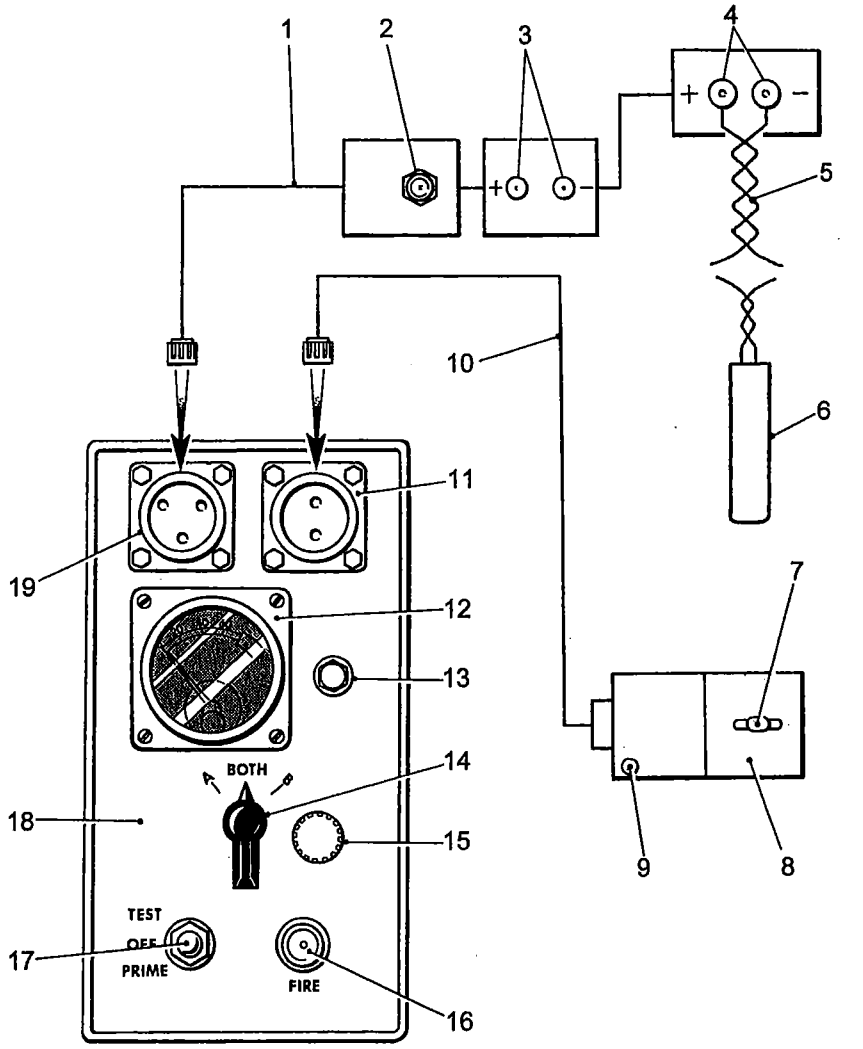
4.1 To test the continuity of electrical demolition circuits.

4.2 To provide the means of priming and firing demolition charges.



1 Dummy sockets
2 Power supply lead
3 Meter
4 Fuse F39
5 Firing button
6 Demolition terminals (internal)
7 Demolition microswitch
8 Smoke discharger switch-box
9 Main switch
10 Test/fire box
11 Selector switch
12 Demolition firing lead
13 Rocket firing lead
(this capability no longer exists)

Fig 1 Test/fire box installation



U4377/087A

1	Demolition firing lead	11	Input socket
2	Demolition microswitch	12	Meter
3	Internal demolition terminals	13	Indicator light
4	External demolition terminals	14	Selector switch
5	Twisted demolition cable	15	Fuse
6	Electric detonator	16	Firing button
7	Battery master switch	17	Main switch
8	Distribution panel (vehicle)	18	Test/fire box
9	Fuse (F7)	19	Output socket
10	Power supply lead		

Fig 2 Demolition circuit - schematic layout

5 The test/fire box is connected to the vehicle electrical system by attaching the appropriate harness connectors to the two sockets on the front panel of the box. Three connectors are employed which connect the following circuits to the test/fire box as required:

5.1 Input, power supply lead (2) (two pin connector).

5.2 Rocket firing lead (13), connects the test/fire box to the plug box (Fig 3 (1)) on the cupola roof (three pin connector). (This capability no longer exists).

5.3 Demolition firing lead (Fig 1 (12)) connects test/fire box to the demolition terminals (6) and (Fig 2 (3) and (4)) via the demolition microswitch (2) (three pin connector).

6 When not in use, the connectors are attached to dummy sockets (Fig 1 (1)) on the compartment wall above the test/fire box.

7 The test/fire box incorporates the following controls and instruments:

7.1 A three pin output socket (Fig 2 (19)) for connection to the demolition firing leads.

7.2 A two pin input socket (11) for connection to the power supply.

7.3 A 7A replaceable fuse (15), in series with the input power supply.

7.4 The main switch (17), which can be switched to the TEST or PRIME positions. The switch is spring-loaded to the central OFF position and must be pulled outwards before it can be moved to the PRIME position.

7.5 An indicator light (13), with a red lens, illuminates to indicate a completed circuit, from the vehicle power supply to the test/fire box, when the main switch is moved to the TEST or PRIME position. The indicator light also provides the source of power for a photo-electric cell located within the case.

7.6 A meter (12), graduated from 0 to 100 μA.

7.7 A firing button (16), which is in series with the main switch in the PRIME position.

7.8 A selector switch (14) with three positions identified A, B, and BOTH. The switch is used to select either rocket for testing and for selection of either or both rockets for firing (this capability no longer exists).

Demolition microswitch

8 A demolition microswitch (Fig 1 (7)), located in the crew compartment beneath the sill of the emergency exit door, provides an additional safeguard when handling the demolition circuits.

9 The microswitch is wired into the demolition firing lead (Fig 2 (1)) between the test/fire box output socket (19) and the demolition terminals (3) and (4). The demolition microswitch (2) is of the 'normally open' type and must be HELD closed before the circuit can be completed for testing or firing.

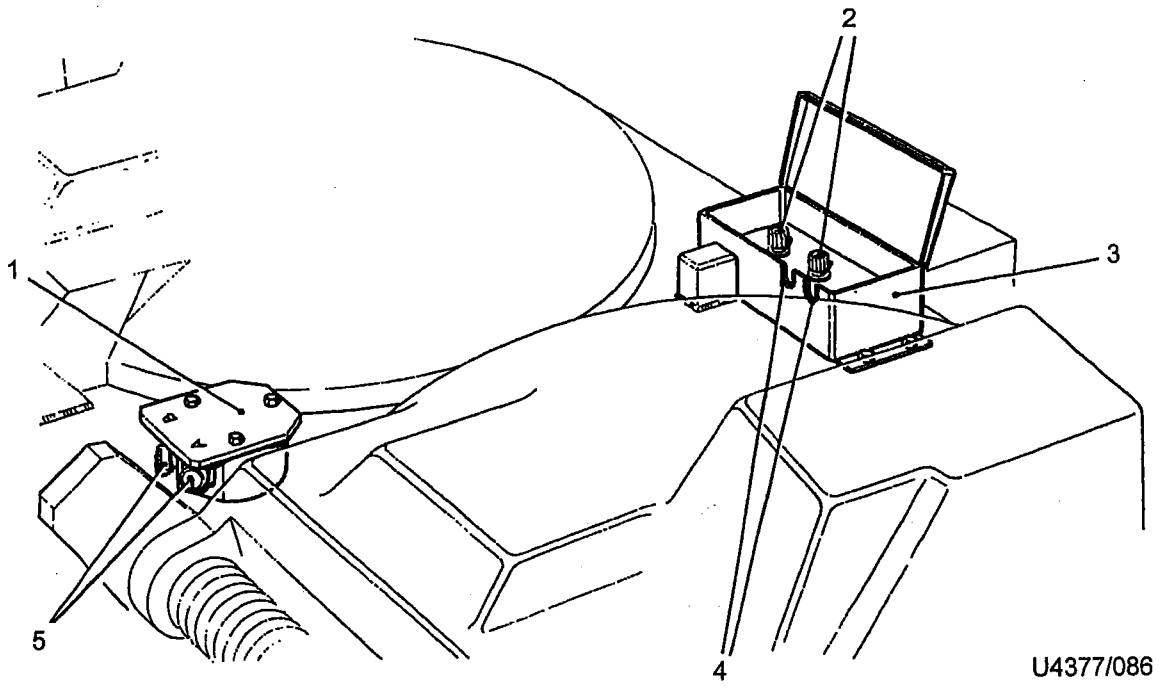
Internal demolition terminals

10 A pair of internal demolition terminals (Fig 1 (6)) are located in the crew compartment beneath the sill of the emergency exit door. The terminals are wired parallel with the external demolition terminals, on the exterior of the cupola, (refer to Fig 2 (3) and (4)) and provide an alternative point of connection accessible from within the vehicle. A service exploder may also be connected to the terminals and used, in place of the test/fire box, to fire a charge from inside the 'closed down' vehicle. If the circuit is used in this way the demolition firing lead (1) must be disconnected from the test/fire box output socket (19).

External demolition terminals

11 The external demolition terminals are located in a protective metal box (Fig 3 (3)) mounted on the cupola roof. The terminals (2) are the main point of connection to the firing leads from remote charges, thus enabling charges to be fired from within the 'closed down' crew compartment.

12 The demolition terminal box is fitted with a hinged lid and grommets (4) are provided to allow firing leads to remain connected with the lid closed.



1 Plug box
2 Demolition terminals (external)
3 Demolition terminal box
4 Grommets
5 Sockets

Fig 3 Plug box and demolition terminal box

OPERATION

Safety precautions

13 All vehicle equipment and circuits MUST be checked carefully before use. The equipment should not be used until faulty electrical equipment is repaired or replaced.

14 All relevant safety regulations appertaining to the use and firing of demolition charges must be rigorously adhered to. Instructions for use and handling of demolition charges may be found in the following publications:

14.1 Military Engineering Volume II - Field Engineering, Part II All Arms Pamphlet No. 4 - Demolitions 1974.

14.2 Military Engineering Volume II Part III - Pamphlet No. 4.

To fire a demolition charge using the test/fire box

Preparation of the vehicle circuit

15 The circuit is insulated from earth (vehicle body) so there is no danger of inadvertent firing by connecting one lead to earth.

16 To prepare the vehicle equipment, proceed as follows:

16.1 Set the battery master switch (Fig 2 (7)) on the distribution panel (8) to OFF.

16.2 Connect the power supply lead (10) to the input socket (11) of the test/fire box (18). No connection should be made at this stage to the output socket (19).

16.3 Set the battery master switch to ON.

16.4 Set the test/fire box main switch (17) to TEST and hold in this position, the indicator light (13) should illuminate. If the light fails to illuminate, release the main switch, check the condition of the fuse (F7) (9) in the distribution panel and the fuse (15) in the test/fire box. Check that the plug and socket connection is properly mated. Re-test the circuit.

16.5 Set the battery master switch to OFF.

16.6 Connect the demolition firing lead (1) to the output socket (19) of the test/fire box and ensure that the harness, in the crew compartment, to the external demolition terminal box (Fig 3 (3) is securely connected.

16.7 Set the battery master switch to ON. Set the selector switch (Fig 2 (14)) to B, press and hold in the microswitch (2) and move the main switch to TEST. The indicator light should illuminate and the pointer on the meter (12) should not move from the 0 position, indicating no continuity.

16.8 Set the battery master switch to OFF.

16.9 Connect the terminals in the external demolition box by means of a short piece of wire, or by using a screwdriver placed across the terminals. Repeat the test detailed at sub-Para 16.7. The indicator light should illuminate and the pointer on the meter should move to the green segment, indicating continuity.

16.10 Set the battery master switch to OFF. Remove shorting wire/screwdriver from the terminals in the external demolition box.

17 The vehicle circuit is now ready for use.

Preparation of the demolition circuit

18 With the vehicle suitability positioned, proceed as follows:

18.1 Stop the engine and set the battery master switch to OFF.

18.2 Connect one end of the twisted demolition cable (5) to the terminals of the external demolition box. Care must be taken to ensure good connections and prevent the cable becoming trapped or damaged by the box lid.

18.3 Test for continuity by joining both wires at the outer end of the twisted cable together - set the battery master switch to ON, put the selector switch to B, press and hold in the microswitch and move the main switch to TEST. The indictor light should illuminate and the pointer on the meter should move to the green segment, indicating continuity.

18.4 Set the battery master switch to OFF.

18.5 Run out the twisted demolition cable to the demolition point. Separate the wires at the outer end of the cable (where previously joined).

18.6 Test for open circuit (discontinuity) - set the battery master switch to ON, turn the selector switch to B, press and hold in the microswitch and move the main switch to TEST. The indicator light should illuminate and the pointer on the meter should remain at 0, indicating no continuity.

18.7 Set the battery master switch to OFF.

18.8 Connect the outer end of the demolition cable to the wires of the electric detonator (6).

18.9 Return to the vehicle and clear the area before making the final test.

18.10 Test for continuity by setting the battery master switch (7) to ON, put the selector switch (14) to B, press and hold in the microswitch (2) and move the main switch (17) to TEST. The indicator light (13) should illuminate and the pointer on the meter (12) should move to the green segment, indicating continuity.

18.11 Turn the battery master switch to OFF.

19 The electrical demolition circuit is now prepared for use.

To fire the demolition charge

20 When the order is given to fire:

20.1 Start the engine, close and secure both crew access doors.

20.2 Carry out the test for continuity (as detailed in Para 18.10).

20.3 Press, and hold in, the demolition microswitch.

20.4 Move the main switch to PRIME.

20.5 Depress the firing button (16).

To fire a demolition charge using a service exploder

21 Demolition charges may be fired remotely from within the vehicle using a separate service exploder. The following sequence of operations is included for guidance:

21.1 Ensure that all relevant safety precautions and procedures are rigorously carried out.

21.2 Position the vehicle carefully, using natural cover and protection where possible. Apply the parking brake.

21.3 Stop the engine and set the battery master switch to OFF.

21.4 Disconnect the demolition firing lead (Fig 2 (1)) from the test/fire box (18) and stow the plug on the dummy connector provided.

21.5 When the charge is laid and the demolition cable (5) is connected to the charge, bring the free end of the cable into the demolition terminal box, on the vehicle roof, and connect the bared wires to the terminals (4).

21.6 Clear the area and ensure that the safety precautions have been observed.

21.7 Enter the vehicle, and if necessary, close the crew access doors.

21.8 Attach the exploder to the internal demolition terminals (3) by means of two short wires. The circuit is now prepared and the charge can be fired, on command, by operating the exploder.

NOTE

The demolition microswitch (2) is inoperative if the charge is to be fired by an exploder wired to the internal demolition terminals and need not be pressed in.

MAINTENANCE

22 There are no maintenance procedures applicable at this level.

CHAPTER 2-11

VEHICLE OPERATION - LIST OF CHAPTERS

CONTENTS

LIST OF CHAPTERS

1 This chapter is divided into the following sub-chapters:

1.1 Chapter 2-11-1 Driving and towing

1.2 Chapter 2-11-2 Trackway laying

CHAPTER 2-11-1

DRIVING AND TOWING

CONTENTS

DRIVING

Instrument readings and warning light operation

1 It is essential that any malfunction in the vehicle system is detected as quickly as possible in order to minimize the risk of serious damage. The vehicle is equipped with a comprehensive array of instruments and warning lights to provide the crew with an early warning of possible fault conditions. It is important, however, to ensure that the instruments are carefully monitored, that the readings are correctly interpreted and that the correct action is taken.

2 An important feature of the vehicle fault detection equipment is the Central Warning Light (CWL) system which is designed to give the crew members a visual indication of a fault condition arising, regardless of whether they are operating 'closed down' or 'head out'. A good understanding of the systems covered by the CWL system is essential.

3 The following tables provide a summary of instrument readings and warning light operating parameters.

TABLE 1 INSTRUMENT READINGS

Instrument (1)	Fig No. (2)	Normal readings (3)	Action if readings are abnormal (4)
TACHOMETER	Fig 1 (19)	Idling 600-650 rev/min Driving 1400-2100 rev/min	If abnormally high or low readings are indicated during normal vehicle operation report to REME
AMMETER	Fig 2 (10)	0 - 140A dependent on electrical load, battery condition and engine speed	If no positive reading and GEN warning light illuminates report to REME
ENGINE OIL PRESSURE GAUGE	Fig 1 (20)	Minimum 1.05 kgf/cm^2 (15 lbf/in.^{2}) Normal 2.11 kgf/cm^2 (30 lbf/in.^{2}) Maximum 3.87 kgf/cm^2 (55 lbf/in.^{2})	If the readings consistently deviate from these parameters - STOP the vehicle and investigate. Check oil level and inspect for leaks, if the fault persists report to REME
ENGINE COOLANT TEMPERATURE GAUGE	Fig 1 (17)	Maximum 116 degrees C (240 degrees F)	If the temperature reading exceeds this figure STOP the engine and investigate. Check coolant pump belts and inspect for leaks. DO NOT ATTEMPT TO REMOVE THE FILLER CAP. If the fault persists report to REME
TRANSMISSION OIL TEMPERATURE GAUGE	Fig 1 (18)	82 - 121 degrees C (180 - 250 degrees F) must not exceed 140 degrees C (284 degrees F)	If the temperature reading is abnormally high check the coolant gauge (Fig 1 (17)) and if that reading is normal allow the engine to idle until the oil temperature returns to normal. If the fault re-occurs report to REME
STEER AIR PRESSURE GAUGE	Fig 1 (9)	5.6 kgf/cm^2 (80 lbf/in.^{2}) minimum	Do not attempt to drive the vehicle until the minimum pressure is attained. The steering may not respond correctly below this figure
BRAKE AIR PRESSURE GAUGE	Fig 1 (10)	4.2 kgf/cm^2 (60 lbf/in.^{2}) minimum	Do not attempt to drive the vehicle until the minimum pressure is attained. The brakes may not work below this figure

TABLE 2 WARNING LIGHT OPERATION

Warning light and system (1)	Fig No. (2)	Colour of lens (3)	Operating condition - will illuminate when: (4)	Action to be taken (5)
Generator	Fig 1 (11)	RED	Generator is not charging	Check AMMETER (Fig 2 (10)) if no reading with the engine running at 1000 rev/min report to REME
Central warning	Fig 1 (12)	RED)	Refer to Paras 4-5	
Central warning	Fig 2 (5)	RED)		
Bilge pump No. 1	Fig 1 (1)	ORANGE	Bilge pump ON	None
Bilge pump No. 2	Fig 1 (2)	ORANGE	Bilge pump ON	None
Steer unit oil low level	Fig 1 (3)	RED	Steer oil level low	STOP vehicle as soon as possible. Check the oil level and inspect for leaks, top-up if necessary. If the light continues to illuminate report to REME
Hydraulic oil low level	Fig 1 (4)	RED	Hydraulic oil level low	STOP operations immediately. Check and top up the oil level. Inspect for leaks. If the light continues to illuminate report to REME
Rad fan boost pressure low	Fig 1 (5)	RED	Fan pack hydraulic oil boost pressure low	STOP the vehicle as soon as possible. Stop the engine, check the fan pack oil level and top-up if necessary. If the light continues to illuminate on re-starting stop and report to REME
Coolant low level	Fig 1 (6)	RED	Coolant level in header tank low	STOP the vehicle and allow to cool. Do not attempt to remove the filler cap and top-up until a check has been made for leaks and the system has cooled down
Turnlights	Fig 1 (7)	GREEN	Turnlight operating	Cancel when appropriate
Main beam	Fig 1 (8)	BLUE	Headlight main beam selected	Dip lights when appropriate
Engine oil low pressure	Fig 2 (2)	RED	Engine oil pressure below 0.7 kgf/cm^2 (10 lbf/in.^{2})	STOP the engine immediately and investigate. Do not restart the engine until the cause is determined NOTE On starting, the light will illuminate until oil pressure builds up

(continued)

TABLE 2 WARNING LIGHT OPERATION (continued)

Warning light and system (1)	Fig No. (2)	Colour of lens (3)	Operating condition - will illuminate when: (4)	Action to be taken (5)
Brake low air pressure	Fig 2 (3)	RED	Brake air pressure dangerously low	STOP the vehicle as soon as possible, using the emergency brake if necessary. All brake system failures must be reported to REME NOTE On starting up the light may illuminate until air pressure builds up
Bilge pump	Fig 2 (4)	ORANGE	Bilge pump No. 1 ON	None
Engine oil high temperature	Fig 2 (6)	GREEN	Engine oil temperature exceeds 120 degrees C (248 degrees F)	STOP the vehicle as soon as possible. Check that the oil pressure gauge (Fig 1 (20)) and coolant temperature gauge (Fig 1 (17)) readings are normal. Allow the engine to idle and the oil to cool
Coolant high temperature	Fig 2 (7)	GREEN	Coolant temperature exceeds 110 degrees C (230 degrees F)	STOP the vehicle and investigate. Check the coolant temperature gauge (Fig 1 (17)) and take the appropriate action
Engine maintenance lights	Fig 2 (8)	CLEAR	Engine compartment lighting ON	Turn off maintenance lights when not in use
Transmission oil high temperature	Fig 2 (9)	GREEN	Transmission oil temperature exceeds 140 degrees C (284 degrees F)	Check the coolant temperature gauge (Fig 1 (17)). If coolant gauge readings are acceptable, either change to a lower gear to allow the engine to idle until the oil cools. DO NOT stop the oil circulating through the heat exchanger

Central warning lights

4 The CWL system comprises four warning lights, two CWLs (Fig 1 (12)) and (Fig 2 (5)) located in the crew compartment and two CWLs (Fig 3 (1) and (6)) mounted externally. The lights will illuminate when a warning condition occurs in one or more of the following systems:

4.1 Engine low oil pressure.

4.2 Engine high oil temperature.

4.3 Engine coolant high temperature.

4.4 Transmission oil high temperature.

4.5 Brakes low air pressure.

4.6 Fan pack boost pressure low.

4.7 Hydraulic oil level low.

4.8 Steer unit oil level low.

4.9 Coolant level low.

NOTE

The external lights do not operate when the vehicle lighting switch is in the convoy position.

Action to be taken when the central warning lights illuminate

5 If the CWL illuminates during driving/operating, STOP the vehicle and identify the system at fault by means of the normal instruments and warning lights as quickly as possible. Take the appropriate action, depending on the system at fault.

NOTES

(1) When the battery master switch (Fig 1 (14)) is set to ON the CWL will illuminate until the engine is started and the air and oil pressures build up.

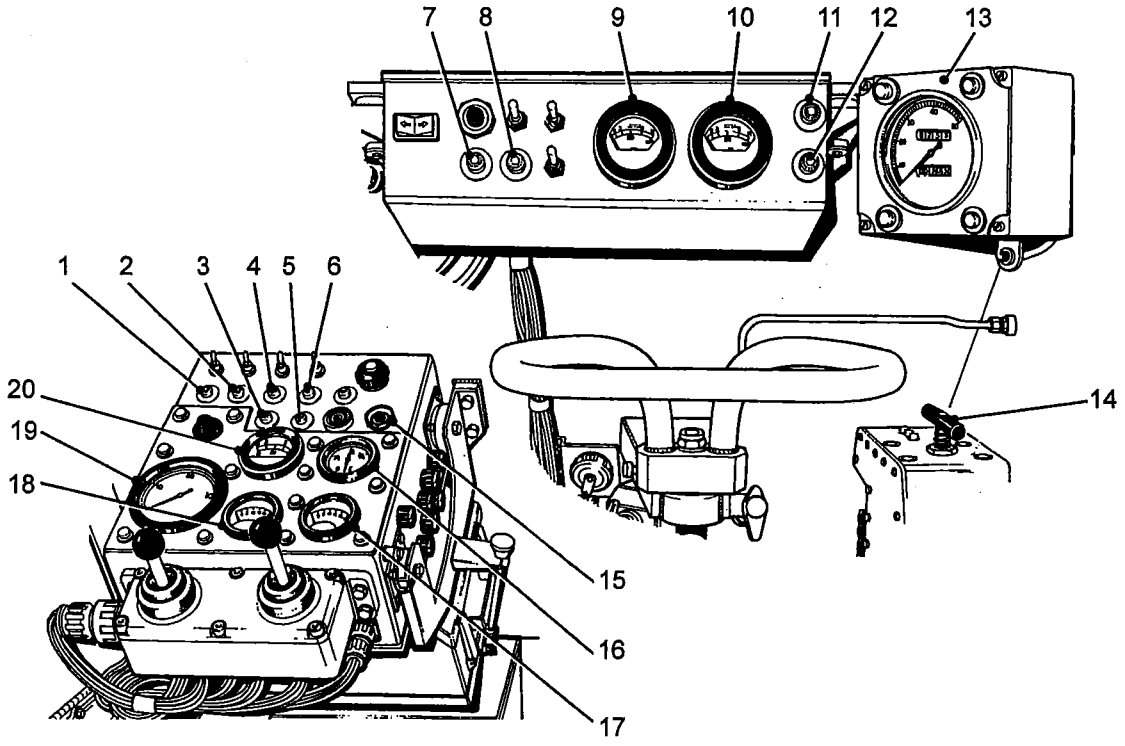
(2) During the engine start up procedure it is important that individual systems are monitored by means of the normal instruments and warning lights in the crew compartment.

DAILY SERVICING AND CHECKS

6 The Maintenance Schedule (Cat 601) details all the servicing and checks to be carried out to the vehicle and detailed instructions covering each task are to be found in the relevant section of this publication (Cat 201). The Maintenance Schedule is the overriding authority on all servicing matters.

STARTING AND STOPPING THE ENGINE

7 Due to the number of systems which are associated with the engine and transfer gearbox it is important to ensure that the control procedure is employed when starting the engine. When the engine has been started, all of the related systems must be correctly monitored to ensure that they are functioning correctly. It is also necessary to observe certain procedures when stopping the engine.



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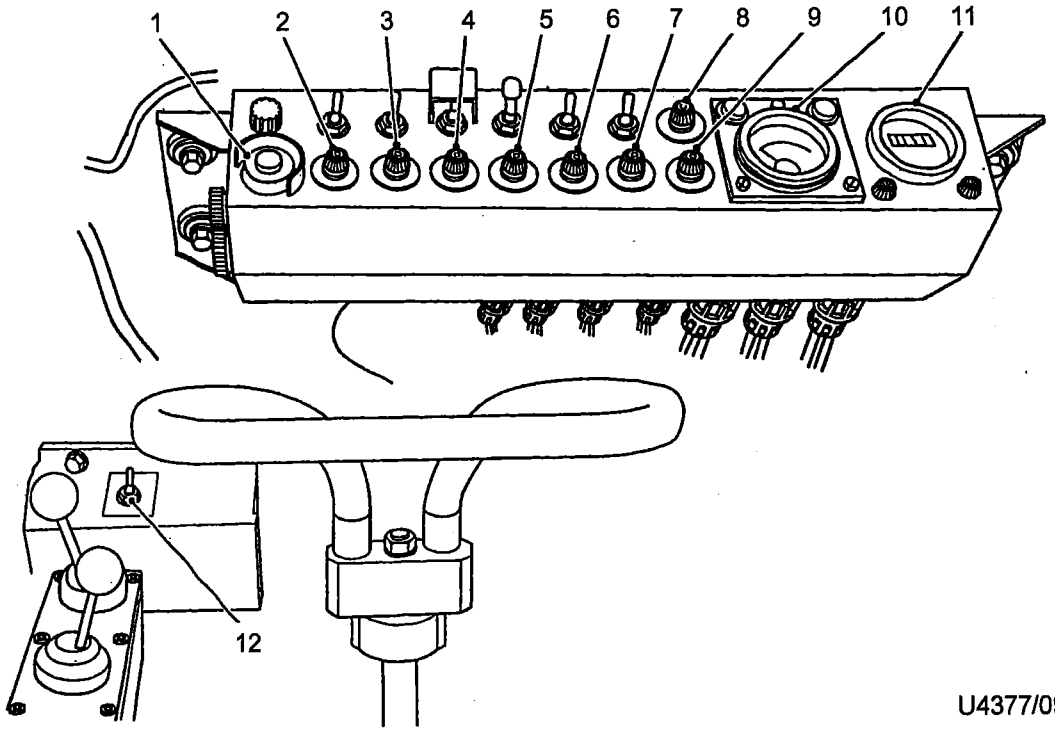
1	Bilge pump No. 1 warning light	11	Generator warning light
2	Bilge pump No. 2 warning light	12	Central warning light
3	Steer unit oil low level warning light	13	Speedometer
4	Hydraulic oil low level warning light	14	Battery master switch
5	Rad fan boost pressure low, warning light	15	Starter button
6	Coolant low level warning light	16	Fuel gauge
7	Turnlights warning light	17	Engine coolant temperature gauge
8	Headlight main beam warning light	18	Transmission oil temperature gauge
9	Steer air pressure gauge	19	Tachometer
10	Brake air pressure gauge	20	Engine oil pressure gauge

Fig 1 Driver's instruments and warning lights



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1 Starter button
2 Engine oil low pressure warning light
3 Brake air low pressure warning light
4 Bilge pump warning light
5 Central warning light
6 Engine oil high temperature warning light
7 Coolant high temperature warning light
8 Engine maintenance lights warning light
9 Transmission oil high temperature warning light
10 Ammeter
11 Hour meter
12 Fire warning test switch

Fig 2 Operator's instruments and warning lights

Pre-start checks

8 Before attempting to start the engine the following checks must be carried out to ensure that:

8.1 All necessary daily servicing tasks have been completed - refer to Para 6.

8.2 The parking brake lever (Fig 5 (15)) has been applied.

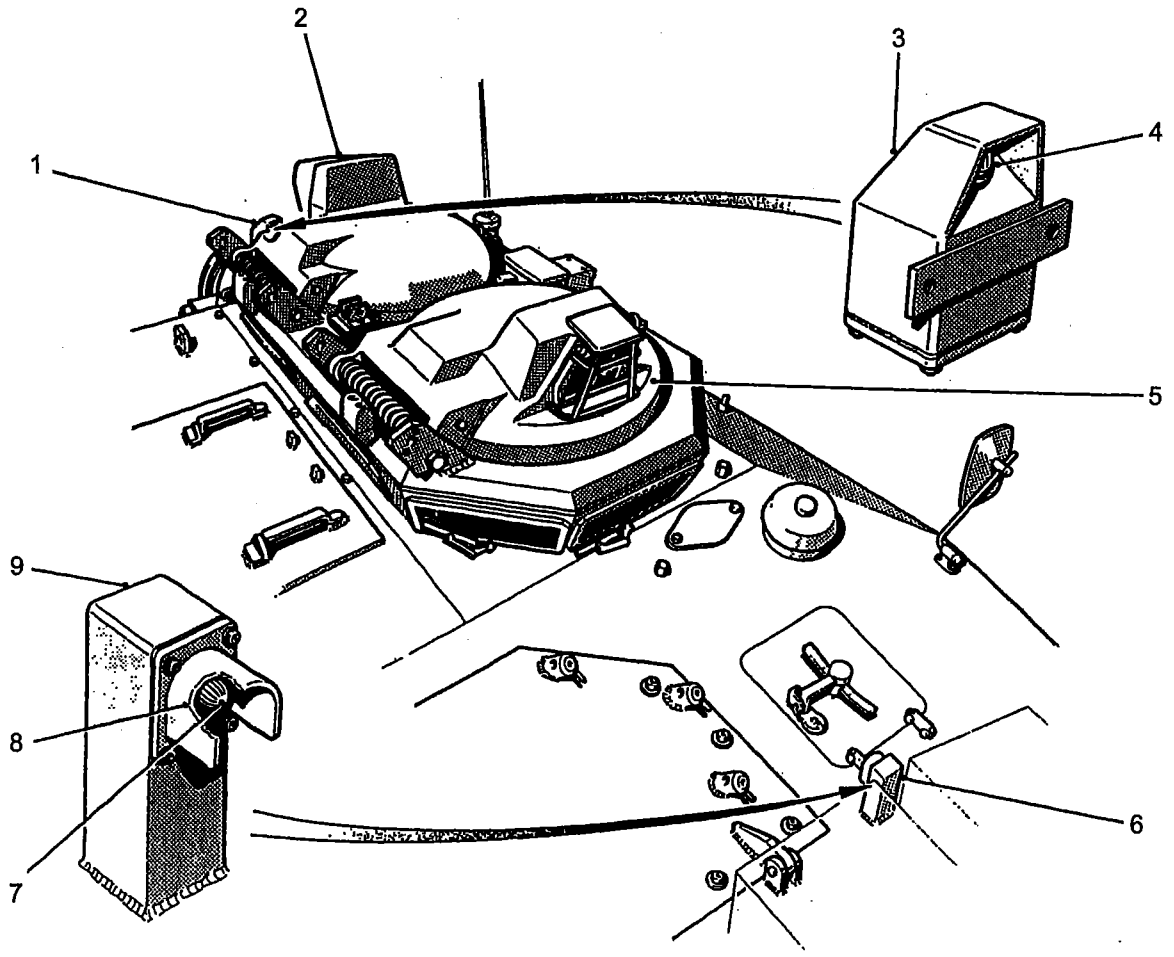
8.3 The emergency brake lever (Fig 4 (13)) is in the OFF position.

8.4 The emergency gear selector lever (Fig 5 (36)) is in the neutral position.

8.5 Both gear selector levers (Fig 7 (1) and (3)) are in neutral.

NOTE

The starter circuit is inoperative when a gear is engaged.



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1 Operator's central warning light
2 Operator's access hatch
3 Housing
4 Lamp and lens
5 Driver's access hatch
6 Driver's central warning light
7 Lamp and lens
8 Hood
9 Support bracket

Fig 3 External central warning lights

8.6 The bucket control levers (Fig 5 (29) and (30)) are in their normal neutral positions, locked.

8.7 The winch control levers (Fig 4 (24), (25) and (26)) are in their neutral positions, pinned.

8.8 The hand accelerator control (Fig 5 (12)) is in the 'off' (uppermost) position.

8.9 All electrical controls are in the OFF position.

NOTE

With the radiator fans disconnect switch, on the driver's instrument panel, in the 'up' (OFF) position the fans will run when the coolant has warmed up.

8.10 The engine stop control (Fig 4 (15)) is pushed fully in.

Normal starting

9 In normal conditions start the engine as follows:

9.1 Carry out the pre-start checks (refer to Para 8).

9.2 Set the battery master switch (Fig 4 (10)) to ON.

9.3 Check that all four CWLs are illuminated.

9.4 Check that the engine oil pressure warning light (Fig 2 (2)) and generator warning light (Fig 1 (11)) are illuminated.

9.5 The brake, air low pressure warning light (Fig 2 (3)) will also illuminate if the vehicle has been standing and the air pressure has dropped.

9.6 Check the fuel gauge (Fig 1 (16)) registers.

9.7 Press to test all remaining warning lights.

9.8 Set on the fuel pump to ON.

9.9 Press the starter button (Fig 1 (15)) or (Fig 2 (1)). Release the button immediately the engine starts. If the engine fails to start after 5 or 6 seconds release the starter button and wait for at least 10 seconds before operating the starter again.

9.10 Check that the engine oil pressure and generator warning lights extinguish as engine speed increases. Allow the engine to run at approximately 1000 rev/min for about five minutes to raise the temperature of the engine and enable air pressure to build up.

9.11 Check that no warning lights are illuminated, that the ammeter is showing a positive rate of charge and that all other instrument readings are normal.

Starting the engine from cold

CAUTION

EQUIPMENT DAMAGE. On no account must the transmission disconnect clutch lever be operated with the engine running.

10 When starting the engine from cold in ambient temperatures of -7 degrees C to +7 degrees C (20 degrees F to 45 degrees F) use the following sequence:

10.1 Carry out the pre-start checks (refer to Para 8).

10.2 Remove the locking pin and move the transmission disconnect clutch lever (Fig 4 (16)) to the disengaged position and lock with the pin.

10.3 Start the engine, using the normal procedure (refer to Para 9).

10.4 Allow the engine to run for a few minutes to allow the oil to warm up.

10.5 Stop the engine and re-engage the transmission disconnect clutch lever.

10.6 Check that the clutch lever is correctly engaged and that the locking pin is in place. Re-start the engine.

Starting the engine in extreme cold

CAUTIONS

(1) EQUIPMENT DAMAGE. The cold start pump should not be operated unless the engine is being rotated by the starter motor. Severe damage may be caused if cold start fluid is pumped into the induction manifold of a stationary engine.

(2) EQUIPMENT DAMAGE. On no account must the transmission disconnect clutch lever be operated with the engine running.

11 When operating in conditions of extreme cold it is better to run the engine at frequent intervals, if tactical conditions permit, than to allow the complete installation to cold soak to the low ambient temperature. To start the engine from cold in ambient temperatures of -18 degrees C to -7 degrees C (0 degrees F to 20 degrees F) use the following sequence:

11.1 Check that the cold starting aid reservoir contains sufficient fluid.

11.2 Carry out the pre-start checks (refer to Para 8).

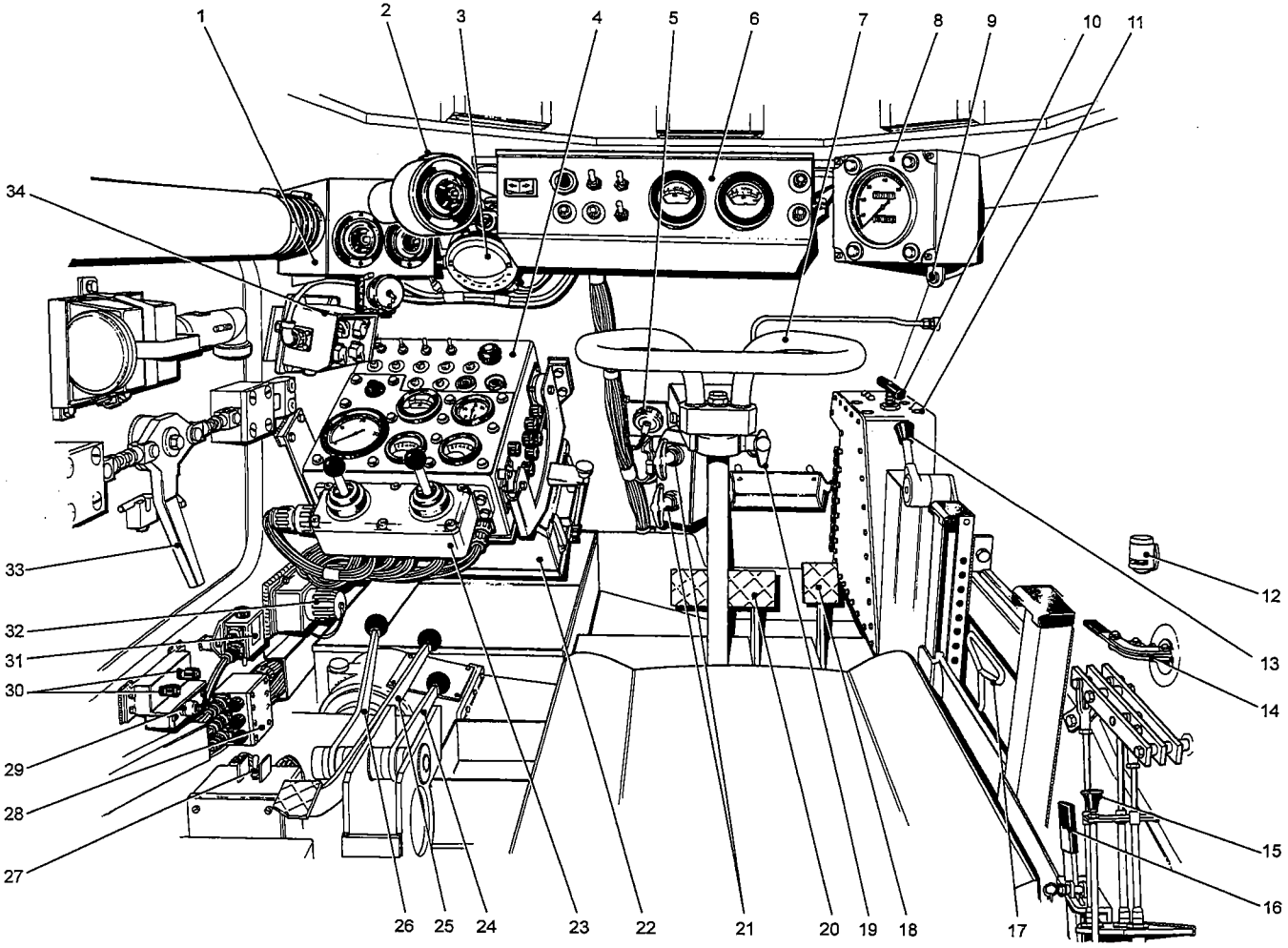
11.3 Remove the locking pin and move the transmission disconnect clutch lever to the disengaged position and lock with the pin.

11.4 Start the engine, using the normal procedure (refer to Para 9) but at the same time as operating the starter button, pump the cold starting aid pump handle (Fig 4 (19)). Continue pumping until the engine fires, it should fire within a few seconds. If the engine falters, having just commenced to run, further operation of the pump will restore smooth running.

11.5 Allow the engine to run for a few minutes to allow the oil to warm up.

11.6 Stop the engine and re-engage the transmission disconnect clutch.

11.7 Check that the clutch is correctly engaged and that the locking pin is in place. Re-start the engine.



1 Diffuser box
2 Python harness aperture
3 Interior light
4 Driver's instrument panel
5 Inspection light socket
6 Driver's road warning instrument panel
7 Steering column
8 Speedometer
9 'Trip' reset knob
10 Battery master switch
11 Distribution panel
12 Air restriction indicator
13 Emergency brake lever
14 Flooding valve
15 Engine stop control
16 Transmission disconnect clutch lever
17 Height adjuster, driver's seat
18 Accelerator pedal
19 Cold starting aid pump handle
20 Brake pedal
21 Fire extinguisher operating handles
22 Night sight stowage
23 Gear selector switch-box
24 Winch gear change lever
25 Pay-out/winch-in control lever
26 High speed pay-out/winch-in control lever
27 Driver/operator select switch
28 Junction box
29 Demolition microswitch
30 Demolition terminals
31 Heated clothing switch-box
32 Inter-vehicle socket
33 Emergency door release handle
34 Crew box - 2 radio

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Fig 4 Controls and instruments (crew compartment - front)

1 Crew box - 2 radio
2 Steering column
3 Washer reservoir filler
4 Fire warning horn
5 Operator's instrument panel
6 Thermos flask
7 Accelerator pedal
8 Interior light
9 Radio
10 Diffuser box
11 Antenna tuning unit
12 Hand operated accelerator control
13 Steer changeover lever
14 Suspension lock control lever
15 Parking brake lever
16 Map reading light
17 Test/fire box
18 Cooker socket
19 Hand held fire extinguisher (BCF)
20 Cooker stowage tray
21 First aid box
22 Smoke discharger firing buttons
23 NBC control box
24 Fire warning light
25 Air cooling control box
26 'Blackout' stowage
27 Winch holding brake lever
28 Operator's winch control lever
29 Bucket raise/lower lever
30 Bucket crowd/dump lever
31 Bucket controls locking lever
32 Drain valve
33 Brake pedal
34 Spares box, lamps and fuses
35 Interconnecting box - 3 radio
36 Emergency gear selector lever
37 Disconnect pedal
38 Gear selector switch-box
39 Firewire control box

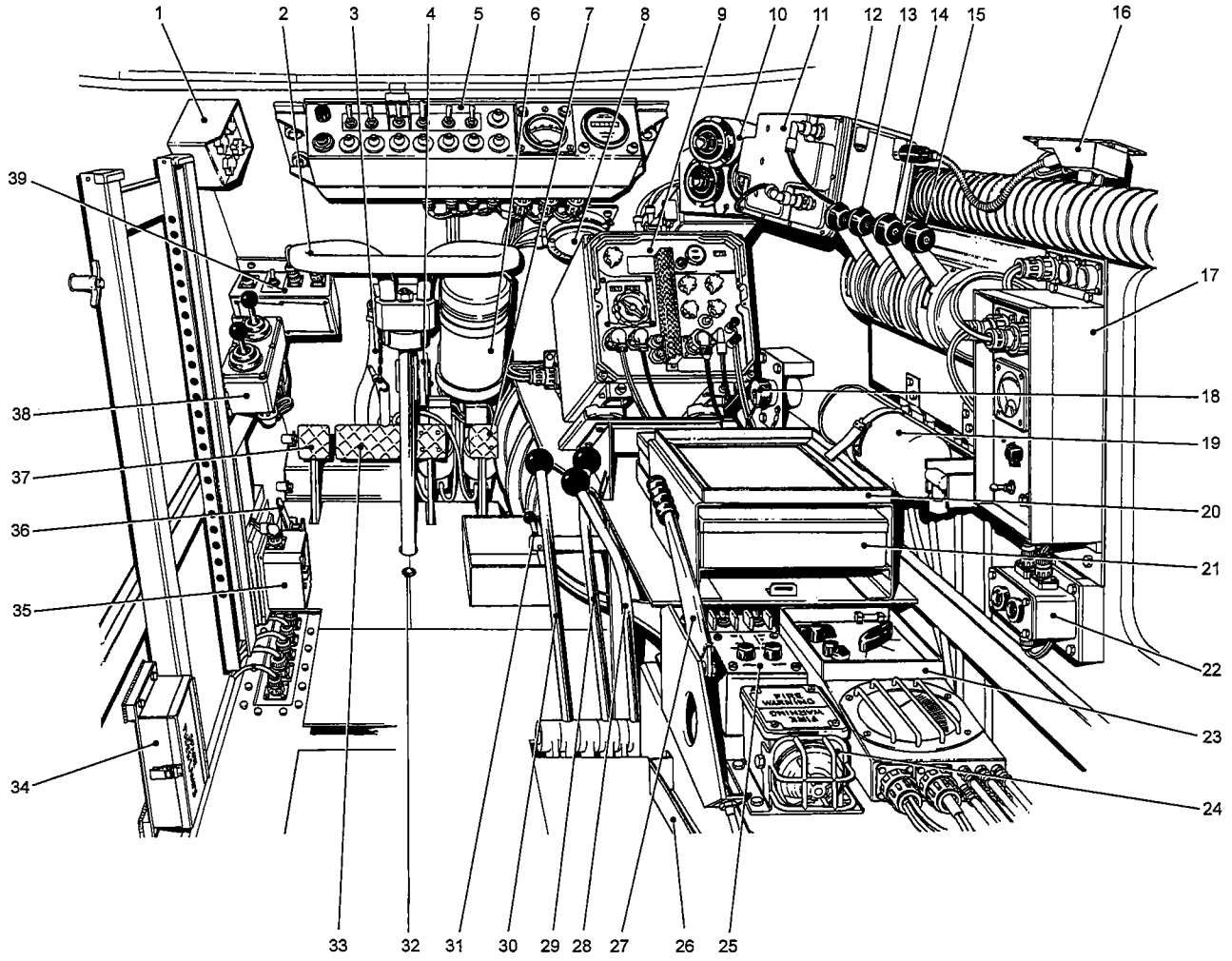

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Fig 5 Controls and instruments (crew compartment - rear)

Starting with the batteries discharged

WARNING

PERSONNEL INJURY. THE INTER-VEHICLE CONNECTING SOCKET IS LIVE WHEN THE BATTERY MASTER SWITCH IS ON. THE SOCKET COVER MUST ALWAYS BE FITTED DURING NORMAL OPERATIONS.

12 If the batteries are partially discharged the engine may start if the transmission disconnect clutch is disengaged - use the procedure detailed in Para 10. If sufficient power is still not available to turn the engine, electrical power may be utilized from a similar vehicle, using the inter-vehicle cable. Proceed as follows:

12.1 Position another vehicle, with fully charged batteries, close alongside.

12.2 Ensure that the battery master switches on BOTH vehicles are in the OFF position.

12.3 Connect the inter-vehicle cable (stowed item) to the inter-vehicle socket (Fig 4 (32)) of each vehicle.

12.4 Carry out the pre-start checks (refer to Para 8).

12.5 Put BOTH battery master switches to the ON position. Start the assisting vehicle before switching on the master switch of the other vehicle, and bring the generator on line.

12.6 Start the casualty engine using the appropriate method depending on the climatic conditions (refer to Paras 9, 10 or 11).

12.7 Run the engine at approximately 1000 rev/min by setting the hand throttle.

12.8 Stop the assisting vehicle engine and put its battery master switch to the OFF position.

12.9 Disconnect the inter-vehicle cable from operating vehicle first - and then from the assist vehicle. Stow the cable.

12.10 Refit slave socket covers on both vehicles.

12.11 If the problem persists seek REME assistance.

To stop the engine

13 It is important to observe certain precautions when stopping the engine, especially when the vehicle has been operating for some time and the engine is hot. The procedure for stopping the engine is intended to prevent 'hot spots' developing in the various systems and to protect the turbocharger. To stop the engine, proceed as follows:

13.1 Bring the vehicle to rest and apply the parking brake.

13.2 Move the gear levers, at both crew positions, to NEUTRAL.

13.3 Ensure that all winch and bucket controls are in the NEUTRAL position.

13.4 When the engine is hot, allow it to run at about 800 rev/min for at least 3 minutes before stopping. This allows the coolant temperature to fall and the cooling fans and turbocharger to slow down.

13.5 Pull the engine stop control (Fig 4 (15)) upwards and hold it in this position until the engine stops. Ensure the control returns to the OFF position. DO NOT 'blip' the accelerator when shutting down the engine as this will cause a sudden speeding up of the turbocharger and could result in reduced turbocharger life.

13.6 Immediately after stopping the engine check the temperature gauges and warning lights. If an appreciable temperature rise is apparent - start the engine and allow it to idle for several minutes. Stop the engine and re-check the instruments.

13.7 If the bucket is placed on the floor, release oil from the rams by quick operation of all levers.

13.8 If temperature checks are satisfactory turn the battery master switch to OFF.

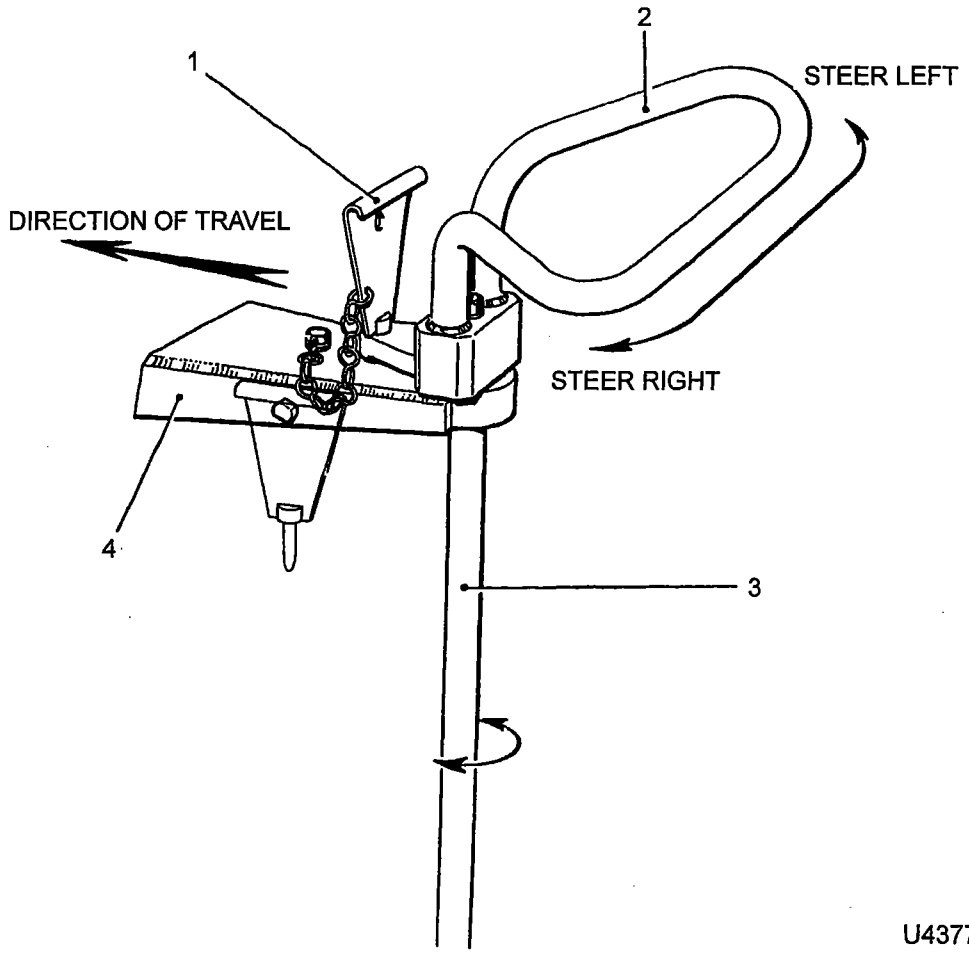
VEHICLE MOVEMENT

Steering

Controlled differential mode

14 With the controlled differential mode, selected steering takes place by varying the speed of the tracks in relation to each other. This mode is always used for road driving.

15 Movement of the steering column (Fig 6) should be as positive as possible to avoid excessive slipping of the brakes, which can cause wear and overheating. At the same time, snatching should be avoided, as this will cause the vehicle to swing in a manner dangerous to other road users.



1 Locking pin (shown in position)
2 Tiller
3 Column
4 Support bracket

Fig 6 Steering column

Clutch/brake mode

WARNINGS

(1) PERSONNEL INJURY. CLUTCH/BRAKE (SKID STEER) MODE OF STEERING MUST NEVER BE USED FOR HIGH SPEED CROSS-COUNTRY DRIVING OR WHEN DRIVING ON THE ROAD. THE STEERING ACTION IN THIS MODE IS VIOLENT IF USED AT SPEED AND MAY CAUSE INJURY TO THE CREW AND DAMAGE TO THE VEHICLE.

(2) PERSONNEL INJURY. BEFORE DRIVING OFF, THE CREW MEMBER IN CONTROL MUST ENSURE THAT HIS STEERING COLUMN LOCKING PIN IS WITHDRAWN AND THAT THE LOCKING PIN IN THE OPPOSITE CREW POSITION IS IN PLACE.

16 When clutch/brake (skid steer) is selected, steering is effected by disconnecting the drive from, and applying a brake to, the track on the inside of the intended turn.

17 This method of steering is used when very tight turns are required.

Braking

Main brakes

18 The main brakes are applied by means of the pedals at each crew position (Fig 4 (20)) and (Fig 5 (33)). The action of the brakes is progressive and does not affect the vehicle steering.

Emergency brake

CAUTION

EQUIPMENT DAMAGE. The emergency brake must not be used as a parking brake by leaving the control lever in the ON (rearmost) position; in time the air will leak away and the brakes will release.

19 The emergency brake lever (Fig 4 (13)) may be used to bring the vehicle to a halt if the brake air system fails. The brake operates progressively, utilizing air from the steer air system.

Parking brake

20 The parking brake lever (Fig 5 (15)) controls a mechanism to lock the main brake in the on (applied) position. The vehicle cannot be slowed or stopped by means of this control.

21 Half pressure must be applied to a main brake pedal before the lever is operated to apply the parking brake. Full pressure must be applied to a main brake pedal to release the parking brake.

Use of the gearbox

WARNING

PERSONNEL INJURY. DO NOT ALLOW THE VEHICLE TO FREE WHEEL IN NEUTRAL AS CONTROL OF THE VEHICLE BECOMES DIFFICULT ONCE MOMENTUM HAS BUILT UP.

CAUTIONS

(1) EQUIPMENT DAMAGE. When the vehicle is stationary do not attempt to engage any gear if the engine speed exceeds 1000 rev/min. This could result in damage to the torque converter.

(2) EQUIPMENT DAMAGE. Do not move the driver/operator select switch or either forward/reverse lever when the vehicle is in motion.

(3) EQUIPMENT DAMAGE. Before attempting to move the vehicle, the position of the driver/operator select switch should be checked to ensure that the appropriate control position is selected.

(4) EQUIPMENT DAMAGE. At the start of each working day with the vehicle stationary and the engine running, select 1st and 2nd gears sequentially holding each gear for at least 3 seconds, repeating 20 times for each gear.

(5) EQUIPMENT DAMAGE. When selecting forward/reverse, the engine must be allowed to idle to enable the correct engagement to take place within the transfer gearbox.

(6) EQUIPMENT DAMAGE. Do not allow the vehicle to freewheel in neutral as damage to the gearbox may occur.

22 When the driver/operator select switch (Fig 7 (5)) is moved to the appropriate position, complete control of the gearbox is made available to the crew position selected. The gear selection controls at each crew position are identical in operation but it must be remembered that when travelling rearwards (bucket first) speed of advance in all gears is half that available when travelling forward.

23 When driving, the following points should be considered:

23.1 In general it is better to keep the vehicle in a gear which allows the engine to run at speeds between 1600 and 2100 rev/min, than to maintain drive in too high a gear. As a guide, depression of the accelerator pedal should always be capable of producing some vehicle acceleration even on a hill. If no acceleration is detectable the next lower gear should be selected.

23.2 To change to a higher gear, release the pressure from the accelerator pedal, select the required gear and re-apply pressure to the pedal.

23.3 When changing to a lower gear, bring the gear lever to the neutral position, rev the engine, release the accelerator and select the required gear.

To engage an emergency gear

24 Before engaging an emergency gear, select neutral on both gear selector switch-boxes (4) and (6). Check all accessible electrical connectors to ensure that they are tight and inspect the fuse (F8) on the distribution panel. If normal gear selection is still not possible, proceed as follows:

24.1 Select neutral in ALL electrical gear controls.

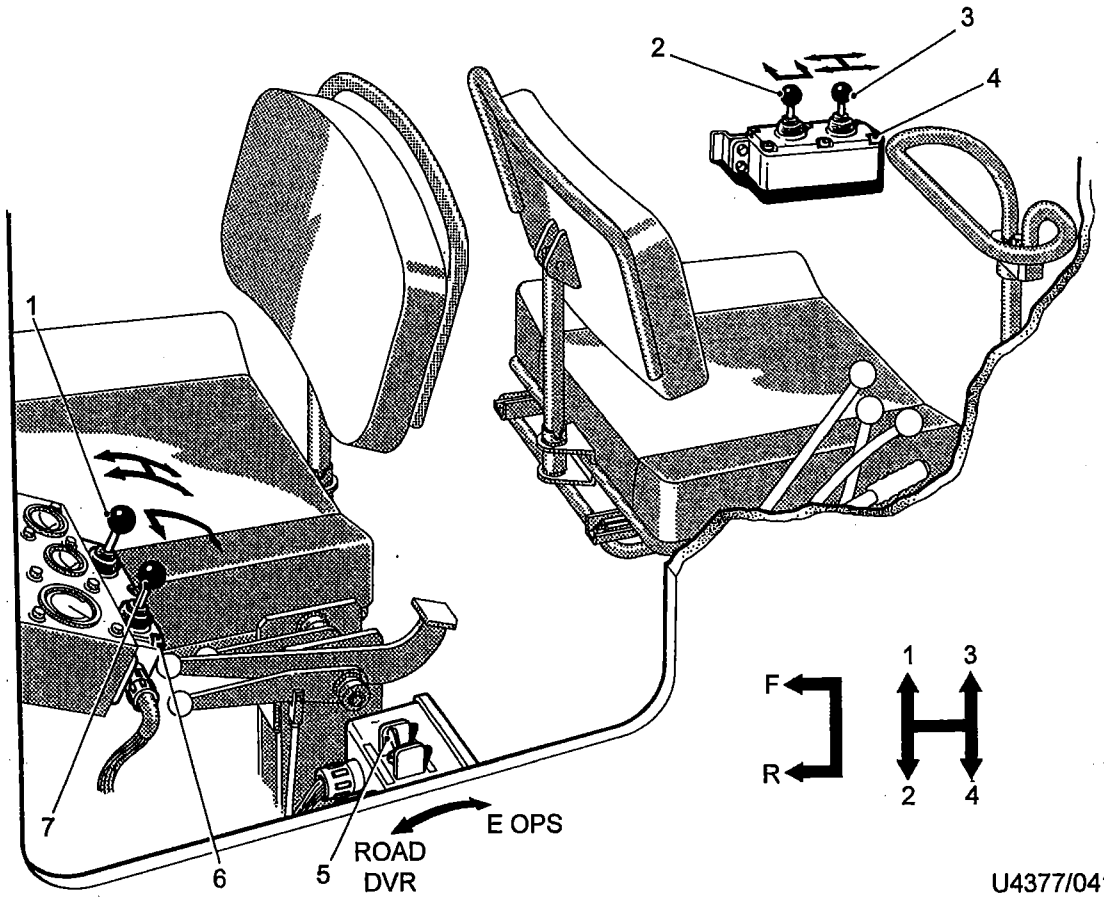
24.2 With the engine running at idling speed remove the retaining pin and move the emergency gear selector lever (Fig 5 (36)) forward - to engage 2nd forward gear; rearwards - to engage 3rd reverse gear.

24.3 Replace the retaining pin to hold the lever in the selected position.

Checks before moving off

25 It is assumed that all necessary servicing and checks have been carried out in accordance with the details in Paras 6 and 7 and that the engine is running satisfactorily. Carry out the following checks:

25.1 Raise the bucket to the travel position. If the vehicle is to travel on the road, fit the bucket travelling locks. For cross-country, raise the bucket fully.



1 Driver's gear selector lever
2 Operator's forward/reverse lever
3 Operator's gear selector lever
4 Operator's gear selector switch-box
5 Driver/operator select switch
6 Driver's gear selector switch-box
7 Driver's forward/reverse lever

Fig 7 Gear selection controls

25.2 If the vehicle is to be used on the public road, ensure that the correct lighting arrangement is fitted to the bucket.

25.3 Check that the winch rope is fully wound in and that the winch control levers are at neutral and secured.

25.4 Check and adjust driving mirrors, if in use.

25.5 Check that the locking pin (Fig 6 (1)) is withdrawn from the tiller (2) in use and that the tiller in the opposite crew position is securely locked.

25.6 Move the steer changeover lever (Fig 5 (13)) to the required position, for the selected mode of operation. Either:

25.6.1 CONTROLLED DIFFERENTIAL (ROAD DRIVE) - for the high mobility role and most normal driving

OR

25.6.2 CLUTCH/BRAKE (SKID STEER) - for tight turning and skid steering, at low speed

NOTE

The suspension will only be locked when the vehicle is engaged in some earth moving operations, negotiating steep inclines and river exits, using the lifting attachments and when laying CLASS 70 or CLASS 30 trackway.

25.7 Check that the driver/operator select switch (Fig 7 (5)) is in the correct position for the crew member in control.

25.8 Check that the brake air pressure gauge (Fig 1 (10)) indicates at least 4.2 kgf/cm^2 (60 lbf/in.^{2}).

25.9 Check that the steer air pressure gauge (9) indicates at least 5.6 kgf/cm^2 (80 lbf/in.^{2}).

To move off

26 The procedures for moving off is the same if the vehicle is being driven by the operator or the driver.

26.1 Move the forward/reverse lever (Fig 7 (2) or (7)) towards the desired direction of travel.

26.2 Engage 1st gear.

26.3 Apply the main brakes and release the parking brake.

26.4 Release the main brakes and accelerate gently.

26.5 Change gear smoothly to suit the engine speed and desired speed of advance. Do not 'jump' gears, use each gear in the correct sequence for at least a few seconds to obtain optimum performance.

26.6 While the vehicle is moving slowly, steer slightly left and right to ensure that the steering is responding correctly and also check that the main brakes are working efficiently.

To bring the vehicle to rest

CAUTION

EQUIPMENT DAMAGE. Irrespective of the gear that is engaged, the gear lever MUST NOT be moved into neutral until the vehicle is at rest and the parking brake has been applied. Allowing the vehicle to freewheel may result in damage to the gearbox.

27 To bring the vehicle to rest, proceed as follows:

27.1 Release the pressure on the accelerator pedal and change down accordingly, applying the main brakes as required.

27.2 Change down to second or first gear before bringing the vehicle to a halt.

27.3 When the vehicle is at rest, apply the parking brake.

27.4 Move the gear lever to neutral.

NOTE

Stopping the vehicle in 3rd/4th gear will result in the engine stalling.

Cross-country driving

28 When driving across country, adjust the speed of the vehicle to suit the terrain, changing gear as necessary to maintain optimum engine speeds.

29 Select the controlled differential mode of steering when travelling at relatively high speeds and, if necessary, change to skid steer to assist when negotiating obstacles.

30 When climbing steep banks, with the vehicle travelling forwards, lock the rear suspension dampers. This will prevent the track fouling the track guard as the suspension deflects. Lock the suspension before starting up the bank, while the vehicle is on level ground.

Driving on the road

31 The vehicle is designed to travel on the road, forwards, with the driver in control and the operator as commander.

32 Before travelling on public roads, fit the bucket travelling locks, the teeth guards and transfer the full rear lighting arrangement to the bucket edge. It is essential to ensure that the lighting at the rear of the vehicle complies with the legal requirements before driving on public roads.

33 Two driving mirrors are provided and these should be fitted on the mounting brackets installed for the driver's use.

TOWING

34 The Combat Engineer Tractor (CET) may be used for towing a variety of trailers or construction plant. All towing is undertaken with the vehicle travelling in reverse (bucket first) because there is no provision for attaching a towed load to the rear of the vehicle. Travelling in reverse restricts the speed of advance when towing to half the normal forward speed in each gear.

Towing from the general service tow hook

35 The general service tow hook (Fig 8 (4)) is a rotatable pintle hook suitable for most towing operations providing that the maximum required pull does not exceed 5.1 tonnes (5 tons).

36 If the pull required exceeds the maximum allowed for this hook, or the drawbar height is unsuitable, it may be an advantage to use the plant tow hook.

Towing from the plant tow hook

37 The plant tow hook (5) is a jaw and pin type of hook which may be used for towing trailers or construction plant where the maximum required pull does not exceed 10.2 tonnes (10 tons). The hook is detachable and when not in use is stowed on the exterior of the bucket.

38 Before using the plant tow hook, check that it is properly secured to the hull mounting and that all four bolts are torqued to the correct figure. During deep wading or river operations, the hook should be removed and replaced by the blanking plate provided. This reduces drag considerably when negotiating muddy banks.

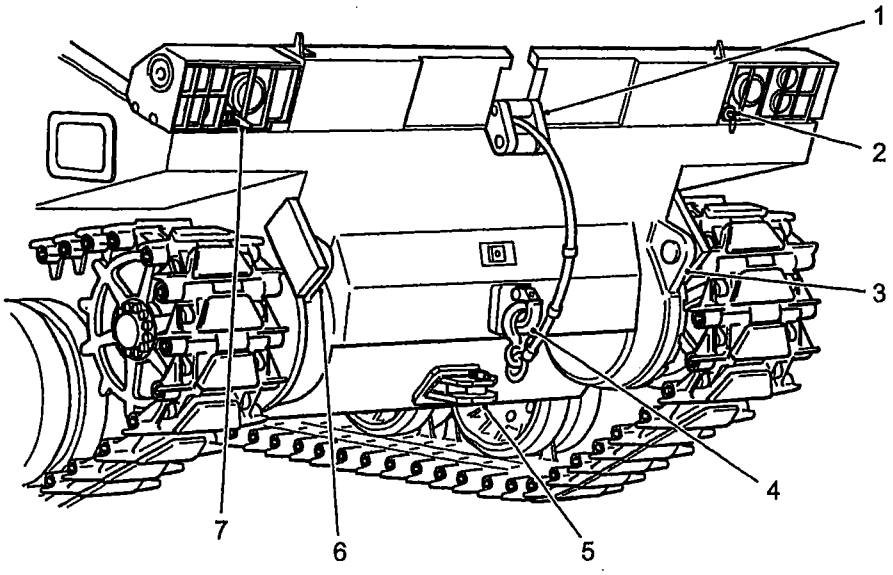
Towing trailers with air brakes

39 The CET is NOT equipped to make use of the two or three line braking systems installed on many service trailers.

40 If it is necessary to tow a trailer which has spring activated air brakes, the external air connection (Fig 8 (7)) on the vehicle may be used to provide a means of releasing the brakes for towing. When the trailer has been coupled to the appropriate tow hook the SERVICE line hose of the trailer braking system is connected to the external air connection and the air supply turned ON, using the cock in the transmission compartment. Providing the vehicle air system pressures are 'normal' the brakes will be released.

Trailer lighting

41 No legal lighting arrangement exists on the vehicle which will satisfy the necessary regulations for towing on public roads.



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1 Winch fairlead (front)
2 Trailer lighting socket
3 Lifting/recovery eye
4 General service tow hook
5 Plant tow hook (detachable)
6 Lifting/recovery eye
7 External air connection

Fig 8 Towing equipment

42 Full trailer rear lighting can be obtained by connecting the trailer lighting cable to the socket (2). Limited vehicle lighting can be achieved by exchanging the sidelight lenses with those on the rear lights, making use of the spotlight at the operator's position.

Towing the Combat Engineer Tractor

43 If the vehicle is immobilised it may be towed for a maximum distance of 32 km (20 miles) without special preparation at a speed not exceeding 24 km/h (15 miles/h).

44 It must be remembered that when the vehicle is without power the main and emergency braking systems will be inoperative due to lack of air pressure. If the vehicle has been parked with the parking brake 'on', an external air source may be necessary to operate the main brakes and so release it.

45 The vehicle should always be towed using a suitable rigid attachment, fitted to the lifting/recovery eyes (3) and (6) at the front of the hull.

CHAPTER 2-11-2

TRACKWAY LAYING

CONTENTS

GENERAL

1 The Combat Engineer Tractor (CET) can carry and lay Class 30 or Class 70 trackway using equipment which forms part of the vehicle's Complete Equipment Schedule (CES) (refer to Cat 741). The trackway is tightly rolled and carried in the bucket.

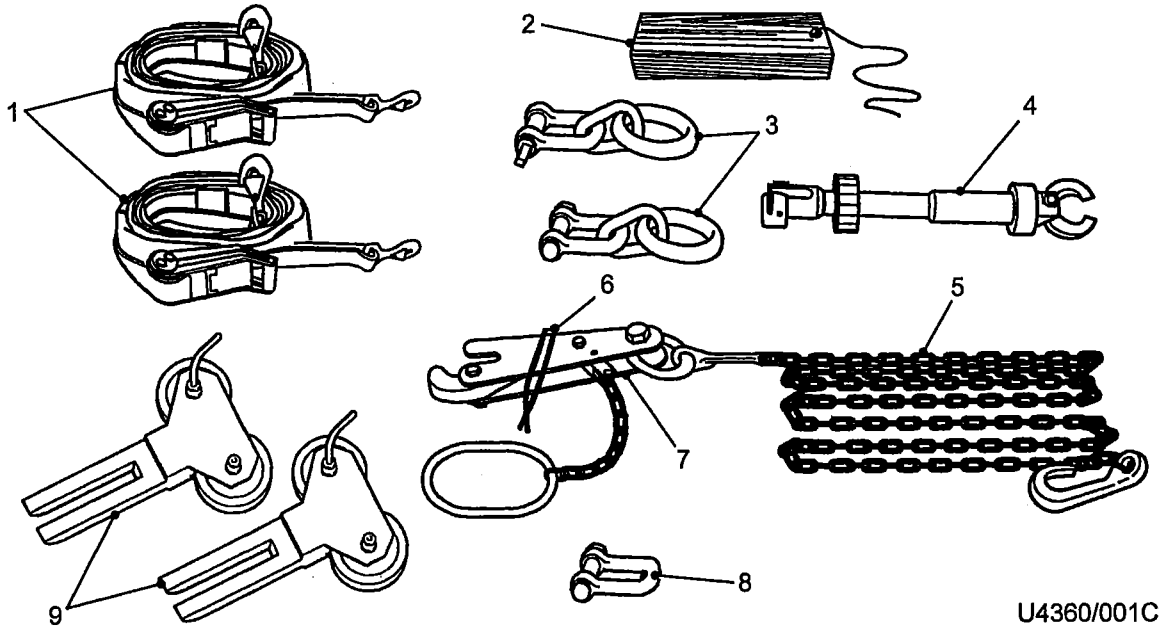
2 Laying the trackway may be carried out 'closed down' under battlefield conditions. The operation is controlled by adjusting the angle of the bucket and by using the winch to actuate a quick release mechanism.

3 The trackway will be supplied from Engineer Resources. The Class 70 which is normally used with CET, is 4.5 m (14.7 ft) wide and in an 18 m (59 ft) length. Class 30 may be laid under special circumstances but requires special preparation and can only be laid upside down. The Class 30 is 4.5 m (14.7 ft) wide and in a 35 m (114.8 ft) length.

4 The following instructions apply only to Class 70 trackway, which may be required to improve river crossing exits, tracks and the approaches to bridges.

TABLE 1 EQUIPMENT

Serial (1)	Description (2)	Quantity (3)	Fig 1 Item Ref (4)	Use and position (5)
1	Webbing straps	2	1	Safety strap. Fits over trackway and bucket, one at each end of trackway
2	Timber block 6 x 4 x 2 in.	1	2	Holds chain and tensioner clear of trackway
3	Link assemblies	2	3	Fits between two centre teeth on bucket. Secured using shackle assembly (Serial 8)
4	Quick release coupling (chain tensioner)	1	4	Fits from chain to lug on spill guard and tensions up chain which holds trackway
5	Chain 15 ft, 1000 lbf. Air portability lashing	1	5	Holds trackway in bucket. Fits from release mechanism to tensioner. (Note: End link modified to 1-1/2 in. to fit release mechanism)
6	Shear wire (16 SWG)	A/R	6	Fits in release mechanism
7	Release mechanism	1	7	Release trackway. Fits to shackle assembly. (Note: End link on release chain modified to 1-1/2 in. to fit release mechanism)
8	Shackle assemblies	3	8	One for anchor point for winch rope. Two used to secure link assemblies to bucket
9	Trackway pusher rollers	2	9	Prevent the bucket teeth damaging the trackway



1 Webbing strap and tensioner
2 Timber block
3 Link assembly (shackle assembly (8) attached)
4 Quick release coupling (chain tensioner)
5 Chain
6 Shear wire
7 Release mechanism
8 Shackle assembly
9 Trackway pusher rollers

Fig 1 Layout of trackway equipment

TRACKWAY PREPARATION (Class 70)

WARNING

PERSONNEL INJURY. PROTECTIVE GLOVES MUST BE WORN WHENEVER THE WINCH ROPE IS HANDLED.

5 The trackway should be rolled as tightly as possible and then lashed. In order to ensure that the trackway will unroll along the intended path, when it is laid, the roll should be as neat as possible with the ends flush.

6 Position the rolled trackway on the two suitable baulks of timber which will allow a sufficient gap beneath the roll to enable the winch rope to be passed underneath (refer to Fig 2). It can be loaded with or without Class 70 spool.

VEHICLE PREPARATION

7 Before preparing the vehicle, the bucket must be cleared of any debris or stores, etc.

7.1 Fit the link assembly (Fig 1 (3)) to each of the holes, located between the centre teeth of the bucket, using shackle assembly (8).

7.2 Bring the winch rope across the roof plate and through the rear fairlead. Pay out sufficient winch rope and stow it on the roof plate.

7.3 Place the release mechanism (7), chain (5) timber block (2), quick release coupling (4) and webbing straps (1) to hand ready for use.

7.4 Lock out the suspension.

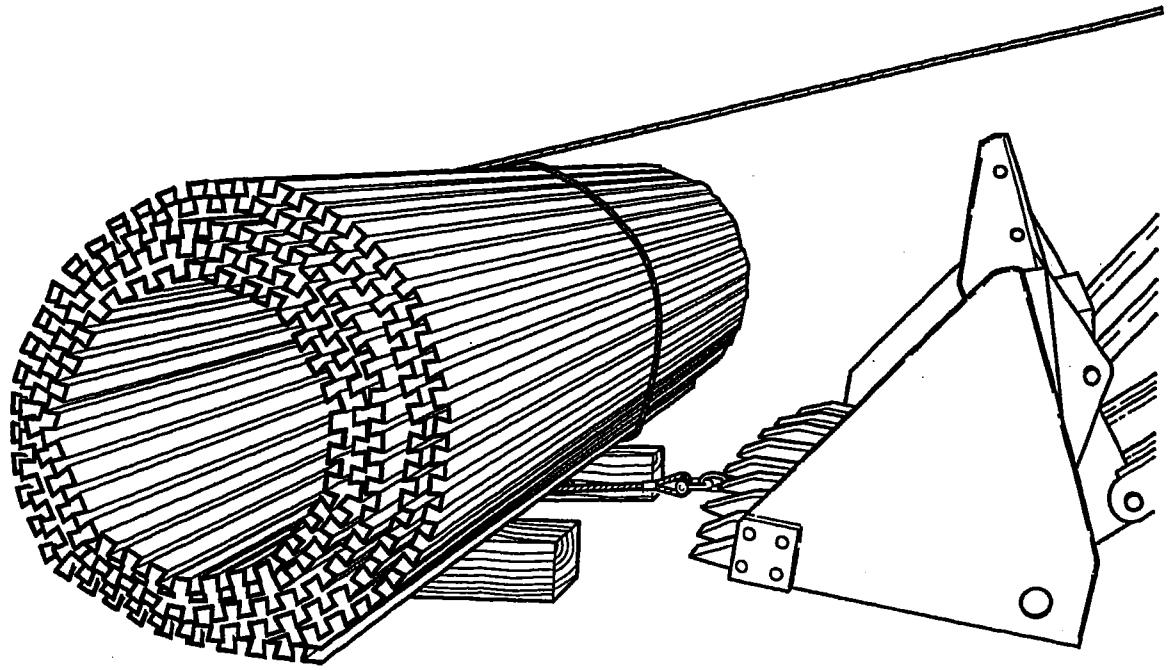


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Fig 2 Loading trackway into the bucket

Loading trackway into the bucket

8 The trackway will normally be loaded from the ground, prepared as detailed in Paras 5 and 6. If necessary, however, it may be loaded from a lorry or trailer of a suitable height.

8.1 Position the bucket, facing the trackway with an equal overhang on each side. Leave a space between the bucket and the trackway of approximately 1 m (3 ft).

NOTE

The leading edge of the trackway must be facing the bucket, at the bottom of the roll (refer to Fig 2). Ensure that the CL70 tensioning straps are at the uppermost edge.

8.2 Pass the winch rope over the trackway and then bring the end under the roll and connect it to the right link and shackle assembly (Fig 4 (4)) as viewed facing the bucket as follows:

8.2.1 Normal winch rope end. Using shackle assembly (8).

8.2.2 Emergency winch rope end. Using safety hook (Fig 4 (A) (3)).

8.3 Winch the trackway into the bucket. The vehicle's position should be adjusted so that when the trackway is in place in the bucket, the leading edge of the trackway is positioned at the bottom of the bucket.

8.4 Secure the trackway using the webbing straps and strap tensioners (Fig 1 (1)). Place the straps around the trackway roll and bucket, in-board of the outermost bucket teeth (Fig 3). The strap tensioner operating handles must be at the rear of the bucket and accessible to the crew.

8.5 Take up the slack in both webbing straps but do not fully tighten.

8.6 Remove the lashings from around the trackway roll.

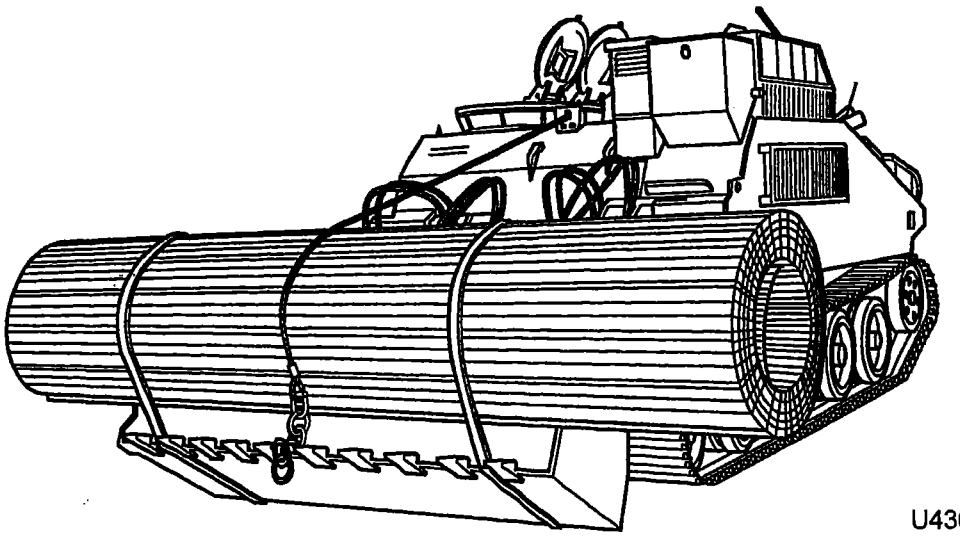

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Fig 3 Trackway secured for travelling

NOTE

The lashings should only be removed when the trackway is in the bucket and the webbing straps are in place but not tightened. Some movement of the bucket and winch rope may be necessary to free the lashings.

8.7 Winch the trackway fully into the bucket and tighten the webbing straps.

To fit the release mechanism and securing chain

9 To fit the release mechanism and securing chain, proceed as follows:

9.1 Fit the quick release coupling (Fig 1 (4)) to the lug on the bucket spill guard. (If fitted prior to the trackway being winched into the bucket, it may foul and cause damage).

9.2 Check that the chain (5) is securely fastened to the release mechanism (7).

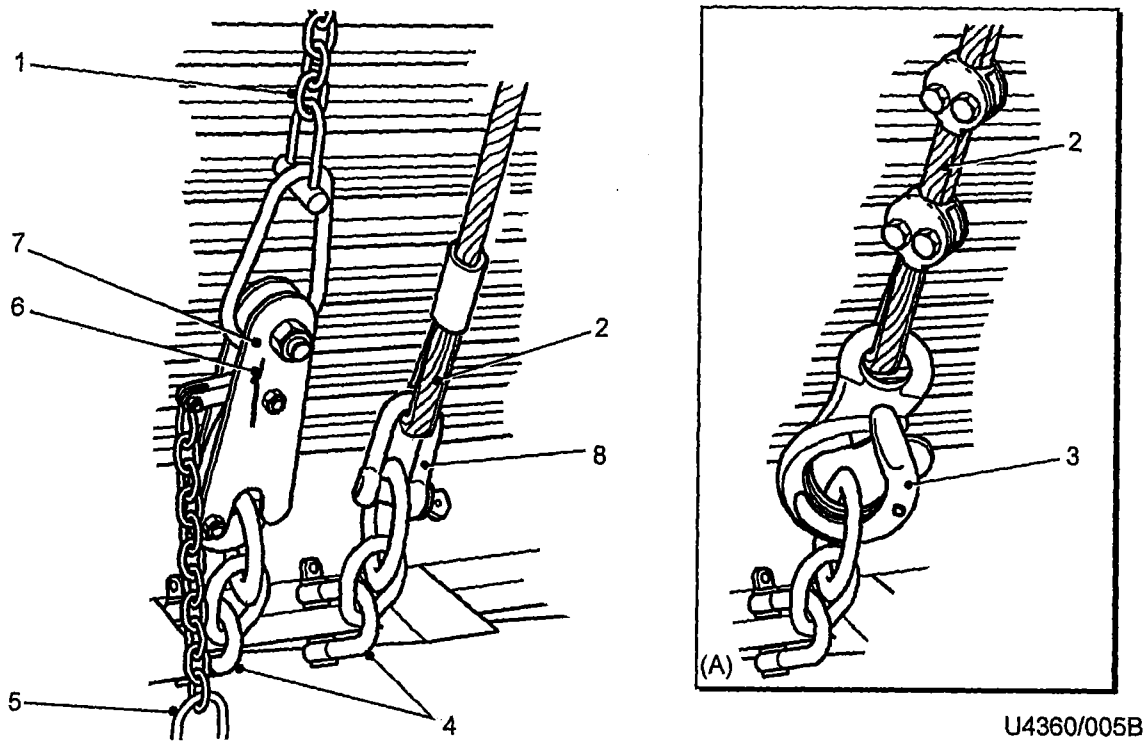
9.3 Connect the release mechanism (Fig 4 (7)) to the left link assembly and shackle assembly (4) (as viewed facing the bucket) with the pull release chain (5) hanging clear.

9.4 Lock the release mechanism by inserting the 16 SWG shear wire (6) through the shear hole.

9.5 Pass the chain (1) over the trackway, pull tight and then connect it to the quick release coupling (Fig 5 (4)).

9.6 Place the timber block (3) under the chain (as shown in Fig 5) near the quick release coupling to prevent the quick release coupling contacting the trackway. Tie the cord from the timber block to the chain. This prevents the block being lost each time a trackway is released.

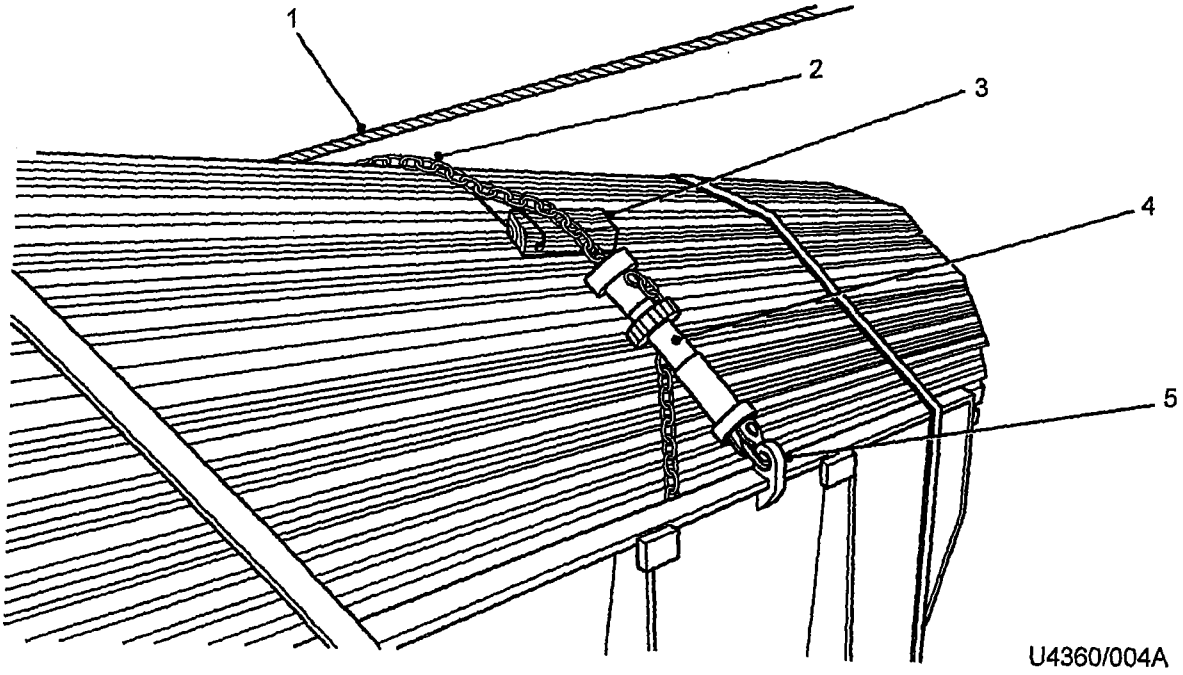
9.7 Tighten the chain fully with the quick release coupling, using the winch to draw the trackway in tightly.



1 Chain
2 Winch rope
3 Safety hook
4 Link assembly and shackle assembly
5 Pull release chain
6 Shear wire
7 Release mechanism
8 Shackle assembly

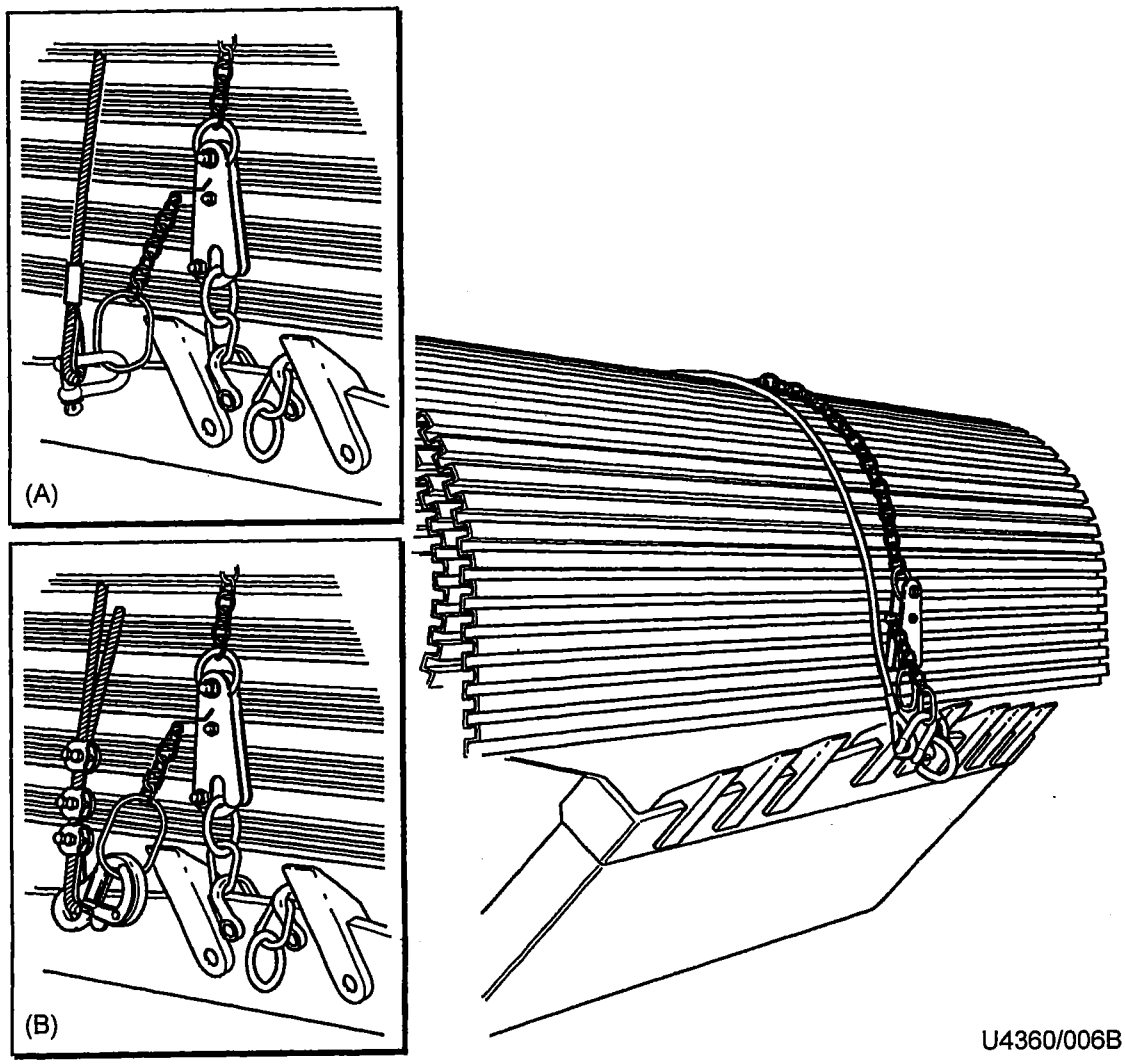
(A) Emergency winch rope end connected to link assembly

Fig 4 Release mechanism



1 Winch rope
2 Chain
3 Timber block (with cord secured to chain)
4 Quick release coupling
5 Lug

Fig 5 Position of quick release coupling



(A) Normal winch rope end connected to pull release chain

(B) Emergency winch rope end connected to pull release chain

Fig 6 Trackway ready for laying

9.8 Slacken the winch rope sufficiently to enable the bucket to be raised. Check the webbing straps are as tight as possible.

NOTE

Trackway pusher rollers must be fitted on the bucket to prevent the teeth damaging the trackway (Fig 9).

9.9 Raise the bucket and fit the travelling locks, tube assemblies, tie bars and trackway pusher roller assemblies. The vehicle is now ready to travel to the area of operation.

To lay trackway

Action in the final preparation area

10 The following actions are to be carried out in the assembly area:

10.1 Check that the release mechanism (Fig 4 (7)) and chain (1) are secure. Tighten if necessary.

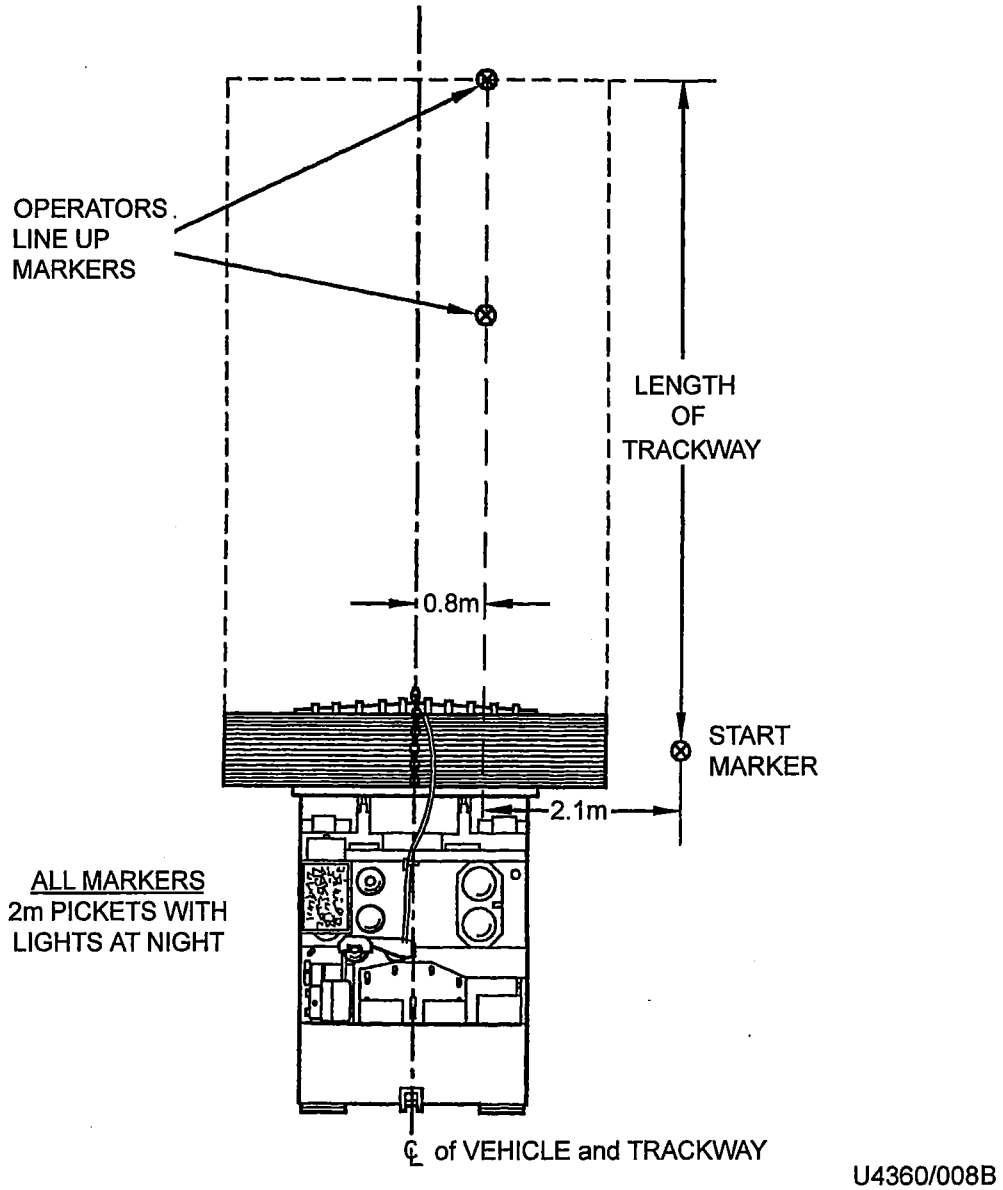


Fig 7 Position of vehicle and markers for trackway laying

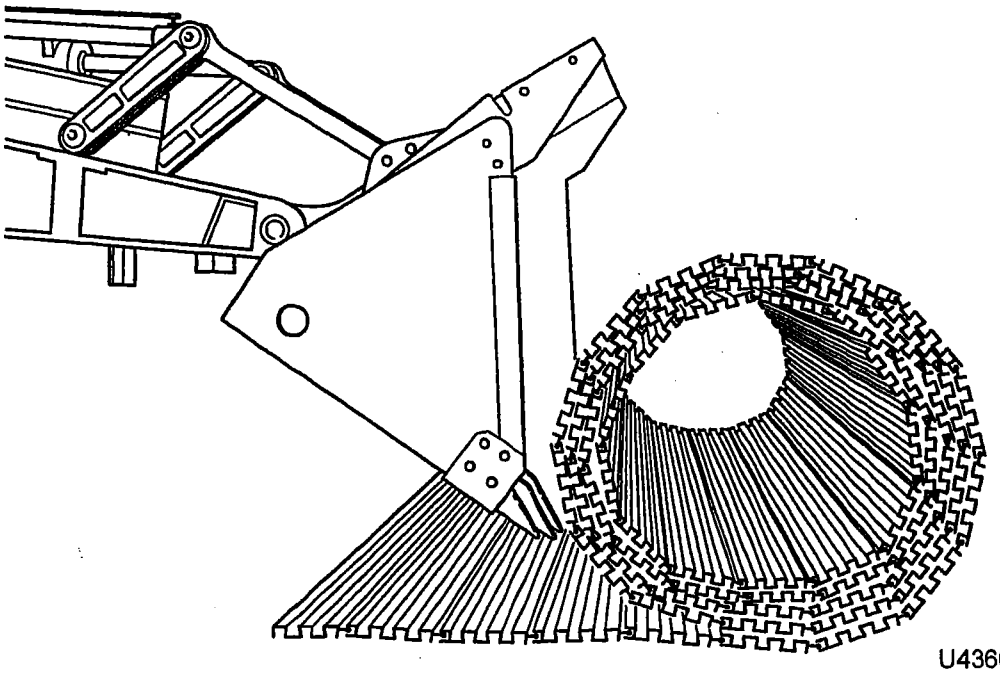


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Fig 8 Pushing out trackway

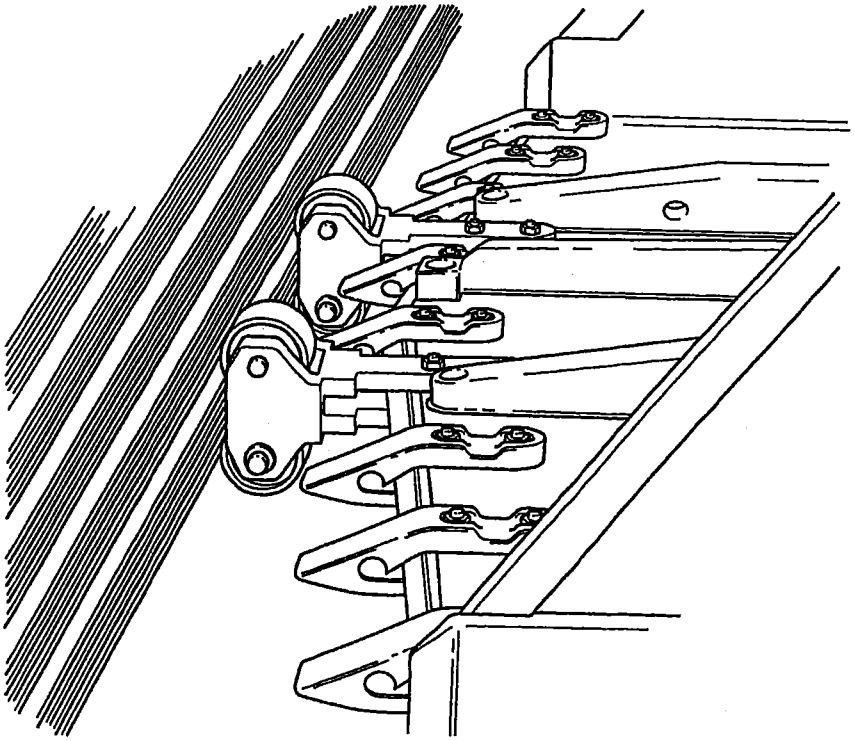

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Fig 9 Use of trackway rollers

10.2 Disconnect the winch rope from the link assembly and shackle assembly (4) and connect it to the ring of the pull release chain (5), as follows:

10.2.1 Normal winch rope end. Using shackled assembly as shown in Fig 6 (A).

10.2.2 Emergency winch rope end. Using safety hook as shown in Fig 6 (B).

NOTE

Connection is ONLY to be carried out if trackway laying is imminent.

10.3 Slacken the winch rope until there is sufficient slack to allow the bucket to be lowered to the ground but not enough to become entangled with the bucket teeth.

10.4 Working from a safe position, between the hull, remove and stow both webbing safety straps. The vehicle is now ready to lay trackway (Fig 6).

Action at the laying site

11 It is assumed that the position of the intended trackway route has been determined and where possible, marked with suitable pickets. Proceed as follows:

11.1 Line up the vehicle with the markers as shown in Fig 7.

11.2 Tilt the bucket forward and lower until the teeth are pointing downwards, approximately 150 mm (6 inches) from the ground.

11.3 Winch in to release the trackway, and pull the release mechanism and chain clear of the trackway.

11.4 On level ground, or down gradients, the trackway will unroll under its own momentum. On slight uphill gradients, or when the trackway has not completely unrolled, push out the trackway by driving slowly forward (refer to Fig 8).

NOTE

Laying uphill is not recommended, whenever possible a plan should be devised which will enable downhill laying to take place.

CHAPTER 3

TRANSPORTATION DETAILS

CONTENTS

INTRODUCTION

General

1 This chapter covers the details required to safely secure the vehicle for the following:

1.1 Slinging.

1.2 Amphibious transportation.

1.3 Air transportation.

1.4 Rail transportation.

1.5 Road transportation.

Basic data

2 The basic data required for transportation can be found in Fig 1 and Table 1.

TABLE 1 BASIC DATA

Serial (1)	Detail (2)	Data (3)
1	**Weight**	[redacted]
	1.1 Unladen	
	1.2 Battle	
2	Military load classification	
3	Maximum ground pressure (hard standing)	
4	Turning circle (between walls)	

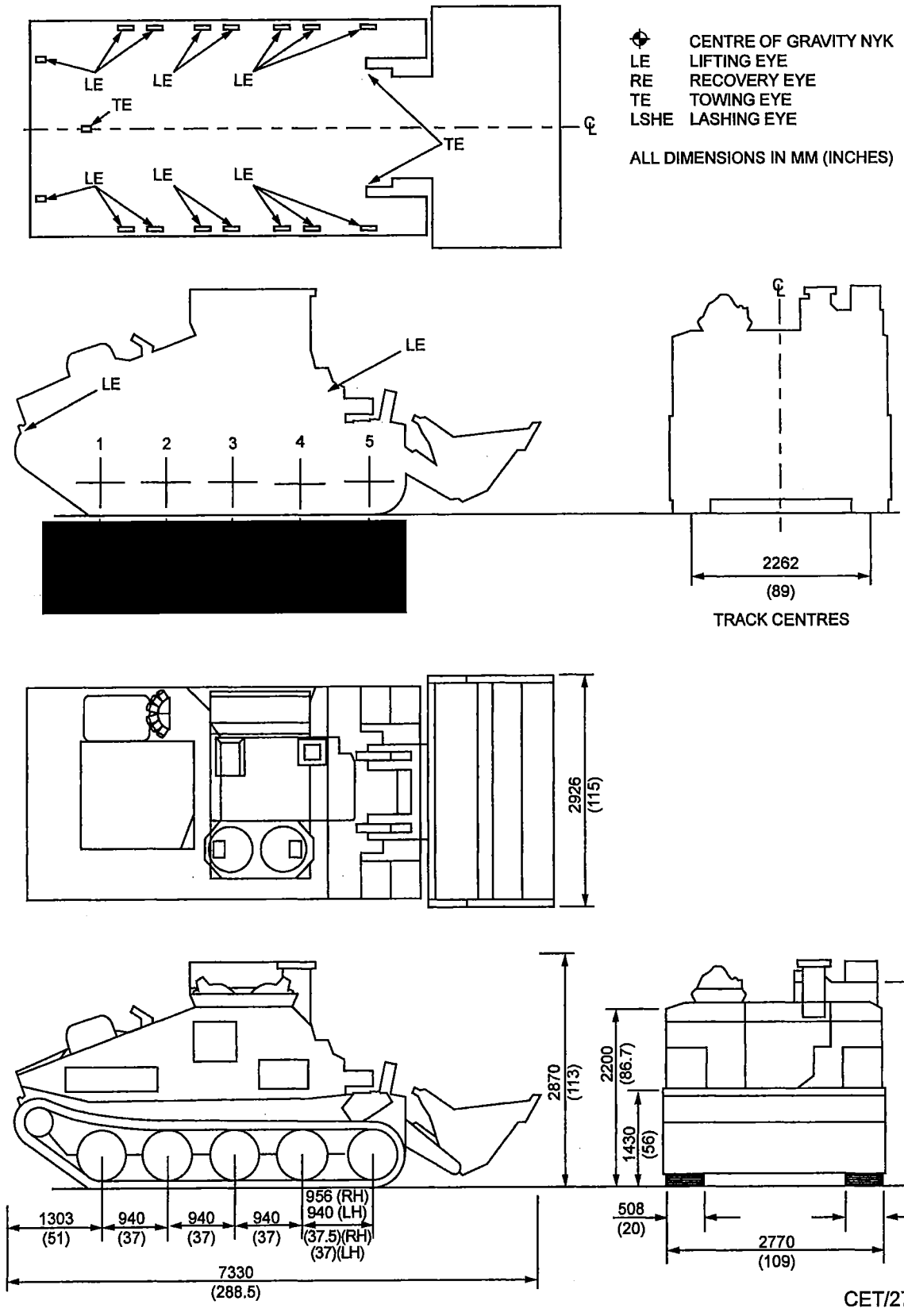
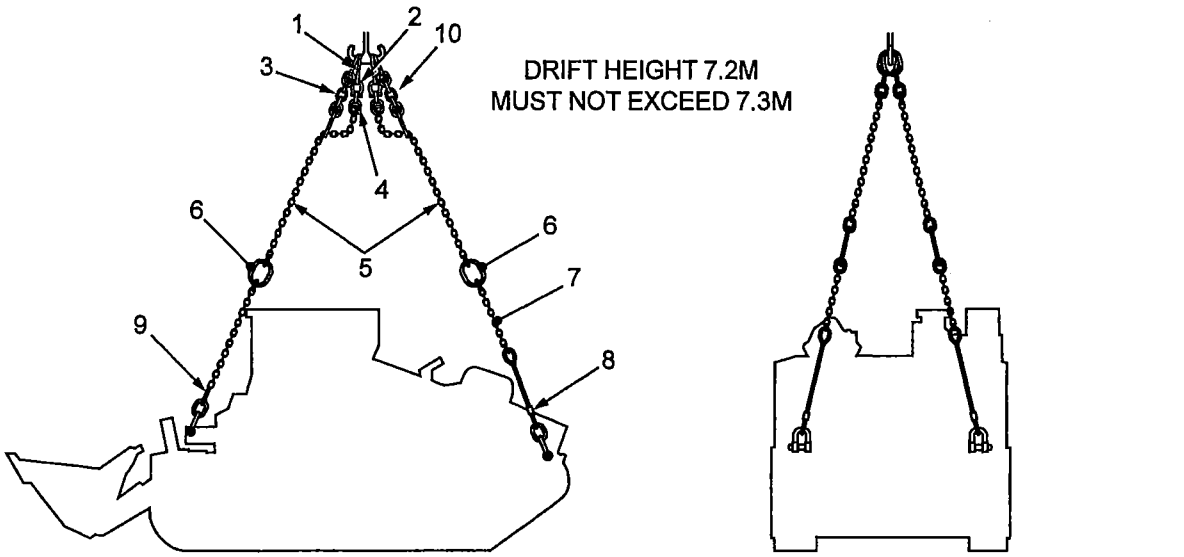


Fig 1 Basic data

SLINGING

3 The slinging details required to enable the equipment to be correctly slung can be found in Fig 2.



1 A56 Masterlinks (2 off)
2 35T safety bow shackle (Crosby) (4 off)
3 B45 transition links (6 off)
4 C32 Connex connectors (16 off)
5 26 link pieces (32 mm dia grade 80 chain) (6 off)
6 A50 Masterlinks (4 off)
7 11 link pieces (32 mm dia grade 80 chain) (2 off)
8 Wire rope (52 mm dia 6 x 41 IWRC) c/w thimble eyes (2 off)
9 35T screw pin bow shackle (Crosby) (4 off)
10 Shortening clutch (4 off)

Fig 2 Slinging details

AMPHIBIOUS TRANSPORTATION

4 The amphibious transportation data can be found in Tables 2 and 3.

NOTE

Dunnage may be required for operations at a quay wall.

TABLE 2 AMPHIBIOUS SHIPPING DATA

Serial (1)	Condition (2)	LPD (3)	LPH (4)	LSL (5)	LCT.8 (6)	LCM9 (7)	RPL (8)	LCVP2 (9)	LVP (10)	MEXEFLOTE (11)
1	CARRIAGE BY A SHIP/CRAFT PONTOON	FLDK NO TK.DK YES LV.DK NO HF.DK NO	FLDK YES HGR NO	VEH.DK NO TANK.DK YES	YES	YES	YES	NO	NO	YES
2	EMBARKATION/ DISEMBARKATION AT HARD8	-	-	YES	YES	YES	YES	NO	NO	YES
3	EMBARKATION/ DISEMBARKATION AT A QUAY WALL	YES	-	YES	YES	NO	NO	NO	-	-
4	EMBARKATION/ DISEMBARKATION TO BEACH WITH CRAFT/PONTOON DRIED OUT	-	-	-	YES	YES	YES	NO	NO	YES
5	DISEMBARKATION TO BEACH WITH SHIP/CRAFT/ PONTOON AFLOAT AND VEHICLE WATERPROOFED AND WADING	-	-	YES	YES	YES	YES	NO	NO	YES
6	EMBARKATION FROM FLAT BEACH WITH CRAFT/PONTOON AFLOAT. VEHICLE WATERPROOFED AND WADING	-	-	-	YES	YES	YES	NO	NO	YES
7	TRANSFER BY RAMP BETWEEN SHIP/CRAFT AND MEXEFLOTE	YES	-	ROW RAMP YES STERN RAMP YES	YES	NO	NO	NO	-	-

TABLE 3 TRANSFER PARAMETERS

Serial (1)	LPD (2)			
1	CAN VEHICLE TRANSFER BETWEEN LPD AND CRAFT?			
	a. AT APRON		b. AT STERN GATE	
	LCU9	YES	LCT (8)	YES
			LCM (9)	YES
	LCVP2	NO	RPL	YES
2	CAN VEHICLE DRIVE FROM DOCK BOTTOM VIA THE APRON TO THE TANK DECK?		YES	
3	CAN VEHICLE DRIVE FROM TANK DECK TO THE FOLLOWING DECKS?			
	a. FLIGHT DECK	b. LOWER VEHICLE DECK	c. HALF DECK	
	NO	NO	NO	

(continued)

TABLE 3 TRANSFER PARAMETERS (Continued)

Serial (1)	LSL (2)			
4	CAN VEHICLE TRANSFER BETWEEN LSL STERN RAMP AND CRAFT?			
	LCM (9) YES		RPL YES	
5	CAN VEHICLE DRIVE FROM TANK DECK TO THE VEHICLE DECK? NO			
6	**SHIPS CRANES**			
	CAN VEHICLE BE TRANSFERRED TO OR FROM SHIP BY?			
	LPD	LPH		LSL
	[redacted]	[redacted]		[redacted]

AIR TRANSPORTATION

Airlanded

5 The vehicle can be airlanded by the following:

5.1 Belfast: Feasible with difficulty.

5.2 Andover: No.

5.3 C130 Mk 1: Feasible with difficulty.

5.4 C130 Mk 3: Feasible with difficulty.

5.5 VC10: Not required.

NOTE

Reference must be made to the appropriate tie down scheme platform clearance for the condition under which the vehicle can be accepted for air transportation.

Airdrop platforms

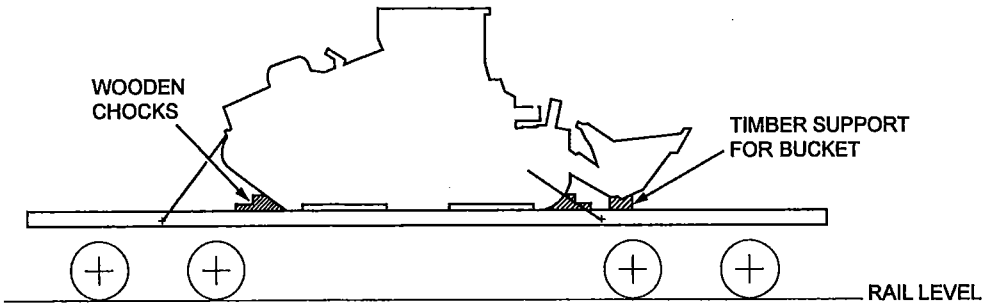
6 It is not practicable to airdrop this equipment.

Helicopter slung loads

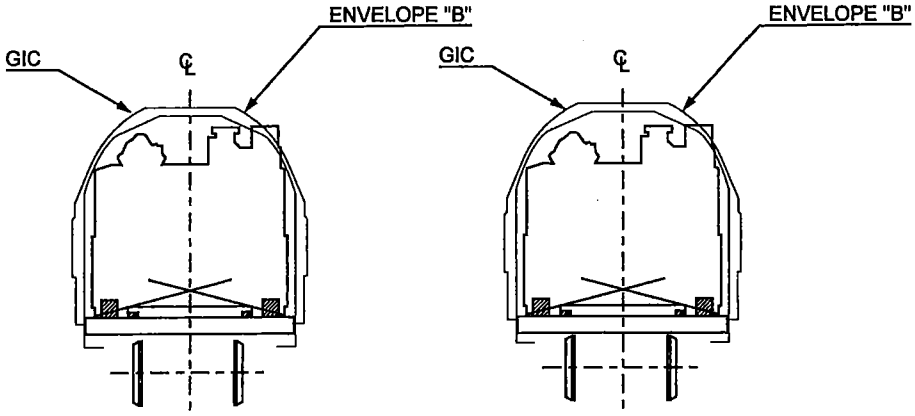
7 It is not practicable to sling this equipment.

RAIL TRANSPORTATION

8 The rail transportation data can be found in Fig 3 and Table 4.



TYPICAL LOADING ARRANGEMENT OF VEHICLE
COMBAT ENGINEER TRACTOR ON MOD WARFLAT



VEHICLE ON CATEGORY 8 WAGON

VEHICLE ON CATEGORY 3 WAGON

CET/272

Fig 3 Rail transportation details

TABLE 4 RAIL TRANSPORTATION DATA

Serial (1)	Requirements (2)	Gt. Britain (3)	NATO countries (4)	Remarks (5)
1	TRANSPORTABLE ON	MOVEMENT IMPRACTICAL	Cat 3..... (1) 4..... (1) 5..... (1) 6..... (1) 7..... (1) 8..... (1) MOD WARFLAT..... (1) See note 3	CAN MOVE AS EXCEPTIONAL LOAD ON DB IF ACCEPTABLE TO RAILWAY AUTHORITY. (OUTSIDE GIC GAUGE BUT WITHIN ENVELOPES A & B REFER TO NOTE 8)
			SKETCH BOOK No.	-
2	PARTS TO BE REMOVED	-	STOWAGE CAGE	-
3	CHOCKS	-	Steel Spiked or Wooden Chocks (angle 35° ht, 200mm, width 200mm min)	Bucket to be raised and blocked if necessary. Lateral wedging to maintain off-centre position. 50x100x1000

(continued)

TABLE 4 RAIL TRANSPORTATION DATA (Continued)

Serial (1)	Requirements (2)	Gt. Britain (3)	NATO countries (4)	Remarks (5)
4	RESTRAINT EQUIPMENT REQUIRED (Refer to STANAG 2173)	-	4 x LASHINGS At Front-Crossed from Lifting Eyes At Rear-Crossed from Towing Eyes	MIN BREAKING STRENGTH 8.4 TONS
5	PARKING BRAKE POSITION	-	FULLY APPLIED	-
6	GEAR LEVER POSITION	-	NEUTRAL	-

NOTES

(1) Loads and loose items must be well secured.

(2) Fuel tanks need not be drained.

(3) Number of vehicles per rail wagon shown in brackets after wagon type.

(4) Use deck guards to position vehicle accurately.

(5) Engine must be made safe against self-starting during transit.

(6) Moveable parts to be secured within gauge.

(7) Nails used to secure chocks/wedges must penetrate wagon floor 40 mm minimum.

(8) On Cat 4, 5, 6, 7, 8 and MOD WARFLEET wagons the vehicle must be loaded 40 mm off-centre.

ROAD TRANSPORTATION

9 Details for road transportation can be found in Table 5.

TABLE 5 ROAD TRANSPORTATION DATA

Serial (1)	Requirements (2)	Gt. Britain and NATO countries (3)	Remarks (4)
1	TRANSPORTABLE	1.1 SEMI-TRLR, LOW PLATFORM, RE (Cranes) 1.2 SEMI-TRAILER 50 TON	1 OUTSIDE LIMITS FOR NORMAL FREE MOVEMENT IN UK AND NATO COUNTRIES (DEF STAN 00-3/1 REFERS) CIVIL AUTHORITY ROAD MOVEMENT LICENCE
2	PARTS TO REMOVED	NIL	
3	LASHINGS REQUIRED	AVAILABLE ON TRAILER/SEMI-TRAILER	
4	CHOCKS	AVAILABLE ON TRAILER/SEMI-TRAILER	2 APPROX. OVERALL HEIGHT
5	HANDBRAKE POSITION	ON	2.1 3681 mm (145 in.) 2.2 3973 mm (156 in.)
6	GEAR LEVER POSITION	NEUTRAL	3 APPROX OVERALL WIDTH 3.1 3048 mm (120 in.) 3.2 3391 mm (134 in.)
			4 BUCKET TO BE LOWERED TO DECK OR RAISED AND BLOCKED, IF NECESSARY, TO FACILITATE CROSSING LASHINGS UNDER BUCKET

NOTES

(1) Loads and loose items must be well secured.

(2) Fuel tanks need not be drained.

(3) Engine must be made safe against self-starting during transit.

(4) Vehicle must be reversed onto trailer (bucket on gooseneck).

CHAPTER 4

FAULT FINDING

CONTENTS

INTRODUCTION

1 This chapter details the fault finding that can be carried out by the user/operator on the Combat Engineer Tractor (CET). Due to the permutations of faults that can be found on the equipment only the most common faults have been identified in Table 1.

2 Any recurring faults on the same, or similar, parts of the equipment must be reported to REME.

3 As an aid to fault finding Tables 2 and 3 detailing the circuit breakers and fuses have been included in this chapter. Each table details ratings, location and the circuit protected on the equipment.

TABLE 1 FAULT FINDING

Serial (1)	Item (2)	Symptom (3)	Probable Fault/Cause (4)	Remedy (5)
1	Lubrication system	No pressure on gauge with engine running	Low oil level	Top up and check for leaks
			Faulty gauge	Report to REME
		Low oil pressure light illuminates whilst vehicle in use	Low oil level	Top up and check for leaks
			Faulty sender/light unit	Report to REME
		Oil high temperature light illuminates whilst vehicle in use	High oil temperature	Check level and/or run down to cool oil Note: If warning light continues to illuminate, report to REME
			Faulty lamp or sender unit	Report to REME

(continued)

TABLE 1 FAULT FINDING (continued)

Serial (1)	Item (2)	Symptom (3)	Probable Fault/Cause (4)	Remedy (5)
			High oil temperature while operating in 1st gear	Ensure oil level is correct. Reduce engine speed, if light extinguishes continue with operation, if light fails to extinguish check coolant temperature, if high run at idle until normal temperature is reached. Report to REME.
			High oil temperature while operating in gear other than 1st	Select a lower gear, if light extinguishes continue with operation, if light fails to extinguish check coolant temperature, if high run at idle until normal temperature is reached. Report to REME.
		Light fails to illuminate when press to test operated	Faulty bulb	Replace bulb
			Fuse blown	Replace fuse
2	Cooling system	Engine overheating during operation	Low coolant level	Top up and check for leaks
			Blocked or restricted air passage	Clear restriction
			Internal fault	Report to REME
			Faulty or damaged fans	Report to REME
3	Hydrostatic fans	Radiator fan boost pressure warning light and CWL illuminates whilst the vehicle is in use	Low oil level/low pressure	Check level
			Fan disconnected	Set switch to OFF position
			Fenner coupling not turning	Check radiator fan switch is in correct position Note: If Fenner coupling remains unserviceable, report to REME

(continued)

TABLE 1 FAULT FINDING (continued)

Serial (1)	Item (2)	Symptom (3)	Probable Fault/Cause (4)	Remedy (5)
4	Fuel system	Engine lacks power	Faulty fuel pump	Report to REME
			Fuel pump switched off	Switch fuel pump on
			Isolation valve set incorrectly	Check setting
5	Fuel injection system	Engine speed too low with accelerator fully depressed	Accelerator pedal incorrectly adjusted	Report to REME
			Faulty governor	Report to REME
		Engine will not start	Engine stop lever is up	Push down engine stop lever
6	Engine air flow and air cleaner	Loss of engine power with black smoke from exhaust	Element blocked	Clean element Note: If symptoms persist, report to REME
7	Exhaust system and turbocharger	High pitched whine heard from turbocharger	Bearing failure	Report to REME
8	Batteries, generator and distribution panel	Starter motor fails to turn or sluggish in operation (lights on instrument panel may dim on pressing button)	Battery connection loose or dirty	Clean and secure terminals
			Batteries discharged	Remove and charge batteries
		Generator warning light fails to illuminate when tested	Faulty bulb	Replace bulb
			Fuse blown	Replace fuse and test
			Fault unidentified (symptoms persist)	Report to REME
		Generator warning light illuminates when engine above 650 rev/min	Drive belt broken	Report to REME
			Loose connection	Rectify or Report to REME
			Fault unidentified	Report to REME

(continued)

TABLE 1 FAULT FINDING (continued)

Serial (1)	Item (2)	Symptom (3)	Probable Fault/Cause (4)	Remedy (5)
9	Lighting and electrical ancillaries	Exterior/interior lights inoperative	Faulty bulb	Replace bulb
			Fuse blown	Replace fuse and test
			Fault unidentified (symptoms persist)	Report to REME
10	Gearbox and torque converter	Loss of drive with gear engaged	Low oil level	Top up and check for leaks
			Fuse blown	Replace fuse
11	Steer unit	Low oil level warning light illuminates when vehicle in use	Low oil level	Top up and check for leaks
12	Main Brakes	Vehicle pulls to one side when brakes applied	Uneven application of brakes	Report to REME
		Vehicle pulls to one side when parking brake released	Parking brake failing to release one side	Repeat correct procedure for releasing parking brake
13	Steering system	Vehicle fails to steer when tiller operated	Air leak	Rectify or report to REME
			Air pressure low	Check for leaks, run up engine
14	Final drives, tracks and sprockets	Final drive overheating	Lack of oil	Top up and check for leaks
			Internal fault	Report to REME
15	Suspension and roadwheels	Studs and holes on road wheels damaged	Roadwheel nuts working loose	Report to REME
16	Main hydraulic system	Low oil level warning light illuminates	Low oil level	Top up and check for leaks
			Leak in system	Rectify or Report to REME

(continued)

TABLE 1 FAULT FINDING (continued)

Serial (1)	Item (2)	Symptom (3)	Probable Fault/Cause (4)	Remedy (5)
17	Air cooling unit	System fails to function	Fuse blown	Replace fuse
			Generator off line	Put generator on line
			Fault unidentified	Report to REME
		No cooling effect	Generator off line	Put generator on line
			Freon level low	Report to REME
			Fault unidentified	Report to REME
		Poor cooling	Condenser blocked	Clear blockage
			Evaporator blocked	Clear blockage
			Generator off line	Put generator on line
			Compressor belt worn, loose or oily	Change or tighten compressor belt
			Vent fan unserviceable	Report to REME
			Freon level low	Report to REME
			Circulating fan faulty	Report to REME
			Fault unidentified	Report to REME
		Compressor noisy	Drive belt worn, loose or oily	Change or tighten drive belt
			Fault unidentified	Report to REME
18	Smoke grenade dischargers	With firing button pressed, smoke grenades fail to fire	Fuse F34 not fitted or blown	Fit or replace fuse
			Fuse F6 not fitted or blown	Fit or replace fuse
			Battery master switch not on	Set battery master switch to ON
			SAFE/ARM switch set to SAFE	Set SAFE/ARM switch to ARM
			Electrical fault	Report to REME
19	Demolition equipment	Indicator light on test/fire box fails to illuminate	Fuse blown	Replace fuse
			Connector loose or not fully engaged	Connect correctly
		Indicator light illuminates but needle does not move	Faulty leads or cable	Check and replace as necessary

TABLE 2 CIRCUIT BREAKERS

Identification (1)	Rating (2)	Location (3)	Circuit Protected (4)
CB 1	15A	Distribution panel	Starter solenoid
CB 2	50A	Distribution panel	Cooking vessel
CB 3	50A	Distribution panel	NBC
CB 4	35A	Distribution panel	Bilge pump No. 1
CB 5	35A	Distribution panel	Radio supply, maintenance lights and inspection sockets
CB 6	50A	Distribution panel	Driver's instrument panel Driver's road warning panel
CB 7	50A	Distribution panel	Operator's instrument panel
CB 8	35A	Driver's instrument panel	Bilge pump No. 2

TABLE 3 FUSES

Identification (1)	Rating (2)	Location (3)	Circuit Protected (4)
F 1	5A	Distribution panel	Generator field cut-off
F 2	15A	Distribution panel	Firewire (battery feed)
F 3	15A	Distribution panel	Firewire (switched)
F 4	10A	Distribution panel	Heater suit - driver
F 5	10A	Distribution panel	Heater suit - operator
F 6	15A	Distribution panel	Junction box (image intensifier and smoke grenade dischargers)
F 7	10A	Distribution panel	Demolition charge
F 8	5A	Distribution panel	Gear change
F 9	15A	Distribution panel	Air cooling system
F 10	10A	Distribution panel	Maintenance lights and inspection light socket eng/transmission compartments
F 11	5A	Distribution panel	NBC and cooking vessel relay coils
F 12	5A	Driver's road warning panel	Turnlights
F 13	2A	Driver's instrument panel	Starter relay
F 14	10A	Driver's instrument panel	Road horn
F 15	-	-	(Not in use)
F 16	10A	Driver's instrument panel	Fuel pump supply and No. 2 bilge pump
F 17	15A	Driver's instrument panel	Road lighting
F 18	5A	Driver's road warning panel	Washer (driver)

(continued)

TABLE 3 FUSES (continued)

Identification (1)	Rating (2)	Location (3)	Circuit Protected (4)
F 19	5A	Driver's road warning panel	Wiper (driver)
F 20	2A	Driver's instrument panel	Instruments (driver)
F 21	2A	Driver's instrument panel	Fuel gauging (instruments and relay box)
F 22	5A	Driver's instrument panel	Radiator fans disconnect solenoid and No. 1 bilge pump
F 23	5A	Driver's instrument panel	Dimmed positive supply (all warning lights etc)
F 24	1A	Driver's instrument panel	Sonalert
F 25	2A	Driver's heated clothing switch-box	Heated suit (driver)
F 26	2A	Operator's heated clothing switch-box	Heated suit (operator)
F 27	5A	Operator's instrument panel	Wiper (operator)
F 28	5A	Operator's instrument panel	Spotlight (and rotary beacon)
F 29	5A	Operator's instrument panel	Washer (operator)
F 30	1A	Operator's instrument panel	Hourmeter
F 31	10A	Radio junction box	Interior lights and inspection light socket (crew compartment)
F 32	10A	Junction box	Night vision periscope (operator)
F 33	10A	Junction box	Night vision periscope (driver)
F 34	10A	Junction box	Smoke grenade dischargers
F 35	5A	NBC control box	NBC scavenge fan
F 36	2A	Driver's road warning panel	Instruments - driver's road warning panel
F 37	5A	Operator's instrument panel	Heated window (operator)
F 38	5A	Driver's road warning panel	Heated window (driver)
F 39	7A	Test/fire box	Demolition circuits

CHAPTER 5

DENIAL OF EQUIPMENT TO AN ENEMY

CONTENTS

MANDATORY DIRECTIVE

1 Destruction of equipment when subject to capture by the enemy will be undertaken by the user arm ONLY WHEN, in the judgement of the unit commander concerned, such action is necessary in accordance with orders of, or policy established by, the Army or Divisional Commanders.

2 The reporting of the destruction of the equipment is to be done through command channels.

Degree of damage

3 The degree of damage inflicted, to prevent the equipment being used by an enemy, shall be as follows:

3.1 Methods of destruction should achieve such damage to equipment and essential spare parts, that it will not be possible to restore the equipment to a usable condition in the combat zone either by repair or canibalization.

3.2 Classified equipment must be destroyed in such degree as to prevent, whenever possible, duplication, or determination of operation or function by the enemy.

3.3 Any classified documents, notes, instructions, or other written material pertaining to function, operation, maintenance or employment, including drawings or parts lists, must be destroyed in a manner to render them useless to the enemy.

4 In general, destruction of essential parts, followed by burning will usually be sufficient to render the equipment unless. However, selection of the particular method of destruction requires imagination and resourcefulness in utilization of the facilities at hand under the prevailing conditions. Time is usually critical.

Spare parts

5 The same priority, for destruction of component parts of a major item necessary to render the item inoperable, must be given to the destruction of similar components in spare parts storage areas.

MEANS AND PROCEDURES

6 If destruction is ordered, due consideration should be given to:

6.1 Selection of point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments or ricocheting projectiles which may occur incidental to the destruction by gunfire.

6.2 Observance of appropriate safety precautions.

7 Of the several means of destruction, those most generally applicable are mechanical, burning and gunfire. The information given in Paras 8, 9 and 10 is for guidance only.

Mechanical

8 This requires an axe, pick, crowbar or similar implement. The equipment should be destroyed in accordance with the priorities given in Table 1.

Burning

WARNING

PERSONNEL INJURY. DUE CONSIDERATION SHOULD BE GIVEN TO THE HIGHLY FLAMMABLE NATURE OF GASOLINE AND ITS VAPOUR. CARELESSNESS IN ITS USE MAY RESULT IN PAINFUL BURNS.

9 This requires gasoline, oil or other flammables. To destroy the equipment by burning, proceed as follows:

9.1 Remove and empty the portable fire extinguishers.

9.2 If quantities of combustibles are limited, smash all vital elements, such as switches, instruments and control levers.

9.3 Place ammunition and charges in and about the equipment so that the greatest damage will result from the explosion.

9.4 Pour gasoline and oil over the equipment. Ignite by means of an incendiary grenade thrown from a safe distance, by a burst from a flame thrower, by a combustible train of suitable length or other appropriate means. Take cover immediately.

Gunfire

WARNING

[redacted]

10 When destroying the equipment by gunfire, proceed as follows:

10.1 Remove and empty the portable fire extinguishers.

10.2 Smash all vital elements as outlined in Para 9.2.

10.3 Destroy the equipment by gunfire, using tank guns, self-propelled guns, artillery, rifles using rifle grenades or launchers using anti-tank rockets.

PRIORITIES

11 The priorities for destruction should be considered as follows:

11.1 Priority must be given to the destruction of classified equipment and associated documents.

11.2 When lack of time and/or means prevents destruction of equipment, priority is to be given to the destruction of essential parts, and the same parts are to be destroyed on all like equipment.

11.3 A guide to priorities for destruction of equipment is shown in Table 1.

TABLE 1 PRIORITIES FOR DESTRUCTION

Serial (1)	Equipment (2)	Priority (3)	Parts (4)
1	VEHICLES (including tanks and engineer equipment)	1	Fuel injector/pump/carburettor/distributor/fuel tanks/fuel lines
		2	Engine block and cooling system
		3	Tyres/tracks and suspension
		4	Mechanical or hydraulic system
		5	Instruments and control boxes
			(1) Optical parts
			(2) Mechanical components
		6	Body hull
2	GUNS	1	Breech, breech mechanism and spares
		2	Recoil mechanism
		3	Tube
		4	Sighting and fire control equipment (including infra-red)
			(1) Optical parts
			(2) Mechanical components
3	SMALL ARMS	1	Breech mechanism
		2	Barrel
		3	Sighting equipment (including infra-red)
		4	Mounts
4	RADIO	1	Transmitter (oscillators and frequency generators) and IFF equipment
		2	Receiver including IFF equipment
		3	Remote control units, or switchboard (exchanges) and operating terminals
		4	Power supply and/or generator set
		5	Antennae
		6	Tuning units/heads

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TRACTOR, COMBAT ENGINEER, TRACKED

MAINTENANCE SCHEDULES

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence
Issued by
DEFENCE LOGISTICS ORGANISATION
ENGINEER SYSTEMS SUPPORT

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PREFACE

Sponsor: ESS ITP
Publications Authority: TES TI Andover

INTRODUCTION

1 Service users should forward any comments concerning this Publication through the channels prescribed in Army Equipment Support Publication (AESP) 0100-P-011-013. An AESP Form 10 is provided at the end of this publication; it should be photocopied and used for forwarding comments on this AESP.

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 Council Instructions (DCIs), Standard Operating Procedures (SOPs) or by local regulations. When any such Instruction, Order or Regulation contradicts any portion of this publication they are to be taken as the overriding authority.

RELATED AND ASSOCIATED PUBLICATIONS

Related publications

4 The Octad for the subject equipment consists of all the categories detailed opposite. 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 (refer to 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	101	101	101
	1	Equipment Support Policy Directives	111	111	111	111
2	0	Operating Information	201	*	*	*
	1	Aide Memoire	211	*	*	*
	2	Training Aids	*	*	*	*
3		Technical Description	201	302	302	302
4	1	Installation Instructions	411	*	*	*
	2	Preparation for Special Environments	*	*	*	*
5	1	Failure Diagnosis	201	512	512	512
	2	Maintenance Instructions	201	522	522	522
	3	Inspection Standards	*	532	532	532
	4	Calibration Procedures	*	*	*	*
6		Maintenance Schedules	601	*	*	*
7	1	Illustrated Parts Catalogues	711	711	711	711
	2	Commercial Parts Lists	*	*	*	*
	3	Complete Equipment Schedule, Production	*	*	*	*
	4	Complete Equipment Schedule, Service Edition (Simple Equipment)	741	741	741	741
	5	Complete Equipment Schedule, Service Edition (Complex Equipment)	*	*	*	*
8	1	Modification Instructions	811	811	811	811
	2	General Instructions, Special Technical Instructions and Servicing Instructions	821	821	821	821
	3	Service Engineered Modification Instructions (RAF only)	*	*	*	*

*Category/Sub-category not published

Associated publications

5 The following associated publications should be read in conjunction with this publication:

Reference	Title
Army Code 22492	Technical Folder
Army Code 60899	Aids to Amphibious Vehicles User Handbook
Army Code 71276	All Arms Training Standing Orders for Safety of Crews in AFVs

EQUIPMENT IDENTITY

6 This publication covers the following:

6.1 Equipment title: Tractor, Combat Engineer, Tracked

6.2 NATO Stock Number: 2350-99-893-2243

6.3 Asset code: 0890-0740

WARNINGS

7 The following WARNINGS are applicable to this equipment:

(1) PERSONNEL INJURY. A RISK OF FIRE AND OR EXPLOSION EXISTS WHEN REFUELLING VEHICLES FITTED WITH RUBBER PADDED TRACKS AND RUBBER TYRES BY EITHER PUMPS OR PLASTIC CONTAINERS DUE TO THE PRESENCE OF STATIC ELECTRICITY. THE VEHICLE MUST BE EARTHED WHILST CARRYING OUT REFUELLING OR TANK DRAINING OPERATIONS.

(2) PERSONNEL INJURY. REFUELLING MUST NOT TAKE PLACE NEAR RADAR EQUIPMENT. SAFE DISTANCE WILL VARY BETWEEN 2 AND 175 METRES DEPENDING ON RADAR EQUIPMENT. VEHICLE CREWS ARE TO CHECK WITH RADAR OPERATORS BEFORE REFUELLING (REFER TO AC 63723).

(3) PERSONNEL INJURY. FLUID AL 11 IS HIGHLY FLAMMABLE. THE PREPARATION OF THE FLUID FOR 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.

(4) TOXIC HAZARD. FLUID AL 39 IS BOTH TOXIC AND HAZARDOUS - REFER TO LOCAL UNIT PRECAUTIONS OR DCIs FOR FULL SAFETY PROCEDURES. MINIMUM PRECAUTION AFTER USE IS TO WASH THE AFFECTED SKIN AREAS WITH SOAP AND WATER.

(5) PERSONNEL INJURY. DO NOT REMOVE RADIATOR FILLER CAP BEFORE TEMPERATURE HAS FALLEN BELOW 93 DEG C (200 DEG F).

(6) PERSONNEL INJURY. CHECK THAT THE EMERGENCY EXIT DOOR LOCKING CATCH IS IN THE OFF POSITION BEFORE OPERATING THE VEHICLE. FAILURE TO DO SO COULD PREVENT RESCUE FROM OUTSIDE THE VEHICLE.

(7) PERSONNEL INJURY. THE SEATS ARE MOUNTED ON SPRING LOADED LINKAGES, DESIGNED TO COUNTERACT THE WEIGHT OF A CREW MEMBER. DO NOT OPERATE THE HEIGHT ADJUSTMENT HANDLES WITH THE SEATS UNOCCUPIED, THIS COULD CAUSE SERIOUS DAMAGE OR PERSONNEL INJURY.

(8) PERSONNEL INJURY. ENSURE THAT THE EMERGENCY GEAR SELECTOR LEVER IS IN NEUTRAL BEFORE OPERATING THE STARTER MOTOR. THERE IS NO ELECTRICAL INTERLOCK ON THIS CONTROL LEVER.

(9) PERSONNEL INJURY. ONLY PERSONNEL WITH SPECIALIST KNOWLEDGE OF AIR COOLING SYSTEMS SHOULD BE ALLOWED TO WORK ON THIS VEHICLE AIR COOLING SYSTEM.

(10) PERSONNEL INJURY. THE NBC SYSTEM IS TO BE SWITCHED ON WHENEVER THE VEHICLE AIR COOLING SYSTEM IS OPERATED CLOSED DOWN.

(11) PERSONNEL INJURY. THIS EQUIPMENT CONTAINS A FM-200 FIRE SUPPRESSION SYSTEM. IF FM-200 IS BREATHED IT CAN CAUSE SUFFOCATION. ONLY TRAINED PERSONNEL UNDER SUPERVISION ARE ALLOWED TO WORK ON THE SYSTEM. ANYONE WHO HAS BREATHED FM-200 IS TO RECEIVE IMMEDIATE MEDICAL ATTENTION.

(12) ENVIRONMENTAL HAZARD. IT IS ILLEGAL UNDER THE ENVIRONMENTAL PROTECTION ACT 1990 TO WILFULLY DISPOSE OF REFRIGERANTS BY VENTING REFRIGERANTS INTO THE ATMOSPHERE. ONLY COMPETENT PERSONNEL WITH A SPECIALIST KNOWLEDGE OF REFRIGERANT SYSTEMS, HOLDING A CURRENT REFRIGERANT HANDLING CERTIFICATE, ARE TO BE ALLOWED TO WORK ON ANY REFRIGERANT SYSTEM. ALWAYS REPORT ANY SUSPECT LEAKS TO REME AS SOON AS POSSIBLE.

(13) PERSONNEL INJURY. REFRIGERANTS ARE NON-TOXIC BUT DISPLACE AIR AND WILL CAUSE ASPHYXIA IN CONFINED SPACES BY THE ACCUMULATION OF HEAVIER THAN AIR REFRIGERANT IN THE LOWEST REGION OF AN ENCLOSED SPACE. ENSURE ADEQUATE VENTILATION AT ALL TIMES WHEN WORKING ON INSTALLATIONS CONTAINING REFRIGERANTS. IF A LEAK IS SUSPECTED THE AREA MUST BE WELL VENTILATED BEFORE ANY INVESTIGATORY WORK IS UNDERTAKEN.

(14) PERSONNEL INJURY. DO NOT SMOKE IN A REFRIGERANT CONTAMINANT ATMOSPHERE OR WHEN WORKING ON ANY EQUIPMENT CONTAINING REFRIGERANT. SMOKING WILL CAUSE ISCEON 49 (R413a) TO BREAK DOWN INTO HYDROCHLORIC ACID (HYDROFLUORIC ACID AND PHOSGENE).

(15) PERSONNEL INJURY. REFRIGERANT CONTACT WITH EYES AND SKIN. ALWAYS WEAR SAFETY GOGGLES, GLOVES AND PROTECTIVE CLOTHING WHEN HANDLING REFRIGERANTS. IF REFRIGERANT CONTACTS EYES DO NOT RUB EYES, SPLASH EYES WITH COLD WATER AND SEEK IMMEDIATE MEDICAL ATTENTION. IF REFRIGERANT CONTACTS SKIN, WASH OFF WITH COLD WATER. IF INJURY TO SKIN OCCURS TREAT AS FROSTBITE, SEEK IMMEDIATE MEDICAL ATTENTION.

(16) PERSONNEL INJURY. TO PREVENT INJURY TO PERSONNEL ENSURE THAT THE REFRIGERANT SYSTEM IS COMPLETELY DEPRESSURISED BEFORE REMOVING ANY COMPONENT NOT EQUIPPED WITH SELF-SEALING COUPLINGS.

(17) PERSONNEL HAZARD. WHEN PRESSURE TESTING REFRIGERANT PIPEWORK OR ANY LRU THE AREA OF THE TEST MUST BE SAFE IN THAT, SHOULD A FAILURE OCCUR PERSONNEL AND EQUIPMENT ARE PROTECTED FROM FLYING DEBRIS.

CAUTIONS

8 The following CAUTIONS are applicable to this equipment:

(1) EQUIPMENT DAMAGE. The cold start pump should not be operated unless the engine is being rotated by the starter motor. Serious damage may be caused if cold start fluid is pumped into the induction manifold of a stationary engine.

(2) EQUIPMENT DAMAGE. To avoid causing damage to the turbocharger bearings, they are to be primed with oil (0.2 litres) before starting the engine when the engine has not been run for a week or more or a replacement turbocharger or engine have been fitted.

(3) EQUIPMENT DAMAGE. Do not attempt to lower the bucket or operate the crowd dump control lever while travelling locks are in place.

(4) EQUIPMENT DAMAGE. Do not operate the disconnect clutch lever with the engine running.

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AESP Form 10 (Issue 5.0 dated Dec 01)

MAINTENANCE SCHEDULE

INTRODUCTION

1 This Maintenance Schedule is the authority for carrying out all scheduled maintenance tasks on the subject equipment and takes precedence over any other conflicting publication.

2 The person in a unit or formation with delegated responsibility for the specified equipment, who is also competent and experienced in that role, is responsible for ensuring that the operations detailed in this Maintenance Schedule are properly carried out. The operations are only to be carried out by personnel who, through either professional trade training or an equipment specific formal training course, are appropriately qualified. The aforementioned responsible person may also order any operation to be carried out more frequently than specified, if conditions under which the equipment operated render it necessary.

3 Scheduled Maintenance is to be recorded in the appropriate equipment document in accordance with single service regulations.

4 Serial numbers left blank in the tables may be taken up by amendment action at a later date.

DEFINITIONS

5 As far as this document is concemed, the following definitions apply:

5.1 Examine. Carry out a survey of the condition of an item without dismantling, **unless** specifically instructed to do so in the relevant task requirement. The condition of an item may be impaired by the following:

5.1.1 Insecurity of attachment.

5.1.2 Cracks or fractures.

5.1.3 Corrosion, contamination or deterioration.

5.1.4 Distortion.

5.1.5 Loose or missing fasteners.

5.1.6 Chafing, fraying, scoring or wear.

5.1.7 Faulty or broken locking devices.

5.1.8 Loose clips or packing, obstruction of, or leakage from pipelines.

5.1.9 Discoloration due to overheating or leakage of fluids.

5.1.10 Damage due to external sources.

5.2 Check. Make a comparison of measurement of time, pressure, temperature, resistance, dimension or other quantity, with a known figure.

5.3 Operate. As far as possible, ascertain that a component or system functions correctly without the use of test equipment or reference to measurement.

5.4 Replenish. Refill a container to a predetermined level, pressure or quantity. This includes any necessary cleaning of orifices, examination of caps, covers, gaskets and washers, renewal of locking devices and clearing of vents.

5.5 Replace. Remove an item and then fit a new or reconditioned item.

WARNINGS, CAUTIONS AND MAINTENANCE NOTES

6 Before any maintenance task is carried out, the WARNINGS, CAUTIONS and Maintenance Notes preceding the appropriate table must be read and understood.

MAINTENANCE INTERVALS AND AREAS OF RESPONSIBILITY

NOTE

The following tables detail the maintenance intervals and areas of responsibility.

7 Table 4 - action on receipt. The maintenance detailed in Table 4 covers the action taken when the equipment arrives on a unit. These operations will normally be of a once only nature, eg the recording of lifting equipment with the appropriate test authority, actions that are necessary to be undertaken before the equipment is put into service or actions that are only required during the running in period. The maintenance detailed in Table 4 must be carried out by appropriately trained personnel, as detailed in Para 2.

8 Table 5 - out of phase maintenance. The maintenance tasks detailed in Table 5 covers tasks that do not fall into line with the time/usage interval requirements of Table 6 or 7. The maintenance detailed in Table 5 must be carried out by appropriately trained personnel, as detailed in Para 2. Maintenance is:

8.1 During halts on the march.

8.2 Mission maintenance. A mission is defined as any vehicle usage totalling from 10 to 60 hours. This maintenance is to be carried out.

8.2.1 Between one mission and the next (preferably at the end of the mission).

8.2.2 On the orders of the local commander during a suitable lull.

8.2.3 Before a mission when more than three consecutive monthly maintenance has been recorded in the AB 413.

9 Table 6 - driver/operator maintenance. The maintenance tasks detailed in Table 6, Maintenance Intervals A, B, C and D are to be carried out by appropriately trained personnel, as detailed in Para 2, as follows:

9.1 A - Daily before use (only on days used).

9.2 B - Daily after use (after the equipment has been operated).

9.3 C - Weekly, whether the equipment is used or not. Not used in this application.

9.4 D - Monthly, whether the equipment is used or not.

10 Table 7 - time/usage maintenance. The maintenance detailed in Table 7, Maintenance Interval 1st, A, B, C and D must be carried out by appropriately trained personnel, as detailed in Para 2, at the following intervals:

10.1 1st - After the vehicle (or new/overhauled assembly) has completed 50 hours.

10.2 A - Every 200 hours or 6 months.

10.3 B - Every 400 hours or 12 months.

10.4 C - Not used in this application.

10.5 D - Contains the Area Maintenance indicator which may be used, at the discretion of the responsible person detailed at Para 2, to carry out Area Maintenance at the appropriate time/usage intervals.

11 Table 8 - out of use maintenance. The Out of Use Maintenance in Table 8 is to be carried out in accordance with single service regulations.

12 Commander's functional test. The Commander's Functional Test (CFT) is to be carried out in those months, when no REME inspection is due. The CFT is detailed in Annex A.

TABLE 1 EQUIPMENT APPLICABILITY

Serial (1)	Equipment Asset Code (2)	Designation (3)	Contract Numbers (4)
1	0890-0740	TRACTOR, COMBAT ENGINEER, TRACKED	

TABLE 2 FUELS, LUBRICANTS AND ASSOCIATED PRODUCTS

NOTES

(1) The products listed below are to be used on this equipment. Alternative products must not be used without the approval of an appropriate equipment support manager.

(2) Oil changes at the -15 deg C point shall only be made on the advice of the responsible person detailed at Para 2.

(3) The capacities listed are to be used as a guide only. A physical check is to be carried out to ensure that all fluid levels are correct. This check should be carried out with the equipment unladen and standing on level ground whenever possible.

Serial	Assembly	Product		Capacity	
		Above -15 deg C	Below -15 deg C	Litres	Pints
(1)	(2)	(3)	(4)	(5)	(6)
1	Lubrication system	OMD 90	OMD 55	38	66
2	Cooling system	AL 39 and water mix	AL 39 and water mix	73	128
3	Gearbox/transfer gearbox	OMD 90	OMD 55	57	100
4	Steer unit	OMD 90	OMD 55	73	128
5	Final drive (each)	OMD 90	OMD 55	9	16
6	Wheel hub (No. 1 - 4 each)	OMD 90	OMD 55	1.7	3
7	Wheel hub (No. 5 each)	OMD 90	OMD 55	1.1	2
8	Dampers (each)	OMD 33	OMD 33	2.25	4
9	Axle arm pivot housings	OMD 90	OMD 55	A/R	A/R
10	Fan hydraulics	OMD 90	OMD 55	48	86.4
11	Earthmoving hydraulics	OMD 90	OMD 55	82	144

(continued)

TABLE 2 FUELS, LUBRICANTS AND ASSOCIATED PRODUCTS (continued)

Serial	Assembly	Product		Capacity	
		Above -15 deg C	Below -15 deg C	Litres	Pints
(1)	(2)	(3)	(4)	(5)	(6)
12	Air cooling unit	Isceon 49 R413a	Isceon 49 R413a		
13	Winch gearbox	OMD 90	OMD 55	15	28
14	Winch rope	XG 279	None - surfaces dry	A/R	A/R
15	Propulsion units (each)	OMD 90	OMD 55	0.3	0.5
16	Bevel boxes (each)	OMD 90	OMD 55	1	1.75
17	Vision block washers	AL 11 and water mix	AL 39 and water mix	A/R	A/R
18	Fuel tank No. 1	Diesel	Diesel	243	424
19	Fuel tank No. 2	Diesel	Diesel	177	312

TABLE 3 EQUIPMENT DATA

Serial (1)	Item (2)	Detail (3)	
	GENERAL DATA		
1	Bridge classification	20	
2	Normal ground pressure	45.2 kN/m^2	(6.6 lbf/in.^{2})
3	Max road speed	50 km/h	(34 mile/h)
4	Overall length	7.3 m	(23 ft 11-1/2 in.)
5	Max width	2.92 m	(9 ft 7 in.)
6	Overall height (battle weight)	2.83 m	(9 ft 3-1/2 in.)
7	Vertical obstacle	0.61 m	(2 ft)
	TORQUE WRENCH SETTINGS		
8	Track pads	204 Nm	(150 lbf ft)
9	Final drive outer sprocket nuts	339 Nm	(250 lbf ft)
10	Final drive inner sprocket nuts	95 Nm	(70 lbf ft)
11	Track pin nuts	238 Nm	(175 lbf ft)
12	Wheel nuts	204 Nm	(150 lbf ft)

TABLE 4 ACTION ON RECEIPT

Serial (1)	Action (2)
1	Perform Out of Phase Maintenance (Table 5)
2	Enter servicing details in AB 413 and report faults

TABLE 5 OUT OF PHASE MAINTENANCE

The following WARNINGS and Maintenance Notes must be read and understood before commencing these maintenance tasks.

WARNINGS

(1) PERSONNEL INJURY. FLUID AL 11 IS HIGHLY FLAMMABLE. THE PREPARATION OF THE FLUID FOR 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.

(2) PERSONNEL INJURY. THIS EQUIPMENT CONTAINS A HALON FIRE SUPPRESSION SYSTEM. IF HALON IS BREATHED IT CAN CAUSE SUFFOCATION. ONLY TRAINED PERSONNEL UNDER SUPERVISION ARE ALLOWED TO WORK ON THE SYSTEM. ANYONE WHO HAS BREATHED HALON IS TO RECEIVE IMMEDIATE MEDICAL ATTENTION.

(3) ENVIRONMENTAL HAZARD. IT IS ILLEGAL UNDER THE ENVIRONMENTAL PROTECTION ACT 1990 TO WILFULLY DISPOSE OF REFRIGERANTS BY VENTING REFRIGERANTS INTO THE ATMOSPHERE. ONLY COMPETENT PERSONNEL WITH A SPECIALIST KNOWLEDGE OF REFRIGERANT SYSTEMS, HOLDING A CURRENT REFRIGERANT HANDLING CERTIFICATE, ARE TO BE ALLOWED TO WORK ON ANY REFRIGERANT SYSTEM. ALWAYS REPORT ANY SUSPECT LEAKS TO REME AS SOON AS POSSIBLE.

(4) PERSONNEL INJURY. REFRIGERANTS ARE NON-TOXIC BUT DISPLACE AIR AND WILL CAUSE ASPHYXIA IN CONFINED SPACES BY THE ACCUMULATION OF HEAVIER THAN AIR REFRIGERANT IN THE LOWEST REGION OF AN ENCLOSED SPACE. ENSURE ADEQUATE VENTILATION AT ALL TIMES WHEN WORKING ON INSTALLATIONS CONTAINING REFRIGERANTS. IF A LEAK IS SUSPECTED THE AREA MUST BE WELL VENTILATED BEFORE ANY INVESTIGATORY WORK IS UNDERTAKEN.

(continued)

TABLE 5 OUT OF PHASE MAINTENANCE (continued)

(5) PERSONNEL INJURY. DO NOT SMOKE IN A REFRIGERANT CONTAMINANT ATMOSPHERE OR WHEN WORKING ON ANY EQUIPMENT CONTAINING REFRIGERANT. SMOKING WILL CAUSE ISCEON 49 (R413a) TO BREAK DOWN INTO HYDROCHLORIC ACID (HYDROFLUORIC ACID AND PHOSGENE).

(6) PERSONNEL INJURY. REFRIGERANT CONTACT WITH EYES AND SKIN. ALWAYS WEAR SAFETY GOGGLES, GLOVES AND PROTECTIVE CLOTHING WHEN HANDLING REFRIGERANTS. IF REFRIGERANT CONTACTS EYES DO NOT RUB EYES, SPLASH EYES WITH COLD WATER AND SEEK IMMEDIATE MEDICAL ATTENTION. IF REFRIGERANT CONTACTS SKIN, WASH OFF WITH COLD WATER. IF INJURY TO SKIN OCCURS TREAT AS FROSTBITE, SEEK IMMEDIATE MEDICAL ATTENTION.

CAUTIONS

(1) EQUIPMENT DAMAGE. The cold start pump should not be operated unless the engine is being rotated by the starter motor. Serious damage may be caused if cold start fluid is pumped into the induction manifold of a stationary engine.

(2) EQUIPMENT DAMAGE. To avoid causing damage to the turbocharger bearings, they are to be primed with oil (0.2 litres) before starting the engine when the engine has not been run for a week or more or a replacement turbocharger or engine have been fitted.

(3) EQUIPMENT DAMAGE. Do not attempt to lower the bucket or operate the crowd dump control lever while travelling locks are in place.

(4) EQUIPMENT DAMAGE. Do not operate the disconnect clutch lever with the engine running.

(continued)

TABLE 5 OUT OF PHASE MAINTENANCE (continued)

MAINTENANCE NOTES

(1) Serials 1 to 12 to be completed during halts on the march.

(2) Serials 13 to 49, mission maintenance, to be carried out as detailed in sub-Para 8.2.

(3) Details of mission maintenance are not to be recorded when carried out as part of another servicing.

Serial (1)	Action (2)	Product (3)
	DURING HALTS ON THE MARCH	
1	Check air cleaner restriction indicator	
2	Check engine and transmission compartment for leaks	
3	Check engine and transmission compartment for security of components	
4	Check condition of track	
5	Check track tension	
6	Check suspensions for leaks	
7	Check suspensions for overheating	
8	Check road wheel hubs for leaks	
9	Check road wheel hubs for overheating	
10	Check final drives for leaks	
11	Check final drives for overheating	
12	Report faults	
	MISSION MAINTENANCE	
13	Carry out Daily Before Use maintenance (refer to Table 6, Column A)	
14	Service all batteries	
15	Check propulsion unit bevel gearbox oil level	OMD 90

(continued)

TABLE 5 OUT OF PHASE MAINTENANCE (continued)

Serial (1)	Action (2)	Product (3)
16	Check propulsion unit oil level	OMD 90
17	Check winch gearbox oil level	OMD 90
18	Check winch operation	
19	Drain fuel collector tank of sediment and water	
20	Lubricate winch pulleys, fairleads, guide rollers, bull wheels and laying on gear	XG 279
21	Lubricate propulsion units, rear bearings and front seals	XG 279
22	Lubricate gearbox to steering unit coupling	XG 279
23	Lubricate steer unit actuator swivel pins	XG 279
24	Lubricate bucket linkage	XG 279
25	Lubricate tow hook	XG 279
26	Lubricate track adjuster pivot bushes	XG 279
27	Lubricate (oil can) seat runners	OMD 90
28	Lubricate (oil can) propulsion control linkages	OMD 90
29	Lubricate (oil can) steer control rod ends	OMD 90
30	Lubricate (oil can) winch control clevis pin	OMD 90
31	Lubricate (oil can) handbrake pawls	OMD 90
32	Lubricate (oil can) all hinges, locks, handles, pivot pins and stowage clamps	OMD 90
33	Clean, service and check operation of vision periscope washers and wipers	
34	Check level of washer reservoir (top up if necessary)	AL 11 and water mix
35	Check operation of bilge pump and warning lights	
36	Check ACU refrigerant level in sight glass	Freon R12

(continued)

TABLE 5 OUT OF PHASE MAINTENANCE (continued)

Serial (1)	Action (2)	Product (3)
37	Clean condenser matrix	
38	Empty condensate bottle	
39	Check operation of ACU	
40	Check track tension (adjust if necessary)	
41	Check track pads for wear	
42	Torque tighten track pads 204 Nm (150 lbf ft)	
43	Torque tighten final drive outer sprocket nuts 339 Nm (250 lbf ft)	
44	Torque tighten final drive inner sprocket nuts 95 Nm (70 lbf ft)	
45	Torque tighten track pin nuts 238 Nm (175 lbf ft)	
46	Torque tighten all wheel nuts 204 Nm (150 lbf ft)	
47	Check operation of NBC system	
48	Enter servicing details in AB 413 (refer to Note 3)	
49	Report faults	

TABLE 6 DRIVER/OPERATOR MAINTENANCE

The following WARNINGS, CAUTIONS and Maintenance Notes must be read and understood before commencing these maintenance tasks.

WARNINGS

(1) PERSONNEL INJURY. A RISK OF FIRE AND OR EXPLOSION EXISTS WHEN REFUELLING VEHICLES FITTED WITH RUBBER PADDED TRACKS AND RUBBER TYRES BY EITHER PUMPS OR PLASTIC CONTAINERS DUE TO THE PRESENCE OF STATIC ELECTRICITY. THE VEHICLE MUST BE EARTHED WHILST CARRYING OUT REFUELLING OR TANK DRAINING OPERATIONS.

(continued)

TABLE 6 DRIVER/OPERATOR MAINTENANCE (continued)

(2) FIRE HAZARD. REFUELLING MUST NOT TAKE PLACE NEAR RADAR EQUIPMENT. SAFE DISTANCE WILL VARY BETWEEN 2 AND 175 METRES DEPENDING ON RADAR EQUIPMENT. VEHICLE CREWS ARE TO CHECK WITH RADAR OPERATORS BEFORE REFUELLING (REFER TO AC 63723).

(3) PERSONNEL INJURY. FLUID AL 11 IS HIGHLY FLAMMABLE. THE PREPARATION OF THE FLUID FOR 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.

(4) TOXIC HAZARD. FLUID AL 39 IS BOTH TOXIC AND HAZARDOUS - REFER TO LOCAL UNIT PRECAUTIONS OR DCIs FOR FULL SAFETY PROCEDURES. MINIMUM PRECAUTION AFTER USE IS TO WASH THE AFFECTED SKIN AREAS WITH SOAP AND WATER.

(5) PERSONNEL INJURY. DO NOT REMOVE RADIATOR FILLER CAP BEFORE TEMPERATURE HAS FALLEN BELOW 93 DEG C (200 DEG F).

(6) PERSONNEL INJURY. CHECK THAT THE EMERGENCY EXIT DOOR LOCKING CATCH IS IN THE OFF POSITION BEFORE OPERATING THE VEHICLE. FAILURE TO DO SO COULD PREVENT RESCUE FROM OUTSIDE THE VEHICLE.

(7) PERSONNEL INJURY. THE SEATS ARE MOUNTED ON SPRING LOADED LINKAGES, DESIGNED TO COUNTERACT THE WEIGHT OF A CREW MEMBER. DO NOT OPERATE THE HEIGHT ADJUSTMENT HANDLES WITH THE SEATS UNOCCUPIED, THIS COULD CAUSE SERIOUS DAMAGE OR PERSONNEL INJURY.

(8) PERSONNEL INJURY. ENSURE THAT THE EMERGENCY GEAR SELECTOR LEVER IS IN NEUTRAL BEFORE OPERATING THE STARTER MOTOR. THERE IS NO ELECTRICAL INTERLOCK ON THIS CONTROL LEVER.

(continued)

TABLE 6 DRIVER/OPERATOR MAINTENANCE (continued)

(9) PERSONNEL INJURY. ONLY PERSONNEL WITH SPECIALIST KNOWLEDGE OF AIR COOLING SYSTEMS SHOULD BE ALLOWED TO WORK ON THIS VEHICLE AIR COOLING SYSTEM.

(10) PERSONNEL INJURY. THE NBC SYSTEM IS TO BE SWITCHED ON WHENEVER THE VEHICLE AIR COOLING SYSTEM IS OPERATED CLOSED DOWN.

(11) PERSONNEL INJURY. THIS EQUIPMENT CONTAINS A HALON FIRE SUPPRESSION SYSTEM. IF HALON IS BREATHED IT CAN CAUSE SUFFOCATION. ONLY TRAINED PERSONNEL UNDER SUPERVISION ARE ALLOWED TO WORK ON THE SYSTEM. ANYONE WHO HAS BREATHED HALON IS TO RECEIVE IMMEDIATE MEDICAL ATTENTION.

(12) ENVIRONMENTAL HAZARD. IT IS ILLEGAL UNDER THE ENVIRONMENTAL PROTECTION ACT 1990 TO WILFULLY DISPOSE OF REFRIGERANTS BY VENTING REFRIGERANTS INTO THE ATMOSPHERE. ONLY COMPETENT PERSONNEL WITH A SPECIALIST KNOWLEDGE OF REFRIGERANT SYSTEMS, HOLDING A CURRENT REFRIGERANT HANDLING CERTIFICATE, ARE TO BE ALLOWED TO WORK ON ANY REFRIGERANT SYSTEM. ALWAYS REPORT ANY SUSPECT LEAKS TO REME AS SOON AS POSSIBLE.

(13) PERSONNEL INJURY. REFRIGERANTS ARE NON-TOXIC BUT DISPLACE AIR AND WILL CAUSE ASPHYXIA IN CONFINED SPACES BY THE ACCUMULATION OF HEAVIER THAN AIR REFRIGERANT IN THE LOWEST REGION OF AN ENCLOSED SPACE. ENSURE ADEQUATE VENTILATION AT ALL TIMES WHEN WORKING ON INSTALLATIONS CONTAINING REFRIGERANTS. IF A LEAK IS SUSPECTED THE AREA MUST BE WELL VENTILATED BEFORE ANY INVESTIGATORY WORK IS UNDERTAKEN.

(continued)

TABLE 6 DRIVER/OPERATOR MAINTENANCE (continued)

(14) DO NOT SMOKE IN A REFRIGERANT CONTAMINANT ATMOSPHERE OR WHEN WORKING ON ANY EQUIPMENT CONTAINING REFRIGERANT. SMOKING WILL CAUSE ISCEON 49 (R413a) TO BREAK DOWN INTO HYDROCHLORIC ACID (HYDROFLUORIC ACID AND PHOSGENE).

(15) PERSONNEL INJURY. REFRIGERANT CONTACT WITH EYES AND SKIN. ALWAYS WEAR SAFETY GOGGLES, GLOVES AND PROTECTIVE CLOTHING WHEN HANDLING REFRIGERANTS. IF REFRIGERANT CONTACTS EYES DO NOT RUB EYES, SPLASH EYES WITH COLD WATER AND SEEK IMMEDIATE MEDICAL ATTENTION. IF REFRIGERANT CONTACTS SKIN, WASH OFF WITH COLD WATER. IF INJURY TO SKIN OCCURS TREAT AS FROSTBITE, SEEK IMMEDIATE MEDICAL ATTENTION.

CAUTIONS

(1) EQUIPMENT DAMAGE. The cold start pump should not be operated unless the engine is being rotated by the starter motor. Serious damage may be caused if cold start fluid is pumped into the induction manifold of a stationary engine.

(2) EQUIPMENT DAMAGE. To avoid causing damage to the turbocharger bearings, they are to be primed with oil (0.2 litres) before starting the engine when the engine has not been run for a week or more or a replacement turbocharger or engine have been fitted.

(3) EQUIPMENT DAMAGE. Do not attempt to lower the bucket or operate the crowd dump control lever while travelling locks are in place.

(4) EQUIPMENT DAMAGE. Do not operate the disconnect clutch lever with the engine running.

(continued)

TABLE 6 DRIVER/OPERATOR MAINTENANCE (continued)

MAINTENANCE NOTES

(1) When the Daily After Use maintenance tasks have been carried out within the previous 4 hours it is acceptable to use the vehicle with carrying out Daily Before Use tasks.

(2) Daily After Use maintenance tasks must be carried out once every 24 hours when vehicle is in continuous use.

(3) Monthly maintenance tasks are to be carried out when the vehicle has not been used or when Monthly usage is less than 10 hours.

(4) Maintenance intervals are as follows:

A - Daily before use (only on days used).

B - Daily after use.

C - Weekly (not used in this application).

D - Monthly.

Serial	Task	Fig/ Item No.	Product	Maintenance Interval			
				A	B	C	D
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Check tension of track				✓		✓
2	Check security of track links				✓		✓
3	Check security of track pads				✓		✓
4	Check security of track pins and nuts				✓		✓
5	Check front suspension dampers for leaks		OM 33		✓		✓
6	Check suspension dampers for overheating				✓		✓
7	Check axle arm pivots for leaks		OMD 90		✓		✓

(continued)

TABLE 6 DRIVER/OPERATOR MAINTENANCE (continued)

Serial	Task	Fig/ Item No.	Product	Maintenance Interval			
				A	B	C	D
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
8	Check axle arm pivots for overheating				≀		≀
9	Check axle arm pivot oil level		OMD 90				≀
10	Check road wheel condition				≀		≀
11	Check road wheel security				≀		≀
12	Check road wheel hubs for leaks		OMD 90		≀		≀
13	Check road wheel hubs for overheating				≀		≀
14	Check security of inner/outer sprocket nuts				≀		≀
15	Check final drive for leaks				≀		≀
16	Check final drive for overheating				≀		≀
17	Check fuel tank level (top up if required)		Diesel	≀	≀		≀
18	Drain fuel collector tank of sediment and water						≀
19	Check coolant level (top up if required)		AL 39 and water mix	≀	≀		≀
20	Check alternator, fan, coolant pump and Air Conditioning Unit (ACU) pump belts				≀		≀
21	Check ACU refrigerant level in sight glass		Isceon49 R413a				≀
22	Clean condenser matrix						≀

(continued)

TABLE 6 DRIVER/OPERATOR MAINTENANCE (continued)

Serial	Task	Fig/ Item No.	Product	Maintenance Interval			
				A	B	C	D
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
23	Empty condensate bottle						✓
24	Check engine oil level (cold)		OMD 90	✓			✓
25	Check hydraulic oil level		OMD 90	✓	✓		✓
26	Check fan pack oil level		OMD 90	✓	✓		✓
27	Check gearbox oil level (cold)		OMD 90	✓			✓
28	Check steering unit oil level (cold)		OMD 90	✓			✓
29	Check air cleaner restrictor indicator				✓		✓
30	Check for leaks in engine and transmission compartment			✓	✓		✓
31	Check engine and transmission compartment security of components			✓	✓		✓
32	Check washer reservoir level		AL 11 and water mix				✓
33	Clean vision blocks						✓
34	Check external stowage for security			✓			✓
35	Check winch gearbox oil level		OMD 90				✓
36	Check internal stowage for security			✓			✓
37	Check condition of batteries						✓
38	Check condition of fire extinguishers			✓			✓

(continued)

TABLE 6 DRIVER/OPERATOR MAINTENANCE (continued)

Serial	Task	Fig/ Item No.	Product	Maintenance Interval			
				A	B	C	D
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
39	Check security of fire extinguishers			≀			≀
40	Check operation of fire warning system			≀			≀
41	Check operation of external lighting			≀			≀
42	Check operation of horn			≀			≀
43	Check operation of central warning lights			≀	≀		≀
44	Start engine (refer to Cat 201 Starting and Stopping Procedure)			≀			≀
45	Run engine at 1000 rev/min for 5 minutes			≀			≀
46	Check steer air warning light			≀			≀
47	Check brake air warning light			≀			≀
48	Compensate for brake band wear (refer to Cat 201 Chap 2-11-1)			≀			≀
49	Check operation of winch						≀
50	Check operation of main brakes			≀			≀
51	Check operation of steering brakes			≀			≀
52	Check operation of vision block washers and wipers						≀
53	Check operation of ACU						≀
54	Check operation of NBC system						≀
55	Switch off engine			≀			≀

(continued)

TABLE 6 DRIVER/OPERATOR MAINTENANCE (continued)

Serial	Task	Fig/ Item No.	Product	Maintenance Interval			
				A	B	C	D
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
56	Check engine oil level (hot)		OMD 90	≀	≀		≀
57	Check gearbox oil level (hot)		OMD 90	≀	≀		≀
58	Check steer unit oil level (hot)		OMD 90	≀	≀		≀
59	Lubricate (oil can) winch control clevis pins		OMD 90				≀
60	Lubricate (oil can) steer control rod ends		OMD 90				≀
61	Lubricate (oil can) handbrake pawls		OMD 90				≀
62	Lubricate (oil can) all hinges, locks, handles, pivot pins and stowage clamps		OMD 90				≀
63	Lubricate bucket linkage		XG 279		≀		≀
64	Lubricate tow hook		XG 279		≀		≀
65	Lubricate track adjuster pivot bushes		XG 279		≀		≀
66	Lubricate (grease gun) winch guide rollers		XG 279				≀
67	Lubricate (grease gun) winch flop-over pulley		XG 279				≀
68	Lubricate (grease gun) hatch retaining pins		XG 279				≀
69	Carry out CFT as detailed in Annex A						≀
70	Enter details in AB 413						≀
71	Report faults			≀	≀		≀

TABLE 7 TIME/USAGE MAINTENANCE

The following Maintenance Note must be read and understood before commencing these maintenance tasks.

MAINTENANCE NOTES

(1) Maintenance tasks bearing the trade task indicator (ST) (Specialist Task), must only be completed by an appropriately qualified person, as detailed in Para 2. These tasks are not appropriate for completion by a driver/operator.

(2) Maintenance intervals are as follows:

1st - After the vehicle (or new/overhauled assembly has completed 50 hours).

A - Every 200 hours or 6 months.

B - Every 400 hours or 12 months.

C - Not used in this application.

D - Area maintenance indicator (refer to sub-Para 10.5).

Serial	Task	Fig/ Item No.	Product	Maintenance Interval				
				1st	A	B	C	D
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Renew gearbox oil filter (ST)			≀	≀	≀		
2	Remove and clean primary fuel filter and filler strainer				≀	≀		
3	Renew hydraulic oil filters			≀	≀	≀		
4	Renew engine oil filters				≀	≀		
5	Renew steer unit oil filter			≀	≀	≀		
6	Renew secondary fuel filter				≀	≀		
7	Renew air cleaner element				≀	≀		

(continued)

TABLE 7 TIME/USAGE MAINTENANCE (continued)

Serial	Task	Fig/ Item No.	Product	Maintenance Interval				
				1st	A	B	C	D
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
8	Check gearbox oil level		OMD 90	⌇				
9	Check steer unit oil level		OMD 90	⌇				
10	Check hydraulic oil level		OMD 90	⌇				
11	Drain and refill engine oil		OMD 90		⌇	⌇		
12	Drain and refill final drives		OMD 90		⌇	⌇		
13	Drain steer unit oil tank (66 litres), clean tank, wire mesh separator and refill (ST)		OMD 90			⌇		
14	Drain and clean hull floor				⌇	⌇		
15	Clean fuel collector tank valve				⌇	⌇		
16	Clean radiator matrix				⌇	⌇		
17	Torque tighten track pads 204 Nm (150 lbf ft)			⌇				
18	Torque tighten final drive outer sprocket nuts 339 Nm (250 lbf ft)			⌇				
19	Torque tighten final drive inner sprocket nuts 95 Nm (70 lbf ft)			⌇				
20	Torque tighten track pin nuts 238 Nm (175 lbf ft)			⌇				
21	Check road wheels for rim rock				⌇	⌇		
22	Check operation of gearbox brake band adjusters (ST)				⌇	⌇		
23	Renew diaphragm in differential brake actuator (ST)					⌇		

(continued)

TABLE 7 TIME/USAGE MAINTENANCE (continued)

Serial	Task	Fig/ Item No.	Product	Maintenance Interval				
				1st	A	B	C	D
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
24	Renew rubber diaphragms in outer brake actuator (ST)					✓		
25	Disconnect fire extinguisher - cables from extinguishers and ensure that all remote control cables operate freely and reconnect (ST)					✓		
26	Clean, inspect and lubricate winch rope		XG 279			✓		
27	Carry out mission maintenance (Table 5)				✓	✓		
28	Enter servicing details in AB 413			✓	✓	✓		
29	Report faults			✓	✓	✓		

TABLE 8 OUT OF USE MAINTENANCE

Serial (1)	Operation (2)	Fig/ Item No. (3)	Product (4)
	NOT TAKEN UP		

ANNEX A

COMMANDER'S FUNCTIONAL TEST (CFT)

CONTENTS

AIM

1 The aim of the test is to enable commanders at all levels to know the general state of the vehicle with particular attention to the following aspects:

1.1 Safety. Correct functioning and condition of those systems and devices which, if defective, could constitute a danger to crew and others, eg:

1.1.1 Brakes and steering.

1.1.2 Tracks and track pins/wheels and tyres.

1.1.3 Fire fighting equipment.

1.1.4 Fuel and lubrication system (leaks).

1.2 Performance. Vehicle and equipment to be fit for combat. This will include testing of the engine, hydraulic equipment and radio equipment.

1.3 Condition of components. General condition such that normal performance may be expected in the future or that observation or repair is necessary.

1.4 Appearance. The appearance is a standard that reflects the role, age and cost necessary for rectification.

WARNINGS AND CAUTIONS

2 Before any maintenance task is carried out, the WARNINGS and CAUTIONS detailed in the Cat 201 must be read and understood.

POINTS CONCERNING TEST

3 The test will be carried out, in those months when no REME inspection is due, by qualified personnel nominated by the Squadron Leader

4 The vehicle to be tested will be detailed from Squadron Headquarters and advance notice of the test will not normally be given.

5 The testing time for a vehicle in average condition will be approximately one hour.

6 The test should be completed in the numerical sequence given in the procedure in order to prevent any unnecessary movement of the vehicle and crew.

7 The crew of the vehicle should be available throughout the test.

RECORDING

8 When the test is completed the date and details will be recorded in the relevant Section of the AB 413. Faults requiring REME action will be reported and rectified as soon as possible.

TABLE 1 COMMANDER'S FUNCTIONAL TEST (CFT)

Item (1)	Task (2)
	NOTE Before starting CFT ensure that Before Use Checks (refer to Table 6, Column A) has been carried out.
1	Check hull for cracks, damage and that drain plug is fitted
2	Check suspension units and shock absorbers for leaks, security and damage
3	Check track tensioners for leaks and security
4	Check final drives and sprockets for leaks, damage, lubrication and security
5	Check track pads for wear and security
6	Check track links for cracks and defects also track pin nuts for security
7	Check bucket for cracks and security of mountings and stowage
8	Check boom for cracks and security
9	Check hydraulic rams for damage, leaks and anchor point security
10	Check hydraulic pipes for leaks, security and chafing
11	Check security of sand shields and flaps
12	Check dowty cowls for damage and security
13	Check that water intake grilles are clear of debris and cover quick release pin, for security
14	Check that radiator inlet and outlet louvres are clear of obstruction to air flow
15	Check radiators for clogging, damage and leaks
16	Ensure fire extinguisher handles are free to turn. **DO NOT PULL**
17	Check Nuclear, Biological and Chemical (NBC) access door for security and sealing
18	Check general tow hook for serviceability and security
19	Check external lights and vehicle horn for operation and condition
20	Check security and serviceability of external radio connections, NATO socket and air coupling

(continued)

TABLE 1 COMMANDER'S FUNCTIONAL TEST (CFT) (continued)

Item (1)	Task (2)
21	Check all external stowage bins, clips, clamps and basket for security, damage and sealing
22	Check all access covers/plates and fitted components for sealing, damage and security
23	Check operation and security of NBC air intake, Python cable cover, external demolition firing box and fuel filler cover
24	Check bonding and security of antenna bases
25	Check smoke dischargers for cleanliness and security
26	Check serviceability of **ALL** portable fire extinguishers
27	Check operation of crew hatch locks and effectiveness of seals
28	Check condition of vision blocks and perspex screens
29	Check operation of vision washers and wipers
30	Check operation and serviceability of crew seals, seat belts and harnesses
31	Check all electrical connections and cables for security and chafing
32	Check all controls for operation and effectiveness of safety devices
33	Check security of floor plate
34	Check emergency door seal and operation of internal and external release catches
35	Check operation of drain valve and flooding valve
36	Check internal stowage for security and serviceability
37	Ensure internal fire extinguisher handles are free to turn. **DO NOT PULL**
38	Test fire alarm system
39	Check content and security of fixed fire extinguishers
40	Check crew compartment wall padding
41	Check operation of dems and firing box
42	Check security and condition of batteries
43	Test bilge pumps and warning lights

(continued)

TABLE 1 COMMANDER'S FUNCTIONAL TEST (CFT) (continued)

Item (1)	Task (2)
44	Start engine
45	Check operation of warning lights and gauges
46	Listen for unusual noises, knocks or vibration
47	Open up and tune radio set
48	Carry out vehicle test run
49	On moving off, check operation of brakes, skid steer, road steer, emergency brakes and emergency gears
50	Check operation of instruments and gauges, noting max oil pressure max rev/min, charging rate, max road speed and engine idling speed
51	Test operation of radio on the move
52	At end of vehicle test run, check operation of bucket controls
53	Run down and stop engine, close down radio set
54	Check final drive, track adjuster wheel and road wheel hubs for leaks and overheating
55	Record number of track lines in each track
56	Check coolant level and Specific Gravity (SG) reading
57	Check engine and transmission compartments for leaks
58	Record details of CFT in AB 413
59	Report all faults requiring repair/replacement action