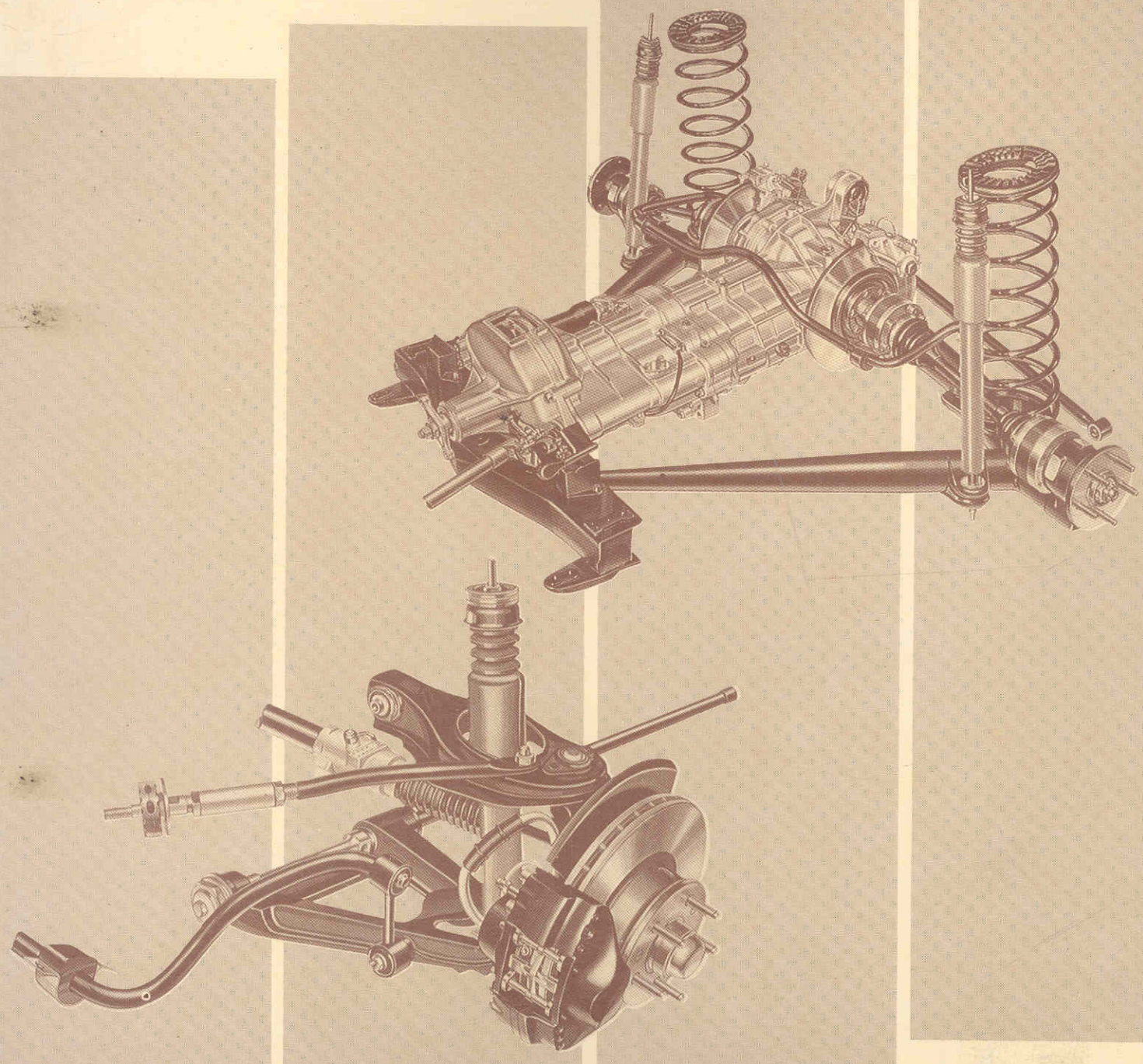
WORKSHOP MANUAL

mechanical units



Alfa Romeo

DIREZIONE ASSISTENZA TECNICA

WORKSHOP MANUAL - MECHANICAL UNITS

WORKSHOP MANUAL

mechanical units

DIREZIONE ASSISTENZA TECNICA

Alfa Romeo

September 1984

UPDATING LIST

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
WORKSHOP MANUAL mechanical units		4	21-6		April 1986
		4	21-7		April 1986
		4	21-8		April 1986
		4		21-8/1	April 1986
		4	21-10		April 1986
		4	21-11		April 1986
		5	21-13		December 1986
		4	21-14		April 1986
		4	21-15		April 1986
		4	21-16		April 1986
		1	21-17		May 1985
		2	21-18		December 1985
		2	21-19		December 1985
		1	21-20		May 1985
		5	21-21		December 1986
		5	21-22		December 1986
		4	21-26		April 1986
		4	21-27		April 1986
	22	4	CONTENTS		April 1988
		4	22-2		April 1986
		4	22-3		April 1986
		1	22-4		May 1985
		1	22-5		May 1985
		5	22-13		December 1986
		4	from 22-14 to 22-23		April 1986
		6	22-23		March 1988
		6	22-24		March 1988
		4	from 22-25 to 22-27		April 1986
		4		22-28	April 1986
		6	22-29		March 1988
		4		22-30	April 1986
		4		22-31	April 1986
		6	22-32		March 1988
		4		from 22-33 to 22-36	April 1986
		6	22-37		March 1988
		6	22-38		March 1988
		4		from 22-39 to 22-43	April 1986
		5	22-44		December 1986

ASSISTENZA TECNICA

Alfa Romeo

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
		4	13-34		April 1986
		4	13-35		April 1986
		3	13-36		March 1986
		1		13-36/1	May 1985
		5	13-36/2		December 1986
		5		13-36/3	December 1986
		2	13-38		December 1985
		2	13-39		December 1985
		1	13-43		May 1985
		2	13-44		December 1985
	15	1	CONTENTS		May 1985
		5	15-3		December 1986
		1	15-4		May 1985
		1	15-10		May 1985
		1	15-11		May 1985
		1	15-12		May 1985
	17	5	CONTENTS		December 1986
		5	17-2		December 1986
		5	17-3		December 1986
		5	17-4		December 1986
		5		17-4/1	December 1986
		5		17-4/2	December 1986
		5		17-8/1	December 1986
		5	17-13		December 1986
		5	17-14		December 1986
		5		17-14/1	December 1986
		5		17-14/2	December 1986
		5	17-15		December 1986
		5	17-16		December 1986
		1	17-17		May 1985
		2	17-26		December 1985
		1	17-27		May 1985
		1	17-28		May 1985
		5	17-29		December 1986
		5	17-30		December 1986
		5	17-31		December 1986
		1	17-33		May 1985
		1	17-34		May 1985
		1	17-37		May 1985
		1	17-38		May 1985
	21	4	CONTENTS		April 1986
		1	21-2		May 1985
		4	21-4		April 1986
		4		21-4/1	April 1986
		4	21-5		April 1986

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
		4	21-6		April 1986
		4	21-7		April 1986
		4	21-8		April 1986
		4		21-8/1	April 1986
		4	21-10		April 1986
		4	21-11		April 1986
		5	21-13		Dicember 1986
		4	21-14		April 1986
		4	21-15		April 1986
		4	21-16		April 1986
		1	21-17		May 1985
		2	21-18		Dicember 1985
		2	21-19		Dicember 1985
		1	21-20		May 1985
		5	21-21		Dicember 1986
		5	21-22		Dicember 1986
		4	21-26		April 1986
		4	21-27		April 1986
	22	4	CONTENTS		April 1988
		4	22-2		April 1986
		4	22-3		April 1986
		1	22-4		May 1985
		1	22-5		May 1985
		5	22-13		Dicember 1986
		4	from 22-14 to 22-23		April 1986
		6	22-23		March 1988
		6	22-24		March 1988
		4	from 22-25 to 22-27		April 1986
		4		22-28	April 1986
		6	22-29		March 1988
		4		22-30	April 1986
		4		22-31	April 1986
		6	22-32		March 1988
		4		from 22-23 to 22-36	April 1986
		6	22-37		March 1988
		6	22-38		March 1988
		4		from 22-39 to 22-43	April 1986
		5	22-44		December 1986

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
		5	22-45		December 1986
		4		22-46	April 1986
		4		22-47	April 1986
		5	22-48		December 1986
		4		from 22-49 to 22-58	April 1986
		6	22-59		March 1988
		6	22-60		March 1988
		4		22-61	April 1986
		6	22-62		March 1988
		4		22-63	April 1986
		4		22-64	April 1986
		6	22-65		March 1988
		4		22-66	April 1986
		6	22-67		March 1988
		4		22-68	April 1986
		6	22-69		March 1988
		6	22-70		March 1988
		4		from 22-71 to 22-74	April 1986
		6	22-75		March 1988
		6	22-76		March 1988
		6		22-76/1	March 1988
		6	22-77		March 1988
		6	22-78		March 1988
		4		from 22-79 to 22-82	April 1986
		6	22-83		March 1988
		6	22-84		March 1988
		6		22-85	March 1988
		6		22-86	March 1988
	23	1	CONTENTS		May 1985
		1	23-2		May 1985
		1	23-16		May 1985
		1	23-17		May 1985
		1	23-18		May 1985
		1	23-19		May 1985
		1	23-20		May 1985
		1	23-21		May 1985
		1	23-22		May 1985
		1	23-28		May 1985
		2	23-29		December 1985
		2	23-30		December 1985
	25	4	CONTENTS		April 1986
		1	25-2		May 1985
		4	from 25-3 to 25-14		April 1986
		4		25-15	April 1986

UPDATING LIST (SHEET 1)

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
WORKSHOP MANUAL mechanical units	00	5	CONTENTS		December 1986
		5	00-2		December 1986
		5		00-2/1	December 1986
		1	00-3		May 1985
		2	00-4		December 1985
		5	00-5		December 1986
		5	00-6		December 1986
		5		00-6/1	December 1986
		5	00-7		December 1986
		1	00-8		May 1985
		4		00-8/1	April 1986
		5		00-8/2	December 1986
		5	00-9		December 1986
		1	00-10		May 1985
		1	00-11		May 1985
		2	00-12		December 1985
		1	00-13		May 1985
		4	00-14		April 1986
		4		00-14/1	April 1986
		5		00-14/2	December 1986
		1	00-15		May 1985
		2	00-16		December 1985
		2	00-17		December 1985
		5	00-18		December 1986
		5	00-19		December 1986
		2	00-20		December 1985
		2	00-21		December 1985
		2		00-22	December 1985
		5	00-23		December 1986
	12	3	CONTENTS		March 1986
		3	from 12-2 to 12-31		March 1986
		3		from 12-32 to 12-40	March 1986
	13	1	CONTENTS		May 1985
		1	13-2		May 1985
		2	13-3		December 1985
		2	13-5		December 1985
		1	13-7		May 1985
		2	13-8		December 1985
		2	13-10		December 1985

ASSISTENZA TECNICA

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Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
		2	13-11		December 1985
		4	13-34		April 1986
		4	13-35		April 1986
		3	13-36		March 1986
		1		13-36/1	May 1985
		5	13-36/2		December 1986
		5		13-36/3	December 1986
		2	13-38		December 1985
		2	13-39		December 1985
		1	13-43		May 1985
		2	13-44		December 1985
	15	1	CONTENTS		May 1985
		5	15-3		December 1986
		1	15-4		May 1985
		1	15-10		May 1985
		1	15-11		May 1985
		1	15-12		May 1985
	17	5	CONTENTS		December 1986
		5	17-2		December 1986
		5	17-3		December 1986
		5	17-4		December 1986
		5		17-4/1	December 1986
		5		17-4/2	December 1986
		5		17-8/1	December 1986
		5	17-13		December 1986
		5	17-14		December 1986
		5		17-14/1	December 1986
		5		17-14/2	December 1986
		5	17-15		December 1986
		5	17-16		December 1986
		1	17-17		May 1985
		2	17-26		December 1985
		1	17-27		May 1985
		1	17-28		May 1985
		5	17-29		December 1986
		5	17-30		December 1986
		5	17-31		December 1986
		1	17-33		May 1985
		1	17-34		May 1985
		1	17-37		May 1985
		1	17-38		May 1985
	21	4	CONTENTS		April 1986
		1	21-2		May 1985
		4	21-4		April 1986
		4		21-4/1	April 1986
		4	21-5		April 1986

UPDATING LIST (SHEET 2)

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
		4	21-6		April 1986
		4	21-7		April 1986
		4	21-8		April 1986
		4		21-8/1	April 1986
		4	21-10		April 1986
		4	21-11		April 1986
		5	21-13		December 1986
		4	21-14		April 1986
		4	21-15		April 1986
		4	21-16		April 1986
		1	21-17		May 1985
		2	21-18		December 1985
		2	21-19		December 1985
		1	21-20		May 1985
		5	21-21		December 1986
		5	21-22		December 1986
		4	21-26		April 1986
		4	21-27		April 1986
	22	4	CONTENTS		April 1986
		4	22-2		April 1986
		4	22-3		April 1986
		1	22-4		May 1985
		1	22-5		May 1985
		5	22-13		December 1986
		4	from 22-14 to 22-27		April 1986
		4		from 22-28 to 22-43	April 1986
		5	22-44		December 1986
		5	22-45		December 1986
		4		22-46	April 1986
		4		22-47	April 1986
		5	22-48		December 1986
		4		from 22-49 to 22-84	April 1986
	23	1	CONTENTS		May 1985
		1	23-2		May 1985
		1	23-16		May 1985
		1	23-17		May 1985
		1	23-18		May 1985
		1	23-19		May 1985
		1	23-20		May 1985

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
		1	23-21		May 1985
		1	23-22		May 1985
		1	23-28		May 1985
		2	23-29		December 1985
		2	23-30		December 1985
	25	4	CONTENTS		April 1986
		1	25-2		May 1985
		4	from 25-3 to 25-14		April 1986
		4		25-15	April 1986

UPDATING LIST

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
WORKSHOP MANUAL mechanical units	00	1	CONTENTS		May 1985
		1	00-2		May 1985
		1	00-3		May 1985
		1	00-4		May 1985
		1	00-5		May 1985
		1	00-6		May 1985
		1	00-7		May 1985
		1	00-8		May 1985
		1	00-9		May 1985
		1	00-10		May 1985
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		1	00-12		May 1985
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		1	00-14		May 1985
		1	00-15		May 1985
		1		00-16	May 1985
		1		00-17	May 1985
		1		00-18	May 1985
		1		00-19	May 1985
		1		00-20	May 1985
		1		00-21	May 1985
	12	1	CONTENTS		May 1985
		1	12-26		May 1985
		1	12-27		May 1985
		1	12-28		May 1985
	13	1	CONTENTS		May 1985
		1	13-2		May 1985
		1	13-3		May 1985
		1	13-7		May 1985
		1	13-8		May 1985
		1	13-34		May 1985
		1	13-36		May 1985
		1		13-36/1	May 1985
		1		13-36/2	May 1985
		1	13-39		May 1985
		1	13-43		May 1985
		1	13-44		May 1985

DIREZIONE ASSISTENZA TECNICA

Alfa Romeo

PA360900000001

May 1985

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
	15	1	CONTENTS		May 1985
		1	15-3		May 1985
		1	15-4		May 1985
		1	15-10		May 1985
		1	15-11		May 1985
		1	15-12		May 1985
	17	1	CONTENTS		May 1985
		1	17-17		May 1985
		1	17-26		May 1985
		1	17-27		May 1985
		1	17-28		May 1985
		1	17-29		May 1985
		1	17-30		May 1985
		1	17-33		May 1985
		1	17-34		May 1985
		1	17-37		May 1985
		1	17-38		May 1985
	21	1	21-2		May 1985
		1	21-6		May 1985
		1	21-17		May 1985
		1	21-18		May 1985
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		1	21-22		May 1985
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		1	22-5		May 1985
		1	22-13		May 1985
		1	22-14		May 1985
		1	22-15		May 1985
		1	22-20		May 1985
		1	22-21		May 1985
		1	22-22		May 1985
		1	22-23		May 1985
	23	1	CONTENTS		May 1985
		1	23-2		May 1985
		1	23-16		May 1985
		1	23-18		May 1985
		1	23-19		May 1985
		1	23-20		May 1985
		1	23-21		May 1985
		1	23-22		May 1985
		1	23-28		May 1985
		1	23-30		May 1985
	25	1	25-2		May 1985
		1	25-11		May 1985
		1	25-12		May 1985

UPDATING LIST

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
WORKSHOP MANUAL mechanical units	00	2	CONTENTS		December 1985
		1	00-2		May 1985
		1	00-3		May 1985
		2	00-4		December 1985
		1	00-5		May 1985
		2	00-6		December 1985
		2	00-7		December 1985
		1	00-8		May 1985
		1	00-9		May 1985
		1	00-10		May 1985
		1	00-11		May 1985
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		1	00-14		May 1985
		1	00-15		May 1985
		2	00-16		December 1985
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		2	00-18		December 1985
		2	00-19		December 1985
		2	00-20		December 1985
		2	00-21		December 1985
		2		00-22	December 1985
		2		00-23	December 1985
	12	1	CONTENTS		May 1985
		1	12-26		May 1985
		1	12-27		May 1985
		1	12-28		May 1985
	13	1	CONTENTS		May 1985
		1	13-2		May 1985
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		2	13-5		December 1985
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		2	13-8		December 1985
		2	13-10		December 1985
		2	13-11		December 1985
		1	13-34		May 1985
		1	13-36		May 1985
		1		13-36/1	May 1985
		1		13-36/2	May 1985
		2	13-38		December 1985
		2	13-39		December 1985
		1	13-43		May 1985
		2	13-44		December 1985

DIREZIONE ASSISTENZA TECNICA

Alfa Romeo

PA360900000002

December 1985

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
	15	1	CONTENTS		May 1985
		2	15-3		December 1985
		1	15-4		May 1985
		1	15-10		May 1985
		1	15-11		May 1985
		1	15-12		May 1985
	17	1	CONTENTS		May 1985
		2	17-4		December 1985
		1	17-17		May 1985
		2	17-26		December 1985
		1	17-27		May 1985
		1	17-28		May 1985
		1	17-29		May 1985
		1	17-30		May 1985
		1	17-33		May 1985
		1	17-34		May 1985
		1	17-37		May 1985
		1	17-38		May 1985
	21	1	21-2		May 1985
		1	21-6		May 1985
		1	21-17		May 1985
		2	21-18		December 1985
		2	21-19		December 1985
		1	21-20		May 1985
		2	21-21		December 1985
		2	21-22		December 1985
	22	1	22-4		May 1985
		1	22-5		May 1985
		1	22-13		May 1985
		1	22-14		May 1985
		1	22-15		May 1985
		2	22-17		December 1985
		2	22-20		December 1985
		1	22-21		May 1985
		1	22-22		May 1985
		1	22-23		May 1985
	23	1	CONTENTS		May 1985
		1	23-2		May 1985
		1	23-16		May 1985
		1	23-17		May 1985
		1	23-18		May 1985
		1	23-19		May 1985
		1	23-20		May 1985
		1	23-21		May 1985
		1	23-22		May 1985
		1	23-28		May 1985
		2	23-29		December 1985
		2	23-30		December 1985
	25	1	25-2		May 1985
		2	25-11		December 1985
		2	25-12		December 1985

UPDATING LIST

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
WORKSHOP MANUAL mechanical units	00	2	CONTENTS		December 1985
		3	00-2		March 1986
		1	00-3		May 1985
		2	00-4		December 1985
		3	00-5		March 1986
		2	00-6		December 1985
		3	00-7		March 1986
		1	00-8		May 1985
		3	00-9		March 1986
		1	00-10		May 1985
		1	00-11		May 1985
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		1	00-13		May 1985
		3	00-14		March 1986
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		2	00-16		December 1985
		2	00-17		December 1985
		2	00-18		December 1985
		3	00-19		March 1986
		2	00-20		December 1985
		2	00-21		December 1985
		2		00-22	December 1985
		3	00-23		March 1986
	12	3	CONTENTS		March 1986
		3	from 12-2 to 12-31		March 1986
		3		from 12-32 to 12-40	March 1986
	13	1	CONTENTS		May 1985
		1	13-2		May 1985
		2	13-3		December 1985
		2	13-5		December 1985
		1	13-7		May 1985
		2	13-8		December 1985
		2	13-10		December 1985
		2	13-11		December 1985
		1	13-34		May 1985
		3	13-36		March 1986
		1		13-36/1	May 1985
		1		13-36/2	May 1985
		2	13-38		December 1985
		2	13-39		December 1985
		1	13-43		May 1985
		2	13-44		December 1985

DIREZIONE ASSISTENZA TECNICA

Alfa Romeo

PA360900000003

March 1986

Manual	Group	Updating N°	Page		Updating Date
			Substitued	Added	
	15	1	CONTENTS		May 1985
		3	15-3		March 1986
		1	15-4		May 1985
		1	15-10		May 1985
		1	15-11		May 1985
		1	15-12		May 1985
	17	1	CONTENTS		May 1985
		2	17-4		December 1985
		1	17-17		May 1985
		2	17-26		December 1985
		1	17-27		May 1985
		1	17-28		May 1985
		3	17-29		March 1986
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		1	22-13		May 1985
		1	22-14		May 1985
		1	22-15		May 1985
		2	22-17		December 1985
		3	22-20		March 1986
		1	22-21		May 1985
		1	22-22		May 1985
		1	22-23		May 1985
	23	1	CONTENTS		May 1985
		1	23-2		May 1985
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		1	23-17		May 1985
		1	23-18		May 1985
		1	23-19		May 1985
		1	23-20		May 1985
		1	23-21		May 1985
		1	23-22		May 1985
		1	23-28		May 1985
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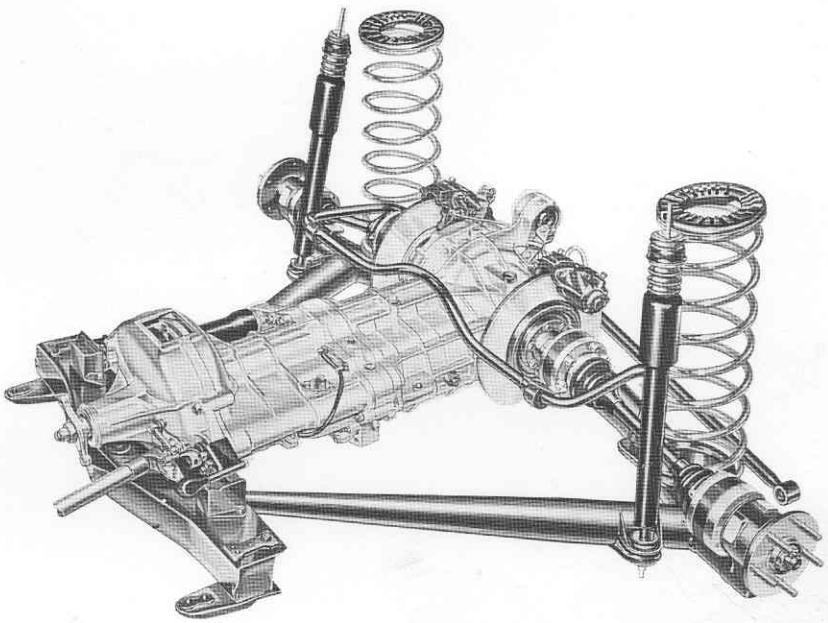
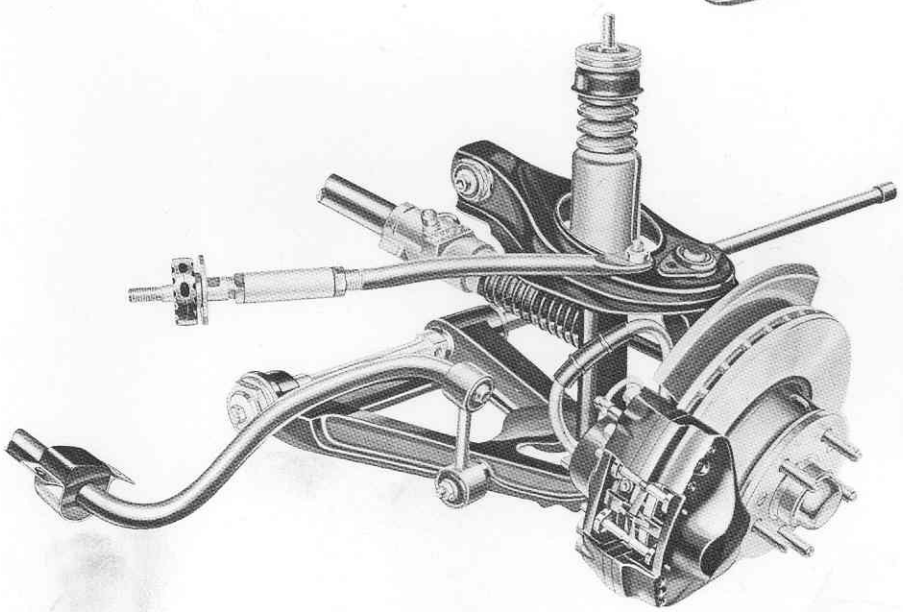
	25	1	25-2		May 1985
		2	25-11		December 1985
		2	25-12		December 1985

WORKSHOP MANUAL

mechanical units





DIREZIONE ASSISTENZA TECNICA

Alfa Romeo

PA360900000000

September 1984

FOREWORD

This manual is intended for use by workshops belonging to the ALFA ROMEO Service Organization. It contains all necessary instructions for tune up, repair and overhaul of the mechanical units with which the ALFA ROMEO cars are equipped. It includes procedures concerning removal and installation, disassembly and assembly, checks and inspections as well as instructions for effective trouble-shooting.

All operations are extensively illustrated so that the part or unit involved, as well as the proper tool to be used, are easily identified.

All data, figures, and technical specifications herein contained are up to date at time of publication. Any subsequent change in values or technical specifications occurring between reprints, will be included in the Technical Bulletins issued by the Service Department as changes take place.

The manufacturer reserves the right to make - at any time and without notice - all those changes that it deems necessary to improve the vehicle or arising out of manufacturing or commercial requirements. It further advises that not all models mentioned in this manual will be available in all countries.

HOW TO USE THE MANUAL

This manual is designed as a guide for personnel assigned to provide effective service to the mechanical units concerned. The instructions herein contained are in general common to all different models of the same group; when they are meant for one particular model, it is previously indicated with a specific detailed reference to be found in the CONTENTS and in the text.

All instructions given for the purpose of restoring faulty components to proper working conditions, do not necessarily reflect manufacturer's directives as regards service, but they must just the same be complied with. Furthermore, since most given instructions concern complete disassembly of components, they should be followed in their entirety only when it is strictly necessary.

For easier consultation of the manual, read the CONTENTS carefully.

The manual contains a SERVICE DATA AND SPECIFICATIONS chapter to be complied with when tuning up and repairing the vehicle. The specifications have been subdivided into four different items: Technical Data, General Specifications, Inspections and Adjustments, and Tightening Torques.

The manual also contains a TROUBLE DIAGNOSIS AND CORRECTIONS chapter where likely causes of trouble, as well as the relevant recommended corrective action, are listed.

The manual contains a list of SPECIAL SERVICE TOOLS designed to allow quick, accurate and safe repairs.

Measurements given in this manual are expressed in the International System of Units (SI) as well as in the metric system and in the yard/pound system.

Captions CAUTION and WARNING emphasize steps that must be followed with extreme care to avoid personal injury and/or damage to the vehicle or part of it.

Remember to keep the manual up-to-date with the data supplied by the "Technical Bulletin" periodically issued by the Service Department.

WORKSHOP INSTRUCTIONS

Disassembly and assembly operations should be always carried out using proper tools (general-purpose as well as special service tools) since makeshift tools will damage the parts involved.

To loosen tight fitting cast iron parts, just lightly strike them with a lead or aluminium hammer; use a wooden or plastic mallet to loosen light alloy parts.
Separate one by one the parts making up each unit and partially tighten nuts onto relevant studs or screws.

On disassembly, check if parts that should be marked do in fact have the relevant number or reference stamped on it. Any previously replaced part is found to be not properly marked, it should be stamped accordingly.

Before washing, clean all parts with a brush and cloth removing most dirt (thus avoiding needless dirtying of the washing fluid); then wash them with detergent or special compound. Remove any residual dirt with a jet of compressed air. Dry all parts immediately after washing to prevent them from rusting.

Thoroughly wash parts that have been ground or lapped and blow them with a jet of compressed air to remove all residues.

On assembly, clean all parts (especially those that have been ground) with a jet of compressed air or a clean brush.
On assembly also suitably lubricate parts (except self-lubricating bushes) to prevent seizure during their running-in period. To apply lubricant, use a clean brush as well as clean oil keeping them away from dust and dirt at all times and using them only for this special purpose.

Suitably protect with adhesive tape or clean cloths all engine parts that after disassembly show orifices or drilling which are likely to let in dust or foreign matter.

On assembly, replace all gaskets, seal rings, spring washers and lock rings in addition to all worn or damaged parts.

IMPORTANT NOTICE

When replacing units or parts thereof, be sure to use only original spare parts to ensure interchangeability as well as proper performance.

When ordering, remember to show the part number taken from the Spare Parts Catalogue or from the microfiches.
Service quality varies according to procedures used, personnel skill, and available tools and parts.

QUICK REFERENCE INDEX

COMPLETE CAR	GR. 00
CLUTCH	GR. 12
GEARBOX	GR. 13
TRANSMISSION	GR. 15
DIFFERENTIAL AND DRIVE SHAFT UNIT	GR. 17
FRONT SUSPENSION	GR. 21
FRONT AND REAR BRAKES	GR. 22
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GROUP 00

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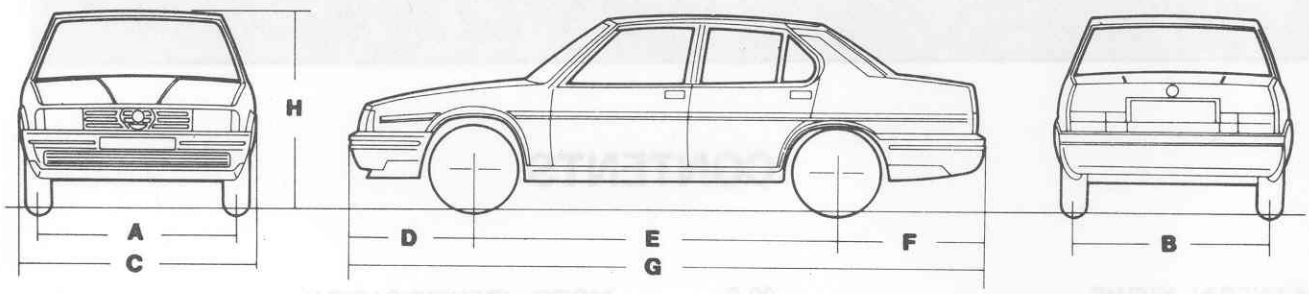
GENERAL VIEWS

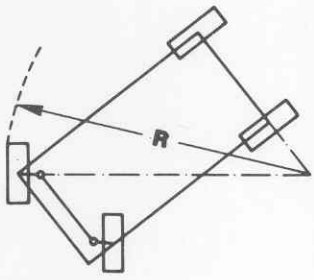
DIMENSIONS

Alfa 90 Alfa 90 Super



Unit: mm (in)

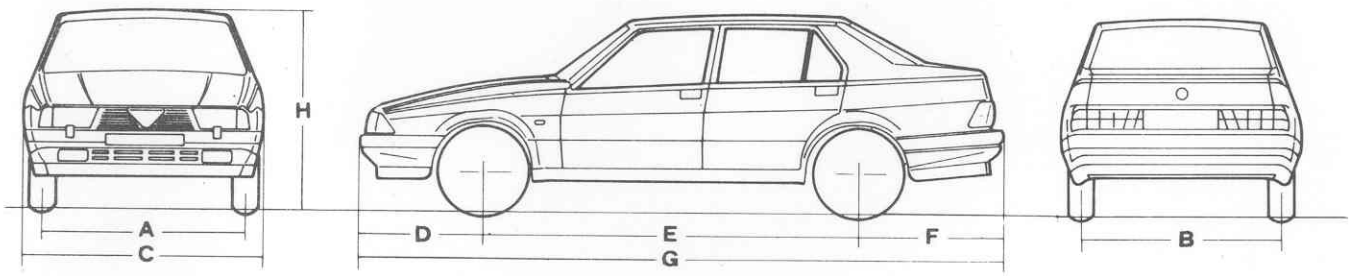
Model \ Dimension	A	B	C	D	E	F	G	H Max	R (*)
Alfa 90 Alfa 90 Super — 1.8	1366 (53.8)	1358 (53.5)	1638 (64.5)	861 (33.9)	2510 (98.8)	1020 (40.2)	4391 (172.9)	1420 (55.9)	5050 (198.8)
(△) 2.0									
2.0 iniezione									
2.0 6V iniezione									
2.4 turbodiesel									
(○) 2.5 iniezione	1366 (1) (53.8) 1376 (2) (54.2)	1358 (1) (53.5) 1368 (2) (53.9)							



(△) Valid for Alfa 90 only
(○) Valid also for Alfa 90 Super 2.5 6V iniezione

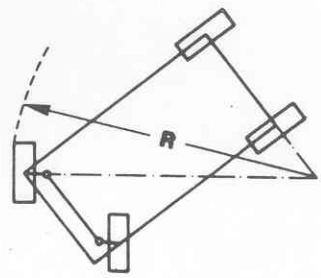
(1) with rims 5 1/2Jx14"
(2) with rims 6Jx15"
(*) Radius of the circumference described in correspondence with ground, from outer rim of the outer drive wheel, when in full steering lock conditions.

Alfa 75 75



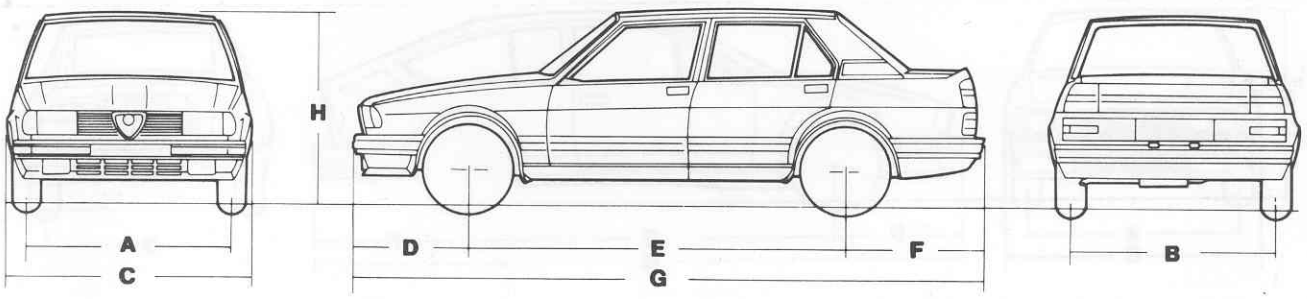
Unit: mm (in)

Model	Dimension	A	B	C	D	E	F	G	H Max	R (*)
Alfa 75	1.6	1368 (53.9)	1358 (53.5)	1630 (64.2)	825 (32.5)	2510 (98.8)	995 (39.2)	4330 (170.5)	1400 (55.1)	5050 (198.8)
	1.8									
	turbo	1398(1) (55.0)	1388(1) (54.6)							
	2.0	1368 (53.9)	1358 (53.5)							
	2.0 turbodiesel									
	6V iniezione	1368(2) (53.9) 1378(3) (54.3)	1358(2) (53.5) 1368(3) (53.9)							
75	1.6	1368 (53.9)	1358 (53.5)	1630 (64.2)	825 (32.5)	2510 (98.8)	995 (39.2)	4330 (170.5)	1400 (55.1)	5050 (198.8)
	1.8									
	i.e. TURBO	1396 (1) (55.0)	1382 (1) (54.4)	1660 (65.4)	865 (34.1)		1045 (41.1)	4420 (174.0)		
	2.0	1368 (53.9)	1358 (53.5)	1630 (64.2)	825 (32.5)		995 (39.2)	4330 (170.5)		
	Twin Spark 2.0	1396(1) (55.0)	1382(1) (54.4)	1660 (65.4)						
	TURBO D	1368 (53.9)	1358 (53.5)	1630 (64.2)						
	6V 2.5	1396 (55.0)	1382 (54.4)	1660 (65.4)						
	6V 3.0				865 (34.1)		1045 (41.1)	4420 (174.0)		

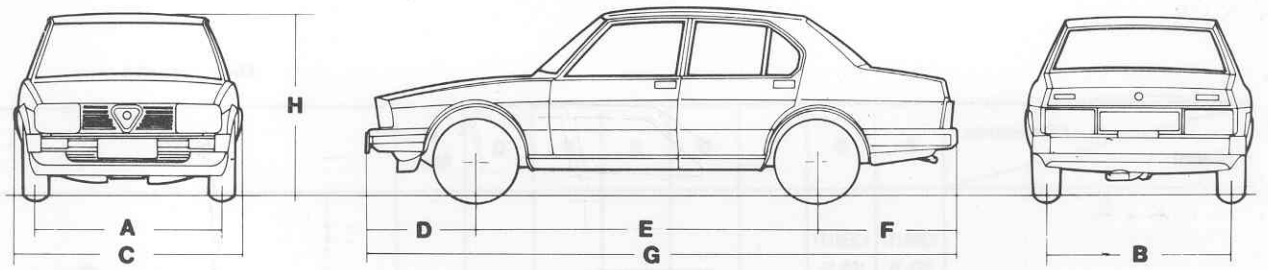


(1) with rims 6 1/2 Jx14"
(2) with pressed steel rims
(3) with alloy rims
(*) Radius of the circumference described in correspondence with ground, from outer rim of the outer drive wheel, when in full steering lock conditions.

Giulietta

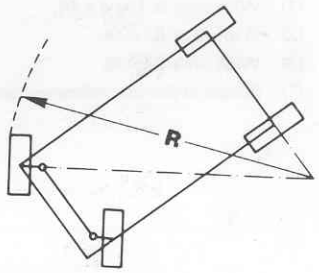


Alfetta



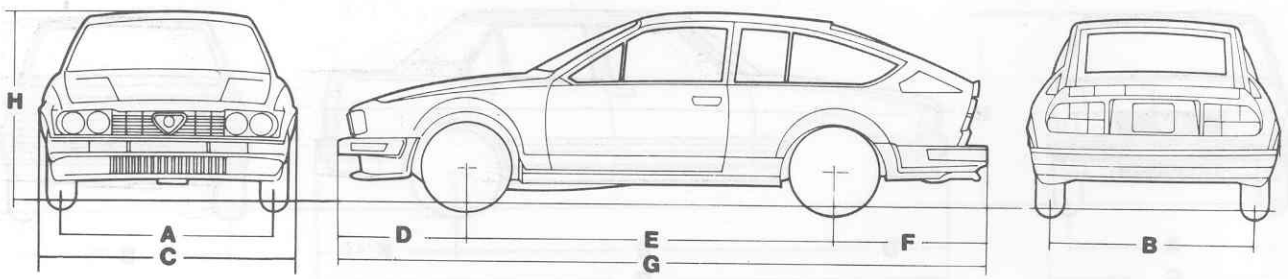
Unit: mm (in)

Model	Dimension	A	B	C	D	E	F	G	H Max	R (*)
Giulietta	1.6	1366(3) (53.8)	1358(3) (53.5)	1650 (65)	765 (30.1)	2510 (98.8)	935 (36.8)	4210 (165.75)	1400 (55.1)	5475 (215.55)
	1.8	1370(4) (53.94)	1362(4) (53.6)							
	2.0	1366 (53.8)	1358 (53.5)							
	2.0 turbodiesel	1360(3) (53.55) 1364(4) (53.7)	1358(3) (53.5) 1362(4) (53.6)							
Alfetta	1.6	1366 (53.8)	1358 (53.5)	1640 (64.56)	825 (32.5)	2510 (98.8)	1050 (41.34)	4385 (172.64)	1430 (56.3)	5050 (198.8)
	1.8									
	2.0									
	2.0 turbodiesel	1360 (53.55)			821 (32.32)	2514 (99)				
	2.4 turbodiesel									



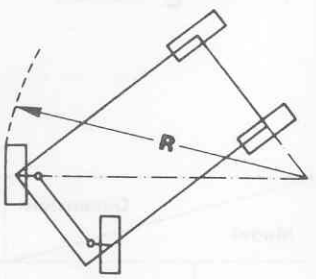
(1) with pressed steel rims
(2) with alloy rims
(*) Radius of the circumference described in correspondence with ground, from outer rim of the outer drive wheel, when in full steering lock conditions.

GTV 2.0 GTV 6 2.5



Unit: mm (in)

Model \ Dimension	A	B	C	D	E	F	G	H Max	R (*)
GTV 2.0	1364 (1) (53.7) 1374 (2) (54.1) 1364 (3) (53.7)	1358 (1) (53.5) 1368 (2) (53.86) 1358 (3) (53.5)	1664 (65.5)	855 (33.66)	2400 (94.5)	1005 (39.57)	4260 (167.7)	1330 (53.36)	5000 (196.85)
GTV 6 2.5	1373 (54.06)	1352 (53.23)	1664 (65.5)	855 (33.66)	2400 (94.5)	1005 (39.57)	4260 (167.7)	1330 (53.36)	5000 (196.85)



(1) With rims 5 $^{1}/_{2}$ J × 14
(2) With rims 6J × 14
(3) With rims 6J × 15
(*) Radius of the circumference described in correspondence with ground, from outer rim of the outer drive wheel, when in full steering lock conditions.

WEIGHTS AND LOADS

Weights and loads		Model / Variation	Alfa 90 1.8	Alfa 90 (△) 2.0	Alfa 90 2.0 iniezione	Alfa 90 Super 2.0 6V iniezione	Alfa 90 Super 2.4 turbodiesel	Alfa 90 Super (○) 2.5 iniezione
Max allowed gross weight	kg (lb)		1505 (3318)	1515 (3340)	1515 (3340)	1595 (3516)	1675 (3693)	1595 (3516)
Kerb weight	kg (lb)		1080 (2381)	1080 (2381)	1090 (2403)	1170 (2579)	1250 (2756)	1170 (2579)
Payload	kg (lb)		425 (937)	425 (937)	425 (937)	425 (937)	425 (937)	425 (937)
Max. allowed axle gross weight	kg (lb)	Front	820 (1808)	820 (1808)	820 (1808)	850 (1874)	940 (2073)	850 (1874)
		Rear	990 (2183)	990 (2183)	990 (2183)	990 (2183)	990 (2183)	990 (2183)
Max. towing gross weight	kg (lb)		1200 (2646)	1200 (2646)	1200 (2646)	1200 (2645)	1300 (2867)	1200 (2646)
Seating capacity		Front	2	2	2	2	2	2
		Rear	3	3	3	3	3	3

(△) Valid for Alfa 90 only

(○) Valid also for Alfa 90 Super 2.5 6V iniezione

Weights and loads		Model / Variation	Alfa 75 1.6	Alfa 75 1.8	Alfa 75 turbo	Alfa 75 2.0	Alfa 75 2.0 turbodiesel	Alfa 75 6V iniezione
Max. allowed gross weight	kg (lb)		1485 (3274)	1485 (3274)	1555 (3429)	1495 (3296)	1615 (3561)	1585 (3495)
Kerb weight	kg (lb)		1060 (2337)	1060 (2337)	1130 (2492)	1070 (2359)	1190 (2624)	1160 (2558)
Payload	kg (lb)		425 (937)	425 (937)	425 (937)	425 (937)	425 (937)	425 (937)
Max. allowed axle gross weight	kg (lb)	Front	820 (1808)	820 (1808)	850 (1874)	820 (1808)	940 (2073)	850 (1874)
		Rear	990 (2183)	990 (2183)	990 (2183)	990 (2183)	990 (2183)	990 (2183)
Max. towing gross weight	kg (lb)		1100 (2426)	1100 (2426)	1200 (2646)	1100 (2426)	1300 (2867)	1200 (2646)
Seating capacity		Front	2	2	2	2	2	2
		Rear	3	3	3	3	3	3

Weights and loads		Model / Variation	75 1.6 1.8	75 i.e. TURBO	75 2.0	75 Twin Spark 2.0	75 TURBO D	75 6V 2.5	75 6V 3.0
Max. allowed gross weight	kg (lb)		1485 (3274)	1605 (3539)	1495 (3296)	1545 (3407)	1615 (3561)	1585 (3495)	1675 (3693)
Kerb weight	kg (lb)		1060 (2337)	1180 (2602)	1070 (2359)	1120 (2470)	1190 (2624)	1160 (2558)	1250 (2756)
Payload	kg (lb)		425 (937)	425 (937)	425 (937)	425 (937)	425 (937)	425 (937)	425 (937)
Max. allowed axle gross weight	kg (lb)	Front	820 (1808)	850 (1874)	820 (1808)	850 (1874)	940 (2073)	850 (1874)	850 (1874)
		Rear	990 (2183)	990 (2183)	990 (2183)	990 (2183)	990 (2183)	990 (2183)	990 (2183)
Max. towing gross weight	kg (lb)		1100 (2426)	1200 (2646)	1100 (2426)	1200 (2646)	1300 (2867)	1200 (2646)	1300 (2867)
Seating capacity		Front	2	2	2	2	2	2	2
		Rear	3	3	3	3	3	3	3

Weights and loads			Model: Giulietta Variation: 1.6	1.8	2.0	2.0 turbodiesel
Max. allowed gross weight	kg (lb)		1525 (3362)	1525 (3362)	1525 (3362)	1655 (3648.6)
Kerb weight	kg (lb)		1100 (2425)	1100 (2425)	1100 (2425)	1230 (2711.6)
Payload	kg (lb)		425 (937)	425 (937)	425 (937)	425 (937)
Max. allowed axle gross weight	kg (lb)	Front	800 (1763.7)	800 (1763.7)	800 (1763.7)	870 (1918)
		Rear	880 (1940)	880 (1940)	880 (1940)	940 (2072.3)
Max. towing gross weight	kg (lb)		1140 (2513.2)	1140 (2513.2)	1140 (2513.2)	1300 (2866)
Seating capacity		Front	2	2	2	2
		Rear	3	3	3	3

Weights and loads			Model: Alfetta Variation: 1.6	1.8	2.0	2.0 turbodiesel	2.4 turbodiesel
Max. allowed gross weight	kg (lb)		1545 (3406)	1545 (3406)	1565 (3450.2)	1695 (3736.8)	1695 (3736.8)
Kerb weight	kg (lb)		1120 (2469.1)	1120 (2469.1)	1140 (2513.2)	1270 (2799.8)	1270 (2799.8)
Payload	kg (lb)		425 (937)	425 (937)	425 (937)	425 (937)	425 (937)
Max. allowed axle gross weight	kg (lb)	Front	800 (1763.7)	800 (1763.7)	800 (1763.7)	870 (1918)	870 (1918)
		Rear	920 (2028.2)	920 (2028.2)	920 (2028.2)	960 (2116.4)	960 (2116.4)
Max. towing gross weight	kg (lb)		1190 (2623.5)	1190 (2623.5)	1200 (2645.5)	1200 (2645.5)	1300 (2866)
Seating capacity		Front	2	2	2	2	2
		Rear	3	3	3	3	3

Weights and loads			Model: GTV 2.0	GTV 6 2.5
Max. allowed gross weight	kg (lb)		1450 (3196.7)	1550 (3417.2)
Kerb weight	kg (lb)		1110 (2447.1)	1210 (2667.6)
Payload	kg (lb)		340 (750)	340 (750)
Max. allowed axle gross weight	kg (lb)	Front	800 (1763.7)	800 (1763.7)
		Rear	880 (1940)	920 (2028.2)
Max. towing gross weight	kg (lb)		1000(*) (2204.6)	1000(*) (2204.6)
Seating capacity		Front	2	2
		Rear	2	2

(*) For Germany, the max gradient is 15%

WHEELS AND TYRES

Model / Variation / Wheels and tyres	Alfa 90 / Alfa 90 Super				
	1.8 2.0 (Δ) 2.0 iniezione	2.0 6V iniezione	2.4 turbodiesel	(○) 2.5 iniezione	
Rims	5 1/2 J × 14 (1)	5 1/2 J × 14 (1)	5 1/2 J × 14 (2)	5 1/2 J × 14 (2)	6J × 15 (2)
Tyres	185/70 R14 86H	185/70 R14 86H	185/70 R14 87H	185/70 R14 86H	195/60 R15 86H

(Δ) Valid for Alfa 90 only
(○) Valid also for Alfa 90 Super 2.5 6V iniezione
(1) With four securing screws
(2) With five securing screws

Model / Variation / Wheels and tyres	Alfa 75				
	1.6 2.0 turbodiesel	1.8	turbo	2.0	6V iniezione
Rims	5 1/2 J × 13 (1)	5 1/2 J × 13 (1)	6 1/2 J × 14 (2)	5 1/2 J × 14 (1)	5 1/2 J × 14 (2)
Tyres	185/70 TR13"	185/70 HR13"	195/60 VR14"	185/65 HR14"	195/60 VR14"

(1) With four securing screws
(2) With five securing screws

Model / Variation / Wheels and tyres	75			
	1.6 TURBO D	1.8	2.0	i.e. TURBO Twin Spark 2.0 6V 2.5 6V 3.0
Rims	5 1/2 J × 13" (1)	5 1/2 J × 13" (1)	5 1/2 Jx14" (1)	6 1/2 J × 14" (2)
Tyres	185/70 TR13	185/70 HR13	185/65 HR14	195/60 VR14

(1) With four securing screws
(2) With five securing screws

Model / Variation / Wheels and tyres	Giulietta			
	1.6	1.8	2.0	2.0 turbodiesel
Rims	5½J × 13 2H (1)		5½J × 14 2H (1)	5½J × 13 2H (1)
	5½J × 13 CH (2)		5½J × 14 CH (2)	5½J × 13 CH (2)
Tyres	165 SR 13	185/70 SR13 (5)	175/70 SR14 (4)	165 SR13
	185/70 SR13 (3)		185/65 R14	185/70 SR13 (3)

(1) Pressed steel rims
(2) Alloy rims
(3) Tyre supplied upon request
(4) Snow tyres
(5) For the German version tyres of the HR type

Model / Variation / Wheels and tyres	Alfetta			
	1.6 1.8	2.0	2.0 2.4 turbodiesel	
Rims	5½J × 14 2H (1)			
	5½J × 14 CH (2)			
Tyres	165 SR 14 (3)	165 HR 14	165 SR 14	
	185/70 R14 86H (4)	185/70 R14 86H	185/70 SR 14	

(1) Pressed steel rims
(2) Alloy rims
(3) For the German version, tyres of the HR type
(4) Tyre supplied upon request

Model / Wheels and tyres	GTV 2.0		GTV 6 2.5
Rims	5 1/2 J × 14	6 J × 15	6 J × 15
Tyres	185/70 R14 86H	195/60 R15 86H	195/60 R15 86H

MODEL IDENTIFICATION

(Except Switzerland, Sweden, Australia)

Model		Alfa 90															
Variation		1.8		2.0		2.0 inlezione		2.0 6V inlezione		2.4 turbodiesel		2.5 inlezione					
Body		4-door saloon															
Drive		Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right				
Identification No.	- on identification label	162.02	—	162.12	—	162.14	162.15	162.10	—	162.06	—	162.18	162.19				
Chassis No. — Type approval No.	- on identification label	162 A1 (1) 162 A1A (2)		162 A2 (1) 162 A2C (2)		162 A2A (1) 162 A2E (2)		162 A2B (1) 162 A2D (2)		162 A3		162 A					
	- on the right rear side of luggage compartment floor	162 A10		162 A20		162 A20		162 A20		162 A30		162 A00					
Chassis No. — Serial No.	- on the rear side of luggage compartment floor	from 00.001.011		from 00.050.011		from 00.001.011	from 03.001.011	from 00.100.011		from 00.001.011		from 00.001.011	from 03.001.011				
Engine No. — Type and serial No.	- on LH rear of cylinder block	062.02 from 000.001		062.12 from 000.001		017.13 from 017.899		062.10 from 000.001		VM 81 A from 00.001		016.46 from 000.001					
Label type and location																	

(1) High-geared gearbox version
(2) Low-geared gearbox version

Model				Alfa 90 Super									
Variation				1.8		2.0 iniezione		2.0 6V iniezione		2.4 turbodiesel		2.5 6V iniezione	
Body				4-door saloon									
Drive				Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Identification No.		Label type and location	- on identification label	162.02.1	–	162.14.1	162.15.1	162.10.1	–	162.06.1	–	162.18.1	162.19.2
Chassis No.	Type approval No.		- on identification label	162 A1A		162 A2E		162 A2D		162 A3		162 AA	
			- on the right rear side of luggage compartment floor	162 A10		162 A20		162 A20		162 A30		162 A00	
	Serial No.		- on the right rear side of luggage compartment floor	from 00.006.511		from 00.017.511	–	from 00.105.011		from 00.014.011		from 00.007.011	from 03.002.011
Engine No.	Type and serial No.		- on LH rear of cylinder block	062.02 from 000.001		017.13 from 017.899		062.10 from 000.001		VM 81 A from 00.001		016.46 from 000.001	

(Except Switzerland, Sweden, Australia)

Model	Alfa 75											
Variation	1.6		1.8		turbo		2.0		2.0 turbodiesel		6V iniezione	
Body	4-door saloon											
Drive	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Identification No. - on identification label	161.000	161.010	161.020	161.030	161.340	161.350	161.080	161.090	161.040	—	161.180	161.190
Chassis No. / Type approval No. - on identification label	162 B2 (1) 162 B2A (2)		162 B1 (1) 162 B1A (2)		162 B1C		162 BA (1) 162 BF (2)		162 BD		162 B3 (2) 162 B3A (1)	
Chassis No. / Type approval No. - on the right rear side of luggage compartment floor	162 B20		162 B10		162 B10		162 B00		16200		162 B30	
Chassis No. / Serial No. - on the right rear side of luggage compartment floor	from 00.001.011	from 03.001.011	from 00.001.011	from 03.001.011	from 00.050.011	from —	from 00.200.011	from 03.010.011	from 00.001.011		from 00.001.011	from 03.001.001
Engine No. / Type and serial No. - on LH rear of cylinder block	061.00 from 000.001		062.02 from 000.001		061.34 from 000.001		062.12 from 000.001		VM 80A from 00.001		016.46 from 000.001	

(1) High-geared gearbox version
(2) Low-geared gearbox version

Model				75															
Variation				1.6		1.8		i.e. TURBO		2.0		Twin Spark 2.0		TURBO D		6V 2.5		6V 3.0	
Body				4-door saloon															
Drive				Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Identification No.		Label type and location	- on identification label	161.000	161.010	161.020	161.030	161.440	–	161.080	161.090	161.220	161.230	161.040	–	161.181	161.191	161.200	161.210
Chassis No.	Type approval No.		- on identification label	162 B2A		162 B1A		162 B1C		162 BF		162 B4		162 BD		162 B3		162 B6	
			- on the right rear side of luggage compartment floor	162 B20		162 B10		162 B10		162 B00		162 B40		16200		162 B30		162 B60	
	Serial No.		- on the right rear side of luggage compartment floor	from 00.001.011	from 03.001.011	from 00.001.011	from 03.001.011	from 00.055.011	–	from 00.200.011	from 03.010.011	from 00.001.001	from 03.001.001	from 00.001.011	–	from 00.003.501	from	from 00.001.001	from 03.001.001
Engine No.	Type and serial No.		- on LH rear of cylinder block	061.00 from 000.001		062.02 from 000.001		061.34 from 000.001		062.12 from 000.001		062.24 from 000.001		VM 80A from 00.001		016.46 from 000.001		061.20 from 000.001	

(Except Switzerland, Sweden, Australia)

Model / Variation			Giulietta											
			16 Vers. 1983		1.8 Vers. 1983		2.0 Vers. 1983				2.0 turbodiesel Vers. 1983			
Body			4 - door saloon											
Drive			Left	Right	Left	Right	Left	Right			Left	Right		
Identification No.	Label type and location	– on identification label	113.48	113.49	113.50	113.51	113.56	113.57			113.52	–		
Chassis No. Type approval No.		– on identification label	116.50.B		116.AA		116.A.1A				116.A2			
		– on scuttle	116.50.0		116.A.00		116.A.10				116.A.20			
Chassis No. Serial No.		– on scuttle	from 00.170.001	from 03.008.01	from 00.065.001	from 03.007.501	from 00.025.001	from 03.003.001			from 00.006.001	–		
Engine No. Type and serial No.		– on LH rear of cylinder block	016.00 from 257.001		016.78 from 000.001		016.55 from 000.001				VM 4HT/2 from 00.001			

(Except Switzerland, Sweden, Australia)

Model		Alfetta															
Variation		16 Vers. 1983		18 Vers. 1983		2.0 Vers. 1983		2.0 ● Vers. 1983		2.0 turbodiesel Vers. 1983			2.4 turbodiesel Vers. 1983				
Body		4 - door saloon															
Drive		Left	Right	Left	Right	Left	Right	Left	Right	Left	Right		Left	Right			
Identification No.	– on identification label	117.18	–	117.17	–	117.01	–	117.13	117.14	117.06	–		117.02	–			
	– on identification label	116.B1A	–	116.B2	–	116.55F	–	116.55N	116.56N	116.BA	–		116.B3	–			
	– on scuttle	116.B10	–	116.B20	–	116.550	–	116.550	116.560	116.B00	–		116.B30	–			
	– on scuttle	from 00.008.011	–	from 00.008.011	–	from 00.177.011	–	from 00.150.011	from 03.012.011	from 00.025.001	–		• from 00.001.001	–			
Chassis No.	Label type and location																
Type approval No.								• 017.13 from 000.001		VM 4HT/2 from 00001			VM 4HT/2.4 from 00001				
Serial No.																	
Engine No.																	
Type and serial No.	– on LH rear of cylinder block	016.00 from 257.001		016.78 from 000.001		016.55 from 000.001											

(Except Switzerland, Sweden, Australia)

Model			GTV 2.0 Vers. 1983		GTV 6 2.5 Vers. 1985	
Body			2-door coupé			
Drive			Left	Right	Left	Right
Identification No.	Label type and location	- on identification label	113.17	113.18	113.15.1	113.16.1
Chassis No.	Type approval No.	- on identification label	116.36.C	116.37.C	116.CA	116.CA
		- on scuttle	116.36.0	116.37.0	116.C00	116.C00
	Serial No.	- on scuttle	from 00.062.501	from 03.017.501	from 00.012.001	from 03.003.001
Engine No.	Type and serial No.	- on LH rear of cylinder block	016.55 from 000.001		016.46 from 000.001	

Model				Alfa 90					
Variation				2.0		2.0 iniezione		2.5 iniezione	
Body				4 - door saloon					
Drive				Left	Right	Left	Right	Left	Right
Version				Svitzerland 1985 Sweden 1985	–	Switzerland 1985 Sweden 1985	–	Switzerland 1985 Sweden 1985	Australia 1985
Identification No.		Label type and location	– on identification label	162.12	–	162.14	–	162.18	162.19
Chassis No.	Type approval No.		– on identification label	162.A2C		162.A2E		162.A	
			– on the right rear side of luggage compartment floor	162.A20		162.A20		162.A00	
	Serial No.		– on the right rear side of luggage compartment floor	from 00.050.011		from 00.001.011		from 00.001.011	
Engine No.	Type and serial No.		– on LH rear of cylinder block	062.12 from 000.001		017.13 from 017.899		016.46 from 000.001	

(Switzerland, Sweden, Australia)

Model		Alfa 75							
Variation		1.8			2.0			6V iniezione	
Body		4-door saloon							
Drive		Left	Right		Left	Right		Left	Right
Version		Switzerland 1985	Australia 1986		Switzerland 1985 Sweden 1985	Australia 1986		Switzerland 1986 Sweden 1986	Australia 1986
Identification No.		161.020	161.030		161.080	161.090		161.180	161.190
Chassis No.	Label type and location								
Type approval No.	- on identification label	162 B1A			162 BF			162 B3	
	- on the right rear side of luggage compartment floor	162 B10			162 B00			162 B30	
Serial No.	- on the right rear side of luggage compartment floor	from 00.001.011	from 03.001.011		from 00.200.011	from 03.010.011		from 00.001.011	from 03.001.011
Engine No.									
Type and serial No.	- on LH rear of cylinder block	062.02 from 000.001			062.12 from 000.001			016.46 from 000.001	

(Switzerland, Sweden, Australia)

Model	Alfa 75							
Variation	1.8		turbo		2.0		6V iniezione	
Body	4-door saloon							
Drive	Left	Right	Left	Right	Left	Right	Left	Right
Version	Switzerland 1985	Australia 1986	Switzerland 1986 Sweden 1986	–	Switzerland 1985 Sweden 1985	Australia 1986	Switzerland 1986 Sweden 1986	Australia 1986
Identification No. — on identification label	161.020	161.030	161.340	–	161.080	161.090	161.180	161.190
Chassis No. — Type approval No. — on identification label	162 B1A		162 B1C	–	162 BF		162 B3	
Chassis No. — Type approval No. — on the right rear side of luggage compartment floor	162 B10		162 B10	–	162 B00		162 B30	
Chassis No. — Serial No. — on the right rear side of luggage compartment floor	from 00.001.011	from 03.001.011	from 00.050.011	–	from 00.200.011	from 03.010.011	from 00.001.011	from 03.001.011
Engine No. — Type and serial No. — on LH rear of cylinder block	062.02 from 000.001		061.34 from 000.001	–	062.12 from 000.001		016.46 from 000.001	

Label type and location

(Switzerland, Sweden, Australia)

Model				75									
Variation				1.8		2.0		Twin Spark 2.0		6V 2.5		6V 3.0	
Body				4-door saloon									
Drive				Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Version				Switzerland 1987	Australia 1987	Switzerland 1987 Sweden 1987	Australia 1987	Switzerland 1987	Australia 1987	Switzerland 1987	—	Switzerland 1987	Australia 1987
Identification No.		Label type and location	- on identification label	161.020	161.030	161.080	161.090	161.300	— (1)	161.261	—	161.320	— (1)
Chassis No.	Type approval No.	Label type and location	- on identification label	162 B1A		162 BF		162 B4	— (1)	162 B3		162 B6	— (1)
Chassis No.	Type approval No.	Label type and location	- on the right rear side of luggage compartment floor	162 B10		162 B00		162 B40		162 B30		162 B60	
Chassis No.	Serial No.	Label type and location	- on the right rear side of luggage compartment floor	from 00.001.011	from 03.001.011	from 00.200.011	from 03.010.011	from 00.001.001	from 03.001.001	from	—	from 00.040.001	from 03.001.001
Engine No.	Type and serial No.	Label type and location	- on LH rear of cylinder block	062.02 from 000.001		062.12 from 000.001		062.24 from 000.001		019.11 from A60.001		061.24 from 000.001	

(1) Applied by Consociate House

Model			Giulietta							
Variation			1.8 L		1.8		2.0 L		2.0	
Body			4 - door saloon							
Drive			Left	Right	Left	Right	Left	Right	Left	Right
Version			Switzerland 1983 Sweden 1983	Australia 1983	Switzerland 1984	–	Switzerland 1983 Sweden 1983	Australia 1983	Switzerland 1984 Sweden 1984	Australia 1984
Identification No.		– on identification label	116.95.1	116.96.1	113.50	–	116.97.1	116.98.1	113.56	113.57
Chassis No.	Type approval No.	– on identification label	116.AB	116.AB	116.AB	–	116.A1A	–	116.A1A	116.A1A
		– on scuttle	116.A	116.A00	116.A00	–	116.A10	116.A10	116.A10	116.A10
	Serial No.	– on scuttle	from 00.040.001	from 03.006.001	from 00.065.001	–	from 00.015.001	from 03.002.001	from 00.025.001	from 03.003.001
Engine No.	Type and serial No.	– on LH rear of cylinder block	016.78 from 000.001		016.78 from 000.001		016.55 from 000.001		016.55 from 000.001	

Label type and location

(Switzerland, Sweden, Australia)

Model				Alfetta					
Variation				1.8		2.0		2.0 ●	
Body				4-door saloon					
Drive				Left	Right	Left	Right	Left	Right
Version				Switzerland 1984	–	Switzerland 1984 Sweden 1984	Australia 1983	Switzerland 1984	–
Identification No.			- on identification label	117.17	–	117.01	117.10	117.13	–
Chassis No.	Type approval No.	Label type and location	- on identification label	116.B2A	–	116.55 G	116.56H	116.55 N	–
			- on scuttle	116.B20	–	116.550	116.560	116.550	–
	Serial No.		- on scuttle	from 00.008.001	–	from 00.170.001	from 03.020.011	from 00.150.001	–
Engine No.	Type and serial No.		- on LH rear of cylinder block	016.78 from 000.001	–	016.55 from 000.001		017.13 from 000.001	–

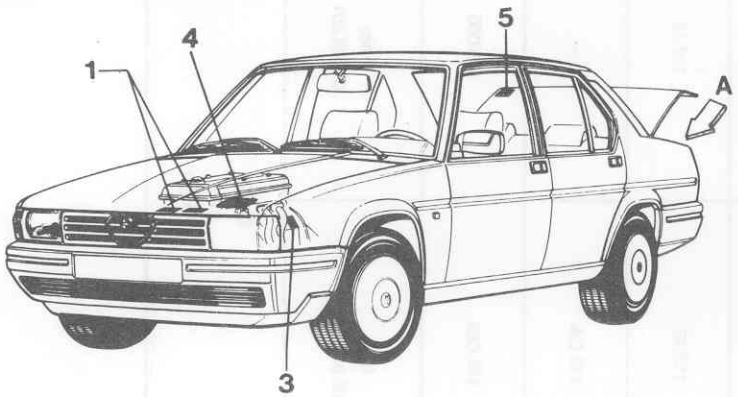
(Switzerland, Sweden, Australia)

Model				GTV 2.0		GTV 6 2.5	
Body				2-door coupé			
Drive				Left	Right	Left	Right
Version				Switzerland 1983 Sweden 1983	Australia 1983	Switzerland 1985 Sweden 1985	Australia 1985
Identification No.			- on identification label	113.17	113.18	113.15	113.16
Chassis No.	Type approval No.	Label type and location	- on identification label	116.36.C	116.37.C	116.CA	–
			- on scuttle	116.360	116.360	116.C00	116.C00
	Serial No.		- on scuttle	from 00.062.501	from 03.017.501	from 00.012.001	from 03.003.001
Engine No.	Type and serial No.		- on LH rear of cylinder block	016.55 from 000.001		016.46 from 000.001	

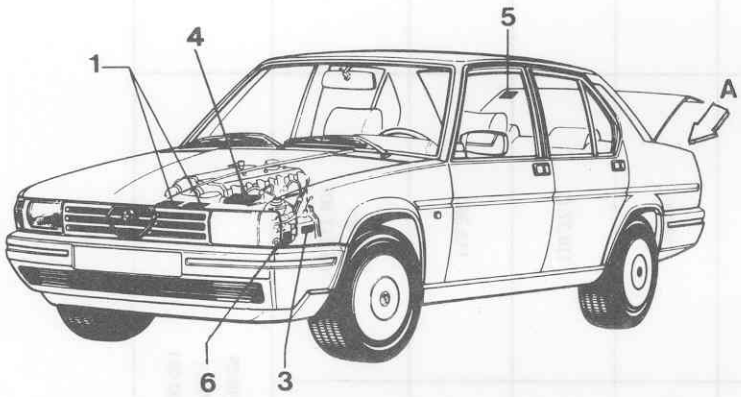
IDENTIFICATION DATA

IDENTIFICATION LABELS

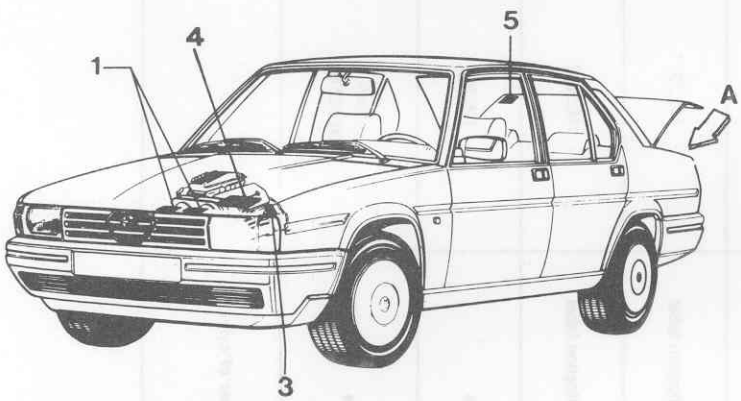
Alfa 90 Alfa 90 Super



18
(△) 20
20 Iniezione



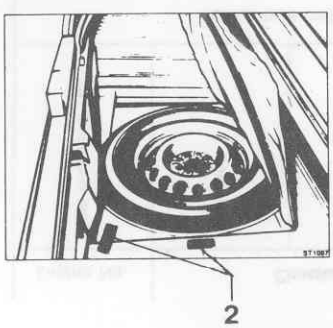
2.4 turbodiesel



2.0 6V iniezione
(○) 2.5 • Iniezione

(△) Valid for Alfa 90 only
(○) Valid also for Alfa 90 Super 2.5 6V iniezione

View from A

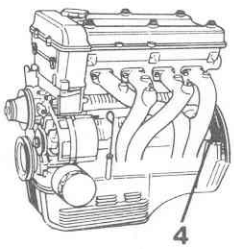


1 Identification label
(Identification No. and Type approval No.)
2 Luggage compartment floor label
(Type approval No. and serial No.)
3 Label on cylinder block LH rear side
(Engine No.)
4 Lubrication data label
(lubrication data)
5 Paint label
6 Printing on the injection pump
(Identification Number)

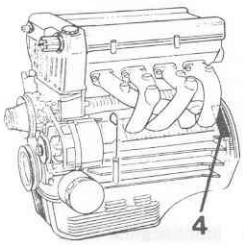
IDENTIFICATION LABELS

Alfa 75

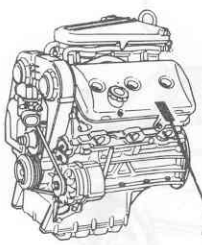
Twin Spark 2.0

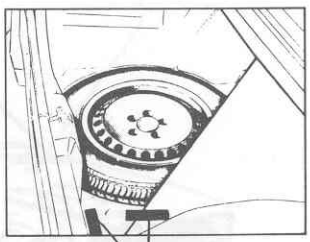


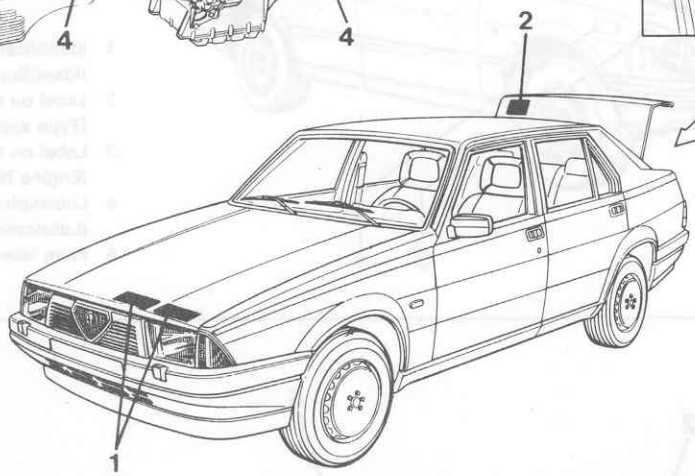
1.6
1.8
TURBO
2.0

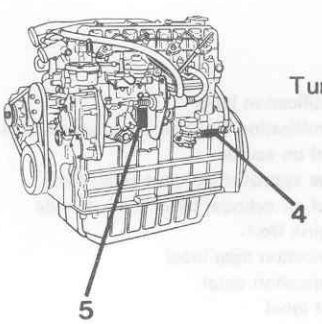


2.5
3.0

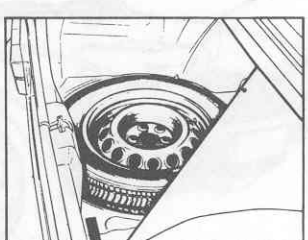


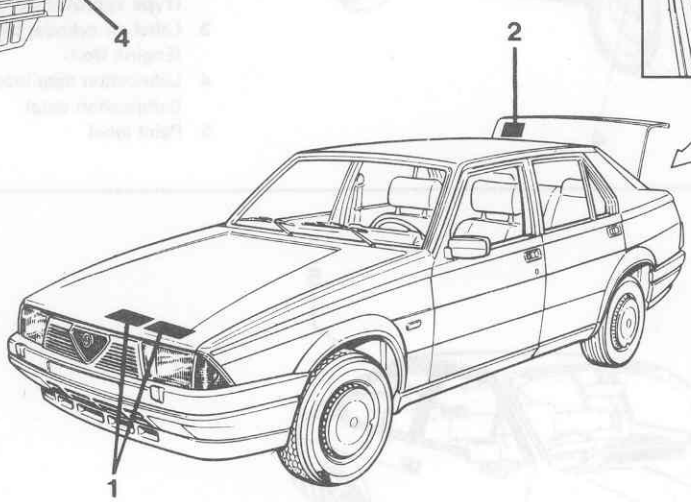






Turbodiesel



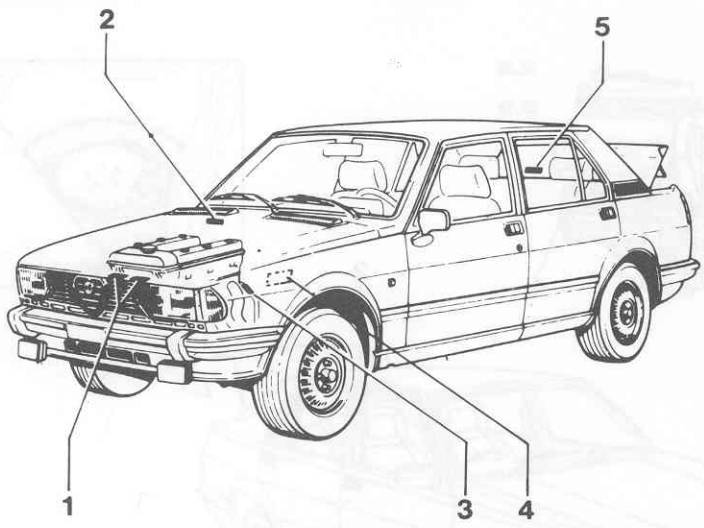


1 Identification label (Identification No. and Type approval No.)
2 Paint label
3 Luggage compartment floor label (Type approval No. and serial No.)
4 Label on cylinder block LH rear side
5 Injection pump identification label (Turbo diesel version only)

IDENTIFICATION LABELS

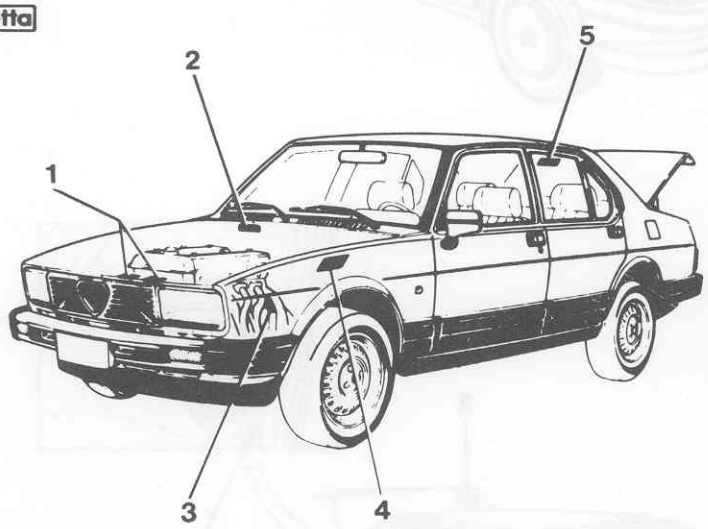
(Except Switzerland, Sweden, Australia)

Giulietta



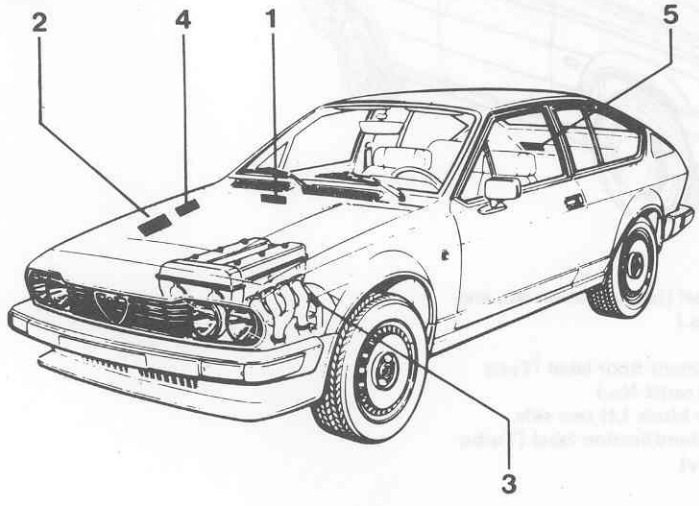
1 Identification label
(Identification No. and Type approval No.)
2 Label on scuttle
(Type approval No. and serial No.)
3 Label on cylinder block LH rear side
(Engine No.)
4 Lubrication data label
(Lubrication data)
5 Paint label

Alfetta



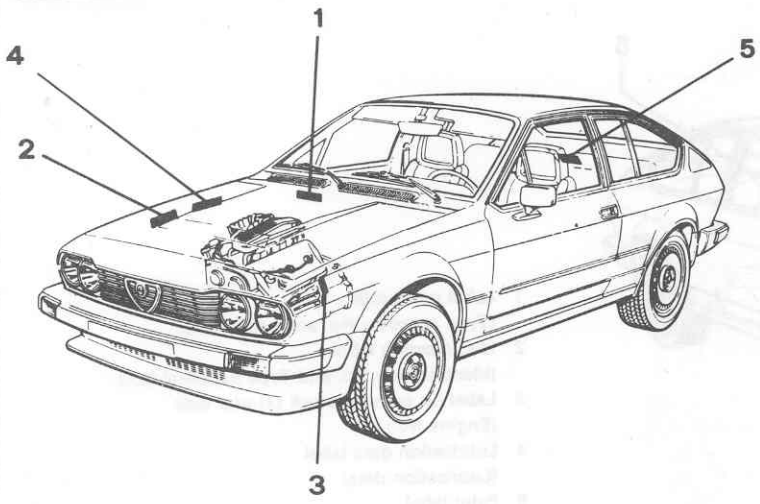
1 Identification label
(Identification No. and Type approval No.)
2 Label on scuttle
(Type approval No. and serial No.)
3 Label on cylinder block LH rear side
(Engine No.)
4 Lubrication data label
(Lubrication data)
5 Paint label

GTV 2.0



1 Label on scuttle
(Type approval No. and serial No.)
2 Identification label
(Identification No. and Type approval No.)
3 Label on cylinder block LH rear side
(Engine No.)
4 Lubrication data label
(Lubrication data)
5 Paint label

GTV6 2.5

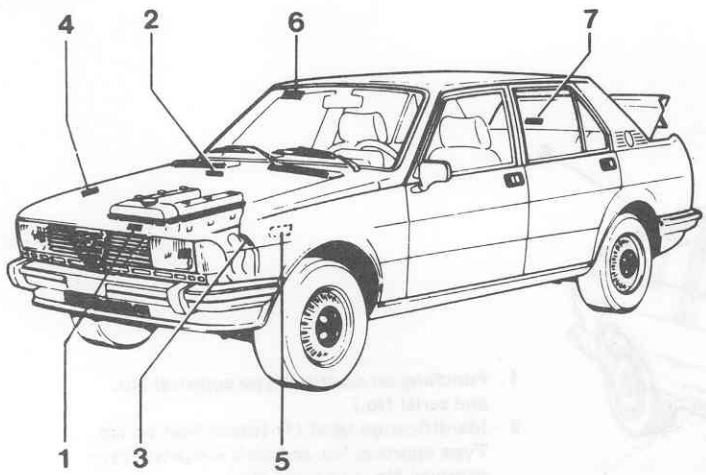


1 Punching on scuttle (Type approval No. and serial No.)
2 Identification label (Identification No., Type approval No. and car's weights)
3 Punching on cylinder block LH rear side (Engine No.)
4 Lubrication data label (Lubrication data)
5 Paint label

IDENTIFICATION LABELS

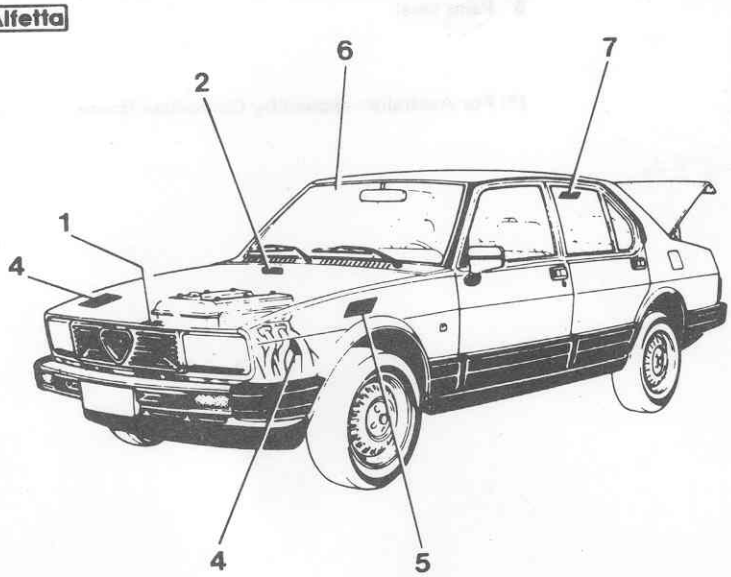
(Switzerland, Sweden, Australia)

Giulietta



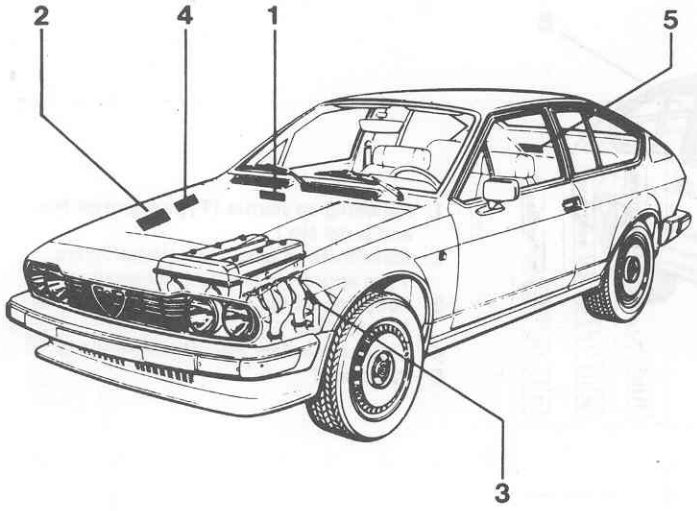
1 Identification label (Identification No. and Type approval No.)
2 Label on scuttle (Type approval No. and serial No.)
3 Label on cylinder block LH rear side (Engine No.)
4 Engine and exhaust emissions regulations
5 Lubrication data label (Lubrication data)
6 Plate affixed to passenger side sun visor (Running in instructions)
7 Paint label

Alfetta



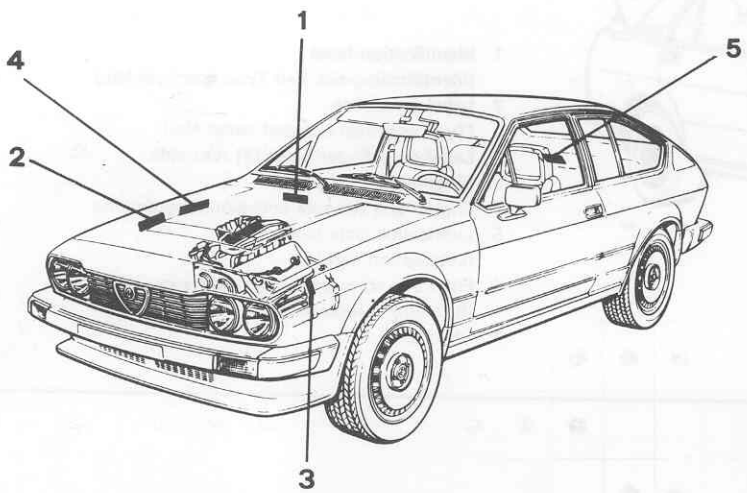
1 Identification label (Identification No. and Type approval No.)
2 Label on scuttle (Type approval No. and serial No.)
3 Label on cylinder block LH rear side (Engine No.)
4 Engine and exhaust emissions regulations
5 Lubrication data label (Lubrication data)
6 Plate affixed to passenger side sun visor (Running in instructions)
7 Paint label

GTV 2.0



1 Label on scuttle
(Type approval No. and serial No.)
2 Identification label
(Identification No. and Type approval No.)
3 Label on cylinder block LH rear side
(Engine No.)
4 Lubrication data label
(Lubrication data)
5 Paint label

GTV 6 2.5



1 Punching on scuttle (Type approval No. and serial No.)
2 Identification label (*) (Identification No., Type approval No. and car's weights) (Type approval No. and serial No.)
3 Punching on cylinder block LH rear side (Engine No.)
4 Lubrication data label (Lubrication data)
5 Paint label

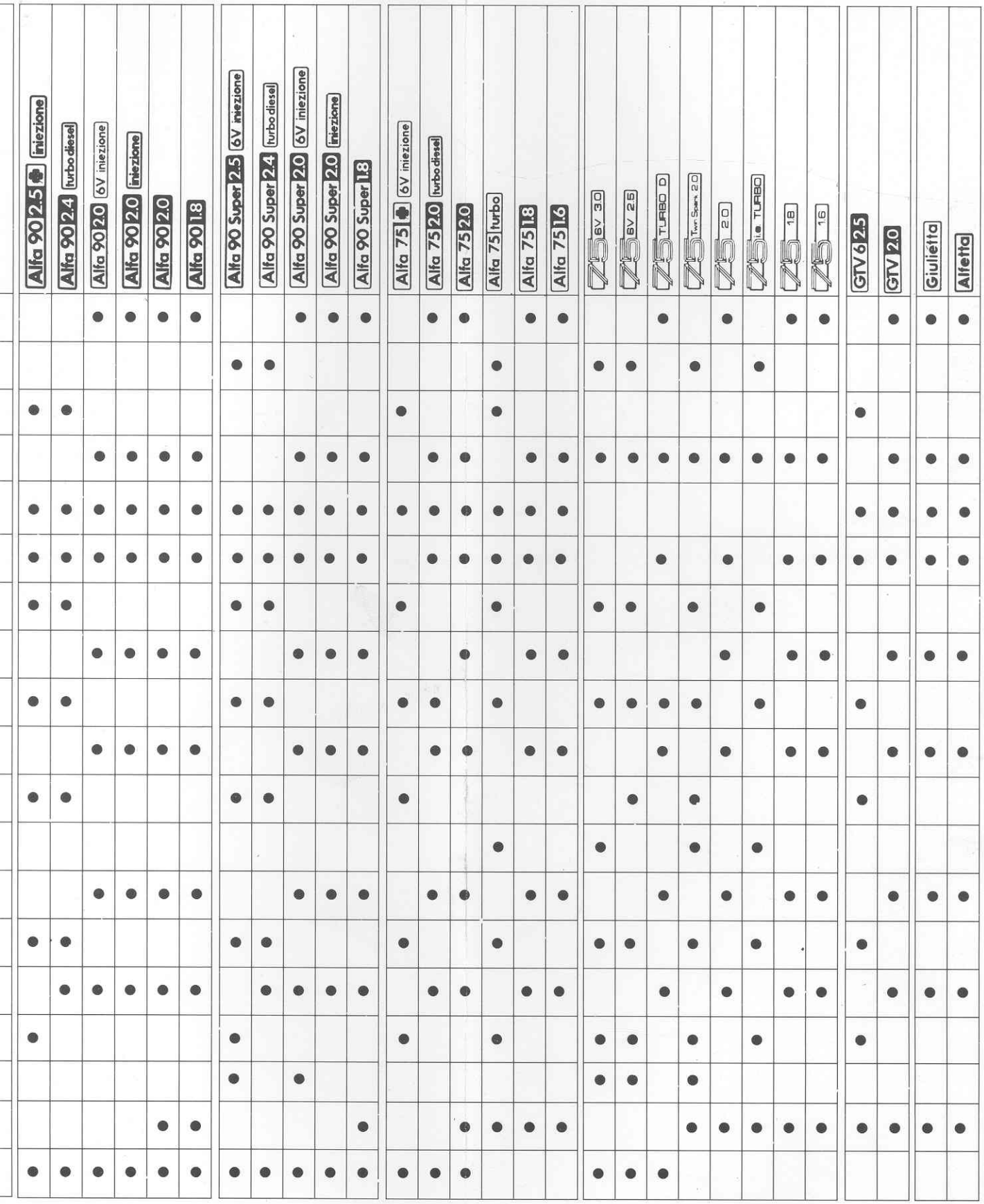
(*) For Australia : applied by Consociate House

Unit	Structural features of the units	Alfa 90 2.5 injezione	Alfa 90 2.4 turbo diesel	Alfa 90 2.0 6V iniezione	Alfa 90 2.0 iniezione	Alfa 90 2.0	Alfa 90 1.8	Alfa 90 Super 2.5 6V iniezione	Alfa 90 Super 2.4 turbo diesel	Alfa 90 Super 2.0 6V iniezione	Alfa 90 Super 2.0 iniezione	Alfa 90 Super 1.8	Alfa 75 6V iniezione	Alfa 75 2.0 turbo diesel	Alfa 75 2.0	Alfa 75 turbo	Alfa 75 1.8	Alfa 75 1.6	75 6V 3.0	75 6V 2.5	75 TURBO D	75 Twin Spark 2.0	75 2.0	75 1.8 TURBO	75 1.8	75 1.6	GTV 6 2.5	GTV 2.0	Giulietta	Alfetta
12	Single-plate clutch with "pushed" diaphragm spring			●	●	●	●			●	●	●		●	●		●	●			●		●		●	●		●	●
12	Single-plate clutch with "drawn" diaphragm spring (external control same as double-plate clutch)							●	●							●			●	●		●		●					
12	Double-plate clutch	●	●										●			●											●			
13	Intermediate flange with skew ball bearings			●	●	●	●			●	●	●		●	●		●	●	●	●	●	●	●	●	●	●		●	●	●
13	Intermediate flange with roller ball compound bearings	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●									●	●	●	●
13	Pinion underhead bearing, premodification	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●			●		●		●	●	●	●	●	●
13	Pinion underhead bearing (without retainer ring), modified	●	●					●	●				●			●			●	●		●		●						
15	Propeller shaft for low torques			●	●	●	●			●	●	●			●		●	●					●		●	●		●	●	●
15	Propeller shaft for high torques	●	●					●	●				●	●		●			●	●	●	●		●			●			
17	Two-side pinion differential			●	●	●	●			●	●	●		●	●		●	●			●		●		●	●		●	●	●
17	Four-side pinion differential	●	●					●	●				●							●		●					●			
17	Four-side pinion limited slip differential															●			●			●		●						
17	Axle shafts without spacers			●	●	●	●			●	●	●		●	●		●	●			●		●		●	●		●	●	●
17	Axle shafts with spacers	●	●					●	●				●			●			●	●		●		●			●			
22	Front brake discs, non-self ventilated		●	●	●	●	●		●	●	●	●		●	●		●	●			●		●		●	●		●	●	●
22	Front brake discs, self ventilated	●						●					●			●			●	●		●		●			●			
22	(ABS) MARK II wheel antilock system (optional)							●		●									●	●		●								
23	Mechanical steering					●	●					●			●	●	●	●				●	●	●	●	●	●	●	●	●
23	Power steering	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●									

USE OF UNITS IN

Unit	Structural features of the units	Alfa 90 2.5 iniezione	Alfa 90 2.4 turbo diesel	Alfa 90 2.0 6V iniezione	Alfa 90 2.0 iniezione	Alfa 90 2.0	Alfa 90 1.8	Alfa 90 Super 2.5 6V iniezione	Alfa 90 Super 2.4 turbo diesel	Alfa 90 Super 2.0 6V iniezione	Alfa 90 Super 2.0 iniezione	Alfa 90 Super 1.8	Alfa 75 6V iniezione	Alfa 75 2.0 turbo diesel	Alfa 75 2.0	Alfa 75 turbo	Alfa 75 1.8	Alfa 75 1.6	3 6V 3.0
12	Single-plate clutch with ''pushed'' diaphragm spring			●	●	●	●			●	●	●		●	●		●	●	
12	Single-plate clutch with ''drawn'' diaphragm spring (external control same as double-plate clutch)							●	●							●			●
12	Double-plate clutch	●	●										●			●			
13	Intermediate flange with skew ball bearings			●	●	●	●			●	●	●		●	●		●	●	●
13	Intermediate flange with roller ball compound bearings	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
13	Pinion underhead bearing, premodification	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	
13	Pinion underhead bearing (without retainer ring), modified	●	●					●	●				●			●			●
15	Propeller shaft for low torques			●	●	●	●			●	●	●			●		●	●	
15	Propeller shaft for high torques	●	●					●	●				●	●		●			●
17	Two-side pinion differential			●	●	●	●			●	●	●		●	●		●	●	
17	Four-side pinion differential	●	●					●	●				●						
17	Four-side pinion limited slip differential															●			●
17	Axle shafts without spacers			●	●	●	●			●	●	●		●	●		●	●	
17	Axle shafts with spacers	●	●					●	●				●			●			●
22	Front brake discs, non-self ventilated		●	●	●	●	●		●	●	●	●		●	●		●	●	
22	Front brake discs, self ventilated	●						●					●			●			●
22	(ABS) MARK II wheel antilock system (optional)							●		●									●
23	Mechanical steering					●	●					●			●	●	●	●	
23	Power steering	●	●	●	●	●	●	●	●	●	●	●	●	●	●				●

USE OF UNITS IN CAR



GROUP 12

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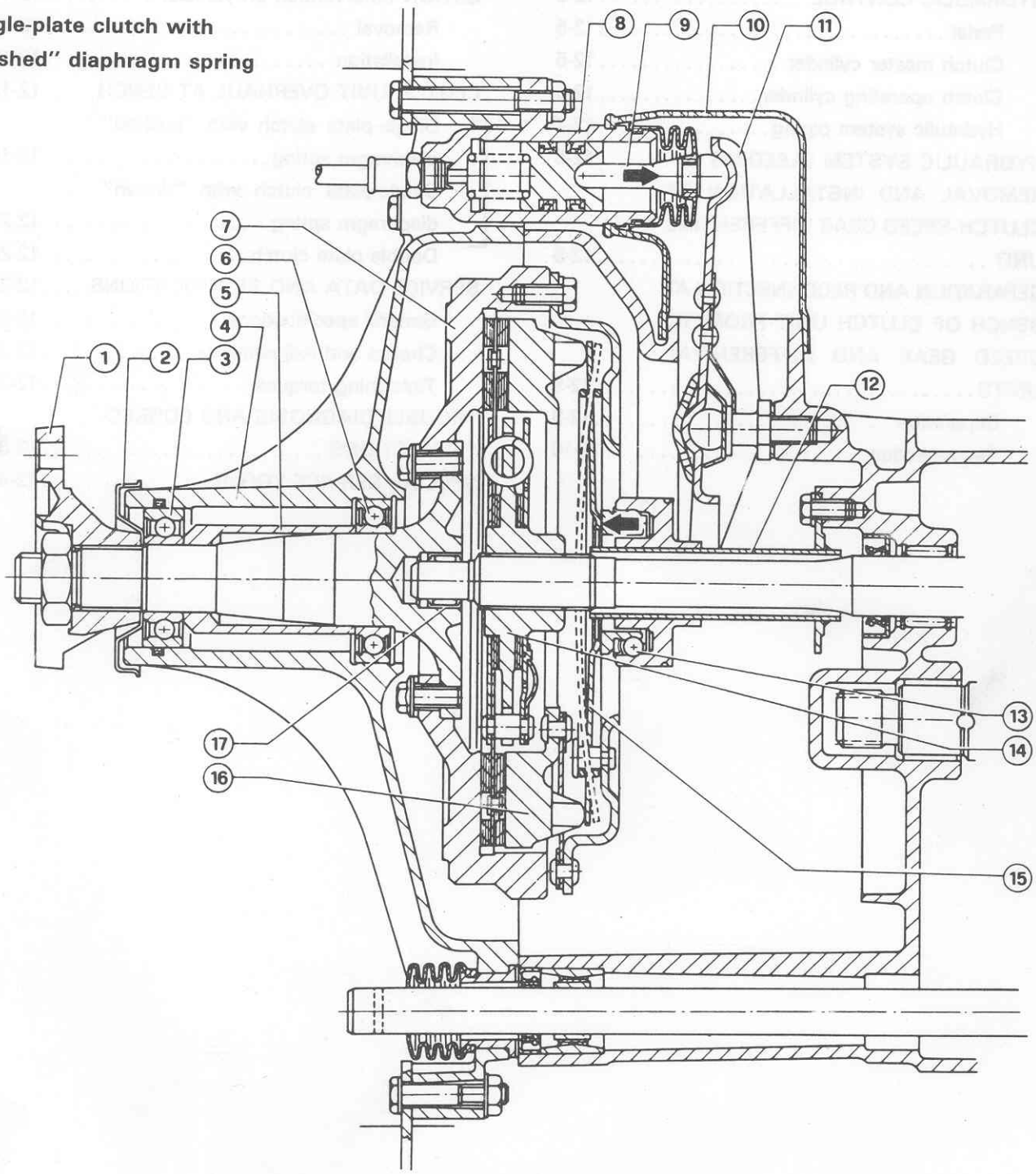
DESCRIPTION

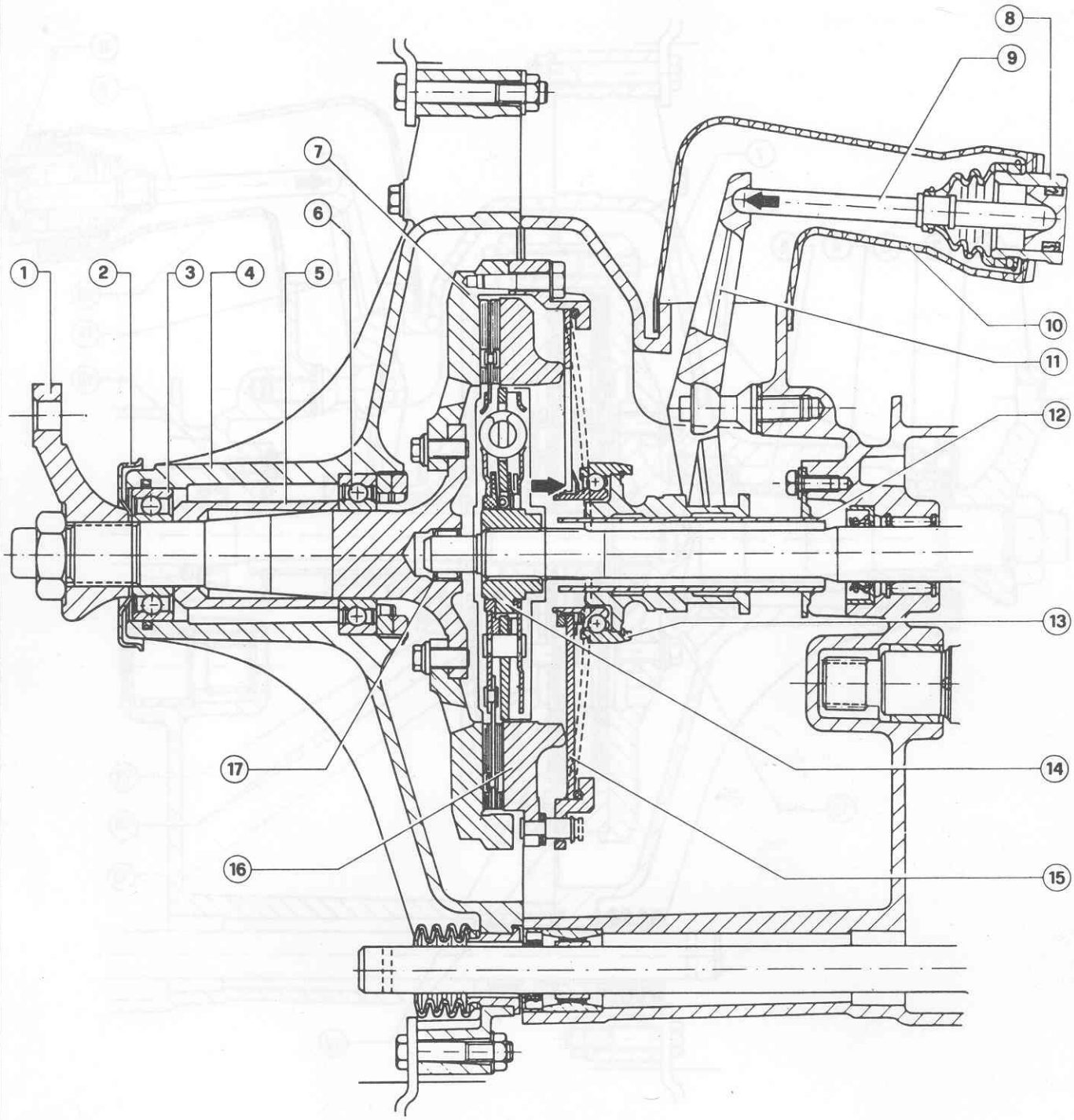
- The clutches used (single-plate or double-plate type according to motorization) are of the hydraulic control type with automatic taking-up.
- Clutch disengagement is realized by means of the special master cylinder which, operated by clutch pedal transmits the pressure increase of system (supplied by the clutch and brake fluid tank) to piston of operating cylinder (8).

  This last, through push rod (9) operates on clutch disengagement fork (11) which moves thrust bearing (13) and wins diaphragm spring (15) action with consequent backing of driven plate (plates) (14) and clutch disengagement.
- The peculiarity of the hydraulic control is that of keeping thrust bearing (13) in contact with diaphragm spring (15) of pressure plate body (16), independently of driven plate (plates) wear degree, thus realizing taking-up in an automatic and progressive way. As a consequence, no adjustment is required for the clutch.

Single-plate clutch with "pushed" diaphragm spring

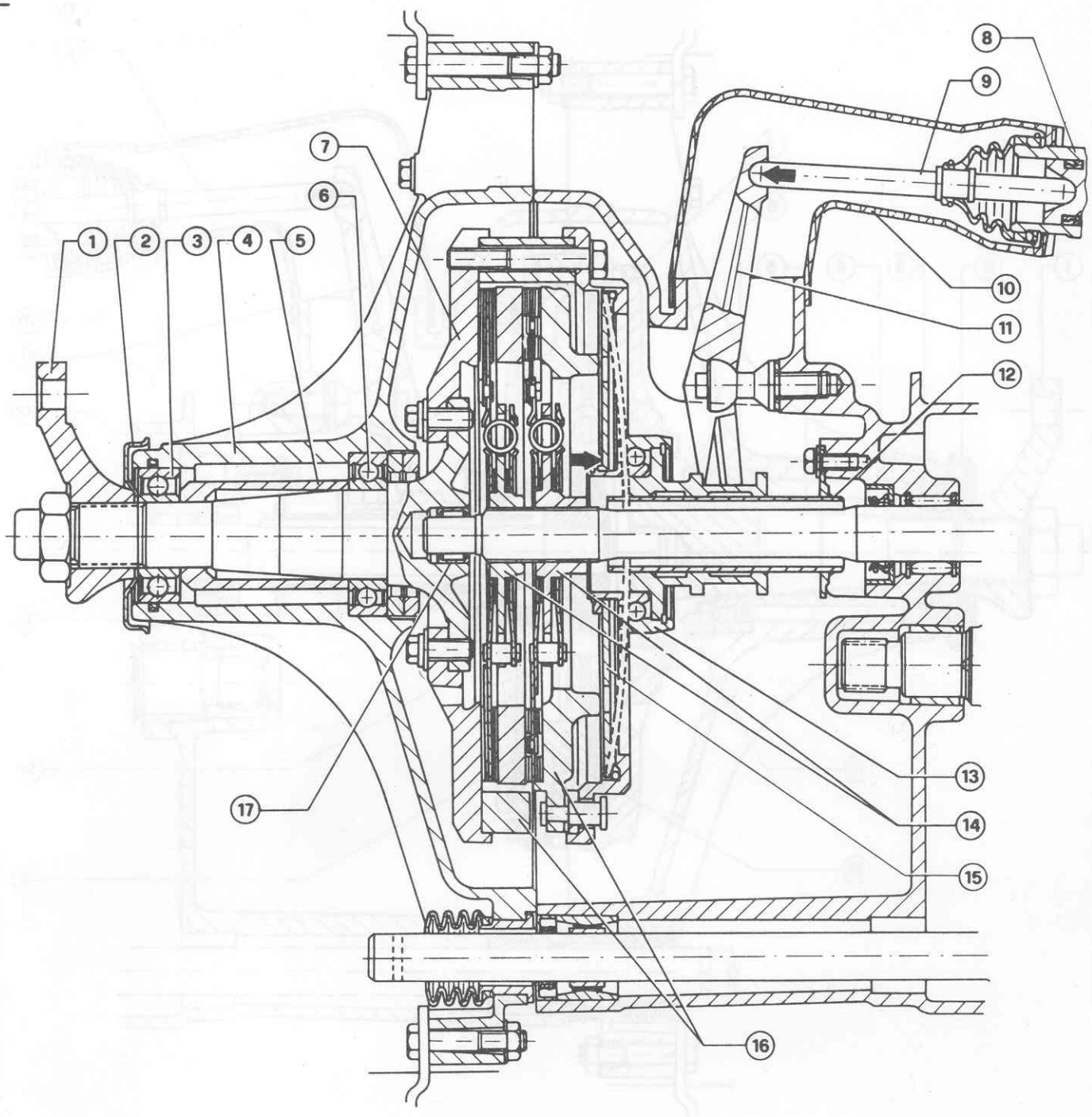


Single-plate clutch with "drawn" diaphragm spring



1 Propeller shaft connection fork
2 Dust cover
3 Clutch shaft support front bearing
4 Clutch cover
5 Spacer
6 Clutch shaft support rear bearing
7 Clutch flywheel
8 Clutch operating cylinder
9 Push rod
10 Guard
11 Clutch disengagement fork
12 Sleeve
13 Thrust bearing
14 Driven plate
15 Diaphragm spring
16 Pressure plate body
17 Speed gear main shaft centering needle bearing

Double-plate clutch



1 Propeller shaft connection fork
2 Dust cover
3 Clutch shaft support front bearing
4 Clutch cover
5 Spacer
6 Clutch shaft support rear bearing
7 Clutch flywheel
8 Clutch operating cylinder
9 Push rod
10 Guard
11 Clutch disengagement fork
12 Sleeve
13 Thrust bearing
14 Driven plates
15 Diaphragm spring
16 Pressure plates bodies
17 Speed gear main shaft centering needle bearing

HYDRAULIC CONTROL

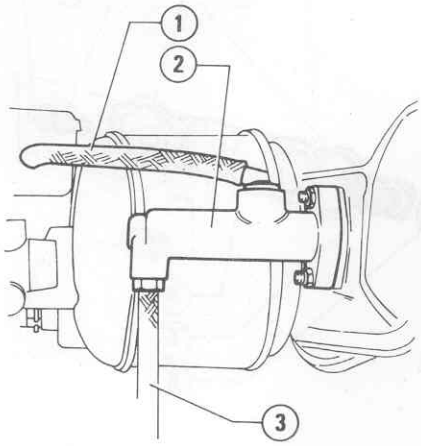
PEDAL

For clutch pedal removal procedure, refer to Group 22 - Front and Rear Brakes - Pedals - Removal.

CLUTCH MASTER CYLINDER

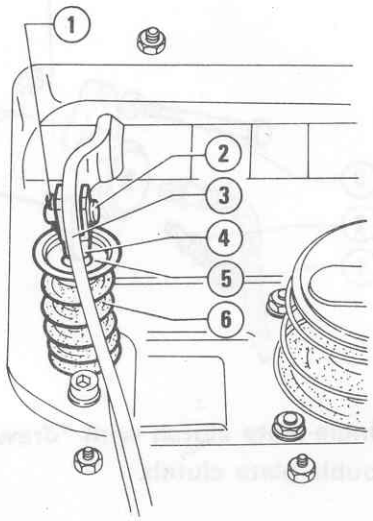
REMOVAL

1. Operating from engine compartment, remove plug from brake and clutch system supply tank, then drain fluid until level is below master cylinder supply hose.
2. Unscrew the screws securing windshield washer liquid tank to body and move tank sideways.
3. Detach hose (1) from clutch master cylinder (2).
4. Unscrew union of pipe (3) and disconnect it from master cylinder.



1 Master cylinder supply hose
2 Clutch master cylinder
3 Clutch control pipe

5. Operating from vehicle inside, remove split pin (1) and withdraw pin (2) then detach pedal (3) from fork (4).
6. Remove cup (5) and recover spring (6).



1 Split pin
2 Pin
3 Clutch pedal
4 Clutch master cylinder control fork
5 Cup
6 Spring

7. Unscrew the two screws securing master cylinder to pedals casing and remove master cylinder by withdrawing it from engine compartment.

INSTALLATION

To install clutch master cylinder, reverse the order of removal and comply with the following.

- Tighten to the prescribed torques

(T): **Tightening torques**
Clutch hidraulic system pipe unions
8 to 10 N·m
(0.8 to 1 kg·m
5.8 to 7.2 ft·lb)

Clutch hydraulic system hose unions
10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

- Restore tank level making use of the fluid prescribed.

Clutch hydraulic system fluid
ATE "Blau S"
or
AGIP Brake Fluid Super HD
or
IP Auto Fluid FR

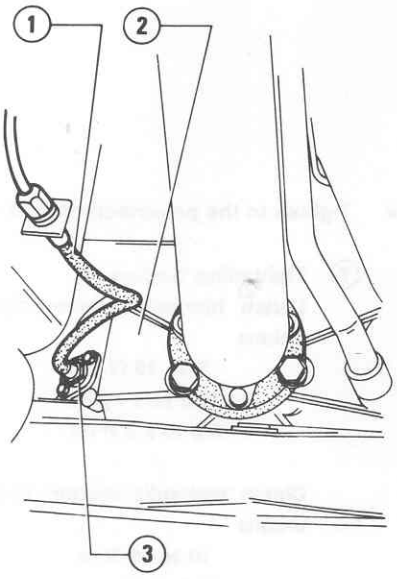
- Carry out air bleeding from clutch hydraulic system (refer to: "Hydraulic System Bleeding").

CLUTCH OPERATING CYLINDER

REMOVAL (INTERVENTION ON VEHICLE)

Single-plate clutch with "pushed" diaphragm spring

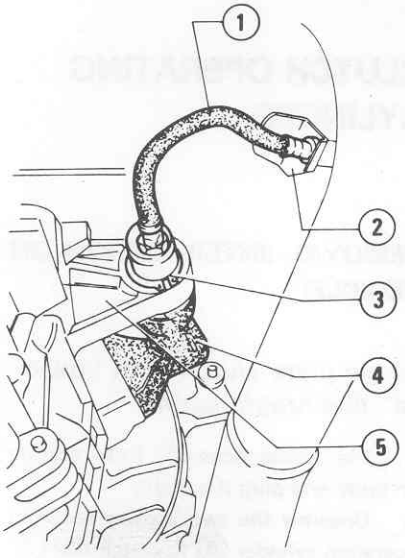
1. Disconnect hose (1) from bracket on body and plug it suitably.
2. Unscrew the two screws securing operating cylinder (3) to clutch box (2), then remove it together with guard.



1 Operating cylinder control hose
2 Clutch box
3 Clutch operating cylinder

Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

1 Disconnect hose (1) from bracket on body and plug it suitably.
2. Remove ring (3) on operating cylinder body.
3. Remove guard (4) and withdraw clutch control fork.
4. Remove operating cylinder from bracket (5).

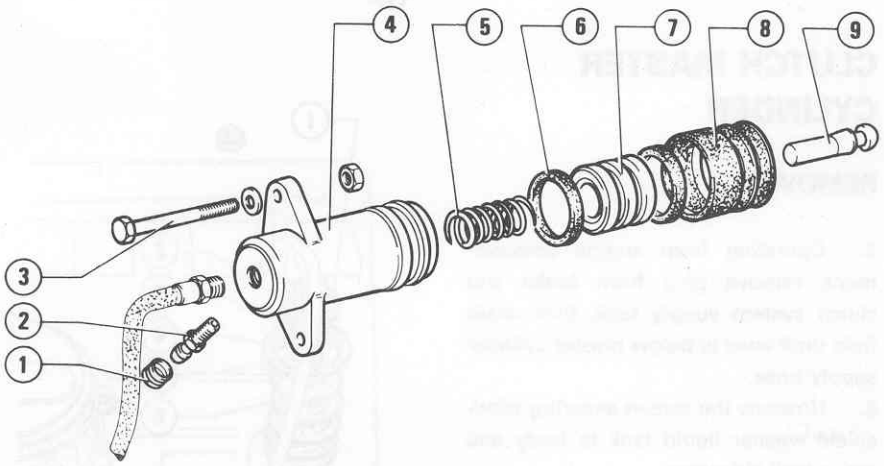


1 Clutch hose
2 Bracket
3 Retaining ring
4 Guard
5 Support bracket

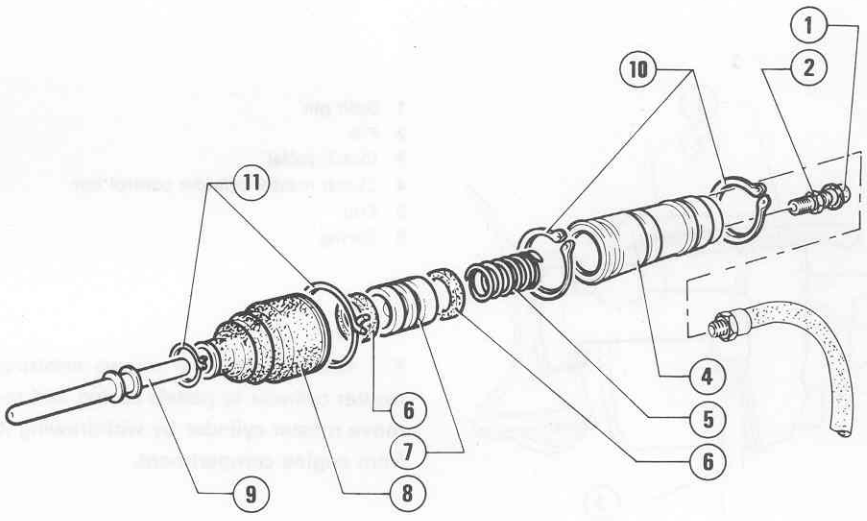
DISASSEMBLY

1. Remove the following items from operating cylinder (4): push rod (9) with guard (8), piston (7) with seal rings (6), and spring (5).
2. Withdraw push rod from guard and remove bleeder screw (2).

Single-plate clutch with "pushed" diaphragm spring



Single-plate clutch with "drawn" diaphragm spring and double-plate clutch.



1 Bleeder screw cap
2 Bleeder screw
3 Bolt securing operating cylinder to clutch cover
4 Operating cylinder
5 Spring
6 Seal ring
7 Piston
8 Guard
9 Push rod with spherical pin
10 Retaining rings
11 Securing springs

CHECKS AND INSPECTIONS

Visually check the disassembled components and replace the worn or damaged ones, supplied in the spare part kit.

CAUTION:
Wash all components of operating cylinder using suitable fluid. Do not use gasoline, kerosene or mineral oils in order not to damage the rubber parts of hydraulic system.

---

1. Check for scratches and rust on piston and inside clutch operating cylinder.
2. Check spring efficiency and integrity of seal rings.
3. Verify that bleeder hole is free from impurities.

REASSEMBLY

Reassemble the clutch operating cylinder by reversing the order of disassembly.

INSTALLATION

For installation, reverse the order of removal and comply with the following.

- Tighten the hydraulic system hose union to support bracket pipe to the prescribed torque.

(T): **Tightening torques**
Unions of clutch hydraulic system hoses
10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

Unions of clutch hydraulic system pipes
8 to 10 N·m
(0.8 to 1 kg·m
5.8 to 7.2 ft·lb)

- Carry out system bleeding (refer to: "Hydraulic System Bleeding").

HYDRAULIC SYSTEM PIPING

CHECKS AND INSPECTIONS

Visually check system piping integrity. Replace damaged parts. In the event of fluid leaks from unions, if due to loosening, tighten them and, if necessary, replace the damaged components.

DISASSEMBLY

1. Remove the top-up plug on supply tank and drain the fluid by means of a syringe.
2. Loosen securing nuts of pipe connecting master cylinder to clutch operating cylinder; then remove pipe.

REASSEMBLY

1. Reassemble piping on vehicle by reverse the order of disassembly.
2. Tighten unions to the prescribed torque.

(T): **Tightening torques**
Unions of clutch hydraulic system hoses
10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

Unions of clutch hydraulic system pipes
8 to 10 N·m
(0.8 to 1 kg·m
5.8 to 7.2 ft·lb)

3. Restore correct fluid level into tank, then bleed air from hydraulic system (refer to: "Hydraulic System Bleeding").

HYDRAULIC SYSTEM BLEEDING

CAUTION:
The clutch hydraulic system must be bled whenever hydraulic system has been disconnected or air has entered it.

Carefully comply with the following procedure:

1. Remove plug of brake and clutch hydraulic system supply tank and, if necessary, restore level with the prescribed fluid.

Fluid for clutch hydraylic system
ATE "Blau S"
or
AGIP Brake Fluid Super HD
or
IP Auto Fluid FR

2. Remove bleeder screw cap on operating cylinder and fit a hose on it dipping hose ends into a transparent tank fitted with system fluid.

3. At the same time, loosen bleeder screw and press clutch pedal up to end of travel, then release it slowly; repeat this operation until all possible air bubbles have been ejected.

4. With clutch pedal pressed to end of travel, close the bleeder screw, remove hose and install cap.

5. Restore fluid level into tank and install the related plug.

CAUTION:
a. **Do not re-use the hydraulic fluid drained during bleeding operations.**
b. **Operate carefully in order to prevent hydraulic fluid from getting in contact with paint, with consequent damage of paint itself.**
c. **During bleeding operation, fluid level in the tank, must be kept above the min. mark.**

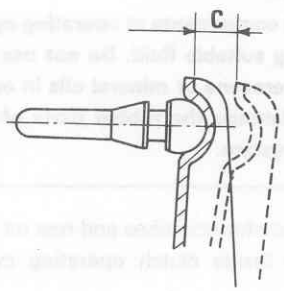
6. Verify that clutch disengagement and speeds engagement takes place properly.

If necessary, verify travel of operating cylinder push rod.

This travel can not be adjusted and depends on the volume of fluid moved by the clutch master cylinder piston.

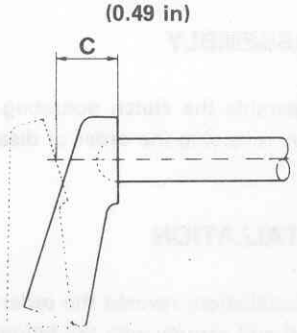
Single-plate with "pushed" diaphragm spring:

C = 11 to 12.7 mm
(0.43 to 0.50 in)



Single-plate with "drawn" diaphragm spring:

C = 12.5 mm
(0.49 in)



7. If **"c"** stroke value is not as specified, check efficiency of control hydraulic system.

REMOVAL AND INSTALLATION OF CLUTCH-SPEED GEAR-DIFFERENTIAL UNIT

Refer to: Group 17 -"Removal and Installation of Clutch Speed Gear-Differential Unit."

SEPARATION AND RECONNECTION AT BENCH OF CLUTCH UNIT FROM/TO SPEED GEAR AND DIFFERENTIAL UNITS

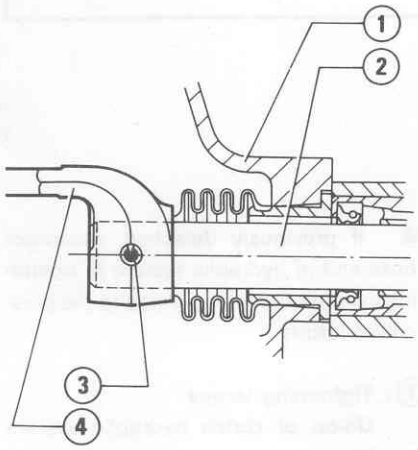
SEPARATION

Set the clutch-speed gear-differential unit on a suitable turning stand (refer to: Group 17 -"Removal and Installation of Clutch-Speed Gear-Differential Unit") then proceed to clutch unit removal operation.

SINGLE-PLATE CLUTCH WITH "PUSHED" DIAPHRAGM SPRING

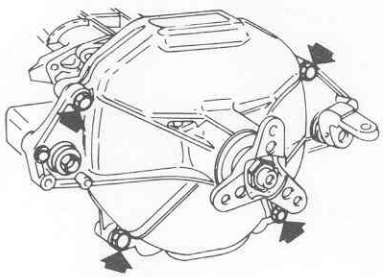
1. Clutch unit disassembly.

a. Remove pin (3) from rod (2) and withdraw lever (4).

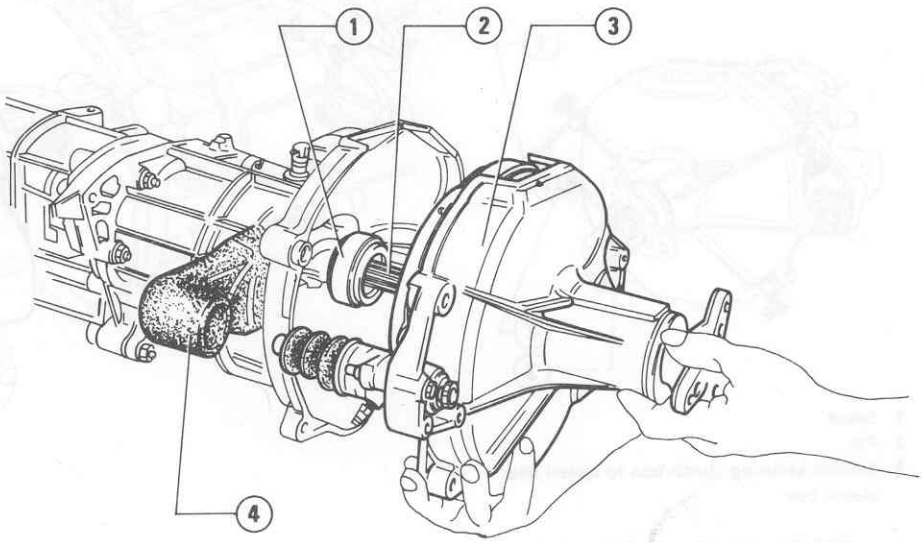


1 Clutch box
2 Speed gear engagement and selection rod
3 Spring pin
4 Lever

b. Loosen and remove the screws securing clutch unit to clutch-speed gear casing.



c. Withdraw clutch unit (3) from shaft (2) and remove cap (4).

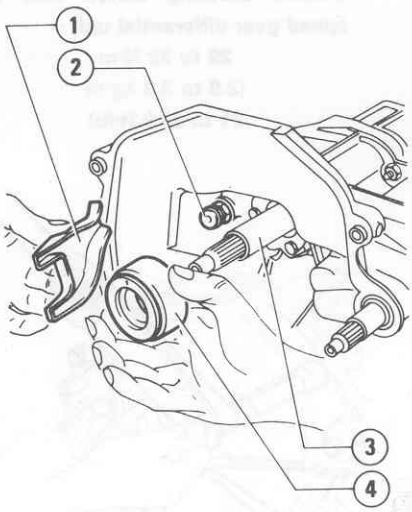


1 Thrust bearing
2 Main shaft
3 Clutch unit
4 Fork control cylinder cap

2. Fork and thrust bearing

a. Withdraw thrust bearing (4) from sleeve (3).

b. Remove fork (1) by releasing it from pin (2).



1 Control fork
2 Spherical pin
3 Guide sleeve
4 Thrust bearing

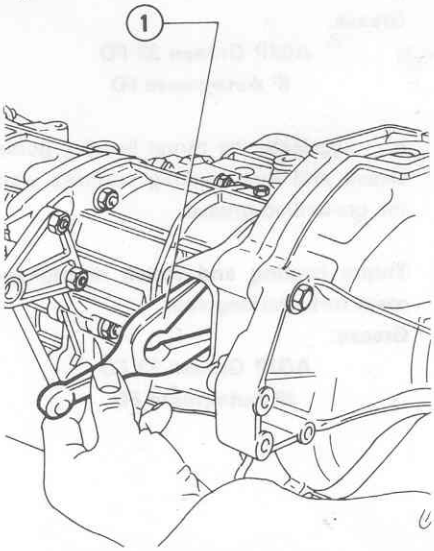
SINGLE-PLATE CLUTCH WITH "DRAWN" DIAPHRAGM SPRING AND DOUBLE-PLATE CLUTCH

DOUBLE-PLATE CLUTCH

1. Clutch unit disassembly.

a. Remove clutch operating cylinder from clutch-speed gear casing.

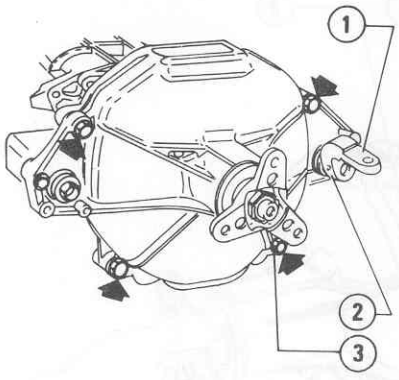
b. Remove fork (1) operating as per figure.



1 Clutch disengagement fork

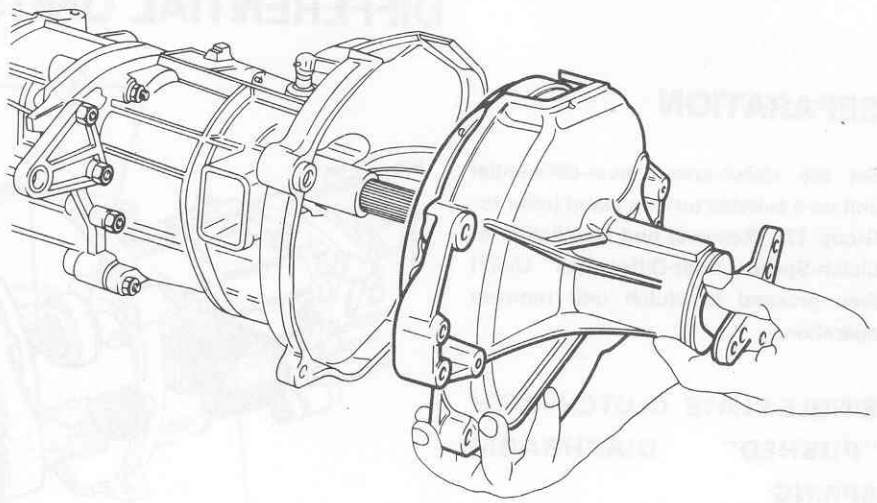
c. Remove pin (2) securing lever (1) to speeds engagement and selection rod.

d. Loosen and remove the four screws (3).



1 Lever
2 Pin
3 Screws securing clutch box to speed gear-clutch box

e. Withdraw clutch unit from shaft.



RECONNECTION

To reassemble clutch unit to speed gear-differential unit, reverse the order of disassembly and comply with the following:

a. **Lubricate** spherical pin on clutch operating cylinder with the prescribed grease.

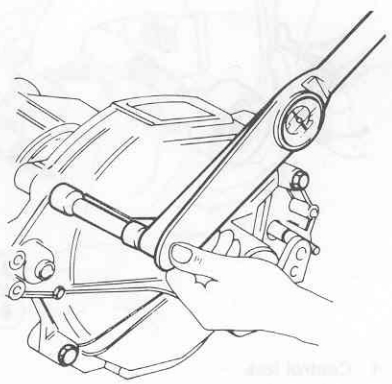
Clutch disengagement fork spherical pin
Grease:
AGIP Grease 33 FD
IP Autogrease FD

b. **Lubricate** the thrust bearing guide sleeve and fork working surfaces with the prescribed grease.

Thrust bearing and clutch disengagement fork working seat
Grease:
AGIP Grease 33 FD
IP Autogrease FD

c. Tighten crosswise the securing screws to the prescribed torque.

(T): **Tightening torque**
Screws securing clutch unit to speed gear-differential unit
29 to 32 N·m
(2.9 to 3.3 kg·m
21 to 23.9 ft·lb)



d. If previously detached, reconnect hose end of hydraulic system to operating cylinder tightening union to the prescribed torque.

(T): **Tightening torque**
Union of clutch hydraulic system hose
10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

e. Reinstall lever on speeds engagement and selection rod, and secure it with a new securing pin.

CLUTCH UNIT REMOVAL AND INSTALLATION (Intervention on vehicle)

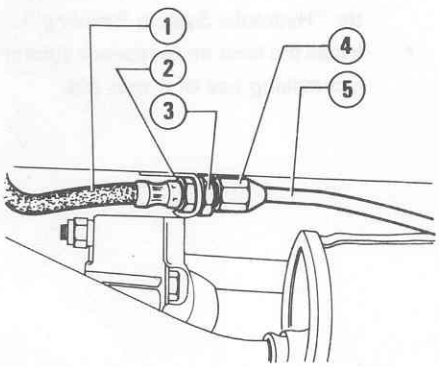
REMOVAL

Single-plate clutch with "pushed" diaphragm spring

1. Remove front and central part of exhaust system, disconnect propeller shaft from clutch shaft fork, remove speeds engagement and selection rod and disconnect isostatic control from gear lever, operating as per: Group 13 - "Outer Linkage - Speed Gear Control Assembly - Removal".

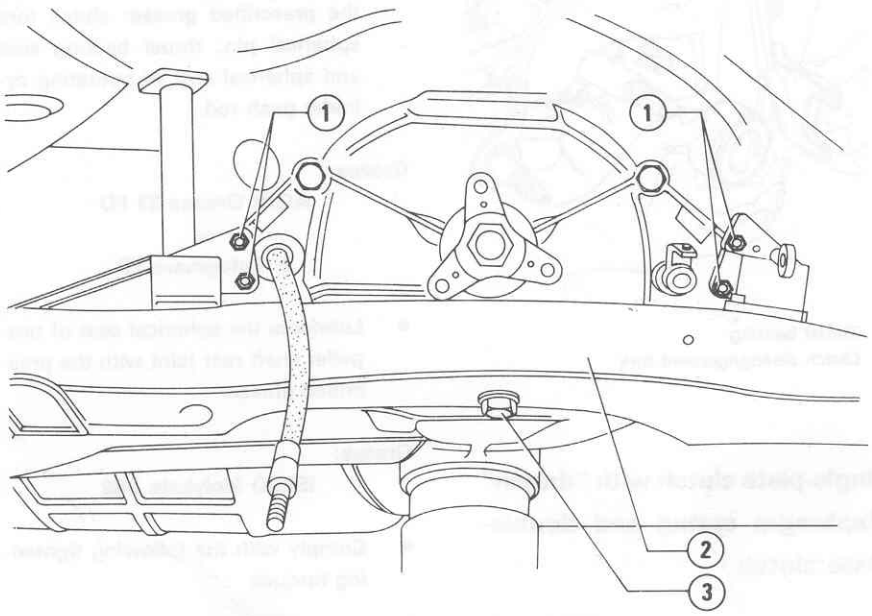
2. Unscrew union (4) disconnecting hose (1) and pipe (5) of clutch system. Plug pipe so as to prevent leaks.

3. Unscrew nut (3) and disconnect hose (1) from bracket (2).



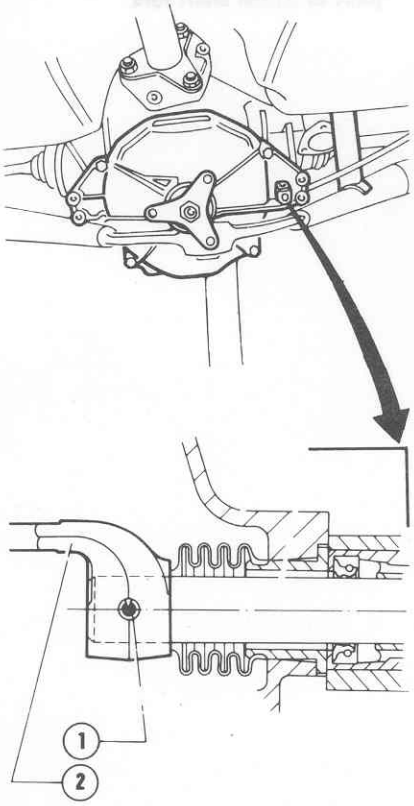
1 Hose
2 Support bracket
3 Nut securing hose to bracket
4 Pipe - hose union
5 Pipe

4. Unscrew and remove bolts (1) securing clutch-speed gear-differential unit to flexible supports on cross member (2).
Unscrew nut (3) and remove cross member.



1 Bolts securing clutch-speed gear- differential unit to supports
2 Cross member
3 Nut securing cross member

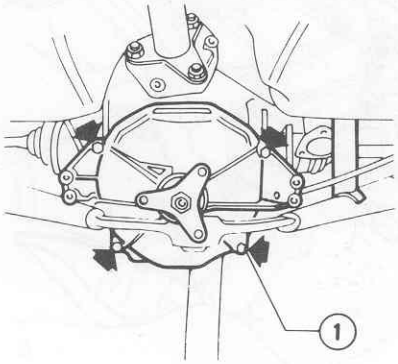
5. Withdraw pin (1) from lever (2), then remove lever.



1 Spring pin
2 Speeds control rear lever

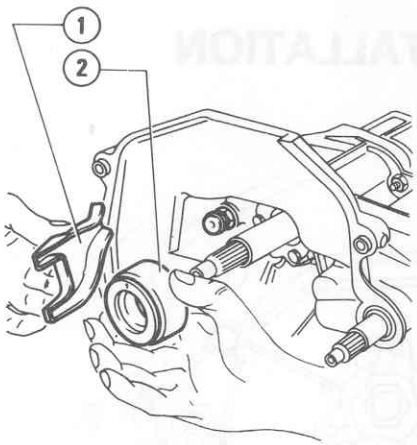
6. Remove boot from clutch operating cylinder

7. Unscrew screws (1) and remove unit from main shaft splined section.



1 Screw securing clutch unit to speed gear-differential unit

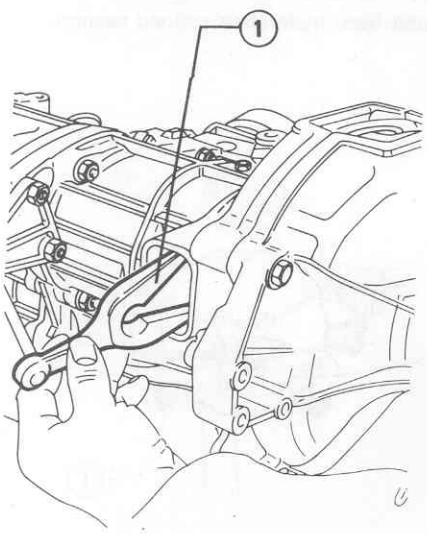
8. Withdraw bearing (1), protection sleeve and fork (2) from sleeve on shaft.



1 Thrust bearing
2 Clutch disengagement fork

Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

Proceed per the single-plate clutch with "pushed" diaphragm spring, taking care to withdraw fork (1) before removing the clutch unit.



1 Clutch disengagement fork

INSTALLATION

For installation, reverse the order of removal and comply with following:

- **Lubricate** the following items with the prescribed grease: clutch fork spherical pin; thrust bearing seat and spherical seat of operating cylinder push rod.

Grease:

AGIP Grease 33 FD
or
IP Autogrease FD

- **Lubricate** the spherical seat of propeller shaft rear joint with the prescribed grease.

Grease:

ISECO Molykote BR2

- Comply with the following tightening torques

(T): Tightening torques

— **Screws securing clutch unit to speed gear-differential unit**

29 to 32 N·m
(2.9 to 3.9 kg·m
21 to 23.9 ft·lb)

— **Screws securing propeller shaft joint to clutch shaft fork**

Single-plate clutch with "pushed" diaphragm spring

40 to 50 N·m
(4 to 5 kg·m
28.9 to 36.1 ft·lb)

Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

55 to 57 N·m
(5.6 to 5.8 kg·m
40.5 to 41.9 ft·lb)

— **Unions of clutch hydraulic system pipes**

8 to 10 N·m
(0.8 to 1 kg·m
5.8 to 7.2 ft·lb)

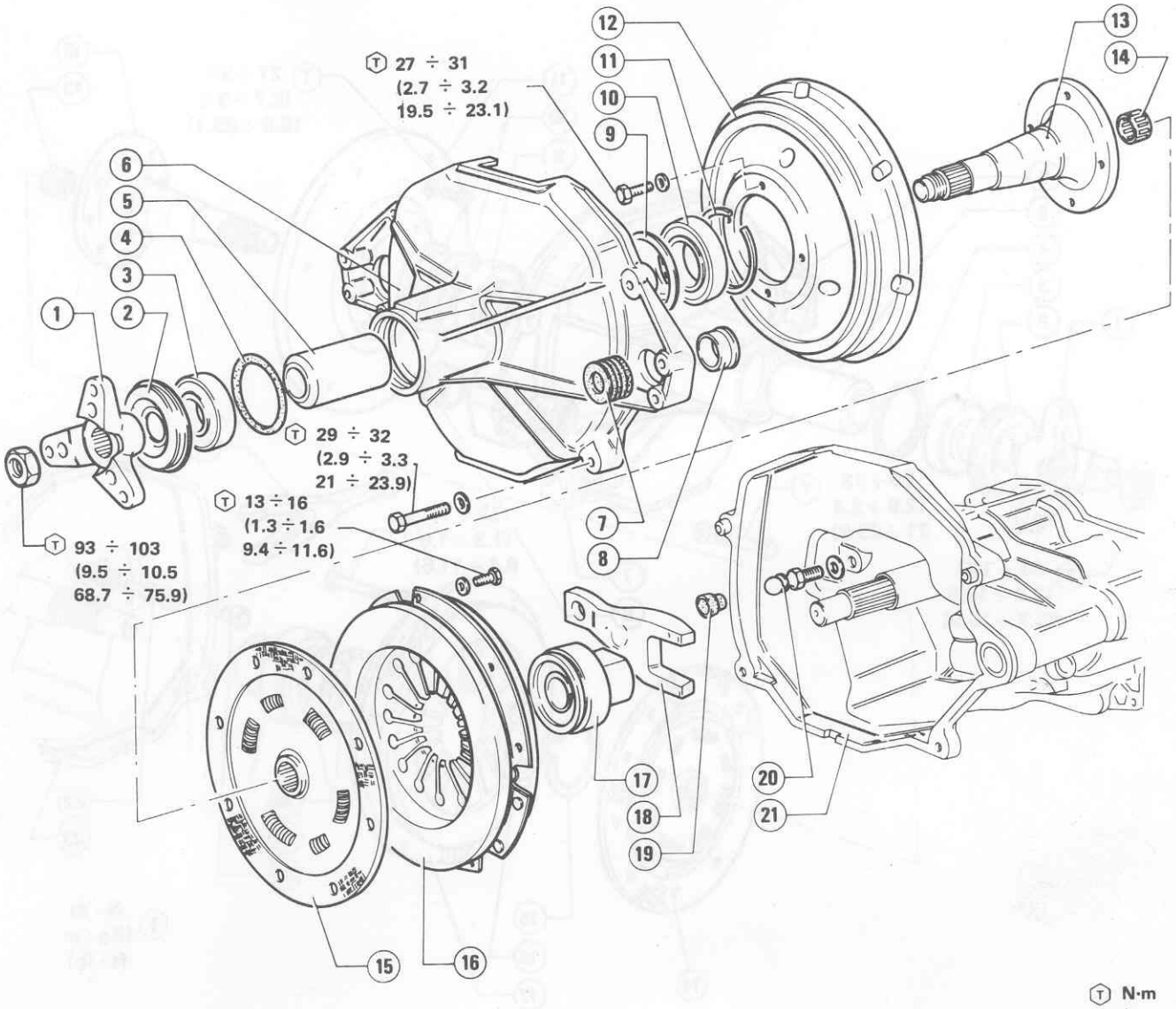
— **Unions of clutch hydraulic system hoses**

10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

- If necessary, carry out air bleeding from clutch hydraulic system (refer to: "Hydraulic System Bleeding").
- Install the lever on the speeds control rod making use of a new pin.

CLUTCH UNIT OVERHAUL AT BENCH

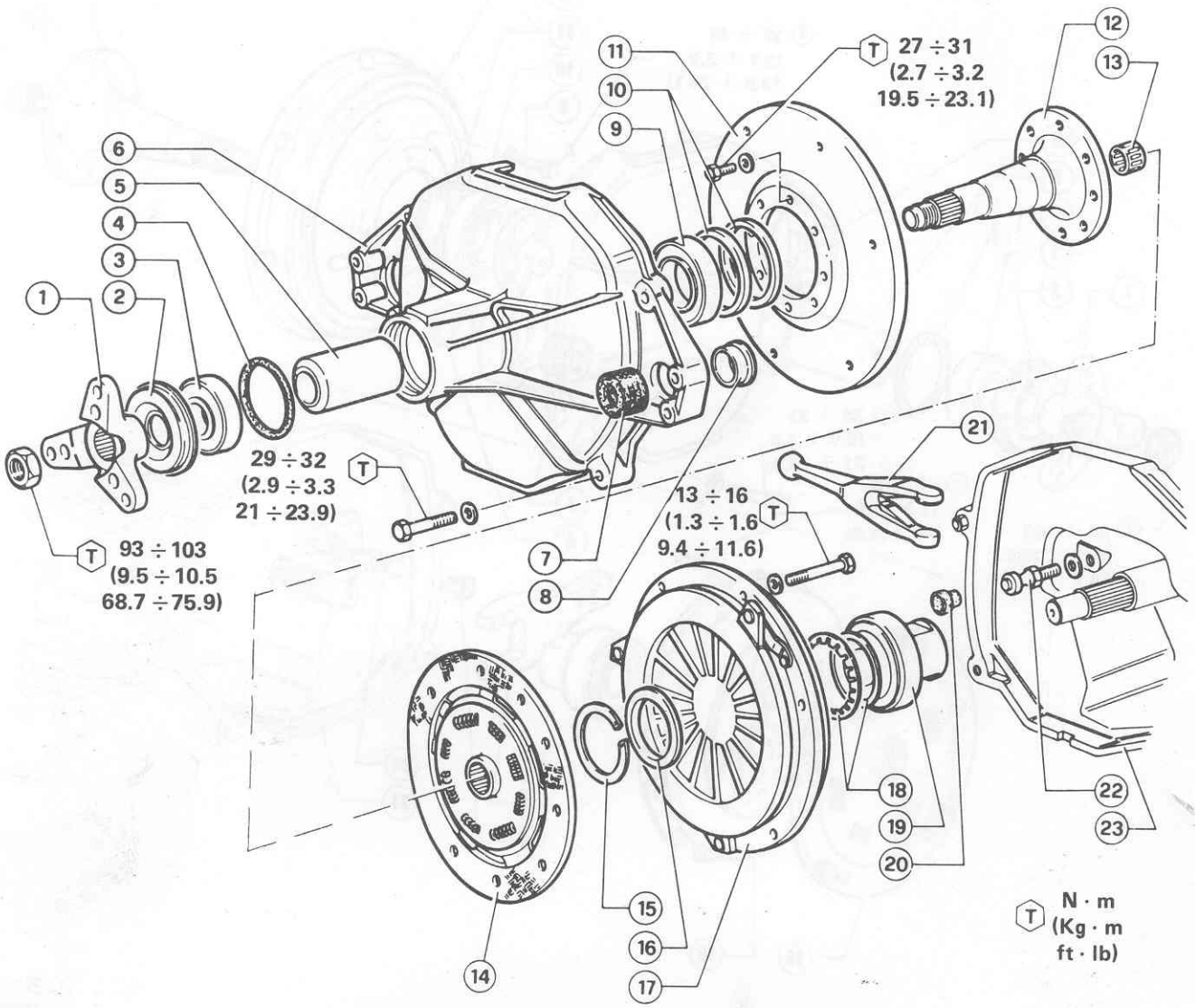
Single-plate clutch with "pushed" diaphragm spring



T N·m
(kg·m
ft·lb)

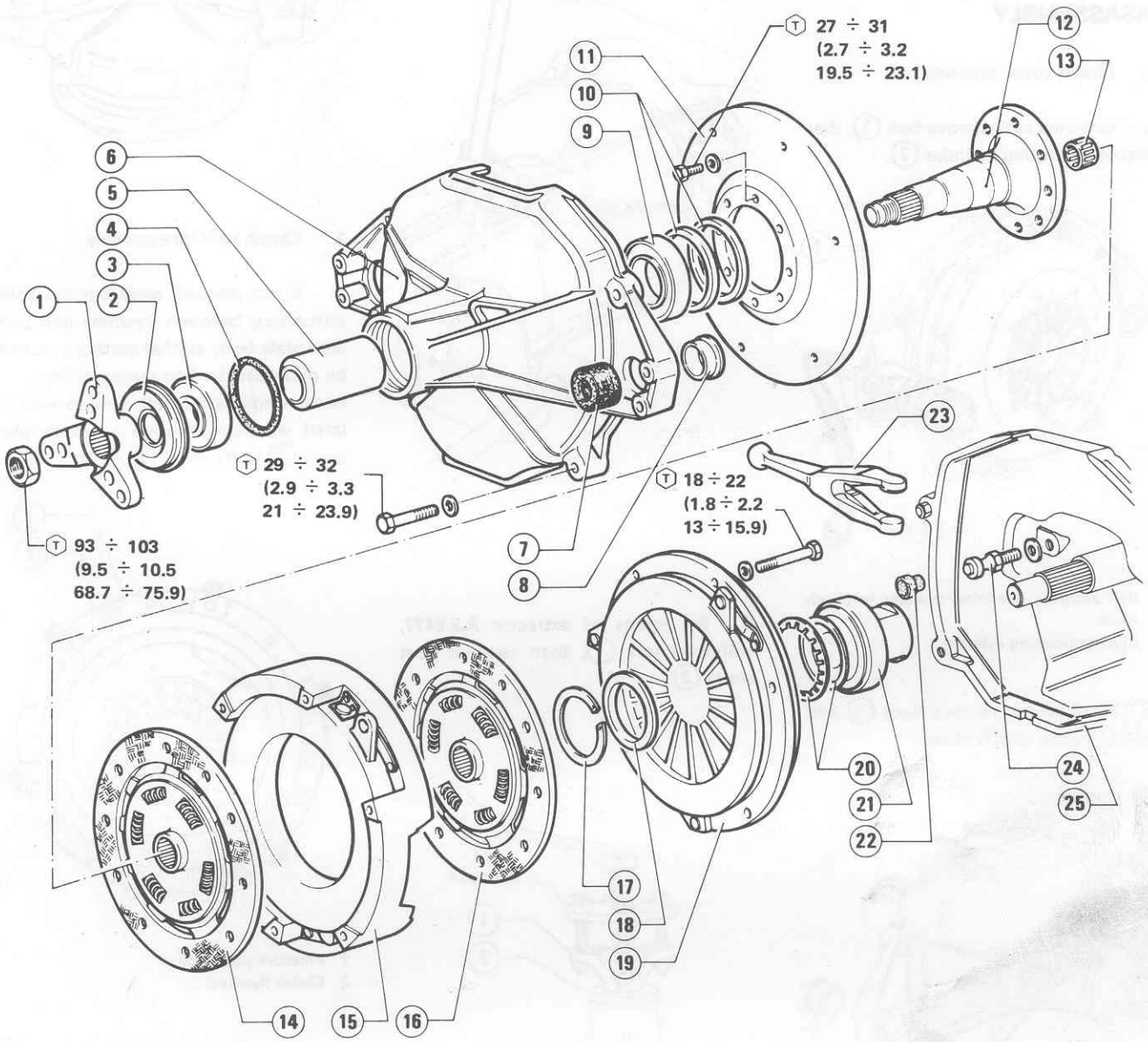
1 Propeller shaft connection fork
2 Dust cover
3 Clutch cover front bearing
4 O-ring
5 Spacer
6 Clutch cover
7 Speeds engagement and selection rod boot
8 Speeds engagement and selection rod bush
9 Shoulder washer
10 Clutch cover rear bearing
11 Rear bearing retaining ring
12 Clutch flywheel
13 Clutch shaft
14 Needle bearing
15 Clutch plate
16 Pressure plate body
17 Thrust bearing
18 Fork
19 Rubber cap on spherical pin
20 Spherical pin
21 Clutch-speed gear casing

Single-plate clutch with "drawn" diaphragm spring



1 Propeller shaft connection fork
2 Dust cover
3 Clutch cover front bearing
4 O-Ring
5 Spacer
6 Clutch cover
7 Speeds engagement and selection rod boot
8 Speeds engagement and selection rod bush
9 Clutch cover rear bearing
10 Threaded ring nuts for rear bearing securing
11 Clutch flywheel
12 Clutch shaft
13 Needle bearing
14 Clutch plate
15 Retaining ring
16 Ring
17 Pressure plate body
18 Belleville springs
19 Thrust bearing
20 Rubber cap on spherical pin
21 Fork
22 Spherical pin
23 Clutch-speed gear casing

Double-plate clutch



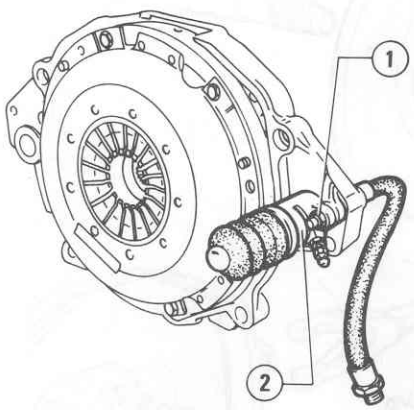
1 Propeller shaft connection fork
2 Dust cover
3 Clutch cover front bearing
4 O-Ring
5 Spacer
6 Clutch cover
7 Speeds engagement and selection rod boot
8 Speeds engagement and selection rod bush
9 Clutch cover rear bearing
10 Threaded ring nuts for rear bearing securing
11 Clutch flywheel
12 Clutch shaft
13 Needle bearing
14 Front clutch plate
15 Intermediate pressure plate body
16 Rear clutch plate
17 Retaining ring
18 Ring
19 Rear pressure plate body
20 Belleville springs
21 Thrust bearing
22 Rubber cap on spherical pin
23 Fork
24 Spherical pin
25 Clutch-speed gear casing

SINGLE-PLATE CLUTCH WITH "PUSHED" DIAPHRAGM SPRING

DISASSEMBLY

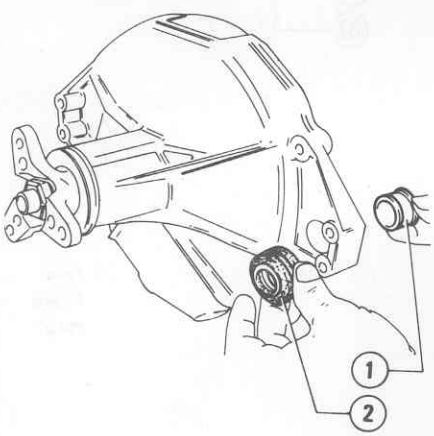
1. Clutch cover removal

a. Unscrew and remove bolt (1), then remove operating cylinder (2).



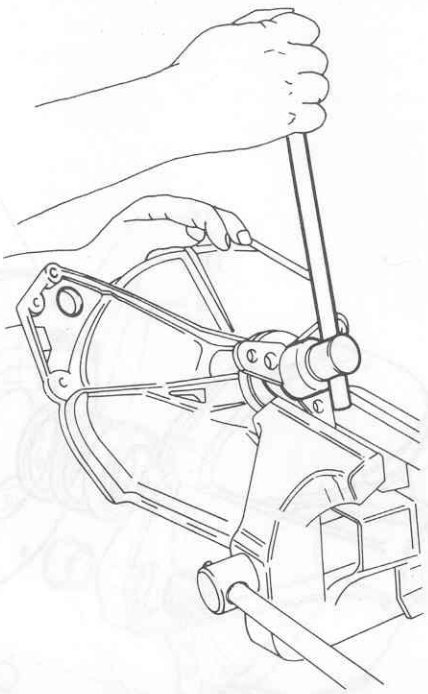
1 Bolt securing operating cylinder to clutch cover
2 Clutch operating cylinder

b. If necessary, remove boot (2) and bush (1) from clutch cover.

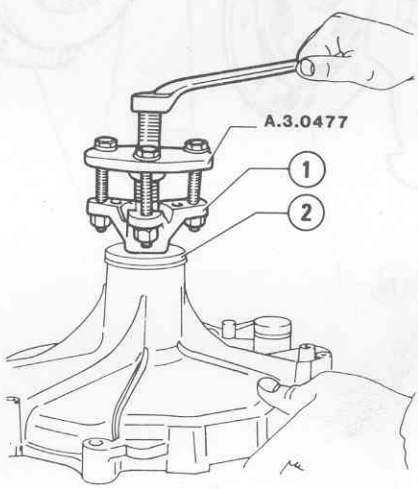


1 Speeds engagement and selection rod bush
2 Speed engagement and selection rods boot

c. Secure clutch cover on vice fitted with jaws, as per figure.
Release and remove the nut securing propeller shaft fork.

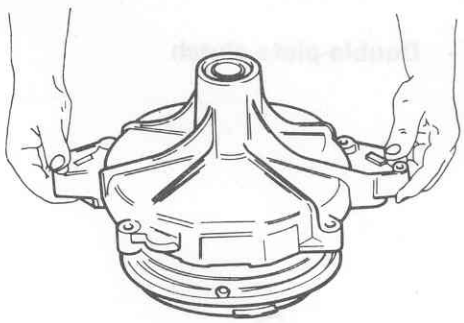


d. By means of extractor **A.3.0477**, withdraw fork (1), then remove dust cover (2).



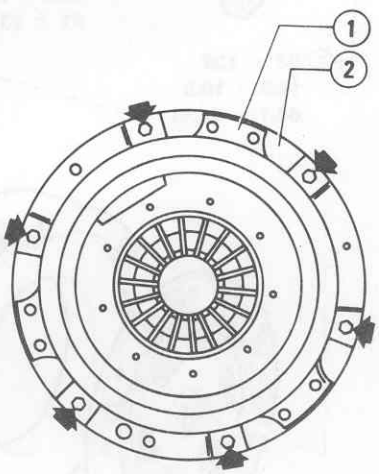
1 Propeller shaft connecting fork
2 Dust cover

e. Withdraw cover of clutch flywheel shaft.



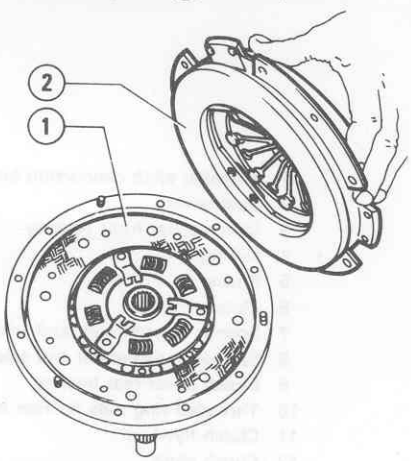
2. Clutch unit disassembly

a. If not present, carry out the countermarking between flywheel and pressure plate body so that correct order can be maintained when reassembling.
Loosen and release the screws with related washers securing pressure plate body (1) to flywheel (2).



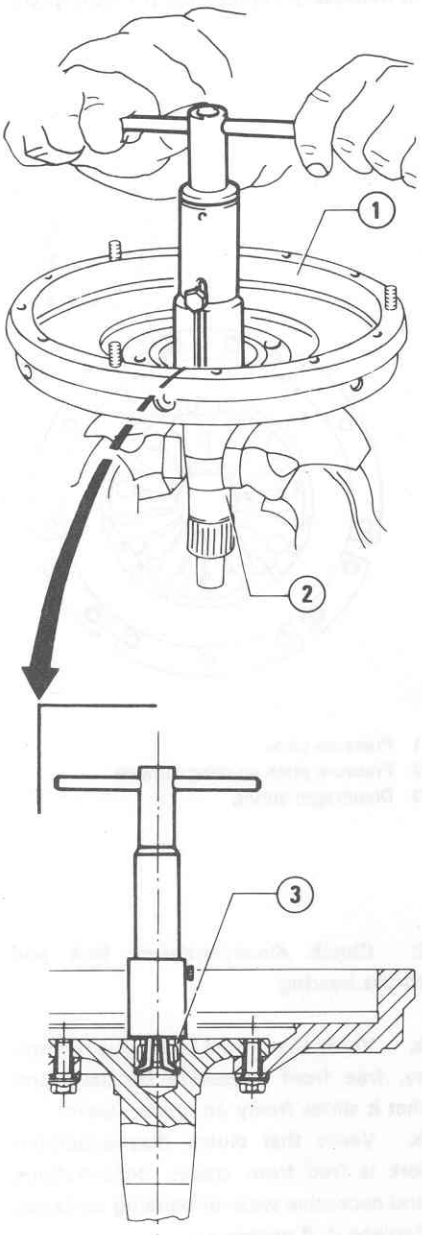
1 Pressure plate body
2 Clutch flywheel

b. Separate pressure plate body (2) and clutch plate (1) from flywheel.



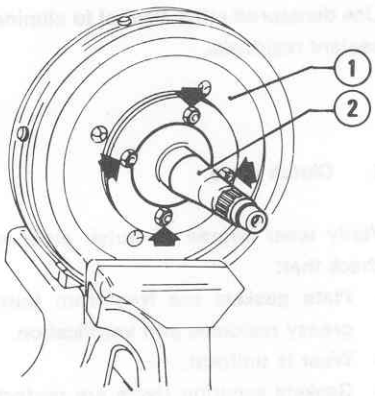
1 Clutch plate
2 Pressure plate body

c. If necessary, withdraw centering bearing (3) of speed gear main shaft from shaft (2), by means of suitable extractor.



1 Clutch flywheel
2 Clutch shaft
3 Needle bearing

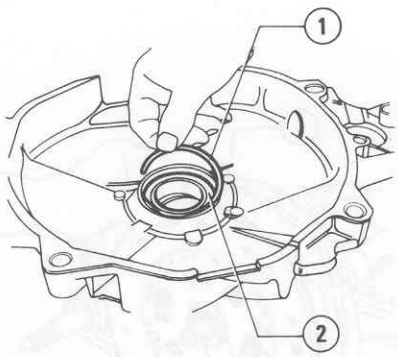
d. If necessary, unscrew and remove the screws with related washers securing flywheel (1) to shaft (2).



1 Clutch flywheel
2 Clutch shaft

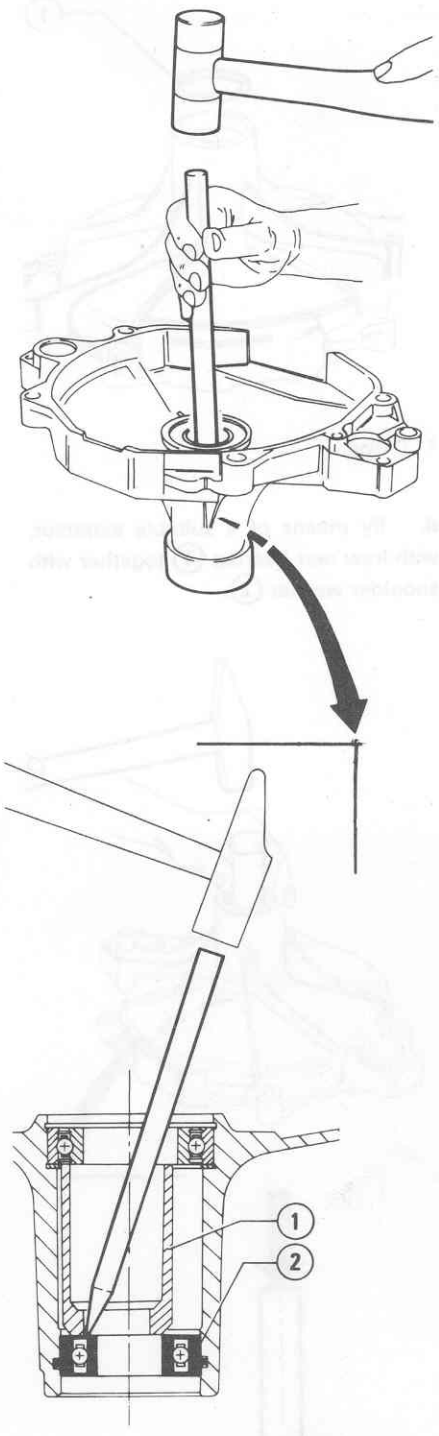
3. Removal of clutch cover bearings

a. Remove retaining ring (1) of rear bearing (2).



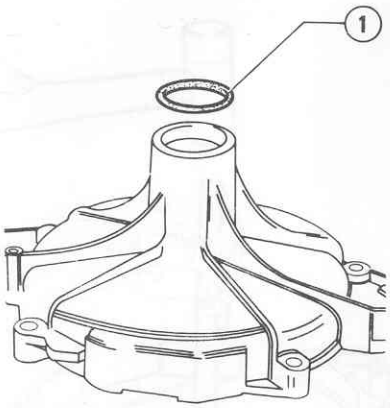
1 Rear bearing retaining ring
2 Clutch cover rear bearing

b. Set clutch cover on a suitable base and, disaligning spacer, tap uniformly, by means of a punch, on outer race of front bearing (2) in order to remove it from the related cover; recover spacer (1).



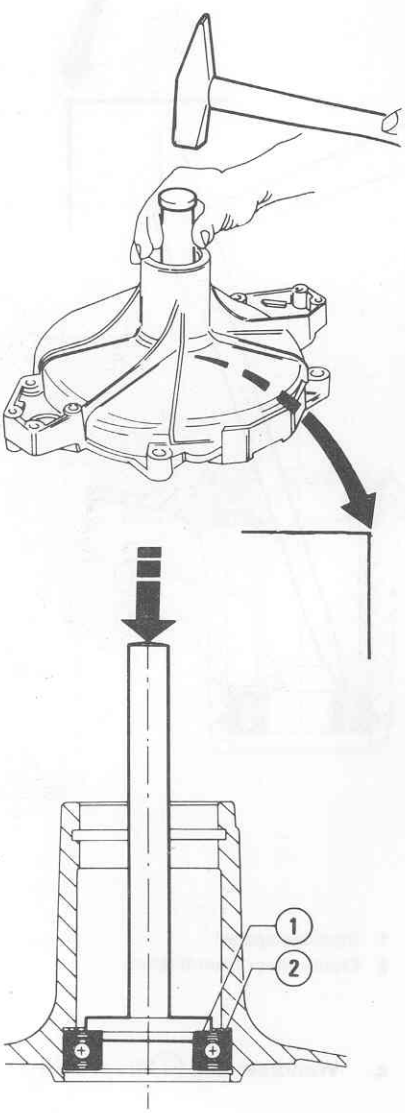
1 Bearings spacer
2 Clutch cover front bearing

c. Withdraw ring (1) from cover.



1 O-Ring

d. By means of a suitable extractor, withdraw rear bearing (1) together with shoulder washer (2).



1 Clutch cover rear bearing
2 Shoulder washer

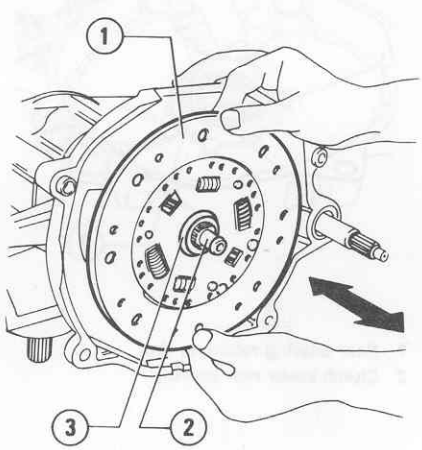
CHECKS AND INSPECTIONS

Before carrying out the checks and inspections, wash with suitable solvent all the disassembled items (exception made for the driven plate), to eliminate the residual dust and grease.
Use denatured ethyl alcohol to eliminate sealant residuals.

1. Clutch plate

Verify wear degree of clutch plate and check that:

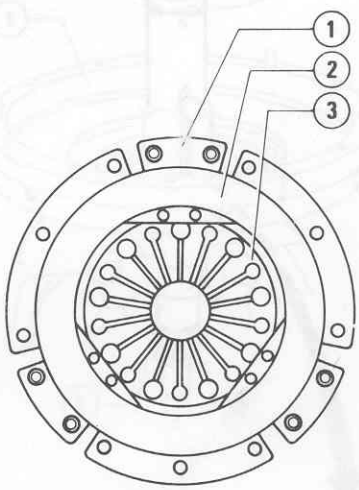
- Plate gaskets are free from burns, greasy residuals and vetrification.
- Wear is uniform.
- Gaskets securing rivets are perfectly riveted.
- Clutch plate springs are in good conditions.
- In the event of clutch malfunctions, due to oil leaks from seal ring on the direct drive shaft, both clutch plate and seal ring are replaced.
- Hub of plate (3) is in good conditions and slides without sticking or excessive backlash on direct drive shaft coupling (2). If necessary, replace the whole plate.



1 Clutch plate
2 Direct drive shaft
3 Clutch plate hub

2. Pressure plate

Verify that pressure plate working surface (2) is free from overheating, uneven wear, scores and removal of material.
If necessary, replace the pressure plate.



1 Pressure plate
2 Pressure plate working surface
3 Diaphragm spring

3. Clutch disengagement fork and thrust bearing

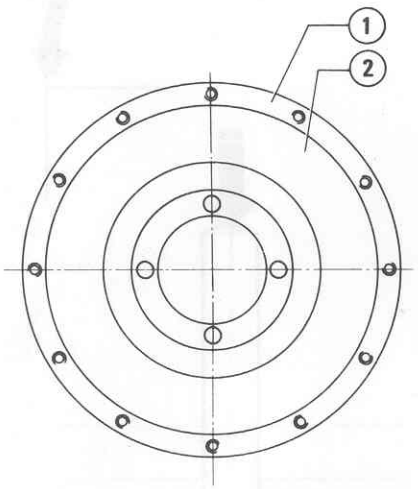
a. Verify that thrust bearing is not noisy, free from excessive backlash and that it slides freely on guide sleeve.
b. Verify that clutch disengagement fork is free from cracks, deformations and excessive wear of working surfaces. Replace it, if necessary.

4. Clutch cover

Check for good conditions of clutch cover; examine accurately the ball bearings supporting clutch flywheel shaft; replace them if too worn or in the event of seizing or noise.

5. Flywheel

Check for overheating, uneven wear, scoring or removal of material on flywheel working surface (2). If necessary, disassemble flywheel and grind both working surface and pressure plate support plane (1).

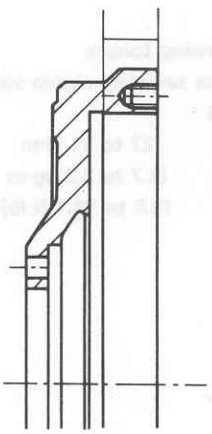


1 Pressure plate support plane
2 Working surface

The following must be taken into account when grinding flywheel:

a. Removal of material on driven plate support plane must be such that the dimension between driven plate support plane and pressure plate is within the below values.

- **For clutch plates ∅ 200 mm dia. (7.87 in) A = 25 + 0.2 mm (0.9842 + 0.0078 in)**
- **For clutch plates ∅ 215 mm dia. (8.46 in) A = 22.5 + 0.2 mm (0.8858 + 0.0078 in)**



b. Should dimension A be out of tolerance, remove material also from support plane of pressure plate.

c. As regards the tolerances, refer to: "Service Data and Specifications".

CAUTION:

a. Should replacement operations or interventions be required on flywheel, pressure plate and flywheel-clutch shaft, the whole unit should be replaced so as not to alter balancing.

b. Or, after grinding or replacement of a few components, carry out balancing of the whole unit.

---

6. Needle bearing

Verify that centering needle bearing of main shaft, previously removed from clutch shaft, is free from seizures, excessive wear; replace it if necessary.

7. Clutch flywheel shaft

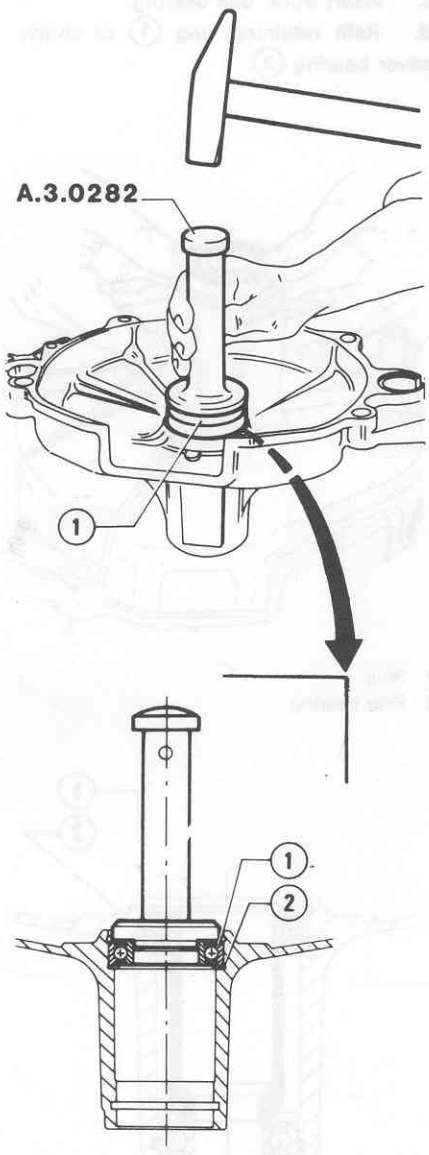
Examine thoroughly the clutch flywheel shaft. Replace it if working surfaces are worn.

REASSEMBLY

1. Clutch cover bearing insertion

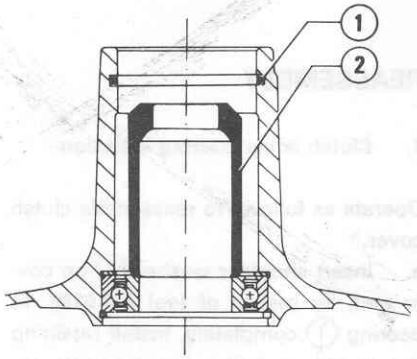
Operate as follows to reassemble clutch cover.

a. Insert shoulder washer (2) on cover and, by means of tool **A.3.0282**, fit bearing (1) completely. Install retaining ring making sure it is housed in the related seat.



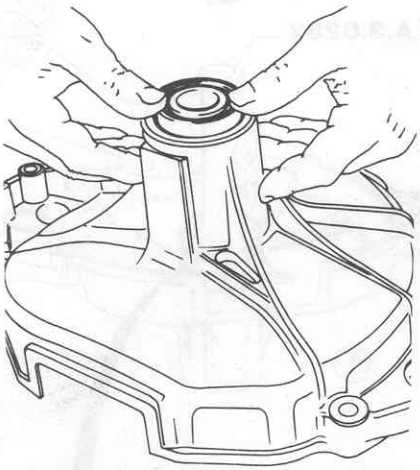
1 Cover rear bearing
2 Shoulder washer

b. Overturn cover and install spacer (2) taking care to position it with the chamfered side towards front part of cover, then install O-ring (1).

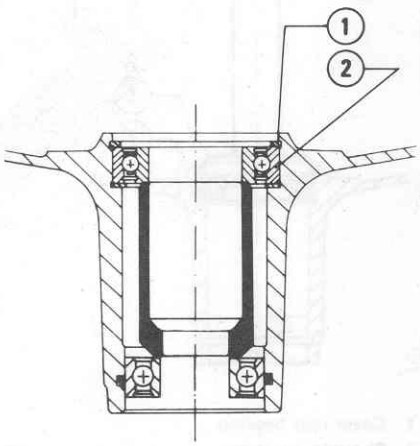


1 O-ring
2 Spacer

c. Insert front ball bearing.
d. Refit retaining ring (1) of clutch cover bearing (2).



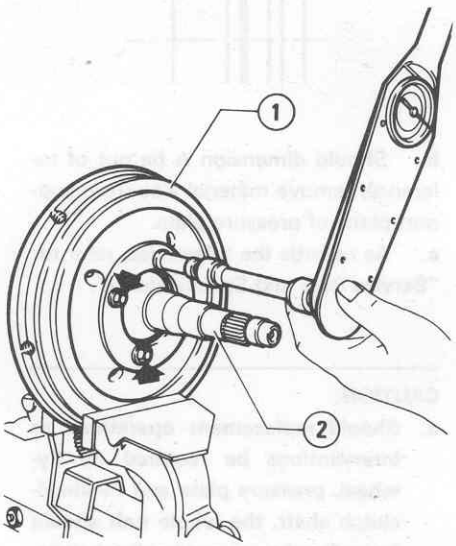
1 Ring
2 Rear bearing



2. Clutch unit reassembly

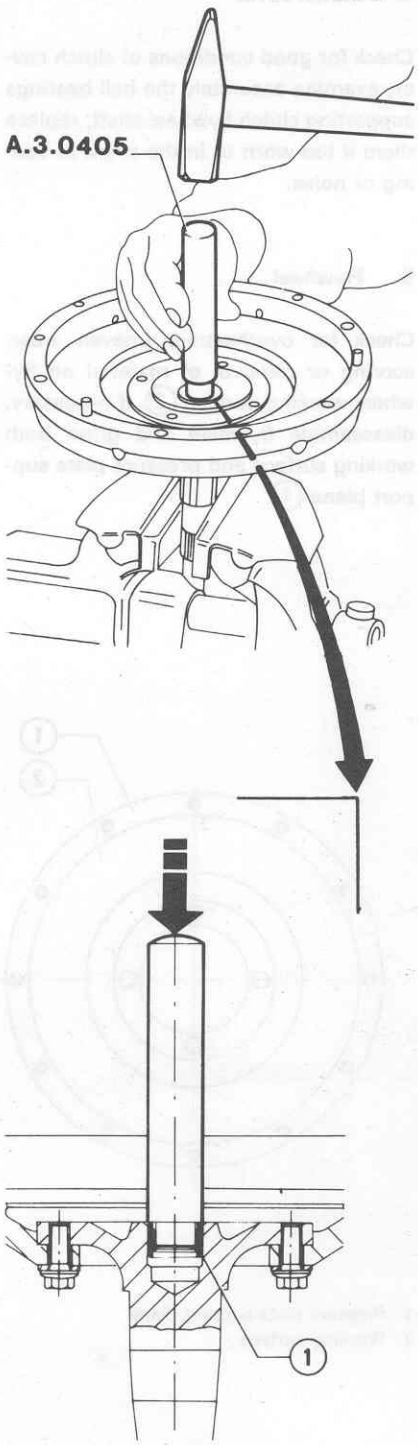
a. If previously disassembled, reassemble flywheel unit (1) and shaft (2) To carry out this operation, tighten the new securing screws treated with **LOCTITE sealing compound Stud Lok (red)** to the prescribed torque, operating as per figure, with flywheel arranged on vice fitted with protective jaws.

(T): **Tightening torque**
Screws securing clutch shaft to flywheel
27 to 31 N·m
(2.7 to 3.2 kg·m
19.5 to 23.1 ft·lb)



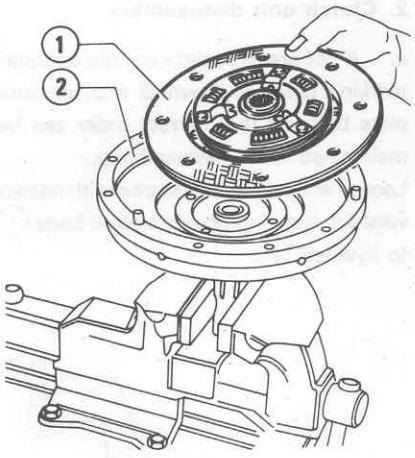
1 Clutch flywheel
2 Clutch shaft

b. If previously disassembled, insert bearing (1), housed in the clutch flywheel shaft, by means of tool **A.3.0405.**



1 Needle bearing

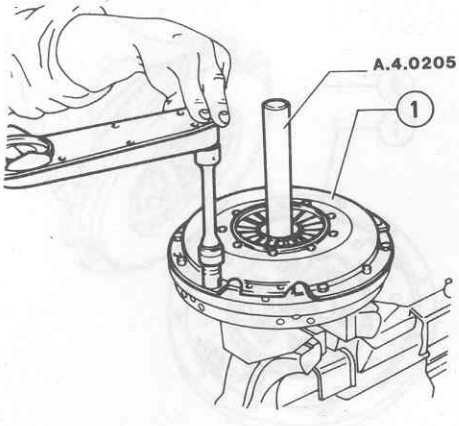
c. Insert driven plate (1) into flywheel (2) with the hub jutting part towards outside, as shown in the figure.



1 Driven plate
2 Clutch flywheel

d. Install pressure plate body on flywheel. By means of spindle **A.4.0205**, center the clutch plate and tighten, crosswise, the screws securing pressure plate body (1) to flywheel.

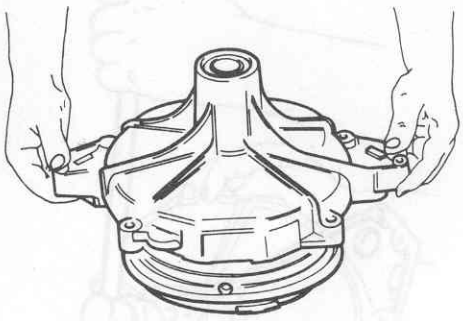
T : Tightening torque
Screws securing pressure plate body to flywheel
13 to 16 N·m
(1.3 to 1.6 kg·m
9.4 to 11.6 ft·lb)



1 Pressure plate body

3. Clutch cover reassembly

a. Remove spindle **A.4.0205** and reinstall cover on clutch unit.

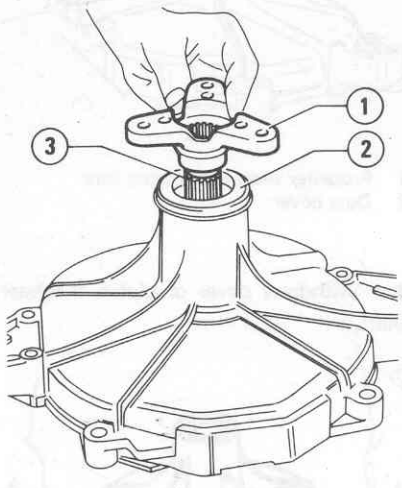


b. Insert dust cover (2)

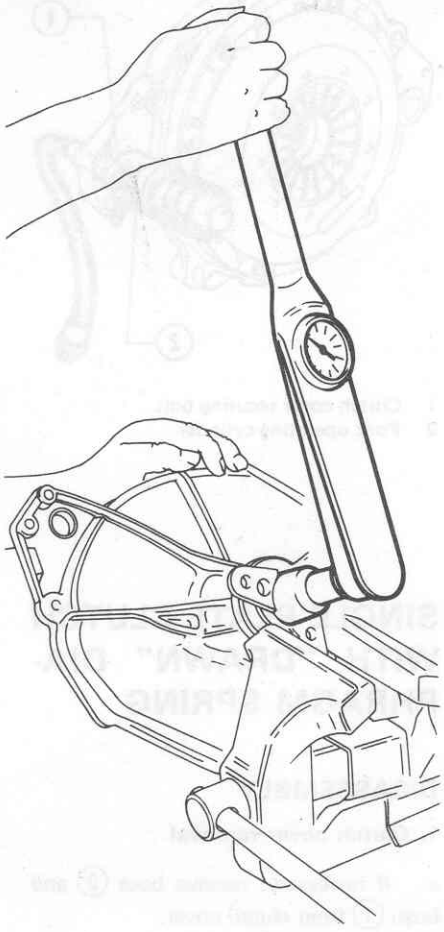
c. Apply a layer of **Sealing compound LOCTITE 242 (Blue)** on shaft tang, taking care to remove previous sealant residuals by swabbing and blowing the surfaces concerned. However, remove grease from surfaces by means of denatured ethyl alcohol.

d. Insert fork (1) on clutch shaft and secure it with the related nut lock fork on a vice fitted with protective jaws, as per figure, and tighten nut to the prescribed torque.

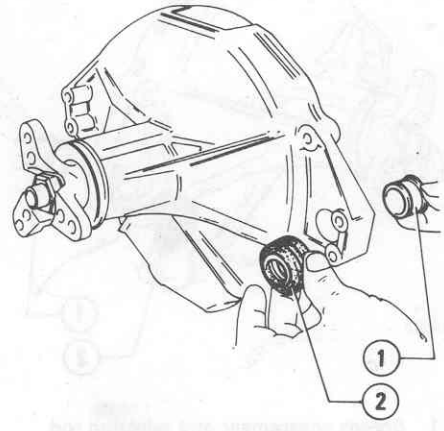
T : Tightening torque
Nut securing propeller shaft connecting fork to clutch shaft
93 to 103 N·m
(9.5 to 10.5 kg·m
68.7 to 75.9 ft·lb)



1 Fork
2 Dust cover
3 Splined tang

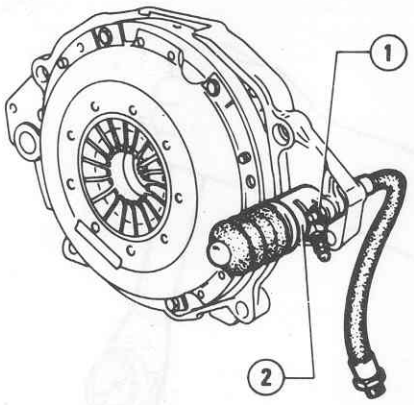


e. Reinstall bush (1) and boot (2).



1 Bush for speeds engagement and selection rod
2 Boot

f. Reconnect operating cylinder (2) to clutch cover and tighten bolt (1).



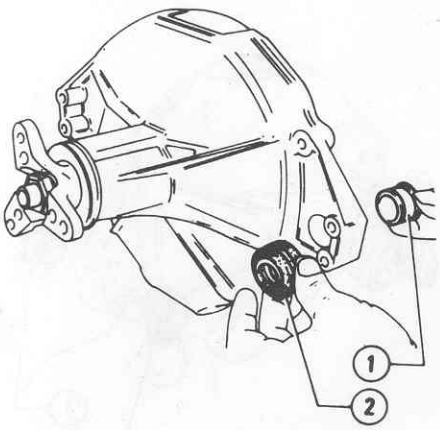
1 Clutch cover securing bolt
2 Fork operating cylinder

SINGLE-PLATE CLUTCH WITH "DRAWN" DIAPHRAGM SPRING

DISASSEMBLY

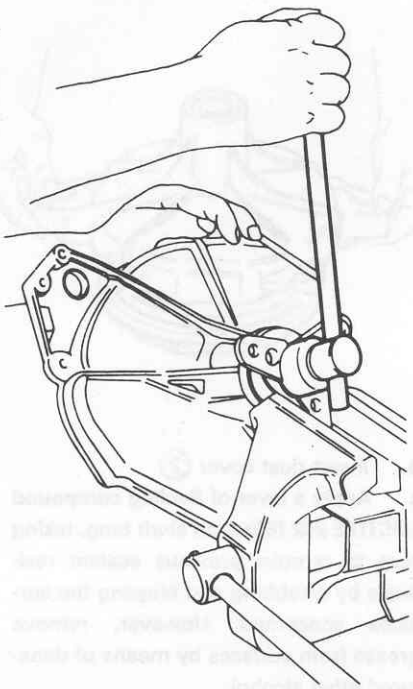
1. Clutch cover removal

a. If necessary, remove boot (2) and bush (1) from clutch cover.

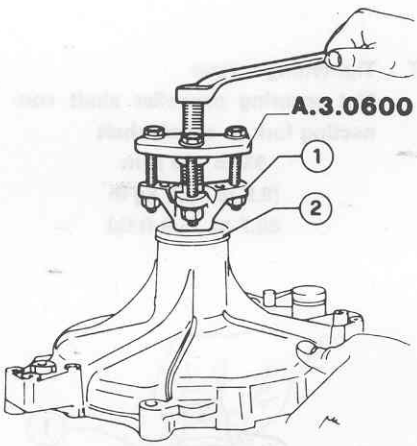


1 Speeds engagement and selection rod bush
2 Speed engagement and selection rods boot

b. Secure clutch cover on vice fitted with jaws, as per figure.
Release and remove the nut securing propeller shaft fork.

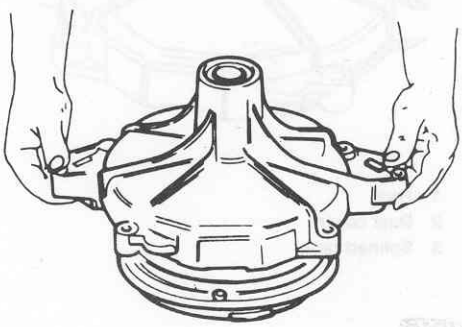


c. By means of extractor **A.3.0600** withdraw fork (1), then remove dust cover (2).



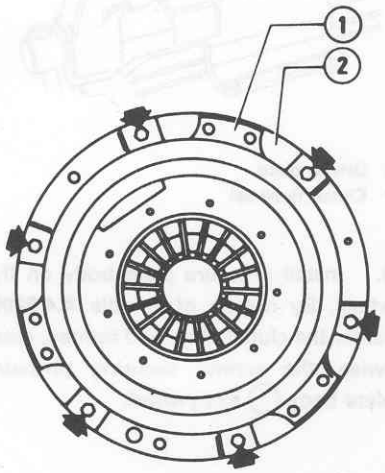
1 Propeller shaft connecting fork
2 Dust cover

d. Withdraw cover of clutch flywheel shaft.



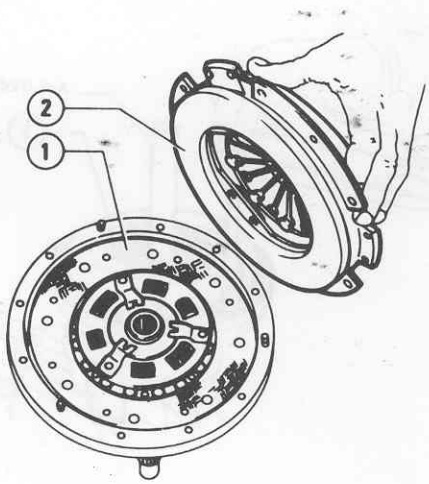
2. Clutch unit disassembly

a. If not present, carry out the countermarking between flywheel and pressure plate body so that correct order can be maintained when reassembling.
Loosen and release the screws with related washers securing pressure plate body (1) to flywheel (2).



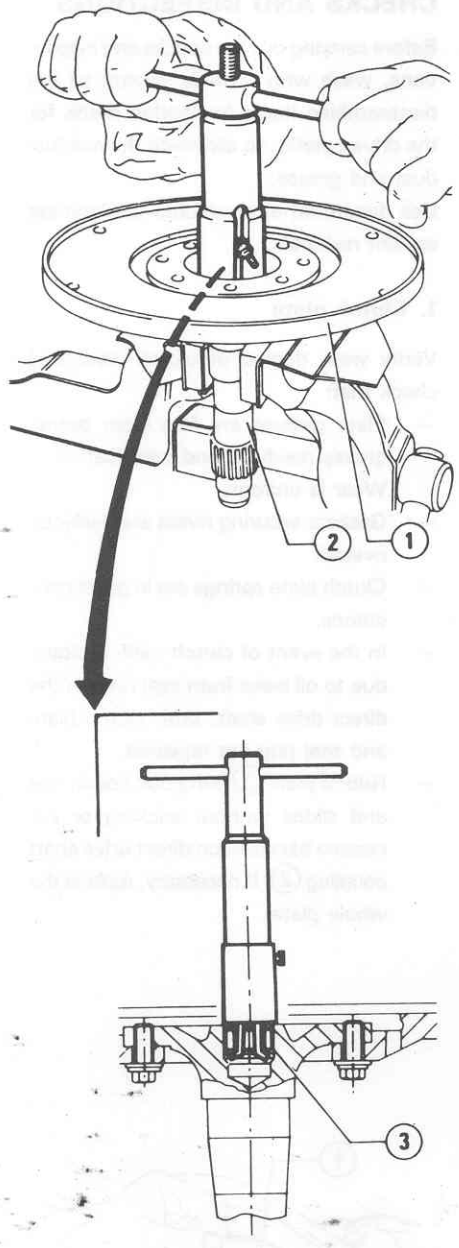
1 Pressure plate body
2 Clutch flywheel

b. Separate pressure plate body (2) and clutch plate (1) from flywheel.



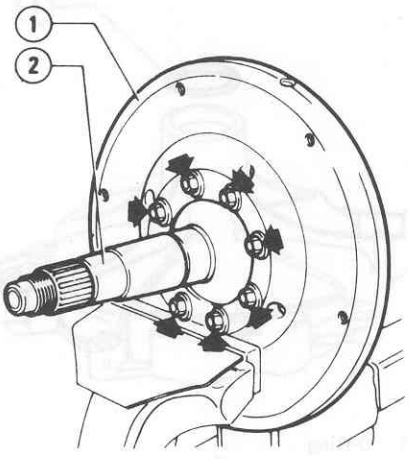
1 Clutch plate
2 Pressure plate body

c. If necessary, withdraw centering bearing (3) of speed gear main shaft from shaft (2), by means of suitable extractor.



1 Clutch flywheel
2 Clutch shaft
3 Needle bearing

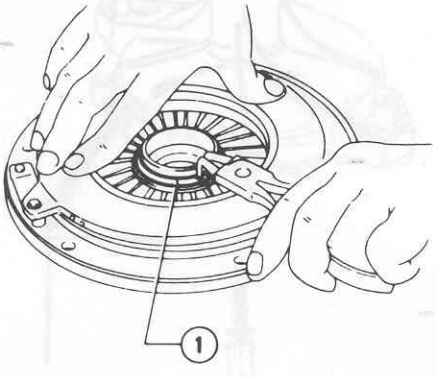
d. If necessary, unscrew and remove the screws with related washers which secure flywheel (1) to shaft (2); separate shaft from flywheel.

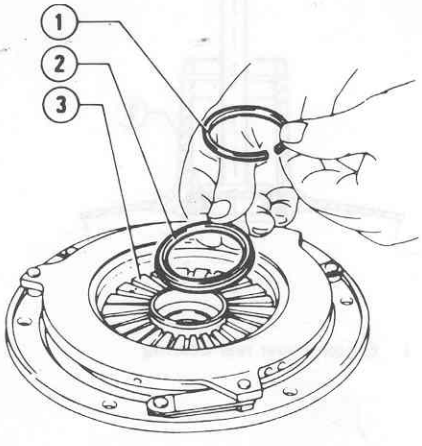


1 Clutch flywheel
2 Clutch shaft

3. Thrust bearing removal

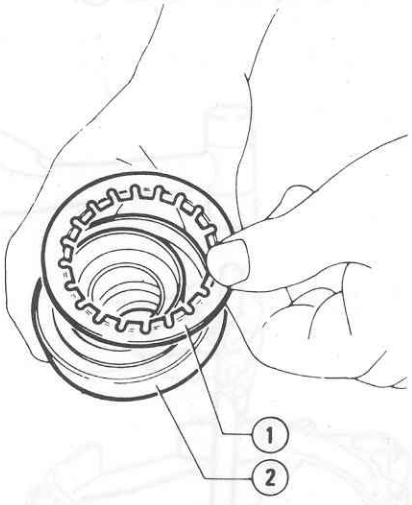
a. Set rear pressure plate body as per figure, then slightly press on it to overcome the reaction of bearing Belleville spring and remove retaining ring (1).
b. Remove ring (2) securing thrust bearing to diaphragm spring (3).





1 Retaining ring
2 Ring
3 Diaphragm spring

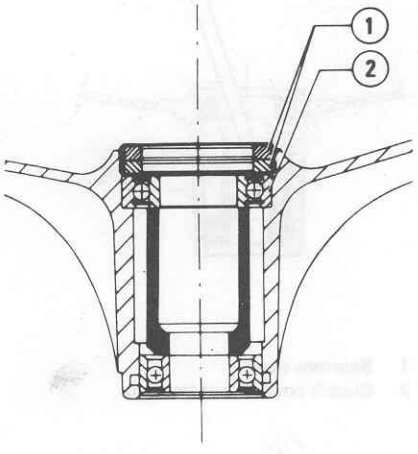
c. Remove bearing (2) from rear pressure plate body and recover spring (1).



1 Belleville spring
2 Thrust bearing

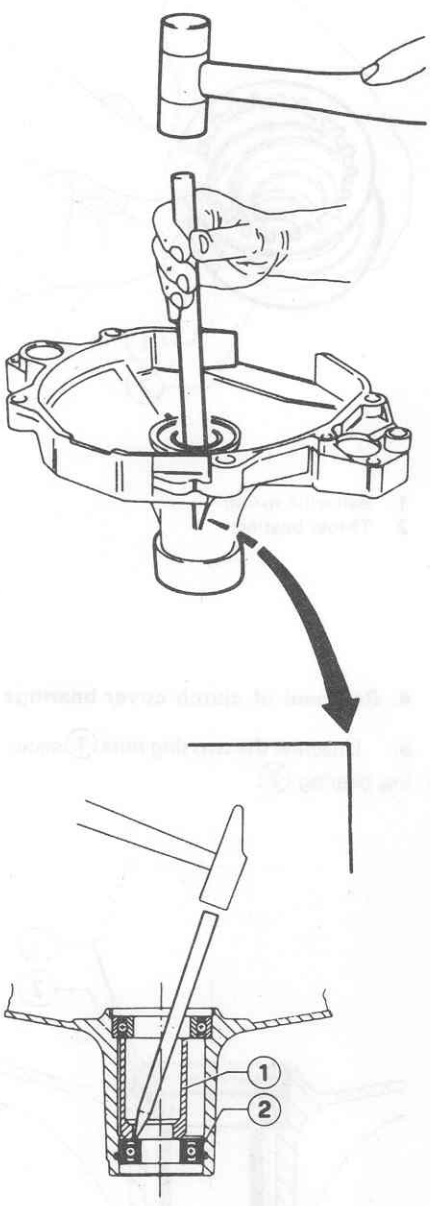
4. Removal of clutch cover bearings

a. Unscrew the two ring nuts (1) securing bearing (2).



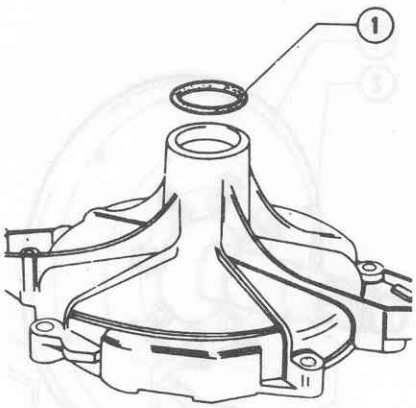
1 Threaded ring nuts
2 Rear bearing

b. Set clutch cover on a suitable base and, disaligning spacer, tap uniformly, by means of a punch, on outer race of front bearing (2) in order to remove it from the related cover; recover spacer (1).



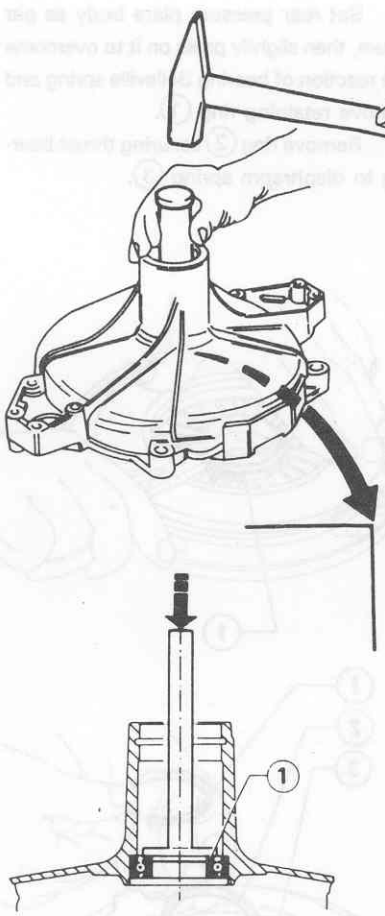
1 Bearings spacer
2 Clutch cover front bearing

c. Withdraw ring (1) from cover.



1 O-Ring

d. By means of a suitable extractor, withdraw rear bearing (1).



1 Clutch cover rear bearing

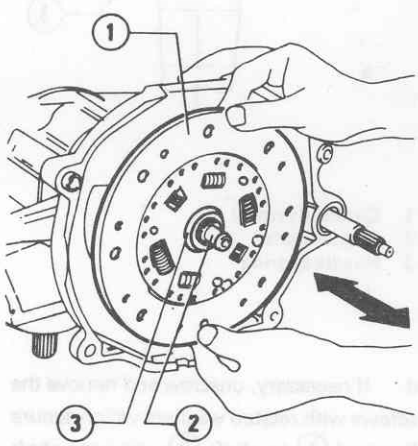
CHECKS AND INSPECTIONS

Before carrying out the checks and inspections, wash with suitable solvent all the disassembled items (exception made for the driven plate), to eliminate the residual dust and grease.
Use denatured ethyl alcohol to eliminate sealant residuals.

1. Clutch plate

Verify wear degree of clutch plate and check that:

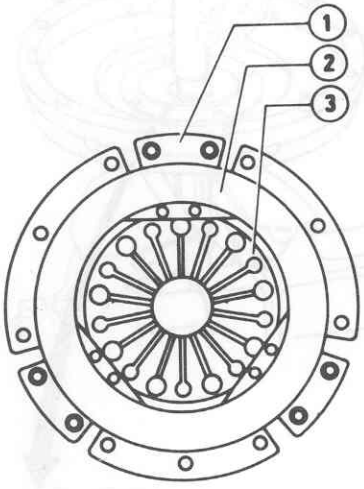
- Plate gaskets are free from burns, greasy residuals and vetrification.
- Wear is uniform.
- Gaskets securing rivets are perfectly riveted.
- Clutch plate springs are in good conditions.
- In the event of clutch malfunctions, due to oil leaks from seal ring on the direct drive shaft, both clutch plate and seal ring are replaced.
- Hub of plate (3) is in good conditions and slides without sticking or excessive backlash on direct drive shaft coupling (2). If necessary, replace the whole plate.



1 Clutch plate
2 Direct drive shaft
3 Clutch plate hub

2. Pressure plate

Verify that pressure plate working surface (2) is free from overheating, uneven wear, scores and removal of material.
If necessary, replace the pressure plate.



1 Pressure plate
2 Pressure plate working surface
3 Diaphragm spring

3. Clutch disengagement fork and thrust bearing

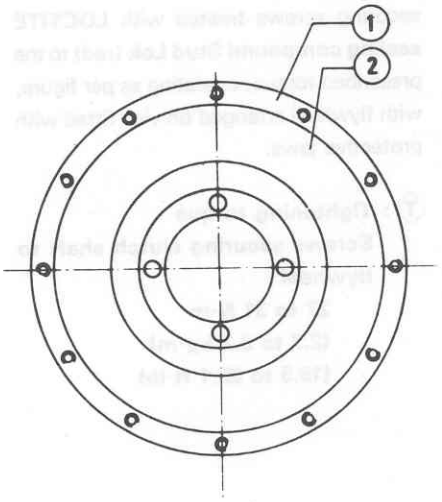
a. Verify that thrust bearing is not noisy, free from excessive backlash and that it slides freely on guide sleeve.
b. Verify that clutch disengagement fork is free from cracks, deformations and excessive wear of working surfaces.
Replace it, if necessary.

4. Clutch cover

Check for good conditions of clutch cover; examine accurately the ball bearings supporting clutch flywheel shaft; replace them if too worn or in the event of seizing or noise.

5. Flywheel

Check for overheating, uneven wear, scoring or removal of material on flywheel working surface (2). If necessary, disassemble flywheel and grind both working surface and pressure plate support plane (1).



1 Pressure plate support plane
2 Working surface

For grinding tolerances, refer to "Service Data and Specifications".

CAUTION:

a. Should replacement operations or interventions be required on flywheel, pressure plate and flywheel-clutch shaft, the whole unit should be replaced so as not to alter balancing.

b. Or, after grinding or replacement of a few components, carry out balancing of the whole unit.

6. Needle bearing

Verify that centering needle bearing of main shaft, previously removed from clutch shaft, is free from seizures, excessive wear; replace it if necessary.

7. Clutch flywheel shaft

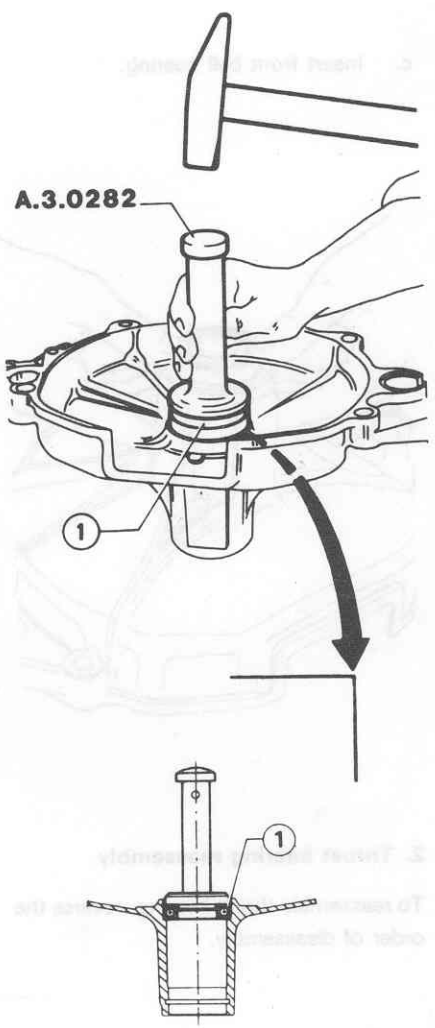
Examine thoroughly the clutch flywheel shaft. Replace it if working surfaces are worn.

REASSEMBLY

1. Clutch cover bearing insertion

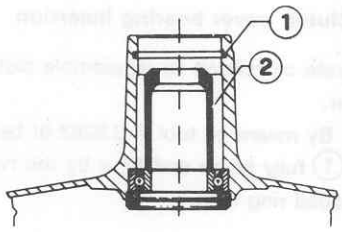
Operate as follows to reassemble clutch cover.

a. By means of tool **A.3.0282** fit bearing (1) fully home and fix it by the two-threaded ring nuts.



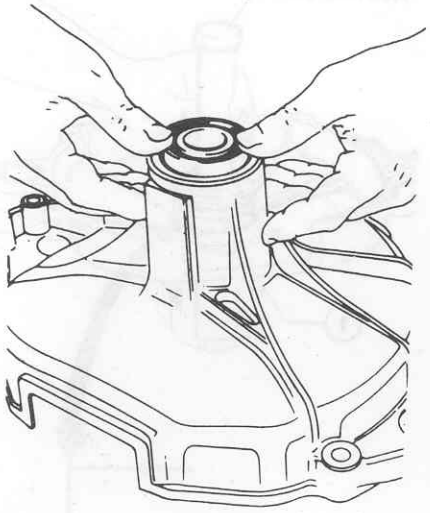
1 Cover rear bearing

b. Overturn cover and install spacer (2) taking care to position it with the chamfered side towards front part of cover, then install O-ring (1).



1 O-Ring
2 Spacer

c. Insert front ball bearing.



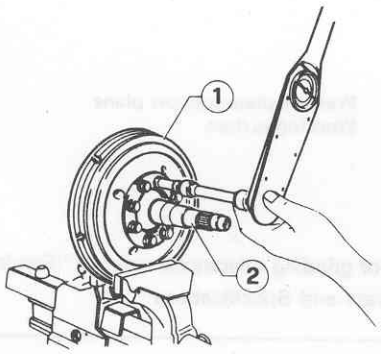
2. Thrust bearing reassembly

To reassemble thrust bearing, reverse the order of disassembly.

3. Clutch unit reassembly

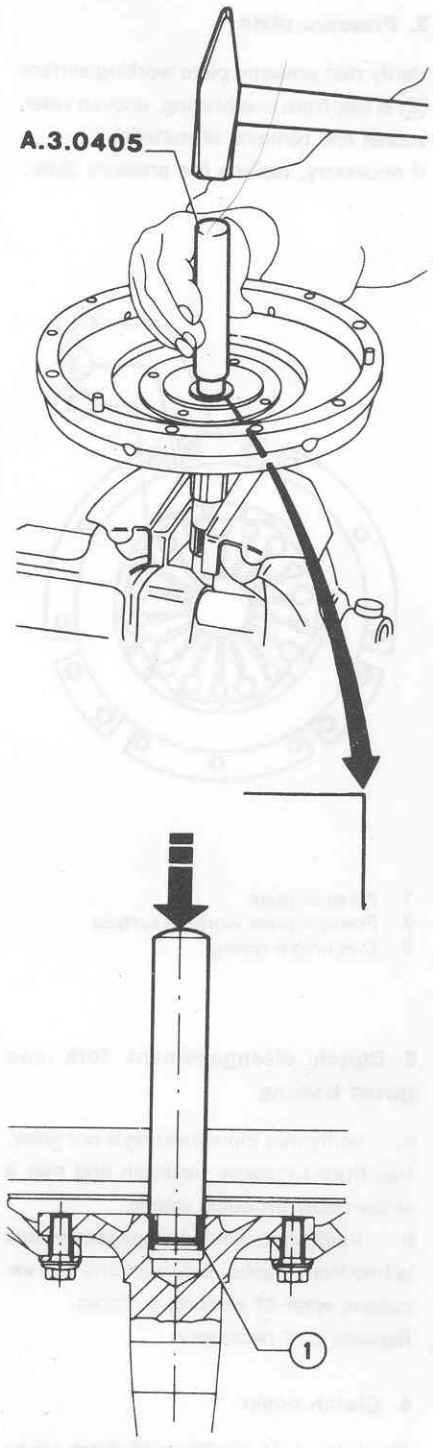
a. If previously disassembled, reassemble flywheel unit (1) and shaft (2).
To carry out this operation, tighten the new securing screws treated with **LOCTITE sealing compound Stud Lok (red)** to the prescribed torque, operating as per figure, with flywheel arranged on vice fitted with protective jaws.

(T) : **Tightening torque**
Screws securing clutch shaft to flywheel
27 to 31 N·m
(2.7 to 3.2 kg·m)
(19.5 to 23.1 ft·lb)



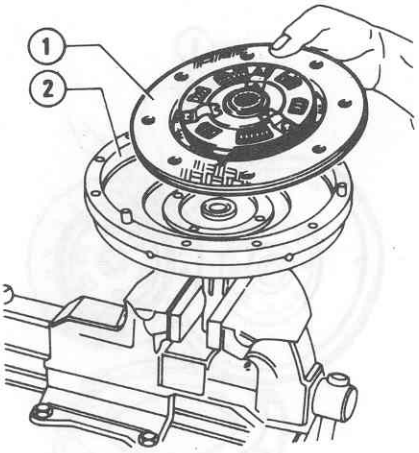
1 Clutch flywheel
2 Clutch shaft

b. If previously disassembled, insert bearing (1), housed in the clutch flywheel shaft, by means of tool **A.3.0405**.



1 Needle bearing

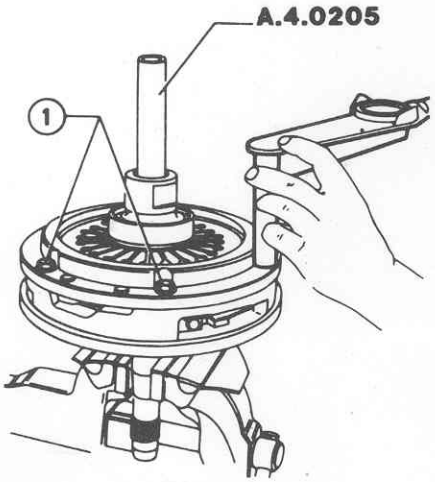
c. Insert driven plate (1) into flywheel (2) with the hub jutting part towards outside, as shown in the figure.

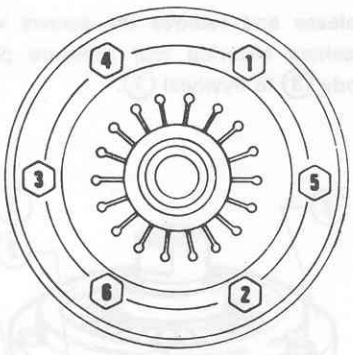


1 Driven plate
2 Clutch flywheel

d. Install pressure plate body on flywheel. By means of spindle **A.4.0205**, center the clutch plate and tighten, crosswise, the screws (1) securing pressure plate body to flywheel.

(T) : **Tightening torque**
Screws securing pressure plate body to flywheel
13 to 16 N·m
(1.3 to 1.6 kg·m)
(9.4 to 11.6 ft·lb)

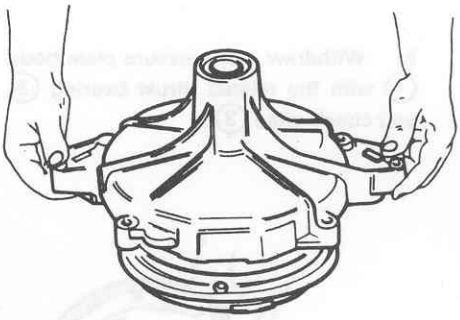




1 Screws securing pressure plate body to flywheel

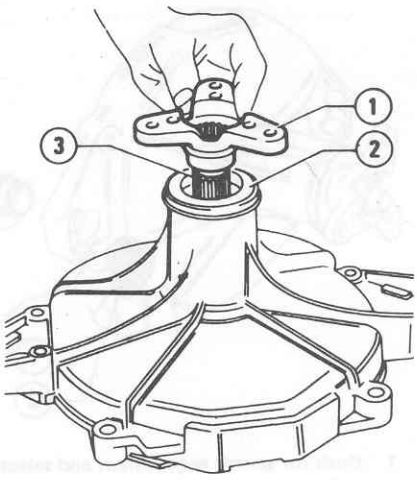
4. Clutch cover reassembly

a. Remove splindle **A.4.0205** and reinstall cover on clutch unit.

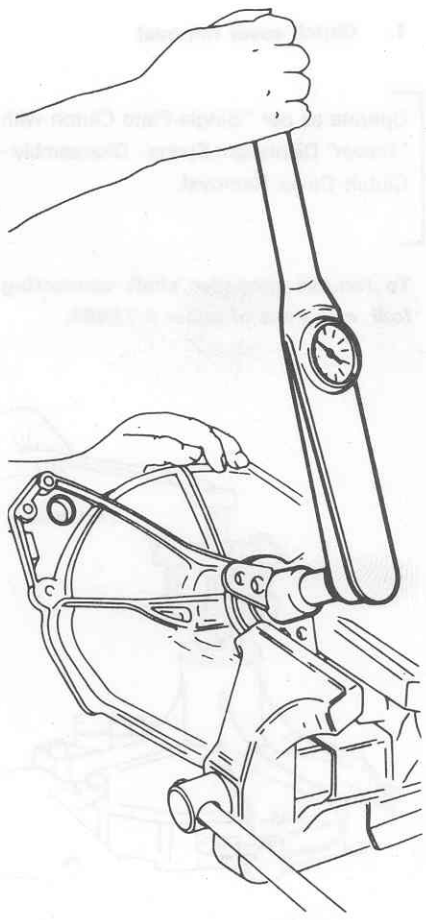


b. Insert dust cover (2).
c. Apply a layer of **Sealing compound LOCTITE 242 (Blue)** on shaft tang, taking care to remove previous sealant residuals by swabbing and blowing the surfaces concerned. However, remove grease from surfaces by means of denatured ethyl alcohol.
d. Insert fork (1) on clutch shaft and secure it with the related nut lock fork on a vice fitted with protective jaws, as per figure, and tighten nut to the prescribed torque.

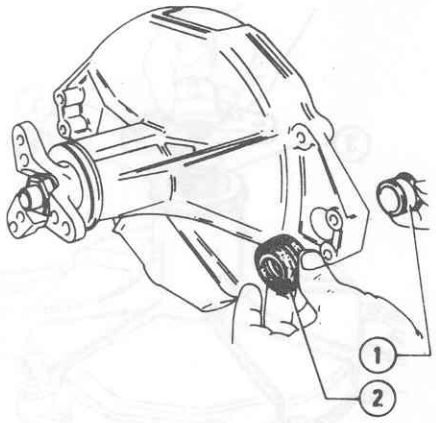
(T) : **Tightening torque**
Nut securing propeller shaft connecting fork to clutch shaft
93 to 103 N·m
(9.5 to 10.5 kg·m)
(68.7 to 75.9 ft·lb)



1 Fork
2 Dust cover
3 Splined tang



e. Reinstall bush (1) and boot (2).



1 Bush for speeds engagement and selection rod
2 Boot

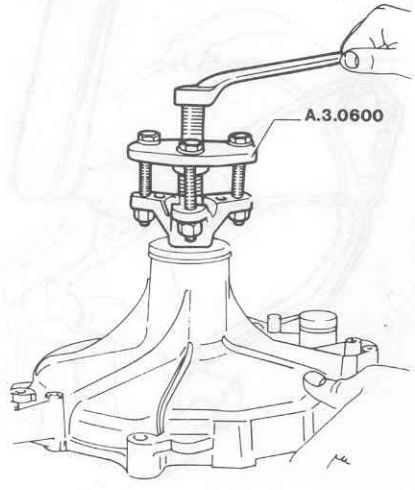
DOUBLE-PLATE CLUTCH

REMOVAL

1. Clutch cover removal

Operate as per "Single-Plate Clutch with "Drawn" Diaphragm Spring - Disassembly - Clutch Cover Removal.

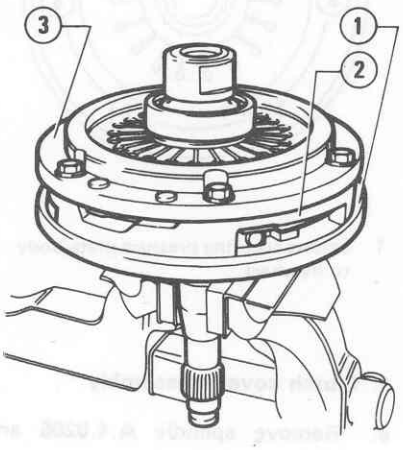
To remove propeller shaft connecting fork, make use of puller A.3.0600.



2. Clutch unit disassembly

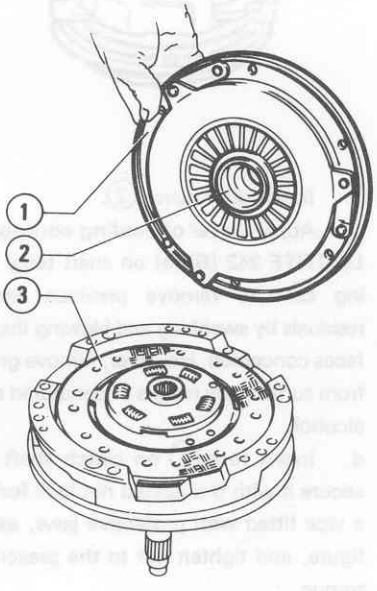
a. If not present, carry out markings between flywheel (1) and pressure plates bodies (2) and (3).

Release and remove the screws with washers securing rear pressure plate body (3) to flywheel (1).



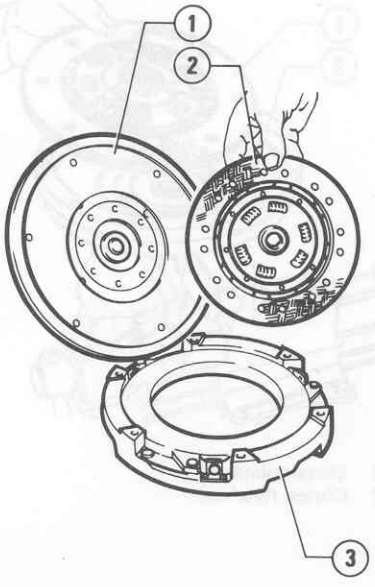
1 Flywheel
2 Intermediate pressure plate body
3 Rear pressure plate body

b. Withdraw rear pressure plate body (1) with the related thrust bearing (2) and clutch plate (3).



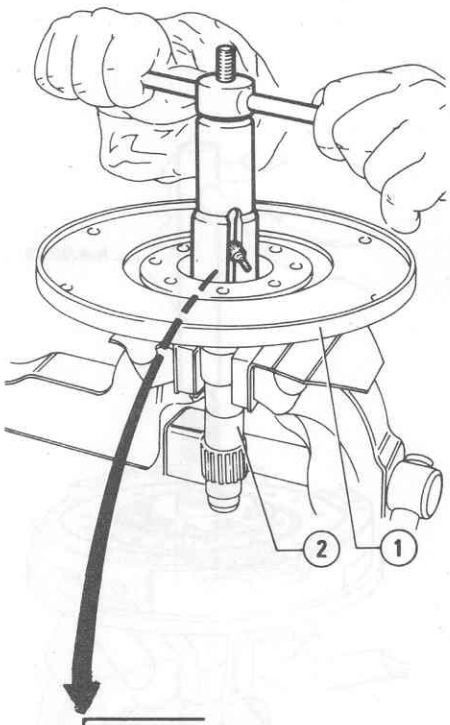
1 Rear pressure plate body
2 Thrust bearing
3 Rear clutch plate

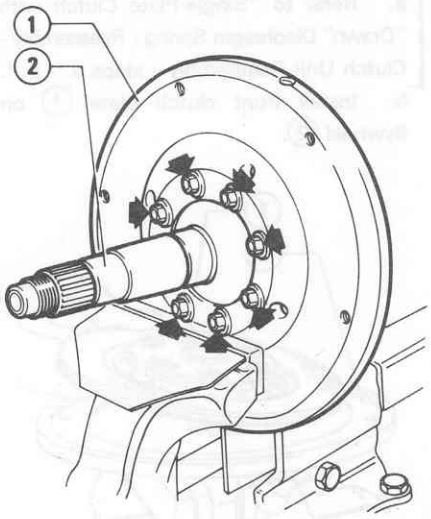
c. Separate intermediate pressure plate body (3) and clutch plate (2) from flywheel (1).



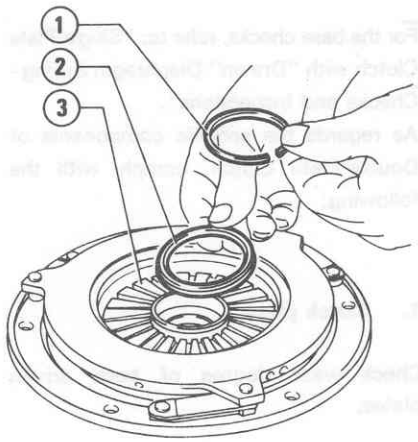
1 Flywheel
2 Front clutch plate
3 Intermediate pressure plate body

d. If necessary, withdraw speed gear main shaft centering bearing (3) from shaft (2), by means of suitable puller.



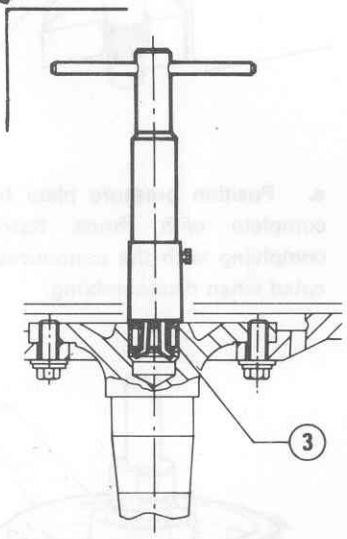


1 Clutch flywheel
2 Clutch shaft



1 Retaining ring
2 Ring
3 Diaphragm spring

c. Remove bearing (2) from rear pressure plate body and recover spring (1).

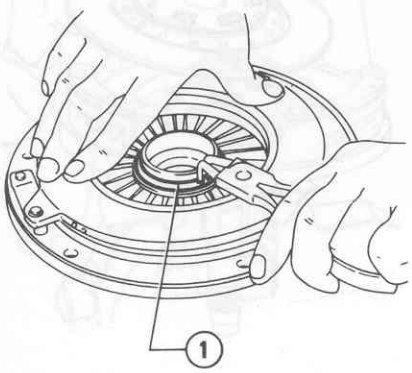


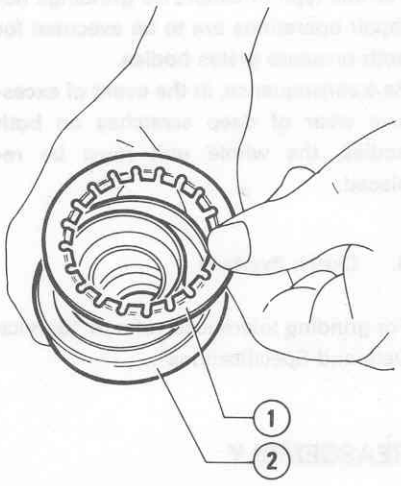
1 Clutch flywheel
2 Clutch shaft
3 Needle bearing

e. If necessary, unscrew and remove the screws with related washers which secure flywheel (1) to shaft (2); separate shaft from flywheel.

3. Thrust bearing removal

a. Set rear pressure plate body as per figure, then slightly press on it to overcome the reaction of bearing Belleville spring and remove retaining ring (1).
b. Remove ring (2) securing thrust bearing to diaphragm spring (3).





1 Belleville spring
2 Thrust bearing

4. Removal of clutch cover bearings

Operate as per "Single-Plate Clutch with "Drawn" Diaphragm Spring - Disassembly - Removal of Clutch Cover Bearings.

CHECKS AND INSPECTIONS

For the base checks, refer to: "Single-Plate Clutch with "Drawn" Diaphragm Spring - Checks and Inspections".
As regards the specific components of Double-Plate Clutch, comply with the following:

1. Clutch plate

Check wear degree of both driven plates.

CAUTION:
In the event of malfunctions identified on one plate only, the replacement of both plates is however required.

2. Pressure plate body

For this type of clutch, no grindings nor repair operations are to be executed for both pressure plates bodies.
As a consequence, in the event of excessive wear of deep scratches on both bodies, the whole unit must be replaced.

3. Clutch flywheel

For grinding tolerances, refer to "Service Data and Specifications".

REASSEMBLY

1. Insertion of clutch cover bearing

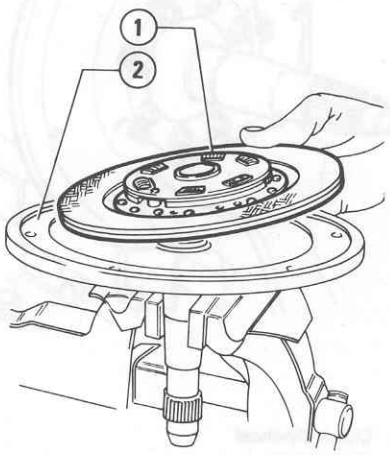
To reinstall bearings, operate as per: "Single-Plate Clutch with "Drawn" Diaphragm Spring - Reassembly - Insertion of Clutch Cover Bearing".

2. Thrust bearing reassembly

To reassemble thrust bearing, reverse the order of disassembly.

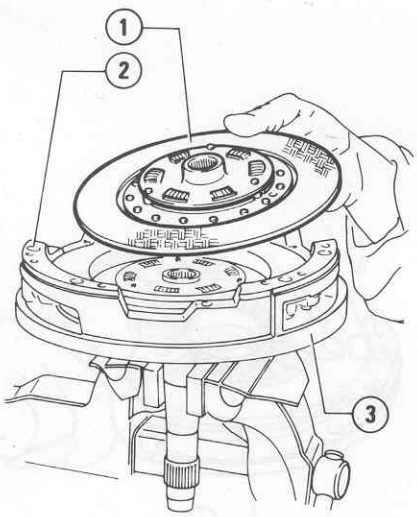
3. Clutch unit reassembly

a. Refer to "Single-Plate Clutch with "Drawn" Diaphragm Spring - Reassembly - Clutch Unit Reassembly - steps a. - b.".
b. Install front clutch plate (1) on flywheel (2).



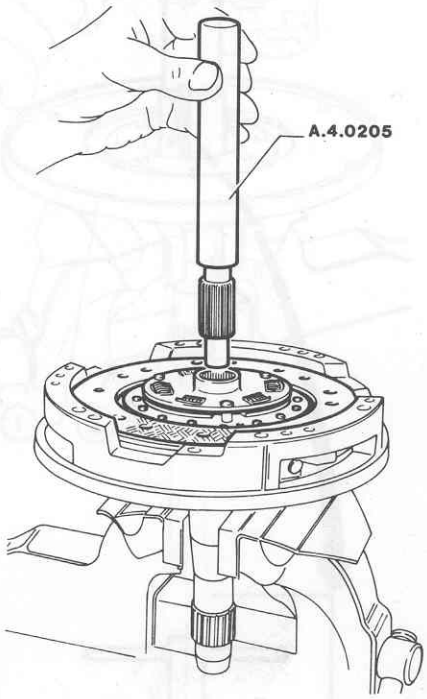
1 Front clutch plate
2 Clutch flywheel

c. Install intermediate pressure plate body (1) (complying with counter-marks executed when disassembling) and rear clutch plate (2).

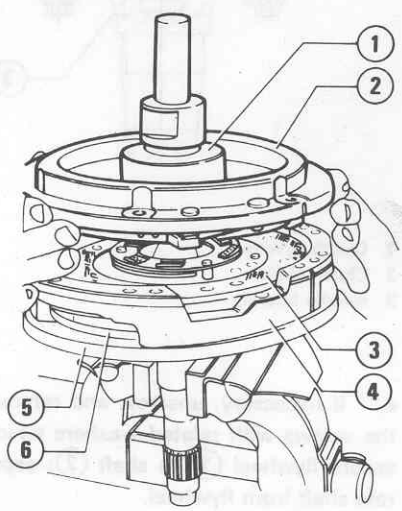


1 Intermediate pressure plate body
2 Rear clutch plate
3 Clutch flywheel

d. By means of tool **A.4.0205**, align hubs grooves of the two clutch plates.



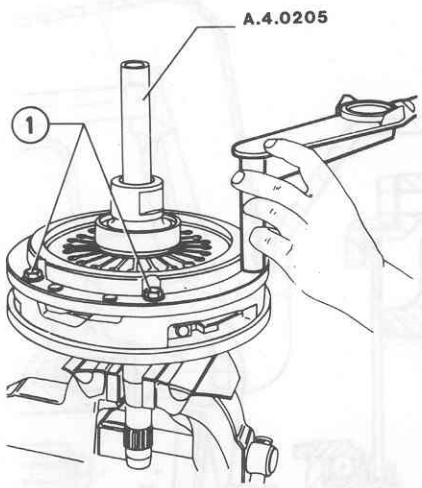
e. Position pressure plate body (2), complete with thrust bearing (1) complying with the countermarks executed when disassembling.

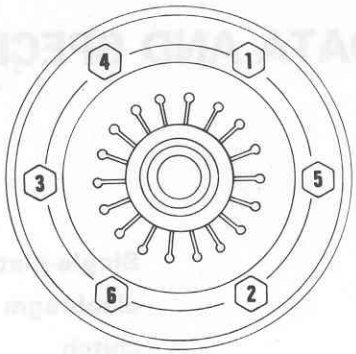


1 Thrust bearing
2 Rear pressure plate body
3 Rear clutch plate
4 Intermediate pressure plate body
5 Clutch flywheel
6 Front clutch plate

f Insert screws (1) securing pressure plate bodies to clutch flywheel, secure them according to the specified sequence, then, by means of tool **A.4.0205**, tighten the screws to the prescribed torque.

(T): **Tightening torque**
Screws securing pressure plate to clutch flywheel
18 to 22 N·m
(1.8 to 2.2 kg·m
13.0 to 15.9 ft·lb)

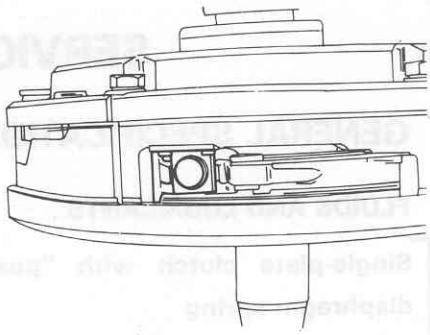




1 Screws

g. After tightening to the prescribed torque, make sure that pressure plate bodies and clutch plates mate perfectly and are coplanar to clutch flywheel.

To carry out verification, visually check that clearance **"A"** (shown in figure), due to diaphragm spring action, occurs in the vicinity of the taking up devices. This condition is necessary to guarantee the clutch unit disengagement travel.



h. Withdraw tool **A.4.0205.**

4. Clutch cover reassembly

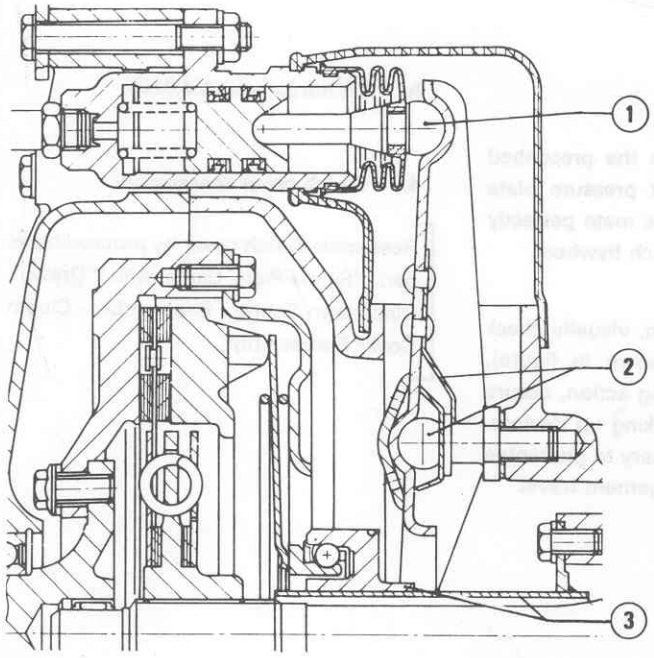
Ressemble clutch cover by proceeding as per: "Single-Plate Cluch with "Drawn" Diaphragm Spring - Reassembly - Clutch Cover Reassembly".

SERVICE DATA AND SPECIFICATIONS

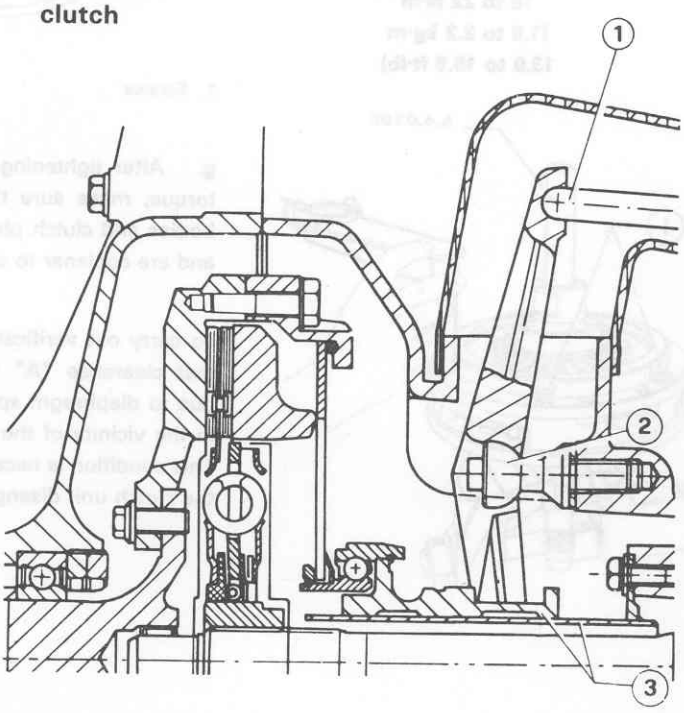
GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Single-plate clutch with "pushed" diaphragm spring



Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

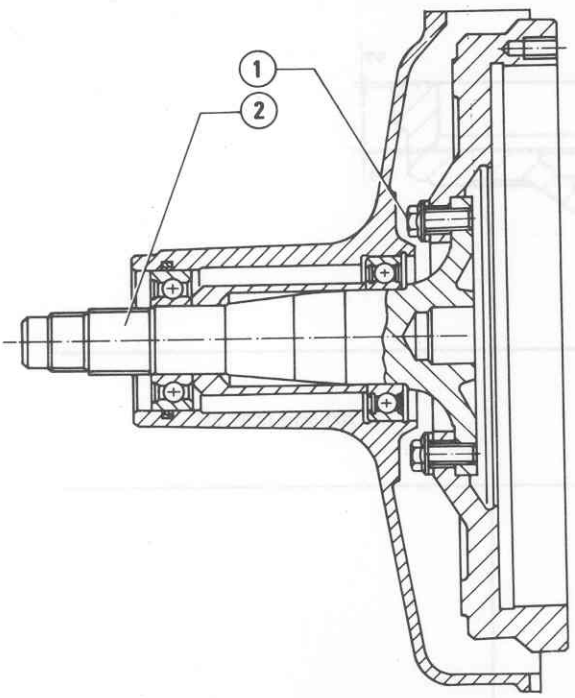


Application	Type	Name	Q.ty
(1) Spherical seat and clutch operating cylinder push rod (1 and 2) (2) Rubber washer on spherical pin for clutch disengagement fork (1) (2) Spherical pin and clucth disengagement fork spherical seat (2) (3) Thrust bearing seat and clutch disengagement fork (1 and 2)	GREASE	– AGIP Grease 33FD – IP Autogrease FD Std. No. 3671-69833/34	–
Propeller shaft rear joint spherical seat	GREASE	ISECO Molykote BR2 Std. No. 3671-69841	5 cm^3 0.3 cuin
Clutch hydraulic system filling (1 and 2)	FLUID	– AGIP Brake Fluid Super HD – ATE "Blau S" – IP Auto Fluid F.R. Std. No. 3681-69905 **CAUTION:** **Product harmful to paint. Keep it away from paint on view**	–

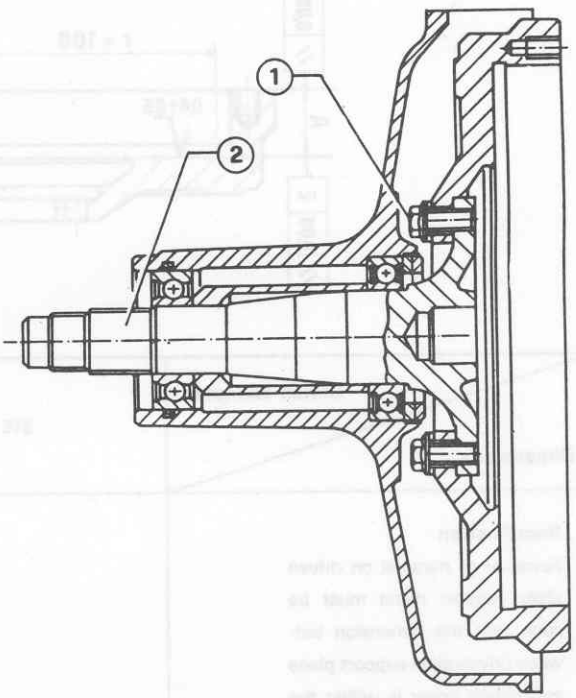
(1) For single-plate clutch with "pushed" diaphragm spring
(2) For single-plate clutch with "drawn" diaphragm spring and for double-plate clutch

SEALANTS

Single-plate clutch with "pushed" diaphragm spring



Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

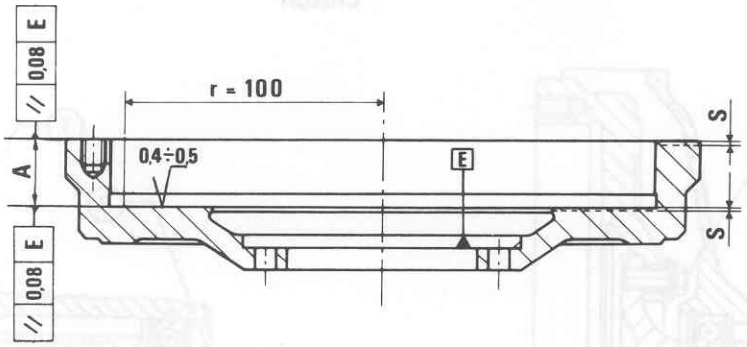


	Application	Type	Name	Q.ty
1	Threading of screws securing clutch shaft to flywheel - See note (1)	SEALING COMPOUND	LOCTITE Stud Lok (Red) Std. No. 3524-00002	-
2	Clutch shaft splined tang for propeller shaft connecting fork See note (1)	SEALING COMPOUND	LOCTITE 242 (Blue) Std.No. 3524-00010	-

(1) Before applying sealing compound, remove any trace of old compound by swabbing and blowing the surfaces concerned. Remove grease from surfaces with thriclorethylene and clorothene.

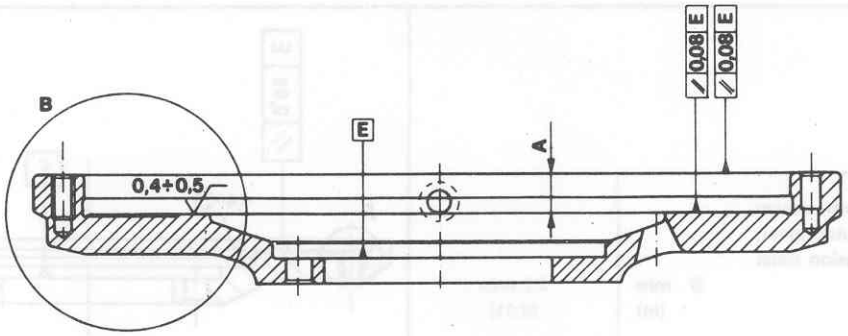
CHECKS AND ADJUSTMENTS

SINGLE-PLATE CLUTCH FLYWHEEL WITH "PUSHED" DIAPHRAGM SPRING



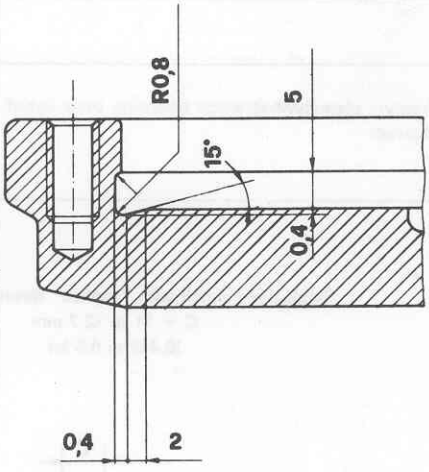
Dimensions \ Clutch diameter		215 mm (8.46 in)	200 mm (7.87 in)
Rectification Removal of material on driven plate support plane must be such that the dimension between driven plate support plane and clutch cover is within the **A** value. Should dimension **A** be out of tolerance, remove material also from support plane of clutch cover.	A mm (in)	22.5 + 0.2 (0.89 + 0.01)	25 + 0.2 (0.98 + 0.01)
Tolerances			
— Parallelism error between driven plate support plane and clutch shaft connection plane (measured on a radius with "r" length)	// mm (in)	0.08 (0.003)	0.08 (0.003)
— Parallelism error between clutch cover support plane and clutch shaft connection plane	// mm (in)	0.08 (0.003)	0.08 (0.003)
— Roughness of driven plate support plane	√ μm	0.4 to 0.5	0.4 to 0.5

SINGLE-PLATE CLUTCH FLYWHEEL WITH "DRAWN" DIAPHRAGM SPRING



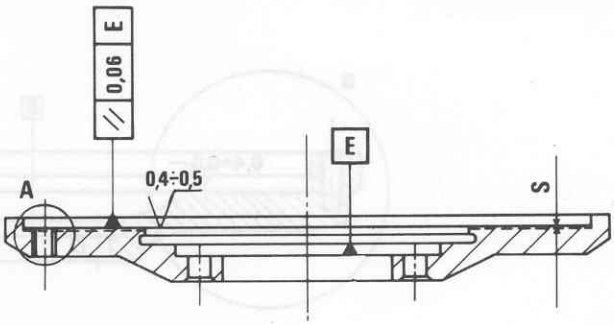
Dimensions \ Clutch diameter		215 mm (8.46 in)
Rectification Removal of material on driven plate support plane must be such that the dimension between driven plate support plane and clutch cover is within the **A** value.	A mm (in)	12.5 + 0.2 (0.49 + 0.01)
Should dimension **A** be out of tolerance, remove material also from support plane of clutch cover.		
Tolerances		
— Parallelism error between driven plate support plane and clutch shaft connection plane	// mm (in)	0.08 (0.003)
— Parallelism error between clutch cover support plane and clutch shaft connection plane	// mm (in)	0.08 (0.003)
— Roughness of driven plate support plane	√ μm	0.4 to 0.5

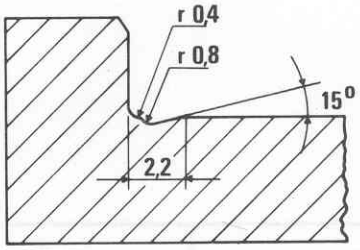
Item B



DOUBLE-PLATE CLUTCH FLYWHEEL

Dimensions		
Removal of material from driven plate support plane and clutch cover, shown by the "S", dimension must be	S mm (in)	0.2 max (0.01)
Tolerances		
Maximum parallelism error between driven plate support plane and clutch shaft connection plane	// mm (in)	0.06 (0.0024)
Roughness of driven plate support plane	√ µm	0.4 to 0.5





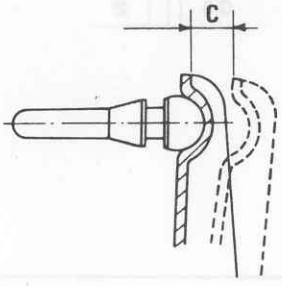
Item A

CLUTCH

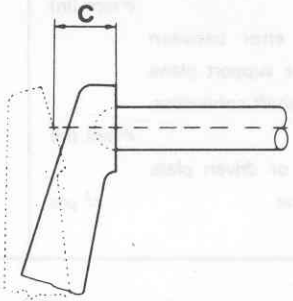
DIMENSIONS (1)		
Pressure plate-flywheel static balancing (max out-of balance allowed)	g·cm (in·lb)	10 (0.0086)

Operating cylinder pushrod travel

Single-plate clutch with "pushed" diaphragm spring:
C = 11 to 12.7 mm
(0.443 to 0.5 in)



Single-plate clutch with "drawn" diaphragm spring:
C = 12.5 mm
(0.49 in)



(1) Dimensions applicable to all versions with single-plate clutch

TIGHTENING TORQUES [N·m (Kg·m; ft·lb)]

Application \ Clutch type	Single-plate with "pushed" diaphragm spring	Single-plate with "drawn" diaphragm spring	Double-plate
Screws securing propeller shaft coupling to clutch shaft fork	39 to 49 (4 to 5 28.9 to 36)	55 to 57 (5.6 to 5.8 40.5 to 41.9)	55 to 57 (5.6 to 5.8 40.5 to 41.9)
Screws securing pressure plate to clutch flywheel	13 to 16 (1.3 to 1.6 9.4 to 11.6)	13 to 16 (1.3 to 1.6 9.4 to 11.6)	18 to 22 (1.8 to 2.2 13 to 15.9)
Screws securing clutch shaft to flywheel (for sealant compounds refer to: "Sealants")	27 to 31 (2.7 to 3.2 19.5 to 23.1)	27 to 31 (2.7 to 3.2 19.5 to 23.1)	27 to 31 (2.7 to 3.2 19.5 to 23.1)
Nut securing propeller shaft connecting fork to clutch shaft	93 to 103 (9.5 to 10.5 68.7 to 75.9)	93 to 103 (9.5 to 10.5 68.7 to 75.9)	93 to 103 (9.5 to 10.5 68.7 to 75.9)
Screws securing clutch unit to differential-speed gear unit.	29 to 32 (2.9 to 3.3 21 to 23.9)	29 to 32 (2.9 to 3.3 21 to 23.9)	29 to 32 2.9 to 3.3 21 to 23.9)
Hydraulic system pipe unions: Hoses	10 to 15 (1 to 1.5 7.2 to 10.8)	10 to 15 (1 to 1.5 7.2 to 10.8)	10 to 15 (1 to 1.5 7.2 to 10.8)
Pipes	8 to 10 (0.8 to 1 5.8 to 7.2)	8 to 10 (0.8 to 1 5.8 to 7.2)	8 to 10 (0.8 to 1 5.8 to 7.2)
Screws securing speed gear-differential unit to lateral support small block	18.6 to 23.5 (1.9 to 2.4 13.7 to 17.3)	18.6 to 23.5 (1.9 to 2.4 13.7 to 17.3)	18.6 to 23.5 (1.9 to 2.4 13.7 to 17.3)

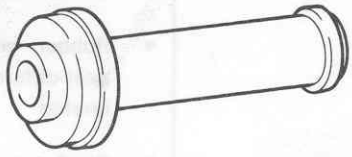
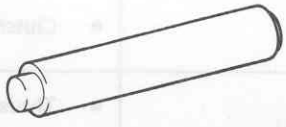
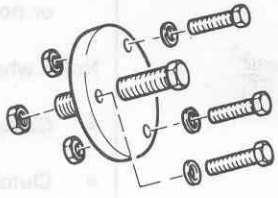
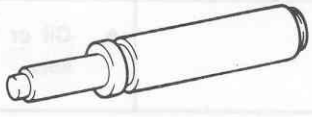
TROUBLE DIAGNOSIS AND CORRECTIVE ACTION

Condition	Probable cause	Corrective action
Clutch slips Symptoms: – Vehicle does not respond to engine speed when accelerating	Some trouble symptoms can be also due to engine malfunctions. First of all, determine whether trouble is caused by engine or clutch. Proceed as follows to test clutch slipping: – engage parking brake – disengage clutch and change to 4th speed – accelerate, then gradually release clutch pedal: if car does not move and engine does not stop, clutch is slipping	
– Wheel power insufficient when uphill driving	• Clutch plate gaskets too worn	Replace clutch plate
– Abnormal increase of fuel consumption	• Oil or grease present on gaskets	Replace clutch plate (if faulty, replace oil seal ring of main shaft).
	• Diaphragm spring damaged or worn condition in correspondance with thrust bearing support area	Replace pressure plate cover
	• Flywheel or pressure plate deformed	Repair or replace flywheel a/o pressure plate
	• Pushrod of clutch operating cylinder does not return to initial position: Operating cylinder piston or master cylinder piston seized	Overhaul operating cylinder or master cylinder
Clutch can not be easily disengaged Symptoms: Noise when changing speed (especially in low gear ratio)	Proceed as follows to check clutch disengagement: – disengage clutch and change to Reverse speed – change to Neutral and accelerate progressively, keeping clutch pedal depressed – after a short interval, change to Reverse speed If noise is heard when changing speed, clutch is dragging.	
	• Wear or rust on splined section of clutch plate hub.	Clean or replace clutch plate hub.
	• Oil leaks from master cylinder, operating cylinder and hydraulic system	Replace faulty components
	• Air in the hydraulic system	Bleed air
	• Pedal travel insufficient	Adjust travel
	• Operating cylinder inefficient	Overhaul or replace operating cylinder
	• Master cylinder inefficient	Overhaul or replace master cylinder

Condition	Probable cause	Corrective action
Clutch can not be easily disengaged (continue)	• Clutch plate deformed or eccentric	Replace clutch plate
	• Diaphragm spring fatigued	Replace diaphragm spring
	• Oil in clutch plate gaskets	Replace clutch plate (if faulty, replace oil seal ring of main shaft)
Clutch chatters	• Clutch plate gaskets vitrified due to overheating	Replace clutch plate
Symptoms:	• Oil or grease on clutch plate gaskets	Replace clutch plate
Clutch pedal chatters when vehicle is started and clutch still partially engaged	• Clutch plate gaskets deformed	Replace clutch plate
	• Flywheel working surface worn or deformed	Repair or replace flywheel
	• Pressure plate working surface worn or deformed	Replace pressure plate
	• Gaskets rivets loose	Replace clutch plate
	• Rubber supports of clutch-speed gear-differential unit loose or deteriorated	Secure or replace supports
	• Diaphragm spring fatigued	Replace pressure plate
	• Clutch shaft bearings damaged	Replace bearings
Noisy clutch	• Thrust bearing inusable	Replace thrust bearing
	Noisy disengagement:	
	• Thrust bearing a/o support damaged or not suitably lubricated	Replace or lubricate thrust bearing a/o support
	Noise when clutch is engaged:	
	• Gaskets rivets loose	Replace clutch plate
	• Clutch plate gaskets cracked	Replace clutch plate
	• Clutch plate springs fatigued	Replace clutch plate
	• Clutch shaft bearings damaged	Replace bearings
Clutch jerks	• Oil or grease on clutch plate gaskets	Replace clutch plate (if faulty, replace main shaft oil seal ring).

Condition	Probalde cause	Corrective action
Clutch jerks (continue) Symptoms: – Vehicle does not start smoothly	• Gaskets worn or rivets loose	Replace clutch plate
	• Wear or rust on direct drive shaft a/o clutch plate splined sections	Clean or replace (according to requirements) the direct drive shaft a/o clutch plate.
	• Flywheel a/o pressure plate friction surfaces worn or deformed	Repair or replace flywheel a/o clutch cover.
	• Supports of clutch-speed gear-differential unit loose or deteriorated	Secure or replace supports

SPECIAL SERVICE TOOLS

Tool P.M.	Name	Page Ref
A.3.0282	Driver for rear bearing 	12-19 12-25
A.3.0405	Driver for centering bush on flywheel-clutch shaft 	12-20 12-26
A.3.0477	Puller for propeller shaft connecting fork (for single-plate clutch with "pushed" diaphragm spring) 	12-16
A.3.0600	Puller for propeller shaft connecting fork (for single-plate clutch with "drawn" diaphragm spring and for double-plate clutch)	12-22 12-28
A.4.0205	Tool for clutch plate centering 	12-21 12-27 12-30 12-31

GROUP 13

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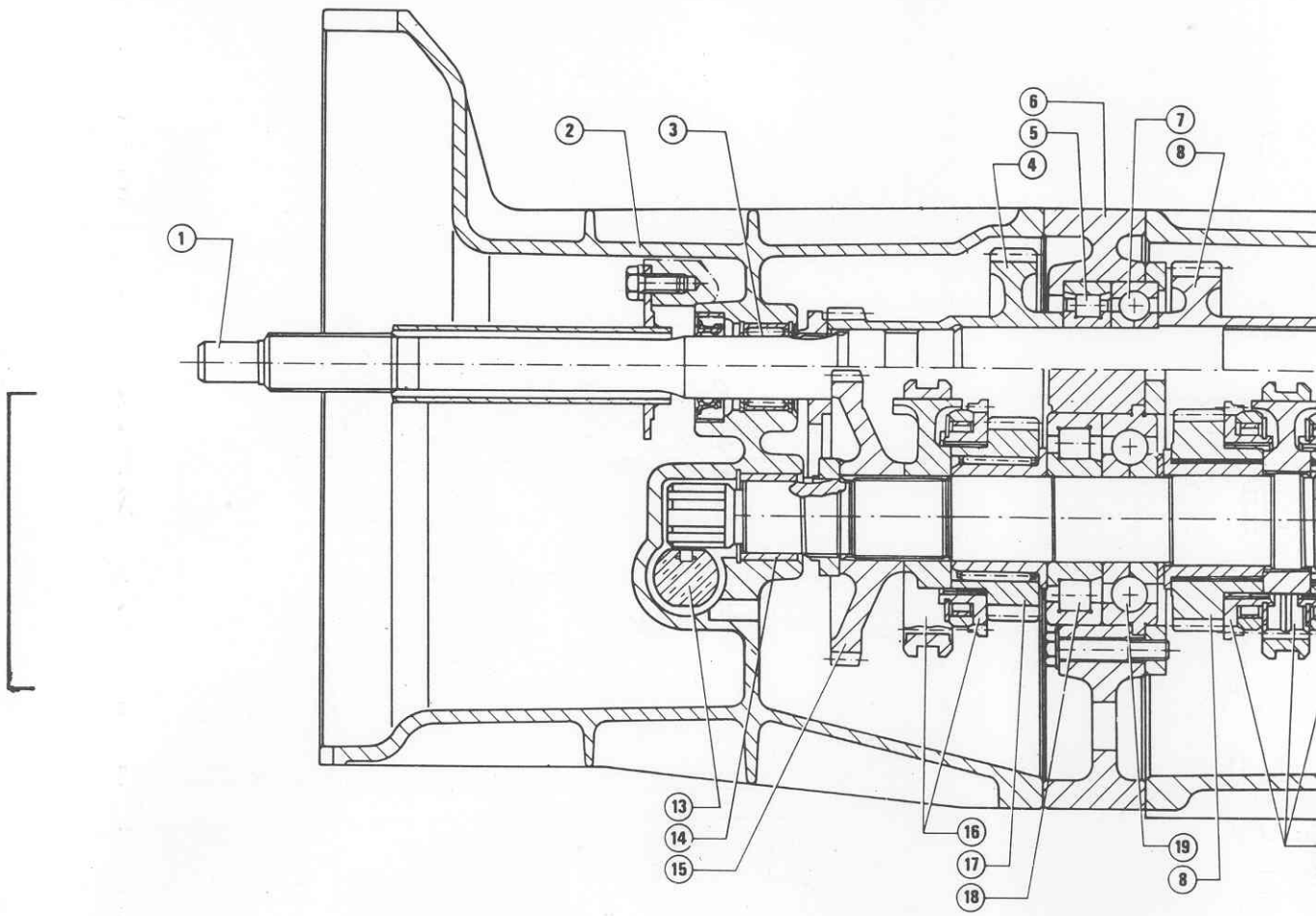
DESCRIPTION

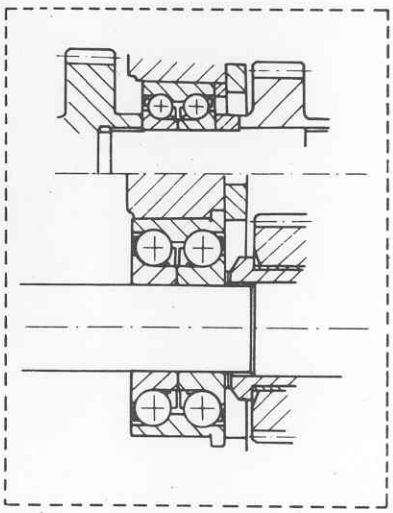
- The speed gear is of the "mechanical type" with 5 speeds plus reverse and is part of a mechanical assembly including also the clutch and differential units.
  Mamely, the front part includes the clutch unit with thrust bearing and control fork, and supports the ends of both main and pinion shafts.
  The intermediate part is composed of a flange on which speed gear shafts with the related forks and rods for speed selection and engagement are supported and secured. This part constitutes a compact assembly which can be easily removed from rear part which, on its turn, supports the ends of speed gear shafts, acts as differential-speed gear casing, and contains the differential system.
- Speed change takes place via a central floor lever connected to gearbox through a speed control lever and a linkage of "isostatic type".
  This type of linkage allows a very smooth speed change to be obtained preventing the slightest sticking.
  The isostatic control makes use of two levers: one for the speed selection and the other for the speed engagement, both housed on gearbox.
  The first lever, through tie rod and bracket, controls the rotation of speed selector rod around its axis, thus allowing speed selection to be obtained.
  The second lever permits the longitudinal movements of speed selector rod, thus determining the engaging of the previously selected speeds.
- The forward speeds gears, in constant mesh, are helical-toothed to guarantee the utmost quietness and are fitted with synchronizers operated by sleeves.
- The reverse gears are straight toothed. Engagement takes place through the movement of a sliding gear which transmits the rotation of main shaft gear to that of pinion shaft thus causing motion reversal.
- The sleeves movement takes place through forks operated by the speed selector rods. The rods slide on a flange inside which are located the positioning devices and some interlock plungers having the purpose of preventing the simultaneous engagement of several speeds.
  Another safety device for the reverse speed is secured on the clutch speed gear casing; it has the purpose of preventing the accidental transition from 5th speed to reverse.The synchronizers, via friction action, cause the driven gear and coupling sleeve to assume same speed. This ease final coupling which causes the mating of coupling toothing between sleeve and driven gear.
  In detail, the synchronizers of 2nd, 3rd, 4th and 5th speed, are fitted with two equal retainers: one used to gear down and the other to gear up, with a guide sector and a locking sector. The 1st speed synchronizer, in addition to the conventional retainer for the transition from the 2nd to 1st speed, and the guide and locking sectors, is fitted with another retainer for the transition from the neutral to the first speed, with spring, two plates and a pawl.
  This solution allows a very smooth engagement of 1st speed to be obtained; infact, in the event of sticking of sleeve toothing on gear front toothing, the spring is compressed and permits the gears to perform a slight rotation and then, a correct mating.

NOTE:
On certain models (See Unit 00 - Use of Units in the Car), a modified pinion underhead bearing, without retainer ring, is now assembled.
The two types of bearing are not interchangeable.

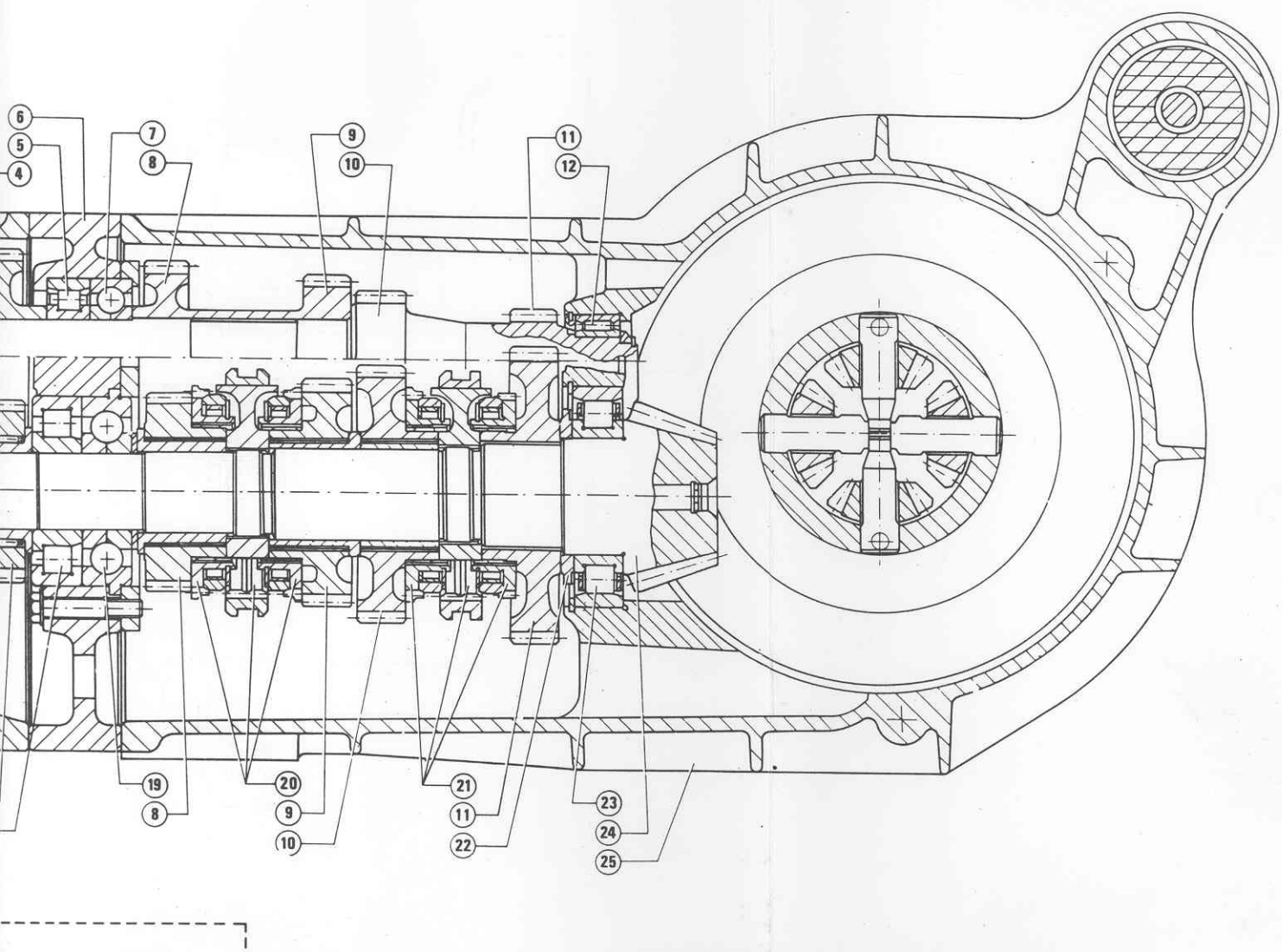
Solution with intermediate roller-ball compound bearings

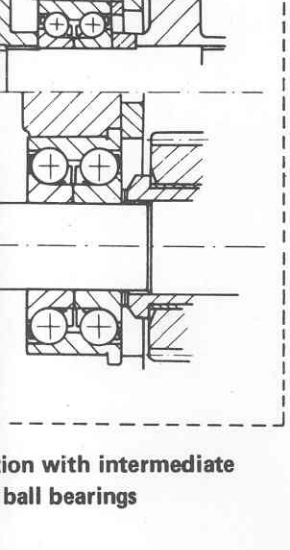


1 Main shaft
2 Clutch-speed gear casing
3 Main shaft support front needle bearing
4 5th and reverse speeds gear
5 Main shaft intermediate roller bearing
6 Intermediate flange
7 Main shaft intermediate ball bearing
8 4th speed gear
9 3rd speed gear
10 2nd speed gear
11 1st speed gear
12 Main shaft support rear needle bearing
13 Electronic odometer socket
14 Pinion shaft support front bush
15 Reverse speed gear
16 5th speed synchronizers
17 5th speed gear
18 Pinion shaft intermediate roller bearing
19 Pinion shaft intermediate ball bearing
20 3rd and 4th speeds synchronizers
21 1st and 2nd speeds synchronizers
22 Ring nut for pinion shaft rear roller bearing
23 Pinion shaft rear roller bearing
24 Pinion shaft
25 Differential-speed gear casing

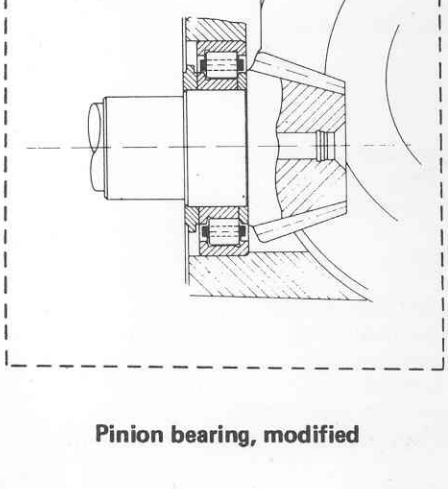


Solution with intermediate skew ball bearings

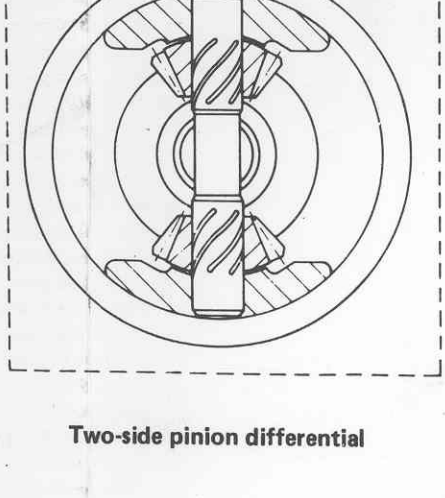




ion with intermediate
ball bearings



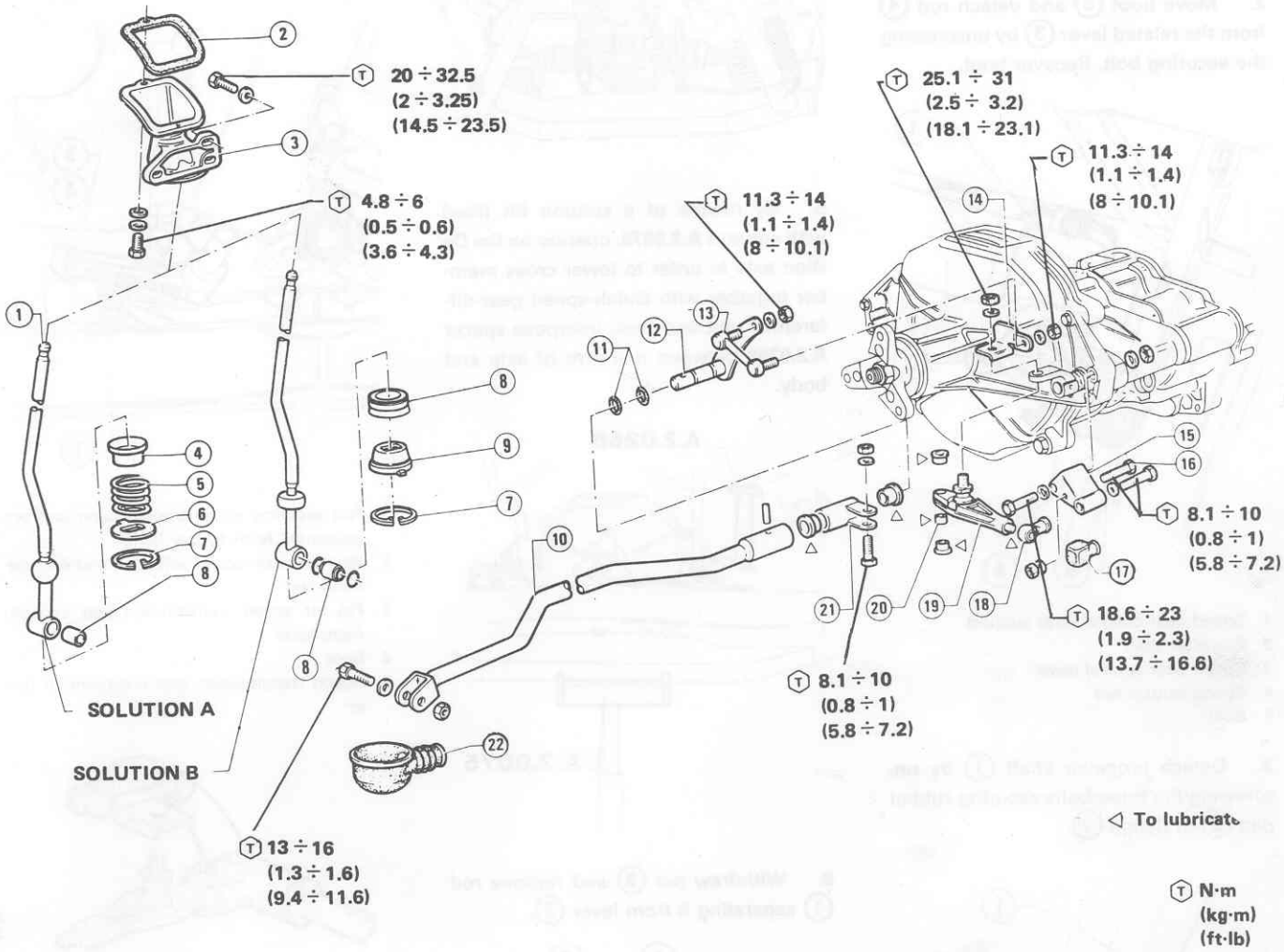
Pinion bearing, modified



Two-side pinion differential

OUTER LINKAGE

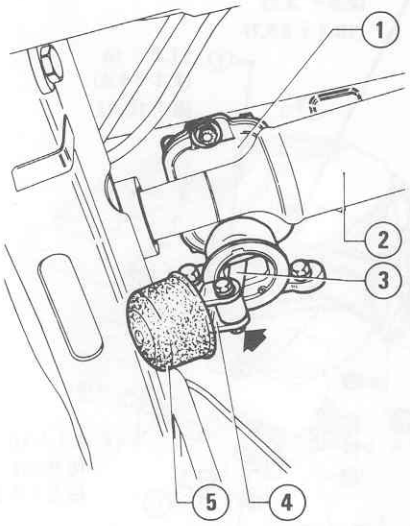
SPEED GEAR CONTROL ASSEMBLY



1 Speed gear control lever
2 Gasket
3 Speed gear control lever support
4 Cup
5 Spring
6 Plate
7 Retaining ring
8 Bush
9 Spacer
10 Speed gear control outer rod
11 O-Rings
12 Speed transmission and selection lever
13 Speed selection tie rod
14 Bracket
15 Securing bracket
16 Bolt securing bracket to speed gear rubber pad
17 Guard
18 Pin with bush for speed transmission and engagement lever
19 Speed transmission and engagement lever
20 Bush
21 Bush for speed transmission and selection lever
22 Boot

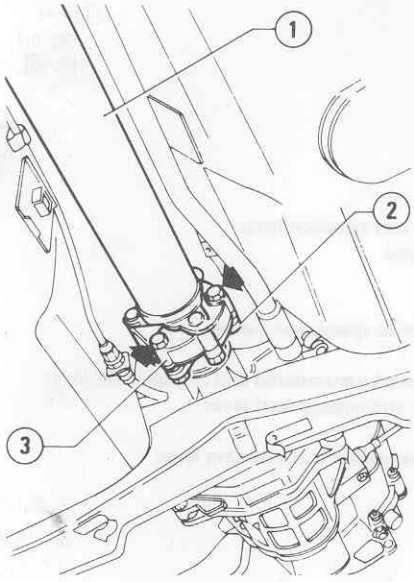
REMOVAL

1. Set vehicle on lift, remove front and central element of exhaust pipe (Refer to: Group 04 - "Exhaust system - Removal" of the "WORKSHOP MANUAL - Engines").
2. Move boot (5) and detach rod (4) from the related lever (3) by unscrewing the securing bolt. Recover boot.



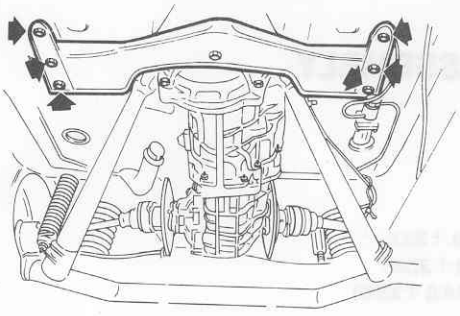
1 Speed gear control lever support
2 Propeller shaft
3 Speed gear control lever
4 Speed control rod
5 Boot

3. Detach propeller shaft (1) by unscrewing the three bolts securing rubber pad (3) to flange (2).

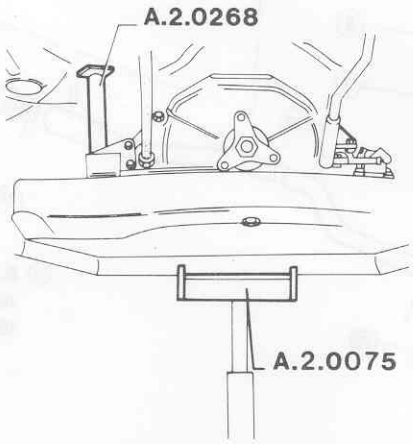


1 Propeller shaft
2 Flywheel-clutch shaft flange
3 Rubber pad

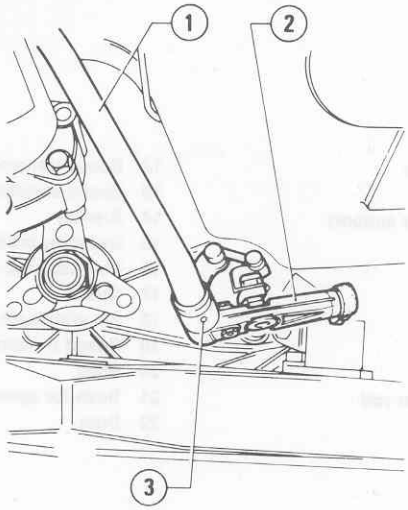
4. Unscrew the six screws securing axle front cross member to body.



5. By means of a column lift fitted with support **A.2.0075**, operate on the De Dion axle in order to lower cross member together with clutch-speed gear-differential unit and then, interpose spacer **A.2.0268** between one arm of axle and body.

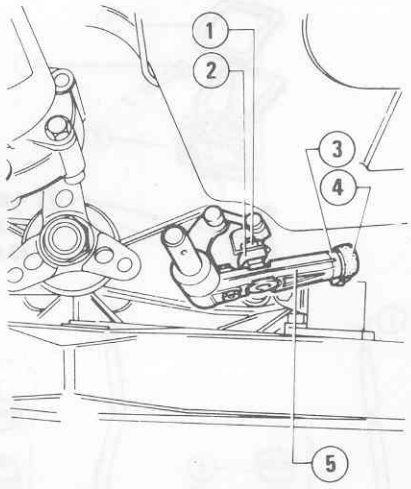


6. Withdraw pin (3) and remove rod (1) separating it from lever (2).

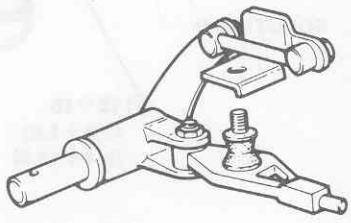


1 Speed control rod
2 Speed transmission and engagement lever
3 Connection pin

7. Unscrew and remove nut (1) securing lever (5) to lever (2) on speed selection and engagement lever.
Release the speed transmission and engagement lever from lever (2) and remove it by withdrawing pin (3) of lever (5) from boot (4) inner ball joint.



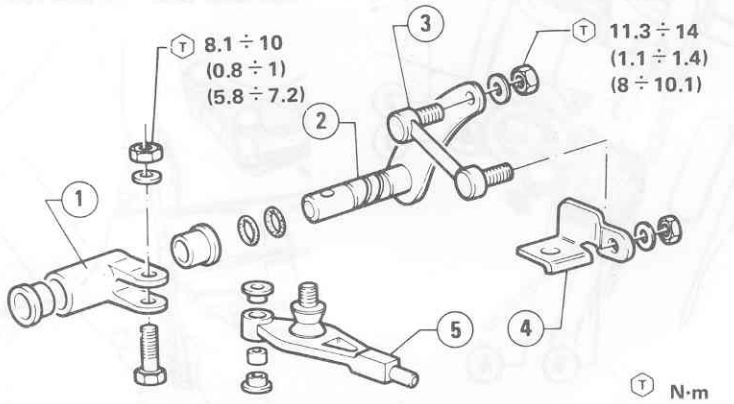
1 Nut securing speed transmission and engagement lever to rear lever
2 Rear lever on speed selection and engagement rod
3 Pin for speed transmission and engagement lever
4 Boot
5 Speed transmission and engagement lever



CHECKS AND INSPECTIONS

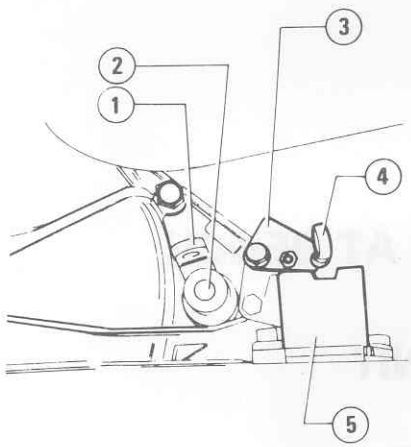
1. Clean the metal items of outer linkage with alcohol and verify they are in good conditions.
2. Check wear degree of bushes on linkage articulated joints.
3. Check ball joints of speed transmission and engagement lever and of speed selection tie rod. Replace them in the event of excessive clearance or seizing.
4. Check that rubber boot is in good conditions. Replace it if worn or damaged.
5. If required, disassemble the isostatic control assembly as shown in the figure.

- **O-Rings must be replaced at each disassembly.**
- **Reassemble the unit tightening screws and nuts to the prescribed torque shown in the figure.**



1 Bush for speed transmission and selection lever
2 Speed transmission and selection lever
3 Speed selection tie rod
4 Bracket
5 Speed transmission and engagement lever

6. If required, unscrew the two bolts securing bracket (3) to clutch - speed gear - differential unit and to rubber pad (5). Remove the bracket.



1 Rear lever speed selection and engagement rod
2 Speed selection and engagement rod
3 Securing bracket
4 Isostatic control articulated joint
5 Rubber pad

INSTALLATION

For the installation, reverse the order of removal and comply with the following. Refer to figure of page 13-5.

1. Lubricate the below items with the prescribed grease **(Molykote Longterm No. 2)**.

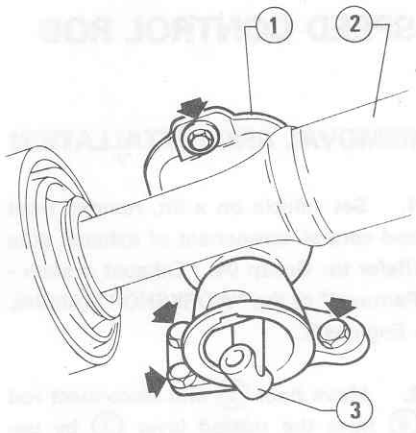
- Bushes for speed transmission and selection lever
- Ball joint for speed transmission and engagement lever
- Innerside of bushes for speed transmission and engagement lever

2. Replace the connecting spring pin with a new one.
3. Tighten screws and bolts to the torques specified in "Service Data and Specifications - Tightening Torques".
4. Check proper functioning of isostatic control.

SPEED GEAR CONTROL LEVER

REMOVAL

1. Operating from passenger compartment inside, withdraw knob of speed gear lever and rubber boot.
2. Carry out steps 1 and 2 of paragraph "Speed Gear Control Assembly - Removal".
3. Unscrew the four screws securing support (1) to body and remove it with lever (3).



1 Speed gear control lever support
2 Propeller shaft
3 Speed gear control lever

DISASSEMBLY

With reference to figure of page 13-5 remove retaining ring (7) by means of suitable pliers, and withdraw plate (6), spring (5), cup (4) and lever (1).

CHECKS AND INSPECTIONS

1. Verify components' good conditions.
2. Verify that spring is not strained.

REASSEMBLY

To reassemble, reverse the order of disassembly taking care to **lubricate** the ball joint of speed gear control lever with the prescribed grease **(ISECO Molykote BR2)**.

INSTALLATION

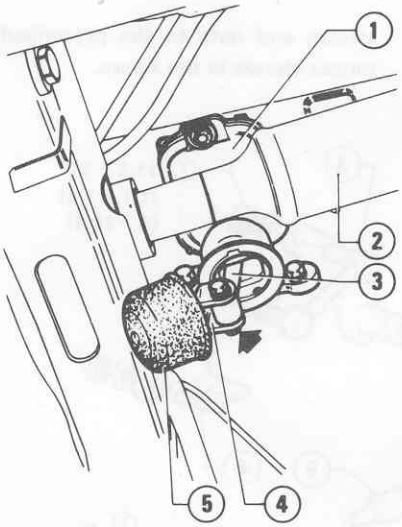
To reinstall lever, reverse the order of removal and comply with the following.
1. Take care when inserting lever into dust cover to prevent damaging it.
2. Tighten screws and bolts to the prescribed torques indicated in "Service Data and Specifications - Tightening Torques".

SPEED CONTROL ROD

REMOVAL AND INSTALLATION

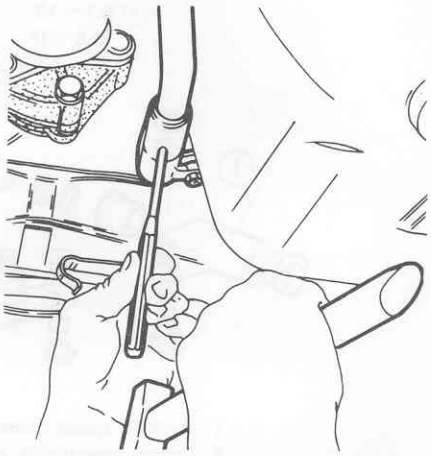
1. Set vehicle on a lift, remove front and central component of exhaust pipe (Refer to: Group 04: "Exhaust system - Removal" of the "WORKSHOP MANUAL - Engines").

2. Move boot (5) and disconnect rod (4) from the related lever (3) by unscrewing the securing bolt. Recover boot.



1 Speed control lever support
2 Propeller shaft
3 Speed control lever
4 Speed control rod
5 Boot

3. By means of a suitable punch, remove the speed control rod securing pin from the speed transmission and selection lever bush; remove rod.



4. Reassemble in reverse order to disassembly operations, replacing the connecting spring pin with a new one.

REMOVAL AND INSTALLATION OF CLUTCH-SPEED GEAR - DIFFERENTIAL UNIT

Refer to Group 17 "Removal and Installation of clutch-speed Gear-Differential Unit".

SEPARATION AND RECONNECTION AT BENCH OF SPEED GEAR UNIT FROM/TO DIFFERENTIAL UNIT

SEPARATION

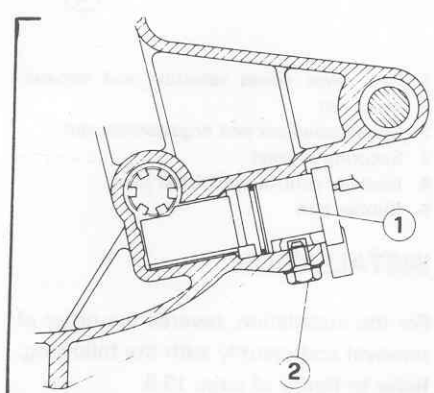
1. Clutch unit separation.

Refer to: Group 12 "Separation and Reconnection at Bench of Clutch Unit from/to speed Gear and Differential Units - Separation".

2. Separation of clutch-speed gear casing.

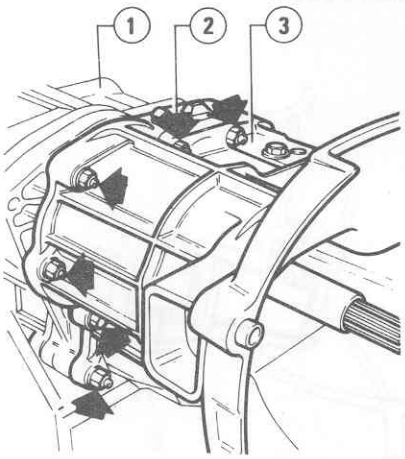
a. Drain the oil from unit, if not already done during unit removal from vehicle.

b. Unscrew the securing screw and remove the odometer electronic pulse transmitter (1).



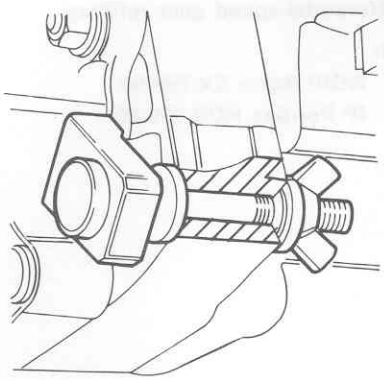
1 Odometer electronic pulse transmitter
2 Transmitter securing screw

c. Loosen and remove the nuts with related washers securing casing (3) to flange (2).



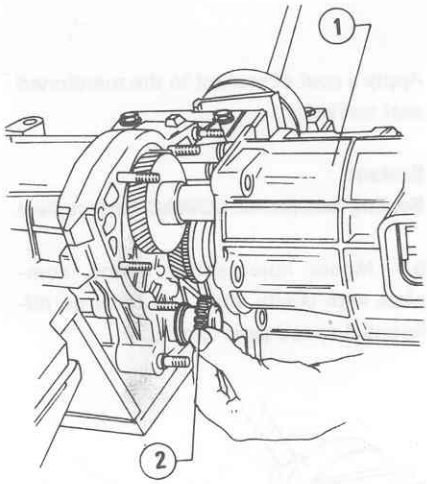
1 Speed gear-differential casing
2 Intermediate flange
3 Speed gear-clutch casing

CAUTION:
The intermediate flange surfaces mating with clutch-speed gear casing and speed gear-differential casing are fitted with sealant.
When removing only the clutch-speed gear casing, the intermediate flange can be secured to the speed gear-differential casing not concerned in the disassembly, by means of suitable clamps.



d. Withdraw casing (1) and, at the same time, recover gear (2).

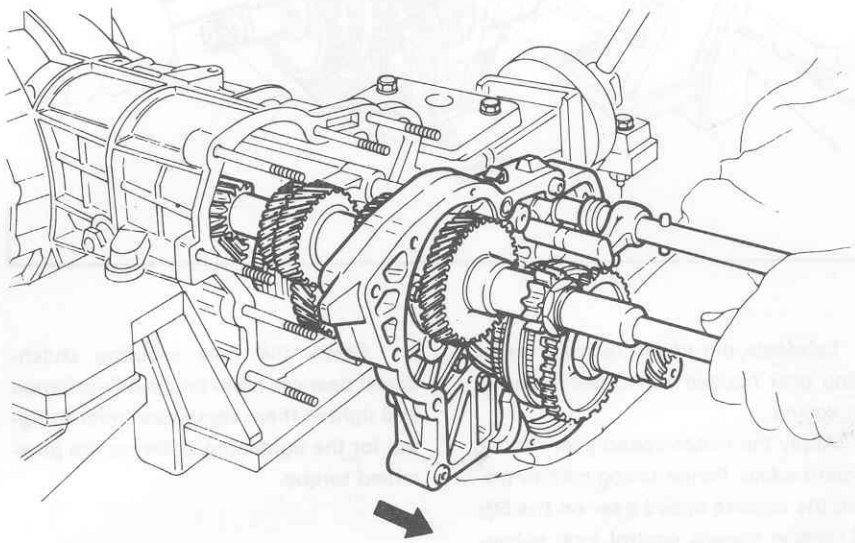
CAUTION:
Take care not to drop the Reverse transmission gear.

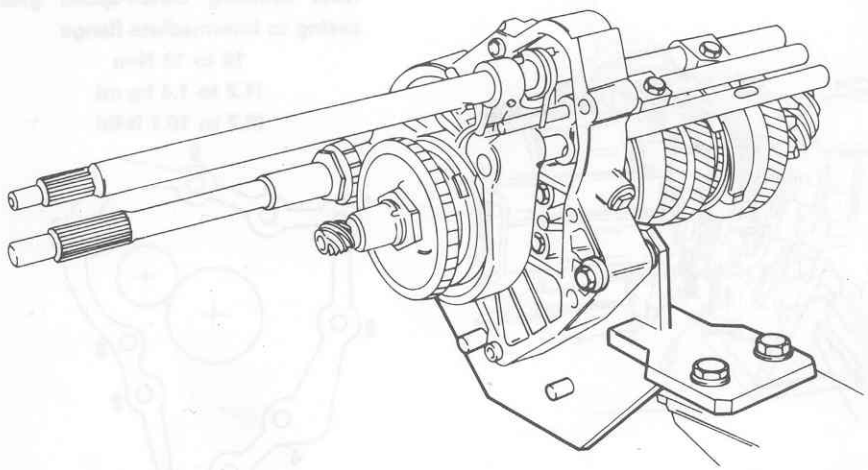


1 Clutch-speed gear casing
2 Reverse sliding gear

3. Intermediate flange positioning on overhaul stand.

a. Withdraw intermediate flange complete with primary and pinion shafts and rods and forks from differential-speed gear casing.
b. Apply the special support to intermediate flange, complete with the related shafts and control devices, then secure flange to an overhaul stand fitted with connection brackets.





RECONNECTION

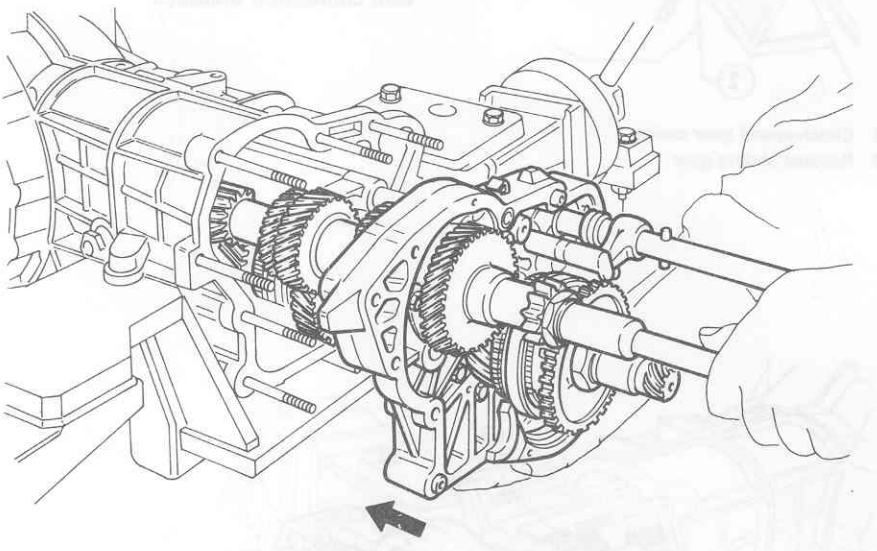
1. Intermediate flange connection to differential-speed gear casing

a. Clean the intermediate flange surfaces mating with clutch-speed gear casing and differential-speed gear casing with denatured ethyl alcohol.

Apply a coat of sealant to the mentioned seal surfaces.

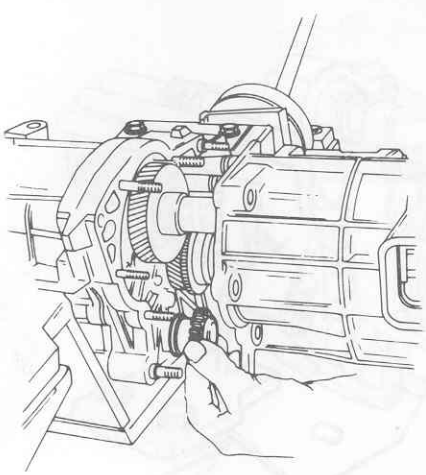
Sealant:
Sealing compound LOWAC Perfect Seal

b. Mount intermediate flange, complete with shafts, rods and forks on differential-speed gear casing.



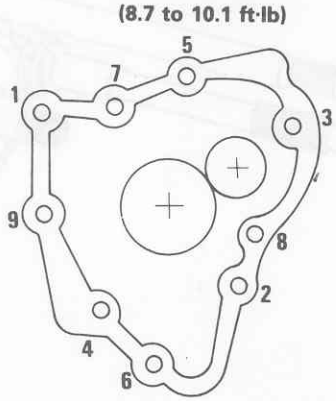
c. **Lubricate** pin of the reverse speed sliding gear housed in the clutch-speed gear casing.

d. Apply the clutch-speed gear casing to intermediate flange taking care to position the reverse speed gear on the 5th and reverse speeds control fork, subsequently centering it in the related pin.

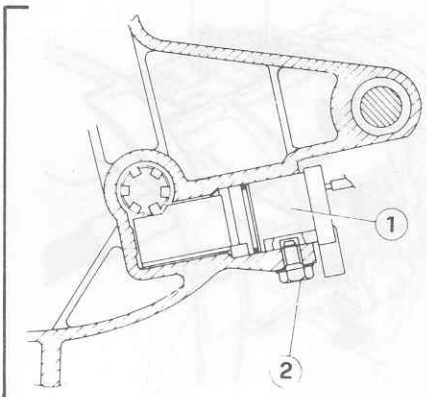


e. Screw the nuts securing clutch-speed gear casing to intermediate flange and tighten them crosswise (refer to figure for the tightening order) to the prescribed torque.

Ⓣ: **Tightening torque**
Nuts securing clutch-speed gear casing to intermediate flange
12 to 13 N·m
(1.2 to 1.4 kg·m)
(8.7 to 10.1 ft·lb)



f. Mount the odometer electronic pulse transmitter and secure it with the suitable screw.



1 Odometer electronic pulse transmitter
2 Transmitter securing screw

2. Clutch unit installation

a. Reconnect clutch unit to differential-speed gear unit (refer to: Group 12 - "Separation and Reconnection at Bench of Clutch Unit from/to speed Gear and Differential Units - Reconnection")

b. Fill the differential-speed gear casing with the prescribed quantity of suggested oil.

Differential-speed gear refilling

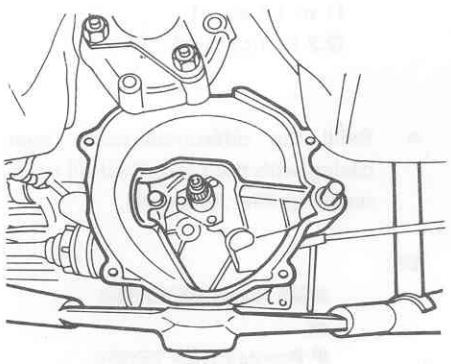
Oil:

AGIP Rotra SX 75W90
IP Pontiax HDS 75W90

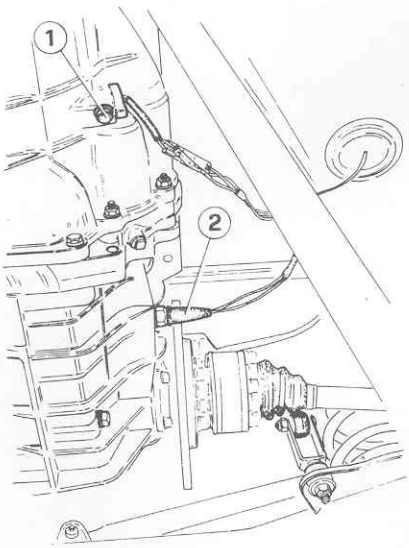
REMOVAL AND INSTALLATION OF SPEED GEAR UNIT (Intervention on vehicle)

REMOVAL

1. Set vehicle on lift and lock front wheels with suitable safety chocks.
2. Raise vehicle and drain oil from differential-speed gear casing.
3. Detach clutch unit (refer to Group 12 - "Clutch Unit Removal and Installation (Intervention on vehicle) Removal")

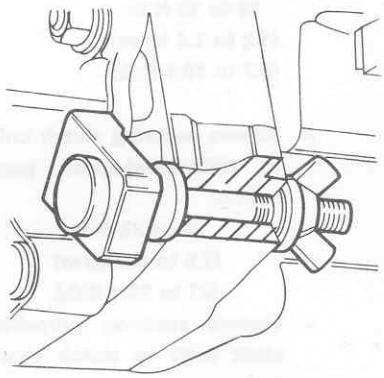


4. Disconnect connection (2), unscrew screw (1) and remove odometer pulse transmitter.



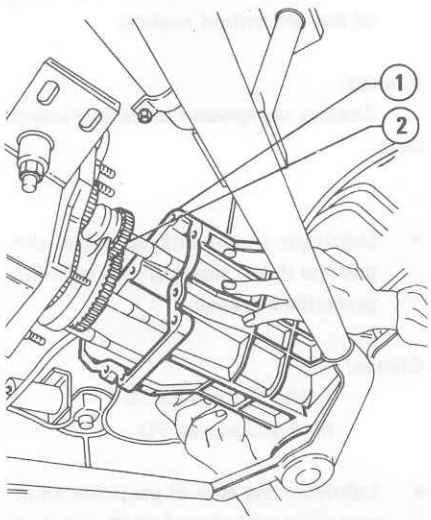
1 Screw securing odometer pulse transmitter to gearbox
2 Connection for reverse lights switch cable

5. By means of suitable clamps, secure intermediate flange to differential-speed gear casing.
Set a column lift under speed gear unit, in the vicinity of intermediate flange, the column lift must be fitted with a support with clamps to secure support itself to gearbox.



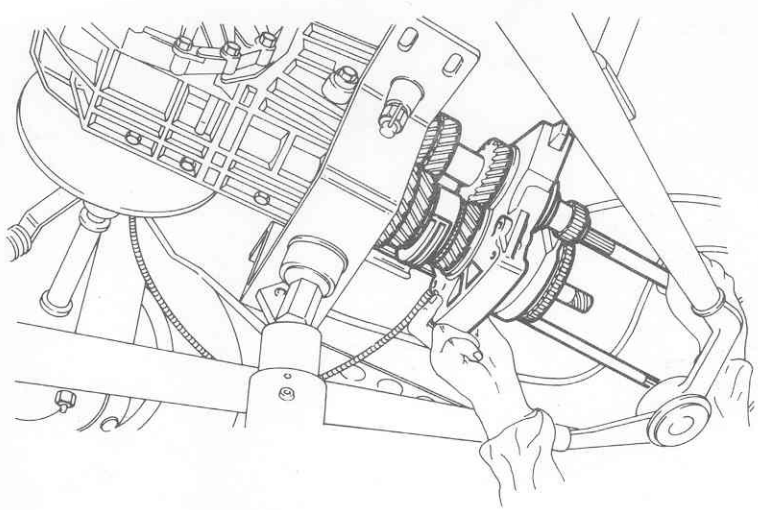
Unscrew screws and nuts connecting clutch-speed gear and differential-speed gear casings.
Remove clutch-speed gear casing (1); if necessary, tap by means of a resin mallet; then recover gear (2).

Take care not to drop the reverse speed transmission gear.



1 Clutch-speed gear casing
2 Reverse speed transmission gear

6. If required, disconnect the intermediate flange previously secured to differential-speed gear casing and remove it, complete with shafts, gears and speed engagement devices.



INSTALLATION

For installation, reverse the order of removal and comply with teh following.

- Clean the flange surfaces mating with differential-speed gear and clutch-speed gear casings with denatured ethyl alcohol, then lay a coat of the prescribed sealant.

Sealant:

Sealing compound LOWAC Perfect Seal

- **Lubricate** clutch fork spherical pin and the thrust bearing seat with the prescribed grease.

Grease:

AGIP Grease 33 FD
IP Autogrease FD

- **Lubricate** the seat of propeller shaft rear joint with 5 cm^3 (0.30 cu.in) of the prescribed grease.

Grease:

ISECO Molykote BR2

- Comply with the following tightening torques

(T): Tightening torques

– Nuts securing clutch-speed gear casing to differential-speed gear casing

Perform tightening crosswise
12 to 13 N·m
(1.2 to 1.4 kg·m)
(8.7 to 10.1 ft·lb)

– Screws securing clutch unit to differential-speed gear casing
29 to 32 N·m
(2.9 to 3.2 kg·m)
(21 to 23.1 ft·lb)

– Screws securing propeller shaft joint to clutch shaft fork

Solution with intermediate skew ball bearings
40 to 50 N·m
(4 to 5 kg·m)
(28.9 to 36.1 ft·lb)

Solution with intermediate roller/ball bearings
55 to 57 N·m
(5.6 to 5.8 kg·m)
(40.5 to 41.9 ft·lb)

– Unions of clutch hydraulic system pipes
8 to 10 N·m
(0.8 to 1 kg·m)
(5.8 to 7.2 ft·lb)

– Unions of clutch hydraulic system hoses
10 to 15 N·m
(1 to 1.5 kg·m)
(7.2 to 10.8 ft·lb)

- Refill the differential-speed gear casing with the prescribed oil up to reaching filler hole level.

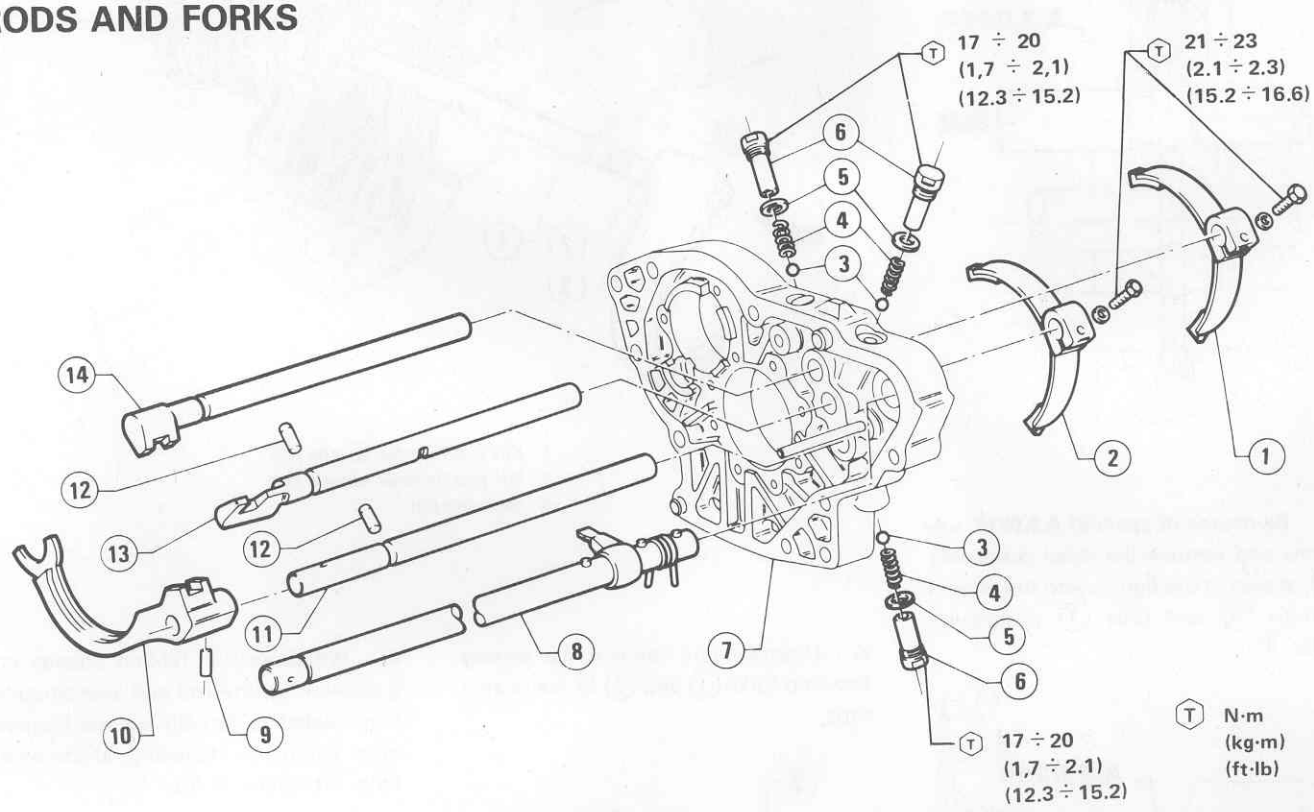
Oil:

AGIP Rotra SX 75W90
or
IP Pontiax HDS 75W90

- Bleed air from clutch system

OVERHAUL AT BENCH OF SPEED GEAR UNIT

RODS AND FORKS



1 1st - 2nd speeds fork
2 3rd - 4th speeds fork
3 Ball
4 Spring
5 Washer
6 Plug-container
7 Intermediate flange
8 Speed selection and engagement control rod
9 Spring pin
10 5th and reverse speeds fork
11 5th and reverse speeds rod
12 Detent ball
13 3rd and 4th speeds rod
14 1st and 2nd speeds rod

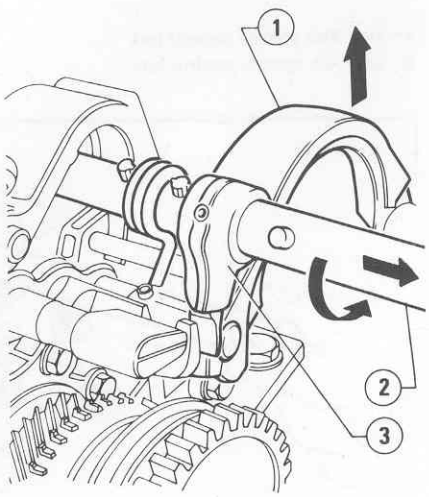
DISASSEMBLY

Set the intermediate flange on an overhaul stand (Refer to: "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential Unit") then disassemble rods and forks operating as follows.

1. Disassembly of speed selection and engagement rod

a. Rotate rod (2) counterclockwise to win reaction of spring thus obtaining the rotation of lever (3) tooth; at the same time rotate counterclockwise fork (1), then withdraw rod (2).

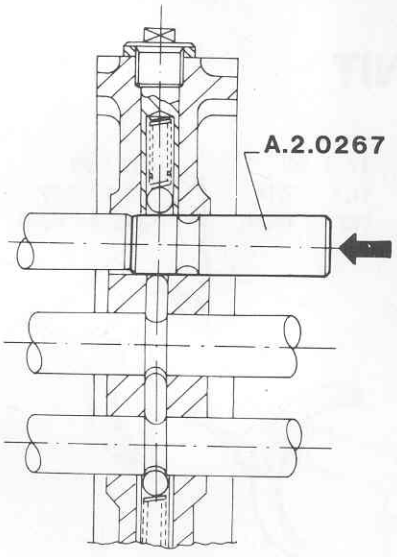
To rotate rod, temporarily insertion is recommended of the related lever with securing pin.

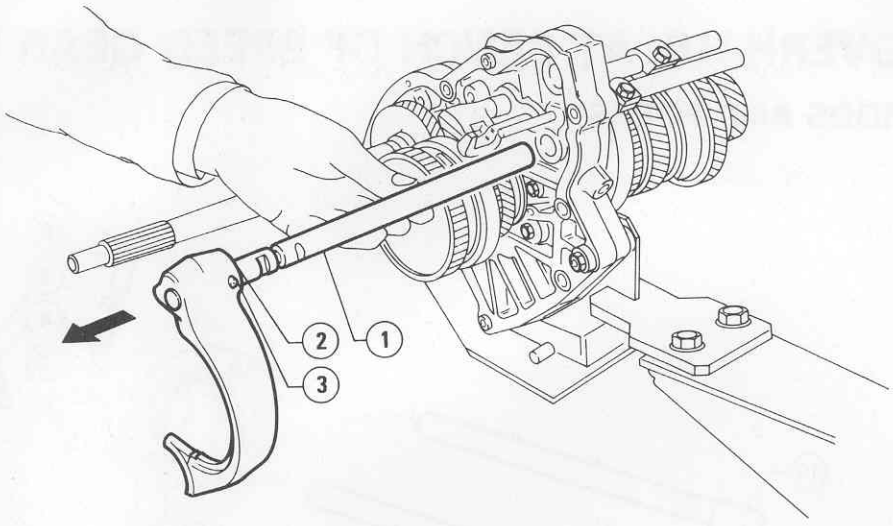


1 5th - Reverse speeds fork
2 Speed selection and engagement lever
3 Speed selection lever

2. Disassembly of speed engagement rods

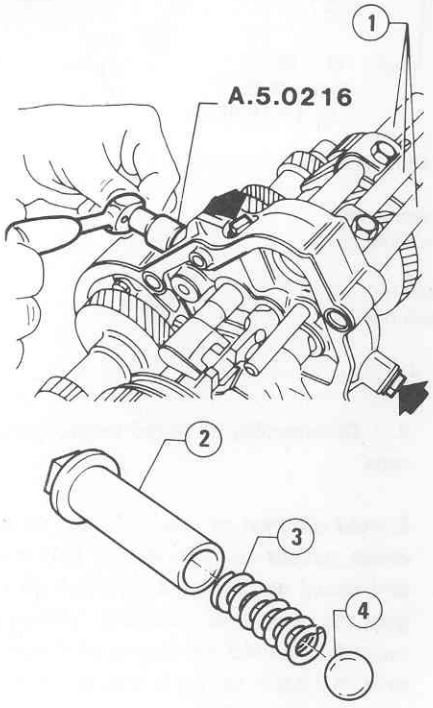
Should removal of one rod only, or no check related to rods detent ball unit and speed engagement interlock plungers be required, interlock plungers must be secured by means of dummy rods A.2.0267 to be inserted, at the same time, at the opposite side with respect to withdrawal of speed engagement rods.





1 5th and Reverse speeds rod
2 5th and Reverse speeds fork
3 Securing pin

a. By means of spanner **A.5.0216**, unscrew and remove the three containers (2), shown in the figure, with the related springs (3) and rods (1) positioning balls (4).

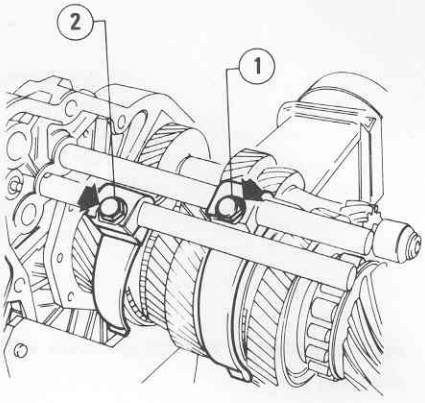


1 Speed engagement rods
2 Container
3 Thrust spring
4 Detent ball

b. Remove rod (1) with fork (2) for 5th and reverse speeds engagement control and, if required, disassemble them by removing pin (3) by means of a punch.

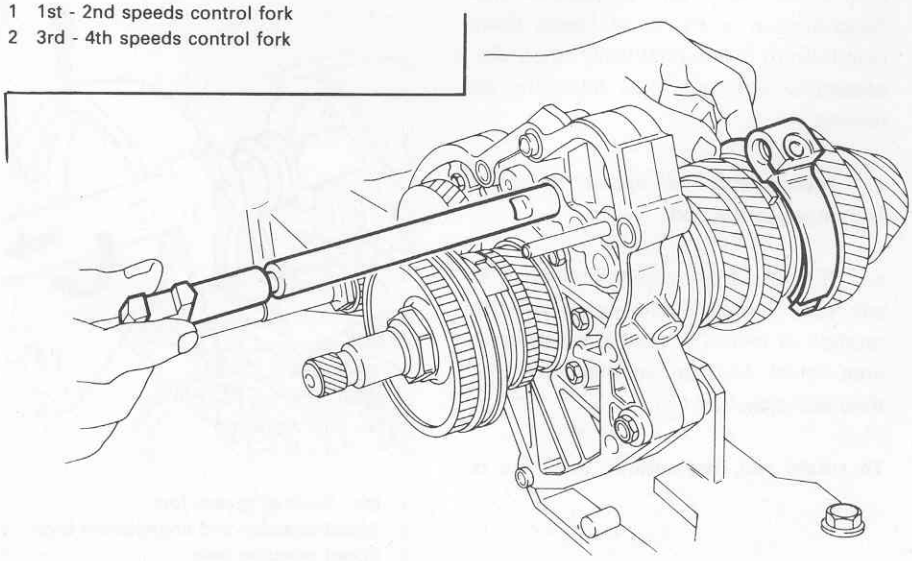
Mark the position related to rod-fork so that correct position can be restored when reassembling.

c. Unscrew and remove the screws securing forks (1) and (2) to the related rods.

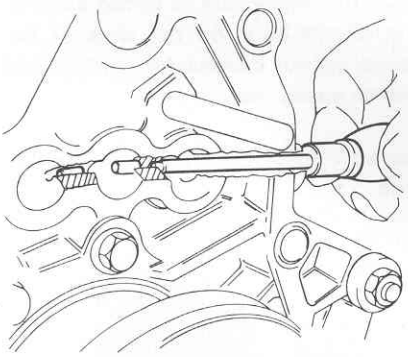


1 1st - 2nd speeds control fork
2 3rd - 4th speeds control fork

d. Withdraw the 1st-2nd speeds engagement control rod and subsequently that related to 3rd-4th speeds engagement control by removing, at the same time, the related forks.



e. Remove the speed engagement interlock plungers from intermediate flange.



CHECKS AND INSPECTIONS

Before carrying out the check-operations, carefully wash the components. This allow the superficial defects, wear degree and efficiency of a few items to be better identified.

1. Springs, balls, pawls.

a. Verify good conditions of rods detent ball thrust springs; in the event of suspected strain, replace them.
If required, check spring stiffness.

Test load
C = 90 to 97.6 N
(9.18 to 9.95 kg)

Unloaded spring length
L = 30.6 mm (1.2 in)

Loaded spring length
L_c = 18.8 mm (0.74 in)

b. Verify that rods detent balls and interlock plungers are free from scratches or seizing.

2. Rods and forks

a. Verify that rods are free from deformations and that no sign of scratch or seizing is present on control rod slots.
b. Verify that speed control forks are not deformed or too worn.
c. Verify that rods slide freely in their seats without excessive clearance.

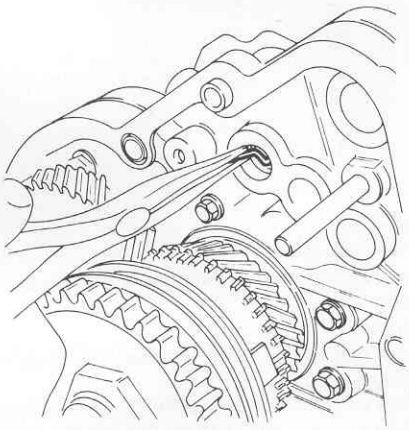
REASSEMBLY

1. Reassembly of speed engagement rods.

a. **Lubricate** the speed engagement interlock plungers with the prescribed grease, then insert them into the related seats on intermediate flange.

Speed engagement and anti-slipping devices

Grease:
AGIP F1 Grease 33 FD
IP Autogrease FD

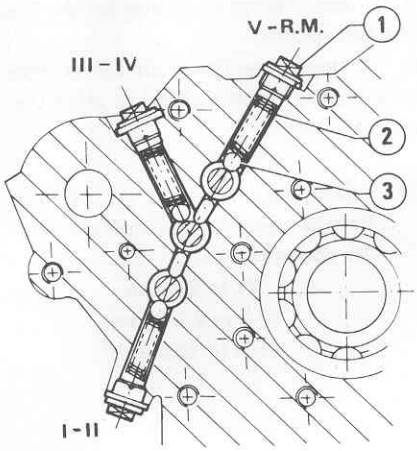


b. Position fork on 1st-2nd speed sleeve. **Lubricate** the working surfaces and insert the related rod into intermediate flange inserting if on fork.
c. Carry out same procedure to reassemble rod and fork of 3rd-4th speed.
d. If previously detached, reconnect 5th. Reverse speeds control fork on the related rod by means of a new pin, then insert the unit into intermediate flange.

When reassembling fork, align the marks carried out during disassembly.

e. **Lubricate** detent balls (3) with the prescribed grease (**Grease: AGIP F1 Grease 33 FD** or **IP Autogrease FD**) then insert them into the related seats on intermediate flange, together with springs (2). Screw plugs (1) and tighten them with spanner **A.5.0216** to the prescribed torque.

(T): **Tightening torque**
Containers securing springs and rods detent balls
17 to 20 N·m
(1.7 to 2.1 kg·m)
(12.3 to 15.2 ft·lb)

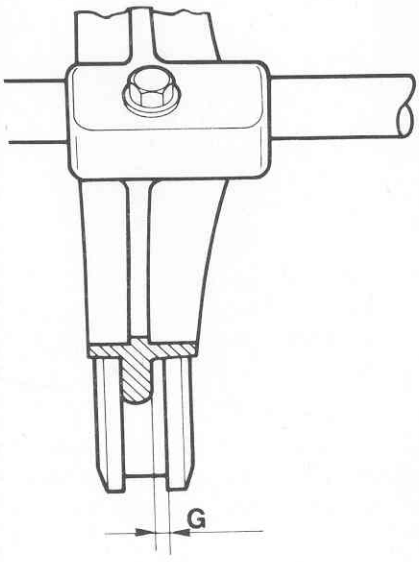


1 Plug
2 Thrust spring
3 Speed engagement rods detent ball

2. Securing of speed engagement forks.

To correctly secure the 1st-2nd and 3rd-4th speeds control forks follow the below procedures.
a. Set speed gear unit to neutral position.
b. Center the synchronizers sleeves, related to the mentioned speeds, on the related hubs and tighten the forks securing screws.
c. Engage the 1st speed, then the 2nd verifying each time that sleeve axial clearance **"G"** is that prescribed.

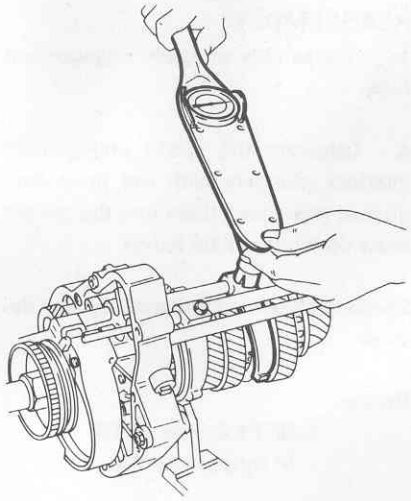
Sleeve axial clearance
G = 0.7 to 0.9 mm
(0.0275 to 0.0354 in)



d. Repeat same operation for the 4th and 5th speeds.

e. If necessary, carry out the suitable adjustments, then tighten to the prescribed torque.

Ⓣ : **Tightening torque**
Screws securing 1st-2nd and 3rd-4th speeds forks
21 to 23 N·m
(2.1 to 2.3 kg·m)
(15.2 to 16.6 ft·lb)



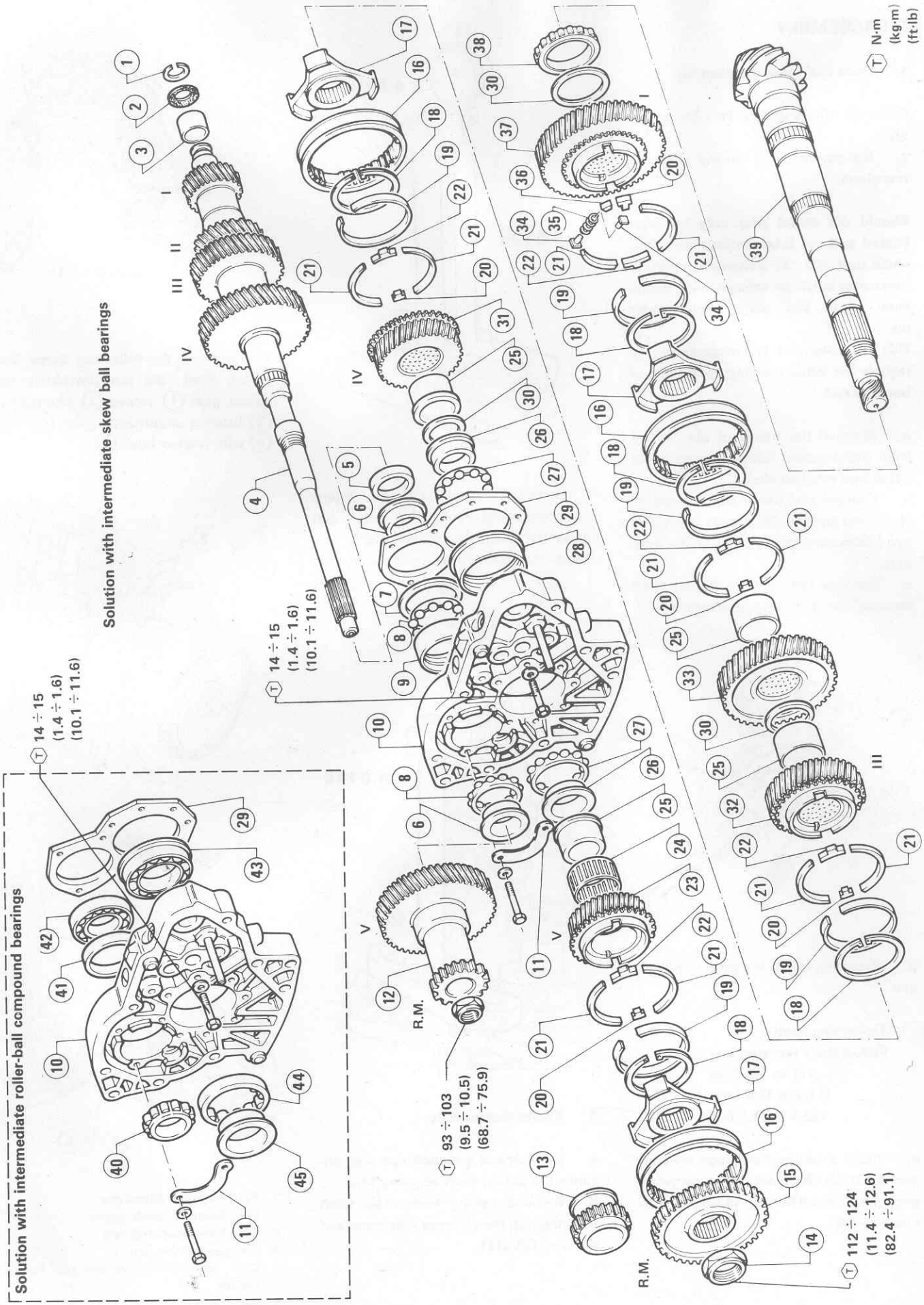
3. Reassembly of speed selection and engagement rod.

Install the speed selection and engagement rod taking care to centre tooth of the related lever on the slots of the speed control devices for 1st-2nd and 3rd-4th speed rods.

Correctly bed the return spring on stud.

SHAFTS AND GEARS

1 Retaining ring
2 Plastic bevel bush
3 Inner ring for main shaft rear needle bearing
4 Main shaft
5 Spacer
6 Inner ring for main shaft intermediate flange bearing
7 Spacer
8 Cage with balls for mainshaft intermediate flange
9 Outer ring for main shaft intermediate flange bearing
10 Intermediate flange
11 Fastener for main shaft intermediate flange bearings outer ring
12 5th and reverse speeds driving gear
13 Reverse speed idle gear
14 Nut
15 Reverse speed driven gear
16 Sleeve
17 Hub
18 Retaining ring
19 Synchronizer ring
20 Guide sector
21 Retainer
22 Locking sector
23 5th speed driven gear
24 Pinion shaft cage with needles
25 Bush
26 Internal ring for pinion shaft intermediate flange bearing
27 Cage with balls for pinion shaft intermediate flange
28 Outer ring for pinion shaft intermediate flange bearing
29 Shoulder plate
30 Shim
31 4th speed driven gear
32 3rd speed drive gear
33 2nd speed driven gear
34 Strikers
35 Spring
36 Pawl
37 1st speed driven gear
38 Pinion shaft roller bearing
39 Pinion shaft
40 Roller bearing for main shatf intermediate flange
41 Outer ring for main shaft intermediate flange roller bearing
42 Main shaft intermediate flange ball bearing
43 Pinion shaft intermediate flange ball bearing
44 Outer ring for pinion shaft intermediate flange roller bearing
45 Inner ring for pinion shaft intermediate flange roller bearing
46 Ring nut



DISASSEMBLY

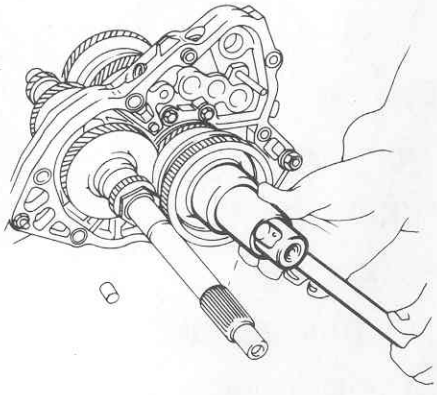
1. Rods and forks disassembly.

Refer to: "Rods and forks - Disassembly".

2. Measurement of pinion shaft dimensions.

Should the speed gear only be overhauled without interventions on differential unit, the "A" dimension must be measured between intermediate flange inner plane and pinion head outer plane.
This measurement is indispensable to restore the initial working conditions of bevel pinion.

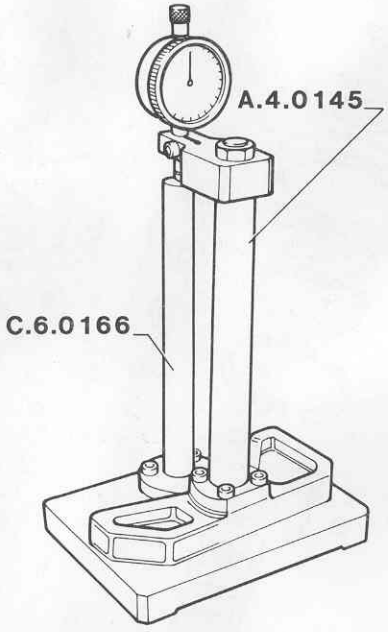
a. Remove the traces of old sealant from intermediate flange planes using denatured ethyl alcohol.
b. Operate on control sleeves related to 1st-2nd and 3rd-4th speeds to engage two speeds in order to block shafts rotation.
c. Remove calking from pinion shaft securing nut, then release pinion shaft.



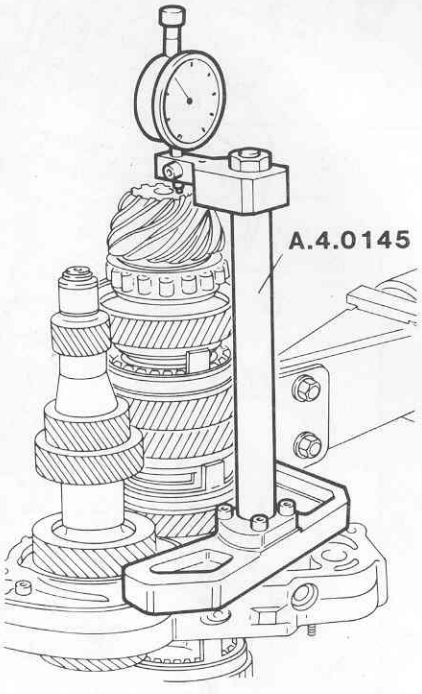
d. Retighten nut to the prescribed torque.

(T): **Tightening torque**
Pinion shaft securing nut
112 to 124 N·m
(11.4 to 12.6 kg·m.)
(82.4 to 91.1 ft·lb)

e. Install a centesimal gauge on support **A.4.0145**, the reset gauge on reference gauge **C.6.0166** to the nominal dimension **"A"**.

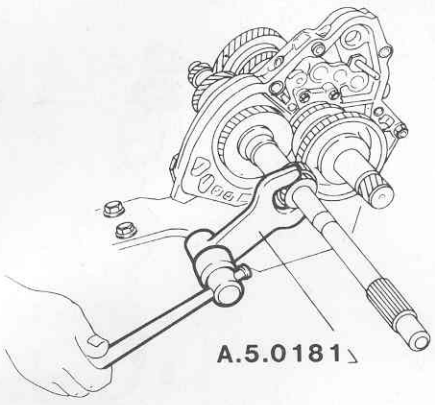


f. Rest the centesimal gauge support on intermediate flange inner plane and gauge probe on pinion head plane.
Measure and note down the read value.

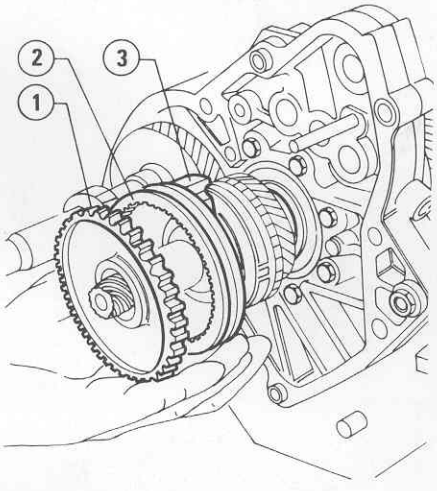


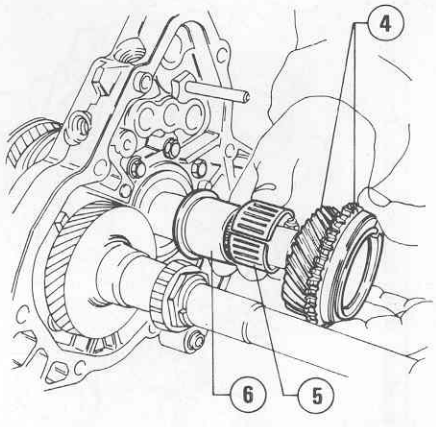
3. Shafts disassembly

a. By means of a suitable spanner, unscrew the pinion shaft securing nut.
b. Remove calking from main shaft securing nut, then release it by means of spanner **A.5.0181**.



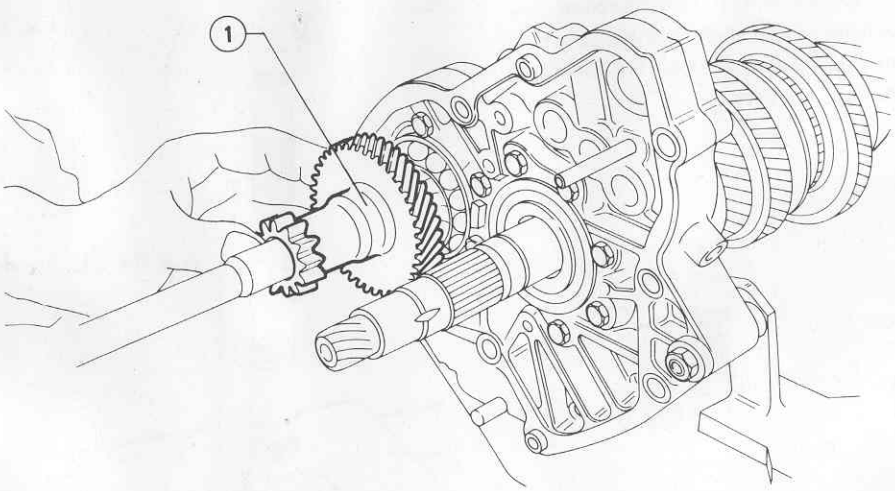
c. Remove the following items from pinion shaft: the nut previously loosened, gear (1), sleeve (2) with the hub (3) located underneath, gear (4), cage (5) with related bush (6).





1 Reverse speed driven gear
2 5th - Reverse speeds sleeve
3 5th - Reverse speeds hub
4 5th speed driven gear
5 Cage with needles for 5th and Reverse speeds
6 5th - Reverse speeds bush

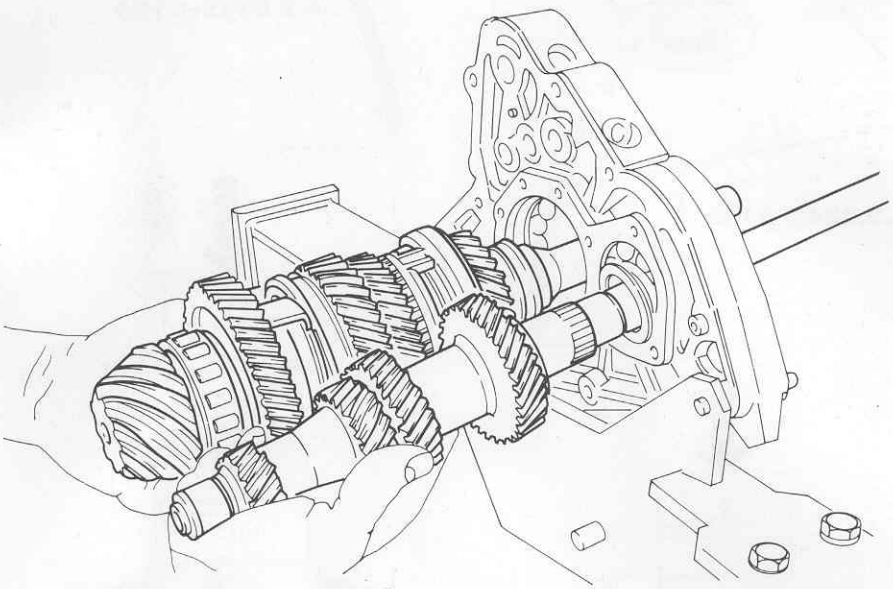
d. Remove the previously loosened nut and gear (1) from main shaft.



1 5th - Reverse speeds driving gear

e. By means of a resin mallet, tap on tangs of main and pinion shafts then withdraw them at the same time from intermediate flange. The rear inner races of intermediate flange ball bearings must be removed at the same time of shafts removal.

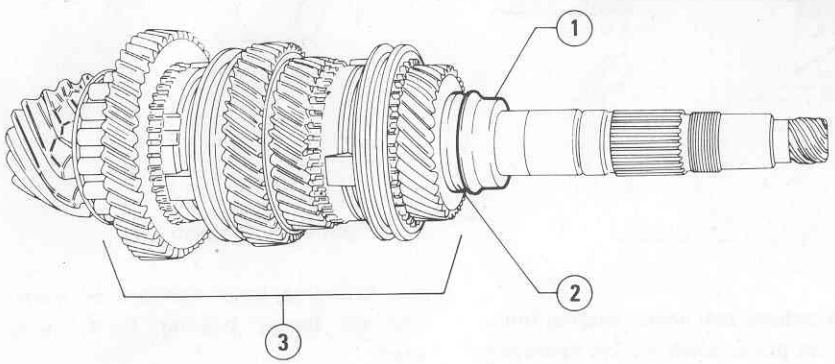
Take care not to drop front inner half-races of bearings.



f. Remove front inner half-races from intermediate flange.

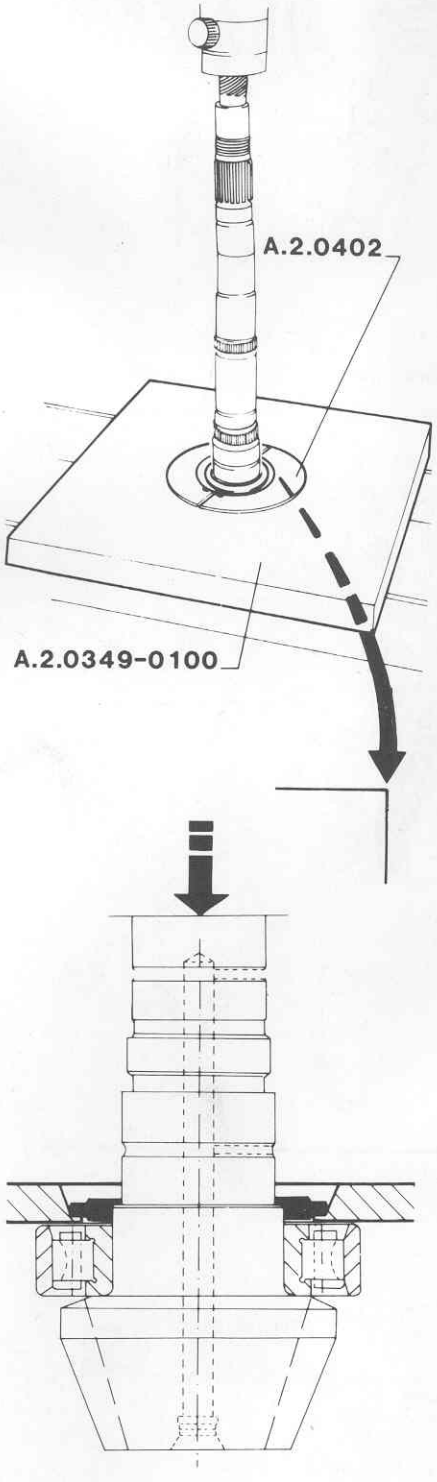
4. Pinion shaft disassembly

a. Remove inner half-race (1), shim ring (2) and then the whole gear package (3) composing shaft itself from pinion shaft.

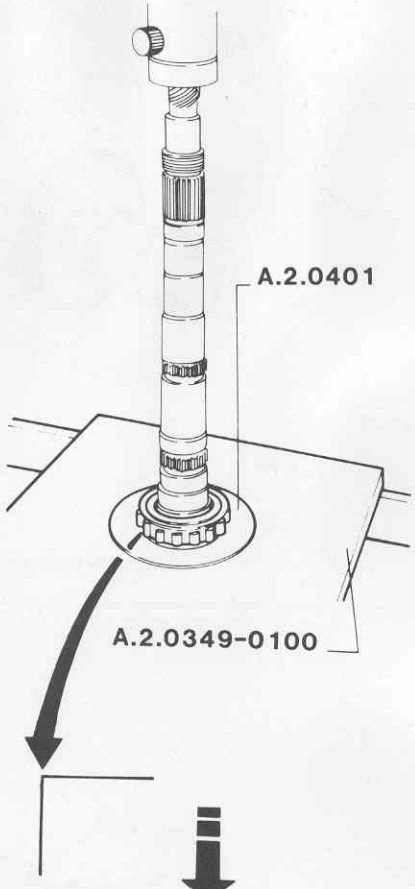


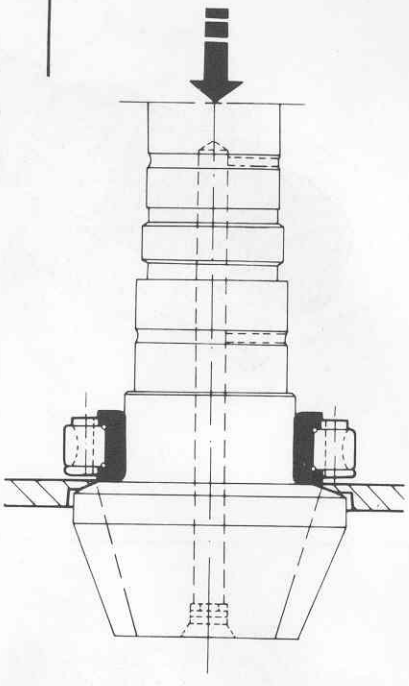
1 Intermediate flange bearing inner half-race
2 Shim ring for pinion-ring bevel gear distance adjustment
3 Driven gear package

b. Withdraw rear roller bearing ring nut from pinion shaft operating at press and making use of plate **A.2.0349-0100** with tool **A.2.0402**.



c. Withdraw rear roller bearing inner race from pinoin shaft always operating at press with plate **A.2.0349-0100** and tool **A.2.0401**.

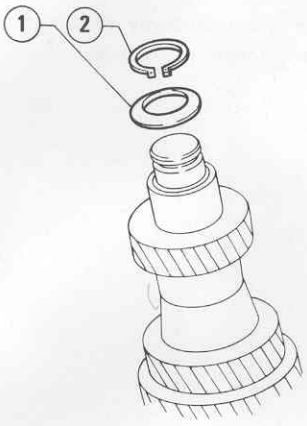




5. Main shaft disassembly

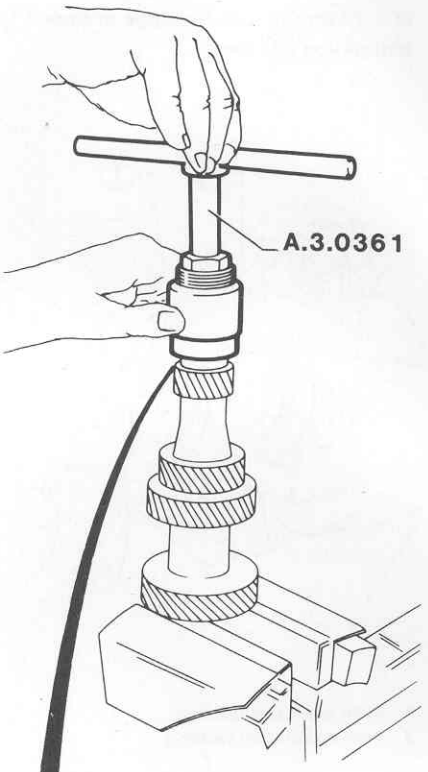
a. Withdraw inner half-race oif intermediate flange bearing from main shaft.

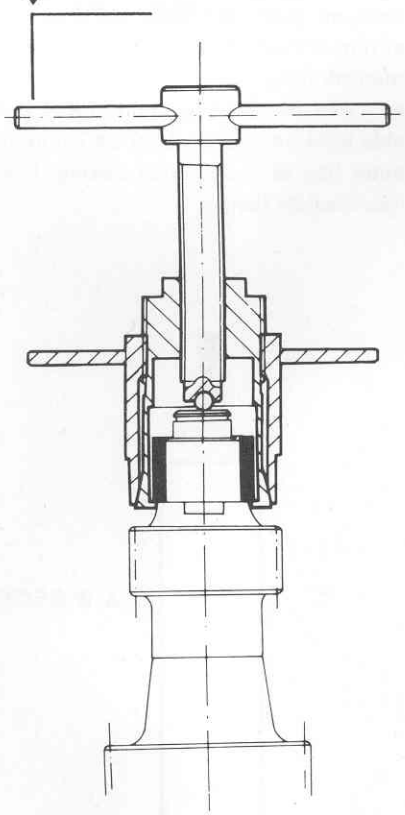
b. Secure main shaft to rice fitted with protective jaws, then remove retaining ring (1) and bush (2).



1 Retaining ring
2 Plastic bevel bush

c. Withdraw inner race of rear needle bearing from main shaft, by means of puller **A.3.0361**.



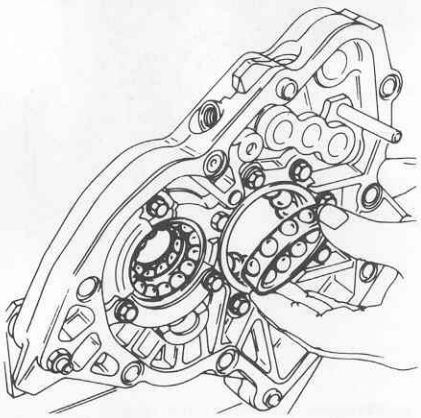


6. Intermediate flange disassembly

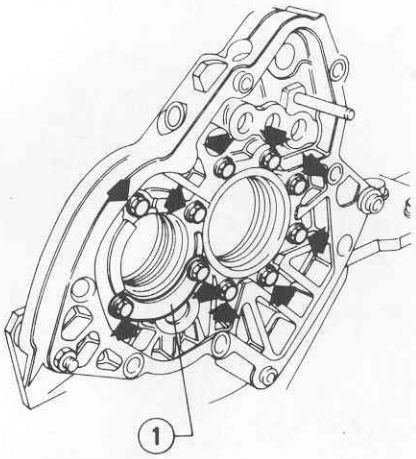
Solution with intermediate skew ball bearings.

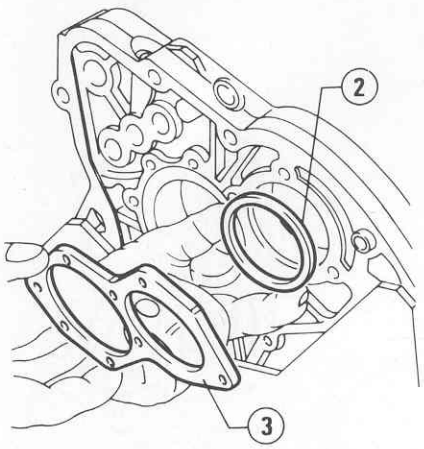
a. Withdraw rolling elements (balls with cages) from outer races of intermediate flange bearings.

CAUTION:
If bearings are not to be replaced, mark them so that original position can be restored during reassembly.



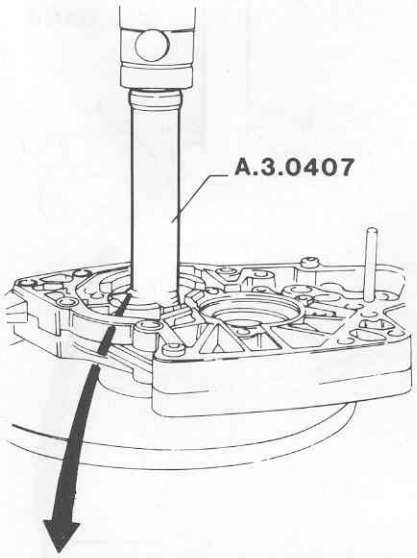
b. Unscrew and remove the screws with related washers securing plate (3) to intermediate flange. Recover clamp (1), plate itself and spacer (2). Remove intermediate flange from support on overhaul stand.

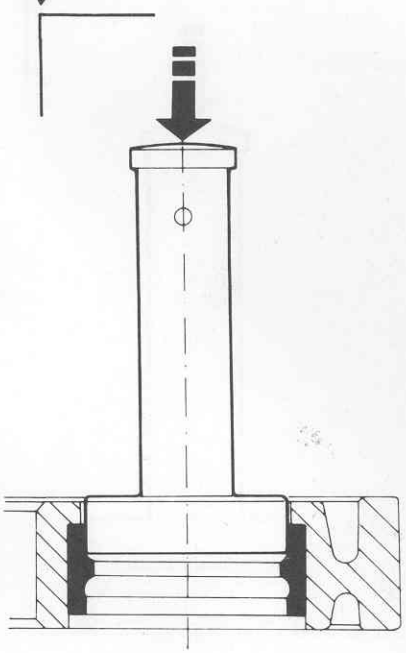




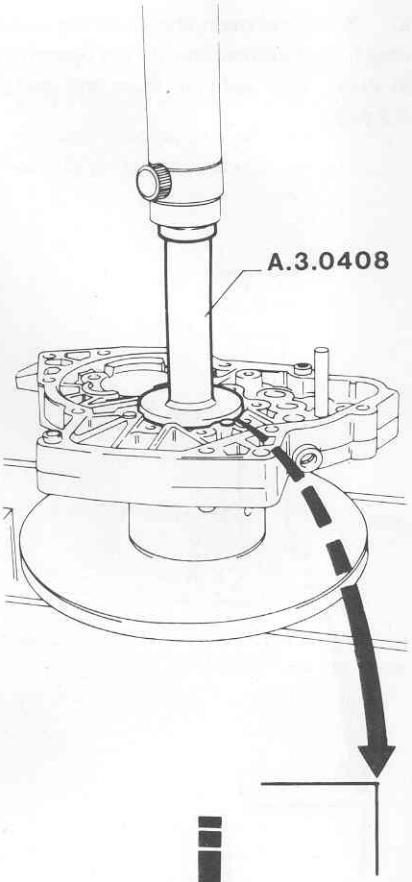
1 Bearing outer race clamp
2 Shoulder spacer
3 Shoulder plate for bearing outer races

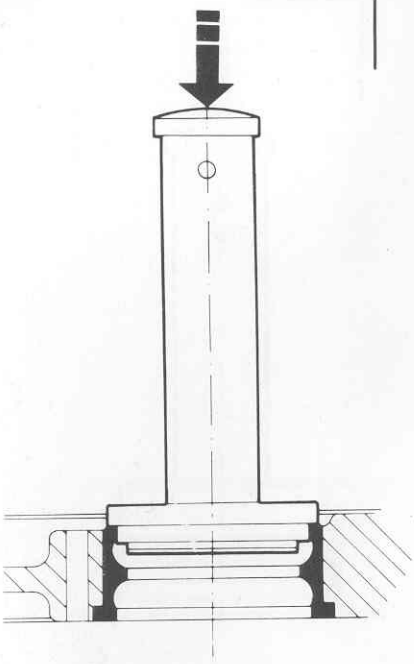
c. Withdraw main shaft bearing outer ring from intermediate flange operating at press, with suitable base and puller **A.3.0407**.





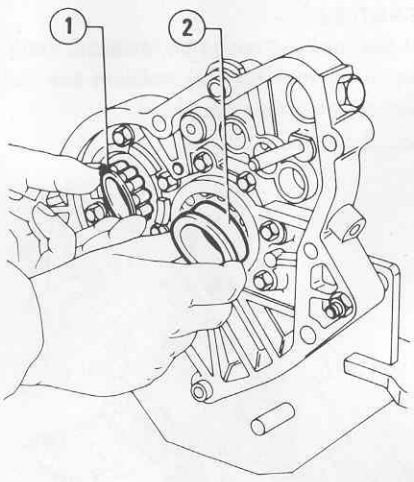
d. Withdraw pinion shaft bearing outer ring from intermediate flange always operating at press, with suitable base and puller **A.3.0408**.





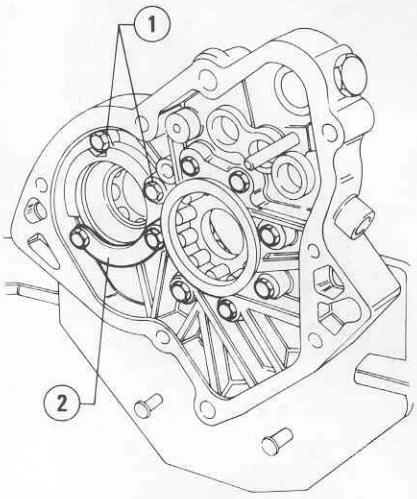
Solution with intermediate roller/ball bearings

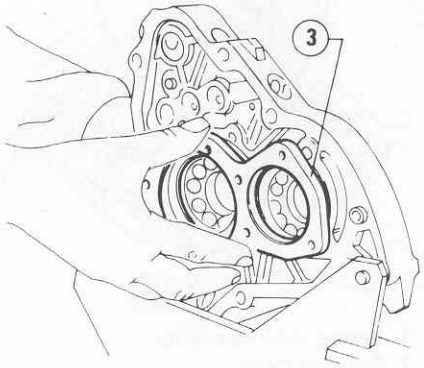
a. Disassemble inner races (1) and (2) of roller bearings related to main and pinion shaft.



1 Main shaft bearing inner race
2 Pinion shaft bearing inner race

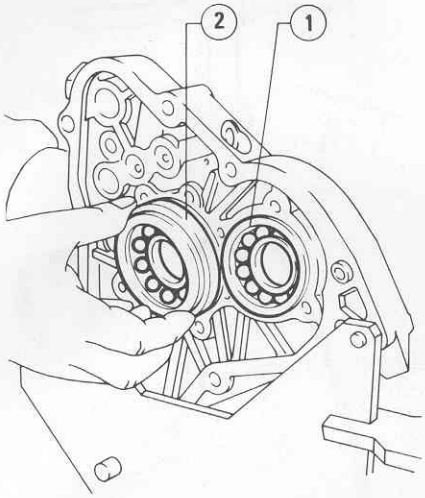
b. Unscrew and remove screws (1) with related washers securing plate (3). Recover retainer (2) and plate itself.





1 Plate securing screws
2 Bearing retainer
3 Bearing retaining plate

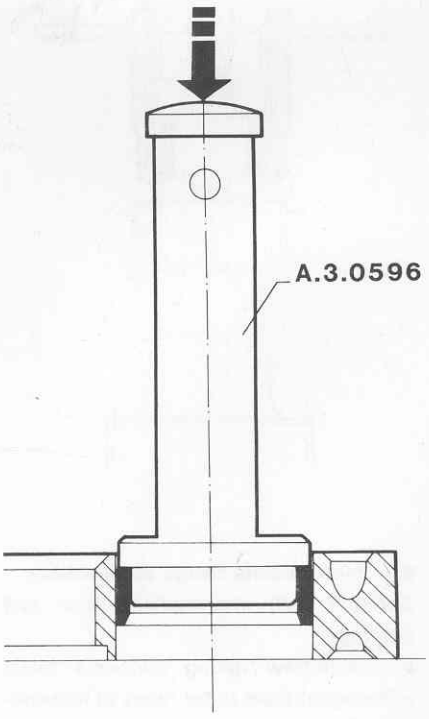
c. Withdraw ball bearings of main (1) and pinion (2) shafts.

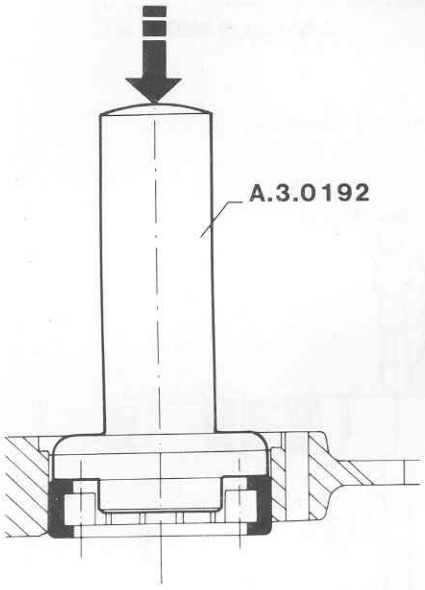


1 Main shaft ball bearing
2 Pinion shaft ball bearing

d. Operating at press with suitable base and puller **A.3.0596**, withdraw outer ring of main shaft bearing from intermediate flange.

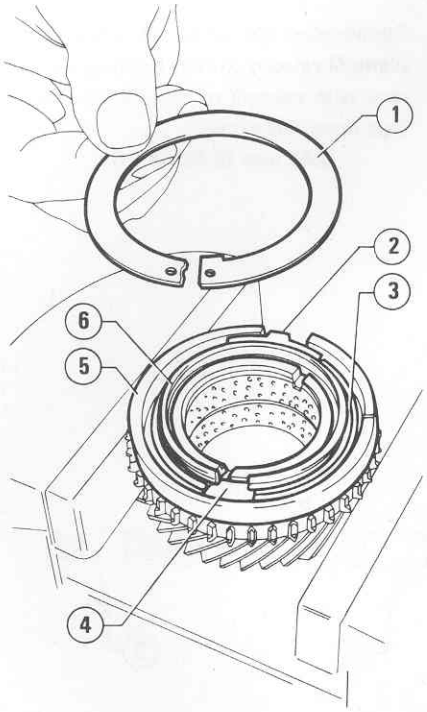
e. Always operating at press with suitable base and puller **A.3.0192** withdraw outer ring of pinion shaft bearing from intermediate flange.





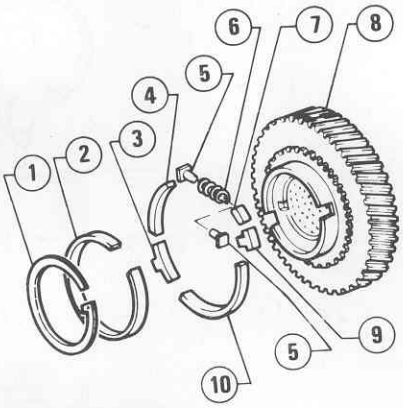
7. Synchronizers disassembly

a. Synchronizers for 1st, 2nd, 3rd, 4th, 5th speeds.
Secure the gear concerned on a vice fitted with protective jaws and, by means of a plier, remove retaining ring (1). Then, withdraw ring (5), sectors (2) and (4) and retainers (3).



1 Retaining ring
2 Locking sector
3 Retainers
4 Guide sector
5 Synchronizing ring

b. 1st speed synchronizer
Operating as per the previous step, remove retaining ring (1), then withdraw ring (2), sectors (3) and (9), retainers (4) and (10), spring (6) with the two strikers (5) and pawl (7).



1 Retaining ring
2 Synchronizing ring
3 Locking sector
4 Retainer
5 Strikers
6 Spring
7 Pawl
8 Gear
9 Guide sector
10 Retainer

CHECKS AND INSPECTIONS

Before carrying out the checks, carefully wash the items, then blow them with compressed air. This permits a better identification of superficial defects, wear and efficiency of a few components.

a. Gears and splined sections

Verify gears teeth. If irregular wear or spalled teeth are found on gears, replace the gears and verify that gears they mate with are not spalled.
Verify also the threaded and splined surfaces of shafts and, particularly, the housings fo bearings inner races.

Gear axial and radial clearance
0.10 to 0.15 mm
(0.00394 to 0.00591 in)

b. Bearings

Verify conditions of surfaces related to rings and rolling elements making sure they are free from scratches, imprintings, grinding caused by scoring due to foreign matters.

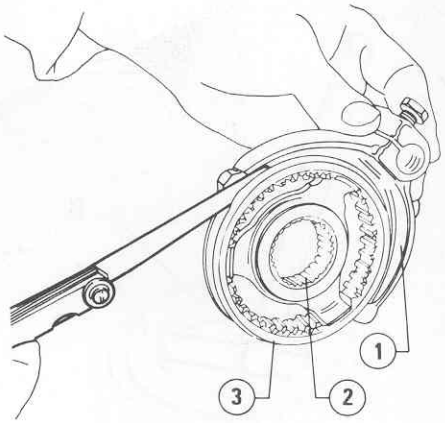
c. Synchronizers

Verify that:
- Synchronizer rings are free from excessive wear.
- Retainers are free from overheating signs in the working points.
- Locking and guide sectors are not excessively scratched in the working points.
- Synchronizer sleeves slide freely on the related hubs.
- Engagement front toothing on sleeves and the corresponding toothing on gears are free from seizing and excessive wear.

d. Forks and sleeves

Check working surfaces of forks (1) and slinding sleeves (3) verifying they are free from seizing and that axial clearance is within the prescribed values.

Sleeve fork axial clearance
0.7 to 0.9 mm
(0.0275 to 0.0354 in)

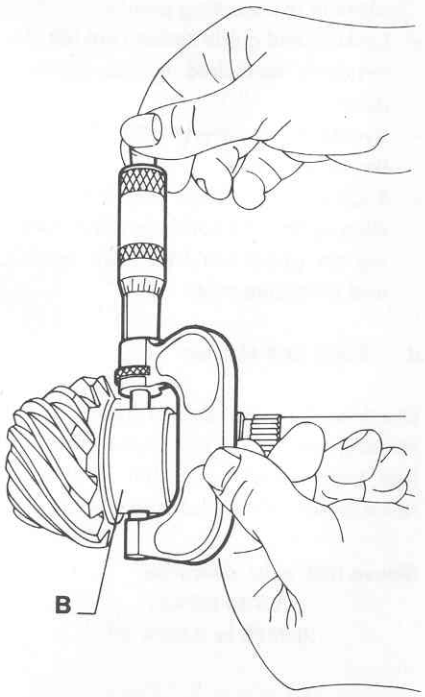


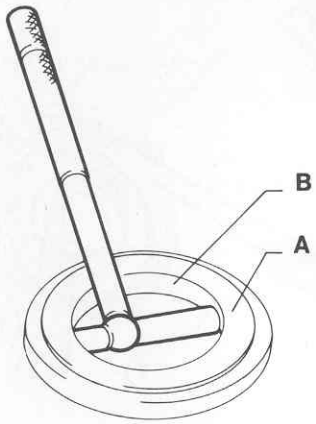
1 Control fork
2 Hub
3 Sleeve

e. Pinion shaft and rear spacer

Verify that squareness deviation of ring nut support plane **A** of pinion shaft rear roller bearing does not exceed **0.02 mm (0.000787 in)** and that installation interference fit between seats **B** of pinion shaft and ring nut is within the prescribed values, i.e.:

0.019 to 0.060 mm
(0.000748 to 0.0024 in)

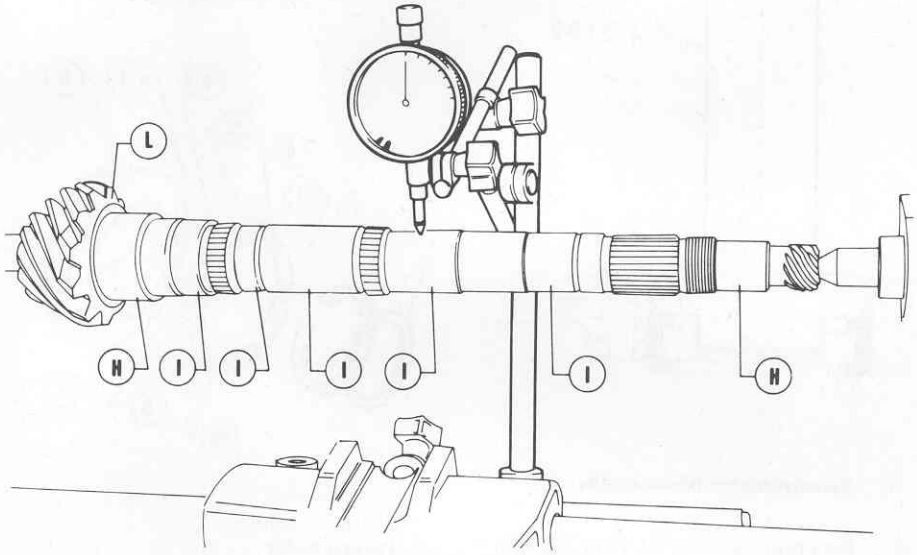




By means of gauge, verify that:

- pinion shaft eccentricity in the seats **H** of front needle bearing and rear roller bearing with respect to seats **I** of bushes related to gears and intermediate bearings does not exceed **0.02 mm. (0.000787 in)**.
- Squareness deviation of abutment plane **L** related to rear bearing inner race with respect to seats **H** of bearings must not exceed:

0.02 mm (0.000787 in)

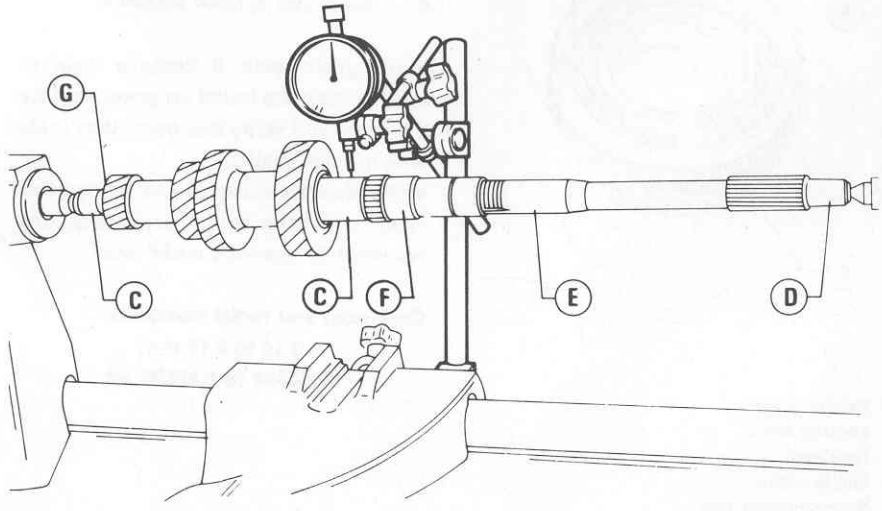


f. Main shaft

By means of gauge, verify that:

- main shaft eccentricity in the seats **C** of bearings related to differential-speed gear casing and of intemediate flange with respect to clutch shaft centering seat **D**, seat **E** of differential-speed gear casing bearing and to seat **F** of 5th speed gear does not exceed **0.03 mm (0.00118 in)** tolerance.
- Squareness deviation of abutment plane **G** related to rear bearing inner race with respect to seats **C** of bearings does not exceed:

0.03 mm (0.00118 in).

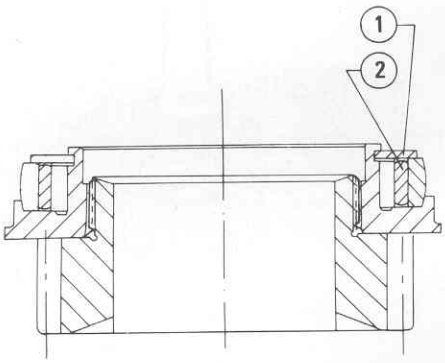


REASSEMBLY

1. Synchronizers reassembly

a. Synchronizers for 2nd, 3rd, 4th, 5th speeds.
Reassemble synchronizers on gears, starting with the positioning of locking and guide sectors followed by retainers, synchronizing ring and retaining ring.

CAUTION:
At the end of reassembly, make sure that ring (1) is correctly mounted in its seat and that ring (2) can move freely.

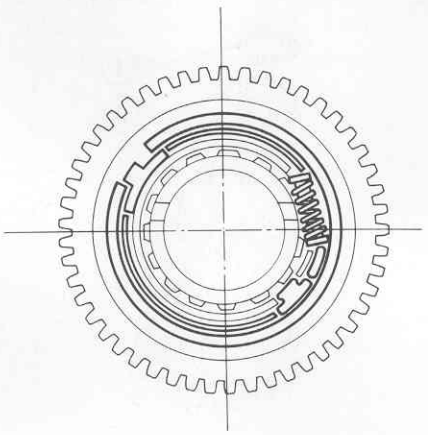


1 Retaining ring
2 Synchronizing ring

b. Ist speed synchronizer

Reassemble synchronizer operating as per the previous step and by correctly positioning the spring with the related strikers and the pawl.

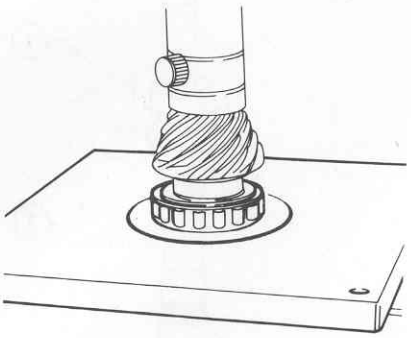
CAUTION:
The retainers are of different length, as a consequence, they must be mounted just as per figure.

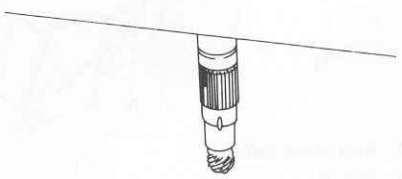


2. Pinion shalft reassembly

a. If previously disassembled, reassemble roller bearing runner race at the press and by means of a plate.

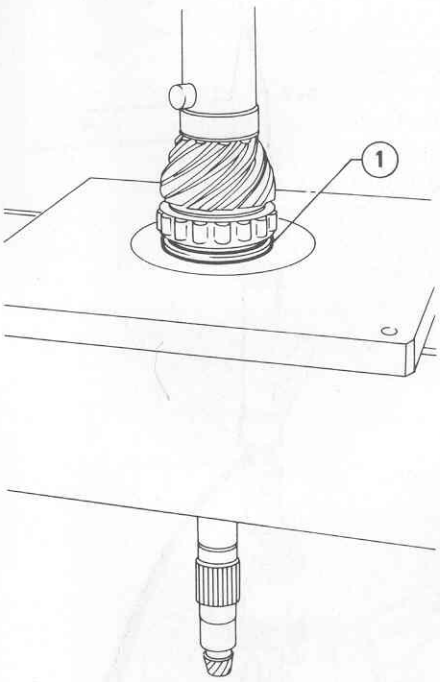
Install bearing with the protrusion towards pinion head.





b. Heat ring nut (1) **(140 °C, 284 °F)** and insert it into pinion shaft, by means of the plate mentioned above.

To obtain the best installation, cool down the ring nut with compressed air when it is still under pressure, held in the press.



1 Ring nut

c. To complete pinion shaft reassembly, reverse the disassembly operations taking care to **lubricate** gears bushes, before reassembly, with the prescribed oil.

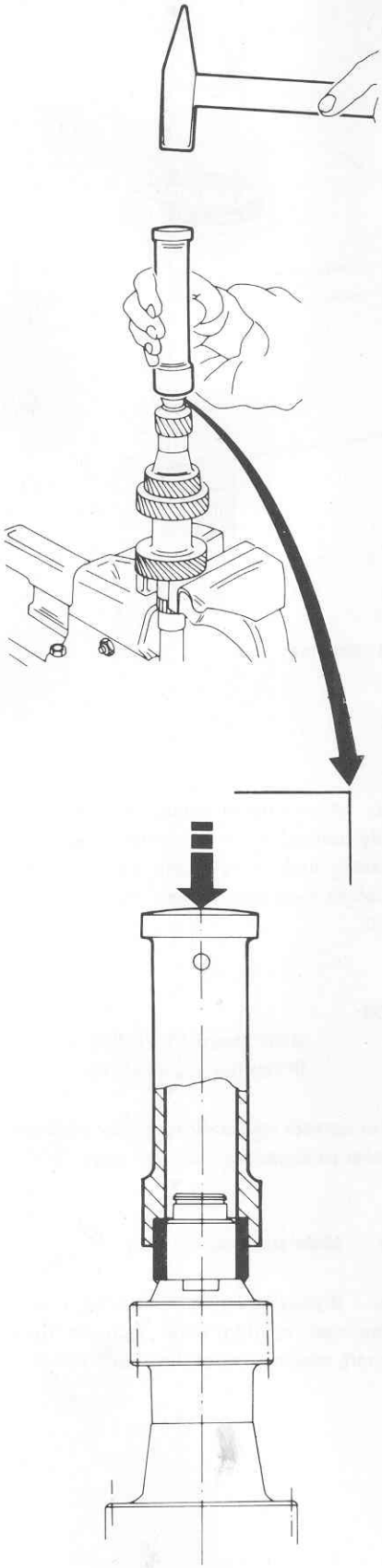
Oil:

AGIP Rotra SX 75W90
IP Pontiax HDS 75W90

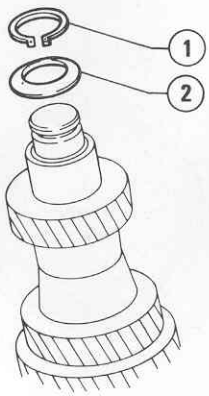
For correct installation of gear package, refer to exploded views of page 13-17

3. Main shaft reassembly

a. If previously disassembled, mount the rear bearing inner race on main shaft, making use of a suitable driver.

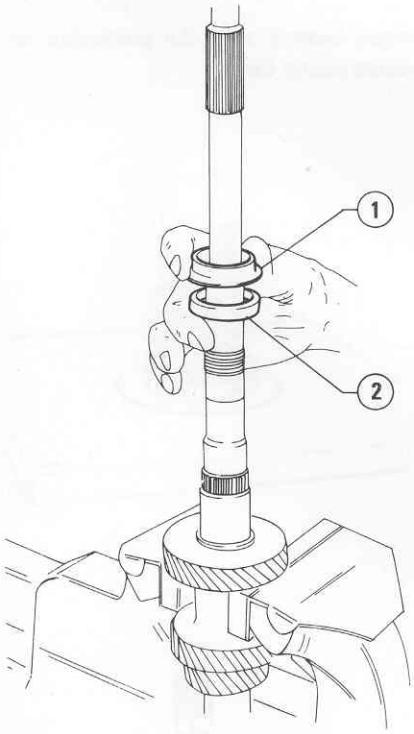


b. Reinstall bush (1) and secure it with ring (2).



1 Plastic bush
2 Retaining ring

c. Insert spacer (2) and then rear inner half-race (1) of intermediate flange bearing on main shaft.



1 Rear inner half-race
2 Spacer

4. Intermediate flange reassembly

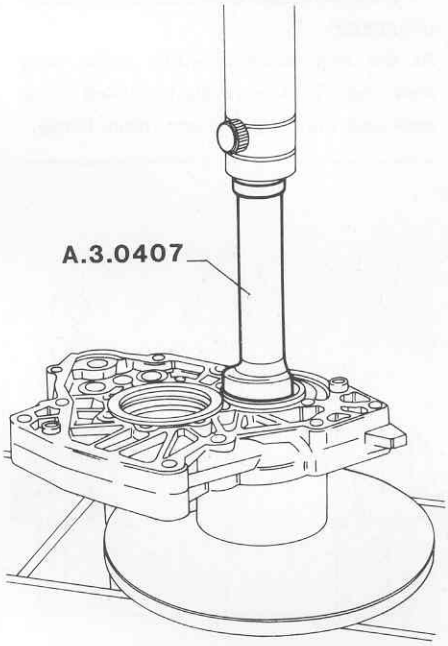
CAUTION:
Before installing roller bearings, lubricate them with the prescribed grease.

Grease:
AGIP F1 Grease 33 FD
IP Autogrease FD

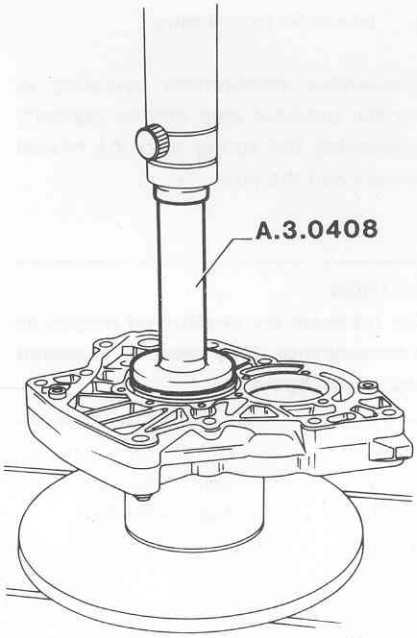
Solution with intermediate skew ball bearings

a. Operating at press and making use of tool **A.3.0407** insert outer race of main shaft ball bearing until it strikes against the intermediate flange striker.

Exert the utmost care during insertion in oder not to force the intermediate flange striker.



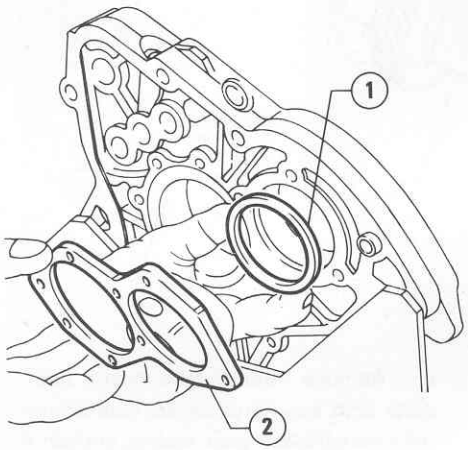
b. Always operating at the press and making use of tool **A.3.0408**, insert outer race of pinion shaft ball bearing until it mates with the plane of intermediate flange front side.

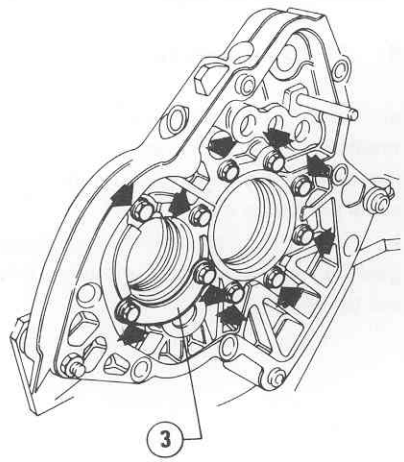


c. Set intermediate flange on the special support, then secure it on an overhaul stand fitted with connection brackets.

d Position spacer (1) and plate (2) on intermediate flange rear side.

e. Apply retainer (3) on rear side, then screw the plate securing screws without tightening them.

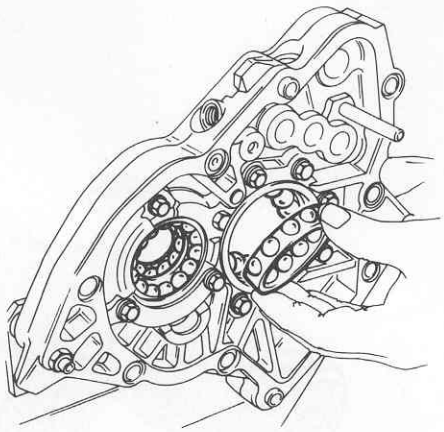




1 Shoulder spacer
2 Bearings shoulder plate
3 Bearing outer race retainer

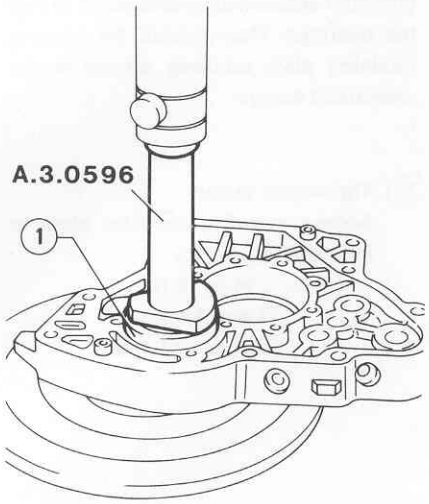
f. Reinstall both front and rear cages with balls related to intermediate flange bearings.

For the re-used bearings, the cages with rolling elements must occupy the same position noted during disassembly.



Solution with intermediate roller/ball bearings

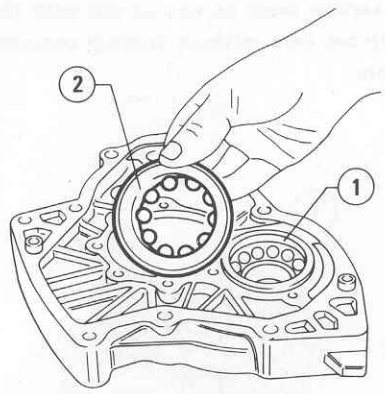
a. Operating at press and by means of tool **A.3.0596**, insert outer race (1) of main shaft roller bearing until it mates with interne diare flange striker.



1 Roller bearing outer race

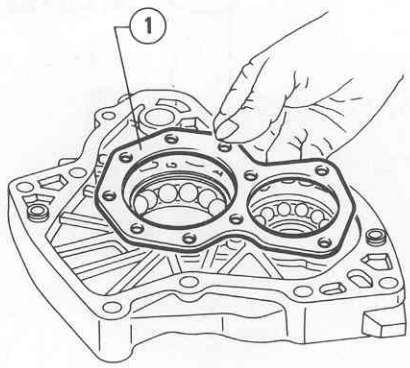
b. Reinstall on flange in the following order:

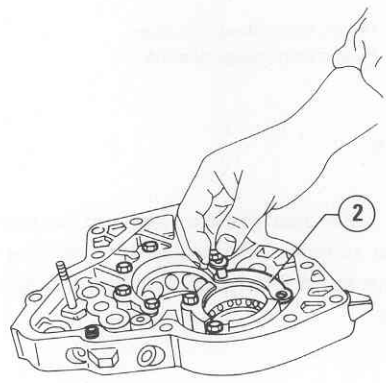
— main shaft ball bearing (1) complete with inner half-race.
— pinion shaft ball bearing (2) taking care to position it correctly with the thinner lip upwards.



1 Main shaft ball bearing
2 Pinion shaft ball bearing

c. Temporarily apply the bearings retaining plate (1) and retainer (2) to flange by screwing the plate securing screws without tightening them.

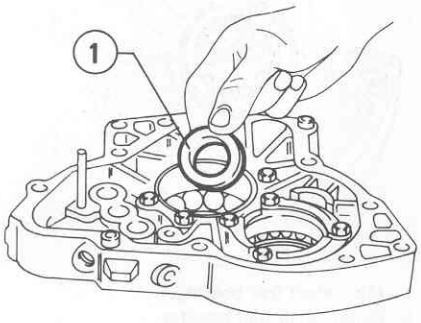


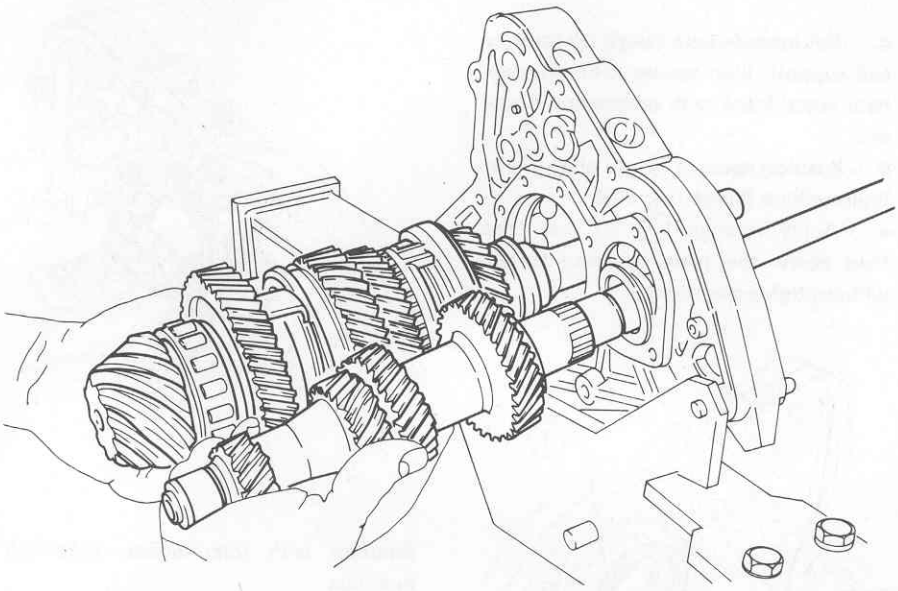


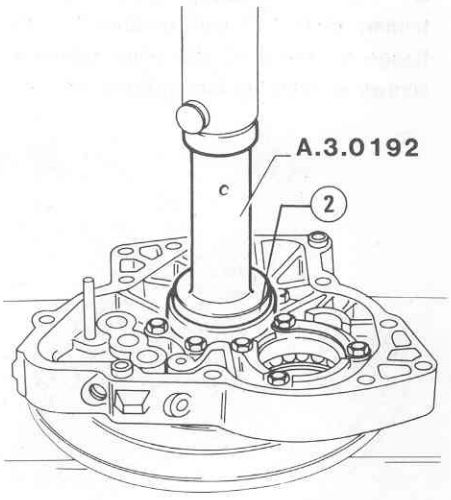
1 Bearings retaining plate
2 Bearing retainer

d. Reassemble inner half-race (1) of pinion shaft ball bearing then, with the press and by means of tool **A.3.0192**, insert pinion shaft roller bearing (2).

Insertion must be carried out with the utmost care without forcing components.







1 Pinion shaft inner half-race
2 Pinion shaft roller bearing

b. Position intermediate flange on differential-speed gear casing taking care to align pinion shaft correctly, then rotate both speed gear shafts so as to bed the bearings. Next tighten the bearing retaining plate securing screws to the prescribed torque.

(T): **Tightening torque**
Screws securing shoulder plate to intermediate flange
14 to 15 N·m
(1.4 to 1.6 Kg·m)
(10.1 to 11.6 ft·lb)

c. Remove intermediate flange complete with main and pinion shafts from differential-speed gear casing, and set it on an overhaul stand to complete the reassembly operations.

6. Shafts reassembly

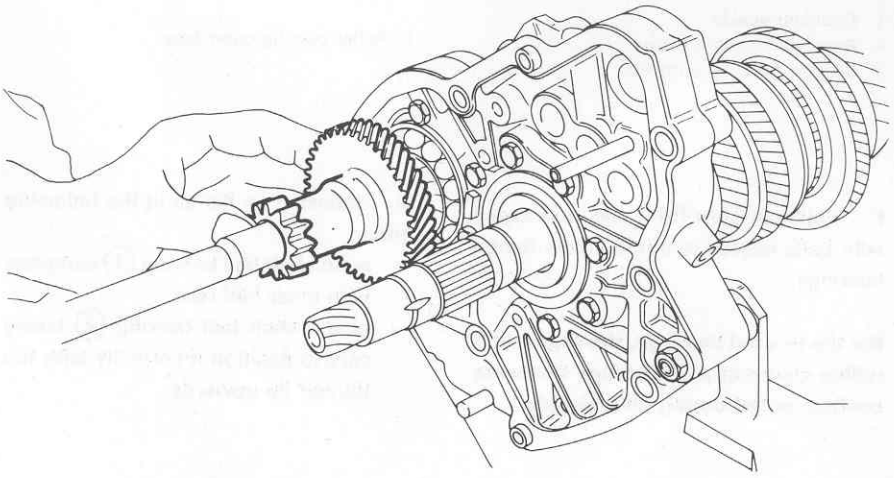
a. Insert front inner half-races of intermediate flange bearings on shafts, taking care to bed them into the related seats on flange itself.

b. Install the 5th and Reverse speeds gear on main shaft, then screw nut without tightening it.

e. Set intermediate flange on the special support, then secure it to an overhaul stand fitted with connection brackets.

5. Tightening of bearings retaining plate screws

a. Insert roller bearings inner races of main and pinion shafts; then install shafts themselves positioning them, at the same time, in the intermediate flange.



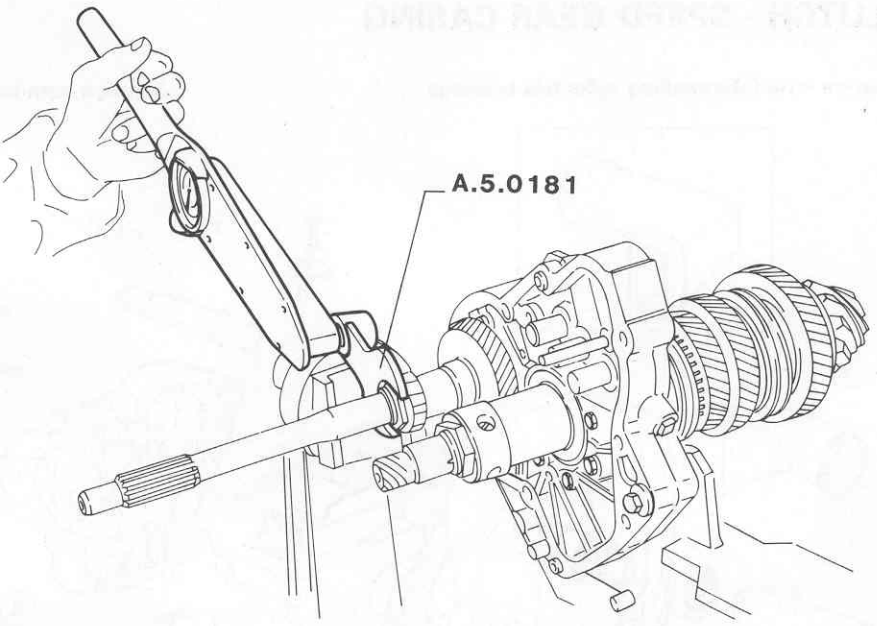
c. Install the 5th and Reverse speeds gear package on pinion shaft, then screw nut without tightening it.

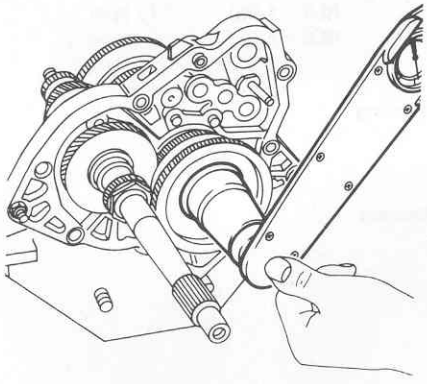
For correct installation of package, refer to exploded views of page 13-17.

d. Operate on the control sleeves for the 1st-2nd and 3rd-4th speeds to engage two speeds in order to block shafts rotation.

e. By means of a torque spanner, tighten pinion shaft nut to the prescribed torque.

(T): **Tightening torque**
Bevel pinion nut
112 to 124 N·m
(11.4 to 12.6 kg·m)
(82.4 to 91.7 ft·lb)





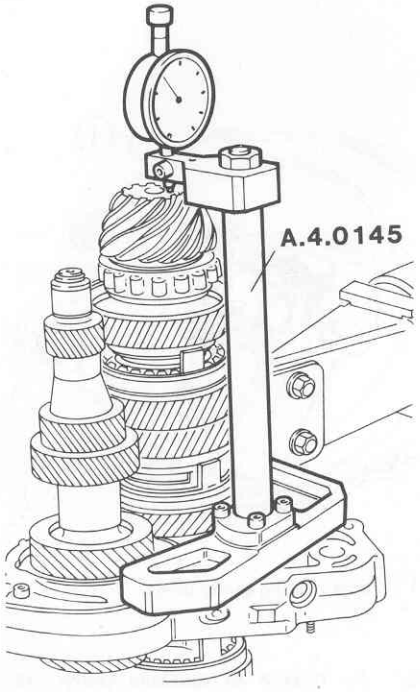
f. By means of a torque spanner fitted with wrench **A.5.0181**, tighten main shaft nut to the prescribed torque.

(T): **Tightening torque**
Main shaft nut
93 to 103 N·m
(9.5 to 10.5 kg·m)
(68.7 to 75.9 ft·lb)

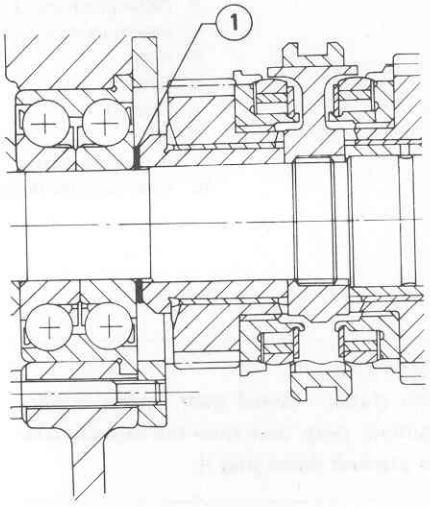
7. Verification of pinion shaft dimension

a. By means of a centesimal gauge mounted on support **A.4.0145**, verify that dimesion **"A"** measured between intermediate flange inner plane and pinion head upper plane corresponds to the value measured before disassembly.

0.03 mm (0.00118 in) tolerance is allowed.



b. If the value does not correspond to that prescribed, modify thickness of the ring (1) between bush of 4th speed gear and half-race of intermediate bearing.



1 Shim ring

c. Caulk the nuts of both speed gear shafts from one side only.

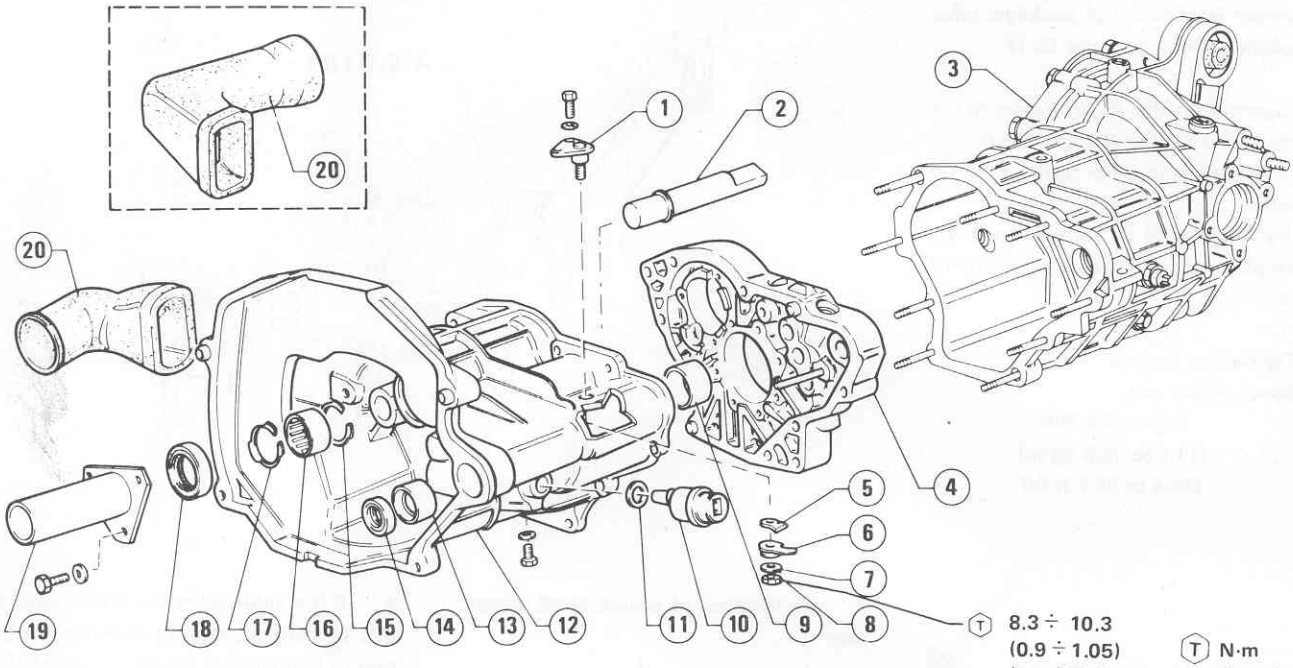
8. Rods and forks reasembly.

Refer to: "Rods and Forks - Reassembly".

CLUTCH - SPEED GEAR CASING

Solution with intermediate roller/ball bearings

Solution with intermediate skew ball bearings



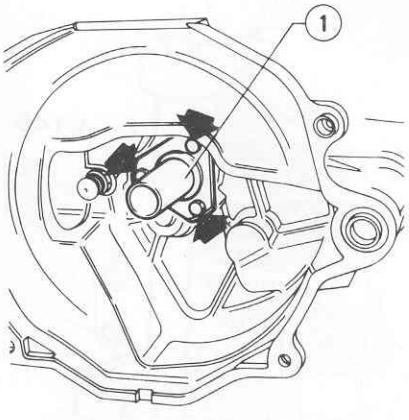
1 Safety device support
2 Reverse speed gear pin
3 Differential-speed gear casing
4 Intermediate flange
5 Plate
6 Pawl
7 Washer
8 Nut
9 Pinion shaft bush
10 Odometer pulse transmitter
11 Washer
12 Clutch - speed gear casing
13 Guide bush
14 Oil seal ring
15 Retaining ring
16 Main shaft needle bearing
17 Retaining ring
18 Oil seal ring
19 Tube
20 Sleeve

CAUTION:
The clutch - speed gear casing in aluminium alloy, take then the utmost care to prevent damaging it.

DISASSEMBLY

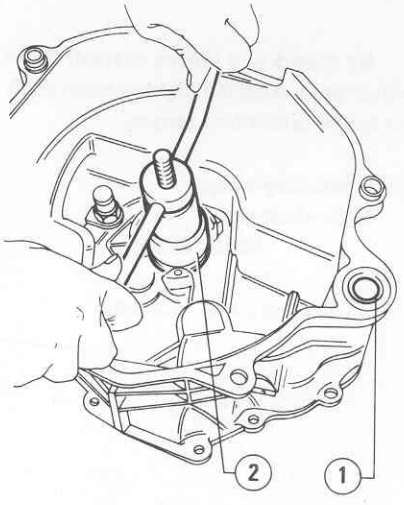
Remove the clutch - speed gear casing from the whole unit (Refer to: "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential unit - Separation") and disassemble it operating as follows:

1. Release and remove the screws with the related washers securing tube (1) from clutch - speed gear casing; remove tube.



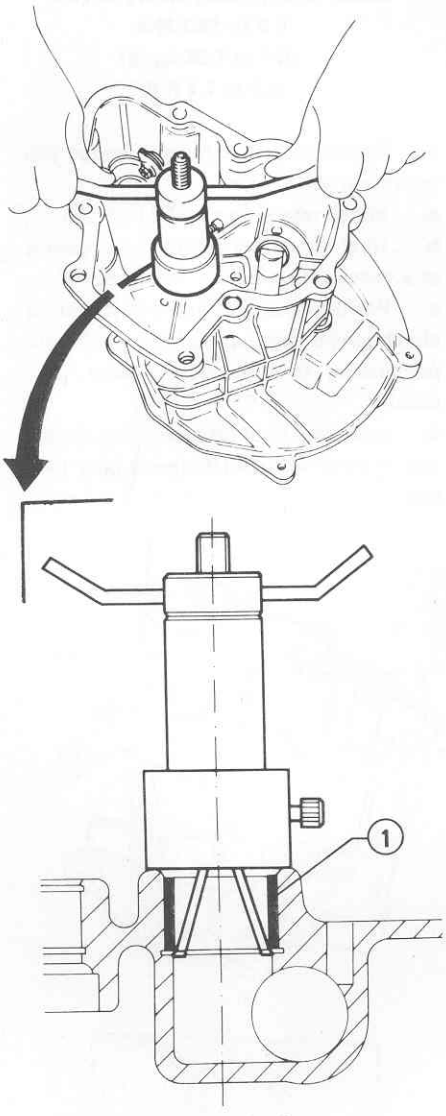
1 Thrust bearing guide tube

2. By means of suitable puller, remove oil seal rings (1) and (2).



1 Oil seal ring for speed selection and engagement rod
2 Main shaft oil seal ring

3. By means of same puller, remove bush (1).



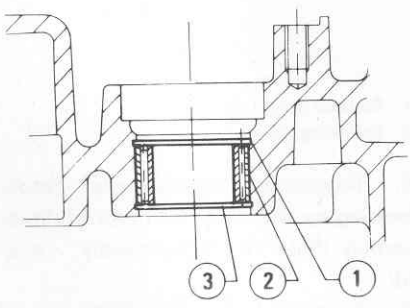
1 Pinion shaft support bush

4. Withdraw main shaft needle bearing operating as follows:

a. Remove retaining ring (1).

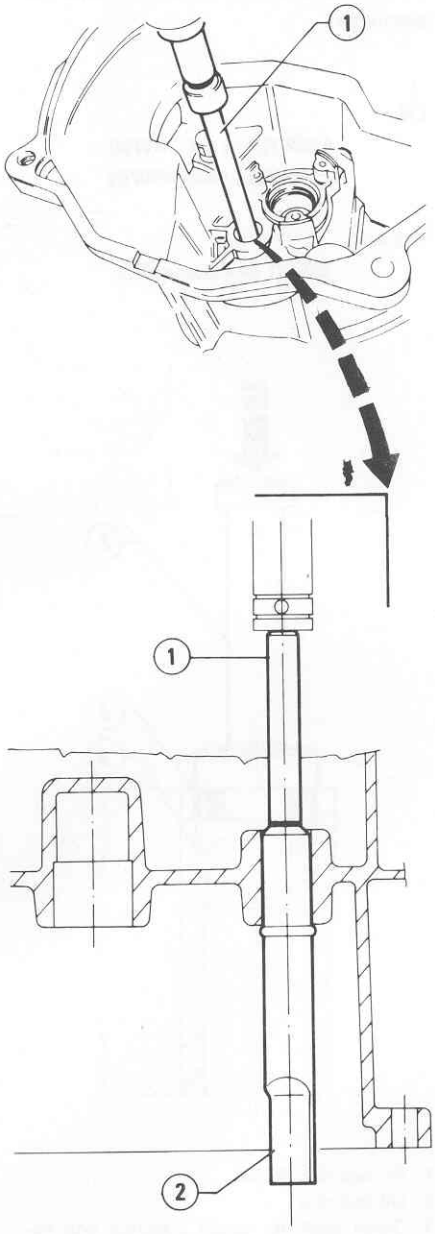
b. Withdraw bearing (2).

c. If necessary, remove retaining ring (3).



1 Front retaining ring
2 Needle bearing
3 Rear retaining ring

5. Rest clutch-speed gear casing on half-plates and, by means of suitable punch, remove pin (2).

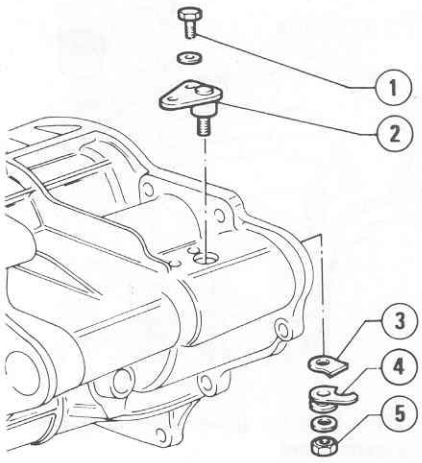


1 Punch
2 Reverse speed pin

6. Disassemble interlock plunger (it prevents accidental transition from 5th to reverse speed) operating as follows:

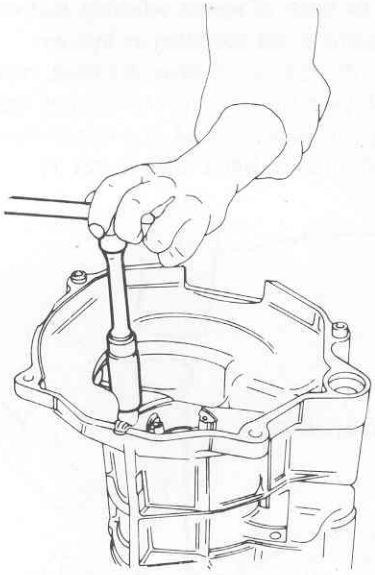
a. Unscrew nut (5), withdraw interlock plunger (4) and the plate (3) underneath.

b. Loosen the two screws (1) and remove support (2).

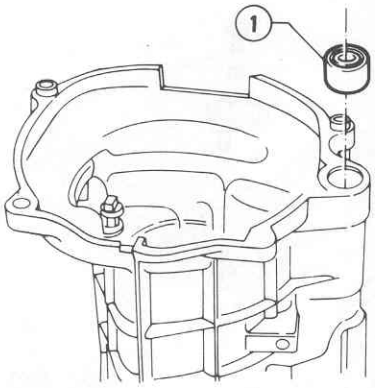


1 Screw
2 Safety device support
3 Plate
4 Interlock plunger
5 Inner nut securing interlock plunger

7. By means of suitable spanner, unscrew the clutch fork pin and remove it with the washer underneath.



8. If necessary, withdraw bush (1) from clutch-speed gear casing.



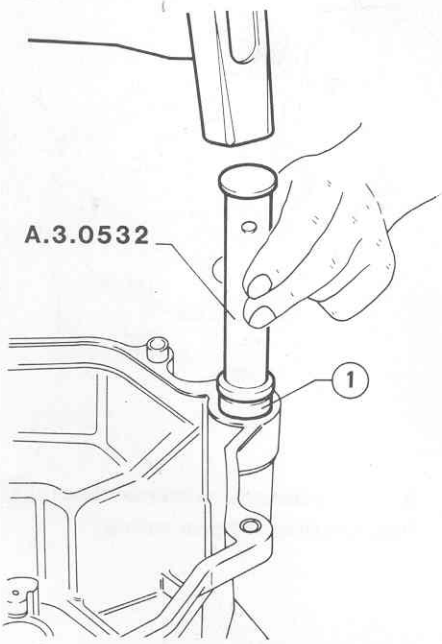
1 Guide bush for speed selection and engagement rod

CHECKS AND INSPECTIONS

1. Clean the casing with solvent removing sealant traces in correspondance with mating surfaces between clutch-speed gear casing and intermediate flange and in correspondance with the housing of reverse speed safety device.
2. Verify that casing is free from scratches and splinters.

REASSEMBLY

1. If previously removed, reinstall guide bush of speed selection and engagement rod operating as follows:
a. By means of driver **A.3.0532**, reinstall bush (1) on clutch-speed gear casing, previously heated at a temperature within **140 to 160 °C (284 to 320 °F)**.



1 Guide bush for speed selection and engagement rod

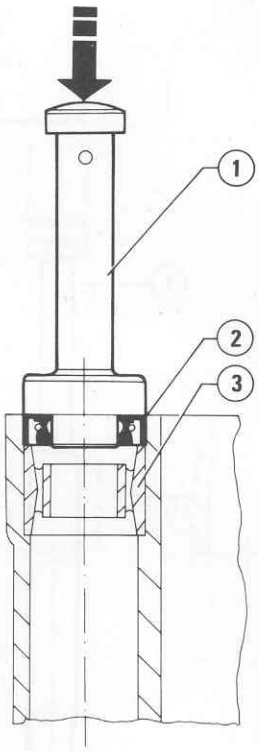
b. Let the clutch-speed gear casing cools down, then install oil seal ring (2) inserting it by means of driver (1) after **lubricating** outer surfaces and inner leap with the prescribed oil and grease, respectively.

Oil:

AGIP Rotra SX 75W90
IP Pontiax HDS 75W90

Grease:

ISECO Molykote BR2



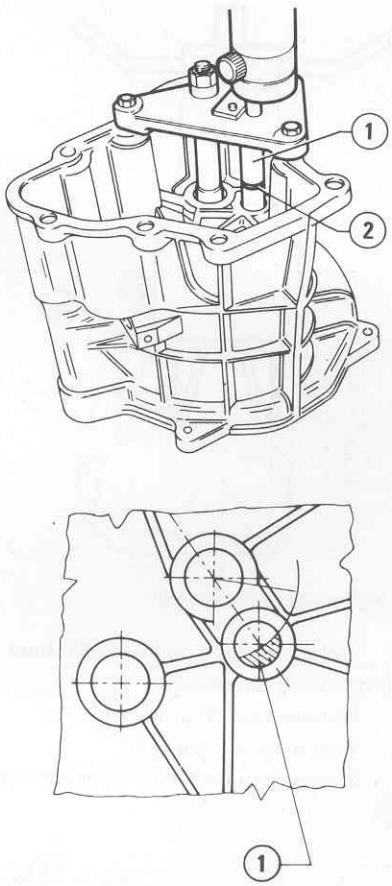
1 Oil seal ring driver
2 Oil seal ring
3 Guide bush for speed selection and engagement rod

2. Tighten fork pin into the related seat.
3. Reassemble interlock plunger by reversing the order of disassembly (Refer to: "Disassembly" - step 6) applying a coat of the prescribed sealant on the mating surface between the support for reverse speed engagement safety device and clutch-speed gear casing.

Sealant:
Sealing compound LOWAC Perfect Seal

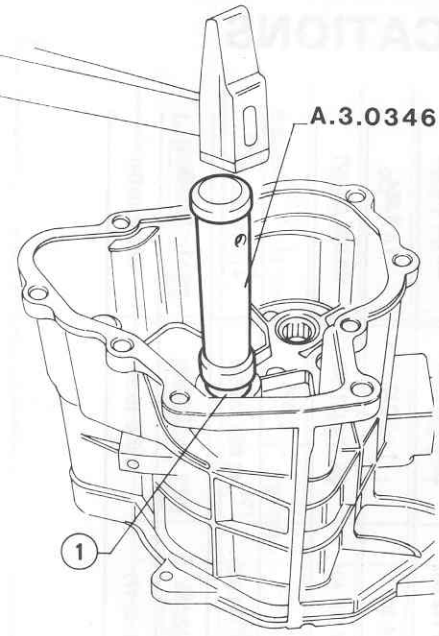
(T): **Tightening torque**
Nut securing plate for reverse speed engagement safety device
8.3 to 10.3 N·m
(0.9 to 1.05 kg·m)
(6.5 to 7.2 ft·lb)

4. Reassemble the reverse speed pin operating as follows:
a. Install retaining ring (2) on pin.
b. Heat the clutch-speed gear casing at a temperature within **140 to 160 °C**.
c. Position pin into the related seat on clutch-speed gear casing. Secure the pin positioning tool to clutch-speed gear casing.
d. Insert pin until retaining ring comes into contact with clutch-speed gear casing.



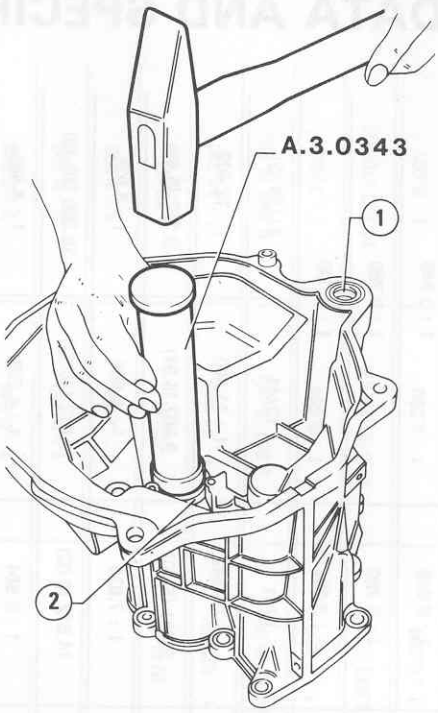
1 Reverse speed pin
2 Retaining ring

5. Reassemble the main shaft needle bearing by reversing the order of disassembly (Refer to: "Disassembly" - step 4).
6. Reinstall bush (1) making use of driver **A.3.0346**.



1 Pinion shaft support bush

7. Reassemble oil seal rings (1) and (2) operating as per figure, by means of driver **A.3.0343**.



1 Oil seal ring for speed selection and engagement rod
2 Main shaft oil seal ring

8. Reassemble guide tube by reversing the order of disassembly (Refer to: "Disassembly" - step 1)

Once the clutch-speed gear casing has been reassembled, reconnect it to Differential unit (Refer to: "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential Unit - Reconnection").

Alfa 90 / Gear ratios		1.8		2.0		2.0 iniezione		2.0 6V iniezione		2.4 turbodiesel		2.5 ● iniezione	
		LH 162.02	RH —	LH 162.12	RH —	LH 162.14	RH 162.15	LH 162.10	RH —	LH 162.06	RH —	LH 162.18	RH 162.19
Speed gear ratios	1st speed	1 : 3.500						1 : 2.875		1 : 3.500			
	2nd speed	1 : 1.956						1 : 1.720		1 : 1.956			
	3rd speed	1 : 1.258						1 : 1.226		1 : 1.258			
	4th speed	1 : 0.946						1 : 0.946		1 : 0.946			
	5th speed	1 : 0.780						1 : 0.780		1 : 0.780			
	R speed	1 : 3.000						1 : 3.000		1 : 3.000			
Differential ratio		11/42				10/43 (1)		9/41		12/41		11/39 (2)	
Differential-speed gear overall ratios	1st speed	1 : 13.364				1 : 15.05		1 : 13.096		1 : 11.960		1 : 12.409	
	km/h (mi/h)	8.508 (5.29)				7.543(4.69)		8.681 (5.40)		9.507 (5.91)		9.162 (5.69)	
	2nd speed	1 : 7.468				1 : 8.41		1 : 7.835		1 : 6.684		1 : 6.935	
	km/h (mi/h)	15.224 (9.46)				13.497 (8.39)		14.512 (9.02)		17.012 (10.57)		16.395 (10.19)	
	3rd speed	1 : 4.803				1 : 5.40		1 : 5.584		1 : 4.299		1 : 4.460	
	km/h (mi/h)	23.671 (14.71)				20.987 (13.04)		20.362 (12.66)		26.451 (16.44)		25.492 (15.84)	
Nominal speed at 1000 r.p.m.	4th speed	1 : 3.612				1 : 4.07		1 : 4.309		1 : 3.232		1 : 3.354	
	km/h (mi/h)	31.478 (19.56)				27.906 (17.34)		26.387 (16.40)		35.174 (21.86)		33.900 (21.07)	
	5th speed	1 : 2.978				1 : 3.35		1 : 3.553		1 : 2.665		1 : 2.765	
	km/h (mi/h)	38.178 (23.73)				33.846 (21.04)		32.001 (19.89)		42.660 (26.51)		41.114 (25.55)	
	R speed	1 : 11.454				1 : 12.90		1 : 13.665		1 : 10.251		1 : 10.636	
	km/h (mi/h)	9.926 (6.17)				8.80 (5.47)		8.320 (5.17)		11.092 (6.89)		10.689 (6.64)	

(1) Alfa 90 2.0 and Alfa 90 2.0 iniezione versions for Switzerland, Sweden and Australia
(2) Also valid for versions for Switzerland, Sweden and Australia

Alfa 90 Super / Gear ratios		1.8		2.0 iniezione (*)		2.0 6V iniezione		2.4 turbodiesel		2.5 6V iniezione (*)	
		LH 162.02.1	RH —	LH 162.14.1 162.14.2	RH 162.15.1	LH 162.10.1	RH —	LH 162.06.1	RH —	LH 162.18.1	RH 162.19.2
Speed gear ratios	1st speed	1 : 2.875						1 : 3.500		1 : 2.875	
	2nd speed	1 : 1.720						1 : 1.956		1 : 1.720	
	3rd speed	1 : 1.226						1 : 1.258		1 : 1.226	
	4th speed	1 : 0.946						1 : 0.946		1 : 0.946	
	5th speed	1 : 0.780						1 : 0.780		1 : 0.780	
	R. speed	1 : 3.000						1 : 3.000		1 : 3.000	
Differential ratio		9/41		10/43		9/41		12/41		10/41	
Differential-speed gear overall ratios	1st speed	1 : 13.096		1 : 12.362		1 : 13.096		1 : 11.960		1 : 11.787	
	km/h (mi/h)	8.683 (5.39)		9.198 (5.71)		8.682 (5.39)		9.507 (5.90)		9.646 (5.99)	
	2nd speed	1 : 7.835		1 : 7.396		1 : 7.835		1 : 6.684		1 : 7.052	
	km/h (mi/h)	14.511 (9.01)		15.374 (9.55)		14.512 (9.01)		17.012 (10.57)		16.123 (10.01)	
	3rd speed	1 : 5.584		1 : 5.272		1 : 5.584		1 : 4.299		1 : 5.027	
	km/h (mi/h)	20.362 (12.65)		21.567 (13.40)		20.362 (12.65)		26.452 (16.43)		22.620 (14.05)	
Nominal speed at 1000 r.p.m.	4th speed	1 : 4.309		1 : 4.068		1 : 4.309		1 : 3.232		1 : 3.879	
	km/h (mi/h)	26.387 (16.39)		27.948 (17.36)		26.387 (16.39)		35.174 (21.85)		29.314 (18.21)	
	5th speed	1 : 3.553		1 : 3.354		1 : 3.553		1 : 2.665		1 : 3.198	
	km/h (mi/h)	32.002 (19.88)		33.900 (21.06)		32.002 (19.88)		42.660 (26.50)		35.552 (22.08)	
	R. speed	1 : 13.665		1 : 12.900		1 : 13.665		1 : 10.251		1 : 12.300	
	km/h (mi/h)	8.321 (5.17)		8.815 (5.48)		8.314 (5.16)		11.093 (6.89)		9.245 (5.74)	

(*) Also valid for versions for Switzerland, Sweden and Australia

Gear ratios	Alfa 75	1.6		1.8		turbo		2.0		2.0 turbodiesel		6V iniezione	
		LH 161.000	RH 161.010	LH 161.020	RH 161.030	LH 161.340	RH 161.350	LH 161.080	RH 161.090	LH 161.040	RH —	LH 161.180	RH 161.190
Speed gear ratios	1st speed	1 : 2.875								1 : 3.500		1 : 2.875	
	2nd speed	1 : 1.720								1 : 1.956		1 : 1.720	
	3rd speed	1 : 1.226								1 : 1.258		1 : 1.226	
	4th speed	1 : 0.946								1 : 0.946		1 : 0.946	
	5th speed	1 : 0.780								1 : 0.780		1 : 0.780	
	R. speed	1 : 3.000								1 : 3.000		1 : 3.000	
Differential ratio		9/41		10/43		11/43		10/43		11/39		10/41	
Differential-speed gear overall ratios	1st speed	1 : 13.096		1 : 12.362		1 : 11.238		1 : 12.362		1 : 12.407		1 : 11.787	
	km/h (mi/h)	8.315 (5.17)		8.809 (5.47)		9.690 (6.02)		8.809 (5.47)		8.777 (5.45)		9.239 (5.74)	
	2nd speed	1 : 7.835		1 : 7.396		1 : 6.723		1 : 7.396		1 : 6.934		1 : 7.052	
	km/h (mi/h)	13.899 (8.64)		14.724 (9.15)		16.198 (10.07)		14.724 (9.15)		15.705 (9.76)		15.442 (9.60)	
	3rd speed	1 : 5.584		1 : 5.272		1 : 4.792		1 : 5.272		1 : 4.460		1 : 5.027	
	km/h (mi/h)	19.502 (12.12)		20.656 (12.84)		22.725 (14.12)		20.656 (12.84)		24.417 (15.18)		21.663 (13.46)	
	4th speed	1 : 4.309		1 : 4.068		1 : 3.698		1 : 4.068		1 : 3.353		1 : 3.879	
	km/h (mi/h)	25.273 (15.71)		26.770 (16.64)		29.448 (18.30)		26.770 (16.64)		32.478 (20.19)		28.074 (17.45)	
	5th speed	1 : 3.553		1 : 3.354		1 : 3.049		1 : 3.354		1 : 2.765		1 : 3.198	
	km/h (mi/h)	30.650 (19.05)		32.469 (20.18)		35.717 (22.19)		32.469 (20.18)		39.385 (24.48)		34.052 (21.16)	
	R. speed	1 : 13.665		1 : 12.900		1 : 11.727		1 : 12.900		1 : 10.635		1 : 12.300	
	km/h (mi/h)	7.969 (4.95)		8.442 (5.25)		9.286 (5.77)		8.442 (5.25)		10.240 (6.36)		8.854 (5.50)	

Nominal speed at 1000 r.p.m.

Gear ratios	Alfa 75 (1)	1.6		1.8		2.0		6V iniezione	
		LH 161.000	RH 161.010	LH 161.020	RH 161.030	LH 161.080	RH 161.090	LH 161.180	RH 161.190
Speed gear ratios	1st speed	1 : 3.500							
	2nd speed	1 : 1.956							
	3rd speed	1 : 1.258							
	4th speed	1 : 0.946							
	5th speed	1 : 0.780							
	R. speed	1 : 3.000							
Differential ratio		11/42						12/41	
Differential-speed gear overall ratios	1st speed	1 : 13.364						1 : 11.960	
Nominal speed at 1000 r.p.m.	km/h (mi/h)	8.149 (5.06)						9.105 (5.66)	
	2nd speed	1 : 7.468						1 : 6.684	
	km/h (mi/h)	14.582 (9.06)						16.293 (10.13)	
	3rd speed	1 : 4.803						1 : 4.299	
	km/h (mi/h)	22.673 (14.09)						25.331 (15.74)	
	4th speed	1 : 3.612						1 : 3.233	
	km/h (mi/h)	30.149(18.74)						33.694 (20.94)	
	5th speed	1 : 2.978						1 : 2.665	
	km/h (mi/h)	36.568 (22.73)						40.863 (25.40)	
	R. speed	1 : 11.454						1 : 10.251	
	km/h (mi/h)	9.507 (5.91)						10.623 (6.60)	

(1) Model with gearbox-rear axle long ratios (Switzerland, Sweden and Australia excluded).

Gear ratios		1.6		1.8		i.e. TURBO		2.0		Twin Spark 2.0		TURBO D		6V 2.5		6V 3.0	
		LH 161.000	RH 161.010	LH 161.020	RH 161.030	LH 161.440	RH —	LH 161.080	RH 161.090	LH 161.220	RH 161.230	LH 161.040	RH —	LH 161.181	RH 161.191	LH 161.200	RH 161.210
Speed gear ratios	1st speed	1 : 2.875										1 : 3.500		1 : 2.875			
	2nd speed	1 : 1.720										1 : 1.956		1 : 1.720			
	3rd speed	1 : 1.226										1 : 1.258		1 : 1.226			
	4th speed	1 : 0.946										1 : 0.946		1 : 0.946			
	5th speed	1 : 0.780										1 : 0.780		1 : 0.780			
	R. speed	1 : 3.000										1 : 3.000		1 : 3.000			
Differential ratio		9/41		10/43		11/43		10/43		10/41		11/39		10/41		11/39	
Differential - speed gear overall ratios	1st speed	1 : 13.096		1 : 12.362		1 : 11.238		1 : 12.362		1 : 11.787		1: 12.407		1 : 11.787		1 : 10.192	
	km/h (mi/h)	8.315 (5.17)		8.809 (5.47)		9.690 (6.02)		8.809 (5.47)		9.239 (5.74)		8.777 (5.45)		9.239 (5.74)		10.685 (6.64)	
	2nd speed	1 : 7.835		1 : 7.396		1 : 6.723		1 : 7.396		1 : 7.052		1 : 6.934		1 : 7.052		1 : 6.097	
	km/h (mi/h)	13.899 (8.64)		14.724 (9.15)		16.198 (10.07)		14.724 (9.15)		15.442 (9.60)		15.705 (9.76)		15.442 (9.60)		17.861 (11.10)	
	3rd speed	1 : 5.584		1 : 5.272		1 : 4.792		1 : 5.272		1 : 5.027		1 : 4.460		1 : 5.027		1 : 4.346	
	km/h (mi/h)	19.502 (12.12)		20.656 (12.84)		22.725 (14.12)		20.656 (12.84)		21.663 (13.46)		24.417 (15.18)		21.663 (13.46)		25.057 (15.57)	
Nominal speed at 1000 r.p.m.	4th speed	1 : 4.309		1 : 4.068		1 : 3.698		1 : 4.068		1 : 3.879		1 : 3.353		1 : 3.879		1 : 3.353	
	km/h (mi/h)	25.273 (15.71)		26.770 (16.64)		29.448 (18.30)		26.770 (16.64)		28.074 (17.45)		32.478 (20.19)		28.074 (17.45)		32.478 (20.19)	
	5th speed	1 : 3.553		1 : 3.354		1 : 3.049		1 : 3.354		1 : 3.198		1 : 2.765		1 : 3.198		1 : 2.765	
	km/h (mi/h)	30.650 (19.05)		32.469 (20.18)		35.717 (22.19)		32.469 (20.18)		34.052 (21.16)		39.385 (24.48)		34.052 (21.16)		39.385 (24.48)	
	R. speed	1 : 13.665		1 : 12.900		1 : 11.727		1 : 12.900		1 : 12.300		1 : 10.635		1 : 12.300		1 : 10.635	
	km/h (mi/h)	7.969 (4.95)		8.442 (5.25)		9.286 (5.77)		8.442 (5.25)		8.854 (5.50)		10.240 (6.36)		8.854 (5.50)		10.240 (6.36)	

Gear ratios	Giulietta	1.6		1.8		2.0		2.0 turbodiesel EDITION '83
		LH 113.48	RH 113.49	LH 113.50	RH 113.51	LH 113.56	RH. 113.57	LH 113.52
Speed gear ratios	1st speed	1:3.500						
	2nd speed	1:1.956						
	3rd speed	1:1.258						
	4th speed	1:0.946						
	5th speed	1:0.780						
	R. speed	1:3.000						
Differential ratio		11/42		11/42		10/43		11/43
Differential-speed gear overall ratios	1st speed	1:13.37		1:13.37		1:15.05		1:13.681
Nominal speed at 1000 r.p.m.	km/h (mi/h)	8.11 (5.04)		8.13 (5.05)		7.20 (4.47)		7.96 (4.94)
	2nd speed	1:7.47		1:7.47		1:8.41		1:7.646
	km/h (mi/h)	14.51 (9.01)		14.56 (9.04)		12.89 (8.01)		14.243 (8.85)
	3rd speed	1:4.80		1:4.80		1:5.40		1:4.917
	km/h (mi/h)	22.57 (14.02)		22.64 (14.06)		20.04 (12.45)		22.148 (13.76)
	4th speed	1:3.61		1:3.61		1:4.07		1:3.698
	km/h (mi/h)	30.01 (18.64)		30.09 (18.69)		26.65 (16.55)		29.448 (18.29)
	5th speed	1:2.98		1:2.98		1:3.35		1:3.049
	km/h (mi/h)	36.31 (22.55)		36.52 (22.68)		32.32 (20.07)		35.717 (22.18)
	R. speed	1:11.42		1:11.42		1:12.90		1:11.727
	km/h (mi/h)	9.46 (5.87)		9.49 (5.89)		8.40 (5.22)		9.286 (5.77)

Gear ratios	Alfetta	16		18		20		20 ♦		2.0 turbodiesel	2.4 turbodiesel
		LH 117.18	RH –	LH 117.17	RH –	LH 117.01	RH –	LH 117.13	RH 117.14	LH 117.06	LH 117.02
Speed gear ratios	1st speed	1:3.500								1:3.500	1:3.500
	2nd speed	1:1.956								1:1.956	1:1.956
	3rd speed	1:1.258								1:1.345	1:1.258
	4th speed	1:0.946								1:1.026	1:0.946
	5th speed	1:0.780								1:0.780	1:0.780
	R. speed	1:3.000								1:3.000	1:3.000
Differential ratio		11/43		11/42						10/41	11/42
Differential-speed gear overall ratios	1st speed	1:13.681		1:13.363						1:14.35	1:13.363
	km/h (mi/h)	8.298 (5.15)		8.495 (5.28)						7.90 (4.91)	8.508 (5.28)
	2nd speed	1:7.646		1:7.468						1:8.019	1:7.468
	km/h (mi/h)	14.847 (9.22)		15.201 (9.44)						14.17 (8.8)	15.225 (9.46)
	3rd speed	1:4.917		1:4.803						1:5.514	1:4.803
	km/h (mi/h)	23.087 (14.34)		23.635 (14.68)						22 (13.66)	23.673 (14.7)
Nominal speed at 1000 r.p.m.	4th speed	1:3.698		1:3.612						1:4.206	1:3.612
	km/h (mi/h)	30.697 (19.07)		31.428 (19.52)						29.26 (18.17)	31.478 (19.55)
	5th speed	1:3.049		1:2.978						1:3.198	1:2.978
	km/h (mi/h)	37.232 (23.12)		38.119 (23.68)						35.49 (22.04)	38.180 (23.71)
	R. speed	1:11.727		1:11.454						1:12.3	1:11.454
	km/h (mi/h)	9.680 (6.01)		9.911 (6.15)						9.22 (5.73)	9.927 (6.16)

Gear ratios		GTV 2.0		GTV 6 2.5 Vers. 1985	
		LH 113.17	RH 113.18	LH 113.15.1 113.15	RH 113.16.1 113.16
Speed gear ratios	1st speed	1 : 3.500		1 : 2.875	
	2nd speed	1 : 1.956		1 : 1.720	
	3rd speed	1 : 1.258		1 : 1.226	
	4th speed	1 : 0.946		1 : 0.946	
	5th speed	1 : 0.780		1 : 0.780	
	R. speed	1 : 3.000		1 : 3.000	
Differential ratio		10/43		10/41	
Differential speed gear overall ratios	1st speed	1 : 15.05		1 : 11.788	
	km/h (mi/h)	7.53 (4.68)		9.646 (6.00)	
	2nd speed	1 : 8.41		1 : 7.052	
	km/h (mi/h)	13.48 (8.37)		16.123 (10.01)	
	3rd speed	1 : 5.40		1 : 5.027	
	km/h (mi/h)	20.98 (13.03)		22.620 (14.05)	
Nominal speed at 1000 r.p.m.	4th speed	1 : 4.07		1 : 3.879	
	km/h (mi/h)	27.90 (17.33)		29.315 (18.21)	
	5th speed	1 : 3.35		1 : 3.198	
	km/h (mi/h)	33.83 (21.01)		35.553 (22.08)	
	R. speed	1 : 12.90		1 : 12.30	
	km/h (mi/h)	8.79 (5.46)		9.244 (5.74)	

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Applicat. No.	Application	Type	Name	Q.ty
1	Differential-speed gear roller bearings Detent devices Clutch fork spherical pin and thrust bearing seat	GREASE	– AGIP: Grease 33 FD – IP: Autogrease FD Std. No. 3671-69833	–
2	Propeller shaft rear joint seat Ball joint on speed control lever Reverse speed sliding gear inner bush Bush for bevel pinion on clutch-speed gear casing	GREASE	ISECO: Molykote BR2 Std. No. 3671-69841	5 cm^3 –
3	Clutch-speed gear casing seal rings – Inner seal lip – Outer surface	GREASE OIL	ISECO: Molykote BR2 Std. No. 3671-69841 – AGIP: Rotra SX 75W90 – IP: Pontiax HDS 75W90 Std. No. 3631-69412	–
4	Differential-speed gear unit oil refilling	OIL	– AGIP: Rotra SX 75W90 – IP: Pontiax HDS 75W90 Std. No. 3631-69412	kg 2.570 (1) (5.66 lb) kg 2.070 (2) (4.56 lb)
5	Bushes for speed transmission and selection lever and speed transmission and engagement lever (isostatic control) (2) Ball joint on speed transmission and engagement lever end	GREASE	Molykote Longterm No. 2 Std. No. 3671-69831	–

(1) For models Alfetta .
For cars with high top-up plug of models: Giulietta GTV 2.0 and GTV 6 2.5

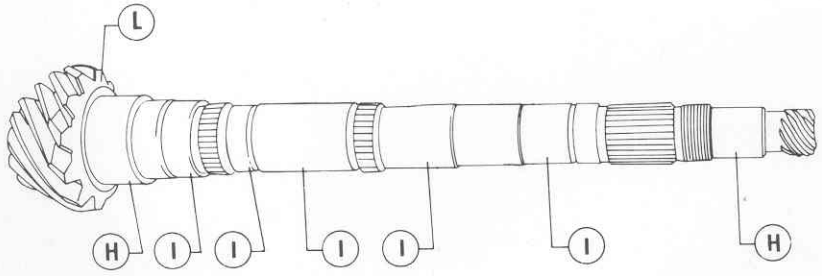
(2) For models Alfa 90 and Alfa 75
For cars with low top-up plug of models: Giulietta GTV 2.0 and GTV 6 2.5

SEALANTS AND SURFACE FIXING AGENTS

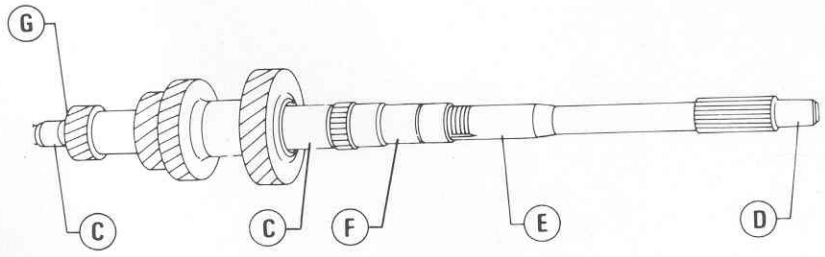
Application	Type	Name	Q.ty
Surfaces of differential-speed gear casing and clutch-speed gear casing mating with intermediate flange Mating surfaces between Reverse speed engagement safety devices and differential-speed gear casing NOTE: Use denatured ethyl alcohol to clean the surfaces	SEALING COMPOUND	LOWAC Perfect Seal Seal Std. No. 3522-00011	–

CHECKS AND ADJUSTMENTS

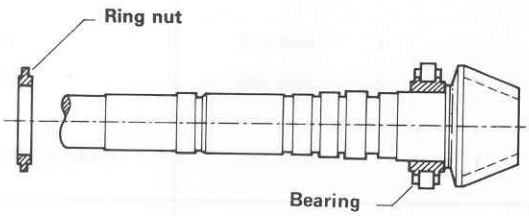
Axial clearance between fork and synchronizers sleeves	G	mm (in)	0.7 to 0.9 (0.0275 to 0.0354)
Spring test load	C	N (Kg lb)	90 to 97.6 (9.18 to 9.95; 20.25 to 21.96)
Spring length			
– Unloaded	L	mm (in)	30.6 (1.2)
– Loaded	L_C	mm (in)	18.8 (0.74)
Gears axial and radial clearance		mm (in)	0.1 to 0.15 (0.00394 to 0.00591)
Pinion, shaft and rear ring nut			
– Squareness deviation of ring nut support planes		mm (in)	0.02 (0.000787)
– Ring nut installation interference fit		mm (in)	0.019 to 0.060 (0.000748 to 0.00236)
– Eccentricity in seats H of front and rear bearings with respect to seats I of gear bushes and intermediate bearings		mm (in)	0.02 (0.000787)
– Squareness deviation for abutment plane L of rear bearing inner race with respect to seats H		mm (in)	0.02 (0.000787)



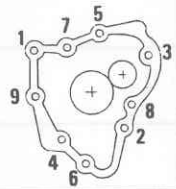
Main shaft			
– Eccentricity in seats C of differential-speed gear casing bearings and intermediate flange with respect to centering seat D on clutch shaft, to seat E of clutch-speed gear casing bearing and to seat F of 5th speed gear		mm (in)	0.03 (0.00118)
– Squareness deviation of abutment plane G for rear bearing inner race with respect to seats C of bearings		mm (in)	0.03 (0.00118)



HEATING TEMPERATURES

Application \ Measurement unit	°C (°F)
Heating temperature for roller bearing locking ring nut of bevel pinion shaft (head side) 	140 (284)
Heating temperature of clutch-speed gear casing for installation of Reverse speed gear pin, and bush of speed selection and engagement rod	140 to 160 (284 to 320)
Heating temperature of 3rd and 4th speed driving gears for installation on main shaft	195 to 210 (383 to 410)

Unit: N·m (kg·m; ft·lb)

Application \ Gearbox type	With roller-ball compound bearings	With skew ball bearings
Main shaft nut	93 to 103 (9.5 to 10.5; 68.7 to 75.9)	
Bevel pinion shaft securing nut	112 to 124 (11.4 to 12.6; 84.4 to 91.1)	
Nuts securing differential speed gear casing and clutch-speed gear casing to intermediate flange Tightening order 	12 to 13 (1.2 to 1.4; 8.7 to 10.1)	
Screws securing shoulder plate to intermediate flange	14 to 15 (1.4 to 1.6; 10.1 to 11.6)	
Containers for the laking of spring and balls securing rods	17 to 20 (1.7 to 2.1; 12.3 to 15.2)	
Nut securing speed control rear lever to speed selection and engagement lever (1)	28 to 32 (2.8 to 3.3; 20.3 to 23.9)	
Nut securing joint connecting rear lever to speed control rod (1)	20 to 31 (2 to 3,2; 14.5 to 23.1)	
Nut securing ball joint connecting rear lever to transmission lever (2)	25.1 to 31 (2.5 to 3.2; 18.1 to 23.1)	
Nut securing speed selection tie rod (2)	11.3 to 14 (1.1 to 1.4; 8 to 10.1)	
Bolt securing speed selection and transmission lever to speed transmission and engagement lever (2)	8.1 to 10 (0.8 to 1; 5.8 to 7.2)	

Unit: N·m (kg·m; ft·lb)

Application \ Gearbox type	With roller-ball compound bearings	With skew ball bearings
Bolt and screw securing bracket to speed gear rubber pad (2)	8.1 to 10 (0.8 to 1 5.8; to 7.2)	
Bolts securing speed gear unit rubber pads to casing	18.6 to 23 (1.9 to 2.3; 13.7 to 16.6)	
Fast idle switch (on intermediate flange)	40 to 48 (4.1 to 4.9; 26.9 to 35.4)	
Screws securing clutch unit to differential speed gear unit	29 to 32 (2.9 to 3.2; 21 to 23.1)	
Screws securing propeller shaft joint to clutch shaft fork	55 to 57 (5.6 to 5.8) (40.5 to 41.9)	39 to 49 (4 to 5) (28.9 to 36.1)
Unions for clutch hydraulic system pipes	8 to 10 (0.8 to 1; 5.8 to 7.2)	
Unions for clutch hydraulic system hoses	10 to 15 (1 to 1.5; 7.2 to 10.8)	
Screws securing forks of 1st-2nd-3rd and 4th speed	21 to 23 (2.1 to 2.3; 15.2 to 16.6)	
Screws securing speed gear-differential unit to lateral support small block	18.6 to 23.5 (1.9 to 2.4; 13.7 to 17.3)	
Screws (lower) securing speed control lever support to body	20 to 32.5 (2 to 3.25; 14.5 to 23.5)	
Screws (upper) securing speed control lever support to body	4.8 to 6 (0.5 to 0.6; 3.6 to 4.3)	
Nut securing plate for Reverse speed engagement safety device	8.3 to 10.3 (0.9 to 1.05; 6.5 to 7.2)	
Bolt securing lever to external speed control rod	13 to 16 (1.3 to 1.6; 9.4 to 11.6)	

(1) For versions Giulietta Alfetta GTV 2.0 GTV 6 2.5 without "isostatic" control

(2) For versions Giulietta Alfetta GTV 2.0 GTV 6 2.5 with "isostatic" control

TROUBLE DIAGNOSIS AND CORRECTIVE ACTION

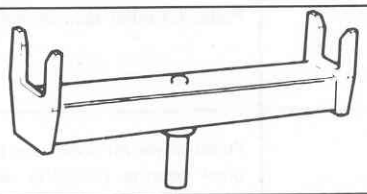
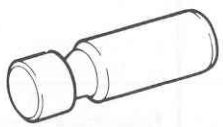
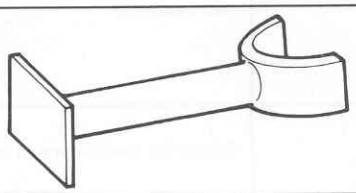
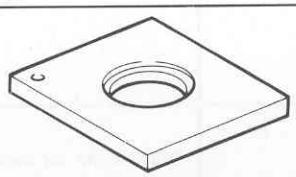
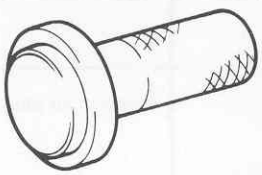
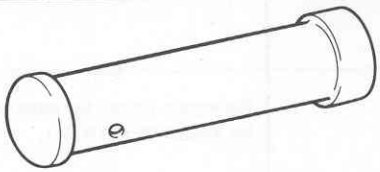
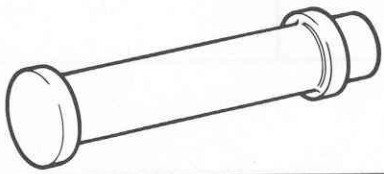
Condition	Probable cause	Corrective action
Transmission is faulty when in forward speeds	Once detected where the noise comes from and established that it does not originate from the engine, proceed as follows in order to, identify the faulty unit – run the car to the speed where noise is most enphasized. – adjusting the speed as required, change alternatively - and within reasonable sequences - all different speeds Once determined the cause of the noise, repair or replace the faulty components	
	• Oil level insufficient or oil not of the prescribed type	Fill-up to proper level or replace oil with the prescribed type
	• Oil leaks from oil seal rings of differential carrier a/o from topping-up or drain plugs	Replace oil seal rings a/o plugs
	• Main shaft bearings (in this case, noise should be present also with speed gear in neutral)	Replace bearings
	• Pinion shaft bearings (noise present only if speed is engaged and this with all speeds)	Replace bearings
Noisy when vehicle is moving even if speedgear is in neutral	• Bearings of differential inner drive shafts faulty or seized	Replace bearings
	• Bevel pinion bearings noisy	Check a/o replace
Noisy when in one particular speed	• Gear teeth mating surfaces worn or seized	Replace gears
Noisy both during acceleration and deceleration (drive shafts already checked)	• Differential gears worn or damaged	Replace gears
	• Hypoid gear excessive clearance	Verify and replace if necessary
	• Crown wheel and pinion securing screws loosened	Tighten the screws
	• Bevel pinion shim (determining pinion-crown axis distance) worn or damaged	Replace washer with another with shim determined by adjustment
	• Pinion shaft securing nut loosened	Check speed gear components a tighten nut
	• Gear package excessive clearance	Adjust package

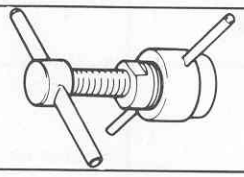
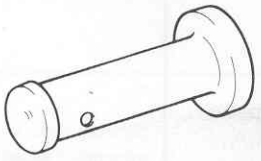
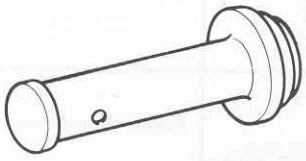
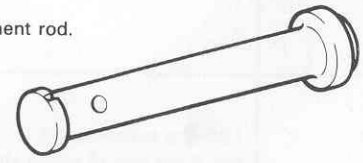
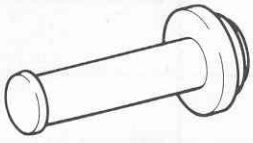
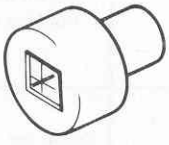
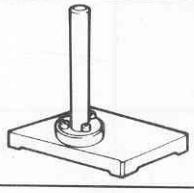
Condition	Probable cause	Corrective action
Transmission noisy when in curve, both with speed engaged and when in "neutral" (drive shafts already checked)	• Teeth of side pinion and crown wheel gears worn, damaged or seized	Replace differential casing
Transmission noisy when in "neutral" (with vehicle stationary)	• Driving torque irregular variation	Adjust idling r.p.m.
	• Not enough oil	Fill up to correct level
Transmission noisy when in reverse speed	• Reverse gears worn or damaged	Replace the faulty components
Speed engagement/disengagement is difficult	First of all, determine whether trouble is due to speed gear or control system. Check whether clutch correctly engages when pedal is released and disengages when pedal is pressed. If clutch s not faulty, the trouble is due to speed gear control system.	
Stiffening of speed gear control a/o non-return of lever to neutral	• Excessive friction in the rotation of tie rod joints of speed transmission and engagement lever	Replace selection tie rod and central ball joint of speed transmission and engagement lever
	• Excessive tightening between speed transmission and selection lever bush and speed transmission and engagement lever	Replace levers, shoulder rings, bushes and pin
	• Insufficient lubrication of speed transmission and selection lever and speed transmission and engagement lever bushes	Grease the points subject to friction
	• O-rings for speed transmission and selection lever broken or too worn, with consequent water a/o dust seepage	Replace O-rings and grease pin of speed transmission and selection lever
	• Insufficient oil level in the differential-speed gear casing	Restore oil correct level
	• Synchronizing unit faulty	Refer to: "Synchronizing unit grinds or is faulty"
	• Inner controls deformed or worn	Repair or replace the faulty components
Excessive clearance in speed selection	• Abnormal wear of pin and related bushes connecting speed transmission and engagement lever with speed transmission and selection lever bush	Replace the worn components

Condition	Probable cause	Corrective action
Noisy	• Incorrect positioning of the unit in the longitudinal direction with interferences	Verify a/o adjust control assembly position
	• Interference with rear floor sidewall	Rivet the area concerned
Speed slip out	• Sleeves and gears worn or faulty	Replace the worn components
	• Excessive clearance of the gear which becomes disengaged (Noise present both in acceleration and deceleration)	Verify gear package adjustment
Speed engagement is poor	• Control levers bushes worn	Replace the worn components
	• Pawls worn or damaged	replace pawls
	• Springs fatigued or broken	Replace springs
	• Rods milling warn or damaged	Replace rods
	• Selector fork a/o lever worn or damaged	Replace selector a/o levers
Synchronizing unit grinds or is faulty	• Sleeve and gear with front toothing worn or damaged	Replace the faulty components
	• Incorrect distance between front toothing of gear and sleeve	Replace the faulty components
	• Synchronizing ring worn	Replace
	• Sleeve splines worn or damaged	Replace
Reverse lights do not light when engaging the Reverse speed	• Reverse lights switch faulty	Replace switch
Speed selector lever vibrates and is noisy	• Lever return spring fatigued	Replace the faulty components
	• Speed control lever bushes faulty	Replace the faulty components
	• Refer to other steps concerning the noisy speed	

Condition	Probable cause	Corrective action
Seizure or breakage	• Insufficient oil level or oil not of the prescribed type	Replace the faulty components and use the prescribed oil
	• Insufficient clearances	Adjust clearances and replace the faulty components
	• Gears and bearings incorrect adjustment	Check the speed gear unit
	• Excessive torque or improper use of clutch	Replace the faulty components
	• Securing screws loosened	Replace the faulty components and restore the rightening torques

SPECIAL SERVICE TOOLS

Tool number	Tool name	Page ref.
A.2.0075	Support for jacking up car 	13-6
A.2.0267	Dummy rods for striking rod balls and speed engagement detent balls. 	13-13
A.2.0268	Spacer for removing De Dion axle 	13-6
A.2.0349-0100	Half-ring support plate for disassembling ring nut and inner race of pinion shaft bearing (to be used with A.2.0401 and A.2.0402) 	13-20
A2.0401	Half-rings for removing inner race of pinion shaft rear bearing - (to be used with A.2.0349/0100) 	13-20
A.2.0402	Half-rings for removing ring nut of pinion shaft rear bearing - (to be used with A.2.0349-0100) 	13-20
A.3.0192	Puller-driver for outer race of pinion shaft bearing on intermediate flange (Solutions with intermediate roller/ball bearings) 	13-22 13-27
A.3.0343	Driver for main shaft oil seal ring 	13-33
A.3.0346	Driver for pinion shaft bush 	13-32

Tool number	Tool name	Page ref.
A.3.0361	Puller for inner race of main shaft rear bearing 	13-20
A.3.0407	Puller-driver for outer race of pinion shaft intermediate bearing (Solution with intermediate skew ball bearings) 	13-21 13-26
A.3.0408	Puller-driver for outer race of pinion shaft intermediate bearing (Solution with intermediate skew ball bearings) 	13-21 13-26
A.3.0532	Driver for bush of speed selection and engagement rod. 	13-32
A.3.0596	Puller-driver for outer race of main shaft bearing on intermediate flange (Solution with intermediate roller/ball bearings) 	13-22 13-27
A.4.0145	Support of gauge for determining pinion shim (to be used with C.6.0166) 	13-18 13-29
A.5.0181	Wrench, 30 mm. for main shaft nut 	13-18 13-29
A.5.0216	Spanner for plug of speed control rod ball 	13-14 13-15
C.6.0166	Reference gauge for determining pinion shim (to be used with A.4.0145) 	13-18

GROUP 15

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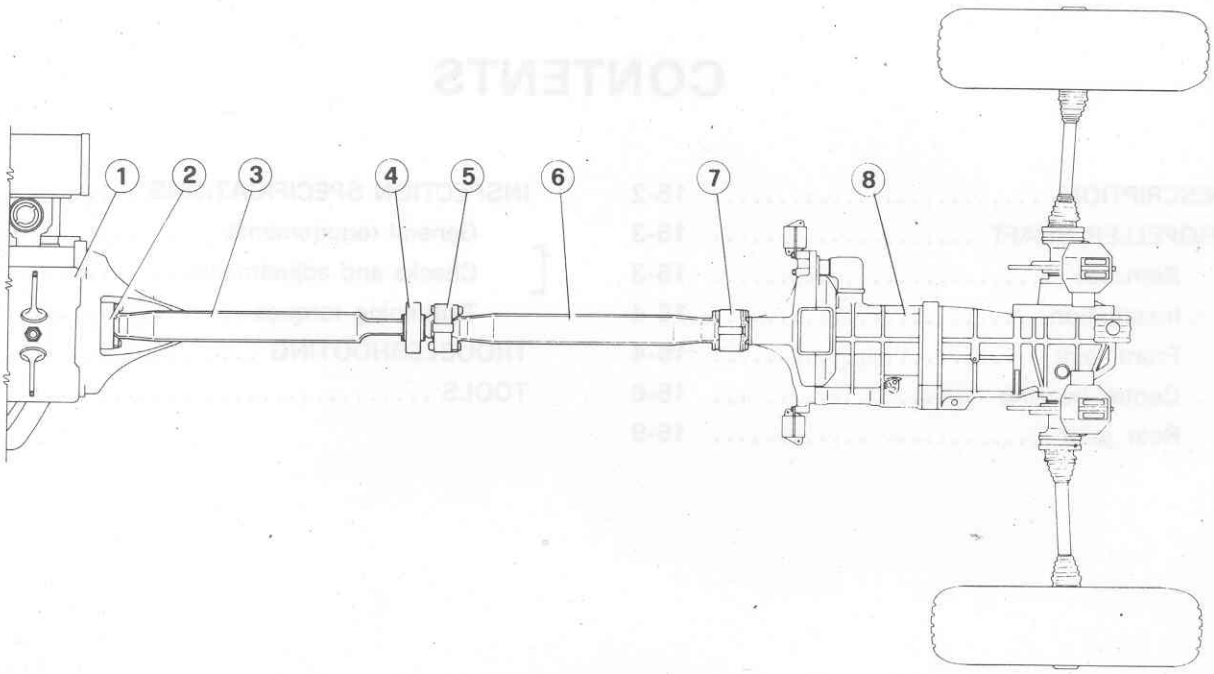
DESCRIPTION



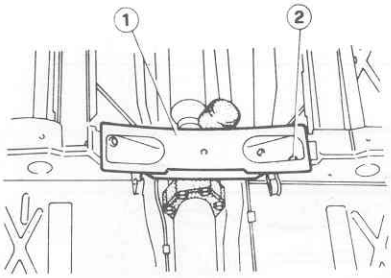
1 Engine
2 Front joint
3 Front shaft
4 Center bearing
5 Center, joint
6 Rear shaft
7 Rear joint
8 Clutch - transmission - axle drive assembly

Drive line consists of shafting connecting engine to clutch - transmission - axle drive assembly.
This unique layout allows propeller shaft to be positively connected to engine at all times.
Propeller shaft consists of two halves connected to one another and to anchor points by means of flexible joints.
Propeller shaft is anchored to body through a center bearing assembly provided with a ball bearing.

PROPELLER SHAFT

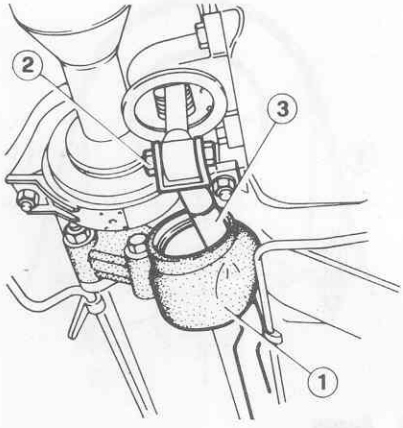
REMOVAL

1. Raise car on a platform lift.
2. Remove exhaust pipe front and center section as specified in Group 04: Exhaust system - Removal.
3. Back off capscrews (2) and remove center crossmember (1).



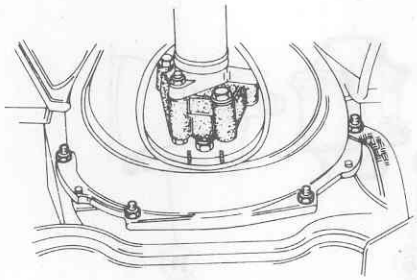
1 Center crossmember
2 Crossmember/body capscrew

4. Remove bellows (1), back off and remove bolt (2) and disconnect rod (3).



1 Bellow
2 Transmission remote control rod/lever bolt
3 Transmission remote control rod

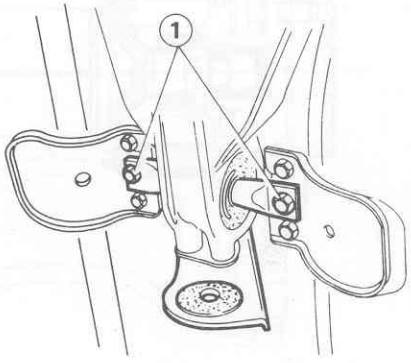
5. Back off plate-bell housing securing bolts and remove plate.



6. Disconnect bell housing from body.

a. For vehicles with high-torque propeller shaft (see: Group 00 - Complete Car - Use of Units in Car):

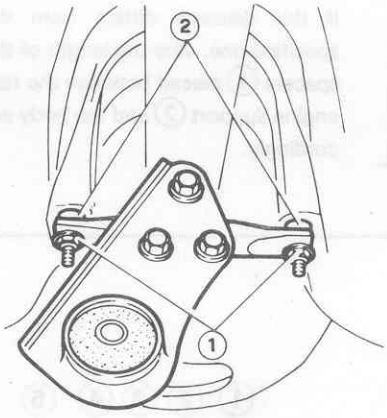
- Back off capscrews (1) and disconnect rear engine mount from body.



1 Rear engine mounting capscrews

b. All other models:

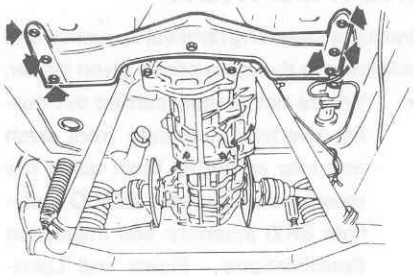
- Back off nuts (1), disconnect rear engine mount from body, retrieving spacers (2).



1 Rear engine mounting retaining nuts
2 Spacers

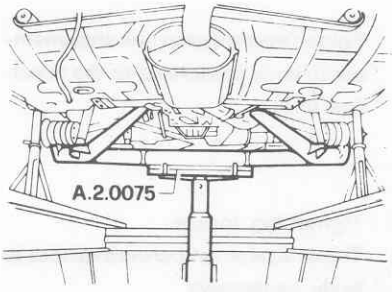
7. Clamp propeller shaft and back off bolts connecting shaft joints to flywheel and clutch fork; rotate shaft and back off the remaining bolts.

8. Back off six screws retaining axle front crossmember to body.

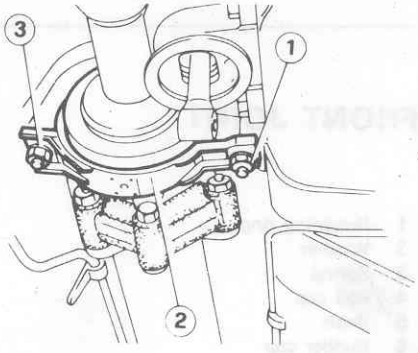


WARNING:
On Alfetta, Giulietta and GTV 2.0 there is no need to disturb the crossmember.

9. Position a column lift provided with cradle **A.2.0075** under De Dion axle.
10. Acting on De Dion axle, lower crossmember and transmission unit.



11. Back off nuts (1) and disconnect support (2) from body.



1 Center bearing to body retaining nut
2 Center bearing
3 Washer

12. Take off shaft disconnecting from clutch shaft fork first and then from flywheel.

INSTALLATION

Install by reversing removal sequence and adhering to the instructions given below.

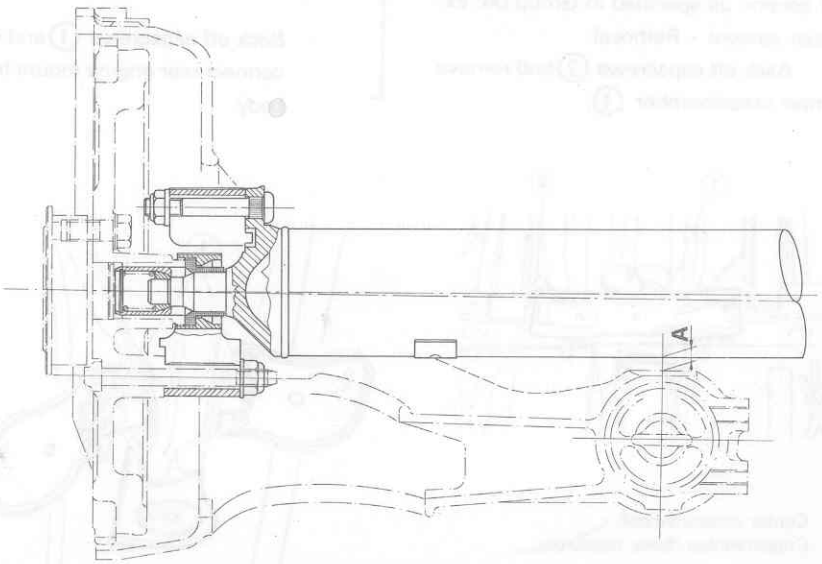
- Where not already carried out during overhaul, lubricate front bush and rear centering bush using the recommended grease (ISECO Molykote BR2) (quantity: see Inspection Specifications - Fluids and Lubricants).
  If necessary, wet flywheel bush using the same type of grease.
- Tighten nuts retaining flexible joints to flywheel and clutch fork to the specified torque (see Inspection Specifications - Tightening Torques).

WARNING:
On assembly, use new self-locking nuts.

- Tighten transmission unit crossmember to body capscrews to the specified torque.

Ⓣ : **Tightening torque**
Transmission unit crossmember to body capscrews
39 to 44 N·m
(4 to 4.5 kg·m)
(28.8 to 32.5 ft·lb)

- For 4 cylinder petrol and turbo diesel cars.
  Check that distance A between the propeller shaft and the rear engine support is as specified.

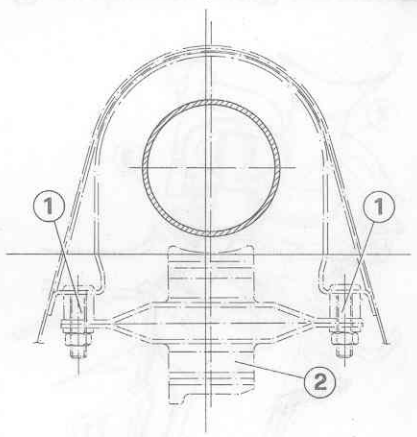


Distance A between the propeller shaft and rear engine support.

4 cylinder petrol run car:
A = 7 mm (0.28 in)

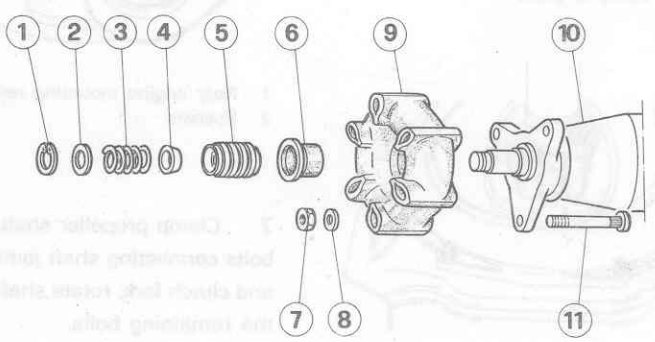
Turbo diesel car:
A = 24 mm (0.94 in)

If this distance differs from the specified one, vary the length of the spacers ① placed between the rear engine support ② and the body accordingly.



1 Spacer
2 Rear engine support

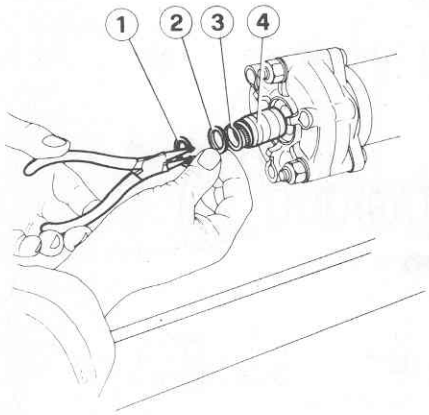
FRONT JOINT



1 Retaining ring
2 Washer
3 Spring
4 Ball cap
5 Bush
6 Rubber cap
7 Nut
8 Washer
9 Flexible member
10 Front shaft
11 Capscrew

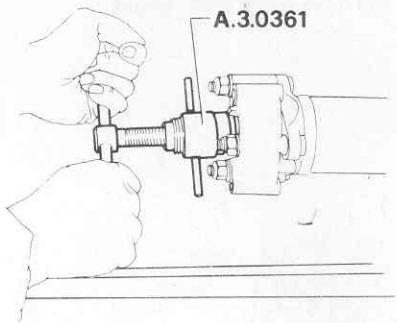
DISASSEMBLY

1. Clamp front shaft in a vice and remove retaining ring (1) from bush (4), take off washer (2) and spring (3).

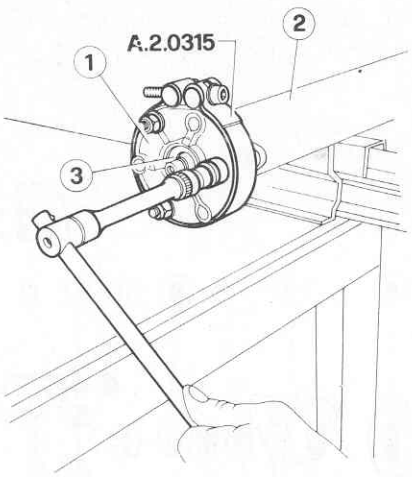


1 Retaining ring
2 Washer
3 Spring
4 Bush

2. Using tool **A.3.0361**, remove bush and ball joint from front shaft spigot.



3. Install tool **A.2.0315** on flexible joint. Back off three nuts retaining joint (1) to front shaft (2), retrieve associated washers, remove joint and rubber ring (3).



1 Flexible joint
2 Front shaft
3 Rubber ring

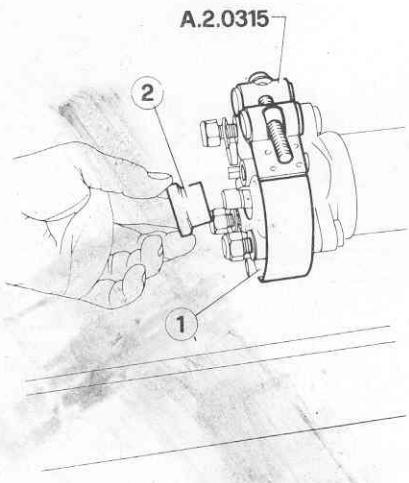
INSPECTION

Clean all parts

1. Check that bush and ball working surface is not worn; replace damaged parts as necessary.
2. Check flexible joint (replace if cracked or dented).

ASSEMBLY

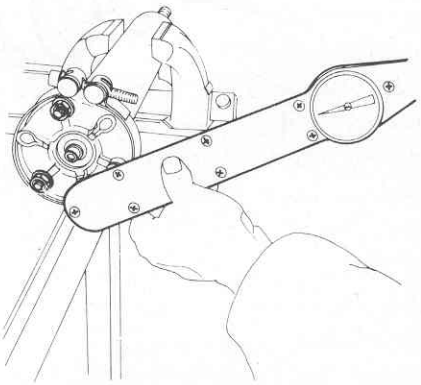
1. Using tool **A.2.0315**, install flexible joint (1) and position rubber ring (2).



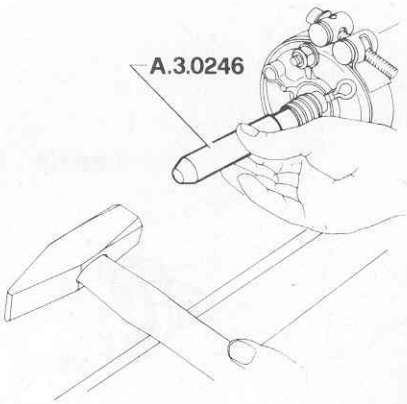
1 Flexible joint
2 Rubber ring

CAUTION:
If flexible joint has been replaced, tool A.2.0315 is not required for assembly.

2. Tighten three flexible joint nuts with associated washers to the specified torques (see Inspection Specifications - Tightening Torques).

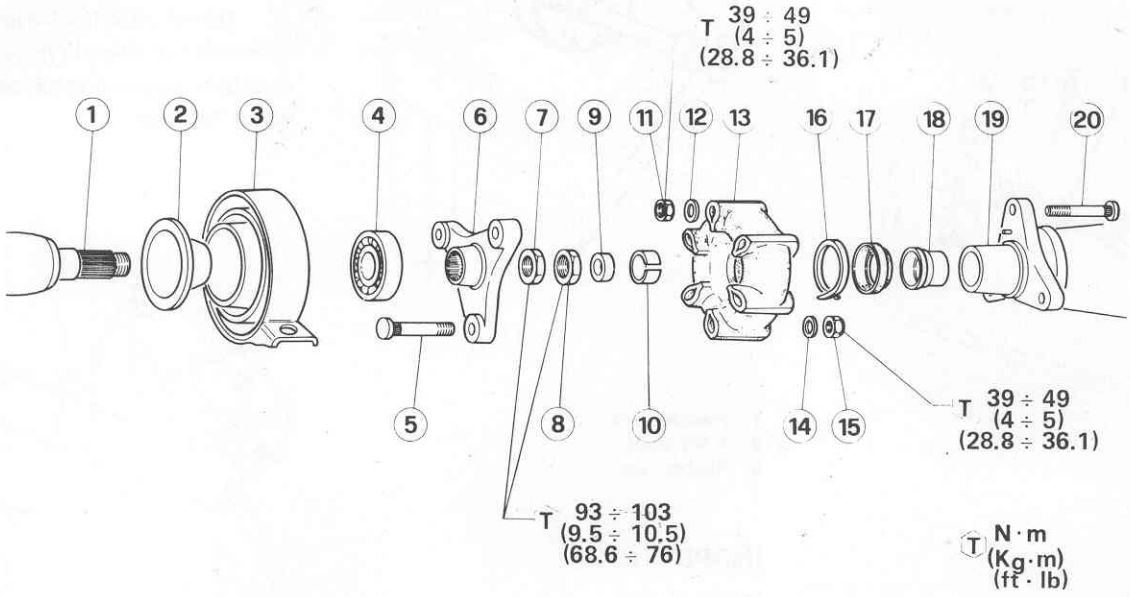


3. Lubricate bush using the recommended grease (ISECO Molykote BR2) (quantity: see Inspection Specifications - Fluids and Lubricants) and coat ball joint and bush working surfaces using recommended grease (ISECO Molykote G Rapid).
4. Insert ball cap in bush and position on front shaft spigot using tool **A.3.0246**.



5. Insert spring and washer in bush and position retaining ring. Remove tool **A.2.0315**.

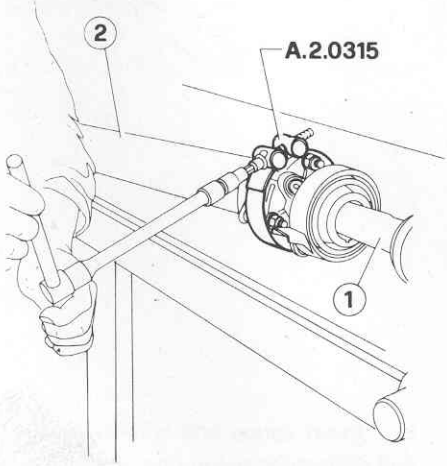
CENTER BEARING



1 Front shaft
2 Cup
3 Center bearing support
4 Bearing
5 Capscrew
6 Fork
7 Nut
8 Locknut
9 Ball
10 Spherical seat
11 Nut
12 Washer
13 Flexible joint
14 Washer
15 Nut
16 Retaining ring
17 Rubber cap
18 Front bush
19 Rear shaft
20 Capscrew

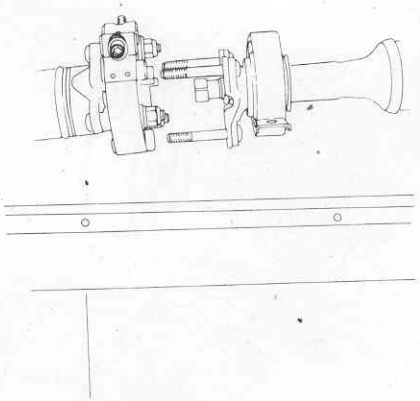
DISASSEMBLY

1. Clamp front shaft (1) in a vice, mark front and rear (2) shaft position, install tool **A.2.0315** on center flexible joint.



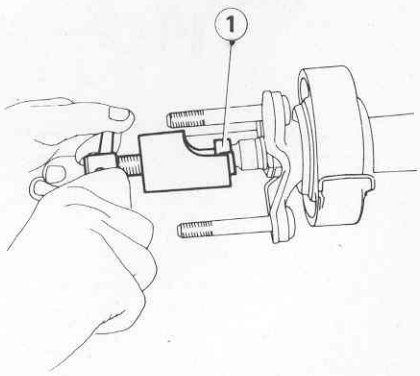
1 Front shaft
2 Rear shaft

2. Back off three nuts retaining front shaft to center bearing, remove associated washers and take off both shafts.



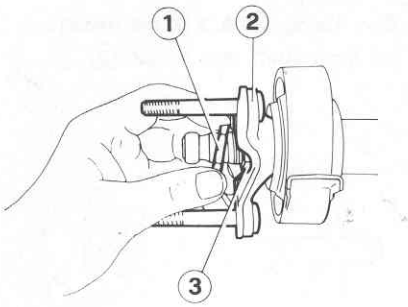
3. Mark front shaft fork and spigot to facilitate assembly.

4. Using a puller, take off spherical seat (1) from front shaft spigot.



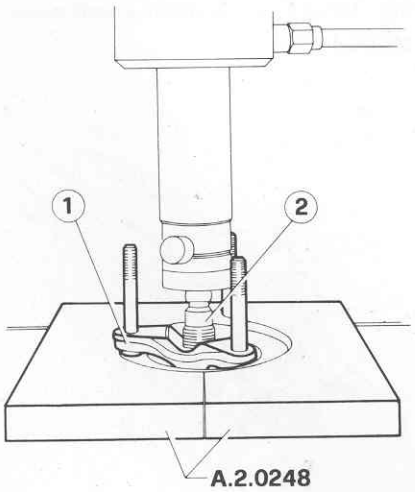
1 Spherical seat

5. Back off and remove locknut (1) and nut (3) retaining fork (2).



1 Locknut
2 Fork
3 Nut

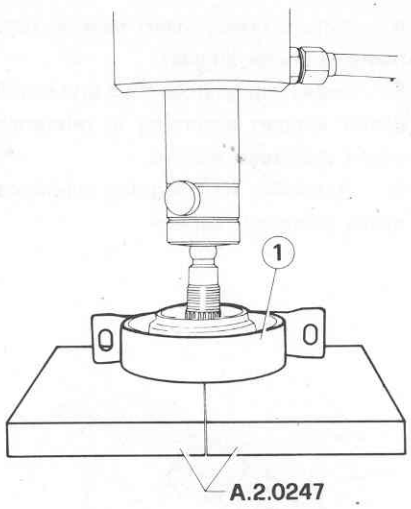
6. Using a press with adapter plates of tool **A.2.0248** take off fork (1) from front shaft (2).



1 Fork
2 Front shaft spigot

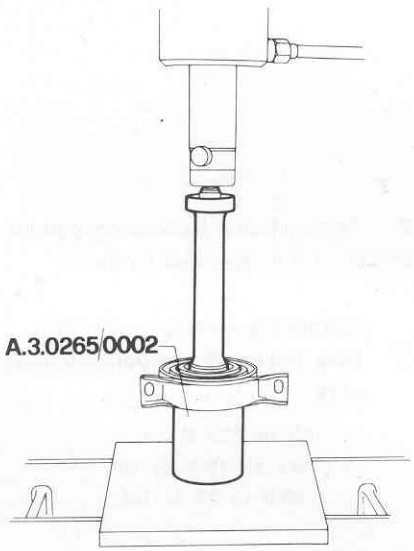
CAUTION:
On disassembly do not damage fork as its replacement will affect shaft balancing.

7. Using a press with adapter plates of tool **A.2.0247**, take off center support (1) after marking front and rear sides, and retrieve associated cup.

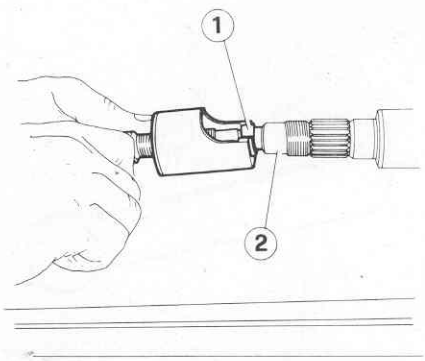


1 Center support

8. Using tool **A.3.0265/0002**, take off center support bearing at the press.

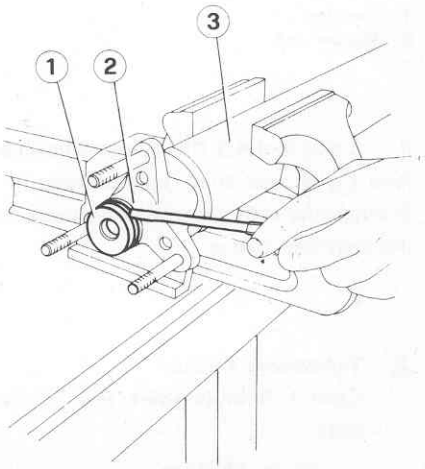


9. Take off ball (1) from front shaft spigot (2).



1 Ball
2 Front shaft spigot

10. Clamp rear shaft in a vice, mark center support position with respect to shaft, install tool **A.2.0315** on joint, back off three retaining nuts, remove associated washers and take off joint.
11. Remove rear shaft front bush rubber ring (1) after removing retaining ring.



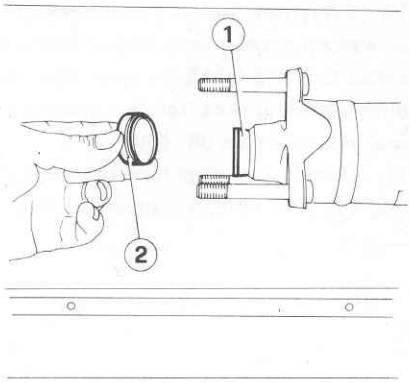
1 Rubber ring
2 Front bush
3 Rear shaft

INSPECTION

Clean all parts.
1. Check support bearing: replace if necessary.
2. Check that ball or spherical seat working surface is not worn or scored; replace damaged parts as necessary.
3. Check flexible joint; if cracked or dented, replace without hesitation.

ASSEMBLY

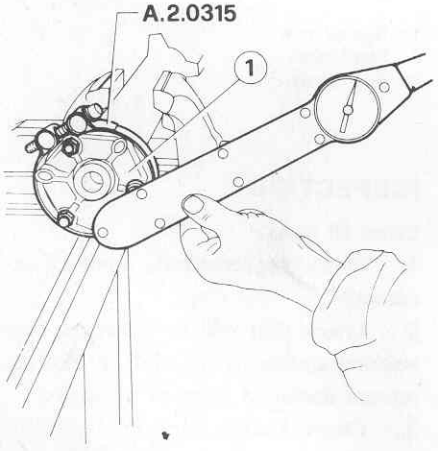
1. Lubricate bush and rubber ring using 5 cc of recommended grease (ISECO Molykote BR2).
2. Install rubber ring (2) in bush (1) and lock through associated retaining ring.



1 Bushing
2 Rubber cap

3. Using tool **A.2.0315**, install flexible joint (1) on rear shaft, tighten three retaining nuts with associated washers to the specified torque.

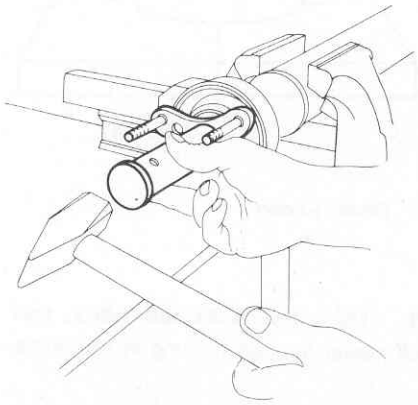
(T) : Tightening torque
Center flexible joint/rear shaft nuts
39 to 49 N · m
(4 to 5 kg · m)
(28.8 ÷ 36.1 ft · lb)



1 Flexible joint

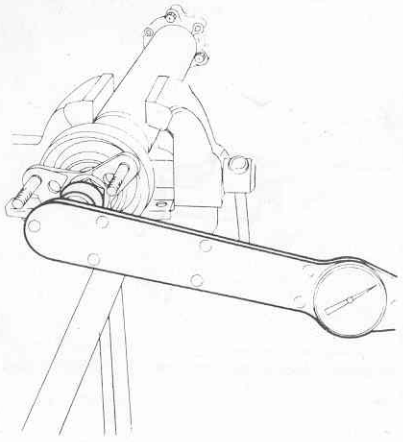
CAUTION:
a. Do not remove tool A.2.0315 as it will be needed to assemble propeller shaft.
b. Il flexible joint has been replaced, tool A.2.0315 is not required for assembly.

4. With a press, insert bearing fully home in center support.
5. Install cup on front shaft and install center support according to reference marks previously applied.
6. Assemble fork aligning reference marks previously applied.

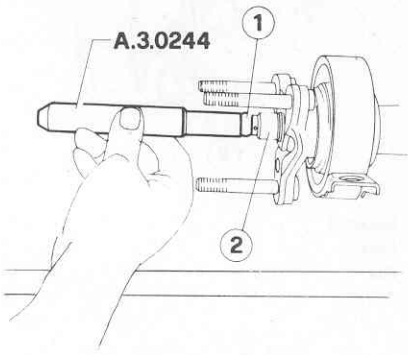


7. Tighten fork and center support nut and locknut to specified torque.

(T) : Tightening torque
Fork and center support retaining nuts
93 to 103 N · m
(9.5 to 10.5 kg · m)
(68.6 to 76 ft · lb)

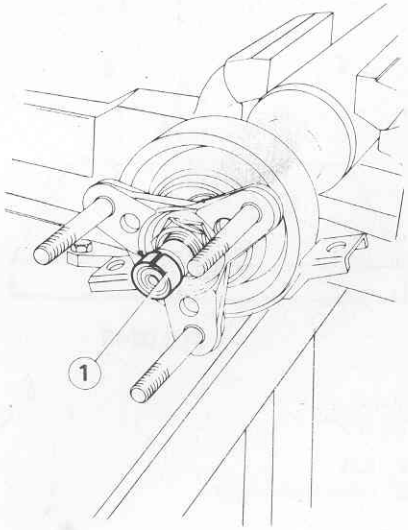


8. Using tool **A.3.0244**, install ball (1) on front shaft rear spigot (2).



1 Ball
2 Front shaft spigot

9. Coat ball and spherical seat working surface using recommended grease (ISECO Molykote G. Rapid).
10. Using a plastic mallet, install spherical seat (1).



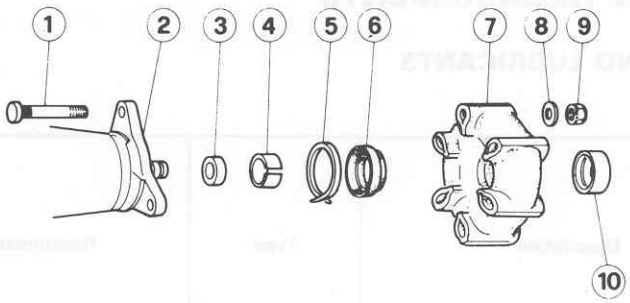
1 Spherical seat

11. Aligning reference marks applied on disassembly, assemble propeller shaft connecting front shaft to rear shaft. Tighten three nuts with associated washers retaining the two shafts to the specificed torque.

(T) : Tightening torque
Center flexible joint/front shaft retaining nuts
39 to 49 N · m
(4 to 5 kg · m)
(28.8 to 36.1 ft · lb)

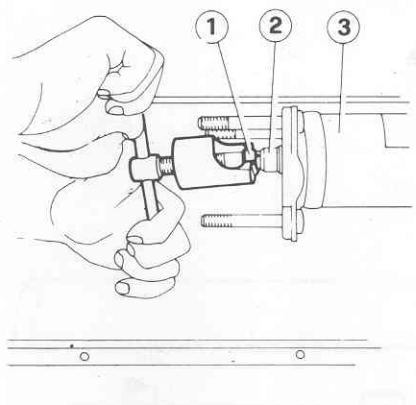
REAR JOINT

1 Capscrew
2 Rear shaft
3 Ball
4 Spherical seat
5 Retaining ring
6 Rubber cap
7 Flexible joint
8 Washer
9 Nut
10 Seal



DISASSEMBLY

1. Clamp rear shaft in a vice and take off rear seal.
2. Install tool **A.2.0315** on flexible joint, back off three retaining nuts, retrieve associated washers, take off flexible joint and rubber cap, after removing retaining ring.
3. Take off spherical seat and remove ball (1) from spigot (2) of rear shaft (3).



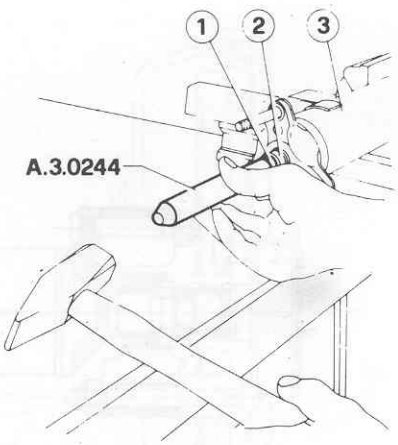
1 Ball
2 Spigot
3 Rear shaft

INSPECTION

Clean all parts.
1. Check that ball or spherical seat working surface is not worn or scored; replace damaged parts as necessary.
2. Check flexible joint; if cracked or dented, replace without hesitation.

ASSEMBLY

1. Using tool **A.3.0244**, install ball (1) on rear shaft (3) spigot (2).



1 Ball joint
2 Spigot
3 Rear shaft

2. Lubricate rear centralizing bush in position on flexible joint using the recommendend grease (ISECO Molykote BR2) (quantity: see Inspection Specifications - Fluids and Lubricants).
3. Install seal on bush and secure through retaining ring.
4. Using tool **A.2.0315**, install flexible joint, tighten 3 retaining nuts with associated washers to the specified torque (see Inspection Specifications - Tightening Torques).

WARNING:
If flexible joint has been replaced, on assembly tool A.2.0315 is not required.

5. Install seal, positioning lip on rear bush.

INSPECTION SPECIFICATIONS

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Description	Type	Recommended product	Quantity	
			Cars with transmission for high torques	All other cars
Flywheel bush	GREASE	ISECO: Molykote BR2 Part. No. 3671-69841	Coat with	Coat with
Propeller shaft front bush			5 cc (0.3 cu.in)	10 cc (0.6 cu.in)
Center bush and rubber ring			5 cc (0.3 cu.in)	5 cc (0.3 cu.in)
Rear centralizing bush on flexible joint			5 cc (0.3 cu.in)	Fill up
Front clearance take up ball and spherical bush working surface	GREASE	ISECO: Molykote G Rapid Part. No. 3671-69842	Coat	Coat
Center ball and spherical seat working surface			Coat	Coat
Rear ball and spherical seat working surface			Coat	Coat

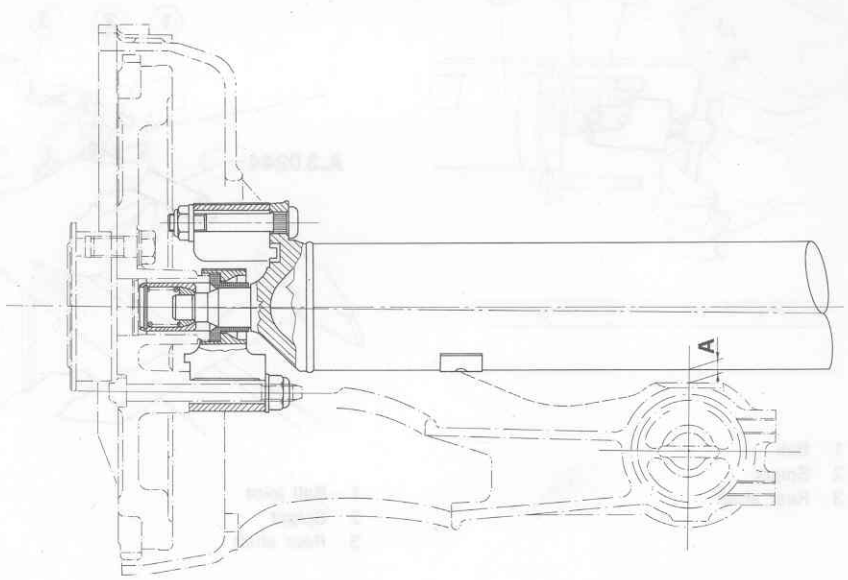
CHECKS AND ADJUSTMENTS

For 4 cylinder petrol and turbodiesel cars

Distance A between the propeller shaft and rear engine support

4 cylinder petrol run car
A = 7 mm (0.28 in)

4 cylinder turbodiesel car
A = 24 mm (0.94 in)



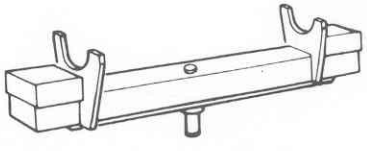
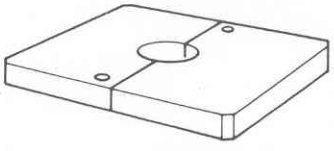
TIGHTENING TORQUES [N·m (kg·m: (ft·lb)]

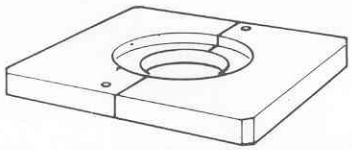
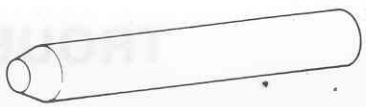
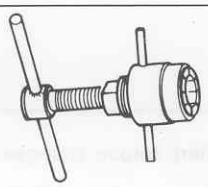
Description	Cars with transmission for high torques	All other cars
Nuts, front/rear flexible joint	55 to 57 (5.6 to 5.8) (40.6 to 42)	39 to 49 (4 to 5) (28.8 to 36.1)
Nuts, center flexible joint to propeller shaft yokes	39 to 49 (4 to 5) (28.8 to 36.1)	39 to 49 (4 to 5) (28.8 to 36.1)
Nuts, fork and center bearing	93 to 103 (9.5 to 10.5) (68.6 to 76)	93 to 103 (9.5 to 10.5) (68.6 to 76)
Capscrews, transmission crossmember to body	39 to 44 (4 to 4.5) (28.8 to 36.1)	39 to 44 (4 to 4.5) (28.8 to 36.1)

TROUBLESHOOTING

Fault	Cause	Remedy
Noise and chatter under any running condition	• Worn flexible joints • Loose flexible joint nuts • Worn center bearing • Loose center bearing suppor cap-screws	Replace worn joints Tighten nuts Replace bearing Tighten screws
Chatter during sharp torque changes	• Worn flexible joints • Loose flexible joints nuts	Replace worn joints Tighten joint nuts

TOOLS

Part No.	Description	Page
A.2.0075	Support, car lift 	15-4
A.2.0247	Adapter plates, front shaft center support 	15-7

Part No.	Description	Page
A.2.0248	Adapter plates, center joint yoke 	15-7
A.2.0315	Remover/replacer, flexible joint 	15-5 15-6 15-8 15-9
A.3.0244	Installer, ball front/rear shaft 	15-8 15-9
A.3.0246	Installer, ball with bush, front shaft 	15-5
A.3.0265/0002	Remover, center bearing, front shaft 	15-7
A.3.0361	Remover, front/rear ball, propeller shaft 	15-5

GROUP 17

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Differential

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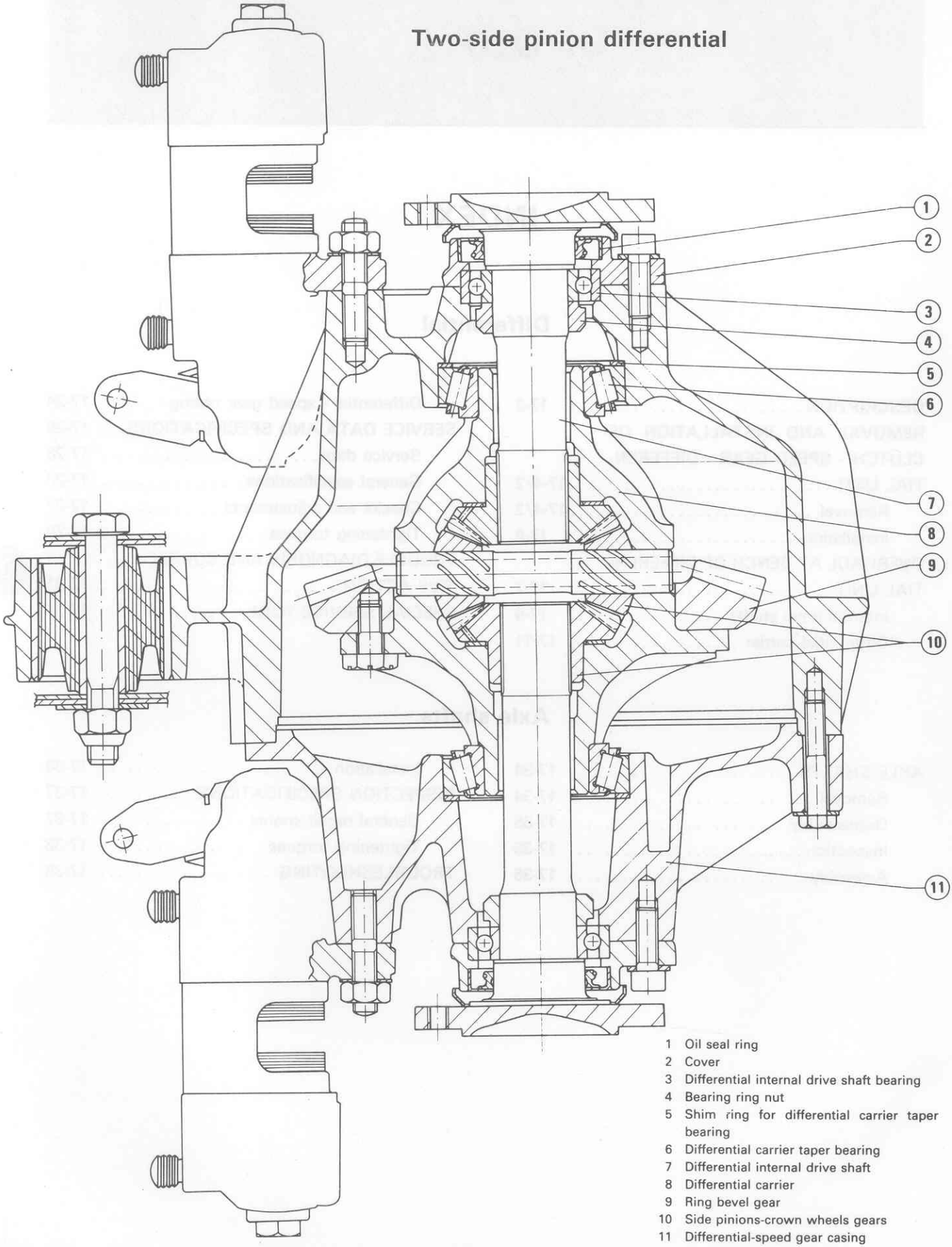
DESCRIPTION

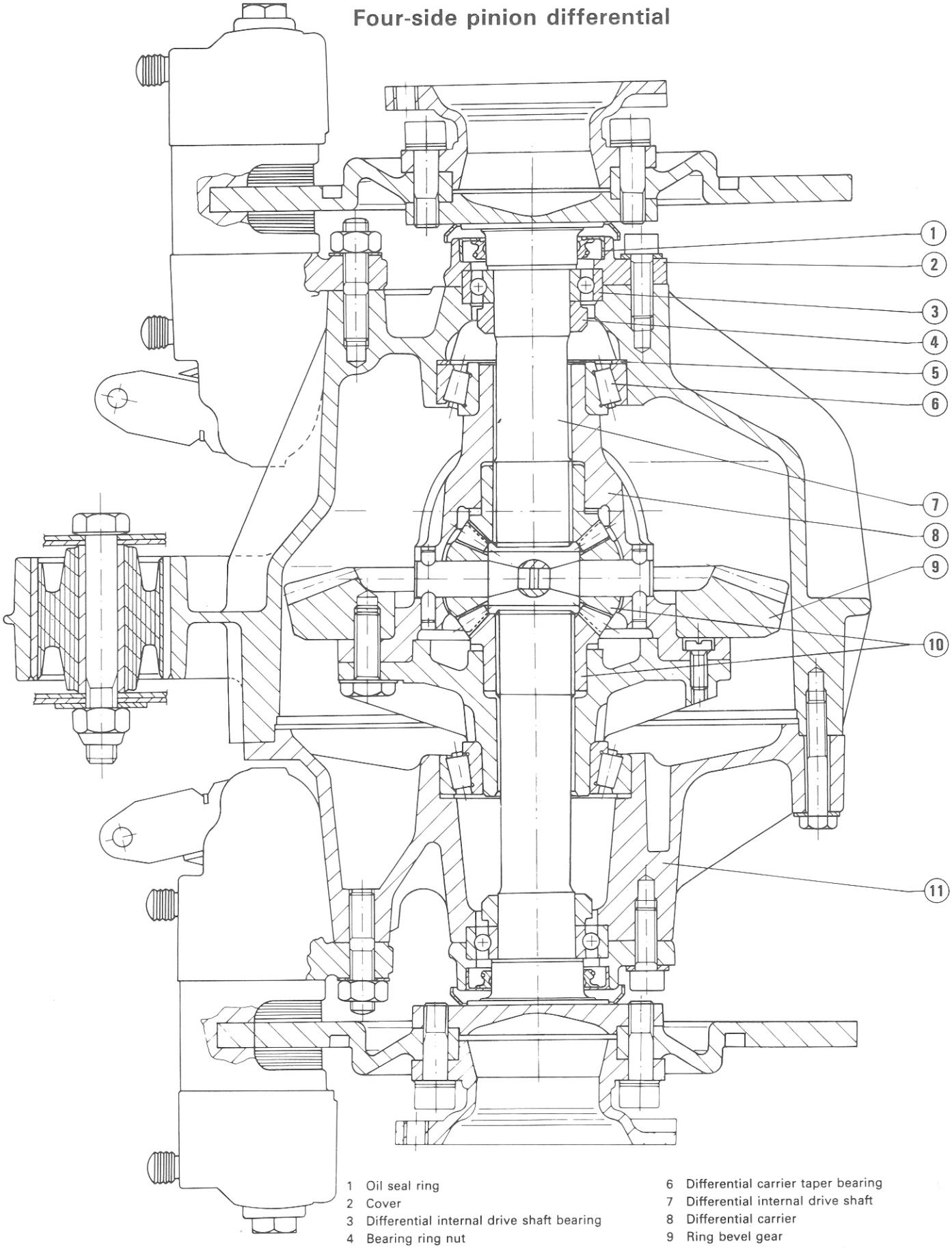
The differential system is composed by a crown wheel and pinion of hypoid type and a crown wheel-side pinion unit with two, four, or four slip limited side pinions according to motorizations (see: Group 00 - Complete Car - Use of Units in Car).

Two-side pinion differential



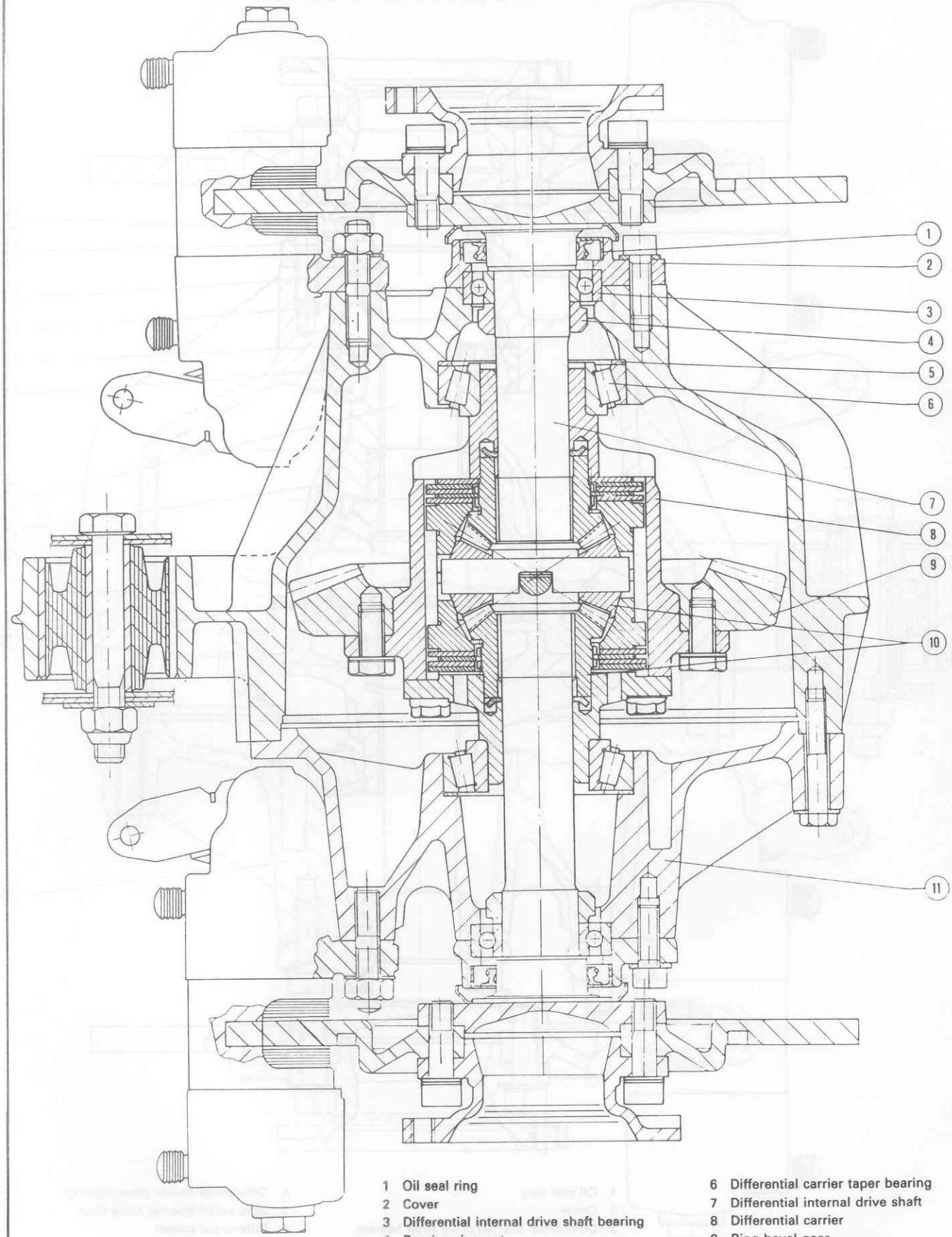
1 Oil seal ring
2 Cover
3 Differential internal drive shaft bearing
4 Bearing ring nut
5 Shim ring for differential carrier taper bearing
6 Differential carrier taper bearing
7 Differential internal drive shaft
8 Differential carrier
9 Ring bevel gear
10 Side pinions-crown wheels gears
11 Differential-speed gear casing

Four-side pinion differential

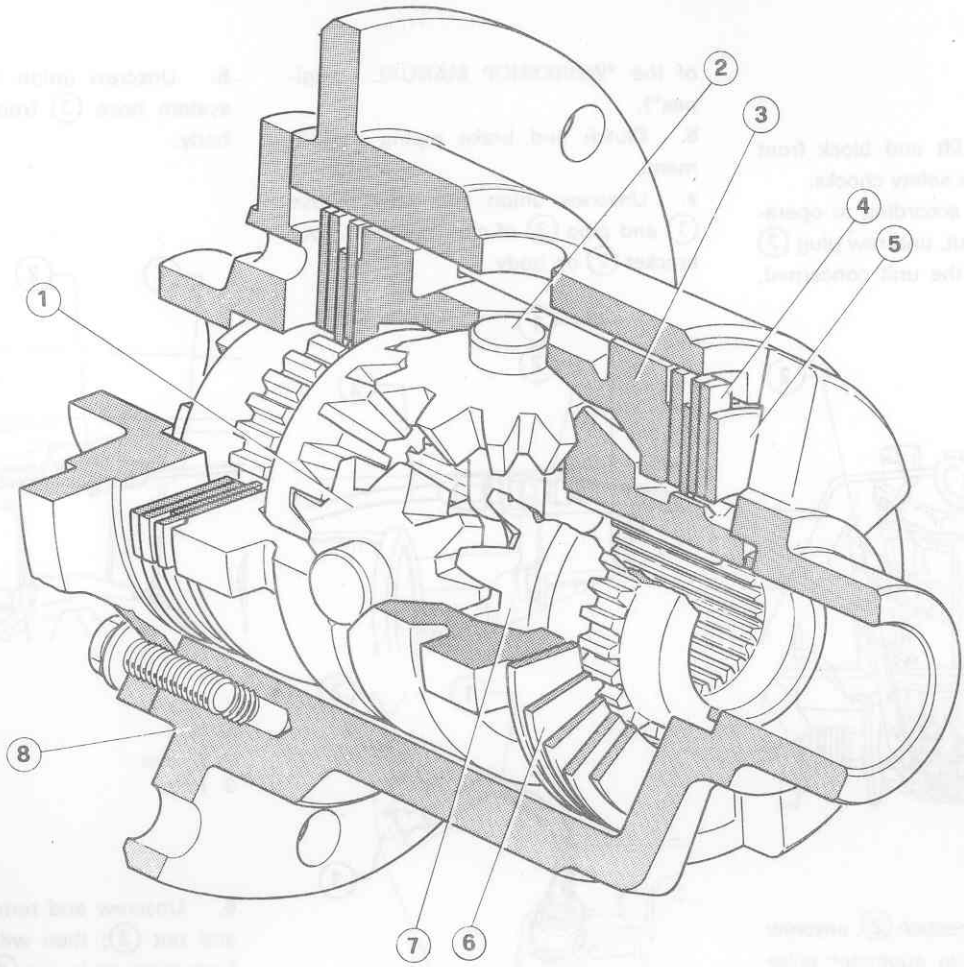


1 Oil seal ring
2 Cover
3 Differential internal drive shaft bearing
4 Bearing ring nut
5 Shim ring for differential carrier taper bearing
6 Differential carrier taper bearing
7 Differential internal drive shaft
8 Differential carrier
9 Ring bevel gear
10 Side pinions-crown wheels gears
11 Differential-speed gear casing

Slip limited - four - side pinion differential (25% slip value)



1 Oil seal ring
2 Cover
3 Differential internal drive shaft bearing
4 Bearing ring nut
5 Shim ring for differential carrier taper bearing
6 Differential carrier taper bearing
7 Differential internal drive shaft
8 Differential carrier
9 Ring bevel gear
10 Side pinions-crown wheels gears
11 Differential-speed gear casing



1 Side-pinion
2 Spider
3 Thrust ring
4 External segment
5 Spacer
6 Internal segment
7 Crown wheel
8 Differential box

The differential box (8) is internally equipped with 4 longitudinal splines in which the thrust rings (3) and the external segments (4) are inserted; thus they are only allowed to move axially as to the differential box. The internal segments (6) are anchored on the splined hubs of the Crown wheels (7). The thrust rings have wedge-shaped millings on the internal front-side in which the spider's extremities (2) are housed. One side-pinion gear (1) is inserted on each spider's extremities and meshes with the crown wheel unit.

The slip limited action is caused by the friction between the internal and external segment's surfaces.

This friction occurs when an axial load is given by the displacement of the shim rings, the supporting surfaces of which are oblique to the spiders.

This special mechanical action generates axial expansion forces on the thrust rings subsequent to the reaction forces due to a variation of the wheel stall torque.

The result is a higher load on the segments. As the external segments are connected with the differential box and the internal segments are connected with the crown wheel units, the relative motion between the differential box and the axle shaft is thus limited.

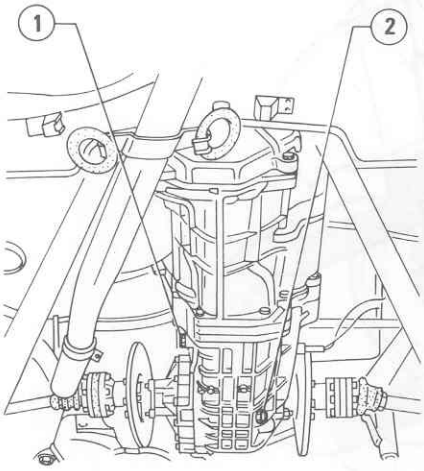
The slip limiting effect is proportional to the engine torque variation as well as to the different speed torque variations.

REMOVAL AND INSTALLATION OF CLUTCH-SPEED GEAR-DIFFERENTIAL UNIT

REMOVAL

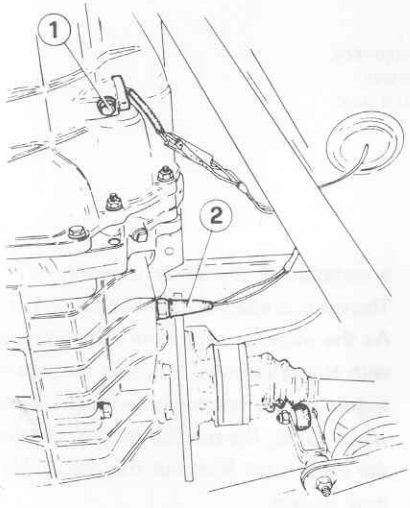
1. Set car on a lift and block front wheels with suitable safety chocks.

2. Raise car and, according to operations to be carried out, unscrew plug (2) and drain oil from the unit concerned, then tighten plug.



1 Filling plug
2 Oil drain plug

3. Disconnect connection (2), unscrew screw (1) and remove odometer pulse transmitter.

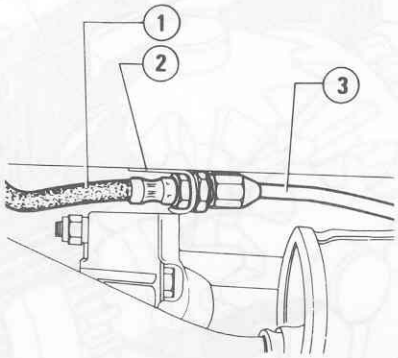


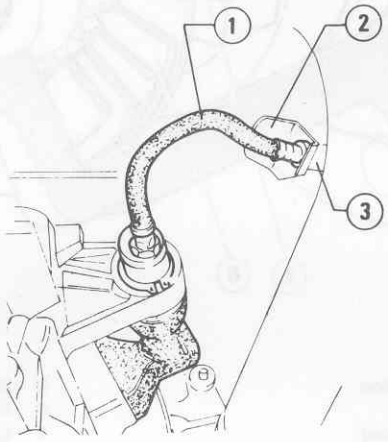
1 Screw securing odometer pulse transmitter to gearbox
2 Connection for reverse lights switch cable

4. Remove exhaust system (refer to: Group 04 - "Exhaust System Removal" of the "WORKSHOP MANUAL - engines").

5. Clutch and brake piping detachment.

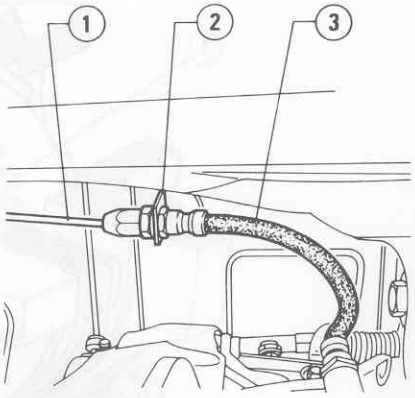
a. Unscrew union and detach hose (1) and pipe (3) of clutch system from bracket (2) on body.





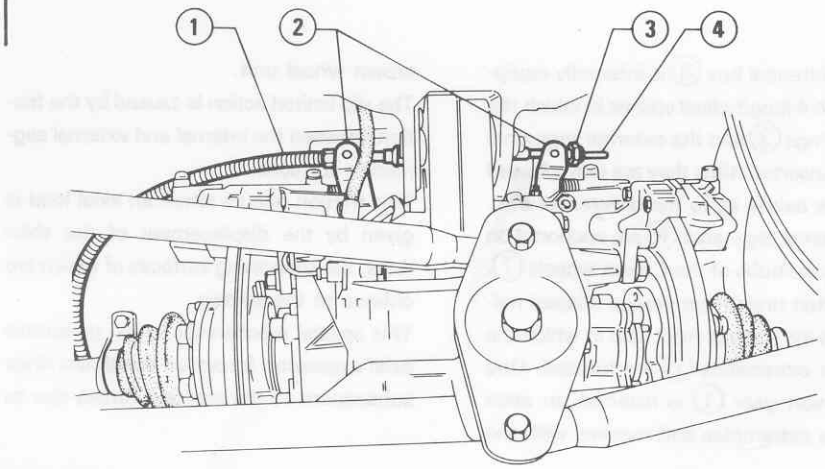
1 Hose
2 Bracket
3 Pipe

b. Unscrew union and detach brake system hose (3) from bracket (2) on body.



1 Pipe
2 Bracket
3 Hose

6. Unscrew and remove lock nut (4) and nut (3); then withdraw cable (1) from seats on levers (2).

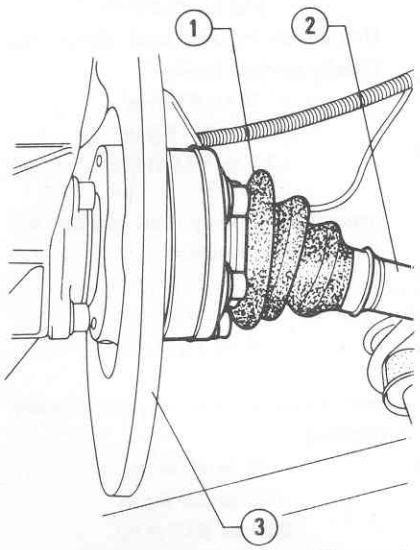


1 Parking brake cable
2 Rear brake caliper levers
3 Adjusting nut
4 Securing lock nut

7. Drive shafts detachment-differential side

a. Unscrew screws (1) recovering the related plates and disconnect external drive shafts (2) from internal drive shafts

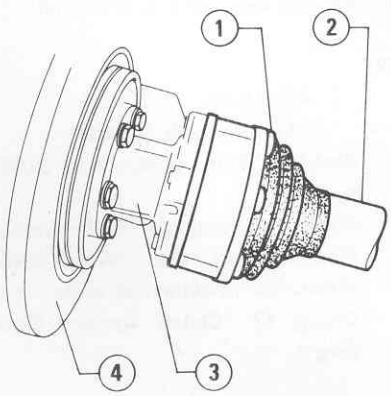
WARNING:
During this operation, support brake disk



1 External drive shaft-brake disk securing screw
2 External drive shaft
3 Brake disk

b. Still supporting brake disk, withdraw pads (refer to Group 22 - Service Brakes - Rear Brakes. Pads Replacement of the "WORKSHOP MANUAL mechanical units") and remove disk.

For models with differential equipped with four side pinions, a spacer (3) is interposed between drive shafts (2) and brake disks (4), unscrew screws (1) and disconnect drive shafts from spacers.

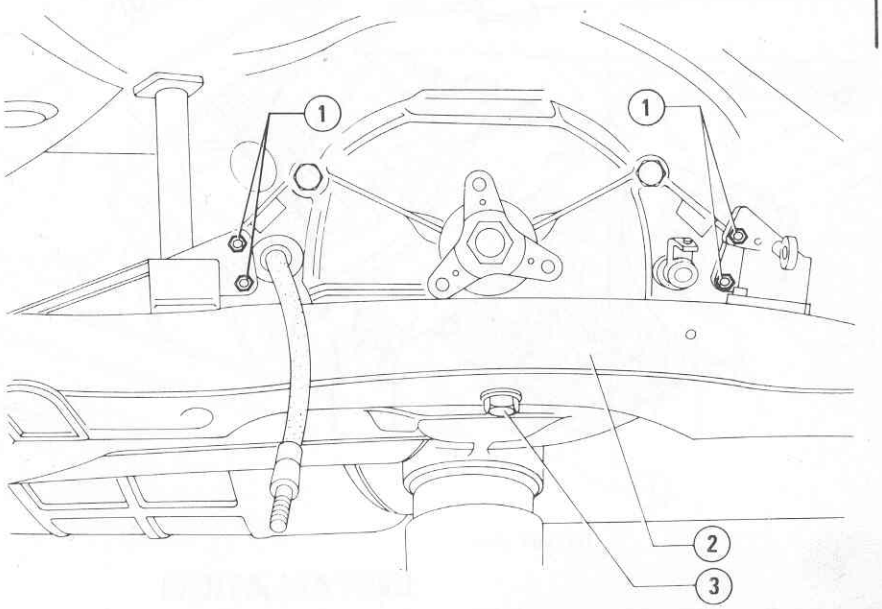


1 External drive shaft-spacer securing screw
2 External drive shaft
3 Spacer
4 Brake disk

c. Lift external drive shafts and secure them suitably to anti-roll bar

8. Disconnect propeller shaft from clutch shaft fork, remove gear selection and engagement rod and detach isostatic control

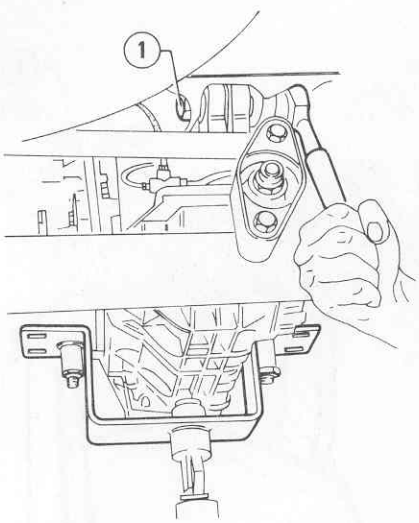
9. Detach the unit from lateral supports on cross member (2) by unscrewing and removing bolts (1).



1 Bolts
2 Cross member

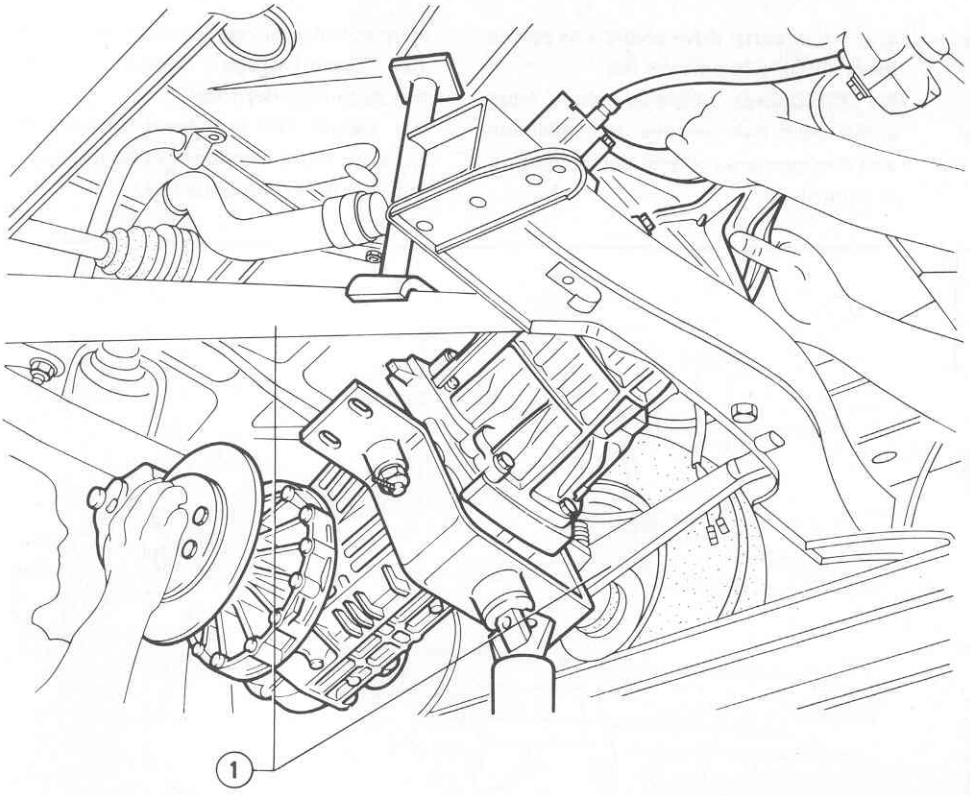
10. Position a column lift (with support fitted with clamps to secure support itself to gearbox) under speed gear unit, in the vicinity of intermediate flange.

11. Lift the unit so as to unload the rear support rubber bushing, then unscrew and remove body securing bolt (1)



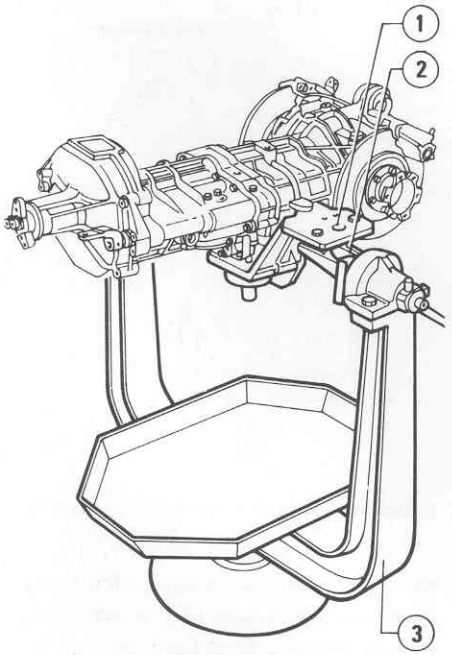
1 Bolt securing rear support rubber bushing

12. Operating on column lift, slowly lower the whole unit and, at the same time, withdraw it from front arms of De-Dion axle.



1 De-Dion axle

13. Set the whole unit with support (1) on stand (3) fitted with suitable brackets (2).



1 Support
2 Support bracket
3 Turning stand

INSTALLATION

To install the whole unit, reverse the order of removal and comply whith the following:

- Apply a coat of prescribed grease on threading of screws securing drive shafts to the differential shaft.

Grease:

ISECO Molykote BR2

- **Lubricate** the spherical seat of propeller shaft joint with same grease **(5 cm³; 0.30 cu·in).**
- Tighten to the following torques:

(T): **Tightening torques**

Screws securing propeller shaft joint to clutch shaft fork

– **Models with differential equipped with two side pinions**
40 to 50 N·m
(4 to 5 Kg·m
28.9 to 36.1 ft·lb)

– **Models with differential equipped with four side pinions**
55 to 57 N·m
(5.6 to 5.8 Kg·m
40.5 to 41.9 ft·lb)

Screws securing external drive shafts to internal drive shafts

Models with differential equipped with two side pinions
29 to 35 N·m
(3 to 3.6 Kg·m
21.7 to 26. ft·lb)

Models with differential equipped with four side pinions
44 to 54 N·m
(4.5 to 5.5 Kg·m
32.5 to 39.8 ft·lb)

Unions of brakes and clutch hydraulic system hoses
10 to 15 N·m
(1 to 1.5 Kg·m
7.2 to 10.8 ft·lb)

Unions of brakes and clutch hydraulic system pipes
8 to 10 N·m
(0.8 to 1 Kg·m
5.8 to 7.2 ft·lb)

Bolt securing rear support rubber bushing
72 to 89 N·m
(7.2 to 8.9 Kg·m
52.1 to 64.3 ft·lb)

Screws securing speed gear-differential unit to lateral support small block
18.6 to 23.5 N·m
(1.9 to 2.4 Kg·m
13.7 to 17.4 ft·lb)

Nut securing plate for Reverse speed engagement safety device
8.3 to 10.3 N·m
(0.9 to 1.05 Kg·m
6.5 to 7.6 ft·lb)

- Fill unit with the prescribed oil

Oil:

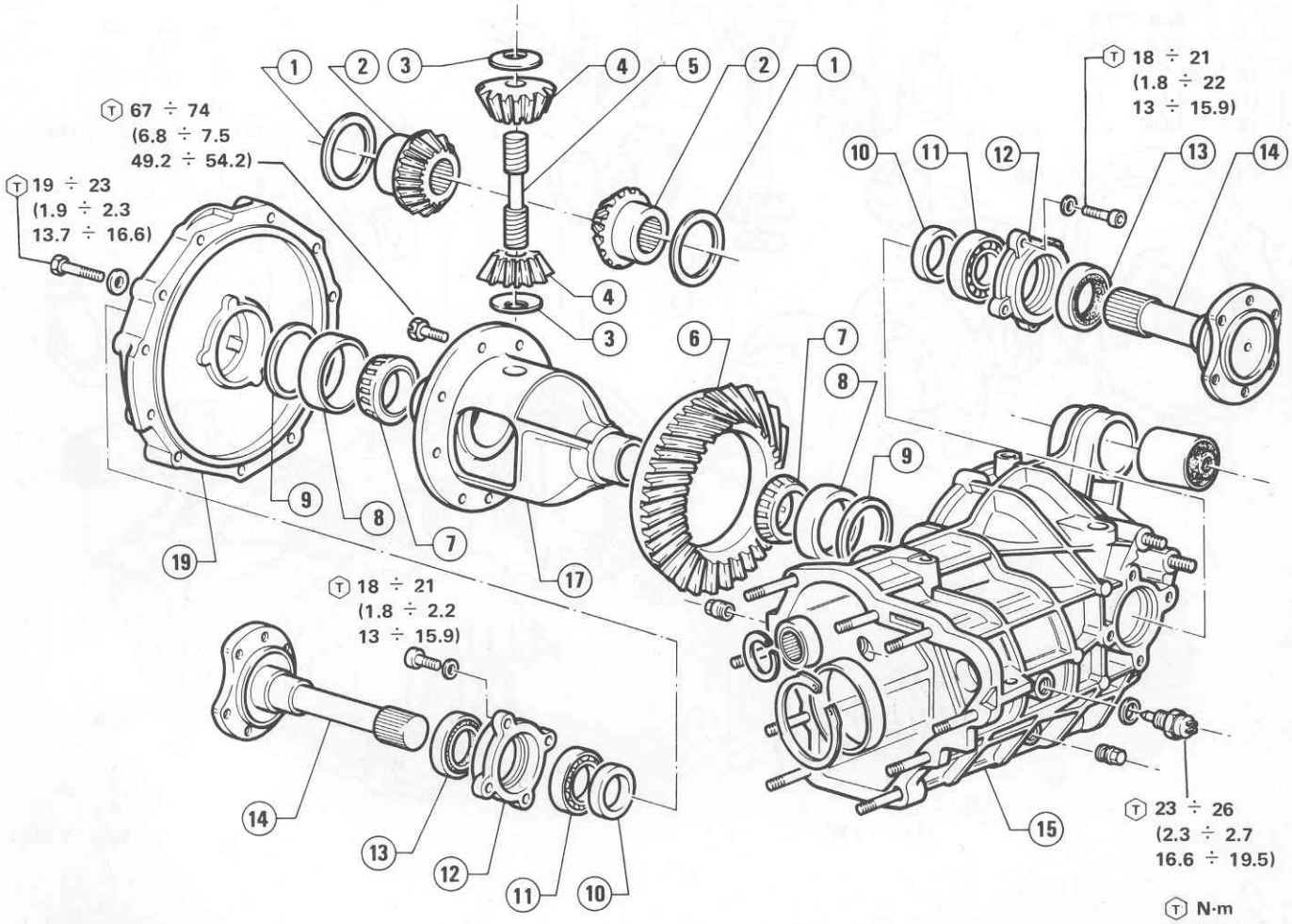
AGIP Rotra SX 75W90
IP Pontiax HDS 75 W 90

- Bleed air from brakes and clutch systems
(Refer to: Group 22 - "Brake system Bleeding" of the "WORKSHOP MANUAL - mechanical units" and Group 12 "Clutch System Bleeding").

- Adjust travel of parking brake lever (Refer to: Group 22 - "Parking Brake - Adjustment of Parking Brake Lever Travel of the "WORKSHOP MANUAL - mechanical units").

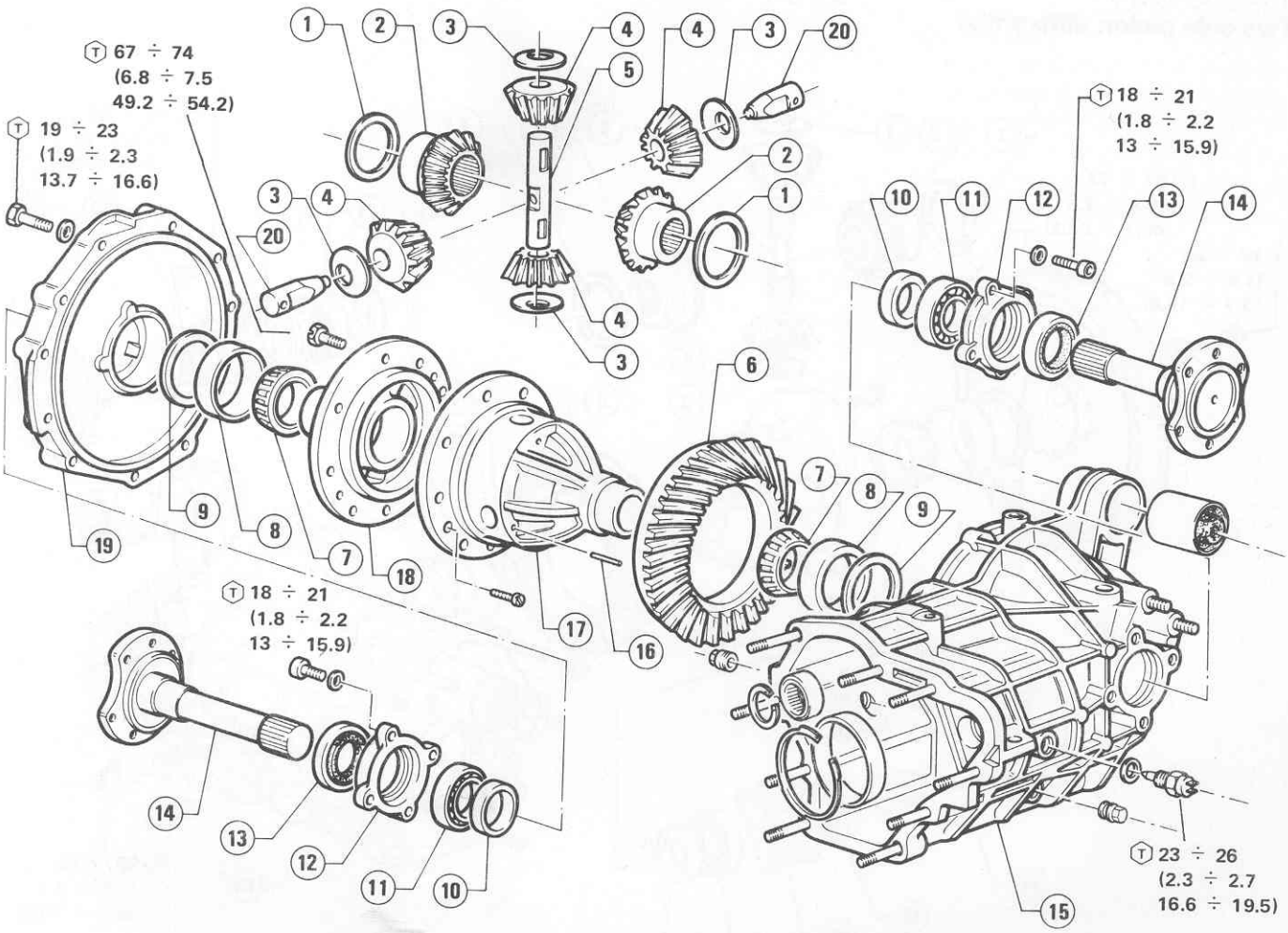
OVERHAUL AT BENCH OF DIFFERENTIAL UNIT

Two-side pinion differential



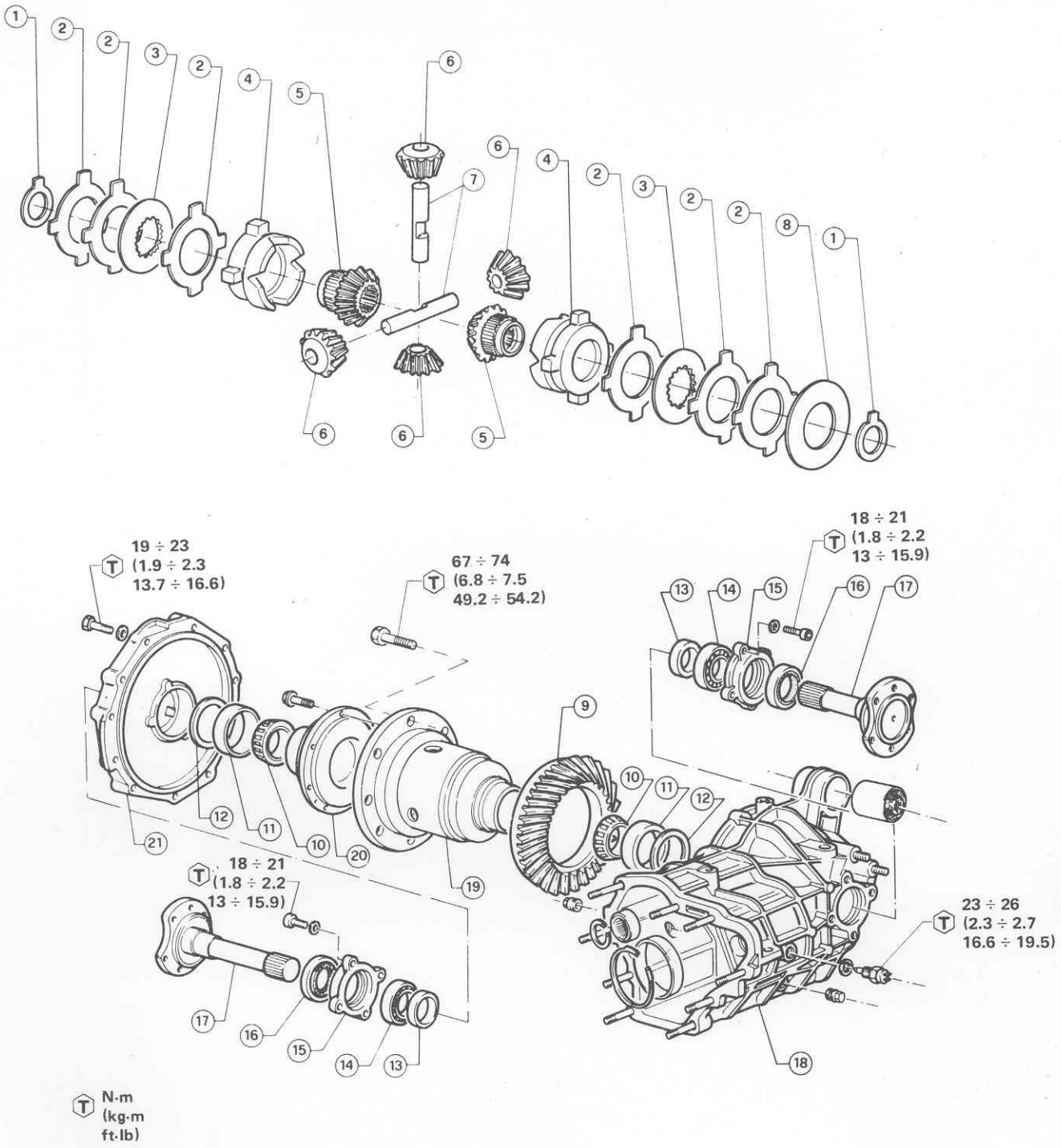
1 Shim ring
2 Crown wheel
3 Spherical washer
4 Side pinion
5 Side pinion holder shaft
6 Ring bevel gear
7 Differential carrier taper bearing
8 Differential carrier taper bearing external race
9 Differential carrier taper bearing shim ring
10 Bearing ring nut
11 Bearing of differential internal drive shaft
12 Cover
13 Oil seal ring
14 Differential internal drive shaft
15 Differential-speed gear casing
16 Differential carrier
17 Differential-speed gear casing cover

Four-side pinion differential



1 Shim ring
2 Crown Wheel
3 Spherical washer
4 Side pinion
5 Side pinion holder shaft
6 Ring bevel gear
7 Differential carrier taper bearing
8 Differential carrier taper bearing external race
9 Differential carrier taper bearing shim ring
10 Bearing ring nut
11 Bearing of differential internal drive shaft
12 Cover
13 Oil seal ring
14 Differential internal drive shaft
15 Differential-speed gear casing
16 Spring pin
17 Differential carrier
18 Differential casing cover
19 Differential-speed gear casing cover
20 Side pinion holder drive shafts

Slip limited - four - side pinion differential



1 Shim ring
2 External segment
3 Internal segment
4 Thrust ring
5 Crown Wheel
6 Side-pinion
7 Spider
8 Spacer
9 Ring bevel gear
10 Differential carrier taper bearing
11 Differential carrier taper bearing external race
12 Differential carrier taper bearing shim ring
13 Bearing ring nut
14 Bearing of differential internal drive shaft
15 Cover
16 Oil seal ring
17 Differential internal drive shaft
18 Differential-speed gear casing
19 Differential carrier
20 Differential casing cover
21 Differential-speed gear casing cover

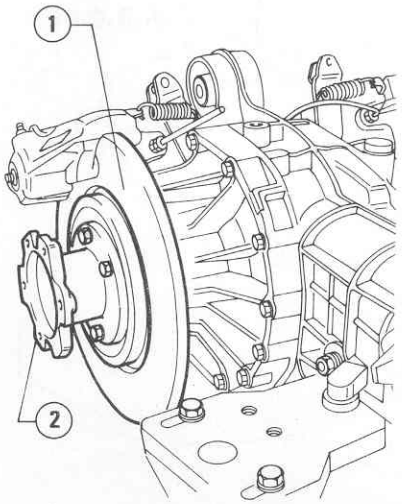
INTERNAL DRIVE SHAFTS

DISASSEMBLY

1. Removal of brake disks and spacers (only for models with differential equipped with four side pinions)

a. Operate on the parking brake control levers to prevent brake disks (1) from rotating, then release the screws securing disks to spacers (2).

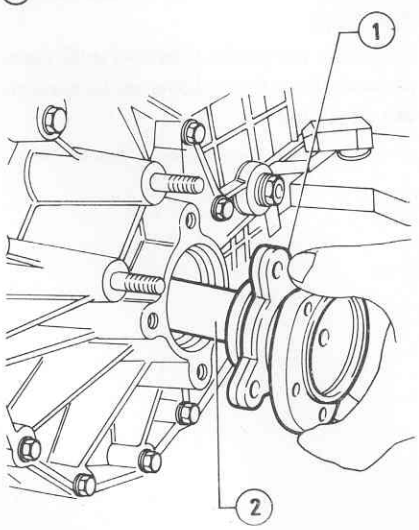
b. Remove spacers and brake disks from both sides.



1 Brake disk
2 Spacer

2. Removal of internal drive shafts.

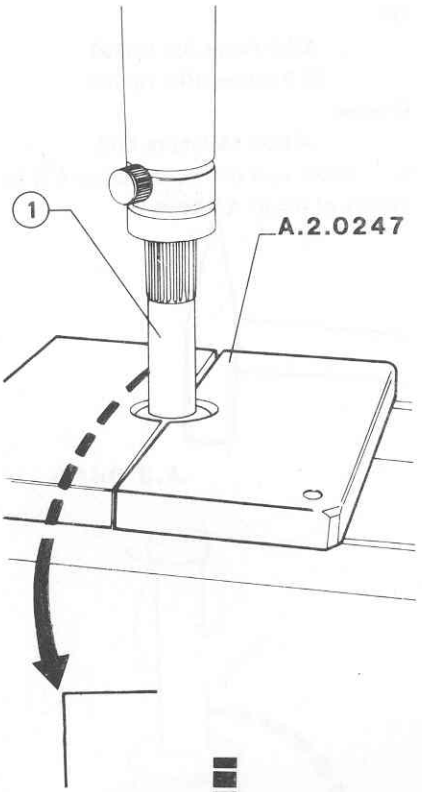
Release and remove securing screws of covers (1) from both sides; then remove them from differential - speed gear casing together with the related drive shafts (2)

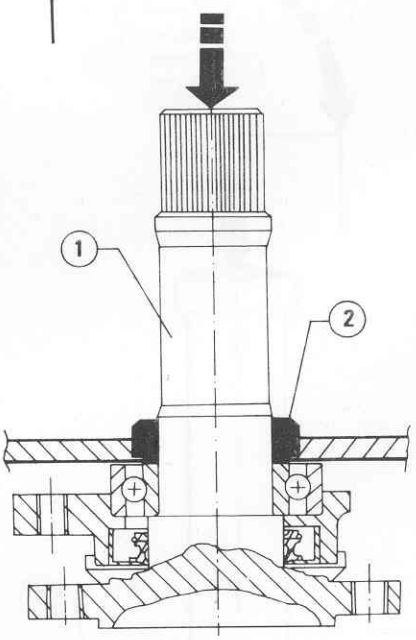


1 Drive shaft cover
2 Drive shaft

3. Disassembly of internal drive shafts

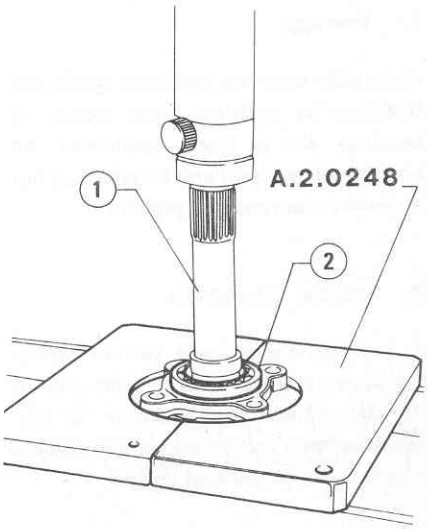
a. Withdraw ring nut (2) from drive shaft (1) by means of a press and plate **A.2.0247.**





1 Drive shaft
2 Bearing ring nut

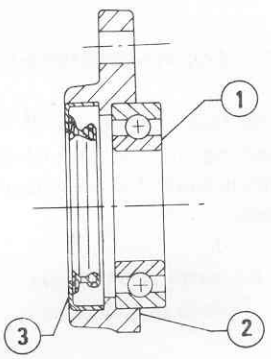
b. Withdraw drive shaft (1) from bearing (2) by means of a press and plate **A.2.0248**



1 Drive shaft
2 Bearing

4. Cover disassembly

Remove oil seal ring (3) from cover (2) and remove bearing (1) mounted without interference fit.



1 Ball bearing
2 Cover
3 Oil seal ring

CHECKS AND INSPECTIONS

Accurately wash components; in particular, remove traces of old sealant from mating surfaces between covers and differential-speed gear casing with denatured ethyl alcohol;

then visually inspect component to identify possible superficial defects.

1. Bearings

Accurately examine the drive shafts ball bearings by rotating them slowly; if bearings are in good conditions, no noise shall be heard and no stickings nor eccessive clearance be present.

2. Internal drive shafts

a. Verify that splined section profile mates with crown wheels correctly in particular, check that backlash **"G"** between splined section and crown wheels is within the prescribed values.

Backlash between splined profile and crown wheels:

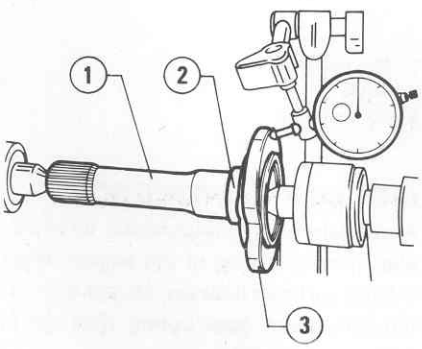
G = 0.07 to 0.13 mm
(0.00275 to 0.0051 in)

b. Verify that squareness deviation of brake disk support plane (3) with respect to bearing seat (1) and oil seal ring seat (2) is lower than the prescribed **"S"** value:

S = 0.05 mm (0.00197 in)

c. Verify that interference fit **"I"** between bearing ring nut and its seat on drive shaft is within the prescribed tolerance range.

I = 0.023 to 0.057 mm
(0.0009 to 0.0022 in)



1 Bearing and ring nut seat
2 Oil seal ring work seat
3 Brake disk support plane

REASSEMBLY

1. Cover reassembly

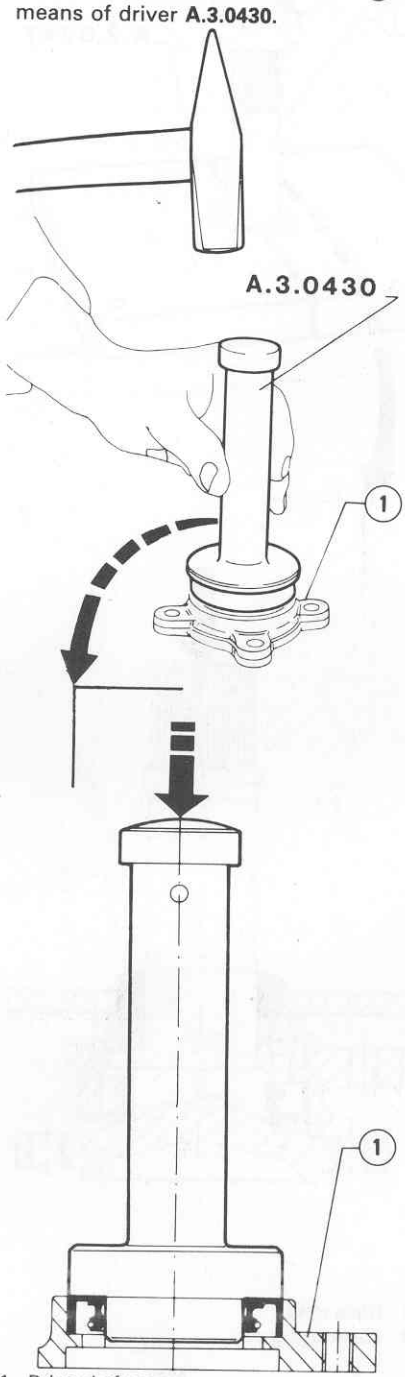
a. Lubricate outer surface and internal lip of drive shaft oil seal ring with prescribed oil and grease, respectively.
Oil:

AGIP Rotra SX 75W90
IP Pontiax HDS 75W90

Grease:

ISECO Molykote BR2

b. Install seal oil ring on cover (1) by means of driver **A.3.0430.**

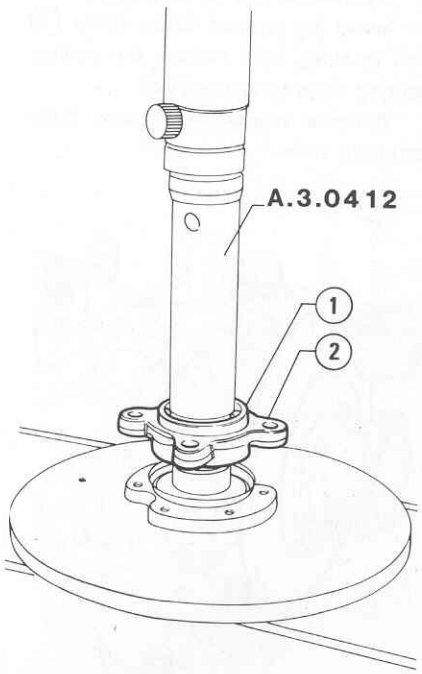


1 Drive shaft cover

c. Insert drive shaft bearing on cover

2. Reassembly of internal drive shafts

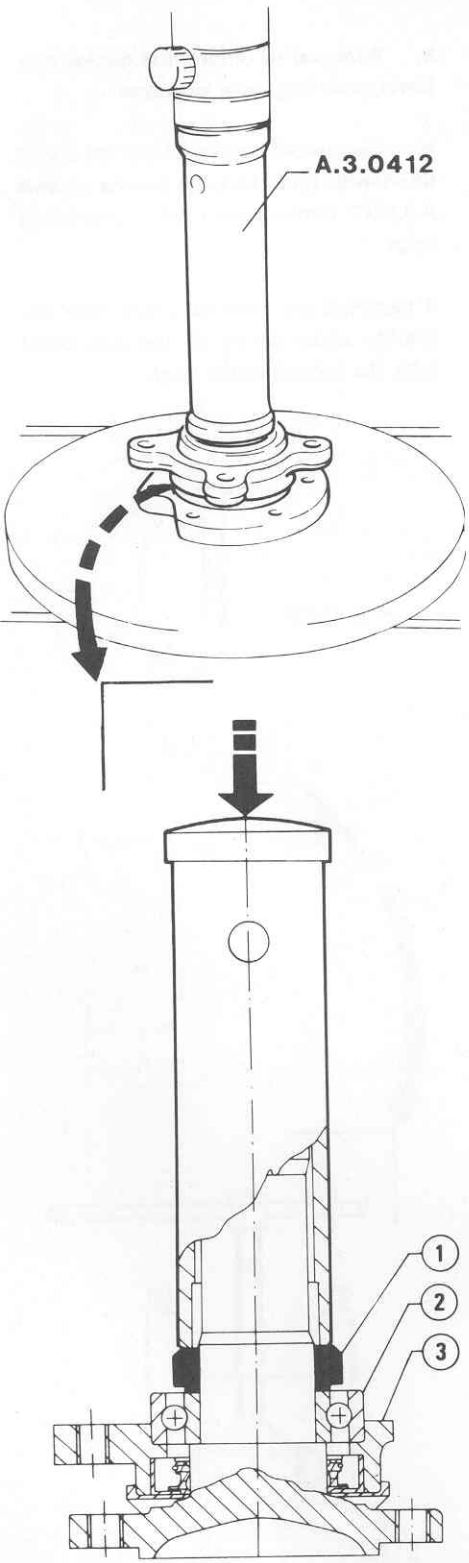
a. Fit cover (2) complete with bearing (1) on internal drive shaft by means of a press and tool **A.3.0412.**



1 Ball bearing
2 Cover

b. Heat (**190 °C; 374 °F**) ring nut (1) of bearing (2), then insert it on drive shaft by means of a press and tool **A.3.0412.**

CAUTION:
Keep ring nut under pressure until complete cooling down; blow air to accelerate operation.



1 Bearing ring nut
2 Ball bearing
3 Cover

3. Installation of internal drive shafts

a. Lay a coat of prescribed sealant on cover mating surface

Sealant:
Sealing-compound LOWAC Perfect Seal

b. Install covers complete with internal drive shafts on differential-speed gear casing, taking into account that the longer drive shaft must be positioned at cover side.
c. Tighten the covers securing screws to the prescribed torque.

(T): **Tightening torque**
Screws securing covers to speed gear-differential casing
18 to 21 N·m
(1.8 to 2.2 kg·m
13 to 15.9 ft·lb)

4. Installation of brake discs and spacers (only for models with differential equipped with four side pinions)

a. Position the brake disks and the related spacers, then temporarily insert the securing screws.
b. Stop brake disks rotation, and tighten the disks securing screws to the prescribed torque.

(T): **Tightening torque**
Screws securing brake disks and spacers to internal drive shafts
50 to 55 N·m
(5.0 to 5.5 kg·m
36.1 to 39.8 ft·lb)

DIFFERENTIAL CARRIER

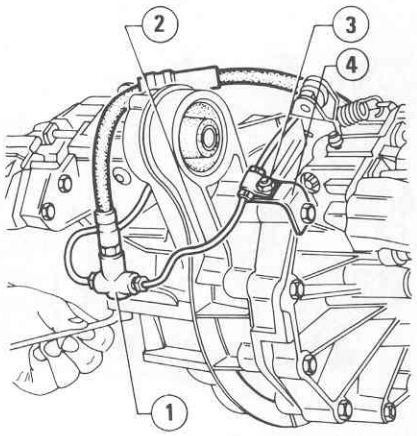
DISASSEMBLY

1. Removal of brake disks and internal drive shafts (refer to: "Internal Drive Shafts - Disassembly").

2. Removal of brake calipers and control system piping

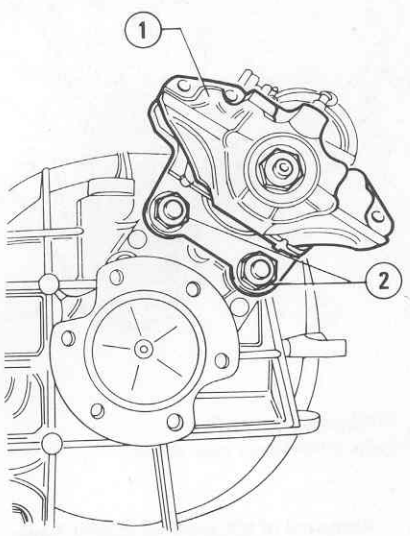
a. Detach control system pipes (2) from brake calipers.

b. Unscrew securing nut and remove union (1) from differential-speed gear casing.
c. Unscrew clamp (4) securing nut (2); then remove piping.



1 Union tee
2 Pipe
3 Clamp securing nut
4 Piping support clamp

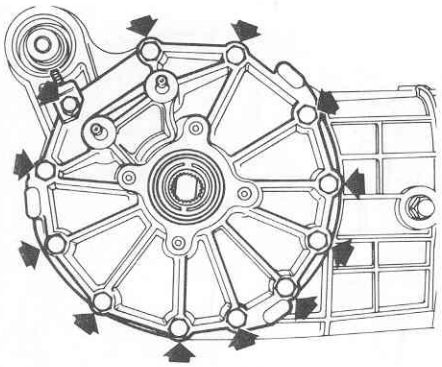
d. Release and remove nuts (2) securing brake calipers (1) to differential-speed gear casing from both sides, then remove calipers.



1 Brake caliper
2 Nuts

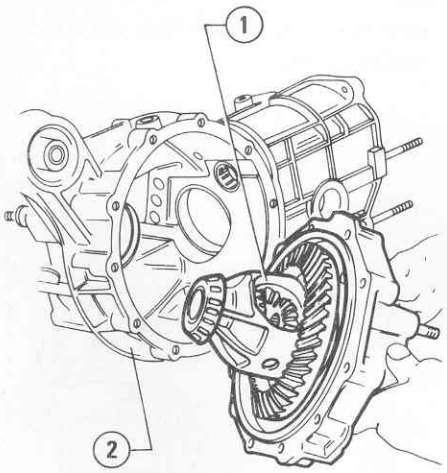
3. Removal of complete differential carrier

a. Unscrew and remove the screws securing differential-speed gear casing cover.



b. Remove cover together with the complete differential carrier (1).

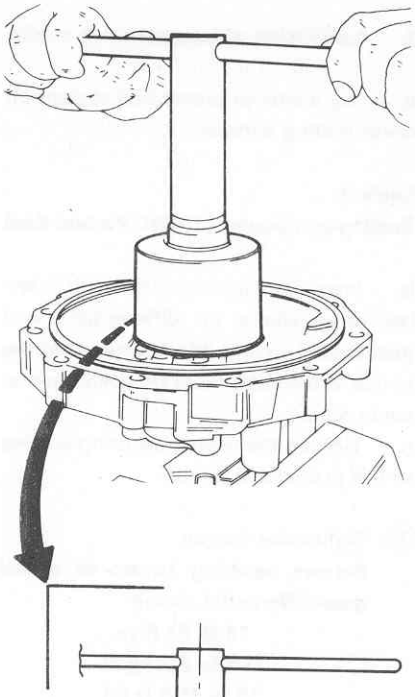
Take care not to drop differential carrier.

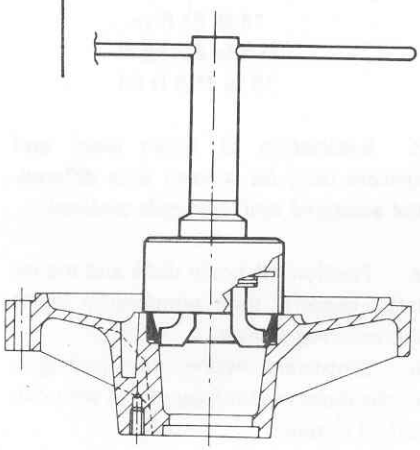


1 Differential casing
2 Differential-speed gear casing

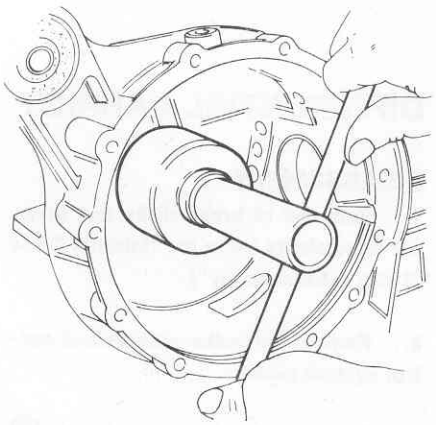
4. Removal of differential carrier bearing external races

a. By means of an adjustable span puller, withdraw outer ring of differential carrier taper bearing from differential-speed gear casing cover, and remove the shim ring below.





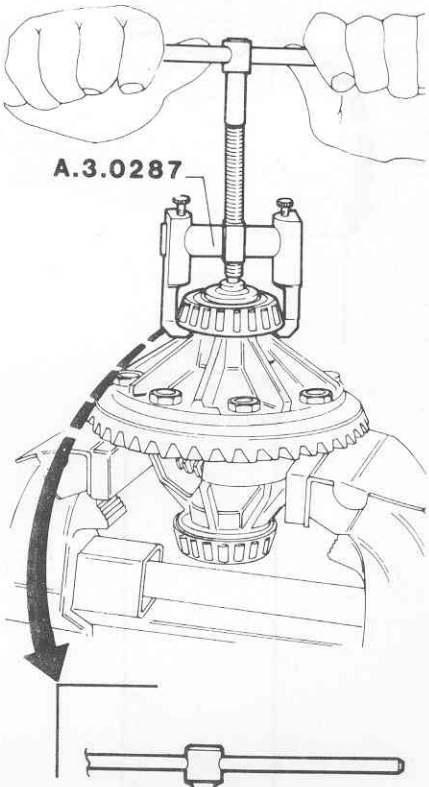
b. By means of same tool, withdraw outer ring of differential carrier taper bearing from differential-speed gear casing, and remove the shim ring below.

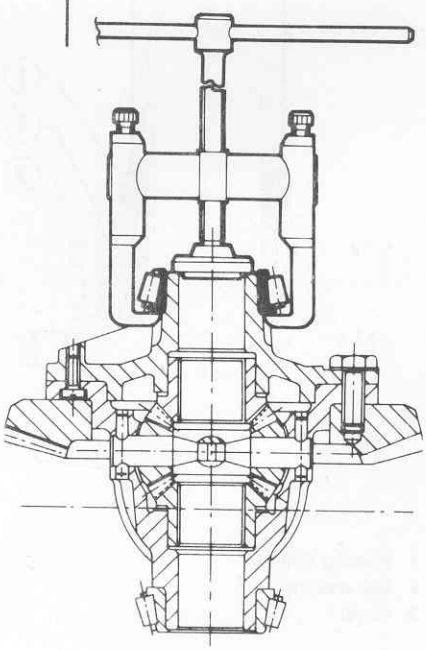


5. Removal of differential carrier ring bevel gear and taper bearings

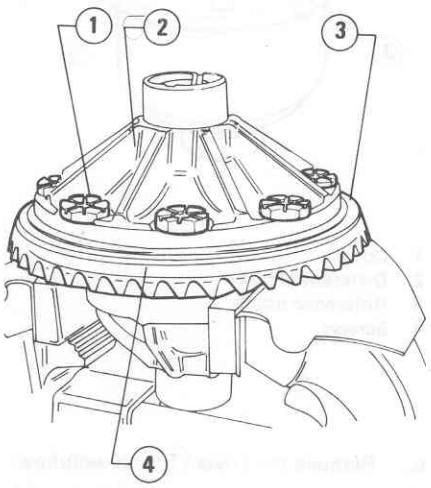
a. Secure differential carrier on a vice fitted with jaws and, by means of tool **A.3.0287**, remove taper bearings internal rings.

If bearings are re-used, mark their assembly order so as to reinstall them with the related outer rings.





b. According to maintenance operations, carry out installation reference (4) between ring bevel gear (3) and differential carrier (2), then loosen and remove securing screws (1) and remove ring bevel gear.

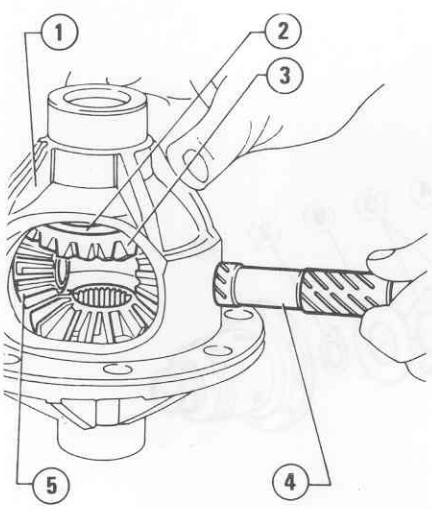


1 Screw
2 Differential carrier
3 Ring bevel gear
4 Installation refence

6. Differential carrier disassembly

Two-side pinion differential

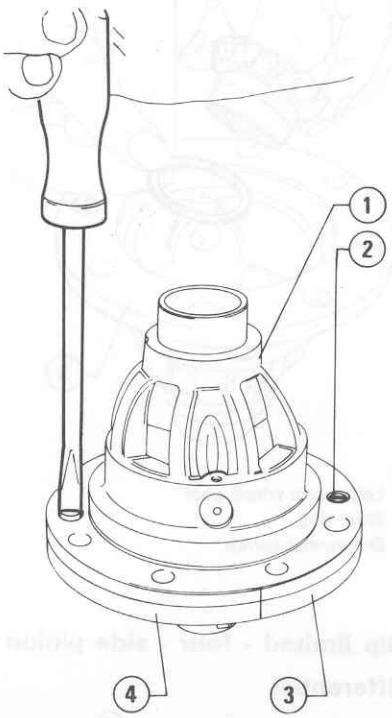
Withdraw side pinion holder shaft (4) and remove side pinions (5) with the related spherical washers and crown wheels (3) with shim rins (2) from differential casing (1).



1 Differential carrier
2 Shim ring
3 Crown wheel gear
4 Side pinion holder shaft
5 Side pinion gear

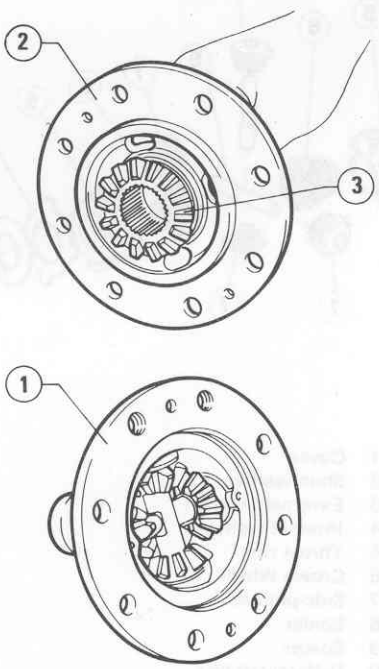
Four-side pinion differential

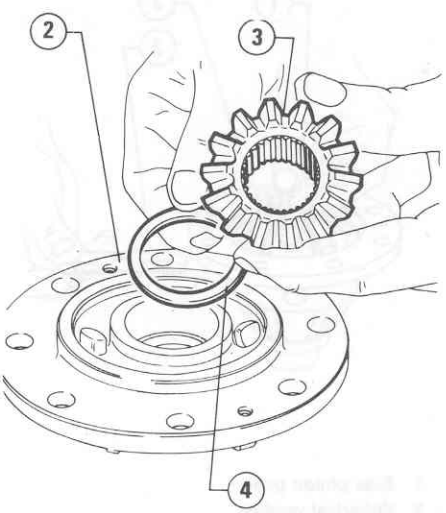
a. Carry out a reference notch (3) between differential casing (1) and related cover (4), then unscrew securing screws (2).



1 Differential carrier
2 Screw
3 Reference notch
4 Differential casing cover

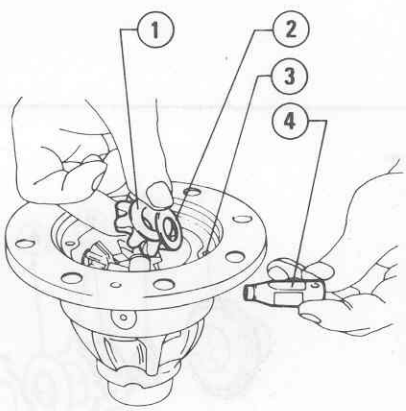
b. Separate cover (2) from differential casing, recovering crown wheel gear (3) with related shim ring (4).





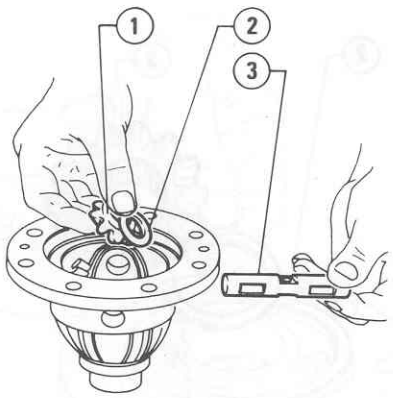
1 Differential carrier
2 Differential casing cover
3 Right crown wheel gear
4 Shim ring

c. Remove the two spring pins securing shafts (4) supporting two of side pinion gears (1); then withdraw shafts and recover side pinions and shim spherical washers (2)



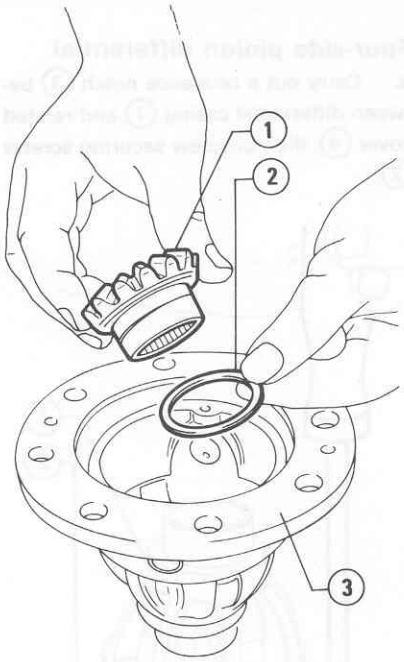
1 Side pinion gear
2 Spherical washer
3 Seat of shaft securing spring pin
4 Shaft

d. Withdraw shaft (3) supporting the other two side pinion gears (1) recover gears and related spherical washers (2).

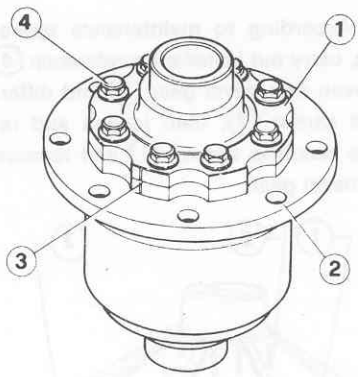


1 Side pinion gear
2 Spherical washer
3 Shaft

e. Withdraw crown wheel gear (1) with related shim ring (2) from differential carrier (3).



1 Left crown wheel gear
2 Shim ring
3 Differential carrier

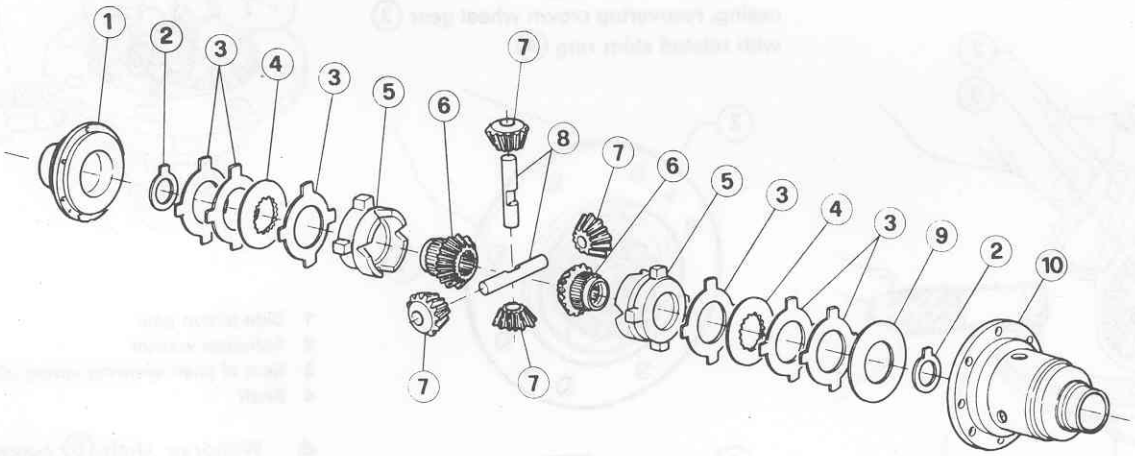


1 Cover
2 Differential box
3 Reference notch
4 Screws

b. Remove the cover (1) and withdraw all the components from the differential box (10).

Slip limited - four - side pinion differential

a. Make a reference notch (3) between the differential box (2) and its cover (1), then remove the fixing screws (4).



1 Cover
2 Shim washer
3 External segment
4 Internal segment
5 Thrust ring
6 Crown Wheel
7 Side-pinions
8 Spider
9 Spacer
10 Differential box

CHECKS AND INSPECTIONS

Accurately wash all components; then execute the following checks.

a. Accurately examine the differential carrier taper bearings by rotating them slowly; if bearings are in good conditions, no noise shall be heard and no sticking be present.
Examine condition of races related to rolling elements making sure they are free from signes of uneven wear, scratches, grinding due to foreign matter scoring, seizing or overheating.
Replace the faulty elements taking into account that taper bearings must be replaced in pairs.

b. Verify that teeth of gears, side pinions and crown wheels are free from scratches and seizure signs, that they work along the whole surface, and meshing takes place without excessive clearance or sticking.

c. Verify side pinion holder shafts, crown wheel shim rings and spherical washers, checking they are free from scratches or wear signs.

d. Verify that no cracks or splinters are present on differential carrier

e. For slip limited differential only.
In the slip limited unit, check that the slip surfaces between the internal and external segments, the thrust rings, the spacer and the shim washers are not incised, worn or burnt. Verify that the internal segments are able to slip with ease on the crown-gear's toothing. Replace the shim washers and the worn segments. The spider's pins and its thrust cones must not have meshing or incisions.

REASSEMBLY

1. Differential carrier reassembly

Two-side pinion differential

a. Lay a coat of oil on the working surfaces of components to be reassembled.

b. Position crown wheel gears together with the related shim rings of same thickness (removed during disassembly or new) and differential carrier.

c. Insert side pinions with related spherical washers opposite differential carrier crown wheels, rotate gears until holes of side pinions holder shaft mates the seats of the two side pinions, then insert side pinions holder shaft.

d. Verify that clearance **"G"** between teeth of side pinions and crown wheels gears is within the prescribed values; if not so, change thickness of shim rings.

Clearance between side pinions and crown wheels teeth

G = 0.01 to 0.11 mm
(0.00039 to 0.00433 in)

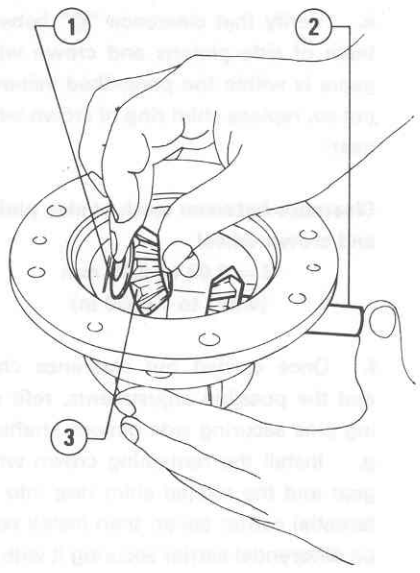
With differential carrier mounted, a certain resistance to gears rotation must take place.

Four-side pinion differential

a. Lay a coat of oil on the working surfaces of components to be reassembled.

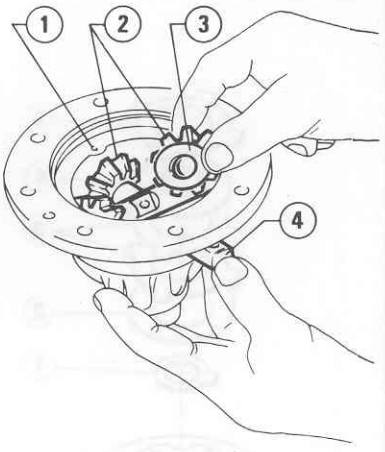
b. Position the left crown wheel gear with the related shim ring of same thickness (removed during disassembly or new) into differential carrier.

c. Insert shaft (2) and two side pinion gears (3) complete with the related spherical washers (1).



1 Spherical washer
2 Shaft
3 Side pinion gear

d. Install shafts (4) with the remaining side pinion gears (2) and the related spherical washers (3), taking care to insert shaft pin into central hole of side pinions holder shaft previously installed.
In addition, verify that seats (1) of shafts spring pins are aligned with those of differential carrier.



1 Spring pin seat
2 Side pinion gears
3 Spherical washer
4 Shaft

e. Verify that clearance **"G"** between teeth of side pinions and crown wheel gears is within the prescribed values; if not so, replace shim ring of crown wheel gear.

Clearance between teeth of side pinions and crown wheel

G = 0.08 to 0.15 mm
(0.003 to 0.0059 in)

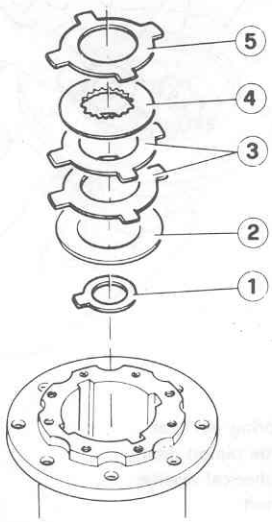
f. Once carried out clearance check and the possible adjustments, refit spring pins securing side pinions shafts.

g. Install the remaining crown wheel gear and the related shim ring into differential carrier cover, then install cover on differential carrier securing it with the related screws, complying with the positioning notch performed during disassembly.

h. Once carried out the differential carrier reassembly, make sure that gears rotation occurs with a certain resistance but without stickings. In the event of incorrect functioning, replace the last shim ring mounted.

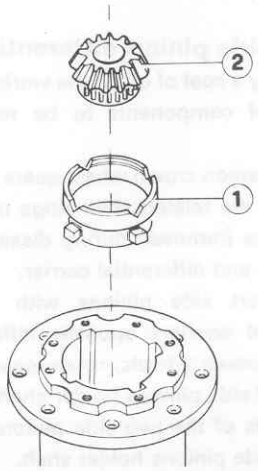
Slip limited - four - side pinion differential

a. Insert the shim ring (1) into the differential box, with the wrought metal surface towards the crown-wheel unit; subsequently insert the spacer (2), the two external segments (3), the internal segment (4) and the external segment (5).



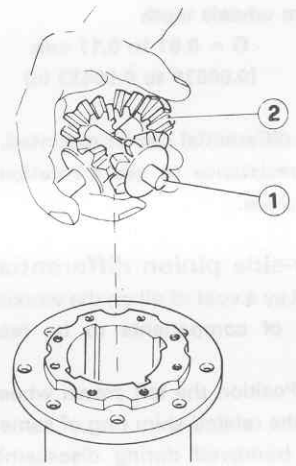
1 Shim washer
2 Spacer
3 External segments
4 Internal segment
5 External segment

b. Insert the thrust ring (1) and the crown-wheel (2).



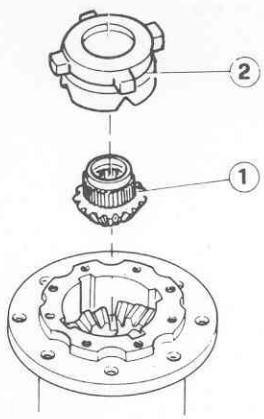
1 Thrust ring
2 Crown Wheel

c. Insert the side-pinions (2) with the spider (1).



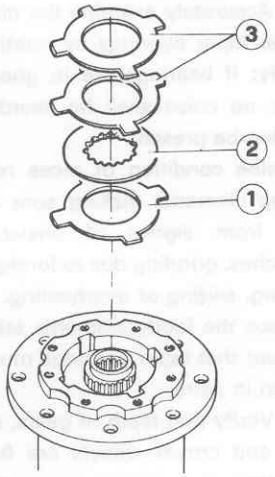
1 Spider
2 Side-pinions

d. Insert the crown-wheel (1) and the thrust ring (2).



1 Crown Wheel
2 Thrust ring

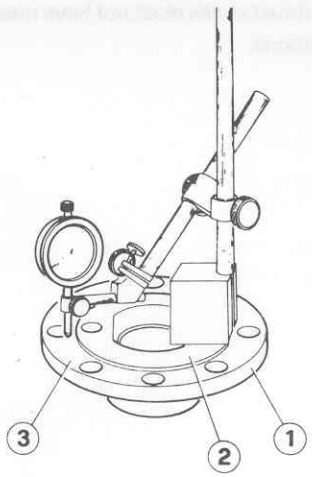
e. Insert the external segment (1), the internal segment (2) and the two external segments (3).



1 External segment
2 Internal segment
3 External segments

f. Check the clearance between the cover and the group of segments.

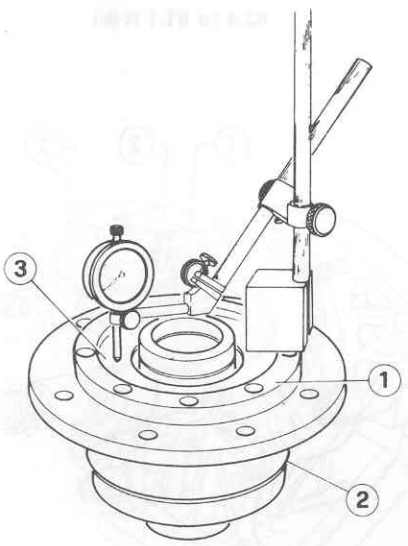
- Rest the supporting base of a (suitably preloaded) dial gauge on the contact surface (2) between cover (1) and segment pack, by operating on the cover of the limited slip differential carrier; zero set the dial gauge on the mating surface (3) between cover and carrier.



1 Cover
2 Cover-segment pack contact surface
3 Cover-carrier mating surface

- Position the gauge supporting base on the mating surface (1) between carrier (2) and cover by operating on the limited slip differential carrier; have the gauge feeler contacting segment pack (3).

NOTE:
Apply a load of 10 Kg (22 lb) to the segment pack.

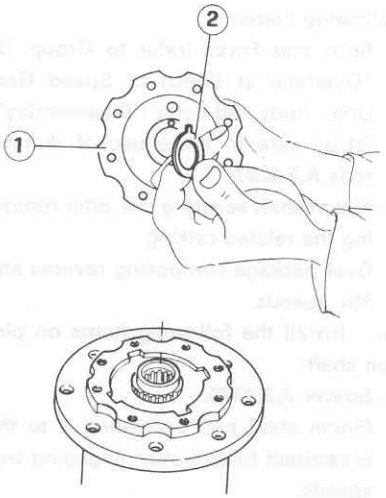


1 Carrier-cover mating surface
2 Carrier
3 Segment pack

- Read the value, with negative sign, of clearance **G**: it must be within the specified values.

Fitment clearance between cover and segment pack:
G = 0.1 thru 0.2 mm
(0.004 thru 0.008 in)

g. Install the shim ring (2) on the cover (1) with its wrought metal surface towards the crown-wheel gear.
Mount the cover on the differential box aligning the reference notch previously made, and fasten the fixing screws.



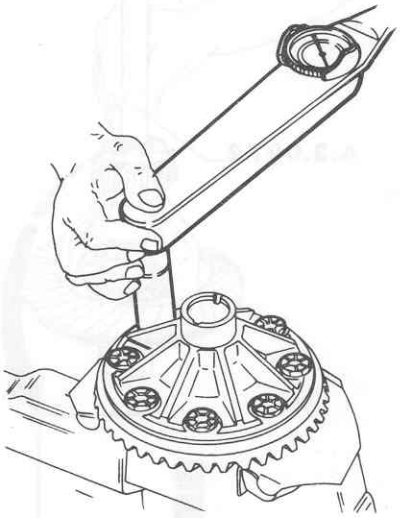
1 Cover
2 Shim ring

2. Ring bevel gear and taper bearings reassembly on differential carrier

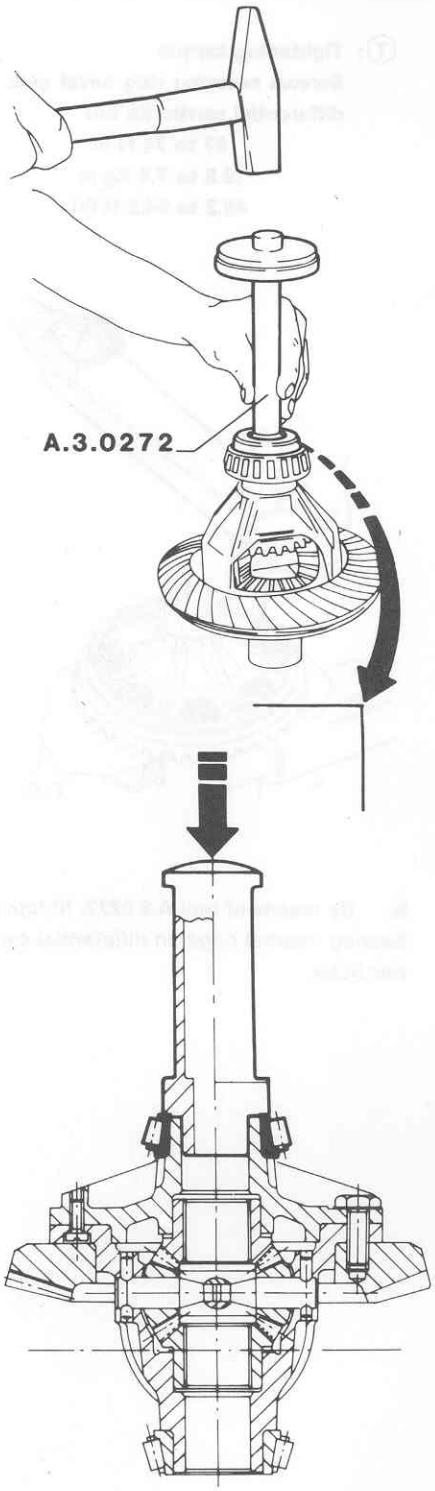
a. Install ring bevel gear on differential carrier after carefully cleaning the mating surfaces. Should the ring bevel gear be reused, comply with the reference notches carried out during disassembly.

Replace the securing screws with spare ones since the presence is required of the fixing agent applied on screws on first installation. Tighten them, crosswise, to the prescribed torque.

(T): **Tightening torque**
Screws securing ring bevel gear to differential carrier (in oil)
67 to 74 N·m
(6.8 to 7.5 Kg·m
49.2 to 54.2 ft·lb)



b. By means of tool **A.3.0272**, fit taper bearing internal rings on differential carrier hubs.



All this, particularly valid when only the crown wheel and pinion is to be replaced, can be integrated by using dummy rods **A.2.0267** to be inserted at the same time of gear selector rods removal, so as to secure interlock plungers and detent balls.

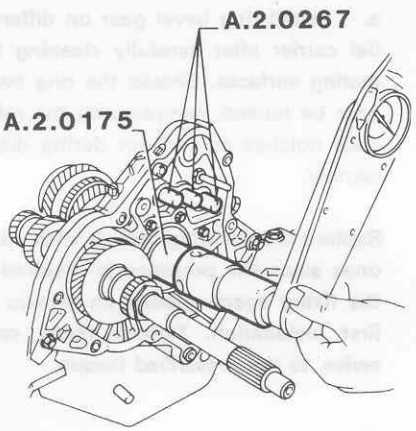
a. Set intermediate flange (complete with gearing and speed control devices) on an overhaul stand, then remove the following items:

- Rods and Forks (refer to Group 13- "Overhaul at Bench of Speed Gear Unit - Rods and Forks - Disassembly") taking care to make use of dummy rods **A.2.0267**.
- Pinion shaft securing nut, after removing the related calking
- Gear package composing reverse and 5th. speeds.

b. Install the following items on pinion shaft:

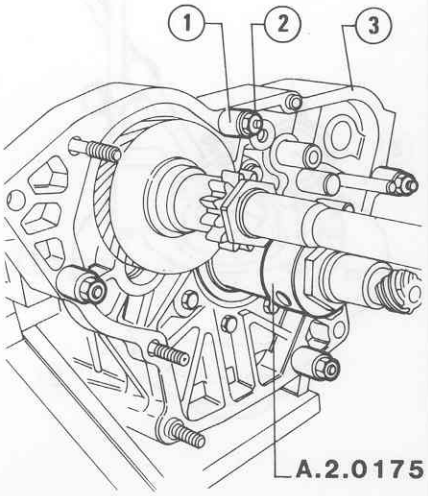
- Spacer **A.2.0175**.
- Pinion shaft nut, tightening it to the prescribed torque after engaging two speeds.

(T): Tightening torque
Pinion shaft securing nut
112 to 124 N·m
(11.4 to 12.6 kg·m
82.4 to 91.1 ft·lb)



c. Remove intermediate flange from overhaul stand and insert it on differential-speed gear casing. Apply spacers (1) in four points of intermediate flange (3) and secure it by tightening nuts (2) crosswise to the prescribed torque.

(T): Tightening torque
Nuts securing spacers and intermediate flange to differential-speed gear casing.
112 to 124 N·m
(11.4 to 12.6 kg·m
82.4 to 91.1 ft·lb)

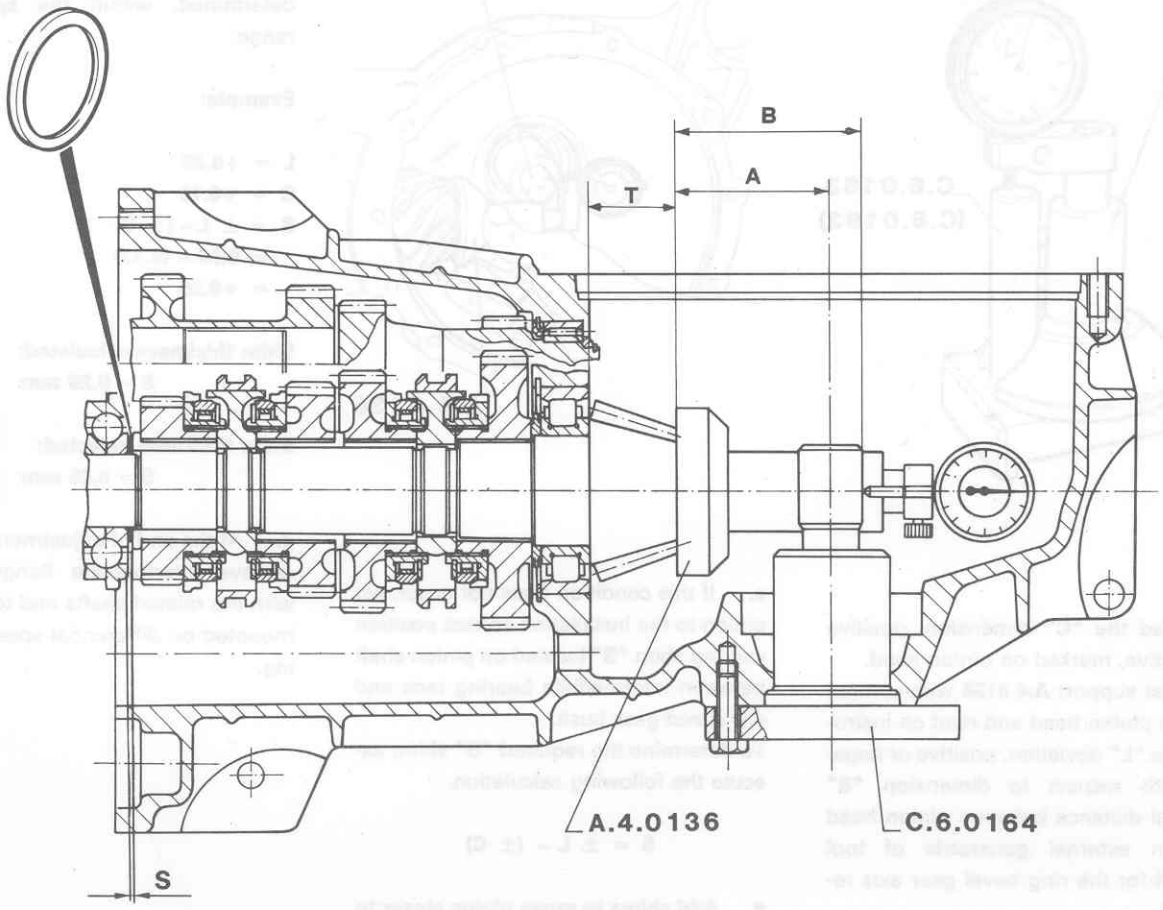


1 Spacer
2 Spacer securing nut
3 Speed gear intermediate flange

3. Preparation of speed gear intermediate flange

To easy the adjustment operations, use is recommended of spacer A.2.0175 in the place of the 5th and reverse speeds gear package.

4. Adjustment of distance between pinion and ring bevel gear axis.



A = Nominal distance between pinion and ring bevel gear axis
- 56.5 ± 0.03 mm (2.2244 ± 0.0012 in) for models with pinion head height T = 42 mm (1.65 in)
- 62.6 − 0.03 mm (2.4646 ± 0.0012 in) for models with pinion head height T = 36 mm (1.42 in)

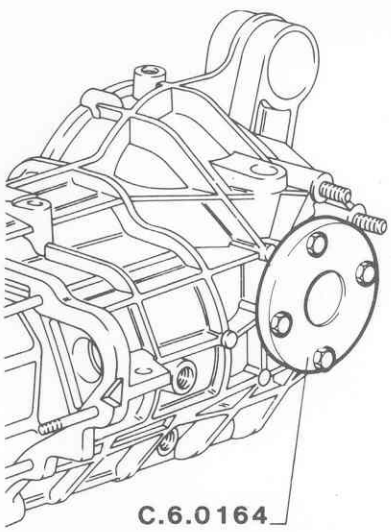
The real distance between pinion and ring bevel gear axis must be equal to the nominal value plus or minus the value indicated on pinion head.

B = nominal distance between pinion head and external generatrix of tool control pin

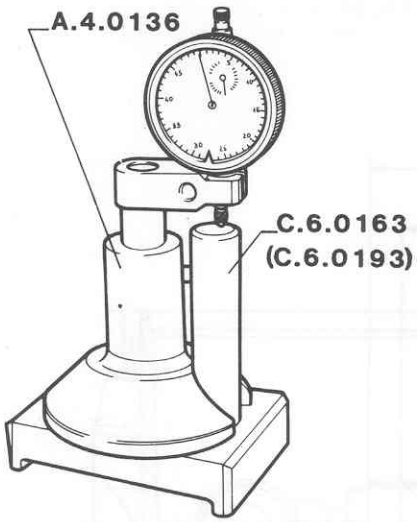
S = ± L − (± C) where:
- S = Shim thickness
- L = Value of ring bevel gear axis deviation measured with centesimal gauge
- C = value printed on pinion head

Comply with the following procedure to determine the distance between pinion and ring bevel gear axis, i.e. the thickness of shim ring to be interposed between 4th speed gear and intermediate flange.

a. For the ring bevel gear axis reference, mount tool **C.6.0164** on outer box (seat of differential taper bearing outer ring).



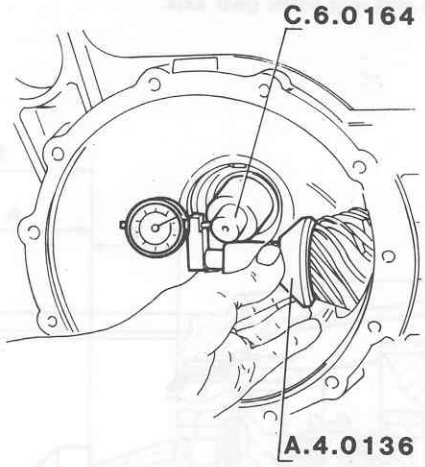
b. Install a centesimal gauge on support **A.4.0136** and zero it to the nominal value on reference gauge **C.6.0163** (pinion head height T = 42 mm (1.65 in)) or **C.6.0193** (pinion head height T = 36 mm (1.42 in)



c. Read the **"C"** dimension, positive or negative, marked on pinion head.

d. Rest support **A.4.0136** with comparator on pinion head and read on instrument the **"L"** deviation, positive or negative with respect to dimension **"B"** (nominal distance between pinion head and pin external generatrix of tool **C.6.0164** for the ring bevel gear axis reference).

This reading, shall correspond in both value and sign to the dimension marked on pinion head



e. If this condition does not occur, set pinion to the installation correct position varying shim **"S"** located on pinion shaft between intermediate bearing race and 4th speed gear bush.
To determine the required **"S"** shim, execute the following calculation.

$$S = \pm L - (\pm C)$$

- **Add shims to move pinion closer to ring bevel gear axis**
- **Remove shims to move pinion away from ring bevel gear axis.**

f. Select the shim nearest to the value determined, within the spare shims range.

Example:

L = +0.39
C = +0.13
S = ± L – (± C)
= 0.39 – (0.13)
= +0.26

Shim thickness calculated:
S = 0.26 mm

Shim thickness selected:
S = 0.25 mm

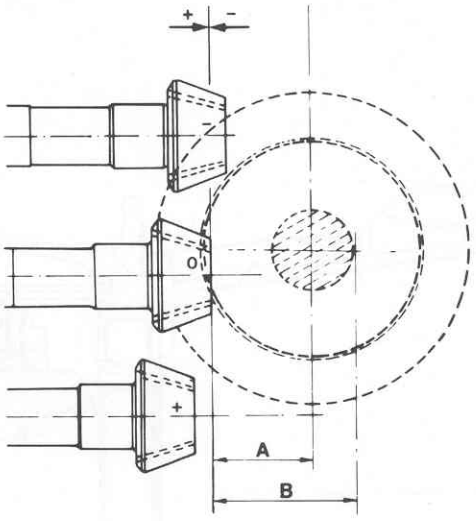
g. At the end of adjustment operation, remove intermediate flange complete with the related shafts and tool **C.6.0164** mounted on differential-speed gear casing.

PRACTICAL EXAMPLE

HOW TO READ VALUE (IN HUNDRETHS OF MM) STAMPED ON THE PINION HEAD

DISTANCE BETWEEN RING BEVEL GEAR AXIS AND PINION HEAD

– less than nominal distance
+ greater than nominal distance
0 equal to nominal distance

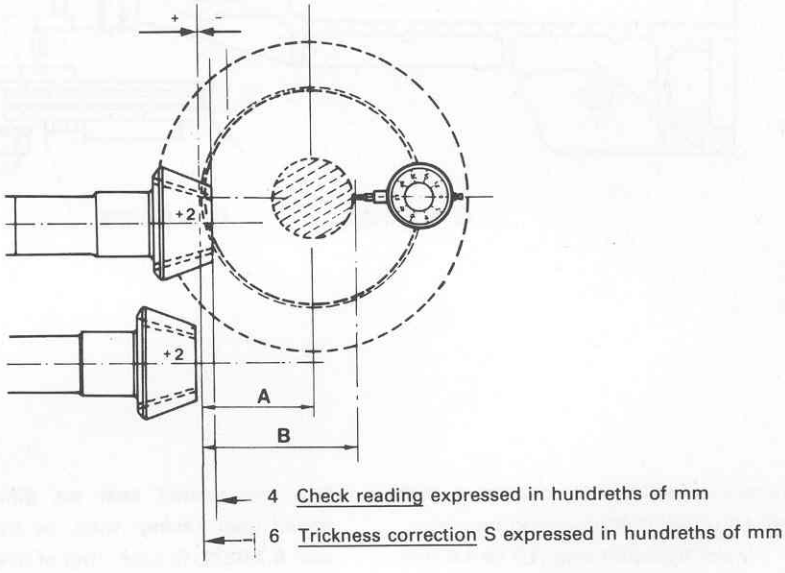


A : Nominal dimension
B : Nominal check dimension corresponding to centesimal gauge set to zero on reference gauge

CONTROL AND SUBSEQUENT CORRECTION OF DISTANCE BETWEEN PINION AND RING BEVEL GEAR AXIS

S = (± reading on dial gauge)
minus
(± Dimension on pinion)
S = (–4) – (+2) = –6

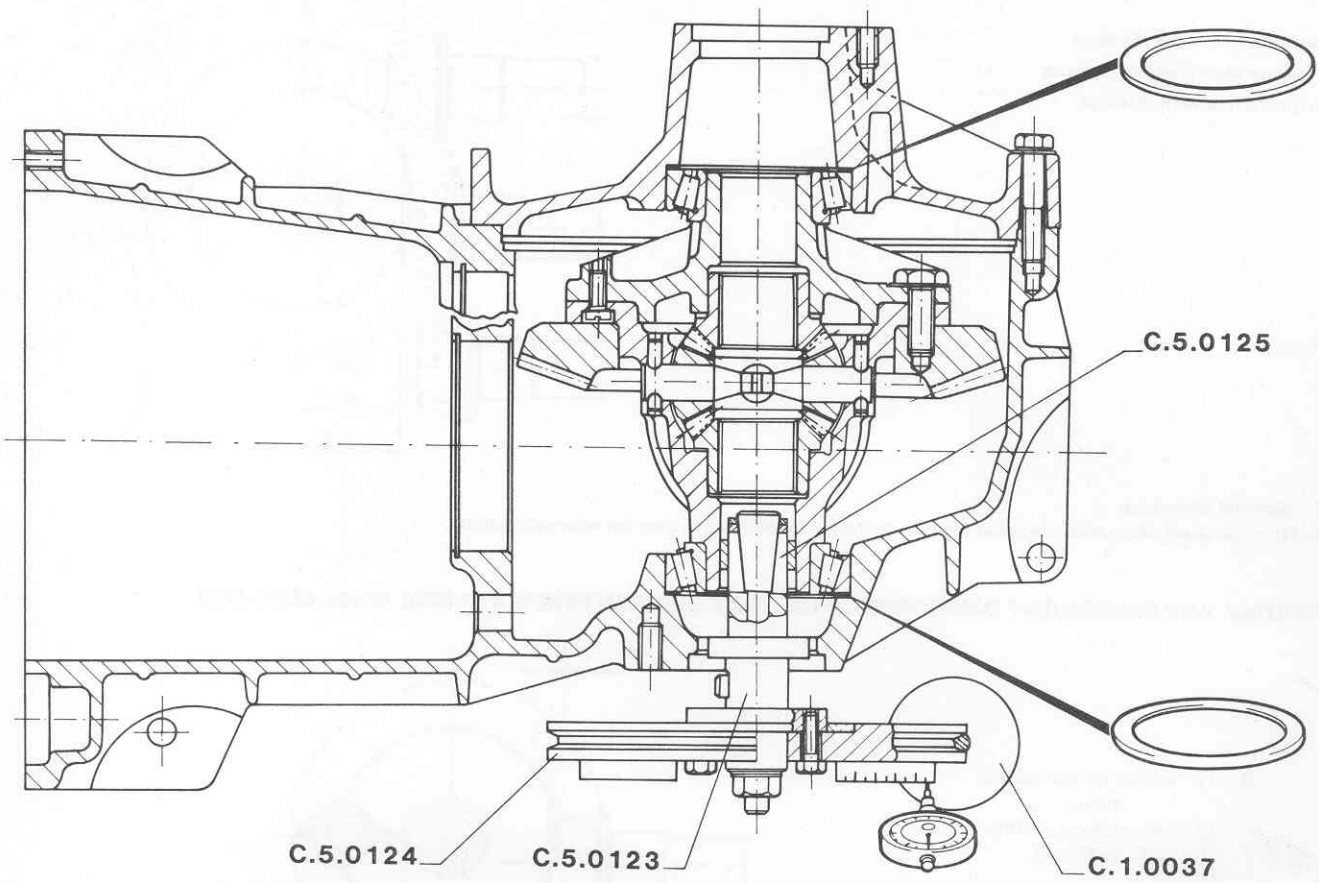
Value (expressed in hundreths of mm) by which the pinion must be moved from the ring bevel gear, by removing shims placed under pinion head.



RANDOM SEQUENCE

	Reading on centesimal gauge	Dimension on pinion	Correction to be made
1st Case	– 4	+ 2	– 6 (subtract shims)
2nd Case	+ 4	– 2	+ 6 (ladd ")
3rd Case	– 2	+ 4	– 6 (subtract ")
4th Case	+ 2	– 4	+ 6 (ladd ")
5th Case	– 4	– 2	– 2 (subtract ")
6th Case	+ 4	+ 2	+ 2 (ladd ")
7th Case	– 2	– 4	+ 2 (ladd ")
8th Case	+ 2	+ 4	– 2 (subtract ")

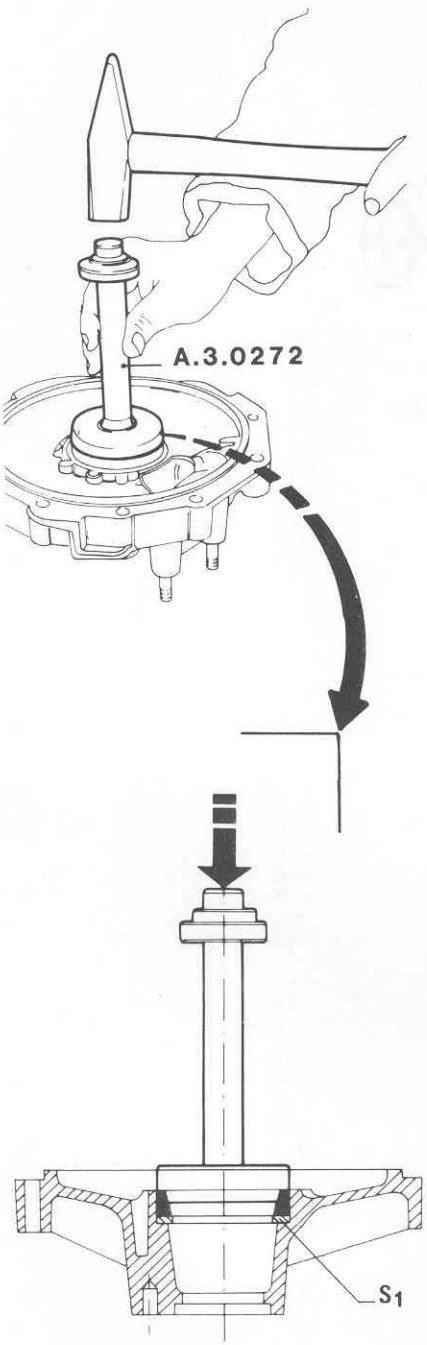
5. Adjustment of differential casing bearing preload



Operate as follows to determine total preload of differential casing bearings.

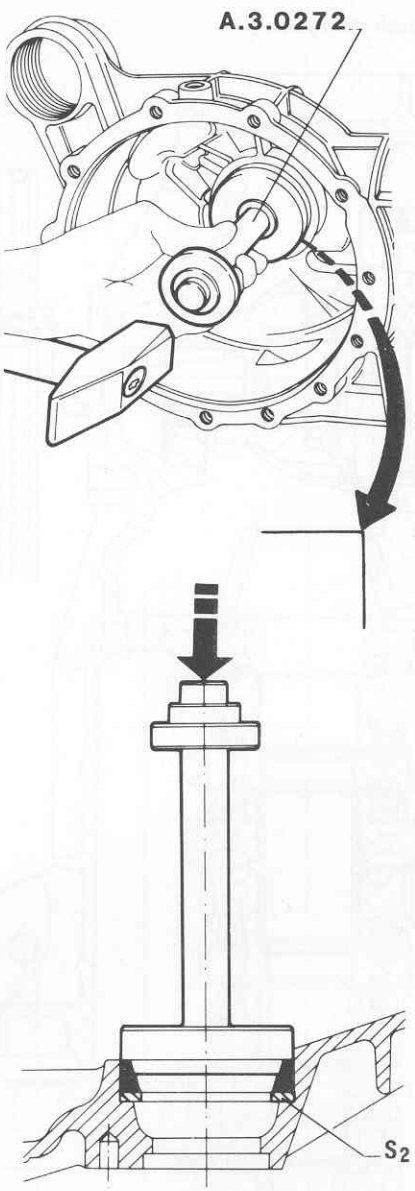
a. Insert the shim ring **(1.7 to 1.8 mm (0.067 to 0.071 in)** thickness into the related seat on differential-speed gear casing; then, by means of tool **A.3.0272**, fit outer ring of differential casing taper bearing.

CAUTION:
Take particular care during installation so that ring mates perfectly with cover.



b. Insert the shim ring, removed during disassembly, into the related seat on differential-speed gear casing cover, then, by means of same tool **A.3.0272**, fit outer ring of differential casing taper bearing.

CAUTION:
Take particular care during installation so that ring mates perfectly with cover.



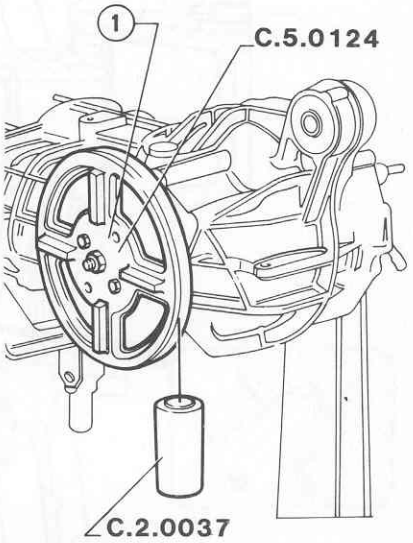
c. Insert the whole differential casing inside the differential-speed gear casing; install cover and tighten the screws crosswise to the prescribed torque.

Ⓣ: **Tightening torque**
Differential - speed gear casing cover securing screws
19 to 23 N·m
(1.9 to 2.3 kg·m
13.7 to 16.6 ft·lb)

d. Install tool **C.5.0123** complete with spring bush **C.5.0125** and sheave **C.5.0124** in the seat of the left internal drive shaft. Secure tools by screwing nut ①.

e. Operating on sheave, rotate differential casing a few times in both directions so as to bed bearings.

f. Wind cable supporting weight **C.2.0037** on sheave **C.5.0124**; then verify that weight lowers correctly without stopping or pulling sheave too rapidly.



1 Nut

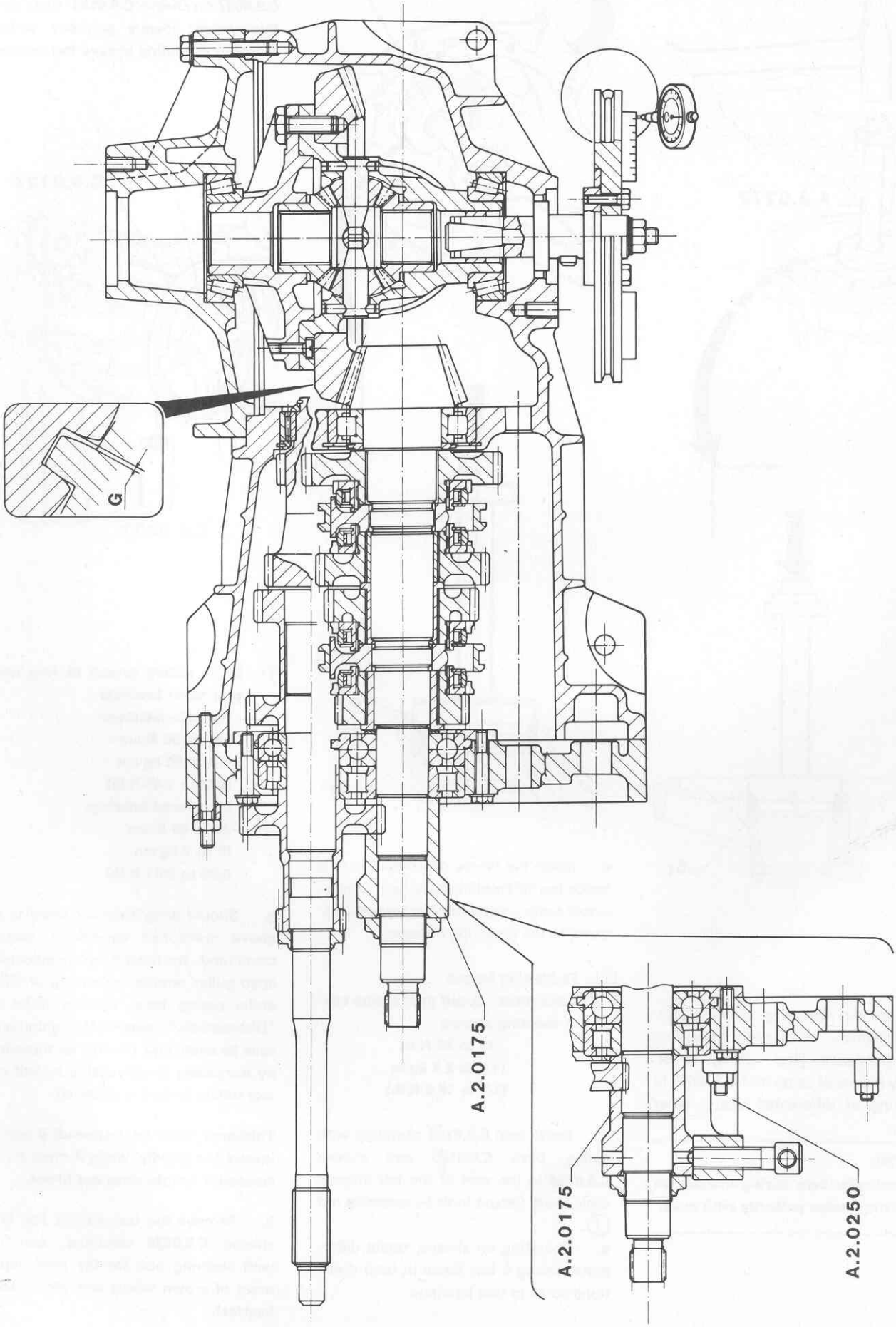
Ⓣ: **Static rolling torque of ring bevel gear taper bearings**
– For new bearings:
98 to 196 N·cm
(10 to 20 kg·cm
0.72 to 1.45 ft·lb)
– For reused bearings
49 to 68 N·cm
(5 to 7 kg·cm
0.36 to 0.51 ft·lb)

g. Should weight do not lower in the above mentioned conditions, remove cover and, by means of an adjustable span puller remove outer ring of differential casing taper bearing (refer to: "Disassembly" - step 4.) thus gaining access to shim ring to vary its thickness; by increasing or decreasing it until correct rolling torque is obtained.

Thickness must be increased if weight lowers too rapidly, while it must be decreased if weight does not lower.

h. Remove the test weight and keep sheave **C.5.0124** mounted, complete with securing hub for the next adjustment of crown wheel and pinion teeth backlash.

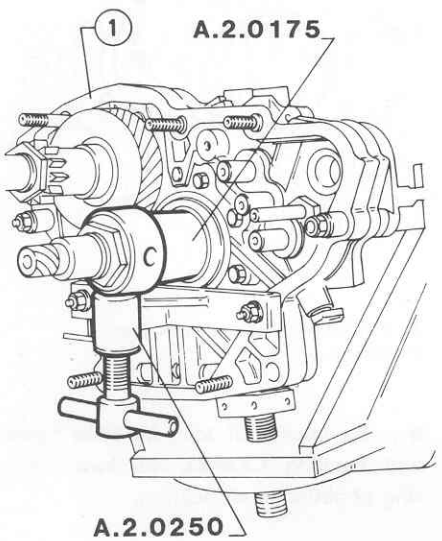
6. Adjustment of crown wheel and pinion teeth clearance.



Determine and adjust clearance of crown wheel and pinion teeth by following the procedure here below.

a. Install intermediate flange (1) suitably preset, on differential-speed gear casing (refer to: step 3. - "Preparation of Speed Gear Intermediate Flange").

b. Install tool **A.2.0250** on intermediate flange (1), tighten the tool screw until inserting it into one of the holes of tool **A.2.0175** on pinion shaft; this allows pinion rotation to be blocked.

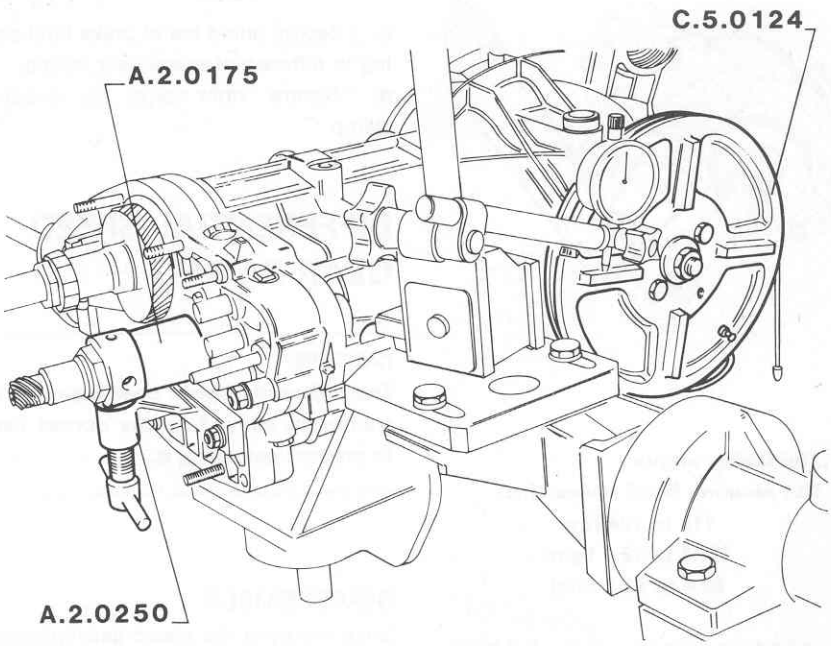


1 Speed gear intermediate flange

c. Set the magnetic base of a centesimal gauge on support of differential-speed gear unit and position probe on one of the four spokes of sheave **C.5.0124** in correspondence with average radius of ring bevel gear; then reset the centesimal gauge.

When in this position, the centesimal gauge gives the real backlash of crown wheel and pinion, in correspondence with average radius.

Ring bevel gear average radius "R"
R = 77 mm (3.03 in)



d. With pinion blocked, move sheave **C.5.0124** by the deviation amount allowed by teeth backlash; then, by means of centesimal gauge, verify that backlash **"G"** on the ring bevel gear average radius is that prescribed.

Clearance "G" between pinion and ring bevel gear
G = 0.10 to 0.20 mm
(0.0039 to 0.0079 in)

Backlash verification is to be performed in four positions of ring bevel gear by rotating differential casing by means of sheave C.5.0124, releasing and blocking pinion via tool A.2.0250.

e. Should backlash of crown wheel and pinion, measured with centesimal gauge, be different from that prescribed, vary shims interposed between outer rings of differential casing taper bearing and the related shoulders on differential-speed gear casing and on cover.

- If backlash is lower than the prescribed value, the ring bevel gear must be moved away from pinion and, as a consequence, it is necessary to increase the shim thickness on the opposite side of ring bevel gear and to by the same amount, the shim thickness on ring bevel gear side (cover).
- If backlash exceeds the prescribed value, the ring bevel gear must be moved closer to pinion and, as a consequence, it is necessary to decrease the shim on the opposite side of ring bevel gear and to increase by the same amount, the shim thickness on the ring bevel gear side (cover).

Since the increase of a ring shim thickness is equal to a decrease on the opposite one, a deviation of ring bevel gear is obtained, without altering preload of bearings.

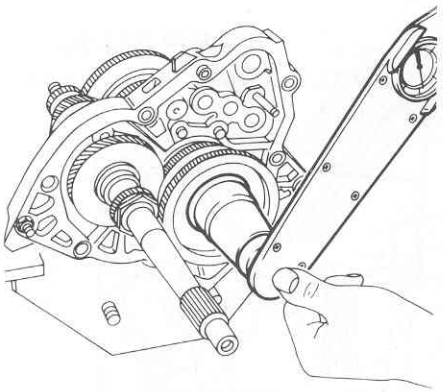
f. At the end of adjustment, remove the intermediate flange from differential speed gear casing complete with the related shafts, and sheave **C.5.0124** complete with hub and spring bush.

7. Reassembly of speed gear intermediate flange.

a. Set intermediate flange on an overhaul stand, engage two speeds, unscrew the nut on pinion shaft and remove spacer **A.2.0175.**

b. Lubricate, then insert the 5th speed gear bush, on pinion shaft, with the related cage with needles.

Install driven gears of 5th and reverse speeds, then screw the securing nut and tighten it to the prescribed torque.



Ⓣ: **Tightening torque**
Nut securing bevel pinion shaft
112 to 124 N·m
(11.4 to 12.6 kg·m
82.4 to 91.1 ft·lb)

c. Withdraw dummy rods **A.2.0267** and, at the same time, insert the gear selector rods into the related seats.
d. Complete the rods and forks reassembly operation. (Refer to Group 13 - "Overhaul at Bench of Speed Gear Unit Rods and Forks - Reassembly").

8. Reassembly of internal drive shafts
(refer to: "Internal Drive Shafts - Reassembly").

9. Reassembly of brakes calipers and control system piping

a. Reassemble brakes calipers and secure nuts tightening them to the prescribed torque (only for the models with differential equipped with four side pinions).

Ⓣ: **Tightening torque**
Nuts securing brakes calipers to differential-speed gear casing
46 to 52 N·m
(4.6 to 5.3 kg·m
33.2 to 38.3 ft·lb)

b. Reconnect the control system piping unions to brakes calipers, by tightening them to the prescribed torque.

Ⓣ: **Tightening torque**
Unions of brakes contol system piping:
8 to 10 N·m
(0.8 to 1.0 kg·m
5.8 to 7.2 ft·lb)

c. Secure union tee of brake fluid piping to differential-speed gear casing.
d. Secure right pipe to support clamp.

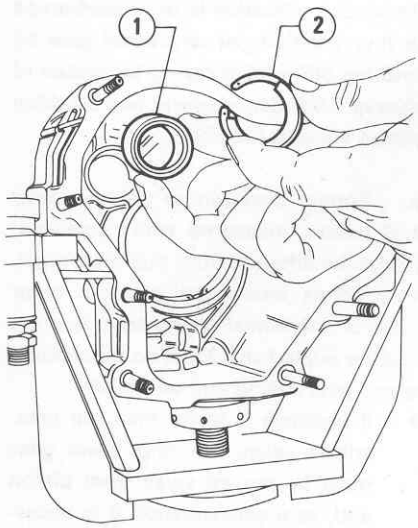
DIFFERENTIAL-SPEED GEAR CASING

CAUTION:
The differential-speed gear cusing is in aluminium alloy. Take the utmost care to prevent damaging it.

DISASSEMBLY

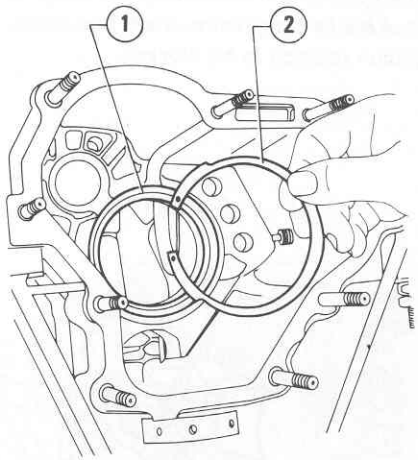
Once removed the speed gear intermediate flange from differential unit (refer to Groupp 13 - "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential Unit - Separation"), disassemble it operating as follows.

1. Removal of main shaft rear bearing
a. Remove retaining ring (2) securing main shaft needle bearing (1).
b. Withdraw bearing from the related seat (no special tool is required, since this item is mounted without interference fit).



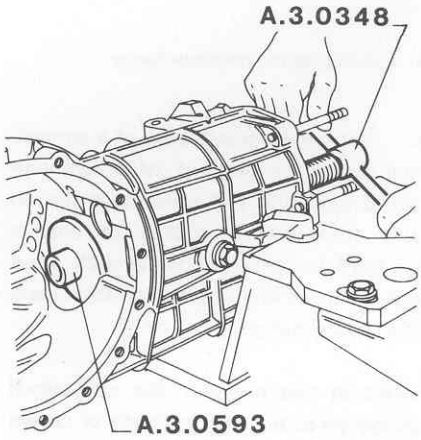
1 Needle bearing
2 Retaining ring

2. Differential casing withdrawal (refer to: "Differential Casing - Removal" steps 1. to 3.)
3. Remove retaining ring (2) securing outer ring (1) of pinion shaft roller bearing.
a. Remove retaining ring (2) which secure outer ring (1) of pinion shaft roller bearing.

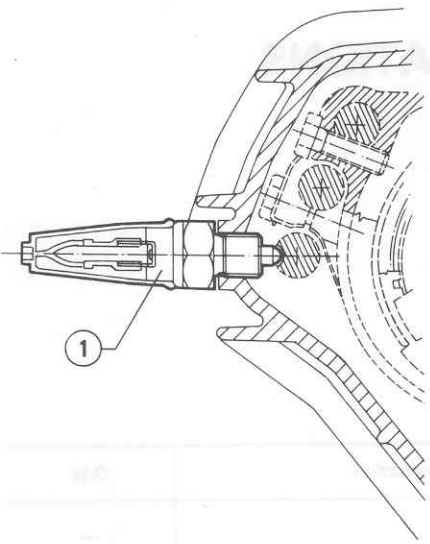


1 Pinion shaft bearing outer ring
2 Retaining ring

b. By means of tool **A.3.0348** fitted with bushing **A.3.0593**, withdraw outer ring of pinion shaft bearing.

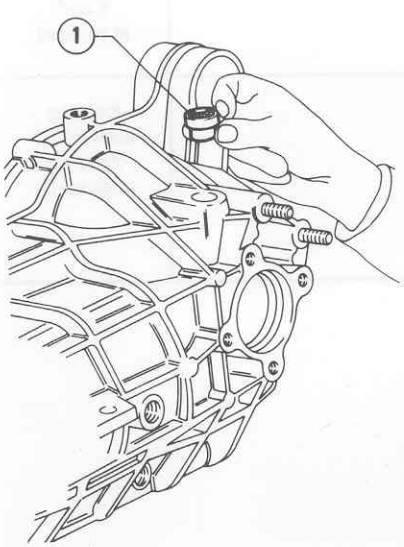


4. Unscrew and remove switch (1).



1 Reverse speed engagement indicator switch

5. If necessary, unscrew and remove oil plugs, then remove plug (1)



1 Oil drain plug

CHECKS AND INSPECTIONS

a. Clean the casing with solvent and check against cracks, splinters or pitting.

b. Check mating surfaces of casing and check agdiust notches, roughness or sealant traces.

c. Verify that threadings of cover securing screws are in good conditions.

d. Examine needle bearing of main shaft verifying that rotation takes place without noise, slight stickings and excessive clearance.

e. Verify that race of pinion shaft roller bearing is free from excessive wear, scratches or seizing.

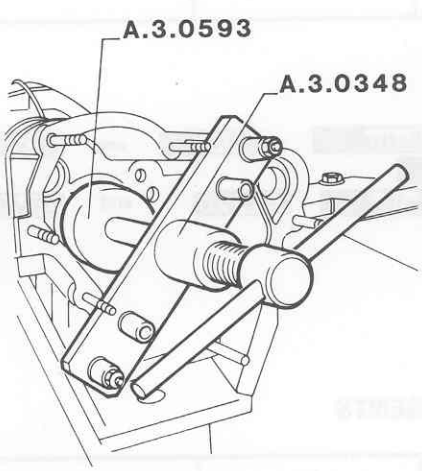
REASSEMBLY

1. If previously removed, mount oil plugs and the reverse speed engagement indicator switch.

(T): **Tightening torque**
Reverse speed engagement indicator switch
23 to 26 N·m
(2.3 to 2.7 kg·m
16.6 to 19.5 ft·lb)

2. Reassembly of pinion shaft bearing outer ring.
By means of tool **A.3.0348** fitted with bushing **A.3.0593**, insert outer race of pinion shaft bearing; then install retaining ring.

The replacement of pinion shaft bearing, involves the check and possible adjustment of distance between pinion and ring bevel gear axis refer to: "Differential Casing - Reassembly" step 4.)



3. Reassembly of main shaft bearing
Reassemble needle bearing of main shaft and secure it with the related retaining ring.

The retaining ring must be mounted with the beveling towards front side (speed gear).

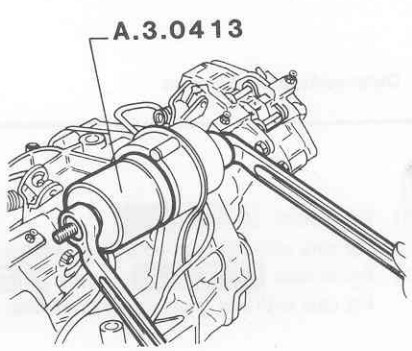
4. Differential casing Reassembly (refer to: "Differential Casing-Reassembly" step 1.).

5. Once the differential-speed gear casing has been reassembled, install intermediate flange complete with speed gear shafts, install the speed gear-clutch casing and, then, the clutch unit.
(Refer to: Group 13 - "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential Unit - Reconnection").

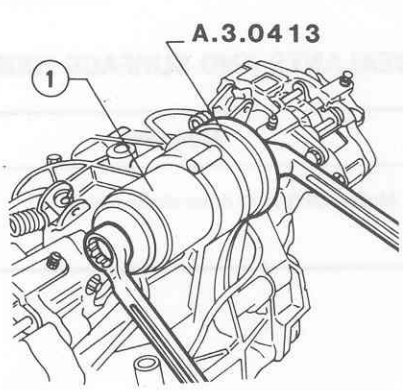
RUBBER BUSHING REPLACEMENT

Set the clutch-speed gear-differential unit on an overhaul stand, then operate as per figure making use of tool **A.3.0413** to replace the rubber bushing securing the unit to body.

Withdrawal



Insertion



SERVICE DATA AND SPECIFICATIONS

SERVICE DATA

Refer to Group 13 - "Service Data and Specifications - Service Data".

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Q.ty
Differential roller bearing	GREASE	AGIP Grease 33 FD IP Autogrease FD (Std.No. 3671-69833)	—
Outer rings of differential taper bearing			—
Threading of screws securing drive shaft to differential shaft	GREASE	ISECO Molykote BR2 (Std.No. 3671-69841)	—
Spherical seat of propeller shaft rear joint			—
Internal lip of seal rings			5 cm^3 (0.30 cuin)
Filling of differential-speed gear casing	OIL	AGIP Rotra SX 75W90 IP Pontiax HDS 75W90 (Std.No. 3631-69412)	2.570 kg (5.66 lb) (1) 2.070 kg (4.56 lb) (2)
Outer surface of seal rings			—

(1) For models Alfetta .
For cars with high top-up plug of models: Giulietta GTV 2.0 and GTV 6 2.5 .
(2) For models Alfa 90 and Alfa 75 .
For cars with low top-up plug of models: Giulietta GTV 2.0 and GTV 6 2.5 .

SEALANTS AND SURFACE FIXING AGENTS

Application	Type	Denomination	Q.ty
Mating surface of drive shafts-covers	SEALING COMPOUND	LOWAC Perfect Seal (Std. No. 3522-00011)	—

CHECKS AND ADJUSTMENTS

Application \ Type of differential		two side pinions	four side pinions
Installation clearance between side pinions and crown wheels teeth	G mm (in)	0.05 to 0.20 (0.002 to 0.008)	0.08 to 0.15 (0.003 to 0.006)

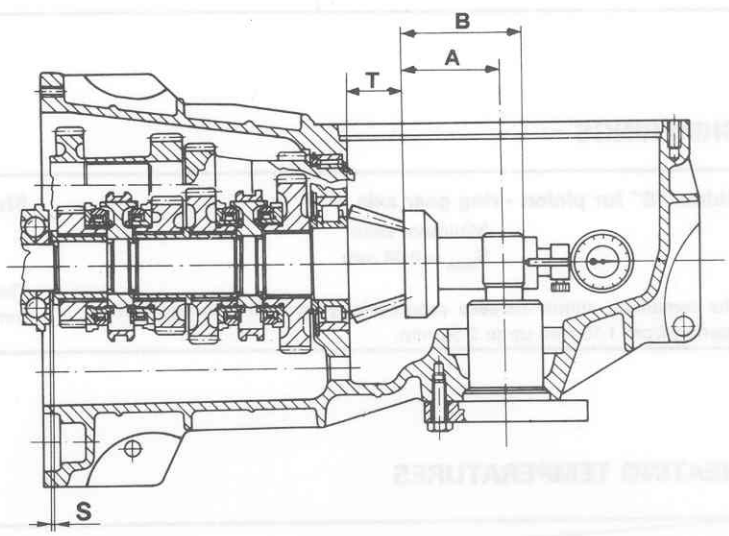
Shim washer correction shim "S" between 4th speed engagement bush and bearing internal ring.

$S = \pm L (\pm C)$

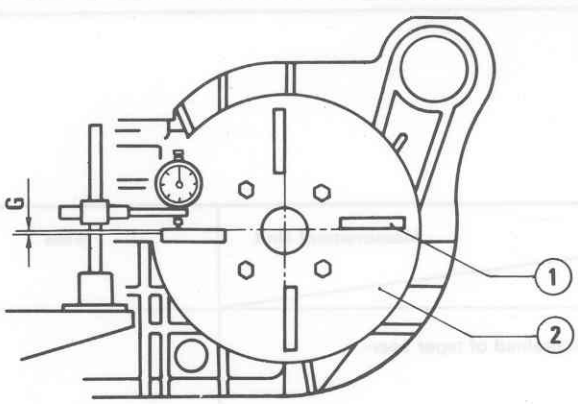
where:
L = Deviation value of ring bevel gear axis measured with centesimal gauge
C = Value marked on pinion head

The real dimension must correspond to the nominal dimension the algebric value marked on pinion head (in hundredths)

T = Pinion head height



Application \ Pinion type		Pinion head height T = 42 mm (1.65 in)	Pinion head height T = 36 mm (1.42 in)
Nominal dimension between ring bevel gear axis and pinion head	A mm (in)	56.5 ± 0.03 (2.22 ± 0.001)	62.6 ± 0.03 (2.46 ± 0.001)
Dimension of tool C.6.0164 for gauge resetting	B mm (in)	66.5 (2.62)	72.6 (2.86)
Installation clearance between ring bevel gear and pinion	G mm (in)	0.10 to 0.20 (0.004 to 0.008)	



1 Graded spoke
2 Tool sheiw

Ring bevel gear average radius	R mm (in)	77 (3.03)

Application	
Clearance between splined section of drive shafts and differential crown wheels G mm (in)	0.07 to 0.13 (0.00275 to 0.0051)
Squareness deviation of brake disk support plane with respect to bearing and oil seal ring seats S mm (in)	0.05 (0.00197)
Installation interference fit for drive shaft bearing retaining ring nut I mm (in)	0.023 to 0.057 (0.0009 to 0.0022)

SHIM RINGS

Shims "S" for pinion - ring gear axis

Minimum shim
S_{min} = 0.08 mm

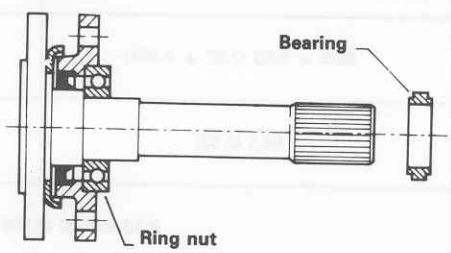
The remaining shims increase progressively by 0.05 mm each time, starting from 1.15 mm up to 2.50 mm.

Shims "S" for preload of the differential casing bearings.

The shims increase progressively by 0.25 each time, starting from 1.350 mm up to 2.600 mm

HEATING TEMPERATURES

Application / Measurement Unit	°C (°F)
Differential shaft bearing ring nut	190 (374)

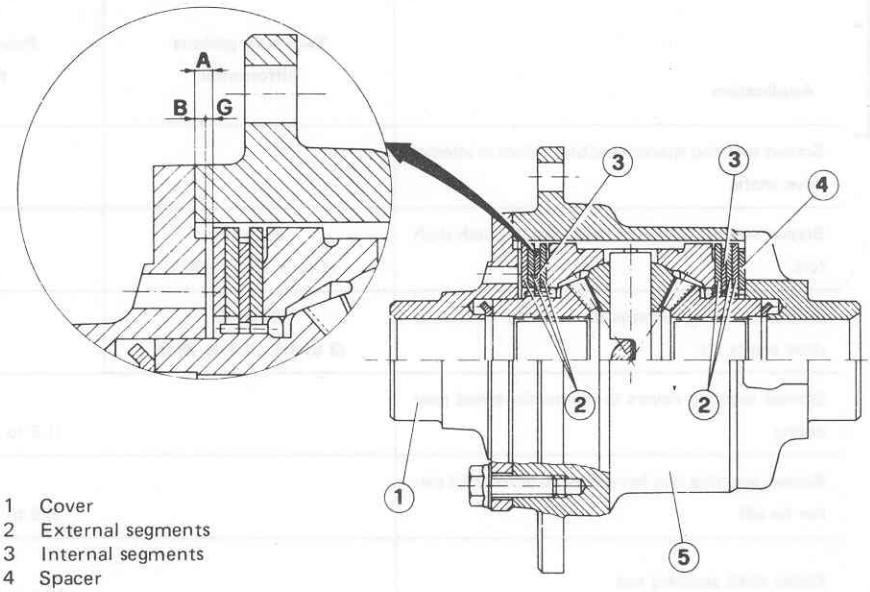


ROLLING TORQUES

Item / Measurement Unit	N·cm	Kg·cm
Differential carrier (to determine static preload of taper bearings)		
— Re-used bearings	49 to 68	5 to 7
— New bearings	98 to 196	10 to 20

LIMITED SLIP DIFFERENTIAL

Fitment clearance between cover and pack of segments
G = A-B = 0.1 thru 0.2 mm
(0.004 thru 0.008 in)



1 Cover
2 External segments
3 Internal segments
4 Spacer
5 Carrier

To check that clearance **G** in within the specified tolerances, proceed as follows:

1. Rest the supporting base of a (suitably preloaded) dial gauge on the contact surface (2) between cover (1) and segment pack, by operating on the cover of the limited slip differential carrier; zero set the dial gauge on the mating surface (3) between cover and carrier.

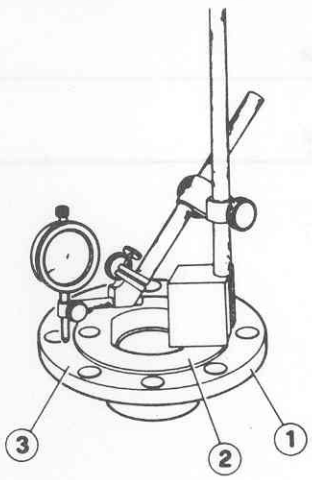
2. Position the gauge supporting base on the mating surface (1) between carrier (2) and cover by operating on the limited slip differential carrier; have the gauge feeler contacting segment pack (3).

NOTE:
Apply a load of 10 Kg (22 lb) to the segment pack.

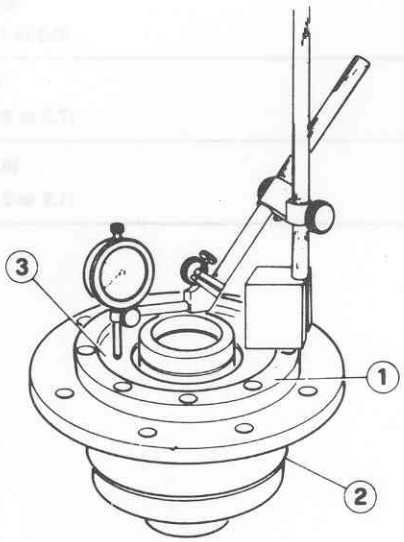
---

3. Read the value, with negative sign, of clearance G: it must be within the specified values.

Fitment clearance between cover and segment pack:
G = 0.1 thru 0.2 mm
(0.004 thru 0.008 in)



1 Cover
2 Cover-segment pack contact surface
3 Cover-carrier mating surface



1 Carrier-cover mating surface
2 Carrier
3 Segment pack

TIGHTENING TORQUES [N·m (kg·m; ft·lb)]

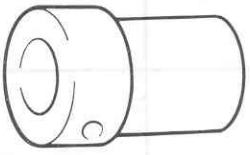
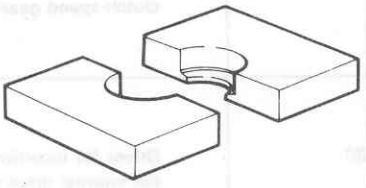
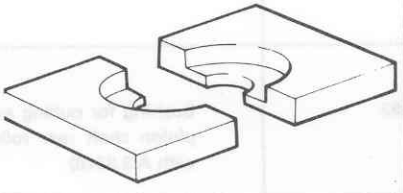
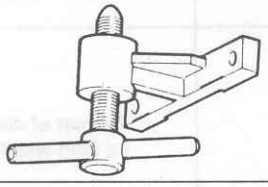
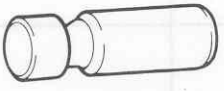
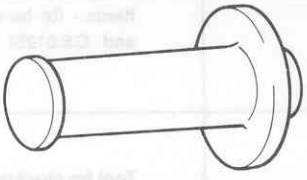
Application	Two side pinions differential	Four side pinions differential	Slip limited - four - side pinion differential
Screws securing spacers and brake discs to internal drive shafts		49 to 54 (5 to 5.5; 36.1 to 39.8)	
Screws securing propeller shaft joint to clutch shaft fork	39 to 49 (4 to 5; 28.9 to 36.1)	55 to 57 (5.6 to 5.8; 40.5 to 41.9)	
Screws securing external drive shafts to internal drive shafts (1)	29 to 35 (3 to 3.6; 21.7 to 26.0)	44 to 54 (4.5 to 5.5; 32.5 to 39.8)	
Screws securing covers to differential speed gear casing	18 to 21 (1.8 to 2.2; 13.0 to 15.9)		
Screws securing ring bevel gear to differential carrier (in oil)	67 to 74 (6.8 to 7.5; 49.2 to 54.2)		
Pinion shaft securing nut	112 to 124 (11.4 to 12.6; 82.4 to 91.1)		
Nut securing spacers and intermediate flange to differential-speed gear casing	112 to 124 (11.4 to 12.6; 82.4 to 91.1)		
Securing screws of differential speed gear casing cover	19 to 23 (1.9 to 2.3; 13.7 to 16.6)		
Nuts securing brakes calipers to differential-speed gear casing	45 to 52 (4.6 to 5.3; 33.3 to 38.3)		
Unions of brakes and clutch control system piping: — Pipes — Hoses	8 to 10 (0.8 to 1; 5.8 to 7.2) 10 to 15 (1 to 1.5; 7.2 to 10.8)		
Reverse speed engagement indicator switch (on speed gear-differential casing)	23 to 26 (2.3 to 2.7; 16.6 to 19.5)		
Nut securing plate for Reverse speed engagement safety device	8.3 to 10.3 (0.9 to 1.05; 6.5 to 7.6)		
Bolt securing rear support rubber bushing of clutch-speed gear-differential unit	71 to 89 (7.2 to 8.9; 52.1 to 64.3)		
Screws securing speed gear-differential unit to lateral support small block	18.6 to 23.5 (1.9 to 2.4; 13.7 to 17.4)		

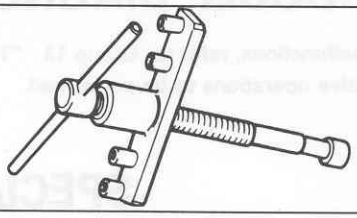
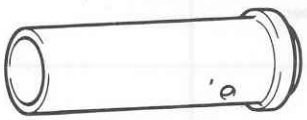
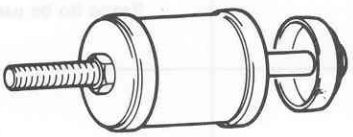
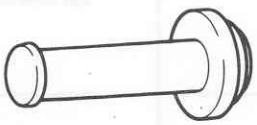
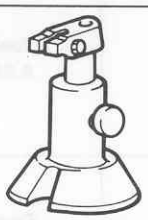
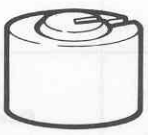
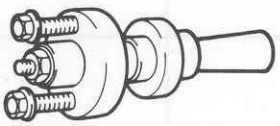
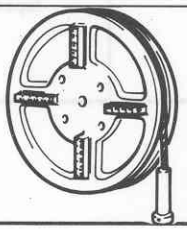
(1) Use the grease prescribed: ISECO Molykote BR2

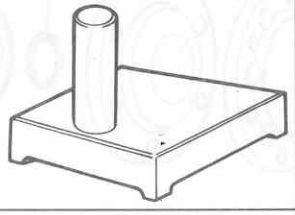
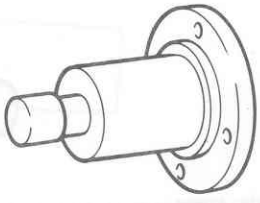
TROUBLE DIAGNOSIS AND CORRECTIVE ACTION

In the event of malfunctions, refer to: Group 13 - "Trouble Diagnosis and corrective action" so as to identify the probable cause and define the corrective operations to be performed.

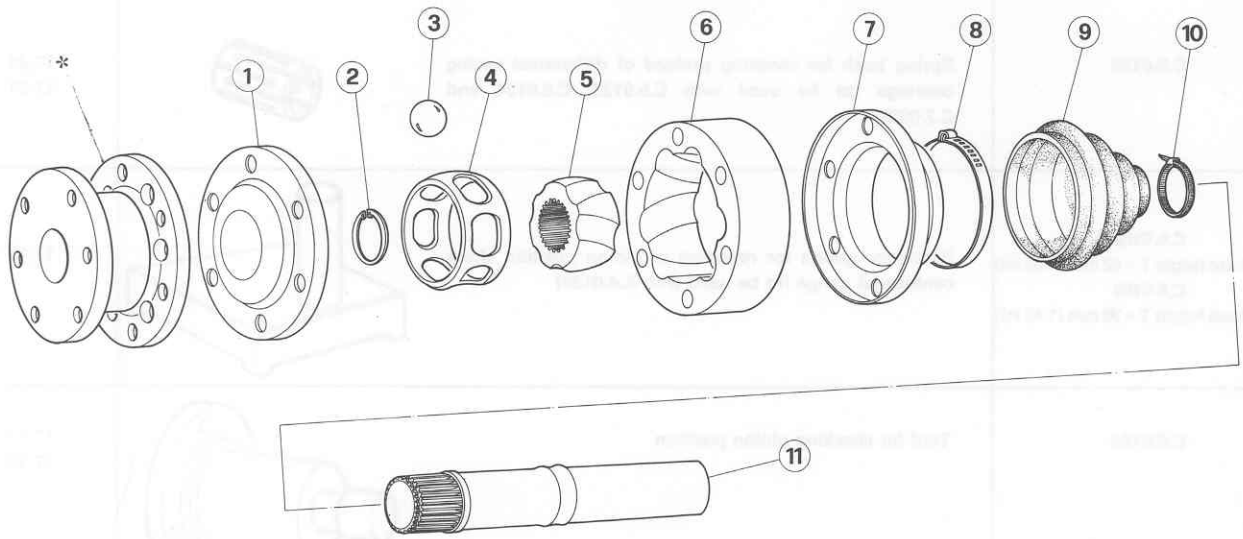
SPECIAL SERVICE TOOLS

Tool Number	Tool name	Page Ref.
A.2.0175	Spacer for locking pinion shaft to intermediate flange (to be used with A.2.0250) 	17-16 17-22 17-23
A.2.0247	Plate for removing retaining ring nut of differential internal drive shaft bearing 	17-9
A.2.0248	Plate for removing differential internal drive shaft 	17-9
A.2.0250	Tool for locking pinion shaft (to be used with A.2.0175) 	17-22 17-23
A.2.0267	Dummy rods for striking rod balls and speed engagement detent balls. 	17-16 17-24
A.3.0272	Driver for internal and external rings of differential carrier taper bearings. 	17-15 17-16 17-20 17-21
A.3.0287	Adjustable span puller for differential carrier taper bearing inner races. 	17-12

Tool Number	Tool name	Page Ref.
A.3.0348	Puller-driver for outer race of pinion shaft rear roller bearing (to be used with A.3.0593) 	17-24 17-25
A.3.0412	Driver for insertion of bearing and ring nut on differential internal drive shaft 	17-10
A.3.0413	Puller-driver of rear rubber bushing securing clutch-speed gear-differential unit to body 	17-25
A.3.0430	Driver for insertion of oil seal ring on differential internal drive shaft covers. 	17-10
A.3.0593	Bushing for pulling and driving outer race of pinion shaft rear roller bearing (to be used with A.3.0348) 	17-24 17-25
A.4.0136	Support of dial gauge for pinion setting (to be used with C.6.0164 und C.6.0163) 	17-17 17-18
C.2.0037-100/2000	Weights for checking bearings preload n.7 items - (to be used with C.5.0124, C.5.0123 and C.5.0125) 	17-20 17-21
C.5.0123	Tool for checking preload of differential casing bearings (to be used with C.5.0124, C.2.0037 and C.5.0125) 	17-20 17-21
C.5.0124	Sheave for checking preload of differential casing bearings (to be used with C.5.0123, C.2.0037 and C.5.0125) 	17-20 17-21 17-23

Tool Number	Tool name	Page Ref.
C.5.0125	Spring bush for checking preload of differential casing bearings (to be used with C.5.0123, C.5.0124 and C.2.0037) 	17-20 17-21
C.6.0163 (pinion head height T = 42 mm (1.65 in)) C.6.0193 (pinion head height T = 36 mm (1.42 in))	Reference gauge for revetting of pinion position check centesimal gange (to be used with A.4.0136) 	17-17
C.6.0164	Tool for checking pinion position 	17-17 17-18

AXLE SHAFTS

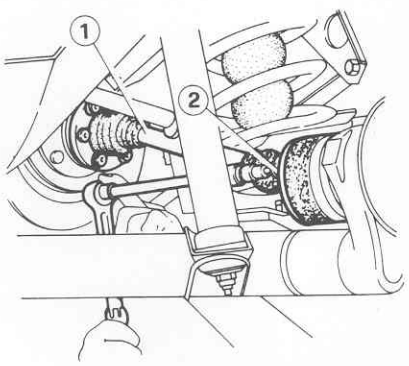


1 Outer cover
2 Retaining ring
3 Ball
4 Cage
5 Inner race
6 Outer race
7 Inner cover
8 Outer clip
9 Bellows
10 Inner clip
11 Axle shaft
* Spacer

NOTE:
For use of the spacer (*), refer to Unit 00 - Use of Units in Car.

REMOVAL

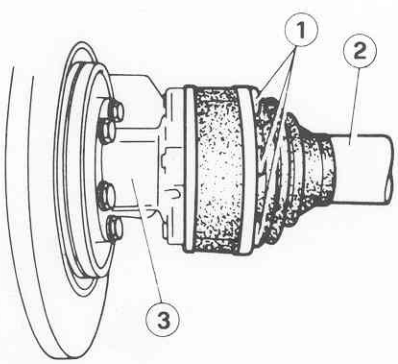
1. Place car on a lift with gear selector lever in neutral position.
2. Back off screws (2), retrieving associated lock plates and disconnect outer axle shafts (1) from wheel shafts.

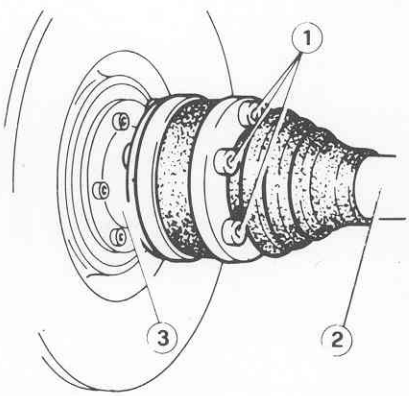


1 Axle shaft
2 Axle shaft/wheel shaft screws

WARNING:
Do not damage axle shaft joint bellows.

3. Remove the axle shafts.
   - For cars equipped with spacer.
     Back off screws (1), retrieving associated lock plates and remove external axle shafts (2) from spacer (3).



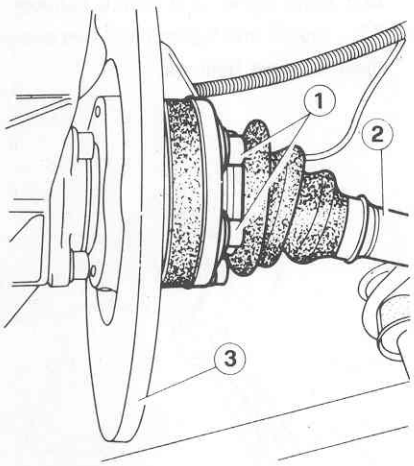


1 Axle shaft/spacer screws
2 Axle shaft
3 Spacer

- For all other models

WARNING:
Take care to prevent brake disc from falling off.

Back off screws (1), retrieve associated lock plates and remove axle shafts (2).

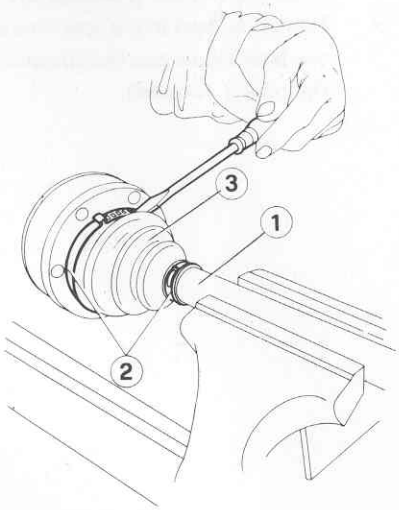


1 Axle shaft screws
2 Axle shaft
3 Brake disc

DISASSEMBLY

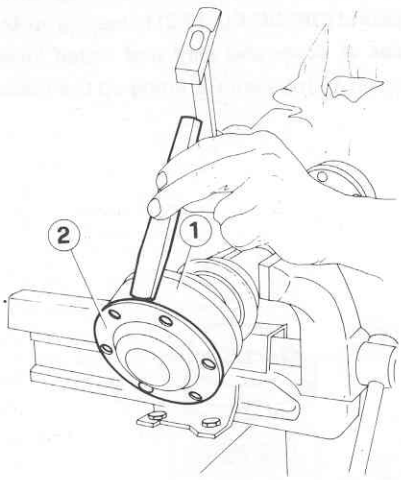
Each axle shaft is provided with two identical constant velocity U-joints, one at each end; overhaul procedure is the same for both joints.

1. Clamp axle shaft in a vice (1), remove bellows clips (2) and take off bellows (3).



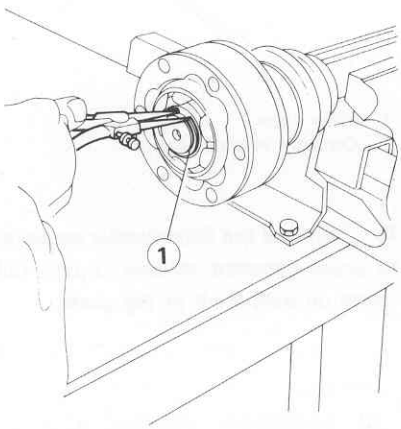
1 Axle shaft
2 Clips
3 Bellows

2. Take out outer cover (2) from joint (1).



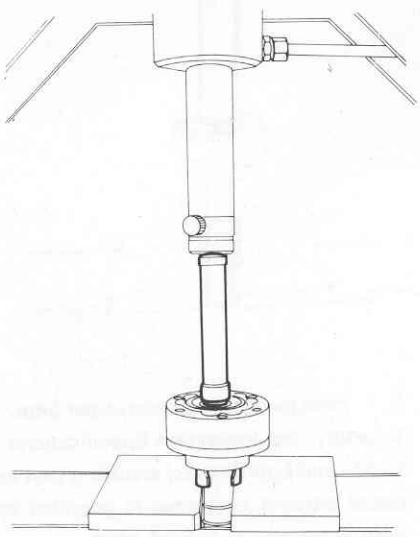
1 Constant velocity U-joint
2 Outer cover

3. Remove retaining ring (1).

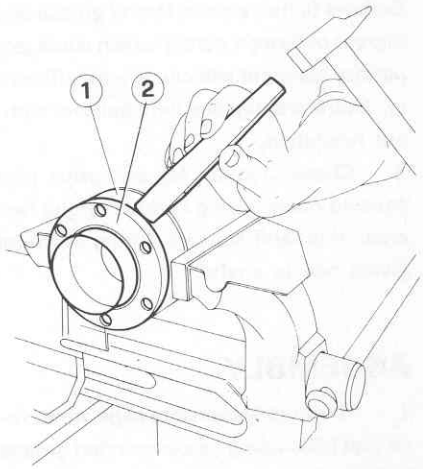


1 Retaining ring

4. Using two half plates, a punch and a base on a suitable press, remove constant velocity U-joint from axle shaft.

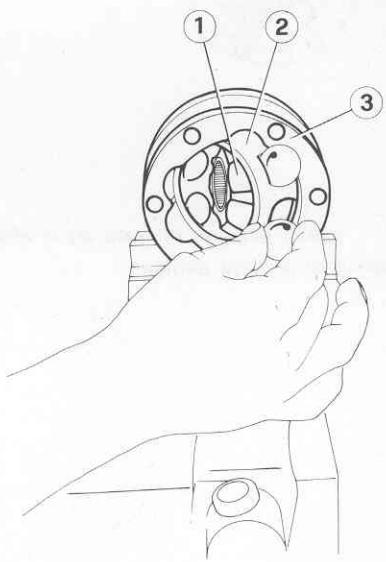


5. Slide bellows off axle shaft.
6. Clamp U-joint (1) in a vice provided with protective jaw liners and take off inner cover (2).



1 Constant velocity U-joint
2 Inner cover

7. Apply suitable reference marks to inner race (1), cage (2) and outer race (3) to facilitate subsequent installation.
8. Take out balls and disassemble constant velocity U-joint.



1 Inner race
2 Cage
3 Outer race

INSPECTION

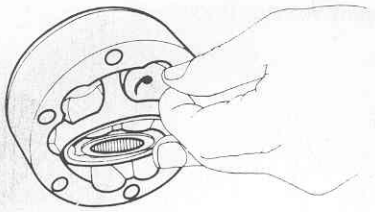
1. Thoroughly clean joint parts.
2. Check working surfaces and balls for dents and abrasion marks caused by foreign matter; replace U-joint if necessary.

Bellows failure causes loss of grease and ingress of foreign matter which could jeopardize constant velocity U-joint efficiency. Therefore, replace joint bellows without hesitation.

3. Check U-joints for excessive play causing noise during sudden torque reversal; this fault appears during overhaul giving rise to chatter.

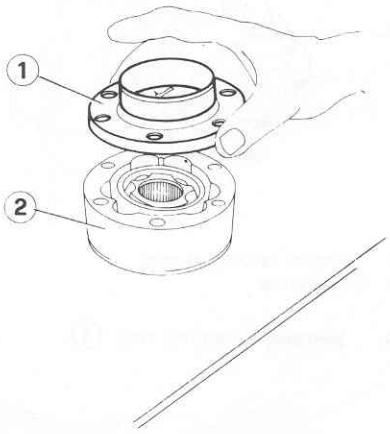
ASSEMBLY

1. Thoroughly lubricate cage, inner race and balls using recommended grease (ISECO Molykote VN 2461 C or OPTIMOL Olistamoly 2LN584) and pack joint inner chamber with the same type of grease.
2. Install inner race and cage reversing disassembly sequence and line up reference marks applied on disassembly.
3. Insert balls as shown in figure and check U-joint for correct operation.



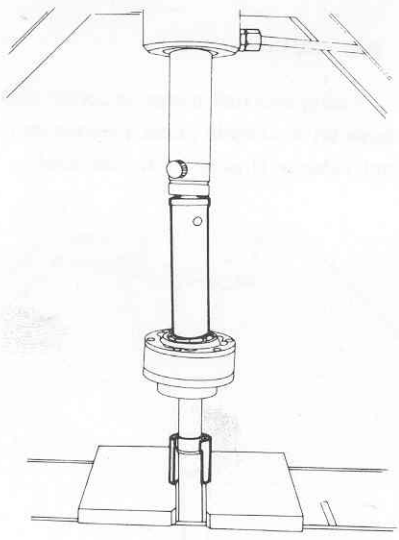
4. Install bellows on axle shaft after taping to prevent damage.

5. Apply the specified jointing compound (DIRING Curil K2) to mating surfaces of cover and joint and install inner cover (1) on joint (2) lining up the holes.



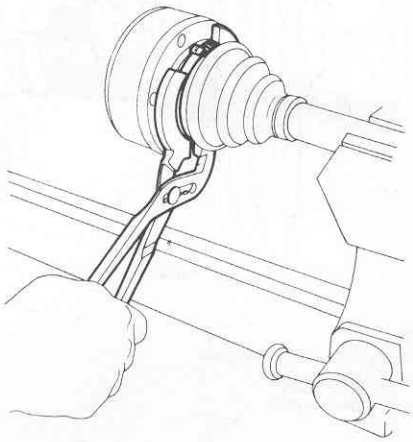
1 Inner cover
2 Constant velocity U-joint

6. Reverse the disassembly sequence to press constant velocity U-joint fully home on axle shaft at the press.



7. Pack joint with grease as per para. 1 (quantity: see Inspection Specifications - Fluids and Lubricants) ensuring that an equal amount of grease is provided on both sides of the row of balls.

8. Install retaining ring on axle shaft end and check for correct position.
9. Apply jointing compound as per para. 5 to mating surfaces of outer cover and joint and install cover lining up the holes.
10. Apply the recommended type of jointing compound (BOSTON Bostik 475 or USM 475) to mating surfaces of bellows and inner cover and install bellows.
11. Install and tighten bellows clips without cutting bellows.



INSTALLATION

Reverse removal sequence to install axle shafts and adhere to the instructions given below.

- Lubricate axle shaft retaining screw threads using the recommended type of grease (ISECO Molykote BR 2).
- Tighten screws to the specified torque (see: Inspection Specifications - Tightening Torques).

INSPECTION SPECIFICATIONS

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Description	Type	Recommended product	Quantity	
			Axle shafts with spacer	Axle shafts without spacer
Axle shaft screw thread	GREASE	ISECO: Molykote BR2 Part. No. 3671-69841	—	—
Axle shaft constant velocity U-joint Apply an equal amount of grease on both sides of row of balls	GREASE	ISECO: Molykote VN2461C OPTIMOL: Olystamoly 2LN584 Part No. 3671-69843	120 g 4.23 oz.	70 g 2.47 oz.

SEALANTS

Description	Type	Recommended product
C. V. U-joint inner and outer cover surface	Jointing compound	DIRING: Curil K2 Part. No. 3522-00031
C.V. U-joint inner cover and bellows surface	Jointing compound	BOSTON: Bostik 475 U.S.M. 475 Part. No. 3521-00034

TIGHTENING TORQUES [N·m (kg·m; ft·lb)]

Description	Axle shafts with spacer	Axle shafts without spacer
Capscrews, axle shaft to differential and wheel shaft		29 to 35 (3 to 3.6) (21.4 to 25.8)
Capscrews, axle shaft to spacer and wheel shaft	44 to 54 (4.5 to 5.5) (32.5 to 39.8)	

TROUBLESHOOTING

Trouble	Cause	Remedy
Chatter during hard torque changes	• Excessive clearance between races and balls	Replace joint
	• Lack of grease and leakage through bellows	Lubrificate and replace bellows

GROUP 21

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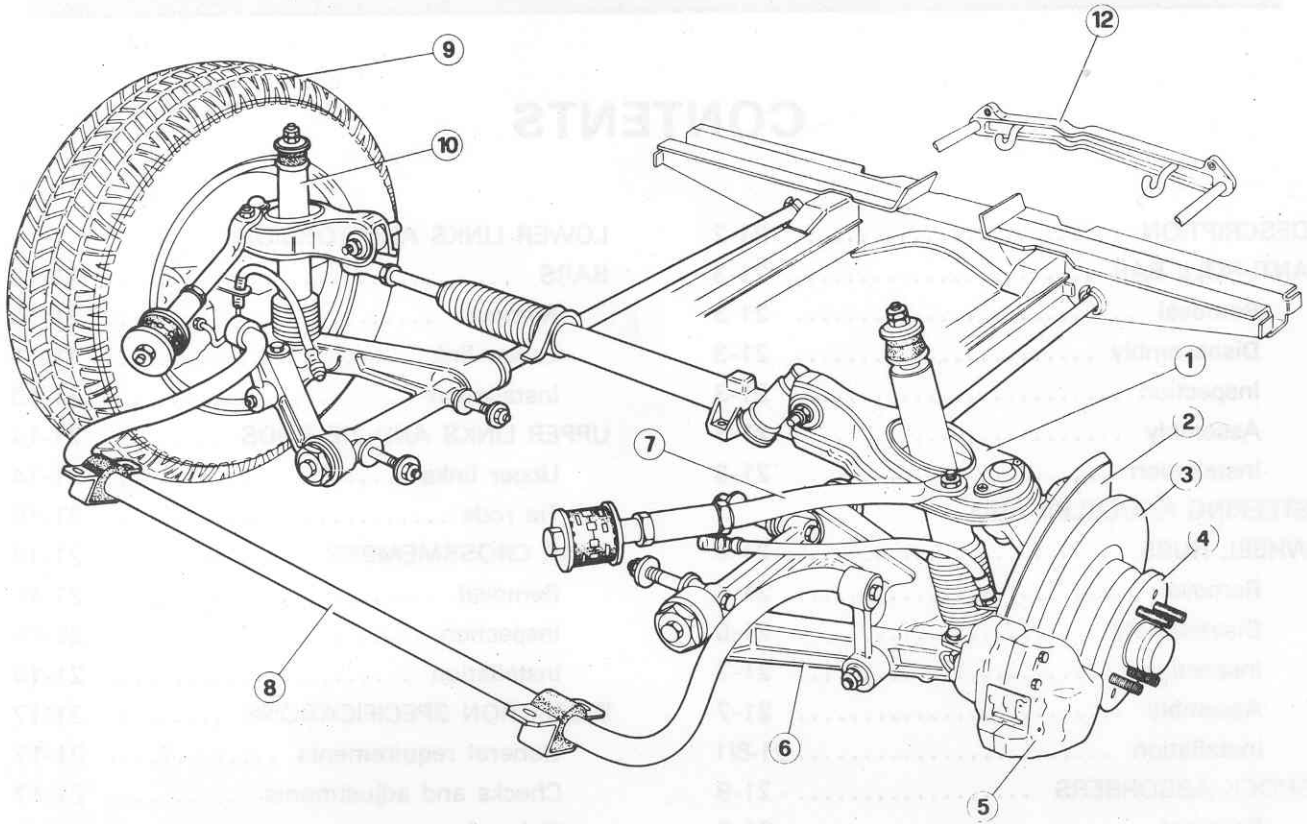
SPECIAL TOOLS 21-26

DESCRIPTION



1	Upper link	7	Tie rod
2	Splash guard	8	Anti-roll bar
3	Brake disc	9	Front wheel
4	Wheel hub	10	Shock absorber
5	Brake caliper	11	Torsion bar
6	Lower link	12	Rear cross member

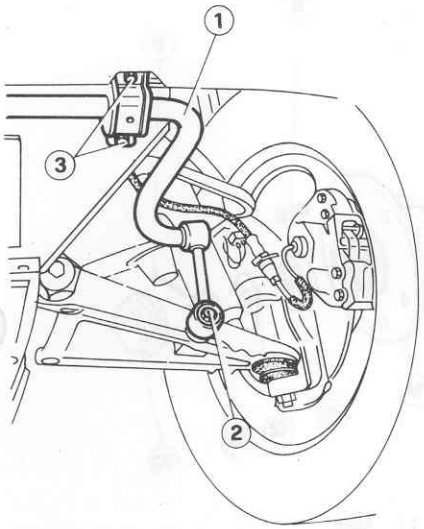
Front suspension is independent, connected to body by transverse links. Two longitudinal torsion bars are connected at the front to the links and at the rear to the chassis.

Front suspension also includes hydraulic double-acting shock absorbers connecting body and lower links and a anti-roll bar improving stability on cornering. Link upward and downward movement is restricted by bump blocks secured to cross member.

ANTI-ROLL BAR

REMOVAL

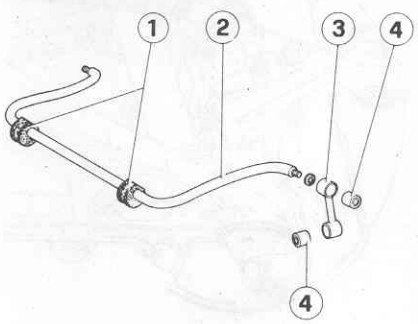
Raise car on a lift, back off nuts (2) and capscrews (3) and disconnect anti-roll bar (1).



1 Anti-roll bar
2 Nut
3 Capscrews

DISASSEMBLY

1. Apply markings on anti-roll bar and conn. rods.
2. Using a press, remove conn. rods from anti-roll bar.
3. Take off anti-vibration bushings (4) from conn. rod (3) and rubber cushions (1) from anti-roll bar (2).



1 Rubber cushions
2 Anti-roll bar
3 Conn. rod
4 Anti-vibration bushing

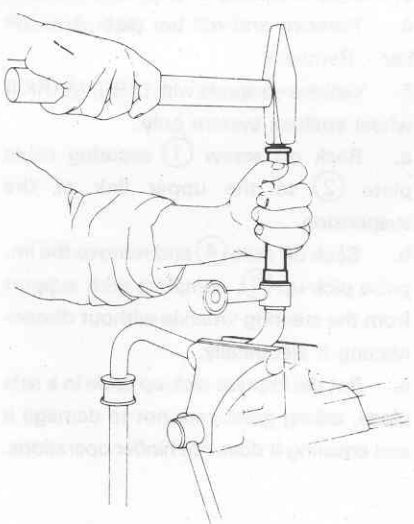
INSPECTION

Clean all parts.

1. Check that anti-roll bar and conn. rods are not damaged or bent and anti-vibration bushing seats are not worn; replace as necessary.
2. Check that rubber cushions, anti-vibration bushings and rubber components are not worn; replace damaged parts as necessary.

ASSEMBLY

1. Lubricate inner surface of anti-roll bar support rubber cushions using the recommended grease (ISECO Ergon Rubber Grease no. 3; SPCA Spagraph; REINACH Sferul B2AR) and install on anti-roll bar.
2. Install anti-vibration bushings on conn. rods.
3. Clamp anti-roll bar in a vice and insert conn. rods on anti-roll bar spigots.



INSTALLATION

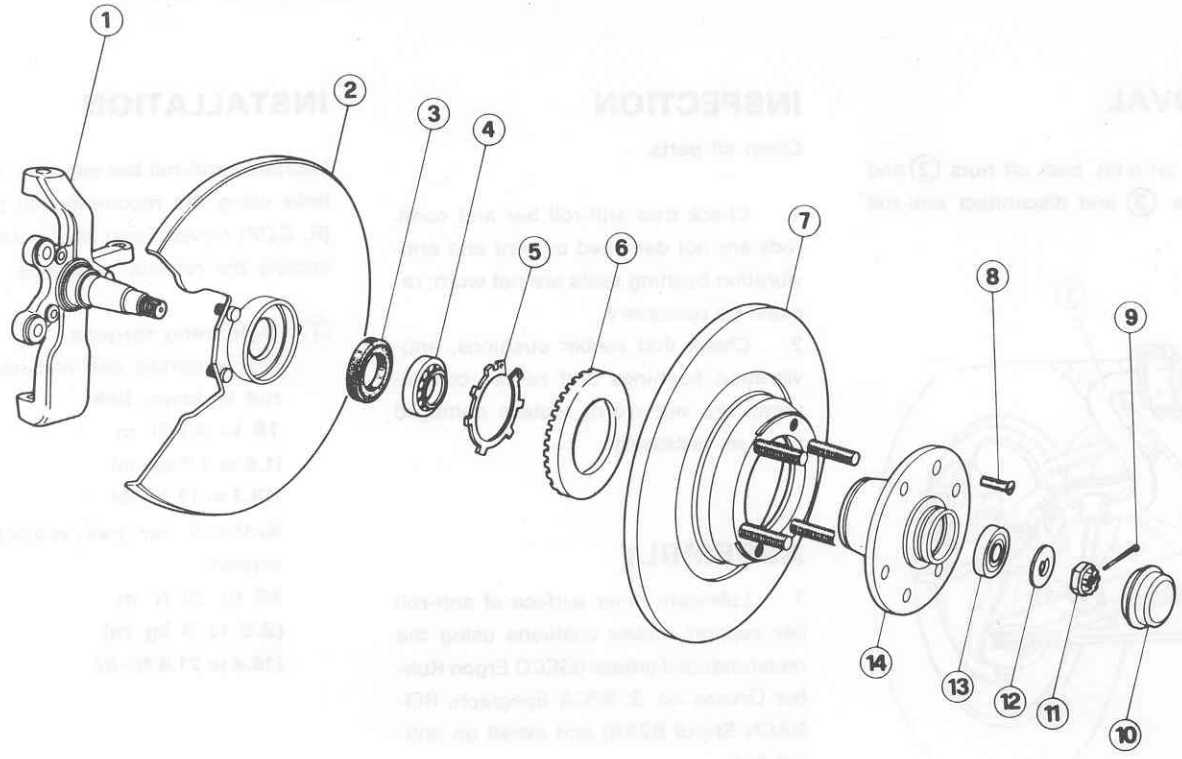
Lubricate anti-roll bar supports on lower links using the recommended antiseize (R. GORI Never Seez) and install by reversing the removal sequence.

(T) : **Tightening torques**

Nut securing anti-roll bar conn. rod to lower link
18 to 23 N·m
(1.8 to 2.3 kg·m)
(13.3 to 17 ft·lb)

Anti-roll bar pad support capscrews
25 to 29 N·m
(2.5 to 3 kg·m)
(18.4 to 21.4 ft·lb)

STEERING KNUCKLES AND WHEEL HUBS

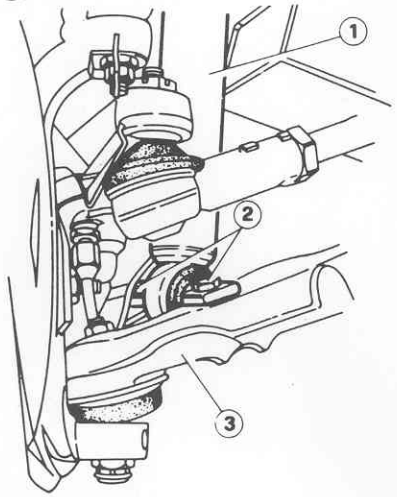


1 Steering knuckle
2 Splash guard
3 Seal
4 Inner bearing
5 Retaining ring (*)
6 Impulse emitting wheel (*)
7 Brake disc
8 Capscrew
9 Cotter pin
10 Hub cover
11 Nut
12 Washer
13 Outer bearing
14 Wheel hub

(*) For vehicles equipped with (ABS) MARK II whell antilock braking system only

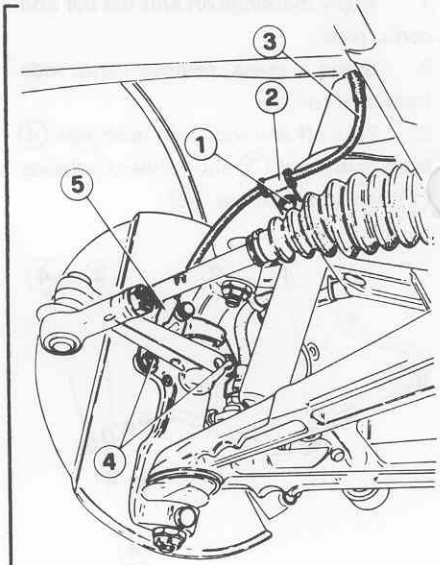
REMOVAL

1. Place car on a lift, operate parking brake, load car statically and slacken wheel nuts.
2. Back off capscrews (2) and disconnect shock absorber (1) from lower link (3).



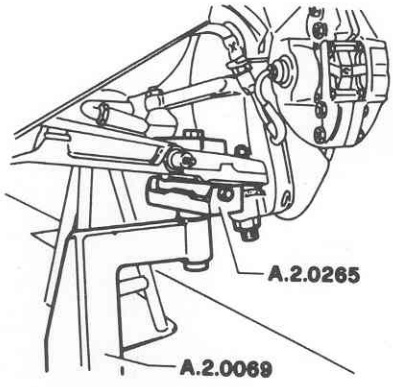
1 Shock absorber
2 Capscrews
3 Lower link

3. Raise car and support it at the front by means of stands and remove wheels.
4. Remove anti-roll bar (see: Anti-roll bar - Removal).
5. Vehicles equipped with (ABS) MARK II wheel antilock system only.
   a. Back off screw (1) securing cable plate (2) to the upper link of the suspension.
   b. Back off nuts (4) and remove the impulse pick-up (5), complete with support from the steering knuckle without disconnecting it electrically.
   c. Put the impulse pick-up aside in a safe place, taking great care not to damage it and ensuring it does not hinder operations.

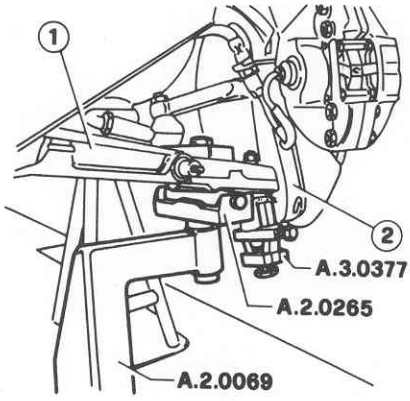


1 Screw
2 Cable plate
3 Impulse pick-up cable
4 Steering knuckle impulse pick-up support securing nut
5 Front impulse pick-up

6. Position tools **A.2.0265** and **A.2.0069** on a column lift and insert in link seats and raise unit.



7. Remove cotter pin, back off nut and disconnect lower link (1) from steering knuckle (2) using tool **A.3.0377**.

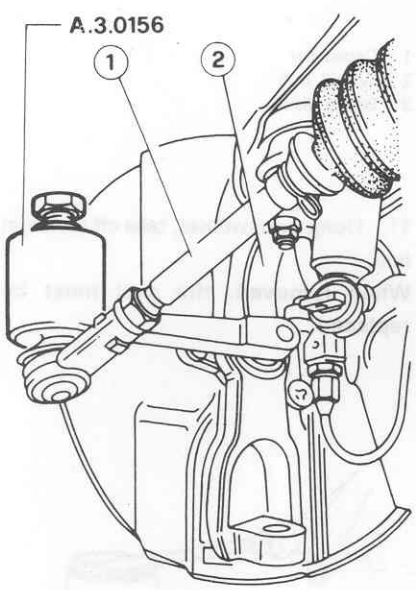


1 Lower link
2 Steering knuckle

8. Unload torsion bar by lowering lift.
9. Disconnect brake fluid pipe from front caliper after draining brake fluid reservoir.

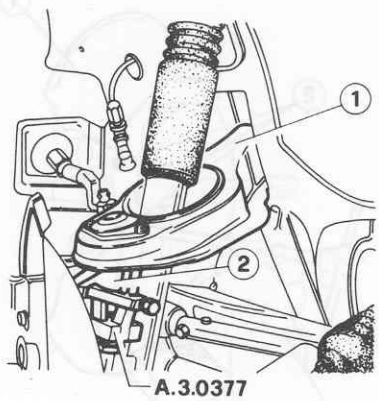
WARNING:
Brake caliper may be removed from steering knuckle without disconnecting from hydraulic system, thereby avoiding having to refill and bleed the system.

10. Remove cotter pin, back off nut and disconnect steering linkage (1) from steering knuckle (2) using tool **A.3.0156**.



1 Steering linkage tie rod
2 Steering knuckle

11. Remove cotter pin, back off nut and disconnect upper link (1) from steering knuckle (2) using tool **A.3.0377**.

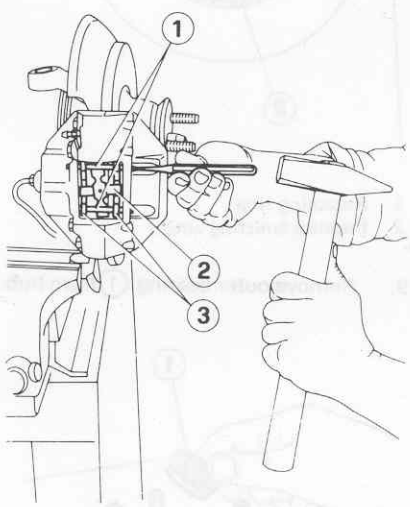


1 Upper link
2 Steering knuckle

12. Remove steering knuckle along with wheel hub.

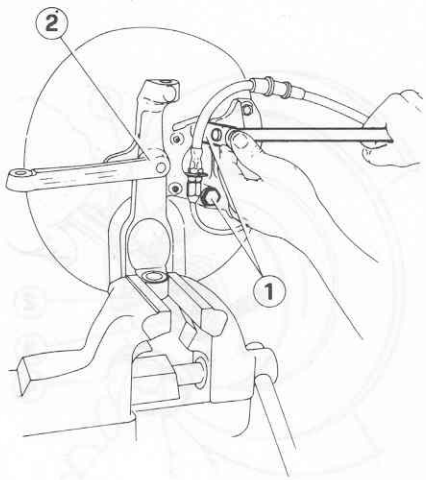
DISASSEMBLY

1. Install wheel hub unit in a vice; using a punch, push and take off brake pad pins (1), remove cross shaped sping (2) and pads (3).



1 Pad pins
2 Cross sping
3 Brake pads

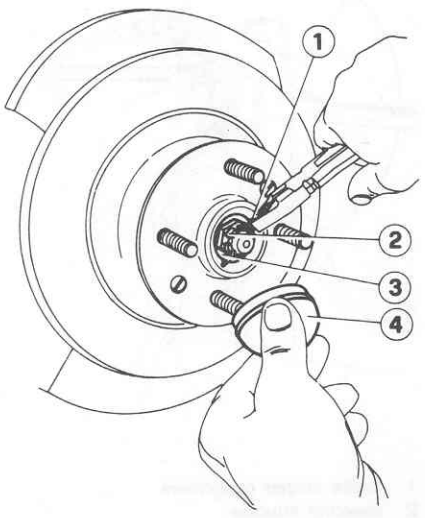
2. Slacken 2 capscrews (1) securing brake caliper to steering knuckle (2).



1 Brake caliper capscrews
2 Steering knuckle

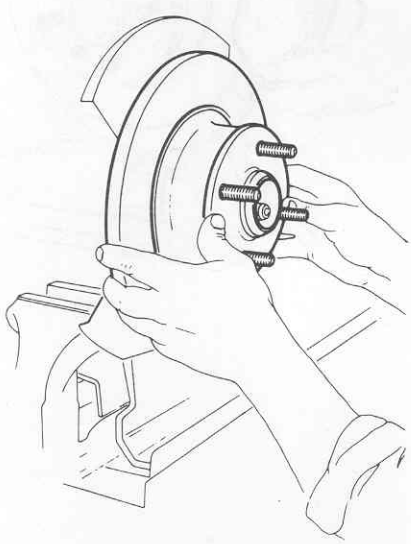
3. Remove brake caliper assembly.

4. Take off hub cover (4) and cotter pin (1).
5. Back off nut (2) and remove together with washer (3).

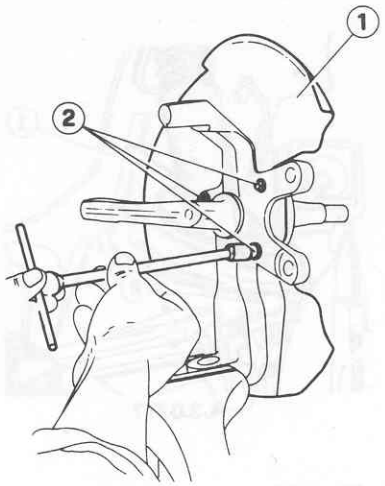


1 Cotter pin
2 Nut
3 Washer
4 Hub cover

6. Remove hub with brake disc and place on bench.

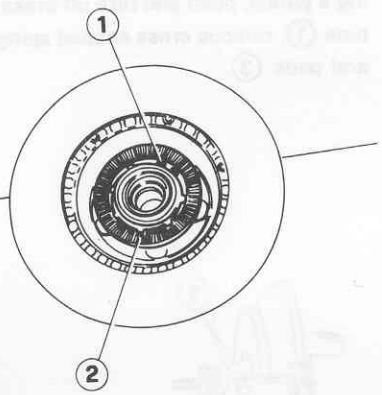


7. Remove splash guard (1) backing off 3 retaining nuts (2).



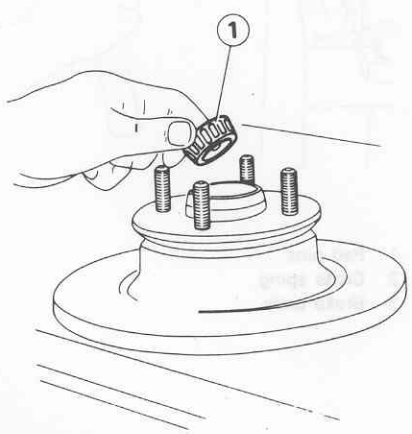
1 Splash guard
2 Retaining nuts

8. Vehicles equipped with (ABS) MARK II wheel antilock system only. Using suitable pliers remove the retaining ring (1) and separate the impulse emitting wheel (2) from the wheel hub.



1 Retaining ring
2 Impulse emitting wheel

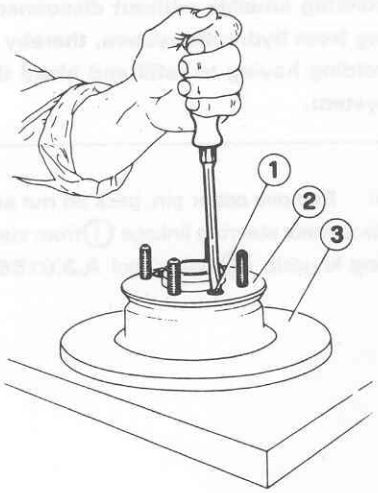
9. Remove outer bearing (1) from hub.



1 Outer bearing

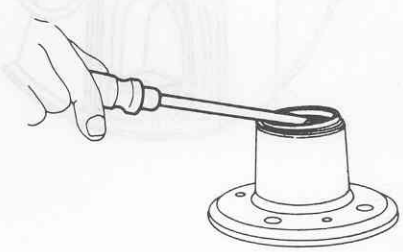
CAUTION:
Prevent shocks to bearing.

10. Back off 2 capscrews (1) securing wheel hub (2) to brake disc (3) and separate the two parts.

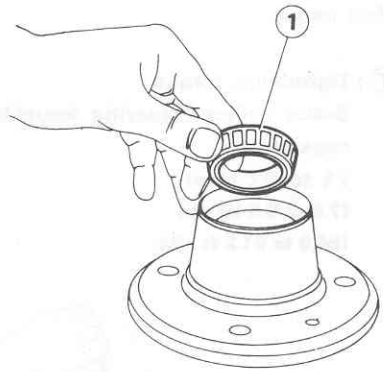


1 Capscrew
2 Wheel hub
3 Brake disc

11. Using a screwdriver, take off seal from hub.
When removed, the seal must be replaced.

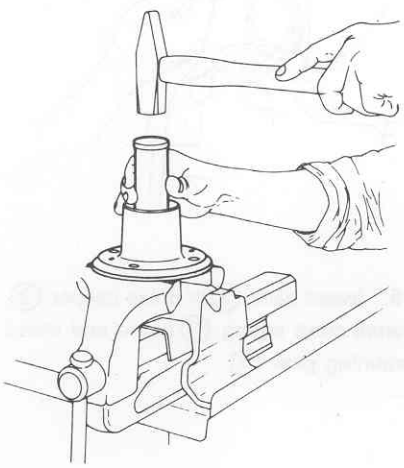


12. Take off inner bearing (1) from seat.

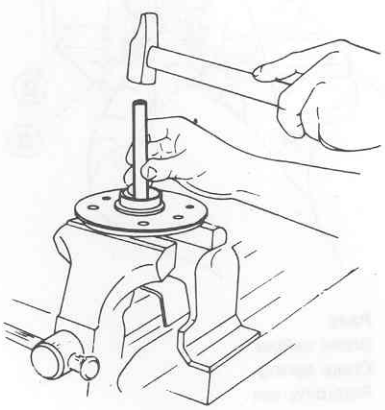


1 Inner bearing

13. Take off outer bearing cup.



14. Take off inner bearing cup.



INSPECTION

Thoroughly clean bearings and other parts and dry by blowing compressed air.

Wheel bearing

In case of pitting, roughness or ovality on race or taper roller surfaces, replace bearing.

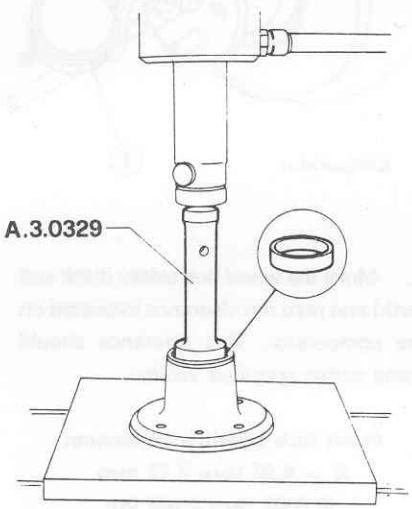
CAUTION:
Bearings must be replaced in pairs, i.e. both inner and outer.

Steering knuckle and hub

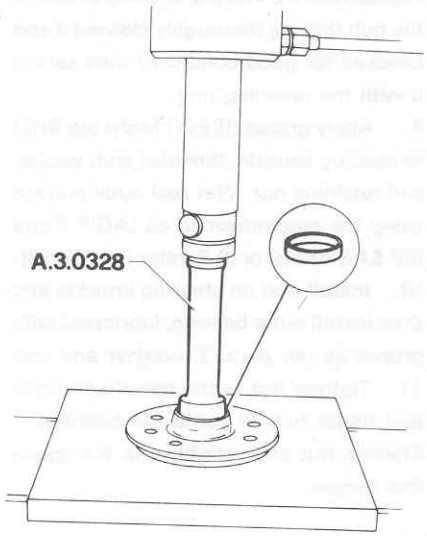
Check wheel hub and steering knuckle; replace damaged parts as necessary.

ASSEMBLY

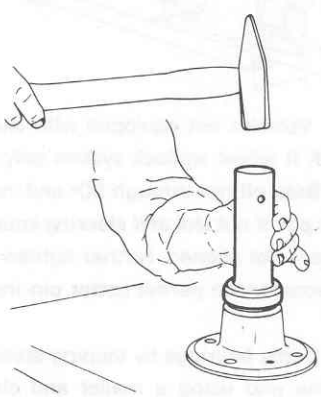
1. Using inserter **A.3.0329** with a press, install inner bearing cup on hub, pressing fully home.



2. Using inserter **A.3.0328** with a press, install outer bearing cup, pressing fully home.

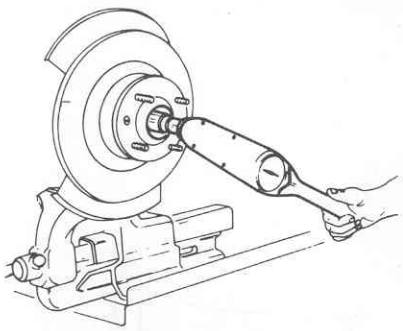


3. Lubricate bearing cups using bearing grease (AGIP Grease 33 FD or IP Autogrease FD) and pack hub recess with 50 g of grease. This quantity must not be exceeded otherwise bearing friction will result in overheating, grease leakage, etc.
4. Lubricate hub inner bearing using grease as per para. 3 and install.
5. Grease (ISECO Molykote BR2) the seal and install it on hub.



6. Install and secure splash guard through 3 nuts.
7. Secure brake disc to hub through 2 capscrews.
8. Vehicles equipped with (ABS) MARK II wheel antilock system only. Reassemble the impulse emitting wheel on the hub (having thoroughly cleaned it and checked for good condition) then secure it with the retaining ring.
9. Apply grease (ISECO Molykote BR2) to steering knuckle, threaded end, washer and retaining nut. Wet seal outer surface using the recommended oil (AGIP Rotra MP SAE 80W90 or IP Pontiax HD 80W90).
10. Install hub on steering knuckle and then install outer bearing, lubricated with grease as per para. 3, washer and nut.
11. Tighten nut to the specified torque and rotate hub to settle the bearings. Slacken nut and retighten to the specified torque.

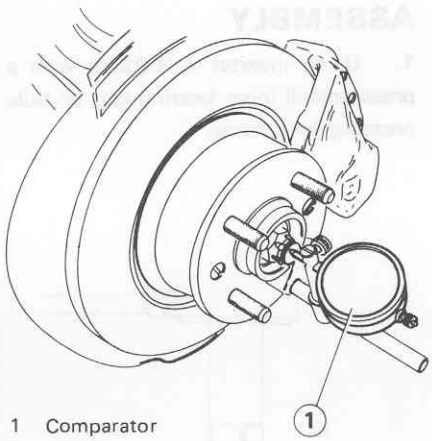
Ⓣ : **Tightening torques**
Wheel hub nut, first tightening stage
20 to 24 N·m
(2 to 2.5 kg · m)
(14.8 to 17.7 ft · lb)
Wheei hub nut, second tightening stage
5 to 10 N·m
(0.5 to 1 kg · m)
(3.7 to 7.4 ft · lb)



12. Vehicles not equipped with (ABS) MARK II wheel antilock system only.
a. Back off nut through 90° and insert cotter pin. If nut slot and steering knuckle hole are not aligned, further tighten nut as necessary to permit cotter pin insertion.
b. Settle bearings by tapping steering knuckle end using a mallet and check that washer is not locked (ensure that washer can be moved by slight pressure prising with a screwdriver between washer and hub).
If washer is locked, remove cotter pin and back off nut to insert cotter pin in a hole perpendicular to the hole previously used. Tap steering knuckle end with a mallet and recheck washer fit.
c. Bend cotter pin and install hub cover.
13. Vehicles equipped with (ABS) MARK II wheel antilock system only. Check front hub bearing clearance.

Front hub bearing clearance check

a. Install a comparator on a magnetic base (or suitable tool) so that it touches the steering knuckle axis (preload the comparator to 1 mm (0.04 in)).



1 Comparator

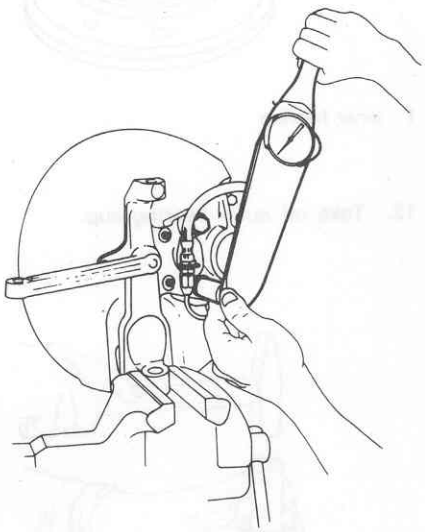
b. Move the wheel hub axially (back and forth) and read the clearance indicated on the comparator. This clearance should come within specified values.

Front hub bearing clearance:
G = 0.02 thru 0.12 mm
(0.0008 thru 0.005 in)

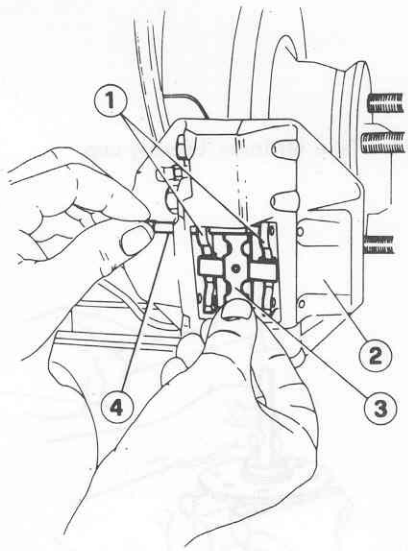
c. Re-position the cotter pin thus:
— If the clearance value is 0.02 thru 0.06 mm (0.0008 thru 0.002 in), back off nut until cotter pin is inserted.
— If the clearance value is 0.06 thru 0.12 mm (0.002 thru 0.005 in), screw on the nut until cotter pin is inserted.
d. Bend the cotter pin back and reassemble the hub cover.

14. Install brake caliper on steering knuckle by reversing the removal sequence and tighten two capscrews to the specified torque.

Ⓣ : **Tightening torque**
Brake caliper/steering knuckle capscrews
74 to 83 N·m
(7.5 to 8.5 kg · m)
(54.6 to 61.2 ft · lb)



15. Insert pads ① in brake caliper ②, install cross spring ③ home and insert retaining pins ④.



1 Pads
2 Brake caliper
3 Cross spring
4 Retaining pin

INSTALLATION

1. Position tools **A.2.0265** and **A.2.0069** as previously specified and load torsion bar to connect steering knuckle to both lower and upper links.
2. Install by reversing the removal sequence and following the instructions detailed below.
3. Tighten nut securing upper link ball joint to steering knuckle to the specified torque (see Inspection Specifications - Tightening Torques).
4. Tighten the following parts to the specified torque.

(T) : **Tightening torques**
Steering link ball joint/steering knuckle nut
45 to 55 N·m
(4.6 to 5.6 kg · lb)
(33.2 to 40.6 ft · lb)
Lower link ball joint/steering knuckle nut
45 to 55 N·m
(4.6 to 5.6 kg · m)
(33.2 to 40.6 ft · lb)

5. Vehicles equipped with (ABS) MARK II wheel antilock system only.
a. Re-install the impulse pick-up in reverse order of removal, observing the following tightening torques.

(T) : **Tightening torques**
Steering knuckle - impulse pick-up support securing nuts
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

Suspension upper link - impulse pick-up cable plate securing screw
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

b. Ensure that impulse pick-up cables have been well secured to their anchor points to avoid damage when vehicle is running.
c. Check the air gap between the impulse pick-ups removed and their respective impulse emitting wheels (see: Group 22 - Inspection Specifications - Checks and Adjustments - Adjustment of Air Gap between Impulse Pick-ups and Impulse Emitting Wheels).
6. Check car trim and front wheel geometrie (see: Group 00 - Car Model Specific Manual - Car Trim Check).

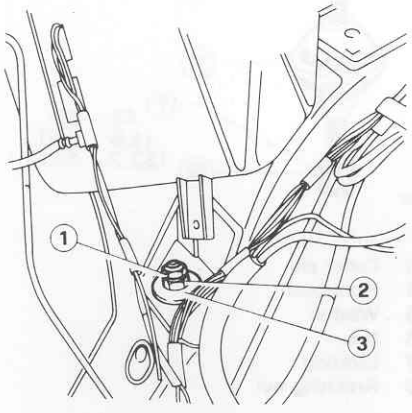
SHOCK ABSORBERS

REMOVAL

1. Place the car on a platform lift.

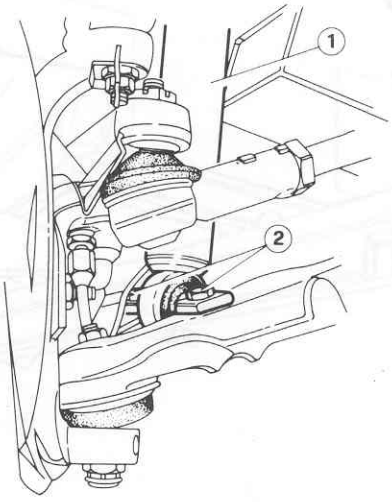
CAUTION:
Remove underhood components as necessary to gain access to nuts securing shock absorbers to body.

2. From engine compartment, detach shock absorbers from body by removing locknuts (1), nuts (2), washers (3) and associated rubber cushions.



1 Locknut
2 Nut
3 Washer

3. Raise car and disconnect shock absorbers (1) from lower links by backing off capscrews (2).



1 Shock absorbers
2 Capscrews

4. Remove shock absorbers.

INSPECTION

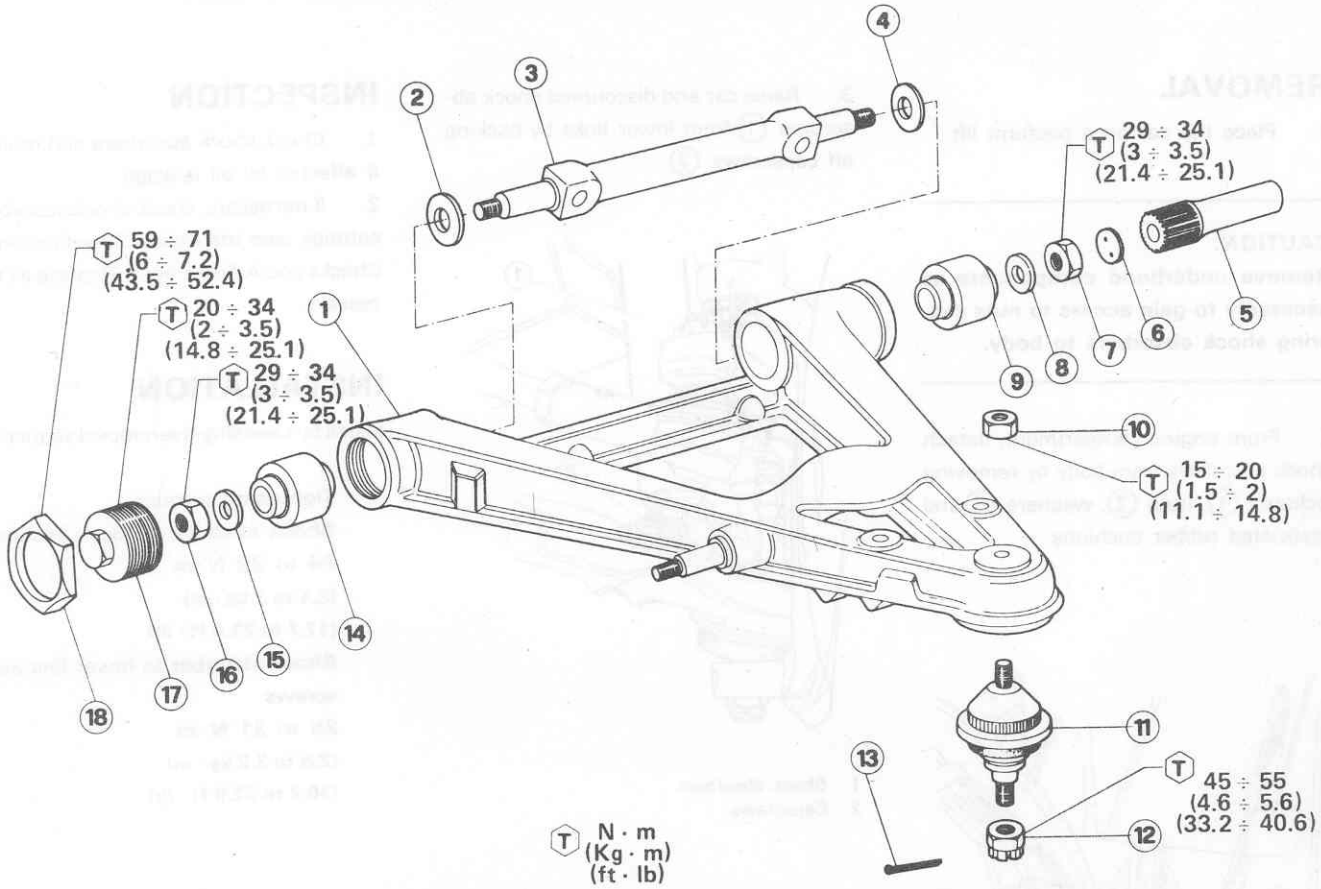
1. Check shock absorbers and replace if affected by oil leakage.
2. If necessary, check shock absorbers settings (see Inspection Specifications - Checks and Adjustments). Replace as necessary.

INSTALLATION

Install by reversing the removal sequence.

(T) : **Tightening torques**
Shock absorber to body locknut
24 to 29 N·m
(2.4 to 3 kg · m)
(17.7 to 21.4 ft · lb)
Shock absorber to lower link capscrews
25 to 31 N·m
(2.5 to 3.2 kg · m)
(18.4 to 22.9 ft · lb)

LOWER LINKS AND TORSION BARS

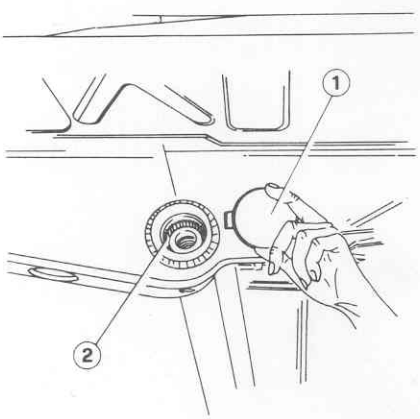


1 Lower link
2 Washer
3 Link support
4 Washer
5 Torsion bar
6 Plastic cover
7 Nut
8 Washer
9 Rear bush
10 Ball joint nut
11 Ball joint
12 Steering knuckle nut
13 Cotter pin
14 Front bush
15 Washer
16 Nut
17 Lockring
18 Retaining nut

REMOVAL

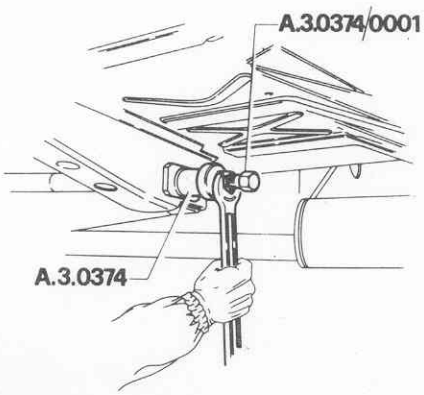
1. Proceed as specified in "Steering knuckles and Wheel hubs - Removal" up to para. 8 (excluding step 5).

2 Remove cover (1) from torsion bar seat (2).

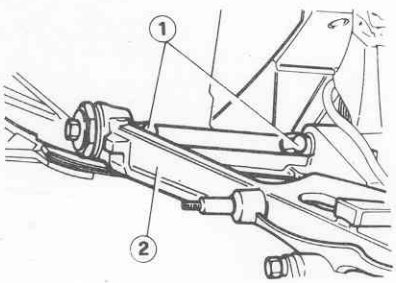


1 Cover
2 Torsion bar seat

3. Mark torsion bar at front and rear, install tool **A.3.0374** and nut along with forcing screw **A.3.0374/0001** and remove torsion bar from seat.



4. Back off bolts (1) and remove lower link (2) retrieving spacers.



1 Bolts
2 Lower link

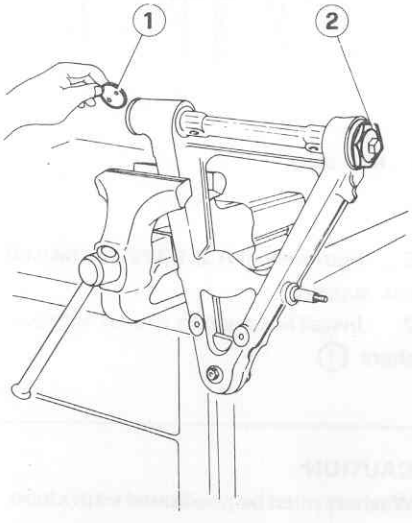
5. Take off torsion bar from the front.

CAUTION:
On cars provided with rear torsion bar connecting crossmember, carry out the following operations:
a. Proceed as specified under "Steering knuckles and Wheel hubs - Removal" up to para. 8 (excluding step 5).
b. Back off and remove rear cover from torsion bar crossmember, mark bars and associated seats, install tool A.3.0374 and take off torsion bar.
c. Remove lower link and torsion bar as specified in "Lower links and Torsion Bars - Removal", paragraphs 4 and 5.

LOWER LINK

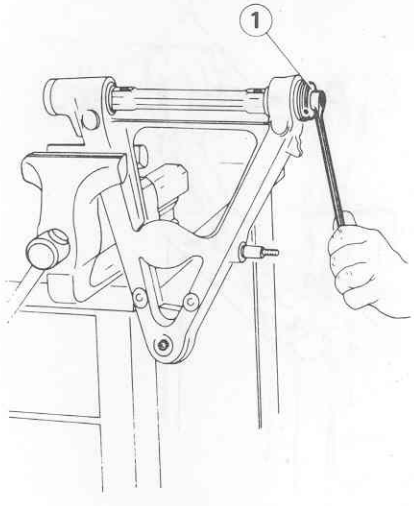
DISASSEMBLY

1. Clamp lower link in a vice, remove plastic cover (1) from torsion bar seat and back off nut (2).



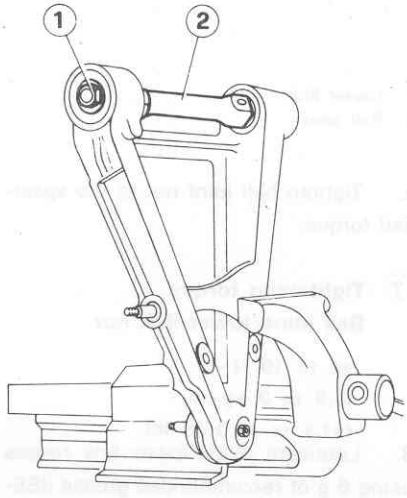
1 Plastic cover
2 Nut

2. Back off and remove lockring (1).



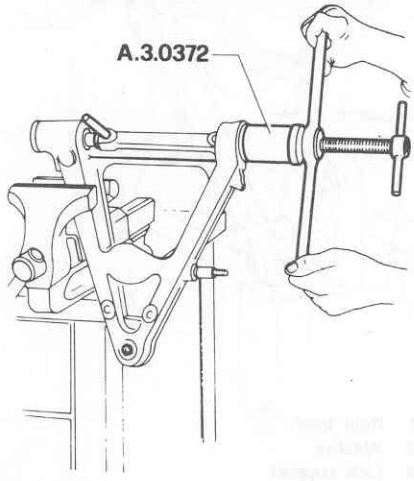
1 Lockring

3. Remove two nuts (1) and associated washers preventing support (2) rotation.

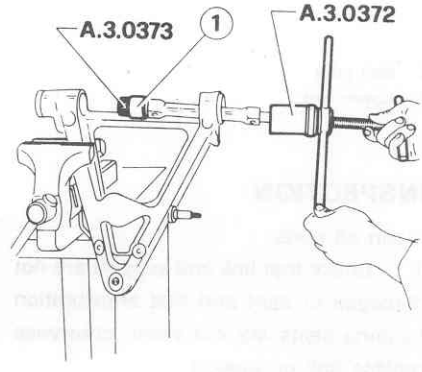


1 Nut
2 Link support

4. Install tool **A.3.0372** on link support front threaded spigot, take off front bush and retrieve associated washer.

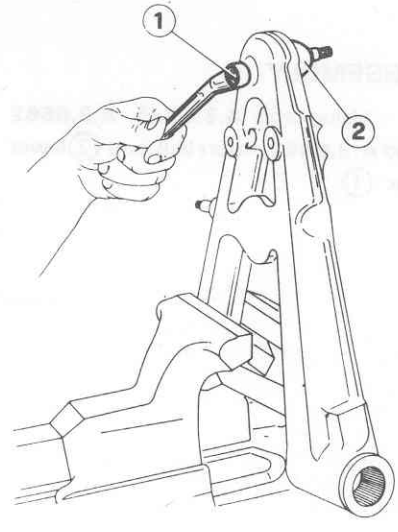


5. Position link support in seat, insert tool washer **A.3.0373** in torsion bar seat and secure on link support threaded spigot through a nut.
Tighten tool **A.3.0372** on link support front threaded spigot and take off rear bush (1).



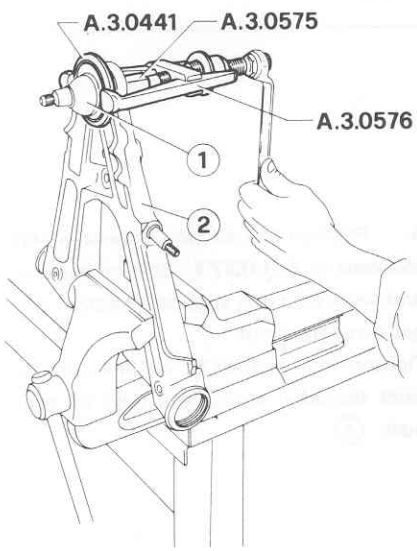
1 Rear bush

6. Back off ball joint (2) nut (1).



1 Nut
2 Ball joint

7. Using tools **A.3.0576, A.3.0575** and **A.3.0441**, take off ball joint (1) from link (2).



1 Ball joint
2 Lower link

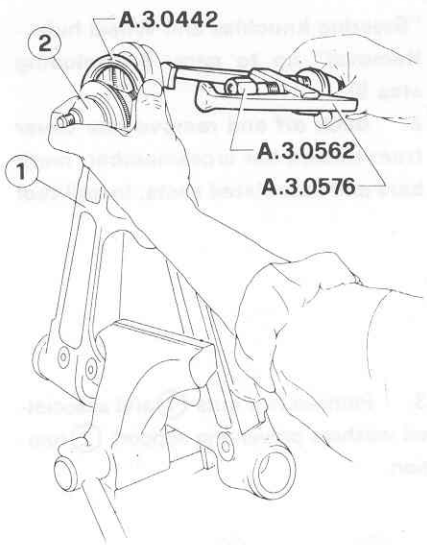
INSPECTION

Clean all parts.

1. Check that link and support are not damaged or bent and that antivibration bushing seats are not worn; otherwise replace link or support.
2. Replace ball joint if roughness or excessive play is detected.
3. Check anti-vibration bushings for damage; in particular, ensure that rubber components are not worn; replace as necessary.

ASSEMBLY

1. Using tools **A.3.0576, A.3.0562** and **A.3.0442**, insert ball joint (2) lower link (1).

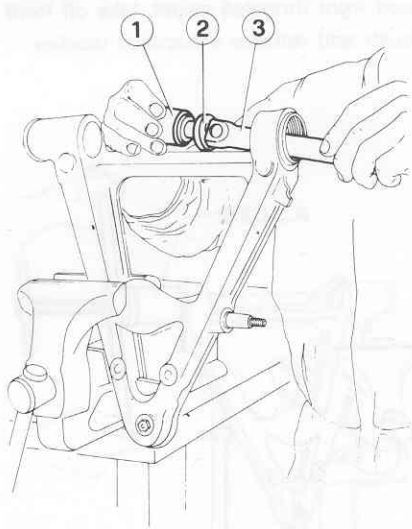


1 Lower link
2 Ball joint

2. Tighten ball joint nut to the specified torque.

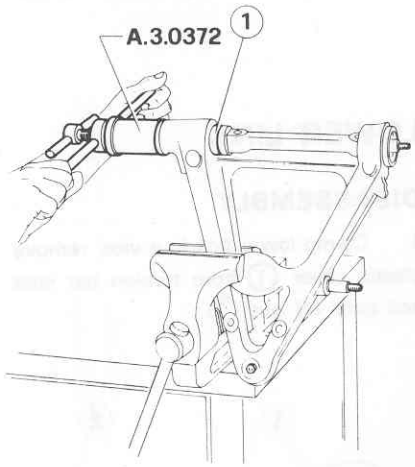
(T) : **Tightening torque**
Ball joint/lower link nut
15 to 19 N · m
(1.5 to 2 kg · m)
(11.1 to 14.0 ft · lb)

3. Lubricate bush/lower link recess using 6 g of recommended grease (ISECO Molykote Longterm no. 2).
4. Insert support (3), washer (2) of tool **A.3.0372** and rear bush (1) in link.



1 Rear bush
2 Washer
3 Link support

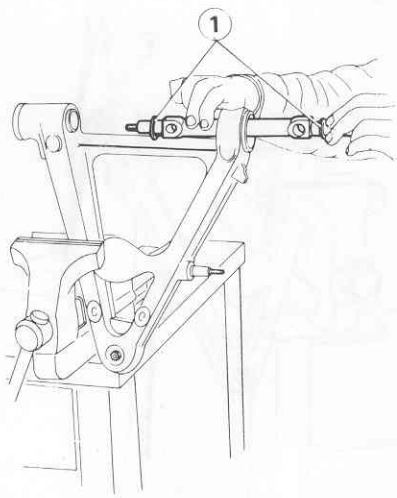
5. Tighten tool **A.3.0372** on link support rear threaded spigot and insert rear bush (1).



1 Rear bush

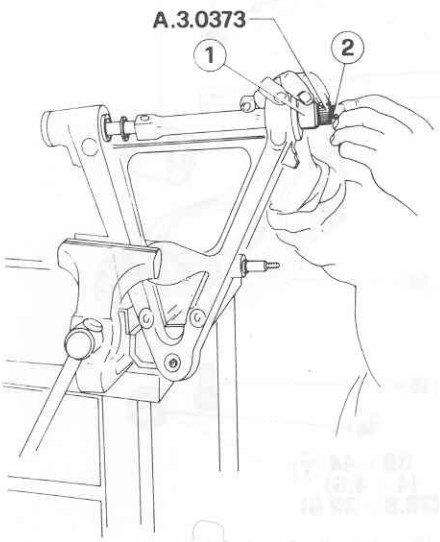
6. Retrieve tool **A.3.0372** and take off link support.
7. Install link support in seat with washers (1).

CAUTION:
Washers must be positioned with chamfer facing toward support.



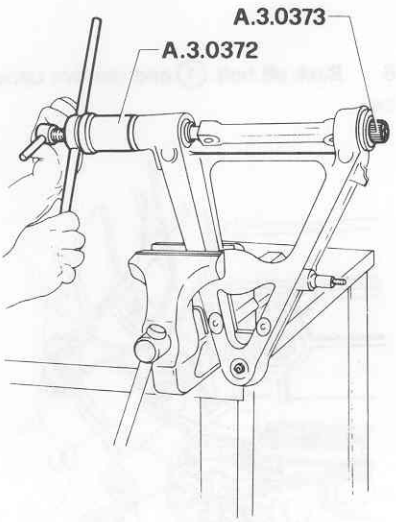
1 Washers

8. Move support forward, insert front bush (1) in support spigot, position tool washer **A.3.0373** on support spigot threaded end and secure through a nut (2).



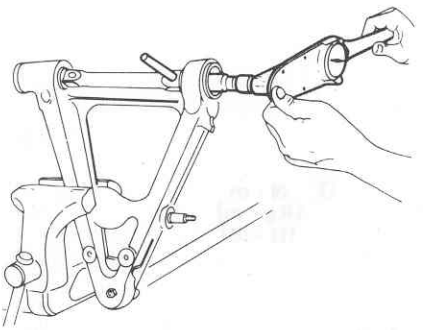
1 Front bush
2 Nut

9. Using tool **A.3.0372** insert front bush in seat and remove tool.



10. Insert two washers in threaded support ends, tighten two nuts to the specified torque, simultaneously preventing support rotation.

(T) : Tightening torque
Lower link support end nut
30 to 34 N·m
(3 to 3.5 kg·m)
(22.1 to 25.1 ft·lb)



11. Tighten lockring on link to the specified torque.

(T) : Tightening torque
Lower link lockring
20 to 34 N·m
(2 to 3.5 kg·m)
(14.8 to 25.1 ft·lb)

12. Tighten lockring nut to the specified torque.

(T) : Tightening torque
Lower link lockring nut
59 to 70 N·m
(6 to 7.2 kg·m)
(43.5 to 51.6 ft·lb)

13. Insert plastic cover in torsion bar seat.

INSTALLATION

Install by reversing the removal sequence and following the instructions given below.

- Before inserting torsion bar in seat, apply the recommended grease (R. GORI Never Seez) on seat and torsion bar splines.

CAUTION:
Ensure that plastic cover is in position on lower link splined seat.

- On bar assembly align reference marks applied on disassembly, and match colour references.

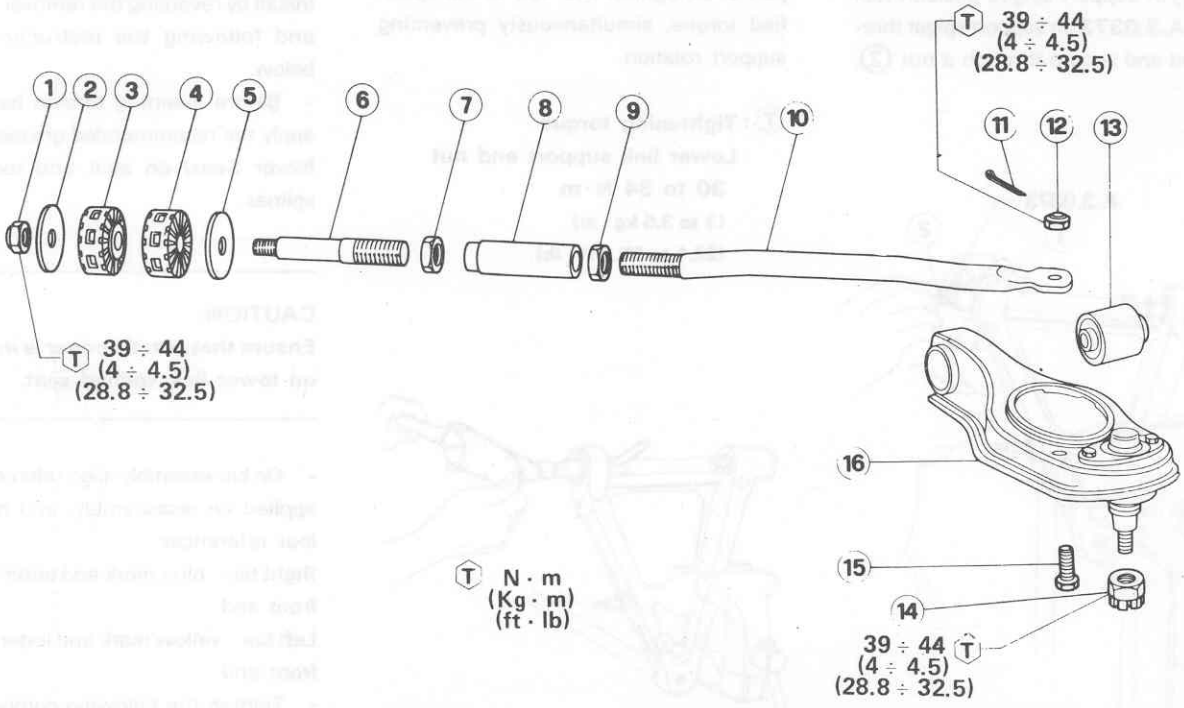
Right bar - blue mark and letter D or R on front end.
Left bar - yellow mark and letter S or L on front end

- Tighten the following components to the specified torque.

(T) : Tightening torques
Lower link/body bolts
64 to 74 N·m
(6.5 to 7.5 kg·m)
(47.2 to 54.6 ft·lb)

Lower link ball joint/steering knuckle nut
45 to 55 N·m
(4.6 to 5.6 kg·m)
(33.2 to 40.6 ft·lb)

UPPER LINKS AND TIE RODS

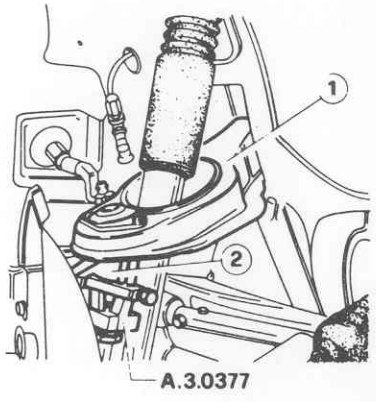


1 Nut
2 Washer
3 Bump block
4 Bump block
5 Washer
6 Outer pin
7 Nut
8 Bushing
9 Nut
10 Inner pin
11 Cotter pin
12 Self locking nut
13 Anti vibration bushing
14 Nut
15 Capscrew
16 Upper link

UPPER LINKS

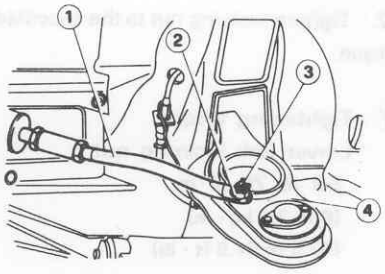
REMOVAL

1. Proceed as specified in "Steering knuckles and Wheel hubs - Removal" up to para. 6.
2. Remove cotter pin, back off nut and disconnect upper link (1) from steering knuckle (2) using tool **A.3.0377**.



1 Upper link
2 Steering knuckle

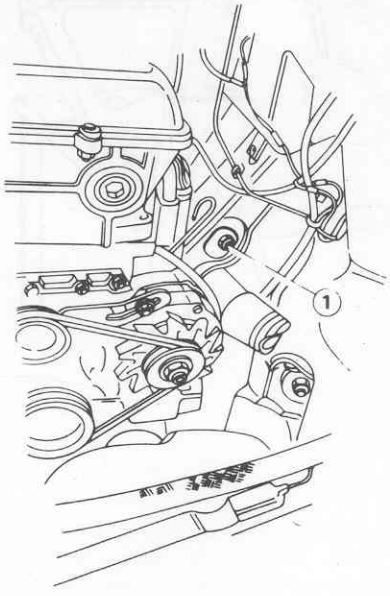
3. Lower the column lift to unload lower link previously loaded.
4. Remove shock absorber (see Shock Absorbers - Removal).
5. Remove cotter pin (3), back off nut (2) and disconnect tie rod (1) from link (4).



1 Tie rod
2 Nut
3 Cotter pin
4 Upper link

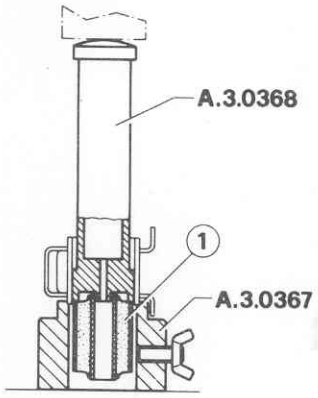
CAUTION:
On cars not provided with bolt securing upper link to tie rod, to remove link, disconnect tie rod from body as specified in "Tie rod - Removal".

6. Back off bolt (1) and remove upper link.



1 Bolt

7. If necessary, take off anti-vibration bushing (1) at the press using tools **A.3.0367** and **A.3.0368**.



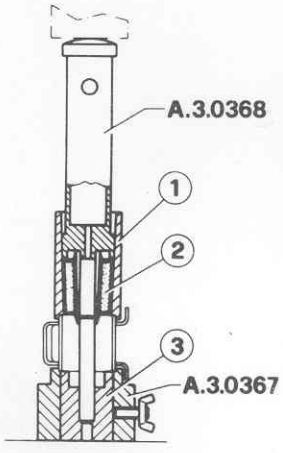
1 Anti-vibrating bushing

INSPECTION

1. Check upper link for damage or distortion and anti-vibration bushing seat for wear; replace as necessary.
2. Replace ball joint if affected by roughness or excessive play.
3. Check that anti-vibration bushing is not damaged and in particular that the rubber portion is not worn; otherwise replace as necessary.

INSTALLATION

1. If previously removed, install anti-vibration bushing (2) using tool **A.3.0367** at the press (with adapter (3) and lead in taper (1)) and tool **A.3.0368**.



1 Lead-in taper
2 Anti-vibration bushing
3 Inner adapter

CAUTION:
Insert anti-vibration bushing from chamfered side.

2. Apply the recommended lubricant (R. GORI Never Seez) on bolt securing upper link to body.
3. Connect upper link to body through securing bolt.
4. Raise upper link by 1 to 2 mm and tighten kink bolt and tie rod nut to the specified torque.

(T) : **Tightening torques**
Upper link/body securing bolt
39 to 44 N·m
(4 to 4.5 kg · m)
(28.8 to 32.5 ft · lb)
Tie rod/upper link retaining nut
39 to 44 N·m
(4 to 4.5 kg · m)
(28.8 to 32.5 ft · lb)

5. Install by reversing the removal sequence.
6. Vehicles equipped with (ABS) MARK II wheel antilock system only.
a. Re-install the impulse pick-up in reverse order of removal, observing the following tightening torques.

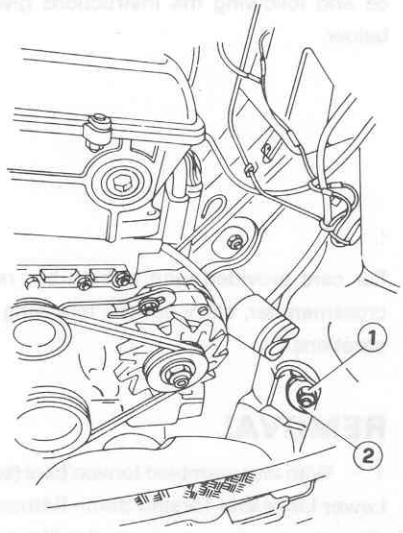
(T) : **Tightening torques**
Steering knuckle - impulse pick-up support securing nuts
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)
Suspension upper link - impulse pick-up cable plate securing screw
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

b. Ensure that impulse pick-up cables have been well secured to their anchor points to avoid damage when vehicle is running.
c. Check the air gap between the impulse pick-ups removed and their respective impulse emitting wheels (see: Group 22 - Inspection Specifications - Checks and Adjustments - Adjustment of Air Gap between Impulse Pick-ups and Impulse Emitting Wheels).

TIE RODS

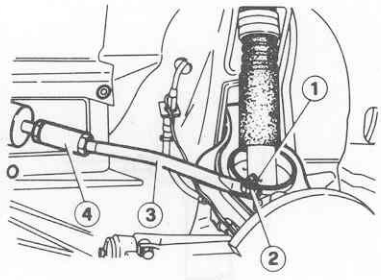
REMOVAL

1. Place car on a platform lift.
2. From engine compartment, remove nut (1) retrieving washer (2) and rubber cushion.



1 Nut
2 Washer

3. Raise lift, remove cotter pin (1) and back off nut (2). Remove tie rod (3).



1 Cotter pin
2 Nut
3 Tie rod
4 Bush

CAUTION:
On cars not provided with a bolt securing tie rod to upper link, remove tie rod/upper link assy (see: Upper Link - Removal).

INSPECTION

Check tie rod for distortion or damage, and bump clocks for wear, replace any damaged parts as necessary.

INSTALLATION

Install by reversing the removal sequence and following the instructions given below.

- Adhere to the specified tightening torques.

Ⓣ : **Tightening torque**
Tie rod to body nut
Tie rod to upper link nut
39 to 44 N·m
(4 to 4.5 kg·m)
(28.8 to 32.5 ft·lb)

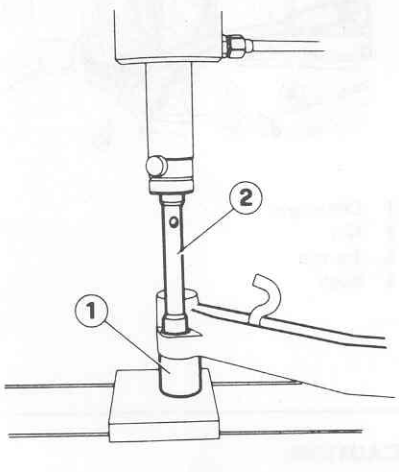
- Check car trim and caster angle (See: Group 00 - Car Model Specific Manual - Car Trim Check).

REAR CROSSMEMBER

For cars provided with torsion bar rear crossmember, carry out the following operations.

REMOVAL

1. With disassembled torsion bars (see: Lower Links and Torsion Bars - Removal) disconnect exhaust piping flexible supports, back off bolts securing crossmember to chassis and take off crossmember.
2. If necessary, take off anti-vibration bushings at the press using a bolster ① and a driver ②.



1 Bolster
2 Driver

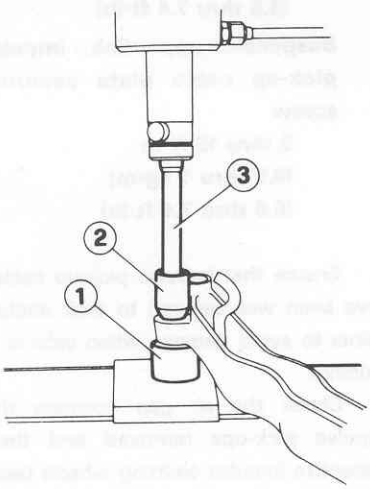
INSPECTION

Clean all parts.

1. Check that crossmember is not damaged or bent, torsion bar and anti-vibration bushing seats are not worn; replace crossmember if necessary.
2. Check that anti-vibration bushings are not damaged and, in particular, that rubber components are not worn; replace as necessary.

INSTALLATION

1. If previously removed, install anti-vibration bushings at the press using bolster ①, lead-in taper ② and driver ③.



1 Bolster
2 Lead-in taper
3 Driver

2. For installation reverse the removal sequence.

Ⓣ : **Tightening torques**
Torsion bar connecting crossmember nuts
64 to 74 N·m
(6.5 to 7.5 kg·m)
(47.2 to 54.6 ft·lb)

INSPECTION SPECIFICATIONS

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Description	Type	Recommended product	Quantity
Wheel hub recess	GREASE	AGIP: Grease 33 FD IP: Autogrease FD Par. no. 3671-69833	50 g 1.76 oz.
Hub sealing ring lip and steering knuckle contact surface.	GREASE	ISECO: Molykote BR2 Part. no. 3671-69841	—
Hub sealing ring outer surface	OIL	AGIP: Rotra MP SAE 80W90 IP: Pontiax HD 80W90 Part. no. 3671-69408	Wet
Anti-roll bar cushion pad inner surface	GREASE	ISECO: Ergon Rubber Grease n. 3 SPCA: Spagraph REINACH: Sferul B2AR Part. no. 3671-69816	Wet
Torsion bar serrations Upper links to body screws Anti-roll bar supports (on lower links)	FLUID	R. GORI: Never Seez - Antigrippante Part. no. 3671-69850	—
Bush/lower link recess	GREASE	ISECO: Molykote Longterm n. 2 Part. no. 3671-69831	6 g 0.21 oz.

CHECKS AND ADJUSTMENTS

TORSION BARS

Left bar yellow mark Part. no.	Right bar blue mark Part. no.	Length mm (in)	Diameter ϕ mm (in)	Minimum trim correction for a tooth mm (in)
11611.21.505.00	11610.21.506.00	989±2 (38.9 ±0.1)	18.4 (0.72)	1.5 (0.06)
11656.21.505.00	11655.21.506.00	989±2 (38.9 ± 0.1)	19.5 (0.77)	1.5 (0.06)
11691.21.505.00	11636.21.506.00	989±2 (38.9 ± 0.1)	21.1 (0.83)	2 (0.08)
16200.21.X15.00	16200.21.X16.00 (*)	931±2 (36.7 ± 0.1)	21.8 (0.86)	2 (0.08)
11642.21.505.00	11642.21.506.00	989±2 (38.9 ± 0.1)	22.1 (0.87)	2 (0.08)
11907.21.505.00	11913.21.506.00	1108±2 (43.6 ± 0.1)	22.6 (0.89)	2 (0.08)
16218.21.X15.00	16218.21.X16.00 (*)	931±2 (36.7 ± 0.1)	22.8 (0.90)	2.5 (0.10)
11660.21.505.00	11659.21.506.00	989±2 (38.9 ± 0.1)	23.4 (0.92)	2.5 (0.10)

* For cars with a 3 piece welded sheet plate crossmember.

FRONT WHEEL GEOMETRY

For Alfa 90 see Print no. PA360500000000 - Workshop Manual Alfa 90 - Unit 00 - Mechanical Components and Body Maintenance - Wheel Alignment Data.

For Alfa 75 see Print no. PA371400000000 - Workshop Manual Alfa 75 - Unit 00 - Mechanical Components and Body Maintenance - Wheel Alignment Data.

	Alfetta	Giulietta GTV 2.0	GTV 6 2.5
Toe-out (α)	9′	9′	9′
Caster (γ) (Max. difference between right and left wheels)	3° ± 30′ 20′	3° 30′ ± 30′ 20′	3° 30′ ± 30′ 20′
Camber (β) (Max. difference between right and left wheels)	−20′ ± 30′ 40′	−30′ ± 30′ 40′	1° ± 30′ 40′

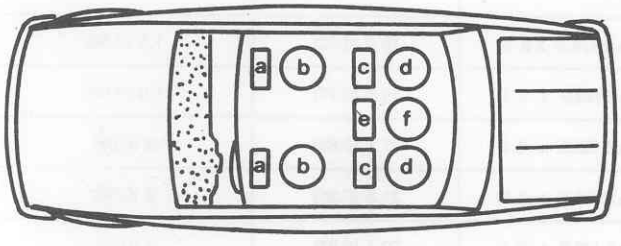
VEHICLE TRIM

For Alfa 90 see Print no. PA360500000000 - Workshop Manual - Alfa 90 - Unit 00 - Mechanical Components and Body Maintenance - Vehicle trim.

For Alfa 75 see Print no. PA371400000000 - Workshop Manual Alfa 75 - Unit 00 - Mechanical Components and Body Maintenance - Vehicle trim.

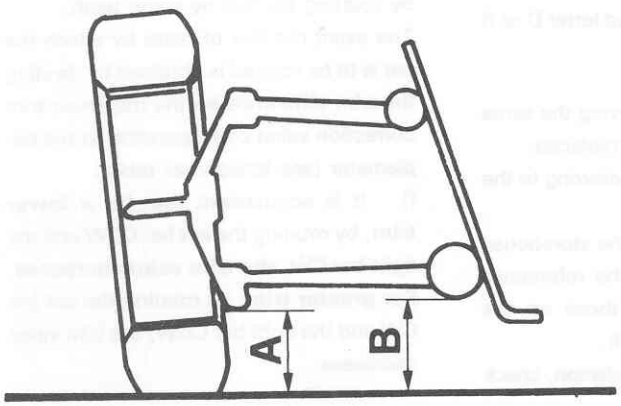
Vehicle loading diagram for trim check

Note: Trim check must be carried out with vehicle in kerb weight conditions.



	Alfetta	Giulietta	GTV 2.0 GTV 6 2.5
a	25 kg (55 lb)	25 kg (55 lb)	25 kg (55 lb)
b	50 kg (110 lb)	50 kg (110 lb)	50 kg (110 lb)
c	25 kg (55 lb)	25 kg (55 lb)	
d	50 kg (110 lb)	50 kg (110 lb)	
e			25 kg (55 lb)
f			50 kg (110 lb)

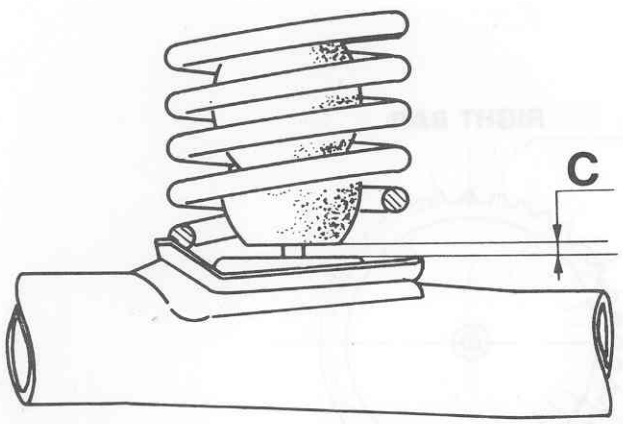
Front trim



B - A = 44 ± 5 mm (1.73 ± 0.2 in)

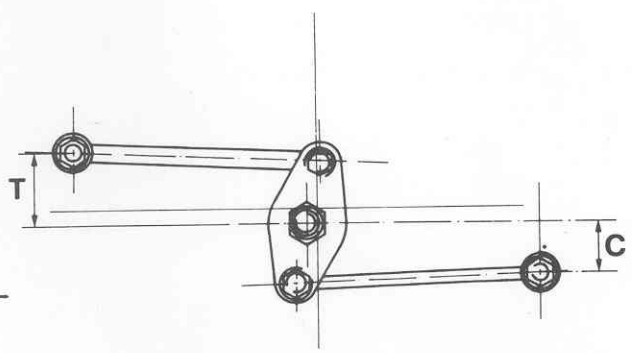
Rear trim

— Alfetta and models featuring bump blocks co-axial with shock absorbers.



C = 44 ± 5 mm (1.73 ± 0.2 in)

— Giulietta GTV 2.0 and GTV 6 2.5



	Giulietta	GTV 2.0 GTV 6 2.5
T	83 ± 5 mm (3.27 ± 0.2 in)	71 ± 5 mm (2.8 ± 0.2 in)
C	−13 ± 5 mm (−0.51 ± 0.2 in)	−25 ± 5 mm (−0.98 ± 0.2 in)

BASIC BAR REPLACEMENT

Foreword

Front trim adjustment is accomplished by rotating the torsion bars with respect to reference notes on the front links and rear cross member.

The different number of serrations (35 at the front, 34 and the rear) allows small trim corrections (about 1.5 - 2 - 2.5 mm depending on bar diameter) to be made by repositioning by one tooth at both ends.

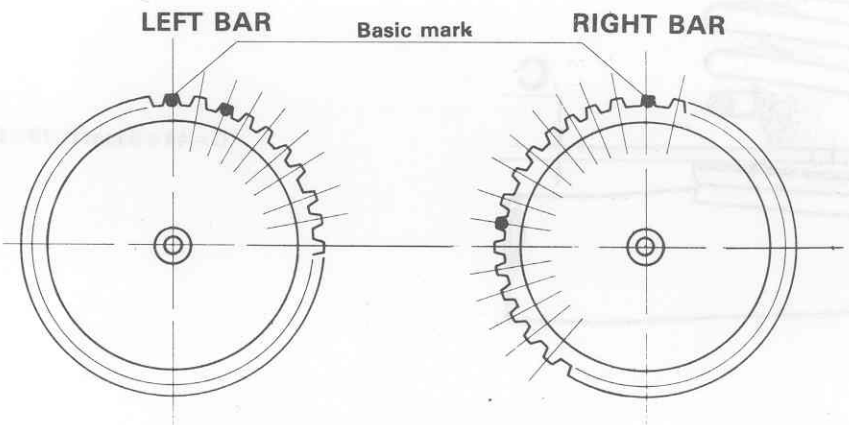
Consequently, torsion bar subdivision has been based on diameter rather than vehicle type. A mark, known as the "basic mark" has been put on both ends of the bars.

When operating on the bars, take care not to switch them over, by observing, during assembly, the following marks:

- left bar, yellow mark and letter S or L
- right bar, blue mark and letter D or R

Basic bar installation

a) Choose a basic bar having the same diameter as the one to be replaced.
b) Trace the part no. by referring to the torsion bar table.
c) Take a new bar from the storehouse then install it by aligning the references on the basic marks with those on the crossmember and lower link.
d) Having completed installation, check the trim as per normal procedure, bearing in mind that with a new torsion bar the trim value is 5 mm greater than the normal one.
e) In the event of incorrect trim, adjust by rotating the bar by some teeth.
The exact number of teeth by which the bar is to be rotated is obtained by dividing the trim difference by the minimum trim correction value corresponding to the bar diameter (see torsion bar table).
f) It is emphasized that for **a lower trim**, by rotating the left bar CCW and the right bar CW, **the trim value increases**.
For greater trim: by rotating the left bar CW and the right bar CCW, the trim value decreases.



Rear view (crossmember side)

SHOCK ABSORBER CALIBRATION AND PAIRING

On all vehicles front and rear shock absorbers must be paired as indicated in the calibration table.

CAUTION:
In case of substitution, the shock-absorber mounted on the vehicle should always be replaced with those of the some Trade Mark (Spica or Boge).

Front

values in [N (kg)] (lb)

Car type		Alfa 90 Super / Alfa 75 / 75	Alfa 75 6V iniezione / Alfa 75 turbo / 75 6V 2.5 / 75 6V 3.0	Alfa 90 / Alfa 90 Super / Alfa 75 / and 75 other models	Alfetta / Giulietta	GTV 2.0 / GTV 6 2.5
Part. no.		161.18.21.072.04	161.18.21.072.03	113.21.21.072.01	116.50.21.070.01	113.19.21.072.01
Low speed	Compression	140 to 220 (14.3 to 22.4) (31.5 to 49.5)	230 to 310 (23.4 to 31.6) (51.7 to 69.7)	170 to 250 (17.3 to 25.5) (38.2 to 56.2)	130 to 250 (13.3 to 25.5) (29.2 to 56.2)	230 to 310 (23.4 to 31.6) (51.7 to 69.7)
	Rebound	550 to 650 (56.1 to 66.3) (123.6 to 146.1)	550 to 650 (56.1 to 66.3) (123.6 to 146.1)	500 to 600 (51 to 61.2) (112.4 to 134.9)	250 to 440 (25.5 to 44.9) (56.2 to 98.9)	550 to 650 (56.1 to 66.3) (123.6 to 146.1)
High speed	Compression	550 to 670 (56.1 to 68.3) (123.6 to 150.6)	580 to 720 (59.1 to 73.4) (130.4 to 161.9)	450 to 590 (45.9 to 60.1) (101.2 to 132.6)	380 to 560 (38.7 to 57.1) (85.4 to 125.9)	580 to 720 (59.1 to 73.4) (130.4 to 161.9)
	Rebound	1600 to 1800 (163.1 to 183.5) (359.7 to 404.6)	1850 to 2050 (188.4 to 209) (415.9 to 460.8)	1400 to 1600 (142.7 to 163.1) (314.7 to 359.7)	1000 to 1370 (101.9 to 139.7) (224.8 to 308)	1850 to 2050 (188.4 to 209) (415.9 to 460.8)

Rear

values in [N (kg)] (lb)

Car type		Alfa 90 / Alfa 90 Super / Alfa 75 / 75		Alfetta / Giulietta	GTV 2.0 / GTV 6 2.5
Part. no.		162.00.25.072.02	(*) 162.00.25.072.05	116.00.25.070.23	113.19.25.072.00
Low speed	Compression	110 to 190 (11.2 to 19.4) (24.7 to 42. 7)	90 to 170 (9.2 to 17.3) (20.2 to 38.2)	70 to 170 (7.1 to 17.3) (15.7 to 38.2)	230 to 310 (23.4 to 31.6) (51.7 to 69.7)
	Rebound	110 to 190 (11.2 to 19.4) (24.7 to 42.7)	180 to 280 (18.3 to 28.5) (40.5 to 62.9)	110 to 290 (11.2 to 29.6) (24.7 to 65.2)	550 to 650 (56.1 to 66.3) (123.6 to 146.1)
High speed	Compression	420 to 520 (42.8 to 53) (94.4 to 116.9)	310 to 450 (31.6 to 45.9) (69.7 to 101.1)	240 to 410 (24.5 to 41.8) (54 to 92.2)	580 to 720 (59.1 to 73.4) (130.4 to 161.9)
	Rebound	1090 to 1270 (111.1 to 129.5) (245 to 285.5)	1060 to 1260 (108.1 to 128.4) (238.3 to 283.2)	890 to 1350 (90.7 to 137.6) (200 to 303.5)	1850 to 2050 (188.4 to 209) (415.9 to 460.8)

(*) The A.R. part number 162.00.25.072.05 shock-absorbers substitute the A.R. part number 117.01.25.070.02. ones. The new type shock-absorbers can be installed on vehicles already equipped with old type ones.
In case of an old type shock-absorber replacement, it will be necessary to substitute the new upper rubber rebound bumper with the old one (if not damaged). Otherwise it is necessary the total replacement of the old shock-absorber pair.

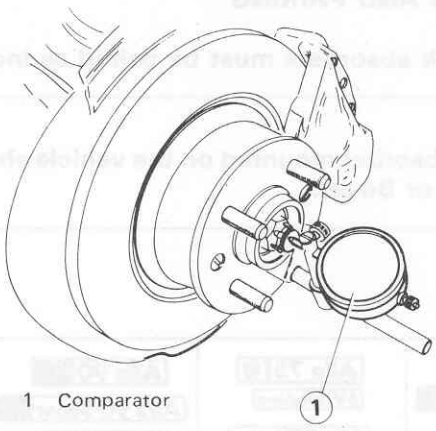
FRONT WHEEL HUB BEARING CLEARANCE CHECK (*)

a. Slacken nuts securing front wheel concerned.

b. Raise the front of the vehicle and rest it on stands; remove the wheel.

c. Remove hub cover.

d. Install a comparator on a magnetic base (or suitable tool) so that it touches the steering knuckle axis (preload the comparator to 1 mm (0.04 in)).



1 Comparator

e. Move the wheel hub axially (back and forth) and read the clearance indicated on the comparator.

This clearance should come within specified values.

Front hub bearing clearance
G = 0.02 thru 0.12 mm
(0.0008 thru 0.005 in)

(*) Vehicles equipped with (ABS) MARK II wheel antilock braking system.

TIGHTENING TORQUES

Description	[N·m (kg·m) (ft·lb)]
Nut, wheel hub (stage 1)	20 to 24 (2 to 2.5) (14.8 to 17.7)
Nut, wheel hub (stage 2)	5 to 10 (0.5 to 1) (3.7 to 7.4)
Nut, lower link support end	29 to 34 (3 to 3.5) (21.4 to 25.1)
Lockring, lower link	20 to 34 (2 to 3.5) (14.8 to 25.1)
Nut, lower link lockring	59 to 71 (6 to 7.2) (43.5 to 52.4)
Nut, ball joint to lower link	15 to 20 (1.5 to 2) (11.1 to 14.8)
Nuts, lower link support to chassis	64 to 74 (6.5 to 7.5) (47.2 to 54.6)
Nut, lower link ball joint to steering knuckle	44 to 54 (4.5 to 5.5) (32.5 to 39.8)
Nut, upper link ball joint to steering knuckle	
– Rims with four securing screws	80 to 90 (8.2 to 9.2) (59 to 66.4)
– Rims with five securing screws	45 to 55 (4.6 to 5.6) (33.2 to 40.6)
Nut, upper link to chassis	39 to 44 (4 to 4.5) (28.8 to 32.5)
Nut, tie rod to chassis	39 to 44 (4 to 4.5) (28.8 to 32.5)
Nut, tie rod to upper link	39 to 44 (4 to 4.5) (28.8 to 32.5)
Nuts, torsion bar connecting crossmember	64 to 74 (6.5 to 7.5) (47.2 to 54.6)
Locknut, shock absorber to chassis	24 to 29 (2.4 to 3) (17.7 to 21.4)
Capscrews, shock absorber to lower link	25 to 31 (2.5 to 3.2) (18.4 to 22.9)
Nut, anti-roll bar conn. rod (on lower link)	18 to 23 (1.8 to 2.3) (13.3 to 17)
Capscrews, anti-roll bar cushion pads	25 to 29 (2.5 to 3) (18.4 to 21.4)
Capscrews, front brake caliper to steering knuckle	74 to 83 (7.5 to 8.5) (54.6 to 61.2)
Nut, steering link ball joint to steering knuckle	45 to 55 (4.6 to 5.6) (33.2 to 40.6)
Steering knuckle - impulse pick-up support securing nuts (1)	9 to 10 (0.9 to 1) (6.6 to 7.4)
Suspension upper link - impulse pick-up cable plate securing screw (1)	9 to 10 (0.9 to 1) (6.6 to 7.4)

(1) Vehicles equipped with (ABS) MARK II wheel antilock braking system.

TROUBLESHOOTING

Fault	Cause	Remedy
Shock, vibration or shimmy	- Shocks on steering wheel from road feedback. May be caused by excessive pinion rack backlash or steering components play.	
	- Steering wheel oscillation may be due to steering linkage play or pinion rack backlash, or front wheel vibration.	
	- Shimmy is a high frequency oscillation transmitted to steering wheel and often occurs at particular vehicle speeds.	
	• Incorrect tyre inflation pressure	Inflate correct tyre
	• Wheel unbalance or rim distortion	Balance or repair
	• Worn tyres or loose wheel screws	Replace or tighten
	• Worn suspension ball joint	Replace ball joint
	• Incorrect pinion-rack backlash	Adjust backlash
	• Failed suspension linkage rubber bushings	Replace bushings
	• Excessive steering linkage play	Check and replace as necessary
	• Loose steering box screws	Tighten screws
	• Loose or defective shock absorber	Tighten or replace
Car wanders	- This fault is detected with the car on the move on a level road by taking hands off the steering wheel. See also: Group 25 - Troubleshooting.	
	• Worn or defective tyres	Replace tyres
	• Incorrect tyre pressure and/or loose wheel screws	Inflate to correct pressure and/or tighten
	• Different tread wear on right and left tyres	Replace tyre with shallower tread
	• Asymmetric car trim	Adjust trim
	• Incorrect wheel geometry	Adjust
	• Brakes binding	Check and repair
	• Worn suspension rubber bushings	Replace worn parts
	• Damaged steering-suspension connection	Replace defective parts

Fault	Cause	Remedy
Excessive steering wheel play	• Incorrect pionion rack backlash	Adjust
	• Worn steering components	Replace worn parts
	• Loose steering box screws	Tighten
Noise	• Incorrect tyre pressure	Inflate to correct pressure
	• Damaged and worn ball joints or steering components. Insufficient lubrication	Replace or lubricate
	• Loose steering linkage or suspension fasteners	Tighten
	• Defective shock absorbers	Replace
	• Inefficient wheel bearings	Replace
	• Inefficient suspension bushings	Replace
	• Damaged torsion bars	Replace
	• Loose shock absorber nut	Tighten
Tyres squeal on corners	• Incorrect tyre pressure	Inflate to correct pressure
	• Incorrect wheel geometry	Adjust
	• Incorrect driving	Avoid incorrect driving
Uneven tyre wear	- See Group 28 - Wheels and tyres.	
Steering wheel binding	• Incorrect tyre pressure	Inflate to correct pressure
	• Worn tyres	Replace
	• Incorrect pinion rack backlash	Adjust
	- After these preliminary operations, if fault persists check and operate as follows: Raise vehicle front end using a jack and apply stands. Detach steering linkage from steering knuckle and move steering wheel. a) If steering wheel movement is light, check steering linkage or suspension. b) If steering wheel binds, check steering box or steering column.	
	• Incorrect steering box lubrication and/or contaminated lubricant	Lubricate or change lubricant

Fault	Cause	Remedy
	• Incorrect steering linkage lubrication, contaminated grease or abnormal steering wear	Lubricate correctly, change grease or replace worn parts
	• Worn or seized ball joint	Replace
	• Distorted steering linkage	Replace
	• Incorrect wheel geometry	Adjust

SPECIAL TOOLS

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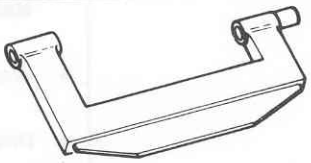
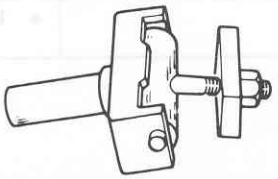
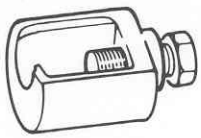
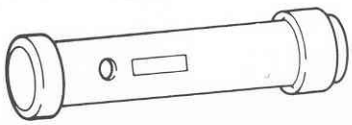
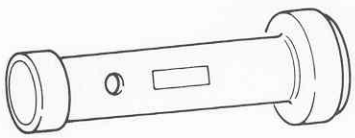
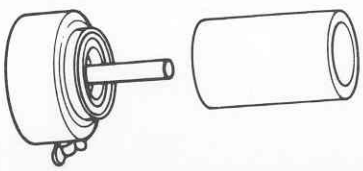
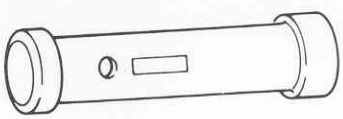
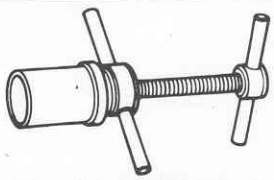
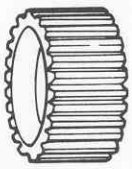
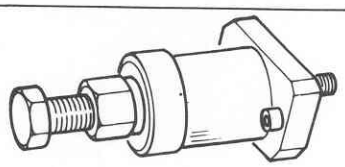
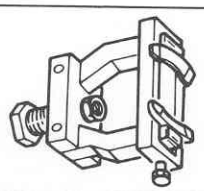
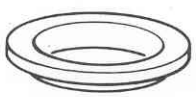
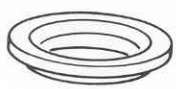
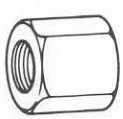
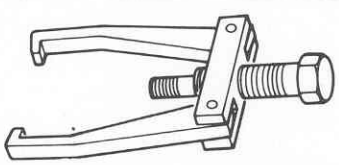
A.2.0069	Support, torsion bar load/unload (use with A.2.0265) 	21-4/1 21-8/1
A.2.0265	Loader/unloader, torsion bars (use with A.2.0069) 	21-4/1 21-8/1
A.3.0156	Puller, steering knuckle upper pins 	21-5
A.3.0328	Installer, front hub outer bearing cup 	21-7
A.3.0329	Installer, front hub inner bearing cup 	21-7
A.3.0367	Bolster, upper link anti-vibration bushing removal/installation (use with A.3.0368) 	21-15
A.3.0368	Remover/replacer, upper link anti-vibration bushing (use with A.3.0367) 	21-15
A.3.0372	Remover/replacer, lower link (use with A.3.0373) 	21-11 21-12 21-13
A.3.0373	Toothed washer, lower link removal/installation (use with A.3.0372) 	21-11 21-13

Part. no.	Description	Page
A.3.0374	Remover, torsion bars 	21-10 21-11
A.3.0374/0001	Forcing screw, torsion bar removal 	21-10
A.3.0377	Puller, upper and lower ball joints, steering knuckle 	21-4/1 21-5 21-14
A.3.0441	Ring, lower link ball joint removal (use with A.3.0576 and A.3.0575) 	21-12
A.3.0442	Ring, lower link ball joint installation (use with A.3.0576 and A.3.0562) 	21-12
A.3.0562	Centralizer, front supension link ball pin installation (use with A.3.0576 and A.3.0442) 	21-12
A.3.0575	Centralizer, front suspension link ball pin removal (use with A.3.0576 and A.3.0441) 	21-12
A.3.0576	Remover/replacer, front suspension link ball pin (use with A.3.0575; A.3.0441; A.3.0442; A.3.0562) 	21-12

GROUP 22

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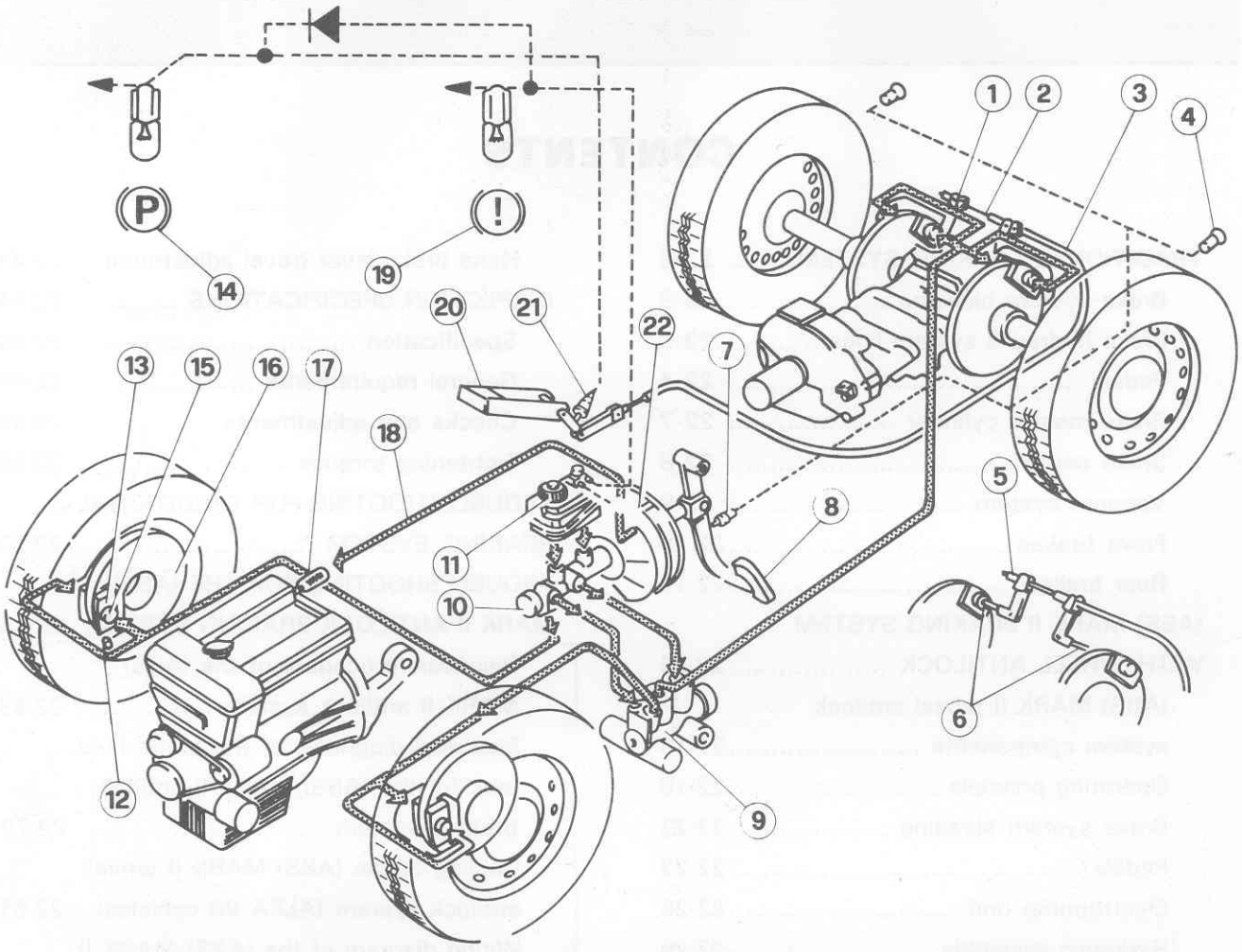
TRADITIONAL BRAKING SYSTEM



1 Hand brake pad actuating levers
2 Hand brake cable
3 Hand brake cable sheath
4 Stop light bulbs
5 Hand brake adjusting nuts
6 Hand brake pad push rods
7 Stop light bulbs
8 Brake pedal
9 Load proportioning valve
10 Brake master cylinder
11 Brake fluid reservoir
12 Air bleed screws
13 Brake pads
14 Hand brake on indicator
15 Piston
16 Brake disc
17 Vacuum port
18 Pipe connecting vacuum port to brake servo
19 Low brake fluid level indicator
20 Hand brake lever
21 Hand brake on indicator sending unit
22 Brake servo

- The hydraulic circuit is supplied by a tandem brake master cylinder, mounted co-axially on the vacuum brake servo unit.
- Brake servo operates through vacuum generated in inlet manifold for gasoline engines and in vacuum pump for diesel engines, to facilitate brake master cylinder actuation.
- The front master cylinder section acts on front brake caliper circuit and directs a pressure signal to load proportioning valve.
  The rear master cylinder section acts on rear brake caliper circuit through load proportioning valve.
- The system, consisting of two independent circuits, ensures braking should either one of the two circuits fail and, through load proportioning valve, provides increased stability during braking in that it prevents rear wheel locking.
- Hand brake acts on rear brake calipers through a mechanical linkage consisting of cable and clearance adjuster.

BRAKE SYSTEM BLEEDING

WARNING:

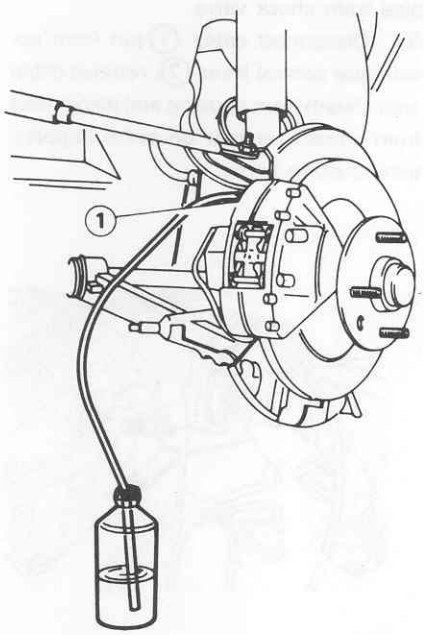
a. Check that fluid level does not fall below minimum during bleeding.

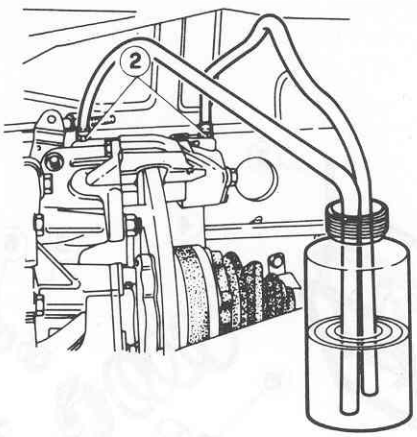
b. Do not reuse fluid after draining.

c. Brake fluid is harmful to paintwork: avoid contact.

d. Carry out operation simultaneously on front and rear brake calipers, first on one side, then on the other.

1. Place car on a lift.
2. If necessary, fill up reservoirs with the recommended fluid (ATE "S" or AGIP Brake Fluid Super or IP Auto Fluid FR.
3. Raise car and remove dust excluders from brake caliper bleed points.
4. Connect a flexible hose to bleed screws (1) and (2) and dip the other hose end in a container filled with the recommended brake fluid.





1 Front brake bleed screw
2 Rear brake bleed screws

5. Slacken bleed screws and pump the brake pedal; allow brake pedal to return and pause a few seconds between each stroke and the next; keep pumping until issuing fluid is free from air bubbles. Fully depress brake pedal and tighten bleed screws.
6. Remove hoses, install dust excluders and top up reservoir.
7. If bleeding has been carried out correctly, no sponginess should be felt after initial free travel. If pedal sponginess is felt repeat the bleeding operation.

BRAKE HYDRAULIC SYSTEM LINES

INSPECTION

Check brake system lines (pipes and hoses) for distortion, cracks or external oxidation. Replace any defective parts.

REMOVAL AND INSTALLATION

WARNING:

a. Prior to removing and installing brake lines, draw fluid from brake and clutch system reservoir by means of a syringe.

b. When removing lines, plug ends to prevent the entry of foreign matter.

c. After installation, check that front and rear hoses are not twisted. For checking, refer to supplier's identification mark on rear hose periphery or to light stripe on front hoses.

d. After assembly, top up reservoir and bleed (see Brake System Bleeding).

(T): **Tightening torques**

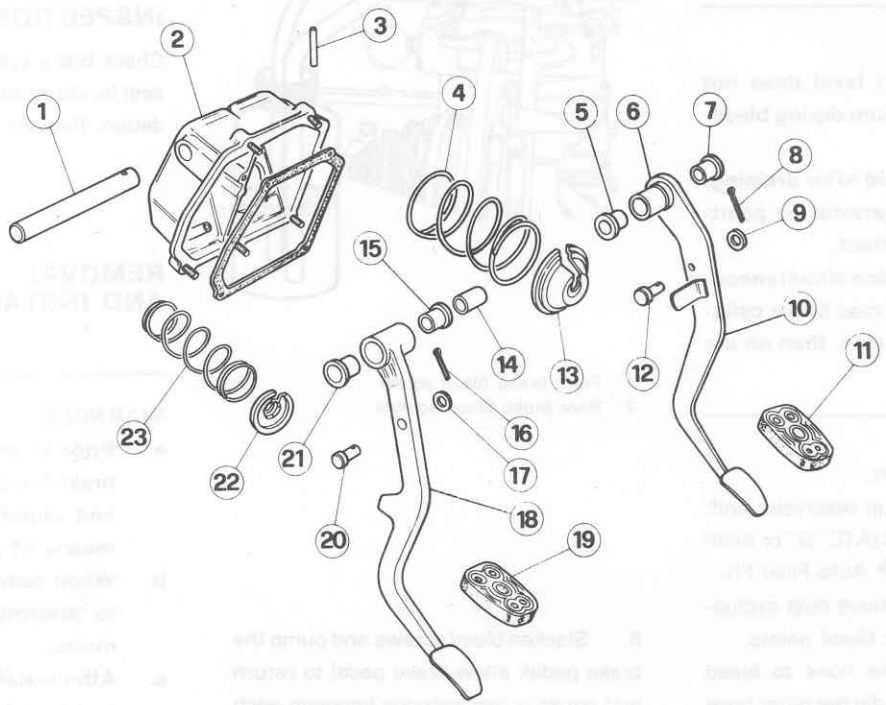
Brake hydraulic system hose fittings

10 to 15 N·m
(1 to 1.5 kg·m)
(7.4 to 11.1 ft·lb)

Brake hydraulic system pipe fittings

10 to 12 N·m
(1 to 1.2 kg·m)
(7.4 to 8.9 ft·lb)

PEDALS



1 Pedal shaft
2 Pedal support
3 Pin
4 Brake pedal return spring
5 Brake pedal bushing
6 Bushing housing
7 Brake pedal bushing
8 Cotter
9 Washer
10 Brake pedal
11 Pedal cover
12 Pin
13 Brake pedal spring cup
14 Spacer
15 Clutch pedal bushing
16 Cotter
17 Washer
18 Clutch pedal
19 Pedal cover
20 Pin
21 Clutch pedal bushing
22 Clutch pedal spring cup
23 Clutch pedal return spring

REMOVAL

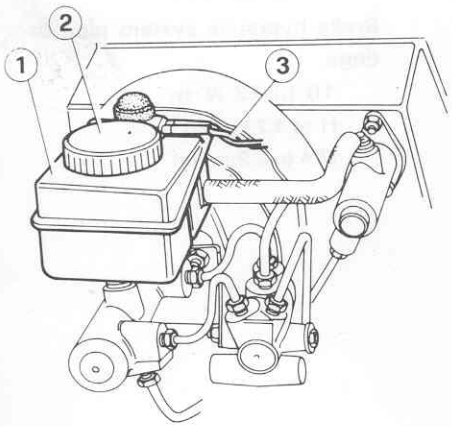
1. Disconnect brake fluid level indicator cables (3) from engine compartment, remove plug (2) and filter from reservoir (1) and draw clutch and brake fluid by means of a syringe.

2. Back off screws retaining windscreen washer reservoir to body and move reservoir sideways.

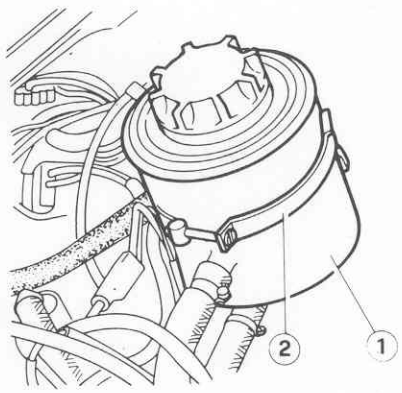
3. Six cylinder cars only.
Slacken reservoir hose clamp (2) and move reservoir (1) sideways.

4. Disconnect brake servo vacuum port pipe from check valve.

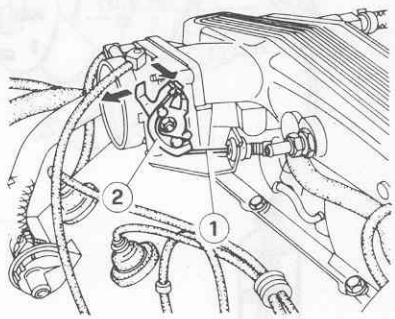
5. Disconnect cable (1) pin from accelerator control lever (2), remove cable with sheath from housing and disconnect from sheath retainer on pedal support, behind brake servo.



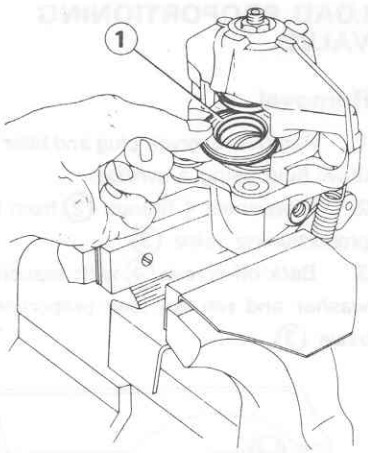
1 Brake fluid reservoir
2 Plug
3 Brake fluid level indicator cables



1 Power steering fluid reservoir
2 Hose clamp



1 Accelerator control cable
2 Accelerator control lever



1 Bellows

Inspection

Clean all parts.

WARNING:
Do not use mineral oil base detergents or metallic tools.

Check each component for wear or damage and replace if necessary.
Always replace bellows and associated retaining rings.

Installation

Install adopting a reversal of the removal sequence and adhering to the instructions given below.

- Check that pad thickness is correct (see: Inspection Specifications - Check and Adjustments).
- Adhere to the following tightening torques.

Ⓣ : **Tightening torques**
Brake caliper/gearbox - differential housing retaining nuts
46 to 52 N·m
(4.7 to 5.3 kg·m)
(33.9 to 38.4 ft·lb)

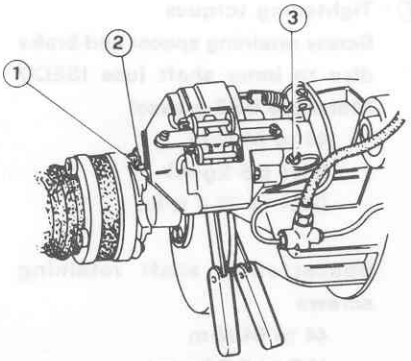
Pipe fittings
10 to 12 N·m
(1 to 1.2 kg·m)
(7.4 to 8.9 ft·lb)

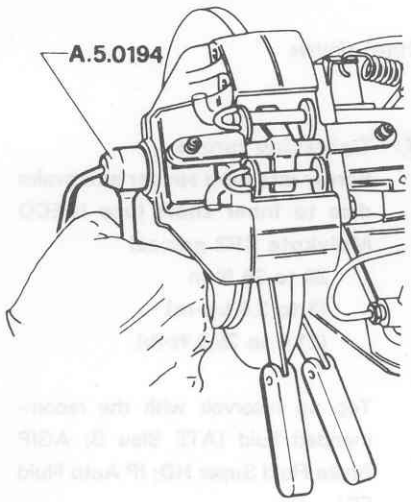
- Top up reservoir with the recommended fluid (ATE Blau S; AGIP Brake Fluid HD; IP Auto Fluid FR).
- Adjust pad clearance as per "Pad Clearance Adjustment".
- Adjust hand brake as per "Hand Brake - Control Cable Adjustment".
- Bleed brake system (see Brake System Bleeding).

Pad Clearance Adjustment

1. **Insert two 0.25 mm (0.01 in) feeler gauges between the disc and the pads.**
2. Remove the dust cover and unscrew the lock nut (2) by means of the **A.5.0194** tool.
3. Acting on the pin (1) and the screw (3) bring the pads into a light contact with the two feeler gauges; in this way, the prefixed clearance is reset.

Pad clearance: 0.25 mm (0.01 in)





1 Outer pad adjusting pin
2 Adjusting pin locknut
3 Inner pad adjusting screw

4. Fasten the lock nut at the prescribed driving torque and refit the dust cover.

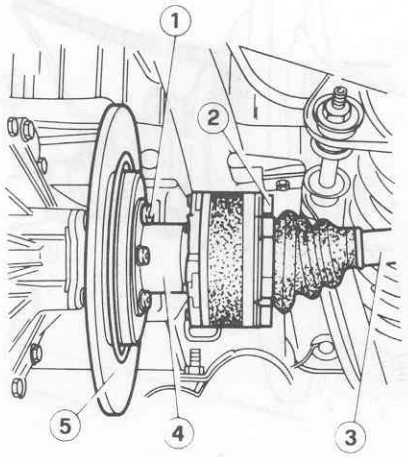
Ⓣ : **Driving torque of the adjustment pin - fixing locknut:**
7 to 10 N·m
(0.7 to 1 Kg·m)
(5.2 to 7.4 ft·lb)

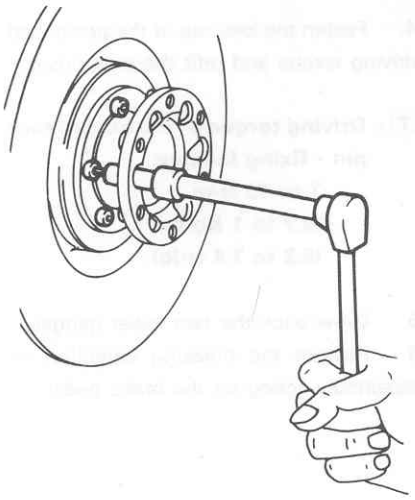
5. Draw back the two feeler gauges.
6. Restore the breaking condition by repeatedly acting on the brake pedal.

BRAKE DISC

Removal

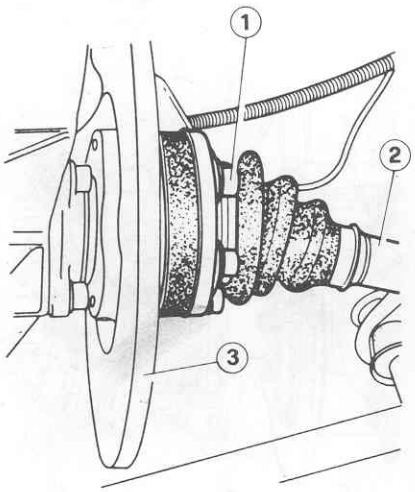
1. Cars equipped with spacer (refer to Unit 00 - Use of Units in Car).
Back off screw (2) and disconnect shaft (3), back off screws (1) and disconnect spacers (4) from inner shafts.





1 Spacer/inner shaft screws
2 Spacer/outer shaft screws
3 Outer shaft
4 Spacer
5 Brake disc

Other models.
Back off screws (1) and disconnect outer shafts (2) from inner shafts.



1 Outer/inner shaft screws
2 Shaft
3 Brake disc

2. Hold brake disc and remove pads as per "Pad Replacement".
3. Remove brake disc.

Inspection

1. Clean brake discs and check that working surfaces are free from score marks or porosity. Replace or grind as necessary.
2. Should working surfaces require grinding, the following instructions should be adhered to.
   a. Always grind off the sasme amount of material on both surfaces.
   b. Dimensions and tolerances as per "Inspection Specifications", "Checks and Adjustments" are mandatory.

Installation

Install adopting a reversal of the removal sequence and adhering to the instructions given below.

- Adhere to the following tightening torques.

Cars equipped with spacer.

(T) : **Tightening torques**
Screw retaining spacer and brake disc to inner shaft (use ISECO Molykote BR2 grease)
49 to 54 N·m
(5 to 5.5 kg·m)
(36.1 to 39.8 ft·lb)

Spacer/outer shaft retaining screws
44 to 54 N·m
(4.5 to 5.5 kg·m)
(32.5 to 39.8 ft·lb)

Other models

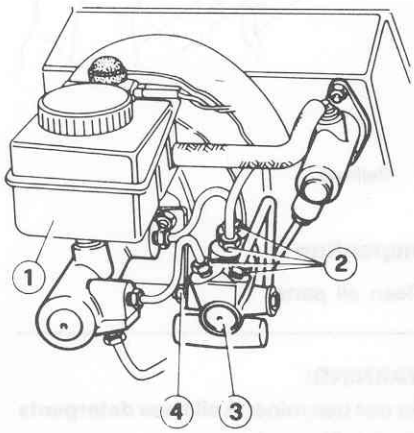
(T) : **Tightening torque**
Screw retaining spacer and brake disc to inner shaft (use ISECO Molykote BR2 grease)
29 to 35 N·m
(3 to 3.6 kg·m)
(21.4 to 25.8 ft·lb)

- Top up reservoir with the recommended fluid (ATE Blau S; AGIP Brake Fluid Super HD; IP Auto Fluid FR).
- Adjust pad clearance as per "Pad Clearance Adjustment".
- Adjust hand brake as per "Hand Brake - Control Cable Adjustment".

LOAD PROPORTIONING VALVE

Removal

1. Remove reservoir plug and filter and draw fluid using a syringe.
2. Disconnect 4 fittings (2) from load proportioning valve (3).
3. Back off screw (4) with associated washer and retrieve load proportioning valve (3).



1 Reservoir
2 Pipes/load proportioning valve fittings
3 Load proportioning valve
4 Load proportioning valve/bracket retaining screw

WARNING:
Do not disassemble load proportioning valve.

Installation

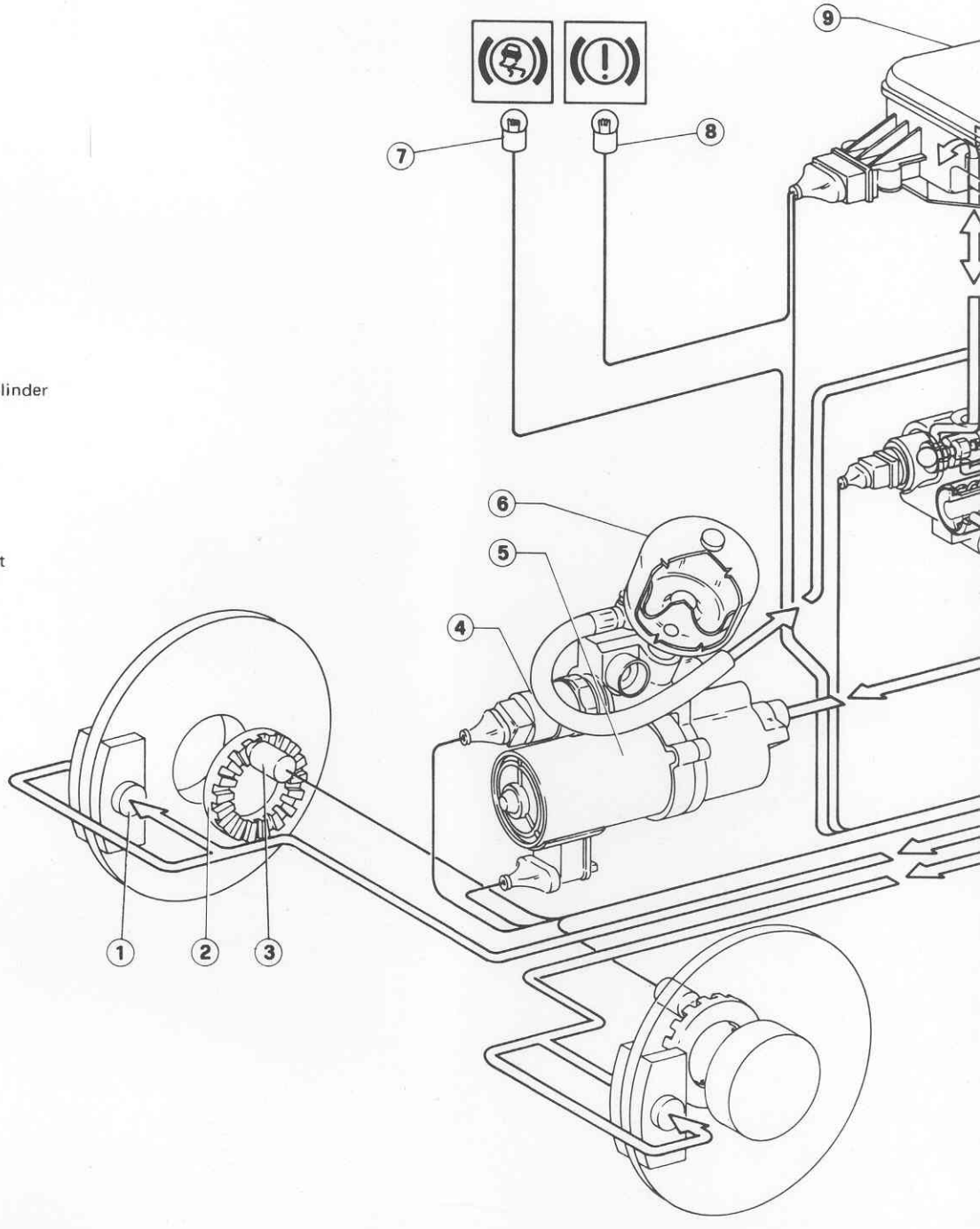
Install adopting a reversal of the removal sequence and adhering to the instructions given below.

- When connecting pipes to load proportioning valve, match arrows on valve body.
- Adhere to the following tightening torque.

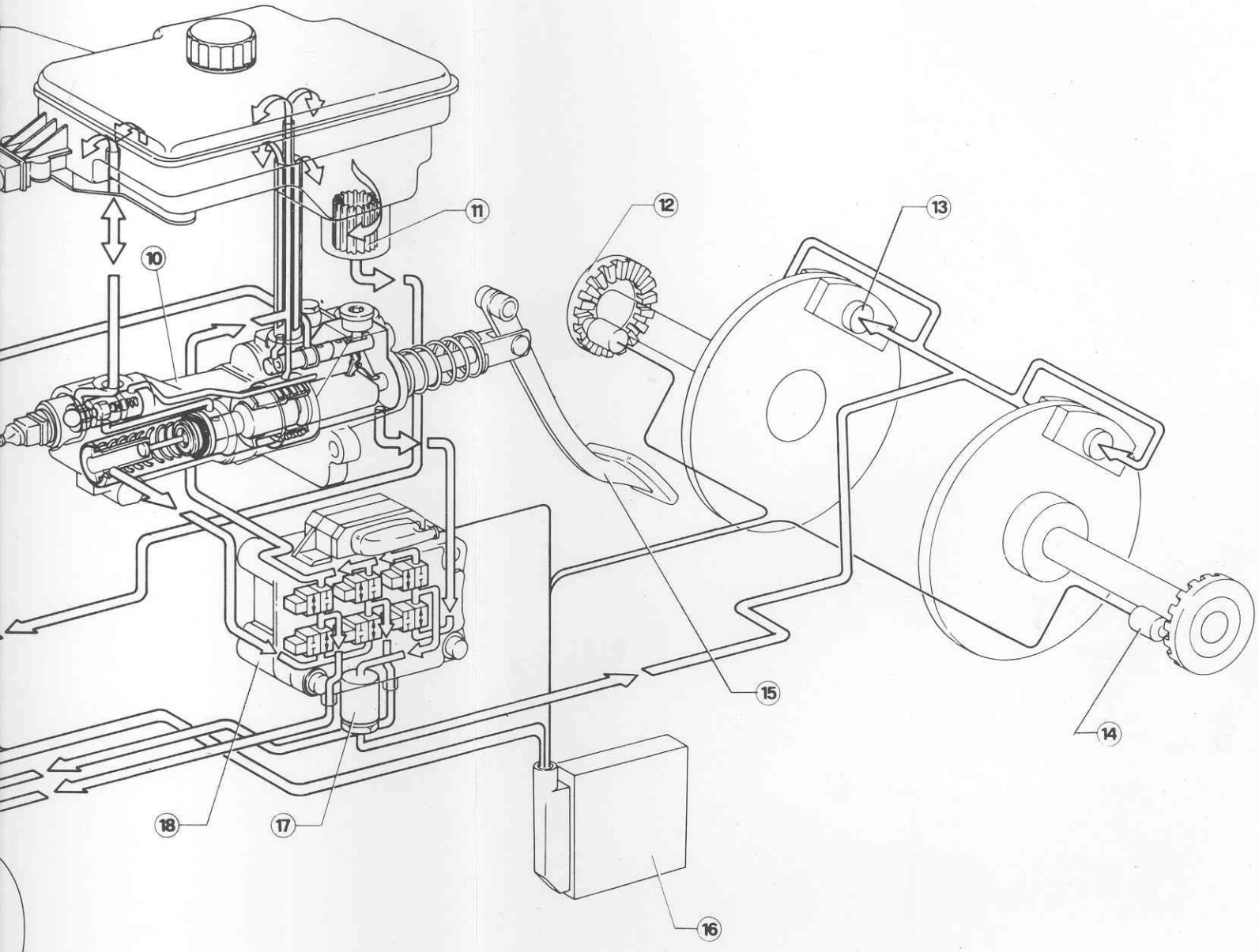
(T) : **Tightening torque**
Pipes/load proportioning valve fittings
10 to 12 N·m
(1 to 1.2 kg·m)
(7.4 to 8.9 ft·lb)

- Fill reservoir with the recommended fluid (ATE Blau S; AGIP Brake Fluid Super HD; IP Auto Fluid FR).
- Bleed brake system (see Brake System Bleeding).

1 Front brake caliper
2 Front impulse emitting wheel
3 Front impulse pick-up
4 Min./max. pressure switch
5 Electropump unit
6 Accumulator
7 ABS MARK II system warning light antilock system failure)
8 Brake fluid minimum level and brake pad wear warning light on A.R. CONTROL
9 Brake fluid tank
10 Brake master cylinder and hydraulic servo cylinder
11 Filter
12 Rear impulse emitting wheel
13 Rear brake caliper
14 Rear impulse pick-up
15 Brake pedal
16 Antilock system control unit
17 Brake pressure adjusting valve
18 Braking pressure modulating electrovalve unit



(ABS) MARK II BRAKING SYSTEM WITH WHEEL ANTILOCK



- The (ABS) MARK II wheel antilock system is a sophisticated computerized system designed to increase driving safety and in fact constitutes the ultimate technical guarantee as regards braking.
- An impulse pick-up (3) is assembled on each wheel and records the r.p.m. by means of an impulse emitting wheel (2) and sends it to the electronic unit (16) for data processing. The electronic unit takes direct action, if one or more wheels tend to lock, by means of electrovalves (18), adjusting the braking pressure on each wheel to prevent it locking. The electronic unit thus "takes" the pressure from the brake caliper of the wheel that is locking to "return" it only when locking no longer occurs; this "giving and taking" of pressure takes place in very short intervals of time and continues until braking ends that is of cause if locking persists and independent of the pressure exerted on the brake pedal.
- On a dry, or even wet, surface the ABS system may not even go into operation for thousands of kilometers. However, in the event of sudden braking due to an unexpected obstacle or immediate danger when a traditional braking system would tend to lock, the ABS sytem intervenes and ensures that the "correct" braking force is applied at all times to each wheel thus allowing the vehicle to stop in the **shortest possible distance** compatible with the road surface.
- Other important advantages offered by the ABS system are:
  - **Complete vehicle control**: the driver at the wheel of a vehicle equipped with the ABS system can avoid any obstacles by turning the steering wheel while the driver of a vehicle without the ABS system, in the event of wheel locking, would not be able to carry out the same manoeuvre in as much as the vehicle goes out of control and may skid dangerously.
  - **More even tyre wear**: as the wheels never lock; the tyres will never suffer damage due to tyre abrasion on the asphalt.
- The (ABS) MARK II wheel antilock braking system is equipped with a **hydraulic servobrake**; an electropump unit (5) with accumulator (6) sucks in oil directly from the tank (9) and, having taken it to a pressure of 140 thru 180 bar (13970 thru 17960 KPa; 142.5 thru 183.2 kg/cm²; 2025.67 thru 2604.42 p.s.i.), then sends it to the hydraulic servo cylinder. During normal braking, that is when no wheels lock and therefore without antilock system activation, the hydraulic servocylinder sends oil under pressure to the brake calipers of the rear wheels only while those of the front wheels are supplied directly by the brake master cylinder (see: Operating principle).
- The instances where a high probability, of ABS system activation exists are examined hereafter.

Braking on a wet road surface

On a wet road surface, the (ABS) MARK II wheel antilock system guarantees considerable reductions in stopping distances and is particularly advantageous in the event of **ACQUAPLANING** (at a certain vehicle speed the water can no longer be disposed of by the tread grooves and a film of water consequently forms between the wheel and the road surface, causing the tyre to lose its grip and impeding it from absorbing braking and steering impacts). If a vehicle not equipped with the ABS system is running at such a speed that this phenomenon has not yet arisen and wheels lock during braking the outrush of water from the tread grooves is impeded and the phenomenon of **acquaplaning** may thus occur. The ABS system, on the other hand, removes this danger because by preventing wheel lock from occuring, it allows the disposal of water via the tread grooves to continue and the tyre remains in contact with the road surface.

If, however, the phenomenon of aquaplaning has already begun, the ABS system, although intervening, is no longer able to assure efficacious control of the vehicle during braking.

Braking on a slippery road surface

The ABS system may activate more frequently on a slippery road surface since the tyre grip limit is reached immediately subsequent to brake activation.

If the vehicle is to be stopped in the shortest distance possible, the brake pedal may be pressed down hard to solicit the activation of the ABS on all wheels.

Braking on loose road surface

If, on the other hand the road surface is not compact (sand, gravel, soft snow or mud), vehicles equipped with the ABS system can stop in greater distances compared to vehicles without hocked wheels, in fact, penetrate deeper into the ground and allow increased tyre function surface, thus guaranteeing a shorter stopping distance; this notwithstanding, the ABS system is most useful on this type of surface because it still assures complete handling of the vehicle.

Braking on different holding co-efficients

It is possible for the wheels of the same axis to be running on surfaces which have varying holding co-efficients (for example, on ice at the right and dry asphalt at the left).

During braking the vehicle will tend to turn towards the dry asphalt, that is towards the side with the greater holding co-efficient due to the arisal of a swaying torque as compared to the vertical axis of the vehicle.

This phenomenon arises both on vehicles equipped with the ABS system and those with a traditional braking system; whereas for the latter there is no remedy, in the former steering is by no means jeopardized and the driver may compensate for the swaying torque by counter-steering the vehicle and thus keeping it straight.

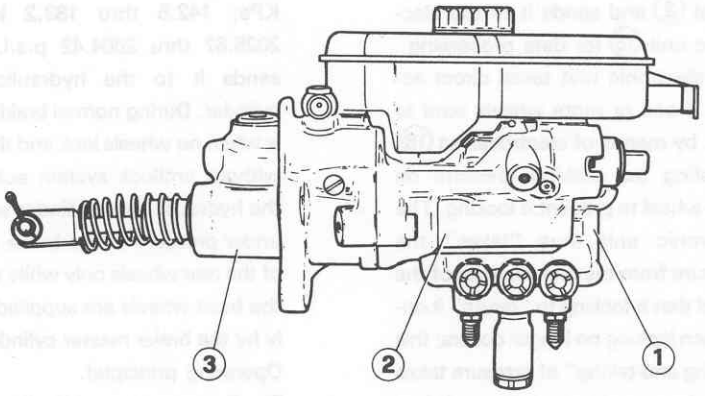
Traffic conditions permitting, on these occasions it is wise not to press the brake too hard so that the driver can apply the adequate steering reaction necessary.

WARNING:
Under no circumstances should the (ABS) MARK II antilock system induce the driver to drive dangerously or take risks.
For the safety of the driver and others it is always necessary to observe speed limits, safe distances and to maintain a prudent approach to driving especially when road surface conditions so demand.

(ABS) MARK II WHEEL ANTILOCK SYSTEM COMPONENTS

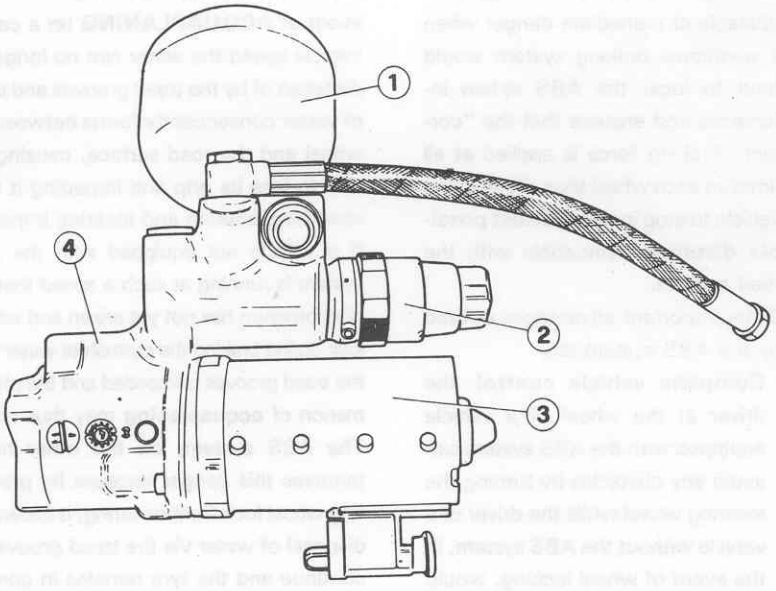
The ABS system installed by Alfa Romeo on some of its cars (see: Group 00- Use of Units in Cars) is manufactured by ALFRED TEVES GmbH (ATE): the system components are:

Hydraulic assembly: comprising a high pressure hydraulic servocylinder (3), a master cylinder (2) and braking pressure modulating electrovalves (1).



1 Braking pressure modulating electrovalve unit
2 Brake master cylinder
3 Hydraulic servo cylinder

Electropump unit: comprising a pump (4) activated by an electric motor (3), an accumulator (1) (containing the brake fluid at a pressure between 140 and 180 bar (13970 thru 17960 KPa; 142.5 thru 183.2 Kg/cm²; 2025.67 thru 2604.42 p.s.i.)) and a pressure switch (2).



1 Accumulator
2 Pressure switch
3 Electric motor
4 Pump

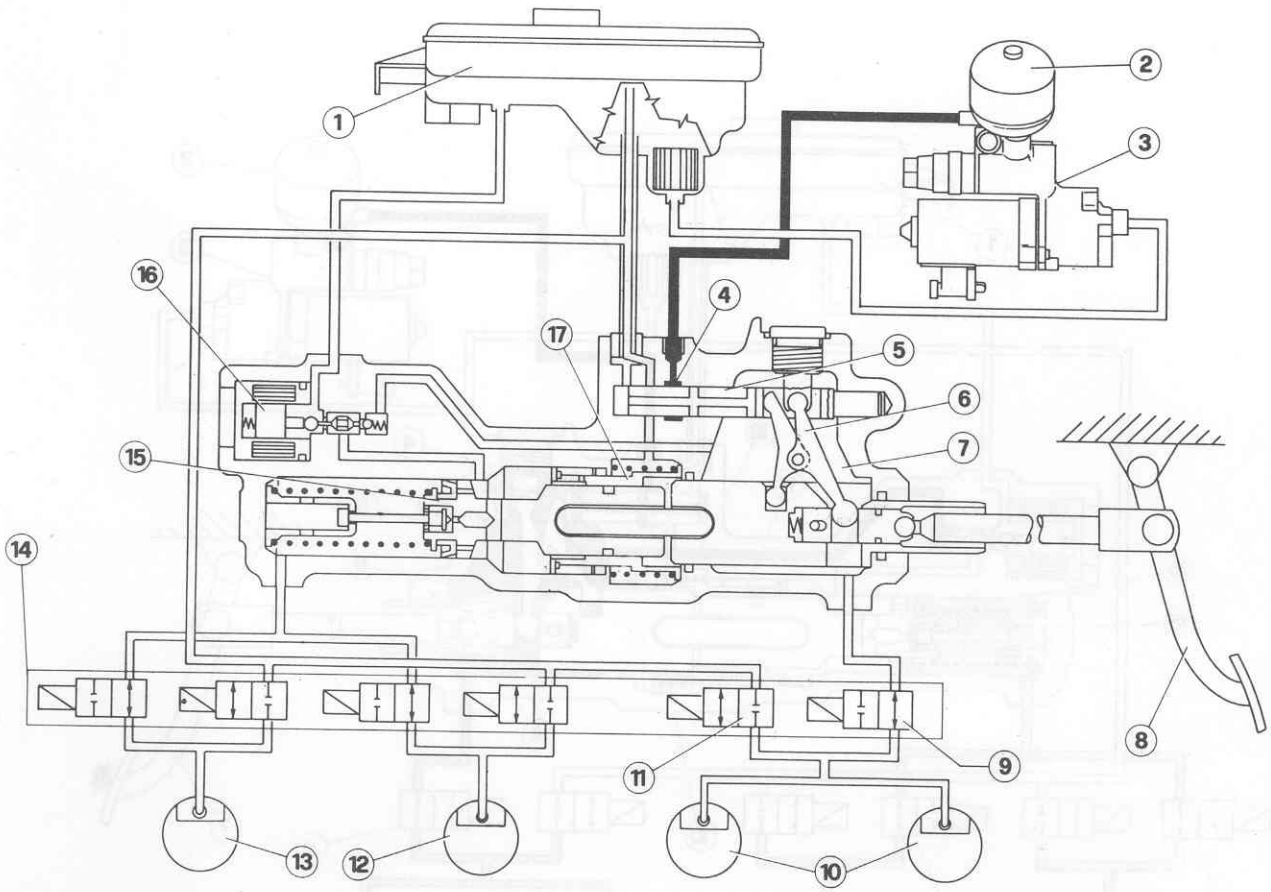
Impulse pick-ups and impulse emitting wheels: assembled one on each wheel to detect r.p.m..

Electronic unit: this represents the intelligent unit of the entire system in that it is capable of processing all the input signals deriving from the impulse pick-ups and supplying in output the control signals to the braking pressure modulating electrovalves.

ABS MARK II system warning light (S) :
assembled on the instrument panel, it notifies the driver of ABS system auto cut off when the electronic unit has encountered a failure (which may only be temporary).
With the warning light (S) illuminated but "brake fluid minimum level and pad wear" on the A.R. CONTROL extinguished it is still possible to carry out normal servoassisted braking actions.

OPERATING PRINCIPLE

BRAKE NON APPLIED



Accumulator pressure

Connection to tank

1 Brake fluid tank
2 Accumulator
3 Electropump unit
4 Chamber with high pressure brake fluid
5 Adjusting valve
6 Leverage
7 Hydraulic servo cylinder
8 Brake pedal
9 Load electrovalve, normally open
10 Rear wheels
11 Drain electrovalve, normally closed
12 R.H. front wheel
13 L.H. front wheel
14 Braking pressure modulation electrovalves
15 Brake master cylinder
16 Main electrovalve
17 Positioning bush

The braking circuit is subdivided into three sections:

- Front wheels: controlled by separate hydraulic circuits.
- Rear wheels: controlled by a single hydraulic circuit.

The ABS system is thus based on **INDIVIDUAL ADJUSTMENT** of the front wheels and according to the **SELECT-LOW** principle for the rear wheels. The term select-low means that the electronic unit processes the signals coming from the impulse pick-ups of the rear wheels separately and carries out the same adjustment on both wheels according to which one tends to lock.

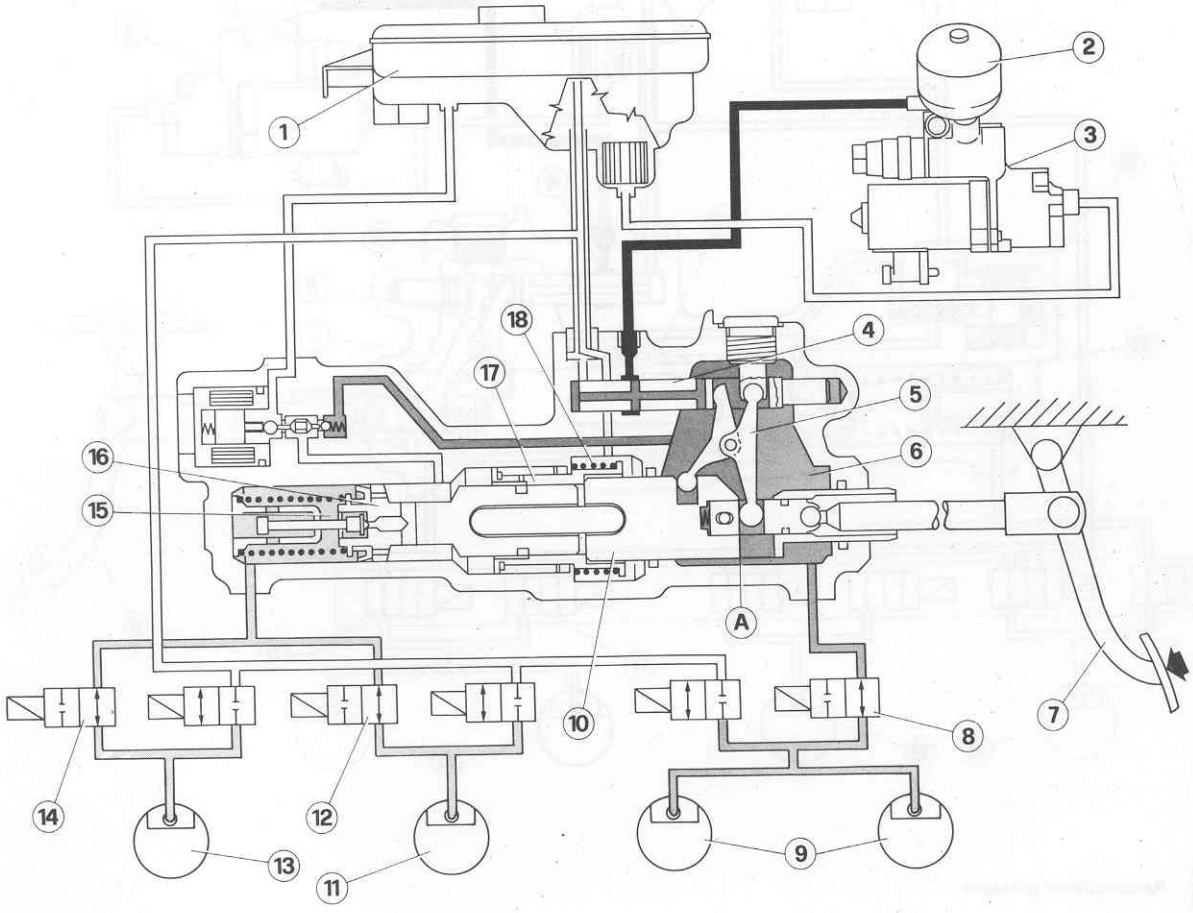
Bear in mind that brake fluid is always present in the accumulator (2) at a pressure between 140 and 180 bar (13970 thru 17960 KPa; 142.5 thru 183.2 Kg/cm²; 2025.67 thru 2604.42 p.s.i.) and that this high pressure is exerted right up to the chamber (4) of the adjusting valve (5).

If braking is not in progress none of the other areas are under pressure (*).

(*) Prior to carrying out repair work involving the removal of system components, it is necessary to discharge braking system pressure as follows:

- **remove the ignition key.**
- **press the brake pedal down repeatedly (at least 20 times) until it sticks.**

BRAKING WITHOUT ANTILOCK SYSTEM ACTIVATION



Accumulator pressure

Connection to tank

Dynamic circuit

Static circuit

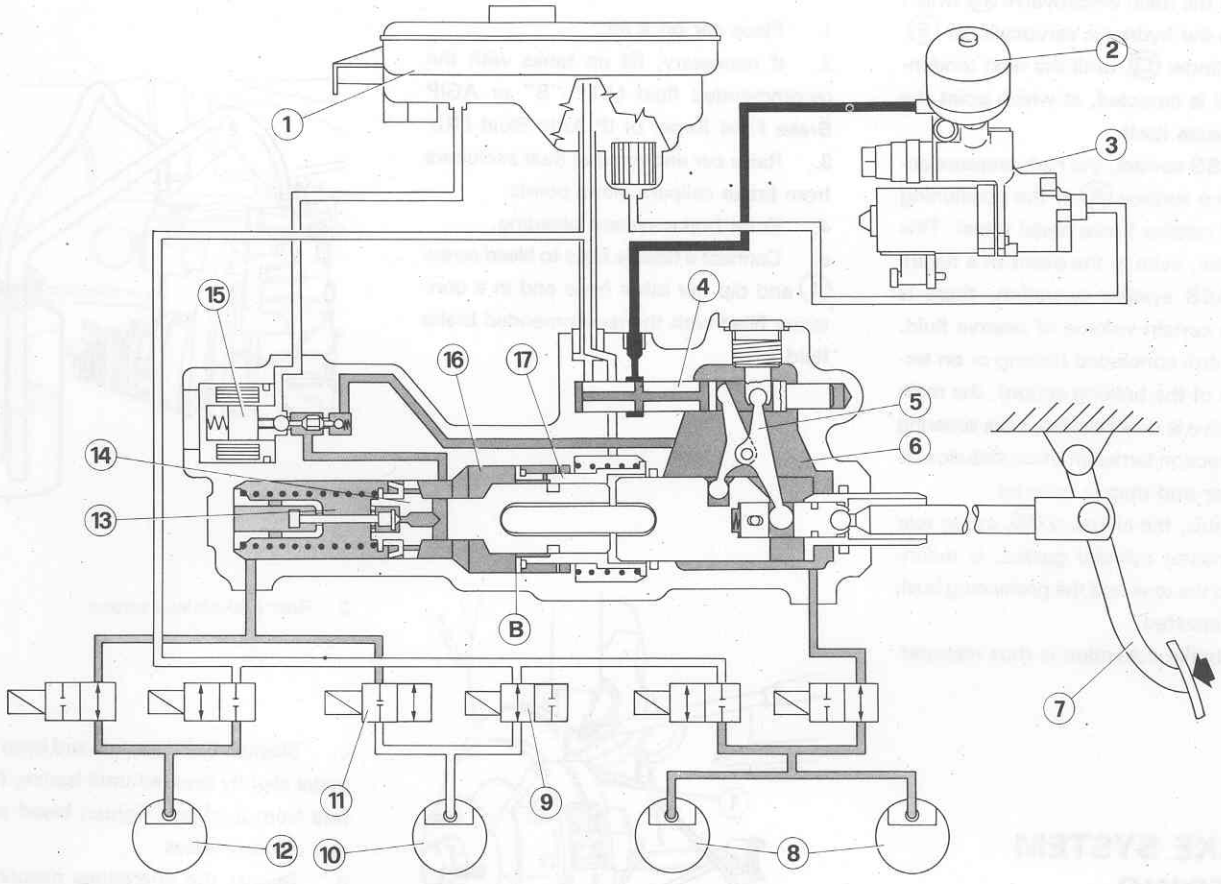
1 Brake fluid tank
2 Accumulator
3 Electropump unit
4 Adjusting valve
5 Leverage
6 Hydraulic servo cylinder
7 Brake pedal
8 Load electrovalve, normally open
9 Rear wheels
10 Brake piston
11 R.H. front wheel
12 Load electrovalve, normally open
13 L.H. front wheel
14 Load electrovalve, normally open
15 Cylinder
16 Brake master cylinder
17 Positioning bush
18 Spring

During normal braking the ABS control system is not activated in as much as none of the wheels decelerates at such a rate as to be interpreted by the electronic unit as a tendency to lock; braking therefore occurs as a normal servo assisted action. Each of the three hydraulic circuits (two front and a single rear one) is controlled by means of two electrovalves: a load one which is normally open and a drain one, normally closed.

On activation of the brake pedal, the adjusting valve (4) opens by means of the leverage (5) thus generating in the hydraulic servo cylinder (6) a pressure which is proportional to the force applied to the brake pedal. This pressure is used directly to activate the rear axis brakes (DYNAMIC CIRCUIT) by means of the load electrovalve (8), normally open. Moreover, by acting on surface (A) of brake pedal (10), this pressure produces a force which goes to the aid of that exerted by the driver on the brake pedal; these two forces simultaneously activate the master cylinder (16) and a further braking pressure is created, in the cylinder (15), which is transmitted to the front brake calipers (STATIC CIRCUIT) by means of load electrovalves (12) and (14), normally open.

By further increasing pressure on the brake pedal, piston (10) reaches positioning bush (17), pulling it into motion. This does not affect the activation however in as much as the pressure of the spring (18) against the bushing is very slight and therefore imperceptible at the pedal.

BRAKING WITH ACTIVATION OF THE ANTILOCK SYSTEM



Accumulator pressure

Connection to tank

Dynamic and static circuits connected

1 Brake fluid tank
2 Accumulator
3 Electropump unit
4 Adjusting valve
5 Leverage
6 Hydraulic servo cylinder
7 Brake pedal
8 Rear wheels
9 Drain electrovalve, normally closed
10 R.H. front wheel
11 Load electrovalve, normally open
12 L.H. front wheel
13 Cylinder
14 Brake master cylinder
15 Main electrovalve
16 Chamber behind master cylinder gasket
17 Positioning bush

If, during activation of the braking system, a wheel, the front RH (10) for example, tends to lock, then the associated loading electrovalve (11) closes and the drain one (9) opens.
Following this the pressure on the brake caliper decreases, on account of the return circuit to the brake fluid tank (1) being opened.
At the same time the main electrovalve (15) is energized and the dinamic circuit (rear) is connected to the static one (front).
When the wheel being braked starts to regain speed, following the decrease in pressure at the calipers, the drain electrovalve is closed and the loading one opened again. In this way, pressure is gradually restored to the brake calipers by means of the main electrovalve (15) which connects the hydraulic servocylinder (6), to the cylinder (13), until the next tendency to lock is detected, at which point the cycle repeats itself.
During ABS control, the high pressure acting on the surface (B) of the positioning bush (17) restrics brake pedal travel. This means that, even in the event of a failure during ABS system operation, there is always a certain volume of reserve fluid.
ABS control concluded (during or on termination of the braking action), the main electrovalve is de-activated, thus severing the connection between the hydraulic servocylinder and master cylinder.
Besides this, the chamber (16), at the rear of the master cylinder gasket, is reconnected to the tank and the positioning bush (17) de-activated.
Normal brake activation is thus restored.

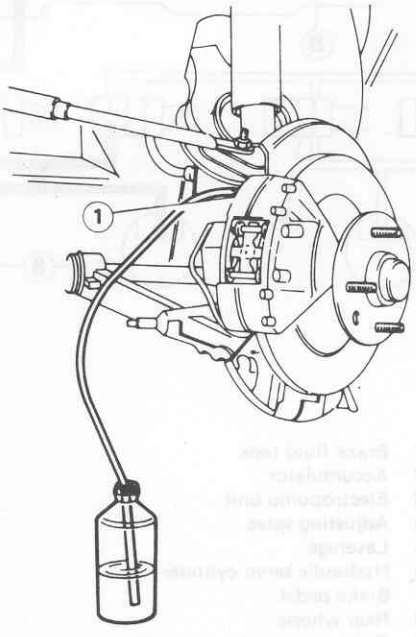
BRAKE SYSTEM BLEEDING

WARNING:

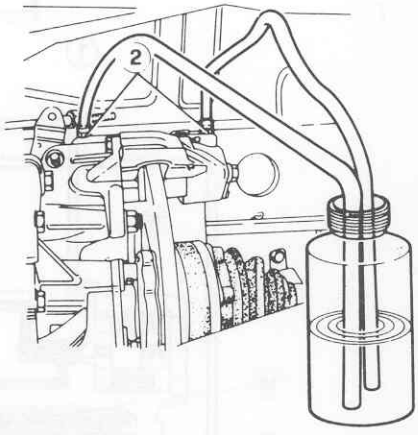
a) **Check that fluid level does not fall below minimum during bleeding, especially when working on the rear calipers as the high pressure oil tends to spurt.**
b) **Do not reuse fluid after draining.**
c) **Brake fluid is harmfull to paintwork: avoid contact.**
d) **Do not carry out this operation simultaneously on front and rear brake calipers, but first on one side, then on the other.**
e) **The electropump should never idle as this may cause damage; ensure that there is sufficient fluid in the tank.**

CAUTION:
The system contains pressurized fluid; WORK WITH CAUTION.

1. Place car on a lift.
2. If necessary, fill up tanks with the recommended fluid (ATE "S" or AGIP Brake Fluid Super or IP Auto Fluid FR).
3. Raise car and remove dust excluders from brake calipers bleed points.
4. Front brake system bleeding.
a. Connect a flexible hose to bleed screw (1) and dip the other hose end in a container filled with the recommended brake fluid.
b. Slacken bleed screw and pump the brake pedal; allow brake pedal to return and pause a few seconds between each stroke and the next; keep pumping until issuing fluid is free from air bubbles. Tighten bleed screw and remove hose.
c. Repeat steps a. and b. on the other front caliper.
5. Rear brake system bleeding.
a. Turn key to IGNITION, check electropump activation and await disconnection.
b. Connect a flexible hose to bleed screws (2) and dip the other hose ends in a container filled with the recommended brake fluid.



1 Front brake bleed screw



2 Rear brake bleed screws

c. Slacken bleed screws and keep brake pedal slightly pressed until issuing fluid is free from bubbles. Tighten bleed screws and remove hoses.
d. Repeat the operations described at steps b. and c. on the other two rear bleed screws.
6. Reinstall dust excluders and top up level in tank.
7. If bleeding has been carried out correctly, no sponginess should be felt after initial free travel; contrarily, repeat bleeding.

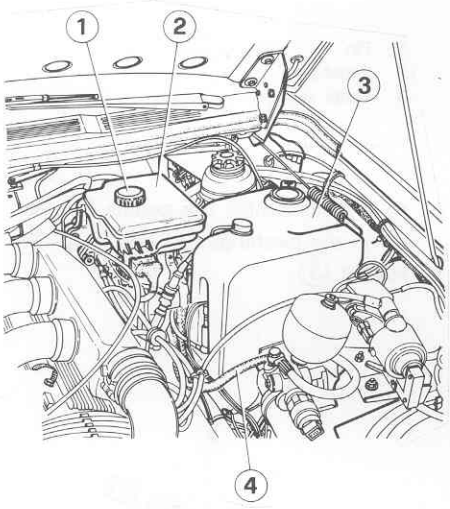
PEDALS

REMOVAL

CAUTION:
Prior to removing, discharge brake system pressure; with the ignition key removed, press the brake pedal down hard repeatedly (at least 20 times) until it sticks.

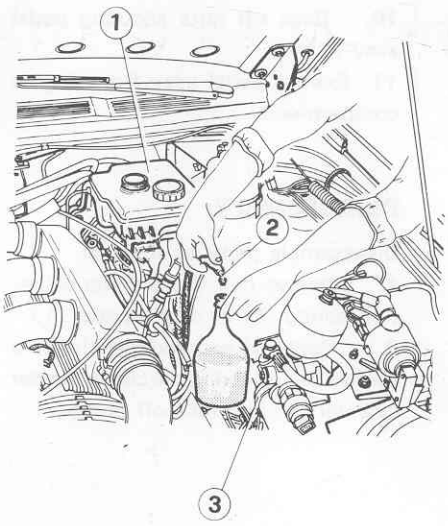
1. Disconnect the battery.
2. Remove windscreen washing liquid container (3) and the fireproof shield so as get a larger working area.
3. Drain the clutch and brake fluid from the tank thus.

a. Remove plug (1) from tank (2).



1 Plug
2 Clutch and brake fluid tank
3 Windscreen washing liquid container
4 Electropump feed hose

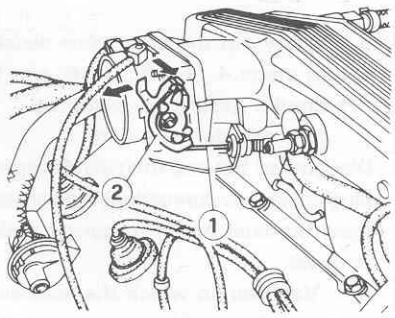
b. Disconnect the feed hose (2), from the electropump (3) and collect fluid directly beneath the tank.



1 Clutch and brake fluid tank
2 Electropump feed hose
3 Electropump

WARNING:
Clutch and brake fluid is corrosive: protect paintwork adequately.

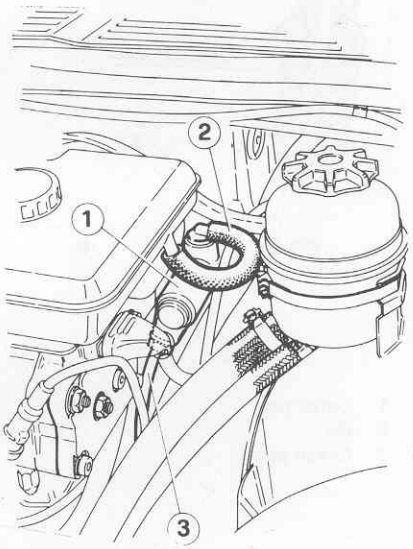
4. Vehicles on which accelerator control cable passes through the pedal assy only.
Detach the pawl (1) from the accelerator control lever (2) then slip out the cable complete with sheath from under the plenum chamber and release it from the sheath fastener on the pedal assy.



1 Accelerator control cable
2 Accelerator control lever

5. Disconnect pipe union (3) and supply duct (2) from the clutch master cylinder.

WARNING:
Clutch and brake fluid is corrosive: protect paintwork adequately.



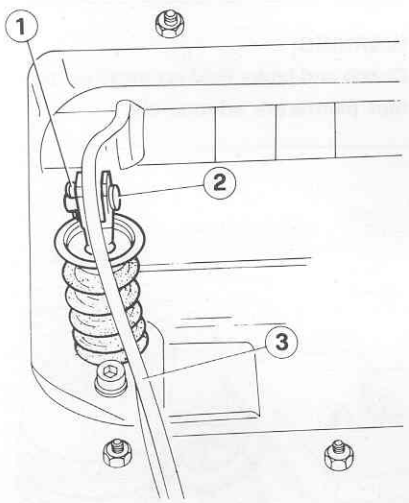
1 Clutch master cylinder
2 Clutch master cylinder feed duct
3 Clutch system pipe

6. Carry out the operations described at steps 4., 5., 6., 7., 8. and 9. - Hydraulic Assembly - Removal.

7. Six cylinder cars only.
Disconnect 5th and 6th cylinder spark plug cables; disconnect wiring harness from terminal board to permit pedal removal.

8. Vehicles on which the accelerator control lever passes through the pedal assy.
Working from within the engine compartment, slip off the cable sheath from the previously disconnected accelerator cable.

9. Remove clutch pedal (3), cotter pin (1) with washer and slide off pin (2).



1 Cotter pin
2 Pin
3 Clutch pedal

10. Back off nuts securing pedal assy to body.

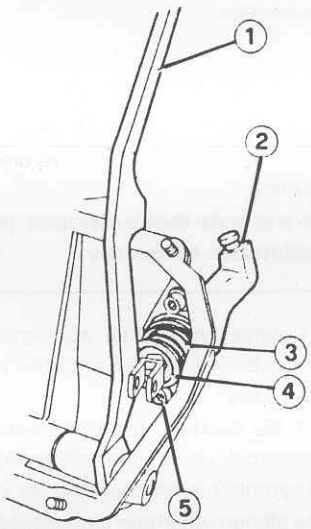
11. Extract pedal assy from engine compartment.

DISASSEMBLY

Disassemble pedal as follows:

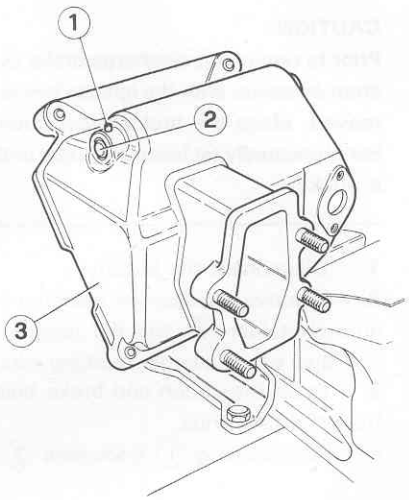
1. Remove cup (4) and slip off return spring (3) of clutch pedal (1).

2. Back off and remove the two screws (5), securing the clutch master cylinder (2) and take off pump.



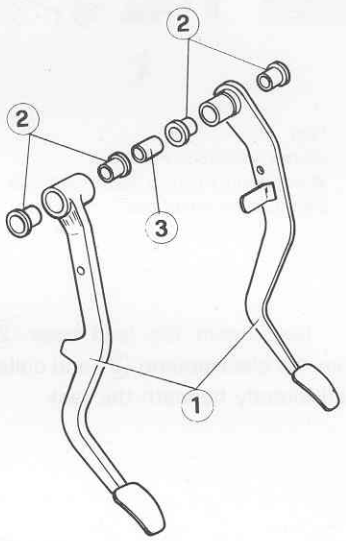
1 Clutch pedal
2 Clutch master cylinder
3 Return spring
4 Cup
5 Screw

3. Extract check pin (1) and remove pedal pin (2) from the pedal support (3).



1 Pin
2 Pedal pin
3 Pedal support

4. Disassemble the pedals (1), remove the bushings (2) and keep the specer (3).



1 Pedal
2 Bush
3 Spacer

Inspection

1. Check bushings and associated housings on pedals, pin and spacer for wear and seizure, replacing as necessary.
2. Check return springs of clutch pedal for weakness, replacing as necessary.

ASSEMBLY

Assemble pedals in reverse order of removal, adhering to the instructions given below.

- Apply a film of the recommended grease (ISECO Molykote Longterm n. 2) to sliding parts.
- Install clutch pedal taper spring positioning larger dia end in contact with pedals.
- Lubricate pins connecting pedals - clutch master cylinder forks with recommended grease (AGIP Grease 15).

INSTALLATION

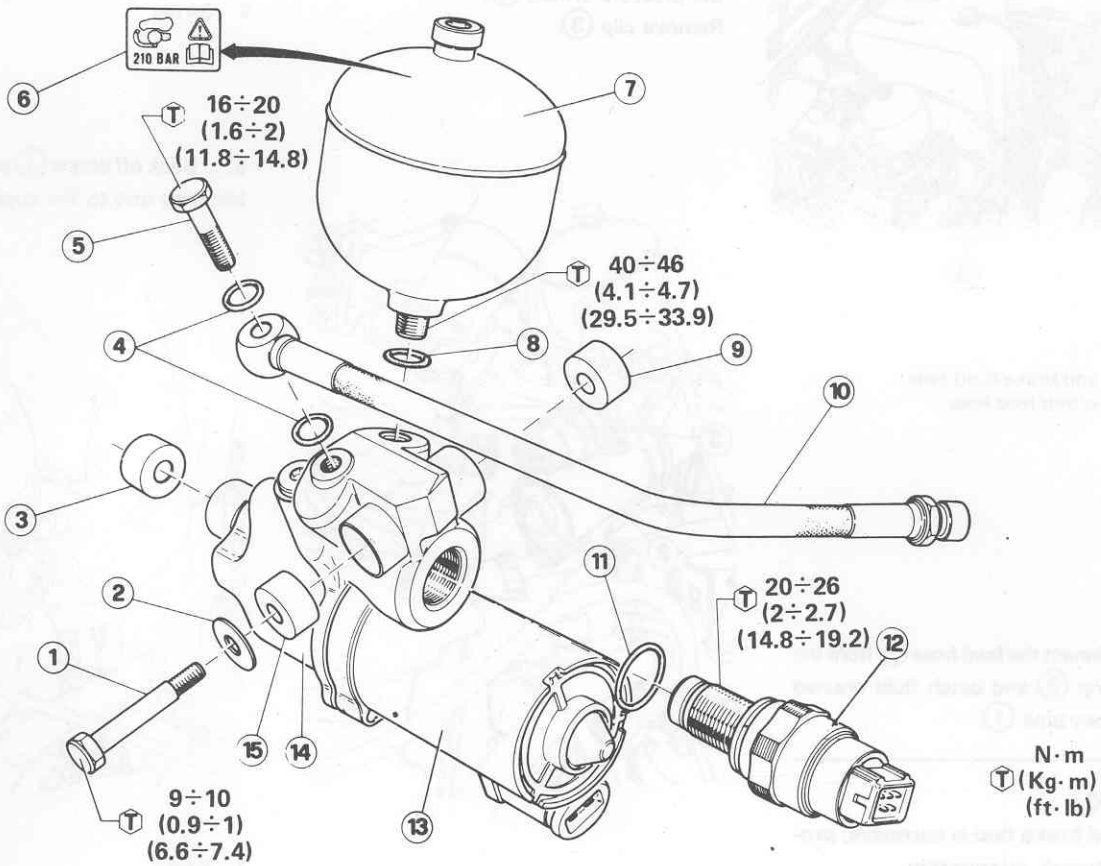
Install in reverse order of removal, adhering to the following instructions.

- Replace seal between pedal support and body if necessary.
- Observe the following tightening torque.

(T) : Tightening torque
Brake and clutch hydraulic system pipe fittings
10 thru 12 N·m
(1 thru 1.2 kg·m)
(7.4 thru 8.9 ft·lb)

- To install hydraulic assy to pedal assy follow stops 1 and 2 - Hydraulic Assy - Installation.
- Fill tank with recommended fluid (ATE Blau S; AGIP Brake Fluid Super; IP Auto Fluid FR).
- Bleed the brake system (see: (ABS) MARK II Braking System with Wheel Antilock - Brake System Bleeding) and clutch system (see: Group 12 - Clutch - Hydraulic System Bleeding).

ELECTROPUMP UNIT



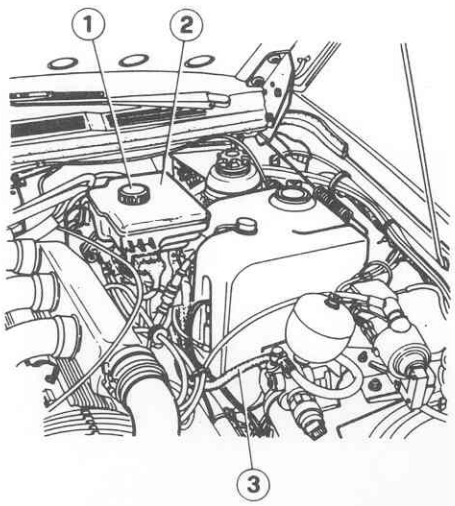
1 Electropump unit - support securing screw
2 Washer
3 Spring bushing
4 O-Rings
5 Screw
6 Label
7 Accumulator
8 O-Ring
9 Spring bushing
10 Pressurized fluid feed hose
11 O-Ring
12 Pressure switch
13 Electric motor
14 Pump
15 Spring bushing

REMOVAL

CAUTION:
Prior to removing the electropump unit it is necessary to discharge the braking system pressure; remove the ignition key and press the brake pedal right down repeatedly (at least 20 times) until it sticks.

1. Disconnect the battery.
2. Drain the brake and clutch fluid by operating as follows.

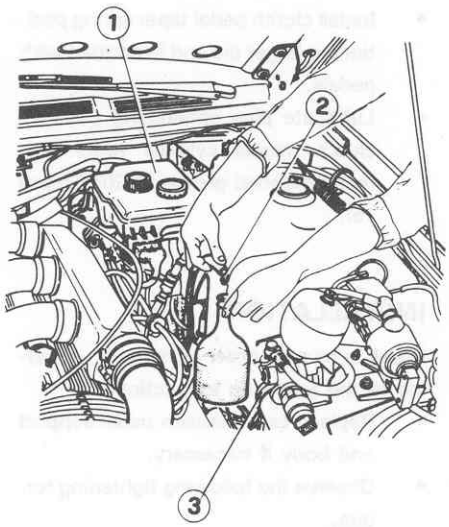
a. Remove plug (1) from tank (2).



1 Plug
2 Clutch and brake fluid tank
3 Electropump feed hose

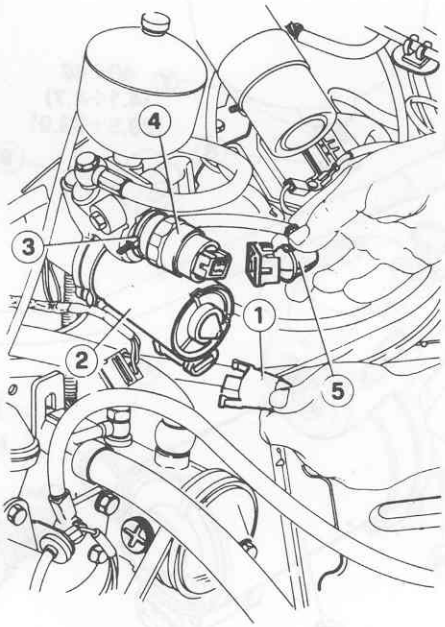
b. Disconnect the feed hose (2) from the electropump (3) and catch fluid drained directly from tank (1).

WARNING:
Clutch and brake flud is corrosive; protect paintwork adequately.



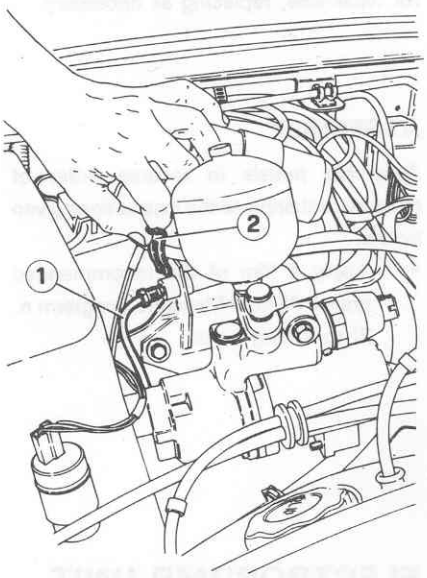
1 Clutch and brake fluid tank
2 Electropump feed hose
3 Electropump

3. Disconnect connector (1) from the electric motor (2) and connector (5) from the pressure switch (4).
Remove clip (3).



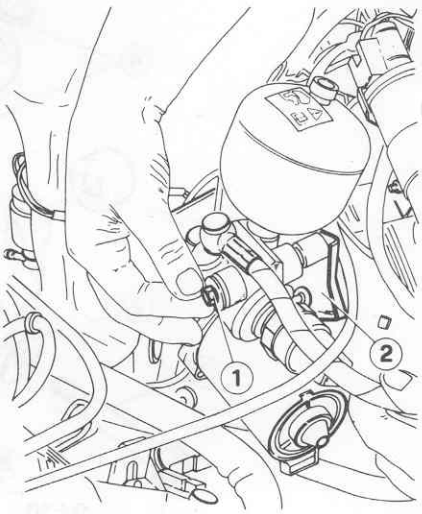
1 Connector for electric motor
2 Electric motor
3 Clip
4 Pressure switch
5 Connector for pressure switch

4. Disconnect the pipe (1) from the electropump unit; keep spring (2).



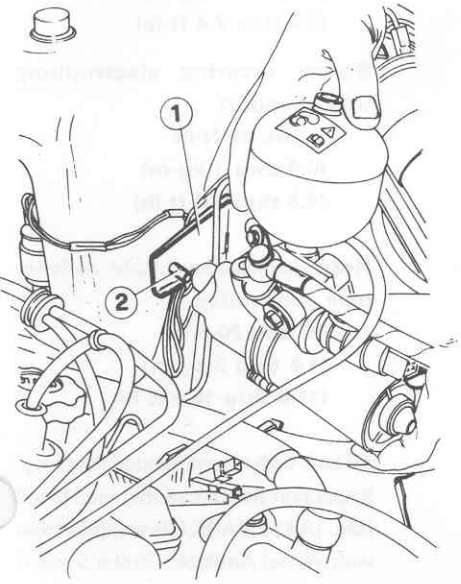
1 Pressurized fluid delivery pipe
2 Spring

5. Back off screw (1) securing the electropump unit to the support (2).



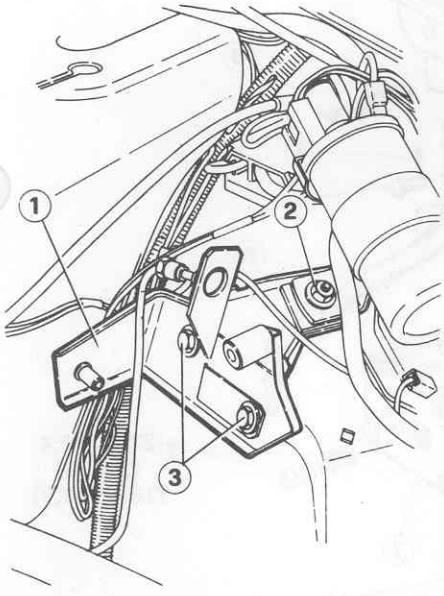
1 Screw
2 Support

6. Remove the electropump unit from the support (1), by sliding it off the pin (2).



1 Support
2 Pin

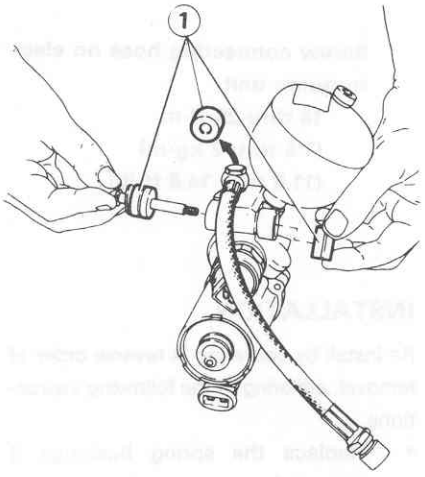
7. If necessary, remove the support (1) by unscrewing screws (3) and nuts (2).



1 Support
2 Nut
3 Screws

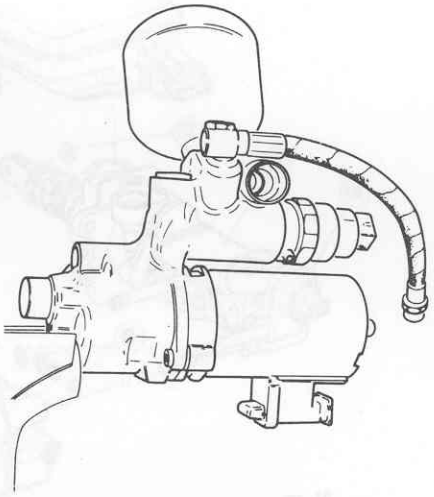
DISASSEMBLY

1. Get hold of spring bushings (1).

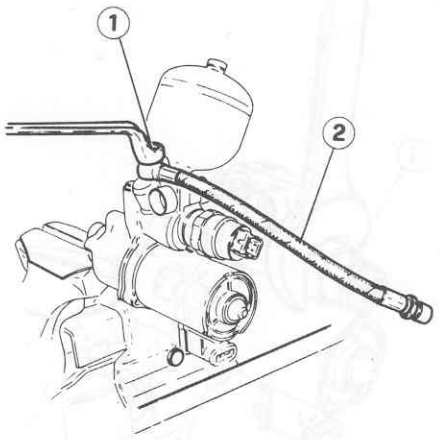


1 Spring bushings

Having clamped the electropump unit in a vice provided with jaw lines, disassemble as follows.



2. Unscrew screw (1) and remove hose (2), retrieving the O-Rings.

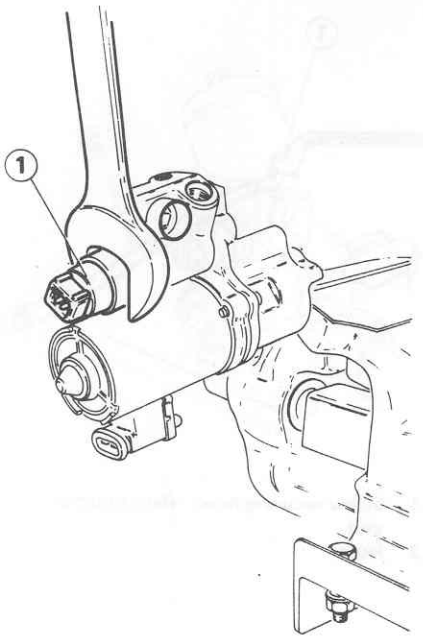


1 Screw securing hose - electropump unit
2 Hose

3. With a suitable tool, unscrew the accumulator (1) from the electropump unit and retrieve the O-Ring.

1 Accumulator

4. Unscrew the pressure switch (1) and remove it from the electropump unit, retrieving the O-Ring.



1 Pressure switch

WARNING:
Do not separate the pump from the electric motor.

REASSEMBLY

Reassemble the electropump unit by operating in reverse order of removal, taking care to lock the various connections to the specified torques.

CAUTION:
The circuit is a high pressure one and correct reassembly is extremely important for the safety of the vehicle during braking: adhere strictly to instructions.

- Replace the O-Rings.
- Observe the following tightening torques.

(T) : **Tightening torques**
Pressure switch - electropump unit connection
20 thru 26 N·m
(2 thru 2.7 kg·m)
(14.8 thru 19.2 ft·lb)

Accumulator - electropump unit connection
40 thru 46 N·m
(4.1 thru 4.7 kg·m)
(29.5 thru 33.9 ft·lb)

Screw connecting hose on electropump unit
16 thru 20 N·m
(1.6 thru 2 kg·m)
(11.8 thru 14.8 ft·lb)

INSTALLATION

Re-install by operating in reverse order of removal, adhering to the following instructions.

- Replace the spring bushings if damaged or worn.
- Observe the following tightening torques.

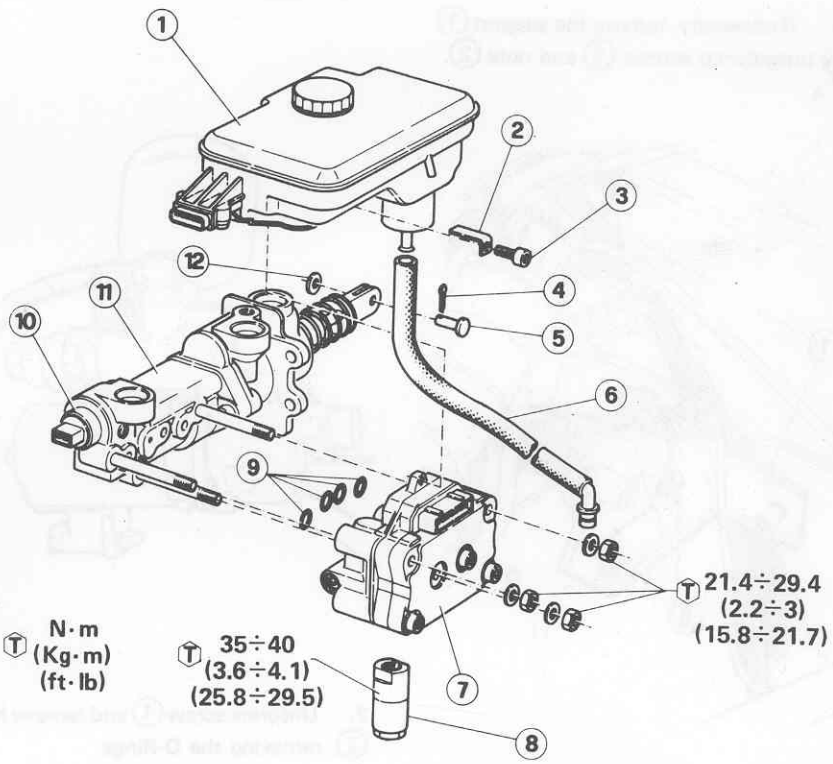
(T) : **Tightening torques**
Screws and nuts securing support - body
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

Screw securing electropump unit - support
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

Hose - pressurized fluid delivery pipe connection
16 thru 20 N·m
(1.6 thru 2 kg·m)
(11.8 thru 14.8 ft·lb)

- Fill tank with recommended fluid (see: Inspection Specifications) then bleed (see: (ABS) MARK II Braking System with Wheel Antilock - Brake System Bleeding).

HYDRAULIC ASSEMBLY



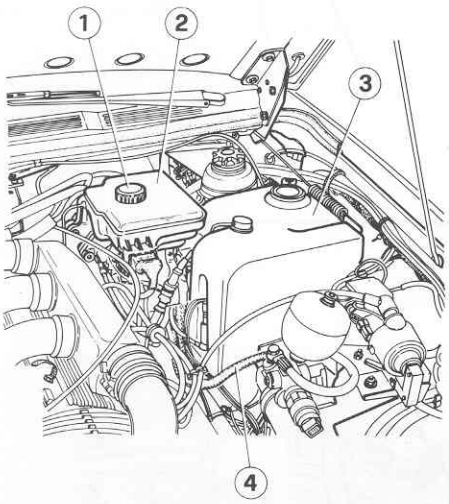
1 Clutch and brake fluid tank
2 Bracket
3 Screw
4 Cotter pin
5 Pin
6 Electropump feed hose
7 Braking pressure modulating electrovalve unit
8 Brake pressure adjusting valve
9 O-Rings
10 Main electrovalve (cannot be separated from (11))
11 Brake master cylinder and hydraulic servo cylinder
12 Washer

REMOVAL

WARNING:
Prior to removing the hydraulic assembly it is necessary to discharge the braking system pressure; remove the ignition key and press the brake pedal right down repeatedly (at least 20 times) until it sticks.

1. Disconnect the battery.
2. Remove the windscreen washing liquid container (3) and the fire proof shield so as get a larger working area.
3. Drain the clutch and brake fluid from the tank by operating thus.

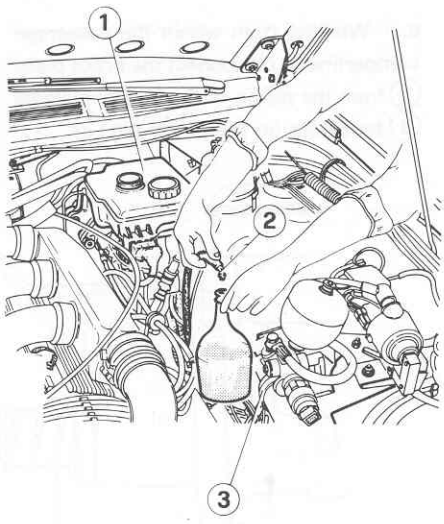
a. Remove plug (1) from tank (2).



1 Plug
2 Clutch and brake fluid tank
3 Windscreen washing liquid container
4 Electropump feed hose

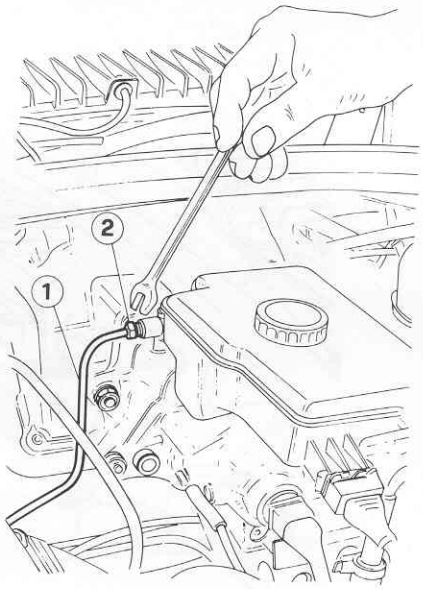
b. Disconnect the feed hose (2) from the electropump (3) and collect the fluid draining directly from the tank (1).

WARNING:
Clutch and brake fluid is corrosive; protect paintwork adequately.



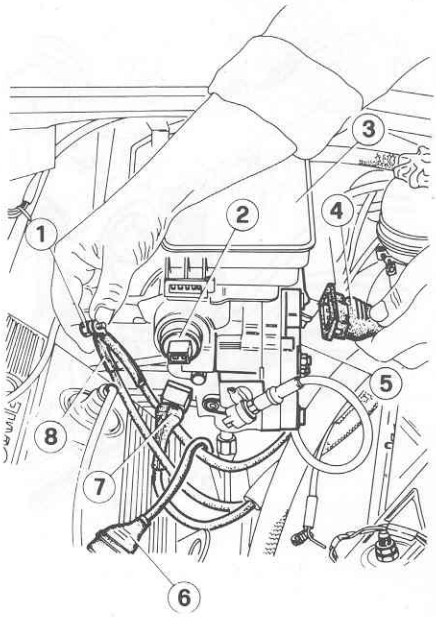
1 Clutch and brake fluid tank
2 Electropump feed hose
3 Electropump

4. Unscrew the union (2) and disconnect the pipe (1) from the hydraulic assembly.



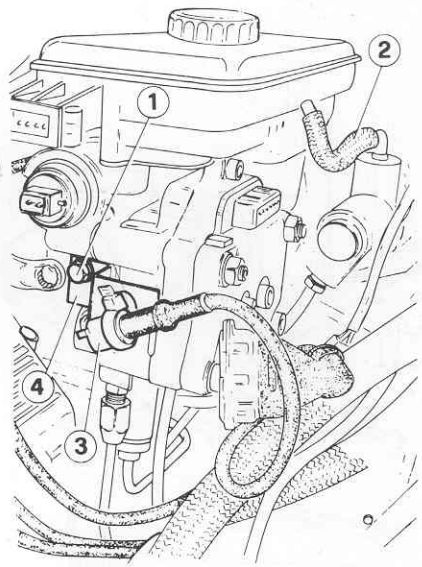
1 Pipe carrying pressurized fluid from the electropump unit to the hydraulic assy
2 Union

5. Bach off the screw (1) tying the ground wires (8) to the hydraulic assy. Disconnect connector (7) from the main electrovalve (2), connector (4) from the electrovalve (5) and connector (6) from the tank (3).



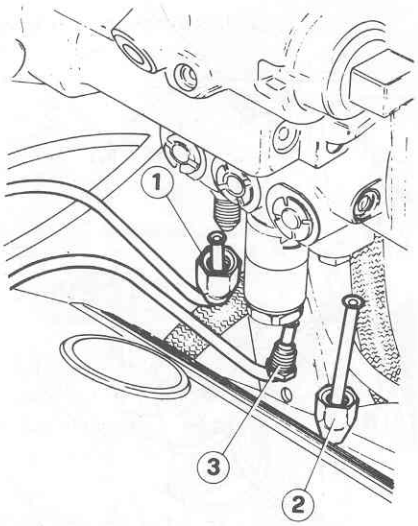
1 Screw
2 Main electrovalve
3 Brake fluid tank
4 Connector for electrovalve unit
5 Electrovalve unit
6 Connector for brake fluid tank
7 Connector for main electrovalve
8 Ground wires

6. Back off the screw (1) securing the square (4) for connection (3) of the front wheel impulse pick-up to the hydraulic assy. Disconnect the clutch master cylinder supply duct (2).



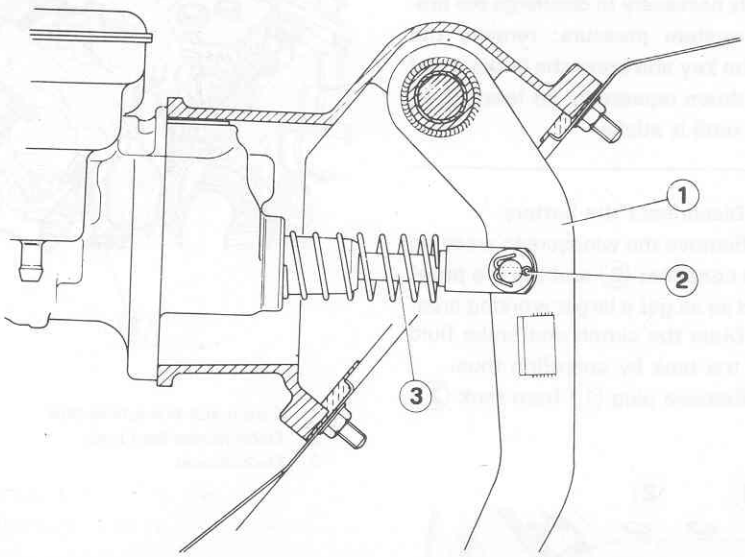
1 Screw
2 Clutch master cylinder supply duct
3 L.H. front wheel impulse pick-up connection
4 Square

7. Unscrew unions (1), (2) and (3) then disconnect corresponding pipes from the hydraulic assy.



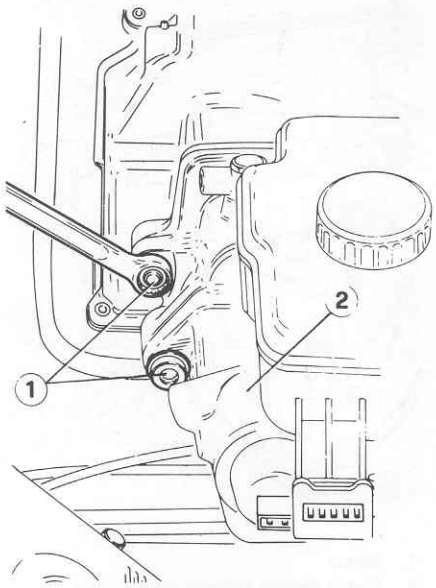
1 Union
2 Union
3 Union

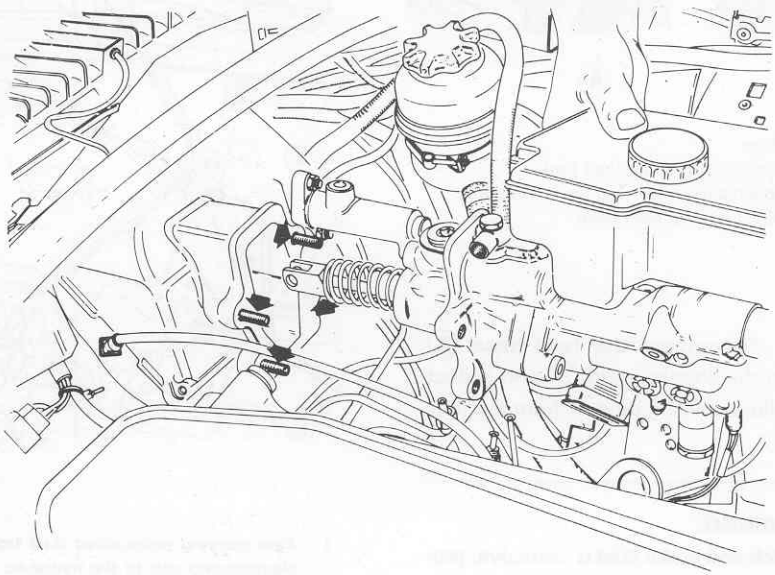
8. Working from within the passenger compartment, disconnect the brake pedal (1) from the piston of the master cylinder (3) by acting on the cotter pin (2).



1 Brake pedal
2 Cotter pin
3 Master cylinder piston

9. Back off the four units (1) connecting the hydraulic assy (2) to the pedal assy and remove the former by extracting it from the four studs.

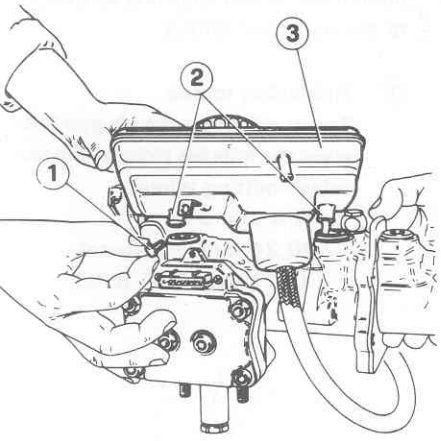




1 Nuts connecting the hydraulic - pedal assy
2 Hydraulic assy

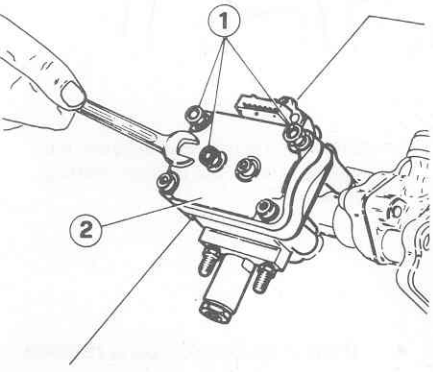
DISASSEMBLY

1. Unscrew screw (1) and with the aid of a lever, free the brake fluid tank (3) from the two unions (2).



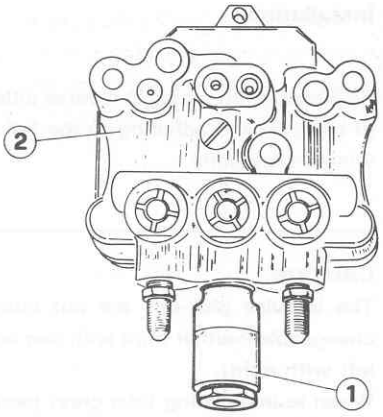
1 Screw connecting the brake fluid tank - hydraulic assy
2 Unions
3 Brake fluid tank

2. Back off the three nuts (1), separate the electrovalve unit (2) from the hydraulic assy and retrieve the O-Rings.



1 Nuts connecting the electrovalve unit - brake master cylinder
2 Electrovalve unit

3. If necessary unscrew the brake pressure adjusting valve (1) and remove it from the electrovalve unit (2).



1 Brake pressure adjusting valve
2 Electrovalve unit

WARNING:
Do not disassemble the electrovalve unit and brake pressure adjusting valve components; do not separate the brake master cylinder from the hydraulic servocylinder.

REASSEMBLY

Reassemble the hydraulic assembly in reverse order of removal, making sure to tighten the various connections to the specified torques.

CAUTION:
The circuit is a high pressure one and correct reassembly is extremely important for the safety of the vehicle during braking; adhere strictly to instructions.

- Replace the O-Rings.
- Observe the following tightening torques.

(T) : **Tightening torques**

Brake pressure adjusting valve-electrovalve unit connection
35 thru 40 N·m
(3.6 thru 4.1 kg·m)
(25.8 thru 29.5 ft·lb)

Nuts securing the electrovalve unit - hydraulic assy
21.4 thru 29.4 N·m
(2.2 thru 3 kg·m)
(15.8 thru 21.7 ft·lb)

Screw locking union on hydraulic assy
16 thru 20 N·m
(1.6 thru 2 kg·m)
(11.8 thru 14.8 ft·lb)

INSTALLATION

Install in reverse order of removal, adhering to these instructions.

1. Apply **Lowac Perfect Seal** to the hydraulic assy - pedal assy joining surfaces.
2. Observe the following tightening torques.

(T) : **Tightening torques**

Nuts connecting the hydraulic assembly - pedal assy
11.3 thru 14 N·m
(1.1 thru 1.4 kg·m)
(8.3 thru 10.3 ft·lb)

Unions connecting the hydraulic assy - pipes carrying pressurized fluid to the brake calipers
12 thru 16 N·m
(1.2 thru 1.6 kg·m)
(8.9 thru 11.8 ft·lb)

Screw securing the square connecting the front left hand wheel impulse pick-up to the hydraulic assy
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

Union connecting pipe ("from" electropump) - hydraulic assy
16 thru 20 N·m
(1.6 thru 2 kg·m)
(11.8 thru 14.8 ft·lb)

3. Fill the tank with recommended fluid (see: Inspection Specifications) then bleed (see: (ABS) MARK II Braking System with Wheel Antilock - Brake System Bleeding).

IMPULSE PICK-UPS AND IMPULSE EMITTING WHEELS

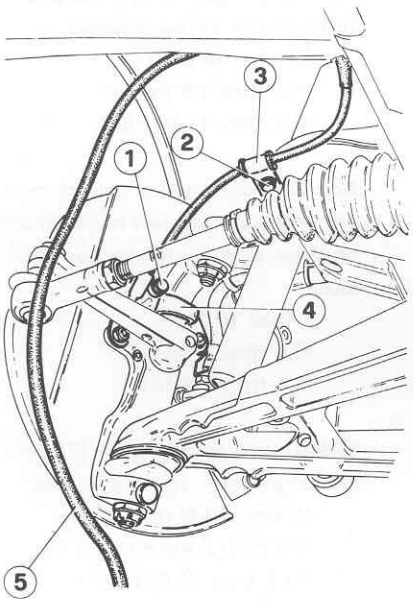
FRONT IMPULSE PICK-UPS

Removal

1. Disconnect the battery.
2. Working in the engine compartment, disconnect the electrical connection of the cable of the front impulse pick-up in question.
3. Place the car on a lift, put on the hand brake and raise the car.
4. Pick-up removal.

a. Alfa 90 only; back off the screw (2) securing the cable plate (3) to the suspension upper link.

b. Release the cable; back off the screw (1) securing the impulse pick-up to the support (4); retrieve the impulse pick-up.



1 Screw securing impulse pick-up support
2 Screw
3 Cable plate
4 Impulse pick-up support
5 Impulse pick-up cable

5. If necessary, remove the support of the impulse pick-up by unscrewing the two nuts securing it to the steering knuckle.

Installation

Re-install by operating in reverse order of removal and adhering to the following instructions.

CAUTION:
The impulse pick-ups are not interchangeable (neither front with rear nor left with right).
When re-installating take great pains to ensure that the impulse pick-ups, new or used, are installed in the correct position.

- Observe the following tightening torques.

(T) : **Tightening torques**
Screw securing cable plate - suspension upper link
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

Screw securing impulse pick-up - support
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

Nuts securing support - steering knuckle
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

- Ensure that the impulse pick-up cables are secure in theri anchor points on the body and secured to the suspension assemblies to prevent damage when the vehicle is runnig.
- Adjust the air gap between the impulse pick-up and the impulse emitting wheel by operating as follows.

Adjustment of the air gap between the front impulse pick-up and impulse emitting wheel.

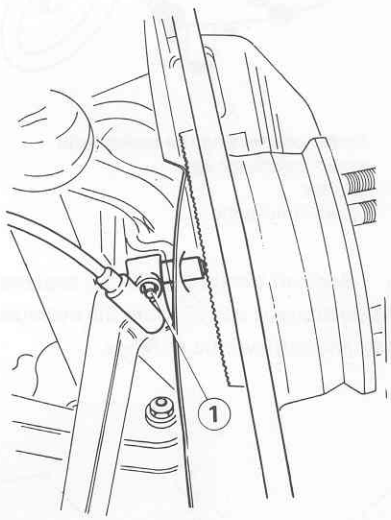
- **If installing a new impulse pick-up.**

a. Loosen the air gap adjusting screw (1).

b. Drive the impulse pick-up home against the impulse emitting wheel (there is a plastic spacer on the impulse pick-up head of the same thickness as the air gap required).

c. Keeping the impulse pick-up against the impulse emitting wheel, tighten the air gap adjusting screw (1) to the specified torque.

(T) : **Tightening torque**
Screw adjusting the air gap between the impulse pick-up and impulse emitting wheel
2.4 thru 3 N·m
(0.24 thru 0.3 kg·m)
(1.77 thru 2.21 ft·lb)

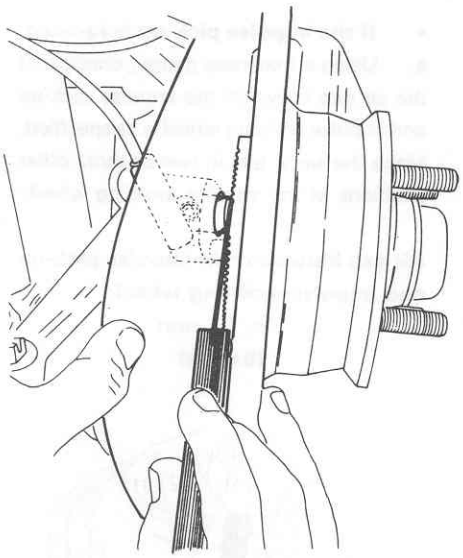


1 Screw adjusting air gap between the impulse pick-up and impulse emitting wheel

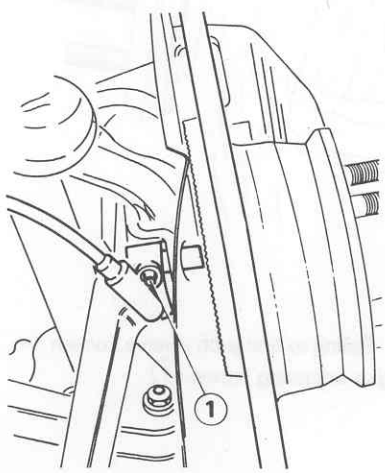
- If the impulse pick-up is re-used.

a. Using a thickness gauge, check that the air gap between the impulse pick-up and impulse emitting wheel is as specified. Make the same test in two or three other positions of the impulse emitting wheel.

Air gap between front impulse pick-up and impulse emitting wheel:
t = 0.7 mm
(0.03 in)



b. Failing to find such a value, loosen the air gap adjusting screw (1).



1 Screw adjusting air gap between impulse pick-up and impulse emitting wheel

c. Put a spacer equivalent to the specified air gap between the impulse pick-up and the impulse emitting wheel **(0.7 mm; 0.03 in)**.
Keeping the impulse pick-up in contact with the spacer and impulse emitting wheel, tighten the adjusting screw to the specified torque.

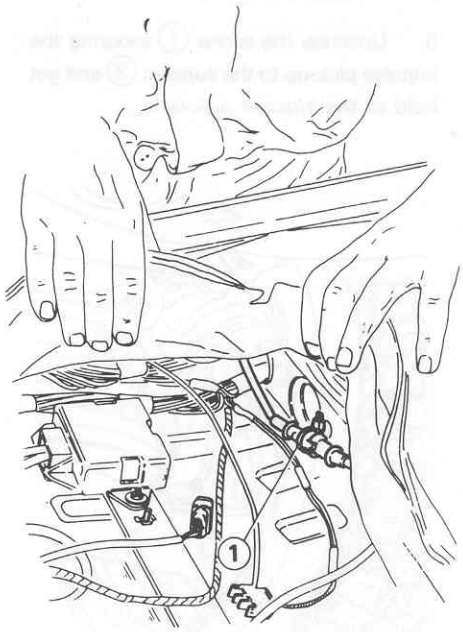
(T) : Tightening torque
Screw adjusting the air gap between the impulse pick-up - impulse emitting wheel
2.4 thru 3 N·m
(0.24 thru 0.3 kg·m)
(1.77 thru 2.21 ft·lb)

d. Check that the air gap remains as specified in two or three further positions of the impulse emitting wheel.

REAR IMPULSE PICK-UPS

Removal

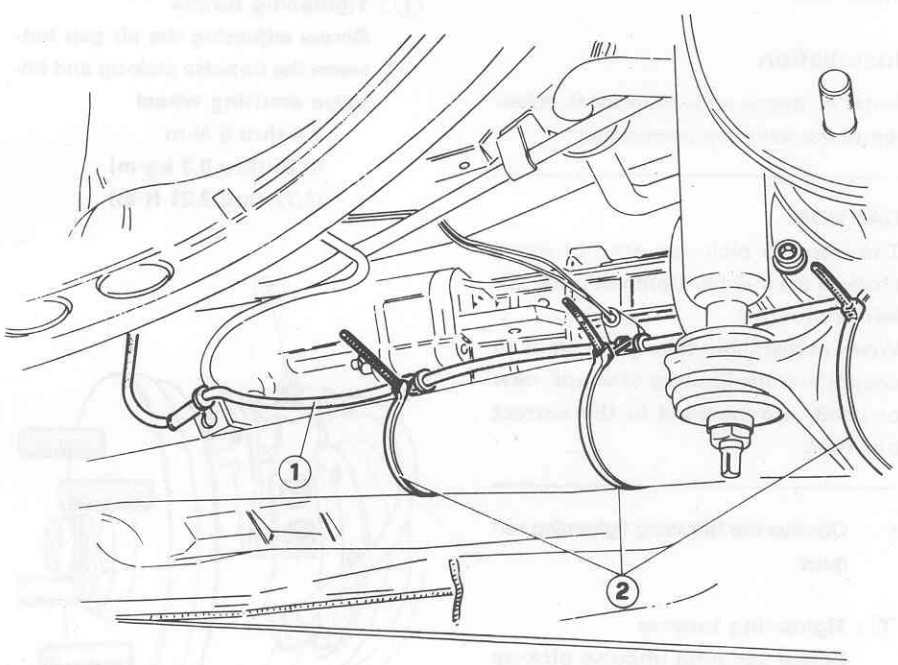
1. Disconnect the battery.
2. Working in the passenger compartment, remove the rear seat, raise the sound proof upholstery then disconnect the electrical connection (1) of the rear impulse pick-up cable concerned, sliding it off from outside the car.



1 Rear impulse pick-up connection

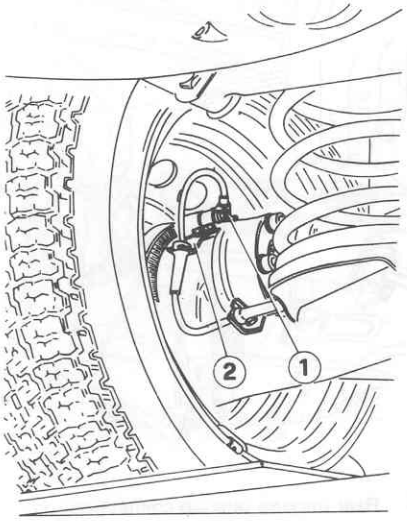
3. Place the vehicle on the lift, activate the hand brake and raise the car.

4. Free the impulse pick-up cable (1) from the three clips (2) securing it to the De Dion axle.



1 Rear impulse pick-up cable
2 Clips

5. Unscrew the screw (1) securing the impulse pick-up to the support (2) and get hold of the impulse pick-up.



1 Screw securing impulse pick-up - support
2 Support

6. If necessary, remove the support by unscrewing the two nuts holding it to the wheel hub.

Installation

Install in reverse order of removal, adhering to the following instructions.

CAUTION:
The impulse pick-ups are not interchangeable (neither front with rear nor left with right).
When re-installing take great pains to ensure that the impulse pick-ups, new or used, are installed in the correct position.

- Observe the following tightening torques.

Ⓣ : **Tightening torques**
Screw securing impulse pick-up - support
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

Nuts securing support - wheel hub
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

- Ensure that the impulse pick-up cables are secure in their anchor points on the body and secured to the suspension assemblies to prevent damage when the vehicle is running.
- Adjust the air gap between the impulse pick-up and the impulse emitting wheel by operating as follows.

Adjustment of the air gap between the rear impulse pick-up and impulse emitting wheel.

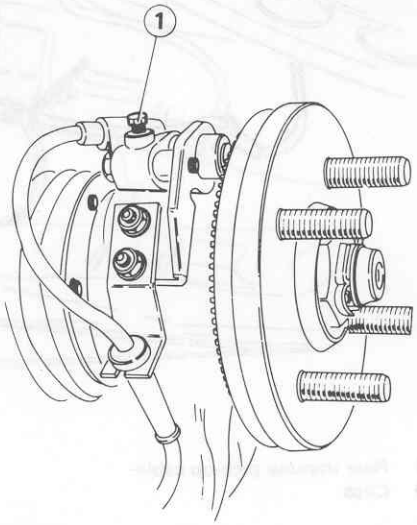
- **If installing a new impulse pick-up**

a. Loosen the air gap adjusting screw (1).

b. Drive the impulse pick-up home against the impulse emitting wheel (there is a plastic spacer on the impulse pick-up head of the same thickness as the air gap required).

c. Keeping the impulse pick-up against the impulse emitting wheel, tighten the air gap adjusting screw (1) to the specified torque.

Ⓣ : **Tightening torque**
Screw adjusting the air gap between the impulse pick-up and impulse emitting wheel
2.4 thru 3 N·m
(0.24 thru 0.3 kg·m)
(1.77 thru 2.21 ft·lb)

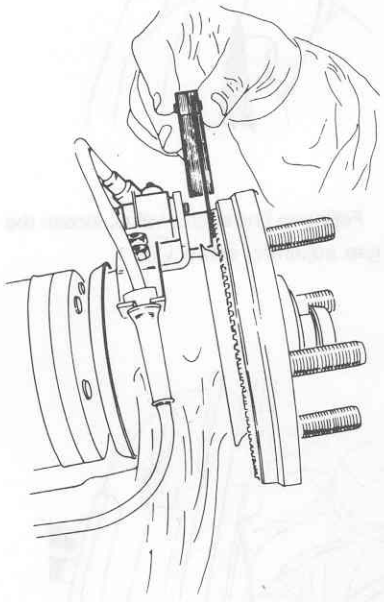


1 Screw adjusting air gap between the impulse pick-up and the impulse emitting wheel

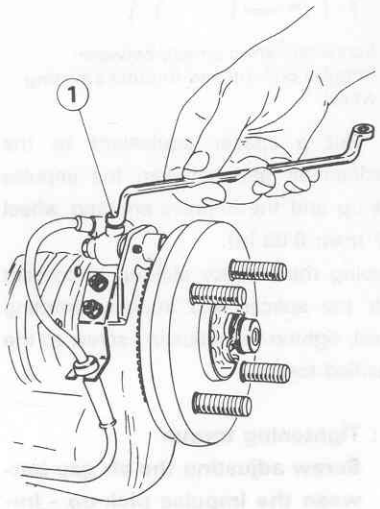
- **If the impulse pick-up is re-used.**

a. Using a thickness gauge, check that the air gap between the impulse pick-up and impulse emitting wheel is as specified. Make the same test in two or three other positions of the impulse emitting wheel.

Air gap between rear impulse pick-up and impulse emitting wheel:
t = 1.1 mm
(0.04 in)



b. Failing to find such a value, loosen the air gap adjusting screw (1).



1 Screw adjusting air gap between the impulse pick-up and the impulse emitting wheel

c. Put a spacer equivalent to the specified air gap between the impulse pick-up and the impulse emitting wheel **(1.1 mm; 0.04 in)**.
Keeping the impulse pick-up in contact with the spacer and impulse emitting wheel, tighten the adjusting screw to the specified torque.

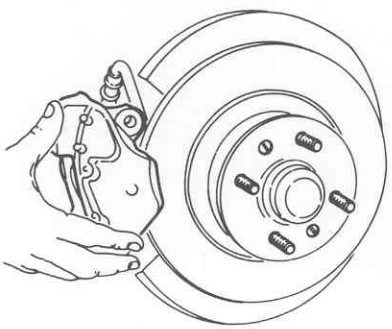
Ⓣ : **Tightening torque**
Screw adjusting the air gap between the impulse pick-up - impulse emitting wheel
2.4 thru 3 N·m
(0.24 thru 0.3 kg·m)
(1.77 thru 2.21 ft·lb)

d. Check that the air gap remains as specified in two or three further positions of the impulse emitting wheel.

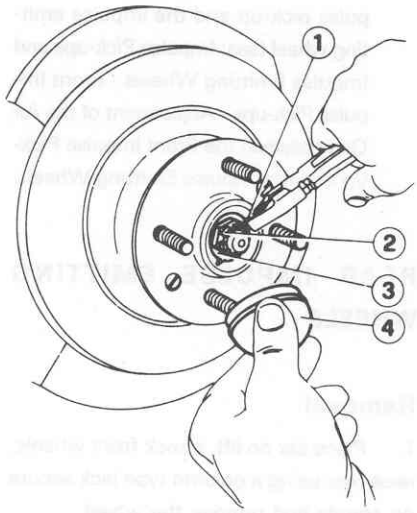
FRONT IMPULSE EMITTING WHEELS

Removal

1. Place car on lift, activate the hand brake, raise the car at the front using a column type jack, secure with stands and remove the wheel.
2. Remove the pads (see: Traditional Braking System - Front Brakes - Pad Replacement - steps 3 and 5).
3. Unlock and back off the two screws, securing the brake caliper to the steering knuckle, without disconnecting it from the brake hose.
4. Remove the brake caliper unit; secure the brake caliper on one of the suspension links.

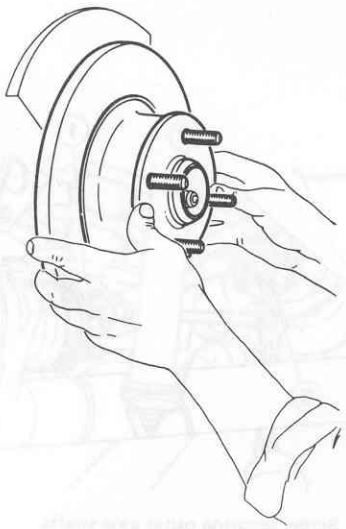


5. Extract the hub cover (4) and cotter pin (1).
6. Back off nut (2) and extract together with washer (3).

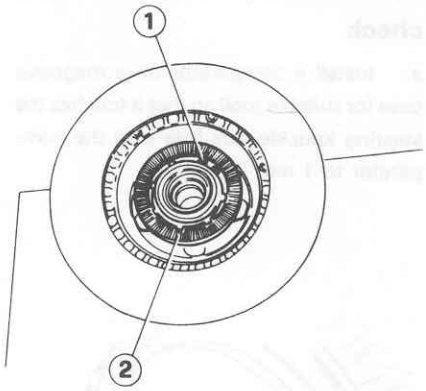


1 Cotter pin
2 Nut
3 Washer
4 Hub cover

7. Remove the hub complete with brake disc and place on bench.



8. Using pliers, remove the retainer ring (1) and separate the impulse emitting wheel (2) from hub.



1 Retainer ring
2 Front impulse emitting wheel

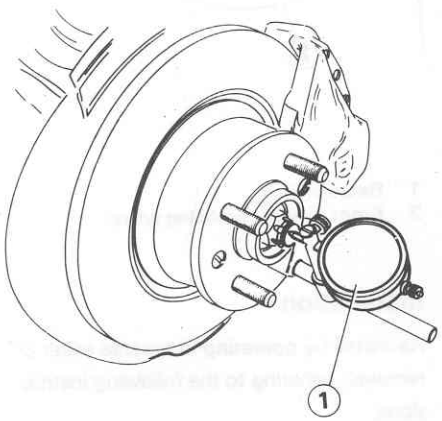
Installation

Re-install by operating in reverse order of removal, adhering to the following instructions.

- Clean the impulse emitting wheel thoroughly, checking that there are no signs of damage.
- Put the impulse emitting wheel into place and secure it to the hub with the retainer ring.
- Re-install the hub on the steering knuckle but do not insert the cotter pin.
- Check the clearance of the front hub bearings by operating as follows.

Front hub bearing clearance check

a. Install a comparator on a magnetic base (or suitable tool) so that it touches the steering knuckle axis (pre load the comparator to 1 mm (0.04 in)).



1 Comparator

b. Move the wheel hub axially (back and forth) and read the clearance indicated on the comparator. This clearance should come within specified values.

Front hub bearing clearance:
G = 0.02 thru 0.12 mm
(0.0008 thru 0.005 in)

c. Re-position the cotter pin thus:
— If the clearance value is 0.02 thru 0.06 mm (0.0008 thru 0.002 in), back off nut until cotter pin is inserted.
— If the clearance value is 0.06 thru 0.12 mm (0.002 thru 0.005 in), screw on the nut until cotter pin is inserted.

d. Bend the cotter pin back and reassemble the hub cover.

- Observe the following tightening torque.

Ⓣ : **Tightening torque**
Screw securing the brake caliper to the steering knuckle
74 thru 83 N·m
(7.5 thru 8.5 kg·m)
(54.6 thru 61.2 ft·lb)

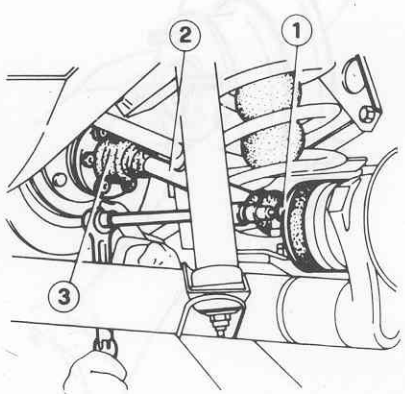
- Check the air gap between the impulse pick-up and the impulse emitting wheel (see: Impulse Pick-ups and Impulse Emitting Wheels - Front Impulse Pick-ups - Adjustment of the Air Gap between the Front Impulse Pick-up and the Impulse Emitting Wheel).

REAR IMPULSE EMITTING WHEELS

Removal

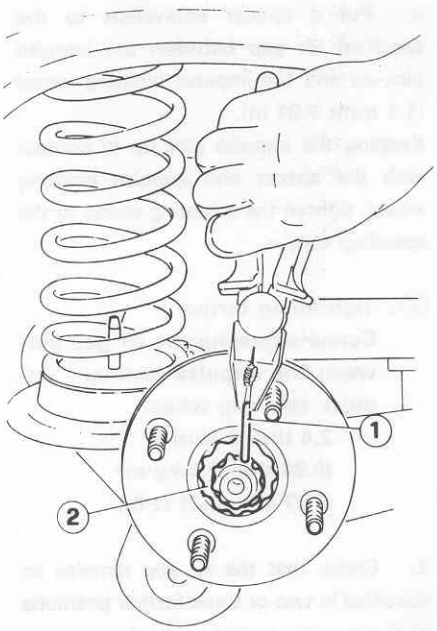
1. Place car on lift, chock front wheels, raise rear using a column type jack secure on stands and remove the wheel.
2. Back off screws (1), get hold of washers and plates then uncouple the outer axle shaft (2).

CAUTION:
During operations take care to avoid damage to the bellows (3) protecting the joints.



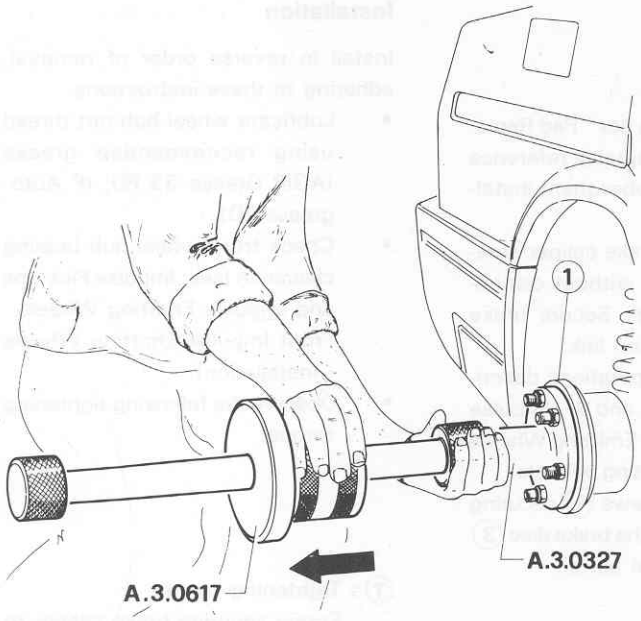
1 Screw securing outer axle shafts
2 Outer axle shaft
3 Bellows protecting joint

3. Extract the cotter pin (1) from the wheel shaft and slide off the lock nut (2).



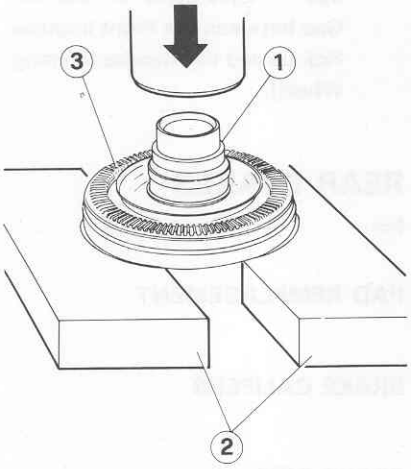
1 Cotter pin
2 Lock nut

4. Having installed a suitable tool to prevent wheel shaft from turning, back off the nut securing the hub to the wheel shaft and slide off the associated washer.
5. Assemble percussion tool **A.3.0617** on tool **A.3.0327**, then, operating as illustrated hereafter, extract the wheel hub (1) and retrieve equipment.



1 Wheel hub

6. Using two suitable half-plates (2) and with the aid of a press, divide the impulse emitting wheel (3) and hub (1).



1 Wheel hub
2 Half plate
3 Impulse emitting wheel

Installation

Install in reverse order of removal, adhering to these instructions.

- Clean the impulse emitting wheel thoroughly, checking that there are no signs of damage.
- Using a press, slip the impulse emitting wheel into the hub and check correct installation (see: Inspection Specifications - Checks and Adjustments).
- Lock the wheel hub securing nut to the following tightening torque.

(T) : **Tightening torque**
Nut securing wheel hub
265 thru 324 N·m
(27 thru 33 kg·m)
(195.5 thru 239 ft·lb)

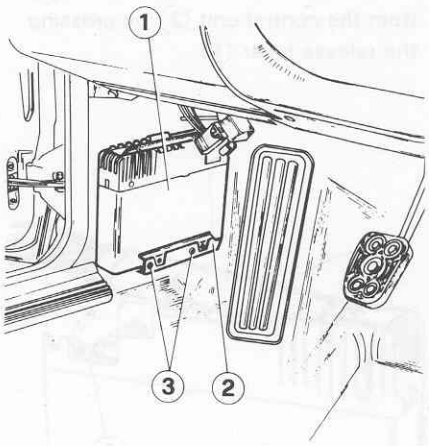
ANTILOCK SYSTEM CONTROL UNIT

1. Alfa 90 only.

NOTE:
The electronic unit is situated in the passenger compartment, to the left of the pedal assy.

REMOVAL AND INSTALLATION

a. Disconnect the battery.
b. Remove protective casing by acting on associated nails.
Back off screws (3) and remove the control unit (1) from the support (2).



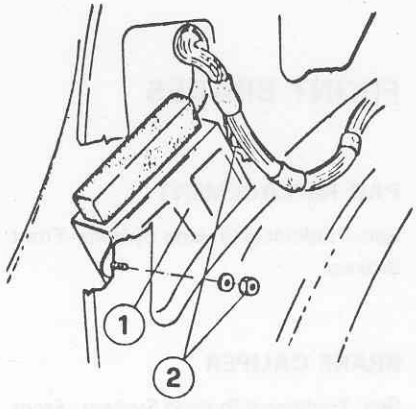
1 Electronic unit
2 Support
3 Screws

2. Z5 only.

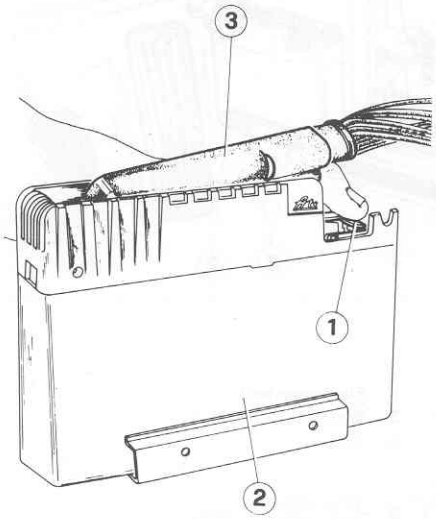
NOTE:
The electronic unit is situated in the luggage compartiment, on the left side of the vehicle.

REMOVAL AND INSTALLATION

a. Disconnect the battery.
b. Remove the soundproofing shield on the left side of the luggage compartement.
c. Uscrew the screws (2) and remove the electronic unit (1).



3. Disconnect the connector (3) from the control unit (2) by pressing the release lever (1).



1 Release lever
2 Electronic unit
3 Connector

WARNING:
Avoid knocks to the electronic unit.

4. Re-install in reverse order of removal.

FRONT BRAKES

PAD REPLACEMENT

See: Traditional Braking System - Front Brakes.

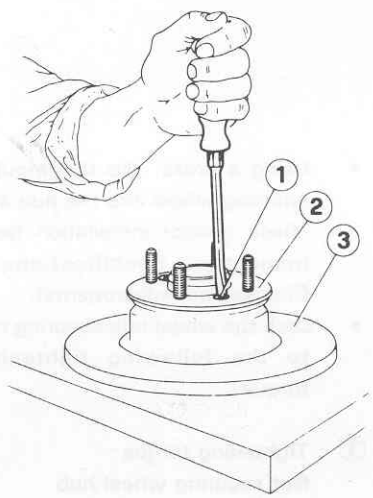
BRAKE CALIPER

See: Traditional Braking System - Front Brakes.

BRAKE DISC

Removal

1. Remove pads as per ''Pad Replacement'', applying suitable reference marks to facilitate subsequent installation.
2. Back off two brake caliper/steering knuckle screws without disconnecting from system. Secure brake caliper to a suspension link.
3. Carry out the operations described in steps 5., 6., 7. and 8. - Impulse Pick-ups and Impulse Emitting Wheels - Front Impulse Emitting Wheels.
4. Back off two screws (1) securing the wheel hub (2) to the brake disc (3) and separate the two parts.



1 Screw
2 Wheel hub
3 Brake disc

Inspection

1. Clean brake discs and check that working surfaces are free from score marks and porosity. Replace or grind as necessary.
2. Should working surfaces need grinding, adhere to the following instructions.

a. Always grind off the same amount of material on both surfaces.
b. Dimensions and tolerances as per ''Inspection Specifications'', ''Checks and Adjustments'' are mandatory.

Installation

Install in reverse order of removal, adhering to these instructions.

- Lubricate wheel hub nut thread using recommended grease (AGIP Grease 33 FD; IP Autogrease FD).
- Check front wheel hub bearing clearance (see: Impulse Pick-ups and Impulse Emitting Wheels - Front Impulse Emitting Wheels - Installation).
- Observe the following tightening torque.

(T) : **Tightening torque**
Screw securing brake caliper to steering knuckle
74 thru 83 N·m
(7.5 thru 8.5 kg·m)
(54.6 thru 61.2 ft·lb)

- Check the air gap between the impulse pick-up and the impulse emitting wheel (see: Impulse Pick-ups and Impulse Emitting Wheels - Front Impulse Pick-ups - Adjustment of the Air Gap between the Front Impulse Pick-up and the Impulse Emitting Wheel).

REAR BRAKES

For:

PAD REMPLACEMENT

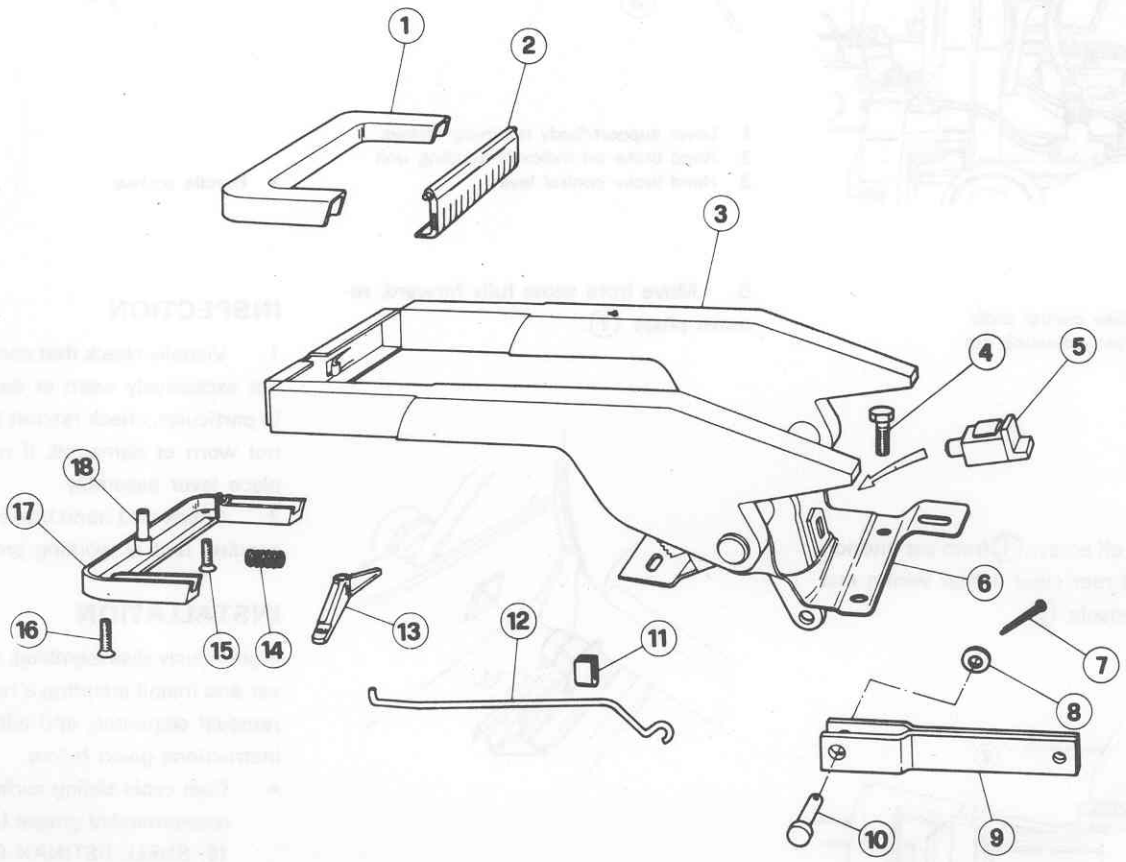
BRAKE CALIPERS

BRAKE DISC

See: Traditional Braking System - Rear Brakes.

HAND BRAKE

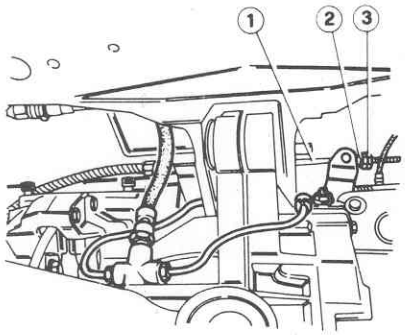
CONTROL LEVER Alfa 90 AND Alfa 75



1 Upper grip
2 Control bar
3 Control lever body
4 Support/body retaining screw
5 Hand brake on indicator sending unit
6 Lever support
7 Cotter
8 Washer
9 Actuating fork
10 Pin
11 Guide
12 Push rod
13 Bracket
14 Spring
15 Screw
16 Screw
17 Lower grip
18 Backet pin

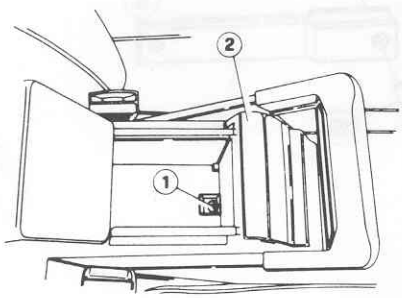
REMOVAL

1. Raise car on a platform lift.
2. Back off locknut (3) and nut (2), and disconnect cable (1).



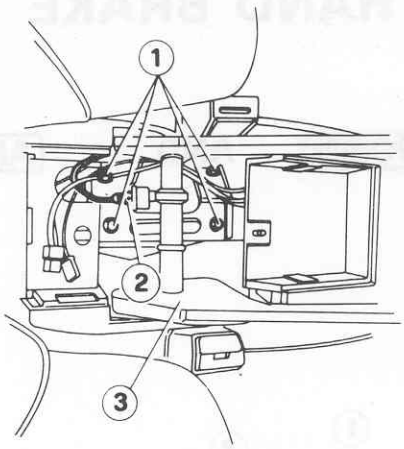
1 Hand brake control cable
2 Hand brake adjusting nut
3 Locknut

3. Back off screw (1) from car interior, disconnect rear cigar lighter wiring and remove console (2).



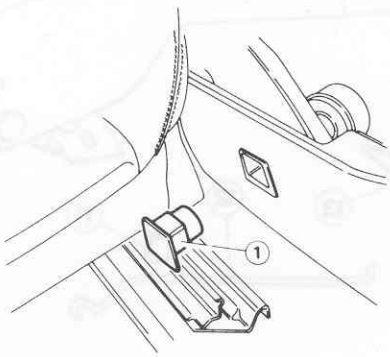
1 Console screw
2 Rear console

4. Back off four screws (1) and disconnect sending unit lead (2).



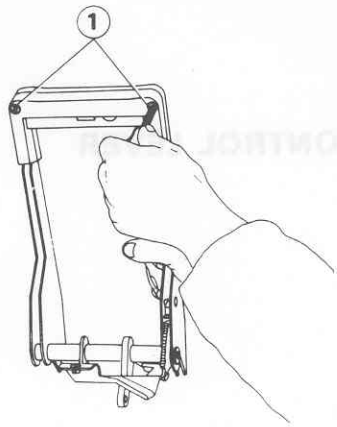
1 Lever support/body retaining screws
2 Hand brake on indicator sending unit
3 Hand brake control lever

5. Move front seats fully forward; remove plugs (1).



1 Rear console plug

6. Move lever to gain access to lever/control cable conn. rod connection.
7. Remove cotter and lever/conn. rod pin; remove control lever.
8. If necessary, back off 2 control lever grip screws (1), disassemble lever and take off indicator sending unit.



1 Handle screws

INSPECTION

1. Visually check that components are not excessively worn or damaged.
In particular, check ratchet and pawl are not worn or damaged; if necessary replace lever assembly.
2. Check that hand brake on indicator sending unit is working properly.

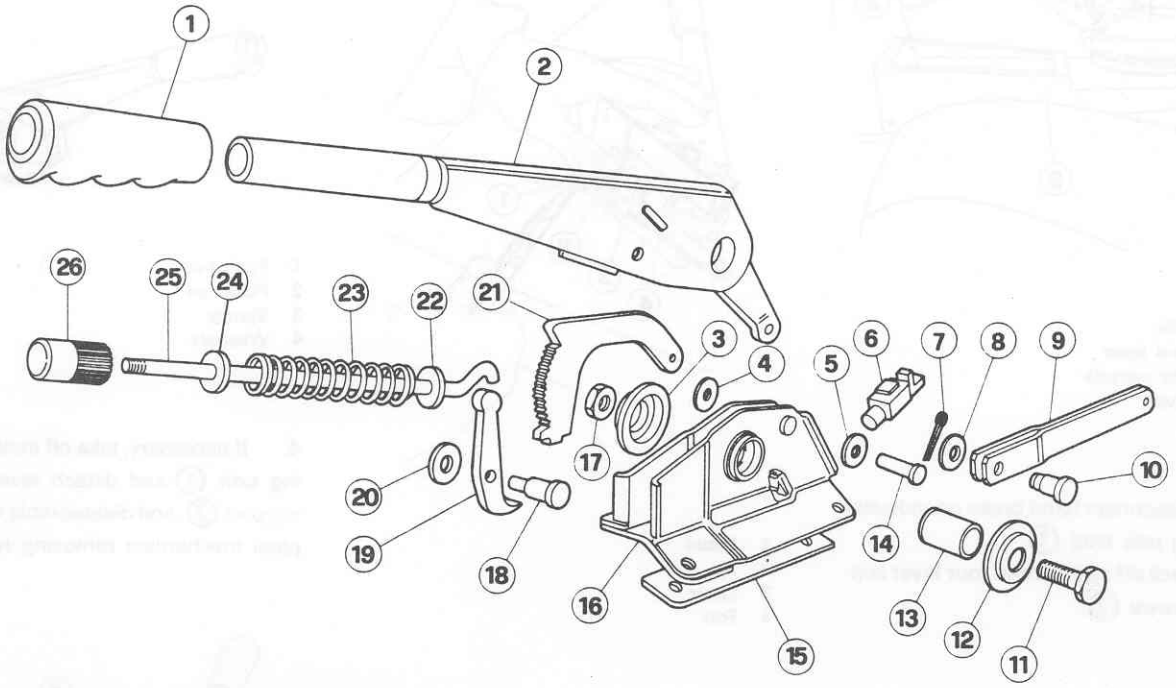
INSTALLATION

If previously disassembled, assemble lever and install adopting a reversal of the removal sequence, and adhering to the instructions given below.

- Coat cable sliding surfaces with the recommended grease (AGIP Grease 15; SHELL RETINAX G11).
- Adjust hand brake (see Hand Brake Lever Travel Adjustment).

CONTROL LEVER

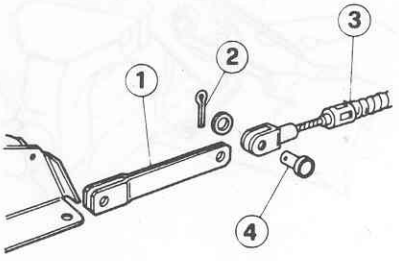
Alfetta | Giulietta | GTV 2.0 | GTV6 2.5



1 Handle
2 Control lever
3 Washer
4 Spacer
5 Spacer
6 Hand brake on indicator sending unit
7 Cotter
8 Washer
9 Fork
10 Pin
11 Screw
12 Washer
13 Bushing
14 Pin
15 Gasket
16 Lever support
17 Nut
18 Pin
19 Pawl
20 Spacer
21 Ratchet
22 Inner washer
23 Spring
24 Outer washer
25 Control rod
26 Push button

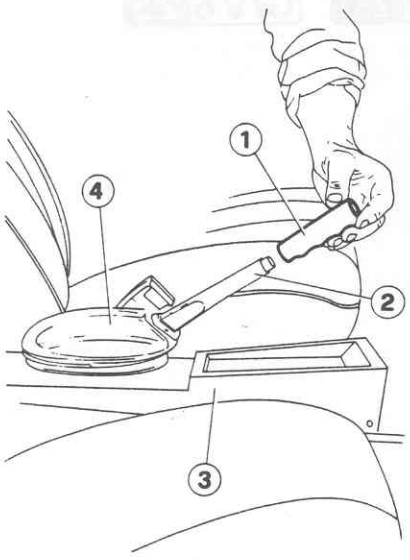
REMOVAL

1. Place car on platform lift, raise and acting on control lever relay assy. remove cotter (2), fork connecting pin (4) and control cable (3).



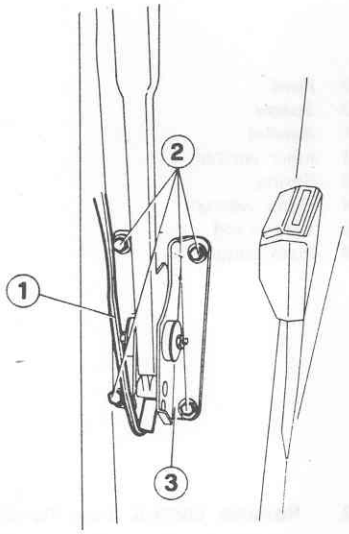
1 Fork
2 Cotter
3 Control cable
4 Pin

2. Remove control lever handle (1) from car interior, back off screws retaining center console (3) to body and remove console with bellows (4).



1 Handle
2 Control lever
3 Center console
4 Bellows

3. Disconnect hand brake on indicator sending unit lead (1).
4. Back off and remove four lever support screws (2).

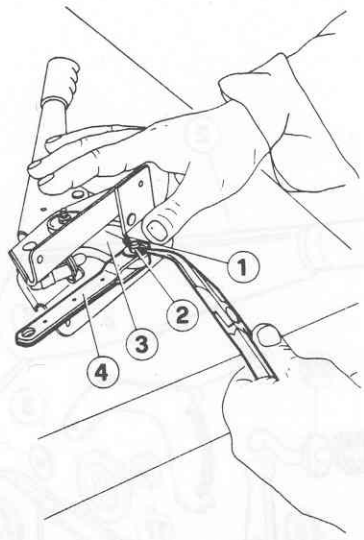


1 Cables
2 Support/body retaining screws
3 Lever support

5. Remove lever with support.

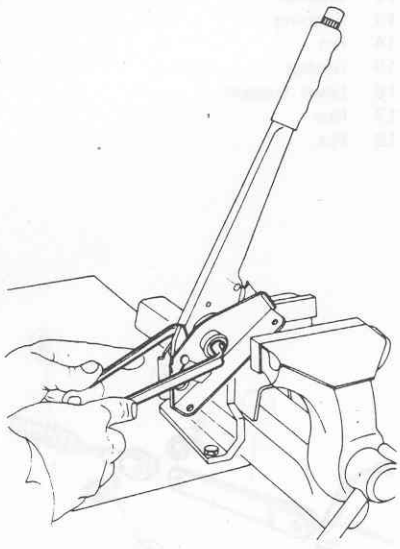
DISASSEMBLY

1. Take off cotter (1) from pin (2) connecting lever (3) to relay fork (4), remove pin, retrieve associated washer and detach fork from lever.

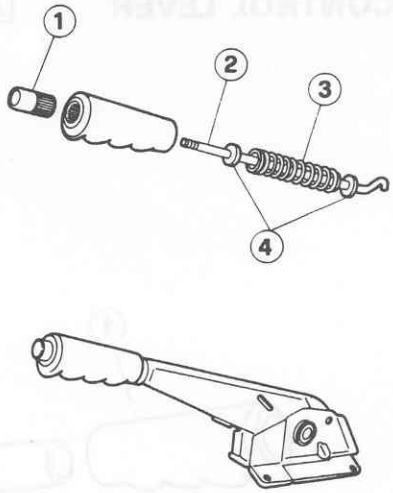


1 Cotter
2 Pin
3 Lever
4 Fork

2. Back off bolt retaining lever to support and pull out associated bushing.

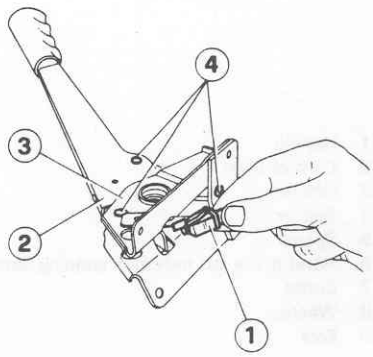


3. Back off push button (1) and take off push rod (2) with spring (3) and associated washers (4).



1 Push button
2 Push rod
3 Spring
4 Washers

4. If necessary, take off indicator sending unit (1) and detach lever (2) from support (3), and disassemble ratchet and pawl mechanism removing rivets (4).



1 Hand brake on indicator sending unit
2 Lever
3 Lever support
4 Rivets

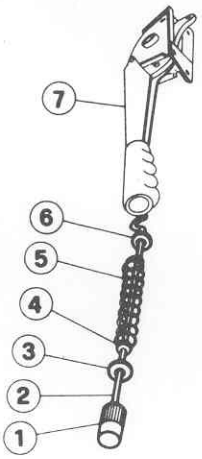
INSPECTION

1. Visually check components for excessive wear or damage. In particular, check lever/support bushing surface conditions and ratchet mechanism teeth for wear.

2. Check that hand brake on indicator sending unit is working properly.
3. Replace worn or defective parts.

ASSEMBLY

Assemble support and lever adopting a reversal of the disassembly sequence and positioning control components as indicated in figure.



1 Push button
2 Control rod
3 Outer washer
4 Shoulder
5 Spring
6 Inner washer
7 Lever

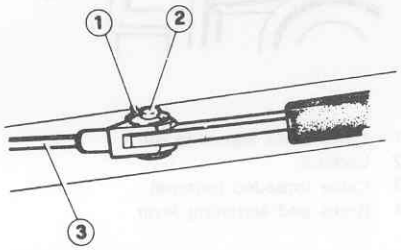
INSTALLATION

1. Install control lever with support on car adopting a reversal of the removal sequence.
2. Adjust hand brake as per "Hand Brake Lever Travel Adjustment".

CONTROL CABLE

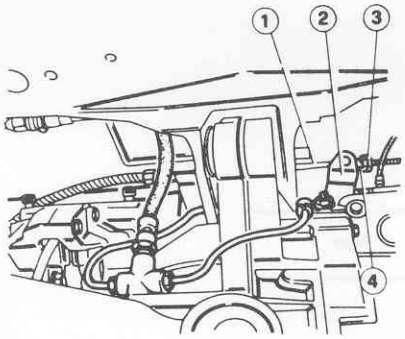
REMOVAL

1. Raise car on platform lift.
2. Remove exhaust pipe center section and front end (see: Group 04 - Exhaust System - Removal).
3. Disconnect remote control rod from gear lever and move out of the way to gain access to hand brake control lever/cable connection.
4. Remove cotter (1) and take out pin (2), thereby releasing cable (3).



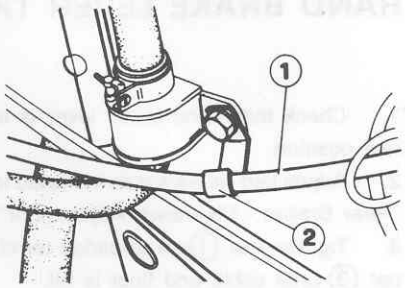
1 Cotter
2 Pin
3 Hand brake control cable

5. Back off locknut (3) and nut (4), remove cable (1) from levers (2) and take off together with sheath.



1 Hand brake cable
2 Brake pad actuating lever
3 Locknut
4 Hand brake adjusting nut

6. Release sheath (1) from retaining brackets (2).



1 Cable sheath
2 Retaining bracket

INSTALLATION

Install by adopting a reversal of the removal sequence and adhering to the instructions given below.

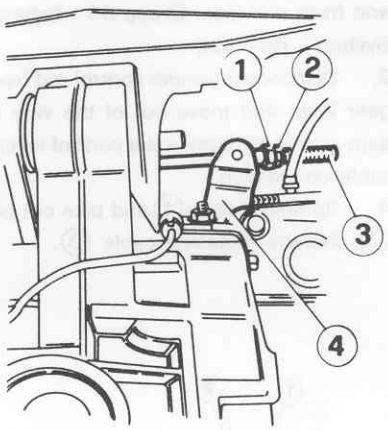
- Adjust hand brake cable as per "Hand Brake Lever Travel Adjustment".

HAND BRAKE LEVER TRAVEL ADJUSTMENT

1. Check that hand brake lever is in rest position.
2. Adjust pad clearance as indicated in "Rear Brakes - Clearance Adjustment".
3. Tighten nut (1) on threaded terminal (3) until cable end float is nil.

WARNING:
Tighten nut without moving levers (4) from rest position (levers abutting limit travel pin) to avoid a reduction in clearance between inner pads and brake disc, as this would cause binding, even with hand brake released.

4. Tighten locknut (2).



1 Hand brake adjusting nut
2 Locknut
3 Cable threaded terminal
4 Brake pad actuating lever

5. Operate hand brake lever and check that rear wheels are locked after 4 to 6 clicks.

INSPECTION SPECIFICATIONS

SPECIFICATION

BRAKE CALIPERS

Model	Front	Rear
Cars with self ventilated front brake discs (see: Group 00 - Complete Car - Use of Units in Car)	BREMBO	ATE
Other models	ATE	ATE

Cylinder dia.

Front	**48 mm (1.89 in)**
Rear	**38 mm (1.50 in)**

TRADITIONAL BRAKING SYSTEM

BRAKE-SERVO

Type: ATE or BENDITALIA

Car type	Vacuum cylinder diam.
6V engine cars	6 in
Other models	8 in

BRAKE MASTER CYLINDER

Type: ATE or BENDITALIA	
Diameter	22.2 mm (0.87 in)
Stroke (front/rear)	16.5/10

BRAKING SYSTEM WITH (ABS) MARK II ANTILOCK

ANTILOCK SYSTEM	ATE ABS MARK II
SERVO BRAKE	High pressure hydraulic
Operating pressure	140 thru 180 bar (13970 thru 17960 KPa) (142.5 thru 183.2 Kg/cm²) (2025.67 thru 2604.42 p.s.i.)
Maximum pressure (prior to safety valve activation)	210 bar (20954 KPa) (213.7 Kg/cm²) (3038.5 p.s.i.)

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Description	Type	Recommended product
Hydraulic brake system	FLUID	ATE: Blau S AGIP: Brake Fluid Super HD IP: Auto Fluid FR Part no.: 3681-69903
Brake caliper bellows	GREASE	ATE: Bremszylinder Pasta
Pedal pivot	GREASE	ISECO: Molykote Longterm n. 2 Part no.: 3671-69831
Parking brake cable sliding surfaces	GREASE	AGIP Grease 15 Part no.: 3671-69810 SHELL RETINAX G 11 Part no: 3671-69811

SEALANTS

Description	Type	Recommended product
Brake servo-shim and pedal support contact surfaces (1) Hydraulic assy - pedal assy adjoining surfaces (2)	JOINTING COMPOUND	LOWAC: Perfect Seal Part no. 3522-00011

(1) Vehicles equipped with traditional braking system
(2) Vehicles equipped with (ABS) MARK II antilock braking system

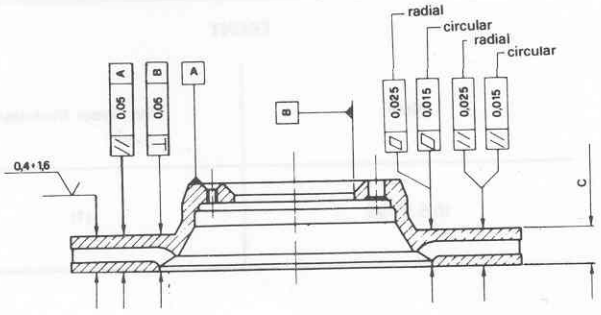
CHECKS AND ADJUSTMENTS

DISC REGRINDING DATA (1)

Front disc

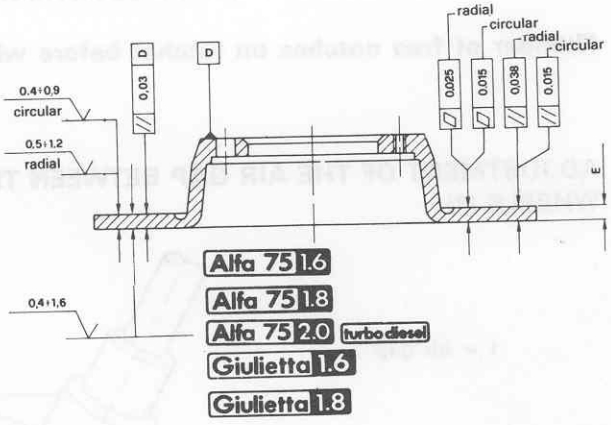
Cars with selfventilated front discs

Brake disc thickness C [mm] (in)	
New	22 (0.866)
Min. thickness after grinding	21 (0.827)
Max. wear thickness	20 (0.787)



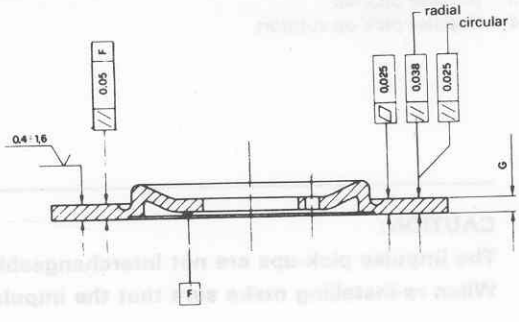
Other models

Brake disc thickness E [mm] (in)		
	Alfa 75 1.6 Alfa 75 1.8 Alfa 75 2.0 turbo diesel Giulietta 1.6 Giulietta 1.8	Alfa 90 Alfa 75 Other models Alfetta Giulietta 2.0 Giulietta 2.0 turbo diesel GTV 2.0
New	12.7 (0.5)	12.7 (0.5)
Min. thickness after grinding	10 (0.39)	11.7 (0.46)
Max. wear thickness	9 (0.35)	10.7 (0.42)



Rear disc

Brake disc thickness G [mm] (in)	
New	10 (0.39)
Min. thickness after grinding	9 (0.35)
Max. wear thickness	8 (0.315)



(1) Symbols √ Roughness [μ]; // Parallelism [mm]; ▱ Flatness [mm] ⊥ Squareness [mm]

REAR BRAKE PAD CLEARANCE

On assembly 0.25 mm (0.01 in)

BRAKE PAD THICKNESS [mm] (in)

FRONT		REAR	
New	Max. wear thickness	New	Max. wear thickness
16.5 (0.65)	(1)	15 (0.59)	(1)

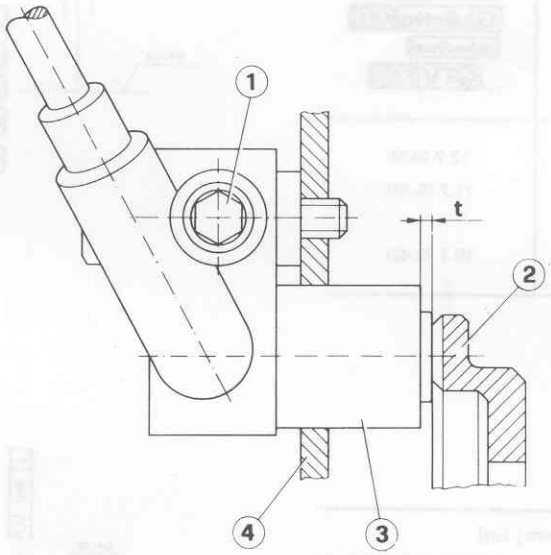
(1) On cars provided with brake pad wear indicator, replace pads when indicator lights up

HAND BRAKE LEVER TRAVEL ADJUSTMENT

Number of free notches on ratchet before wheel locking: 4 to 6

ADJUSTMENT OF THE AIR GAP BETWEEN THE IMPULSE PICK-UPS AND THE IMPULSE EMITTING WHEELS (*)

t = air gap



1 Screw adjusting air gap (t) between the impulse pick-up and impulse emitting wheel
2 Impulse emitting wheel
3 Impulse pick-up
4 Impulse pick-up support

CAUTION:
The impulse pick-ups are not interchangeable (neither front with rear nor left with right).
When re-installing make sure that the impulse pick-ups, new or re-used, are installed in their correct position.

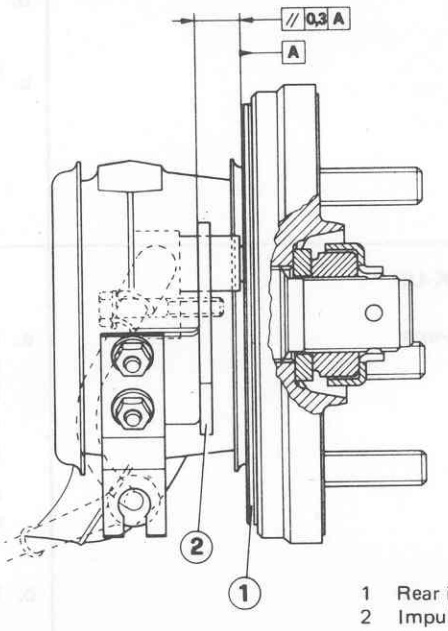
(*) Vehicles equipped with (ABS) MARK II antilock braking system

• **NEW IMPULSE PICK-UP** (The impulse pick-up head bears a plastic spacer equivalent to the air gap required).	a. Loosen adjusting screw (1). b. Drive the impulse pick-up (3) home against the impulse emitting wheel (2). c. Keeping the impulse pick-up against the impulse emitting wheel, tighten the adjusting screw (1) to the specified torque: **2,4 thru 3 N·m** **(0,24 thru 0,3 kg·m)** **(1.77 thru 2.21 ft·lb)**
• **USED IMPULSE PICK-UP** - **Front impulse pick-ups**	a. Using a thickness gauge, check that the air gap (t) between the impulse pick-up (3) and the impulse emitting wheel (2) is as specified. Also check same in two or three further positions of the impulse emitting wheel. **Air gap between front impulse pick-up and impulse emitting wheel:** **t = 0,7 mm (0.03 in)** b. Failing to find this value, loosen the air gap adjusting screw (1). c. Place a spacer equivalent to the specified air gap (0,7 mm; 0.03 in) between the impulse pick-up and impulse emitting wheel. Keeping the impulse pick-up, spacer and impulse emitting wheel in contact, tighten the adjusting screw (1) to the specified torque: **2,4 thru 3 N·m** **(0,24 thru 0,3 kg·m)** **(1.77 thru 2.21 ft·lb)** d. Check that the air gap (t) is as specified in two or three further positions of the impulse emitting wheel
- **Rear impulse pick-ups**	a. Using a thickness gauge, check that the air gap (t) between the impulse pick-up (3) and the impulse emitting wheel (2) is as specified. Also check same in two or three further positions of the impulse emitting wheel. **Air gap between front impulse pick-up and impulse emitting wheel:** **t = 1,1 mm (0.04 in)** b. Failing to find this value, loosen the air gap adjusting screw (1). c. Place a spacer equivalent to the specified air gap (1,1 mm; 0.04 in) between the impulse pick-up and impulse emitting wheel. Keeping the impulse pick-up, spacer and impulse emitting wheel in contact, tighten the adjusting screw (1) to the specified torque: **2,4 thru 3 N·m** **(0,24 thru 0,3 kg·m)** **(1.77 thru 2.21 ft·lb)** d. Check that the air gap (t) is as specified in two or three further positions of the impulse emitting wheel.

REAR IMPULSE EMITTING WHEELS (*)

Assembly tolerance

Parallelism error between the impulse emitting wheel (1) and impulse pick-up support (2):
0,3 mm
(0.01 in)



1 Rear impulse emitting wheel
2 Impulse pick-up support

(*) Vehicles equipped with (ABS) MARK II antilock braking system

TIGHTENING TORQUES [N·m (kg·m; ft·lb)]

Description	[N·m (kg·m; ft·lb)]
Screws front brake caliper to steering knuckle	74 to 83 (7.5 to 8.5) (54.6 to 61.2)
Nuts, rear brake caliper to gearbox/differential housing	46 to 52 (4.7 to 5.3) (33.9 to 38.4)
Screws, spacer and rear brake disc to inner axle shaft (1)	49 to 54 (5 to 5.5) (36.1 to 39.8)
Screws, spacer to outer axle shaft (1)	44 to 54 (4.5 to 5.5) (32.5 to 39.8)
Screws, rear brake disc to axle shaft (2)	29 to 35 (3 to 3.6) (21.4 to 25.8)
Locknut, rear brake disc clearance adjusting screw (torque for guidance only, to be obtained by means of a wrench)	7 to 10 (0.7 to 1) (5.2 to 7.4)

(1) Cars with axle shafts equipped with spacer (refer to Group 00 - Use of Units in Car)

(2) Cars with axle shafts not equipped with spacer (refer to Group 00 - Use of Units in Car)

TRADITIONAL BRAKING SYSTEM data

Part	[N·m (kg·m; ft·lb)]
Fittings, hydraulic brake system piping	10 thru 12 (1 thru 1.2) (7.4 thru 8.9)
Fittings, hydraulic brake system hoses	10 thru 15 (1 thru 1.5) (7.4 thru 11.1)
Nuts, brake servo to pedal support	12 thru 15 (1.2 thru 1.5) (8.9 thru 11.1)
Nuts, brake master cylinder to brake servo	12 thru 15 (1.2 thru 1.5) (8.9 thru 11.1)

(ABS) MARK II WHEEL ANTILOCK BRAKING SYSTEM data

Part	[N·m (kg·m; ft·lb)]
Pressure switch - electropump unit connection	20 thru 26 (2 thru 2.7) (14.8 thru 19.2)
Accumulator - electropump unit connection	40 thru 46 (4.1 thru 4.7) (29.5 thru 33.9)
Screw connecting hose - electropump unit (union)	16 thru 20 (1.6 thru 2) (11.8 thru 14.8)
Screw securing electropump unit - support	9 thru 10 (0.9 thru 1) (6.6 thru 7.4)
Hose (on electropump unit) - pressurized fluid delivery pipe connection	16 thru 20 (1.6 thru 2) (11.8 thru 14.8)
Screws securing electropump unit support - body	9 thru 10 (0.9 thru 1) (6.6 thru 7.4)
Nuts securing coil and electropump unit support - body	9 thru 10 (0.9 thru 1) (6.6 thru 7.4)
Brake adjusting valve - braking pressure modulation electrovalve unit connection	35 thru 40 (3.6 thru 4.1) (25.8 thru 29.5)
Nuts securing electrovalve unit - hydraulic assy	21.4 thru 29.4 (2.2 thru 3) (15.8 thru 21.7)
Screw tightening union on hydraulic assy	16 thru 20 (1.6 thru 2) (11.8 thru 14.8)
Nuts connecting hydraulic - pedal assies	11.3 thru 14 (1.1 thru 1.4) (8.3 thru 10.3)
Unions connecting hydraulic assy - pipes carrying pressurized fluid to brake calipers	12 thru 16 (1.2 thru 1.6) (8.9 thru 11.8)
Screw securing hydraulic assy - square for connection of front left hand wheel impulse pick-up	9 thru 10 (0.9 thru 1) (6.6 thru 7.4)
Union connecting pipe ("from" electropump unit) - hydraulic assy	16 thru 20 (1.6 thru 2) (11.8 thru 14.8)
Screw securing front impulse pick-up cable plate - suspension upper link	9 thru 10 (0.9 thru 1) (6.6 thru 7.4)
Screw securing impulse pick-up (front and rear) - support	9 thru 10 (0.9 thru 1) (6.6 thru 7.4)
Nuts securing front impulse pick-up - steering knuckle	9 thru 10 (0.9 thru 1) (6.6 thru 7.4)
Nuts securing rear impulse pick-up - wheel hub	9 thru 10 (0.9 thru 1) (6.6 thru 7.4)
Screw adjusting air gap, impulse pick-up impulse emitting wheel (front and rear)	2.4 thru 3 (0.24 thru 0.3) (1.77 thru 2.21)

TROUBLESHOOTING FOR TRADITIONAL BRAKING SYSTEM

For correct brake system troubleshooting check:
— Tyres for wear
— Tyre inflation pressure
— Brake fluid and compliance with programmed maintenance instructions.

Fault	Cause	Remedy
Excessive pedal travel	• Brake master cylinder leakage	Overhaul brake master cylinder
	• Defective vacuum system non return valve	Replace valve
	• Load proportioning valve leakage	Overhaul or replace
	• Brake system fittings leakage	Tighten fittings
	• Air in brake system	Bleed
Pedal sponginess	• Air in brake system	Bleed
	• Clogged air vent on reservoir	Clean and bleed system
	• Hose swelling caused by deterioration or use of poor quality hose	Replace hoses and bleed system
	• Worn caliper seals	Drain hydraulic system, wash using spirit and replace seals
	• Low boiling point brake fluid	Change to recommended brake fluid and bleed system
Insufficient braking power	• Brake line leakage	Check brake master cylinder and piping to detect and repair any leakage
	• Air in brake system	Bleed system
	• Grease, oil, mud or water on pad surfaces	Clean and detect cause of trouble. Replace pads
	• Excessive pad wear or deterioration	Replace pads and grind discs as necessary
	• Improper contact between pad and disc	Replace pads and grind discs as necessary
	• Brake master cylinder malfunction	Repair or replace
	• Worn or seized pad actuating pistons	Remove brake calipers, overhaul pistons as necessary
	• Obstruction to pedal travel and pad movement	Remove as necessary

Fault	Cause	Remedy
Uneven braking	• Incorrect tyre pressure	Inflate to the correct pressure
	• Grease, mud or water on pad surfaces	Clean components and detect cause of trouble Replace pads
	• Pad surfaces excessively worn or deteriorated	Replace pads
	• Load proportioning valve not properly adjusted or inefficient	Adjust or overhaul or replace as necessary
	• Incorrect wheel bearing adjustment	Adjust bearings
	• Incorrect wheel alignment	Adjust alignment
Fade	Unsuitable or inefficient friction materials	Replace pads
Vibration on brake application	• Scored discs	Grind or replace as necessary
	• Distorted pads	Replace as necessary
	• Grease or brake fluid on braking surfaces	Replace pads
Brake squeal	• Return springs weakened or failed	Replace defective parts
	• Glazed pads	Dress or replace pads
Brakes binding	• Pedal articulation binding or excessive brake servo output rod length	Lubricate connection, check pedal return spring and adjust rod as necessary
	• Brake master cylinder by-pass clogged	Remove foreign matter by blowing compressed air
	• Brake master cylinder pistons seized	Overhaul brake master cylinder and bleed system
	• Piston protectors distorted	Replace
	• Defective brake calipers spring-back because of defective piston seals	Replace piston seals
	• Excessive disc distortion	Grind or replace disc
	• Hand brake stuck	Check and repair
	• Brake master cylinder clogged	Overhaul master cylinder and bleed system
	• System lines clogged	Check and clean
	• No pedal free travel	Adjust pedal travel

Fault	Cause	Remedy
Pedal rattle	• Excessive disc runout	Check using a gauge, manually rotating disc. If runout exceeds requirements, repair or replace disc.
	• Excessive disc thickness variation	Measure using a suitable gauge. Replace disc if necessary
Rear wheel locking (on light braking)	Defective load proportioning valve	Replace
Rear wheel locking (on hard braking)	• Low front brake effectiveness	Overhaul front brakes
	• Grease, oil, mud or water on braking surfaces	Clean or replace and detect causes of trouble
	• Excessive front pad wear	Replace pads
	• Brake master cylinder in pad condition	Repair or replace
Brake servo Lack of assistance	• Non-return valve leakage	Check valve
	• Seal leakage between vacuum housing and control unit	Replace brake servo assembly
	• Disc valve leakage	
	• Actuating piston gland leakage	
	• Master cylinder/brake servo sealing ring leakage	Replace sealing ring
	• Damaged hose or fittings	Repair or replace
Idle adjustment impossible (all connections tight)	Engine draws air from brake servo	Replace non-return valve or brake servo
Hand brake inoperative	• Incorrect adjustment	Adjust
	• Control cable damaged or broken	Replace cable
	• Defective brake control cable connection	Check connection
Hand brake stuck after application	• Binding in cable return travel	Remove obstacles or replace cable
	• Lever push button stuck	Disassemble and unlock or replace lever

Fault	Cause	Remedy
Hand brake on indicator fails to light up	• Open circuit	Restore circuit continuity
	• Defestive sending unit	Replace
	• Defective indicator	Replace

TROUBLESHOOTING FOR THE (ABS) MARK II ANTILOCK BRAKING SYSTEM

For correct brake system troubleshooting check:
- Tyres for wear
- Tyre inflation pressure
- Brake fluid and compliance with scheduled maintenance instructions.

NOTE:
The correct operation of the "brake fluid min. level and pad wear" warning light on the A.R. CONTROL and of the "ABS MARK II system" warning light (ABS) on the instrument panel is the following:
- **On turning the key to IGNITION, both lights illuminate and extinguish (not at the same time) after approximately two seconds.**
- **On starting the engine, the (ABS) light only will illuminate again, to extinguish about two seconds after the key has returned from the START position to IGNITION.**
- **In motion, both lights are off.**

WARNING:
If ABS control is disconnected, indicated by the illumination of the (ABS) light on the instrument panel, the servo assisted braking system still continues to operate; the simultaneous illumination of the (ABS) light on the instrument panel and the "brake fluid minimum level and pad wear" warning light on the A.R. CONTROL, on the other hand indicates an effectively hazardous situation on account of an excessive reduction in hydraulic circuit pressure and the lack of servo assistance.

NOTE:
Reference should be made to the wiring diagram and cabling shown at the end of this paragraph for electrical testing and component location.

Fault	Cause	Remedy
(ABS) light fails to illuminate with key to IGNITION	• Blown bulb • Diode N29a (see Wiring Diagram) is cut off and ABS unit not supplied at same time	Replace bulb or check wiring Carry out diagnosis procedure of the (ABS) MARK II antilock system
(ABS) lights but remains so with key to IGNITION	• ABS unit not supplied or inefficient • Brake fluid tank switch H34 or N28 pressure switch (see Wiring Diagram) inefficient	Carry out diagnosis procedure of the (ABS) MARK II antilock system
With key to IGNITION, the (ABS) light and the "brake fluid minimum level and pad wear" light on the A.R. CONTROL light up but both remain so	• Insufficient brake fluid • The pressure in the high pressure circuit has not overtaken the minimum safety value (105 bar) • N28 pressure switch (see Wiring Diagram) inefficient	Top up Wait 30 seconds Carry out diagnosis procedure of the (ABS) MARK II antilock system
With key to IGNITION, the "brake fluid minimum level and pad wear" on A.R. CONTROL lights up but remains so	• Worn pads • Insufficient brake fluid • Brake fluid tank switch H34 (see Wiring Diagram) inefficient • N28 pressure switch (see Wiring Diagram) inefficient	Replace Top up Carry out electrical diagnosis of the brake fluid tank for the (ABS) MARK II antilock braking system Carry out diagnosis procedure of the (ABS) MARK II antilock system
With key to IGNITION, (ABS) light illuminates and extinguishes duly after 2 seconds but fails to light up again on starting	• Relay I38 (see Wiring Diagram) inefficient	Carry out diagnosis procedure of the (ABS) MARK II antilock system
With the key to IGNITION, the (ABS) light illuminates and duly extinguishes after 2 seconds, but on starting lights up again and remains so	• ABS unit inefficient	Replace
When running, the (ABS) light illuminates or both the (ABS) light and the "brake fluid minimum level and pad wear" on A.R. CONTROL light up	• Multiple causes	Carry out diagnosis procedure of the (ABS) MARK II antilock system

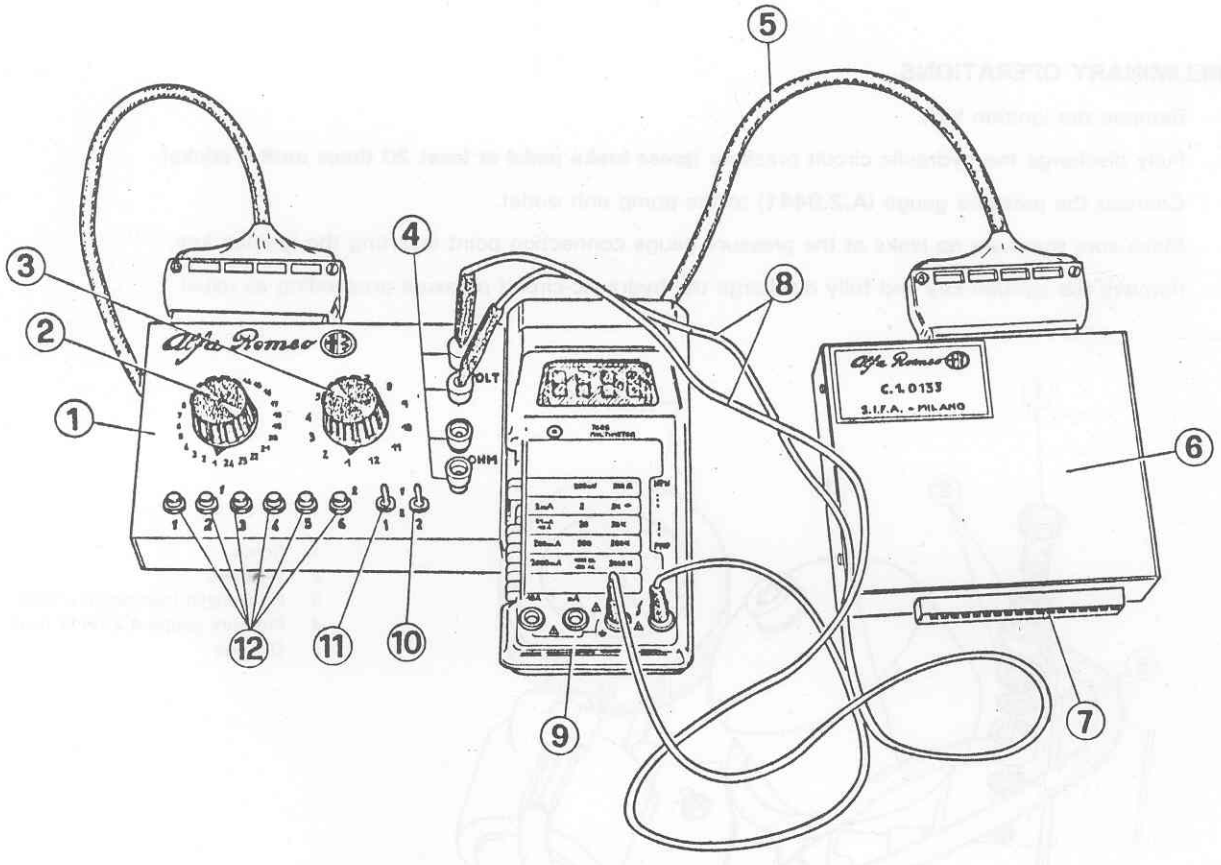
Fault	Cause	Remedy
When running the (ABS) light illuminates now and again due to causes unknown (and not shown by the diagnosis of the (ABS) MARK II antilock system)	• Badly connected or rusty connections	Verify and rectify
	• Clearance of the front wheel hub bearings not within specified tolerance limits	Return clearance to within specified values (see: Group 21 - Front Suspension Inspection Specifications - Checks and Adjustment)
	• Diode N29b (see Wiring Diagram) cut off	Replace
	• Relay I40 (see Wiring Diagram) inefficient	Replace
	• ABS control unit occasionally inefficient	Replace
Insufficient braking power	• Brake line leakage	Repair or replace faulty parts
	• Air in brake system	Bleed system
	• Grease, oil, mud or water on pad surfaces	Clean and detect cause of trouble. Replace pads
	• Pad deterioration	Replace pads and grind discs as necessary
	• Worn or seized pad actuating pistons	Replace calipers
	• Brake master cylinder/hydraulic servo cylinder inefficient due to internal leakage	Verify presumed cause thus: - Connect two 100 bar pressure gauges (**A.2.0440**) to the front caliper bleed screws - Turn the key to IGNITION and wait for the electropump to come to a halt - Remove key - Press brake pedal with suitable tool (**A.2.0442**) until 100 bar is reached on front caliper pressure gauges - Wait about 3 minutes for the pressure to settle then check that the loss of pressure is no greater than 5 bar in 5 minutes. If pressure loss is greater, replace master cylinder with hydraulic servo cylinder
Excessive pedal travel	• Brake master cylinder and/or hydraulic servo cylinder leakage	Replace brake master cylinder with hydraulic servo cylinder
	• Fluid leakage from brake pressure adjusting valve	Replace
	• Brake system union leakage	Tighten unions to specified torque. Replace
	• Air in brake system	Bleed
	• Gaskets inside master cylinder and/or hydraulic servo cylinder inefficient	Replace brake master cylinder with hydraulic servo cylinder

Fault	Cause	Remedy
Pedal sponginess	• Air in brake system	Bleed
	• Clogged air vent on brake fluid tank	Clean and possibly replace
	• Use of unsuitable brake fluid	Change to recommended brake fluid and bleed system
Uneven braking	• Incorrect tyre pressure	Inflate to correct pressure
	• Grease, oil, mud or water on pad surfaces	Clean components and detect cause of trouble. Replace pads
	• Pad surfaces unevenly worn or deteriorated	Detect cause of trouble and replace pads
	• Inefficient brake pressure adjusting valve	Replace
	• Incorrect wheel trim	Adjust
Vibration on brake application	• Unevenly worn pads	Detect cause and replace pads
	• Grease or brake fluid on braking surfaces	Detect cause and replace pads
	• Distorted discs	Grind or replace
Brakes squeal	• Unsuitable pads	Replace
	• Rusty discs	Grind or replace
Brakes binding	• Pedal fails to return to rest position	Check pedal motion and repair fault. Replace master cylinder with hydraulic servo cylinder
	• Calipers stay partially closed	Check and possibly replace
	• Hand brake stuck	Check and repair
Rear wheels tend to brake more than front ones	Inefficient brake pressure adjusting valve	Replace
Hand brake inoperative	• Pads not adjusted	Adjust
	• Hand brake travel adjustment incorrect	Adjust
	• Control cable damaged or broken	Replace cable
	• Hand brake control on calipers defective	Replace calipers
Car still braking with hand brake off	Binding in cable return travel	Remove obstacles or replace cable

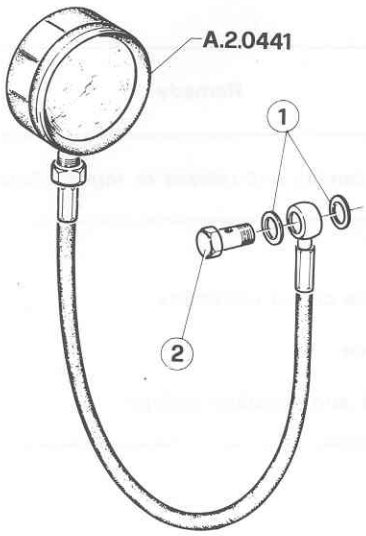
Fault	Cause	Remedy
Hand brake stuck	Lever pushbutton stuck	Disassemble and release or replace lever
Hand brake on indicator fails to light up	• Open circuit	Restore circuit continuity
	• Defective switch	Replace
	• Defective A.R. CONTROL	Check and possibily replace

DIAGNOSIS PROCEDURE OF THE (ABS) MARK II ANTILOCK SYSTEM

DIAGNOSTIC INSTRUMENTATION



1 Universal diagnoser for electronic systems (**C.1.0132**)
2 Selector (1)
3 Selector (2)
4 Jacks
5 Connecting cable (**C.9.0033** 3 mt long, or **C.9.0032**)
6 Interface for ABS MARK II (**C.1.0133**)
7 Connection to wiring connector
8 Tie cables
9 Multimeter
10 Switch (2)
11 Switch (1)
12 Pushbuttons

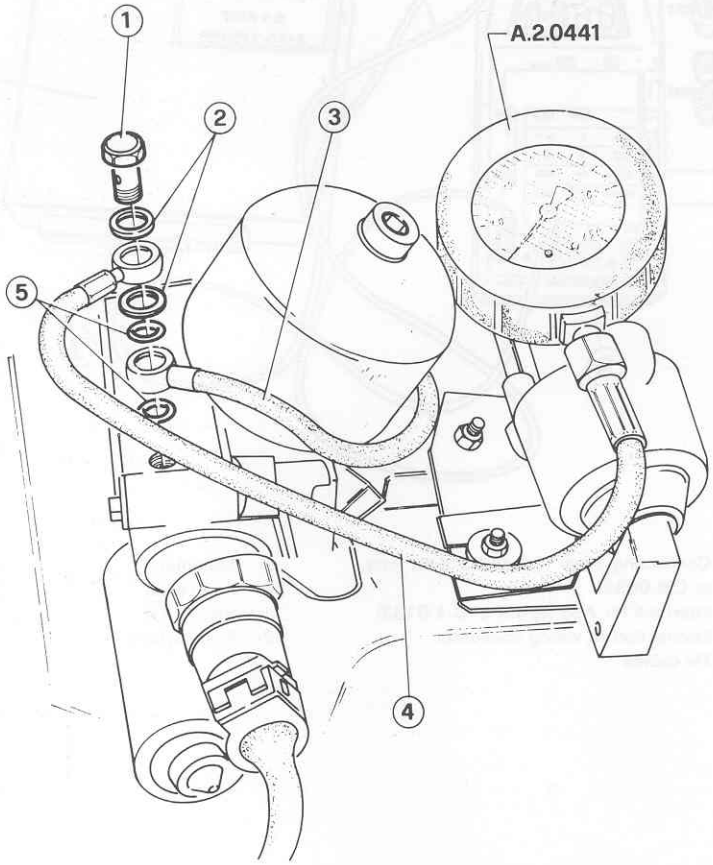


Hydraulic circuit pressure gauge (**A.2.0441**)
1 Washers
2 Screw

CAUTION:
Prior to working on the hydraulic circuit, the brake fluid pressure should be completely discharged by pressing the brake pedal at least 20 times until it sticks, with the ignition key removed. The circuit is at 180 bar.

PRELIMINARY OPERATIONS

- Remove the ignition key.
- Fully discharge the hydraulic circuit pressure (**press brake pedal at least 20 times until it sticks**).
- Connect the pressure gauge (**A.2.0441**) to the pump unit outlet.
- Make sure there are no leaks at the pressure gauge connection point inserting the ignition key.
- Remove the ignition key and fully discharge the hydraulic-circuit pressure proceeding as usual.



1 Screw
2 Washers
3 Pressurized fluid delivery hose
4 Pressure gauge **A.2.0441** hose
5 O-Rings

Test N° 1

Ensure that the pressure in the hydraulic circuit is below 80 bar.

Insert the ignition key and check the "brake fluid min. level and pad wear" light illumination on A.R. CONTROL and (!) illumination on instrument panel.

NO → Carry out "ELECTRICAL TESTS WITH DIAGNOSER" (with particular reference to test N° 5).

YES

Check that the pressure in the hydraulic circuit starts to increase.

NO → Is pump motor working?

NO →

Check that electric motor supply is 12V.

a) If supply is 12V : replace electropump.

b) If supply is not 12V : find fault by testing these points with a multimeter, referring to ground.

Pressure switch connector pin 1	~ 0V
Pressure switch connector pin 4	~ 0V
Terminal 85 relay I40	~ 0V
Terminal 86 relay I40	12V
Fuse relay I40	12V
Terminal 87 relay I40	12V
Electropump connector, pin 2	12V
Electropump connector, pin 1	~ 0V

YES

YES

YES

- Check brake fluid supply circuit.
- Replace electropump.

Check that at approx. 145 bar the (!) warning light extinguishes and the alarm on the A.T. CONTROL ceases.

NON

A) (!) warning light fails to extinguish:

Carry out : ELECTRICAL TESTS WITH DIAGNOSER.

B) The "brake fluid min. level and pad wear" on A.R. CONTROL fails to extinguish:

- Check pads for wear and level of brake fluid in tank.
- Test terminal 85 of relay 136 with a multimeter referred to ground.

1) If value read is 12V : replace relay 136 (should alarm fail to cease, test entire pad circuit as per A.R. CONTROL Troubleshooting).

2) If value read is ~ OV :

a) disconnect brake fluid tank connector; if alarm ceases, replace tank;

b) disconnect pressure switch connector; if alarm ceases, replace pressure switch.

- Eliminate the short circuit between terminal 85 of relay 136 and ground.

YES

YES

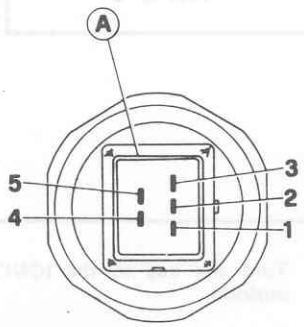
Check that the pressure does not exceed 180 bar.

NO

- If the pressure settles at a pressure above 190 bar, the pressure switch is incorrectly calibrated and should therefore be replaced.
- If electropump however keeps running, disconnect the pressure switch connector;
  a) if the electropump stops, replace the pressure switch;
  b) if the electropump does not stop, look for the fault by testing these points with a multimeter referred to ground.

Pressure switch connector pin 4	12V
Terminal 87 of relay I40	~ 0V

YES



A Pressure switch connector

Check that the time elapsed on reaching 180 bar is no more that 60 seconds.

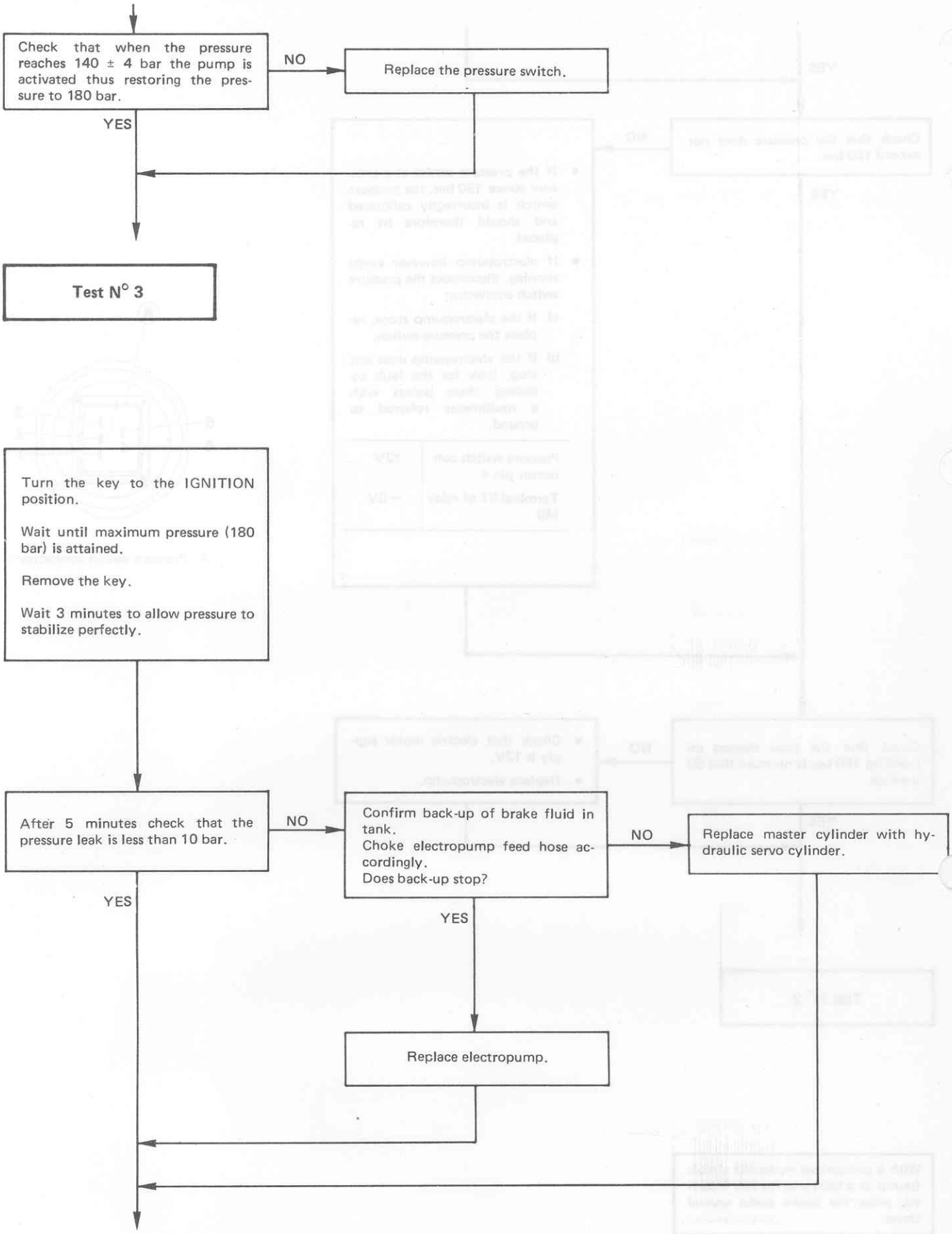
NO

- Check that electric motor supply is 12V.
- Replace electropump.

YES

Test N° 2

With a pressurized hydraulic circuit (pump at a halt) and the key inserted, press the brake pedal several times.

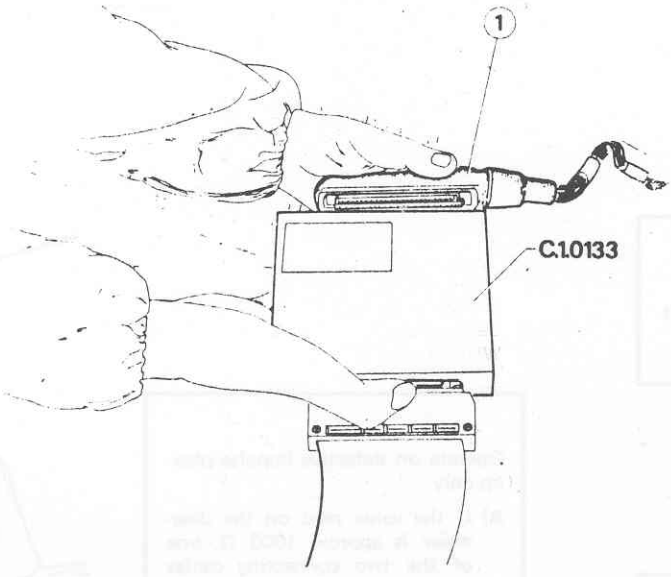


ELECTRICAL TESTS WITH DIAGNOSER

NOTE:
Subsequent to a repair it is advisable to resume the diagnosis from the start.

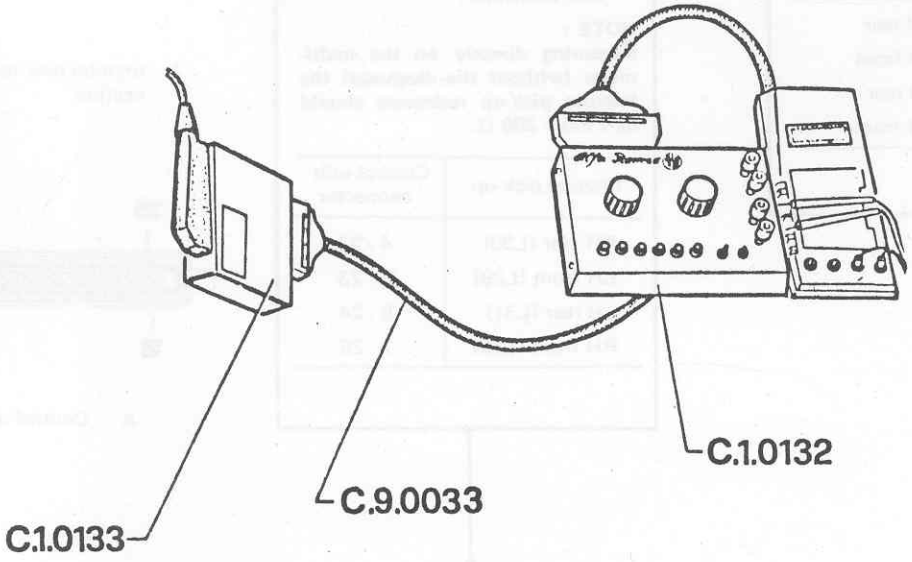
Ohmmetric measurement set-up

- Disconnect the connector from the ABS unit.
- Insert the diagnostic equipment interface (**C.1.0133**) in the cable connector.



1 Cable connector

- Ensure that the interface (**C.1.0133**) is connected to the diagnoser (**C.1.0132**) by means of the cable supplied (**C.9.0032**) (**C.9.0033** 3 mt. long, or **C.9.0032**).



- Set rotating selectors (1) and (2) to position 1.
- Set switches (1) and (2) to position 1.
- Verify that the pressure in the hydraulic circuit is 140 thru 180 bar.
- Remove the key.
- Set-up the multimeter for OHM measurement and insert the prods of the tie cables into the blue and black jacks of the diagnoser marked OHM.
- Selectors (1) and (2) to position 1.

Test N° 4

Impulse pick-ups test

Selector (1) to position 1.

Set multimeter to position 20 KΩ F.S..

Read 2100 ± 300 Ω on the multimeter.
Turn selector (1) to positions 2 - 3 - 4 and check that the value obtained remains between 2100 ± 300 Ω.

Selector 1	Impulse pick-up tested
position 1	RH rear
position 2	LH front
position 3	LH rear
position 4	RH front

NO

Operate on defective impulse pick-up only.

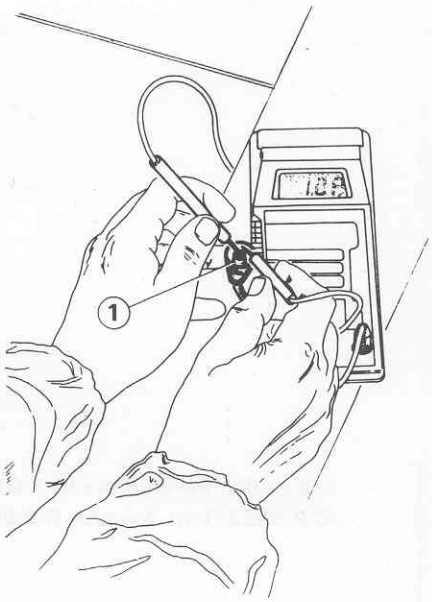
A) If the value read on the diagnoser is approx. 1000 Ω, one of the two connecting cables between the impulse pick-up and control unit connector is short circuiting on the body; eliminate the problem.

B) For other values (and therefore for other types of failure) the resistance should be measured directly on the impulse pick-up involved and also on the control unit connector.

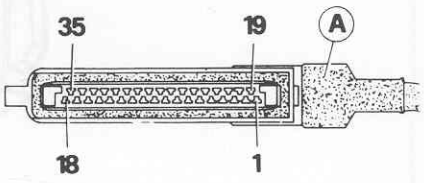
NOTE :
Measuring directly on the multimeter (without the diagnoser) the impulse pick-up resistance should be 1100 ± 300 Ω.

Impulse pick-up	Control unit connector
RH rear (L30)	4 - 22
LH front (L29)	5 - 23
LH rear (L31)	6 - 24
RH front (L28)	7 - 25

YES



1 Impulse pick-up electrical connection



A Control unit connector

Test N° 5

((!)) warning light alarm SW test (tank and pressure switch)

Selector (1) to position 5.

Set up multimeter to position 200 Ω F.S..

Read a value < 5 Ω on the multimeter.

NO

Check brake fluid tank level.
If level is normal, use the previously set up multimeter directly on the tank connector, pins 1 and 2 to check that the resistance value is ~ 0 Ω.

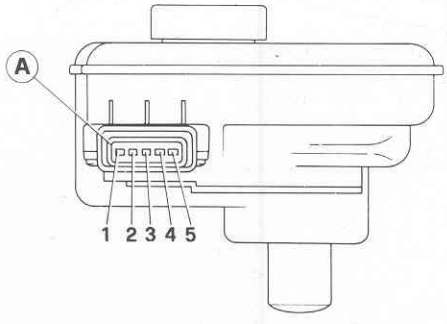
Is the value read ~ 0 Ω?

NO

Replace tank.

YES

YES



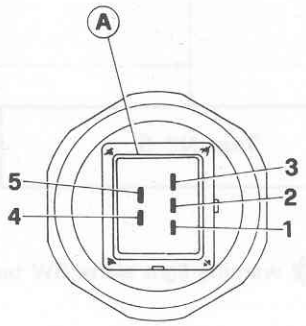
A Tank connector

- Reconnect connector to tank.
- Turn key to IGNITION position.
- Wait for electropump to stop.
- Remove key.
- Disconnect pressure switch connector.
- Using previously set up multimeter, check directly on the pressure switch connector, pins 3 and 5 that the resistance value is ~ 0 Ω.

Is the value read ~ 0 Ω?

NO → Replace pressure switch.

YES



A Pressure switch connector

Reconnect the connectors and check continuity between pins 9 and 10 of the control unit connector (disconnecting interface **C.1.0133**).
Otherwise look for opening on cable between :

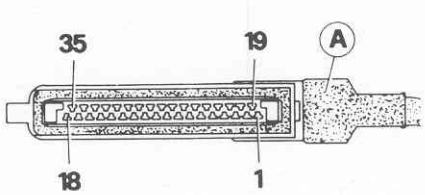
- Pin 2 tank connector and pin 3 pressure switch connector.
- Pin 1 tank connector and pin 9 control unit connector.
- Pin 5 tank connector and pin 10 control unit connector.

Remove brake fluid tank connector.

Read infinite resistance on the multimeter.

NO → Verify that there is no continuity to ground on one of the two pins 9 and 10 of the control unit connector (with interface **C.1.0133** disconnected).
Otherwise look for the short circuit in the connections of pins 1 and 2 of the tank connector.

YES



A Control unit connector

Replace tank connector.

Read a value < 5 Ω on the multimeter.

Press the brake pedal several times.

Read infinite resistance on the multimeter when the pressure goes below 105 bar.

NO

Disconnect the pressure switch connector.
Is infinite resistance read on the multimeter?

NO

Eliminate the short circuit on the pressure switch cable:

- from pin 10, control unit, connector to pin 5, pressure switch connector;
- from pin 3, pressure switch connector, to pin 2, brake fluid tank connector;
- from pin 1, brake fluid tank to pin 9, control unit connector.

YES

YES

Replace pressure switch.

Test N° 6

Electrovalve test

Multimeter to position 200 Ω F.S.

Check the resistances indicated below for the various selector positions (1).

position 6	6 thru 9 Ω (FRONT RH load)
position 7	4 thru 6 Ω rear drain)
position 8	4 thru 6 Ω (FRONT LH drain)
position 9	4 thru 6 Ω (FRONT RH drain)
position 10	6 thru 9 Ω rear load)
position 11	6 thru 9 Ω (FRONT LH load)

YES

NO

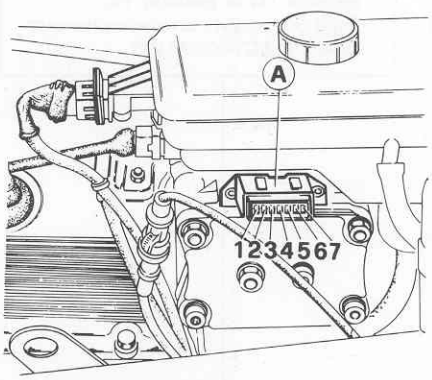
Using previously set up multimeter, check the following values directly on the electrovalve unit connector.

Prod position	Correct value (Ω)	Corresponding electrovalve
7 - 1	6 thru 9	Front LH Load
7 - 2	4 thru 6	Front LH Drain
7 - 3	6 thru 9	Rear Load
7 - 4	4 thru 6	Rear Drain
7 - 5	4 thru 6	Front RH Drain
7 - 6	6 thru 9	Front RH Load

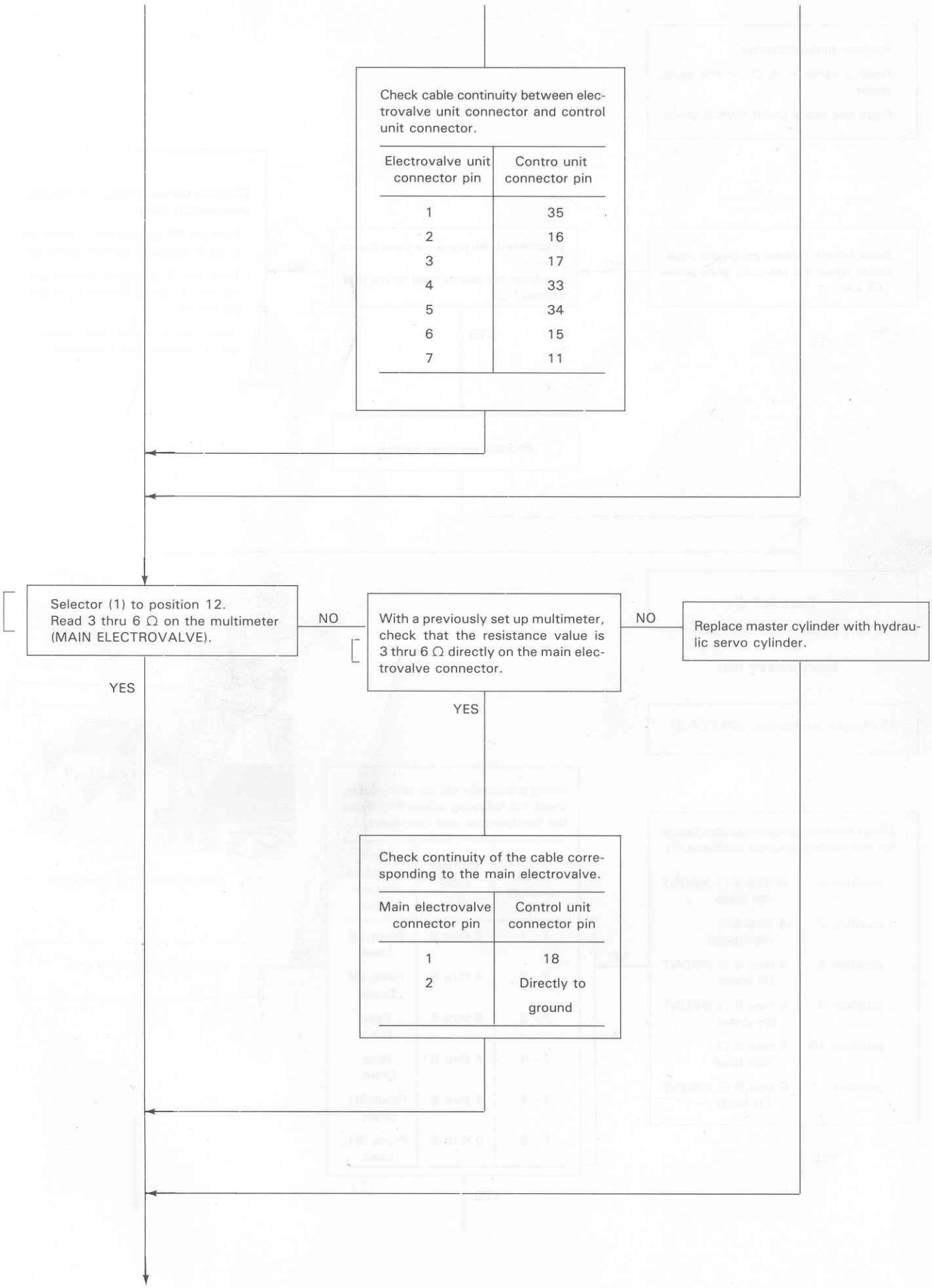
YES

NO

Replace electrovalve unit.



A Electrovalve unit connector



Voltmetric measurement set-up

- Remove the key.
- Selector (1) to position 1.
- Selector (2) to position 1.
- Switches (1) and (2) to position 1.
- Turn the key and wait until maximum pressure (180 bar) is reached in the hydraulic circuit.
- Remove the key.
- Set the multimeter up for VOLT measurement and insert the cable tie black prod into the black jack marked VOLT and the red prod of the other cable tie into the red jack marked VOLT.

Test N° 7

Control unit inhibit test during start-up phase

Selector (2) to position 1.

Set multimeter to 20 V F.S. position.

Turn the key to the IGNITION position.

Read 12V on the multimeter.

NO

Is the fuse of relay I38 open?

NO

YES

Replace.

YES

Attempt to start and verify that the voltage goes down to ~ 0V in this phase.

NO

YES

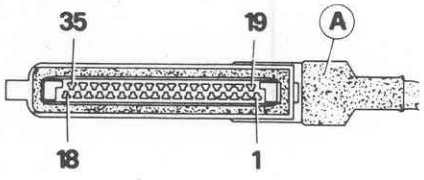
Replace relay I38.
Should trouble persist, look for the failure by testing these points with a multimeter referred to ground.

Without starting the engine :

Terminal 30 relay I38	12V
Terminal 87 relay I38	12V
Terminal 85 relay I38	~0V
Control unit connector pin 2	12V

During start-up :

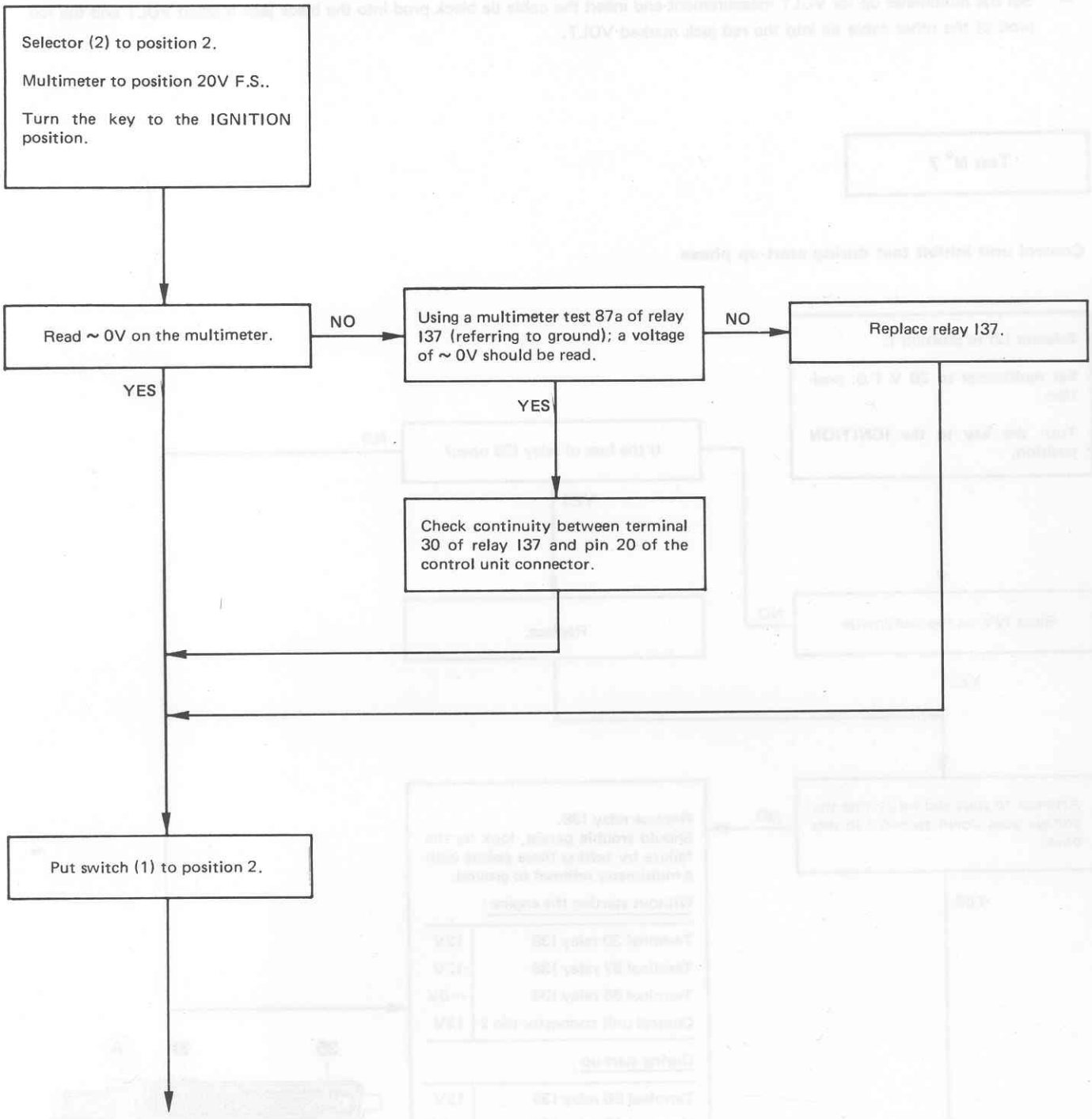
Terminal 86 relay I38	12V
Terminal 85 relay I38	~0V
Terminal 87 relay I38	~0V
Control unit connector pin 2	~0V



A Control unit connector

Test N° 8

ABS control unit main supply test



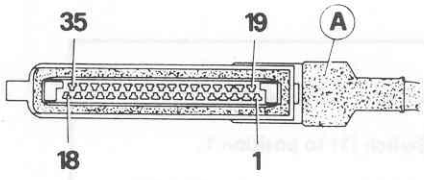
Read 12V on the multimeter.

NO

Replace relay 137 or associated fuse.
If the trouble persists, look for the cause by testing these points with a multimeter, referring to ground.

Fuse of relay 137	12V
Terminal 85 relay 137	~0V
Terminal 86 relay 137	12V
Terminal 30 relay 137	12V
Control unit connector pin 20	12V

YES



A Control unit connector

Turn selector (2) to position 3.

Carry out the same procedure as described for selector (2) in position 2.

- With switch (1) to position 1, read ~ 0V on the multimeter.
- With switch (1) to position 2, read 12V on the multimeter.

NO

Check continuity of the cable between terminal 30 of relay 137 and control unit connector on pin 3.

YES

Test N° 9

Diode N29a diminished voltage test (see Wiring Diagram)

Selector (2) to position 4.

Switch (1) to position 1.

Multimeter to position 20V F.S..

Turn the key to the IGNITION position.

Read 0.6 thru 0.8V on the multimeter.

NO → Replace diode N29a. If failure persists, continue with diagnosis.

YES

Check that (warning light) warning light is illuminated.

NO →
- Check fuse box fuse.
- Check bulb efficiency.
- Check cable of diode N29a both at pin 2 of connector G124 and terminal 30 of relay I37.
- Check connection between instrument panel, (warning light) warning light and pin 2, connector G124.

YES

Switch (1) to position 2.

Read 12V on the multimeter.

NO → Check cable between pin 2 of connector G124 and pin 27 of the control unit connector.

YES

Check that the (!) warning light is extinguished.

Test N° 10

Electrovalve ground efficiency test

Selector (2) to position 5.

Switch (1) to position 2.

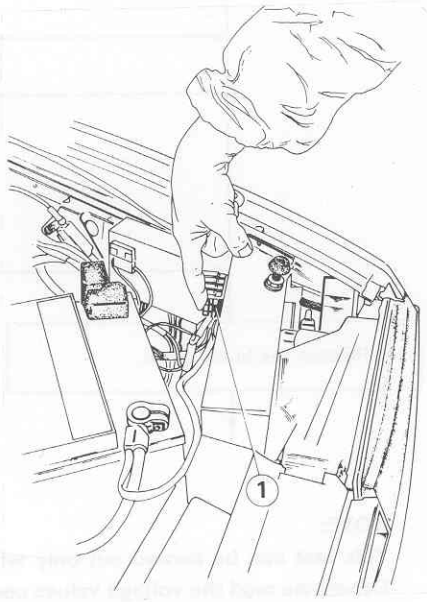
Set multimeter to 200 mV F.S..

Turn the key to the IGNITION position.

Read ~ 0V on multimeter.

Briefly press pushbuttons 1 - 2 - 3 - 4 individually, verifying that the voltage read on the multimeter never exceeds 35 mV.
Then press pushbutton 4, verifying that the voltage read on the multimeter does not exceed 25 mV.

NO → Check efficiency of electrovalve ground.



1 Electrovalve unit ground.

*** Test N° 11**

*** Valid for 75 vechicles only**

Stop-pushbutton connection test

Set multimeter to position 20V F.S. in D.C.

Switch (1) in position 1.

Selector (2) in position 10.

Turn the key into position "MARCIA".

Read ~ 0V on the multimeter. NO → Replace the stop light switch.

YES

Press the brake pedal.

Read 12V on the multimeter. NO → Fuse 21 burnt out? NO → Check the stop switch for proper functioning. NO

YES

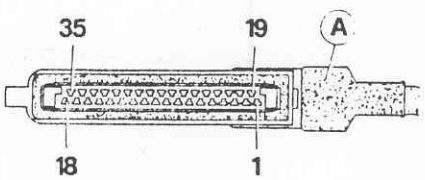
YES → Replace fuse 21

YES → Check wiring from the battery to control unit connector pin 12 for continuity.

Replace the stop light switch.

Release the brake pedal.

NOTE:
This test can be carried out only with properly modified interface C.1.0133. Otherwise read the voltage values corresponding to the "brake pedal released" and "brake pedal pressed" conditions directly at pin 12 of the cable fan of the ABS unit (wiring side).



Test N° 12

Impulse pick-up dynamic test

Set multimeter to position 2V F.S. in ALTERNATED CURRENT.

Switch (1) in position 1.

Raise the vehicle so that the wheels turn freely.

- Selector (2) to position 6. Turn the rear RH wheel at approx. 1 rev. per sec. and rear 0.15 thru 0.7 V on the multimeter.
- Selector (2) to position 7. Turn the front LH wheel at approx. 1 rev. per sec. and read 0.15 thru 0.7 V on the multimeter.
- Selector (2) to position 8. Turn the rear LH wheel at approx. 1 rev. per sec. and read 0.15 thru 0.7 V on the multimeter.
- Selector (2) to position 9. Turn the front RH wheel at approx. 1 rev. per sec. and read 0.15 thru 0.7 V on the multimeter.

NO

- Complete the four tests so as to establish that there is no inversion between the cables of the individual impulse pick-ups, bearing in mind that when a rear wheel is turned it may pull the other one into motion.
- Check good condition of the impulse emitting wheel.
- Check the air gap between the impulse pick-up and impulse emitting wheel. (See: Inspection Specifications).

YES

Electrovalve dynamic test set-up

- Remove the key.
- **Ascertain that all previous tests proved positive otherwise refrain from carrying out the following.**
- Selector (1) to position 1.
- Selector (2) to position 1.
- Switch (1) to position 2.
- Switch (2) to position 1.
- Raise the car enough to allow the wheels to turn freely.
- Insert the key and wait until the pressure in the hydraulic circuit reaches the maximum pressure of 180 bar.

Test N° 13

Front LH load and drain electrovalve test

Press the brake pedal quite hard.

Check that front LH wheel is locked.

Press pushbutton 1 and check that the front LH wheel unlocks within 1 - 2 seconds.

WARNING:

The pushbutton should never be pressed for more than 30 seconds; in the event of test repetition, allow at least the time for which the button was pressed to elapse between one test and the next in order to avoid overheating of the electrovalves.

NO → Replace the electrovalve unit.

YES

Release pushbutton 1.

Verify a slight sinking of the brake pedal with a consequent wheel look.

NO → Replace the electrovalve unit.

YES

Release the brake pedal.

Test N° 14

Front RH load and drain electrovalve test

Proceed as per the previous test by pressing pushbutton 2 and check the effect on the front RH wheel.

NO → As per previous test, if hypothesized conditions fail to be met, proceed with electrovalve unit remplacement.

YES

Test N° 15

Rear load and drain electrovalve test

Proceed as per the previous test by pressing pushbutton 3 and check the effect on both rear wheels.
WARNING:
Brake pedal sinking on release of the pushbutton will be less than in previous tests.

NO → As per previous test, if hypothesized conditions fail to be met, proceed with electrovalve unit remplacement.

YES

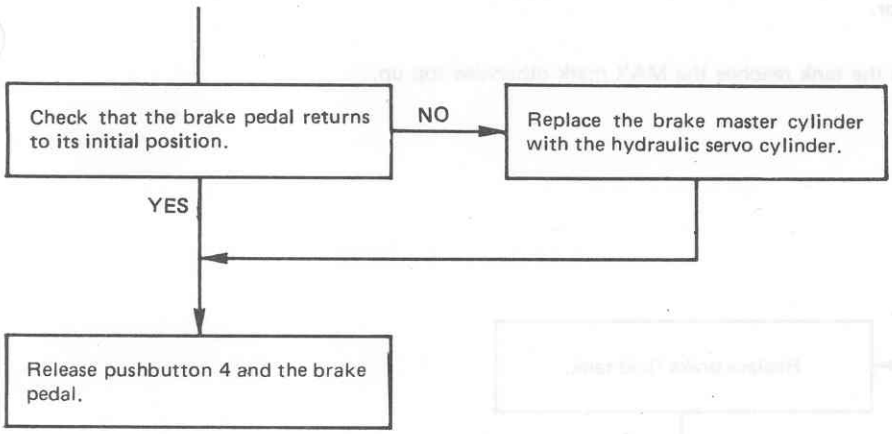
Test N° 16

Main electrovalve test

Press the pedal quite hard until test completion.

Press pushbutton 1 several times until the brake pedal sinks completely.

Press pushbutton 4.

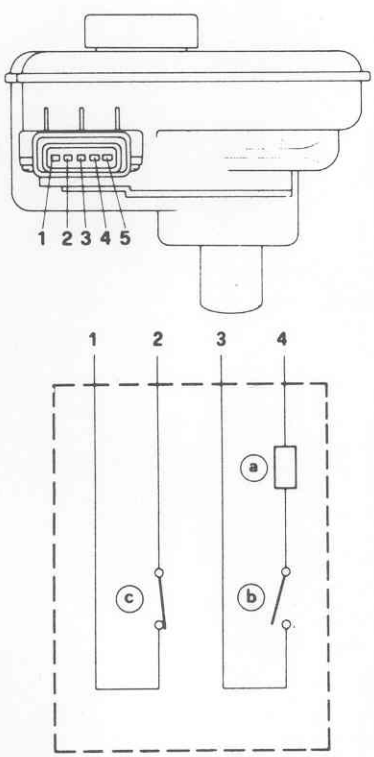


OBSERVATIONS

Should the problem persist on completion of the diagnostic procedure, proceed thus:

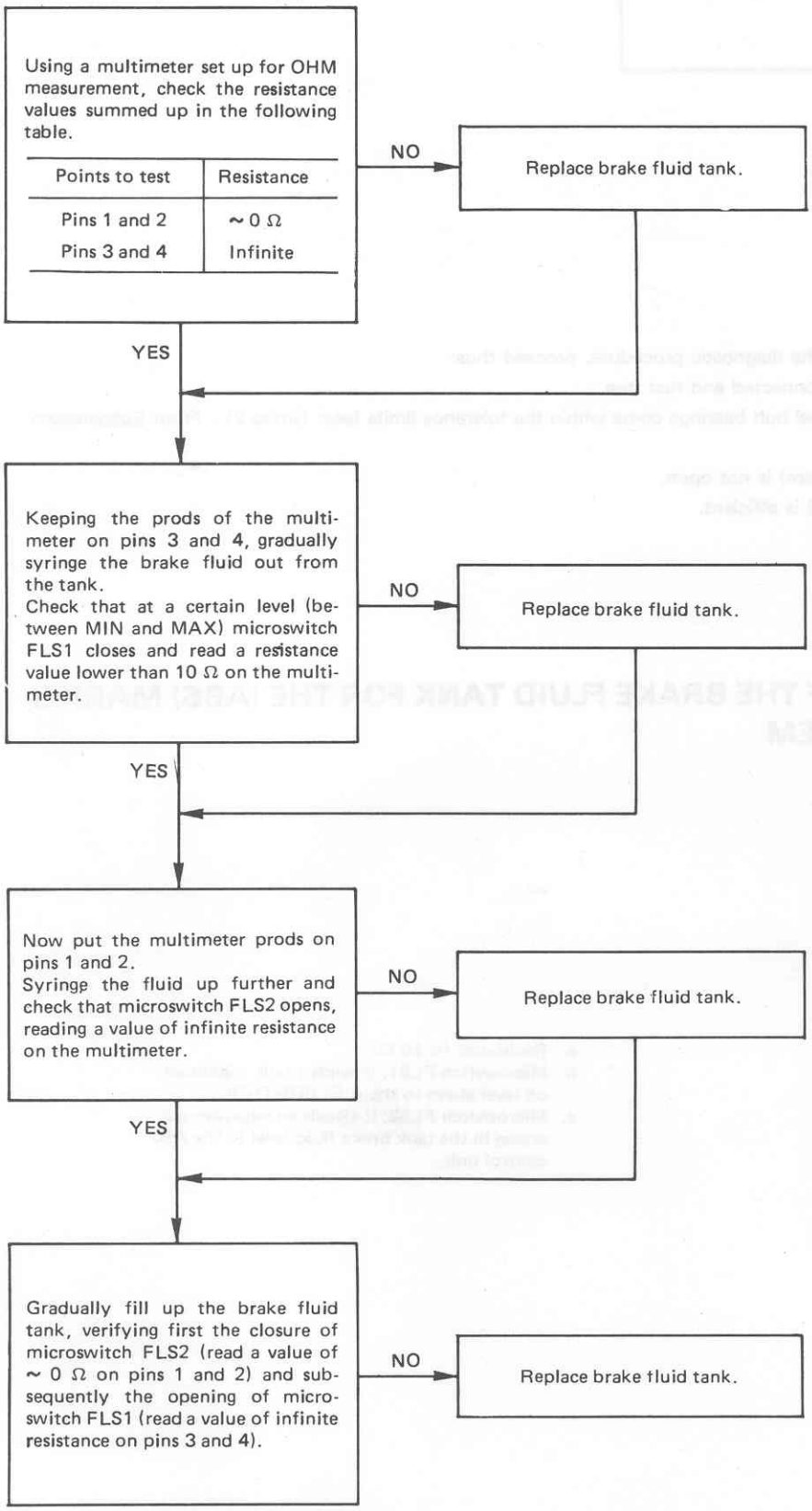
- Check that all the connections are well connected and rust free.
- Check that the clearance of the front wheel hub bearings come within the tolerance limits (see: Group 21 - Front Suspensions - Inspection Specifications).
- Check that diode N29b (see Wiring Diagram) is not open.
- Check that relay I40 (see Wiring Diagram) is efficient.
- Replace ABS control unit.

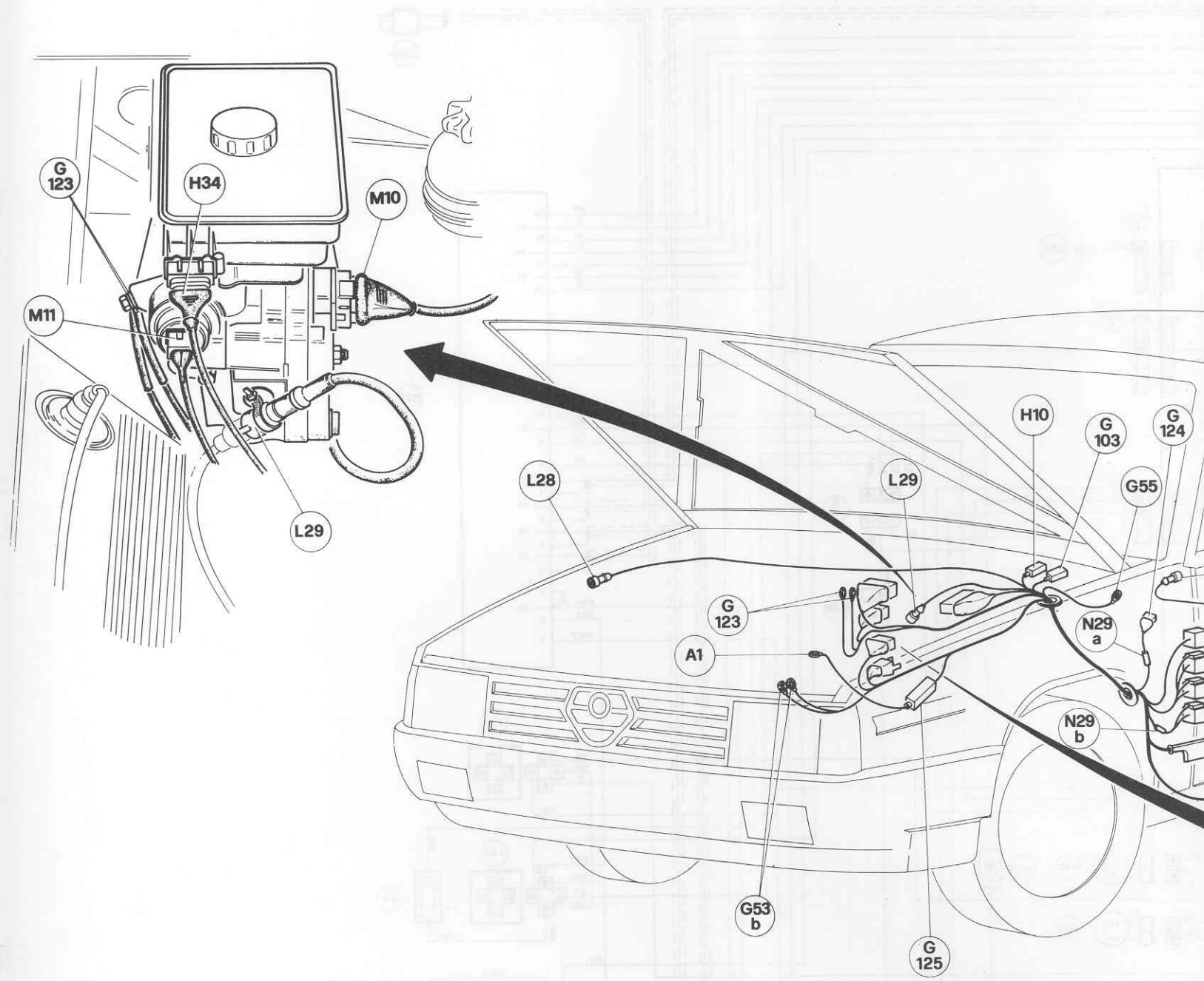
ELECTRICAL DIAGNOSIS OF THE BRAKE FLUID TANK FOR THE (ABS) MARK II ANTILOCK BRAKING SYSTEM



a. Resistance ($\leqslant 10\ \Omega$)
b. Microswitch FLS1; it sends a tank minimum oil level alarm to the A.R. CONTROL
c. Microswitch FLS2; it signals an excessive decrease in the tank brake fluid level to the ABS control unit.

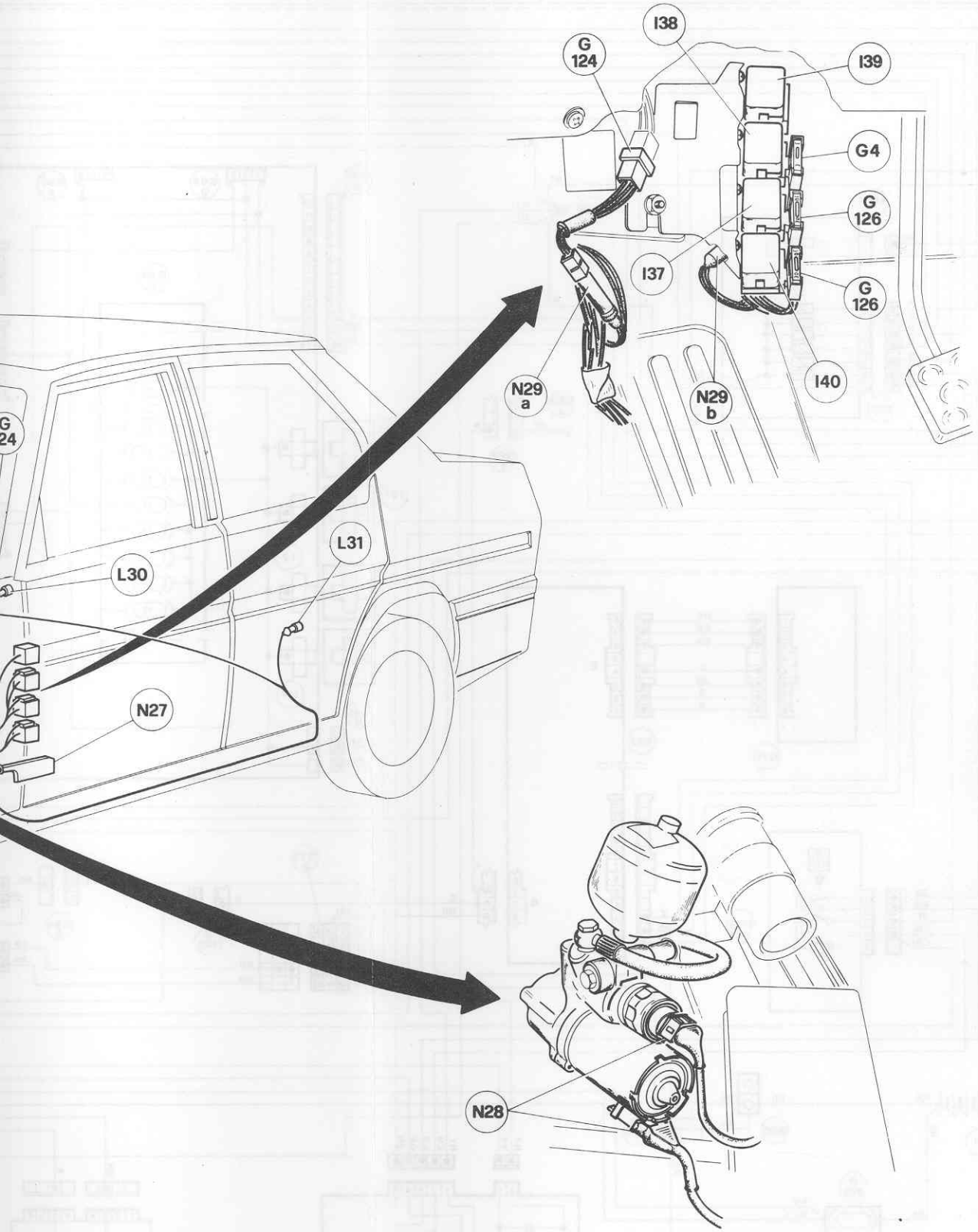
- Disconnect the brake fluid tank connector.
- Remove the plug.
- Check that the level of the brake fluid in the tank reaches the MAX mark otherwise top up.





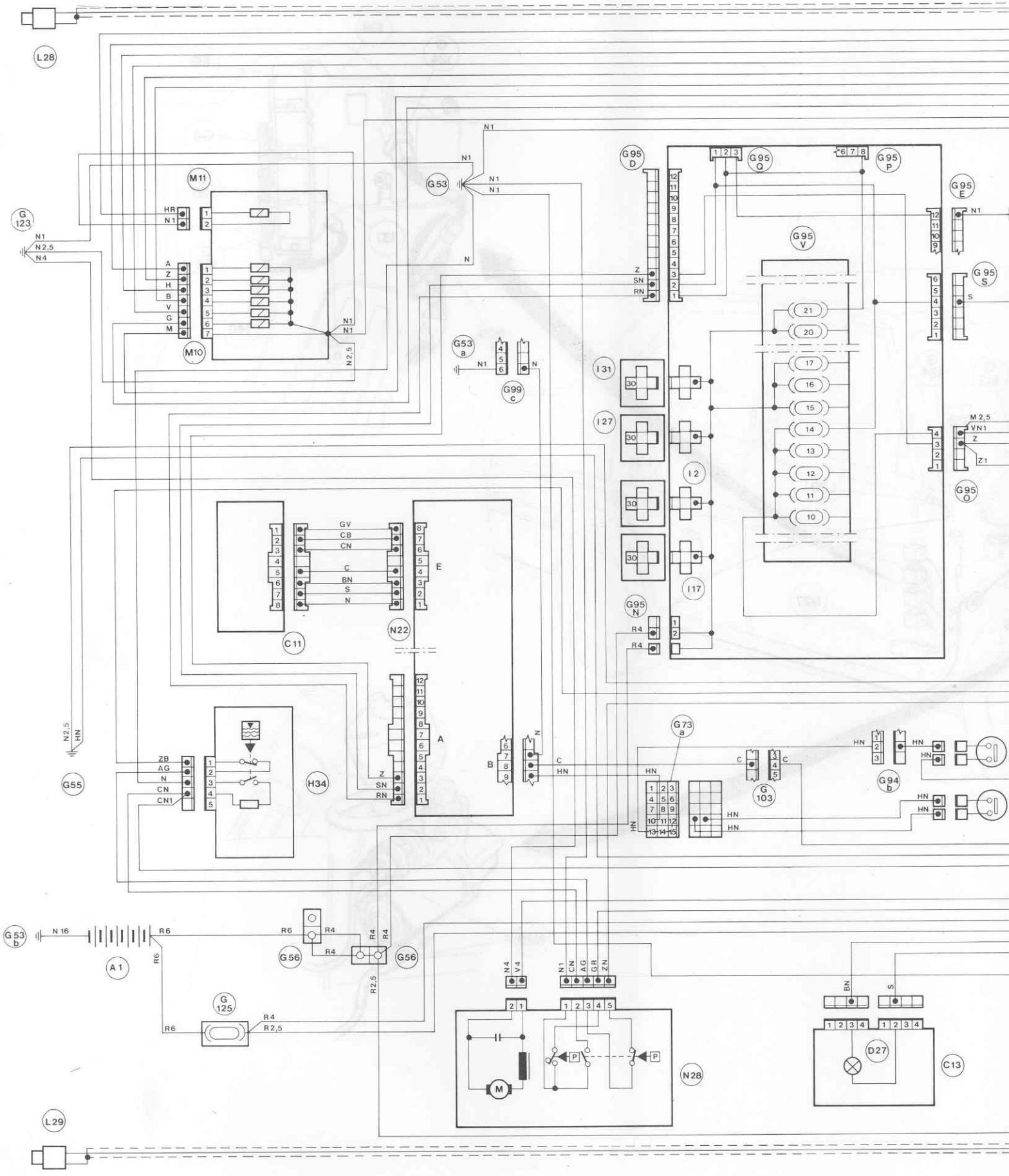
CABLING OF THE (ABS) MARK II WHEEL ANTILOCK SYSTEM

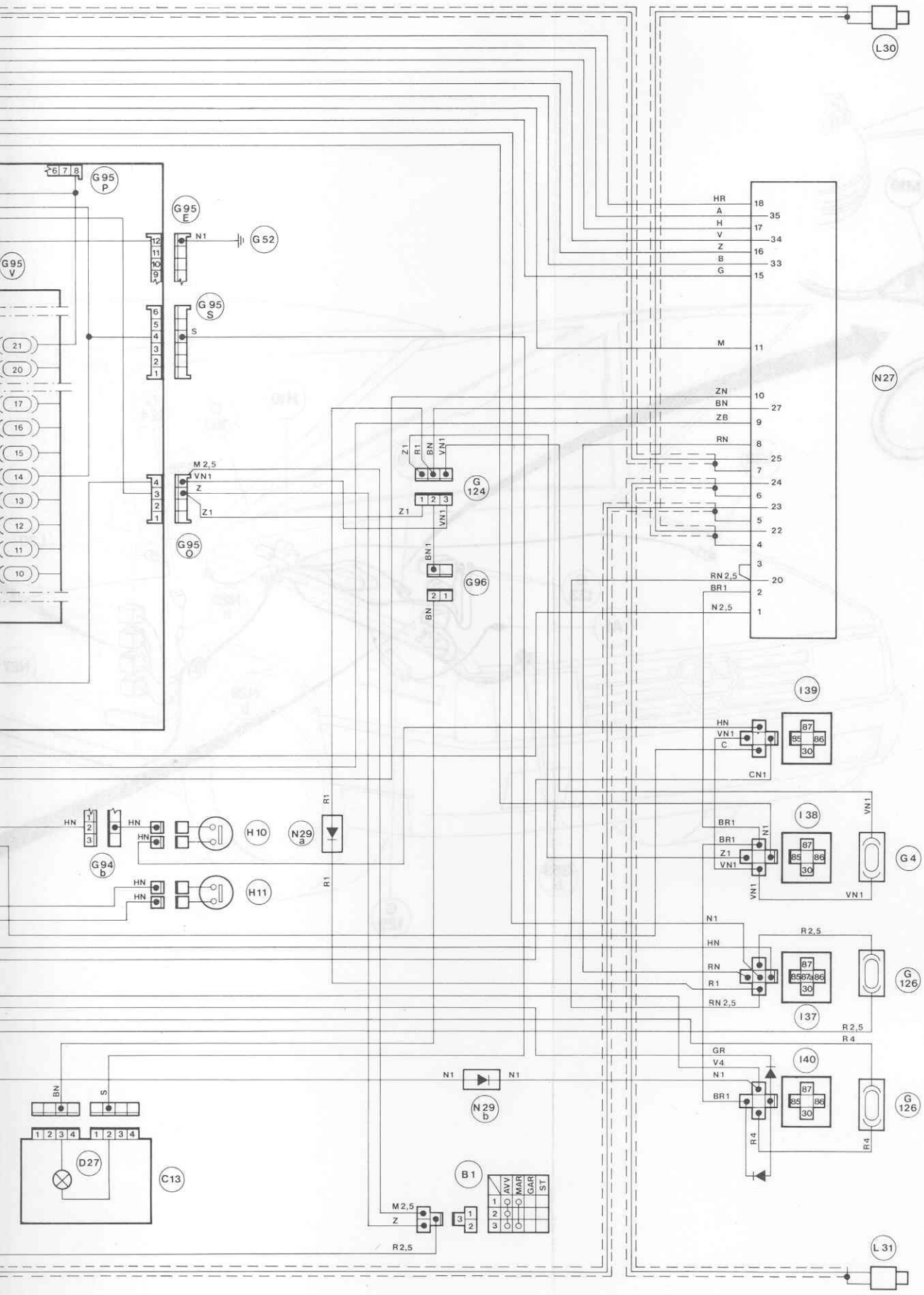
(vehicles Alfa 90 Super 6V iniezione)



WIRING DIAGRAM OF THE (ABS) MARK II WHEEL ANTILOCK SYSTEM

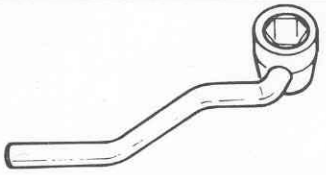
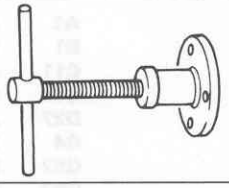
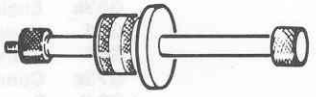
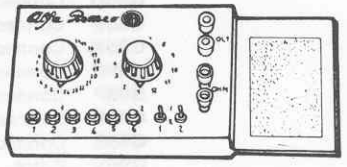
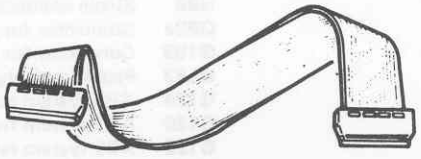
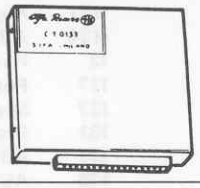
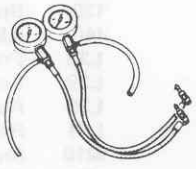
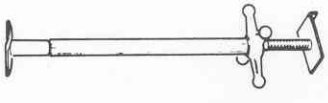
(vehicles Alfa 90 Super 6V iniezione)

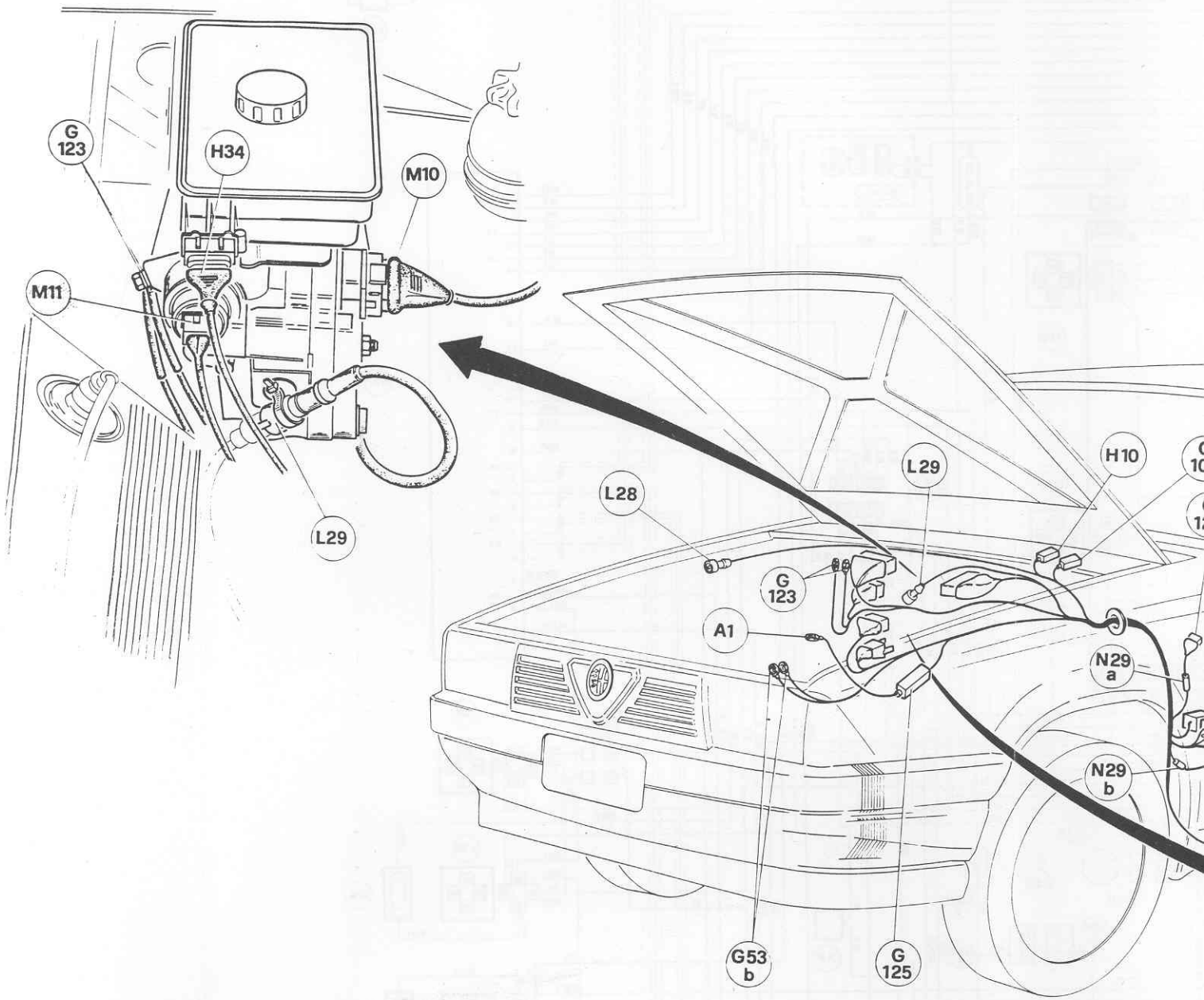




A1	Battery
B1	Ignition switch
C11	ALFA ROMEO Control display
C13	Optoelectronic cluster
D27	ABS system warning lamp
G4	Free fusebox
G52	Fusebox ground
G53	Engine compartment ground
G53a	Engine compartment ground - right side
G53b	Engine compartment ground - left side
G55	Hood ledge panel ground
G56	Branch terminal board
G73a	Connector for right rear services
G94b	8-way connector for engine compartment
G95	Central fusebox
G95D	Connector for ALFA ROMEO Control
G95E	Connector for console
G95N	Connector for battery
G95O	Connector for ignition switch
G95P	Connector for door services
G95Q	Connector for performance gauge
G95S	Connector for cluster
G95V	Fuses
G96	Single connector for ALFA ROMEO Control - cluster
G99c	Connector for engine dashboard (C)
G103	Connector for grounds and brakes fluid tank
G123	Pedal assembly ground
G124	ABS system connector
G125	ABS system free fusebox
G126	ABS system relay safety fuse
H10	Left front brake pad switch
H11	Right rear brake pad switch
H34	ABS system brake fluid tank switch
I2	Heated rear window relay
I17	Fog light relay
I27	Seat height adjustment relay
I31	Front power windows - heater relay
I37	ABS system control unit relay
I38	ABS system auxiliary relay
I39	Brake fluid level warning lamp relay
I40	ABS system brake fluid electropump relay
L28	Front RH pick-up
L29	Front LH pick-up
L30	Rear RH pick-up
L31	Rear LH pick-up
M10	Brake fluid adjusting valves
M11	ABS system main valve
N22	ALFA ROMEO Control unit
N27	ABS system control unit
N28	Brake fluid electropump apparatus
N29a	Connection for free diode (A)
N99b	Connection for free diode (B)

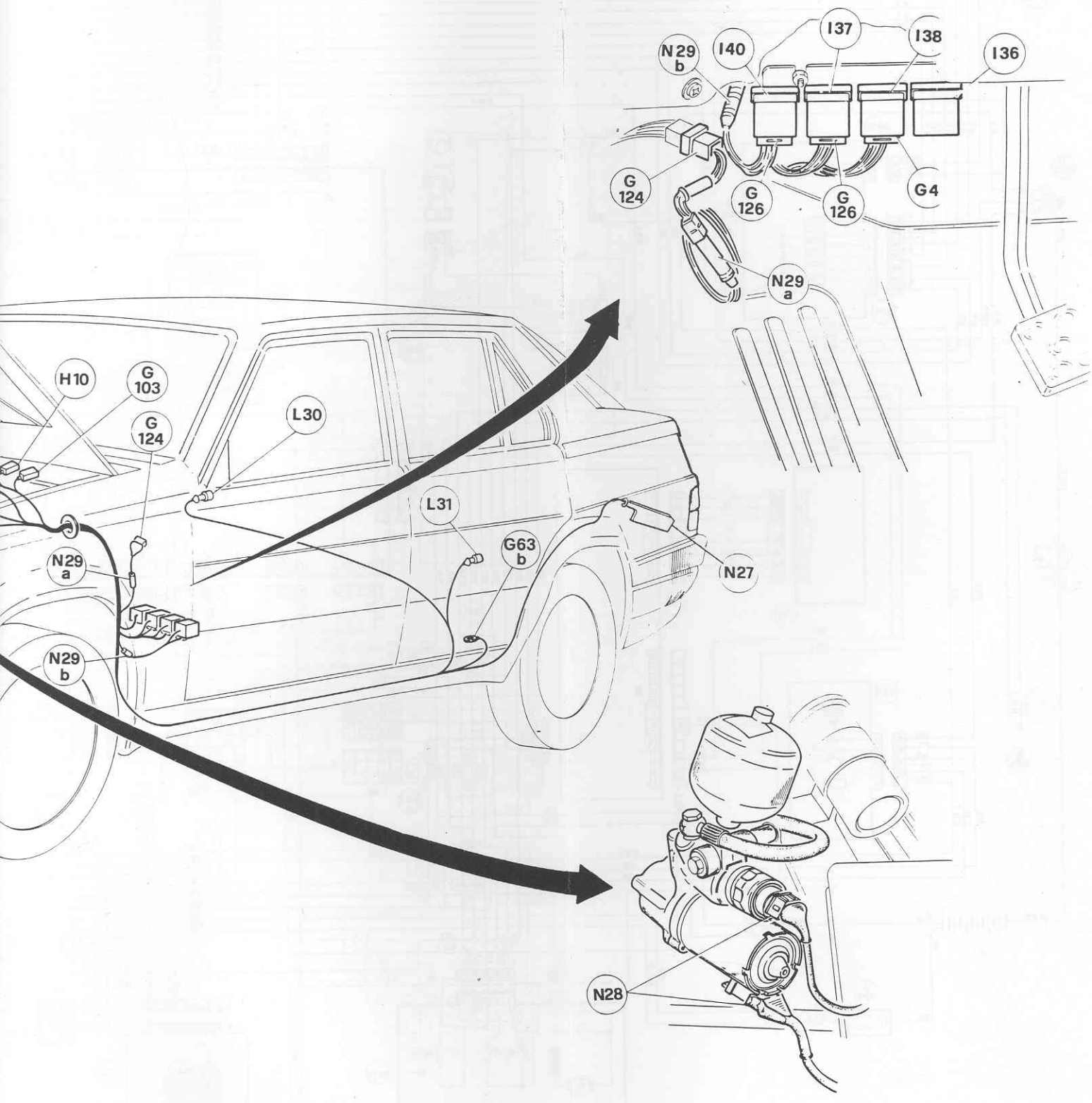
SPECIAL TOOLS

Part No.	Description	Page
A.5.0194	Wrench, wheel cylinder, 17 	22-12 22-13
A.3.0327	Hub puller (to be used, without screw, with tool A.3.0617) 	22-36 22-37
A.3.0617	Percussion tool for rear wheel hub pulling (to be used with tool A.3.0327 without screw) 	22-36 22-37
C.1.0132	Universal diagnoser for electronic system 	22-59 22-65
C.9.0032	Cable connecting C.1.0132 and C.1.0133 	22-59 22-65
C.1.0133	Interface for ABS MARK II 	22-59 22-65 22-68
A.2.0440	Front and rear brake calipers 100 bar pressure gauges 	22-57
A.2.0441	Hydraulic circuit 200 bar pressure gauge (ABS MARK II system) 	22-60
A.2.0442	Brake pedal operating tool 	22-57



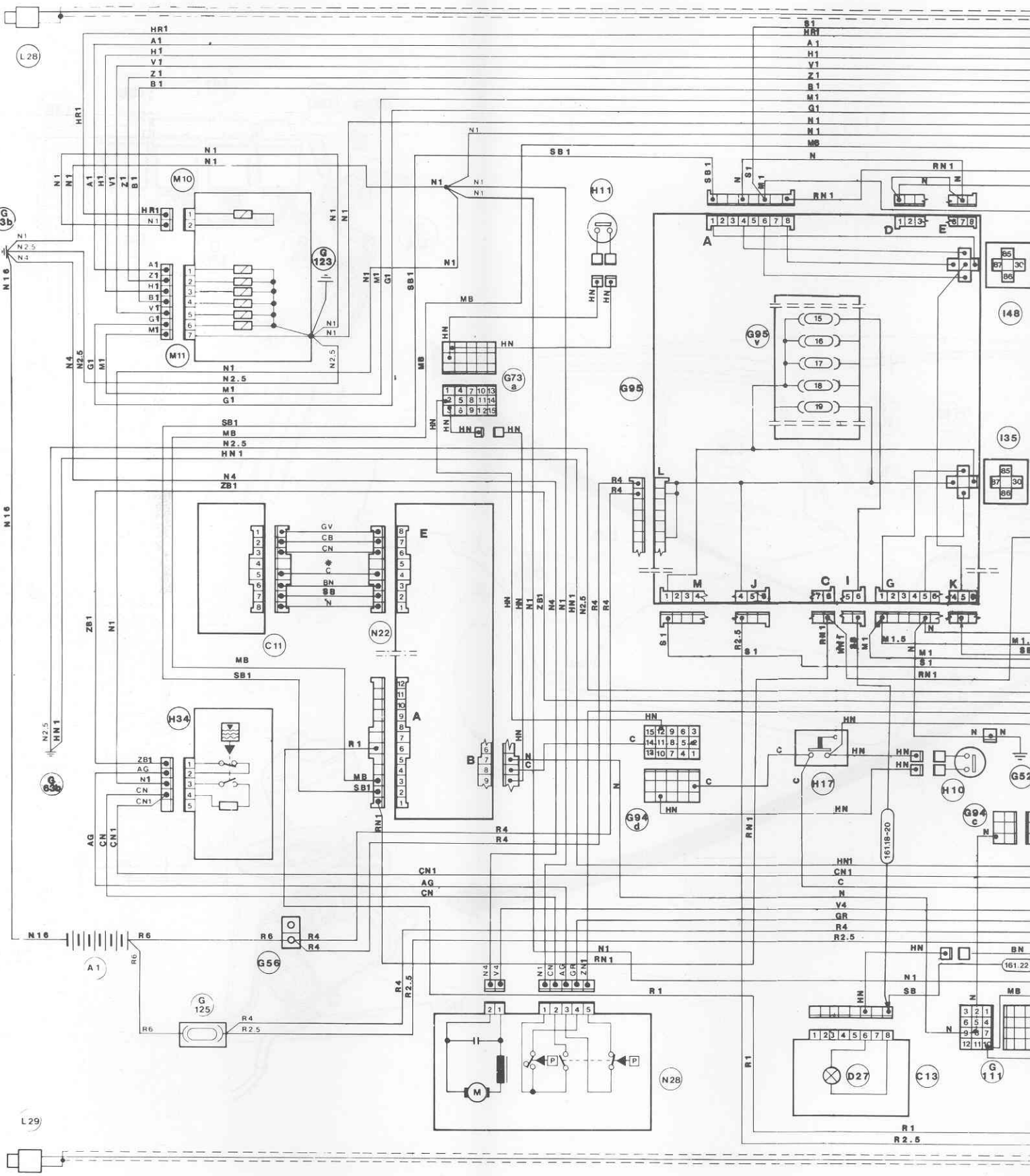
CABLING OF THE (ABS) MARK II WHEEL ANTILOCK SYSTEM

(vehicles 75 Twin Spark 2.0 75 6V 3.0 75 6V 2.5)

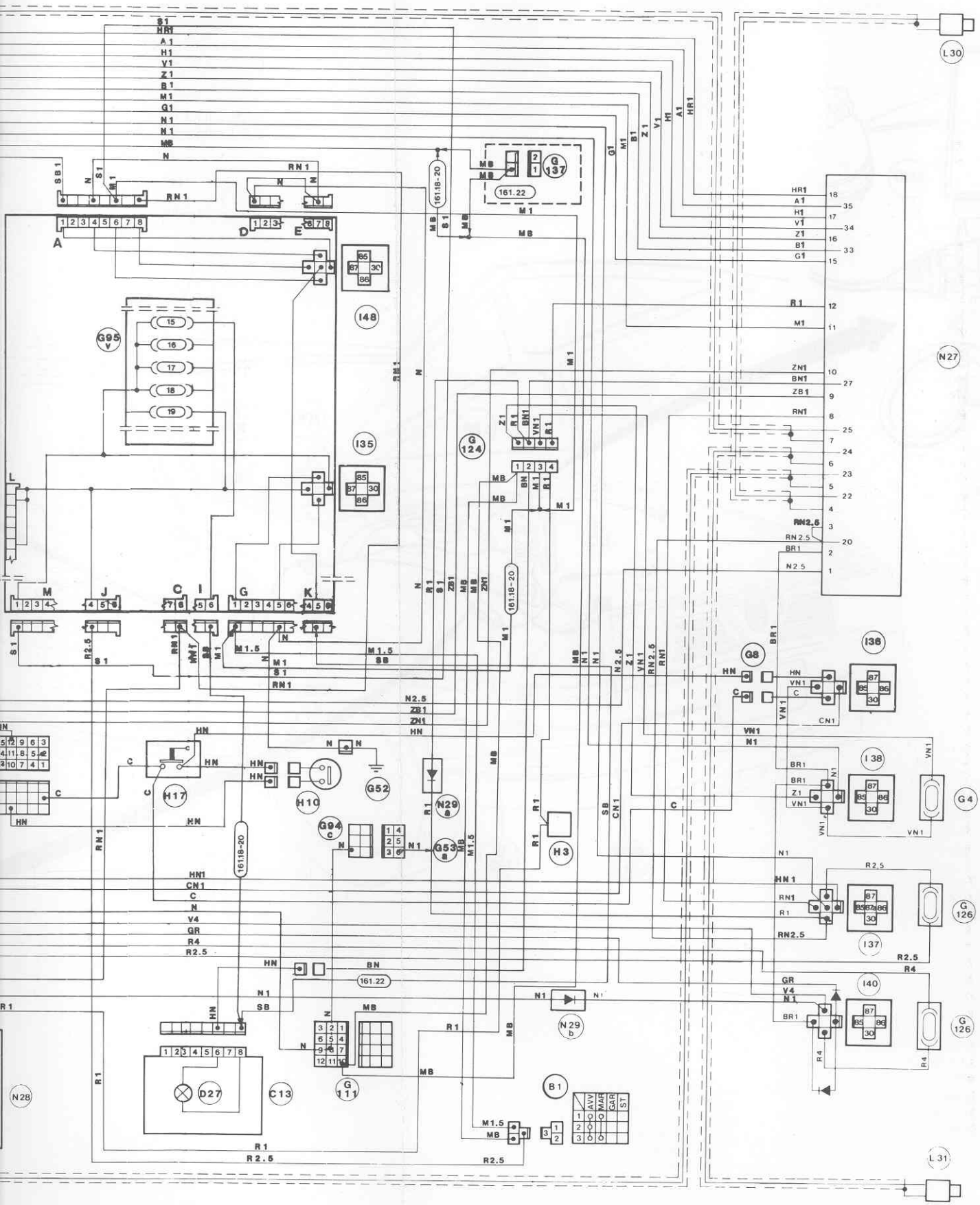


WIRING DIAGRAM OF THE (ABS) MARK II WHEEL ANTILOCK SYSTEM

(vehicles 75 6V 3.0 | 75 Twin Spark 2.0 | 75 6V 2.5)



SYSTEM



Legend

A1	Battery
B1	Ignition switch
C11	ALFA ROMEO Control display
C13	Optoelectronic cluster
D27	ABS MARK II system warning lamp
G4	Free fusebox
G8	Single connector
G52	Fusebox ground
G53	Engine compartment ground
G53a	Engine compartment ground - right side
G53b	Engine compartment ground - left side
G55	Hood ledge panel ground
G56	Branch terminal board
G63b	Rear left ground
G73a	Connector for right rear services
G94b	8-way connector for engine compartment
G94c	Engine compartment connector - right side
G94d	Engine compartment connector - left side
G95	Central fusebox
G95D	Connector for ALFA ROMEO Control
G95E	Connector for console
G95N	Connector for battery
G95O	Connector for ignition switch
G95P	Connector for door services
G95Q	Connector for performance gauge
G95S	Connector for cluster
G95V	Fuses
G96	Single connector for ALFA ROMEO Control - cluster
G99c	Connector for engine dashboard (C)
G103	Connector for grounds and brakes fluid tank
G111	Connector for dashboard instruments wiring
G123	Pedal assembly ground
G124	ABS system connector
G125	ABS system free fusebox
G126	ABS system relay safety fuse
G137	Injection supply wiring connector
H3	Stop light switch
H10	Left front brake pad switch
H11	Right rear brake pad switch
H17	Brake fluid minimum level check switch
H34	ABS system brake fluid tank switch
I2	Heated rear window relay
I17	Fog light relay
I27	Seat height adjustment relay
I31	Front power windows - heater relay
I35	Key-operated supply relay
I36	Relay for brake wear and liquid level
I37	ABS system control unit relay
I38	ABS system auxiliary relay
I39	Brake fluid level warning lamp relay
I40	ABS system brake fluid electropump relay
I48	Ignition key-controlled relay for A.R. Control unit and instruments
L28	Front RH pick-up
L29	Front LH pick-up
L30	Rear RH pick-up
L31	Rear LH pick-up
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SPECIAL TOOLS

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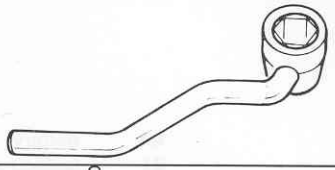
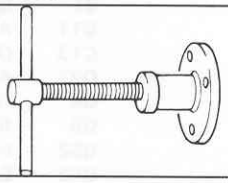
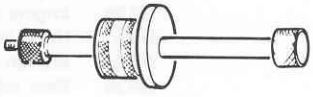
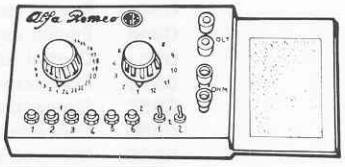
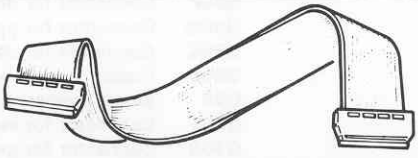
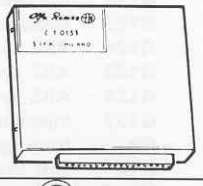
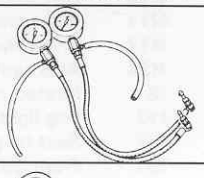
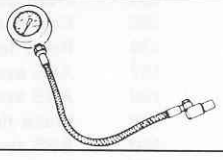
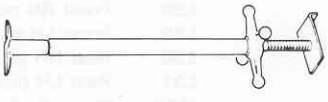
A.5.0194	Wrench, wheel cylinder,17 	22-12 22-13
A.3.0327	Hub puller (to be used, without screw, with tool A.3.0617) 	22-36 22-37
A.3.0617	Percussion tool for rear wheel hub pulling (to be used with tool A.3.0327 without screw) 	22-36 22-37
C.1.0132	Universal diagnoser for electronic system 	22-59 22-65
C.9.0032	Cable connecting C.1.0132 and C.1.0133 	22-59 22-65
C.1.0133	Interface for ABS MARK II 	22-59 22-65 22-68
A.2.0440	Front and rear brake calipers 100 bar pressure gauges 	22-57
A.2.0441	Hydraulic circuit 200 bar pressure gauge (ABS MARK II system) 	22-60
A.2.0442	Brake pedal operating tool 	22-57
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GROUP 23

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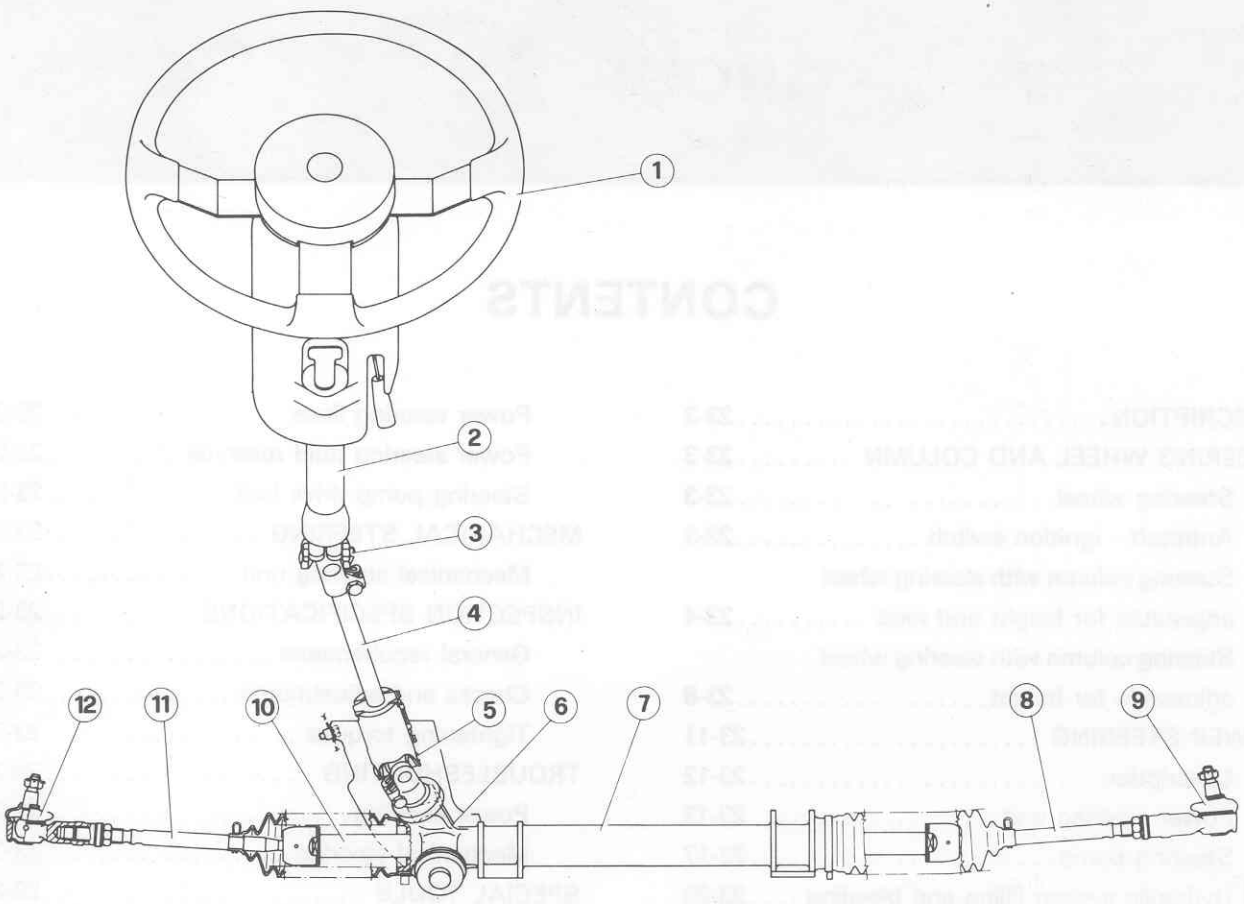
DESCRIPTION



1 Steering wheel
2 Steering column support and upper column
3 Upper U-joint
4 Lower column
5 Lower U-joint
6 Steering unit
7 Rack housing
8 Right tie rod
9 Ball joint
10 Rack
11 Left tie rod
12 Ball joint

Steering is rack and pinion, mechanical or power assisted depending on car model.

Tie rods are directly connected to rack. To afford the driver increased protection in the event of frontal impact steering unit is offset rearward.

For the same reason, steering column is split and incorporates two universal joints. Two types of steering columns are installed depending on car model.

On Alfa 90 and Alfa 75 steering column support is secured to body through sliding pads permitting steering wheel adjustment for height and reach.

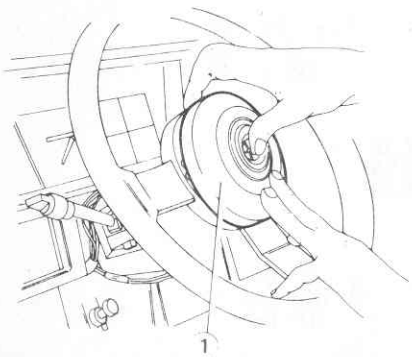
On other models, steering columns support is hinged to chassis, permitting steering wheel adjustment for height.

STEERING WHEEL AND COLUMN

STEERING WHEEL

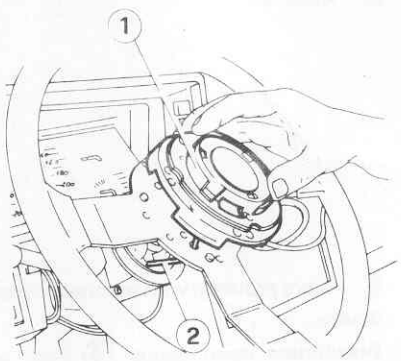
REMOVAL

1. Disconnect battery ground cable.
2. Remove hub cover (1) by finger pressure.



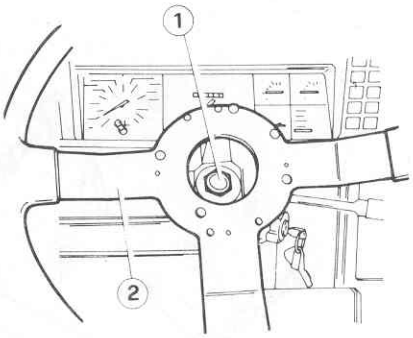
1 Hub cover

3. Back off 4 horn capscrews (1), disconnect lead (2) and remove pushbutton.



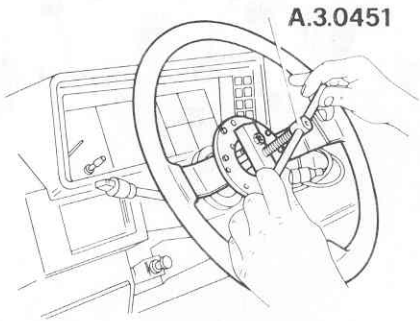
1 Horn pushbutton
2 Horn ground lead

4. Back off nut (1), remove washer and take off steering wheel (2) using tool A.3.0451.



1 Steering wheel nut
2 Steering wheel

A.3.0451



INSTALLATION

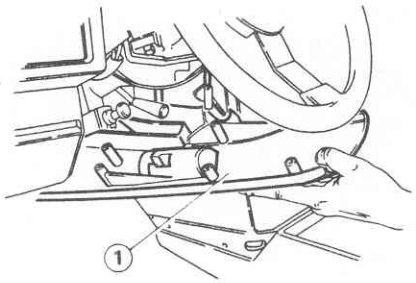
Install steering wheel on car by reversing the removal sequence and adhering to the instructions given below.

- Align wheels.
- Position steering wheel on steering colum, centralize spokes and tighten nut to the specified torque (see Inspection Specifications - Tightening Torques).
- Rotate steering wheel in both directions and check for binding.
- Check horn operation.

ANTITHEFT - IGNITION SWITCH

REMOVAL AND INSTALLATION

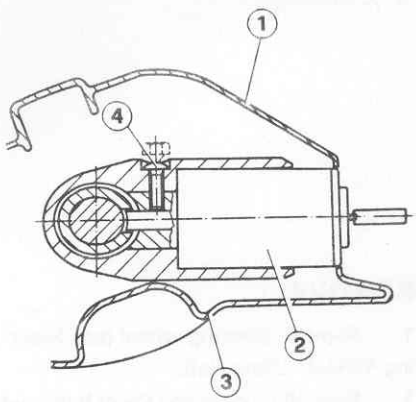
1. Back off capscrews and remove upper and lower half cowls (1) of steering column.



1 Lower half cowl

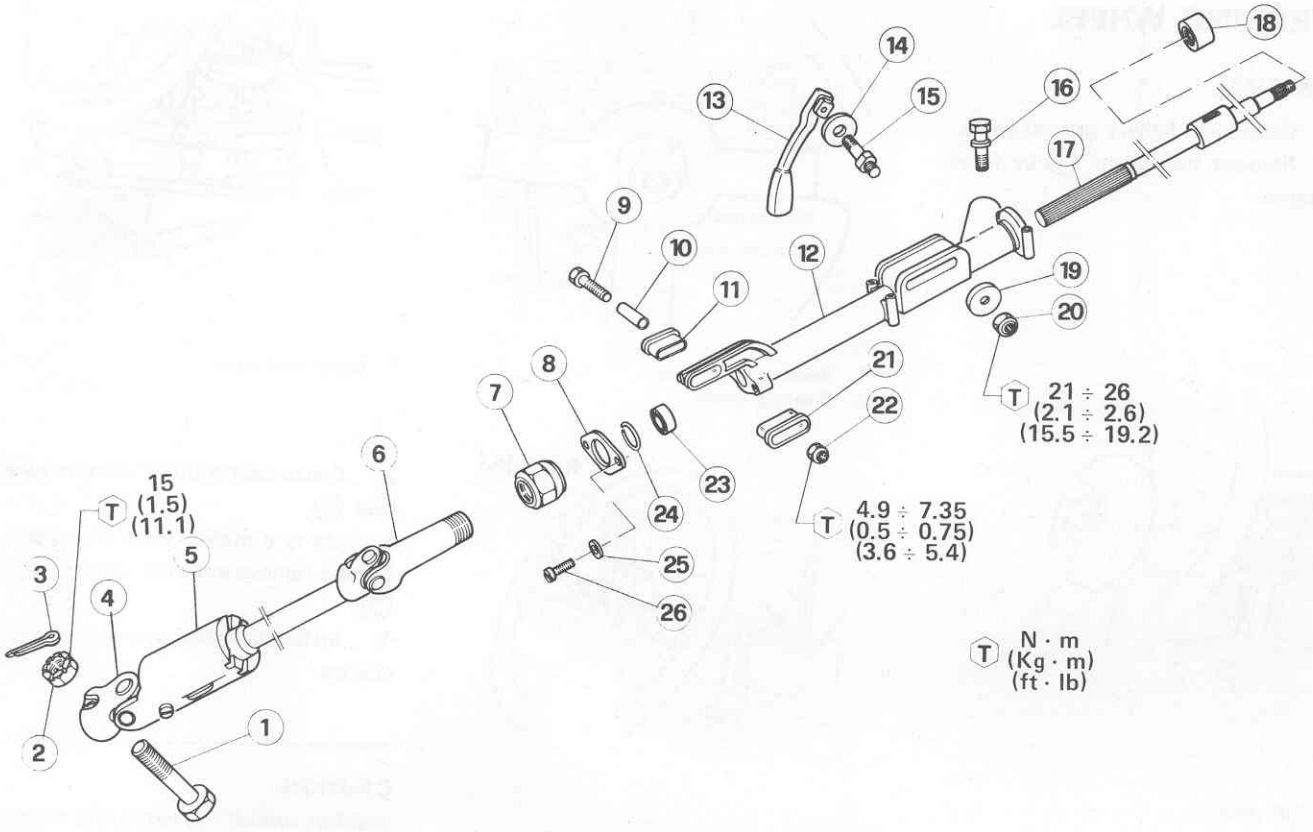
2. Disconnect antitheft-ignition switch lead (2).
3. Using a punch, back off capscrew (4) and remove antitheft-ignition switch (2).
4. Install by reversing the removal sequence.

CAUTION:
Ingition switch (2) capscrew must be tightened until hex. head is wrenched off.



1 Upper half cowl
2 Antitheft-ignition switch
3 Lower half cowl
4 Ignition switch capscrew

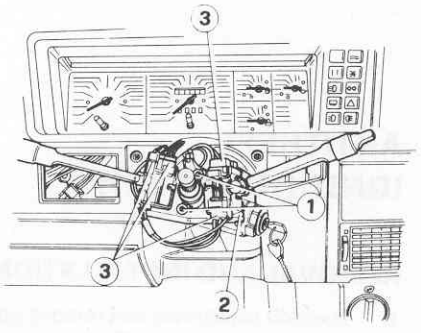
STEERING COLUMN WITH STEERING WHEEL ADJUSTABLE FOR HEIGHT AND REACH



1 Steering box pinion capscrew
2 Nut
3 Cotter pin
4 Lower U-joint
5 Lower steering column
6 Upper U-joint
7 Sliding sleeve nut
8 Retaining plate
9 Capscrew
10 Bushing
11 Sliding pad seal
12 Steering column support
13 Steering wheel adjusting lever
14 Washer
15 Pin
16 Anti-theft capscrew
17 Upper steering column
18 Needle roller bushing
19 Washer
20 Nut
21 Sliding pad seal
22 Nut
23 Ball bearing
24 Retaining ring
25 Washer
26 Capscrew

REMOVAL

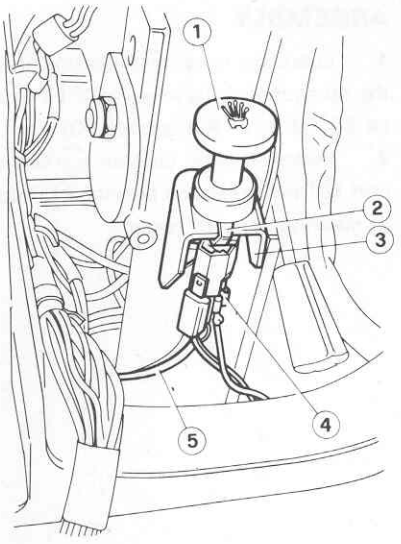
1. Remove steering wheel (see Steering Wheel - Removal).
2. Back off 6 upper and lower half cowl capscrews and remove cowl.
3. Unlock steering column through the lever, lower and remove upper half cowl.
4. Disconnect connectors (3), back off capscrews (1) and remove turn signal switch unit (2).



1 Capscrews
2 Turn signal switch unit
3 Turn signal switch unit connectors

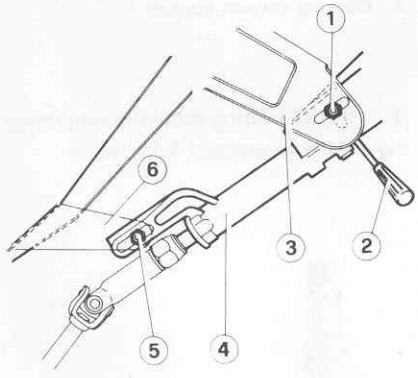
5. Cars provided with manual cold start device.

Disconnect connections (4) from cold start device control, remove control by releasing spring (2) and disconnect from support (3) withdrawing cable (5) from associated slot.



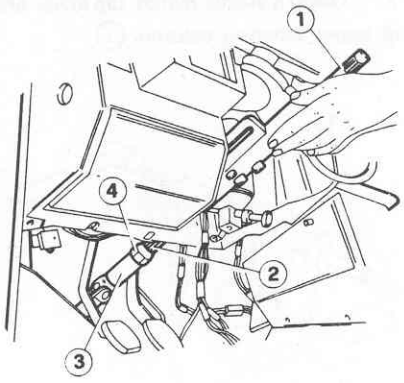
1 Cold start device control
2 Retaining spring
3 Cold start device control support
4 Cold start device control on indicator connection
5 Cold start device control cable

6. Back off nut (1), remove lever (2) with associated washers and disconnect steering column from bracket (3).
7. Remove bolt (5) and disconnect steering column (4) from bracket (6) retrieving spacer.



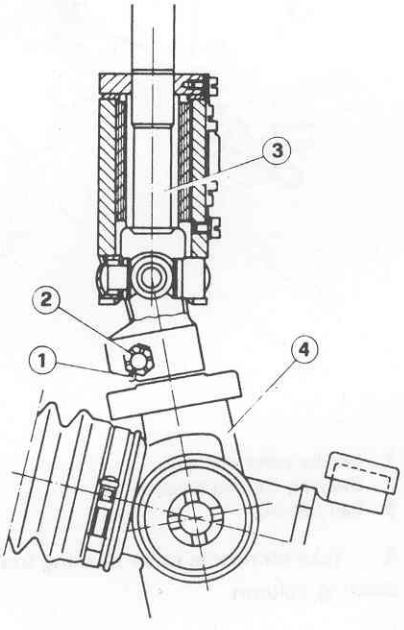
1 Lever retaining nut
2 Steering wheel adjusting lever
3 Upper bracket
4 Steering column
5 Steering column to lower bracket bolt
6 Lower bracket

8. Slacken nut (4) and take off steering column (1) disconnecting from intermediate shaft sleeve (3).



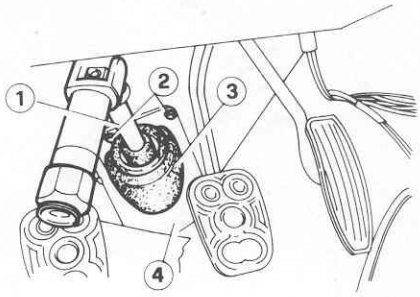
1 Steering column
2 Steering column spline
3 Sleeve
4 Nut

9. Remove cotter pin (1), back off bolt (2) and disconnect intermediate shaft (3) with U-joint and sleeve from steering unit (4).



1 Cotter pin
2 Bolt
3 Intermediate shaft
4 Steering unit

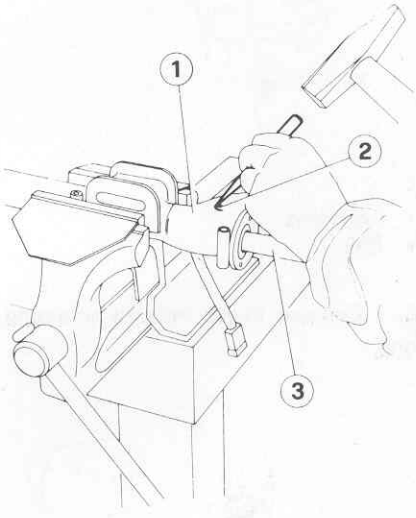
10. Back off 3 capscrews (2) and take off intermediate shaft (1) with boot (3) and retaining plate (4).



1 Intermediate shaft
2 Capscrews
3 Boot
4 Retaining plate

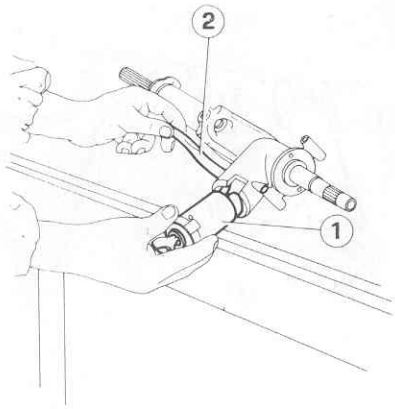
DISASSEMBLY

1. Clamp steering column support (1) with upper steering column (3) in a vice provided with jaw liners.
2. Using hammer and punch, back off capscrew (2) securing anti-theft to steering column support.



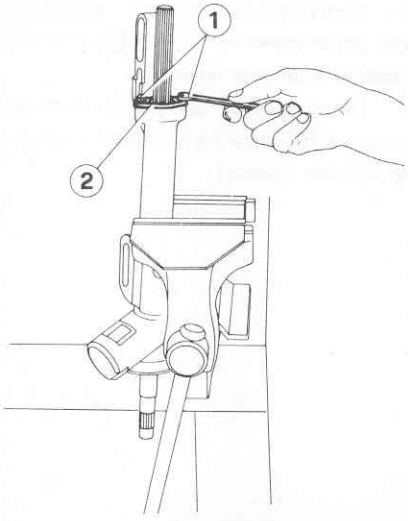
1 Steering column support
2 Anti-theft capscrew
3 Upper steering column

3. Disconnect lead ends from connector and mark relative position.
4. Take off anti-theft (1) without damaging leads (2).



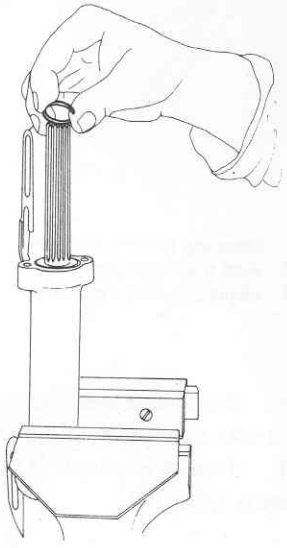
1 Anti-theft
2 Leads

5. Back off and remove lower bearing plate capscrews (1).

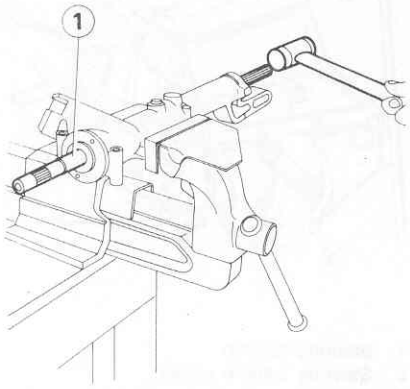


1 Capscrews
2 Plate

6. Remove lower bearing retaining ring.

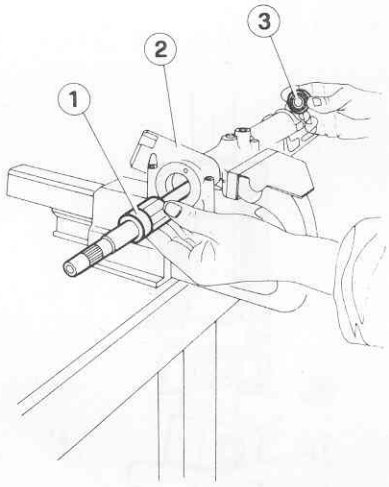


7. Using a plastic mallet, tap lower end of upper steering column (1).



1 Upper steering column

8. Take off upper steering column with needle roller bushing (1) from steering column support (2) and retrieve bearing (3).



1 Needle roller bushing
2 Steering column support
3 Ball bearing

9. Take off needle roller bushing from steering column.

INSPECTION

Clean all parts.

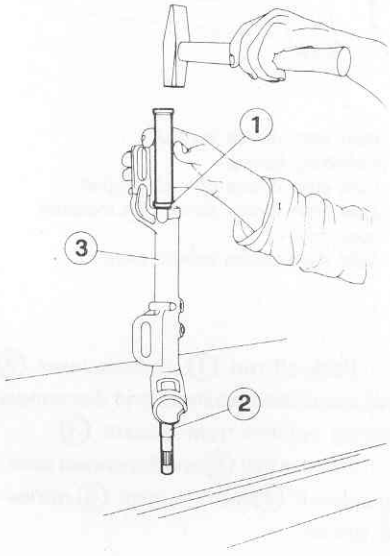
1. Check needle roller bushing and ball bearing for damage or malfunction; replace as necessary.

2. Check upper steering column ensuring that bearing and needle roller bushing working surfaces are not scored. Check splines for damage or undue wear. Also check anti-theft pin recess.

ASSEMBLY

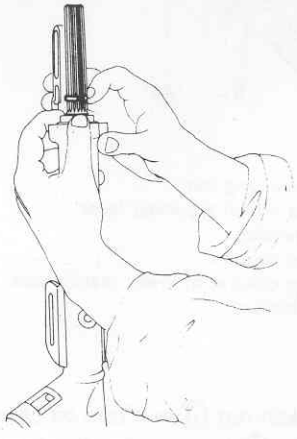
1. Lubricate lower ball bearing using the recommended grease (AGIP F1 Grease 33 FD or IP Autogrease FD).

2. Insert steering column (2) in support (3) and press ball bearing (1) home in steering column bottom.

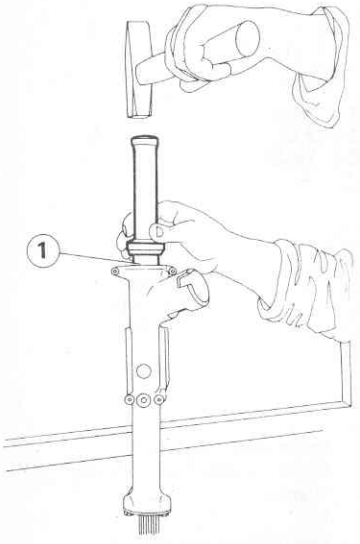


1 Ball bearing
2 Steering column
3 Steering column support

3. Install bearing retaining ring ensuring that it is pressed fully home.

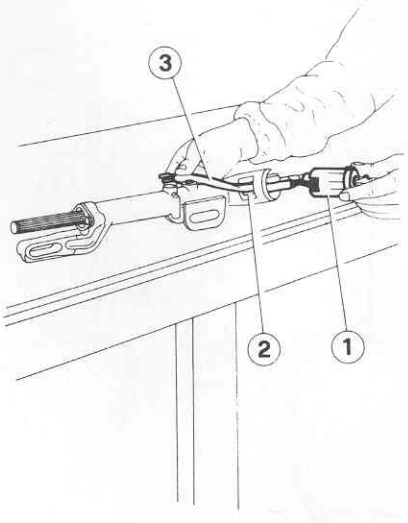


4. Place lower bearing retaining plate in position and lock through associated capscrews.
5. Lubricate needle roller bushing seat on steering column support using the recommended grease (SPCA Spagraph or ISECO Ergon Rubber Grease n. 3).
6. Insert upper needle roller bushing (1) fully home between steering column and support and check that steering column rotates without binding or excessive clearance.



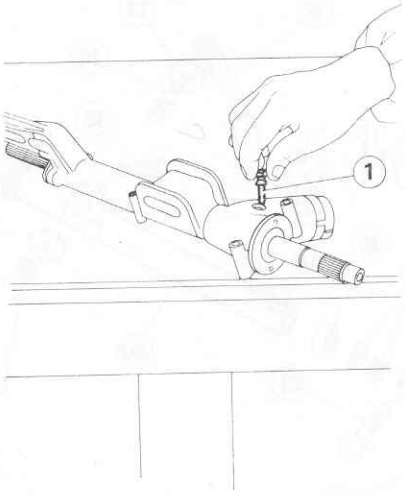
1 Needle roller bushing

7. Insert antitheft device (1) feeding leads (3) through associated slot (2).



1 Antitheft device
2 Slot
3 Leads

8. Centralize antitheft device, insert capscrew (1) available as spare and tighten until head is wrenched off.



1 Locking capscrew

9. Install lead connector aligning reference marks previously applied.

INSTALLATION

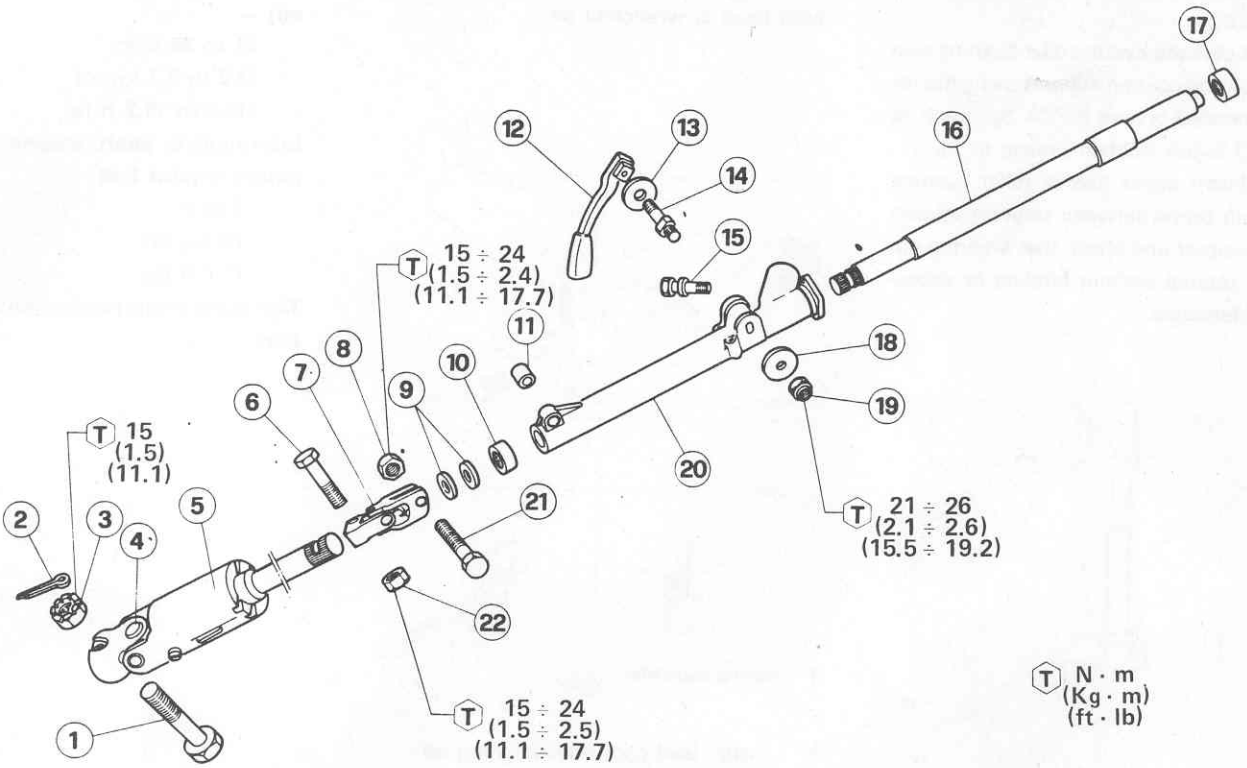
CAUTION:
Sliding sleeve nut connecting steering column to intermediate shaft spline must be tightened to obtain 34 to 44 N (3.5 to 4.5 kg) (7.7 to 9.9 lb) end sliding load on spline.

Install by reversing the removal sequence and adhering to the instructions given below.

- Correctly position turn signal switch unit on steering column.
- Apply the recommended grease (ISECO Molykote Pasta G) on steering column support flanges and on steering column and sliding sleeve splines.
- Adhere to the following tightening torques.

(T) : **Tightening torques**
Steering column/lower support bolt
4.9 to 7.35 N·m
(0.5 to 0.75 kg·m)
(3.6 to 5.4 ft·lb)
Steering column/upper support nut (with steering wheel lever locked)
21 to 26 N·m
(2.2 to 2.7 kg·m)
(15.5 to 19.2 ft·lb)
Intermediate shaft/steering unit pinion U-joint bolt
15 N·m
(1.5 kg·m)
(11.1 ft·lb)
Tighten to permit cotter pin insertion.

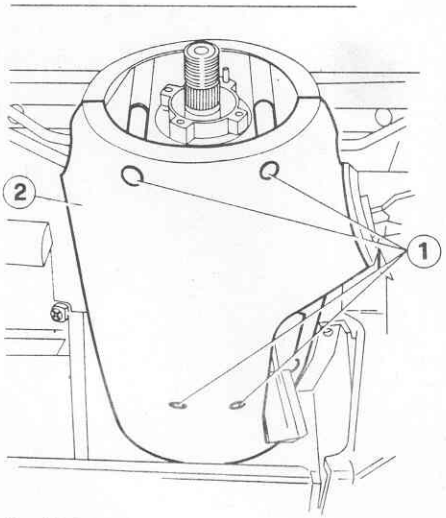
STEERING COLUMN WITH STEERING WHEEL ADJUSTABLE FOR HEIGHT



1 Steering unit pinion capscrew
2 Cotter pin
3 Nut
4 Lower U-joint
5 Lower steering column
6 Capscrew
7 Upper U-joint
8 Nut
9 Washers
10 Lower needle roller bushing
11 Antivibration bushing
12 Steering wheel adjusting lever
13 Washer
14 Pin
15 Antitheft capscrew
16 Upper steering column
17 Upper needle roller bushing
18 Washer
19 Nut
20 Steering column support
21 Capscrew
22 Nut

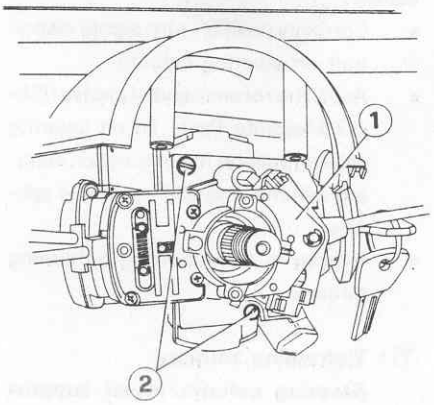
REMOVAL

1. Remove steering wheel (see: Steering Wheel - Removal).
2. Back off lower half cowl capscrews (1) and remove cowl (2).



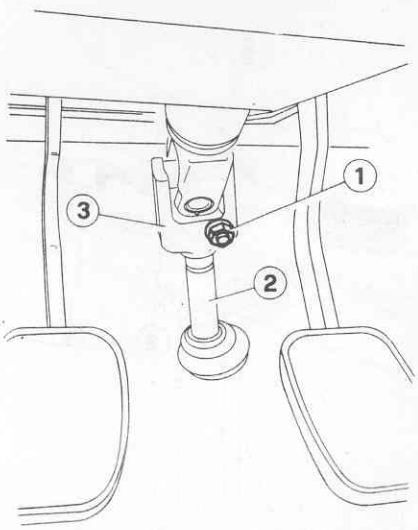
1 Capscrews
2 Lower half cowl

3. Cut lead clip and disconnect turn signal switch unit wiring harness.
4. Remove turn signal switch unit (1) by backing off 2 bolts (2).



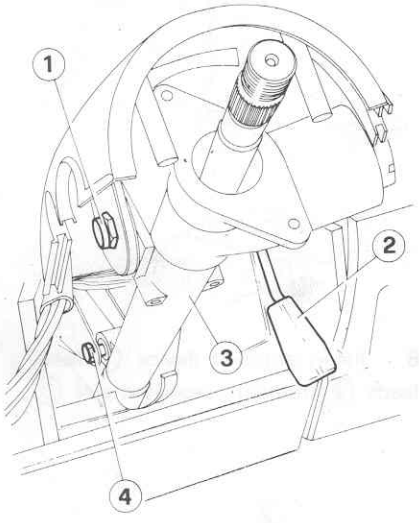
1 Turn signal switch unit
2 Bolts

5. Disconnect antitheft wiring harness.
6. Slacken and remove bolt (1) securing U-joint (3) to lower steering column (2).



1 Bolt
2 Lower steering column
3 U-joint

7. Back off and remove bolt ④ securing steering column support ③ to body.
8. Remove adjusting lever pin after backing off associated nut ①.

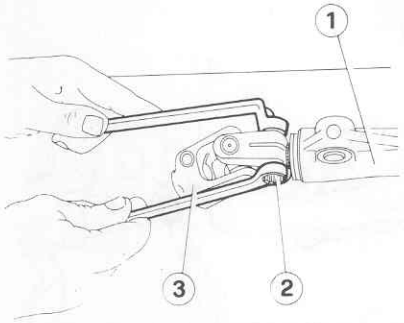


1 Nut
2 Adjusting lever
3 Steering column support
4 Bolt

9. Remove steering column and retrieve upper half cowl.

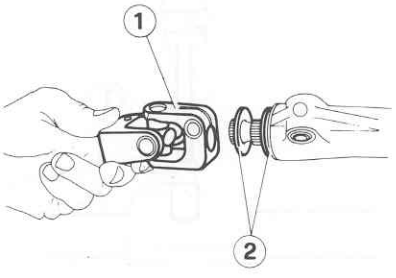
DISASSEMBLY

1. Clamp steering column support ① with attached upper steering column in a vice provided with protective jaw liners and back off upper U-joint ③ securing bolt ②.



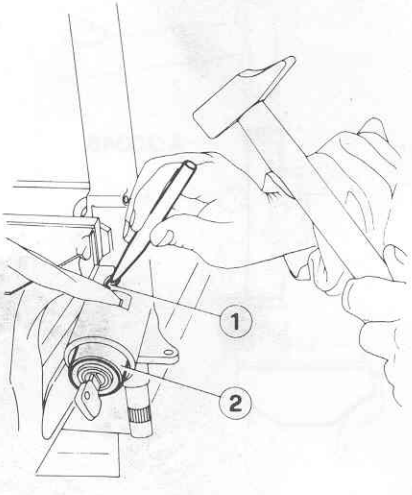
1 Steering column support
2 Bolt
3 U-joint

2. Take off U-joint ① and 2 washers ② from upper steering column lower end.



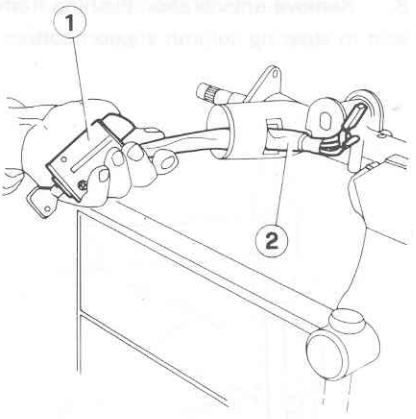
1 U-joint
2 Washers

3. Using hamer and punch, back off capscrew ① securing antitheft to steering column support ②.



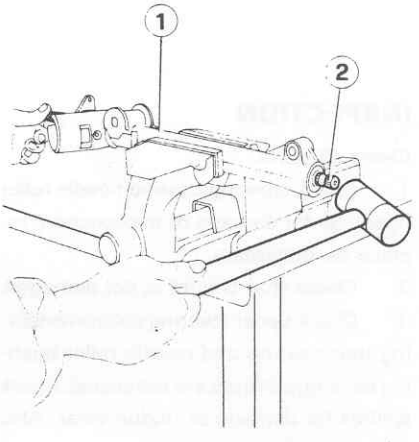
1 Locking screw
2 Antitheft device

4. Disconnect lead ends from connector and mark relative position.
5. Take off antitheft ① without damaging leads ②.



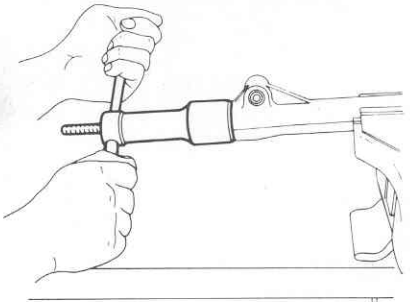
1 Antitheft device
2 Leads

6. With unit clamped in vice and using a plastic mallet, tap on steering column lower end ② to remove it from support ① with associated upper needle roller bushing.

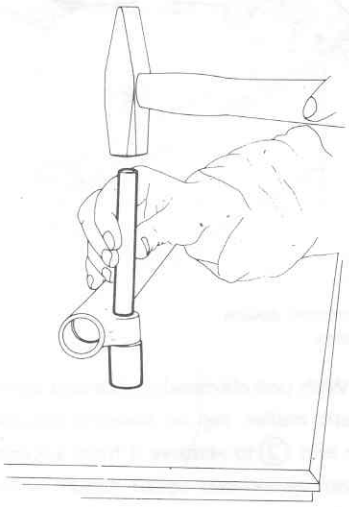


1 Steering column support
2 Steering column

7. Remove upper needle roller bushing from steering column and take off lower needle roller bushing from steering column support.



8. Remove antivibration bushing from seat in steering column support bottom.



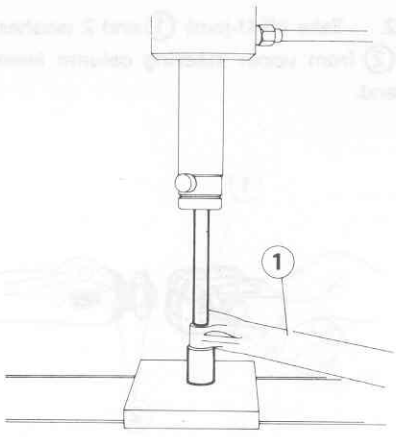
INSPECTION

Clean all parts.

1. Check steering column needle roller bushings for damage or malfunction; replace as necessary.
2. Check that U-joint is not damaged.
3. Check upper steering column ensuring that bearing and needle roller bushing working surfaces are not scored. Check splines for damage or undue wear. Also check antitheft pin recess.
4. Check antitheft and steering column support for damage; replace as necessary.

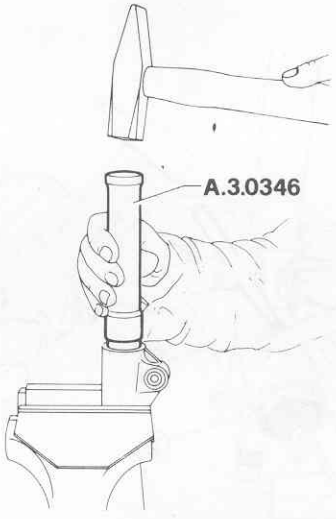
ASSEMBLY

1. At the press, insert ball joint in seat on steering column support bottom.

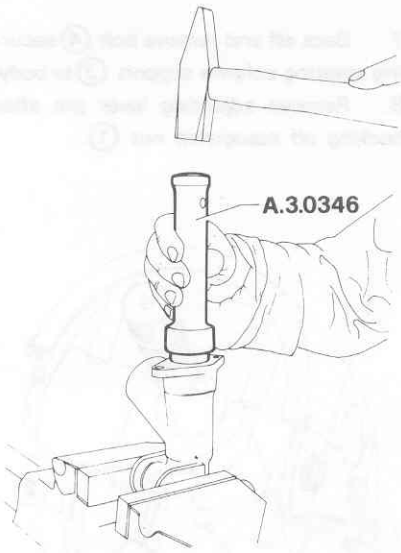


1 Steering column support

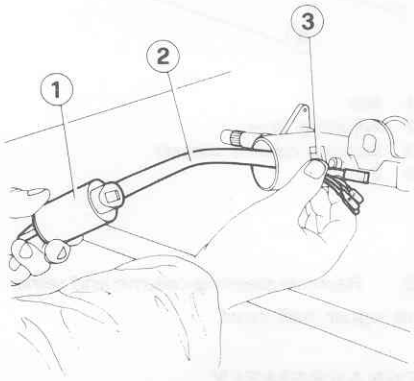
2. Lubricate needle roller bushing seat on steering column support using the recommended grease (SPCA Spagraph or ISECO Ergon Rubber Grease No. 3).
3. Using tool **A.3.0346**, insert lower needle roller bushing fully home in seat on steering column support.



4. Introduce steering column from steering column support top and insert in lower bushing.
5. Using tool **A.3.0346**, insert upper needle roller bushing in seat on steering column support and check that steering column rotates freely without binding or excessive clearance.

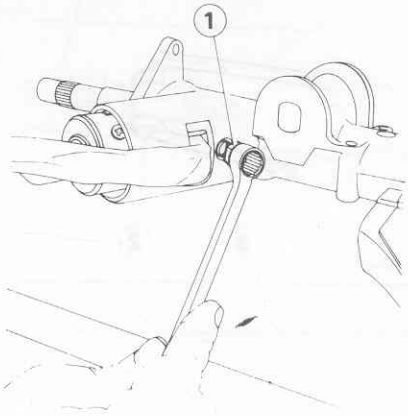


6. Insert antitheft device (1) feeding leads (2) through associated slot (3).



1 Antitheft device
2 Slot
3 Leads

7. Centralize antitheft device, insert capscrew (1) available as spare and tighten until head is wrenched off.



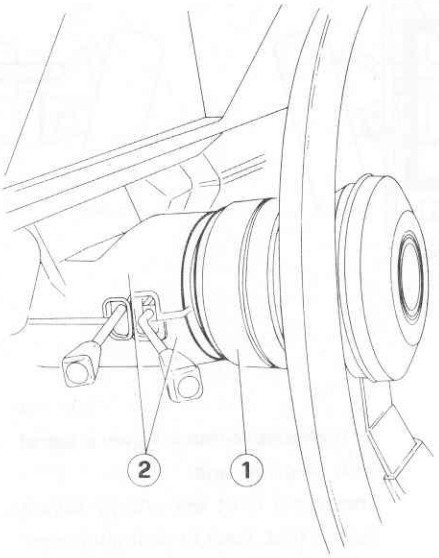
1 Locking capscrew

8. Install lead connector aligning reference marks previously applied.
9. Install U-joint with associated washers on steering column lower end.

INSTALLATION

Install by reversing the removal sequence and following the instructions given below.

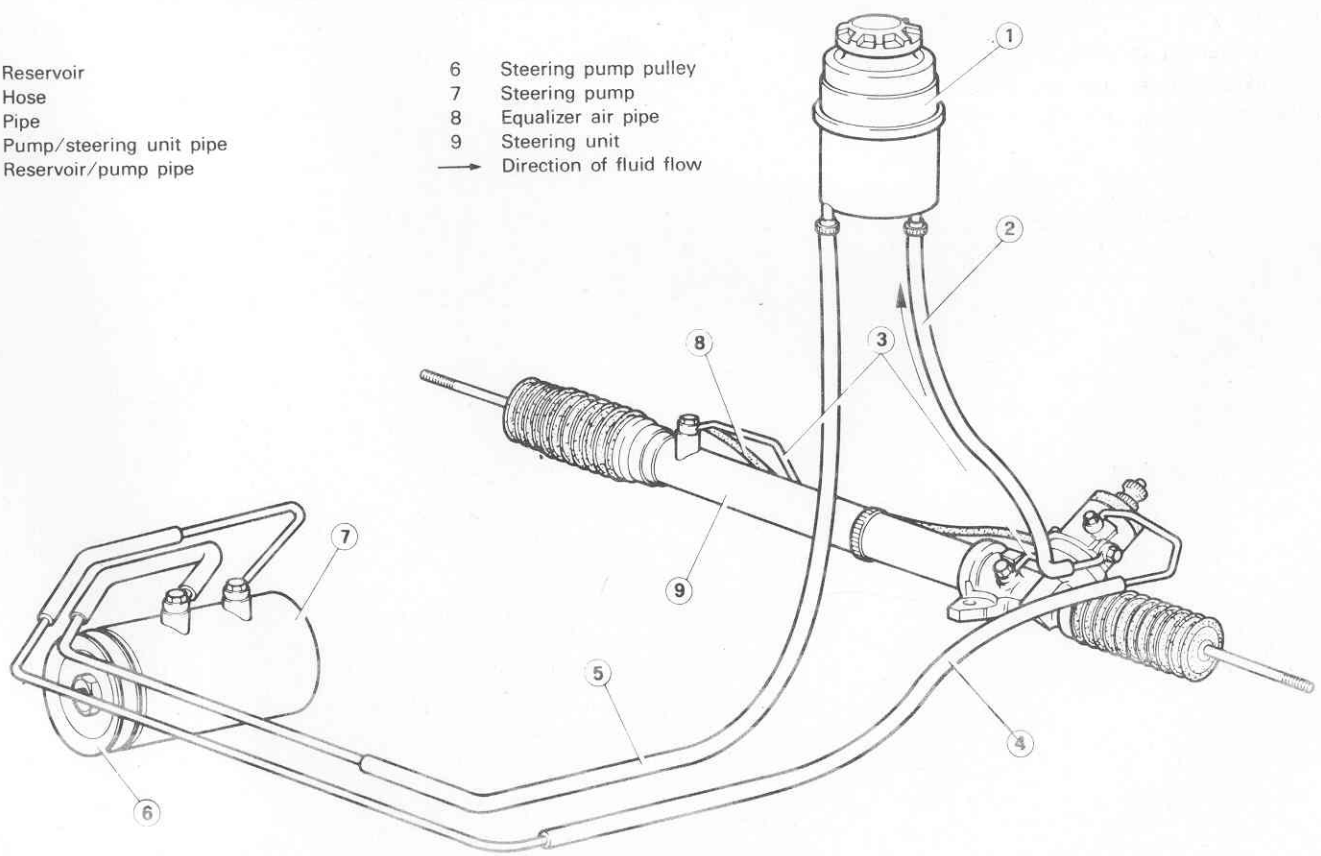
1. Place front wheels in straight ahead driving position and install upper half cowl, steering column and steering wheel with spokes horizontal.
2. Secure steering column support to body and U-joint to lower steering column installing bolt without tightening.
3. Take off steering wheel.
4. Install turn signal switch unit, lower half cowl and steering wheel (see steering Wheel-Installation).
5. Tighten U-joint/lower steering column bolt ensuring freedom from binding or excessive clearance between steering wheel (1) and half cowl (2).
6. Install horn pushbutton, hub, and connect battery lead.
7. Check turn signal switmch and horn operation.

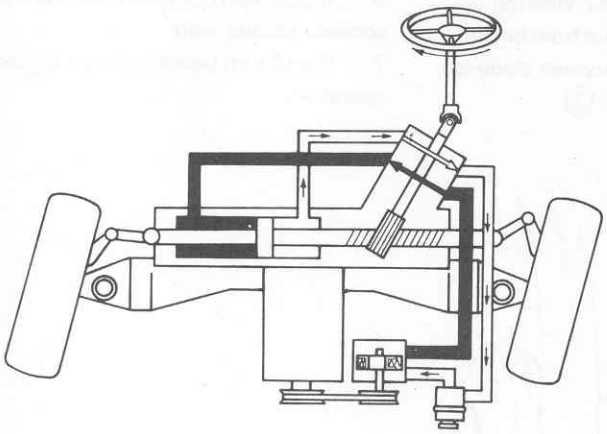


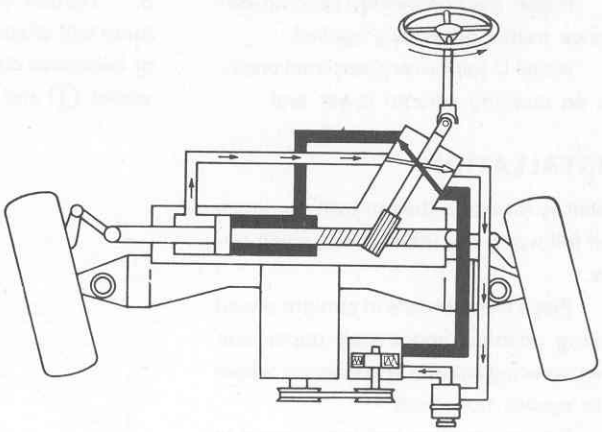
1 Steering wheel
2 Cowls

POWER STEERING

1 Reservoir
2 Hose
3 Pipe
4 Pump/steering unit pipe
5 Reservoir/pump pipe
6 Steering pump pulley
7 Steering pump
8 Equalizer air pipe
9 Steering unit
→ Direction of fluid flow



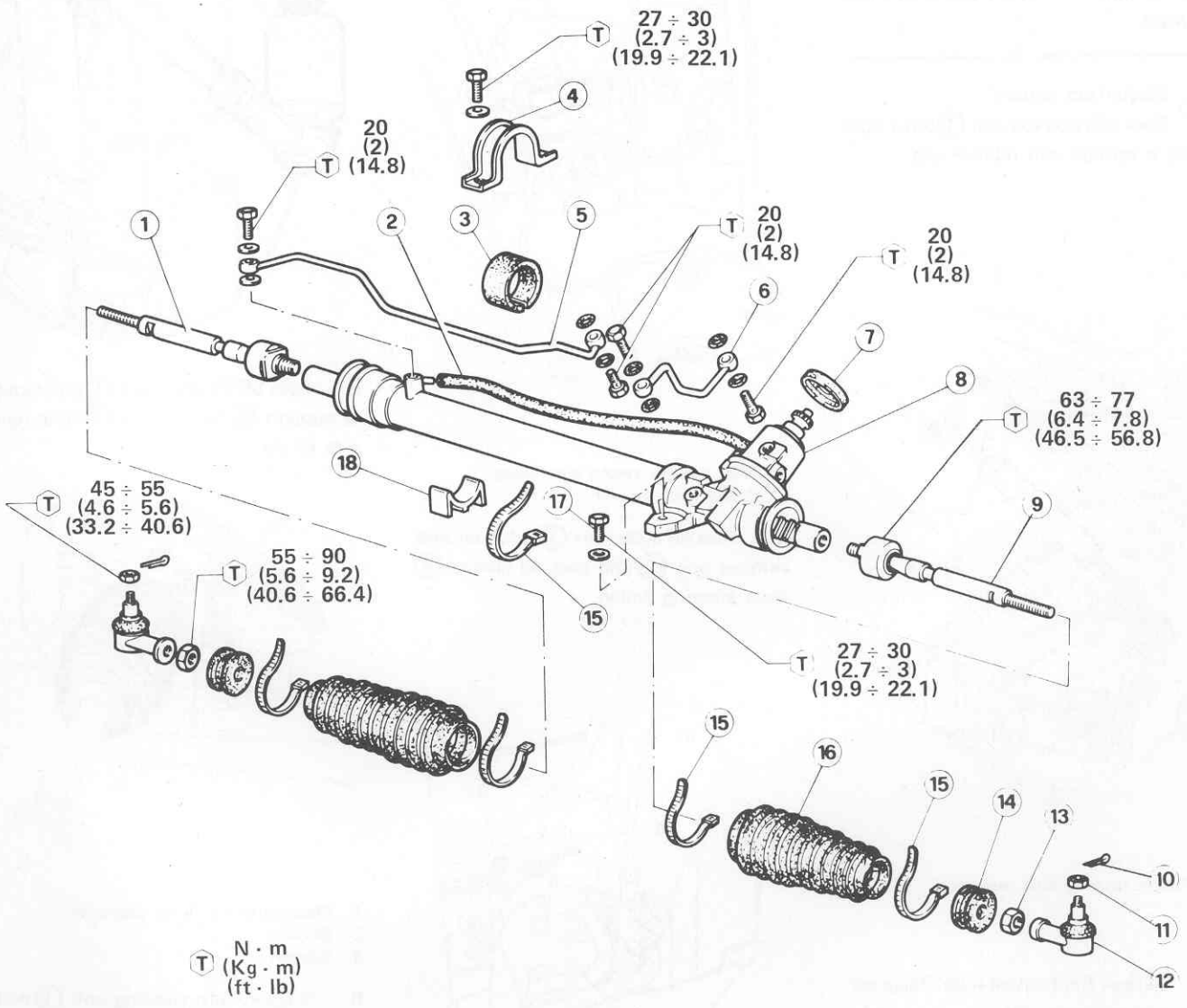




DESCRIPTION

- Power steering consists of:
  - Reservoir (1)
  - Pump (7)
  - Hydraulic piping
  - Steering unit (9)
- The reservoir provided with filter feeds circuit and eliminates impurities.
- The V-belt crankshaft-driven pump is a swash plate and radial piston unit supplying fluid under pressure to hydraulic control valve integral with steering unit.
  The pump is of the energy-saving type in that, even in changing operating conditions, it draws only the amount of fluid necessary for power steering operation.
- A pump-mounted relief valve maintains delivery pressure at a safe level.
- On steering wheel rotation, pinion on the end of steering column moves the rack, tie rods and steering knuckles to steer the road wheels.
  Simultaneaously, hydraulic control valve is activated to supply fluid under pressure to actuating cylinder.
  The resulting boost on steering wheel rotation reduces driver's effort.
- Thus, steering is a mechanical unit with assistance in the form of hydraulic power boost. Consequently, in case of fluid supply failure the unit operates as a normal mechanical non-assisted device.

POWER STEERING UNIT



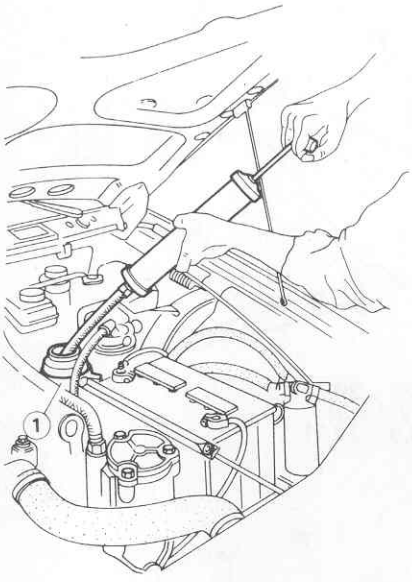
1 Right tie rod
2 Equalizer air pipe
3 Cushion support
4 Bracket
5 Pipe
6 Pipe
7 Dust excluder
8 Power steering control valve
9 Left tie rod
10 Cotter pin
11 Nut
12 Ball joint
13 Nut
14 Rubber ring
15 Clip
16 Bellows
17 Steering unit capscrew
18 Support

REMOVAL

1. Place car on a platform lift and restrain rear wheels using suitable chocks.

WARNING:
If the engine is warm proceed with caution.

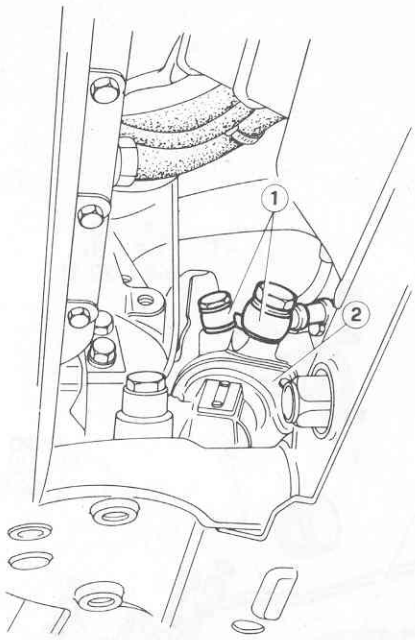
2. Disconnect battery.
3. Back off reservoir cap (1) draw fluid using a syringe and replace cap.



1 Power steering fluid reservoir

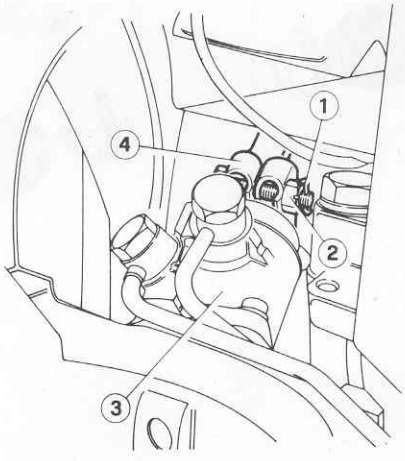
4. Slacken front wheel nuts. Raise car front end and prop with support stands. Remove front wheels.
5. Raise car on platform lift and disconnect two fittings (1) from steering unit (2) from underside of body.

CAUTION:
After removal, put back the two fitting capscrews on steering unit.



1 Fluid delivery/return pipe fitting
2 Power steering unit

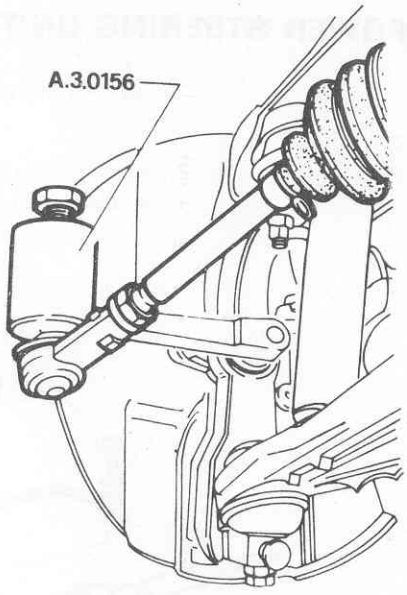
6. Take off cotter pin (1), back off and remove bolt (2) and take off sleeve (4) from steering pinion.



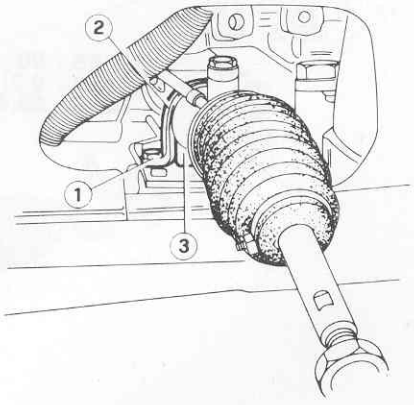
1 Cotter pin
2 Bolt
3 Power steering unit
4 U-joint sleeve

7. Remove ball joint pins from steering knuckles.

a. Take off nut cotter pin.
b. Back off and remove unit.
c. Using puller **A.3.0156**, take off ball joint pins.

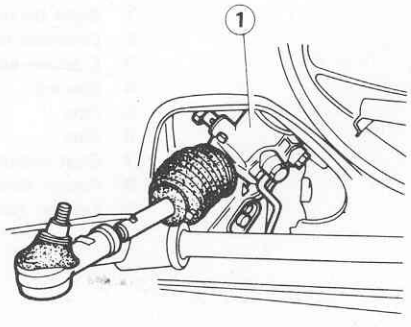


8. Back off 4 capscrews (1) and remove support (3) and bracket (2) from right side of car.



1 Steering unit to body capscrew
2 Bracket
3 Support

9. Suitably turn steering unit (1) with attached tie rods and take off from left side of car.

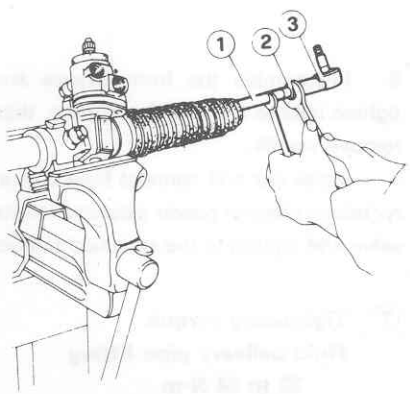


1 Power steering unit

DISASSEMBLY

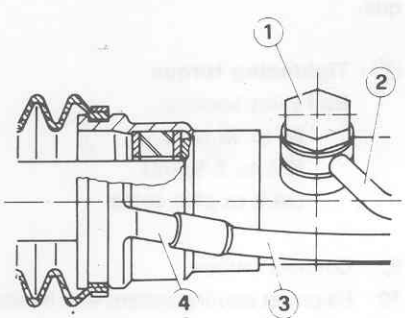
WARNING:
Measure ball joint ③ protrusion from tie rods ① to be restored on assembly.

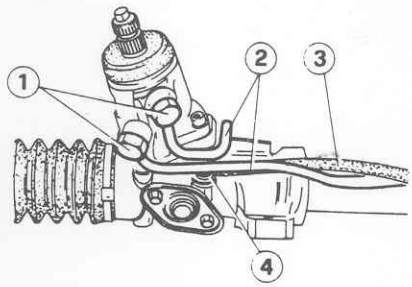
1. Slacken locknut ②, back off and remove ball joint from tie rod ①.

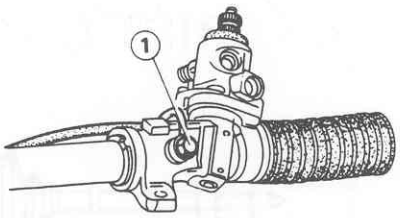


1 Tie rod
2 Locknut
3 Ball joint

2. If necessary, back off and remove 4 fittings ① from power steering unit.
3. If necessary, remove pipe ③ from associated fittings ④.

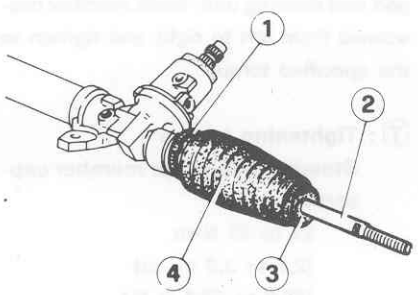






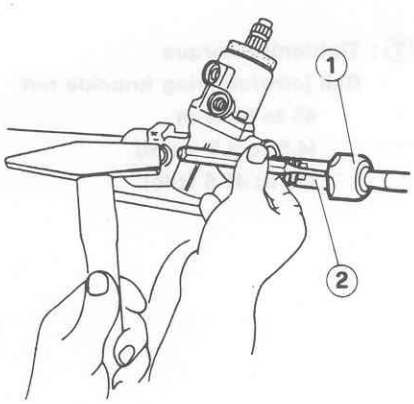
1 Pipe fitting
2 Pipes
3 Equalizer air pipe
4 Equalizer air pipe fitting

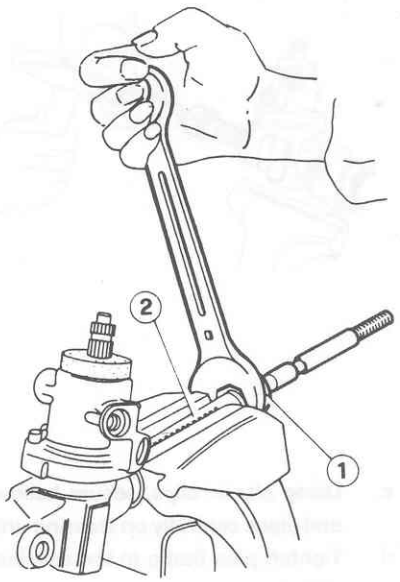
4. Cut clips ① and remove bellows ④ on both sides, along with rubber rings ③ on tie rod ②.



1 Plastic clip
2 Tie rod
3 Rubber ring
4 Bellows

5. Remove staked metal on ball joints ①, back off and remove joints from rack ②.





1 Ball joint
2 Rack

INSPECTION

Clean and visually inspect all parts carefully.

a. Check that tie rod ball joints are not damaged or worn, and that they rotate freely without binding or excessive play.
b. Check that tie rods are not damaged or distorted.
c. Check rubber bellows, if cracked or scored replace without hesitation.

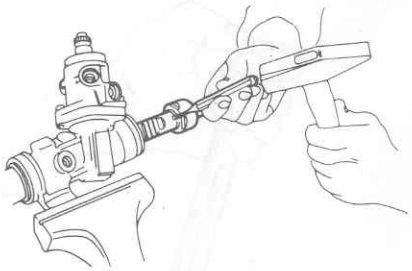
ASSEMBLY

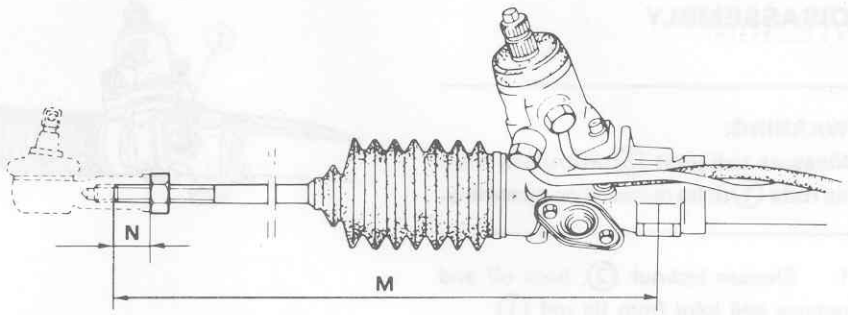
Assemble by reversing the disassembly sequence and following the instructions given below:

a. Tighten tie rods on rack to the specified torque.

Ⓣ : Tightening torque
Tie rod ball joint
63 to 77 N·m
(6.4 to 7.9 kg·m)
(46.5 to 56.8 ft·lb)

b. Stake tie rod ball joint.



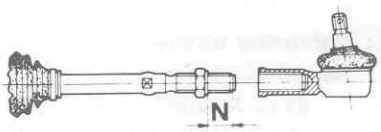


c. Using plastic clips, secure bellows and pipes centrally on steering unit.
d. Tighten pipe fitting to the specified torque.

Ⓣ : **Tightening torque**
Pipe fitting to steering unit
20 N·m
(2 kg·m)
(14.8 ft·lb)

e. Install locknut and ball joint on tie rods. Check that ball joint protrusion is as measured on disassembly; in case of replacement, restore specified fitted length.

Tie rod ball joint assembly data
N = 26 mm (1.02 in)



INSTALLATION

1. Position rack so that protrusion from steering unit is as specified.

Steering unit assembly data
M = 399.5 mm LHD (15.73 in)
M = 394 mm RHD (15.51 in)

2. Suitably turn steering unit and position on vehicle from left side.
3. From right side, install cushion support and steering unit/cross member capscrews from left to right and tighten to the specified torque.

Ⓣ : **Tightening torque**
Steering box/cross member capscrews
27 to 30 N·m
(2.7 to 3.0 kg·m)
(19.9 to 22.1 ft·lb)

4. With road wheels in straight-ahead driving position, check that steering wheel spokes are centralized and install intermediate shaft U-joint on steering pinion. Insert bolt in spline, tighten bolt and insert cotter pin.
5. Connect ball joint pins to steering knuckles from both car sides. Tighten nuts to the specified torque and insert another cotter pin.

Ⓣ : **Tightening torque**
Ball joint/steering knuckle nut
45 to 55 N·m
(4.5 to 5.5 kg·m)
(33 to 40.6 ft·lb)

6. Reassemble the front wheels and tighten nuts to the specified torque, then remove stands.
7. Raise car and connect fluid delivery/return pipes to power steering control valve and tighten to the specified torque.

Ⓣ : **Tightening torque**
Fluid delivery pipe fitting
22 to 24 N·m
(2.2 to 2.4 kg·m)
(16.2 to 17.7 ft·lb)

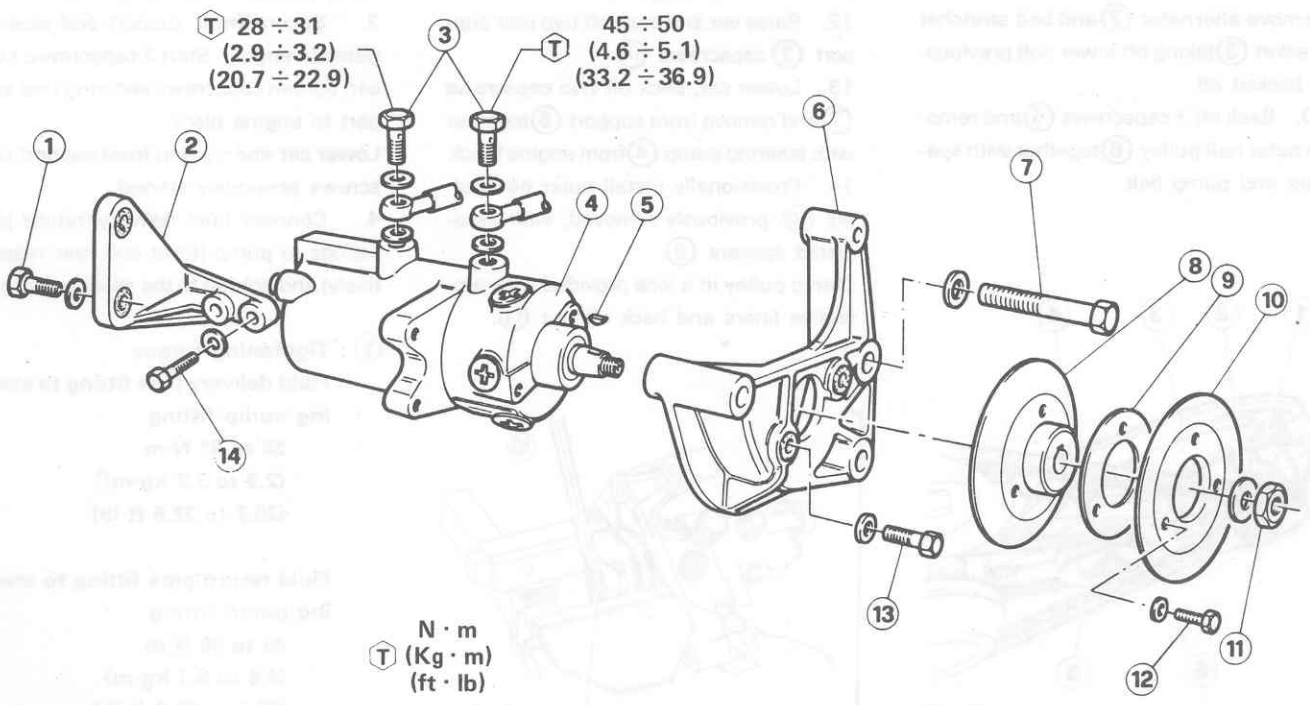
Fluid return pipe fitting
38 to 43 N·m
(3.9 to 4.4 kg·m)
(28 to 31.7 ft·lb)

8. After installation check toe-out (see Group 21 - Wheel Alignment). Tighten tie rod ball joint locknut to the specified torque.

Ⓣ : **Tightening torque**
Ball joint locknut
54 to 88 N·m
(5.5 to 9 kg·m)
(39.8 to 64.9 ft·lb)

9. Connect battery.
10. Fill power steering system with oil and bleed the system as instructed in Hydraulic System Filling and Bleeding.

STEERING PUMP



1 Capscrew
2 Pump rear support
3 Fluid pipe fitting
4 Steering pump
5 Key
6 Pump front support
7 Front support to engine block capscrew
8 Inner half-pulley
9 Spacer
10 Outer half pulley
11 Nut
12 Capscrew
13 Capscrew
14 Rear support to engine block capscrew

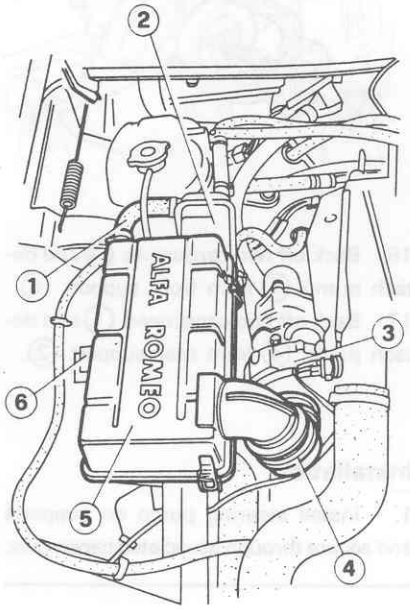
REPLACEMENT TURBODIESEL VERSION

Removal

1. Place car on a platform lift and restrain rear wheels using suitable chocks.

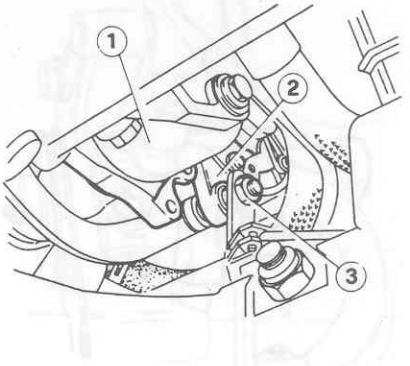
CAUTION:
If the engine is warm proceed with caution.

2. Disconnect battery.
3. Back off reservoir cap and draw fluid using a syringe and replace cap.
4. Disconnect pipe (1) from separator (2) and hose (4) from turbocharger inlet (3).
5. Remove air cleaner cover (5), pipe (1) and hose (4).
Remove filter element.
6. Back off bolts (6) and remove air cleaner housing from side wall.



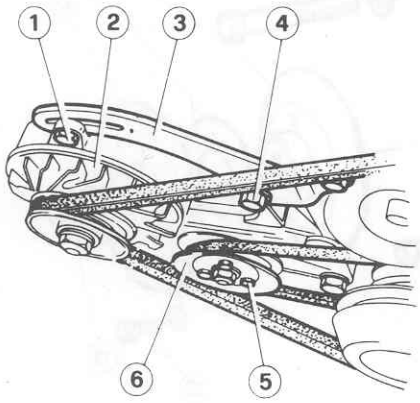
1 PCV pipe
2 Oil vapour separator
3 Turbocharger
4 Hose
5 Air cleaner cover
6 Air cleaner housing/body bolt

7. Disconnect alternator supply and indicator leads.
8. Raise car and back off bolt (3) but do not remove. Lower car.



1 Steering pump
2 Alternator
3 Bolt

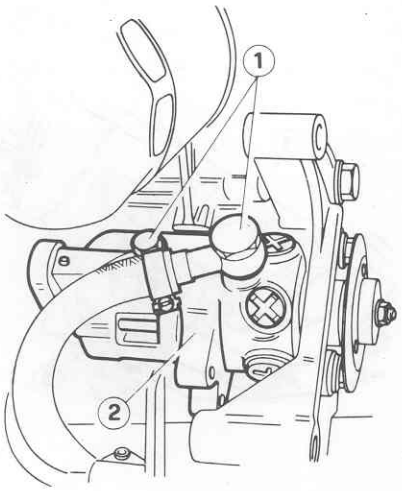
9. Back off bolts ① and ④, slacken and remove alternator belt.
Remove alternator ② and belt stretcher bracket ③ taking off lower bolt previously backed off.
10. Back off 3 capscrews ⑤ and remove outer half pulley ⑥ together with spacers and pump belt.



1 Bolt
2 Alternator
3 Belt stretcher bracket
4 Bolt
5 Capscrew
6 Outer half pulley

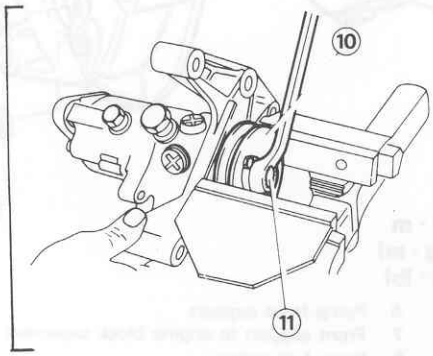
11 Back off and disconnect fittings ① from pump.

WARNING:
Tighten fittings capscrews on pump together with seals.

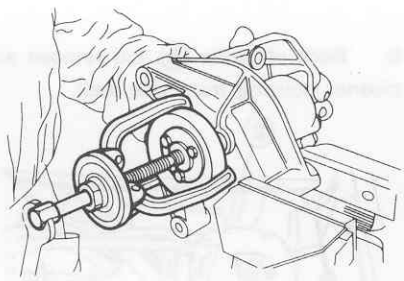


1 Fluid delivery/return pipe fittings
2 Steering pump

For the following paragraphs refer to exploded view on page 23-17.
12. Raise car and back off two rear support ② capscrews ⑭.
13. Lower car, back off two capscrews ⑦ and remove front support ⑥ together with steering pump ④ from engine block.
14. Provisionally install outer half pulley ⑩, previously removed, with associated spacers ⑨.
Clamp pulley in a vice provided with protective liners and back off nut ⑪.



15. Take off pulley with pump shaft and retrieve key ⑤.



16. Back off two capscrews ⑬ and detach pump ④ from front support ⑥.
17. Back off two capscrews ① and detach pump ④ from rear support ②.

Installation

1. Install steering pump on supports and secure through associated capscrews.

WARNING:
Correctly position supports as pump must be placed with oil pipe fittings facing upward.

2. Install pulley on pump shaft and correctly position key; tighten nut.
3. Secure front support and steering pump to engine. Start 2 capscrews, raise car, tighten capscrews securing rear support to engine block.
Lower car and tighten front support capscrews previously started.
4. Connect fluid delivery/return pipe fittings to pump (front and rear respectively) and tighten to the specified torque.

Ⓣ : **Tightening torque**
Fluid delivery pipe fitting to steering pump fitting
28 to 31 N·m
(2.9 to 3.2 kg·m)
(20.7 to 22.9 ft·lb)

Fluid return pipe fitting to steering pump fitting
45 to 50 N·m
(4.6 to 5.1 kg·m)
(33.2 to 36.9 ft·lb)

5. Install steering pump drive belt and associated half pulley with spacers correctly selected to obtain the right belt tension.
Check that yield "f" is 15 mm (0.6 in) for a force "P" of 147 ± 10 N (15 ± 1 kg; 33 ± 2 lb).

WARNING:
Increase spacer thickness to reduce belt tension and vice versa.

6. Install alternator with attached belt stretcher bracket and start but do not tighten lower bolt; the same bolt is used to secure outlet pipe support to steering pump.
7. Secure belt stretcher bracket to pump front support and engine cover and tighten capscrew and bolt.
8. Install alternator belt, adjust belt tension, and tighten upper bolt on belt stretcher bracket.

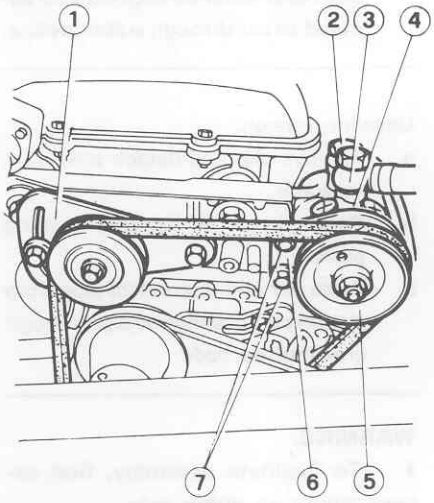
Check that yield "f" is 20 mm (0.8 in) for a force "P" of 150 N (15 kg; 33 lb) applied midway on belt leg.

9. After adjustment, raise car on a platform lift and tighten alternator lower bolt previously started.
10. Lower car and connect alternator supply and indicator leads.
11. Complete installation reversing the removal procedure then operate as instructed in Hydraulic System Filling and Bleeding.

REPLACEMENT GASOLINE VERSION (4-cylinder)

Removal

1. Disconnect battery.
2. Empty power steering fluid reservoir using a syringe.
3. Back off and disconnect fittings (2) and (3) from pump.
4. Slacken stretcher bracket (1) capscrews. Slacken and remove drive belt.
5. Back off capscrews (7) and remove pump (4) with attached drive pulley and front bracket.



1 Belt stretcher bracket
2 Delivery pipe fitting
3 Return pipe fitting
4 Steering pump
5 Steering pump drive pulley
6 Front bracket
7 Front bracket capscrews

6. If necessary, remove pulley and front bracket from pump.

Installation

Install by reversing the removal sequence and adhering to the instructions given below:

- Move stretcher bracket and adjust drive belt tension: belt tension is correct when yield is 13 mm (0.5 in) under a 147 to 294 N (15 to 30 kg; 33 to 66 lb) force applied midway on belt leg.
- Adhere to the following tightening torques.

(T) : **Tightening torques**

Fluid return pipe fitting to steering pump fitting
45 to 50 N·m
(4.6 to 5.1 kg·m)
(33.2 to 36.9 ft·lb)

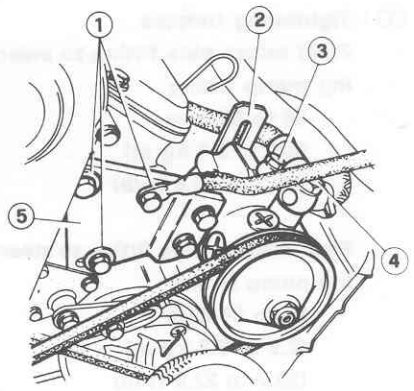
Fluid delivery pipe fitting to steering pump fitting
28 to 31 N·m
(2.9 to 3.2 kg·m)
(20.7 to 22.9 ft·lb)

- Operate as indicated in Hydraulic System Filling and Bleeding.

REPLACEMENT GASOLINE VERSION (6-cylinder)

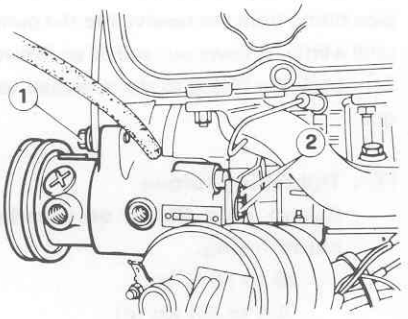
Removal

1. Disconnect battery terminals and remove battery.
2. Empty power steering fluid reservoir using a syringe.
3. Back off and disconnect fittings (3) and (4) from pump.
4. Slacken three capscrews (1) on front bracket (5) and two pump/rear bracket (2) capscrews.
5. Move pump to slacken drive belt. Take belt off drive pulleys.



1 Front bracket/engine block capscrews
2 Front bracket
3 Delivery pipe fitting
4 Return pipe fitting
5 Front bracket

6. Back off and remove two capscrews (1) and capscrews (2). Remove power steering pump.



1 Pump/front bracket capscrew
2 Pump/rear bracket capscrews

7. If necessary, remove pump drive pulley.

Installation

Install by reversing the removal sequence and adhering to the instructions given below:

- Move pump to adjust drive belt tension: belt tension is correct when yield is 13 mm (0.5 in) under a 147 to 294 N (15 to 30 kg; 33 to 66 lb) force applied midway on belt leg.
- Adhere to the following tightening torques.

Ⓣ : **Tightening torques**

Fluid return pipe fitting to steering pump fitting
45 to 50 N·m
(4.6 to 5.1 kg·m)
(33.2 to 36.9 ft·lb)

Fluid delivery pipe fitting to steering pump fitting
28 to 31 N·m
(2.9 to 3.2 kg·m)
(20.7 to 22.9 ft·lb)

- Operate as instructed in Hydraulic System Filling and Bleeing.

HYDRAULIC SYSTEM FILLING AND BLEEDING

1. To up the tank with specified oil (AGIP ATF DEXRON B 11297; IP DEXRON FLUID B 11297) to the limit.
2. On the pump fitting, loosen the return pipe fitting from the reservoir to the pump until a little oil flows out and all air is bled.
3. Lock the fitting to the specified torque.

Ⓣ : **Tightening torque**
Return pipe fitting on steering pump fitting.
45 to 50 N·m
(4.6 to 5.1 kg·m)
(33.2 to 36.9 ft·lb)

4. Start the engine and feed the tank until level settles.
5. With the engine running, carry out a few full steering locks to right and left, then top up the oil in the tank to the "Max" mark.
6. Reassemble the tank plug.

POWER STEERING LINES

REPLACEMENT

Applicable to all lines.

1. Place car on a platform lift and restrain rear wheels using suitable chocks.

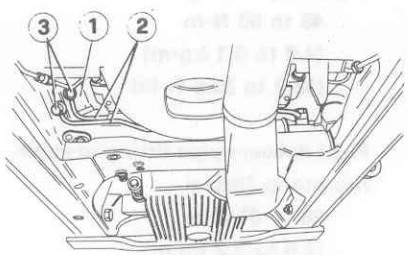
CAUTION:
If the engine is warm proceed with caution.

---

2. Back off reservoir cap, draw fluid using a syringe and replace cap.
3. Having concluded, tighten the fittings to the specified torques and refill system as instructed in Hydraulic System Filling and Bleeding.
There are different procedures for the various types of piping.

Power steering unit piping

a. Raise car and unscrew from the steering unit ① the pipe fittings ③ of the pipe ② being disconnected then remove the pipe.



1 Power steering unit
2 Pipes
3 Fittings

b. Install pipe reversing the removal sequence.

Steering unit/reservoir hose

Turbo diesel version.

a. Remove battery together with plastic tray.
b. Disconnect reservoir inlet hose by slackening clip.
c. Raise car on a platform lift, disconnect reservoir hose fitting from steering unit and remove hose.
d. Connect hose reversing the removal sequence.

Gasoline version.

Remove hose from lower fitting on steering unit and hose clip on reservoir.

Reservoir-pump and pump-steering unit connecting pipes

Turbo diesel version.

a. Remove battery together with plastic tray.
b. Remove air cleaner housing and alternator as specified in "Power Steering Pump - Removal" from para. 4 to para. 9.
c. Back off pipe fittings from steering pump.
d. If pipe to be removed connects reservoir to pump, slacken clip securing pipe to reservoir and disconnect. If pipe to be removed connects pump to steering unit, raise car and back off fitting securing pipe to steering unit; lower car.
e. Free pipe from clips and remove.

WARNING:
a. To facilitate assembly, first secure piping on pump side.
b. Piping should not be excessively bent and must be aligned and secured to car through suitable clips.

Gasoline version.

a. Remove clip and detach pipe from reservoir.
b. Back off pipe fitting from steering pump.
c. Raise car and disconnect pipe from steering unit; withdraw pipe through grommet on body.

WARNING:
1. To facilitate assembly, first secure piping on pump side.
2. Piping should not be excessively bent and must be aligned and secured to car through suitable clips.

POWER STEERING FLUID RESERVOIR

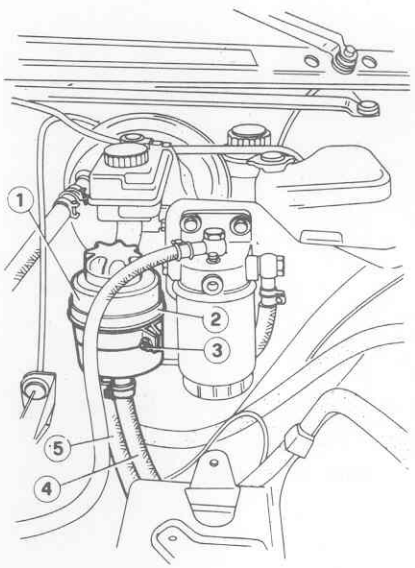
REPLACEMENT

Turbodiesel version.

1. Remove battery together with plastic tray.
2. Back off fluid reservoir cap and draw fluid using a syringe.
3. Disconnect fluid outlet/inlet piping ④ and ⑤ by slackening associated clips.

CAUTION:
Hold piping ends up to prevent oil spillage.

4. Slacken reservoir clip bolt ③ and remove reservoir ① by withdrawing it from clip ②.



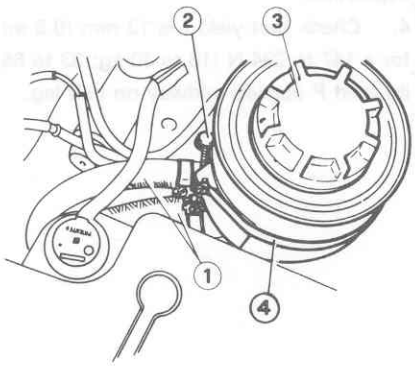
1 Power steering fluid reservoir.
2 Clip
3 Bolt
4 Reservoir outlet pipe
5 Reservoir inlet pipe

5. Install by reversing the removal sequence; fill reservoir with recommended fluid (AGIP ATF DEXRON B 11297: IP DEXRON FLUID B 11297; quantity 0.8 kg).

REPLACEMENT

Gasoline version.

1. Empty reservoir using a syringe.
2. Disconnect piping ① from reservoir ③ by slackening clip screws.
3. Slacken clip screw ② and remove reservoir by withdrawing it from clip ④.



1 Fluid outlet/inlet piping
2 Clip screw
3 Fluid reservoir
4 Reservoir retaining clip

4. Install by reversing the removal sequence and fill reservoir with recommended fluid.

STEERING PUMP DRIVE BELT

REPLACEMENT

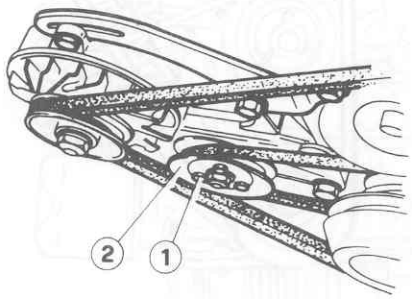
Turbo diesel version.

Steering pump drive bolt replacement necessitates alternator drive belt removal.

1. Place car on a platform lift and restrain rear wheels using suitable chocks.

CAUTION:
If the engine is warm proceed with caution.

2. Remove battery together with plastic tray.
3. Slacken bolt securing alternator to belt stretcher bracket.
4. Raise car and slacken alternator lower bolt. Lower car.
5. Move alternator to slacken belt and remove belt.
6. Back off 3 split pulley capscrews ① and remove outer pulley half ② together with tension spacers; remove belt.



1 Capscrew
2 Outer pulley half

7. To install reverse the removal sequence and adhere to the instructions given below.

- Adjust steering pump belt tension until yield is 15 mm (0.6 in) for a force P of 147 ± 10 N (15 ± 1 kg; 33 ± 2 lb) applied midway on belt leg. To adjust, alter spacers between pulleys half; increase spacer thickness to reduce belt tension and vice versa.
- Adjust alternator belt until yield f is 20 mm (0.8 in) for a force P of 147 ± 10 N (15 ± 1 kg; 33 ± 2 lb) applied midway on belt leg.

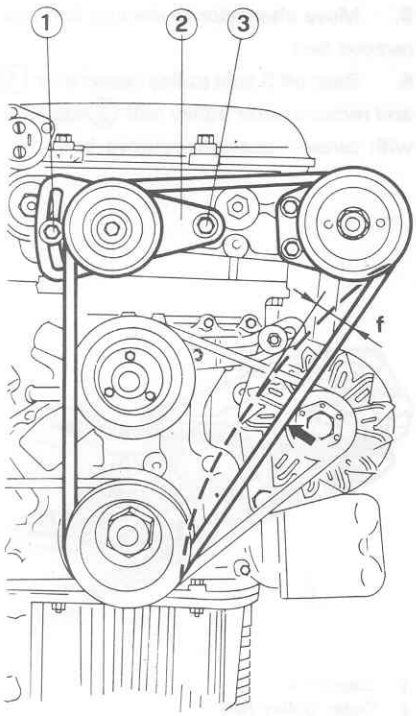
REPLACEMENT

Gasoline version - 4-cylinder.

1. Slacken capscrews ① and ③, push belt stretcher bracket ② downward and take off belt.
2. Install new belt over the three drive pulleys and move stretcher bracket to obtain the specified tension.

Belt tension is correct when yield is 13 mm (0.5 in) for a force P of 147 to 294 N (15 to 30 kg; 33 to 66 lb) applied midway on belt leg.

3. Fully tighten capscrew ①, recheck belt tension and tighten capscrew ③.

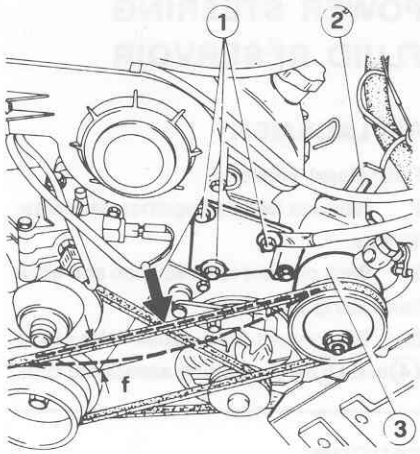


1 Capscrew
2 Stretcher bracket
3 Capscrew

REPLACEMENT

Gasoline version - 6-cylinder.

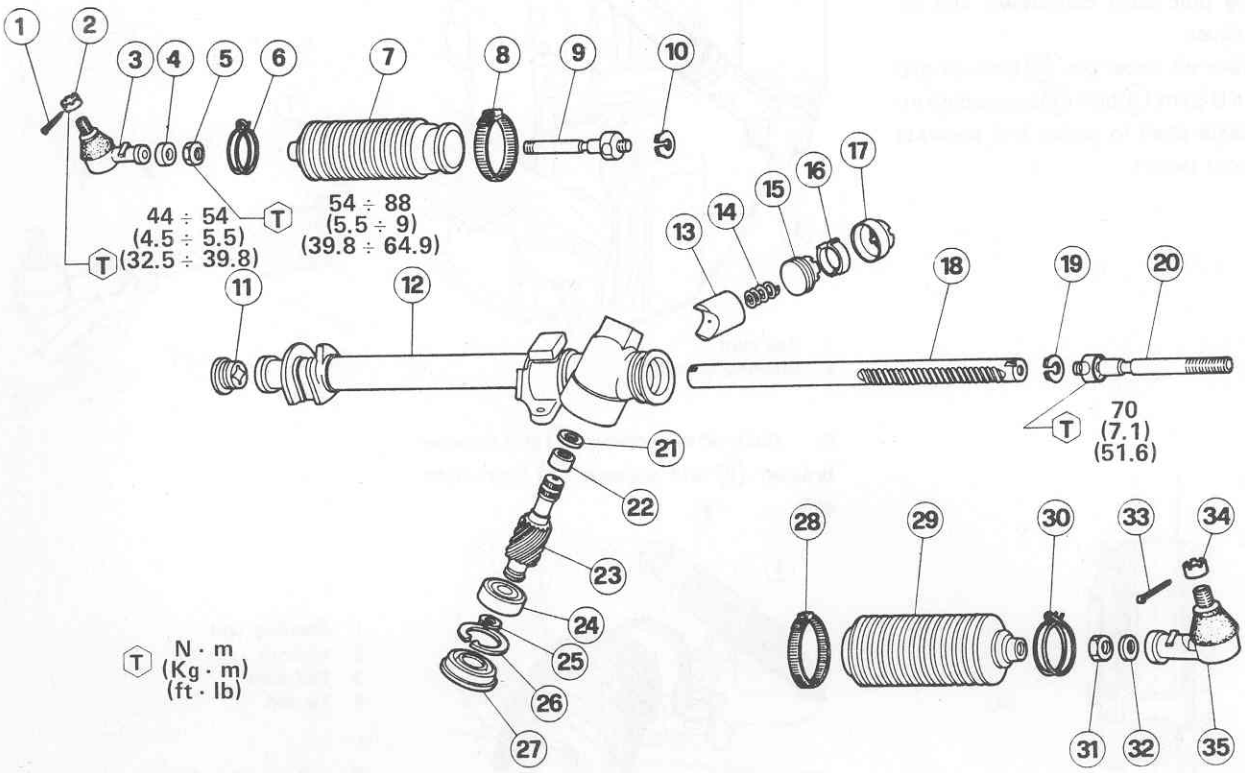
1. Slacken three capscrews (1) retaining front bracket to engine and two capscrews retaining pump (3) to rear bracket.
2. Move pump (3) to loosen belt; remove belt.
3. Install belt and move pump to adjust belt tension. Tighten front/rear bracket capscrews.
4. Check that yield f is 13 mm (0.5 in) for a 147 to 294 N (15 to 30 kg; 33 to 66 lb) load P applied midway on belt leg.



1 Front bracket to engine block capscrews
2 Rear bracket
3 Steering pump
4 Front bracket

MECHANICAL STEERING

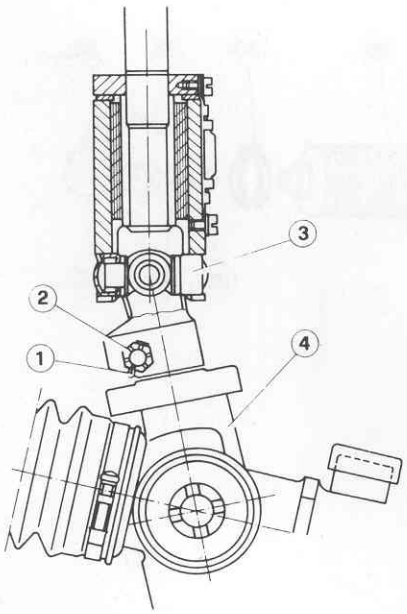
MECHANICAL STEERING UNIT



1 Cotter pin
2 Nut
3 Ball joint
4 Washer
5 Locknut
6 Outer clip
7 Bellows
8 Inner clip
9 Tie rod
10 Retainer
11 Rack bushing
12 Rack housing
13 Piston
14 Spring
15 Adjusting screw
16 Spring
17 Cover
18 Rack
19 Retainer
20 Tie rod
21 Seal
22 Pinion bushing
23 Pinion
24 Bearing
25 Bearing retaining ring
26 Pinion retaining ring
27 Lower cover
28 Inner clip
29 Bellows
30 Outer clip
31 Locknut
32 Washer
33 Cotter pin
34 Nut
35 Ball joint

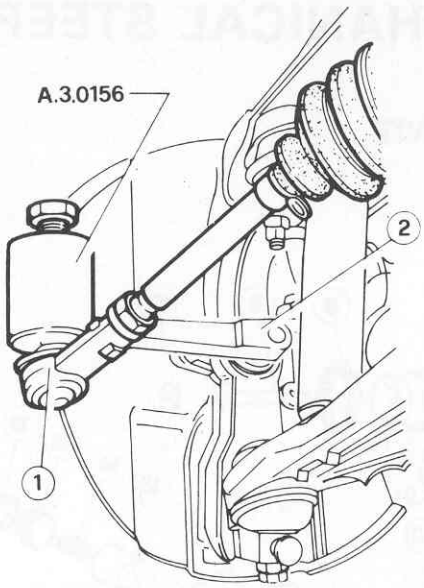
REMOVAL

1. Place car on a platform lift, apply parking brake and slacken front wheel nuts.
2. From engine compartment, back off steering unit cover capscrews, and remove cover.
3. Take off cotter pin (1) back off and remove U-joint (3) bolt (2) connecting intermediate shaft to pinion and separate joint from pinion.



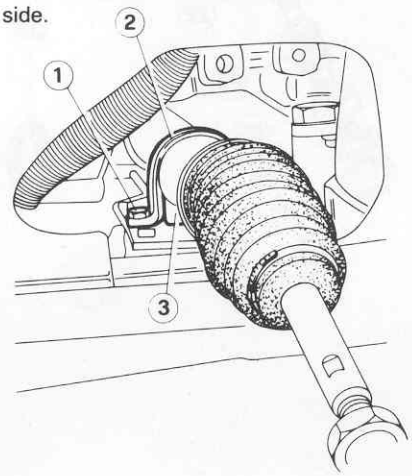
1 Cotter pin
2 U-joint/steering unit bolt
3 U-joint
4 Steering unit

4. Remove cotter pin, back off nuts and remove ball joint pins (1) from steering knuckles (2) using tool **A.3.0156**.



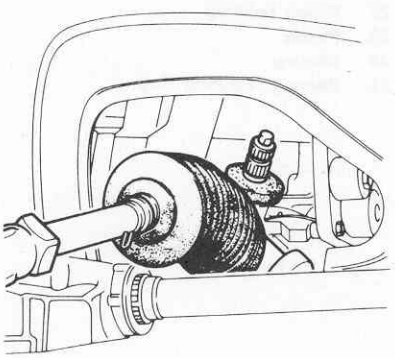
1 Ball joint
2 Steering knuckle

5. Back off capscrews (1) and remove bracket (2) and support (3) from right side.



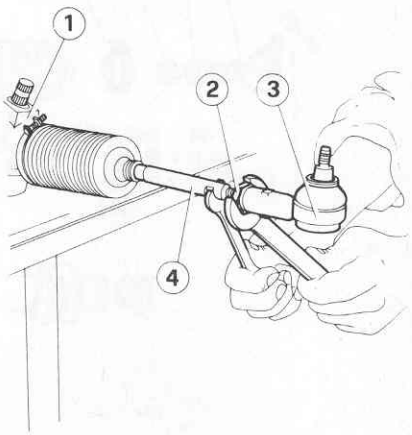
1 Bracket/crossmember capscrew
2 Bracket
3 Support

6. Back off steering unit/crossmember capscrews from left side.
7. Take off steering unit from opening in left side panel.



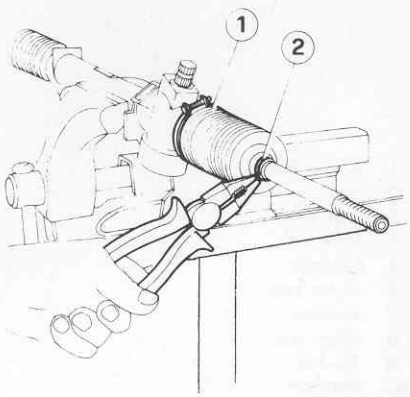
DISASSEMBLY

1. Clamp steering unit (1) in a vice and slacken two ball joint (3) locknuts (2) reacting on tie rods (4) applying a wrench to flats on tie rods.



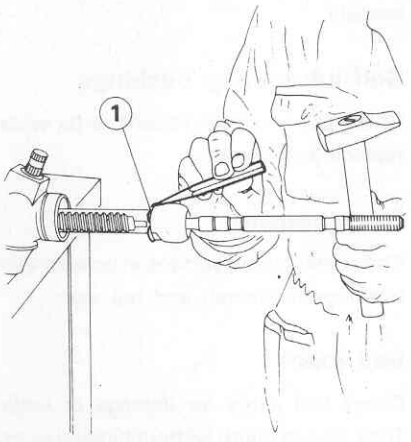
1 Steering unit
2 Locknut
3 Ball joint
4 Tie rod

2. Back off ball joints and remove bellows clips (1) and (2).



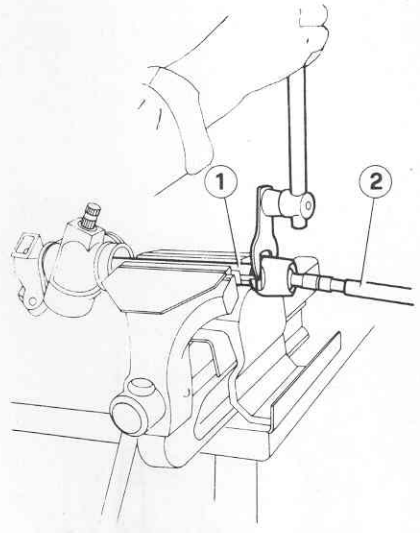
1 Inner clip
2 Outer clip

3. Take off bellows and straighten retainers (1).



1 Retainer

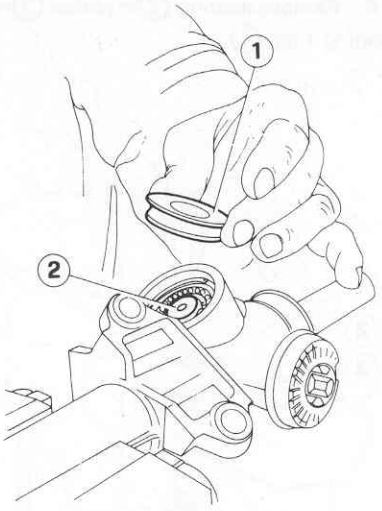
4. Take off rack (1) from teeth side, clamp in a vice provided with protective liners, back off and remove two tie rods (2).



1 Rack
2 Tie rod

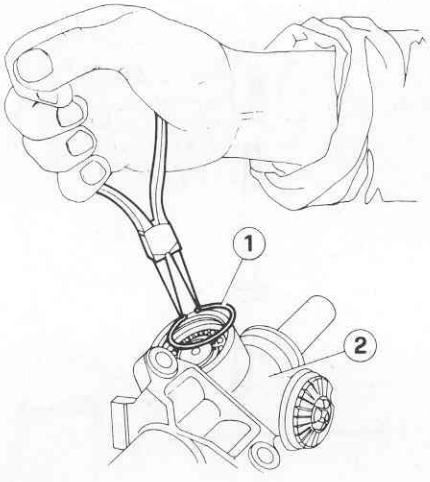
5. Remove rubber support from rack housing.

6. Remove pinion lower cover (1) protecting pinion (2).



1 Lower cover
2 Pinion

7. Remove pinion bearing to rack housing (2) retaining ring (1).

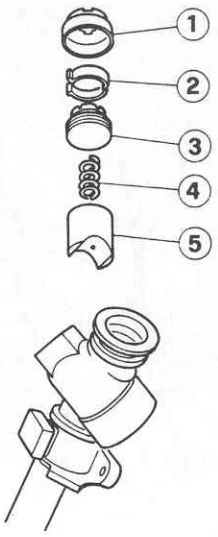


1 Retaining ring
2 Rack housing

8. Remove adjusting screw cover (1) from rack housing.

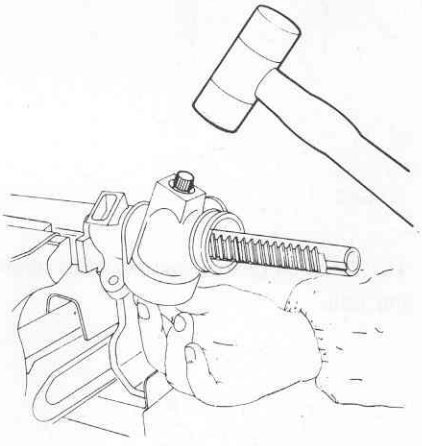
9. Remove clicking spring (2) from adjusting screw.

10. Back off adjusting screw (3), take off spring (4) and backlash take-up piston (5) controlling clearance between rack housing and rack.



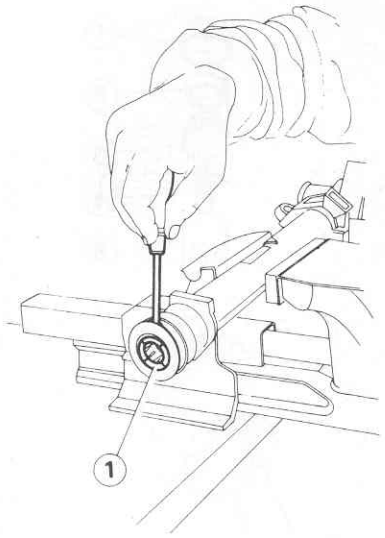
1 Cover
2 Spring
3 Adjusting screw
4 Spring
5 Piston

11. Using a plastic mallet, remove pinion with attached bearing from rack housing.



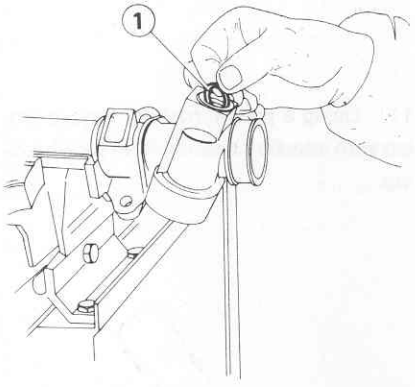
12. Remove rack.

13. Remove rack bushing (1) on side opposite to steering pinion.



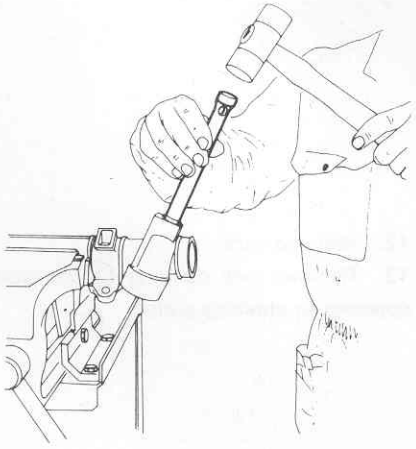
1 Rack bushing

14. Remove seal (1) from steering unit.

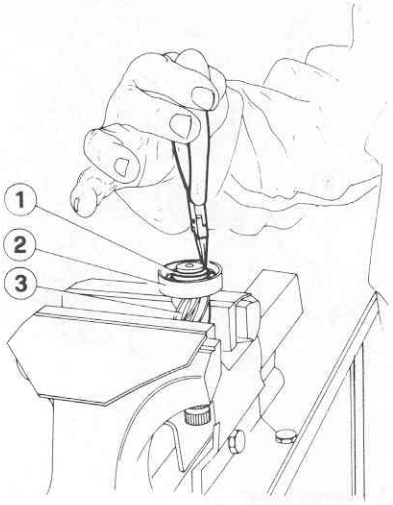


1 Seal

15. Take off pinion bushing from steering unit.

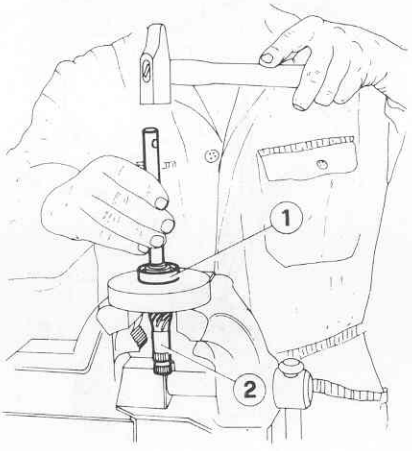


16. Remove bearing (2) to pinion (3) retaining ring (1).



1 Retaining ring
2 Bearing
3 Pinion

17. Disassemble bearing (1) from pinion (2).



1 Bearing
2 Pinion

INSPECTION

Clean all parts.

Bellows

Check bellows for cracks or score marks and replace as necessary.

Rack

Check rack and pinion teeth for oxidation, score marks or dents and replace as necessary.

Self-lubricating bushings

Check self-lubricating bushings for wear; replace as necessary.

Rack housing

Check that pinion surface in contact with bushings is smooth and not worn.

Ball joints

Check ball joints for damage or wear. They should rotate without binding or excessive play; replace as necessary.

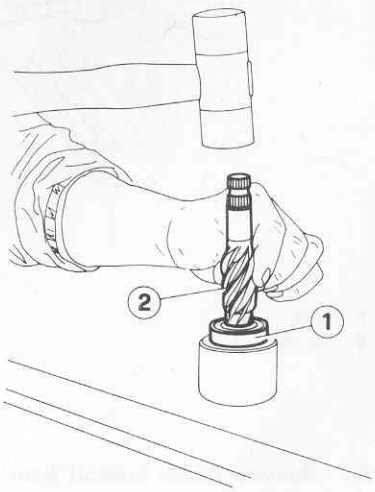
Tie rods

Check tie rods for damage or distortion; replace as necessary.

ASSEMBLY

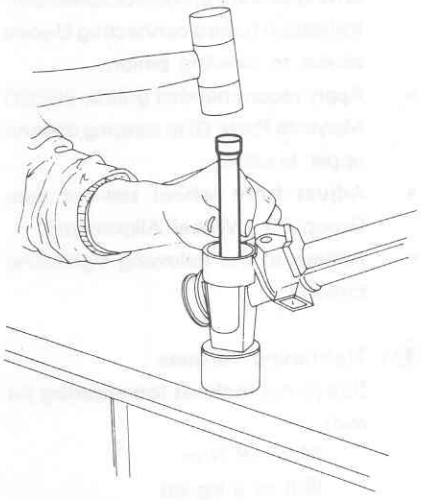
Assemble by reversing the removal sequence and adhering to the instructions given below.

1. Install bearing (1) on pinion (2).

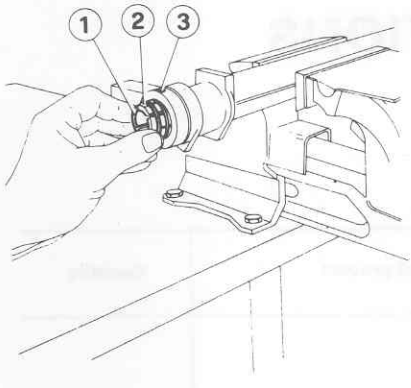


1 Bearing
2 Pinion

2. Insert bearing retaining ring on pinion and check that it is properly seated.
3. Install self-lubricating bushing in steering unit.

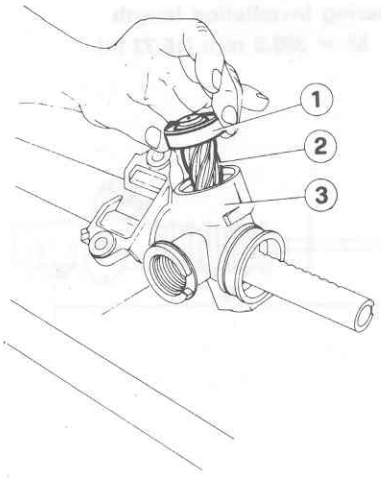


4. Insert a new seal in steering unit.
5. Pack steering unit recess with 90 g of grease (AGIP Grease 33 FD or IP Autogrease FD) and lubricate pinion bushing.
6. Insert bushing (1) in rack housing ensuring that the two projections (2) engage the associated seats (3).



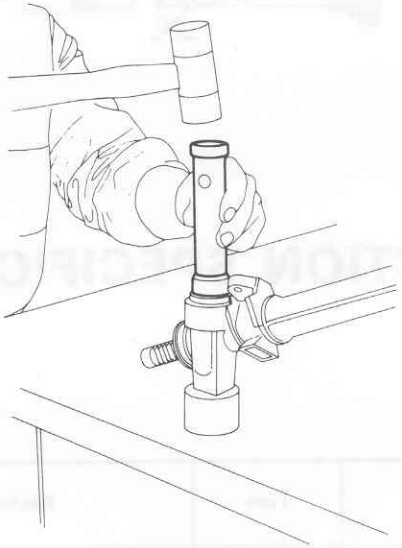
1 Rack bushing
2 Projection
3 Seat

7. Lubricate rack using grease as per para. 5 and insert in rack housing.
8. Insert pinion (2) with attached bearing (1) in rack housing (3).

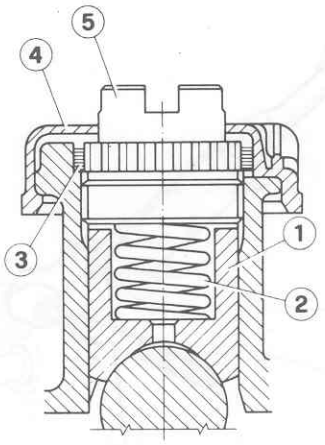


1 Bearing
2 Pinion
3 Rack housing

9. Install pinion as shown in figure.



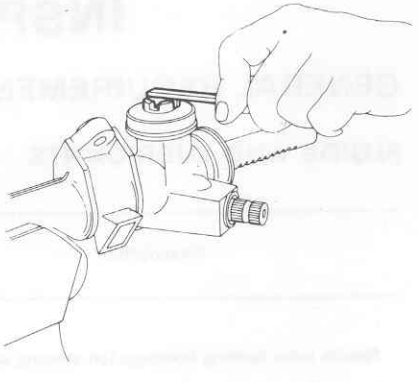
10. Insert pinion retaining ring ensuring that it is properly seated.
11. Install pinion lower cover.
12. Lubricate backlash take-up piston and adjusting screw using grease as per para. 5.
13. Insert backlash take-up piston (1), spring (2) and adjusting screw (5). Insert spring (3) and cover (4).



1 Piston
2 Spring
3 Spring
4 Cover
5 Adjusting screw

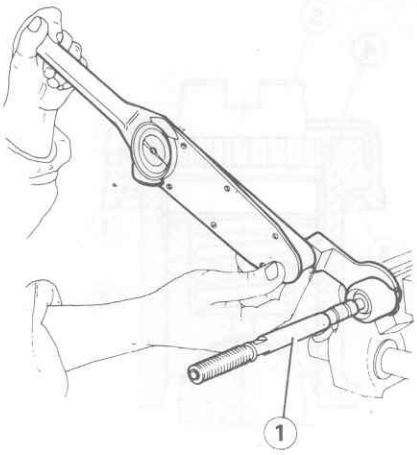
14. Tighten adjusting screw to 3 N·m (0.3 kg·m) (2.2 ft.lb). Back off screw through 3 notches (equal to 3 clicks on spring). Check rack travel for binding.

WARNING:
After a brief trial, check adjustment.



15. Install retainers and tie rods (1) and tighten to the specified torque.

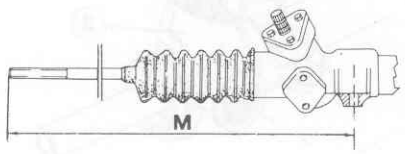
(T) : **Tightening torque**
Tie rod on rack.
70 N·m
(7.1 kg·m)
(51.6 ft·lb)



1 Tie rod

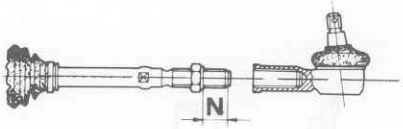
16. Bend two retainers.
17. Pack outer recess between housing and rack with grease as per para. 5; install two bellows and secure through clips.
18. Prepare steering for installation positioning rack at the specified dimension.

Steering installation length
M = 399.5 mm (15.73 in)



19. Install two ball joints on tie rods and tighten nuts at the specified dimension.

Tie rod ball joint installation dimension
N = 26 mm (1.02 in)



INSTALLATION

Install by reversing the removal sequence and adhering to the instructions given below.

- Position wheels in straight-ahead driving posture and check spoke centralization before connecting U-joint sleeve to steering pinion.
- Apply recommended grease (ISECO Molykote Pasta G) to steering column upper bracket.
- Adjust front wheel toe-out (see Group 00 - Wheel Alignment).
- Adhere to the following tightening torques.

Ⓣ : **Tightening torques**

Ball joints locknut (on steering tie rod)
54 to 88 N·m
(5.5 to 9 kg·m)
(39.8 to 64.9 ft·lb)

Tie rod ball joint locknut (on steering knuckle)
45 to 55 N·m
(4.5 to 5.5 kg·m)
(33.2 to 40.6 ft·lb)

Steering unit to crossmember capscrews
27 to 30 N·m
(2.7 to 3 kg·m)
(19.9 to 22.1 ft·lb)

INSPECTION SPECIFICATIONS

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Description	Type	Recommended product	Quantity
Needle roller bushing housings (on steering column support)	GREASE	SPCA: Spagraph ISECO: Ergon Rubber Grease n. 3 REINACH Sferul B2 AR Part. no. 3671-69816	
Steering unit inner chamber Rack Outer recess between housing and rack Pinion bushing Backlash take-up piston Backlash adjusting screws Steering column support lower bearing Alfa 90 and Alfa 75	GREASE	AGIP: Grease 33 FD IP: Autogrease FD Part. no. 3671-69833	90 g 3.17 oz.

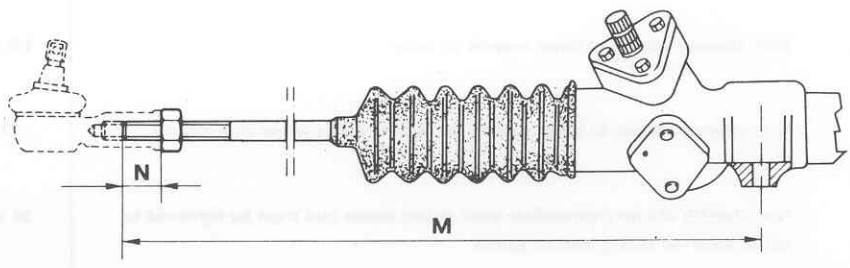
Description	Type	Recommended product	Quantity
Mating surfaces of steering wheel adjustment guides on column. Steering column and sliding sleeve spline.	GREASE	ISECO: Molykote Pasta G Part. no. 3671-69840	
ZF steering rack	OIL	Calypsol Part. no. 3671-69838	
Power steering fluid	OIL	AGIP: ATF DEXRON B 11297 IP: DEXRON FLUID B 11297 Part. no. 3631-69525	0.8 kg 1.76 lb

CHECKS AND ADJUSTMENTS

MECHANICAL STEERING

Steering installation dimension
M = 399.5 mm (15.73 in)

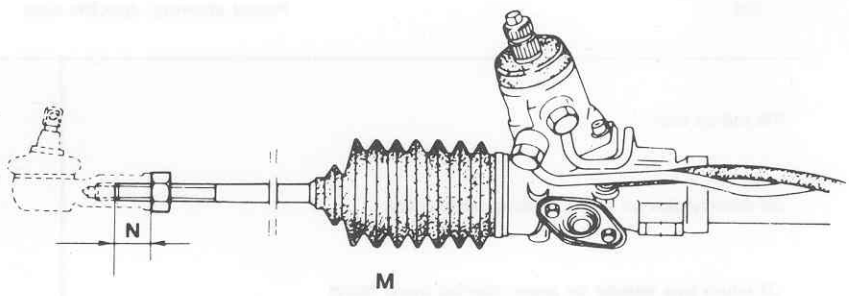
Tie rod ball joint installation dimension
N = 26 mm (1.02 in)



POWER STEERING

Steering installation dimension
LHD M = 399.5 mm (15.73 in)
RHD M = 394 mm (15.51 in)

Tie rod ball joint installation dimension
N = 26 mm (1.02 in)



HYDRAULIC POWER STEERING SYSTEM FILLING

1. Before starting engine, fill the tank with recommended oil to the limit.
2. On the pump, loosen the feeding pipe fitting (this pipe leads the oil from the reservoir to the pump) until a little oil flows out and all air is bled.
3. Lock the fitting to the specified torque.
4. Start the engine and feed the tank until level settles.
5. With the engine running, carry out a few full steering locks to right and left, then top up the oil in the tank to the "Max" mark.
6. Reassemble the tank plug.

TIGHTENING TORQUES [N·m (kg·m; ft·lb)]

Description	Alfa 90 Alfa 75	Alfetta Giulietta GTV 2.0 GTV 6 2.5
Tie rod on rack	70 (7,1) (51.6)	70 (7,1) (51.6)
Capscrews, steering unit to crossmember	26 to 29 (2.7 to 3) (19.2 to 21.4)	26 to 29 (2.7 to 3) (19.2 to 21.4)
Locknut, ball joint on tie rod	54 to 88 (5.5 to 9) (39.8 to 64.9)	54 to 88 (5.5 to 9) (39.8 to 64.9)
Nut, tie rod ball joint	44 to 54 (4.5 to 5.5) (32.5 to 39.8)	44 to 54 (4.5 to 5.5) (32.5 to 39.8)
Bolt, intermediate shaft/pinion shaft U-joint (Tighten further to permit cotter pin insertion)	15 (1.5) (11.1)	15 (1.5) (11.1)
Bolts, intermediate shaft/steering column U-joint		15 to 24 (1.5 to 2.4) (11.1 to 17.7)
Bolt, steering column to lower support on body	4.9 to 7.35 (0.5 to 0.75) (3.6 to 5.4)	13 to 16 (1.3 to 1.6) (9.6 to 11.8)
Nut, steering column to upper support on body (steering wheel lever locked)	21 to 26 (2.1 to 2.6) (15.5 to 19.2)	21 to 26 (2.1 to 2.6) (15.5 to 19.2)
Nut, steering column intermediate shaft sliding sleeve (nut must be tightened to obtain specified sliding load on spline)	34 to 44 (3.5 to 4.6) [1] (7.6 to 9.9)	
Nut, steering wheel on steering column	28 to 32 (2.9 to 3.3) (20.6 to 23.6)	30 to 35 (3.1 to 3.6) (22.1 to 25.8)

(1) [N (kg)]
(lb)

Power steering, specific data

Tie rod on rack	63 to 77 (6.4 to 7.8) (46.5 to 56.8)
Oil delivery pipe on power steering pump fitting	28 to 31 (2.9 to 3.2) (20.7 to 22.9)
Oil return pipe adapter on power steering pump fitting	45 to 50 (4.6 to 5.1) (33.2 to 36.9)
Oil delivery pipe adapter on control valve fitting	22 to 24 (2.2 to 2.4) (16.2 to 17.7)
Oil return pipe adapter on control valve fitting	38 to 43 (3.9 to 4.4) (28 to 31.7)
Oil pipe fittings on steering unit	20 (2) (14.8)

TROUBLESHOOTING

POWER STEERING

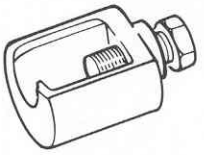
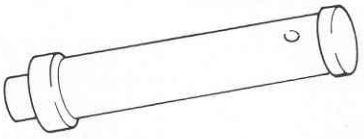
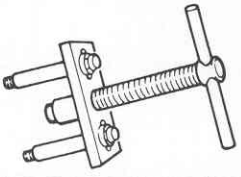
Preliminary operations:
— Check tyre for pressure and wear
— Check vehicle trim and wheel alignment
— Place car on level and dry floor and run engine at idle speed.

Fault	Cause	Remedy
Low fluid level in reservoir	• Normal air expulsion during operation	Top up reservoir
	• Defective control valve seal	Replace steering unit
	• Leakage through steering unit and pump fittings	Tighten fittings to the speficied torque; replace fittings seals if necessary
Fluid level drops after topping up (even in the absence of visible leakage)	Defective steering unit seals and fluid leakage into bellows	Replace steering unit
Hard steering	• Low rpm at idle	Adjust engine rpm
	• Steering unit leakage	Replace steering unit
	• Low pump delivery pressure	
	• Loose pump drive belt	Adjust belt tension
	• Failed pump	Replace pump
Hard steering persists after pump replacement	Defective steering unit	Install pump previously removed and replace steering unit
Noisy power steering system	• Insufficient fluid	Top up and rotate steering wheel in both directions from lock to lock to bleed system
	• Air in system	
	• Loose fittings on intake side	Tighten fittings to the specified torque
	NOTE Foam in reservoir	
	• Worn pump shaft seal	Replace pump
	• Fluid reservoir filter clogged	Replace reservoir
	• Loose power steering screws	Tighten to the specified torque
	• Damaged or worn tie rods and/or ball joints	Replace tie rods and/or ball joints
Damaged bellows	External agents and/or rubber aging	Replace bellows

MECHANICAL STEERING

Fault	Cause	Remedy
Noisy intermediate shaft	• Excessive U-joint play	Replace intermediate shaft
	• Excessive column-intermediate shaft spline backlash	Replace defective parts
Excessive column-intermediate shaft spline sliding	• Excessive wear	Replace defective parts
	• Insufficient adjusting nut tightening	Correctly tighten nut
Noisy steering column	• Worn and/or damaged column bearing	Replace defective parts
	• Column fouling cowl	Install cowl correctly
	• Loose bolts securing column to upper and lower supports	Tighten correctly
Difficult axial and radial steering wheel adjustment	• Column-shaft sliding sleeve nut excessively tight	Tighten correctly
	• Insufficient lower column support guide clearance	Replace lower bolt spacer
	• Excessively tight column/upper support nut	Tighten correctly
	• Insufficient lubrication on sliding surfaces of column supports and column/shaft spline	Lubricate
Excessive steering wheel play	• Loose steering unit capscrews	Tighten screws
	• Damaged tie rods or U-joints	Replace defective parts
Noisy steering	• Loose steering unit capscrews	Tighten screws
	• Worn steering linkage	Replace defective parts
	• Excessive pinion/rack backlash	Adjust backlash
Hard steering	• Incorrect suspension geometry	Adjust
	• Worn or under-inflated tyres	Check and replace or adjust
	• Insufficient pinion/rack backlash	Adjust backlash
	• Insufficient lubrication	Lubricate
	• Damaged U-joints	Replace U-joints
	• Steering column foluing turn signal switch unit	Check for correct turn signal switch unit installation

SPECIAL TOOLS

Part No.	Description	Page
A.3.0156	Puller steering lever ball joint 	23-14 23-24
A.3.0346	Installer, column and steering unit bushings 	23-10
A.3.0451	Puller, steering wheel 	23-3

GROUP 25

CONTENTS

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- Installation 25-4
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- De Dion axle antivibration bushing 25-7
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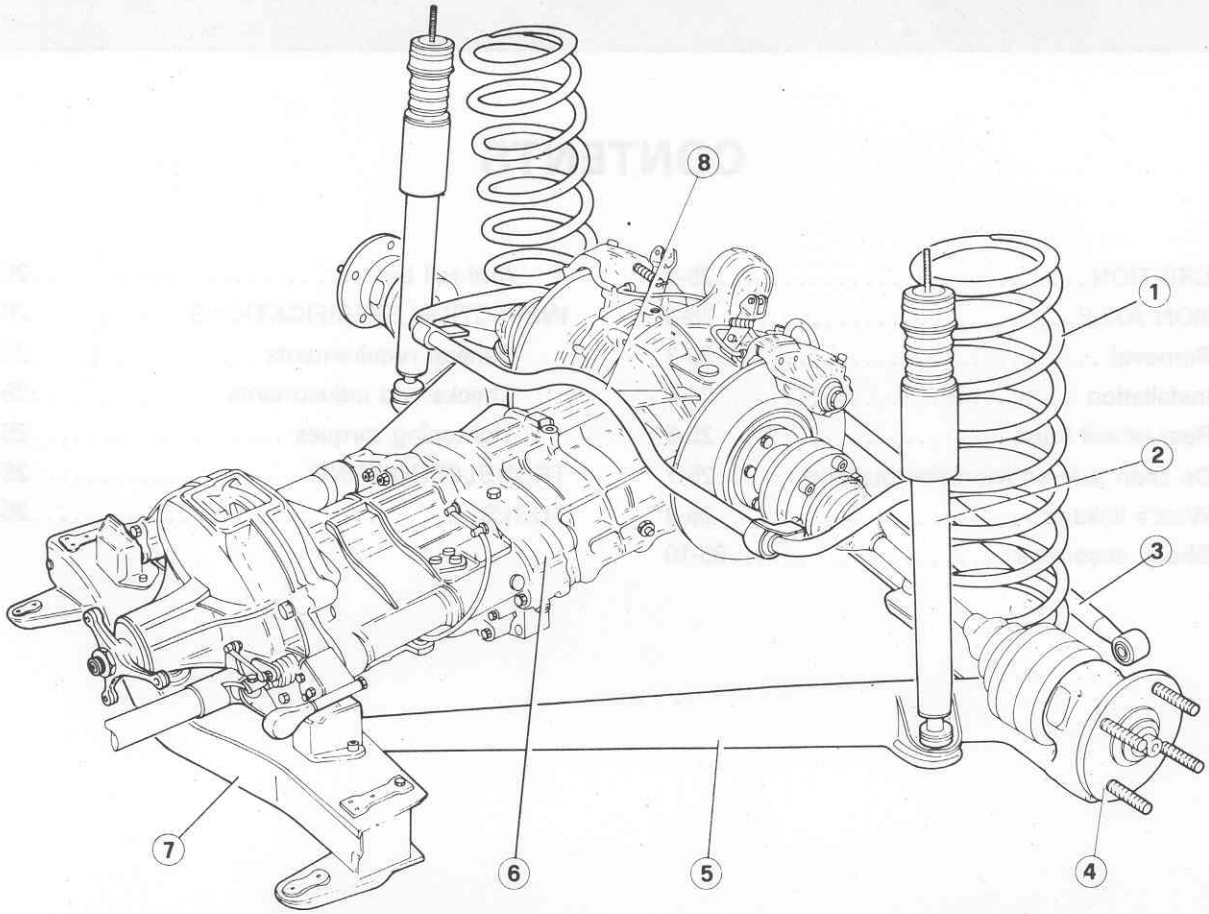
DESCRIPTION



1 Coil spring
2 Shock absorber
3 Transverse link
4 Wheel hub
5 De Dion axle
6 Power train
7 Cross member
8 Anti-roll bar

Rear suspension features a De Dion type axle.

This design, which combines the advantages of rigid axles and those of independent axles, permits a reduction in unsprung mass; it also improves rear wheel geometry ensuring that the wheels remain perpendicular and provide full adhesion around corners and on rough surfaces at all times.

Triangular De Dion tubular structure is connected at front to a cross member, bolted to body through antivibration bushing. Thrust generated by driving wheels is transmitted to body through this point.

At rear, axle is anchored by a Watt's linkage hinged to axle through a rocker connected to body by means of two transverse links.

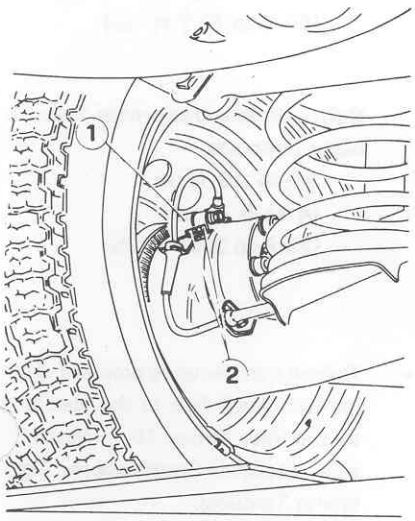
Watt's linkage transverse links react in push or pull fashion with forces equal to those transmitted by wheels to axle, to prevent lateral body movement.

Rear suspension also includes coil springs, hydraulic telescopic shock absorbers and anti-roll bar.

DE DION AXLE

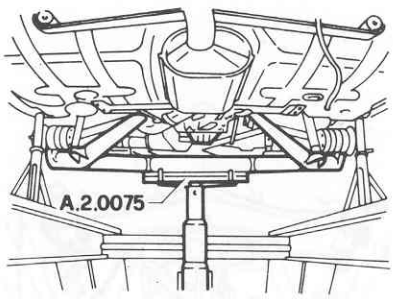
REMOVAL

1. Place car on a lift, lock front wheels using suitable chocks and slacken rear wheel nuts.
2. Vehicles equipped with (ABS) MARK II wheel antilock system only.
a. Free the rear impulse pick-up cables from the De Dion axle.
b. Back off nuts (2) and remove the impulse pick-ups (1), complete with supports, from the wheel hubs without disconnecting them electrically.
c. Put the impulse pick-ups in a safe place, taking great care to avoid damage to them, where they do not hinder operations.



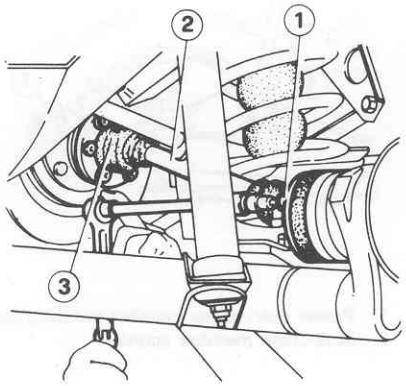
1 Rear impulse pick-up
2 Nuts securing impulse pick-up support to wheel hub

3. Install tool **A.2.0075** on hydraulic lift, raise rear axle by 40 cm min. and apply support stands; remove rear wheels.



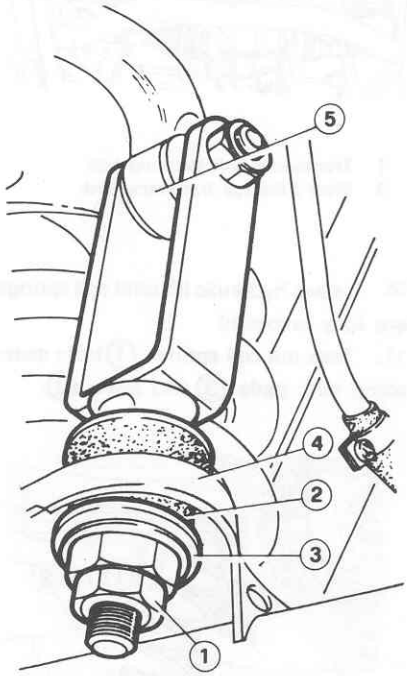
4. Remove exhaust line as directed in "Group 04 - Exhaust System - Removal".
5. Remove transmission remote control rod and isostatic control as directed in "Group 13 - External controls - Complete control - Removal".
6. Back off screws (1), retrieve associated washers and lock plates and remove axle shafts (2).

CAUTION:
Take care not to damage joint bellows (3) during removal operation.



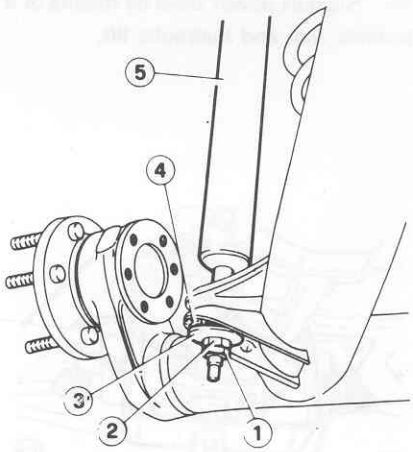
1 Axle shaft screw
2 Axle shaft
3 Joint bellows

7. Back off lock nuts (1) and associated nuts, retrieve rubber cushions (2) and cups (3); disconnect anti-roll bar (5) from De Dion axle (4).



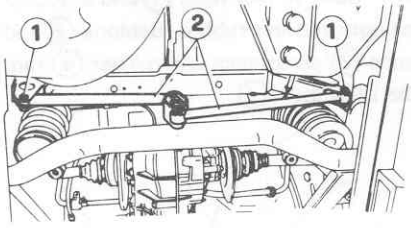
1 Lock nut
2 Rubber cushion
3 Cup
4 De Dion axle
5 Anti-roll bar

8. Back off lock nuts (1) and nuts (2), retrieve rubber cushions (4) and cups (3) and remove shock absorber (5).



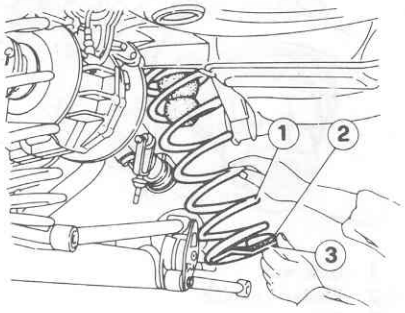
1 Lock nut
2 Shock absorber - axle retaining nut
3 Cup
4 Rubber cushion
5 Shock absorber

9. Back off and retrieve bolts (1); disconnect Watt's linkage transverse links (2).



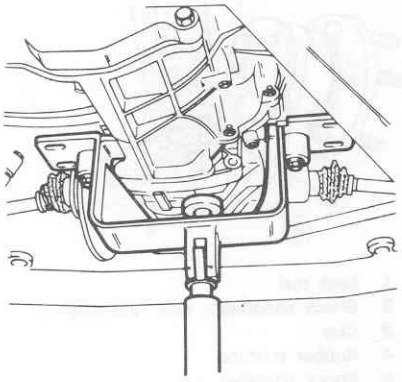
1 Transverse link securing bolt
2 Watt's linkage transverse link

10. Lower hydraulic lift until coil springs are fully unloaded.
11. Take out coil springs (1) from seats along with pads (3) and seals (2).

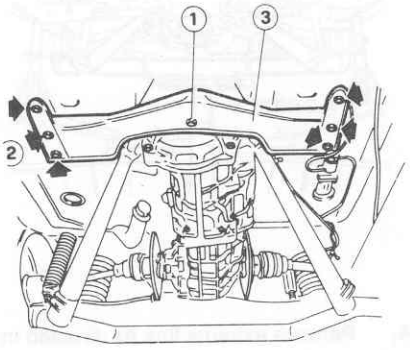


1 Coil spring
2 Seals
3 Pads

12. Disconnect speedometer and back-up light switch cables.
13. Support power train by means of a suitable tool and hydraulic lift.

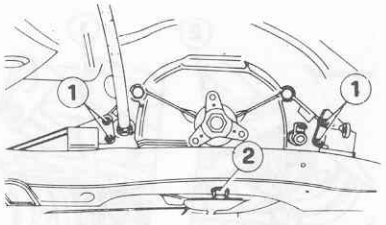


14. Back off and remove bolts securing propeller shaft joint to clutch fork.
15. Slacken screw (1) and back off screws (2).



1 Axle-cross member screw
2 Cross member-body screws
3 Cross member

16. Lower power train, back off and remove bolts (1).
17. Back off and remove screw (2) and take off cross member.
18. Install cross member to support power train, remove supporting tool and axle with Watt's linkage.



1 Power train/cross member securing bolts
2 Axle-cross member screw

INSTALLATION

Install by reversing the removal sequence and following the instructions given below.

- Before tightening propeller shaft joint to clutch fork, lubricate centralization seat using the recommended grease (ISECO Molykote BR 2 - see Group 15 - Transmission - Inspection Specifications - Fluids and Lubricants).
- Lubricate axle shaft screws using the grease specified above.
- Lubricate shock absorber pins and bolts securing Watt's linkage transverse links to body using antiseize lubricant (R. GORI Never Seez.).
- Adhere to the following tightening torque requirements:

(T): **Tightening torques**
Screw, transmission crossmember to body
39 to 44 N·m
(4 to 4.5 kg·m)
(28.8 to 32.5 ft·lb)

Screw, axle to transmission
88 to 108 N·m
(9 to 11 kg·m)
(64.9 to 79.7 ft·lb)

Bolts, Watt's transverse links to body supports
39 to 49 N·m
(4 to 5 kg·m)
(28.8 to 36.1 ft·lb)

- Tighten nuts securing propeller shaft joint to clutch fork to the specified torque, (see Group 15 - Transmission - Inspection Specifications - Tightening Torques).
- Tighten axle shaft/wheel shaft retaining screws to the specified torque (see Group 17 - Axle Shafts - Inspection Specifications - Tightening Torques).
- Vehicles equipped with (ABS) MARK II wheel antilock system only.

a. Install the impulse pick-ups in reverse order of removal, observing the following tightening torque.

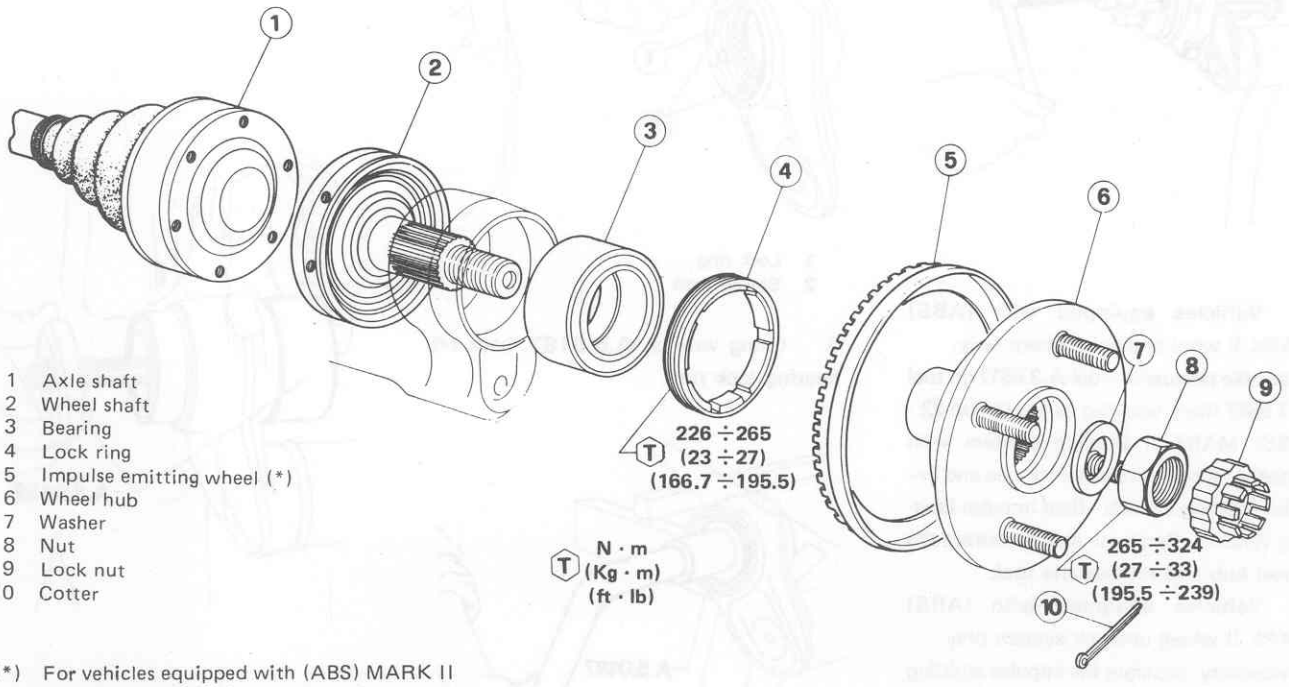
(T): **Tightening torque**
Nuts securing impulse pick-up supports - wheel hubs
9 thru 10 N·m
(0.9 thru 1 kg·m)
(6.6 thru 7.4 ft·lb)

b. Ensure that the impulse pick-up cables are well secured to their anchor points and properly fixed to the suspension unit to prevent damage when the vehicle is running.

c. Check the air gap between the impulse pick-ups and impulse emitting wheel (see: Group 22 - Inspection Specifications - Checks and Adjustments - Adjustment of the Air Gap between the Impulse Pick-ups and Impulse Emitting Wheels).

- Check car trim and rear wheel geometrie (see: Group 00 - Car Model Specific Manual - Car Trim Check).

REAR WHEEL HUBS

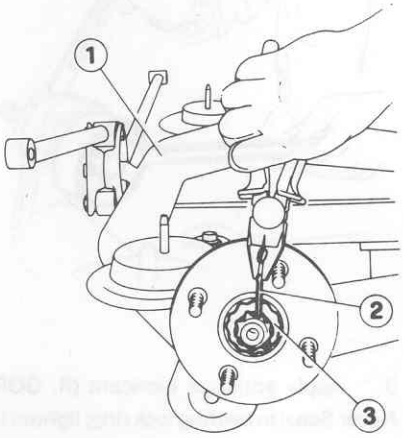


1 Axle shaft
2 Wheel shaft
3 Bearing
4 Lock ring
5 Impulse emitting wheel (*)
6 Wheel hub
7 Washer
8 Nut
9 Lock nut
10 Cotter

(*) For vehicles equipped with (ABS) MARK II wheel antilock braking system only

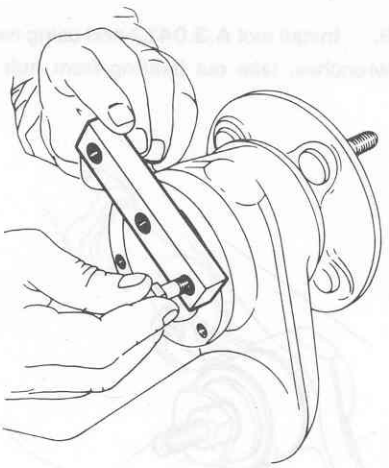
DISASSEMBLY

1. Place De Dion axle (1) on a suitable bench. Remove cotter (2) from wheel shaft and take off lock nut (3).

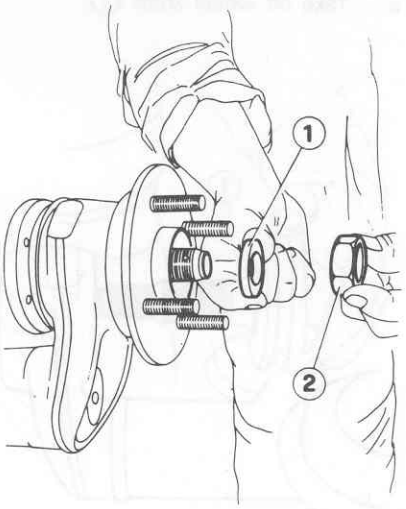


1 De Dion axle
2 Cotter
3 Lock nut

2. Install a retainer tool to prevent wheel shaft rotation.



3. Back off nut (2) retaining hub to wheel shaft and take off associated washer (1).

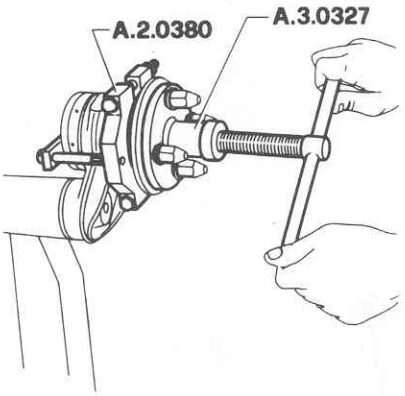


1 Washer
2 Nut

4. Wheel hub extraction.

a. Vehicles not equipped with (ABS) MARK II wheel antilock system.

Install tools **A.2.0380** and **A.3.0327**, remove wheel hub and remove tools.



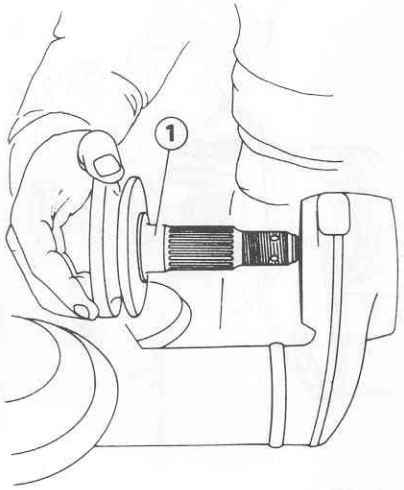
b. Vehicles equipped with (ABS) MARK II whel antilock system only.

Assemble percussion tool **A.3.0617** on tool **A.3.0327** then, working as per Group 22 - (ABS) MARK II Braking System with Wheel Antilock - Impulse Pick-ups and Impulse Emitting Wheels - Rear Impulse Emitting Wheels - Removal- step 5, extract the wheel hub and retrieve the tool.

5. Vehicles equipped with (ABS) MARK II wheel antilock system only.

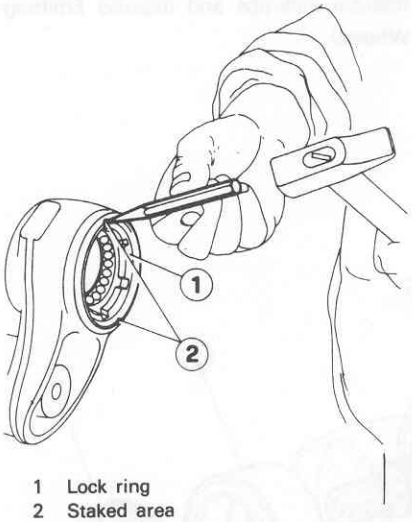
If necessary, separate the impulse emitting wheel from the wheel hub by operating as described in Group 22 - (ABS) MARK II Braking System with Wheel Antilock - Impulse Pick-ups and Impulse Emitting Wheels - Rear Impulse Emitting Wheels - Removal - step 6.

6. Take off wheel shaft ①.



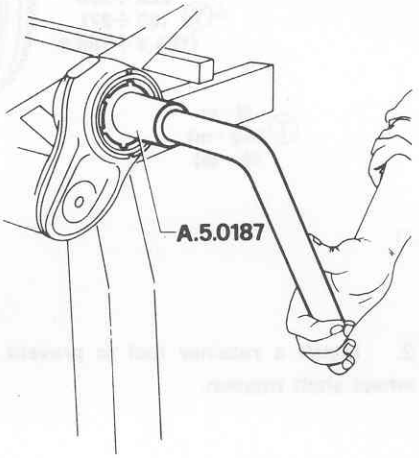
1 Wheel shaft

7. Using a punch, release two staked areas ② on bearing lock ring ①.

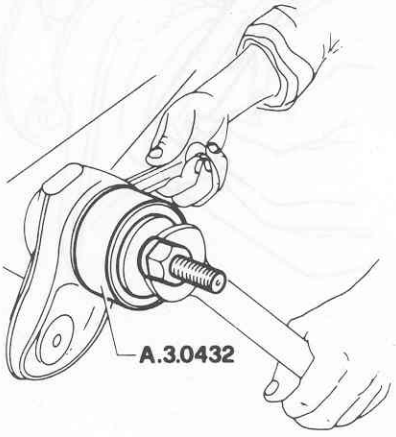


1 Lock ring
2 Staked area

8. Using wrench **A.5.0187**, back off bearing lock ring.



9. Install tool **A.3.0432** and using two wrenches, take out bearing from hub.



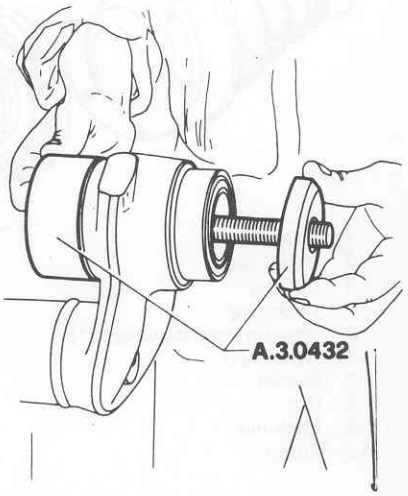
INSPECTION

Clean all parts.

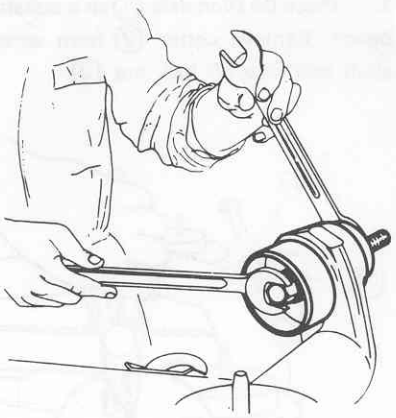
1. Check axle seat, wheel shaft and hub for damage or distortion; replace as necessary.
2. Replace hub bearing.

ASSEMBLY

1. Install tool **A.3.0432** and install hub bearing after thorough cleaning and lubrication.

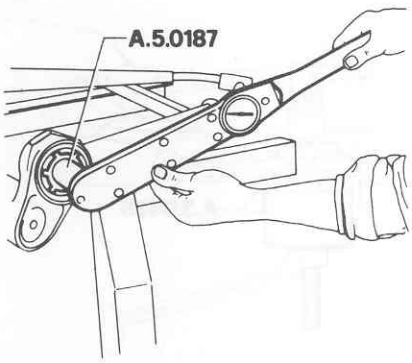


2. Using two wrenches, insert bearing fully home and remove tools.



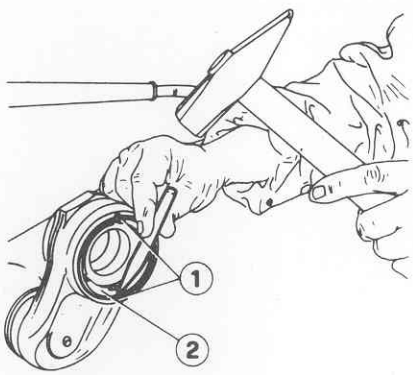
3. Apply antiseize lubricant (R. GORI Never Seez) to bearing lock ring; tighten to the specified torque using tool **A.5.0187**.

Ⓣ : **Tightening torque**
Wheel hub bearing lock ring
226 to 265 N·m
(23 to 27 kg·m)
(166.7 to 195.5 ft·lb)



CAUTION:
Right and left bearing lock rings are not interchangeable as they are provided with opposite threads.

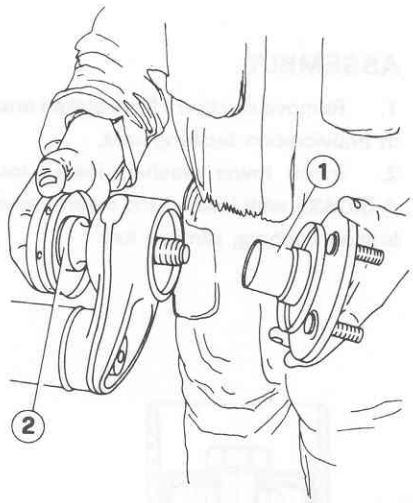
4. Stake lock ring (2) on seat notches (1).



1 Staked area
2 Lock ring

5. Vehicles equipped with (ABS) MARK II wheel antilock system only.
If previously disassembled, reassemble the impulse emitting wheels thus.
a. Clean the impulse emitting wheels thoroughly ensuring they are not damaged in any way.
b. With the aid of a press, fit the impulse emitting wheels on the hubs and check correct installation (see: Group 22 - (ABS) MARK II Braking System with Wheel Antilock - Inspection Specifications - Checks and Adjustments - Rear Impulse Emitting Wheels).

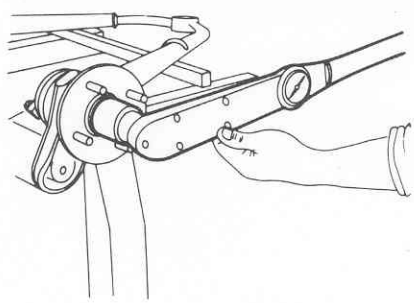
6. Install hub (1) and wheel shaft (2).



1 Hub
2 Wheel shaft

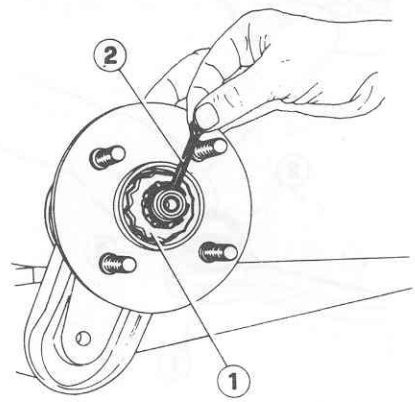
7. Install washer, tighten nut securing hub to wheel shaft to the specified torque holding wheel shaft to prevent rotation.

Ⓣ : **Tightening torque**
Wheel hub retaining nut
265 to 324 N·m
(27 to 33 kg·m)
(195.5 to 239 ft·lb)



8. Using a brush, apply grease film protective fluid (MILLA Protective LT or HOUGHTON Rust Veto 1064) to wheel shaft threaded end.

9. Install lock nut (1) and insert cotter (2).

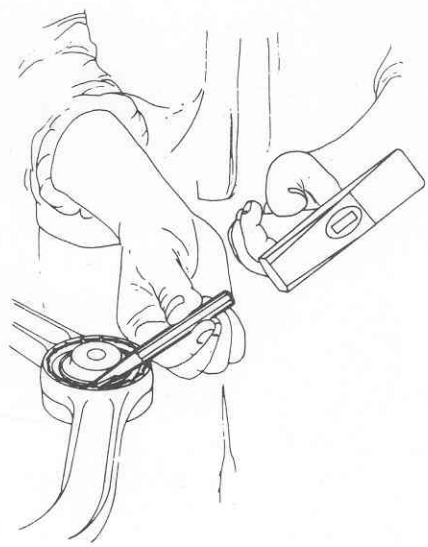


1 Lock nut
2 Cotter

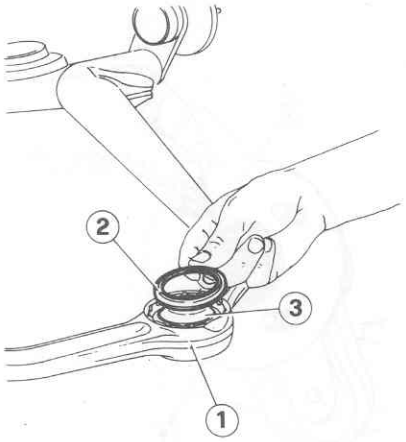
DE DION AXLE ANTIVIBRATION BUSHING

DISASSEMBLY

1. Using a punch, release staked area in antivibration bushing seat top.

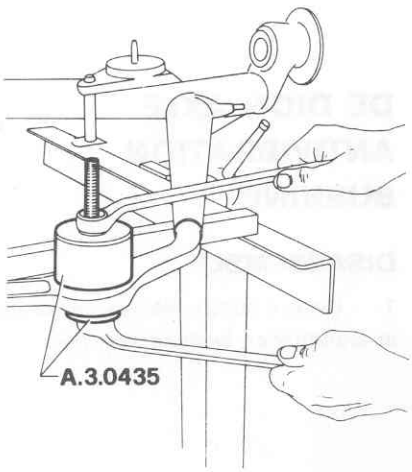


2. Take off antivibration bushing ③ upper washer ② from seat ①.



1 Seat
2 Upper washer
3 Antivibration bushing

3. Install puller **A.3.0435** and remove antivibration bushing and lower washer.



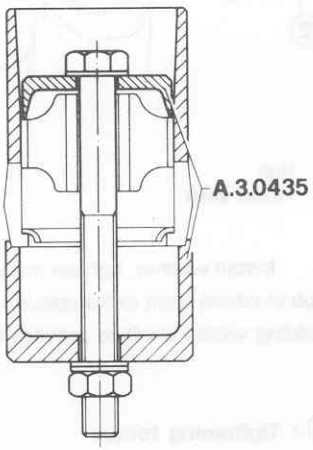
INSPECTION

Clean antivibration bushing, seat and washers.

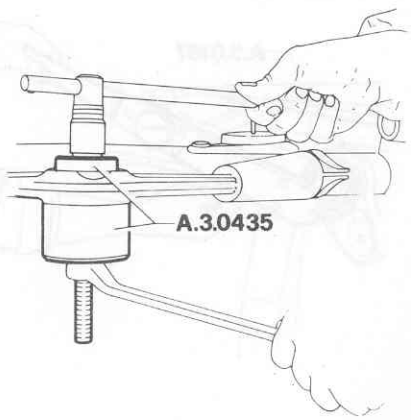
1. Check axle and antivibration bushing seat for damage or distortion; replace axle if necessary.
2. Check antivibration bushing for damage ensuring that rubber is not worn; replace if necessary.

ASSEMBLY

1. Remove any burrs from staked area in antivibration bushing seat.
2. Insert lower washer, install tool **A.3.0435** with lead-in and insert antivibration bushing; remove tool.

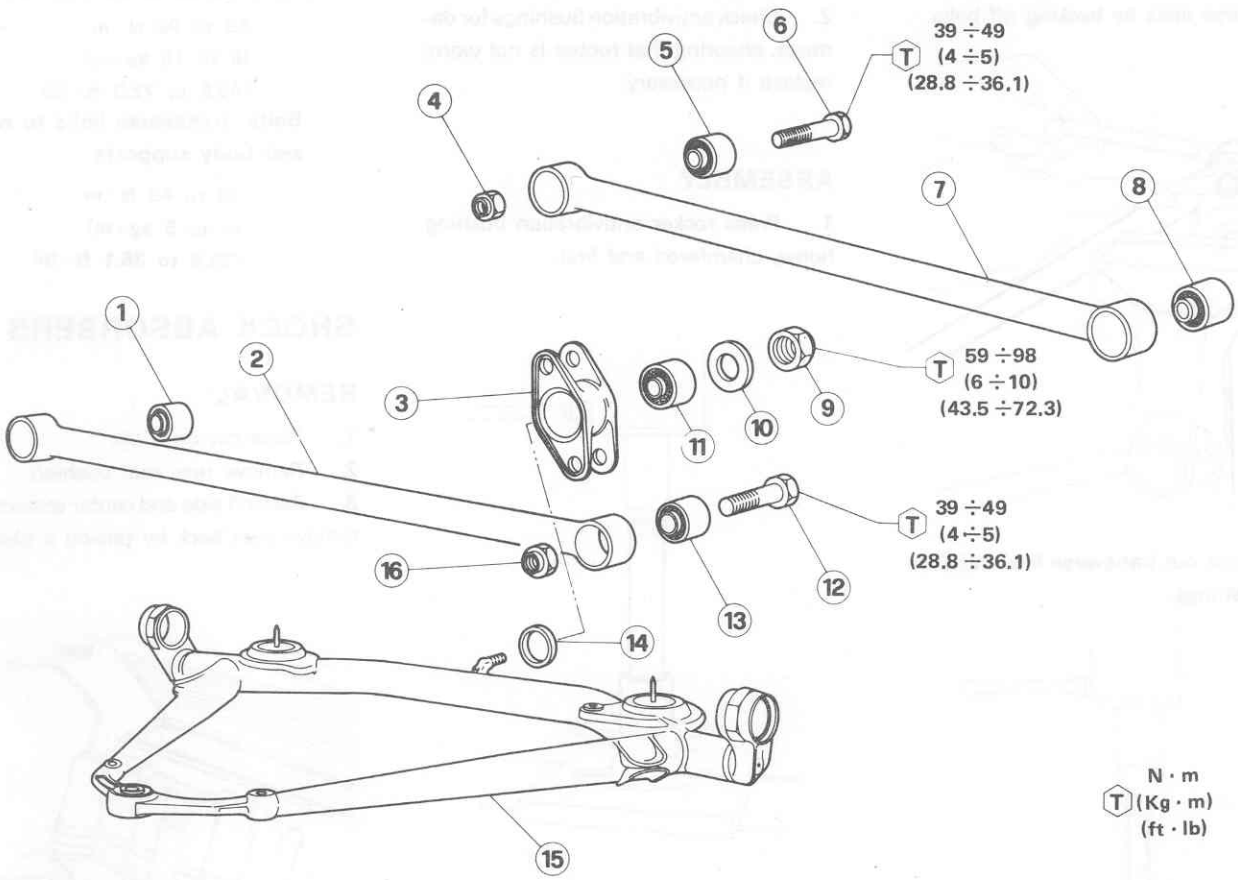


3. Position upper washer on antivibration bushing, install tool **A.3.0435** with smaller inserter ring and operate tool until bushing is fully home.



4. Using a punch, stake antivibration bushing seat at several points to prevent upper washer workout. Remove tool.

WATT'S LINKAGE

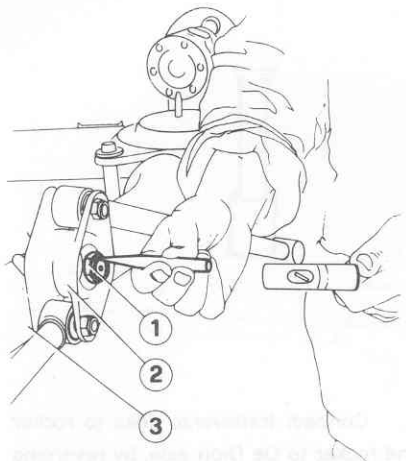


1 Antivibration bushing
2 Transverse link
3 Rocker
4 Nut
5 Antivibration bushing
6 Screw
7 Transverse link
8 Antivibration bushing
9 Nut
10 Outer washer
11 Antivibration bushing
12 Screw
13 Antivibration bushing
14 Inner washer
15 De Dion axle
16 Nut

DISASSEMBLY

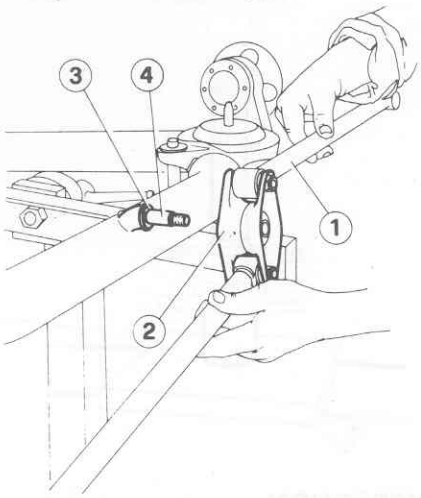
CAUTION:
The following operations can be carried out also with De Dion axle installed on vehicle after disconnecting transverse links from body proceeding as specified in "De Dion axle - Removal", para. 9.

1. Using a punch, release staked area on nut (1) retaining rocker (2) to De Dion axle (3).



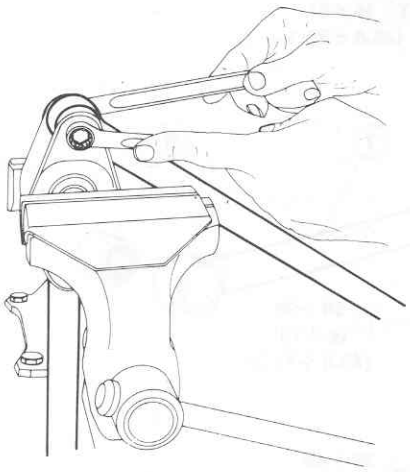
1 Nut
2 Rocker
3 De Dion axle

2. Back off nut, remove outer washer, take off rocker (2) together with two transverse links (1) from pin (4) on axle and retrieve inner washer (3).

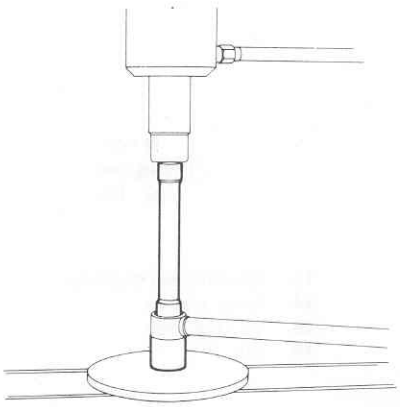


1 Transverse link
2 Rocker
3 Inner washer
4 Pin

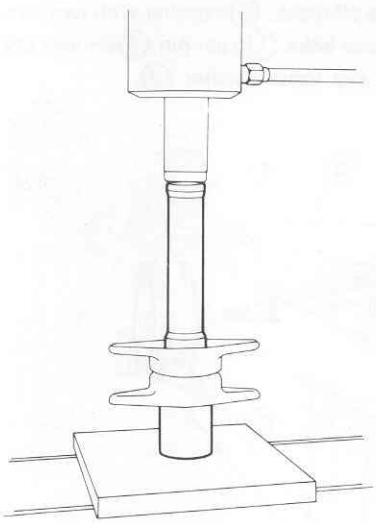
3. Clamp rocker in a vice provided with protective jaw liners and disassemble transverse links by backing off bolts.



4. Press out transverse link antivibration bushings.



5. Press out rocker antivibration bushing.



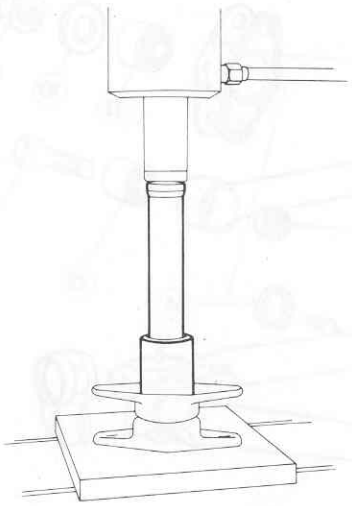
INSPECTION

Clean all parts.

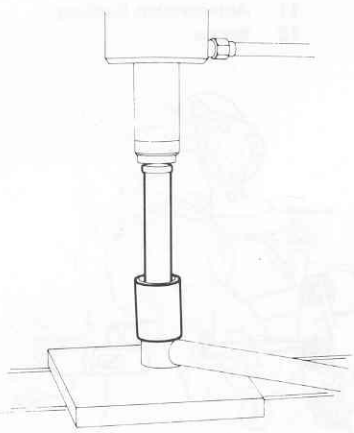
1. Check transverse links, pin and rocker for damage or distortion; replace if necessary.
2. Check antivibration bushings for damage, ensuring that rubber is not worn; replace if necessary.

ASSEMBLY

1. Press rocker antivibration bushing home, chamfered end first.



2. Press transverse link antivibration bushing home, chamfered end first.



3. Connect transverse links to rocker and rocker to De Dion axle, by reversing the disassembly sequence.

CAUTION:

Do not tighten bolts and nut fully; final tightening must be carried out with static laden vehicle adhering to the torques specified below.

(T) : Tightening torques

Nut, rocker to De Dion axle pi

59 to 98 N · m
(6 to 10 kg · m)
(43.5 to 72.3 ft · lb)

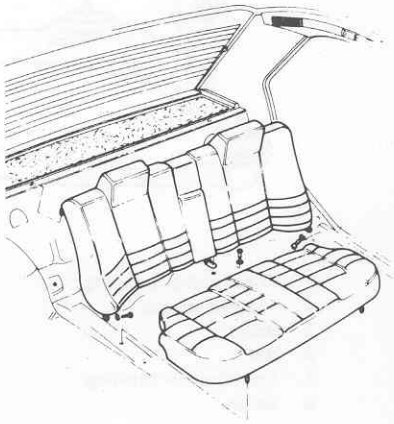
Bolts, transverse links to rocker and body supports

39 to 49 N · m
(4 to 5 kg · m)
(28.8 to 36.1 ft · lb)

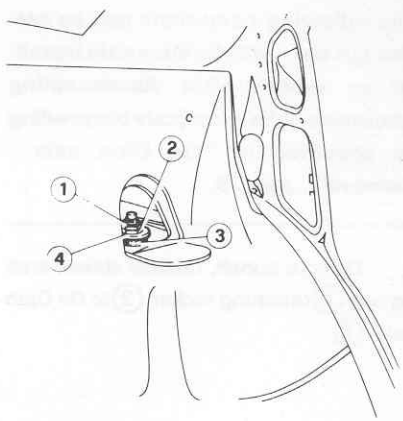
SHOCK ABSORBERS

REMOVAL

1. Place car on a lift.
2. Remove rear seat cushion.
3. Back off side and center screws, and remove seat back by raising it clear.

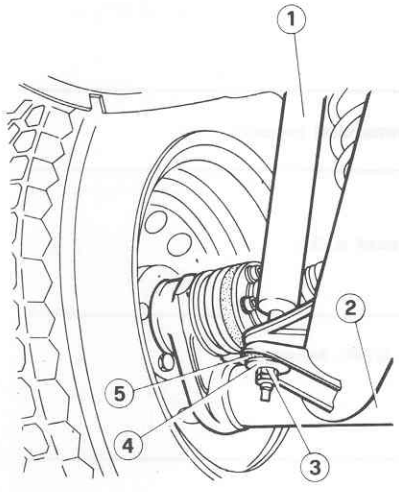


4. Back off nuts (2) and lock nuts (1), retrieve rubber cushions (3) and cups (4) and remove shock absorbers from body.



1 Lock nut
2 Shock absorber to body nut
3 Rubber cushion
4 Cup

5. Raise car.
6. Back off nut (3), retrieve rubber cushion (5) and cup (4), remove shock absorber (1) from axle (2).



1 Shock absorber
2 De Dion axle
3 Shock absorber to axle nut
4 Cup
5 Rubber cushion

INSPECTION

1. Check shock absorber efficiency and replace in case of oil leakage.
2. If necessary, check shock absorber settings (see Group 21 - Inspection Specifications - Checks and Adjustments). Replace if necessary.

INSTALLATION

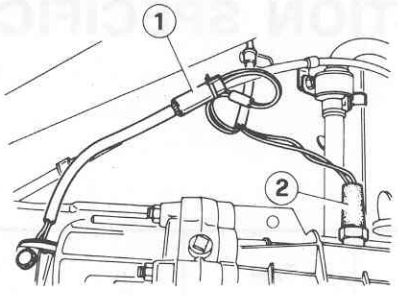
Install by reversing the removal sequence and adhere to the following tightening torque.

Ⓣ : **Tightening torque**
Shock absorber upper and lower lock nuts (after driving nut to end of thread)
23 to 27 N · m
(2.3 to 2.8 kg · m)
(17 to 19.9 ft · lb)

ANTI-ROLL BAR

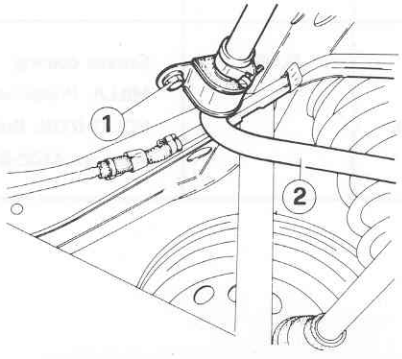
REMOVAL

1. Raise car on a lift.
2. Disconnect hand brake control cable, back-up light switch (2) and speedometer (1) wiring harness.



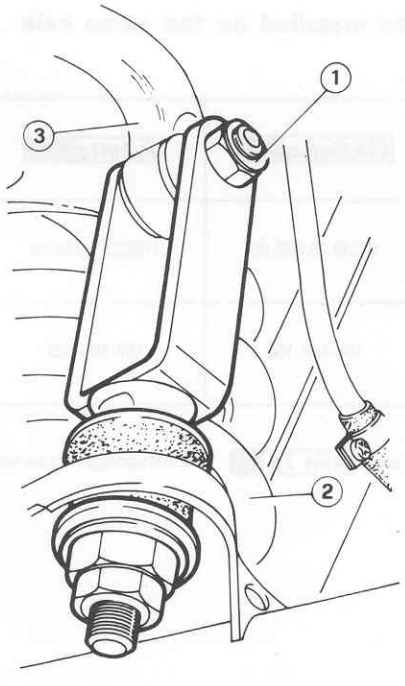
1 Sppedometer cable connection
2 Back-up light cable connection

3. Back off nuts retaining anti-roll bar conn. rods to axle and retrieve associated cups and rubber cushions.
4. Back off 4 screws (1) and remove anti-roll bar (2) from body.



1 Anti-roll bar to body screws
2 Anti-roll bar

5. Back off and remove bolts (1), disconnect anti-roll bar (3) from De Dion axle (2).



1 Conn. rod to anti-roll bar bolt
2 De Dion axle
3 Anti-roll bar

6. Support power train using a suitable tool and hydraulic lift.
7. Back off and remove bolt securing rear power train support to body.
8. Lower lift to take out anti-roll bar.

CAUTION:
Take care not to damage brake system pipe; disconnect from three-way connection if necessary.

INSPECTION

1. Check anti-roll bar and conn. rods for damage or distortion; replace if necessary.
2. Check rubber cushions connecting supports to body and to conn. rods and axle for wear; replace if necessary.

INSTALLATION

Install by reversing the removal sequence and adhering to the instructions given below.

- Wet inner surface of anti-roll bar support rubber cushions using the recommended type of grease (SPCA Spagraph or ISECO Ergon Rubber Grease no. 3).
- Adhere to the following tightening torques.

Ⓣ : **Tightening torques**
Bolt, power train rear support to body
44 to 54 N · m
(4.5 to 5.5 kg · m)
(32.5 to 39.8 ft · lb)
Lock nuts, anti-roll bar to axle
23 to 27 N · m
(2.3 to 2.8 kg · m)
(17 to 19.9 ft · lb)
Screws, anti-roll bar support to body
19 to 24 N · m
(1.9 to 2.4 kg · m)
(14 to 17.7 ft · lb)

Adjust hand brake (see Group 22 - Hand Brake - Adjustment).

INSPECTION SPECIFICATIONS

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Description	Type	Recommended product
Rear anti-roll bar support rubber cushion inner surface	GREASE	SPCA: Spagraph ISECO: Ergon Rubber Grease n. 3 Part. no. 3671-69816
Wheel hub bearing lock ring Shock absorber lower pin Transverse link screws	FLUID	Antiseizure compound R. GORI: Never Seez Part. no. 3671-69850
Wheel shaft threaded end Apply using a brush after tightening wheel hub nut and before installing lock nut	FLUID	Grease coating MILLA: Protective LT HOUGHTON: Rust Veto 1064 Part. no. 4100-81210

CHECKS AND ADJUSTMENTS

REAR SUSPENSION SPRING LOAD GRADES

Springs of equal load grade must be installed on the same axle

	Alfa 90 Alfa 75	Giulietta	Alfetta	GTV 2.0	GTV 6 2.5
Part. no.	16218.25.090.01	16200.25.510.00	11655.25.510.00	11646.25.510.02	11315.25.090.00
Load grade	129-130-131	106-107-108	107-108-109	104-105-106	124-125-126

Note: If a tow bar is assembled on cars Alfa 90 and Alfa 75, normal springs may be replaced by the more rigid type, part. no. 162.10.25.090.00.

REAR WHEEL GEOMETRY

For Alfa 90 see Print no. PA360500000000 - Workshop Manual* Alfa 90 - Group 00 - Mechanical Components and Body Maintenance - Wheel Alignment Data.

For Alfa 75 see Print no. PA371400000000 - Workshop Manual Alfa 75 - Group 00 - Mechanical Components and Body Maintenance - Wheel Alignment Data.

	Alfetta Giulietta GTV 2.0 GTV 6 2.5
Toe-in (α) (Max. difference between right and left wheels)	0° ± 10' 10'
Camber (β) (Max. difference between right and left wheels)	0° ± 30' 20'

VEHICLE TRIM

See Group 21 - Checks and Adjustments - Vehicle trim.

TIGHTENING TORQUES

Description	[N·m (kg·m)] (ft·lb)
Lock ring, wheel hub bearing	226 to 265 (23 to 27) (166.7 to 195.5)
Nut, wheel hub	265 to 324 (27 to 33) (195.5 to 239)
Screws, power train cross member to body	39 to 44 (4 to 4.5) (28.8 to 32.5)
Screws, axle to power train cross member	88 to 108 (9 to 11) (64.9 to 79.7)
Bolts, Watt's linkage transverse links to rocker and body supports	39 to 49 (4 to 5) (28.8 to 36.1)
Nuts securing impulse pick-up supports - wheel hubs (1)	9 to 10 (0.9 to 1) (6.6 to 7.4)
Nut, rocker to De Dion axle pin	59 to 98 (6 to 10) (43.5 to 72.3)
Lock nuts, top and bottom, shock absorber (nut on thread end)	23 to 27 (2.3 to 2.8) (17 to 19.9)
Lock nuts, anti-roll bar to axle	23 to 27 (2.3 to 2.8) (17 to 19.9)
Screws, anti-roll bar to body	19 to 24 (1.9 to 2.4) (14 to 17.7)

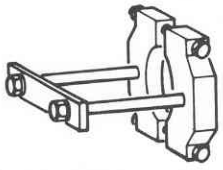
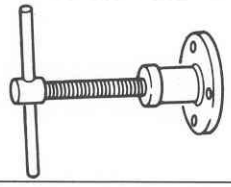
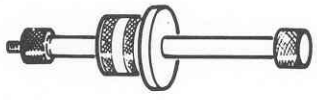
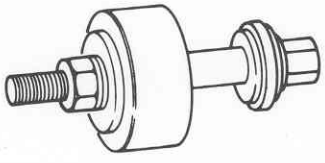
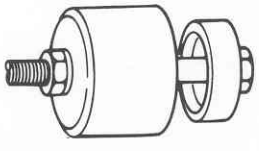
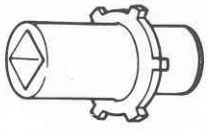
(1) For vehicles equipped with (ABS) MARK II wheel antilock braking system

TROUBLESHOOTING

In case of noise assumed to originate from rear suspension, carefully check to ensure that it is not caused by tyres, road surface, exhaust system, engine, power train or wheel bearings.

Trouble	Cause	Remedy
Noise	• Loose wheel screws	Tighten to the specified torque
	• One or more loose bolts	Tighten to the specified torque
	• Defective shock absorber	Replace
	• Worn or damaged wheel bearing	Replace
	• Wheel and tyre out of balance	Balance
	• Rubber parts damaged	Replace damaged parts
Instability on the move. This problem is also connected to front suspensions. For troubleshooting, also refer to group 21.	• Loose wheel screws	Tighten to the specified torque
	• Defective shock absorber	Repair or replace
	• Weak coil springs	Replace
	• Damaged transverse link antivibration bushings	Replace
	• Loose transverse link connections	Tighten or replace

TOOLS

Part. No.	Description	Page
A.2.0075	Support, car raising 	25-3
A.2.0380	Remover, rear wheel hub (use with A.3.0327) 	25-6
A.3.0327	Puller hubs (use with A.2.0380) 	25-6
A.3.0617	Percussion tool for rear wheel hub pulling (to be used with tool A.3.0327 without screw) (*) 	25-6
A.3.0432	Remover-replacer, hubs and rear bearings 	25-6
A.3.0435	Remover-replacer, axle antivibration bushing 	25-8
A.5.0187	Wrench, rear wheel hub bearing lock nut 	25-6 25-7

(*) For vehicles equipped with (ABS) MARK II wheel antilock braking system

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