Ministry of Defence

Defence Equipment and Support
Secretariat
#2043 Maple 0a
Ministry of Defence
Abbey Wood
Bristol BS34 8JH

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

[redacted]

Our Reference:
FOI2021/05871
Date:
16 July 2021

Dear [redacted]

I am writing further to my letter of 1 July 2021 about your request for the following information:

> *I have recently purchased an ex-military TRUCK UTY MED (HD) 6X6 PPV (PINZGAUER) VECTOR. In order to correctly repair and maintain this vehicle I require access to the various operating / repair manuals produced for this vehicle when in service.*
>
> *Therefore, I submit an FOI request for the electronic copies of the following operator / repair manuals:*
> *1) Technical Description 2320-D-503-302*
> *2) Complete Equipment Schedule 2320-D-503-741*

I have treated your correspondence as a request for information under the Freedom of Information (FOI) Act 2000.

I previously advised you that the information in scope of your request is held by the Ministry of Defence (MOD); namely:

- AESP 2320-D-503-302 (1st Edition, March 2007) - TRUCK UTILITY MEDIUM (HEAVY DUTY) 6X6 PPV VECTOR - Technical Description

- AESP 2320-D-503-741 (1st Edition March 2007) - TRUCK UTILITY MEDIUM (HEAVY DUTY) 6X6 PPV VECTOR - Complete Equipment Schedule, Service Edition - Simple Equipment Service

As some of the information falls within the scope of qualified exemptions of the FOI Act, it was necessary to undertake a Public Interest Test to determine whether the balance for withholding outweighs that for disclosure. That work has now concluded, and I am pleased to be able to provide copies of the two documents with this response.

However, it has proved necessary to withhold some information under qualified exemptions Section 26(1)(a) and (b) (Defence) and Section 38(1)(a) and (b) (Health and Safety) of the FOI Act. Section 26 applies to information that if disclosed would or would likely prejudice the defence of the British Islands or any colony; and/or the capability, effectiveness or security of the Armed Forces of the Crown or any forces cooperating with them. Section 38 applies to information that if disclosed would or would likely endanger the physical or mental health, or safety of any individual.

The Public Interest arguments for releasing both documents in their entirety were that it would demonstrate the MOD's commitment to openness and transparency; make Government more accountable to the electorate; and demonstrate that activities are conducted in an open and honest way. However, these arguments were outweighed by those for withholding information relating to vehicle protection schemes and specialist equipment which, if released, would compromise the ability of UK Armed Forces to carry out operations safely; by revealing information about capabilities and actions which could assist adversaries in planning attacks against Armed Forces personnel and equipment.

On balance, the weight of public interest lies in withholding some information under qualified exemptions Section 26(1) (Defence) and Section 38(1)(a) and (b) (Health and Safety) of the FOI Act. The level of prejudice against release of this exempted information has been set 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 Policy 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.

TRUCK UTILITY MEDIUM (HEAVY DUTY), 6X6 PPV VECTOR

COMPLETE EQUIPMENT SCHEDULE, SERVICE EDITION

SIMPLE EQUIPMENT

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

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence
Issued by

DEFENCE LOGISTICS ORGANISATION

AMENDMENT RECORD

Amdt No.	Incorporated By (Signature)	Date
1	BAE Systems Land Systems Pinzgauer Limited	Aug 07
2	BAE Systems Land Systems Pinzgauer Limited	Dec 07
3	BAE Systems Land Systems Pinzgauer Limited	Sep 08
4	INCORPORATED	Dec-12
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CONTENTS

PRELIMINARY MATERIAL Page

COMPLETE EQUIPMENT SCHEDULE (SERVICE) INFORMATION

Chapter

PREFACE

Sponsor : DEC CSS

Publications Authority: DLO Andover

INTRODUCTION

1 Service users should forward any comments on this publication through the channels prescribed in AESP 0100-P-011-013. An AESP Form 10 is provided after the preliminary pages 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), by Standing Operating Procedures (SOPs) or by local regulations. When any such Instruction, Order or regulation contradicts any portion of this publication it is to be taken as the overriding authority.

4 The subject matter of this publication details information specific to Truck Utility Medium (Heavy Duty) 6x6 PPV VECTOR Pinzgauer variant.

5 This Illustrated Parts Catalogue (IPC) is designed as an aid to the identification of components, parts or assemblies of parts of the equipment and to provide information necessary for demanding spares.

6 This IPC may list some or all of the parts comprising the equipment concerned, but only those parts assigned a NATO Stock Number, Service Catalogue or Reference Number will normally be available as spares. Should there be a requirement for an item not assigned a number, demands may be submitted quoting the AESP, Item Number, Figure Reference and Item Name. Where a manufacturer's reference is known, this should also be quoted..

Instructions for use by units

7 Detailed instructions for use by Units are given in Material Regulations for the Army Vol 1, Para 1.

Initial issues RLC

8 Initial issues by RLC as detailed below:

8.1 One copy of the CES will be attached to the Units copy of the issue voucher and one further copy accompanying every equipment.

8.2 Deficiencies (if any) will be enfaced on the covering issue voucher by reference to the Serial Number of the items listed in the simple CES.

8.3 'To follow' vouchers will not be created.

8.4 All items listed in the CES can be issued separately. If any listed herein becomes unserviceable it should be extracted and exchanged and the equipment retained pending receipt. Transfers between equipment holders should normally be complete to CES.

In lieu items

9 Authorised 'in lieu' items held against this CES will not be replaced until such time as they are no longer serviceable. When replacement becomes necessary the correct item, as listed in the CES, will be demanded.

General notes

10 Certain items may be annotated as follows:

10.1 (E) - Expendable stores, consumable stores and material, 'NON LEDGER' spare parts of minor value.

10.2 (X) - ESSENTIAL ITEMS without which the RLC will not issue the equipment.

10.3 (*) - This star indicated the accountability classification of the item.

10.4 (NI) - (Not illustrated) when appearing with a number in the 'Fig Item' column indicates that the item is not illustrated.

10.4.1 (NIV) - (Not in Vocabulary) indicates that the item is not available within the Stores System.

Annotations

11 The following notations are used in this publication:

11.1 AR When appearing in the 'Number off' column indicates that the quantity is 'as required'.

11.2 NI (Not Illustrated) when appearing with a number in the 'Fig Item' column Indicates that the item is not illustrated.

11.3 NP (Non Provisioned) when appearing in the 'NATO Stock Number' column indicates that the item may be illustrated, but not available from stock as a replacement item.

11.4 Ref In the 'Number off' column indicates that the item is listed for reference purposes only.

Abbreviations

12 Abbreviations and symbols used in this IPC have been approved and are listed separately.

Amendments

13 Amendments to the catalogue will be published as and when necessary. They will be numbered consecutively and the Amendment Record Sheet is to be completed for each Amendment List embodied.

14 New or amended material will be highlighted by side lining to show the extent of the amendment.

Indentations

15 Items are listed in a logical assembly/disassembly order and are indented by the 'Dot System' in which each 'dot' depicts the relationship of the item to the main assembly.

MAIN ASSEMBLY.
Attaching parts for main assembly.

. FIRST LEVEL OF BREAKDOWN (Sub-assembly or detail part of main assembly).
. Attaching parts for first level.

. . SECOND LEVEL OF BREAKDOWN (Sub-sub-assembly or detail part of Sub-assembly).
. . Attaching parts for second level.

. . . THIRD LEVEL OF BREAKDOWN (Sub-sub-sub-assembly or detail part of Sub-sub-assembly).

. . . Attaching parts for third level.

NOTES

(1) Attaching parts for the Main Assembly are listed at the end of the text of the Main Assembly.

(2) Catalogue numbers quoted in this catalogue will supersede any number that may have been allotted previously.

Description

16 The Item Description and Annotations block is also used to convey additional information to the IPC user, such as:

16.1 Related location detail, ie another AESP or Chapter/Item within this AESP.

16.2 Circuit reference numbers relating to the illustration.

EQUIPMENT IDENTITY

17 The details are listed in Table 1

TABLE 1 EQUIPMENT IDENTITY

Serial (1)	Asset Code (2)	Designation (3)	UCE/ UCA
1	1774 3100	Truck Utility Medium (Heavy Duty) 6X6 PPV VECTOR	A
2		Truck Utility Medium (Heavy Duty) 6X6 PPV VECTOR 2	B
3	1045-3100	Ambulance Protected TUM (HD) 1 Stretcher 6x6 2.5 LTR DSL VECTOR	C
4	1045-3101	Ambulance Protected TUM (HD) 1 Stretcher 6x6 2.5 LTR DSL VECTOR 2	D
5	1785-3100	Truck Utility Medium (Heavy Duty) 6X6 PPV VECTOR WATCHKEEPER MISSION SUPPORT VEHICLE	E

6.1 The Original Equipment Manufacturer (OEM) is as follows:

BAE Systems
Hadley Castle Works
PO Box 106
Telford
Shropshire
TF1 6QW 8XW
England

www.baesystems.com

6.2 Contract Nos:

SUVC1/0077

RELATED AND ASSOCIATED PUBLICATIONS

Related publications

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

Category/Sub-category			Information Level			
			1 User/ Operator	2 Unit Maintenance	3 Field Maintenance	4 Base Maintenance
1	0	Purpose and Planning	101	101	101	101
	1	Equipment Support Policy Directives	111	111	111	111
2	0	Operating Information	201	201	201	201
	1	Aide Memoire	*	*	*	*
	2	Training Aids	*	*	*	*
3		Technical Description	*	302	302	302
4	1	Installation Instructions	411	411	411	411
	2	Preparation for Special Environments	*	*	*	*
5	1	Failure Diagnosis	*	512	512	512
	2	Maintenance Instructions	201	522	522	522
	3	Inspection Standards	*	532	532	532
	4	Calibration Procedures	*	*	*	*
6		Maintenance Schedules	601	601	601	601
7	1	Illustrated Parts Catalogue	711	711	711	711
	2	Commercial Parts List	*	*	*	*
	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

NOTES

(1) Reference to AESP 0100-A-001-013 must be made to ensure the availability of the listed publications.

(2) Category 8 preliminary pages to be issued with the first Modification or General Instruction.

Associated publications

8	Reference	Title
	JSP 71	Joint Service Movement Diagrams
	JSP 341	Joint Service Road Transport Regulations
	JSP 800	Defence Movements and Transportation Regulations Volume 5 Road Transport

COMMENT(S) ON AESP*

To: DCCS
BFPO 794

From: .....
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.....

Sender's Reference	BIN Number	Date
AESP* Title:		
Chapter(s)/Instruction	**Page(s)/Paragraph(s)**	
If you require more space, please use the reverse of this form or a separate piece of paper. **Comment(s):**		

Signed: ..... Telephone No.: .....

Name (Capitals): ..... Rank/Grade: .....Date: .....

✂ .....

FOR AESP* SPONSOR USE ONLY

To: .....
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From: DCCS
BFPO 794

Thank you for commenting on AESP*: .....

Your reference: ..... Dated: .....

Action is being taken to:	Tick		Tick
Issue a revised/amended AESP*		Under investigation	
Incorporate comment(s) in future amendments		No action required	
Remarks			

Signed: ..... Telephone No.: .....

Name (Capitals): ..... Rank/Grade: .....Date: .....

* AESP or EMER

CHAPTER 1

INDEX OF MAIN ASSEMBLIES

AND

LIST OF ILLUSTRATIONS THROUGHOUT CES

INDEX OF MAIN ASSEMBLIES AND LIST OF ILLUSTRATIONS THROUGHOUT IPC

CHAPTER 2

COMPLETE EQUIPMENT SCHEDULE (SERVICE)
SIMPLE EQUIPMENT

CES ITEMS - TRUCK UTILITY MEDIUM (HEAVY DUTY) 6X6 PPV VECTOR

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COMPLETE EQUIPMENT SCHEDULE (SERVICE)
SIMPLE EQUIPMENT

MAIN ITEMS

Chapter

CHAPTER 2-1-1

COMPLETE EQUIPMENT SCHEDULE (SERVICE)
SIMPLE EQUIPMENT

MAIN ITEMS - VECTOR AND VECTOR 2

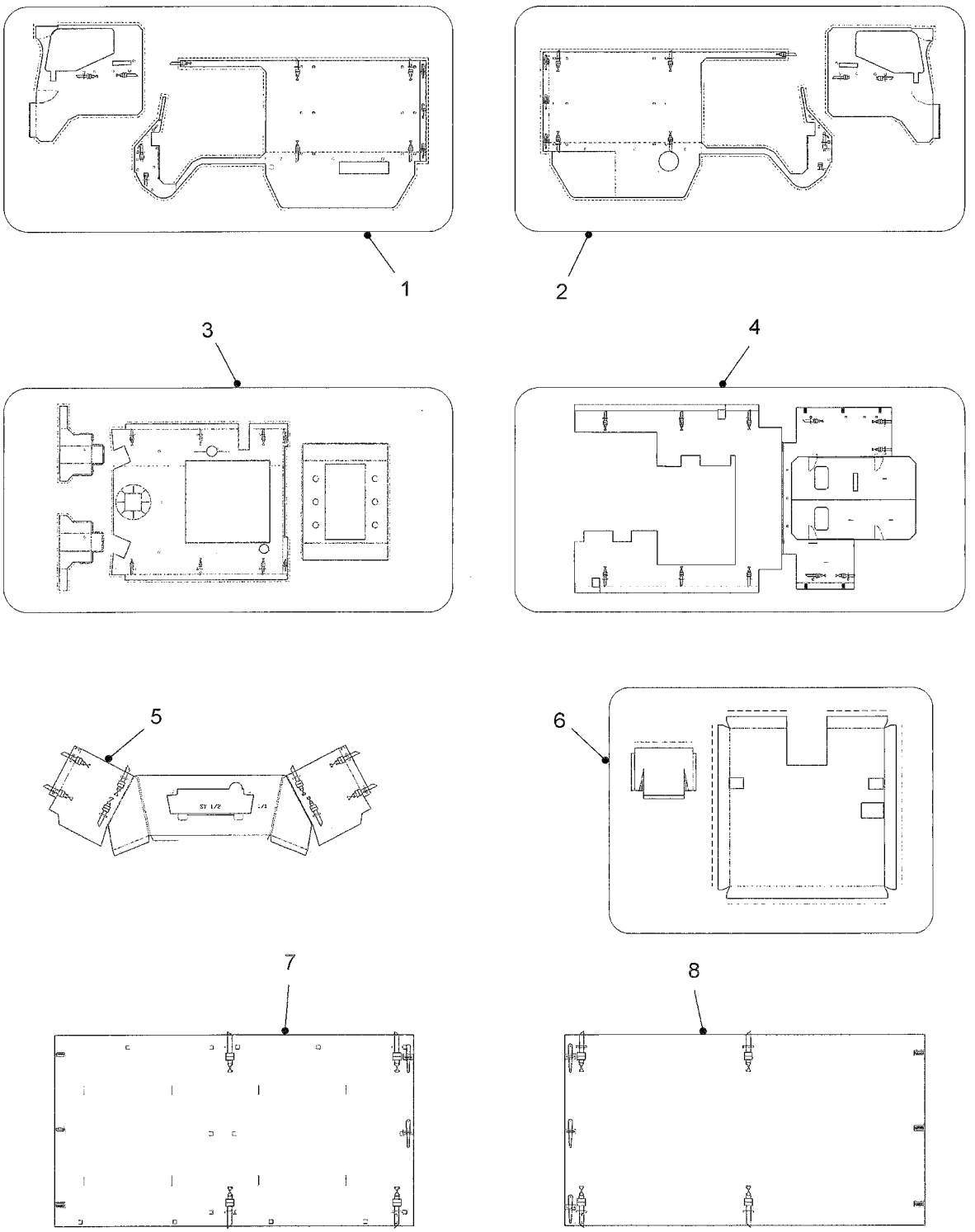

Fig 1 Main Items

Fig. No Item No		DMC NSCM	Army NSN Part Number	Item Description and Annotations	No Off D of Q	Quantity on Issue
1 NI	0		NP	BARRACUDA	REF EA	
	1	7VECT U8637	2540-99-133-8034 8251999070	. LH SIDE, FRONT	1 EA	
	1A	7VECT	2510-99-404-2682 8251999476	. LH SIDE, FRONT (VECTOR 2 ONLY)	1 EA	
	2	7SDP U8637	2540-99-812-5891 8251999072	. RH SIDE, FRONT	1 EA	
	2A	7VECT	2510-99-492-9348 8251999477	. RH SIDE, FRONT (VECTOR 2 ONLY)	1 EA	
	3	7SDP U8637	2540-99-752-8078 8251999067	. ROOF, FRONT	1 EA	
	4	7SDP U8637	2540-99-133-8033 8251999068	. ROOF, REAR	1 EA	
	5	7SDP U8637	2540-99-463-7527 8251999067	. FRONT	1 EA	
	5A	7VECT	2510-99-617-8937 8251999474	. FRONT (VECTOR 2 ONLY)	1 EA	
	6	7SDP U8637	2540-99-359-4596 8251999069	. ROOF HATCH	2 EA	
	6A	7VECT	2510-99-133-9771 8251999475	. ROOF HATCH (VECTOR 2 ONLY)	2 EA	
	7	7SDP U8637	2540-99-147-9629 8251999071	. LH SIDE, REAR	1 EA	
	8	7SDP U8637	2540-99-708-6760 8251999101	. RH SIDE, REAR	1 EA	
NI	9	7SDP U8637	5315-99-383-4295 758.1.84.007.1/30	PIN, STRAIGHT, HEADED (FRONT TOWING PIN)	1 EA	
NI	10	J1 K5753	9905-99-137-2067 0000-99-151-0639	SIGN, TRAFFIC, DANGER; COMPLETE WITH PLASTIC CONTAINER	1 EA	
NI	11	X1 K0156	6230-99-634-6510 TL1	LIGHT, MARKER, GROUND OBSTRUCTION; 1 LAMP; PLASTICS CASE; 7-1/2 IN. LG, 3-3/4 IN. W, 13-1/2 IN. H; PLASTIC LENS; AMBER; W/BLINKING FACILITY	1 EA	
NI	12	G1 K1368	5340-99-910-8185 A3-9517	PADLOCK; STEEL; ZINC PLATED; 4 LEVER TYPE 38.00 MM W	3 EA	
NI	13	J1 U4542	5120-99-910-5934 10-99-543	SHOVEL, HAND; RD MOUTH; FORGED; STRAPPED TYPE; 8 IN. BY 9-1/2 IN.; 28 IN. HANDLE	1 EA	

NOT ILLUSTRATED

Fig. No Item No	DMC NSCM	Army NSN Part Number	Item Description and Annotations	No Off D of Q	Quantity on Issue
1 NI 14		5120-99-910-5474	PICK HEAD, DIGGING	1 EA	
NI 15	J1 K1368	5120-99-910-4746 UKD1S2162	HANDLE; MATTOCK-PICK; HICKORY W/METAL SOCKET; 36 IN. LG	1 EA	
NI 16		5110-99-910-4066	AXE, SINGLE BIT	1 EA	
NI 17	J2 K1368	7240-99-120-7251 D2478	CAN, WATER, MILITARY; 5 GALLON; W/2 CAPS AND SECURING CHAINS	2 EA	
NI 18	H8 K3397	8345-99-125-0857 H8HH0190	FLAG, BLUE	1 EA	
NI 19	H8 K3397	8345-99-125-0539 H8HH0193	FLAG, YELLOW	1 EA	
NI 20	H8 K3397	8345-99-125-0858 H8HH0191	FLAG, GREEN	1 EA	
NI 21		8345-99-125-0553	POLE, TENT; VERTICAL; SOLID; WOOD; ROUND; 965 MM LG	2 EA	
NI 22	7SDP D0673	5120-99-721-9618 250183.0	JACK, HYDRAULIC, HAND	1 EA	
NI 23	7SDP D0673	5120-99-192-5491 7101552211	BAR, CAPSTAN (JACK, HYDRAULIC)	1 EA	
NI 24	7SDP D8242	5120-99-670-4339 715-01	WHEEL BRACE	1 EA	
NI 25		4210-99-998-3537	EXTINGUISHER, FIRE	2 EA	
NI 26		6545-99-505-1883	FIRST AID KIT, MOTOR VEHICLE	1 EA	
NI 27		4020-99-996-9812	CORD ASSEMBLY, ELASTIC	4 EA	
NI 28	7SDP U0205	2540-99-599-0502 5/1629	STROP ASSEMBLY, TOWING; 5000 MM LG STROP, LOOP BOTH ENDS, 7000 KG RECOVERY LOAD LIMIT; COILED & RETAINED USING STOWAGE LASHING	1 EA	
NI 29		8415-99-575-0673	VEST, HIGH VISIBILITY	1 EA	
NI 30		6230-99-910-5033	FLASHLIGHT	1 EA	
NI 31		7240-99-820-5428	SPOUT, JERRYCAN	1 EA	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	

NOT ILLUSTRATED

Fig. No Item No	DMC NSCM	Army NSN Part Number	Item Description and Annotations	No Off D of Q	Quantity on Issue
1					
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
NI 34	7VECT U8637	2540-99-215-5775 8251780011	SIDE FACING SEAT REAR, COMPLETE	4 EA	
NI 35	7VECT U8637	2510-99-134-8233 8251830914	GUNNER STEP PANEL	2 EA	
NI 36	7VECT U8637	8465-99-226-0260 8251839341	BAG, MISC STOWAGE, 35" x 20" W/DRAW CORD	1 EA	
NI 37	7VECT U8637	2590-99-613-4911 8251878554	THERMAL BLANKET, WINDSCREEN	1 EA	
NI 38	U8637	8251878555	THERMAL BLANKET, SIDE SCREEN (VECTOR 1)	2 EA	
NI 39	U8637	8251878556	THERMAL BLANKET, SIDE SCREEN (VECTOR 2)	2 EA	

CHAPTER 2-1-2

COMPLETE EQUIPMENT SCHEDULE (SERVICE)
SIMPLE EQUIPMENT

MAIN ITEMS - VECTOR AMBULANCE

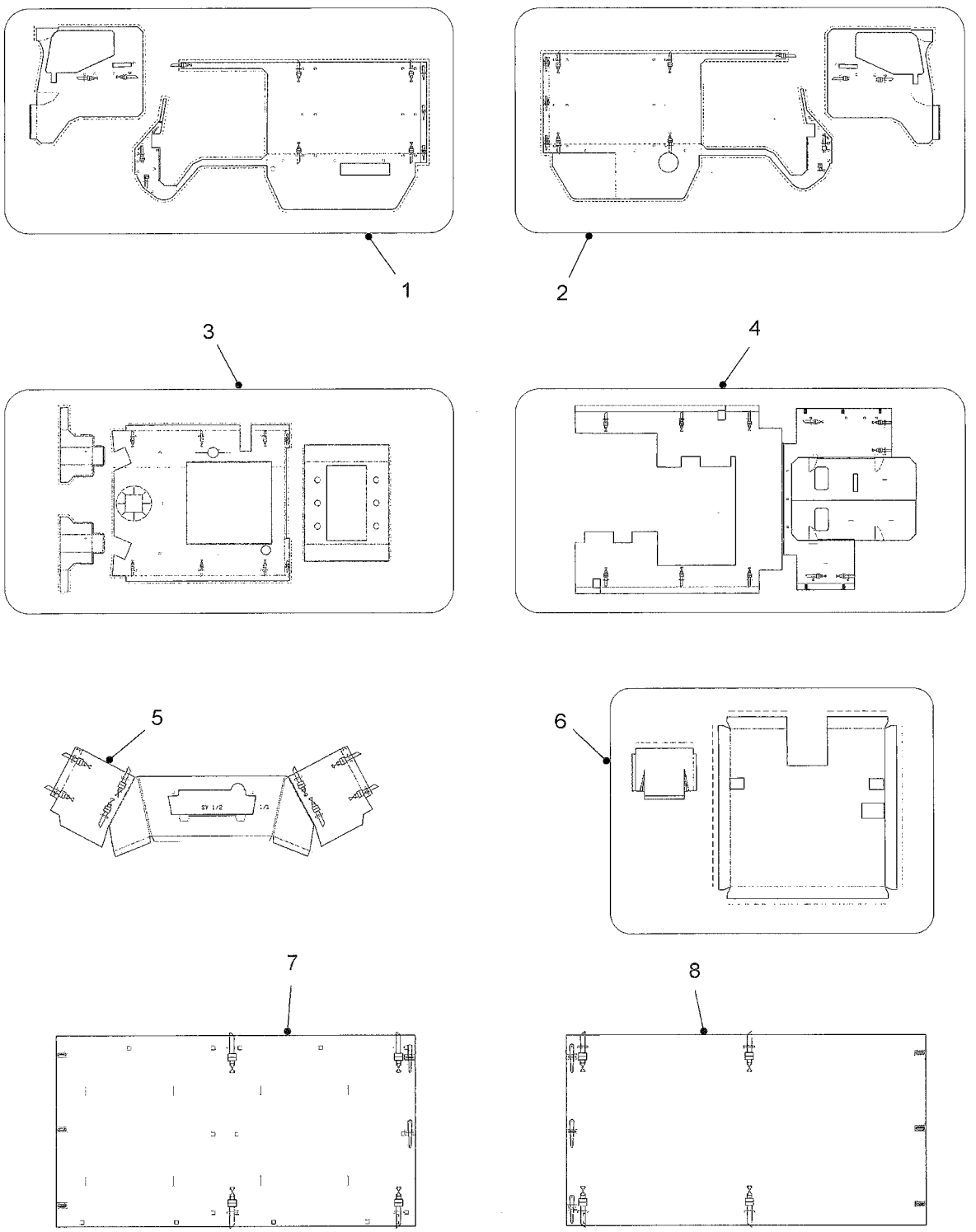

Fig 1 Main Items

Fig. No Item No		DMC NSCM	Army NSN Part Number	Item Description and Annotations	No Off D of Q	Quantity on Issue
1 NI	0		NP	BARRACUDA	REF EA	
	1	7SDP U8637	2540-99-133-8034 8251999070	. LH SIDE, FRONT	1 EA	
	1A	7VECT	2510-99-404-2682 8251999476	. LH SIDE, FRONT (VECTOR 2 ONLY)	1 EA	
	2	7SDP U8637	2540-99-812-5891 8251999072	. RH SIDE, FRONT	1 EA	
	2A	7VECT	2510-99-492-9348 8251999477	. RH SIDE, FRONT (VECTOR 2 ONLY)	1 EA	
	3	7SDP U8637	2540-99-752-8078 8251999067	. ROOF, FRONT	1 EA	
	4	7SDP U8637	2540-99-133-8033 8251999068	. ROOF, REAR	1 EA	
	5	7SDP U8637	2540-99-463-7527 8251999067	. FRONT	1 EA	
	5A	7VECT	2510-99-617-8937 8251999474	. FRONT (VECTOR 2 ONLY)	1 EA	
	6	7SDP U8637	2540-99-359-4596 8251999069	. ROOF HATCH	2 EA	
	6A	7VECT	2510-99-133-9771 8251999475	. ROOF HATCH (VECTOR 2 ONLY)	2 EA	
	7	7SDP U8637	2540-99-147-9629 8251999071	. LH SIDE, REAR	1 EA	
	8	7SDP U8637	2540-99-708-6760 8251999101	. RH SIDE, REAR	1 EA	
	8A		TBA 8252940947	. RH SIDE, REAR (VECTOR AMBULANCE)	1 EA	
NI	9	7SDP U8637	5315-99-383-4295 758.1.84.007.1/30	PIN, STRAIGHT, HEADED (FRONT TOWING PIN)	1 EA	
NI	10	J1 K5753	9905-99-137-2067 0000-99-151-0639	SIGN, TRAFFIC, DANGER; COMPLETE WITH PLASTIC CONTAINER	1 EA	
NI	11	X1 K0156	6230-99-634-6510 TL1	LIGHT, MARKER, GROUND OBSTRUCTION; 1 LAMP; PLASTICS CASE; 7-1/2 IN. LG, 3-3/4 IN. W, 13-1/2 IN. H; PLASTIC LENS; AMBER; W/BLINKING FACILITY	1 EA	
NI	12	G1 K1368	5340-99-910-8185 A3-9517	PADLOCK; STEEL; ZINC PLATED; 4 LEVER TYPE 38.00 MM W	3 EA	

NOT ILLUSTRATED

Fig. No Item No	DMC NSCM	Army NSN Part Number	Item Description and Annotations	No Off D of Q	Quantity on Issue
1 NI 13	J1 U4542	5120-99-910-5934 10-99-543	SHOVEL, HAND; RD MOUTH; FORGED; STRAPPED TYPE; 8 IN. BY 9-1/2 IN.; 28 IN. HANDLE	1 EA	
NI 14		5120-99-910-5474	PICK HEAD, DIGGING	1 EA	
NI 15	J1 K1368	5120-99-910-4746 UKD1S2162	HANDLE; MATTOCK-PICK; HICKORY W/METAL SOCKET; 36 IN. LG	1 EA	
NI 16		5110-99-910-4066	AXE, SINGLE BIT	1 EA	
NI 17	J2 K1368	7240-99-120-7251 D2478	CAN, WATER, MILITARY; 5 GALLON; W/2 CAPS AND SECURING CHAINS	2 EA	
NI 18	H8 K3397	8345-99-125-0857 H8HH0190	FLAG, BLUE	1 EA	
NI 19	H8 K3397	8345-99-125-0539 H8HH0193	FLAG, YELLOW	1 EA	
NI 20	H8 K3397	8345-99-125-0858 H8HH0191	FLAG, GREEN	1 EA	
NI 21		8345-99-125-0553	POLE, TENT; VERTICAL; SOLID; WOOD; ROUND; 965 MM LG	2 EA	
NI 22	7SDP D0673	5120-99-721-9618 250183.0	JACK, HYDRAULIC, HAND	1 EA	
NI 23	7SDP D0673	5120-99-192-5491 7101552211	BAR, CAPSTAN (JACK, HYDRAULIC)	1 EA	
NI 24	7SDP D8242	5120-99-670-4339 715-01	WHEEL BRACE	1 EA	
NI 25		4210-99-998-3537	EXTINGUISHER, FIRE	2 EA	
NI 26		6545-99-505-1883	FIRST AID KIT, MOTOR VEHICLE	1 EA	
NI 27		4020-99-996-9812	CORD ASSEMBLY, ELASTIC	4 EA	
NI 28	7SDP U0205	2540-99-599-0502 5/1629	STROP ASSEMBLY, TOWING; 5000 MM LG STROP, LOOP BOTH ENDS, 7000 KG RECOVERY LOAD LIMIT; COILED & RETAINED USING STOWAGE LASHING	1 EA	
NI 29		8415-99-575-0673	VEST, HIGH VISIBILITY	1 EA	
NI 30		6230-99-910-5033	FLASHLIGHT	1 EA	

NOT ILLUSTRATED

Fig. No Item No	DMC NSCM	Army NSN Part Number	Item Description and Annotations	No Off D of Q	Quantity on Issue
1 NI 31		7240-99-820-5428	SPOUT, JERRYCAN	1 EA	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	
NI 34	7VECT U8637	2540-99-215-5775 8251780011	SIDE FACING SEAT REAR, COMPLETE	2 EA	
NI 35	7VECT U8637	2590-99-265-1406 8251940994	GUNNER STEP	1 EA	
NI 36	7VECT U8637	8465-99-226-0260 8251839341	BAG, MISC STOWAGE, 35" x 20" W/DRAW CORD	1 EA	
NI 37	7VECT U8637	4110-99-349-5848 8251949831	COOLING/FREEZING BOX	1 EA	
NI 38	7VECT U8637	4110-99-724-9302 8251949832	COOLING/HEATING BOX	1 EA	
NI 39	7VECT U8637	2590-99-613-4911 8251878554	THERMAL BLANKET, WINDSCREEN	1 EA	
NI 40	U8637	8251878555	THERMAL BLANKET, SIDE SCREEN (VECTOR 1)	2 EA	
NI 41	U8637	8251878556	THERMAL BLANKET, SIDE SCREEN (VECTOR 2)	2 EA	

CHAPTER 2-2

COMPLETE EQUIPMENT SCHEDULE (SERVICE)
SIMPLE EQUIPMENT

TOOLS

NOT ILLUSTRATED

Fig 1

Fig. No Item No	DMC NSCM	Army NSN Part Number	Item Description and Annotations	No Off D of Q	Quantity on Issue
1					
NI 1	7SDP U8637	5120-99-400-1243 D052440010	PLIERS	1 EA	
NI 2	7SDP U8637	5120-99-500-1294 7101552141	KEY, SOCKET HEAD SCREW; STEEL; ZINC PLATED; 122 MM NOM O/A LG; 112 MM MAX LONG ARM LG; 20 MM NOM SHORT ARM LG; 10 MM HEX A/F	1 EA	
NI 3	O D8242	5120-12-120-9362 2100-06	WRENCH KEY, SOCKET HEAD SCREW; STEEL; 92 MM TO 96 MM O/A LG; 6 MM HEX A/F	1 EA	
NI 4	O D9617	5120-12-123-5451 900-8	BAR, SOCKET WRENCH HANDLE; STEEL; 180 MM MAX O/A LG; 8 MM MAX OD	1 EA	
NI 5	7SDP U8637	5120-99-695-3440 D009000019	BAR, SOCKET WRENCH HANDLE; STEEL; 6 MM MAX OD	1 EA	
NI 6	7SDP U8637	5120-99-660-9360 D008960029	WRENCH, BOX; 10 MM X 13 MM; 145 MM MAX O/A LG	1 EA	
NI 7	7SDP U8637	5120-99-160-4226 D008380059	RING SPANNER; 10 MM X 13 MM; 230 MM MAX O/A LG	1 EA	
NI 8	7SDP U8637	5120-99-172-9937 D008380049	RING SPANNER; 17 MM X 19 MM; 295 MM MAX O/A LG	1 EA	
NI 9	7SDP U8637	5120-99-301-1473 D008380069	RING SPANNER; 22 MM X 24 MM; 340 MM MAX O/A LG	1 EA	
NI 10	7SDP U8637	5120-99-968-1042 D031130010	COMBINATION SPANNER; 27 MM RING/OPEN ENDED; 240 MM MAX O/A LG	1 EA	
NI 11	7SDP U8637	5120-12-123-5054 D031100010	WRENCH, OPEN END, DOUBLE OPEN ENDED SPANNER 10 MM X 11 MM; 130 MM MAX O/A LG	1 EA	
NI 12	F1 D9524	5120-12-120-6707 S130-8X10	WRENCH, OPEN END; STEEL; DOUBLE HD; 120 MM MAX O/A LG; WRENCHING SURFACE SIZE 8 MM 1ST END, 10 MM 2ND END; BOTH ENDS OVAL SHAPE	1 EA	
NI 13	7SDP D9617	5120-99-759-5980 9 0895 1314 30	WRENCH, OPEN END; DOUBLE OPEN ENDED SPANNER 13 X 14 MM	1 EA	
NI 14	7SDP D9617	5120-99-535-4952 9 0895 1722 30	WRENCH, OPEN END; DOUBLE OPEN ENDED SPANNER 17 X 22 MM	1 EA	
NI 15	7SDP U8637	5120-99-983-0528 D008950099	WRENCH, OPEN END; DOUBLE OPEN ENDED SPANNER, 19 MM X 24 MM; 220 MM MAX O/A LG	1 EA	
NI 16	F1 U8637	5120-12-121-1058 D009110061	KEY, SOCKET HEAD SCREW; STEEL; 5/16" A/F; 109 MM O/A LG	1 EA	

NOT ILLUSTRATED

Fig 1

Fig. No Item No	DMC NSCM	Army NSN Part Number	Item Description and Annotations	No Off D of Q	Quantity on Issue
1					
NI 17	7SDP U8637	5120-99-147-1767 D008960019	WRENCH, SOCKET; BOX SPANNER 13 X 17 MM	1 EA	
NI 18	7SDP U8637	5120-99-376-2585 D010410019	HAMMER, HAND; 300 G; 300 MM O/A LG	1 EA	
NI 19	7SDP C0494	5120-99-551-2562 7101552110	SCREWDRIVER, REVERSIBLE	1 EA	
NI 20	U8637	5120-12-121-1057 D009110086	KEY, SOCKET HEAD SCREW; STEEL; 5 MM A/F	1 EA	
NI 21	7SDP U8637	5120-99-877-9429 D008380079	RING SPANNER; 13 MM X 15 MM	1 EA	
NI 22	6MT2 U2042	4910-99-807-0183 019-0031-0003-99-056-6	GAUGE, TYRE PRESSURE, SELF CONTAINED, CALIBRATED 10-120 LBS / SQ.IN., IN 2LB DIVISIONS, C/W POCKET CLIP	1 EA	
NI 23	7SDP U8637	5140-99-721-9616 7101552152	ROLL, TOOLS AND ACCESSORIES; 650 MM NOM O/A LG; 500 MM NOM 0/A W;8 POCKETS; W/TIE	1 EA	
NI 24	U8637	9010764	INSULATING TAPE, BLACK	1 EA	
NI 25	7VECT U8637	5120-99-958-7574 8251569269	PRE SET CLICKER TORQUE WRENCH FITTED WITH 3/8 SQ DRIVE RATCHET SUPPLIED PRE SET AT 66NM	1 EA	
NI 26	U8637	8251569270	3/8 SQ DRIVE RATCHET SPECIAL	1 EA	
NI 27	7VECT U8637	5120-99-874-1303 8251569271	17MM SOCKET X 3/8 SQ DRIVE SPECIAL	1 EA	
NI 28	7VECT U8637	2590-99-744-8993 8251560932	FILL ADAPTOR, HYDRAULIC SYSTEM	1 EA	
NI 29	7VECT	6150-99-789-9806 8251859458	CABLE, JUMP START (1 METRE LONG)	1 EA	
NI 30	F1	5120-99-977-4608	WRENCH, VARIABLE (600-3000 INCH POUNDS)	1 EA	
NI 31	F1	5120-99-910-6319	EXTENSION	1 EA	
NI 32	F1	5130-99-978-1880	SOCKET	1 EA	

CHAPTER 2-4

COMPLETE EQUIPMENT SCHEDULE (SERVICE)
SIMPLE EQUIPMENT

LITERATURE

NOT ILLUSTRATED

Fig 1

Fig. No Item No	Army DMC NSCM	 NSN Part Number	Item Description and Annotations	No Off D of Q	Quantity on Issue
1					
NI 1	U1269	NIV AESP 2320-D-503-741	SERVICE EDITION	1 EA	
NI 2	U1269	NIV AB 562	VEHICLE RECORD BOOK	1 EA	
NI 3	U1269	NIV AESP 2320-D-503-601	MAINTENANCE SCHEDULE	1 EA	
NI 4	U1269	NIV AESP 2320-D-503-201	OPERATING INFORMATION	1 EA	

CHAPTER 3

INDEXES

CONTENTS

INTRODUCTION

1 This chapter identifies the number of indexes provided in support to the Main Parts List.

CHAPTER 3-1

INDEX OF NATO STOCK NUMBERS

TO

CHAPTER, FIGURE AND ITEM NUMBERS

INDEX OF NATO STOCK NUMBERS TO CHAPTER, FIGURE AND ITEM NUMBERS

NATO Stock Number	Chapter-Sub Chapter	Fig No	Item No	NATO Stock Number	Chapter-Sub Chapter	Fig No	Item No
2510-99-133-9771	2-1-1	1	6A	5120-12-120-9362	2-2	1	NI3
	2-1-2	1	6A	5120-99-121-1057	2-2	1	NI20
2510-99-134-8233	2-1-1	1	NI35	5120-12-121-1058	2-2	1	NI16
2510-99-404-2682	2-1-1	1	1A	5120-12-123-5054	2-1-2	1	NI11
	2-1-2	1	1A	5120-12-123-5451	2-2	1	NI4
2510-99-492-9348	2-1-1	1	2A	5120-99-147-1767	2-2	1	NI17
	2-1-2	1	2A	5120-99-160-4226	2-2	1	NI7
2510-99-617-8937	2-1-1	1	5A	5120-99-172-9937	2-2	1	NI8
	2-1-2	1	5A	5120-99-192-5491	2-1-1	1	NI23
2540-99-133-8033	2-1-1	1	4	5120-99-192-5491	2-1-2	1	NI23
2540-99-133-8033	2-1-2	1	4	5120-99-301-1473	2-2	1	NI9
2540-99-133-8034	2-1-1	1	1	5120-99-376-2585	2-2	1	NI18
2540-99-133-8034	2-1-2	1	1	5120-99-400-1243	2-2	1	NI1
2540-99-147-9629	2-1-1	1	7	5120-99-500-1294	2-2	1	NI2
2540-99-147-9629	2-1-2	1	7	5120-99-535-4952	2-2	1	NI14
2540-99-215-5775	2-1-1	1	NI34	5120-99-551-2562	2-2	1	NI19
2540-99-215-5775	2-1-2	1	NI34	5120-99-660-9360	2-2	1	NI6
2540-99-359-4596	2-1-1	1	6	5120-99-670-4339	2-1-1	1	NI24
2540-99-359-4596	2-1-2	1	6	5120-99-670-4339	2-1-2	1	NI24
2540-99-463-7527	2-1-1	1	5	5120-99-695-3440	2-1-2	1	NI5
2540-99-463-7527	2-1-2	1	5	5120-99-721-9618	2-1-1	1	NI22
2540-99-599-0502	2-1-1	1	NI28	5120-99-721-9618	2-1-2	1	NI22
2540-99-599-0502	2-1-2	1	NI28	5120-99-759-5980	2-2	1	NI13
2540-99-708-6760	2-1-1	1	8	5120-99-874-1303	2-2	1	NI27
2540-99-708-6760	2-1-2	1	8	5120-99-877-9429	2-2	1	NI21
2540-99-752-8078	2-1-1	1	3	5120-99-910-4746	2-1-1	1	NI15
2540-99-752-8078	2-1-2	1	3	5120-99-910-4746	2-1-2	1	NI15
2540-99-812-5891	2-1-1	1	2	5120-99-910-5474	2-1-1	1	NI14
2540-99-812-5891	2-1-2	1	2	5120-99-910-5474	2-1-2	1	NI14
2590-99-265-1406	2-1-2	1	NI35	5120-99-910-5934	2-1-1	1	NI13
2590-99-613-4911	2-1-1	1	NI37	5120-99-910-5934	2-1-2	1	NI13
	2-1-2	1	NI39	5120-99-910-6319	2-2	1	NI31
2590-99-744-8993	2-2	1	NI28	5120-99-958-7574	2-2	1	NI25
[redacted]	[redacted]	[redacted]	[redacted]	5120-99-968-1042	2-2	1	NI10
[redacted]	[redacted]	[redacted]	[redacted]	5120-99-977-4608	2-2	1	NI30
[redacted]	[redacted]	[redacted]	[redacted]	5120-99-983-0528	2-2	1	NI15
[redacted]	[redacted]	[redacted]	[redacted]	5130-99-978-1880	2-2	1	NI32
4020-99-996-9812	2-1-1	1	NI27	5140-99-721-9616	2-2	1	NI23
4020-99-996-9812	2-1-2	1	NI27	5315-99-383-4295	2-1-1	1	NI9
4110-99-349-5848	2-1-2	1	NI37	5315-99-383-4295	2-1-2	1	NI9
4110-99-724-9302	2-1-2	1	NI38	5340-99-910-8185	2-1-1	1	NI12
4210-99-998-3537	2-1-1	1	NI25	5340-99-910-8185	2-1-2	1	NI12
4210-99-998-3537	2-1-2	1	NI25	6230-99-634-6510	2-1-1	1	NI11
4910-99-807-0183	2-2	1	NI22	6230-99-634-6510	2-1-2	1	NI11
5110-99-910-4066	2-1-1	1	NI16	6230-99-910-5033	2-1-1	1	NI30
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5120-12-120-6707	2-2	1	NI12	6545-99-505-1883	2-1-1	1	NI26

INDEX OF NATO STOCK NUMBERS TO CHAPTER, FIGURE AND ITEM NUMBERS

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6545-99-505-1883	2-1-2	1	NI26
7240-99-120-7251	2-1-1	1	NI17
7240-99-120-7251	2-1-2	1	NI17
7240-99-820-5428	2-1-1	1	NI31
7240-99-820-5428	2-1-2	1	NI31
8345-99-125-0539	2-1-1	1	NI19
8345-99-125-0539	2-1-2	1	NI19
8345-99-125-0553	2-1-1	1	NI21
8345-99-125-0553	2-1-2	1	NI21
8345-99-125-0857	2-1-1	1	NI18
8345-99-125-0857	2-1-2	1	NI18
8345-99-125-0858	2-1-1	1	NI20
8345-99-125-0858	2-1-2	1	NI20
8415-99-575-0673	2-1-1	1	NI29
8415-99-575-0673	2-1-2	1	NI29
8465-99-226-0260	2-1-1	1	NI36
	2-1-2	1	NI36
9905-99-137-2067	2-1-1	1	NI10
9905-99-137-2067	2-1-2	1	NI10

CHAPTER 3-2

INDEX OF MANUFACTURER'S PART/DRAWING NUMBERS

TO

CHAPTER, FIGURE AND ITEM NUMBERS

INDEX OF MANUFACTURERS' PART/DRAWING NUMBERS TO CHAPTER, FIGURE AND ITEM NUMBERS

Manufacturers Parts or Drawing Numbers	Chapter-Sub Chapter	Fig No	Item No	Manufacturers Parts or Drawing Numbers	Chapter-Sub Chapter	Fig No	Item No
250183	2-1-1	1	NI22	8251999474	2-1-1	1	5A
250183	2-1-2	1	NI22	8251999474	2-1-2	1	5A
9010764	2-2	1	NI24	8251999475	2-1-1	1	6A
7101552110	2-2	1	NI19	8251999475	2-1-2	1	6A
7101552141	2-2	1	NI2	8251999476	2-1-1	1	1A
7101552152	2-2	1	NI23	8251999476	2-1-2	1	1A
7101552211	2-1-1	1	NI23	8251999477	2-1-1	1	2A
7101552211	2-1-2	1	NI23	8251999477	2-1-2	1	2A
8251560932	2-2	1	NI28	8252940947	2-1-2	1	8A
8251569269	2-2	1	NI25	0000-99-151-0639	2-1-1	1	NI10
8251569270	2-2	1	NI26	0000-99-151-0639	2-1-2	1	NI10
8251569271	2-2	1	NI27	019-0031-0003-99-056-6	2-2	1	NI22
8251780011	2-1-1	1	NI34	10-99-543	2-1-1	1	NI13
8251780011	2-1-2	1	NI34	10-99-543	2-1-2	1	NI13
[redacted]	[redacted]	[redacted]	[redacted]	2100-06	2-2	1	NI3
[redacted]	[redacted]	[redacted]	[redacted]	5/1629	2-1-1	1	NI28
[redacted]	[redacted]	[redacted]	[redacted]	5/1629	2-1-2	1	NI28
[redacted]	[redacted]	[redacted]	[redacted]	715-01	2-1-1	1	NI24
8251830914	2-1-1	1	NI35	715-01	2-1-2	1	NI24
8251839341	2-1-1	1	NI36	7581840071/30	2-1-1	1	NI9
8251839341	2-1-2	1	NI36	7581840071/30	2-1-2	1	NI9
8251859458	2-2	1	NI29	90895131430	2-2	1	NI13
8251878554	2-1-1	1	NI37	90895172230	2-2	1	NI14
8251878554	2-1-2	1	NI39	900-8	2-2	1	NI4
8251878555	2-1-1	1	NI38	A3-9517	2-1-1	1	NI12
8251878555	2-1-2	1	NI40	A3-9517	2-1-2	1	NI12
8251878556	2-1-1	1	NI39	D008380049	2-2	1	NI8
8251878556	2-1-2	1	NI41	D008380059	2-2	1	NI7
8251940994	2-1-2	1	NI35	D008380069	2-2	1	NI9
8251949831	2-1-2	1	NI37	D008380079	2-2	1	NI21
8251949832	2-1-2	1	NI38	D008950099	2-2	1	NI15
8251999067	2-1-1	1	3	D008960019	2-2	1	NI17
8251999067	2-1-1	1	5	D008960029	2-2	1	NI6
8251999067	2-1-2	1	3	D009000019	2-2	1	NI5
8251999067	2-1-2	1	5	D009110061	2-2	1	NI16
8251999068	2-1-1	1	4	D009110086	2-2	1	NI20
8251999068	2-1-2	1	4	D010410019	2-2	1	NI18
8251999069	2-1-1	1	6	D031100010	2-2	1	NI11
8251999069	2-1-2	1	6	D031130010	2-2	1	NI10
8251999070	2-1-1	1	1	D052440010	2-2	1	NI1
8251999070	2-1-2	1	1	D2478	2-1-1	1	NI17
8251999071	2-1-1	1	7	D2478	2-1-2	1	NI17
8251999071	2-1-2	1	7	H8HH0190	2-1-1	1	NI18
8251999072	2-1-1	1	2	H8HH0190	2-1-2	1	NI18
8251999072	2-1-2	1	2	H8HH0191	2-1-1	1	NI20
8251999101	2-1-1	1	8	H8HH0191	2-1-2	1	NI20
8251999101	2-1-2	1	8	H8HH0193	2-1-1	1	NI19

INDEX OF MANUFACTURERS' PART/DRAWING NUMBERS TO CHAPTER, FIGURE AND ITEM NUMBERS

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S130-8X10	2-2	1	NI12
TL1	2-1-1	1	NI11
TL1	2-1-2	1	NI11
UKD1S2162	2-1-1	1	NI15
UKD1S2162	2-1-2	1	NI15

CONDITIONS OF RELEASE

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TRUCK UTILITY MEDIUM (HEAVY DUTY), 6X6 PPV VECTOR

TECHNICAL DESCRIPTION

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence
Issued by

DEFENCE LOGISTICS ORGANISATION

AMENDMENT RECORD

Amdt No.	Incorporated By (Signature)	Date
1	BAE Systems Land Systems Pinzgauer Limited	Aug 07
2	BAE Systems Land Systems Pinzgauer Limited	Nov 07
3	BAE Systems Land Systems Pinzgauer Limited	Sep 08
4	BAE Systems Land Systems Pinzgauer Limited	Mar 09
5	BAE Systems Land Systems Pinzgauer Limited	Sep 09
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Amdt No.	Incorporated By (Signature)	Date
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CONTENTS

PRELIMINARY MATERIAL

TECHNICAL DESCRIPTION

Chapter

PREFACE

Sponsor : DEC CSS

Publications Authority: DLO Andover

INTRODUCTION

1 Service users should forward any comments on this publication through the channels prescribed in AESP 0100-P-011-013. An AESP Form 10 is provided after the preliminary pages 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), by Standing Operating Procedures (SOPs) or by local regulations. When any such Instruction, Order or regulation contradicts any portion of this publication it is to be taken as the overriding authority.

4 The subject matter of this publication details information specific to Truck Utility Medium (Heavy Duty) 6x6 PPV VECTOR Pinzgauer variant.

5 For periods of servicing and lubricants to be used reference must be made to the Maintenance Schedule.

EQUIPMENT IDENTITY

6 The details are listed in Table 1

TABLE 1 EQUIPMENT IDENTITY

Serial (1)	Asset Code (2)	Designation (3)	UCE/ UCA
1	1774 3100	Truck Utility Medium (Heavy Duty) 6X6 PPV VECTOR	A
2		Truck Utility Medium (Heavy Duty) 6X6 PPV VECTOR 2	B
3	1045 3100	Ambulance Protected TUM (HD) 1 Stretcher 6x6 2.5 LTR DSL VECTOR	C
4	1045 3101	Ambulance Protected TUM (HD) 1 Stretcher 6x6 2.5 LTR DSL VECTOR 2	D

6.1 The Original Equipment Manufacturer (OEM) is as follows:

BAE Systems Land Systems Pinzgauer Limited
Midleton House
Midleton Industrial Estate
Guildford
Surrey
GU2 8XW
England

www.baesystems.com

6.2 Contract Nos:
SUVC1/0077

RELATED AND ASSOCIATED PUBLICATIONS

Related publications

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

Category/Sub-category			Information Level			
			1 User/ Operator	2 Unit Maintenance	3 Field Maintenance	4 Base Maintenance
1	0	Purpose and Planning	101	101	101	101
	1	Equipment Support Policy Directives	111	111	111	111
2	0	Operating Information	201	201	201	201
	1	Aide Memoire	*	*	*	*
	2	Training Aids	*	*	*	*
3		Technical Description	*	302	302	302
4	1	Installation Instructions	411	411	411	411
	2	Preparation for Special Environments	*	*	*	*
5	1	Failure Diagnosis	*	512	512	512
	2	Maintenance Instructions	201	522	522	522
	3	Inspection Standards	*	532	532	532
	4	Calibration Procedures	*	*	*	*
6		Maintenance Schedules	601	601	601	601
7	1	Illustrated Parts Catalogue	711	711	711	711
	2	Commercial Parts List	*	*	*	*
	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

NOTES

(1) Reference to AESP 0100-A-001-013 must be made to ensure the availability of the listed publications.

(2) Category 8 preliminary pages to be issued with the first Modification or General Instruction.

Associated publications

8

Reference	Title
JSP 71	Joint Service Movement Diagrams
JSP 341	Joint Service Road Transport Regulations
JSP 800	Defence Movements and Transportation Regulations Volume 5 Road Transport

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* AESP or EMER

CHAPTER 1

ENGINE TECHNICAL DESCRIPTION

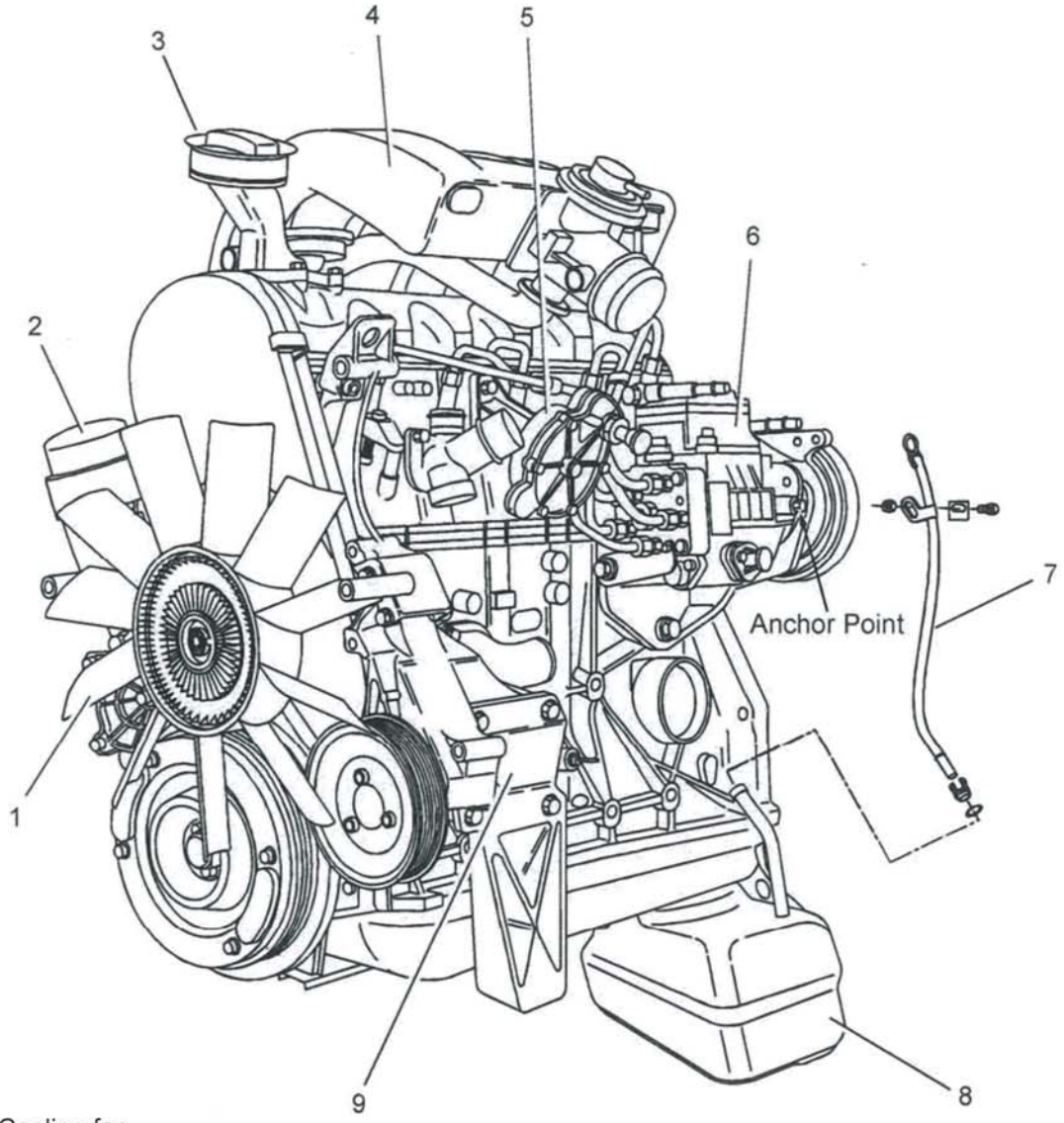
CONTENTS

(continued)

CONTENTS (continued)

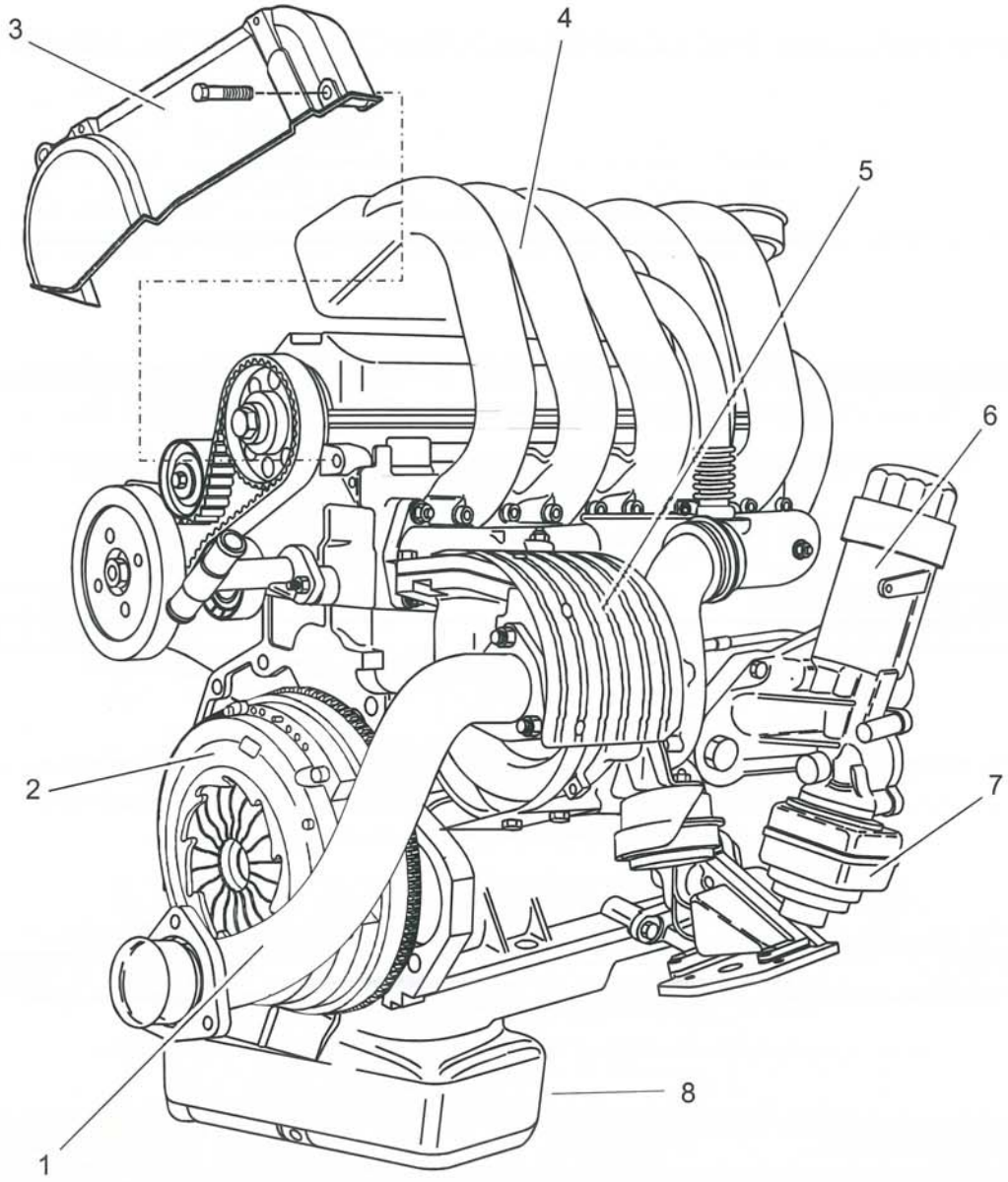
GENERAL DESCRIPTION

1 The water-cooled, five-cylinder, in line diesel engine with direct fuel injection, operates on a four-stroke cycle and has a turbocharger and intercooler. The cylinders have a capacity of 2460 cm^3 and the unit develops power of 100 kW at 4500 rpm and torque of 280 Nm at 1900 - 2500 rpm. The engine satisfies the 1998 EURO III exhaust emission limits and is the major reason for its installation in the Pinzgauer vehicle. The engine is equipped with an Electronic Diesel Control (EDC) engine management system which is described further in this chapter.



1 Cooling fan
2 Oil filter
3 Oil filler pipe
4 Intake manifold
5 Vacuum pump
6 Fuel injection pump
7 Engine oil dipstick
8 Engine oil sump
9 Power Assisted Steering (PAS) pump (obscured by engine mounting)

Fig 1 Engine view, LHS



1 Turbocharger exhaust
2 Flywheel
3 Cover for toothed belt
4 Intake manifold
5 Turbocharger with heat shield.
6 Oil filter
7 Oil cooler
8 Oil sump

Fig 2 Engine view, RHS

2 In-cab access to the engine is via a maintenance cover located between the seats. The cover has a removable top panel for frequent access to the oil filler, dipstick etc. Scheduled maintenance tasks, however, require complete removal of both the driver / passenger seats and maintenance cover.

ELECTRONIC DIESEL CONTROL SYSTEM OVERVIEW

Sensors

3 To optimise engine performance with respect to torque delivery, consumption and emission in every operating situation, the Electronic Diesel Control (EDC) control unit (J248) refers to 25 maps and characteristic curves embedded in the EDC control unit (J248) software. Sensors supply the EDC control unit (J248) with information regarding the vehicle's momentary operating state. The EDC control unit (J248) may sometimes be referred to as the 'brain' or 'ECU' and is located behind the passenger seat adjacent to the fuses on the near side of the vehicle.

NOTE

The 'self-diagnosis' monitors all the components shown in Fig 3 and Fig 4. (see 'internal functions of the control unit').

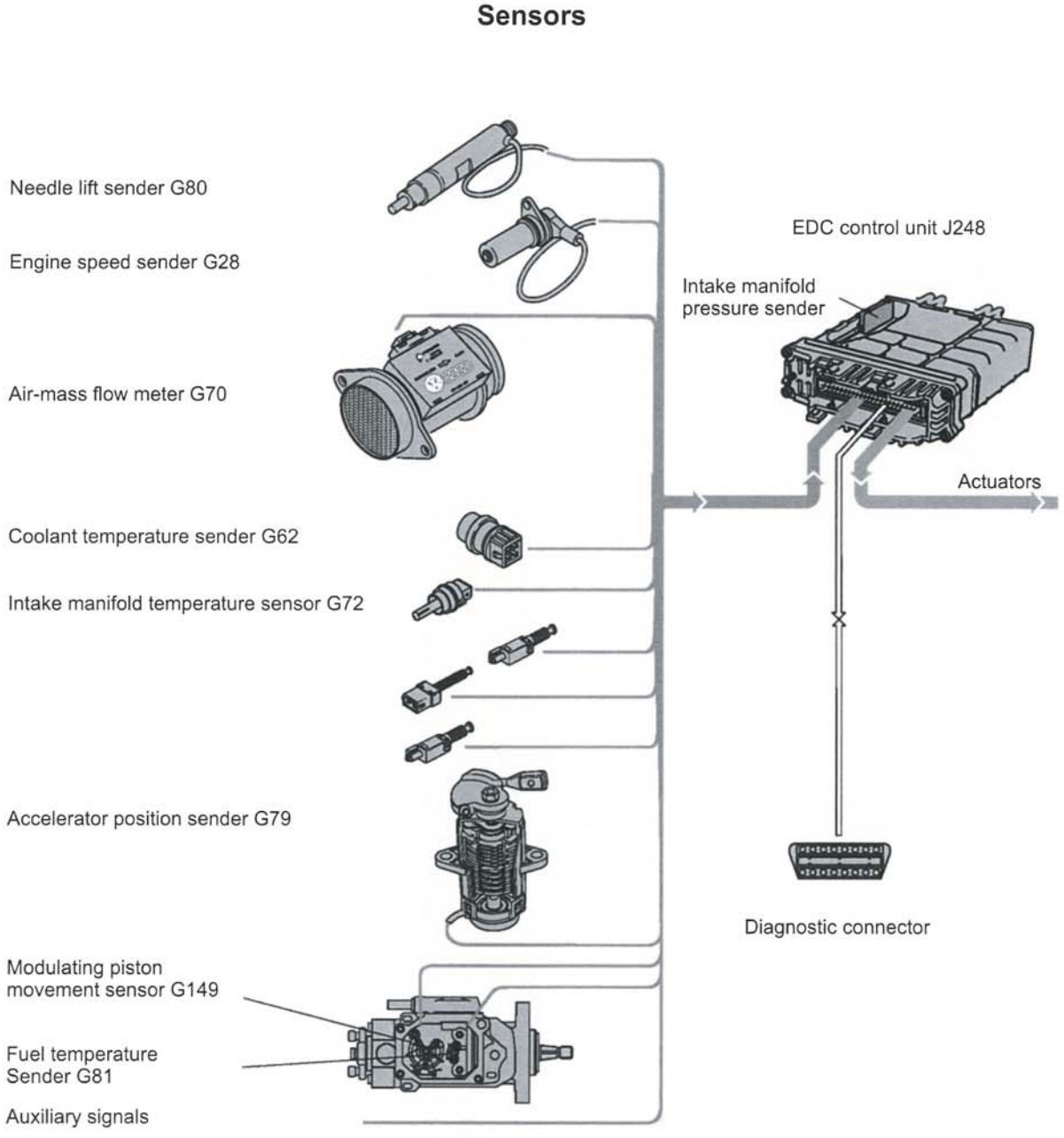


Fig 3 System overview – sensors

Actuators

4 After the information supplied by the sensors has been evaluated, the EDC control unit (J248) sends signals to the final control elements (actuators). Injection quantity, commencement of injection, charge pressure and exhaust gas recirculation are monitored and regulated in this way.

5 The EDC control unit (J248) also assumes the task of controlling the glow plug system.

NOTE

Location of sensors and actuators shown in Fig 5.

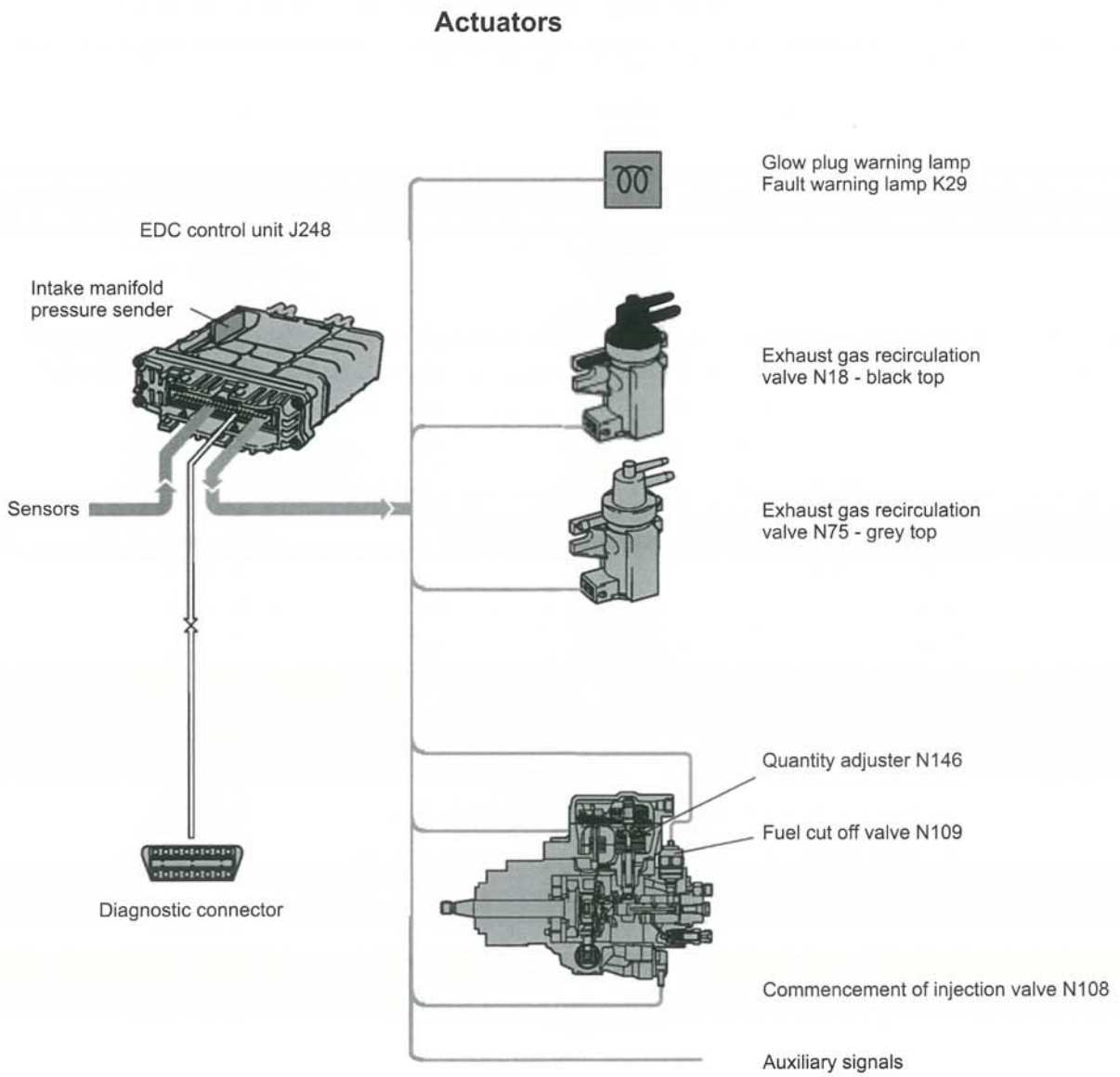
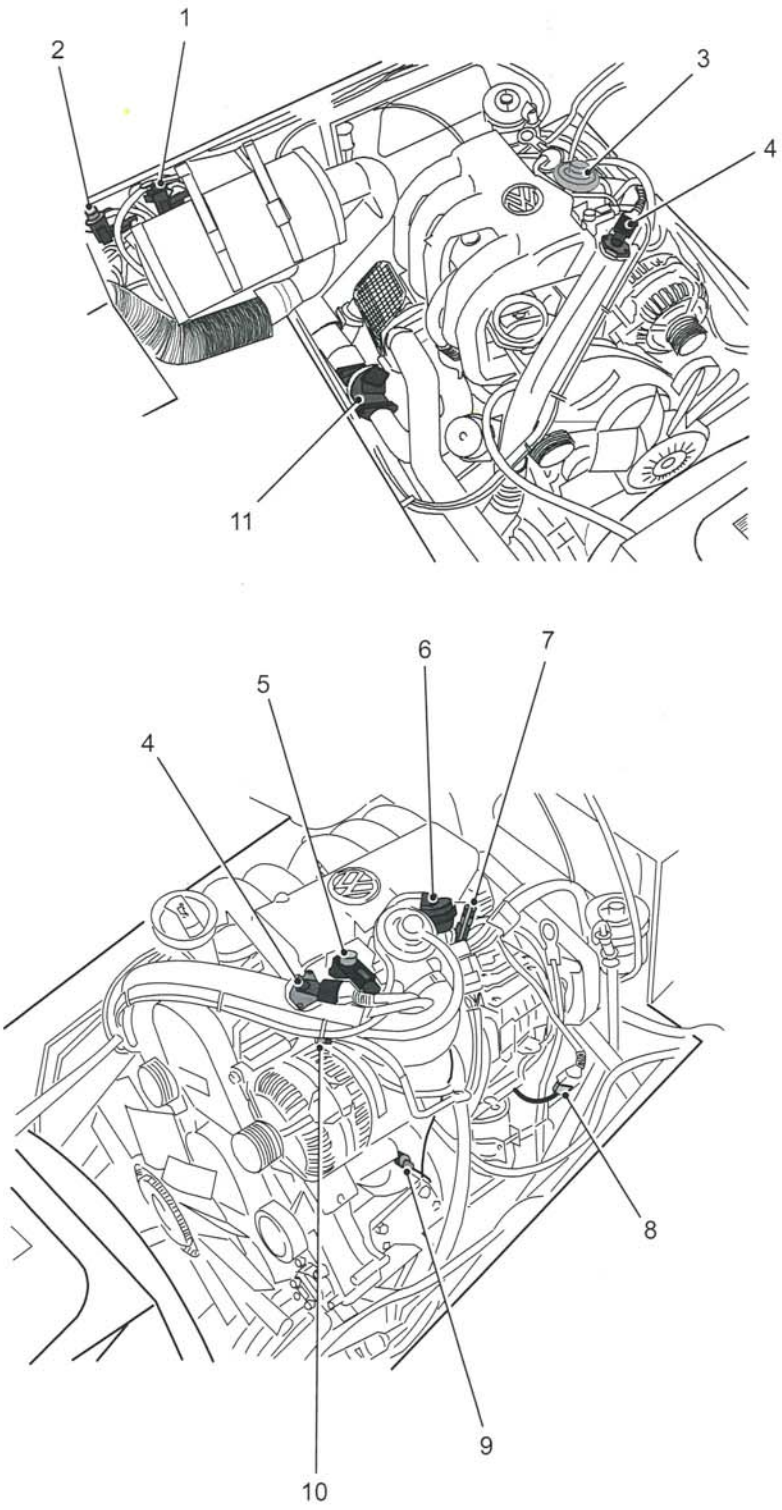


Fig 4 System overview - actuators



1 Exhaust gas recirculation valve N18
2 Solenoid valve for charge pressure control N75
3 EGR valve
4 Intake manifold pressure/temperature sender G71/G72
5 Switchover valve for intake manifold flap B239 (NOT CONNECTED)
6 Engine shut off actuator
7 Needle lift sender G80
8 Engine speed sender G28
9 Oil pressure switch
10 Coolant temperature sender G62
11 Air mass flow meter G70

Fig 5 Location of sensors and actuators

FUEL INJECTION

General

6 The aluminium cylinder head assembly facilitates direct injection. The intake port, pistons and injectors have been designed specifically to optimise the combustion process with respect to noise emission and running chraracteristics.

Combustion process

Direct injection

7 In the direct injection engine, diesel fuel is injected directly into the main combustion chamber, resulting in more efficient combustion and lower consumption.

Inlet swirl port

8 The intake port is shaped in a way that induces a swirling motion of the intake air (see Fig 6) and as a result, produces greater turbulence in the combustion chamber and piston recess.

Piston recess

9 The shape of the recess in the piston crown is of an optimised design for engine efficiency.

Five-hole injector

10 The fuel is injected into the piston recess in two stages and is ignited by the hot air in the cylinder. The two-stage injection process avoids sharp rises in pressure.

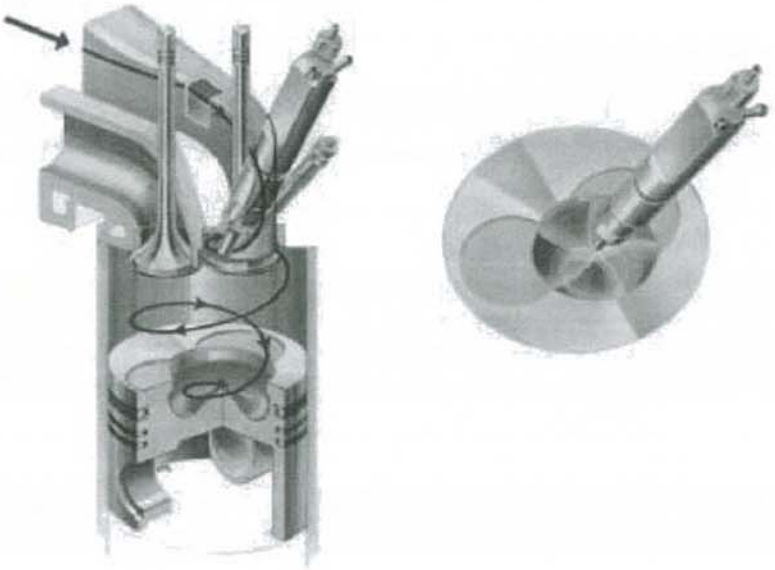


Fig 6 Fuel inlet swirl, and injection process

Injector needle

Two-spring injector holder

11 A two-spring injector is used for the direct injection system. The injector holder allows fuel to be injected in two stages. The injector has a five-hole nozzle design.

Function

12 Two springs with different thicknesses are integrated in the injector holder. The injector needle is only lifted against the force of the first spring when injection starts (see Fig 7, stroke 1). A small quantity of fuel is pre-injected through the small gap which appears at low pressure.

13 This pre-injection cycle produces a gentle rise in the combustion pressure and creates the optimum conditions for igniting the main fuel quantity. The gentle rise in pressure within the combustion chamber also minimises noise levels and reduces mechanical load.

14 As the injection pump delivers more fuel than can actually flow through the small gap, the pressure in the injector rises. The force of the second spring is overcome (see Fig 7, stroke 2) and the injector needle is lifted further. The main injection cycle now follows at a higher injection pressure.

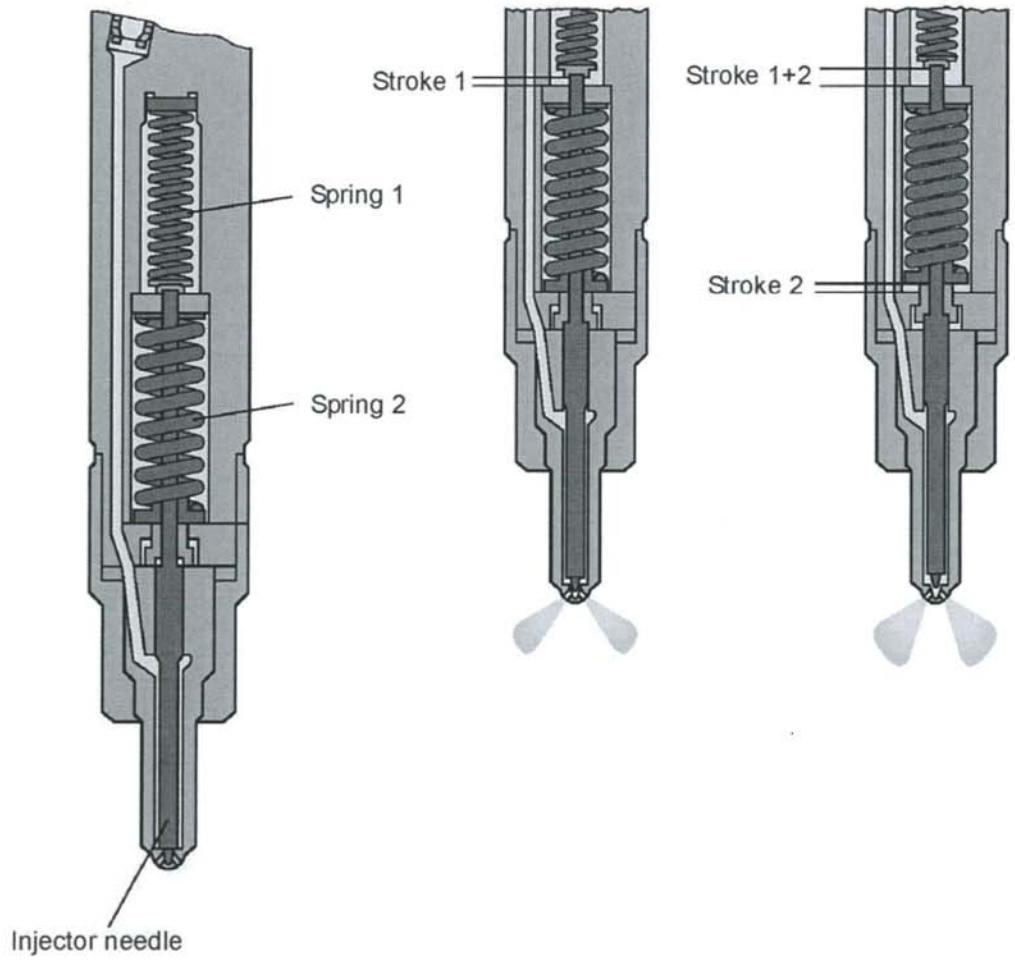


Fig 7 Injector cycle

Needle lift sender

General

15 The injector of the 5th cylinder is equipped with a needle lift sender (G80) (see Fig 8) for registering the point of commencement of injection. The needle lift sender (G80) signals the actual opening time of the injector to the EDC control unit (J248). This signal provides the EDC control unit (J248) with feedback on whether the point of commencement of fuel injection conforms to the commencement of injection map (see 'injection commencement control').

Function

16 Needle lift sender (G80) is a solenoid that is supplied with a constant current by the EDC control unit (J248). This produces a magnetic field.

17 A pressure pin inside the solenoid forms an extension to the end of the injector needle. The movement of the injector needle alters the magnetic field and causes distortion of the dc voltage applied to the solenoid.

18 The EDC control unit (J248) calculates the actual point of commencement of fuel injection from the time difference between the needle lift pulse and the Top Dead Centre (TDC) signal supplied by the engine speed sender (G28). At the same time, the system compares the actual point of commencement of injection with the setpoint stored in the EDC control unit (J248) and corrects any deviations from the setpoint.

Backup function

19 If the needle lift sender (G80) fails, an emergency running program is started. In this program, the commencement of fuel injection is controlled according to fixed setpoints as defined in a map. The injection quantity is also reduced.

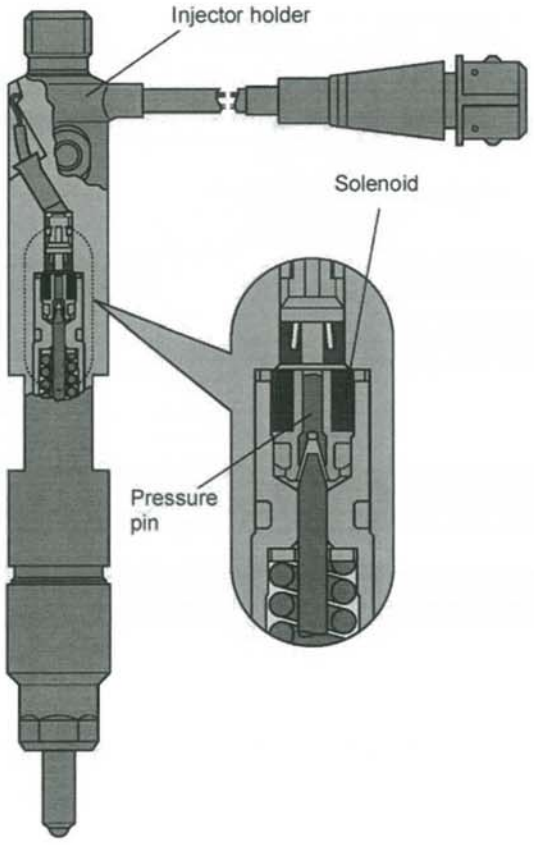


Fig 8 Needle lift sender

Air-mass flow meter

General

20 The task of the air-mass flow meter (G70) (see Fig 9), located on the off-side of the engine, is to measure the fresh air mass supplied to the engine. The fresh air mass is used to calculate the exhaust gas recirculation rate and the permissible injection quantity.

Function

21 A heated surface, the hot film, is regulated to a constant temperature. The intake air cools the hot film as it flows past. The current necessary to keep the temperature of the hot film constant serves as a measure of the intake air mass required.

22 The advantage of hot-film air mass metering over other methods is that air-mass data can be acquired without additional air pressure and temperature sensors.

Backup function

23 If the air-mass flow meter (G70) fails, the EDC control unit (J248) defaults to a fixed air mass value. This fixed value is calculated such that a reduction in engine performance will occur.

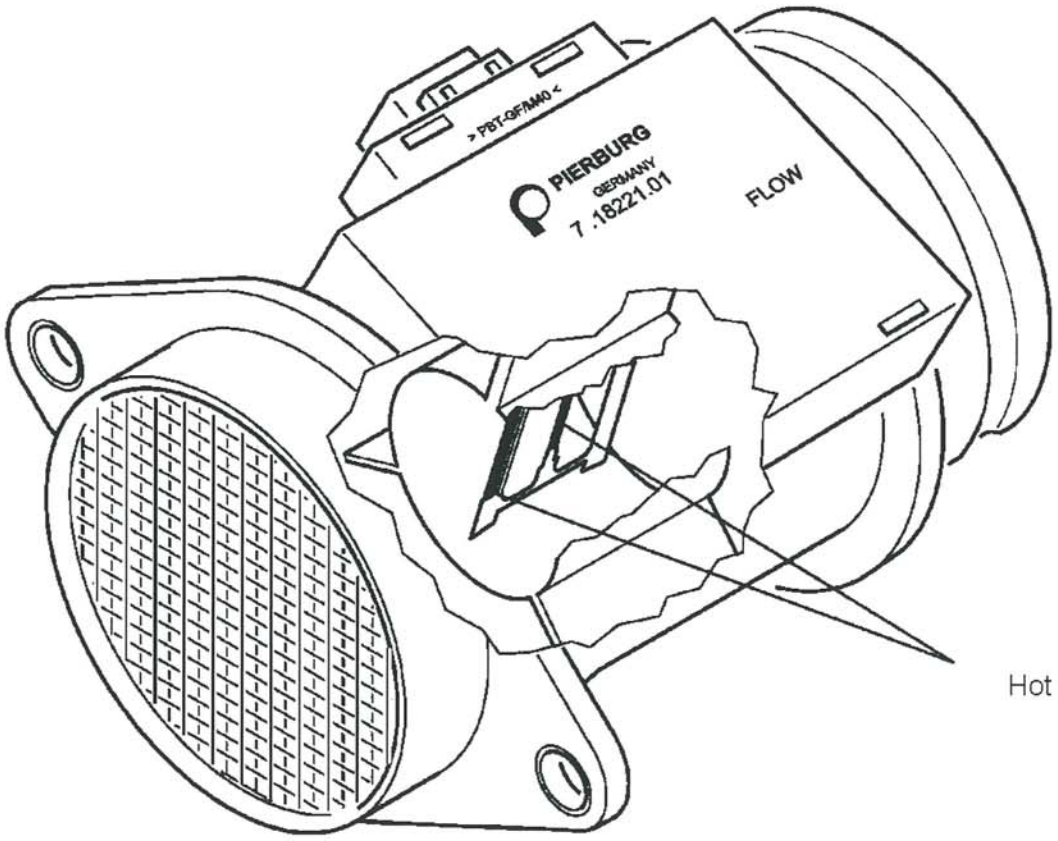


Fig 9 Air-mass flow meter

Modulating piston movement sender

General

24 Modulating piston movement sender (G149) (see Fig 10) supplies the EDC control unit (J248) with information on the momentary position of the quantity adjuster (N146) in the fuel injection pump. The injected fuel quantity is calculated from this information.

25 Modulating piston movement sender (G149) is a non-contact sensor for measuring the angle of rotation. It is attached to the eccentric shaft of the quantity adjuster (N146).

Function

26 An alternating magnetic field is produced in a specifically shaped iron core by ac voltage. A metal ring attachment to the eccentric shaft moves along the iron core and influences this magnetic field. The change in the magnetic field is evaluated electronically in the EDC control unit (J248) and indicates the position of the quantity adjuster (N146).

27 The non-contact sender offers the following advantages:

(1) High wear resistance.
(2) High interference immunity.
(3) Low susceptibility to temperature fluctuation.

Backup function

28 If the EDC control unit (J248) does not receive a signal from the modulating piston movement sender (G149), the engine is turned off for safety reasons.

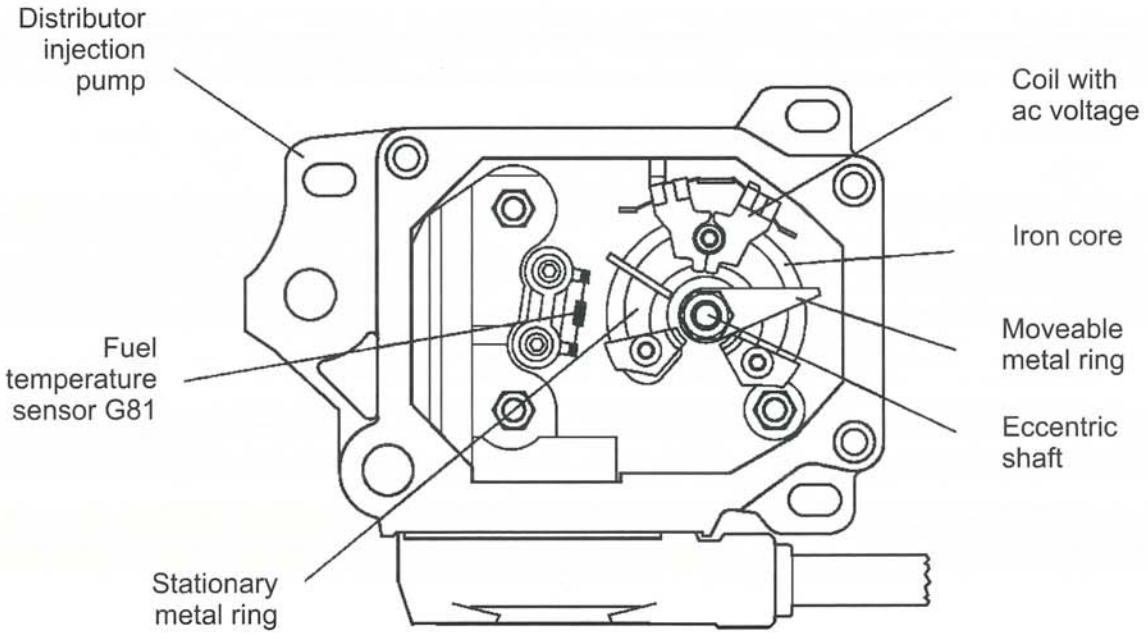


Fig 10 Modulating piston movement sender

FUEL REGULATION

Overview

29 The engine meters the fuel quantity electronically. The correct quantity is determined in the EDC control unit (J248) using the sensor inputs shown in Fig 11. The EDC control unit (J248), located behind the passenger's seat on the near-side bulkhead, sends a signal to the quantity adjuster (N146) in the fuel injection pump. There is no mechanical link between the accelerator pedal and the injection pump. The term 'fly-by-wire throttle' is often used to describe this process.

30 To avoid black exhaust smoke, the injection quantity is limited via a smoke characteristic curve.

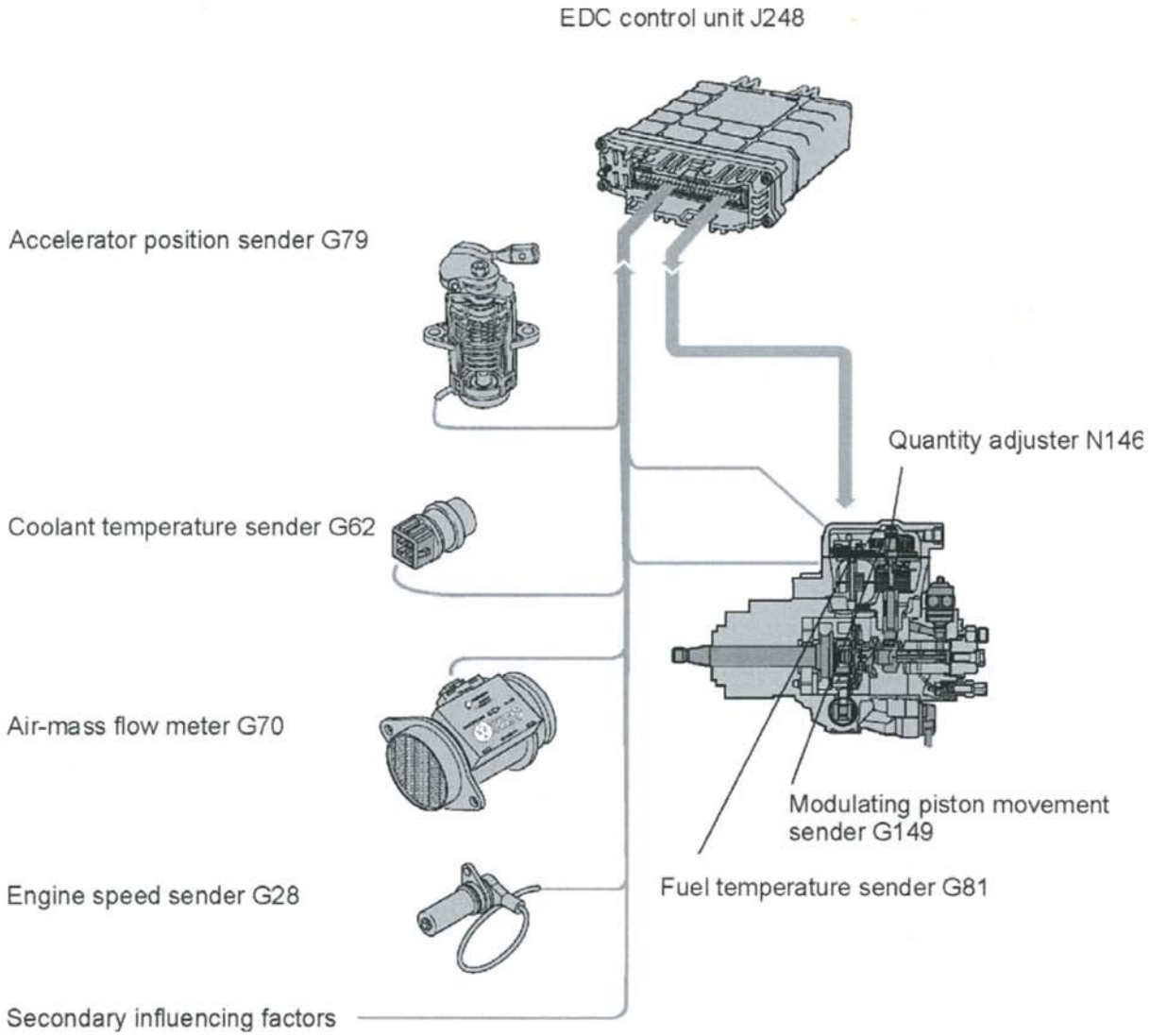


Fig 11 Fuel regulation system

Influencing factors

31 Accelerator pedal position (Fig 12). A decisive factor for determination of the injection quantity is the position of the accelerator pedal, ie the driver input. The accelerator position sender (G79) (see Fig 12) is a sliding contact potentiometer and includes an idling switch and kick down switch. The accelerator position sender (G79) is located on the rear bulkhead of the cab behind the air filter. From these signals, the EDC control unit (J248) calculates the necessary fuel quantity using additional parameters.

Fig 12 Accelerator pedal position sender G79

32 Backup function. If a fault occurs, the engine runs at a higher idling speed so that the vehicle can reach the nearest maintenance facility. The accelerator position sender (G79) is deactivated.

33 Fuel and coolant temperature (Fig 13). The EDC control unit (J248) calculates the quantity of fuel to be injected. The EDC control unit (J248) receives a data input from the fuel temperature sender (G81), which is located internally with the modulating piston movement sender (G149). It also receives a signal from the coolant temperature sender (G62), located on top of the engine forward of the inlet manifold. In order for the EDC control unit (J248) to make a precise calculation, allowance must be made for the coolant temperature and the density of the diesel fuel. The temperature of the fuel is determined, therefore.

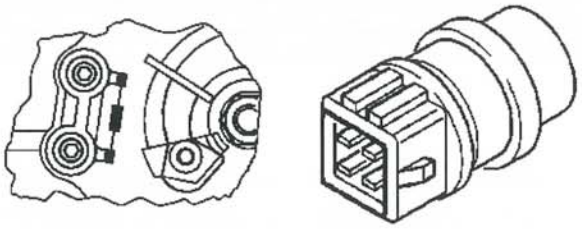


Fig 13 Fuel temperature sender G81 and coolant temperature sender G62

34 Backup function. If one (or both) of these signals is missing, the coolant and fuel temperatures are calculated with stored substitute values.

35 Engine speed (Fig 14). The engine speed sender (G28), located on the near-side of the engine, is one of the main inputs which the EDC control unit (J248) processes in order to calculate the injection quantity.

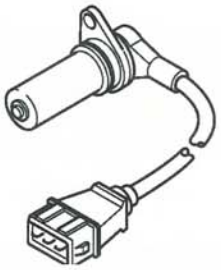


Fig 14 Engine speed sender G28

36 Backup function. If the engine speed sender (G28) is faulty the engine is switched OFF for safety reasons.

37 Air mass (Fig 15). The air-mass flow meter (G70) determines the intake air mass. A smoke map, stored in the EDC control unit (J248), limits the injection quantity if the induced air mass is too low for smoke-free combustion.

38 Backup function. If the signal fails an emergency program is activated, (see 'air-mass flow meter')

39 Smoke map (Fig 16). The permissible injection quantity is determined using the smoke map stored in the EDC control unit (J248). If the air mass is too low, the injection quantity is limited to the extent that no black smoke occurs.

40 Modulating piston movement (Fig 17). To check the quantity adjuster (N146) and to calculate the fuel quantity, the EDC control unit (J248) requires feedback on the actual quantity of fuel injected. Modulating piston movement sender (G149) is permanently linked to the eccentric shaft of the quantity adjuster (N146). It signals the position of the shaft to the control unit and thus the exact position of the modulating piston.

41 Backup function. If the modulating piston movement sender (G149) fails, the engine is switched OFF for safety reasons.

Fig 15 Air-mass flow meter G70

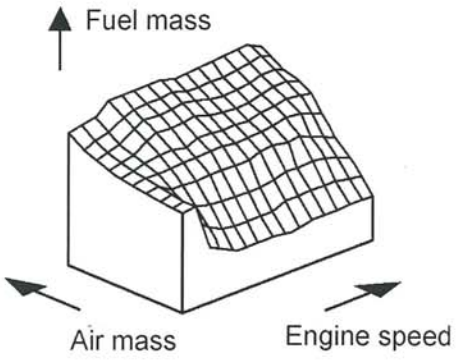


Fig 16 Smoke map

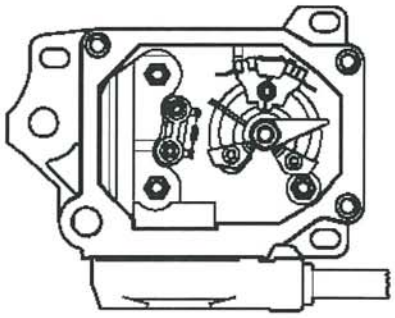


Fig 17 Modulating piston movement sender G149

FUEL QUANTITY CONTROL

EDC control unit

42 The EDC control unit (J248) processes the incoming information. From this it calculates the necessary injection quantity and sends control signals to the quantity adjuster (N146).

Quantity adjuster N146

43 The quantity adjuster (N146) is integrated in the distributor injection pump. The task of the quantity adjuster (N146) is to generate the correct injection quantity from the control signals.

44 The quantity adjuster (N146) is a solenoid that acts like an electric motor, which adjusts the position of the modulating piston via an eccentric shaft and thus regulates the fuel quantity continuously from zero to maximum delivery rate.

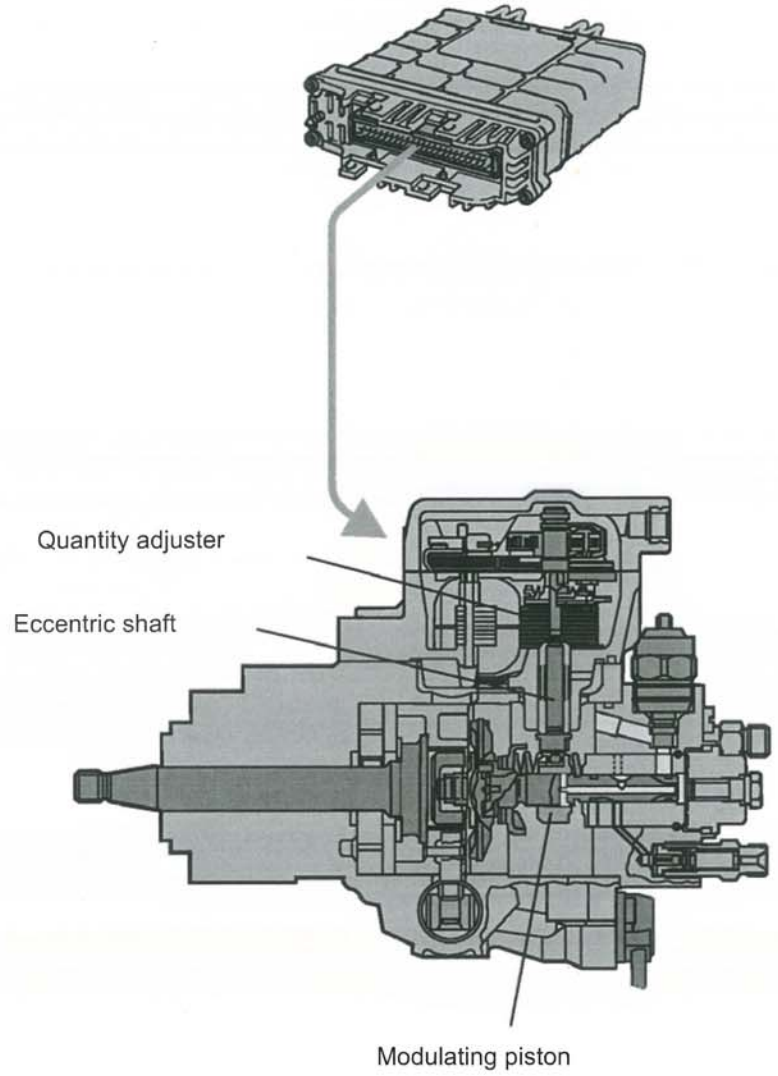


Fig 18 Fuel quantity control function

INJECTION COMMENCEMENT CONTROL

Overview

45 The point of commencement of fuel injection influences various engine characteristics such as starting response, fuel consumption and finally, exhaust emissions. The task of the injection commencement control is to determine the correct point in time for fuel delivery. The EDC control unit (J248) calculates the commencement of injection depending on the influencing factors shown in Fig 19, and issues the corresponding output command to the commencement of injection valve (N108) in the injection pump.

NOTE

To reduce the proportion of nitrogen oxides (NOx) in the exhaust gas, the injection cycle commences slightly later than would otherwise be necessary to develop maximum power output. This causes an increase in hydrocarbon (HC) and particle formation.

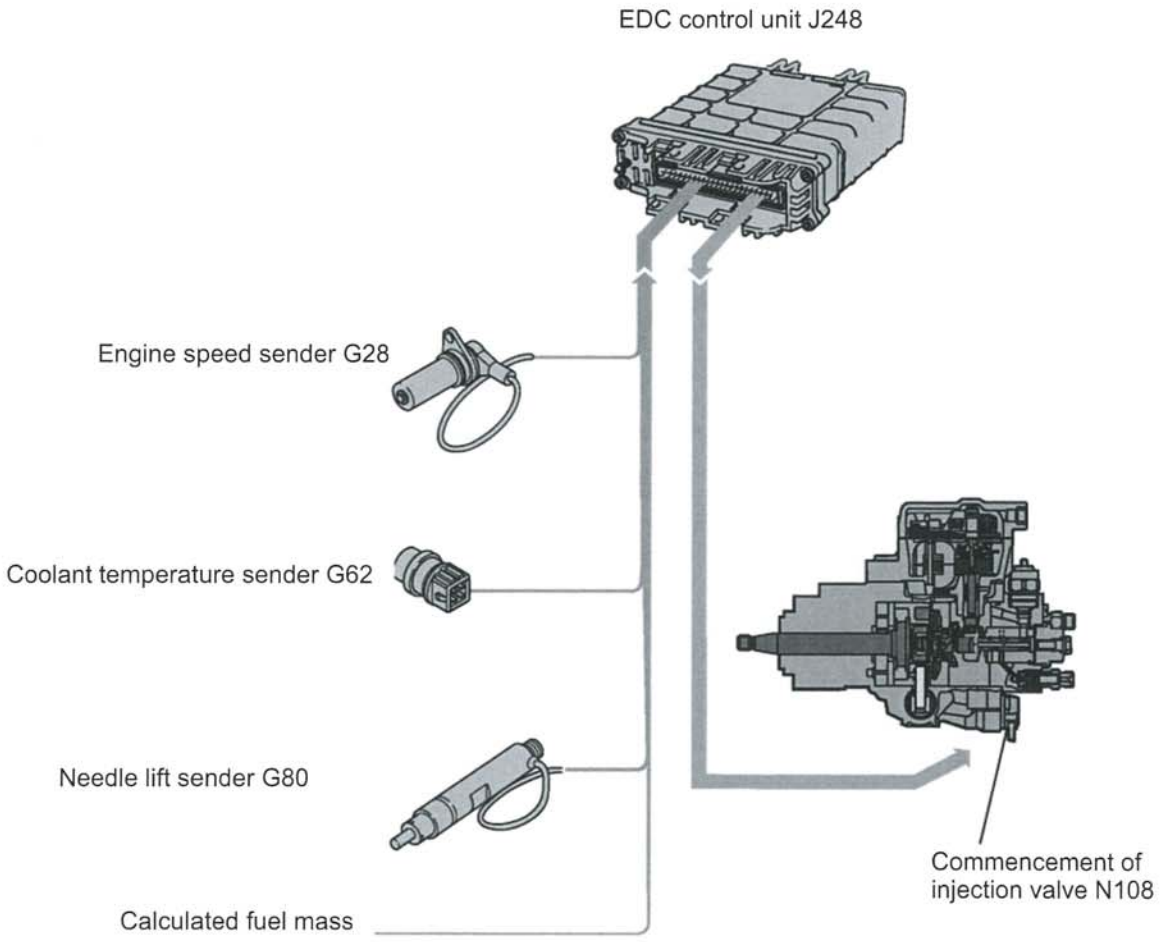


Fig 19 Injection commencement control system

Influencing factors

46 There are several factors that influence control of the point of commencement of fuel injection.

47 Commencement of injection map. A commencement of fuel injection map is stored in the EDC control unit (J248) it essentially makes allowance for the engine speed and the fuel quantity to be injected. As a correcting parameter, the coolant temperature also has a bearing on the commencement of injection. The map (see Fig 20) was determined empirically and represents an optimal compromise between good running characteristics and emission behaviour.

48 Calculated fuel mass. The point of commencement of injection must be brought forward with increasing injection quantity and engine speed, because the injection cycle takes longer. The fuel mass to be injected was calculated by the EDC control unit (J248) (see 'fuel regulation'). This theoretical value is used in the commencement of injection map.

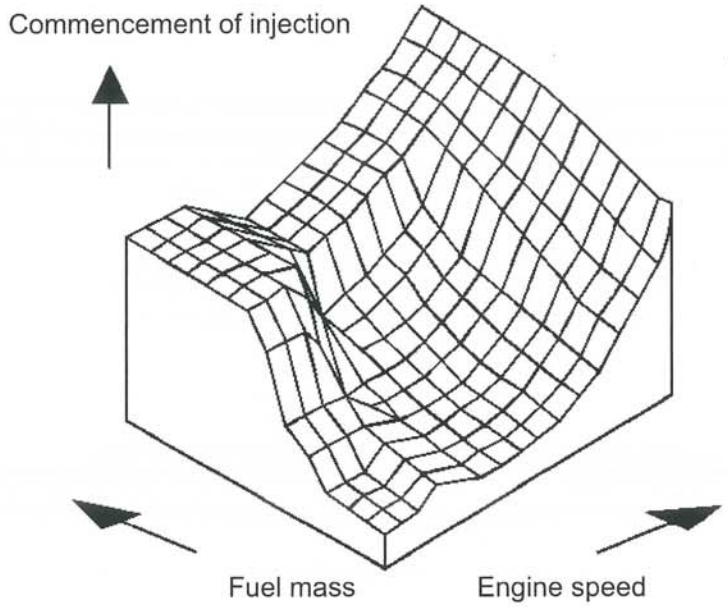


Fig 20 Commencement of injection map

49 TDC signal and engine speed (Fig 21). The engine speed sender (G28), in co-operation with the sender wheel on the crankshaft supplies a TDC signal to the EDC control unit (J248) for each cylinder.

50 Backup function. If the engine speed sender (G28) is faulty the engine is switched OFF for safety reasons.

51 Coolant temperature (Fig 22). To compensate for the longer firing delay when the engine is cold, the injection cycle must be advanced. The temperature signal from the coolant temperature sender (G62) corrects the commencement of injection map in the EDC control unit (J248) accordingly.

52 Backup function. If the coolant temperature sender (G62) fails, a fixed coolant temperature is defaulted.

53 Point of commencement of injection. From the signal supplied by the needle lift sender (G80) (Fig 23), the EDC control unit (J248) recognises the actual point of commencement of fuel injection and compares this with the setpoint as defined in the commencement of injection map. If deviations from the setpoint occur, the point of commencement of injection is corrected via commencement of injection valve (N108).

54 Backup function. If the signal is missing, no feedback is provided regarding the commencement of injection. The system activates an emergency running program in which the commencement of injection is only just controlled. The injection quantity is limited at the same time.

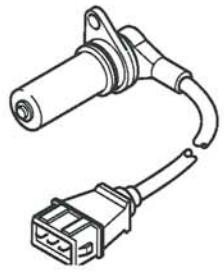


Fig 21 Engine speed sender G28 unit

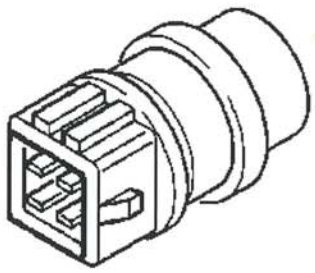


Fig 22 Coolant temperature sender G62

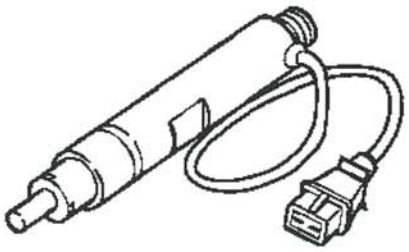


Fig 23 Needle lift sender G80

Injection timing device

55 To provide a better overview, the commencement of injection valve (N108), located on the forward face of the injection pump, is shown in Fig 24 rotated through 90°. Fig 24 shows the point of commencement of fuel injection adjusted towards "advance". The mechanical injection timing device in the distributor injection pump operates using the speed-dependent fuel pressure inside the pump. The injection timing device works by selectively adjusting the pressure acting on the non spring-loaded side of the injection timing piston. The pressure is adjusted by means of defined pulse duty factors which are used to control commencement of injection valve (N108), ie an exact point of commencement of fuel injection is assigned to each pulse duty factor. In this way it is possible to continuously regulate the point of commencement of fuel injection between max advance and max retard.

EDC control unit

56 From the incoming values, the EDC control unit (J248) calculates the setpoint for injection commencement and sends a corresponding pulse duty factor to commencement of injection valve (N108).

Commencement of injection valve N108

57 The commencement of injection valve (N108) converts the pulse duty factor into a change in control pressure which acts on the non-spring-loaded side of the injection timing piston.

Backup function for N108

58 If the commencement of injection valve (N108) fails, the point of commencement of injection is no longer regulated. Instead it is permanently defaulted.

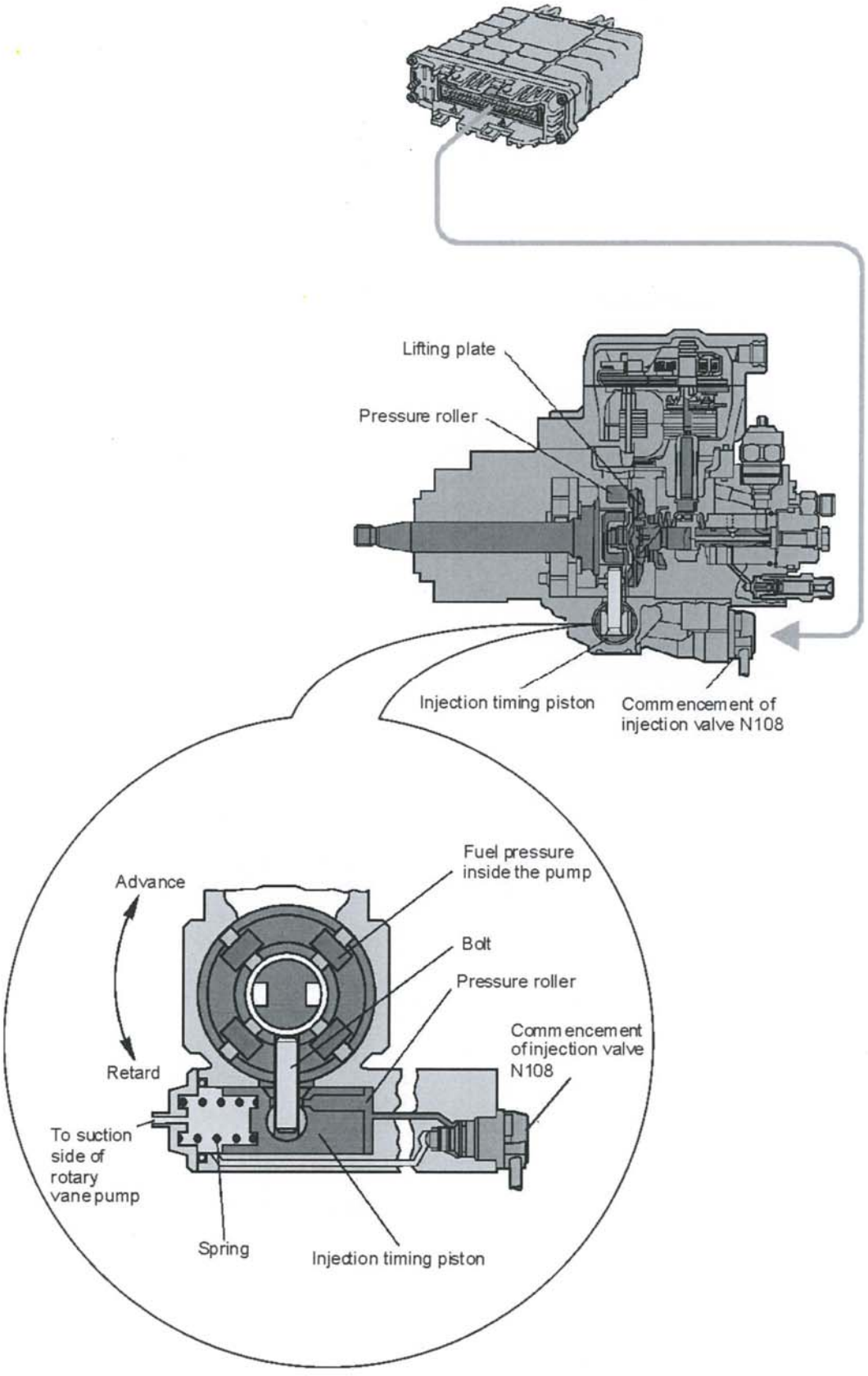


Fig 24 Injection commencement control showing timing device schematic.

EXHAUST GAS RECIRCULATION

59 The Exhaust Gas Recirculation (EGR) system (see Fig 25) is designed to reduce pollutant emissions in the exhaust gas. The direct injection process uses higher combustion temperatures than the chamber process. The formation of Nitrogen Oxides (NOx) increases with higher temperatures, provided that sufficient excess air is available.

60 The EGR valve adds a fraction of the exhaust gases to the fresh air supplied to the engine. This reduces the oxygen content in the combustion chamber and slows down NOx formation. The exhaust gas recirculation rates are, however, limited by a rise in Hydrocarbon (HC), Carbon Dioxide (CO_2) and particle emissions.

NOTE

The effect of exhaust gas recirculation is that the supply of exhaust gases to the combustion chamber reduces the oxygen component in the combustion chamber. This reduces the emission of NOx, but increases particle emissions in certain operating states. The addition of the recirculated exhaust gas quantity is therefore adapted precisely.

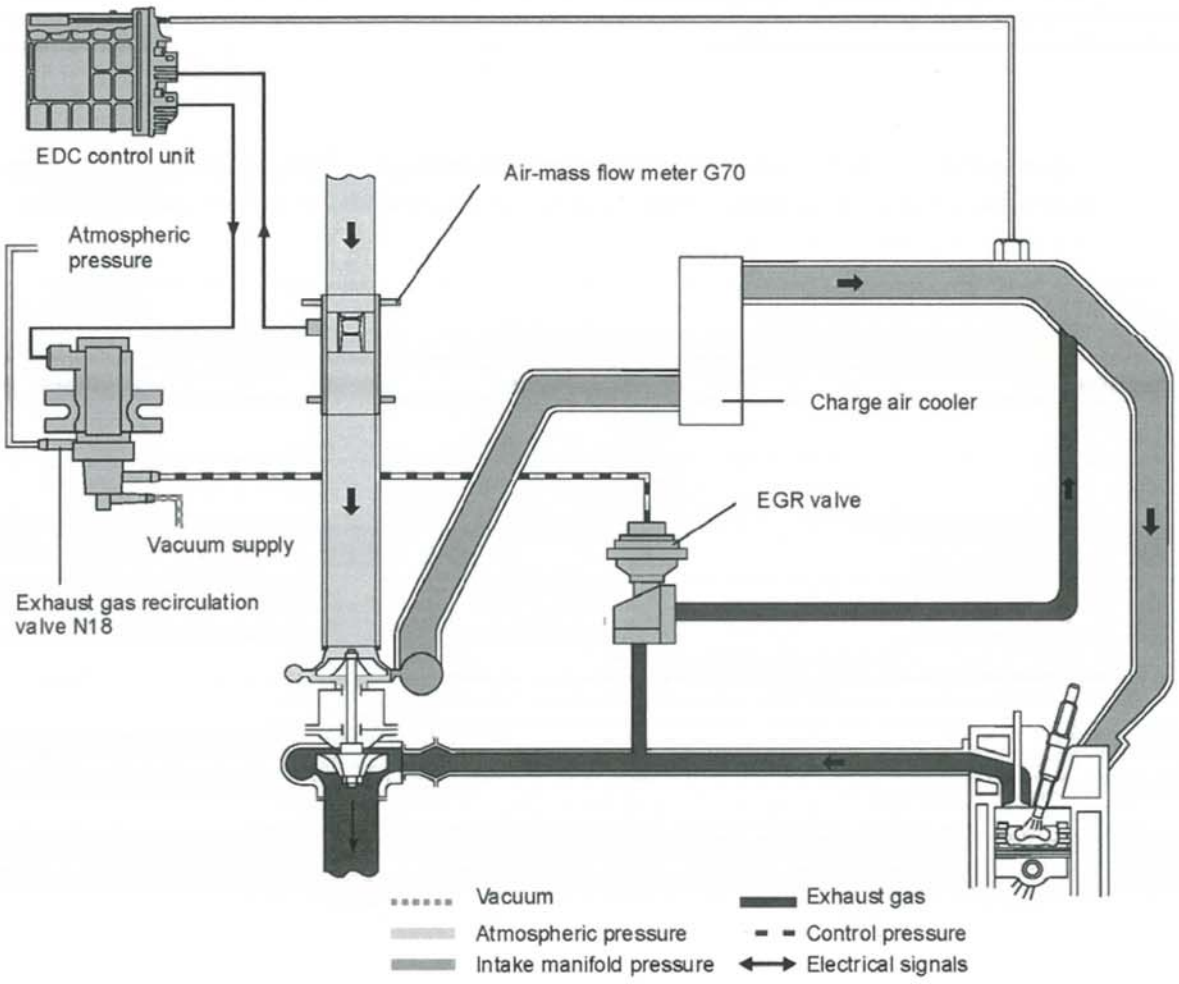


Fig 25 Regulation of gas recirculation schematic

FUEL REGULATION

EGR map

61 An EGR map (see Fig 26) is stored in the EDC control unit (J248). It contains the necessary air mass for every operating point of the engine; this is dependent upon engine speed, injection quantity and engine temperature.

62 The EDC control unit (J248) calculates using the air-mass flow meter (G70) signal whether the intake air mass is too high for the vehicle in its momentary operating state. To compensate for any deviation, more exhaust gas is supplied as required. If the supplied exhaust gas quantity is too high, the intake air mass decreases. The EDC control unit (J248) then reduces the proportion of the exhaust gases.

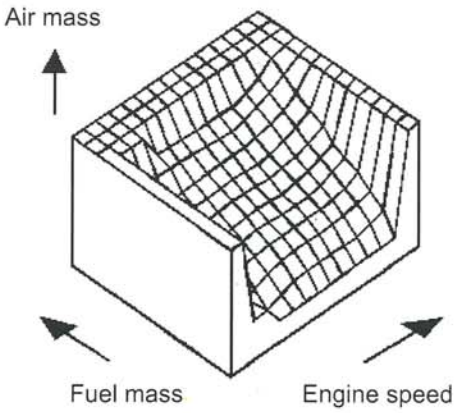


Fig 26 EGR map

EGR valve

63 The EGR valve (see Fig 27) is mounted in a connecting duct between the exhaust gas and the intake
pipe on the top of the engine. When the valve is subjected to a vacuum, it opens and allows exhaust gas to enter the fresh air flow. A switchover valve for intake manifold flap (N239) is located adjacent to the EGR valve, but is not used or connected on the Pinzgauer.

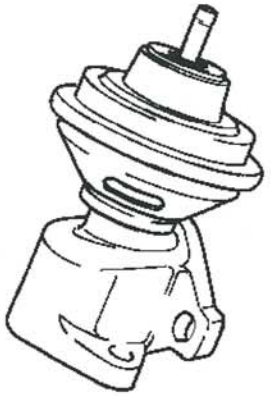


Fig 27 EGR valve

Exhaust gas recirculation valve N18

64 Exhaust gas recirculation valve (N18) (Fig 28) converts the signals supplied by the control units into a control vacuum for the EGR valve. It is supplied by the engine's vacuum pump and is opened by signals from the EDC control unit (J248). The pulse duty factor of these signals defines the vacuum which is admitted to the EGR valve.

NOTE

Exhaust gas recirculation valve (N18) is identified by its black coloured top and is located on the rear bulkhead of the cab adjacent to the air filter.

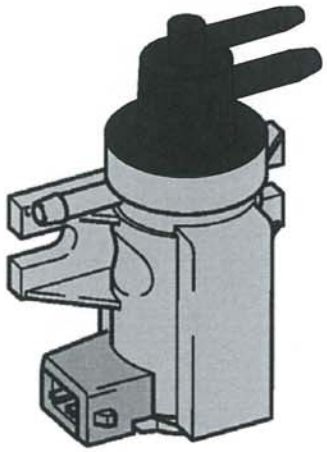


Fig 28 Exhaust gas recirculation valve N18

CHARGE PRESSURE CONTROL

System overview

65 The solenoid valve for charge pressure control (N75) applies pressure to the charge pressure control valve on the exhaust gas turbo charger (waste gate). Solenoid valve for charge pressure control (N75) receives electrical signals (pulse duty factor) from the EDC control unit (J248). Charge pressure is thus regulated according to a characteristic map.

66 Feedback on the actual pressure in the intake pipe is provided along a hose connection routed from the intake pipe to a sensor in the EDC control unit (J248). If a deviation from the setpoint occurs, the pressure is also corrected in the EDC control unit (J248) by the intake pipe temperature to make allowance for the effect of temperature on the density of the charge air.

67 To ensure that the air mass supplied to the engine remains almost constant, the charge pressure specified map is corrected dependent upon the air pressure, using the information supplied by the altitude sender (F96), (not illustrated). The charge pressure is reduced above an altitude of approximately 1500 m to prevent the turbocharger from over-speeding in excessively thin air.

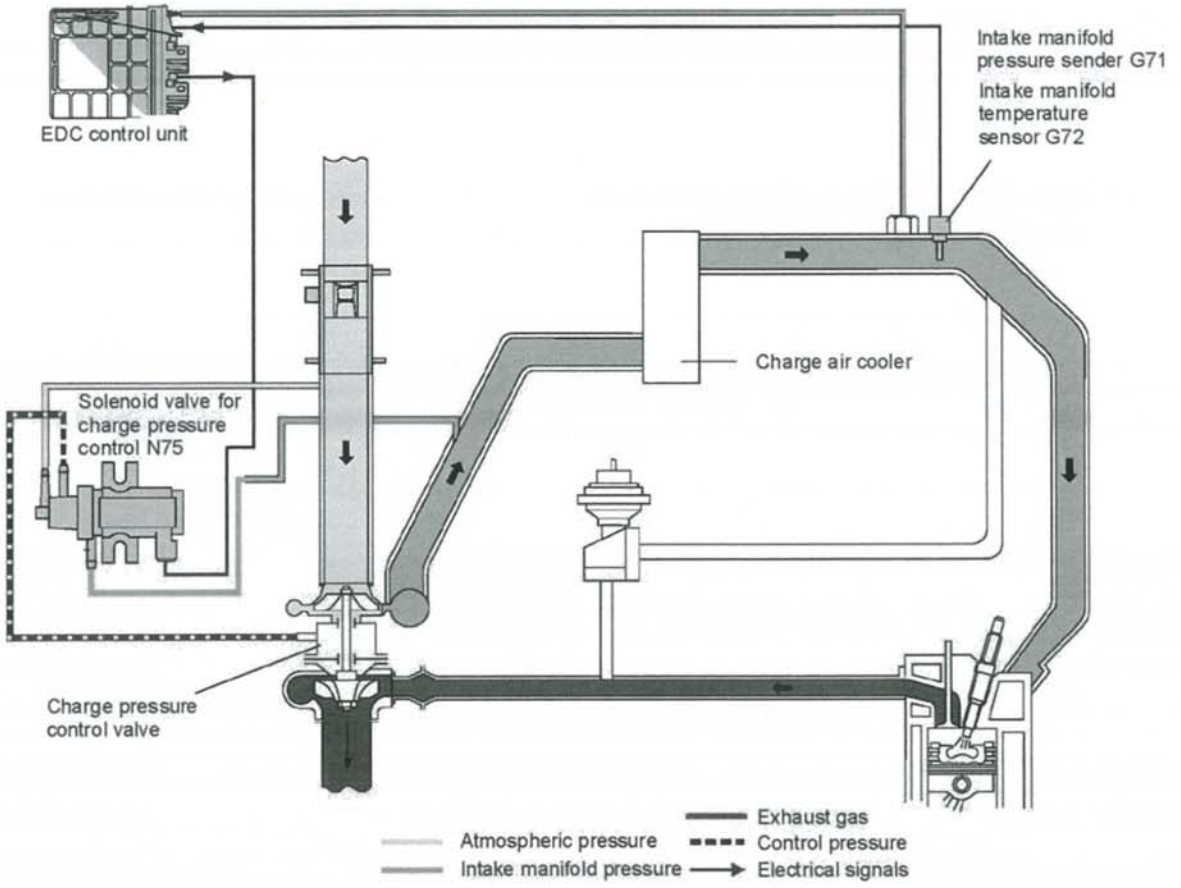


Fig 29 Charge pressure control schematic

Solenoid valve for charge pressure control N75

68 The EDC control unit (J248) sends output signals to the solenoid valve for charge pressure control (N75) according to the charge pressure specified map. By changing the signal pulse duty factor, more or less intake manifold pressure is applied to the charge pressure control valve on the exhaust gas turbocharger. The charge pressure can thus be varied between the minimum and maximum permissible values.

NOTE

The solenoid for charge pressure control (N75) is identified by its grey coloured top and is located on the rear bulkhead of the cab adjacent to the air filter.

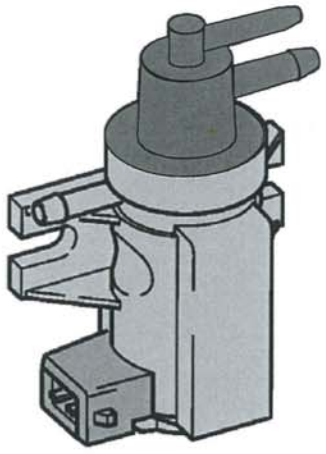


Fig 30 Solenoid valve for charge pressure control N75

Intake manifold temperature sender G72

69 The charge pressure is also corrected by the EDC control unit (J248) by the intake pipe temperature to make allowance for the effect of temperature on the density of the charge air. Intake manifold temperature sender (G72) is located on the near-side of the engine near the PAS pump.
The intake manifold pressure sender (G71) is located with the intake manifold temperature sender on the main intake pipe.

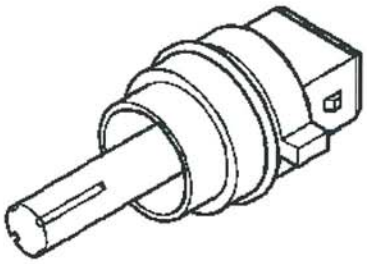


Fig 31 Intake manifold temperature sender G72

GLOW PLUG SYSTEM

General

70 A glow plug controller is integrated in EDC control unit (J248). This process is divided into two phases:

(1) Glow phase
(2) Afterglow phase

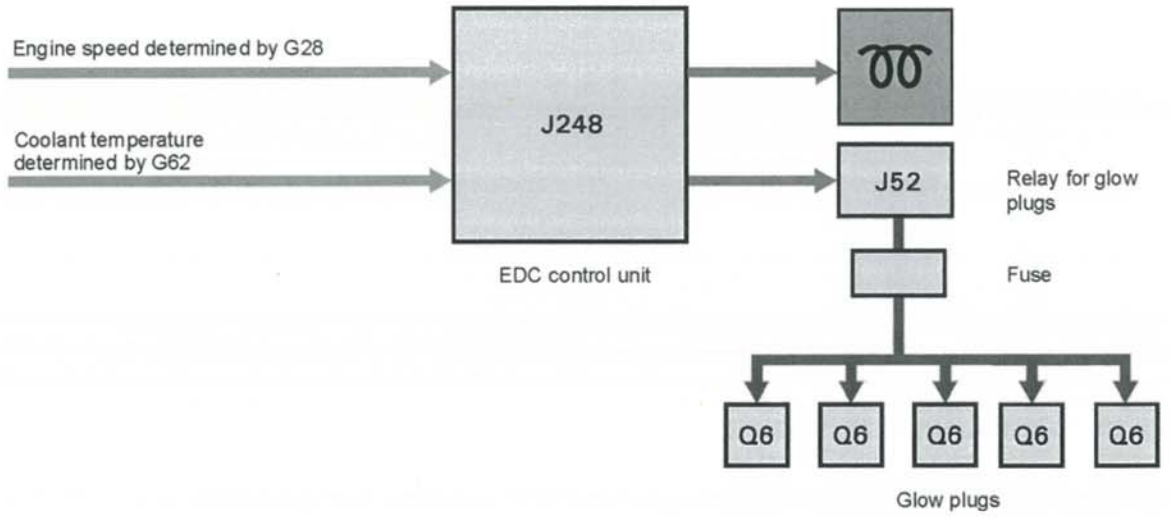


Fig 32 Glow plug system

Glow phase

CAUTION

WARNING LAMP. The warning lamp for the glow period has a dual function. If it illuminates during general vehicle operation, it serves as a warning lamp for the driver regarding a fault in the engine management system. It is recommended that a diagnostic test is carried out as soon as possible.

71 Due to the starting response of the direct injection diesel engine, a glow phase is only necessary below +9 °C. The control unit receives the corresponding temperature signal from coolant temperature sender (G62). The duration of the glow period is dependent upon the value of this temperature signal. The warning lamp for glow period (K29) on the instrument panel indicates to the driver when the glow phase is in progress.

Afterglow phase

72 The afterglow phase follows the glow phase after starting the engine. This improves combustion efficiency shortly after the engine is started and dampens engine noise, improves idling quality and reduces HC emissions. The afterglow phase always takes place irrespective of the glow phase. The afterglow phase is interrupted at an engine speed of 2500 rpm.

INTERNAL FUNCTIONS OF THE CONTROL UNIT

General

73 In the Electronic Diesel Control (EDC) control unit (J248) (see Fig 33), several auxiliary functions take place continuously during vehicle operation.

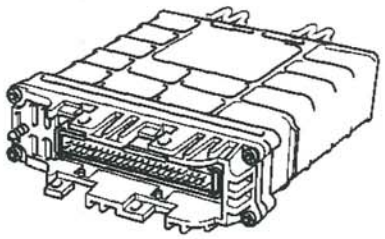


Fig 33 EDC control unit J248

Idling speed control

74 From the engine speed signal, which is supplied four times per revolution, the EDC control unit (J248) recognises deviations from the set idling speed at an early stage. The quantity adjuster in the fuel injection pump receives a signal immediately. The idling speed is therefore kept constant in every operating state, eg when electrical current consumers are switched on.

Even running control

75 To ensure the engine runs evenly, the injection quantity of every cylinder is regulated in such a way that the engine speed signal is uniform.

Shudder damping

76 To avoid shudder, that occurs when marked load changes occur, the information regarding the accelerator pedal position is electronically 'damped' when the pedal is moved too quickly.

Maximum speed cut off

77 When the maximum engine speed is reached, the EDC control unit (J248) reduces the injection quantity to protect the engine against over speeding.

Starting quantity regulation

78 The injection quantity necessary for starting the engine is dependent upon the cooling temperature. The EDC control unit (J248) determines the correct quantity to keep the exhaust emissions low.

Signal monitoring

CAUTION

> **GLOW PLUG WARNING LAMP. The warning lamp for the glow period has a dual function. If it illuminates during general vehicle operation, it serves as a warning lamp for the driver regarding a fault in the engine management system. It is recommended that a diagnostic test is carried out as soon as possible.**

79 The EDC control unit (J248) monitors itself and the functions of sensors and actuators during vehicle operation.

SELF-DIAGNOSIS

The self-diagnosis and safety concept of the EDC

80 The EDC control unit (J248) assumes the following functions during vehicle operation:

80.1 It continuously cross-checks the measured values supplied by the sensors for plausibility.

80.2 It monitors the electrical and mechanical functional capability of the final control elements (actuators) by observing system reactions. The self-diagnosis carries out actual value / setpoint comparisons; the results of these comparisons must meet the given requirements (maps).

80.3 The self-diagnosis monitors the electrical connectors and cable connections for cable breakage (open circuit) and short circuit.

81 If faults occur in the system, the EDC control unit (J248) reacts according to the significance of the fault. These reactions are covered in four stages dependent upon severity of the fault:

81.1 Stage 1. Should any sensors with a correcting function fail, the EDC control unit (J248) uses a default substitute value or accepts data from other sensors. The actions of this self-correcting function are usually transparent to the driver.

81.2 Stage 2. Major faults, ie faults leading to the failure of sub-functions, result in a reduction of performance and a warning is issued to the driver via illumination of the fault warning lamp.

81.3 Stage 3. If the driver can no longer control engine power output with the accelerator pedal, the EDC control unit (J248) switches the engine to high idling speed mode. In this way, servo functions of the vehicle are preserved and vehicle operability is retained.

81.4 Stage 4. If reliable engine operation can no longer be ensured, the quantity adjuster (N146) turns the engine OFF. If this is not possible on account of the fault, the engine is turned OFF via the fuel cut off valve (redundant system).

EDC INTERROGATION AND FAULT FINDING

82 For fault finding, the EDC control unit (J248) is interrogated using the engine system tester plugged into the diagnostic connector. The diagnostic connector is located within the Vehicle Power Distribution Box (VPDB) located behind the passenger seat on the rear (nearside) bulkhead of the cab. Full details on the use of the tester for diagnostic purposes can be found in 2320-D-400-512 Chapter 1.

TECHNICAL DATA

83 Engine technical data is shown in Table 1.

TABLE 1 TDI 2.5 EURO 3 ENGINE TECHNICAL DATA

Data Item	Value / Description
Type	2.5 litre, water-cooled, five-cylinder in-line diesel engine with direct fuel injection, turbocharger and charge air cooler (intercooling).
Displacement	2460 cm^3
Bore	81.0 ø mm
Stroke	95.5 mm
Power	100 kW at 4500 min^{-1}
Max torque	280 Nm from 1900 to 2400 min^{-1}
Compression ratio	17.5 : 1
Charge air pressure (at P_{max} and standard conditions)	1.1 bar
Crankcase	Grey cast iron
Cylinder head	Aluminium alloy
Crankshaft	Steel, die forged
Fuel feed	Direct injection with electronic distributor type pump
Fuel injector	Dual spring system with six-hole nozzle
Fuel	Diesel (DIN EN 590), minimum cetane number (CZ) > 49
Firing order	1-4-5-3
Alternator	24 V (charging up to ≈ 28 V / 100 A)
Starter	24 V
Lubrication system	Pressure lubrication system, chain driven oil pump, oil filter
Oil cooler	Oil / water heat exchange
Oil filter	Vertical, with filter cartridge

(continued)

TABLE 1 TDI 2.5 EURO 3 ENGINE TECHNICAL DATA (continued)

Data Item	Value / Description
Cooling system	Sealed cooling system (overpressure system with separate expansion tank and excess pressure valve)
Upper idling speed	4600 min^{-1}
Lower idling speed	780 min^{-1}

NOTE

The vehicle electrics are 24 V dc, all engine systems operate on 12 V dc.

CHAPTER 3

AUTOMATIC GEARBOX TECHNICAL DESCRIPTION

CONTENTS

GENERAL DESCRIPTION (Figs 1 and 2)

1 The ZF 4HP 22 automatic gearbox consists of a hydrodynamic torque converter with lock up clutch and a rear mounted planetary unit. The planetary gearbox has four forward and one reverse speed. At a preset engine speed, the clutch in the converter locks to provide purely mechanical transmission. The hydraulically operated control unit is located in the bottom of the gearbox. The control unit changes gears via multi disc clutches, epicyclic gears and free wheel units, actuating points are determined by road speed and pedal position. The control unit can be overridden when accelerating hard. A kick down throttle ensures that the gearbox changes down to the lowest possible gear and holds each gear until the maximum engine speed has been reached.

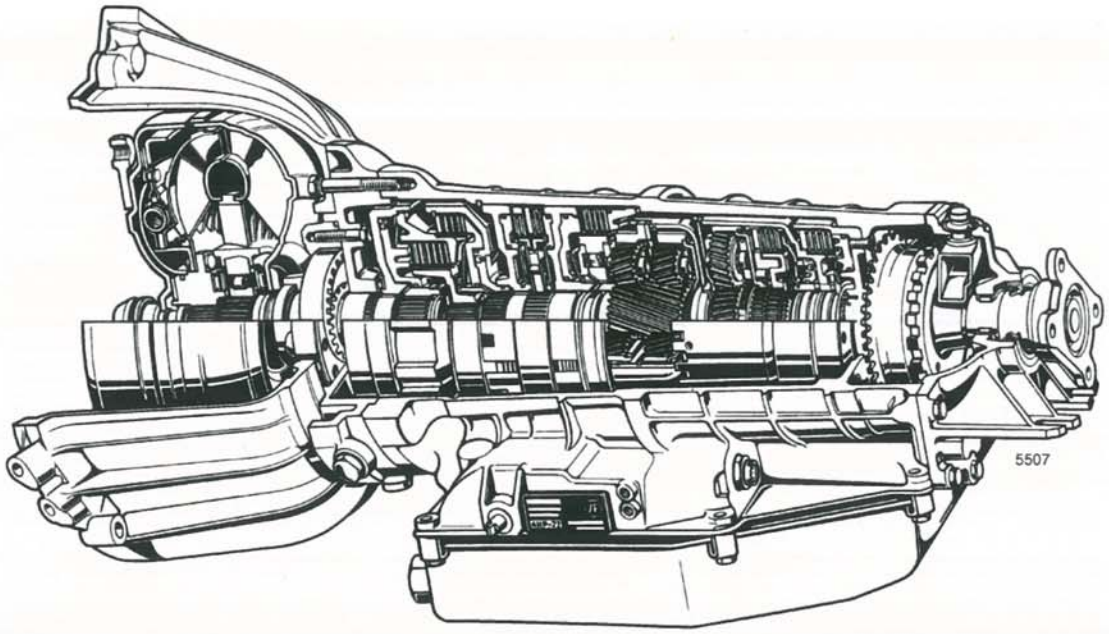
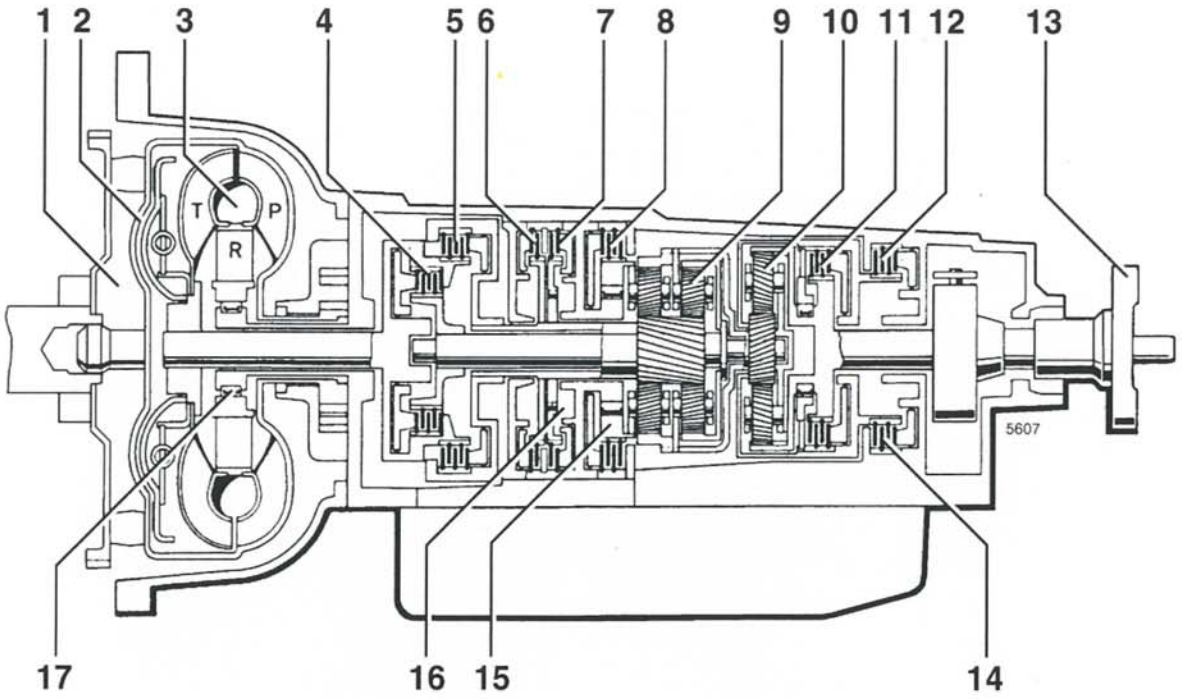


Fig 1 Sectional view of automatic gearbox

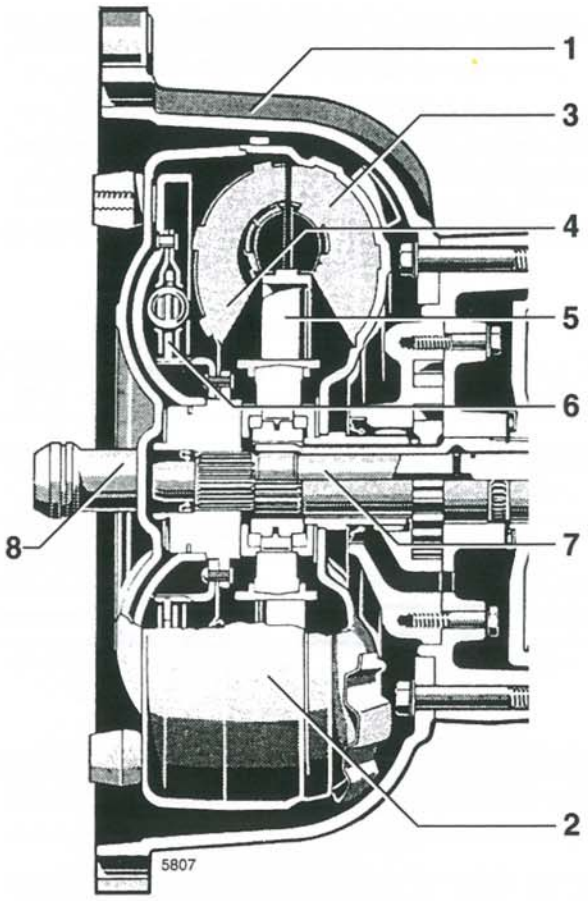


1	Drive	10	Planetary gear train (fourth gear)
2	Torque converter lock up clutch	11	Rotating multi-disc clutch
3	Hydrodynamic torque converter	12	Fixed multi-disc clutch
4, 5	Rotating multi-disc clutches	13	Output
6, 7 & 8	Fixed multi-disc clutches	14 & 15	Over-run clutches
9	Planetary gear train	16 & 17	Over-run clutches

Fig 2 Automatic gearbox power transmission

TORQUE CONVERTER (Fig 3)

2 The hydrodynamic torque converter operates on a Trilock principle. Oil is contained between the input rotor, output rotor and stator. The boundary layer effect of the oil provides a linear pick up of engine transmission to the gearbox. The engine drives the converter casing (see Fig 3/2) via the engine drive shaft (see Fig 3/8). The engine drive shaft rotates the input rotor (see Fig 3/3) which in turn forces the oil at its surface to rotate. As more of the oil is forced to rotate, the stator (see Fig 3/5) which is held static, directs oil across the converter to the output rotor (see Fig 3/4). The output rotor soon reaches rotational speed slightly lower than the input rotor, the difference being due to the losses incurred by the oil. The stator is then disengaged via the overrun clutch (see Fig 2/17) allowing the stator to run freely and reduce resistance. When the vehicle speed reaches approximately 70 km/h, the lock up clutch (see Fig 3/6) engages, mechanically locking the converter casing to the turbine shaft (see Fig 3/7), thus increasing transmission efficiency and reducing fuel consumption.



1	Gearbox Housing	5	Stator
2	Converter Housing	6	Lock-up Clutch
3	Input Rotor	7	Turbine Shaft
4	Output Rotor	8	Input Shaft

Fig 3 Torque converter

GEAR SELECTION (Fig 4)

3 The gearbox selector has an in line selection gate. Parking and reversing gears are protected by an arrester button located on the underside of the selector lever. This button must be depressed to select either gear, thus avoiding accidental engagement whilst the vehicle is in motion. The engine and transmission are also protected from damage when down shifting to 1st and 2nd gears. Safety valves are used to ensure that the engine does not over speed.

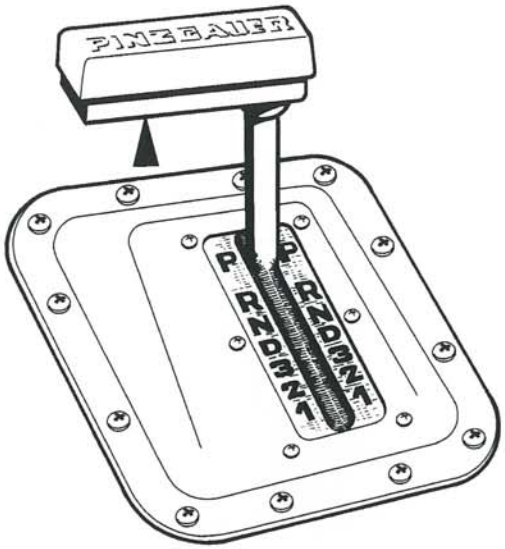


Fig 4 Selector lever

4 Selector positions are as follows:

'P' Parking. This position provides an extra brake on the vehicle when parked. Change into and out of 'P' only when the vehicle is stationary.

'R' Reverse. Change into and out of 'R' only when the vehicle is stationary.

'N' Neutral. In this position no drive is transmitted to the axles. 'N' or 'P' should be engaged if the vehicle is allowed to idle for any period of time. When brakes are released the vehicle is freely movable. Change into and out of 'N' only when the vehicle is standing or rolling slowly.

'D' Drive. When drive is selected, the gearbox operates automatically, changing gears sequentially at the optimum engine speed.

'3' Changing up only to third gear. Recommended for driving down small gradients in order to use the braking effect of the engine in third gear.

'2' Changing up only to second gear. Recommended for driving down medium gradients in order to use the braking effect of the engine in second gear.

'1' Only first gear available. Recommended for driving down steep gradients in order to use the braking effect of the engine within the admissible speed range of first gear.

CHAPTER 4

TRANSMISSION TECHNICAL DESCRIPTION

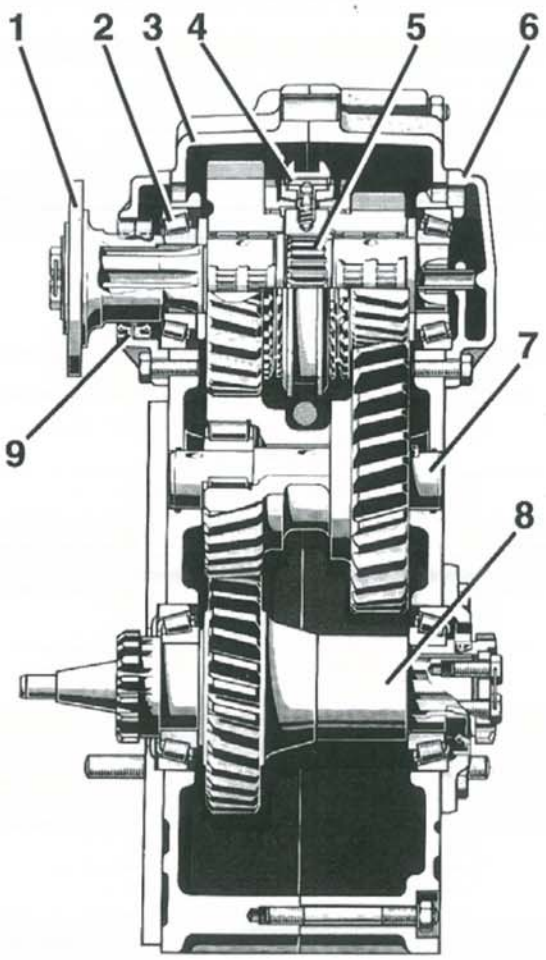
CONTENTS

GENERAL DESCRIPTION

1 Power is transmitted from the gearbox to the transfer gearbox via a propeller shaft. The transfer gearbox transmits drive to the main prop shaft in either high or low gear ratio. The main propeller shaft, which is protected by a carrier tube, transmits power to the front and rear lockable differentials. Drive is then transmitted to the front and rear portal axles via half shafts.

TRANSFER GEARBOX

2 The transfer gearbox is flange mounted between the central carrier tube and the rear axle. It consists of two synchromeshed spur gears, gear shifting is performed by a ZF-speed locking synchromesh unit as in the gearbox. The drive shaft (see Fig 1/8) has teeth at both ends for connection to the front and rear axle drives. The rear teeth of the drive shaft are directly connected to the rear axle whereas the front teeth are connected to an axle journal which can engage and disengage drive to the front axle.



1 Flange
2 Bearing
3 Housing
4 Operating sleeve
5 Drive shaft
6 Cover
7 Intermediate shaft
8 Drive shaft
9 Rotary shaft seals

Fig 1 Section of transfer gearbox

3 By shifting the transfer gearbox selector, the operating sleeve is forced either forward or backward. The operating sleeve engages the input shaft onto the selected gear via the synchronizing unit. This gear drives the intermediate shaft which in turn rotates the drive shaft. Depending on the power path, either of two gear ratios can be obtained.

4 The transfer box does have a neutral position in which the synchronizing unit stays central and does not engage a gear.

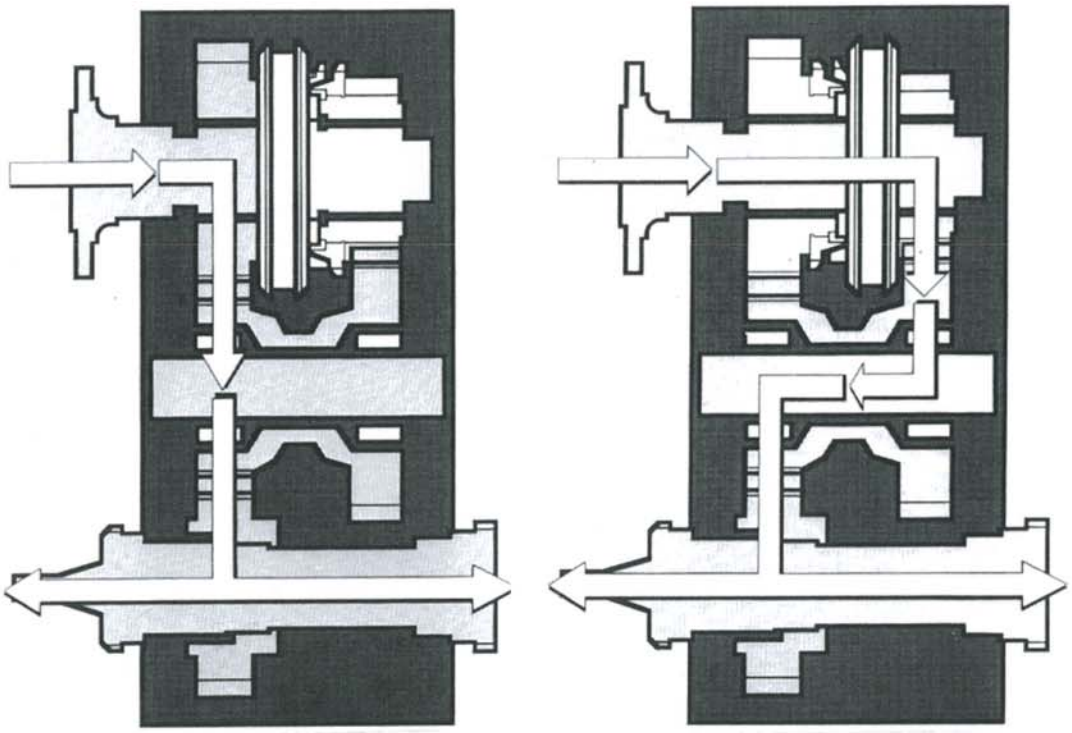
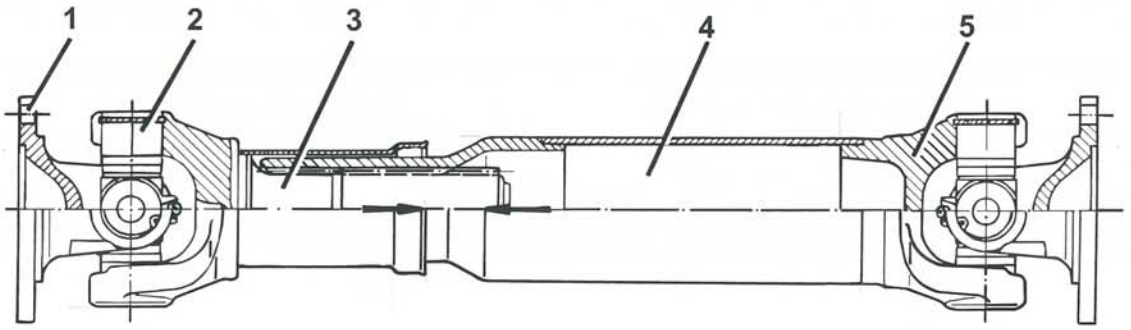


Fig 2 Transfer gearbox power transmission

CARDAN SHAFT

5 The cardan shaft connects the main gearbox to the transfer gearbox and is positioned deep in the vehicle underside to prevent damage. The cardan shaft consists of the cardan shaft tube (see Fig 3/4) with a splined end (see Fig 3/3), two pin joints (see Fig 3/2), cardan forks (see Fig 3/5) and flanges (see Fig 3/1). The cardan forks are attached to the pin joint by pivot pins. The pivot pins are supported in the cardan forks by needle bearings.

6 The cardan shaft has two joints to ensure uniform angular velocity at all times. The spline end is telescopic to allow for any changes in the distance between the joints.



1 Flange
2 Pin joint
3 Spline end
4 Cardan shaft tube
5 Cardan fork

Fig 3 Section of cardan shaft

CHAPTER 5

AXLES TECHNICAL DESCRIPTION

CONTENTS

GENERAL DESCRIPTION

1 The enclosed drive train propeller shaft is positively spline engaged to the rear differential housing. Drive is transmitted via half shafts within the half axles to portal hubs. The left and right half axles are not connected and therefore have no effect on each other. The portal hubs contain straight cut spur gears providing a multiplication of torque and greater ground clearance. The speed reduction in the differential gear is 2.81:1 and in the portal axle is 2.231:1.

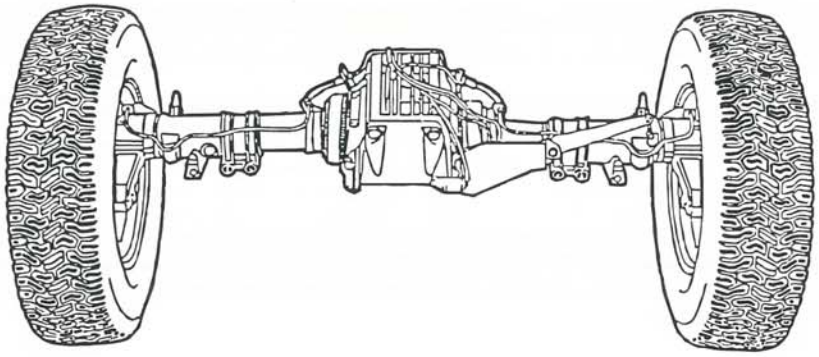


Fig 1 Complete axle

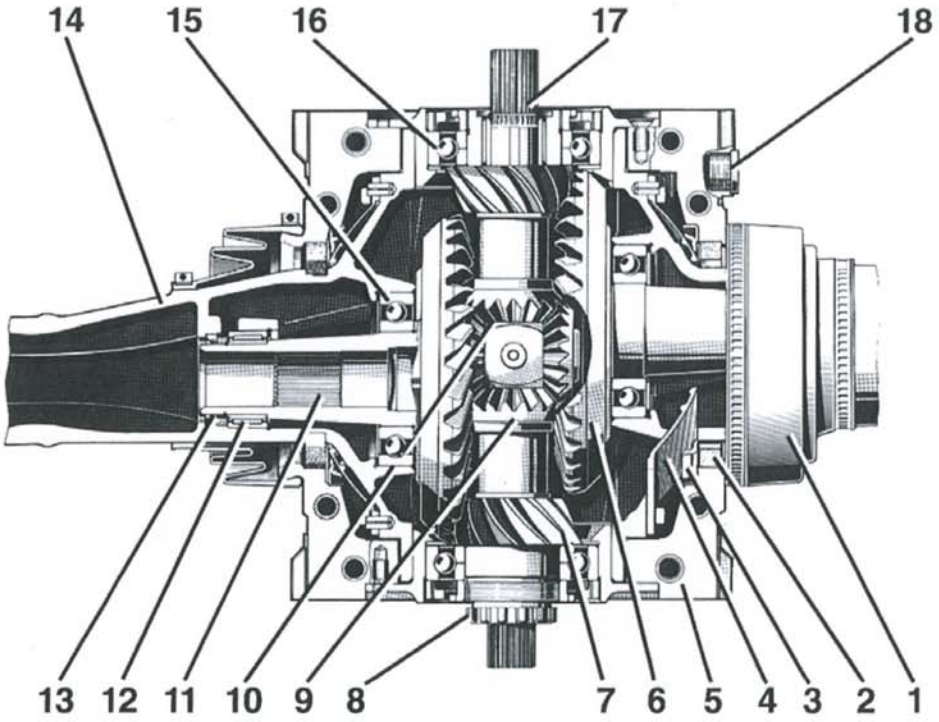
DIFFERENTIAL GEARBOX

2 The differential box is unique in that the front and rear axles are halved and do not actually meet in the differential box. This enables the independent action of the suspension. The centre input drive shaft which runs through the middle of the differential is solid and it has a hole across the centre to locate the planet gear's 'X' shaft. The solid shaft is the means by which the through drive is achieved between differentials; front, rear, middle and hand brake.

3 The planet gears are therefore positively driven by the input drive shaft via the 'X' shaft (as in a standard differential). They in turn drive the sun gears (as in a standard differential), which in this case are floating on the outside diameter of the main input drive shaft. Each side is carried in the same way.

4 The sun gears and shafts are attached positively to each of the drive pinions, which in turn positively drive the crown wheels.

5 If a wheel spins, then the drive is lost, because the sun gears are able to rotate at differential speeds due to being driven by the planet gears, which can rotate around the 'X' shaft (as in a standard differential). The differential lock dog clutch is directly fitted onto the input shaft spline. When engaged, it slides forward and engages positively with one drive pinion, therefore locking the input shaft directly to the pinion. This positively drives one crown wheel and because the planet gears can no longer rotate about the 'X' shaft, positively drives the remaining crown wheel, providing equal torque to both half-shafts.



1	Axle sleeve	10	Differential planetary gear
2	Stop ring (rubber)	11	Retainer toothing for final drive gear
3	Seal ring to ball socket	12	Needle bearing
4	Ball socket	13	Seal ring
5	Axle housing	14	Half axle
6	Crown wheel	15	Bearing
7	Pinion	16	Bearing
8	Retainer toothing for lock	17	Differential shaft
9	Differential bevel gear	18	Oil level screw

Fig 2 Section of differential box

Differential Action

6 When the vehicle corners, the inside driven wheels must be allowed to turn slower than the outside ones. This is the requirement of a differential box. When the vehicle travels around a bend, the inside wheel experiences a resistive torque. This resistance tries to slow the inside wheel while leaving the outside wheel unaffected. The resistance on the inside wheel is transmitted through the axle drive, crown wheel, pinion and onto the bevel gear. This causes the bevel gear to slow down as the torque supplied is in sufficient to maintain rotational velocity. As one bevel gear is now rotating faster than the other, the planet gear teeth are forced to turn circumferentially around the bevel gears. This allows one bevel gear to decelerate while the other is forced to accelerate by the same amount.

Differential Locks

7 As the differentials work on the difference in resistive torque experienced by each wheel, travelling through mud and water can cause one wheel to spin while the other does not turn at all. This is unacceptable for off road driving so differential locks are used.

8 The differential lock works by locking one of the bevel gears to the differential axle. This fixes its rotational speed and thereby the speed of the planet gears. As the rotational speed of the planet gears is constant, so must be the rotational speed of the other bevel gear. Since the planet gears are unable to rotate around the bevel gears, the axles can not turn at different speeds and the differential is locked.

9 The differential lock stops the wheels spinning when driving off road but it also stops the vehicle taking bends effectively. As the vehicle takes a bend with the differential locks on, the inside wheel still feels the resistance but does not slow down. This resistive torque twists the axle and is called 'wind up'. This wind up is then dissipated as the axles travel over uneven terrain and leave the ground momentarily thus enabling the axles to unwind themselves. Special torsional axles are used to accommodate wind up. As wind up is caused during cornering and dissipated over rough ground, using the differential locks on paved roads will result in tyre and axle wear and damage very quickly. Differential locks should only be used in off road or icy conditions.

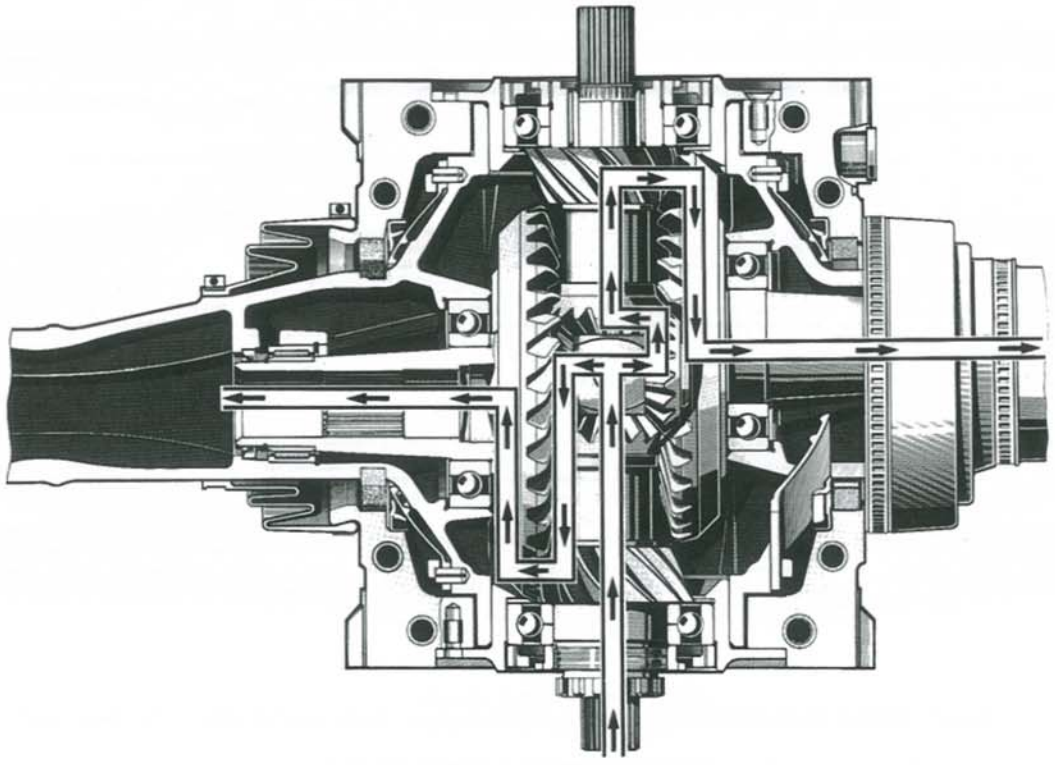


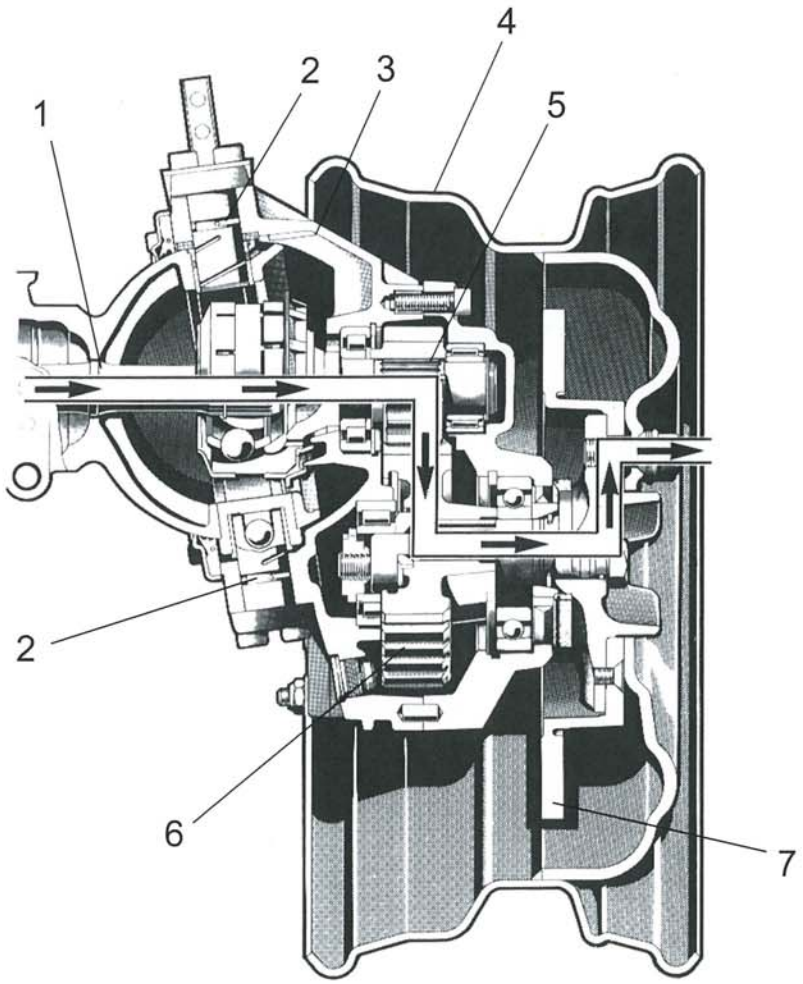
Fig 3 Drive path through differential

SWING AXLES

10 Normally axles are one piece and pivot through the differential housing. This means that raising one wheel will force down the opposite wheel in a 'sea-saw' action. By splitting the axle into two half axles, the suspension at each wheel station becomes independent. This is made possible by the differential box. The axles pivot in the differential housing around their crown wheels. As the wheels pass undulations in the road surface, the axles rise and fall around the crown wheels. This just causes the crown wheel to rotate around the pinion in the same way that planet gears rotate around bevel gears.

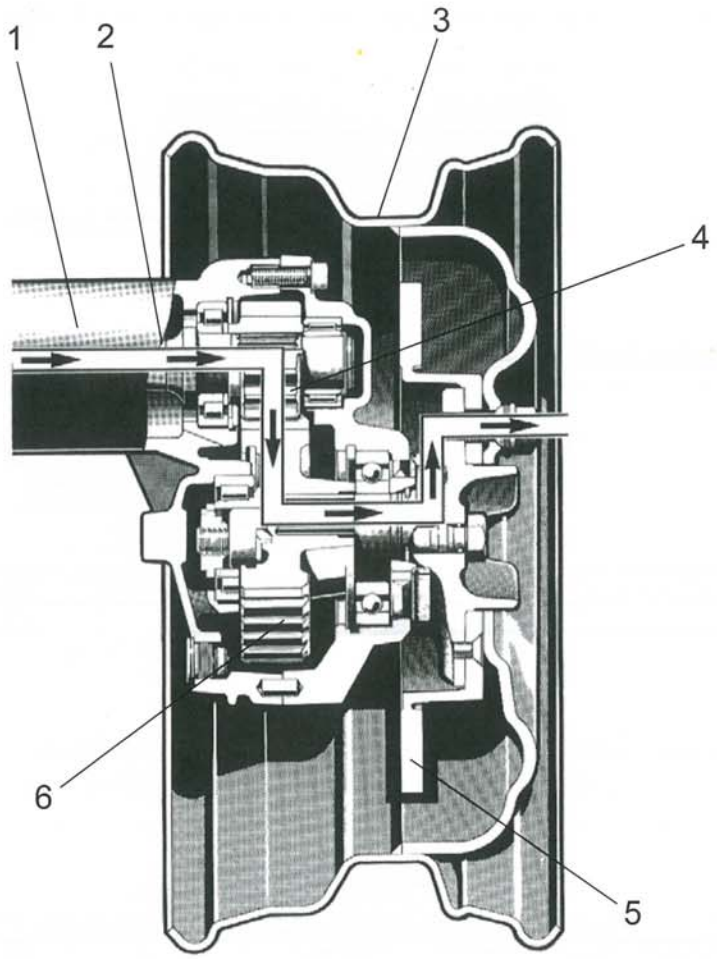
PORTAL AXLES

11 Drive to the wheels is transmitted to the portal axle hubs via half shafts through the centre of the half axle. The portal axles give a final torque multiplication whilst giving the vehicle extra ground clearance. By increasing the torque at the wheel drive, excess strain is prevented from being applied to the whole transmission system. The gear set-up in the portal axles also increases the clearance of the transmission. This raises vehicle clearance to 360 mm.



1 Constant velocity joint shaft
2 Pivot
3 Wheel drive housing
4 Wheel
5 Pinion to drive gear
6 Gear to wheel drive
7 Brake disc

Fig 4 Front portal axle

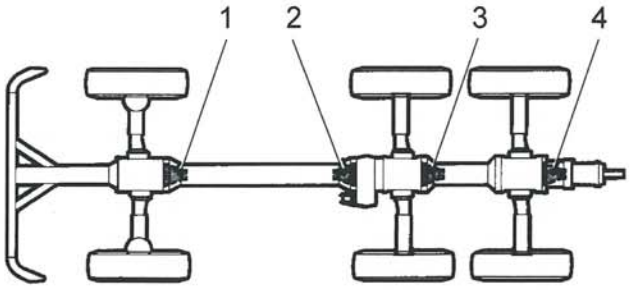


1 Wheel drive housing
2 Rear axle driving shaft
3 Wheel
4 Pinion to drive
5 Brake disc
6 Gear to wheel drive

Fig 5 Rear portal axle

ENGAGING DIFFERENTIAL LOCKS AND ALL-WHEEL DRIVE

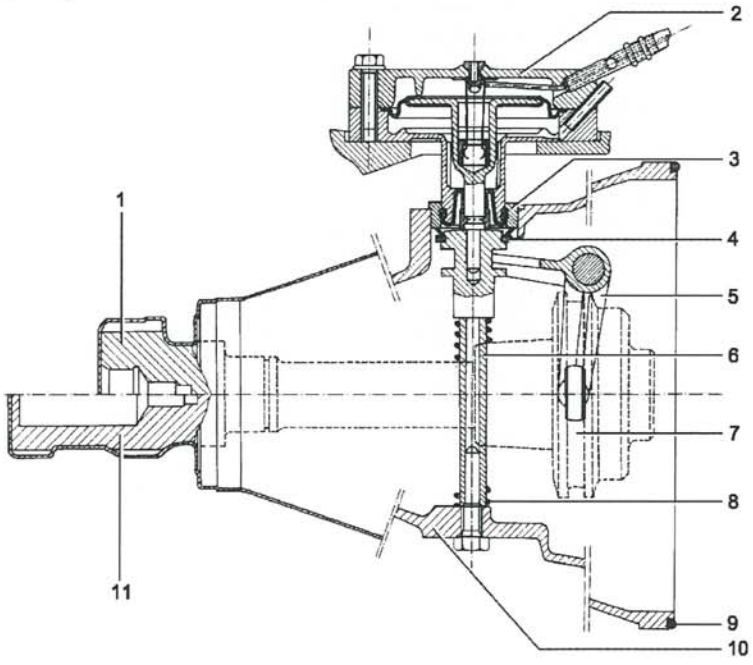
12 Engaging differential locks and all-wheel drive is carried out by journals which form part of the drive train running through the central tube of the vehicle. The differential lock journals are located in housings attached to the rear of the axle drives (see Figs 6/1 and 6/3). The journal which engages/disengages all-wheel drive is housed in front of the transfer gearbox (see Fig 6/2).



1	Front axle journal	3	First rear axle journal
2	Central axle journal	4	Second rear axle journal

Fig 6 Location of axle journals

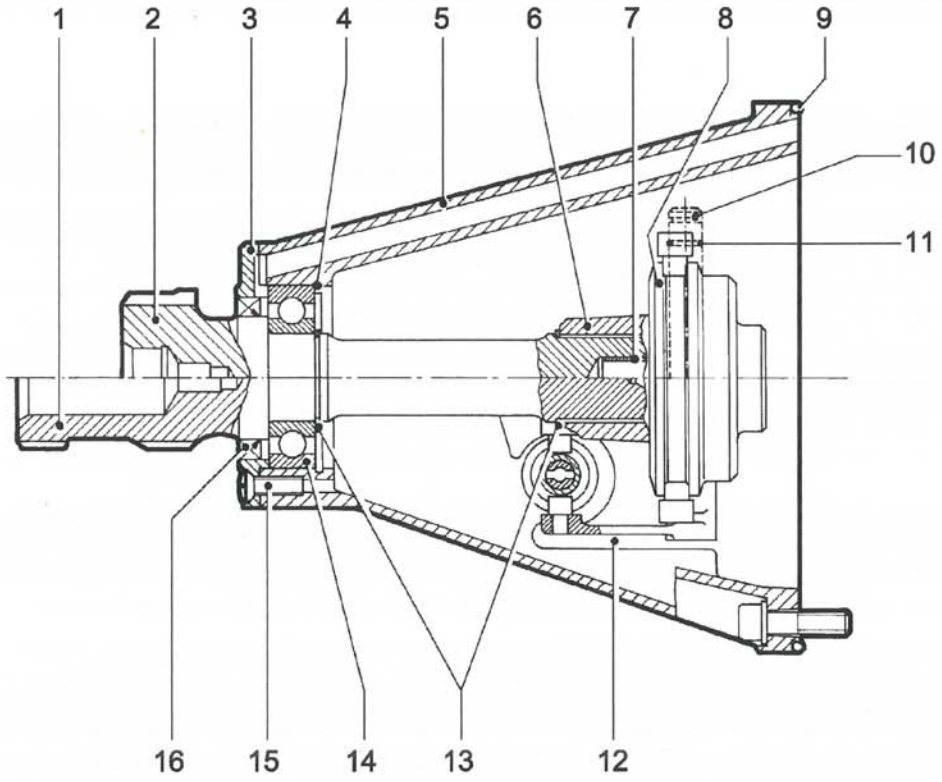
13 The front axle journal connects the drive shaft to the front differential box. The rear axle journal is identical with the addition of a connection for the hand brake. When the front differential lock is selected the control cylinder (see Fig 7/2) is evacuated. This pulls up the spring bolt (see Fig 7/6) which is attached to the control fork (see Fig 7/5). As one end of the control fork is lifted, the other end pushes the operating sleeve over the drive shaft (see Fig 7/1). The drive shaft is then connected directly to the rear pinion in the differential box. This effectively locks the differential. On disengaging the differential locks, the control cylinder is re-compressed causing the spring bolt to pull the selector fork and operating sleeve back to their original positions.



1	Drive shaft	7	Operating sleeve
2	Control cylinder	8	Return spring inside
3	Guide sleeve	9	O-ring
4	V-ring	10	Bearing cap
5	Gear control fork	11	Operating sleeve
6	Spring bolt, complete		

Fig 7 Front and rear axle journal

14 The central axle journal is bolted to the front of the transfer gearbox. When all wheel drive is disengaged, the drive from the transfer box and the drive shaft are disconnected. On actuation of the all wheel drive, the gearshift fork (see Fig 8/12) is forced to the left. This is connected to the fork axle (see Fig 8/10) which pulls the operating sleeve over the drive shaft, thus transferring drive to the front axle. On disengaging all wheel drive, the reverse occurs with the operating sleeve being disconnected from the drive shaft.

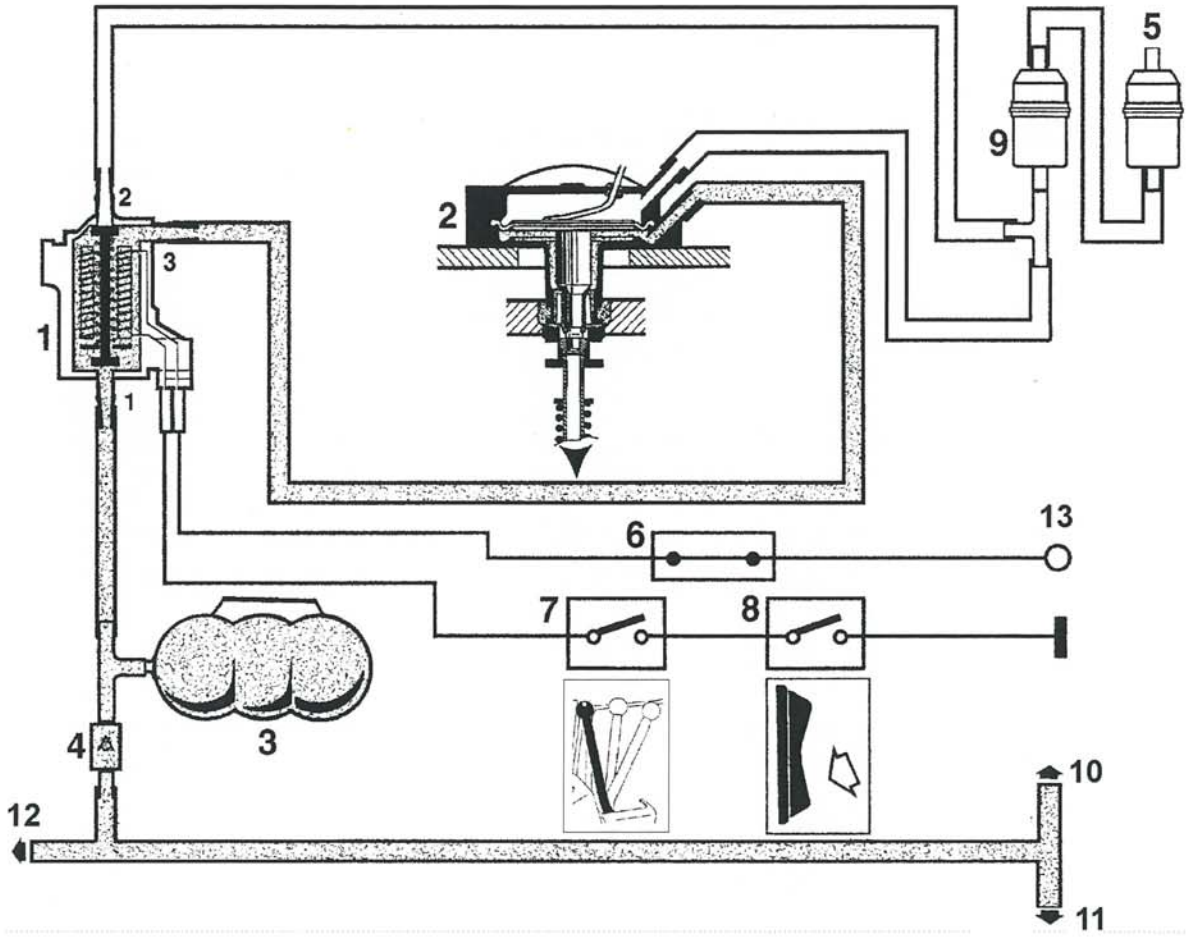


1	Brake shaft (rear axle)	9	O-ring
2	Drive shaft	10	Gearshift fork axle
3	Axle journal cover	11	O-ring
4	Circlip 62 x 2	12	Gearshift fork
5	Axle journal	13	Circlip 30 x 1.5
6	Clutch piece	14	Deep groove ball bearing
7	Dry bearing bush	15	Raised countersunk head screw
8	Operating sleeve	16	Sealing ring

Fig 8 Central axle journal

OPERATION OF ALL WHEEL DRIVE

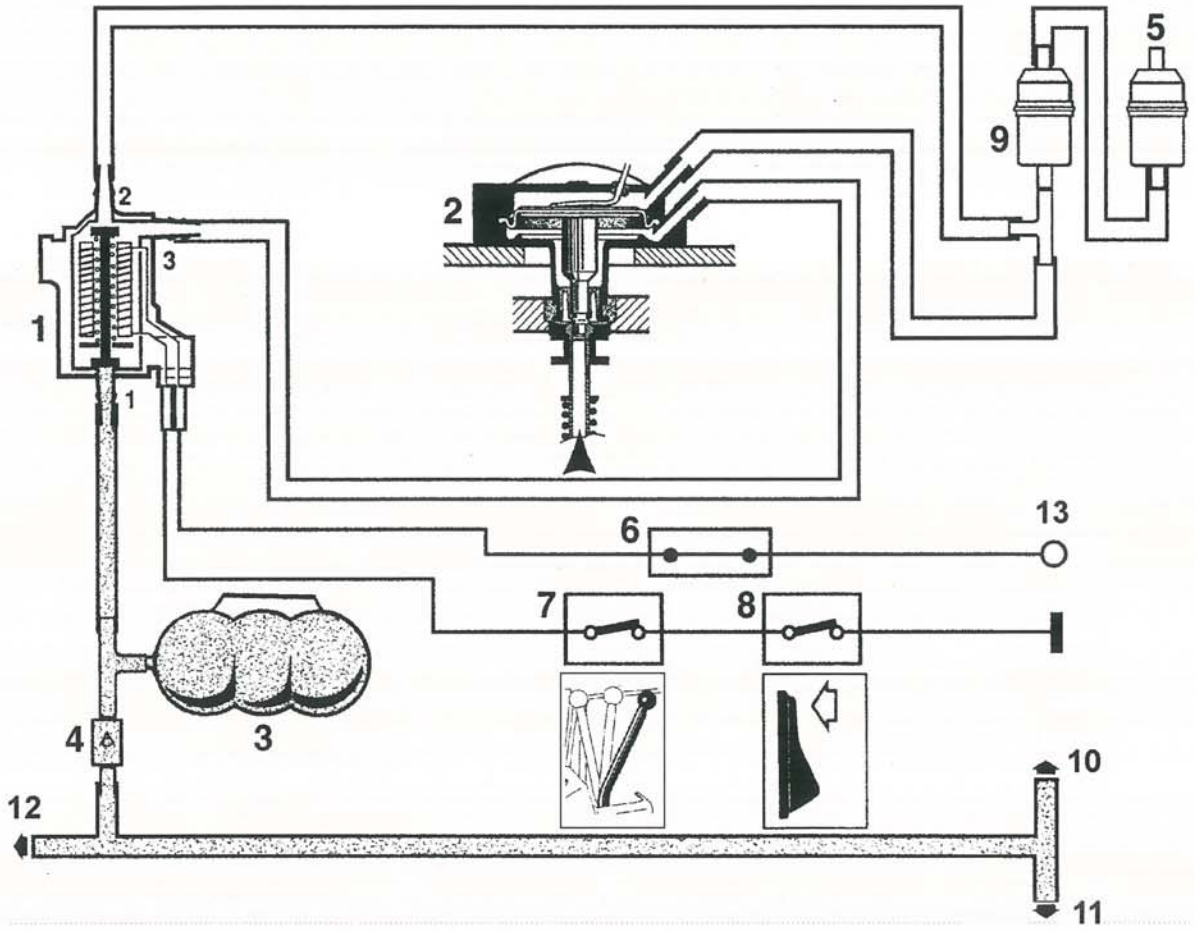
15 The solenoid valve is connected to an electrical circuit (see Fig 9/1). The circuit is closed by either engaging low range on the auxiliary gearbox selector (see Fig 9/7) or by depressing the all wheel drive switch (see Fig 9/8). When the solenoid valve is opened, ports 1 and 3 are connected. This enables the vacuum pipe connection to the control cylinder to be connected the vacuum pump (see Fig 9/10) and reservoir (see Fig 9/13). As the underside of the control cylinder is evacuated of air, the atmospheric pressure above the piston forces it down against its spring. This piston is connected to a control fork at the axle journal and thus engages all wheel drive.



1 Solenoid valve
2 Actuator
3 Vacuum reservoir
4 Non-return valve
5 Dryer 11
6 Fuse 8A
13
7 Switch at auxiliary gearbox shift lever
8 Toggle switch actuated
9 Air filter
10 Vacuum – from vacuum pump
Vacuum – to servo
12 To diff. lock system (vacuum supply)
Ignition switch

Fig 9 Engaging all wheel drive

16 When all wheel drive is disengaged, the electrical supply to the solenoid valve is broken and the valve closes. This isolates port 1 but connects ports 2 and 3. Air pressure then returns to the vacuum pipe via an air filter (fig. 10/9). The vacuum reservoir (fig. 10/3) stays at low pressure even when the vacuum pump is turned off by means of the non return valve (fig. 10/4).

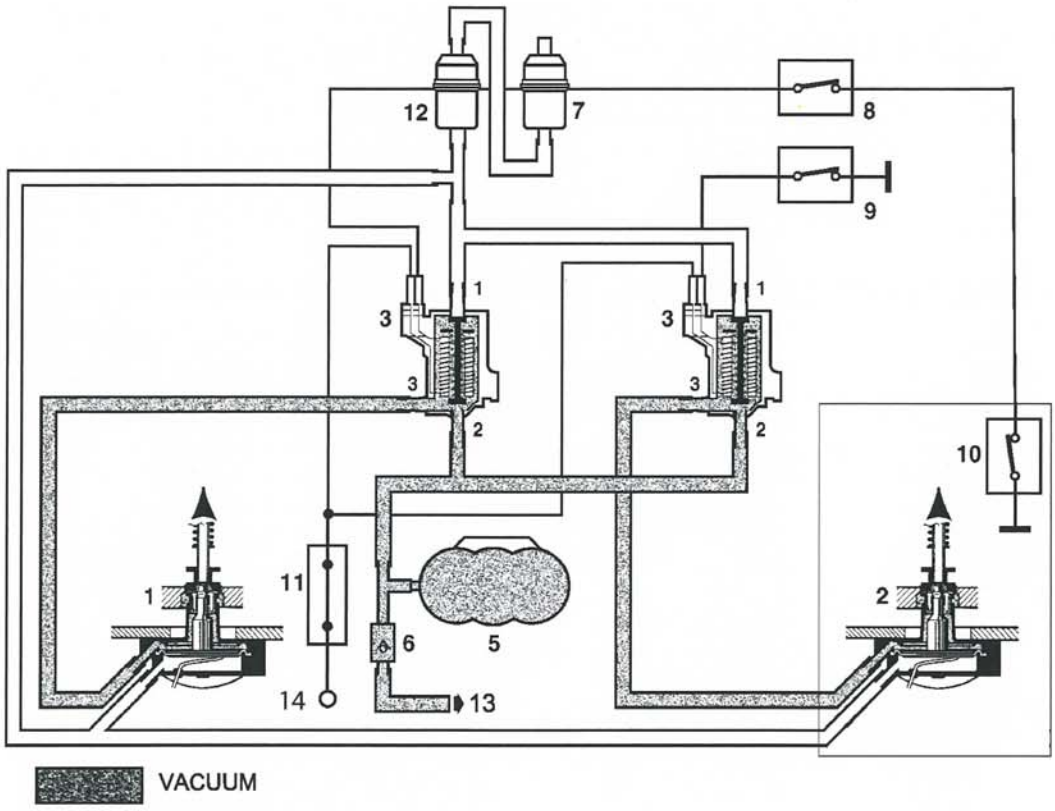


1	Solenoid valve	7	Switch at auxiliary gearbox shift lever
2	Actuator	8	Toggle switch not actuated
3	Vacuum reservoir	9	Air filter
4	Non-return valve	10	Vacuum – from vacuum pump
5	Dryer 11	Vacuum – to servo	
6	Fuse 8A	12	To diff. lock system (vacuum supply)
		13	Ignition switch

Fig. 10 Disengaging all wheel drive

OPERATION OF DIFFERENTIAL LOCKS

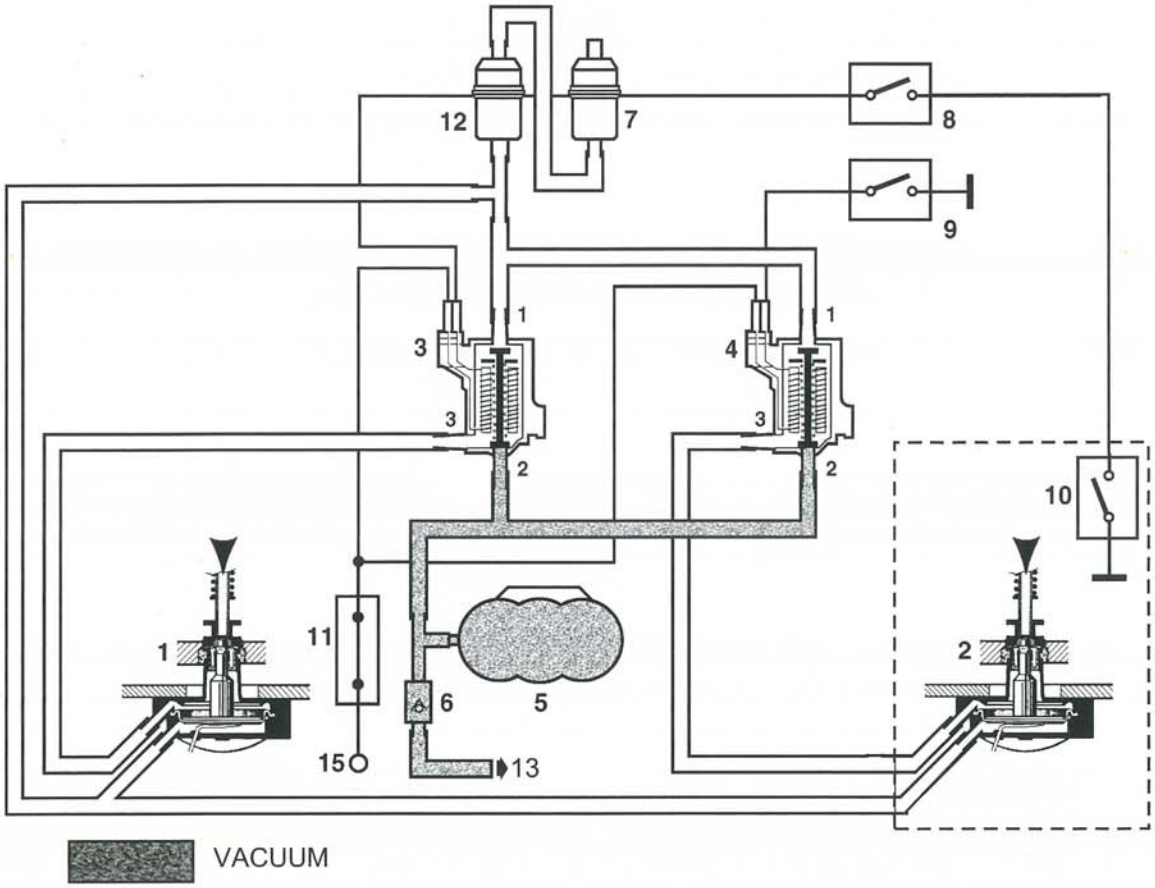
17 The front and rear differential locks are engaged in the same way as is all wheel drive. Both the front and rear axles have control cylinders (see Figs 11/1 and 11/2) connected to solenoid valves (see Figs 11/3 and 11/4) when either of the toggle switches (see Figs 11/8 and 11/9) is depressed, the electrical circuit to the respective solenoid valve is closed. The micro switch (see Fig 11/10) on the front differential can be engaged. Opening either of the solenoid switches connects the respective control cylinder vacuum pipe to the vacuum pump (see Fig 11/13) and reservoir (see Fig 11/5). The resultant pressure drop on one side of the control cylinder forces the piston up against its spring. The pistons are connected to control forks in the front and rear axle journals thereby engaging the differential locks.



1	Actuator front axle lock	8	Toggle switch front axle lock
2	Actuator rear axle lock	9	Toggle switch rear axle lock
3	solenoid valve front axle lock	10	Microswitch rear axle
4	Solenoid valve rear axle lock	11	Fuse 8A
5	Vacuum reservoir	12	Air filter
6	Non-return valve	13	To vacuum pump
7	Dryer	14	Ignition switch

Fig 11 Engaging differential locks

18 When the differential locks are disengaged, the electrical supply to the solenoid valves is broken and the valves are closed by springs. This isolates port 2 but connects ports 1 and 3 air pressure then returns to the vacuum pipes via an air filter (see Fig 12/12). The vacuum pump (see Fig 12/13) and non return valve (see Fig 12/6) ensure that the vacuum reservoir (see Fig 12/5) remains at low pressure.



1	Actuator front axle lock	8	Toggle switch front axle lock
2	Actuator rear axle lock	9	Toggle switch rear axle lock
3	Solenoid valve front axle lock	10	Microswitch rear axle
4	Solenoid valve rear axle lock	11	Fuse 8A
5	Vacuum reservoir	12	Air filter
6	Non-return valve	13	To vacuum pump
7	Dryer	15	Ignition switch

Fig 12 Disengaging differential locks

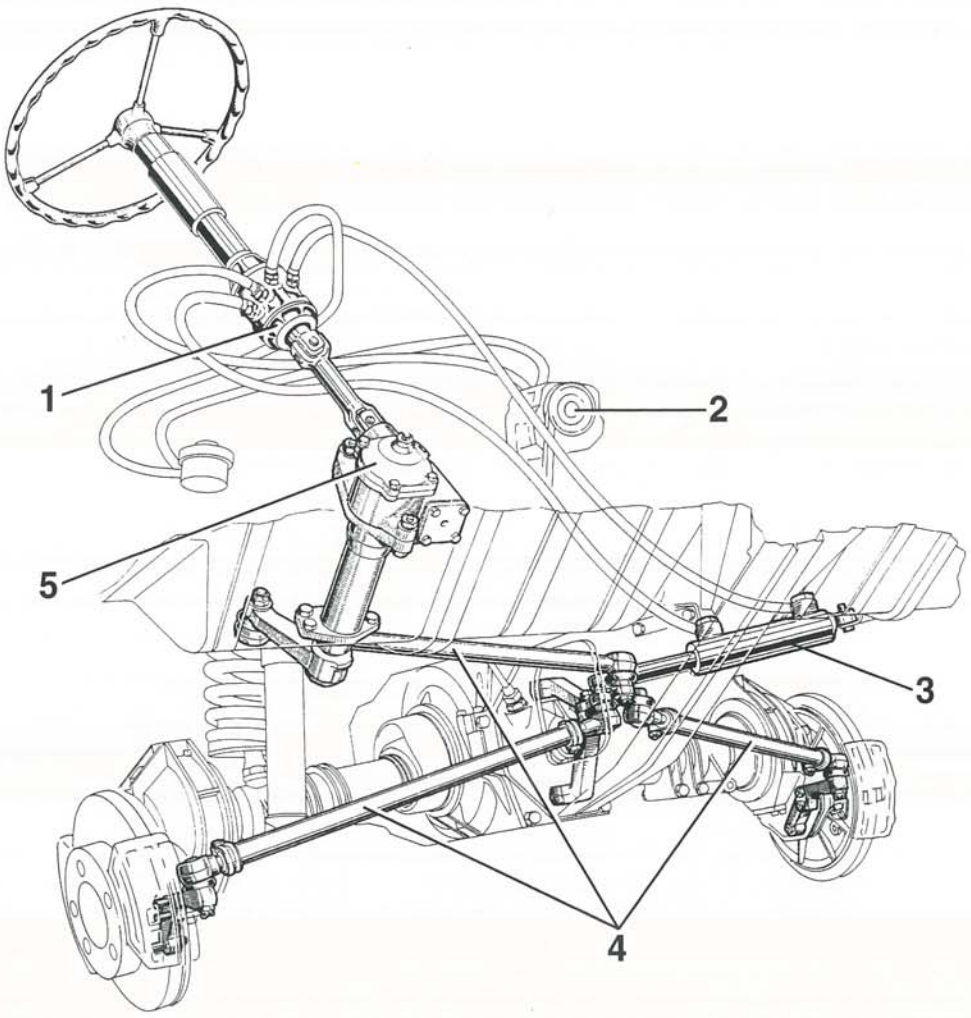
CHAPTER 7

STEERING SYSTEM TECHNICAL DESCRIPTION

CONTENTS

GENERAL DESCRIPTION

1 The ZF power assisted worm gear steering system consists of a conventional steering box and a hydraulic ram. Hydraulic power is provided by a belt drive pump connected to the engine. The steering wheel takes 3-4 turns from lock to lock and gives the vehicle a turning circle of 11.5 m. As the steering wheel is turned, the rotary valve (see Fig 1/1) located in the steering column opens forcing hydraulic fluid into the steering pump. The steering pump (see Fig 1/2) is belt driven by the crankshaft and supplies high pressure fluid to the hydraulic ram (see Fig 1/3).



1 Cylindrical rotary valve
2 Servo-steering pump
3 Hydrauli c ram
4 Track rods
5 Steering gear

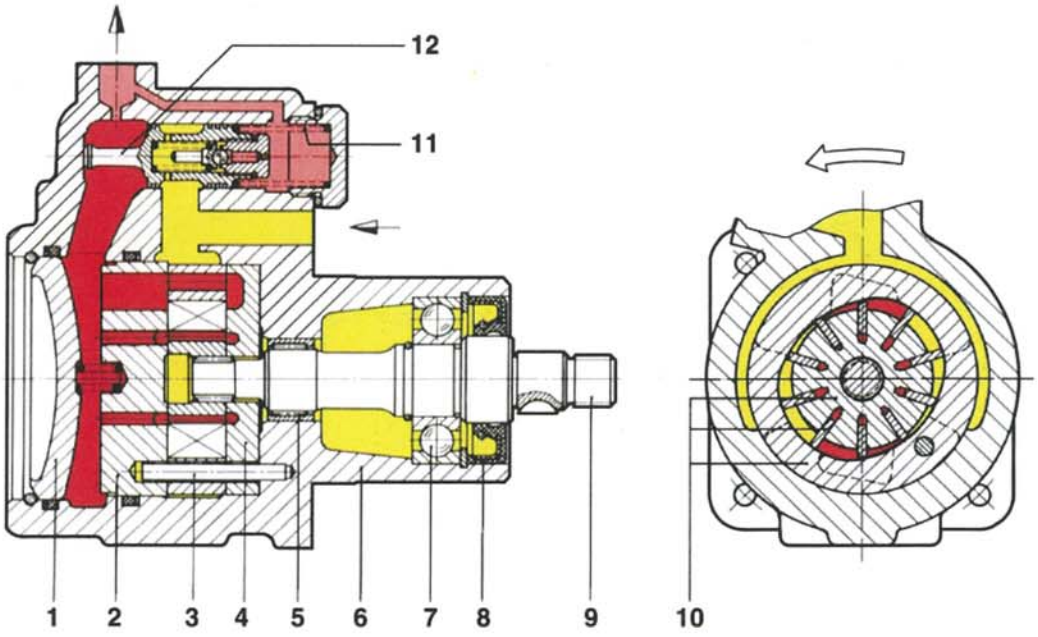
Fig 1 Steering system

STEERING LINKAGE

2 The ram and steering gear linkage are connected to the relay lever. As the lever is twisted, the track rods (see Fig 1/4) turn the wheels. Since turning effect is transmitted via the steering gear, failure of the servo-steering pump does not immobilise the steering. Failure of the pump only results in heavier, less effective steering.

HYDRAULIC PUMP

3 The centrifugal type hydraulic pump uses a rotor to pressurise the hydraulic fluid supplied to the calipers. The rotor set (see Fig 2/10) consists of a centre piece, ten vanes and an eccentric outer ring. As the centre piece rotates, centrifugal action forces the vanes outwards until they contact the outer ring. The vanes then travel along the wall of the outer ring, being forced into the centre piece twice every revolution. This action draws fluid in through the inlet pipe and forces pressurised fluid out through the throttled outlet.

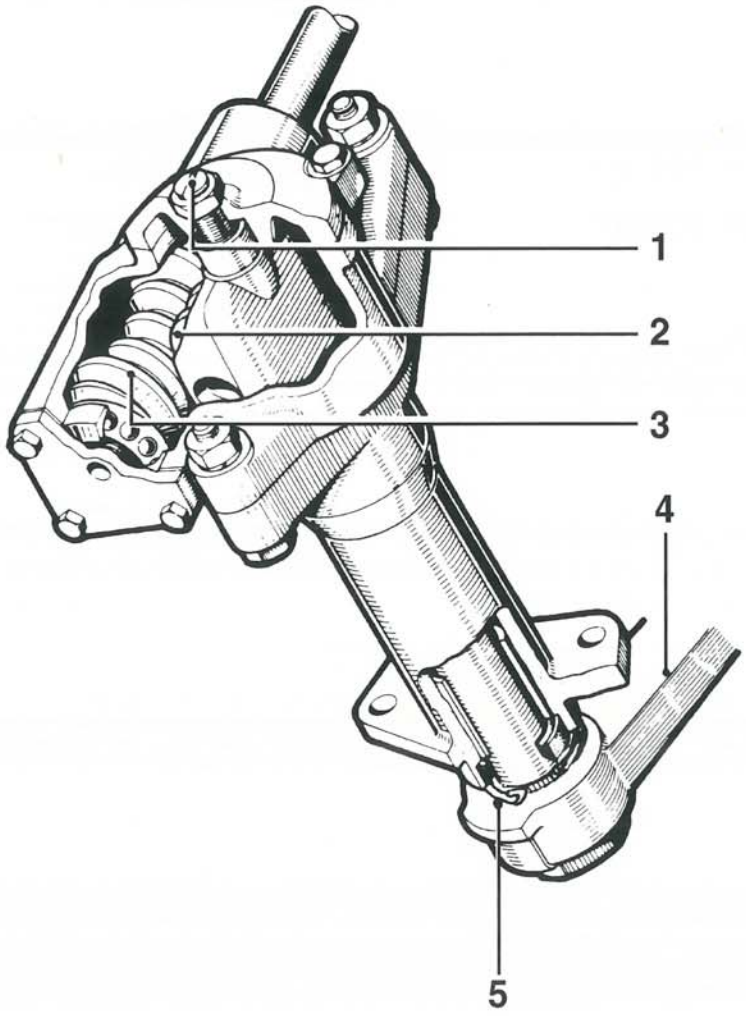


1	Cover	7	Deep groove ball bearing
2	Front plate, cover side	8	Rotary shaft seal ring
3	Dowel pin	9	Driving shaft
4	Front plate, driving side	10	Rotor set, complete
5	Needle bearing	11	Compression spring
6	Housing	12	Valve piston, complete

Fig 2 Hydraulic pump

STEERING GEAR

4 The steering box operates on a worm and nut gear principal. This allows the steering wheel to make many turns this providing a tight turning circle. The worm gear is attached to the steering wheel by a spindle. As the steering wheel is turned, the worm gear (see Fig 3/3) is rotated. As the worm gear turns, the steering rollers (see Fig 3/2) placed between the worm gear threads are forced to rotate. As the rollers rotate, they also swivel around their centre and turn the roller shaft which in turn twists the steering drop arm (see Fig 3/4).

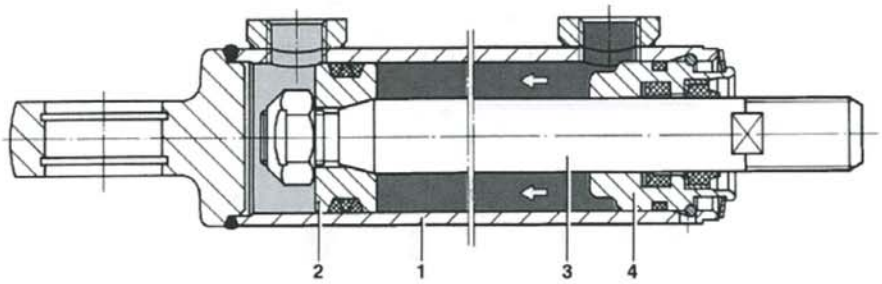


1 Adjusting shim
2 Steering roller shaft
3 steering worm
4 Steering drop arm
5 Sealing ring

Fig 3 Steering gear

HYDRAULIC RAM

5 Depending on the direction of the steering wheel rotation, the control valve directs pressurised oil into the left or right side of the cylinder (see Fig 4/1). The oil on the high pressure side of the cylinder forces the piston (see Fig 4/2) back towards the low pressure side. This pushes the oil on the low pressure side out of the cylinder returning via the rotary valve to the reservoir. The piston is attached to the piston rod (see Fig 4/3) and pushes it to the left or right depending on the steering wheel rotation. The piston rod is attached to the relay lever where its force assists the turning effect of the steering gear.

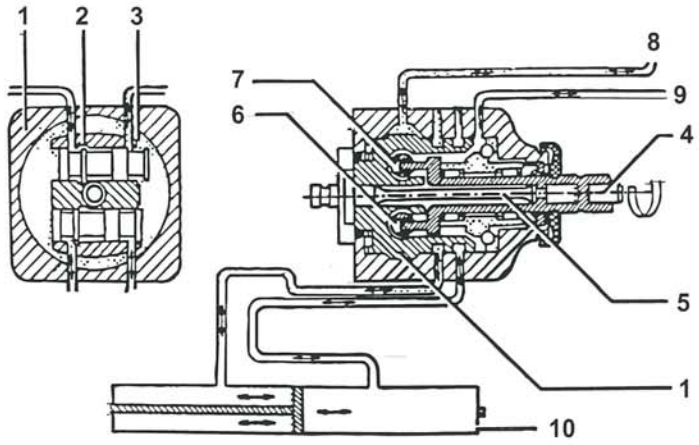


1 Cylinder
2 Piston
3 Piston rod
4 Piston rod guide

Fig 4 Hydraulic ram

ROTARY VALVE

6 The rotary valve (see Fig 1/1) is connected to the steering column and controls the power assistance. When the steering wheel is turned, the torsion bar (see Fig 5/9) attached to the steering column is forced to rotate. As the bar rotates, it turns the two control pistons (see Figs 5/11 and 5/12) in one direction or the other. These pistons contain valves which direct hydraulic fluid to the hydraulic ram (see Fig 5/16). As one valve is opened, the other is shut so that hydraulic fluid is supplied to only one side of the working cylinder at a time. Turning the steering wheel in one direction will force hydraulic fluid to one side of the working cylinder, while turning the wheel the other way will force the fluid to the other side.



1	Control valve	6	Control piston
2	Return groove	7	Control piston
3	Inlet groove	8	Input from pump
4	Steering spindle	9	Output
5	Torsion bar	10	Hydraulic ram

Fig 5 Rotary valve

CHAPTER 8

SUSPENSION TECHNICAL DESCRIPTION

CONTENTS

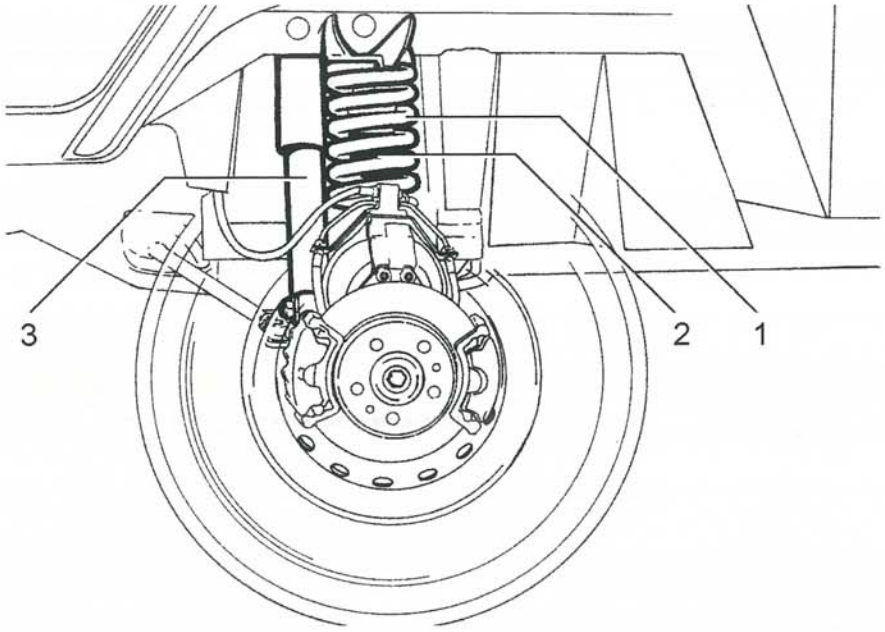
GENERAL DESCRIPTION

1 Suspension on the front axle consists of coil springs, rubber springs and shock absorbers. A tapered leaf spring is fitted between each of the rear axles. A hydraulic shock absorber is fitted at each rear wheel station.

2 The front and rear axles are connected to the central carrier tube, this forms the chassis of the vehicle providing torsion and deflection resistance to the vehicle. Independent suspension at each wheel station is made possible by the ability of each half axle to pivot about its differential box.

FRONT SUSPENSION

3 The front axle is fitted with double action hydraulic shock absorbers which acts to dampen vibration and smooth the vertical movement of the half axle. Coil springs are fitted over the shock absorbers and carry the weight of the vehicle body. Hollow rubber bump stops are fitted inside the coil springs to provide additional spring support when the coil spring is under maximum compression.

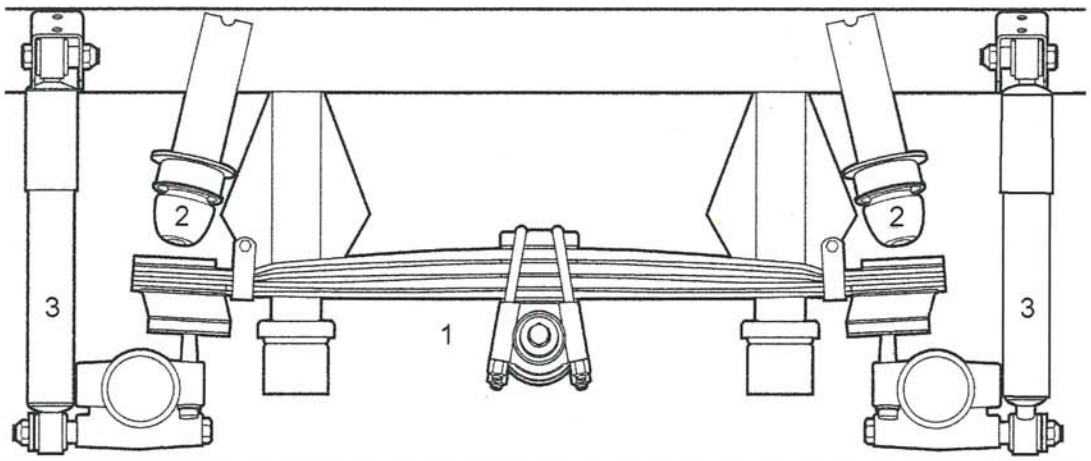


1 Coil spring
2 Hollow rubber suspension
3 Shock absorber

Fig 1 Front suspension

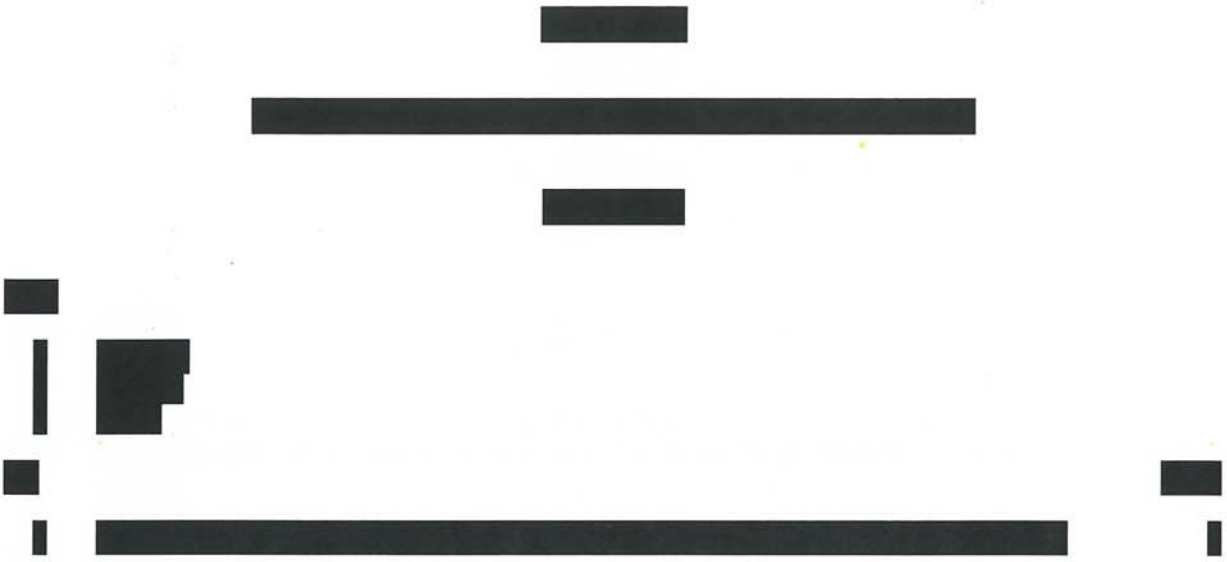
REAR SUSPENSION

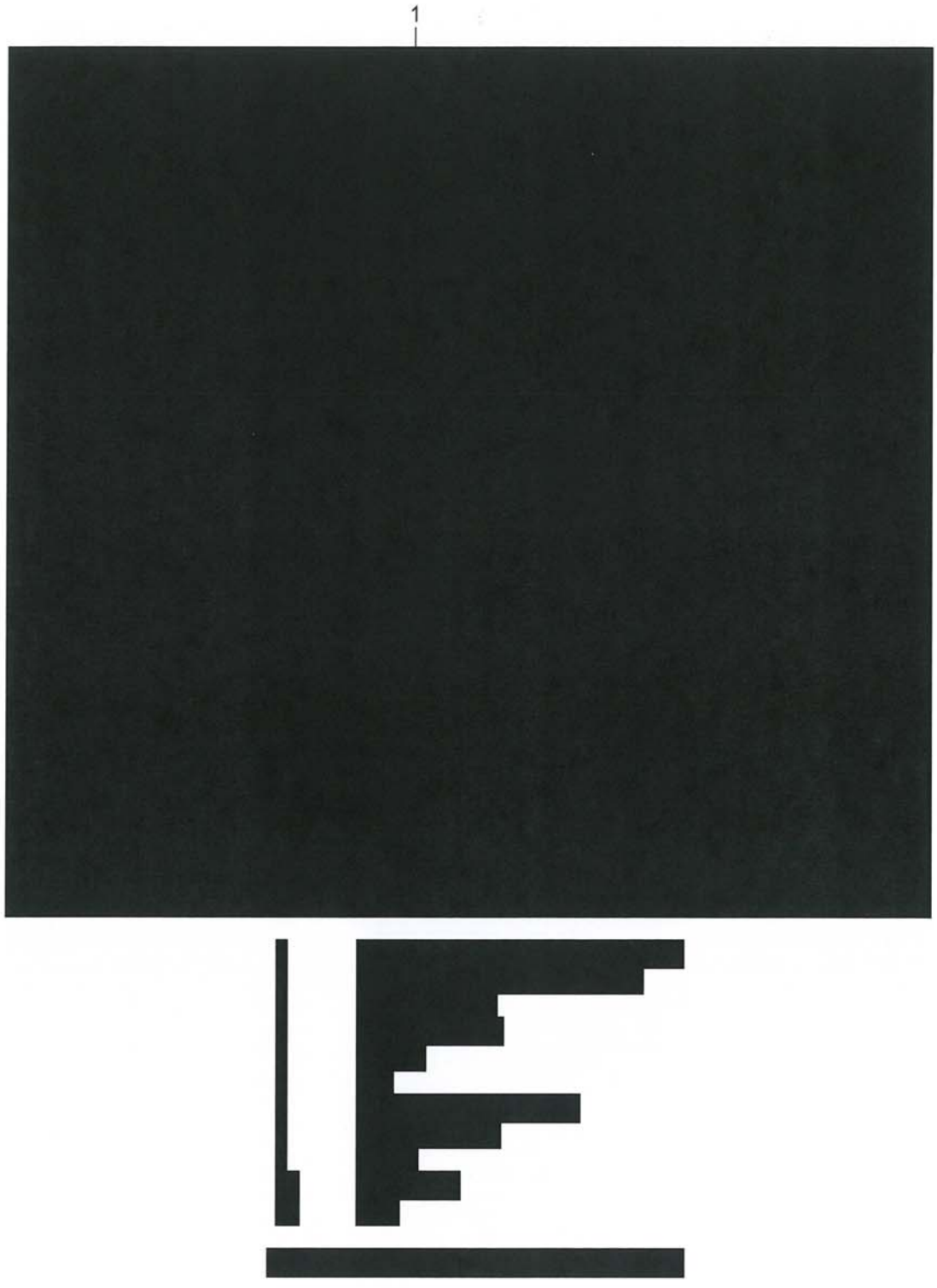
4 A tapered leaf spring is fitted between each of the rear axles. The leaf spring provides rocking beam suspension to the rear axle bogie. A hydraulic shock absorber is fitted at each wheel station.



1 Rear axle bogie
2 Hollow rubber suspension
3 Shock absorber

Fig 2 Rear suspension

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CHAPTER 10

ANTILOCK BRAKING SYSTEM TECHNICAL DESCRIPTION

CONTENTS

GENERAL DESCRIPTION

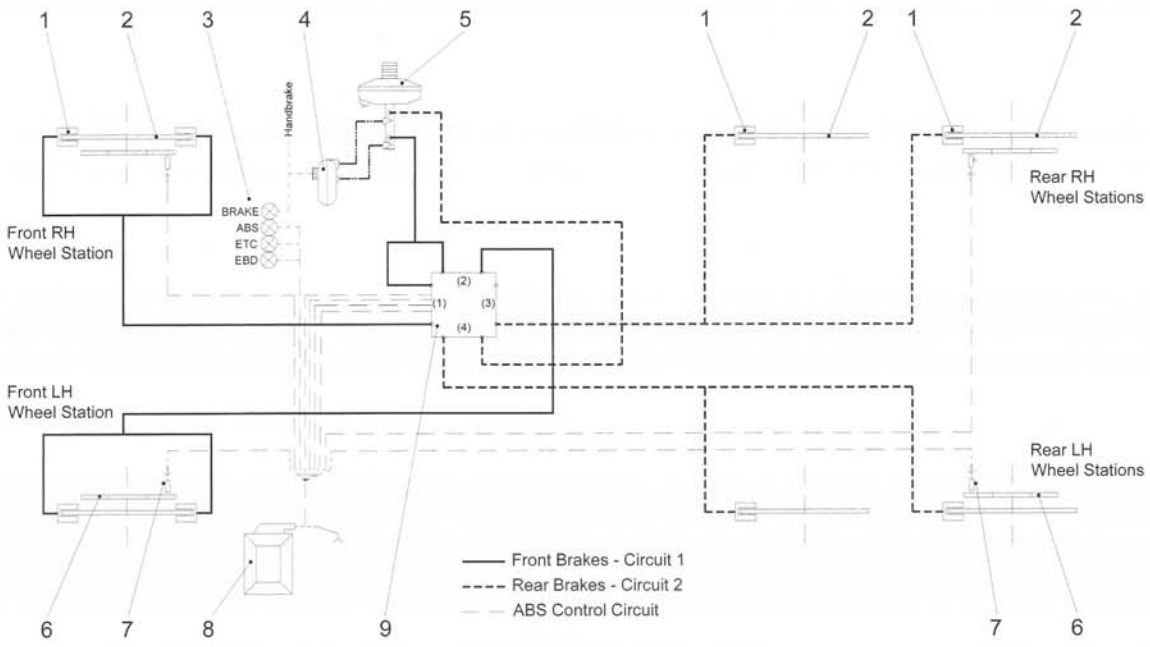
1 The hydraulic Antilock Brake System (ABS) is dual circuit with disc brakes on all wheels (see Fig 1). The system is vacuum assisted. The front axle is equipped with two callipers per wheel while the rear wheels have one calliper each. The tandem master cylinder is operated by pedal pressure with servo assistance on a dual circuit system. The system is split with both sets of front and rear wheel callipers operating in tandem but on independent circuits. By these means, damage to one of the circuits will not result in total brake failure. ABS control is provided via a four-channel brake pressure modulator, four speed sensors with pole wheels and a central Electronic Control Unit (ECU). The ABS also introduces Electronic Brake Distribution (EBD) and Electronic Traction Control (ETC) to the Pinzgauer brake system.

2 A pole wheel and sensor is provided on front axle and second rear axle wheel stations to monitor wheel speed.

NOTES

(1) The ABS eliminates the hydraulic brake pressure control valve found on non-ABS 6x6 Pinzgauer variants.

3 The handbrake lever operates a disc brake located on the central drive shaft of the rear axle drive. When all wheel drive is engaged, the handbrake also operates on the front axle.



1	Brake calliper	6	Pole wheel
2	Brake disc	7	Sensor
3	Brake system warning lamps	8	Electronic Control Unit
4	Fluid reservoir with loss indicator	9	Modulator
5	Servo unit and tandem master brake cylinder		

Fig 1 Brake system

BASIC FUNCTIONS AND TASKS OF THE ANTILOCK BRAKE SYSTEM

4 During full or even partial braking on a slippery road in a vehicle not equipped with ABS, it may not be possible to transmit all of the brake force onto the road due to the low coefficients of friction between the tyres and the carriageway. The braking force is excessive and the wheels lock up

5 When the wheels are locked up, they cease to offer any purchase on the road and they transmit almost no cornering forces (steering and tracking), which has serious consequences: The vehicle cannot be steered; swerves despite countersteering and starts to skid; the braking distance is significantly increased.

6 As a result, cornering forces on braked wheels should be maintained even during full braking, so as to guarantee that the vehicle or vehicle combination remains stable and can still be steered as far as physically possible. At the same time, the friction contact between tyres and the carriageway should be fully optimised, therefore reducing the braking distance and making the vehicle decelerate more rapidly.

7 The principal task of the ABS system is to guarantee that the vehicle can still be steered and holds its course during braking. ABS systems must prevent the vehicle's wheels from locking as a result of excessively powerful actuation of the service brake, mainly on slippery road surfaces. If the critical locking point of the wheels is reached during braking, the brake pads are pulsed (released and reapplied) within fractions of a second. This permits the wheels to continue to turn and means that the vehicle can still be steered, even during full braking.

8 Although ABS is an effective safety device, it cannot overcome the limits of driving dynamics. Even a vehicle fitted with ABS will become uncontrollable if driven too fast around a bend.

ABS CONTROL LOOP

Control Procedure

9 As the driver presses the brake pedal, the brake pressure increases. The speed of the wheel in question suddenly drops more quickly than the reference speed of the ECU. Although the wheel is still within the stable braking range (i.e. between 10 % and 30 % slip), the ECU already starts the control procedure. A corresponding trigger signal is sent to the integrated ABS solenoid valve installed in the modulator, which rapidly reduces the pressure in the brake cylinder of this wheel. The wheel begins to accelerate again. The ECU changes over the solenoid valve settings (modulator), thereby keeping the brake pressure constant until the wheel is once again in the stable slip range.

10 If more brake force can now be transmitted, the brake pressure on the brake is increased further by pulsing (i.e. alternating between maintaining pressure and increasing pressure). A new control cycle starts if the wheel speed once again drops markedly in relation to the reference speed of the ECU. The procedure repeats itself for as long as the brake pedal continues to be pressed down too much for the condition of the road in question, or until the vehicle comes to a halt. The maximum control frequency (valve pulses) which can be achieved in this case is 3 to 5 cycles per second.

SYSTEM FUNCTIONS

11 In addition to providing controlled braking the ABS system also provides the Pinzgauer with Electronic Brake Distribution (EBD) and Electronic Traction Control (ETC). The function and operation of the individual elements of the system are described in the following paragraphs.

ABS

12 A stationary speed sensor continuously picks up the rotary motion of the wheel by means of the pole wheel. The electrical pulses generated in the sensor are sent to the ECU which uses them to calculate the speed of the wheel.

13 At the same time, the ECU utilises an internal mode to calculate a reference speed which approximates to the indirectly measured vehicle speed. Using all this information, the ECU continuously calculates the wheel acceleration or deceleration values as well as the amount of brake slip. The

modulator is activated whenever certain slip values are exceeded. This causes the pressure in the brake to be restricted, maintained or even lowered. As a result, the wheel is kept within the optimum slip range.

14 The ABS ensures the vehicle remains stable and can still be steered during braking, and minimises the braking distance under most road conditions. The ECU continuously registers the speed of all wheels using the speed sensors. The ABS algorithm determines whether any wheel is starting to lock up and this causes the ECU to activate the corresponding solenoid valves in the modulator in order to adjust the brake pressure at the wheel brake. The brake pressure is set so the wheel continues to turn while still transmitting the greatest possible brake force. As a rule, every wheel is individually controlled depending on the adhesion between its particular tyre and the carriageway. In case a carriageway has varying coefficients of friction, modified individual control is performed in order to reduce the yawing moment on the front axle. In this way, an optimum compromise is reached between stability/steering ability and deceleration.

How the ABS Operates

15 When the wheel brakes of the vehicle are applied, ABS makes optimum use of the surface friction for braking. It ensures that the wheels continue to turn so the vehicle remains manoeuvrable. This is guaranteed by the ABS control components. These components evaluate the rotation speed of the wheel and adjust the braking procedure to match the road conditions. Depending on the requirements, the brake pressure is reduced, increased or kept constant using solenoid valves. This is so the wheels continue to turn and optimum braking is assured. The values are controlled by the ECU in accordance with the ABS algorithm.

16 Brakes on all wheels are controlled by two solenoid valves, an inlet valve and an outlet valve (which are integral to the modulator). If the inlet valve is closed, the pressure in the wheel brake cylinder and in the line is maintained. The pressure is reduced if the outlet valve is opened whilst the inlet valve is closed. The pressure is increased if the inlet valve is opened whilst the outlet valve is closed (providing the brake pedal remains fully depressed). During ABS control, the solenoid valves are pulsed, which allows the brake pressure of the hydraulic fluid to be set in finely spaced stages.

EBD

17 Due to dynamic weight transfer when the vehicle decelerates, it is necessary to provide a balance between front and rear brakes. This balance is achieved by control of the rear brake line hydraulic pressure and takes into account any change in the payload on the vehicle. As a result of this system the vehicle remains stable when braking and has the correct braking pressure on the rear axle whether loaded or not. On non-ABS Pinzgauers this function was provided by a brake pressure control valve. The Electronic Brake Distribution (EBD) module of the ABS replaces both the traditional hydraulic and pneumatically controlled hydraulic valve.

18 The EBD module is intended to guarantee the necessary locking sequence (front axle before rear axle). The optimised brake force distribution during partial braking manoeuvres (long before ABS control intervention is required) increases utilisation of adhesion on the rear axle with less force being required at the pedal.

How the EBD Operates

19 When the vehicle's brakes are applied, EBD guarantees the specified locking sequence is achieved (front axle before rear axle), so that the vehicle will remain stable and can be steered during partial braking manoeuvres. This is guaranteed by the ABS control components which evaluate the wheel speed and set the brake pressure at the rear axle. EBD utilises the wheel station solenoid valve in order to function correctly. If the inlet valve is closed, the pressure in the brake cylinder and in the line is maintained. The pressure is increased if the inlet valve is opened whilst the outlet valve is closed (providing the brake pedal remains actuated).

ETC

20 In a speed range from zero to 50 km/h, Electronic Traction Control (ETC) guarantees the maximum possible traction and constant vehicle stability. If braking takes effect on a wheel which is spinning, the corresponding torque is transferred via the axle differential to the wheel with the higher coefficient of

friction. The limits of traction control are represented by the maximum engine or braking torque and the available adhesion between the tyres and the carriageway.

How the ETC system operates

21 The ETC system uses largely the same components as the ABS, ie wheel speed sensors, ECU and modulator with integrated ABS solenoid valves for each wheel. Using the ABS wheel speed signals, the algorithm in the ECU calculates the speed difference between the wheels on one axle. As a result, it can determine when a wheel is slipping excessively.

22 The ECU actuates the return pump and the ABS solenoid valves of the modulator in order to direct hydraulic power to the brake. The brake pressure is then adapted by the corresponding ABS solenoid valves of the modulator. The pressure at the spinning wheel is increased until the speed of both wheels is once again synchronised. This means a torque is transmitted to the wheel which is not spinning.

BRAKE SYSTEM WARNING LAMPS

23 The braking system is supported by four warning lamps located in the drivers display panel.

Handbrake And Low Brake Fluid Level

24 As fitted on a non-ABS Pinzgauer, a combined red warning lamp is provided. The purpose of the lamp is to indicate that the handbrake is "ON" or the brake fluid is low.

ABS

25 The purpose of the amber ABS warning lamp is to display a malfunction of the electronic or electrical ABS components or of the entire system. A self-test of the ECU and the connected electrical circuits is performed when the ignition is switched on.

26 The lamp comes on when the ignition is switched on. It then goes out for about 2 seconds and comes back on until all wheels with sensors have exceeded a road speed of 7 km/h for the first time. This provides an optical indicator that the system self-test has been performed successfully. If the 1 second lamp off phase does not take place, this means a fault has been detected and stored in the ECU memory or the charge in the vehicle batteries is low

EBD

27 The purpose of the red EBD warning lamp is to display a malfunction of the electronic or electrical ABS components or a fluid error has occurred. If a serious fault occurs, both the EBD and the ABS warning lamp come on.

ETC

28 The ETC function is available between 0 and 50 km/h, as soon as the ignition is switched on and the ECU has completed its self-test. An amber display lamp indicates when the ETC function is operating. If a fault occurs, both the ETC and the ABS warning lamp come on.

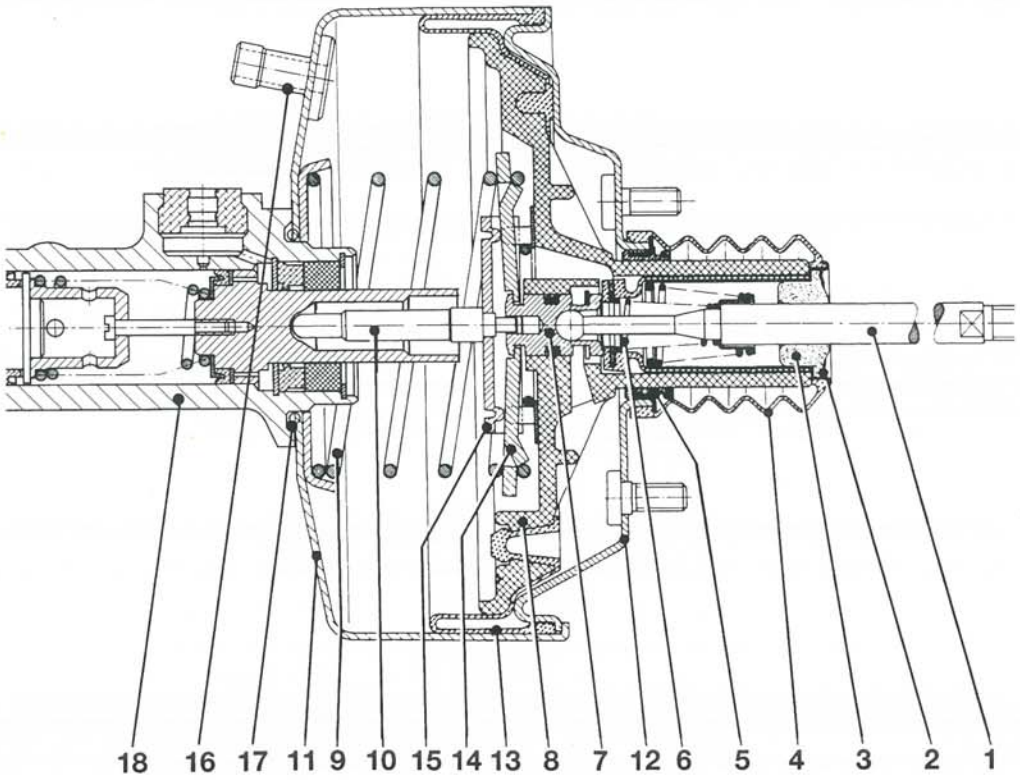
BRAKE SYSTEM COMPONENTS

29 The system comprises of the following major components:

Vacuum Servo

30 The servo unit assists the driver's downward foot pressure by means of an engine driven vacuum pump. Downward pressure on the brake pedal forces in the piston rod (see Fig 2/1) which in turn pushes in the control valve (see Fig 2/7) and the push rod (see Fig 2/10). The push rod then exerts pressure onto the piston in the master cylinder (see Fig 2/18), thus enabling braking even under brake booster failure.

31 The servo unit is split into two sections by the working piston (see Fig 2/8). On the left hand side of the piston is the vacuum chamber (see Fig 2/11) and on the right, the working chamber (see Fig 2/12). As the piston rod moves toward the left, the control valve opens the vacuum connection (see Fig 2/16) to the vacuum pump. At the same time the working chamber is opened to the atmosphere via a double valve. The valve is also connected to the vacuum pump. This forces the working piston to the left thus aiding the pressure on the push rod. As the pressure is released from the brake pedal, the piston rod returns to its original position aided by the piston return spring (see Fig 2/9). The double valve in the working chamber is also connected to the vacuum pump while the connection in the vacuum chamber is closed.



1	Piston rod	10	Push rod
2	Serrated ring	11	Vacuum chamber
3	Foamed filter	12	Working chamber
4	Protection cap	13	Roller diaphragm
5	Seal ring	14	Lever
6	Compression spring	15	Yoke
7	Control valve	16	Vacuum connection
8	Working piston	17	O-ring
9	Piston return spring	18	Brake master cylinder

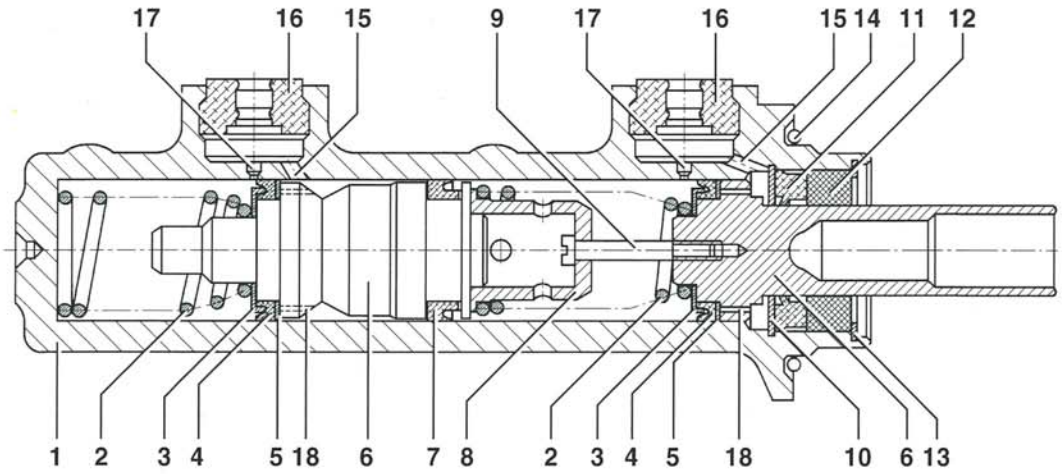
Fig 2 Vacuum servo

Master Cylinder

32 The master cylinder consists of chambers in tandem. The master cylinder housing (see Fig 3/1) contains the push rod and the intermediate pistons (see Fig 3/6). Both pistons are lubricated by brake fluid via intake bores (see Fig 3/15). While the brakes are disengaged, the springs (see Fig 3/2) force the cylinders towards the right. This results in the cylinder cups (see Fig 3/4) lying just to the right of the compensation bores (see Fig 3/17). The compensation bores are connected to the intake bores and a compensation reservoir. This allows movement of brake fluid to compensate for heating or cooling in the cylinders. As the brake pedal is depressed, the push rod attached to the master cylinder forces the

pistons towards the left. As they pass the compensation bores, their connection to the compensation reservoir is closed and the pressure of the trapped brake fluid increases.

33 As the pressure is released from the brake pedal, the push rod returns to its original position by spring pressure. As it does, the pistons are forced back towards the right by their springs. As the pistons move towards the right, the cylinder cups (see Fig 3/4) are bent back and the supporting shim (see Fig 3/5) is lifted off the filler bores (see Fig 3/18). This allows brake fluid to flow through the filler bores into adjacent low pressure chamber. By these means, the brakes are released quickly.



1	Tandem master cylinder housing	10	Stop washer
2	Spring	11	Secondary cup
3	Supporting ring	12	Bush
4	Master cylinder cup	13	Circlip
5	Supporting shim	14	Seal ring
6	Piston	15	Intake bore
7	Partition cup	16	Rubber stopper
8	Stop sleeve	17	Compensating bore
9	Bolt	18	Filler bore

Fig 3 Master cylinder

ECU

34 The ECU uses the wheel sensor signals to calculate the road speed and the wheel speeds as well as the wheel deceleration and acceleration values. If required, it activates solenoid valves in the modulator in order to prevent the vehicle's wheels from locking.

35 The 4-channel ECU has a dual-circuit structure. Each circuit monitors two diagonally opposed vehicle wheels and can be subdivided into four functional groups: Input circuit; Master circuit; Safety circuit; Valve control.

36 In the input circuit, the signals generated by the speed sensors are filtered and converted into digital information. The master circuit consists of a microcomputer. By means of a complex program, the control signals are calculated and used in logic functions. In addition, actuator signals are output for controlling the valves in the modulator.

37 The ECU signals to the driver via the warning lamps if there are any messages and, if necessary, switches off the control of one wheel, both diagonally opposed wheels or, in certain circumstances, the entire ABS system. The brake system remains fully functional in this case, it is merely that the anti-lock protection and the ETC function are partially or fully unserviceable – in this event the EBD function will not operate and the vehicle should be driven with care.

38 Messages are permanently saved in the electronic control unit for diagnostic purposes. It is possible to read out and delete the message memory using the diagnostic connection and diagnostic controller.

39 The valve control units contain power transistors (output stages) which are activated by the signals coming from the master circuit and which switch the current for operating the control valves. The non-steered axle is controlled individually. Modified individual control is used for the steered axle.

40 The ECU is mounted behind a cover on the ABS control board located on the left hand side wall of the cab, adjacent to the Vehicle Power Distribution Box (VPDB). The ECU is a non-serviceable item and must be replaced if a fault is diagnosed that cannot be resolved with the diagnostic controller. Fuses, relays, the ABS power converter and diagnostic connection are also located on the ABS control board.

Pole Wheel and Sensor

41 Using a proximity method, the stationary wheel speed sensor detects the movement of an impulse pole wheel which rotates together with the vehicle's wheel. The bar sensor operates inductively and mainly consists of a permanent magnet with a round pole pin and a coil. The rotation of the pole wheel connected to the wheel hub produces a change in the magnetic flux picked up by the sensor coil, thereby generating an alternating voltage. The frequency of this voltage is proportional to the wheel speed.

42 On 6x6 variants wheel speed is monitored on front axle and second rear axle wheel stations. The pole wheel is attached to a modified axle wheel flange. The sensor mounting bracket is fitted with a removable split bush into which the speed sensor is pushed; this permits adjustment of the sensor/pole wheel air gap (see Fig 4).

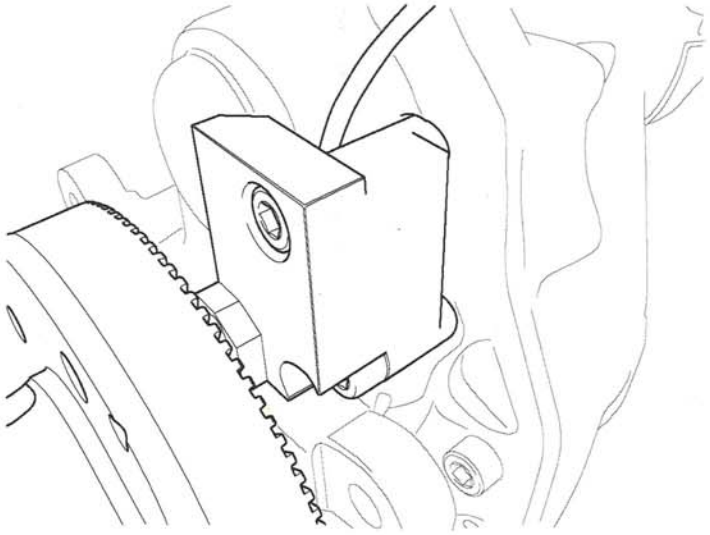


Fig 4 Pole wheel and sensor

Modulator

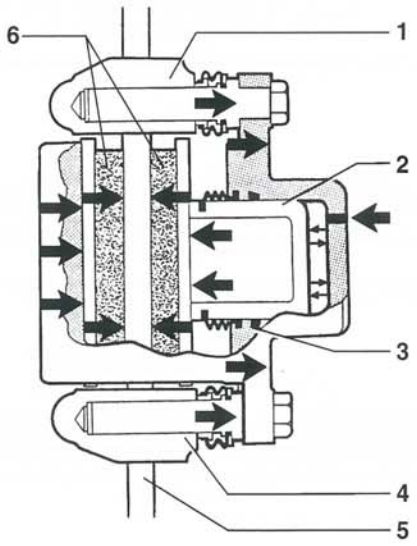
43 The electro-hydraulic modulator allows the brake pressure applied by the driver via the brake booster / master cylinder to pass through to the wheel brake cylinders. In addition, it is responsible for safeguarding the two brake systems in relation to one another in the event of a failure of one of these brake circuits, and to ensure brake pressure control (4 wheel channels) for ABS brake control with 2/2-way solenoid control valves.

44 The modulator comprises of the ABS solenoid valves (one inlet and one outlet valve supporting each wheel station), a pump and accumulator. The modulator is located behind a cover in the driver's foot well and is a non-serviceable item that must be replaced if a fault is diagnosed.

45 On 6x6 variants rear axle wheel stations are paired on each side of the vehicle and modulated in tandem.

Callipers

46 The brake callipers are attached to the wheel drive housings (see Fig 5/1). When hydraulic fluid is forced into the small induction chamber, the internal pressure increases. As fluid pressure is equal in all directions the piston (see Fig 5/2) is forced inwards while the calliper housing is forced outwards by an equal amount along its guide pins (see Fig 5/4). This pushes both brake pads against the brake disc with equal force.

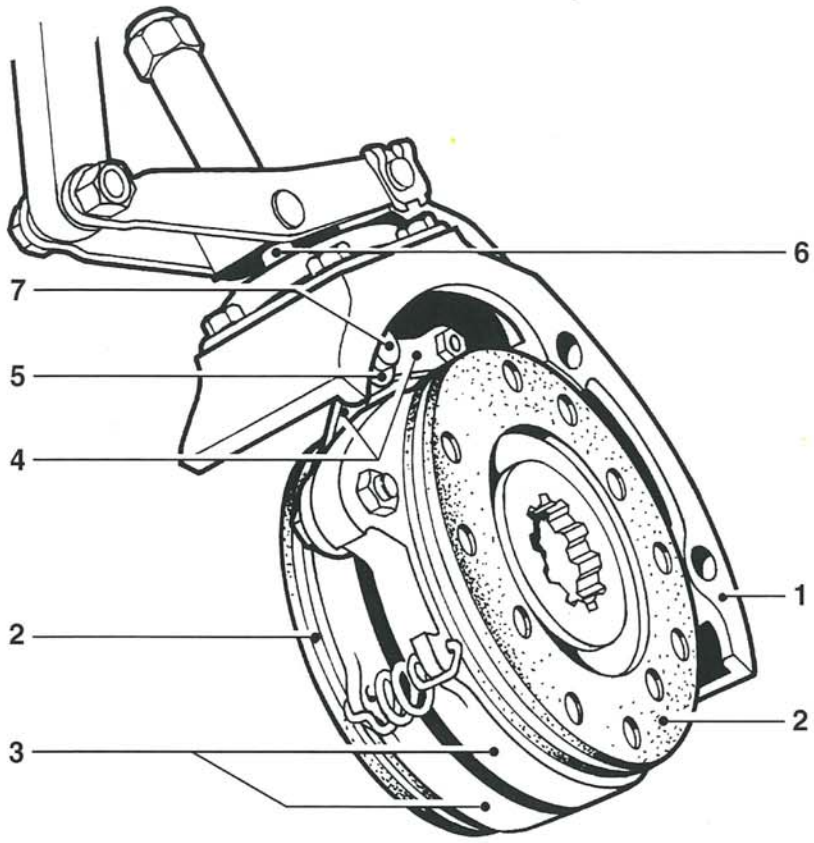


1	Housing	4	Guide pin
2	Piston	5	Brake disc
3	Seal ring	6	Brake pad

Fig 5 Brake calliper

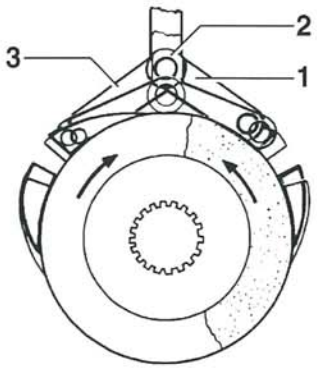
Handbrake

47 The handbrake is located on the rear of the rear differential and is connected to the drive shaft. This enables the brake to operate on all four wheels when all wheel drive is selected (this is also the default setting when the ignition is switched off). The brake housing (see Fig 6/1) is attached to the vehicle body and is water tight. The two double-pad discs (see Fig 6/2) are centrally splined onto the drive shaft and rotate when the vehicle moves. Between the pad discs are two steel actuation discs (see Fig 6/3) these are forced together by springs. Sandwiched between the discs, steel balls rest in shallow cups held in place by the tension in the springs. As the handbrake is applied, the retainer bolt (see Fig 6/7) is pulled up also drawing up the yoke (see Fig 6/5). As the yoke is raised, the draw links (see Fig 6/4) are pulled together. One of the draw links is attached to each of the actuation discs. This pulling action causes the discs to be twisted in opposite directions. As the discs turn, the steel balls sandwiched between them are forced out of their cups and consequently push the discs apart. As the actuation discs separate, they contact the pad discs and turn together until the catches on the actuation discs are stopped by collars in the housing. While the handbrake is engaged, the discs and pads are held together and the friction on the pads prevent the drive shaft turning.



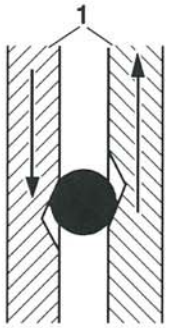
1	Housing	5	Yoke
2	Pad discs	6	Drawbar
3	Steel discs	7	Retainer bolt
4	Fastenings		

Fig 6 Handbrake



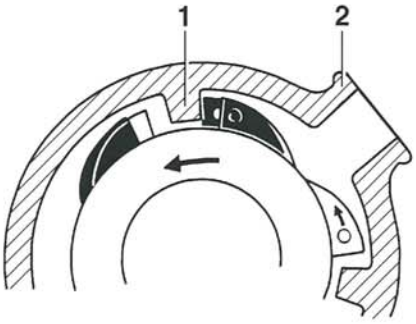
1 Draw links
2 Yoke

Fig 7



1 Steel discs

Fig 8



1 Stop
2 Brake housing

Fig 9

Actuation of handbrake

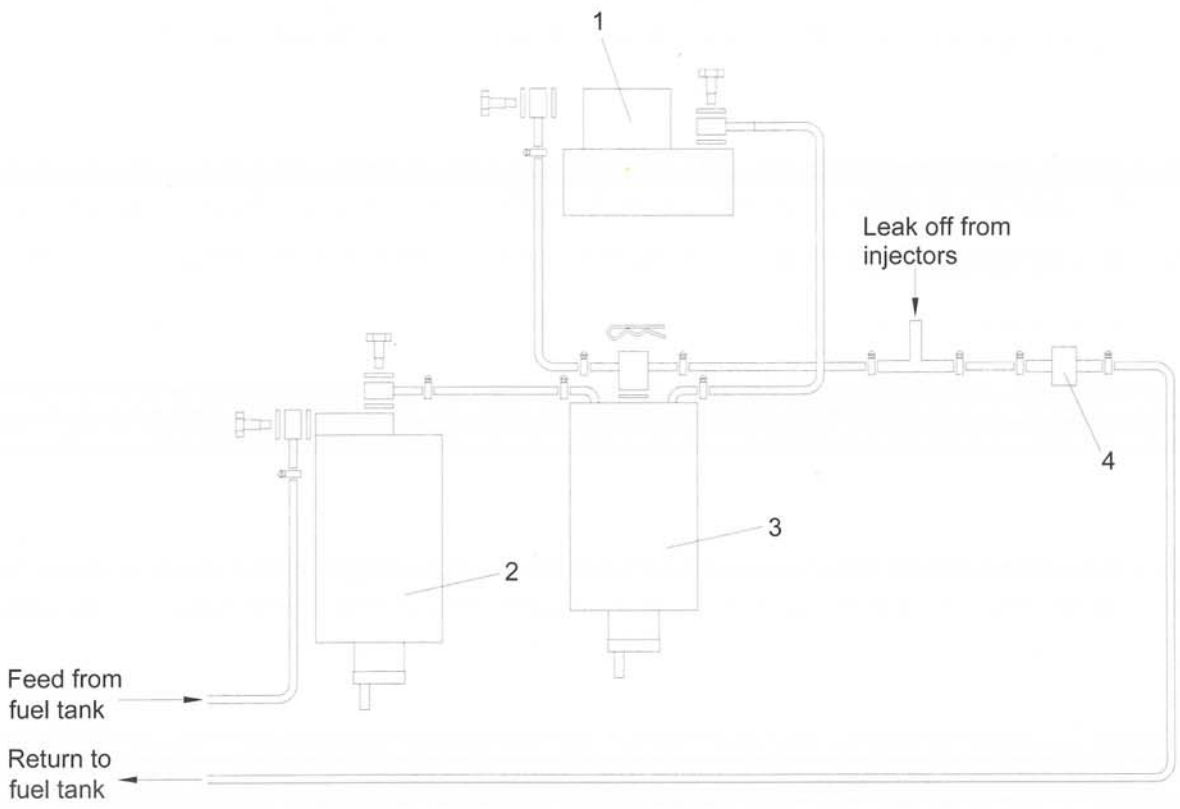
CHAPTER 11

FUEL AND EXHAUST TECHNICAL DESCRIPTION

CONTENTS

GENERAL DESCRIPTION

1 The fuel system is self bleeding and can run on aviation fuel without significant performance losses. The exhaust system has a turbo charger which supplies a boost intercooler. These increase the efficiency of combustion in the cylinders.



1	Fuel Injection Pump	3	Fuel filter
2	Fuel/water separator	4	Non-return valve

Fig 1 Fuel system

FUEL SYSTEM CARE

2 The use of clear, good quality fuel is essential if peak performance is to be maintained. The fuel injector pump is built to extremely fine limits, the smallest particle of dirt will diminish the accuracy of operation. To prevent damage and to achieve maximum efficiency:

2.1 Avoid running out of fuel as this draws sediment from the fuel tank into the system.

2.2 Ensure that the fuel is clean and free of water.

2.3 Never store fuel in a galvanised or uncovered container.

FUEL TANK

3 A 130 litre plastic fuel tank is provided. The tank is filled with explosion suppressant foam.

FUEL LIFT PUMP

4 The fuel is lifted from the reservoir by the fuel injection pump. This acts as both a lift pump from the reservoir and an injector pump to the combustion chambers. The fuel injection pump is an integral element of the engine management system and is controlled by the Electronic Diesel Control (EDC) unit. The EDC engine management system is described in Chapter 1.

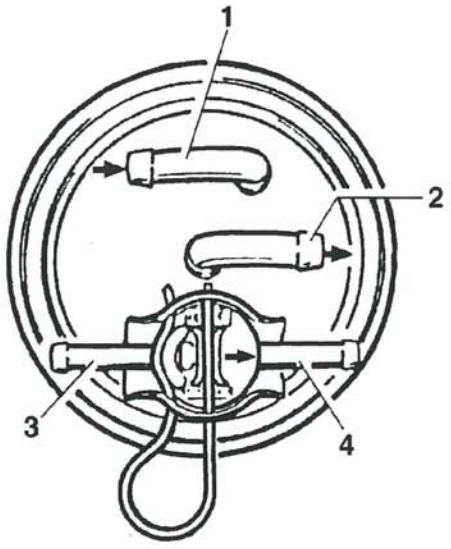
FUEL WATER SEPARATOR

5 Condensation is constantly occurring in storage tanks, fuel carriers and the fuel tank. This water displaces a fuels lubricative qualities, can lead to damage of the fuel injection pump and injectors and potentially shortens fuel filter life. The fuel water separator removes water content from the diesel. Water collected should then be regularly drained from the separator in accordance with the maintenance schedule.

6 The water separator draining procedure is provided in the Operating Information User Maintenance (see 2320-D-503-201).

FUEL FILTER

7 The fuel filter cleans the diesel from the tank (see Fig 2/1) before supplying it to the fuel injection pump (see Fig 2/2). At temperatures below 3 °C, the control valve in the return pipe (see Fig 2/3) opens admitting some fuel from the injection pump into the filter. This fuel is warm due to the compression in the injection pump. This warm fuel mixes with the cold, raising its temperature and preventing clogging. As the fuel reaches greater than 3 °C, the control valve closes and all fuel from the injection pump returns to the fuel reservoir (see Fig 2/4).



1 Feed from fuel reservoir
2 Feed to injection pump
3 Return flow from injection pump
4 Return flow to fuel reservoir (arrow-marked)

Fig 2 Fuel filter and pre-heater

8 In addition to cleaning the diesel, the fuel filter also removes water content. The fuel filter should be regularly drained in accordance with the maintenance schedule. The fuel filter draining procedure is provided in the Operating Information User Maintenance (see 2320-D-503-201). The fuel filter should be changed in accordance with the Maintenance Schedule (see 2320-D-503-601).

FUEL INJECTION PUMP

9 The fuel injection pump is an integral element of the engine management system and is controlled by the EDC unit. The EDC engine management system is described in Chapter 1. The fuel injection pump is a non-serviceable item.

FUEL INJECTION

10 The fuel injection process is an integral element of the engine management system and is controlled by the EDC unit via the fuel injection pump. The EDC engine management system and fuel injection process is described in Chapter 1.

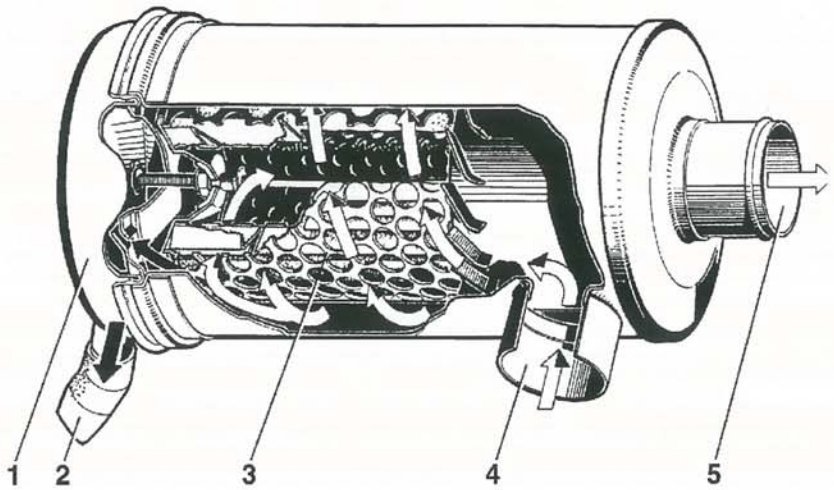
10.1 To improve performance when operating the vehicle on AVTUR, an Optimum Engine Mapping (OEM) module is provided. The OEM module **should only be connected** when it is necessary to operate the vehicle on AVTUR and is designed to achieve enhanced performance by modifying the fuel injection parameters. The OEM operates independently of the EDC engine management system and is installed in-line between the fuel injection pump and the engine harness.

CAUTION

ENGINE DAMAGE. Operating the vehicle on regular diesel will damage the engine if the OEM module is fitted. Always remove the OEM module prior to operating on diesel.

AIR FILTER

11 The air filter is positioned behind the driver's seat. Its function is to prevent any large particles of dirt entering the air intake system. Air enters through the intake (see Fig 3/4) and circulates through the filter (see Fig 3/3). The dust is extracted and exits via the valve (see Fig 3/2). Clean air is then supplied to the engine.



1 Cover
2 Dust valve
3 Air filter
4 Air intake (from air induction)
5 Air outlet (into the engine)

Fig 3 Air filter

12 Upstream of the air filter a pre cleaner is provided, positioned externally on the top of the vehicle. Air is drawn in to the base of the unit and the rotating vanes automatically expel a high percentage of contaminants 20 microns or larger (see Fig 4). The pre-cleaner is self exhausting, ensure the side vent outlet is clear from obstruction and there are no gaps between the pre-cleaner and downpipe.

NOTE

Ensure pre-cleaner is orientated towards rear of vehicle and is not obstructed by the Barracuda camouflage system.

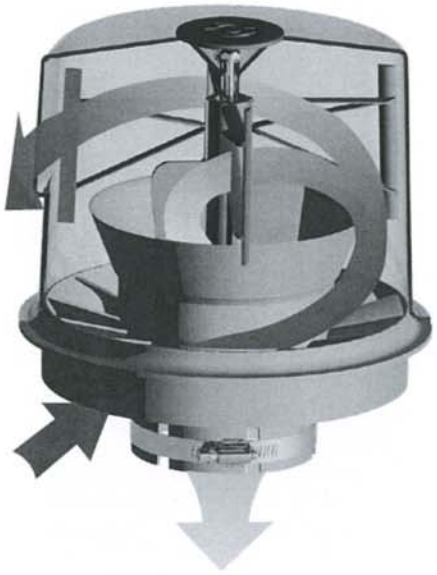


Fig 4 Air filter pre cleaner

TURBOCHARGER

13 A turbocharger utilises the energy contained in hot exhaust gases to provide more combustible air for the diesel engine. The increase in air supplied to the cylinders enables more fuel to be burned in the combustion chambers, resulting in higher performance and efficiency.

14 This effect is achieved by compressing the intake air. The higher intake air density allows a larger volume of air, and therefore more oxygen, to enter the combustion chamber during each intake cycle. The larger oxygen supply boosts the efficiency of the combustion process.

15 The exhaust gas of an engine contains both thermal and kinetic energy. These energies are utilised to drive the exhaust gas turbine of the turbocharger. The exhaust gas loses some of its energy and cools down as a result.

16 The exhaust gas turbine drives the compressor which in turn compresses the intake air, heating it up and thus reducing its density. The intake air is cooled down again in the air intercooler, thereby increasing its density.

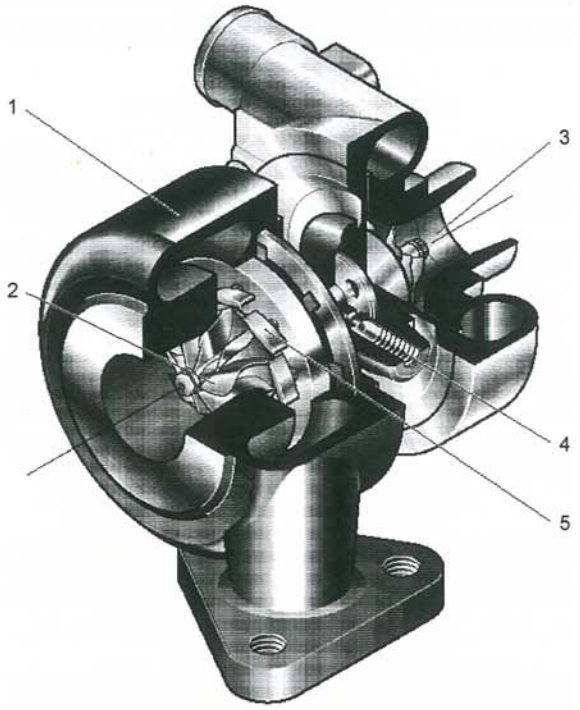
17 Traditionally turbochargers have two inherent inefficiencies: 1) the turbine speed at the top end of the speed range is high and the air is compressed more than is necessary. 2) at the bottom end of the speed range, the exhaust gas turbine does not reach the required speed. The air is not compressed sufficiently and the engine is unable to deliver the desired power output (turbo lag).

18 At the top end of the speed range, a partial exhaust gas flow bypasses the turbocharger, thus ensuring that the optimum air compression ratio is not exceeded and that the engine delivers its full power output. However, this system is ineffectual at the lower end of the speed range.

19 The turbocharger used on the engine uses variable vanes instead of the by-pass (see Fig 5/5). The variable vanes control the exhaust gas flow acting on the turbine wheel. The variable turbocharger,

in contrast to the exhaust gas turbocharger fitted with a by-pass, produces the necessary compression not only at the top end of the speed range but also across the full speed range. This is made possible by feeding the exhaust gas flow into the turbine wheel via variable vanes.

20 To allow a quick build-up of charge pressure at low speed and under full load, the vanes are set to a narrow inlet cross-section. The effect of the restriction is to speed up the exhaust gas flow, thus increasing turbine speed.



1	Housing	4	Lubricating oil inlet
2	Exhaust gas turbine	5	Variable vanes
3	Compressor		

Fig 5 Variable vane turbocharger

21 The vanes are set at a steeper angle with increasing exhaust gas flow rate or if a lower charge pressure is required. The inlet cross-section is enlarged. As a result, the charge pressure and the turbine output remain virtually constant.

22 The variable vanes are moved by means of the charge pressure control valve which is controlled by the EDC unit via the solenoid valve for charge pressure control (N75). The EDC engine management system is described in Chapter 1.

COLD START

23 If the vehicle is to be started in cold weather, glow plugs in the combustion chambers heat the air. This helps to start the engine running but the air intake will still be cold. The glow plugs are an integral element of the engine management system, controlled by the EDC unit. The EDC engine management system is described in Chapter 1.

ELECTRICAL STOP DEVICE

24 As diesel engines work on the principle of compression ignition, the only way to stop the engine is by interrupting the fuel supply. The fuel injection pump is therefore equipped with an electrical stop device – fuel cut off solenoid valve N109.

25 The solenoid valve for the fuel feed interruption is built into the fuel injection pump. When the engine is running, an electro magnet keeps the intake port open. When the ignition is switched off, the current to the solenoid is stopped and the magnetic field is broken. This allows the valve to close over the intake port and stops the supply of fuel to the combustion chambers thereby stopping the engine.

EXHAUST SYSTEM

26 The exhaust system consists of the exhaust manifold from the combustion chamber, turbocharger turbine, exhaust down pipe and silencer. The silencer is a standard resonant box.

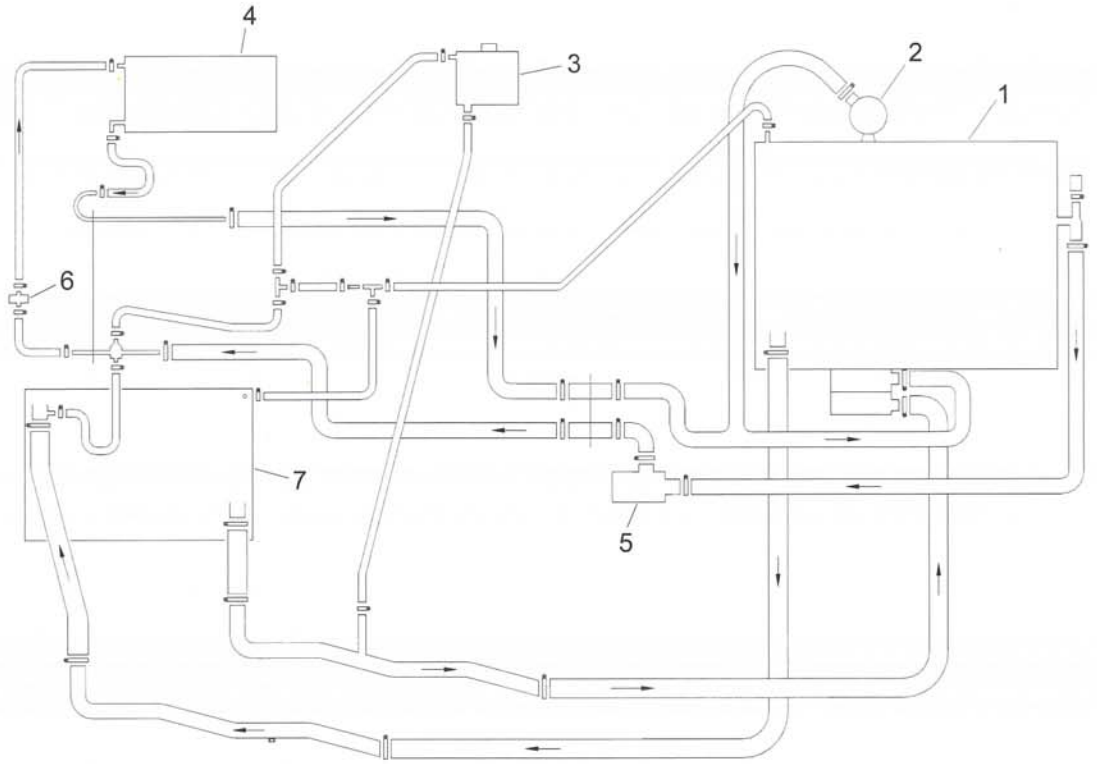
CHAPTER 12

COOLING SYSTEM TECHNICAL DESCRIPTION

CONTENTS

GENERAL DESCRIPTION

1 The engine cooling system is a pressurised closed system. Coolant removes heat from the engine by means of a forced circulation system, this is controlled by a thermostat and driven by a water pump. An additional electric pump is fitted to further improve flow. The coolant should be AL39 or a mixture of a glycol based antifreeze and clean soft water in the ratio of 50:50. The engine is additionally air cooled by an electromagnetic fan system. This is operated as necessary through engine or gearbox temperature sensing.



1	Engine
2	Oil cooler
3	Expansion tank
4	Heater matrix
5	Recirculating pump (not applicable to Vector PPV)
6	Heater cab control
7	Radiator

Fig 1 Cooling system

ELECTROMAGNETIC FAN/CLUTCH SYSTEM

2 The electromagnetic fan clutch system (Fig 2) engages the belt driven radiator cooling fan as demanded by engine or gearbox temperatures. The fan (Fig 2/1) is mounted on the clutch assembly (Fig 2/2) and is located within a flexible duct (Fig 2/3) to optimise air flow and prevents low pressure air from being drawn from beneath the vehicle.

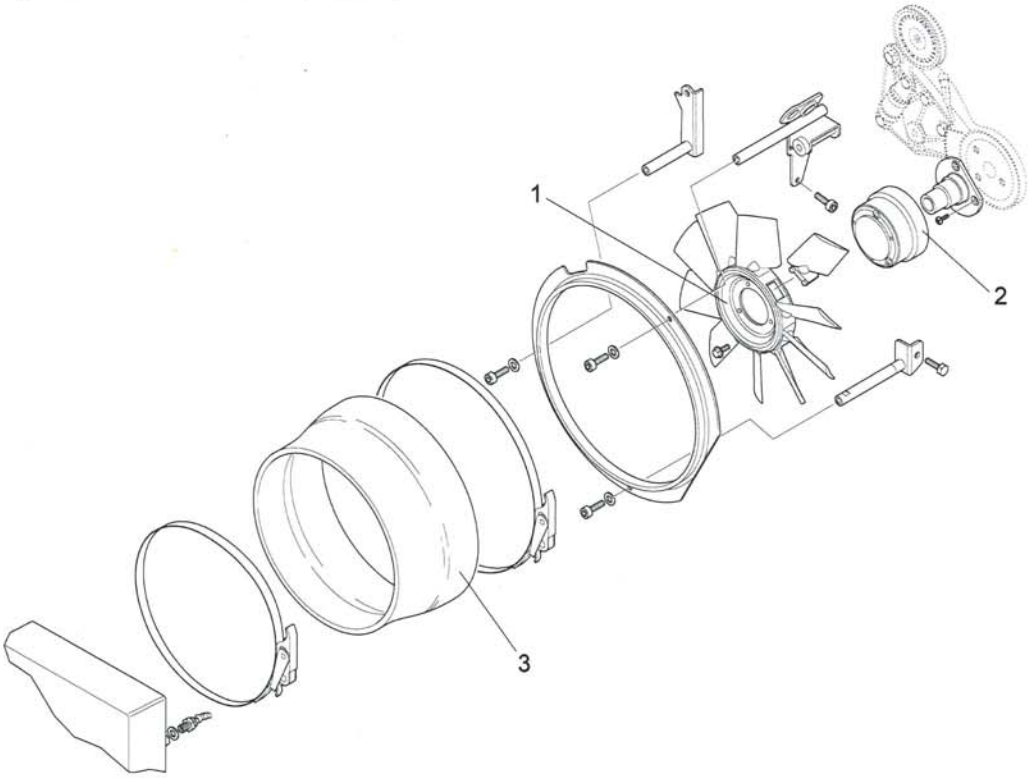
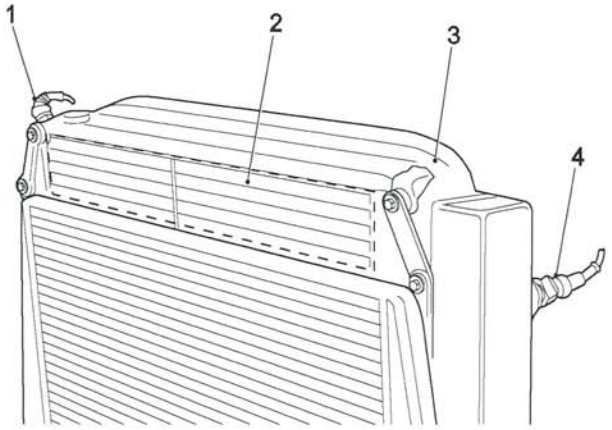


Fig 2 Electromagnetic fan clutch

3 A control unit monitors engine and gearbox temperatures via sensors mounted in the radiator (Fig 3/4) and gearbox oil cooler (Fig 3/1). When coolant temperature exceeds 105 °C or gearbox oil temperature exceeds 100 °C the cooling fan is engaged by the control unit activating the electromagnetic fan clutch (Fig 2/2). The clutch remains engaged until temperatures have reduced to 100 °C and 95 °C respectively.

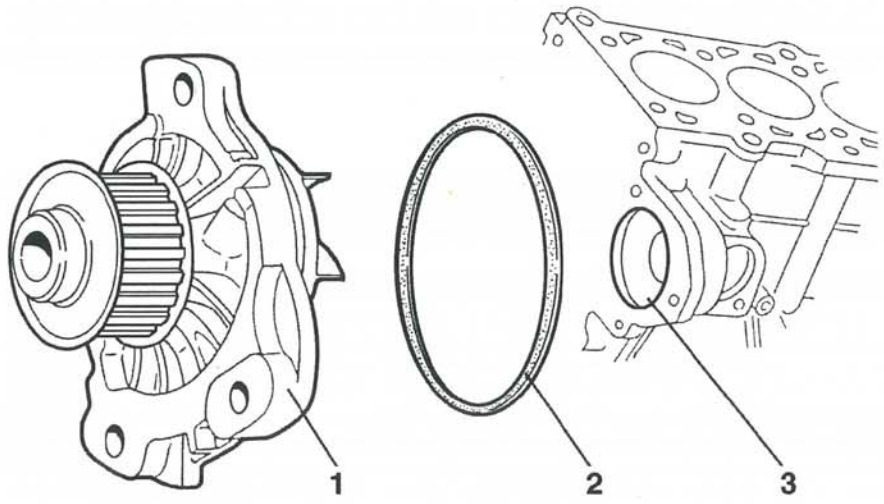


1 Gearbox oil temperature sensor
2 Oil cooler
3 Radiator
4 Coolant temperature sensor

Fig 3 Electromagnetic fan clutch system temperature sensors

WATER PUMP

4 The water pump circulates coolant around the cooling system and is driven by a toothed belt connected to the camshaft. When the engine is switched off, the water pump stops operating and the aftercooler pump takes over.



1 Water pump
2 Seal ring
3 Housing

Fig 4 Water pump

CHAPTER 13

ELECTRICAL SYSTEM TECHNICAL DESCRIPTION

CONTENTS

INTRODUCTION

1 This Chapter includes the wiring diagrams and schematics plus data on the Vehicle Power Distribution Box (VPDB), alternator, starter motor and ABS.

ALTERNATORS

CAUTIONS

(1) DAMAGE TO ELECTRICS. The batteries must always be connected while the alternator is operating.

(2) DAMAGE TO ELECTRICS. The batteries must be connected to the electrical system with the correct polarity. If the batteries are wrongly connected, damage to the alternator will result.

2 The vehicle is provided with two 24 V alternators (providing up to ≈ 28 Volts / 100 Amps when charging) powered by the hydraulic system (see Fig 1). The alternators supply alternating current to an integral rectifier. From the rectifier the full wave rectified ac supplies all electrical components and recharges the battery.

3 Drive to the alternators is supplied by a pulley that is connected by a drive belt to the hydraulic system motor (an engine driven pump provides hydraulic power to a motor in the hydraulic module located on the left external side of the vehicle). A pulley and fan are mounted onto the rotor shaft which is supported by bearings. The rotor mounted on the shaft rotates charging carbon brushes in the collector ring. The excited AC current is supplied to the excitation winding which induces an ac current in the stator core. This is supplied to diodes in the collector ring end shields where the AC is rectified.

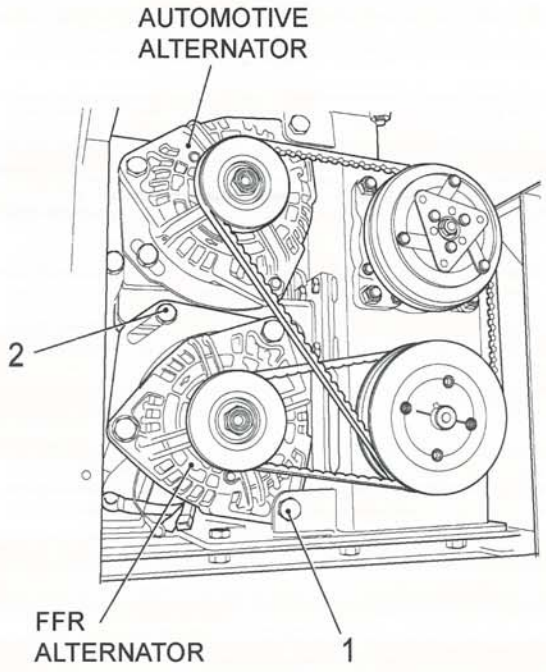


Fig 1 Alternators

4 Belt tension is achieved by loosening the pivot and adjuster bolts (see Fig 1/1/2), rotating the alternator around the pivot and re-tightening the pivot and adjuster bolts when the required tension has been achieved.

5 Each alternator is supported with a dashboard charge lamp.

STARTER MOTOR

6 The starter motor is an EV type, back geared unit with a power output of 2.4 kw. The motor is equipped with planetary gears to reduce size and provide a 40% reduction weight.

Planetary gears

7 The planetary gears are made of steel while the annulus gear, requiring greater strength and wear resistance is a high grade polyamid compound with mineral fillers.

8 As the starter motor requires direct current, excitation and armature windings are arranged in tandem. The high speed created by the electro motor is reduced by the planet gears at a ratio of 3.3:1, this increases the torque to the drive shaft. Drive from the motor rotates the sun gear which in turn rotates the surrounding planet gears. Drive from the planet gears is transmitted to the annulus gear. The annulus has a spiral spline on which the drive shaft is mounted.

Solenoid switch

9 As the ignition lock is switched on, the solenoid switch engages. This pulls and holds the shift lever whilst engaging the starter motor. The shift lever forces the clutch and pinion to mesh with the ring gear. If the gears do not mesh together, the meshing spring is compressed and holds the gears together. As the pole shoes are charged, the motor is powered, supplying drive to the clutch and pinion. If the pinion and ring gear have not already meshed, they do so as the pinion starts to rotate. Thus drive is transmitted to the crankshaft.

ELECTRICAL CIRCUIT DESCRIPTION

Starting/charging/supply

10 When the ignition is switched ON, the starter motor is engaged with the solenoid switch and the engine Electronic Diesel Control (EDC) unit is activated. In cold conditions, the EDC unit manages the cold start glow plugs automatically. Stopping the engine is achieved by activation of the fuel cut off valve (N109) located on the injection pump, managed by the EDC unit.

CAUTION

BATTERY LIFE. Due to the large current demand, the vehicle should not be repeatedly started without a period of continuous running as this may drain the batteries.

11 Main vehicle power is supplied by a pair of Absorbed Glass Mat (AGM) maintenance free sealed for life lead acid batteries wired in series to provide 24 V dc for vehicle electrical systems. A centre tap is taken from these batteries to provide a 12 V dc feed for the engine EDC, and for the glow plugs. Equalisation of the two batteries is achieved by circuitry within the VPDB. The batteries are charged by the automotive alternator (see Fig 1) located in the hydraulic module when the engine is running.

NOTE

The glow plugs provided on the engine are 12 V dc. The glow plugs also provide an element of the emission control and operate for a short period in most operating conditions.

12 Secondary power for radios or other equipment is supplied from a second set of batteries. The batteries are charged by the FFR alternator (see Fig 1) located in the hydraulic module when the engine is running.

WARNING

ELECTRIC SHOCK. ALWAYS ISOLATE VEHICLE ELECTRICS AT THE BATTERY MAIN SWITCH AND DISCONNECT BATTERIES PRIOR TO MAINTENANCE OF THE ELECTRICAL SYSTEM.

CAUTION

DAMAGE TO ELECTRONIC DIESEL CONTROL (EDC) UNIT – AUTOMOTIVE BATTERIES. If the 12 V dc positive (+ve) wire is not disconnected first and the 24 V dc negative (-ve) cable is removed first, the 12 V dc wire could act as a negative (-ve) wire for the 24 V dc system and could cause system damage.

13 The battery main switch is connected directly to the batteries. With the exception of the hazard warning flasher circuit, all automotive electrical circuits are isolated when the battery main switch is OFF. The automotive battery main switch is mounted on the bulkhead behind the co-driver's seat (see Fig 2/1).

NOTE

Always turn the main battery switch to the OFF position when the engine is to be stopped for a period in excess of 60 minutes. This will maintain battery integrity and is considered good operational practice.

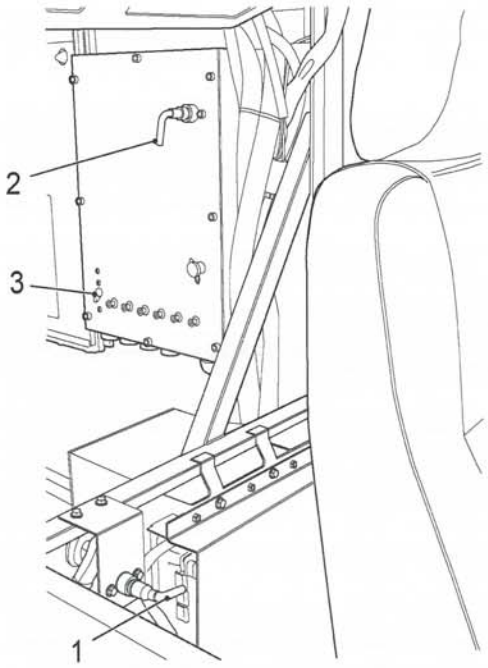


Fig 2 Battery main switches

14 FFR circuits are isolated when the FFR battery main switch is OFF. The FFR battery main switch is mounted on the FFR box, located adjacent to the right hand side of the battery box fixed to the side of the rear compartment (see Fig 2/2).

[redacted]

Circuit Description

16 The electrical system installed in the vehicle is based around two main circuits:

(1) Vehicle Power Distribution Box (VPDB)
(2) Dashboard and associated electrical items

VPDB functions

17 The VPDB performs both 'active' and 'passive' functions.

Active functions

18 Active functions are:

(1) Engine Electronic Diesel Control (EDC) unit
(2) Gearbox start inhibitor

Passive functions

19 Passive functions are:

(1) Engine EDC unit interconnections
(2) Vehicle rear circuits
(3) Front cab systems

20 The direct connection to the engine EDC unit is provided inside the VPDB. Two 'D' type connectors take all EDC signals to and from the engine itself.

21 The rear circuits of the vehicle, which include lighting circuits, trailer feeds and air suspension circuits (where fitted) are routed through the VPDB and onward to the appropriate area on the vehicle, via the rear loom.

22 Circuits from the engine bay area are routed to the dashboard via the VPDB. The front cab systems routed via the VPDB include the dashboard warning lights, coolant temperature circuits, oil temperature circuits and the fuel level sender signal.

Battery Equalisation

23 The EDC draws its power from a 12 Volt tap on the vehicle batteries. This requires a current when the engine is in the running condition of approximately 3-4 Amps depending on engine conditions. The EDC also has a glow plug system for cold engine starts. This feature also draws its power from this 12 Volt tap on the vehicle battery. This requires a maximum of 50 Amps current, and may continue for a maximum of 300 seconds from engine start depending on ambient temperature conditions.

24 This arrangement means there is likely to be an imbalance in the charging of the two 12 Volt batteries as the two batteries are charged by a 24 Volt alternator (providing up to 28 Volts / 100 Amps when charging). There are several situations that will make this situation worse. If one battery is fully charged it will not allow the other to charge at a high rate. If the vehicle is used for very short durations then more energy will be removed from the '12 Volt system'. The battery equalisation system is intended to compensate for this situation by taking energy from the 24 Volt system and using it to put energy into the 12 Volt system.

25 Essentially this system consists of a 24 Volt to 14 Volt step down power supply (the ABS system power supply). The battery equalisation system will operate when the engine is running.

NOTE

Because each battery pair now has a dedicated alternator (unlike a standard Euro 3 Pinzgauer) the Vector PPV variant is provided with a bespoke VPDB to account for the alternative circuit arrangement. A Vector and a standard Pinzgauer VPDB are <u>not</u> interchangeable.

VPDB Maintenance

CAUTION

DAMAGE TO ELECTRICS. The main cover of the VPDB must only be removed if absolutely necessary, ie when using the EDC test box 8001560161. Extreme care must being taken not to cause damage to the components housed within the VPDB.

26 The VPDB is a line replaceable unit, which contains no user-serviceable parts. The only exception being the fuses located behind the small removable panel (see Table 3), which is held in place by six captive screws, at the upper forward face of the unit. Access to the engine EDC diagnostic plug is also via this panel. When necessary the engine EDC test box (8001560161) is connected between the EDC and the connector within the VPDB. This is the only reason that the main lid of the EDC should be removed.

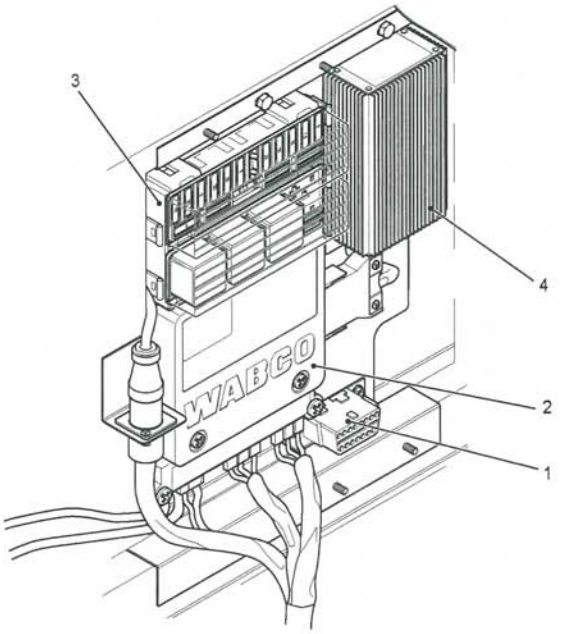
Dashboard electrics

27 The dashboard area contains:

(1) Display warning lamps, etc
(2) Driver system controls
(3) Circuit protection for lighting etc
(4) Relays for convoy controls
(5) Windscreen wiper timer

ABS

28 The electrical element of the Antilock Brake System (ABS) complete with the ABS Electronic Control Unit (ECU) and diagnostic point is co-located on the ABS control board (Fig 3) located on the rear bulkhead of the vehicle cab, behind the passenger's seat. To access the control board, remove the cover.



1	Diagnostic point	3	Fuse and relay housing
2	ABS ECU	4	Power supply

Fig 3 ABS control board

ABS Power Supply

29 A dedicated ABS power supply (Fig 3/4) is provided to charge the12 Volt battery that supplies power to the ABS. Operation of the 12 Volt ABS potentially draws a significant current from the battery when operating and therefore additional charging is required on Pinzgauer variants with ABS, to maintain the charge level of the battery and avoid detrimental effect on other vehicle systems.

Circuit protection

30 Circuit protection is provided by two fuse boxes located under the dashboard instrument panel, fuses located within the VPDB (behind removable panel at the upper forward face) and fuses located on the ABS control board in support of the ABS and its power supply. A number of other in line and system specific fuses also provide circuit protection.

31 Fuse ratings and applications are provided at 2320-D-503-512 Chapter 13.

Vehicle light bulbs

32 Electrical data on the vehicle light bulbs is provided at 2320-D-503-512 Chapter 13.

WIRING DIAGRAMS

33 Wiring diagrams are provided at 2320-D-503-512 Chapter 13.

CHAPTER 15

CHASSIS, FRAME AND FITTINGS

CONTENTS

GENERAL DESCRIPTION

1 The chassis consists of a torsion resistant central tube with the front and rear differentials and transfer gearbox all flange mounted. Cross members behind the front axle and in front of the rear axles attach the chassis to the body.

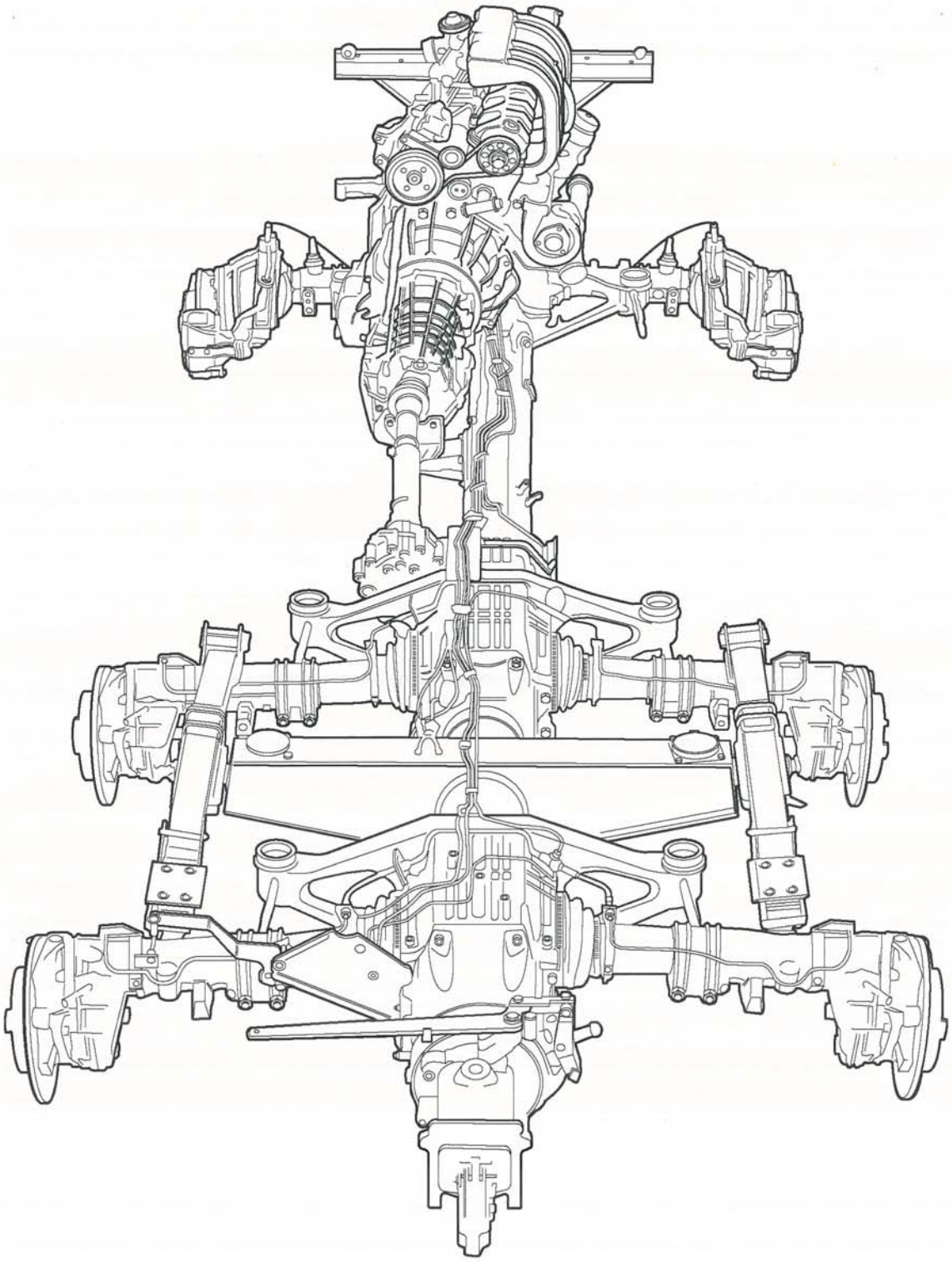


Fig 1 Chassis

CHAPTER 16

BODY, CAB AND FITTINGS TECHNICAL DESCRIPTION

CONTENTS

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FITTINGS

[redacted]

3 The vehicle is provided Fitted For Radio (FFR) and is equipped with various facilities to permit stowage of a fire extinguisher, personal weapons, pioneer kit, jerry cans and miscellaneous tools and equipment.

4 A battery box is located at the forward end of the rear compartment. Two pairs of 12 V 85 Ah Absorbed Glass Mat (AGM) maintenance free sealed for life lead acid batteries supply the 12/24 V dc automotive electrical system and 24 V dc FFR circuit. Automotive batteries are located on the right hand side of the battery box. FFR batteries are located on the left hand side

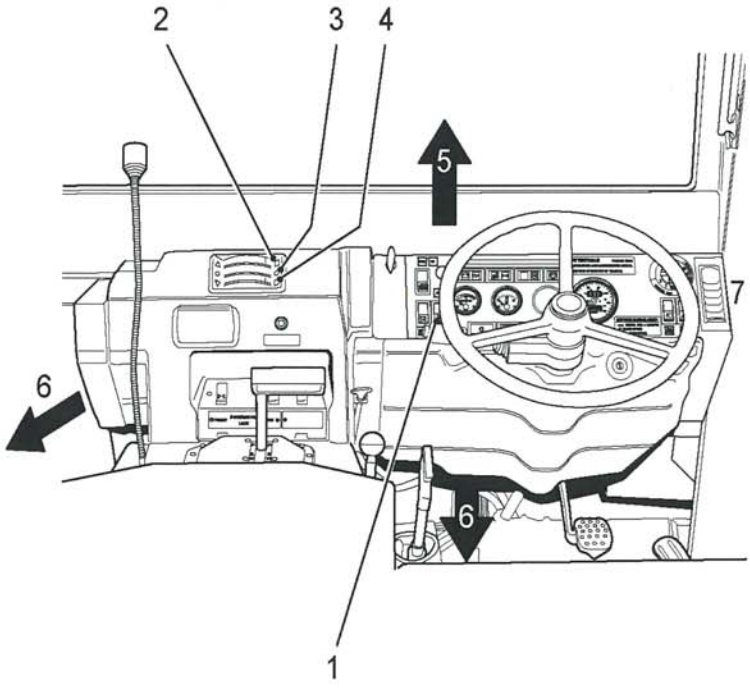
5 The fuel tank is situated below the platform on the right hand side. A towing point is supplied on the front of the vehicle. To extract the bolt, twist it through 90° and pull it up.

6 The rear of the vehicle is fitted with a towing device. The device can be used as either a rigid or swivel coupling, depending on what is to be towed.

7 Front and rear external lights are provided with riot protection grilles.

HEATING & COOLING

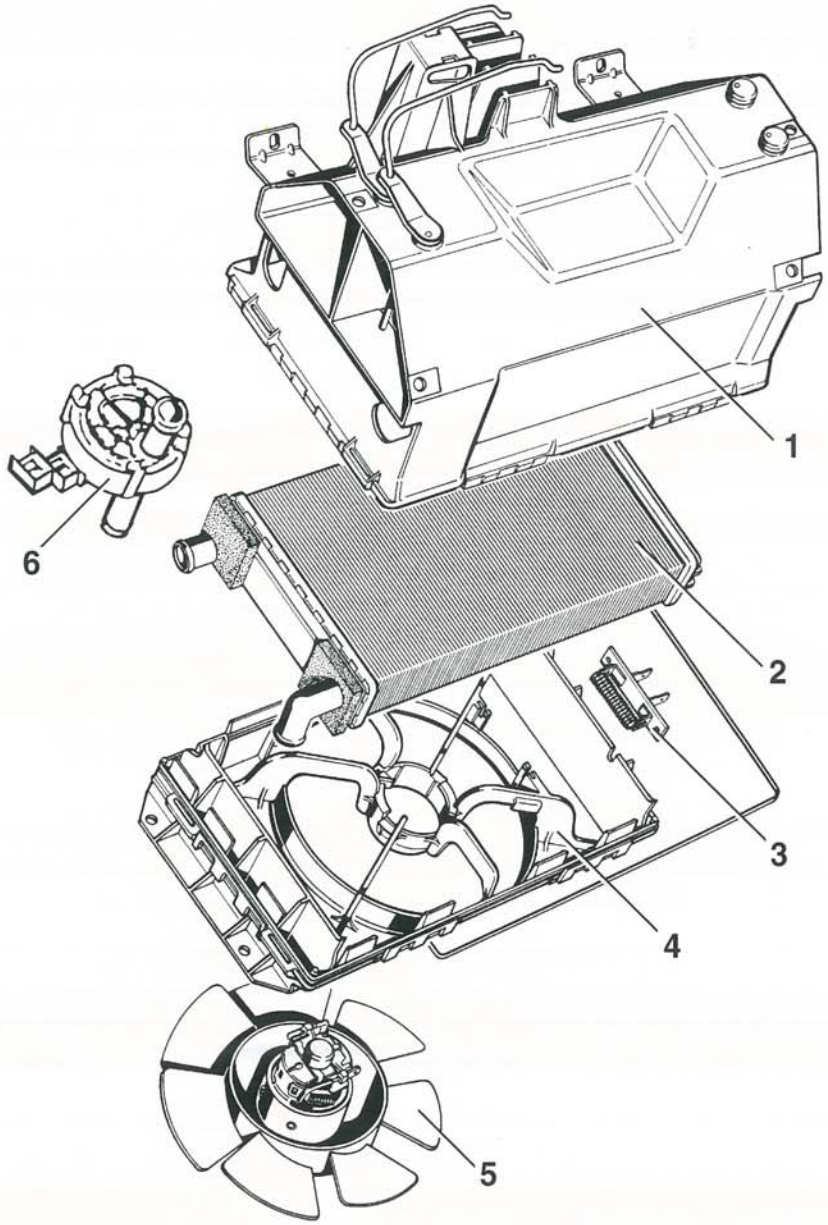
8 A heater exchanger built into the engine's cooling system supplies warm air to the cab interior. Regulating levers located in the centre of the dash board are used to vary the interior temperature. The air can be distributed into the foot wells or onto the windscreen. A two stage fan increases the air through put.



1	Fan switch with indicator lamp	5	Aerating and defrosting nozzles
2	Windscreen aerating or defrosting	6	Ventilation and heating nozzle or hose
3	Regulating lever for heating	7	Redundant
4	Leg room aerating or heating		

Fig 2 Heating and cooling

9 The heat exchanger is located in a compact box below the instrument panel. The heater valve (see Fig 3/6) is opened and closed to adjust the interior temperature. The blower (see Fig 3/5) acts as a hot air blower when the heat exchanger (see Fig 3/2) is operating and acts as a cool air fan when the heat exchanger is closed.



1	Housing upper part	4	Housing lower part
2	Heat exchanger	5	Blower
3	Resistor	6	Heater valve

Fig 3 Cab heater and de-mister

10 The vehicle is also provided with an Environmental Control System (ECS). The ECS is based on a: Ceiling mounted evaporator for cooling the driver and commander with additional ducting for counter measure equipment cooling; Roof mounted condenser; Hydraulic driven refrigeration compressor. Refer to Eberspacher ECS manual for further information. See 2320-D-503-522 Chapter 18-1.

11 The Vector Ambulance variant is fitted with Heating Ventilation & Air Conditioning System (HVAC). Refer to Eberspacher HVAC manual for further information. See 2320-D503-522 Chapter 18-2

12 In support of the ECS, the vehicle is covered with a "Barracuda" Heat Transfer Reduction (HTR) incorporated in a Mobile Camouflage System. The Barracuda is retained by a combination of Velcro and belts.

SEATS

12 All seats in the cab are equipped with seat belts. The two forward seats are adjustable as follows:-

12.1 To move seat laterally; lift the lever under the seat cushion (see Fig 4/1).

12.2 To reposition backrest; lift the lever and move the seat into the desired position (see Fig 4/2).

12.3 To move headrest; push up or down (see Fig 4/3).

Fig 4 Front seats

13 The rear compartment is provided with 4 off sideways facing seats with four point safety harnesses and 1 off sideways facing occasional seat with a lap belt. No adjustment of the sideways occasional seat is possible.

14 The sideways facing seats are provided with a height adjustable headrest (see Fig 5) and to provide maximum space in the rear compartment the seat base can be stowed in the vertical position by using the four point harness.

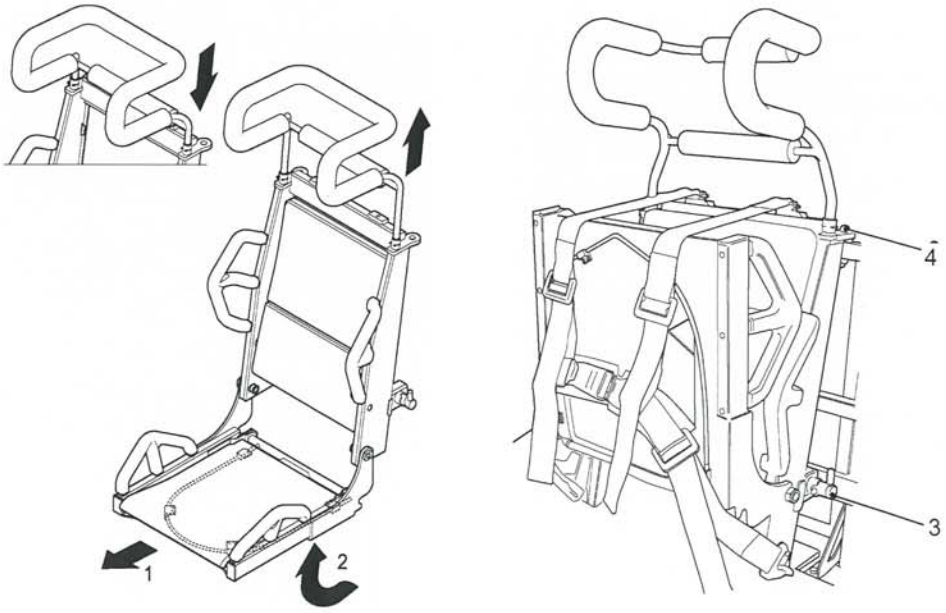


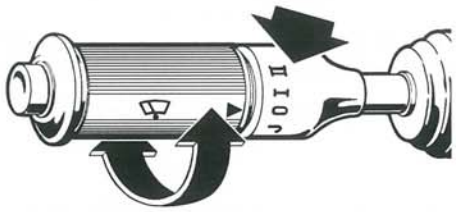
Fig 5 Sideways facing seat adjustment/stowage

15 The rear panel of the sideways facing seat may be reversed to accommodate webbing and the whole seat can be removed from the vehicle by releasing the cam lock at each side of the lower frame (see Fig 5/3), rotating the base seat away from the side of the vehicle and lifting it from the upper frame locating pins (see Fig 5/4)

WINDSCREEN WIPERS

16 The wipers can only operated when the ignition lock is in position 2. Twisting the body of the multi-function stalk on the steering wheel operates the windscreen wipers. Pressing the ring in the direction of the arrow operates the pump which sprays washer fluid onto the windscreen. Wipers will work for a few seconds after the ring is released.

17 Two speeds and interval wiping are available with the wiper blades always returning to their rest position when switched off (provided the ignition is on).



"O" Switched off
"I" Slow
"II" Fast
"J" Interval wiping

Fig 6 Multi-function stalk

18 The wiper motor is situated above the instrument panel on the passenger's side and the linkage assembly is housed behind a cover running across the top of the vehicle dashboard.

CHAPTER 17

HYDRAULIC SYSTEM TECHNICAL DESCRIPTION

CONTENTS

GENERAL

1 An engine driven pump (see Fig 1/2) provides hydraulic power to a motor in the hydraulic module located on the left external side of the vehicle. The hydraulic motor drives two alternators and the ECS compressor. The hydraulic system operates whenever the vehicle engine is running.

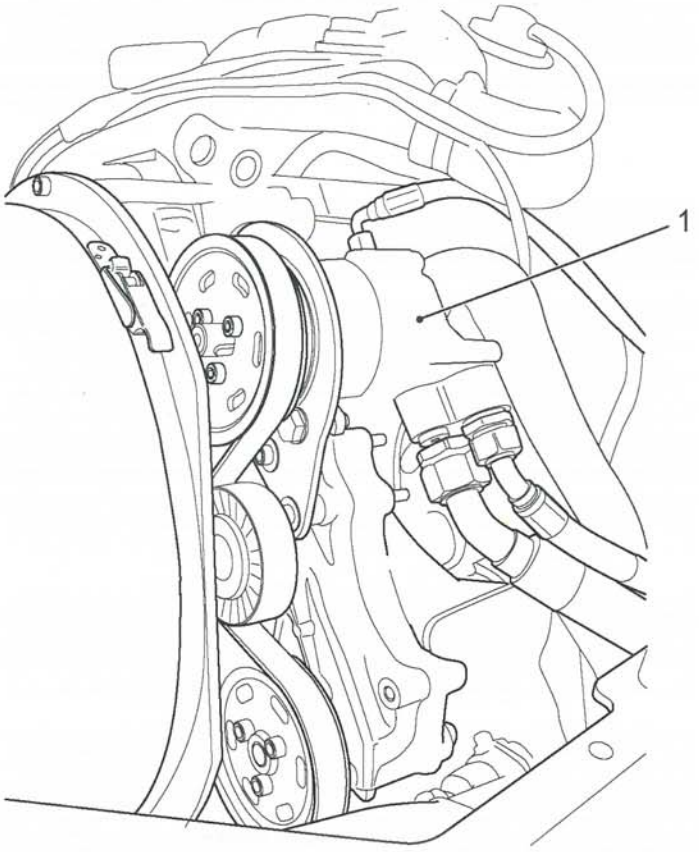


Fig 1 Hydraulic pump

2 The component layout in the hydraulic module is provided in Fig 1.

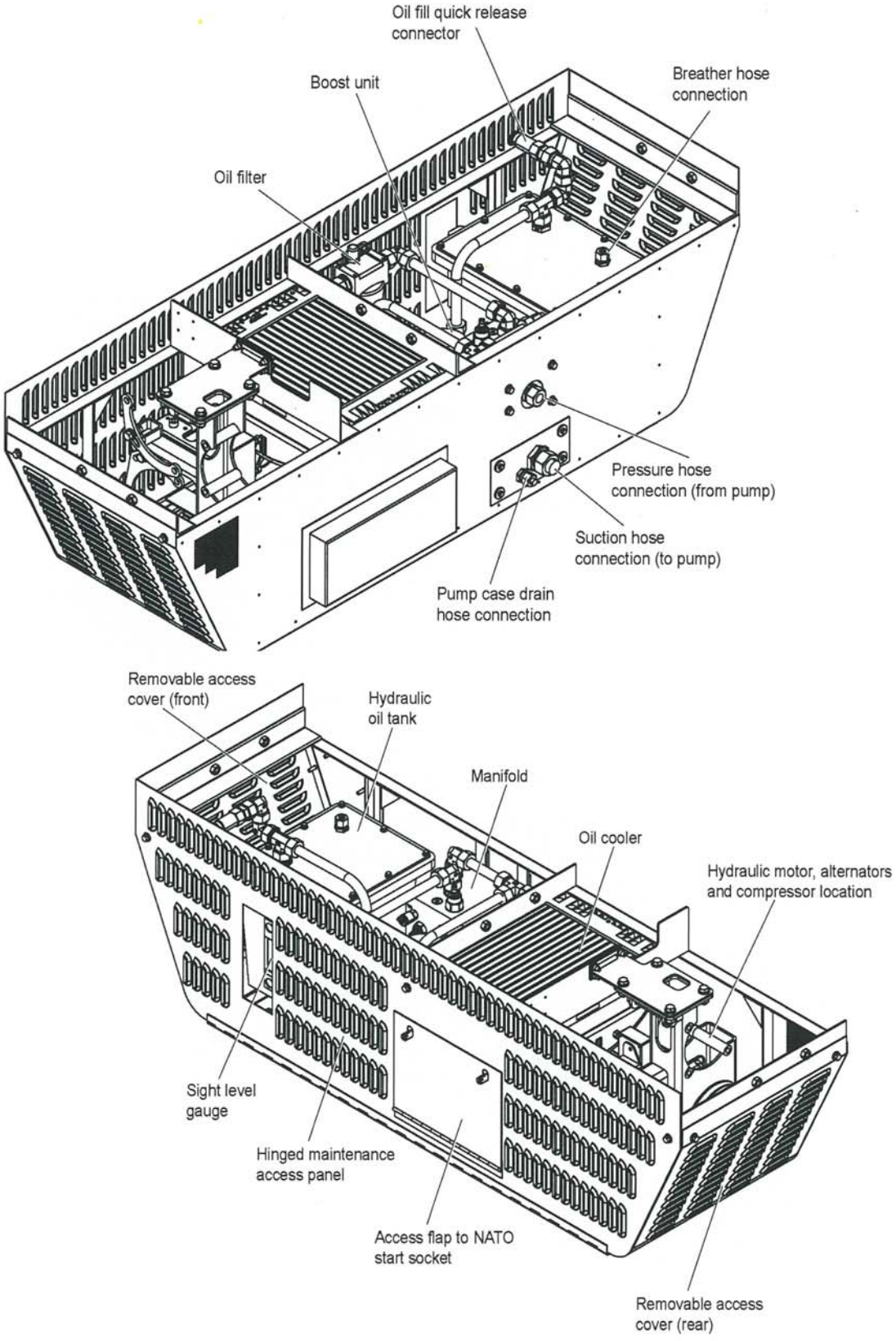


Fig 2 Hydraulic module component layout

PRINCIPLE OF OPERATION

3 Hydraulic power is provided by the engine driven piston pump (driven via the FEAD belt). The speed of the engine is therefore directly proportional to the flow that the pump produces. The oil to the pump is supplied from a 13 litre capacity hydraulic reservoir via a hydraulic suction boost unit.

4 The flow from the pump enters the control manifold which is fitted with the main system relief valve. This valve is set to 350 bar and protects the system if the motor drive jams in position. The manifold is also fitted with a flow control valve and a sequence valve. These two valves are used to control the maximum speed of the system. The system pressure is monitored by a low and a high pressure switch. There is also a main test point (TP2) fitted for fault finding. A check valve is fitted in the manifold to allow a gradual hydraulic slow down of the motor on system shutdown. The filter and cooler are also protected by the bypass check valve.

5 The low pressure switch is set to switch at 0.5 bar. This switch is used to load the air conditioning compressor once there is pressure in the system. The high pressure switch is set to 300 bar and prevents the air conditioning compressor being loaded if the system pressure reaches 300 bar. This can happen when starting the system fully on load and at low engine speeds. Once the engine speed increases the system pressure drops and the high pressure switch will not operate.

6 The oil flows from the control manifold into the inlet port of a hydraulic motor. The hydraulic motor belt drives the 2 off alternators and the air conditioning compressor (see Fig 3). To ensure that the case of the motor is always full of oil, the case drain line is fitted with a check valve set to 0.3 bar.

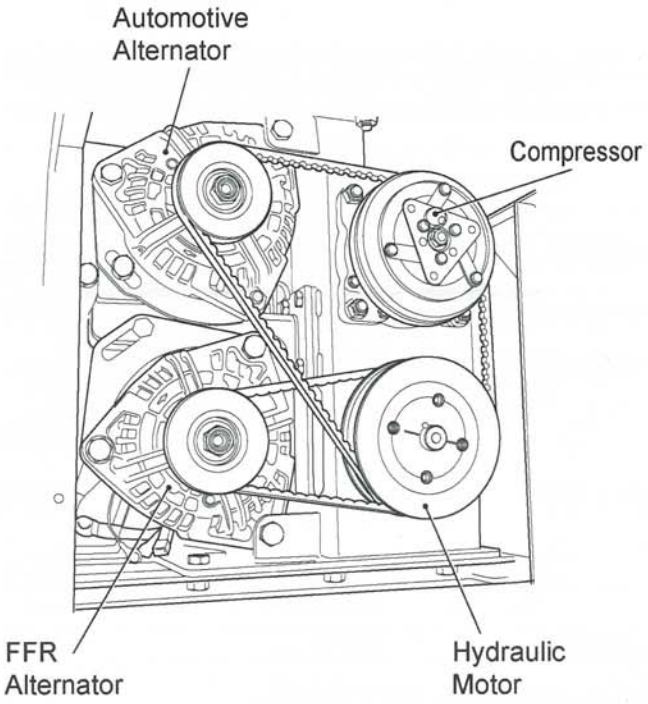


Fig 3 Hydraulic motor drive

7 The return oil from the hydraulic motor flows into the return side of the manifold block and then through a 2 Bar check valve, filter and a cooler. The returning oil then passes back through the hydraulic boost unit and to the oil tank. The reservoir is fitted with a combined sight level and temperature gauge. The cooler is controlled by a temperature switch that is fitted in the side of the oil tank. The cooler operates when the oil reaches a temperature of 45°C.

8 The tank is also fitted with a high temperature switch that operates if the oil temperature in the tank reaches 75°C. When this switch operates the air conditioning compressor is taken off line to allow the system oil temperature to cool. The high temperature should only operate if there is a problem with the hydraulic system

9 See Fig 4 for the hydraulic system circuit.

10 System status is presented to the driver via a warning lamp on the dashboard.

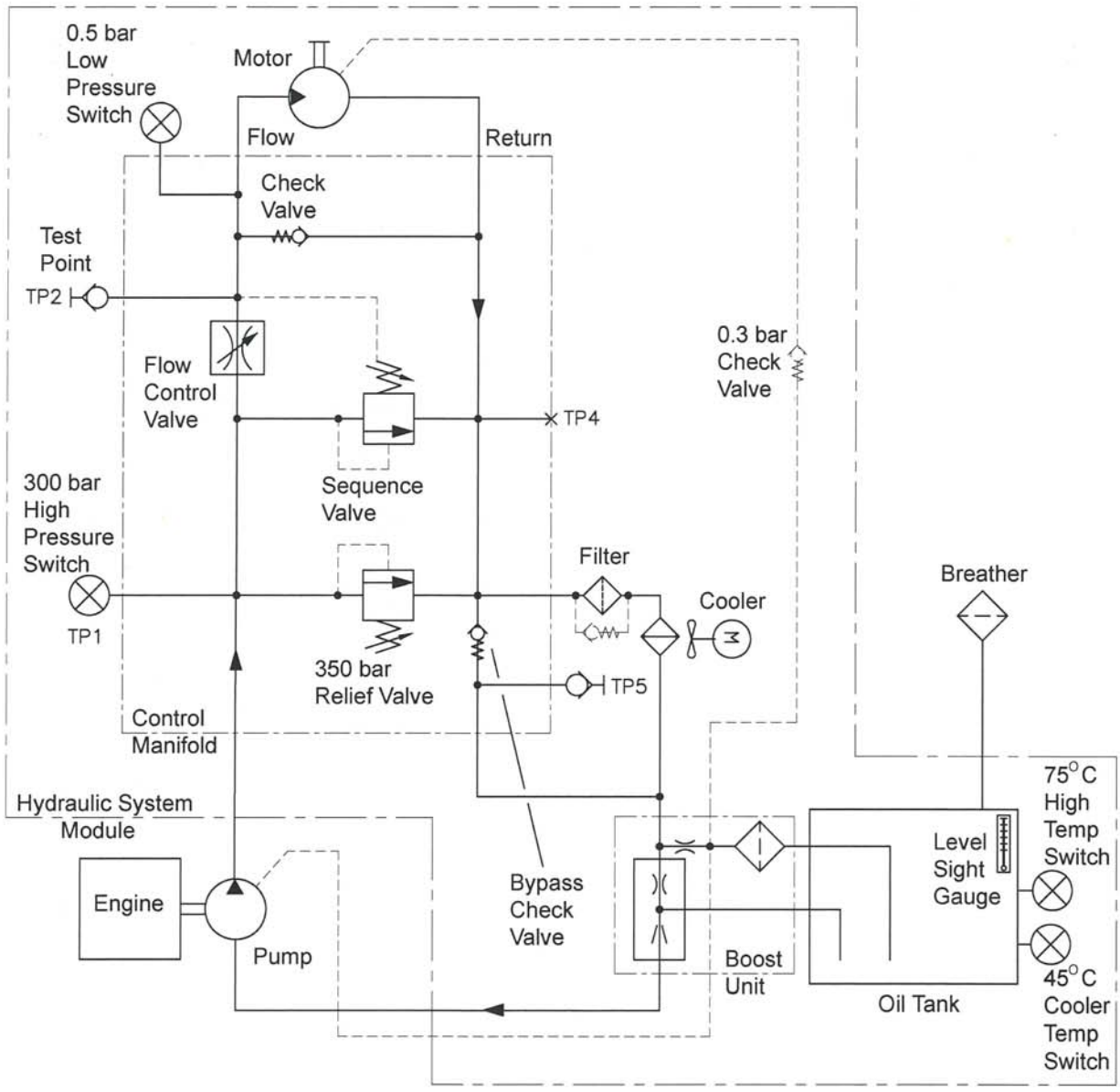


Fig 4 Hydraulic system circuit

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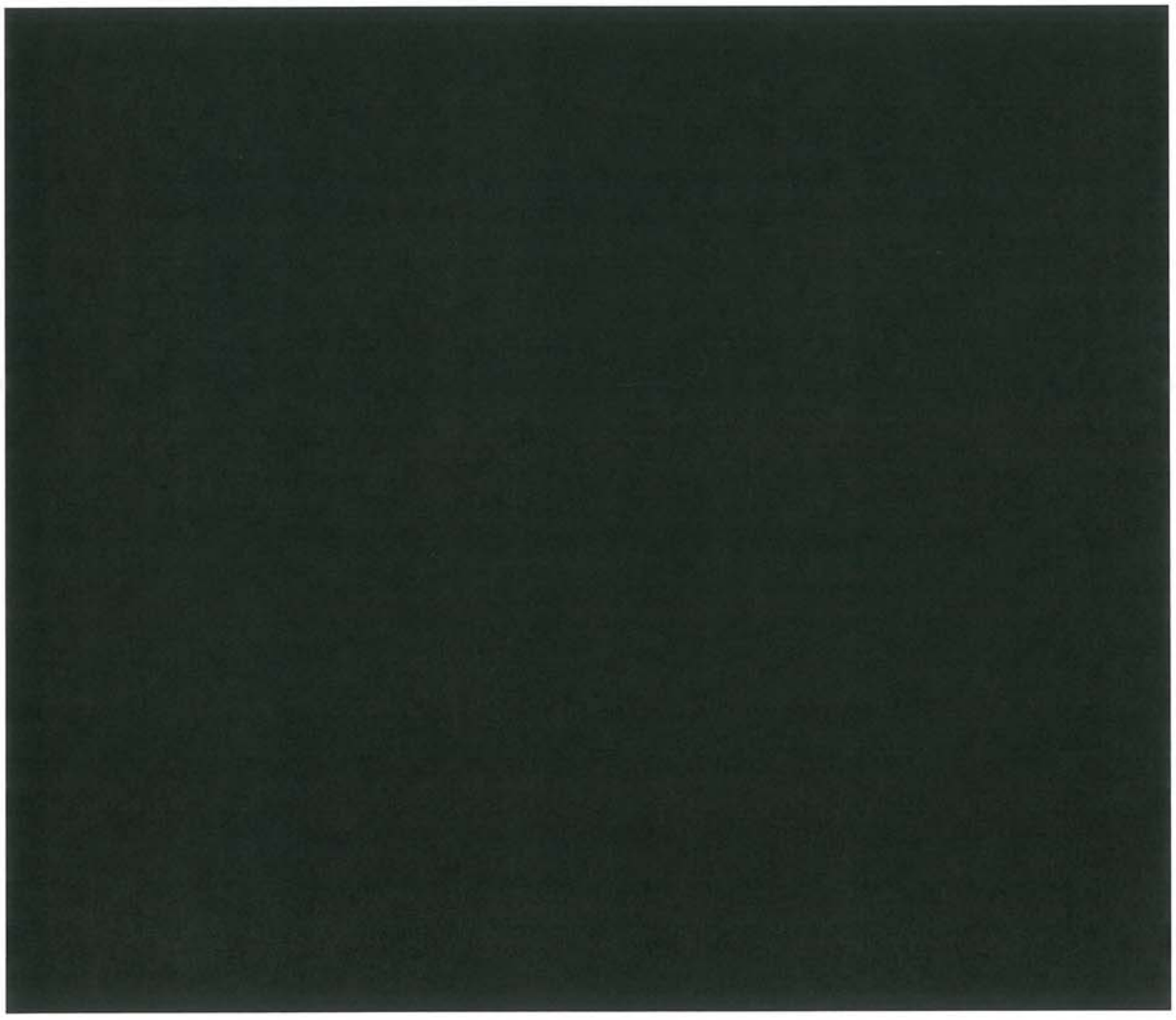

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