Workshop service manual

n° 3378545M1

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A . Using the manual

General

The purpose of this manual is to assist Dealers and Agents in the efficient installation, maintenance and repair of AGCO equipment. Carrying out the procedures as detailed, together with the use of special tools where appropriate, will enable the operations to be completed within the time stated in the Repair Time Schedule.

Page numbering

The present manual is divided into chapters and sections, and each page is numbered with the following information:

Example: **10A01.1**

10 = Chapter

A = Section

01 = Sequence number within the section

1 = Page number within the section

The issue number and date are indicated at the bottom of the page.

Using the manual

For quick reference, each chapter of the manual is preceded by a table of contents listing the sections included in that chapter.

Meaning of references

(..) : identification of parts and components

Amendments

Amended pages will be issued carrying the same page number as the former pages; only the issue number and date will be changed.

Former pages should be destroyed.

Service tools

Where the use of a service tool is necessary to carry out an operation, the tool reference is mentioned following the relevant instruction.

Drawings for locally made tools are given in the final sections of the relevant chapters.

Repairs and replacements

When parts have to be replaced, it is essential that only genuine AGCO parts are used.

The following points are of particular importance when carrying out repairs and fitting replacement parts and accessories.

Tractor safety features may be impaired if non-genuine parts are fitted.

Legislation in certain countries prohibits the fitting of parts that do not comply with the tractor manufacturer's specifications. Torque wrench setting figures given in the Workshop Service Manual must be strictly adhered to. Locking devices must be fitted where specified. If the efficiency of a locking device is impaired during removal, it must be replaced.

The tractor warranty may be invalidated if non-genuine AGCO parts are fitted. All AGCO replacement parts have the full backing of the manufacturer's warranty. AGCO Dealers and agents are required to supply only genuine service parts.

B . Specifications

Model 5425

Engine	
DIN power (CV)	65
DIN power (Kw)	49
Trademark	PERKINS
Type	1104C-44
Number of cylinders / Cylinder capacity (L)	4 / 4,4
Turbocharger	No
Intercooler	No
Injection pump	Bosch VE10
Fan	Viscostatic
Alternator	80 A / 120 A
Gearbox	
Gearbox model	GBA20
Clutch / Reverse shuttle	Dry clutch / Mechanical reverse shuttle Wet clutch / Power Shuttle
Number of discs	5 pads (mechanical reverse shuttle) 4 forward discs / 3 reverse discs (Power Shuttle)
Type	Speedshift
Creeper unit 4/1	Optional
Creeper unit 14/1	Optional
Rear axle	
Axle model	GPA20
Final drive units	ND
Wheel shaft Ø	76 mm
Flanged shaft	Standard
Brake discs per trumpet housing	1
Handbrake discs	3
Differential lock	Coupler
Linkage	
Stabilisers	Telescopic / without
Perforated bar	Optional
3-point linkage	Type 2, hook or ball type (*)
Clevis	Standard or assisted
Automatic clevis	Standard or assisted
Semi-mounted trailer hitch	Closed eye bolt or automatic hook (*)
Swinging drawbar	Standard
Roller swinging drawbar	Optional
PTO	
Type	Interchangeable / shiftable shaft
540/1000/eco	Optional (*)
Number of clutch discs	4
Power take-off brake	Hydraulics
Proportional PTO	Optional
Front power take-off	Optional

Front axle	
Model	DANA AG 85
Type	Fixed
Rotational direction	Clockwise
Clutch	Coupler
Swinging fender (4WD)	Optional
2WD	Optional (standard wheel track / wide wheel track)
Front linkage (optional)	2.5 T
Hydraulics	
Open Centre 57L/min.	Optional
Open Centre 100L/min.	Optional
Orbitrol steering unit	100cc
Brake master cylinder	Standard
Assisted braking	No
Trailer brake	Optional (*)
Auxiliary spool valves	0 - 4 mechanical
Couplers	Pressure relief
Electronics	
Transmission control	AUTOTRONIC 5 (if Power Shuttle) Without (if mechanical reverse shuttle)
Linkage calculator	Linkage
Draft sensors	1
Sensor capacity	4 T
Datatronic	Without
Fieldstar	Optional
Cab	
Rear view mirrors	Standard / Telescopic (optional)
Air conditioning	Manual (optional)
Windscreen	Standard / Opening (optional)
Standard bonnet	Standard
Steep nose bonnet	Optional
Standard roof	Standard
High-visibility roof	Optional
Slimline roof	Optional
Platform	Optional
Reference (*): according to country	

Model 5435

Engine	
DIN power (CV)	75
DIN power (Kw)	56
Trademark	PERKINS
Type	1104C-44
Number of cylinders / Cylinder capacity (L)	4 / 4,4
Turbocharger	No
Intercooler	No
Injection pump	Bosch VE10
Fan	Viscostatic
Alternator	80 A / 120 A
Gearbox	
Gearbox model	GBA20
Clutch / Reverse shuttle	Dry clutch / Mechanical reverse shuttle Wet clutch / Power Shuttle
Number of discs	5 pads (mechanical reverse shuttle) 4 forward discs / 3 reverse discs (Power Shuttle)
Type	Speedshift
Creeper unit 4/1	Optional
Creeper unit 14/1	Optional
Rear axle	
Axle model	GPA20
Final drive units	ND
Wheel shaft Ø	76 mm
Flanged shaft	Standard
Brake discs per trumpet housing	1
Handbrake discs	3
Differential lock	Coupler
Linkage	
Stabilisers	Telescopic / without
Perforated bar	Optional
3-point linkage	Type 2, hook or ball type (*)
Clevis	Standard or assisted
Automatic clevis	Standard or assisted
Semi-mounted trailer hitch	Closed eye bolt or automatic hook (*)
Swinging drawbar	Standard
Roller swinging drawbar	Optional
PTO	
Type	Interchangeable / shiftable shaft
540/1000/eco	Optional (*)
Number of clutch discs	4
Power take-off brake	Hydraulics
Proportional PTO	Optional
Front power take-off	Optional

Front axle	
Model	DANA AG 85
Type	Fixed
Rotational direction	Clockwise
Clutch	Coupler
Swinging fender (4WD)	Optional
2WD	Optional (standard wheel track / wide wheel track)
Front linkage (optional)	2.5 T
Hydraulics	
Open Centre 57L/min.	Optional
Open Centre 100L/min.	Optional
Orbitrol steering unit	100cc
Brake master cylinder	Standard
Assisted braking	No
Trailer brake	Optional (*)
Auxiliary spool valves	0 - 4 mechanical
Couplers	Pressure relief
Electronics	
Transmission control	AUTOTRONIC 5 (if Power Shuttle) Without (if mechanical reverse shuttle)
Linkage calculator	Linkage
Draft sensors	1
Sensor capacity	4 T
Datatronic	Without
Fieldstar	Optional
Cab	
Rear view mirrors	Standard / Telescopic (optional)
Air conditioning	Manual (optional)
Windscreen	Standard / Opening (optional)
Standard bonnet	Standard
Steep nose bonnet	Optional
Standard roof	Standard
High-visibility roof	Optional
Slimline roof	Optional
Platform	Optional
Reference (*): according to country	

Model 5445

Engine	
DIN power (CV)	85
DIN power (Kw)	63
Trademark	PERKINS
Type	1104C-44T
Number of cylinders / Cylinder capacity (L)	4 / 4,4
Turbocharger	Yes
Intercooler	No
Injection pump	Lucas DP210
Fan	Viscostatic
Alternator	80 A / 120 A
Gearbox	
Gearbox model	GBA20
Clutch / Reverse shuttle	Dry clutch / Mechanical reverse shuttle Wet clutch / Power Shuttle
Number of discs	6 pads (mechanical reverse shuttle) 4 forward discs / 3 reverse discs (Power Shuttle)
Type	Speedshift
Creeper unit 4/1	Optional
Creeper unit 14/1	Optional
Rear axle	
Axle model	GPA20
Final drive units	ND
Wheel shaft Ø	76 mm
Flanged shaft	Standard
Brake discs per trumpet housing	1
Handbrake discs	3
Differential lock	Coupler
Linkage	
Stabilisers	Telescopic / without
Perforated bar	Optional
3-point linkage	Type 2, hook or ball type (*)
Clevis	Standard or assisted
Automatic clevis	Standard or assisted
Semi-mounted trailer hitch	Closed eye bolt or automatic hook (*)
Swinging drawbar	Standard
Roller swinging drawbar	Optional
PTO	
Type	Interchangeable / shiftable shaft
540/1000/eco	Optional (*)
Number of clutch discs	4
Power take-off brake	Hydraulics
Proportional PTO	Optional
Front power take-off	Optional

Front axle	
Model	DANA AG 85
Type	Fixed
Rotational direction	Clockwise
Clutch	Coupler
Swinging fender (4WD)	Optional
2WD	Optional (standard wheel track / wide wheel track)
Front linkage (optional)	2.5 T
Hydraulics	
Open Centre 57L/min.	Optional
Open Centre 100L/min.	Optional
Orbitrol steering unit	100cc
Brake master cylinder	Standard
Assisted braking	No
Trailer brake	Optional (*)
Auxiliary spool valves	0 - 4 mechanical
Couplers	Pressure relief
Electronics	
Transmission control	AUTOTRONIC 5 (if Power Shuttle) Without (if mechanical reverse shuttle)
Linkage calculator	Linkage
Draft sensors	1
Sensor capacity	4 T
Datatronic	Without
Fieldstar	Optional
Cab	
Rear view mirrors	Standard / Telescopic (optional)
Air conditioning	Manual (optional)
Windscreen	Standard / Opening (optional)
Standard bonnet	Standard
Steep nose bonnet	Optional
Standard roof	Standard
High-visibility roof	Optional
Slimline roof	Optional
Platform	Optional
Reference (*): according to country	

Model 5455

Engine	
DIN power (CV)	95
DIN power (Kw)	71
Trademark	PERKINS
Type	1104C-44T
Number of cylinders / Cylinder capacity (L)	4 / 4,4
Turbocharger	Yes
Intercooler	No
Injection pump	Lucas DP210
Fan	Viscostatic
Alternator	80 A / 120 A
Gearbox	
Gearbox model	GBA20
Clutch / Reverse shuttle	Dry clutch / Mechanical reverse shuttle Wet clutch / Power Shuttle
Number of discs	6 pads (mechanical reverse shuttle) 4 forward discs / 3 reverse discs (Power Shuttle)
Type	Speedshift
Creeper unit 4/1	Optional
Creeper unit 14/1	Optional
Rear axle	
Axle model	GPA20
Final drive units	ND
Wheel shaft Ø	76 mm
Flanged shaft	Standard
Brake discs per trumpet housing	1
Handbrake discs	3
Differential lock	Coupler
Linkage	
Stabilisers	Telescopic / without
Perforated bar	Optional
3-point linkage	Type 2, hook or ball type (*)
Clevis	Standard or assisted
Automatic clevis	Standard or assisted
Semi-mounted trailer hitch	Closed eye bolt or automatic hook (*)
Swinging drawbar	Standard
Roller swinging drawbar	Optional
PTO	
Type	Interchangeable / shiftable shaft
540/1000/eco	Optional (*)
Number of clutch discs	4
Power take-off brake	Hydraulics
Proportional PTO	Optional
Front power take-off	Optional

Front axle	
Model	DANA AG 85
Type	Fixed
Rotational direction	Clockwise
Clutch	Coupler
Swinging fender (4WD)	Optional
2WD	Optional (standard wheel track / wide wheel track)
Front linkage (optional)	2.5 T
Hydraulics	
Open Centre 57L/min.	Optional
Open Centre 100L/min.	Optional
Orbitrol steering unit	100cc
Brake master cylinder	Standard
Assisted braking	No
Trailer brake	Optional (*)
Auxiliary spool valves	0 - 4 mechanical
Couplers	Pressure relief
Electronics	
Transmission control	AUTOTRONIC 5 (if Power Shuttle) Without (if mechanical reverse shuttle)
Linkage calculator	Linkage
Draft sensors	1
Sensor capacity	4 T
Datatronic	Without
Fieldstar	Optional
Cab	
Rear view mirrors	Standard / Telescopic (optional)
Air conditioning	Manual (optional)
Windscreen	Standard / Opening (optional)
Standard bonnet	Standard
Steep nose bonnet	Optional
Standard roof	Standard
High-visibility roof	Optional
Slimline roof	Optional
Platform	Optional
Reference (*): according to country	

Model 5460

Engine	
DIN power (CV)	105
DIN power (Kw)	78
Trademark	PERKINS
Type	1104C-44TA
Number of cylinders / Cylinder capacity (L)	4 / 4,4
Turbocharger	Yes
Intercooler	Air / air
Injection pump	Lucas DP210
Fan	Viscostatic
Alternator	80 A / 120 A
Gearbox	
Gearbox model	GBA20
Clutch / Reverse shuttle	Dry clutch / Mechanical reverse shuttle Wet clutch / Power Shuttle
Number of discs	6 pads (mechanical reverse shuttle) 5 forward discs / 4 reverse discs (Power Shuttle)
Type	Speedshift
Creeper unit 4/1	Optional
Creeper unit 14/1	Optional
Rear axle	
Axle model	GPA20
Final drive units	ND
Wheel shaft Ø	76 mm
Flanged shaft	Standard
Brake discs per trumpet housing	1
Handbrake discs	3
Differential lock	Coupler
Linkage	
Stabilisers	Telescopic / without
Perforated bar	Optional
3-point linkage	Type 2, hook or ball type (*)
Clevis	Standard or assisted
Automatic clevis	Standard or assisted
Semi-mounted trailer hitch	Closed eye bolt or automatic hook (*)
Swinging drawbar	Standard
Roller swinging drawbar	Optional
PTO	
Type	Interchangeable / shiftable shaft
540/1000/eco	Optional (*)
Number of clutch discs	5
Power take-off brake	Hydraulics
Proportional PTO	Optional
Front power take-off	Optional

Front axle	
Model	DANA AG 105
Type	Fixed
Rotational direction	Clockwise
Clutch	Coupler
Swinging fender (4WD)	Optional
2WD	Optional (standard wheel track / wide wheel track)
Front linkage (optional)	2.5 T
Hydraulics	
Open Centre 57L/min.	Optional
Open Centre 100L/min.	Optional
Orbitrol steering unit	125cc
Brake master cylinder	Standard
Assisted braking	Optional
Trailer brake	Optional (*)
Auxiliary spool valves	0 - 4 mechanical
Couplers	Pressure relief
Electronics	
Transmission control	AUTOTRONIC 5 (if Power Shuttle) Without (if mechanical reverse shuttle)
Linkage calculator	Linkage
Draft sensors	1
Sensor capacity	4 T
Datatronic	Without
Fieldstar	Optional
Cab	
Rear view mirrors	Standard / Telescopic (optional)
Air conditioning	Manual (optional)
Windscreen	Standard / Opening (optional)
Standard bonnet	Standard
Steep nose bonnet	No
Standard roof	Standard
High-visibility roof	Optional
Slimline roof	No
Platform	Optional
Reference (*): according to country	

5465

Engine	
DIN power (CV)	110
DIN power (Kw)	82
Trademark	PERKINS
Type	1106C-E60TA
Number of cylinders / Cylinder capacity (L)	6 / 6
Turbocharger	Yes
Intercooler	Air / air
Injection pump	Bosch VP30
Fan	Viscostatic
Alternator	80 A / 120 A
Gearbox	
Gearbox model	GBA20
Clutch / Reverse shuttle	Dry clutch / Mechanical reverse shuttle Wet clutch / Power Shuttle
Number of discs	6 pads (mechanical reverse shuttle) 5 forward discs / 4 reverse discs (Power Shuttle)
Type	Speedshift
Creeper unit 4/1	Optional
Creeper unit 14/1	Optional
Rear axle	
Axle model	GPA20
Final drive units	HD
Wheel shaft Ø	76 mm
Flanged shaft	Standard
Brake discs per trumpet housing	1
Handbrake discs	3
Differential lock	Coupler
Linkage	
Stabilisers	Telescopic / without
Perforated bar	Optional
3-point linkage	Type 2/3, hook or ball type (*)
Clevis	Standard or assisted
Automatic clevis	Standard or assisted
Semi-mounted trailer hitch	Closed eye bolt or automatic hook (*)
Swinging drawbar	Standard
Roller swinging drawbar	Optional
PTO	
Type	Interchangeable / shiftable shaft
540/1000/eco	Optional (*)
Number of clutch discs	5
Power take-off brake	Hydraulics
Proportional PTO	Optional
Front power take-off	Optional

Front axle	
Model	CARRARO 20.19
Type	Fixed
Rotational direction	Clockwise
Clutch	Coupler
Swinging fender (4WD)	Optional
2WD	Optional (standard wheel track / wide wheel track)
Front linkage (optional)	2.5 T
Hydraulics	
Open Centre 57L/min.	Optional
Open Centre 100L/min.	Optional
Orbitrol steering unit	125cc
Brake master cylinder	Standard
Assisted braking	Optional
Trailer brake	Optional (*)
Auxiliary spool valves	0 - 4 mechanical
Couplers	Pressure relief
Electronics	
Transmission control	AUTOTRONIC 5 (if Power Shuttle) Without (if mechanical reverse shuttle)
Linkage calculator	Linkage
Draft sensors	1
Sensor capacity	4 T
Datatronic	Without
Fieldstar	Optional
Cab	
Rear view mirrors	Standard / Telescopic (optional)
Air conditioning	Manual (optional)
Windscreen	Standard / Opening (optional)
Standard bonnet	Standard
Steep nose bonnet	No
Standard roof	Standard
High-visibility roof	Optional
Slimline roof	No
Platform	Optional
Reference (*): according to country	

C . Ground speed

Road speed at 2200 rpm for models **5425** and **5435**. 16.9R34 tyres

POSITION			FORWARD AND REVERSE POWER SHUTTLE FORWARD MECHANICAL REVERSE SHUTTLE						REVERSE MECHANICAL REVERSE SHUTTLE					
RANGE			Speedshift		Creeper 1/4		Creeper 1/14		Speedshift		Creeper 1/4		Creeper 1/14	
Version (kph)			30	40	30	40	30	40	30	40	30	40	30	40
LO	1	C	1,96	2,47	0,49	0,62	0,14	0,18	1,90	2,40	0,47	0,60	0,14	0,17
		D	2,47	3,12	0,62	0,78	0,18	0,22	2,40	3,03	0,60	0,76	0,17	0,22
	2	C	2,95	3,73	0,74	0,93	0,21	0,27	2,87	3,62	0,72	0,91	0,21	0,26
		D	3,73	4,72	0,93	1,18	0,27	0,34	3,62	4,58	0,91	1,14	0,26	0,33
	3	C	4,09	5,17	1,02	1,29	0,29	0,37	3,96	5,01	0,99	1,25	0,28	0,36
		D	5,17	6,53	1,29	1,63	0,37	0,47	5,01	6,33	1,25	1,58	0,36	0,45
	4	C	5,92	7,48	1,48	1,87	0,42	0,53	5,74	7,26	1,44	1,81	0,41	0,52
		D	7,48	9,45	1,87	2,36	0,53	0,68	7,26	9,17	1,81	2,29	0,52	0,66
HI	1	C	7,84	9,91	-	-	-	-	7,61	9,61	-	-	-	-
		D	9,91	12,53	-	-	-	-	9,61	12,15	-	-	-	-
	2	C	11,85	14,97	-	-	-	-	11,49	14,52	-	-	-	-
		D	14,97	18,92	-	-	-	-	14,52	18,36	-	-	-	-
	3	C	16,39	20,72	-	-	-	-	15,90	20,10	-	-	-	-
		D	20,72	26,72	-	-	-	-	20,10	25,40	-	-	-	-
	4	C	23,73	30,00	-	-	-	-	23,02	29,10	-	-	-	-
		D	30,00	37,91	-	-	-	-	29,10	36,77	-	-	-	-

Road speed at 2200 rpm for models **5445**. 16.9R38 tyres

POSITION			FORWARD AND REVERSE POWER SHUTTLE; FORWARD MECHANICAL REVERSE SHUTTLE						REVERSE MECHANICAL REVERSE SHUTTLE					
RANGE			Speedshift		Creeper 1/4		Creeper 1/14		Speedshift		Creeper 1/4		Creeper 1/14	
Version (kph)			30	40	30	40	30	40	30	40	30	40	30	40
LO	1	C	2,08	2,63	0,52	0,66	0,15	0,19	2,02	2,55	0,51	0,64	0,14	0,18
		D	2,63	3,33	0,66	0,83	0,19	0,24	2,55	3,23	0,64	0,81	0,18	0,23
	2	C	3,15	3,98	0,79	0,99	0,23	0,28	3,05	3,86	0,76	0,96	0,22	0,28
		D	3,98	5,03	0,99	1,26	0,28	0,36	3,86	4,88	0,96	1,22	0,28	0,35
	3	C	4,66	5,89	1,16	1,47	0,33	0,42	4,52	5,71	1,13	1,43	0,32	0,41
		D	5,89	7,44	1,47	1,86	0,42	0,53	5,71	7,22	1,43	1,80	0,41	0,52
	4	C	6,30	7,97	1,58	1,99	0,45	0,57	6,11	7,73	1,53	1,93	0,44	0,55
		D	7,97	10,07	1,99	2,52	0,56	0,71	7,73	9,77	1,93	2,44	0,55	0,68
HI	1	C	7,81	9,87	-	-	-	-	7,57	9,57	-	-	-	-
		D	9,87	12,47	-	-	-	-	9,57	12,10	-	-	-	-
	2	C	11,79	14,90	-	-	-	-	11,44	14,46	-	-	-	-
		D	14,90	18,84	-	-	-	-	14,46	18,27	-	-	-	-
	3	C	17,46	22,07	-	-	-	-	16,94	21,40	-	-	-	-
		D	22,07	27,89	-	-	-	-	21,40	27,05	-	-	-	-
	4	C	23,63	29,86	-	-	-	-	22,92	28,96	-	-	-	-
		D	29,86	37,74	-	-	-	-	28,96	36,61	-	-	-	-

Road speed at 2200 rpm for models **5455** and **5460**. 18.4R38 tyres

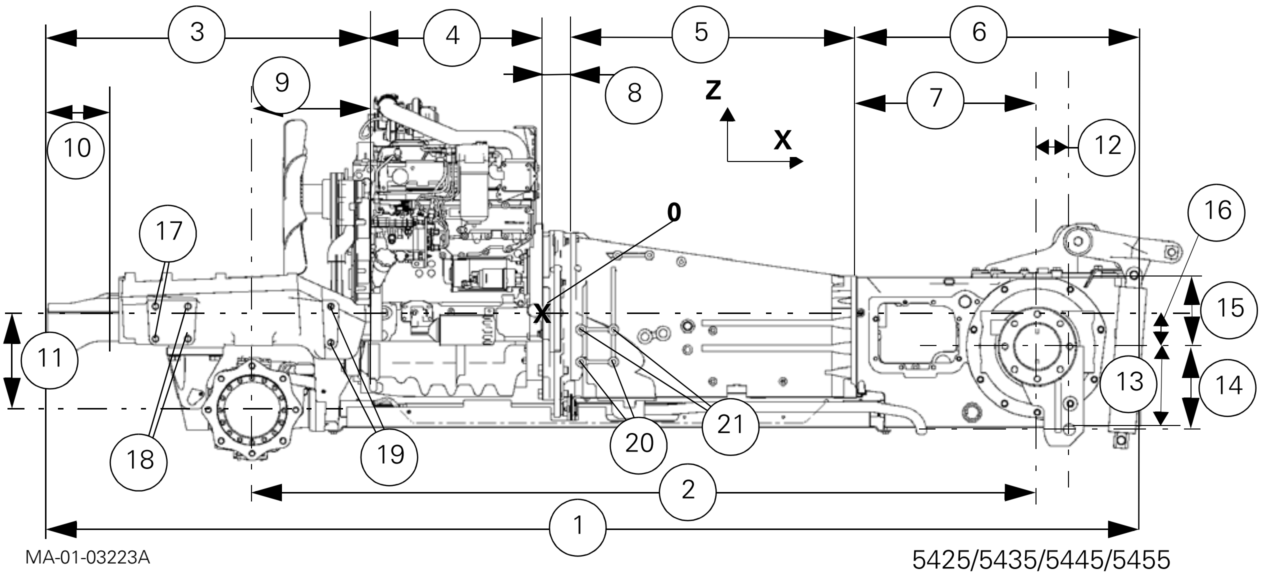
POSITION			FORWARD AND REVERSE POWER SHUTTLE; FORWARD MECHANICAL REVERSE SHUTTLE						REVERSE MECHANICAL REVERSE SHUTTLE					
RANGE			Speedshift		Creeper 1/4		Creeper 1/14		Speedshift		Creeper 1/4		Creeper 1/14	
Version (kph)			30	40	30	40	30	40	30	40	30	40	30	40
LO	1	C	2,18	2,76	0,55	0,69	0,16	0,20	2,12	2,68	0,53	0,67	0,15	0,19
		D	2,76	3,49	0,69	0,87	0,20	0,25	2,68	3,38	0,67	0,85	0,19	0,24
	2	C	3,30	4,17	0,82	1,04	0,24	0,30	3,20	4,04	0,80	1,01	0,23	0,29
		D	4,17	5,27	1,04	1,32	0,30	0,38	4,04	5,11	1,01	1,28	0,29	0,37
	3	C	4,88	6,17	1,22	1,54	0,35	0,44	4,74	5,98	1,18	1,50	0,34	0,43
		D	6,17	7,80	1,54	1,95	0,44	0,56	5,98	7,56	1,50	1,89	0,43	0,54
	4	C	6,61	8,35	1,65	2,09	0,47	0,60	6,41	8,10	1,60	2,02	0,46	0,58
		D	8,35	10,55	2,09	2,64	0,60	0,75	8,10	10,24	2,02	2,56	0,58	0,73
HI	1	C	8,18	10,34	-	-	-	-	7,94	10,03	-	-	-	-
		D	10,34	13,07	-	-	-	-	10,03	12,68	-	-	-	-
	2	C	12,36	15,62	-	-	-	-	11,99	15,15	-	-	-	-
		D	15,62	19,74	-	-	-	-	15,15	19,15	-	-	-	-
	3	C	18,30	23,12	-	-	-	-	17,75	22,43	-	-	-	-
		D	23,12	29,23	-	-	-	-	22,43	28,35	-	-	-	-
	4	C	24,76	31,29	-	-	-	-	24,02	30,35	-	-	-	-
		D	31,29	39,55	-	-	-	-	30,35	38,36	-	-	-	-

Road speed at 2200 rpm for models **5465**. 18.4R38 tyres

POSITION			FORWARD AND REVERSE POWER SHUTTLE; FORWARD MECHANICAL REVERSE SHUTTLE						REVERSE MECHANICAL REVERSE SHUTTLE					
RANGE			Speedshift		Creeper 1/4		Creeper 1/14		Speedshift		Creeper 1/4		Creeper 1/14	
Version (kph)			30	40	30	40	30	40	30	40	30	40	30	40
LO	1	C	2,18	2,76	0,55	0,69	0,16	0,20	2,12	2,68	0,53	0,67	0,15	0,19
		D	2,76	3,49	0,69	0,87	0,20	0,25	2,68	3,38	0,67	0,85	0,19	0,24
	2	C	3,30	4,17	0,82	1,04	0,24	0,30	3,20	4,04	0,80	1,01	0,23	0,29
		D	4,17	5,27	1,04	1,32	0,30	0,38	4,04	5,11	1,01	1,28	0,29	0,37
	3	C	4,88	6,17	1,22	1,54	0,35	0,44	4,74	5,98	1,18	1,50	0,34	0,43
		D	6,17	7,80	1,54	1,95	0,44	0,56	5,98	7,56	1,50	1,89	0,43	0,54
	4	C	6,61	8,35	1,65	2,09	0,47	0,60	6,41	8,10	1,60	2,02	0,46	0,58
		D	8,35	10,55	2,09	2,64	0,60	0,75	8,10	10,24	2,02	2,56	0,58	0,73
HI	1	C	8,18	10,34	-	-	-	-	7,94	10,03	-	-	-	-
		D	10,34	13,07	-	-	-	-	10,03	12,68	-	-	-	-
	2	C	12,36	15,62	-	-	-	-	11,99	15,15	-	-	-	-
		D	15,62	19,74	-	-	-	-	15,15	19,15	-	-	-	-
	3	C	18,30	23,12	-	-	-	-	17,75	22,43	-	-	-	-
		D	23,12	29,23	-	-	-	-	22,43	28,35	-	-	-	-
	4	C	24,76	31,29	-	-	-	-	24,02	30,35	-	-	-	-
		D	31,29	39,55	-	-	-	-	30,35	38,36	-	-	-	-

D . General dimensions

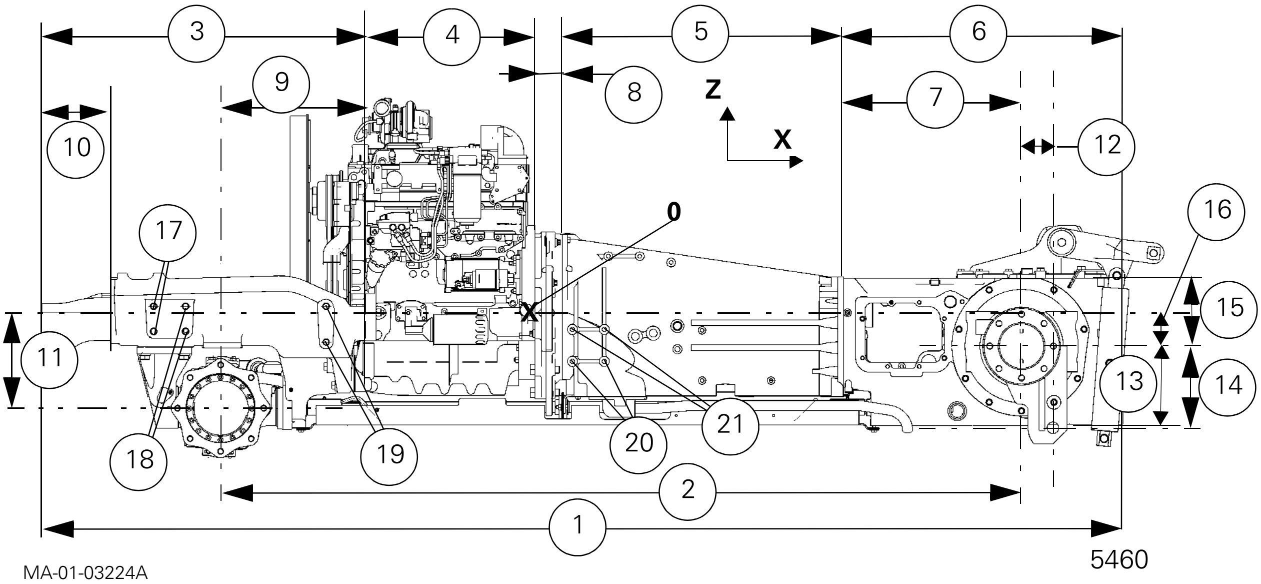
Dimensions and attachment points for 5425, 5435, 5445 and 5455 tractors



REFERENCE	DIMENSIONS (mm)				REFERENCE	DIMENSIONS (mm)			
0 = Engine axis		x	y	z	0 = Engine axis		x	y	z
1	3427	-	-	-	12	100	-	-	-
2	2464	-	-	-	13	249	-	-	-
3	1012	-	-	-	14	260	-	-	-
4	540	-	-	-	15	216	-	-	-
5	896	-	-	-	16	106	-	-	-
6	890	-	-	-	17	2xM20	-1215	+/-280	20/-82
7	567	-	-	-	18	2xM20	-1113	+/-280	20/-82
8	89	-	-	-	19	2xM20	-665	+/-275	20/-94
9	372	-	-	-	20	2xM16	120/222	+/-183	-155
10	222	-	-	-	21	2xM16	120/222	+/-223	-53
11	306	-	-	-	-	-	-	-	-

Fig. 1

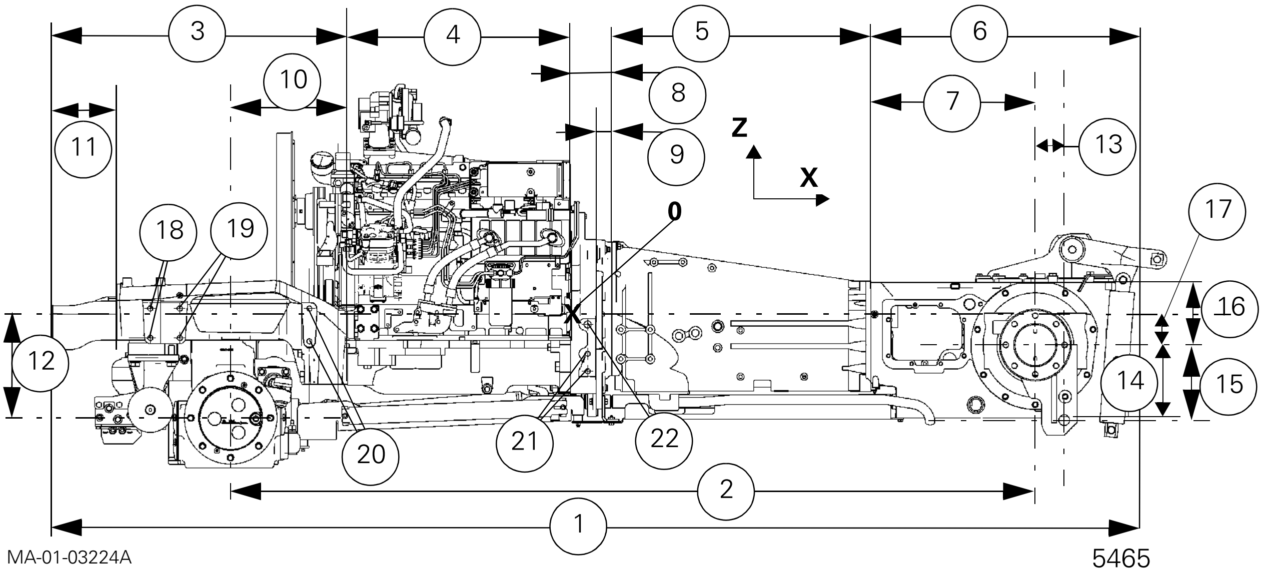
Dimensions and attachment points for 5460 tractors



REFERENCE	DIMENSIONS (mm)				REFERENCE	DIMENSIONS (mm)			
0 = Engine axis		x	y	z	0 = Engine axis		x	y	z
1	3447	-	-	-	12	100	-	-	-
2	2553	-	-	-	13	249	-	-	-
3	1032	-	-	-	14	260	-	-	-
4	540	-	-	-	15	216	-	-	-
5	896	-	-	-	16	106	-	-	-
6	890	-	-	-	17	2xM20	-1215	+/-280	21/-59
7	567	-	-	-	18	2xM20	-1113	+/-280	21/-59
8	89	-	-	-	19	2xM20	-665	+/-275	21/-93
9	462	-	-	-	20	2xM16	120/222	+/-183	-155
10	222	-	-	-	21	2xM16	120/222	+/-223	-53
11	306	-	-	-					

Fig. 2

Dimensions and attachment points for 5465 tractors



REFERENCE		DIMENSIONS (mm)			REFERENCE		DIMENSIONS (mm)		
0 = Engine axis		x	y	z	0 = Engine axis		x	y	z
1	3717	-	-	-	12	361	-	-	-
2	2780	-	-	-	13	100	-	-	-
3	1018	-	-	-	14	249	-	-	-
4	772	-	-	-	15	260	-	-	-
5	896	-	-	-	16	216	-	-	-
6	890	-	-	-	17	106	-	-	-
7	567	-	-	-	18	2xM20	-1452	+/-280	20/-82
8	89	-	-	-	19	2xM20	-1351	+/-280	20/-82
9	53	-	-	-	20	2xM20	-903	+/-275	20/-94
10	404	-	-	-	21	2xM20	59	+/-274	-137/-197
11	222	-	-	-	22	M20	59	+/-274	-35

Fig. 3

E . Capacities

	Engine oil	Engine cooling	Transmission oil	Front axle	Front final drive units	Fuel tank	Additional tank	Windshield washer	Air conditioning
5425	7,5	16,6	62 (Inv. Méca.) 74 (ISC)	5,5	0,9	150	50	4	1550
5435	7,5	16,6	62 (Inv. Méca.) 74 (ISC)	5,5	0,9	150	50	4	1550
5445	7,5	16,6	62 (Inv. Méca.) 74 (ISC)	5,5	0,9	150	50	4	1550
5455	7,5	16,6	62 (Inv. Méca.) 74 (ISC)	5,5	0,9	150	50	4	1550
5460	7,5	16,6	62 (Inv. Méca.) 74 (ISC)	6,8	1,1	150	50	4	1550
5465	14,5	25	56 (Inv. Méca.) 68 (ISC)	6	0,7	150	80	4	1550
Value in litres, and in grammes for the air conditioning circuit									

F . Conversion tables

LENGTH		
multiply by		
mm	x 0.0394	in
in	x 25,400	mm
m	x 3.2808	ft
ft	x 0.3048	m
km	x 0.6214	mile
mile	x 1.6093	km

AREA		
multiply by		
mm^2	x 15	in^2
in^2	x 645.16	mm^2
m^2	x 10,764	ft^2
ft^2	x 0.0929	m^2
ha	x 2.4711	acre
acre	x 0.4047	ha

VOLUME		
multiply by		
mm^3	x 0.6102	in^3
in^3	x 163.87	mm^3
m^3	x 35,315	ft^3
ft^3	x 0.0283	m^3

CAPACITY		
multiply by		
ml	x 0.0351	liquid oz
liquid oz	x 28,413	ml
litre	x 0.2200	imp. gal.
imp. gal.	x 4.5640	litre
litre	x 0.2640	gal. English US
gal. English US	x 3.7850	litre
imp. gal.	x 1.2010	gal. English US
gal. English US	x 0.8330	imp. gal.

POWER		
multiply by		
ps	x 0.9863	ch
ch	x 1.0139	ps
kW	x 1.3410	ch
ch	x 0.7457	kW

TORQUE		
multiply by		
Nm	x 738	lbf ft
lbf ft	x 1,356	Nm

PRESSURE		
multiply by		
bar	x 14,504	lbf/in^2
lbf/in^2	x 0.0690	bar

SPEED		
multiply by		
kph	x 0.6214	mph
mph	x 1.6093	kph

WEIGHT		
multiply by		
gramme	x 0.0353	oz
oz	x 28,350	gramme
kg	x 2.2046	pound
pounds	x 0.4536	kg
kg	x 0.00098	British ton
British ton	x 1016.1	kg
ton (metric)	x 0.9842	British ton
British ton	x 1,016	ton (metric)

TEMPERATURE		
°C	°C x 1.8 + 32	°F
°F	(°F - 32)/1.8	°C

G . Locking compounds and sealants

The Loctite compounds mentioned in this manual are referred to by their industrial name.

For repair purposes, use their commercial names or the corresponding AGCO references listed in the following table:

Loctite industrial name	Commercial name
270	Stud lock
242	Lock and Seal
Silicone AS 310	Clear silicone
5910 black silicone trumpet sealant	Blacktite
510 mating face sealant	Formajoint Masterjoint
518 mating face sealant	Unijoint Masterjoint

Note: *use the product "Form A gasket 2" when sealing between plastic material and cast iron (or steel).*

These products can be ordered from the following address:

Henkel Loctite France S.A.
10, avenue Eugène Gazeau
BP 40090
F-60304 Senlis Cedex, FRANCE

Application method for Loctite products

1. Remove all traces of previous sealants and corrosion
- mechanically: wire brush or emery cloth
- chemically: "DECAPLOC 88"

Leave the product to take effect and then wipe clean.

2. Degrease the components with dry solvent
- preferably, use "Super Solvant Sec LOCTITE 706".

3. Allow the solvents to evaporate

4. Apply the recommended type of LOCTITE product to the parts:
- for blind tapped holes, apply a quantity of the product to the last threads at the bottom of the hole.
- for cylindrical fittings, apply the product on the two mating faces using a clean brush.
- for mating faces, apply a bead to one of the two faces, circling the holes, and then tighten as quickly as possible.

Note:

a) Do not use too much of the compound in order to avoid locking adjacent parts.

b) Do not attempt to retighten after 5 minutes of curing, in order to avoid breaking the film of compound.

c) If the ambient temperature is less than +10°C, and to ensure quicker setting of Loctite compounds, (except SILICOMET), use LOCTITE T 747 activator on at least one of the two parts. Excess sealant outside the joint will not harden (anaerobic curing of the compound – i.e. curing takes place only in absence of oxygen).

Grease

When grease is used in components which are in contact with transmission oil, use grease which is miscible with oil to avoid clogging the hydraulic filters.

Use "Amber Technical" grease supplied by: WITCO company, 76320 Saint-Pierre des Elfes, France.

03 - Engine

CONTENTS

03A01 - Perkins engine - General

CONTENTS

A . Introduction

This section only provides general information about Perkins engines used on this tractor series.

B . Specifications and standards concerning fuel, oil and coolant

The engines fitted on this tractor series comply with standards concerning emissions imposed by the authorities (EU97/68/EC Stage 2 and EPA 40 CFR 89 Tier 2).
The quality of fluids used in these engines as well as the servicing schedule must be respected in order to keep pollution emission levels low and to maintain the tractor's good performance during it's whole life.

Fuel quality:

The fuel must comply with standard DIN EN 590 and with the following specifications:

Density (at 15°C): 0.82 to 0.84 Kg/dm3

Viscosity (at 40°C): 2 to 4.5 mm2/s

Cetane index: min. 51

Sulphur content: max. 0.005 p-%

Water content: max. 200 mg/kg

Oil quality:

The oil used must comply with standard API CH-4.

Coolant quality:

The coolant used must comply with standard ASTM D 3306. It must be composed of pure water and ethylene/propylene glycol antifreeze agent in the following proportions:

40 - 60% water

40 - 60% antifreeze agent

The ideal ration is 50% water to 50% antifreeze agent.

C . Main characteristics

Model	**5425**
Engine type	1104C-44
Perkins engine list N° (Standard / Steep Nose)	RE 37873 / RE 37917
Number of cylinders	4
Bore	105
Stroke	127
Capacity	4,4
Compression ratio	19,3/1
Compression pressure (kPa)	2000 / 3500
Allowable compression deviation between cylinders (kPa)	350
Output at 2200 rpm (kw) ISO	73 (54)
Maximum torque (Nm)	297
at speed (rpm)	1400
Idle speed	950
Nominal speed	2200
Maximum speed at no load	2354
Injection pump	
Trademark and type	Bosch VE10
Rotation	Clockwise
Static timing angle (degrees)	4°
Engine position	TDC
Engine check angle (degrees)	pin
Pump check angle (degrees)	pin
Injection order	1.3.4.2
Injectors	
Trademark	Delphi
New and servicing setting (bar)	294
Suction system	Ambient air
Valve spring	simple
Valve seat insert (Inlet / Exhaust)	yes
Valve angle	0,30° / 0,30°
Inlet / Exhaust valve tip clearance (mm)	0,20 / 0,45
Oil cooler	yes
Number of temperature switches	1
Opening temperature (start/full)	79°C / 93°C
Piston cooling nozzle	yes
Oil filter	1
Fuel filter	1

Model	5435
Engine type	1104C-44
Perkins engine list N° (Standard / Steep Nose)	RE 37831 / RE 37919
Number of cylinders	4
Bore	105
Stroke	127
Capacity	4,4
Compression ratio	19,3/1
Compression pressure (kPa)	2000 / 3500
Allowable compression deviation between cylinders (kPa)	350
Output at 2200 rpm (kw) ISO	81 (60)
Maximum torque (Nm)	297
at speed (rpm)	1400
Idle speed	950
Nominal speed	2200
Maximum speed at no load	2354
Injection pump	
Trademark and type	Bosch VE10
Rotation	Clockwise
Static timing angle (degrees)	4°
Engine position	TDC
Engine check angle (degrees)	pin
Pump check angle (degrees)	pin
Injection order	1.3.4.2
Injectors	
Trademark	Delphi
New and servicing setting (bar)	294
Suction system	Ambient air
Valve spring	simple
Valve seat insert (Inlet / Exhaust)	yes
Valve angle	0,30° / 0,30°
Inlet / Exhaust valve tip clearance (mm)	0,20 / 0,45
Oil cooler	yes
Number of temperature switches	1
Opening temperature (start/full)	79°C / 93°C
Piston cooling nozzle	yes
Oil filter	1
Fuel filter	1

Perkins engine - General

Model	**5445**
Engine type	1104C-44T
Perkins engine list N° (Standard / Steep Nose)	RG 37832 / RG 37915
Number of cylinders	4
Bore	105
Stroke	127
Capacity	4,4
Compression ratio	18,2/1
Compression pressure (kPa)	2000 / 3500
Allowable compression deviation between cylinders (kPa)	350
Output at 2200 rpm (kw) ISO	90 (67)
Maximum torque (Nm)	380
at speed (rpm)	1400
Idle speed	950
Nominal speed	2200
Maximum speed at no load	2354
Injection pump	
Trademark and type	Lucas DP 210
Rotation	Clockwise
Static timing angle (degrees)	4°
Engine position	TDC
Engine check angle (degrees)	pin
Pump check angle (degrees)	pin
Injection order	1.3.4.2
Injectors	
Trademark	Delphi
New and servicing setting (bar)	294
Suction system	Turbo + Waste Gate
Type	Garrett GT25
Valve spring	simple
Valve seat insert (Inlet / Exhaust)	yes
Valve angle	0,30° / 0,30°
Inlet / Exhaust valve tip clearance (mm)	0,20 / 0,45
Oil cooler	yes
Number of temperature switches	1
Opening temperature (start/full)	79°C / 93°C
Piston cooling nozzle	yes
Oil filter	1
Fuel filter	1

Model	5455
Engine type	1104C-44T
Perkins engine list N° (Standard / Steep Nose)	RG 37826 / RG 37916
Number of cylinders	4
Bore	105
Stroke	127
Capacity	4,4
Compression ratio	18,2/1
Compression pressure (kPa)	2000 / 3500
Allowable compression deviation between cylinders (kPa)	350
Output at 2200 rpm (kw) ISO	100 (74,5)
Maximum torque (Nm)	415
at speed (rpm)	1400
Idle speed	950
Nominal speed	2200
Maximum speed at no load	2354
Injection pump	
Trademark and type	Lucas DP 210
Rotation	Clockwise
Static timing angle (degrees)	4°
Engine position	TDC
Engine check angle (degrees)	pin
Pump check angle (degrees)	pin
Injection order	1.3.4.2
Injectors	
Trademark	Delphi
New and servicing setting (bar)	294
Suction system	Turbo + Waste Gate
Type	Garrett GT25
Valve spring	simple
Valve seat insert (Inlet / Exhaust)	yes
Valve angle	0,30° / 0,30°
Inlet / Exhaust valve tip clearance (mm)	0,20 / 0,45
Oil cooler	yes
Number of temperature switches	1
Opening temperature (start/full)	79°C / 93°C
Piston cooling nozzle	yes
Oil filter	1
Fuel filter	1

Model	**5460**
Engine type	1104C-44TA
Perkins engine list number	RJ
Number of cylinders	4
Bore	105
Stroke	127
Capacity	4,4
Compression ratio	18,2/1
Compression pressure (kPa)	2000 / 3500
Allowable compression deviation between cylinders (kPa)	350
Output at 2200 rpm (kw) ISO	112 (83,5)
Maximum torque (Nm)	471
at speed (rpm)	1400
Idle speed	950
Nominal speed	2200
Maximum speed at no load	2354
Injection pump	
Trademark and type	Lucas DP 210
Rotation	Clockwise
Static timing angle (degrees)	4°
Engine position	TDC
Engine check angle (degrees)	pin
Pump check angle (degrees)	pin
Injection order	1.3.4.2
Injectors	
Trademark	Delphi
New and servicing setting (bar)	294
Suction system	Turbo + Waste Gate + Air/air intercooler
Type	Garrett GT25
Valve spring	simple
Valve seat insert (Inlet / Exhaust)	yes
Valve angle	0,30° / 0,30°
Inlet / Exhaust valve tip clearance (mm)	0,20 / 0,45
Oil cooler	yes
Number of temperature switches	1
Opening temperature (start/full)	79°C / 93°C
Piston cooling nozzle	yes
Oil filter	1
Fuel filter	1

Model	5465
Engine type	1106C-E66TA
Perkins engine list number	VK 31483 (until 21/09/03) VK 31486 (from 22/09/03)
Number of cylinders	6
Bore	100
Stroke	127
Capacity	6
Compression ratio	17,25/1
Compression pressure (kPa)	2000 / 3500
Allowable compression deviation between cylinders (kPa)	350
Output at 2200 rpm (kw) ISO	117 (87)
Maximum torque (Nm)	500
at speed (rpm)	1400
Idle speed	950
Nominal speed	2200
Maximum speed at no load	2354
Injection pump	
Trademark and type	Bosch VP30
Rotation	Clockwise
Static timing angle (degrees)	4°
Engine position	TDC
Engine check angle (degrees)	pin
Pump check angle (degrees)	pin
Injection order	1, 5, 3, 6, 2, 4
Injectors	
Trademark	Bosch
New and servicing setting (bar)	294
Suction system	Turbo + Waste Gate + Air/air intercooler
Type	Garrett GT35
Valve spring	simple
Valve seat insert (Inlet / Exhaust)	yes
Valve angle	0,46° / 0,31°
Inlet / Exhaust valve tip clearance (mm)	0,20 / 0,45
Oil cooler	yes
Number of temperature switches	1
Opening temperature (start/full)	83°C / 93°C
Piston cooling nozzle	yes
Oil filter	1
Fuel filter	1 (+ 1 prefilter)

05 - Gearbox

CONTENTS

05A02 - General - GBA20 with Power Shuttle Operation

CONTENTS

A . General

The housing of the GBA20 gearbox with Power Shuttle consists of the following main components, in the order given:
- the Power Shuttle,
- the Speedshift input unit,
- the input gear train,
- the main gearbox,
- the creeper or super creeper gearbox (option).

Only the gearbox is described in this section.

A broad description is given of the major components because specific and detailed descriptions can be seen in the sections provided for each component.

Power Shuttle

The Power Shuttle consists of two oil bath multidisc clutches (one for forward operation and one for reverse operation). These clutches are located to the front of the input unit, in front of the Speedshift unit.

The Power Shuttle is controlled by two proportional solenoid valves operated by a lever located to the left under the steering wheel and managed by the tractor electronic system.

Speedshift input unit

The Speedshift input unit consists of a hydraulic mechanism and an epicyclic gear train. It is located to the rear of the Power Shuttle. It allows to obtain two gearbox input ratios via a hydraulic control unit and a solenoid valve.

Gearbox input gear train

The gearbox input gear train consists of two meshed pinions:
- a driving pinion located at the rear of the input unit,
- a driven pinion integral with the gearbox mainshaft.

The input gear train transmits drive from the engine to the gearbox.

Main gearbox

The main gearbox consists of four basic gears and two speed ranges (Hare and Tortoise), giving a total of eight gear ratios for each direction of travel.

This transmission covers all usage requirements.

Creeper unit (option)

The creeper unit is fitted to the gearbox output shaft.

It allows slow travel. It operates at a ratio of 4/1.

It is controlled mechanically and should only be engaged when the gearbox is in Tortoise range.

Super creeper unit (option)

The super creeper unit is also fitted to the gearbox output shaft.

It consists of two epicyclic gear trains which allow to obtain a reduction ration of 14/1 and therefore allows very slow travel.

Like the creeper unit, it is controlled mechanically.

Parts list (Fig. 1)

(3) Screw
(4) Ring
(5) Secondary shaft
(6) Output sun gear
(7) Input sun gear
(8) Pinion gear pins
(9) Planet carrier cover
(10) Friction washer
(12) Double pinion gears
(13) Unit
(14) Spacers
(15) Hub
(16) Needle bearings
(17) Friction washer
(18) Spring washer (Belleville)
(19) Ring restrictor
(20) Clutch plate
(21) Brake disc
(22) O'ring
(23) O'ring
(24) Screw
(25) Hydraulic cover
(26) O'ring
(27) Front cover
(28) Clutch piston
(29) O'ring
(30) Intermediate plates
(31) Rings
(32) Needle bearings
(33) Ring carrier
(34) Screw
(36) Primary shaft
(37) Circlip
(38) Tab washer
(39) Washer
(40) Ball
(41) Screw
(42) Discs
(43) Spring washers
(48) Brake piston
(50) Planet carrier assembly (30 kph version)
(51) Screw
(52) Cover
(53) Shim(s)
(54) Bearing cup
(56) Driving pinion
(57) Bearing cup
(58) Bearing cone

GBA20 Speedshift and input gear train with Power Shuttle

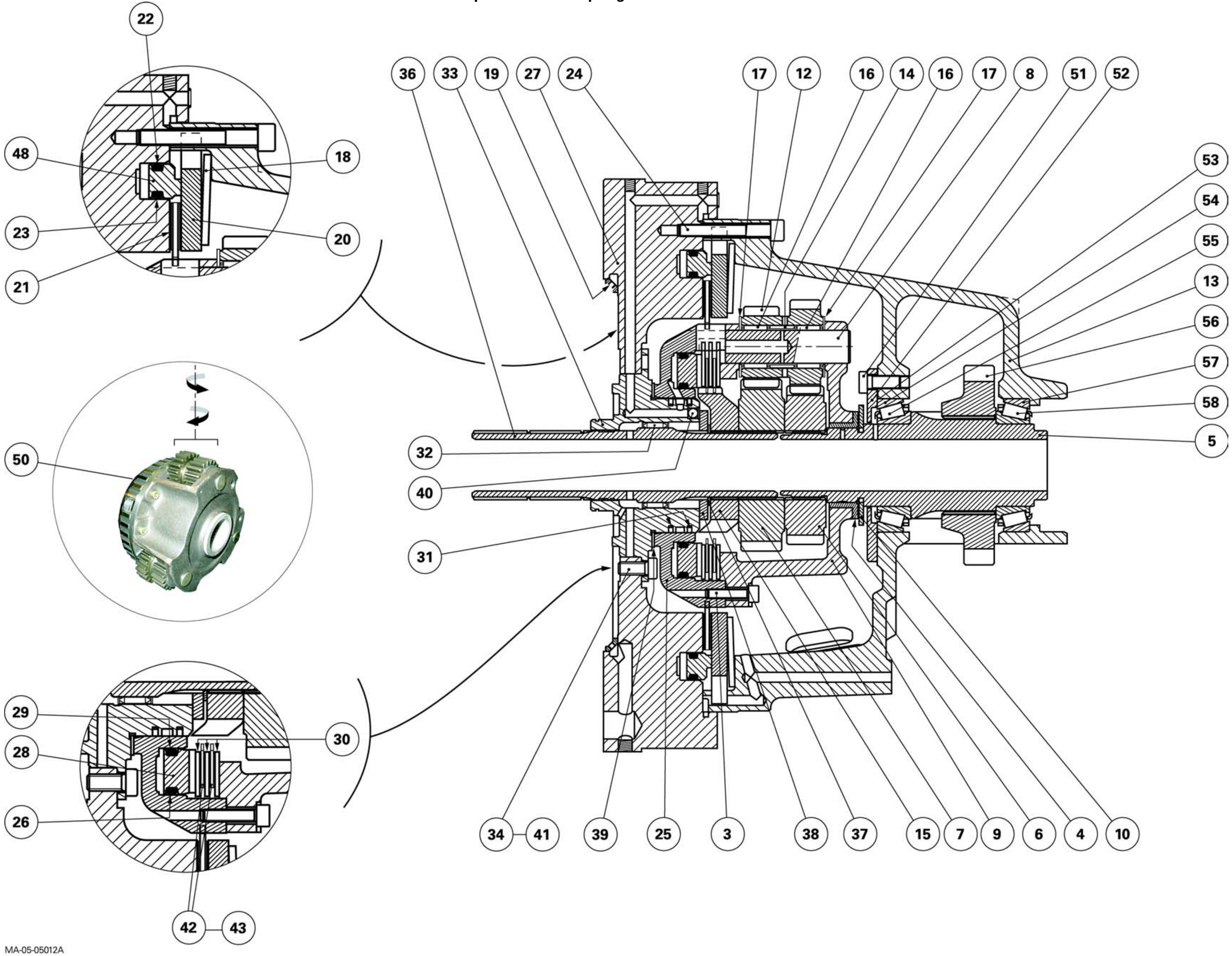


Fig. 1

Parts list Fig. 2

(1) Bearing cone
(2) Bearing cup
(3) Shim(s)
(6) Serrated washers
(7) 1st driving pinion
(8) Ring
(11) 1st - 2nd double cone synchroniser
(14) 2nd driving pinion
(16) Bearing cup
(17) Bearing cone
(18) 4th driving pinion
(23) 3rd - 4th double cone synchroniser
(24) Needle bearing
(26) Circlip
(27) Washer
(28) Needle bearings
(29) 3rd driving pinion (Hare)
(31) Hare / Tortoise double cone synchroniser
(32) Washer
(35) Ring
(36) Tortoise pinion
(37) Bearing cup
(38) Shim(s)
(39) Bearing cone
(40) Bearing cone
(41) Screw
(42) Shim(s)
(43) Laminated shim
(44) Output shaft
(45) Circlip
(46) Stop plate
(48) Bearing cup
(49) Circlip
(50) Deflector
(51) Shim(s)
(52) Bearing cup
(53) Bearing cone
(54) Layshaft
(55) 3rd driven pinion
(56) 4th driven pinion
(57) Spacer
(58) Shim(s)
(59) 2nd driven pinion
(60) 1st driven pinion
(61) Circlip
(62) Needle bearing
(63) Bearing cone
(64) Bearing cup
(65) Gearbox housing
(67) Drive pinion
(68) Nut
(69) Mainshaft
(70) Snap ring
(71) Lubricating pipe
(72) Spring
(77) Washer with flat sections
(78) Tab washer
(79) Needle bearing
(80) Spacer
(81) Needle bearing
(82) Spacer

GBA20 gearbox with Power Shuttle

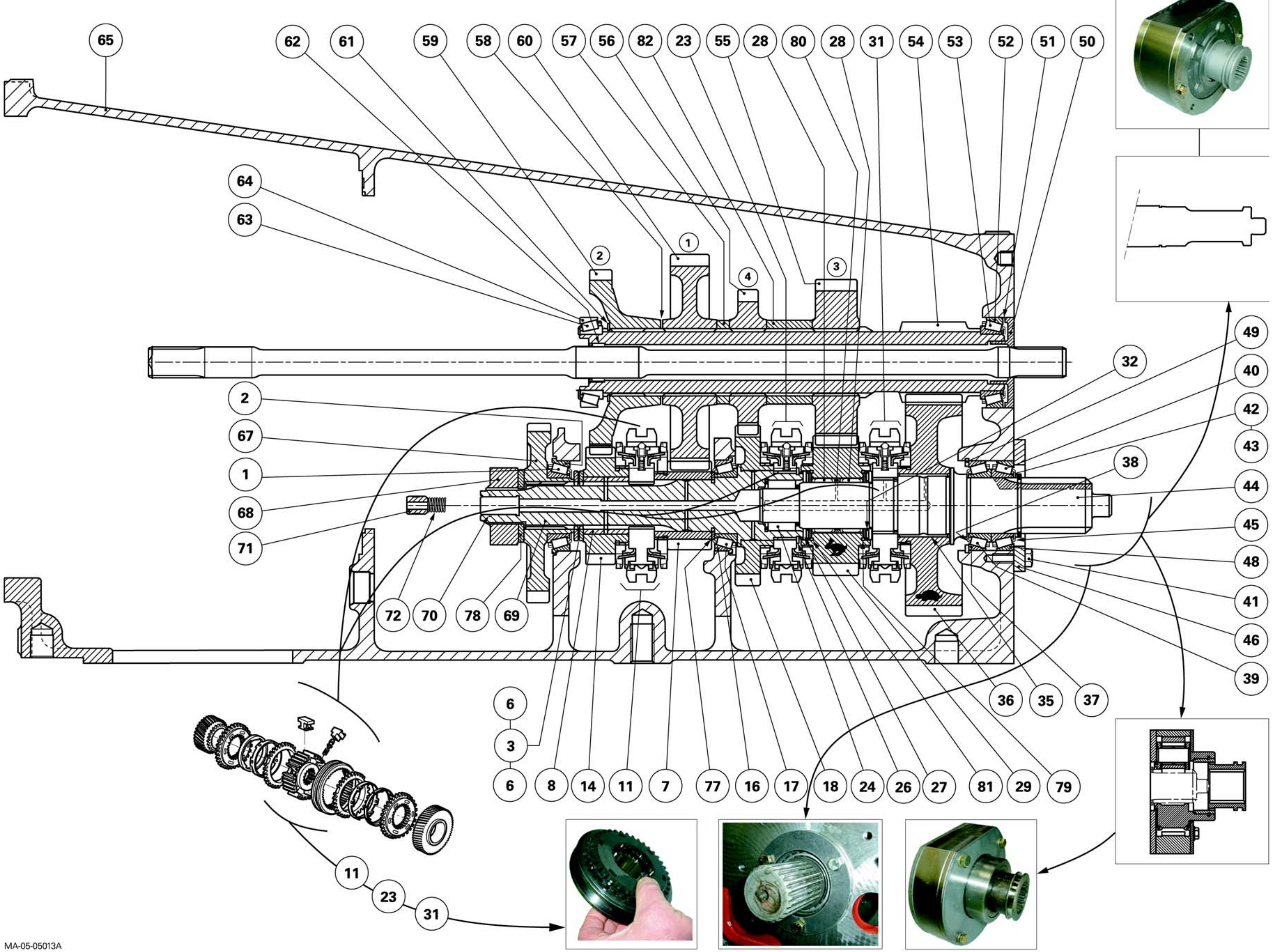


Fig. 2

B . Construction and description

Construction

The GBA20 gearbox with Power Shuttle consists of three gear trains fitted to:

- mainshaft,
- layshaft (or transmission shaft),
- output shaft.

It allows to obtain eight basic synchronised gear ratios:

- four gear ratios: 1st, 2nd, 3rd, 4th;
- two range ratios: Hare and Tortoise.

Its main characteristic is its assembly of three double cone synchronisers.

The main gearbox consists of four synchronised gears. An pinion idle-mounted to the output shaft and controlled by a synchroniser allows to double the four initial gears to obtain the eight basic gears.

The mainshaft and the layshaft are carried by tapered roller bearings.

The output shaft is fitted on two taper roller bearings and one needle bearing.

The mainshaft bearing cups are fitted up against the housing.

All pinions have helical teeth and are continuously meshed.

To ensure optimum gearbox reliability, the bearings are fitted:

- with preload for the mainshaft,
- with clearance for the layshaft.

The output shaft may be set either with a slight clearance or a slight preload.

Lubrication

The lubricating oil of the lower shaftline is supplied from the tractor hydraulic system via a 1.5 bar valve. It crosses a channel in the mainshaft and output shaft. Radial bores direct the oil to the pinions, bearings, rings and synchronisers.

The splines of the Hare / Tortoise synchro hub are lubricated via a radial bore drilled in the output shaft.

The oil flowing inside the layshaft lubricates the taper roller bearings and needle bearing (62). These bearings are fitted respectively at the ends of the shaft.

Description (Fig. 2)

Drive is transferred from the main unit by the driven pinion (67) which is permanently meshed with the driving pinion of the input gear train (Power Shuttle).

The driven pinion (67) is secured to the mainshaft (69) by splines.

The two synchroniser hubs (11) (23) are splined to the mainshaft (69).

The 2nd driving pinion (14) is idle-mounted on a ring (8).

The 1st (7) and 4th (18) driving pinions are idle-mounted directly on the shaft.

The third driving pinion (29) is fitted on needle bearings (28). It is also fitted with a needle thrust bearing on each of its faces to absorb any axial pressure.

The hub of the Hare / Tortoise synchroniser (31) is secured to the output shaft (44).

The driven pinions (55) (56) (59) (60) drive the layshaft (54) by means of splines. The rear teeth of this shaft are constantly meshed with the Tortoise pinion (36) idle-mounted on the output shaft.

C . Operation

NOTE : On GBA20 gearboxes with Power Shuttle, the gear synchronisers (1st - 2nd and 3rd - 4th) and the Hare / Tortoise synchroniser are double cone type.

The double cone synchroniser has the following advantages: increased reliability and greater resistance to transmission effort.

Synchronisers (double cone)

Parts list (Fig. 3)

(1) Sliding coupler
(2) Cone (brake)
(3) Coupling flange
(4) Ball
(5) Pressure element
(6) Spring
(7) Ring
(8) Cone (brake)

Locked position (Fig. 3)

When the sliding coupler (1) moves towards the pinion to be locked, it is pressed against the ring (7) by the balls (4) and pressure elements (5).

The ring (7) transmits pressure received to the cones (2) and (8) to set a synchronisation speed.

When the synchronisation is set, the sliding coupler (1) can mesh and lock noiselessly with the teeth of the coupling flange (3).

Neutral position (Fig. 3)

Sliding coupler (1) is in the middle position. The balls (4) are pushed into the V groove of the sliding coupler by pressure springs (6). The pinions can turn freely on the shaft. In this neutral position, the sliding coupler is locked by three balls held in place by the pressure springs.

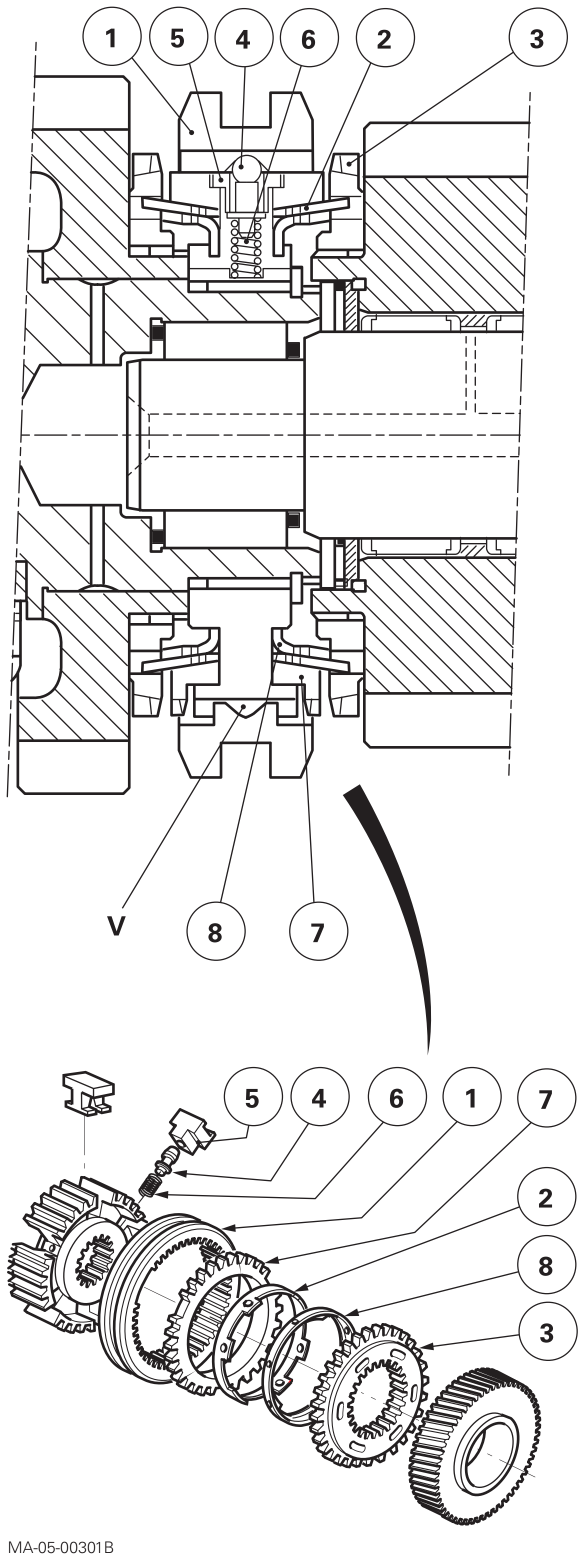


Fig. 3

Reconditioning

If the synchronisers (11), (23) et (31) are disassembled, check the wear to the cones (2) and (8) in the following manner:

1. Stack the coupling flange (3), cones (2) and (8) and ring (7).
2. Correctly position the ring (7) on the cones (2) et (8), revolving them alternately each several turns and applying pressure manually.
3. Using a set of laminated shims, measure dimension X (Fig. 4) at three equidistant points.

   Calculate the average of the three values and proceed as described below, depending on the result obtained:

   On a new synchroniser, dimension X must be **1.6 mm minimum**.

   After operation, if X is **less than or equal to 0.60 - 0.80 mm**:

   - replace the cones (2) and (8),
   - check the measurement of X again, using the same process.

     If dimension X remains incorrect, also replace ring (7) or, if necessary, the complete synchroniser.

Low range (Tortoise)

Gear engagement is obtained by moving one of the synchroniser sliding couplers (11) or (23) to join, in rotation, the mainshaft (69) with one of the idle-mounted pinions (1st, 2nd, 3rd, 4th). No matter what gear is selected, the drive is transmitted to the layshaft (54). The output shaft (44) is driven by the teeth machined on the layshaft, which is constantly meshed to the idle-mounted pinion (36).

The low range (Tortoise) is obtained by moving the synchroniser sliding coupler (31) backwards.

High range (Hare)

The high range is obtained by moving the synchroniser sliding coupler (31) forwards, meshing the driving pinion (29) and the output shaft.

Consequently, in 3rd gear Hare, the layshaft (54) is inoperative. The other gears are obtained by moving the synchroniser sliding couplers (11) or (23) as with the Tortoise range. Drive is transmitted to the output shaft (44) by driven pinions (29) and (55).

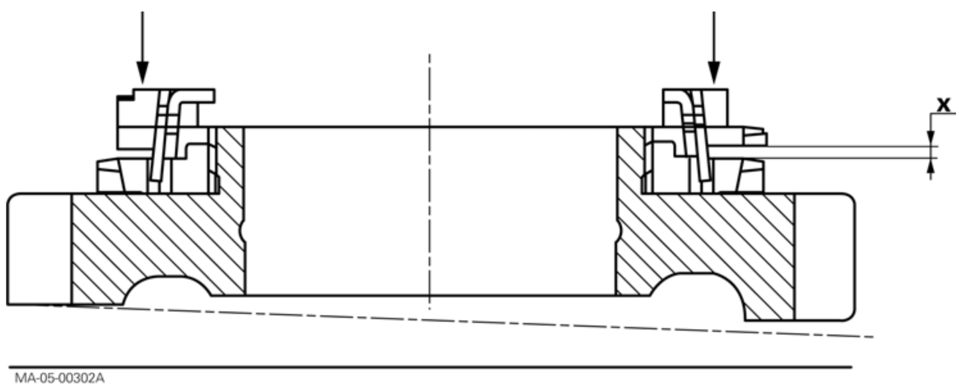


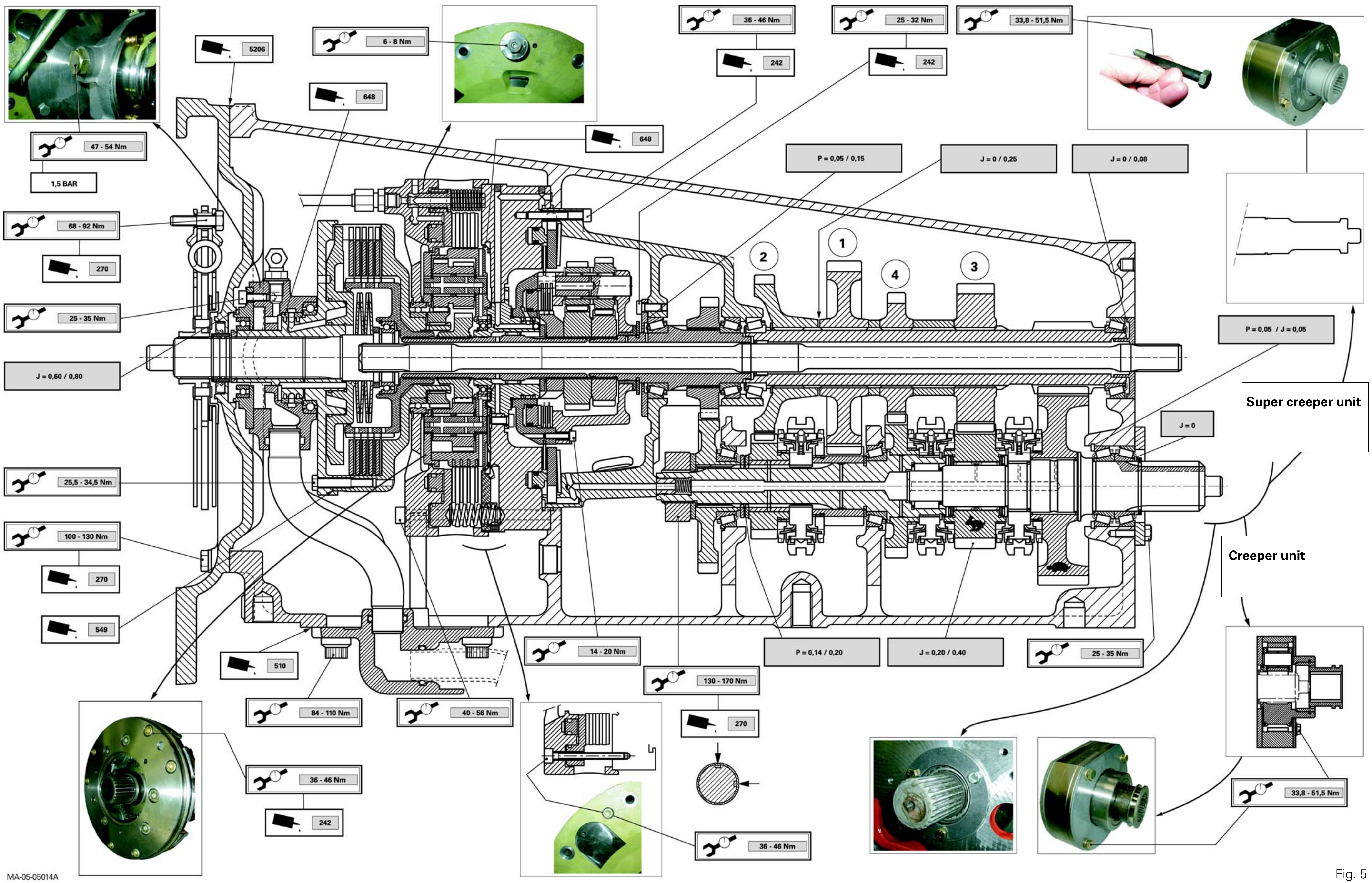
Fig. 4

D . Specifications of the GBA20 transmission assembly with Power Shuttle

See Fig. 5.

Legend

J	Clearance
P	Preload



5206
6 - 8 Nm
648
648
36 - 46 Nm
242
25 - 32 Nm
242
33,8 - 51,5 Nm
47 - 54 Nm
1,5 BAR
68 - 92 Nm
270
25 - 35 Nm
J = 0,60 / 0,80
P = 0,05 / 0,15
J = 0 / 0,25
J = 0 / 0,08
2
1
4
3
P = 0,05 / J = 0,05
Super creeper unit
J = 0
25,5 - 34,5 Nm
100 - 130 Nm
270
549
Creeper unit
510
14 - 20 Nm
P = 0,14 / 0,20
J = 0,20 / 0,40
25 - 35 Nm
130 - 170 Nm
84 - 110 Nm
40 - 56 Nm
270
36 - 46 Nm
242
36 - 46 Nm
33,8 - 51,5 Nm
MA-05-05014A

Fig. 5

05B01 - GBA20 input unit with mechanical reverse shuttle

CONTENTS

A . General

The GBA20 input unit with mechanical reverse shuttle (Fig. 1) consists of an interchangeable module.
It is located at the front of the main unit.

It is made of two separate parts: the mechanical reverse shuttle and the Speedshift (see chapter 5).

The input unit receives drive from the engine clutch and transmits it to the transmission via a driving pinion (forward operation) or a transfer pinion (reverse operation).
These pinions are located in the rear compartment of the input unit.

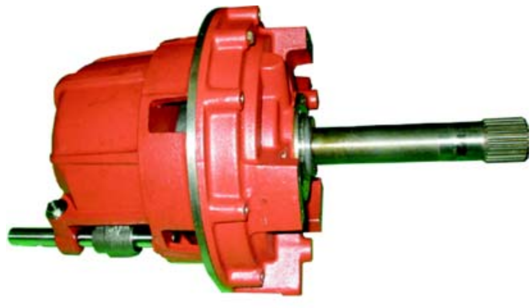

MA-05-05015A

Fig. 1

B . Removing and refitting the input unit

Preliminary operations

1. Disassemble the tractor between the engine and the gearbox (see chapter 2).
2. Mark the PTO shaft position and remove it from the gearbox.
3. Separate the hydraulic unit (1) from the input unit spacer (Fig. 2 and chapter 4)
4. Drain the transmission.
5. Remove the selector cover (see chapter 5).
6. Remove the selector (2) from the mechanical reverse shuttle (Fig. 2).
7. Attach tool ref. 3376883M1 to the front cover of the input unit (Fig. 3).

   IMPORTANT: *To correctly attach the tool to the front cover of the input unit, use locally obtained screws (1) (Fig. 3) long enough and of suitable strength.*

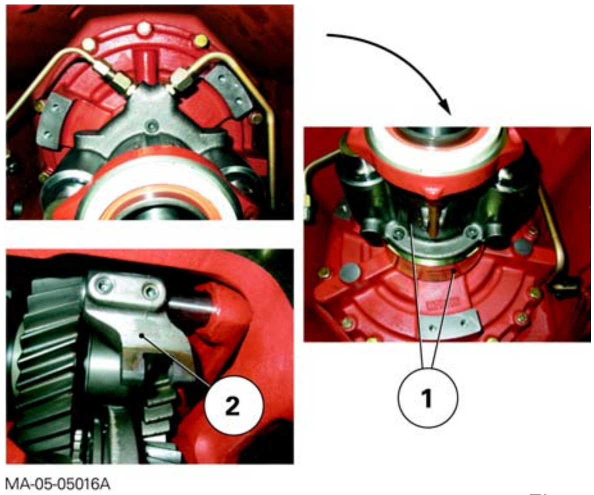


Fig. 2

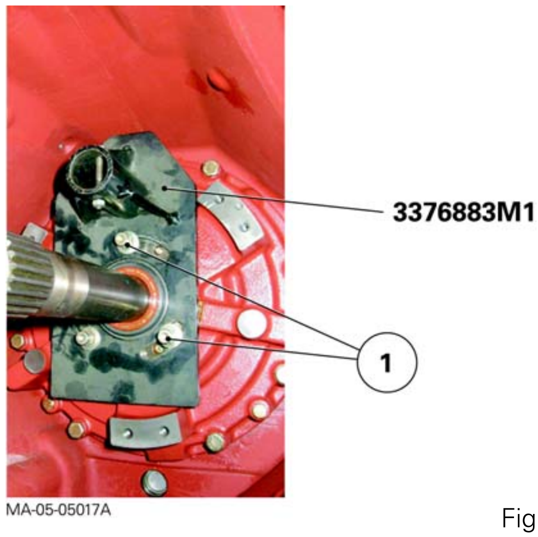


Fig. 3

Removal

8. Take out the M10 screws (1) (Fig. 4).

__IMPORTANT:__ Do not take out the M8 screws (2) (Fig. 4) to avoid removing certain parts from the input unit.

9. Remove the gearbox input unit using tool ref. 3376883M1 (Fig. 4) and the handling bar (see § C).

Caution: Use the handling bar to prevent the input unit from tipping over during removal.

10. After removing the input unit, separate the tool from the front cover if necessary.

11. Discard the O'rings (2) and (3) (Fig. 5).

12. Recover the cup (64) (Fig. 6) and locating pin (4) (Fig. 5).

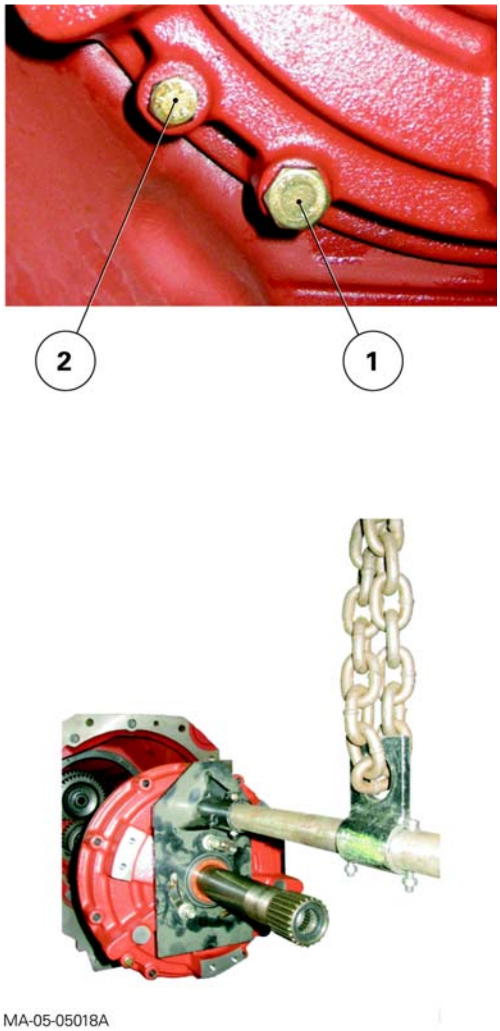


Fig. 4

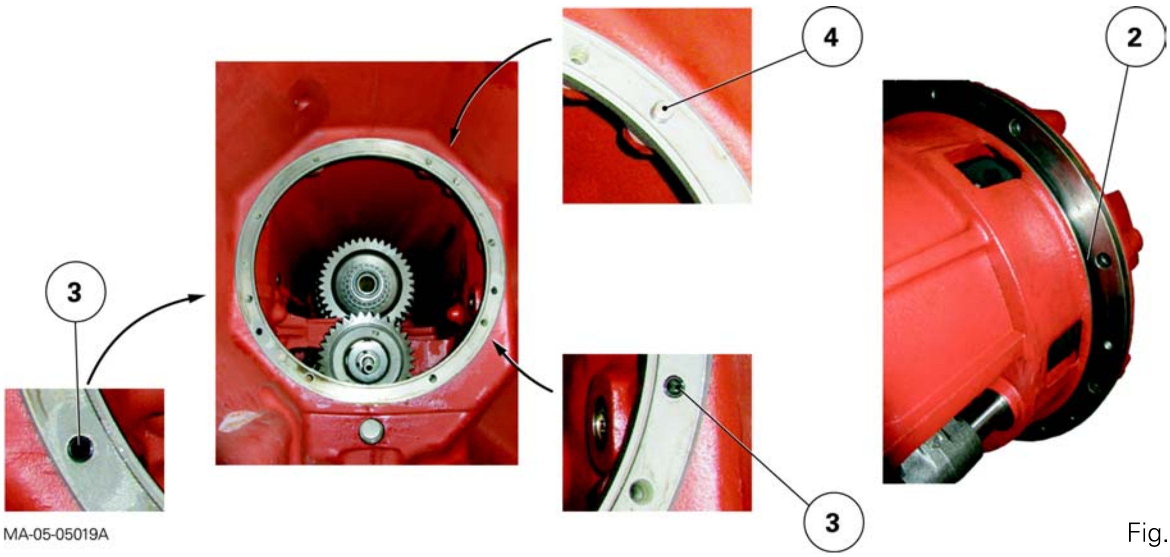


Fig. 5

Refitting the input unit

13. Clean the mating faces of the gearbox and input unit.

14. Check for the presence of the cup (64) (Fig. 6).

15. Fit the gearbox and input unit with new O'rings (2) and (3).

Place the locating pin (4) (Fig. 5).

16. Screw two diametrically opposed guide studs "G" into the gearbox (Fig. 7).

NOTE: *The guide studs "G" assist insertion of the unit into the gearbox. Their use is advisable but not mandatory.*

17. With the help of an operator, insert the input unit into the gearbox and align the gearbox layshaft with the input unit: slightly raise the layshaft with the selector cover to ensure alignement (Fig. 8).

18. Turn the input shaft of the unit.

19. Engage the unit in the locating pin (4).

Place the input unit on the gearbox mating face.

20. Fit and tighten the M10 screws to a torque of 50 - 70 Nm.

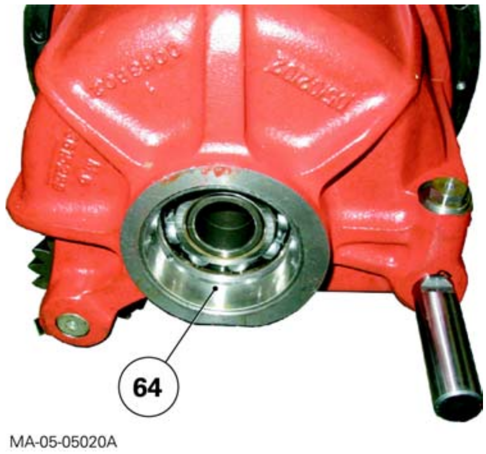


Fig. 6

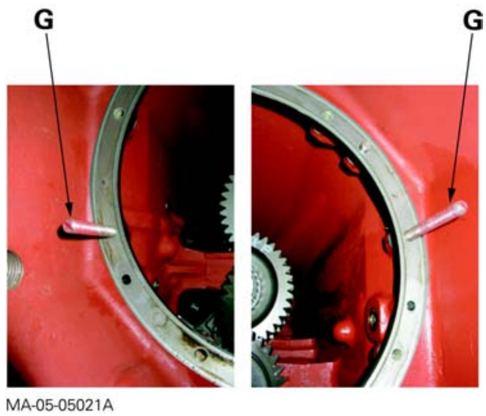


Fig. 7

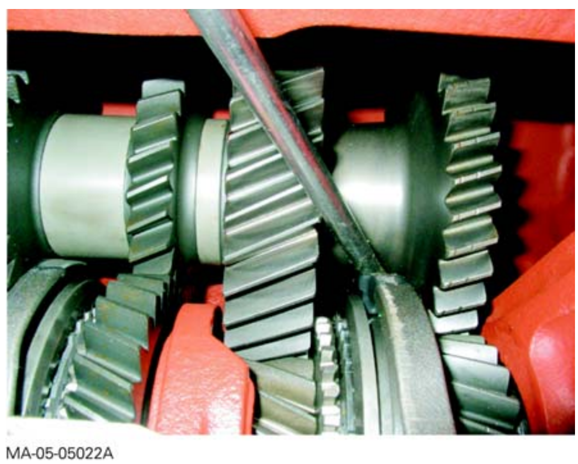


Fig. 8

Final operations

21. After refitting the input unit, remove the tool ref. 3376883M1 and the handling bar from the front cover.

22. Assemble the spacer and hydraulic unit (1) of the engine clutch on the front cover of the input unit (Fig. 9 and chapter 4).

23. Fit and adjust the selector (2) on the mechanical reverse shuttle (Fig. 2 and chapter 5).

24. Refit the selector cover (see chapter 5).

25. Refit the PTO shaft (Fig. 10 and chapter 2).

26. Assemble the tractor between the engine and the gearbox (see chapter 2).

27. Bleed the hydraulic unit of the engine clutch (see chapter 9).

28. Carry out a road test of the mechanical reverse shuttle and the Speedshift (low range and high range).

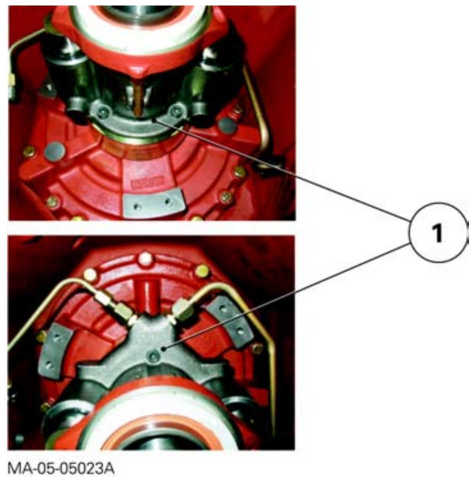


Fig. 9

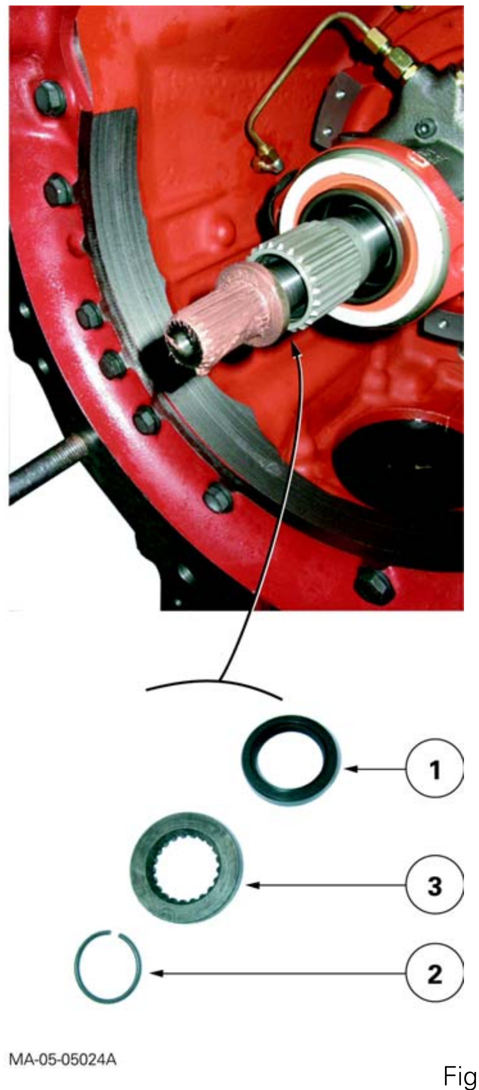


Fig. 10

C . Service tools

Tool available in the AGCO network

- **3376883M1:** Sling for input unit (Fig. 11)

Fig. 11

Locally made tool

- **Handling bar** (Fig. 12)

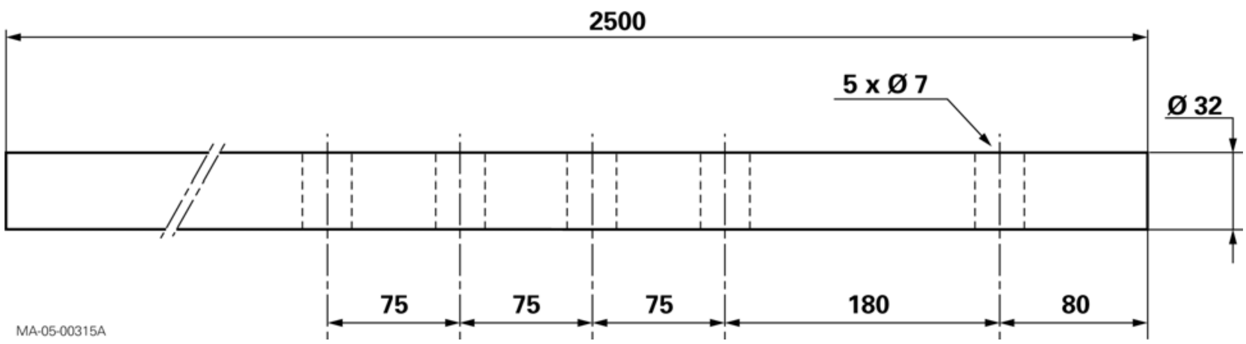


Fig. 12

05B02 - Input unit - GBA20 with Power Shuttle

CONTENTS

A . General

The input unit with Power Shuttle is in the form of an interchangeable module on which a Power Shuttle is assembled.
It is fitted at the gearbox input.

It is made of two separate parts:
- the Power Shuttle (see section 5) ;
- Speedshift.

The input unit is fed with movement from the Power Shuttle and transmits it to the transmission by means of a drive pinion located in the rear compartment of the unit.

Speedshift

This is an independent function allowing to obtain two gearbox input ratios.
It is located in front of the driving pinion of the gearbox input gear train.
It consists of a hydraulic mechanism and an epicyclic gear train.
For operation, see section 5.

B . Preliminary operations

SPECIAL POINT : *If the input unit is removed to replace the complete unit or only the cover (1) and the casing (2) (Fig. 1), it is necessary, during refitting, to reshim the layshaft of the gearbox (see section 5).*

1. Disassemble the tractor between the engine and the gearbox (see section 2).
2. Drain the gearbox and the rear axle.
3. Remove the spacer (4) (see section 3).

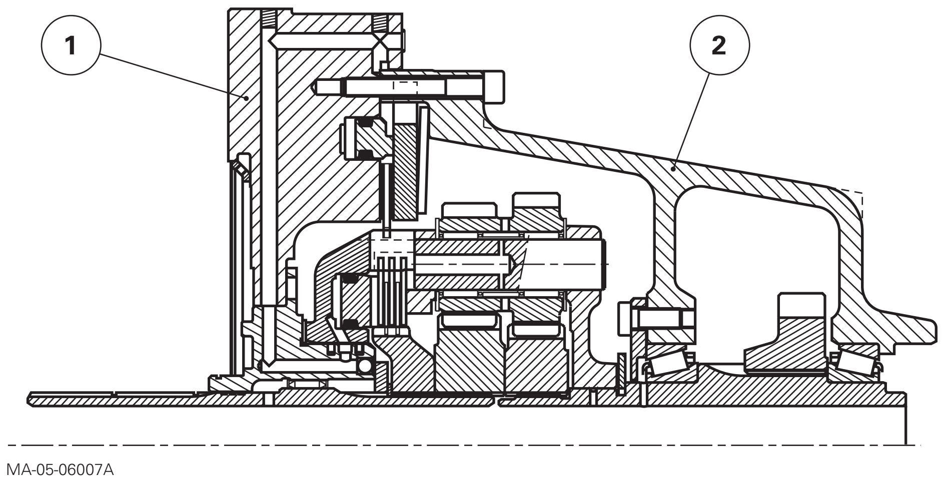


Fig. 1

C . Removal

4. Remove the forward clutch from the Power Shuttle (see section 5).

5. Take out the PTO shaft (1) from the gearbox (Fig. 4) and mark its position.

6. Remove union (91) (Fig. 2).

7. Extract the transfer pipe (88) (Fig. 2, pressure connector line, lubrication).

8. Disconnect and remove the progressivity sensor (1) located above the right-hand side of the selector cover (Fig. 3).

9. Sling the input unit using tool 3378225M11, a handling bar made locally (see § G) and a suitable lifting device as in Fig. 4.

***Note :** The sling hides two diametrically opposed screws (1) on the input unit (Fig. 5). Before fitting the tool on the unit, remove these screws.*

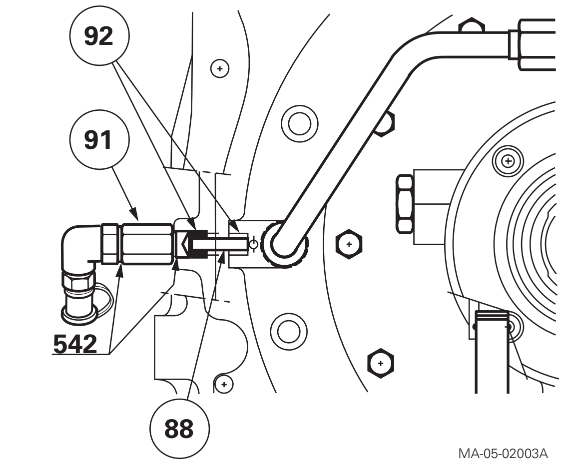


Fig. 2

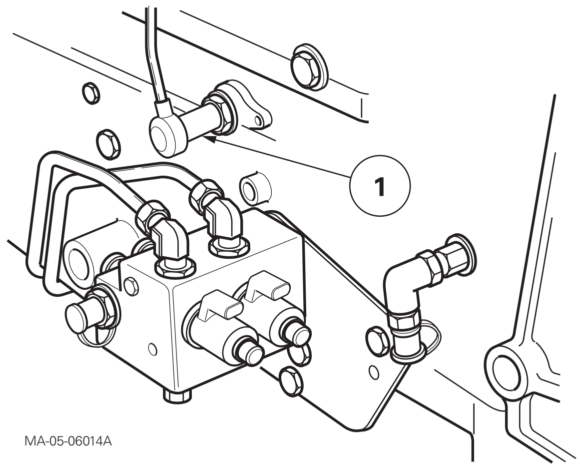


Fig. 3

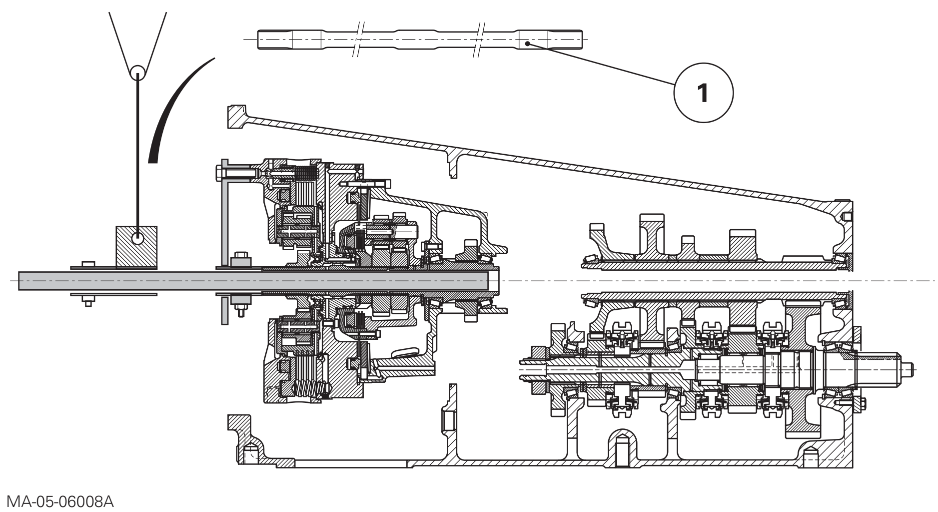


Fig. 4

10. Remove the remaining screws (1) securing the unit to the gearbox (Fig. 5) without touching screws (2) (8 mm Allen key) (Fig. 5).

11. With the help of an assistant, **carefully** pull the unit forward.

12. Pull out the unit from the gearbox and remove it.

WARNING: Use a handling bar to prevent the input unit from tipping over during removal.

13. Discard the O'rings (3) (Fig. 6).

14. Remove the tool and the handling bar.

15. Position the unit vertically.

16. Separate the Power Shuttle reverse clutch from the input box unit (see section 5).

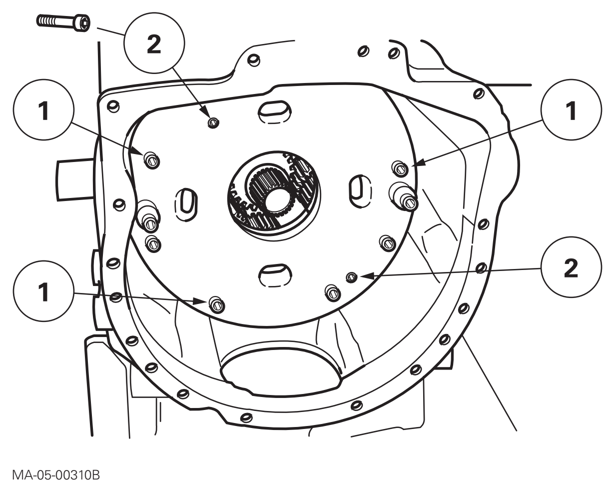


Fig. 5

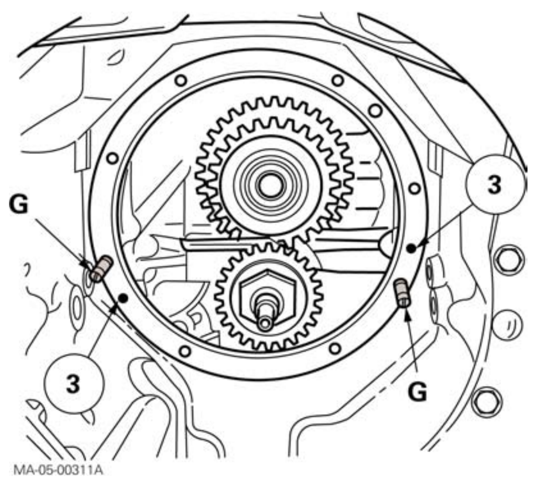


Fig. 6

D . Refitting

17. Install the reverse clutch previously removed (see section 5).

18. On the input unit, check that the cup (64) (Fig. 7) is fitted.

19. On the gearbox housing (Fig. 6) place:

- new O'rings (3),
- two guide studs "G" approximately 200 mm in length (optional).

Note: *On the Power Shuttle version, there is no locating pin between the gearbox housing and the input unit.*

20. Using the tools used for removal and with the help of an assistant, position the unit in the gearbox housing, taking the same safety steps as those used during removal.

21. Slide the unit on the guide studs (if mounted) until they are in contact with the housing.

If it is difficult to fit the input unit home, proceed as follows:

- Remove the clutch control unit and the selector cover.
- Check that the bearing cone of the gearbox layshaft engages correctly in the cup (64) (see section 5). If not, raise the shaft slightly.

22. Replace the O'rings (92) on the transfer pipe (88) (Fig. 2).

23. On the input unit, tighten screws (1) (Fig. 5) to a torque of 40 - 56 Nm.

24. Lightly smear the thread of the union (91) (Fig. 2) with Loctite 542 or equivalent. Refit the union to the gearbox housing.

25. Reinstall and adjust the progressivity sensor (see § E).

26. Put the PTO shaft in the gearbox, with the longest end "E" (Fig. 8) directed towards the forward clutch of the Power Shuttle.

27. Install forward clutch (see section 5).

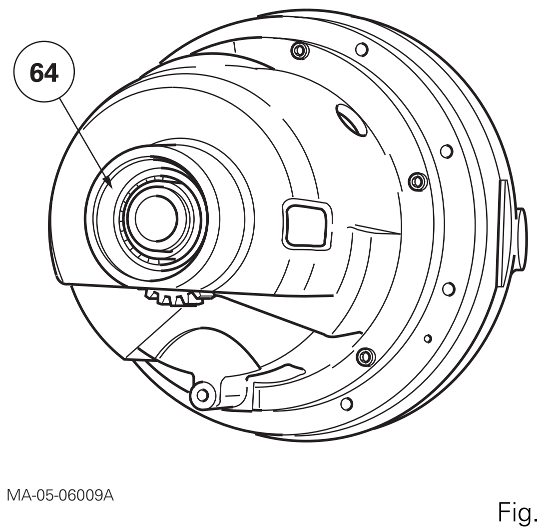


Fig. 7

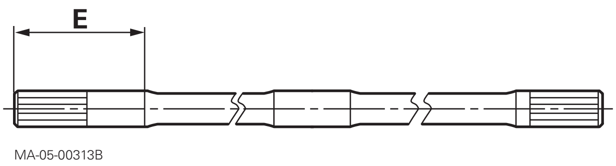


Fig. 8

E . Adjusting the progressivity sensor

28. Smear the sensor thread with Loctite 5922 or equivalent.

Install and adjust the sensor.

29. Screw the sensor (1) home (Fig. 9), without forcing it. Make sure that its end is in contact with the drive pinion (2) (see section 5).

Unscrew the sensor 1/2 to 3/4 of a turn.

Tighten the nut to a torque of 5 - 7 Nm.

For operation, see section 11 - Electronics.

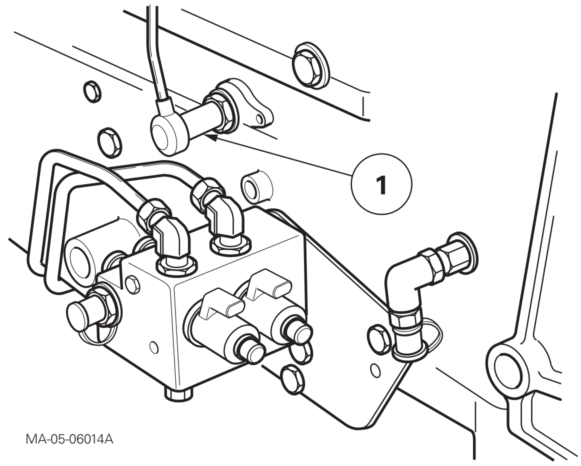


Fig. 9

F . Final operations

30. Refit the spacer (4) (see section 3).

31. If removed, install the selector cover (see section 5).

32. If removed, install the Power Shuttle clutch control unit. Refit the lubricating pipes. Reconnect the connectors (see section 9).

33. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

34. Assemble the tractor between the engine and the gearbox (see section 2).

35. Carry out a road test of the Power Shuttle and high and low Speedshift ranges.

36. Check tightness of mating faces of the selector cover (if necessary), the spacer (4) and the hydraulic unions.

G . Service tools

Tool available in the AGCO network

- **3378225M11**: Sling for Power Shuttle housing (Fig. 10)

Locally made tool

- **Handling bar** (Fig. 11)

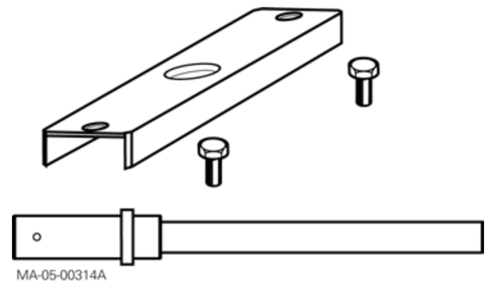


Fig. 10

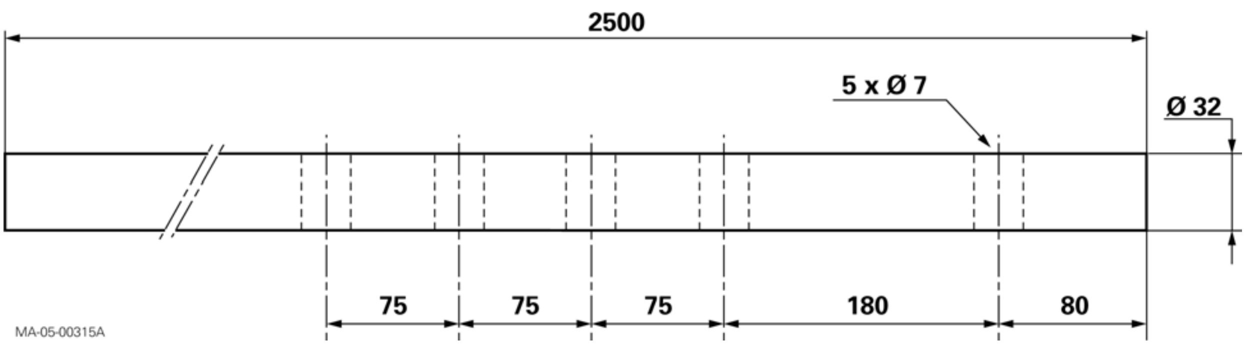


Fig. 11

05C01 - GBA20 mechanical reverse shuttle

CONTENTS

A . General

The mechanical reverse shuttle transmits drive from the Speedshift to the drive pinion (1) of the gearbox (Fig. 1).

The mechanical reverse shuttle assembly is located in the rear housing of the input unit, behind the Speed-shift.

It comprises (Fig. 2):
- two helical pinions (forward operation (5) and reverse operation (23)) fitted on the needle bearing (6) and (20);
- a double cone synchromesh (18) whose hub (2) is splined to the secondary shaft;
- a secondary shaft (19) fitted on two ball bearings and supported by the two bearings of the reverse shuttle unit;
- a selector rail / synchromesh control fork assembly;
- a double transfer pinion (15) constantly meshed with the reverse pinion (23) and the drive pinion (1) of the gearbox.

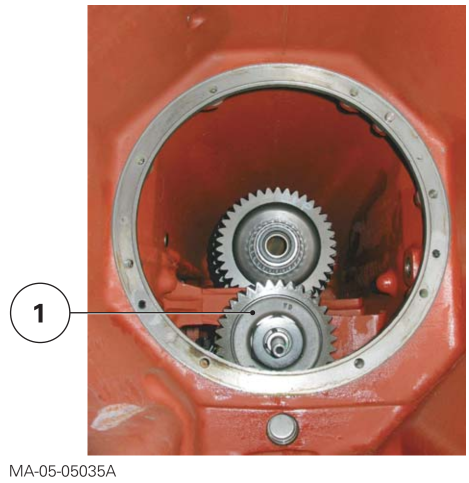


Fig. 1

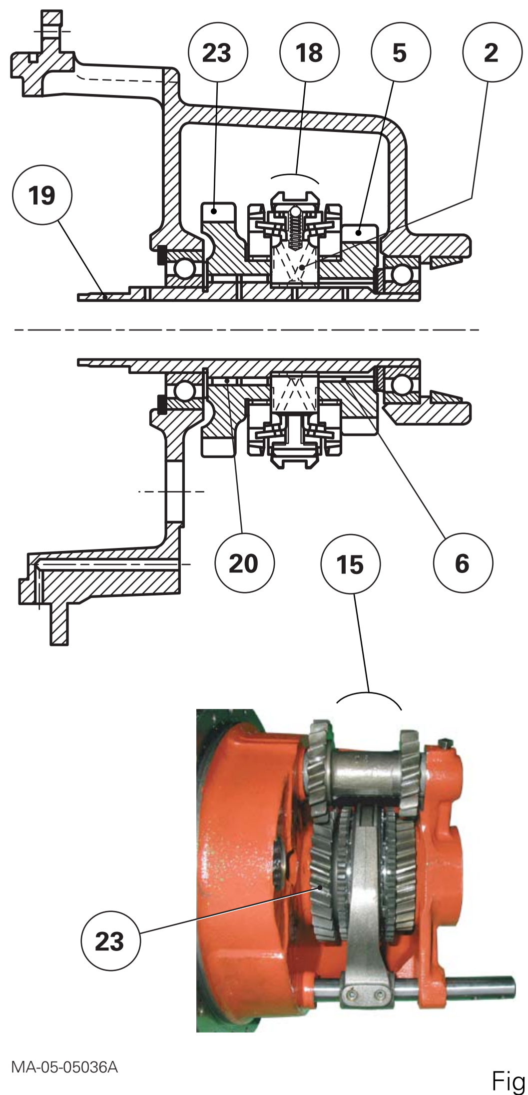


Fig. 2

Parts list (Fig. 3)

(1) Shim(s)
(2) Synchromesh hub
(3) Sliding coupler
(4) Cone (brake)
(5) Forward driving pinion
(6) Needle bearing
(7) Ring
(8) Friction washer
(9) Ball bearing
(10) Set screw
(11) Spacer
(12) Friction washers
(13) Reverse pinion shaft
(14) Needle bearings
(15) Reverse double pinion
(17) Locking device
(18) Synchromesh assembly
(19) Secondary shaft
(20) Needle bearing
(21) Rings
(22) Coupling flanges
(23) Reverse driving pinion
(24) Ball bearing
(25) Circlip
(26) Housing
(35) Friction washer
(39) Cones (brake)

Overall view

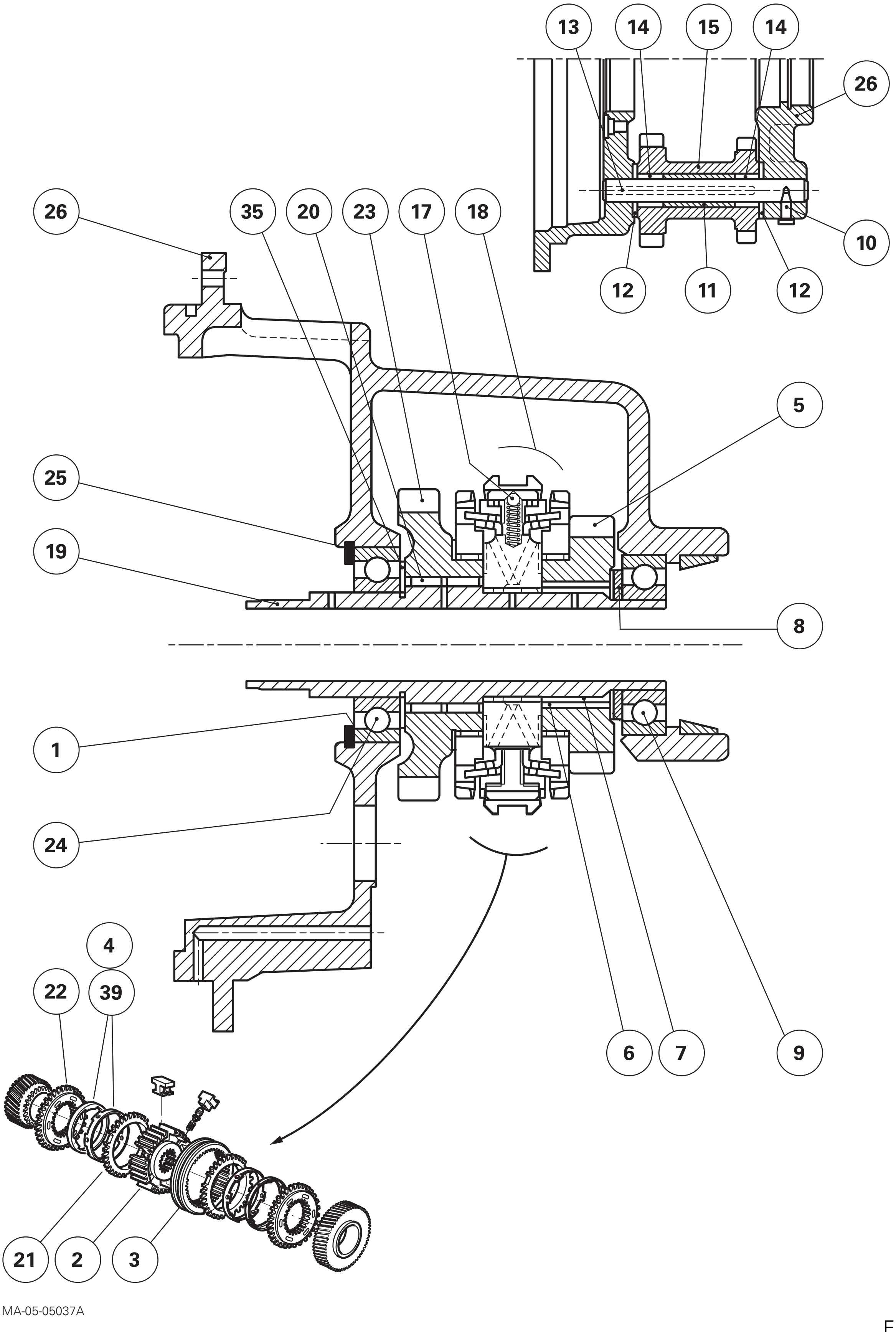


Fig. 3

Parts list (Fig. 4)

(1) Shim(s)
(2) Synchromesh hub
(3) Sliding coupler
(4) Cone (brake)
(5) Forward driving pinion
(6) Needle bearing
(7) Ring
(8) Friction washer
(9) Ball bearing
(10) Set screw
(11) Spacer
(12) Friction washers
(13) Reverse pinion shaft
(14) Needle bearings
(15) Reverse double pinion
(17) Locking device
(19) Secondary shaft
(20) Needle bearing
(21) Rings
(22) Coupling flanges
(23) Reverse driving pinion
(24) Ball bearing
(25) Circlip
(35) Friction washer
(39) Cones (brake)

Exploded view

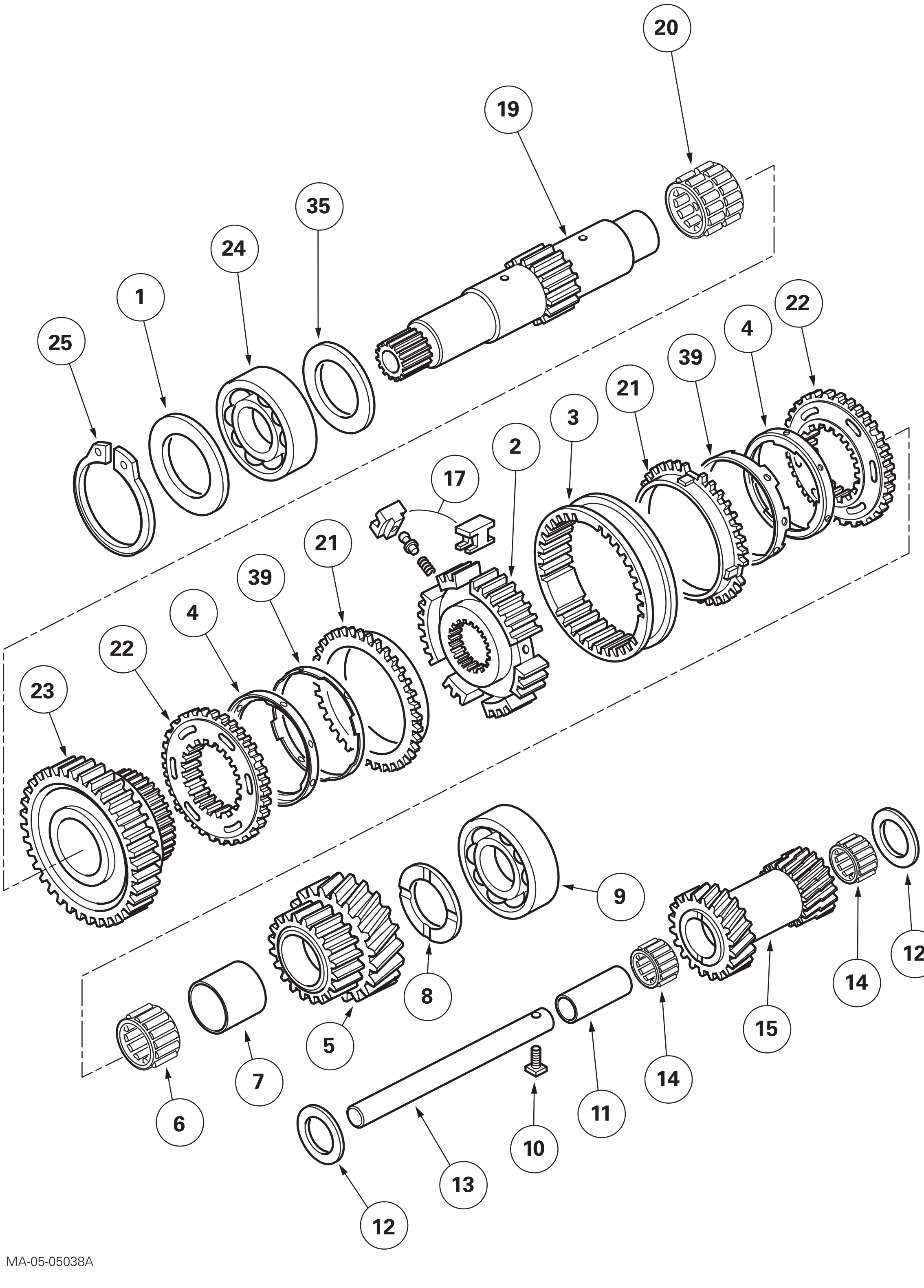


Fig. 4

B . Operation

Forward operation kinematics (Fig. 5)

The movement of the synchromesh slider (3) to the rear joins the pinion (5) with the shaft (19).

The pinion (1) is secured to the mainshaft (69) by splines.

The constant meshing of pinions (5) and (1) allows drive to be transmitted to the gearbox.

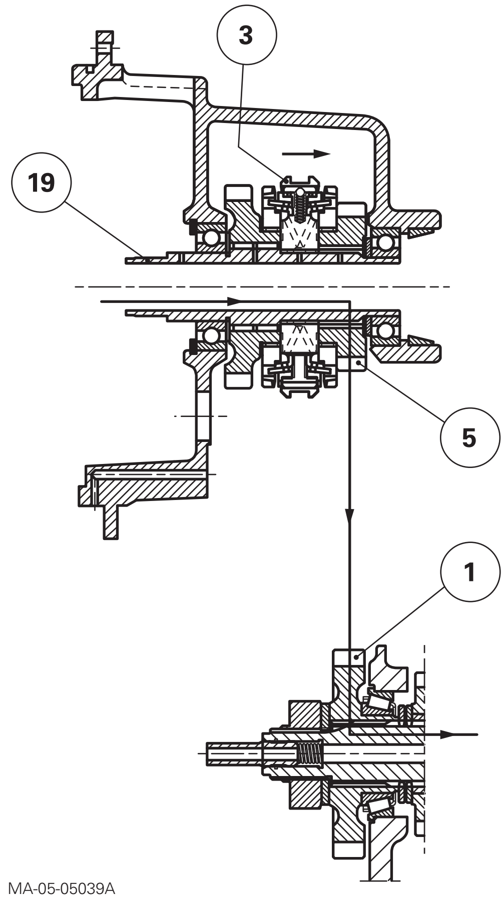


Fig. 5

Reverse operation kinematics (Fig. 6)

The movement of the synchromesh slider (3) to the front joins the pinion (23) firmly with the shaft (19). Drive is transmitted via the pinion (23), the teeth of the transfer pinion (15), and the pinion (1). Therefore, drive is transmitted to the mainshaft of the gearbox and reversed.

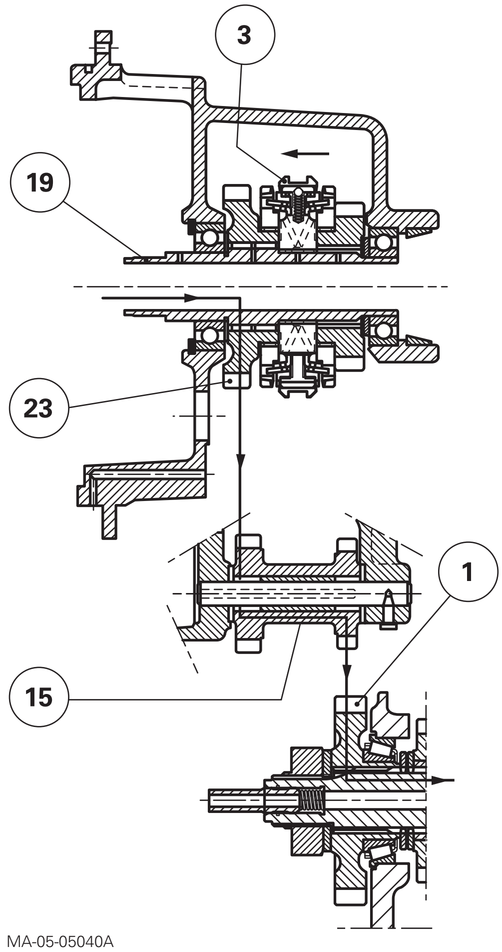


Fig. 6

C . Preliminary operations

IMPORTANT: *If the input unit is removed to replace the complete unit or only the housing (26) , it is necessary to shim the layshaft of the gearbox again after removing the input unit (see chapter 5).*

1. Disassemble the tractor between the engine and the gearbox (see chapter 2).
2. Drain the gearbox and the rear axle.
3. Remove the input unit (see chapter 5).
4. Disassemble the locking device, the selector rail and the shuttle fork (see chapter 5).
5. Disassemble the Speedshift unit (see chapter 5).

D . Disassembling and reassembling the reverse shuttle

Disassembling the transfer pinion (15) for reverse operation (Fig. 7)

6. Take out set screw (10).
7. Take out the shaft (13).
8. Remove the transfer pinion (15), washers (12), needle bearings (14) and spacer (11).

Disassembling the reverse shuttle (Fig. 8)

9. Take off circlip (25).
10. Remove the shim(s) (1).
11. Drive the secondary shaft out of the pinion / synchromesh assembly.
12. Take out the pinion / synchromesh assembly (18) from the housing. Remove the washer (8), marking its positioning.
13. Fit the pinion / synchromesh assembly on a work-bench.
14. Separate (Fig. 9):
- pinion (5);
- ring (7);
- needle bearing (6);
- cones (brake) (4) and (39);
- coupling flanges (22);
- pinion (23);
- needle bearing (20).

15. If required, extract the ball bearing (24) from the secondary shaft (19).
Remove the washer (35), marking its positioning.

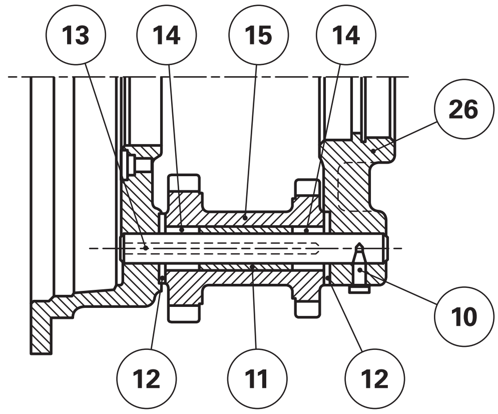


Fig. 7

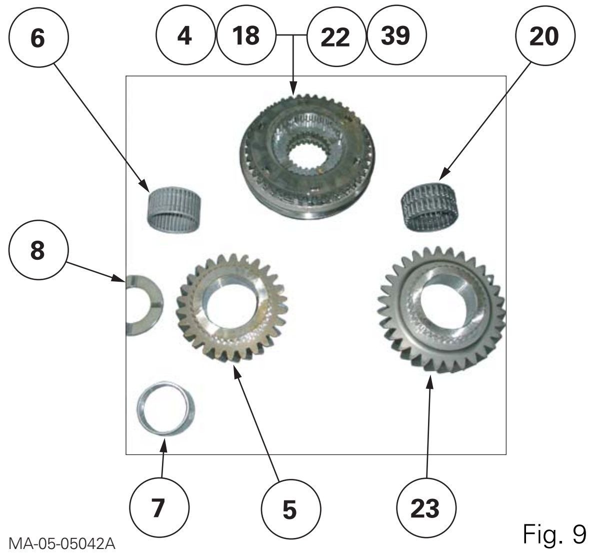


Fig. 9

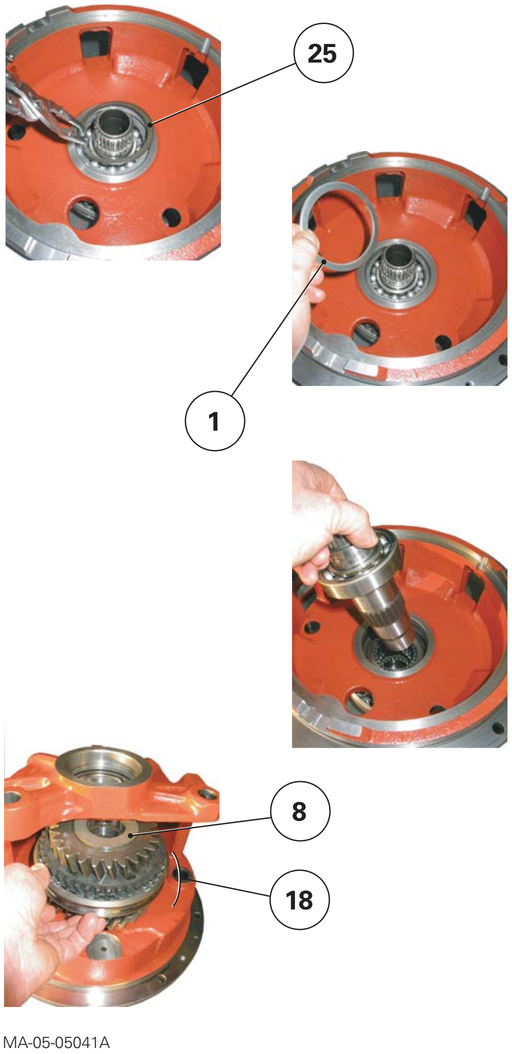


Fig. 8

Reassembling the reverse shuttle

16. Clean and check all components. Replace any defective parts.

17. Check that the ports and channels of the secondary shaft (19), shaft (13) and housing (26) are not blocked.

18. Lubricate the secondary shaft, the ring (7) and needle bearings (6) and (20).

19. If removed, place the washer (35) on the secondary shaft (19) as shown in Fig. 10.

Fit the ball bearing (24) home against the washer (35) (Fig. 10), using a press and a locally made sleeve (internal Ø = 47 mm; L = 60 mm).

Important: *The sleeve is used to push against the internal cage of the ball bearing.*

20. Assemble (Fig. 11):

- pinion (5);
- ring (7);
- needle bearing (6);
- cones (brake) (4) and (39);
- coupling flanges (22);
- pinion (23);
- needle bearing (20).

21. Refit the ball bearing (9) in the housing.

22. Refit the pinion (5) (23) / synchromesh (18) assembly and the washer (8) in the housing (Fig. 12).

Turn the lubricating grooves of the washer (8) towards the pinion (5) (Fig. 12).

23. Position the washer centrally (8).

24. Insert the secondary shaft (19) (Fig. 12) into the pinion / synchromesh (18) assembly through the bore in the front of the gearbox.

25. Turn the shaft from left to right and vice versa to partially engage the splines of the secondary shaft in those of the synchromesh.

26. With the help of an operator, install the fitted unit on a table press.

27. Position a locally made sleeve (internal Ø = 44 mm; L = 32 mm) under the internal ring of the ball bearing (9).

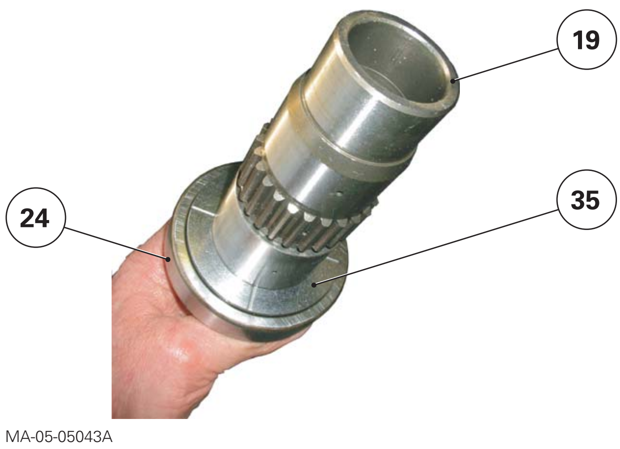


Fig. 10

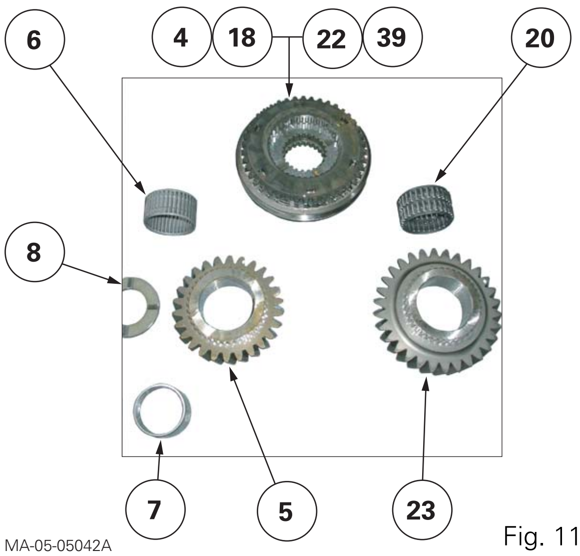


Fig. 11

28. Fit the sleeve used at operation 19 on the internal ring of the ball bearing (24).

29. Gradually fit home the secondary shaft (19) using a press until resistance is felt.

Simultaneously check that pinions rotate smoothly.

IMPORTANT: *It is recommended to use a press and sleeves to fit the secondary shaft without damaging it, and to avoid exposing the ball bearings to excessive force when fitting.*

30. Fit the shim(s) (1) removed during disassembly, and the circlip.

REMINDER: *If it is necessary to shim the secondary shaft (19), see § E.*

31. Check the axial clearance and rotation of the pinions (5) and (23).

Manually check the rotation of the shaft (19).

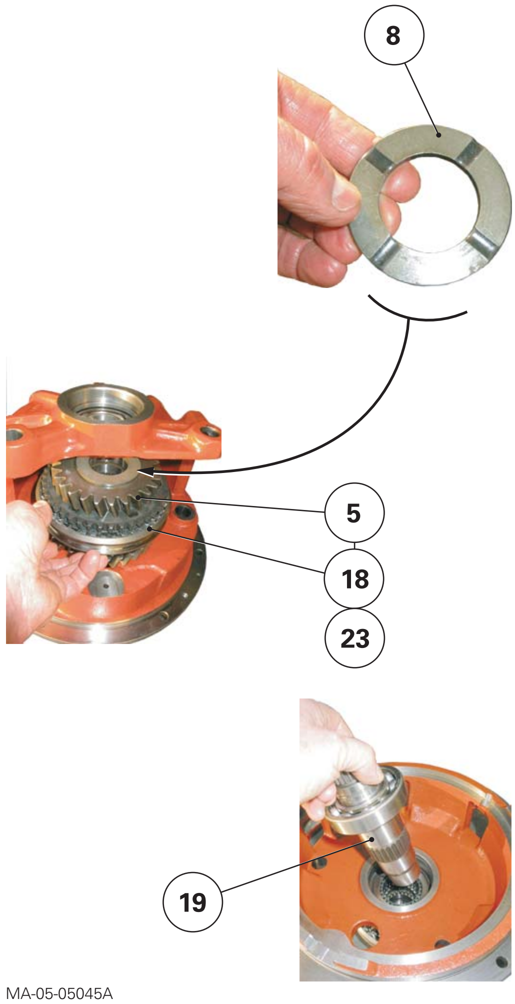


Fig. 12

Reassembling the transfer pinion (15) for reverse operation (Fig. 13)

32. Slide the needle bearings (14) separated by the spacer (11) into the transfer pinion(15).

33. Install the assembled transfer pinion in the housing (26). Slide a washer (12) onto each of its faces.

34. Fit the shaft (13).

35. Lightly smear the thread of the set screw (10) with Loctite 242 or equivalent. Tighten to a torque of 28 - 43 Nm.

36. Manually check the axial clearance and backlash of the reverse transfer pinion.

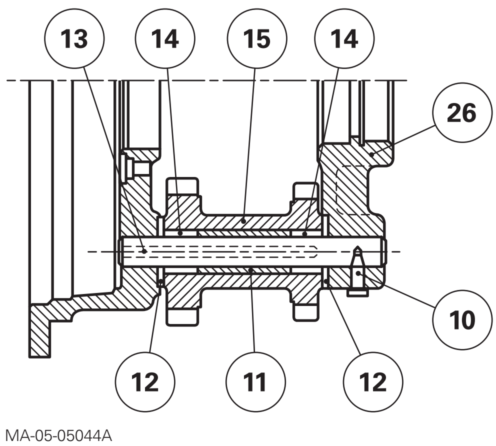


Fig. 13

E . Shimming the secondary shaft

37. Secure the unit in a clamp fitted with soft jaws.

Preparing for shimming

38. Manually check for clearance on the secondary shaft (19) in the housing (26).
If there is no clearance, momentarily remove one or several shims (1).

Shimming

39. Position the dial gauge feeler pin on the end of the shaft (19) (Fig. 14).
40. Pull hard on the secondary shaft (19) to correctly position the ball bearing (24) against the circlip (25).
41. Set the dial gauge to zero.
42. Repeat operation 40 while pushing to bring the ball bearing (9) up against the shoulder of the housing (26).
43. Depending on the clearance measured, select a new thickness of shim(s) (1) to obtain a clearance of **J1 = 0.05 to 0.20 mm** (Fig. 15).
NOTE: *If possible, shim the secondary shaft close to the minimum tolerance value.*
44. Take off circlip (25).
45. Position the final shim(s) (1) selected during operation 43 on the bearing (24).
46. Refit the circlip (25). Check that it is positioned correctly at the bottom of the groove.

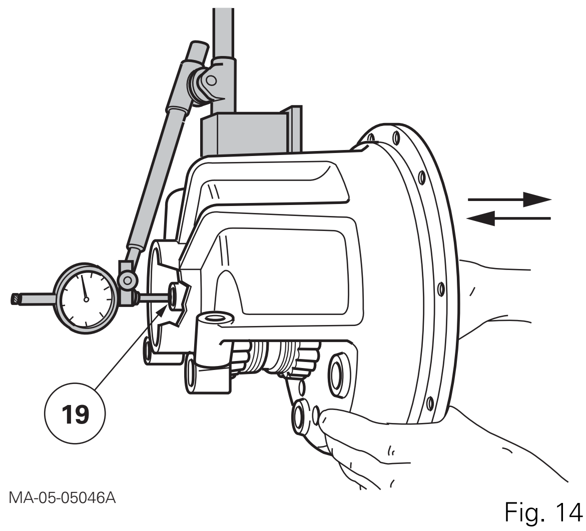


Fig. 14

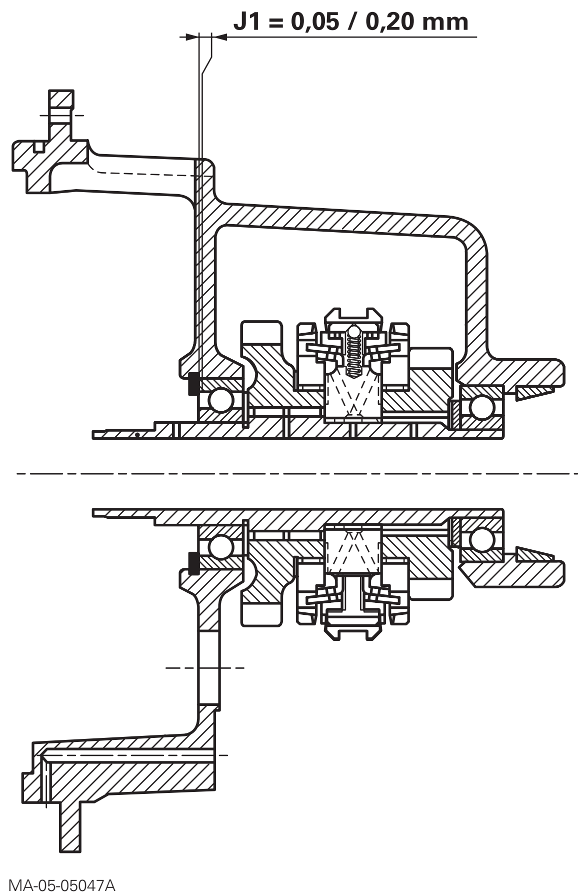


Fig. 15

F . Final operations

47. Refit:
- the Speedshift unit (see chapter 5);
- the shuttle fork, the selector rail and its locking device (see chapter 5).

48. Refit the input unit (see chapter 5).

49. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

50. Assemble the tractor between the engine and the gearbox (see chapter 2).

51. Carry out a road test on all controls.

52. Check the oil tightness of the seals and hydraulic unions.

05C02 - GBA20 Power Shuttle

CONTENTS

A . General

The Power Shuttle, also called "ISC", consists of two electrohydraulically controlled clutches. It is designed to enable operating direction reversal under load. It can be fitted to all 5400 tractors.

The Power Shuttle transmits the drive from the engine to the mainshaft mounted on the front of the main gearbox by means of pinions located respectively to the rear of the input unit and at the gearbox input.

A lever located to the left, under the steering wheel, controls the Power Shuttle.
Depending on the position selected by the operator (forward, neutral, reverse), the lever manages the proportional solenoid valves of the forward and reverse clutches by means of the electronic system of the tractor.

The solenoid valves are located to the front and to the right of the gearbox on a clutch unit containing the Speedshift hydraulic control system.
A filter (60 microns) located under the selector cover, upstream from the clutch unit, provides complementary filtering for oil supplying the solenoid valves (clutches, Speedshift).

A progressivity sensor screwed to the box housing sends information on shaft rotational speed to the electronic system.

Shifting of any forward gear to the corresponding reverse gear, or vice versa, is easy without declutching or stopping the tractor. This "assisted" gear reversal enables gradual changing of the operating direction, even at high travel speeds without abrupt changes in speed. The clutches slow down tractor movement until the required speed is reached so that the direction of travel can be reversed.

The conventional hydraulically operated clutch pedal is replaced by an electrohydraulically operated manoeuvring pedal. This pedal modulates the pressure in the forward or reverse clutches through the electronic system of the tractor and thus facilitates precise movements such as implement hitching.

Construction

The forward and reverse clutches of the Power Shuttle are of different design.

Forward clutch

The forward clutch consists of:
- a conventional type oil-bath multidisc clutch consisting of a cover (33), the rear side of which is splined to assemble the input sun gear (53),
- an input shaft (19) crossing the spacer (4) which separates the engine flywheel from the transmission oil. The shaft is constantly meshed with the damper secured to the engine flywheel. It is splined so as to rotate with the clutch unit (18) comprising the intermediate plates (30) and the discs (29) in which piston (28) moves,
- a drive hub (27) comprising the discs (29), which is secured to the primary shaft (55). The forward clutch is centred in the cover (38) of the reverse clutch by ball bearing (32).

Reverse clutch

The reverse clutch consists of:
- an epicyclic gear train consisting of three double pinion gears (52) and three single pinion gears (59),
- a hydraulic braking device for the planet carrier (49),
- a cover (38) supporting the forward clutch and with an inner side machined to assemble hydraulic parts.

The double and single pinion gears (52) (59) of the epicyclic gear train mesh respectively on the input and output sun gears (53) (58). The pins (50) are idle-mounted and held in the planet carrier by plates (63). A central drilled channel and radial ports supply lubrication to the needle bearings (60).

The planet carrier braking device consists of an annular piston (39) and a plate (43) that is loaded by springs (62) and discs (47) integral with the planet carrier through splines.

The intermediate plates (46) are immobilised by the pins (71).

Fixed unit

The fixed unit (1) has two functions:

- it receives the low pressure supplying the forward clutch via the pipe (74),
- it acts as casing for the clutch lubricating and cooling pump.

The pipes (31) connecting the pump housing (1) and the cover (38) lubricate the reverse clutch braking device.

The shims (3) located between the closing spacer (4) and the fixed unit (1) provide end play for the forward clutch.

Drive transmission

Drive from the Power Shuttle is transmitted to a mechanical unit located in the rear compartment of the input box.

This element comprises a secondary shaft (1) which is secured to the pinion (2) by splines (Fig. 1).

The shaft is fitted on two taper roller bearings "R", and is carried by two bearings of the input unit.

The shims (3) (Fig. 1) fitted between the cover and the unit are used to preload the bearings.

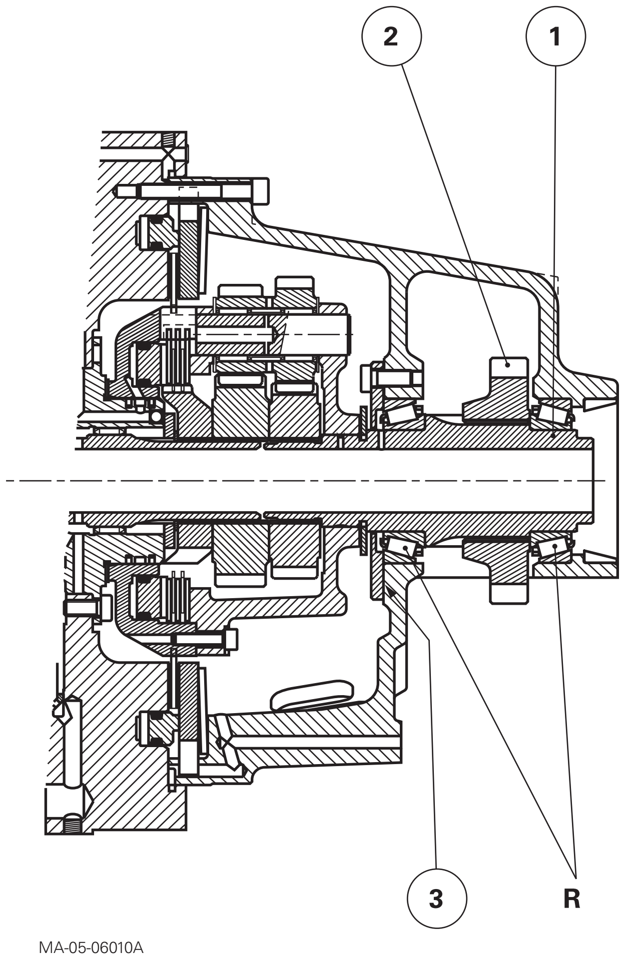


Fig. 1

Operating principle

Forward clutch

When the lever under the steering wheel is in the Forward position, the relevant solenoid valve is activated and supplies a pressure that moves piston (28). This, in turn, compresses the intermediate plates (30) and the discs (29) against cover (33).

The drive from the engine to the gearbox complies with the following kinematics:

- input shaft (19) splined to unit (18),
- unit housing (18),
- intermediate plates (30),
- discs (29) compressed by the piston (28),
- hub (27),
- primary shaft (55),
- main unit mainshaft via the input pinion.

Simultaneously, the pressure applied behind the piston (39) of the braking device drops and the planet carrier assembly (discs (47), intermediate plates (46) and epicyclic gear train) rotate freely.

Lubrication

During forward operation, the oil flow from the centre housing via the pump (14) is directed towards the intermediate plates (30) and the discs (29) via the ports of the forward clutch unit (18) opened by movement of piston (28).

At the same time, lubrication of the braking device of the planet carrier (discs (47) and intermediate plates (46)) of the reverse clutch is interrupted.

Reverse clutch

When the previously mentioned lever is moved from the Forward to Reverse position, the solenoid valve concerned is activated and supplies the piston (39) of the braking device of the planet carrier. The piston then presses on plate (43) which compresses discs (47) and the intermediate plates (46) against the front cover of the input unit and stops the rotation of the planet carrier. The drive from the engine is directly transmitted to the cover (33) that is integral with the input sun gear (53) via splines, without passing through the discs and intermediate plates of the forward clutch.

Simultaneously, the oil pressure in the piston chamber (28) drops and frees the discs (29) and intermediate plates (30).

The input sun gear (53) then drives the double pinion gears (52) freely mounted on the pins (50) which, in turn, drive the single pinion gear (59), integral with primary shaft (55) thus reversing rotation of the output sun gear (58) splined to the primary shaft (55). The primary shaft then sends the drive from the engine to the mainshaft of the main gearbox via the input pinion.

NOTE: *A valve screwed to the top of cover (38) ensures a small permanent bleed starting from 13 bar to provide an automatic bleed of the hydraulic supply of piston (39).*

Lubrication

As the piston (39) moves, it operates spools (44) that act as valves and compress springs (45) via the plate (43). The spools have a drilled centre channel and radial ports, allowing oil to flow to the channels in the cover (38) and the channels in the front cover of the input unit, thus lubricating the discs (47) and the intermediate plates (46). Lubrication of the mechanical parts of the epicyclic gear train is via the lubricating system of the input unit.

At the same time, the lubricating oil flow to the discs (29) and intermediate plates (30) of the forward clutch is stopped, thus preventing any possible driving of the discs through a drag effect.

Neutral position

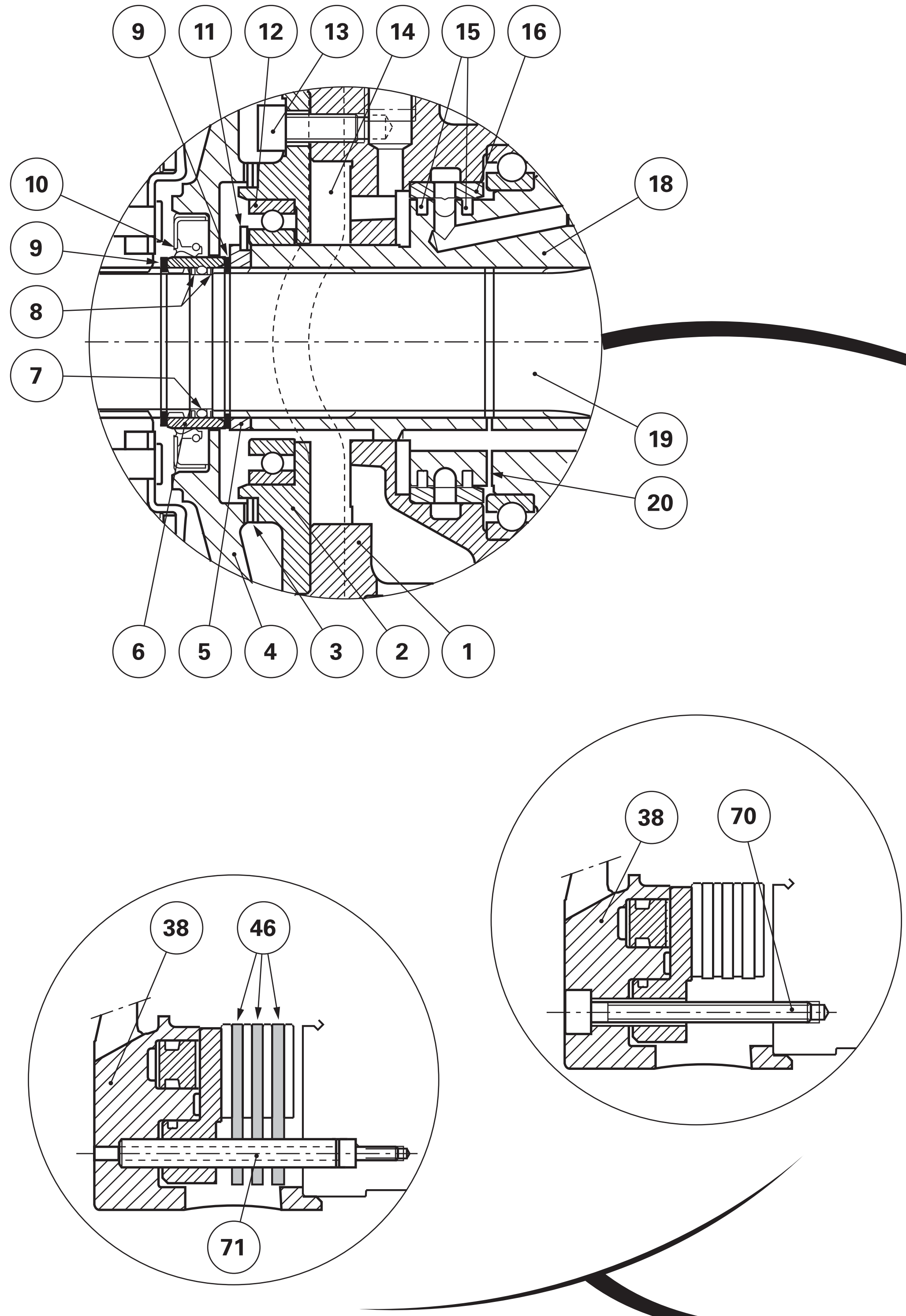
In neutral position, the supply to the solenoid valves is cut, placing the forward and reverse clutches at rest and eliminating transmission of the engine drive to the gearbox.

The oil flow is also interrupted. The pressure in the circuit opens the valve (1) (Fig. 18) and directs the oil to the housing.

NOTE: *After replacement of the solenoid valve or its solenoid, the Power Shuttle hydraulic unit, the power shuttle unit or one of its component or the transmission control unit, it is necessary to calibrate the clutch (see section 11).*

Parts list (Fig. 2, Fig. 3, Fig. 4)

(1) Pump casing
(2) Pump cover
(3) Shim(s)
(4) Spacer
(5) Locking ring
(6) Splined ring
(7) O'ring
(8) Anti-extrusion ring
(9) Snap rings
(10) Oil seal
(11) Circlip
(12) Ball bearing
(13) Screw
(14) Lubricating pump
(15) Sealing rings
(16) Ring
(17) Locating pin
(18) Forward clutch unit
(19) Input shaft
(20) Cotter pin
(21) Circlip
(22) Ball bearing
(23) Snap ring
(24) Seal
(25) Belleville washers
(26) Indexing ports
(27) Drive hub
(28) Forward clutch piston
(29) Forward clutch discs
(30) Forward clutch intermediate plates
(31) Lubricating pipe
(32) Ball bearing
(33) Forward clutch cover
(34) Planet carrier cover
(35) Rivets
(36) Seal
(37) Cover
(38) Reverse clutch cover
(39) Reverse clutch piston
(40) Rivets
(41) Seal
(42) Seal
(43) Plate
(44) Spools
(45) Springs
(46) Reverse clutch intermediate plates
(47) Reverse clutch discs
(48) Ring restrictor
(49) Planet carrier
(50) Pinion gear pins
(51) Spacers
(52) Double pinion gears
(53) Input sun gear
(54) Snap ring
(55) Primary shaft
(56) Snap ring
(57) Ball bearing
(58) Output sun gear
(59) Single pinion gear
(60) Needle bearings
(61) Snap rings
(62) Springs
(63) Stop plates
(64) Screw
(65) Snap ring
(66) Screw
(67) O'ring
(68) Ball bearing
(69) Seal
(70) Screw
(71) Pins
(72) Union
(73) 1.5 bar valve
(74) Pipe
(75) O'rings
(76) Pipe
(77) Screw
(78) Pipe
(79) Screw
(80) Flange
(81) Seal
(82) Strainer
(83) Cover
(84) Plug
(85) Seal
(86) Pipe
(87) Pipe
(88) Transfer pipe
(89) Seal (Loctite)
(90) Diagnostics connector (lubrication)
(91) Union
(92) O'rings
(93) Union
(94) Pipe
(95) O'rings
(96) Dust seal
(97) Screw
(98) Snap ring
(99) Screw
(100) Ring
(101) Elbow union



Overall view

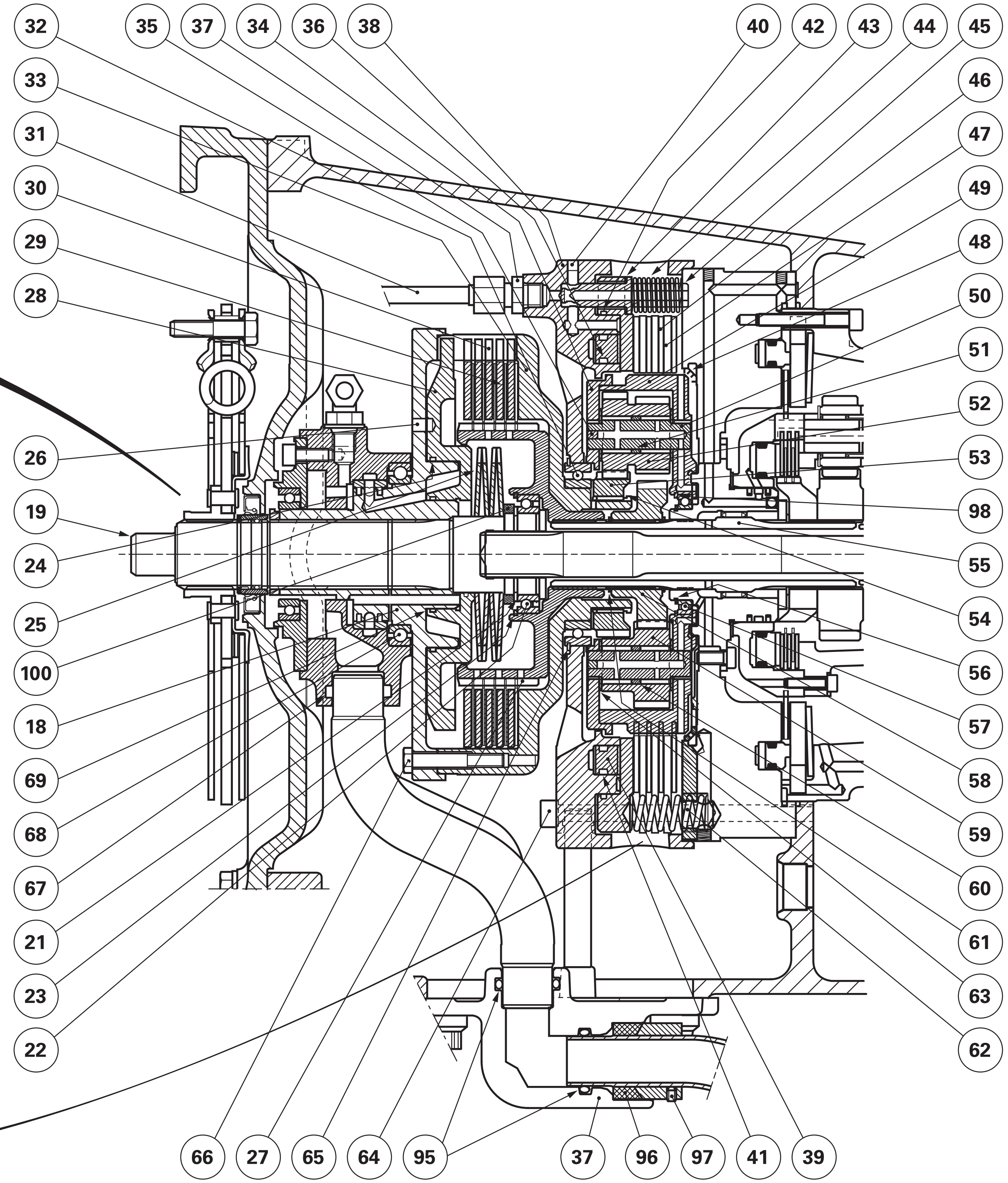


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Fig. 2

Parts list (Fig. 2, Fig. 3, Fig. 4)

(1) Pump casing
(2) Pump cover
(3) Shim(s)
(4) Spacer
(5) Locking ring
(6) Splined ring
(7) O'ring
(8) Anti-extrusion ring
(9) Snap rings
(10) Oil seal
(11) Circlip
(12) Ball bearing
(13) Screw
(14) Lubricating pump
(15) Sealing rings
(16) Ring
(17) Locating pin
(18) Forward clutch unit
(19) Input shaft
(20) Cotter pin
(21) Circlip
(22) Ball bearing
(23) Snap ring
(24) Seal
(25) Belleville washers
(26) Indexing ports
(27) Drive hub
(28) Forward clutch piston
(29) Forward clutch discs
(30) Forward clutch intermediate plates
(31) Lubricating pipe
(32) Ball bearing
(33) Forward clutch cover
(34) Planet carrier cover
(35) Rivets
(36) Seal
(37) Cover
(38) Reverse clutch cover
(39) Reverse clutch piston
(40) Rivets
(41) Seal
(42) Seal
(43) Plate
(44) Spools
(45) Springs
(46) Reverse clutch intermediate plates
(47) Reverse clutch discs
(48) Ring restrictor
(49) Planet carrier
(50) Pinion gear pins
(51) Spacers
(52) Double pinion gears
(53) Input sun gear
(54) Snap ring
(55) Primary shaft
(56) Snap ring
(57) Ball bearing
(58) Output sun gear
(59) Single pinion gear
(60) Needle bearings
(61) Snap rings
(62) Springs
(63) Stop plates
(64) Screw
(65) Snap ring
(66) Screw
(67) O'ring
(68) Ball bearing
(69) Seal
(70) Screw
(71) Pins
(72) Union
(73) 1.5 bar valve
(74) Pipe
(75) O'rings
(76) Pipe
(77) Screw
(78) Pipe
(79) Screw
(80) Flange
(81) Seal
(82) Strainer
(83) Cover
(84) Plug
(85) Seal
(86) Pipe
(87) Pipe
(88) Transfer pipe
(89) Seal (Loctite)
(90) Diagnostics connector (lubrication)
(91) Union
(92) O'rings
(93) Union
(94) Pipe
(95) O'rings
(96) Dust seal
(97) Screw
(98) Snap ring
(99) Screw
(100) Ring
(101) Elbow union

Overall view

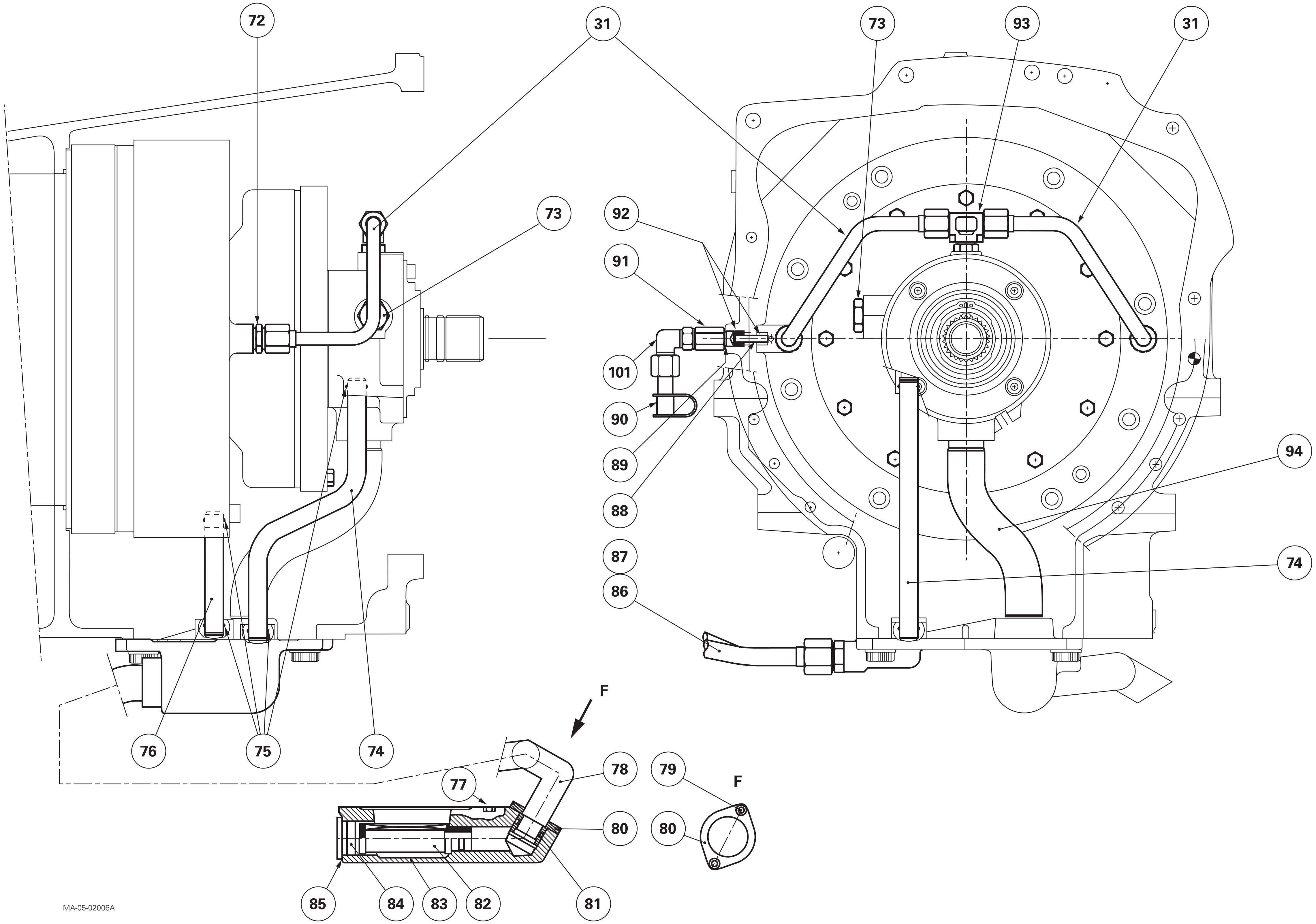

Fig. 3

Parts list (Fig. 2, Fig. 3, Fig. 4)

(1) Pump casing
(2) Pump cover
(3) Shim(s)
(4) Spacer
(5) Locking ring
(6) Splined ring
(7) O'ring
(8) Anti-extrusion ring
(9) Snap rings
(10) Oil seal
(11) Circlip
(12) Ball bearing
(13) Screw
(14) Lubricating pump
(15) Sealing rings
(16) Ring
(17) Locating pin
(18) Forward clutch unit
(19) Input shaft
(20) Cotter pin
(21) Circlip
(22) Ball bearing
(23) Snap ring
(24) Seal
(25) Belleville washers
(26) Indexing ports
(27) Drive hub
(28) Forward clutch piston
(29) Forward clutch discs
(30) Forward clutch intermediate plates
(31) Lubricating pipe
(32) Ball bearing
(33) Forward clutch cover
(34) Planet carrier cover
(35) Rivets
(36) Seal
(37) Cover
(38) Reverse clutch cover
(39) Reverse clutch piston
(40) Rivets
(41) Seal
(42) Seal
(43) Plate
(44) Spools
(45) Springs
(46) Reverse clutch intermediate plates
(47) Reverse clutch discs
(48) Ring restrictor
(49) Planet carrier
(50) Pinion gear pins
(51) Spacers
(52) Double pinion gears
(53) Input sun gear
(54) Snap ring
(55) Primary shaft
(56) Snap ring
(57) Ball bearing
(58) Output sun gear
(59) Single pinion gear
(60) Needle bearings
(61) Snap rings
(62) Springs
(63) Stop plates
(64) Screw
(65) Snap ring
(66) Screw
(67) O'ring
(68) Ball bearing
(69) Seal
(70) Screw
(71) Pins
(72) Union
(73) 1.5 bar valve
(74) Pipe
(75) O'rings
(76) Pipe
(77) Screw
(78) Pipe
(79) Screw
(80) Flange
(81) Seal
(82) Strainer
(83) Cover
(84) Plug
(85) Seal
(86) Pipe
(87) Pipe
(88) Transfer pipe
(89) Seal (Loctite)
(90) Diagnostics connector (lubrication)
(91) Union
(92) O'rings
(93) Union
(94) Pipe
(95) O'rings
(96) Dust seal
(97) Screw
(98) Snap ring
(99) Screw
(100) Ring
(101) Elbow union

Exploded view

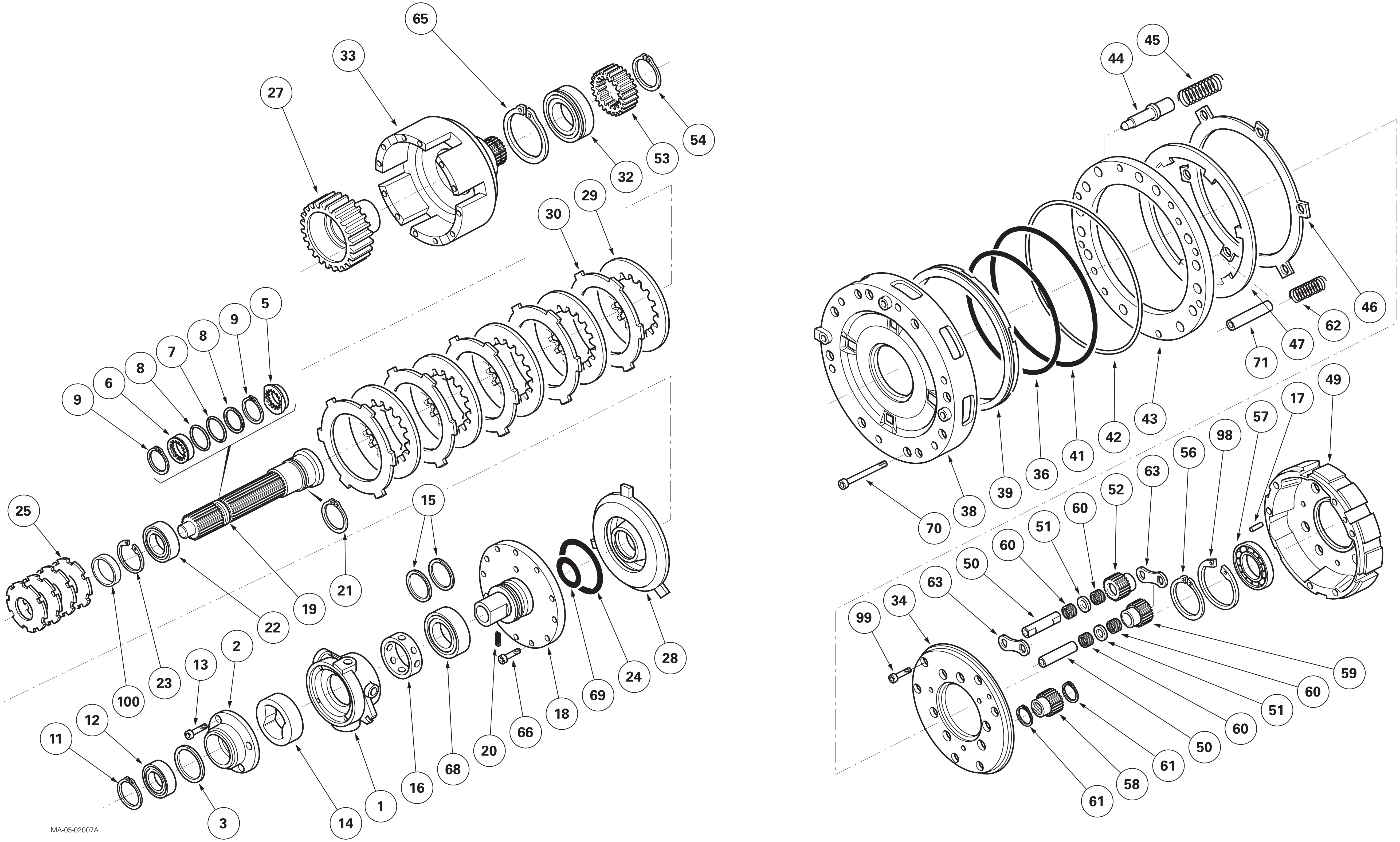

Fig. 4

B . Removing and refitting the forward clutch

Preliminary operations

1. Disassemble the tractor between the engine and the gearbox (see section 2).
2. Drain the gearbox and the centre housing.
3. Remove the spacer (4) from the gearbox (see section 3).
4. Remove the pipes (86) and (87).

   Detach and remove the covers (37) (83), the flange (80) and the pipe (78) (Fig. 3).
5. Remove the pipes (31) (74) (76) (94) (Fig. 3).

Removal

6. Remove the forward clutch (2) (Fig. 5) and pull it from the housing using a locally made tool (see § G).

Refitting

7. Clean the components. Replace any defective parts.

   Note : *If forward clutch shimming is necessary, refer to § D.*
8. Check that PTO shaft (1) is installed (Fig. 5).
9. Refit the clutch using the tool used for removal.

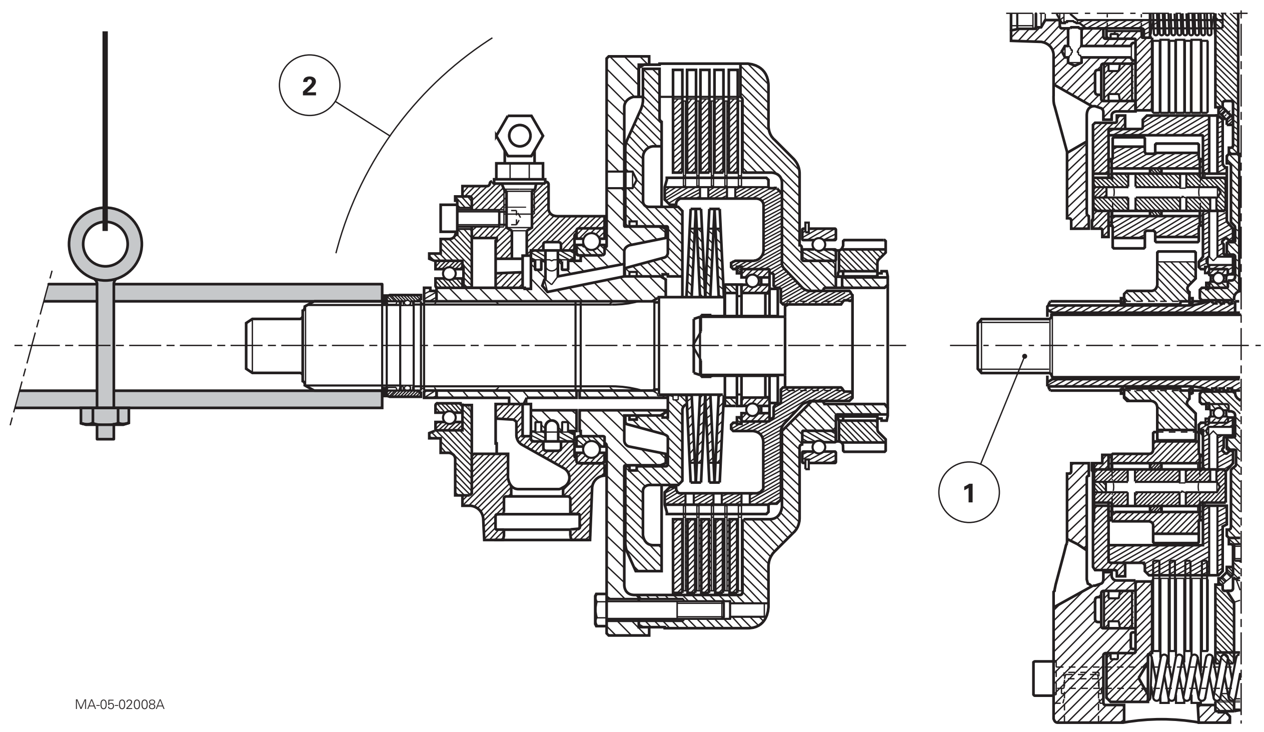

Fig. 5

Final operations

10. Replace the seals (67) (75).

11. Refit the pipes (31) (74) (76) (94).

12. Replace the O'rings (95).

13. Clean the mating faces on the gearbox housing and the cover (37). Smear the mating face of the housing with Loctite 510 or equivalent.

14. Replace the dust seal (96) and the O'ring (81).

15. Fit the pipe (78), the flange (80) and the covers (37) (83) previously coated with Loctite 510 or equivalent. Tighten the screws to a torque of 84 - 110 Nm.

16. Tighten screw (97) moderately and screws (79) to a torque of 44 - 53 Nm.

17. Reconnect the pipes (86) (87).

18. Refit the gearbox spacer (4) (see section 3).

19. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

20. Assemble the tractor between the engine and the gearbox (see section 2).

21. Carry out a road test of the Power Shuttle and high and low Speedshift ranges.

22. Check tightness of the mating faces on the spacer (4), covers (37) (83) and the hydraulic unions.

C . Disassembling and reassembling the forward clutch

Disassembly

23. Separate cover (33) from unit (18). Remove clutch discs (29) and intermediate plates (30).

24. Remove the front snap ring (9). Remove the splined ring (6), the anti-extrusion rings (8) and seal (7).

25. Take off circlip (11). Remove the cover (2) from the pump (14) complete with bearing (12).

26. Pull the lubricating pump out of the pump unit (1) and take it apart from the clutch housing (18).

27. Remove seal rings (15). If necessary, extract ring (16) and remove the 1.5 bar valve (73).

28. Place the partially disassembled clutch on a suitable locally made fixture (Fig. 6 and § G).

29. Compress the Belleville washers (25) and remove the rear snap ring (9) (Fig. 6).

30. Remove locking ring (5). Gradually release the Belleville washers.

31. Split unit (18) fitted with piston (28) from shaft (19).

32. Remove the Belleville washers and the ring (100).

33. Remove snap ring (23). Pull out the shaft (19) complete with bearing (22) from hub (27).

34. Take off circlip (21). Extract bearing (22) from shaft (19).

35. Remove the piston.

Remove seals (24) (69). Discard them.

If necessary, extract the bearing (68) from the unit (1) of the pump (14).

36. If necessary, remove snap ring (54) and remove the input sun gear (53). Remove snap ring (65). Extract bearing (32).

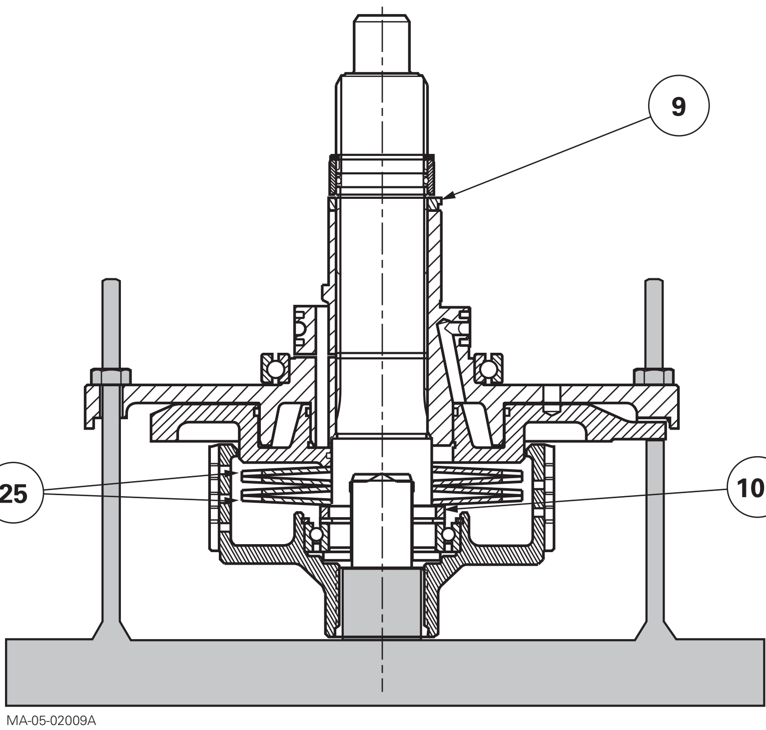

Fig. 6

Reassembly

37. Make sure that pin (20) is fitted.

38. If removed, fit the bearing (32) on cover (33), using a press and a suitable tool. Fit snap ring (65).

39. If disassembled, refit bearing (68).

40. Lubricate the new seals (24) (69) and fit them on the piston.

41. Fit the piston (28), using a pin of suitable diameter to align the index holes bored in the unit (18) and piston (Fig. 7).

NOTE: *The angular position of the piston depends on the position of unit (18) lubricating ports.*

Complete the installation of the piston by gradually and alternately striking around its top rim with a plastic mallet.

Check that no fragments of the seal remain after assembly,

42. Using a suitable fixture, force fit the bearing (22) on the shaft (19), with the sealed side directed towards the reverse clutch. Fit the circlip (21).

43. Put the assembly (shaft, bearing, circlip) in the hub (27). Fit snap ring (23).

44. Refit the ring (100) and the Belleville washers as shown in Fig. 8.

45. Assemble unit (18) fitted with the piston (28) on shaft (19).

46. Compress the Belleville washers using the same procedure as in operation 28. Position the ring (5), aligning two of the flat sections with those of the unit (18). Replace the rear snap ring (9) and correctly position it in the bottom of the groove.

47. Remove the fixture.

48. Check that the seal rings (15) turn freely in their grooves. Fit the seal rings, lightly coated with miscible grease, making sure that they do not protrude beyond the rim of unit (18).

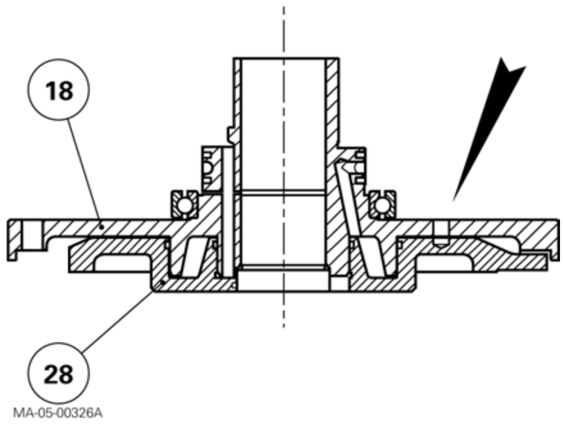

Fig. 7

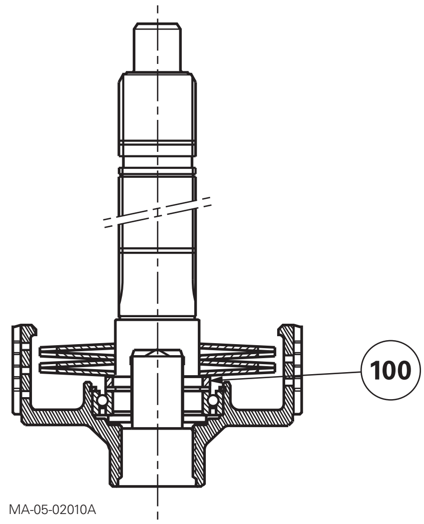

Fig. 8

49. If required, fit the 1.5 bar valve (73). Tighten to a torque of 47 - 54 Nm.

Insert ring (16) using a suitable fixture, with the chamfer "C" turned as shown in Fig. 9.

50. Lubricate the ring. Assemble pump unit (1) on unit (18).

51. Lubricate pump (14) with transmission oil and position it aligning the flat sections of the rotor with those on the unit (18).

52. Manually check the angular movement of the rotor on the flat sections of unit (18).

53. Fit the bearing (12) on the cover (2) of the pump. Fit the cover. Install circlip (11) and screws (13) and tighten to a torque of 25 - 35 Nm.

54. Lubricate and install a new assembly (O'ring (7) and anti-extrusion ring (8)). Slide on the splined ring (6). Fit a new front snap ring (9).

55. Soak the discs (29) in a transmission oil bath for approximately 1 hour. Check that they are correctly impregnated.

56. Position the intermediate plates (30), aligning the tabs and the discs (29) on the hub (27) (see remark and Fig. 10).

NOTE 1: *The number of discs and intermediate plates depends on the tractor type.*

Power (CV)	N° of discs	N° of intermediate plates
65 to 105	4	5
110	5	6

NOTE 2: *The forward clutch cover (33) differs according to the number of discs.*

57. Put the forward clutch cover (33) on the unit (18) with Loctite 549 or equivalent, with the tabs of the intermediate plates inserted in the notches of the forward clutch cover.

Fit and tighten the screws (66) to a torque of 25.5 - 34.5 Nm.

58. Manually check the rotation of the hub (27).

59. If necessary, refit the input sun gear (53) and fit snap ring (54).

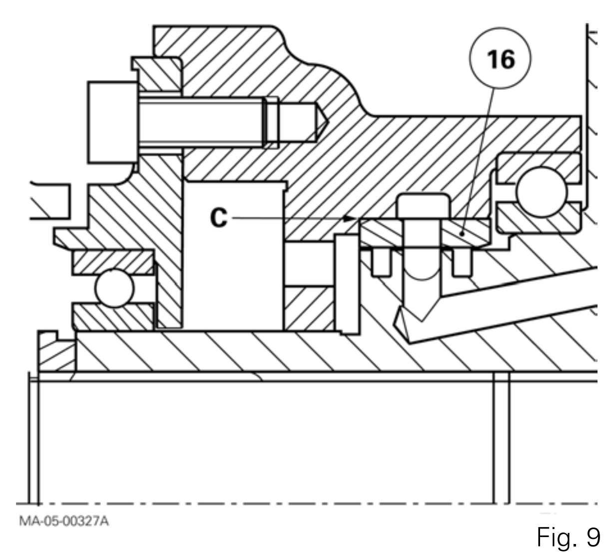

Fig. 9

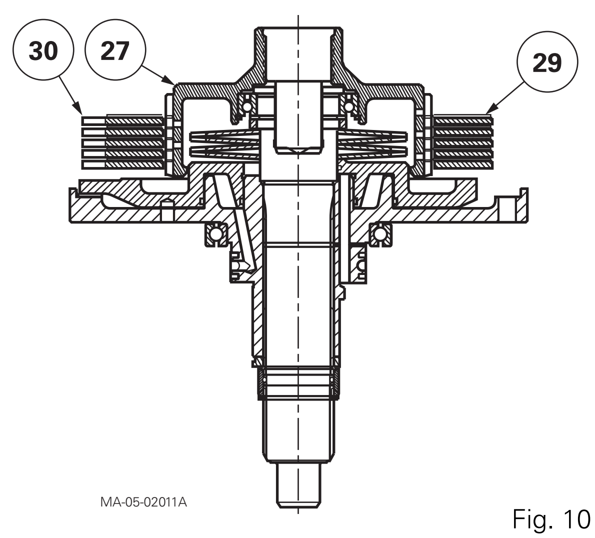

Fig. 10

D . Shimming the forward clutch

This operation consists in obtaining an end play J1 of 0.60 to 0.80 mm between the pump cover (2) and the spacer (4) (Fig. 11).

Remove the PTO shaft to perform this operation.

60. Install the clutch on the cover (38) of the reverse clutch, using the tool used in Fig. 5, § B.

61. Fit a 2 mm shim (3) on cover the (2) (Fig. 11).

62. Lubricate the lip of seal (10). Protect the lip of the seal by fitting a protector (see section 3) on the splines of the shaft (19). Fit two guide screws on opposite sides of the gearbox housing and temporarily fit the spacer (4) without Loctite. Gradually tighten several screws.

63. Place a dial gauge at the end of shaft (19) and check the clearance by moving the shaft sideways (Fig. 11).

***IMPORTANT:** Check that the snap ring (65) of the bearing (32) is correctly in contact with the cover (38) (Fig. 11).*

64. Remove spacer (4).

Depending on the reading previously obtained with the dial gauge, define a new thickness for shim(s) (3) in order to obtain a **J1 clearance of between 0.60 and 0.80 mm** (*Fig. 11*).

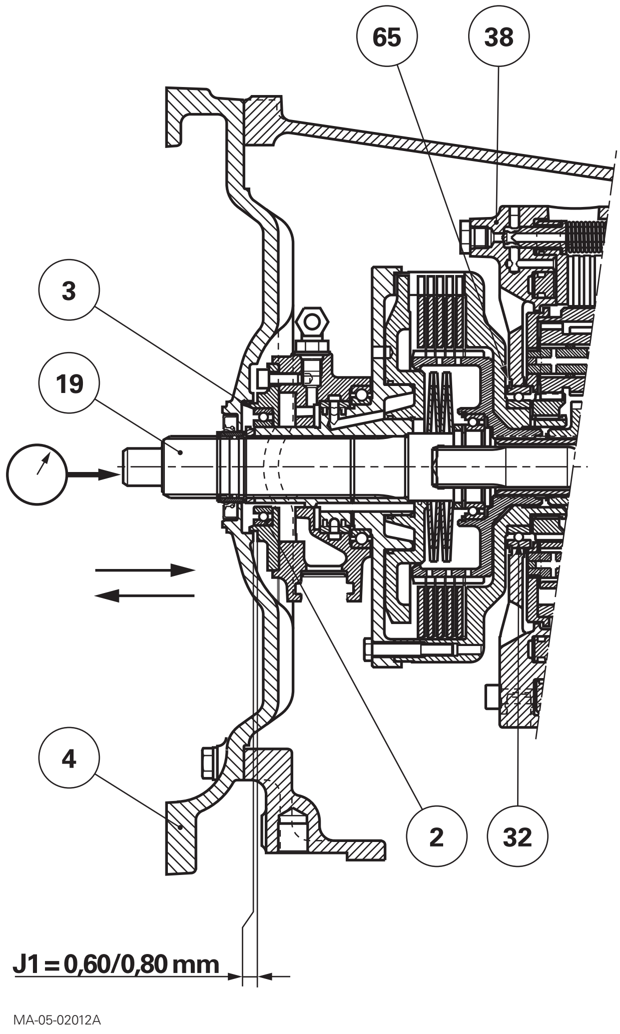

Fig. 11

E . Disassembling and reassembling the reverse clutch

Preliminary operations

65. Remove the forward clutch (see § B).

66. Remove the input unit (see section 5).

Disassembly (Fig. 12)

67. Remove the screws (70) and the cover (38).

68. Recover the spools (44) and the springs (45) (Fig. 12).

69. Remove the large springs (62) and the pins (71).

70. On cover (38), remove:
- the plate (43),
- the seal (42) and discard it,
- the piston (39),
- the seals (36) (41) and discard them,
- the unions (72), the valve (1) (Fig. 18) and the O'ring (75) of the 17 bar supply port (Fig. 3).

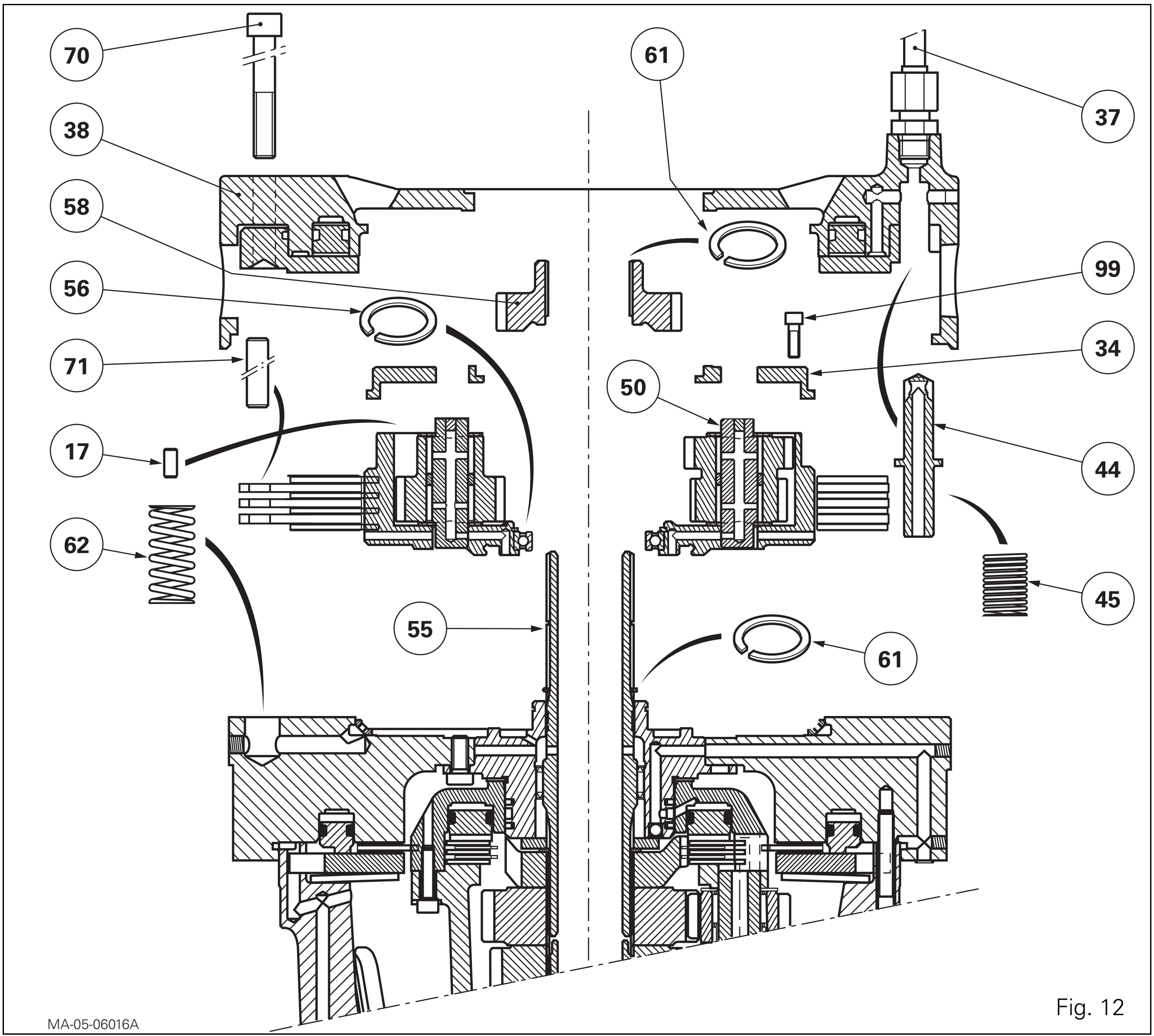

Fig. 12

71. Immobilise the planet carrier (49) with a holding tool, ref. 3378240M1 (see Fig. 13 and § G).

72. Remove screws (99) securing the cover (34) (Fig. 12 and Fig. 13) and remove it.

73. Remove clutch discs (47) and intermediate plates (46).

74. Separate the output sun gear (58), held by the snap rings (61), from the primary shaft (55) (Fig. 12).

75. Remove snap ring (56) (Fig. 12).

76. Remove the planet carrier (49) with the double and single pinion gears (52) (59).

77. On the planet carrier (49), remove:

- the plates (63),
- the double pinion gears (52) and the pins (50). Mark their position,
- the single pinion gears (59) and pins (50). Mark their position,
- the snap ring (98) and bearing (57).

***NOTE:** The rotation of planet gears around the pins (50) is on two rows of needle bearings (60), joined and separated by a spacer (51).*

***IMPORTANT:** When the planet gears and the shafts have been removed, check that no needle or spacer remains in the planet carrier.*

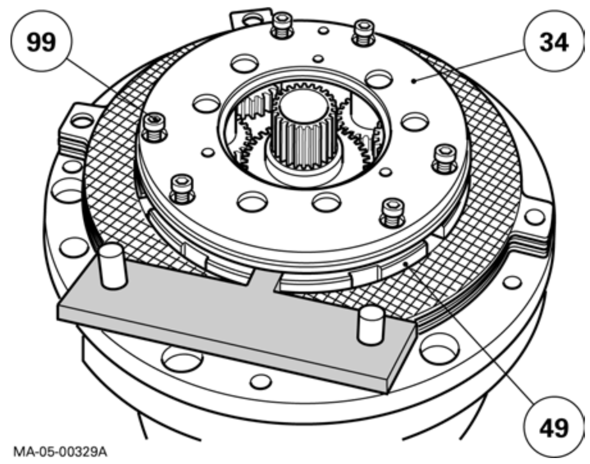

Fig. 13

Reassembly

78. Clean and check all components. Replace any defective parts.

79. Check that the ports in the pinion gear pins and the channels in the planet carriers are not blocked.

80. Where necessary, fit the pinion gears with two rows of needle bearings coated with miscible grease and separated by a spacer.

81. On the planet carrier, refit:
- bearing (57) and snap ring (98),
- double and single pinion gears (52) (59) positioned as shown in Fig. 14,
- pins (50), with the lubricating ports placed facing those in the planet carrier (49).

  Note: *Each end of the pins (50) is provided with:*
  - *a port, one of which is closed off by a rivet (35) while the other is used for pinion gear lubrication,*
  - *a flat section and a shoulder that stop any pin rotation or any side movement.*

82. Install the partially assembled planet carrier. Fit the snap ring (56) and the rear snap ring (61).

83. Position marks "R" (punch marks) on the double pinion gears (52) (Fig. 15) so that they pass through a centerline meeting at "O" (Fig. 15).

Important: *The mark on the front side of the pinion gear corresponds to the alignment of the two splines. It is **mandatory** to respect the positions of the punch marks during assembly of the output sun gear (58).*

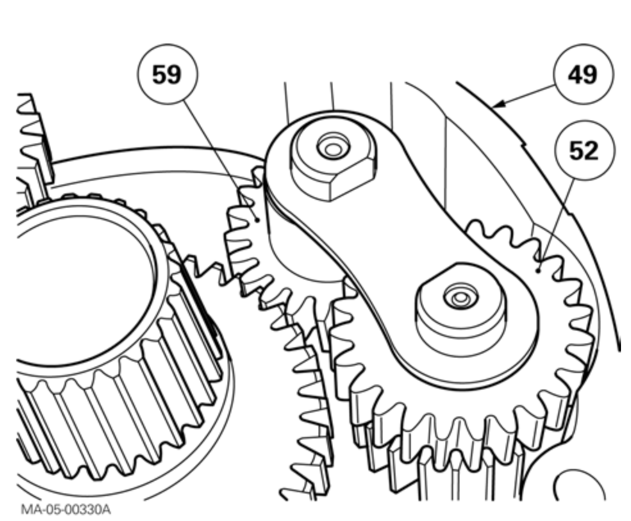

Fig. 14

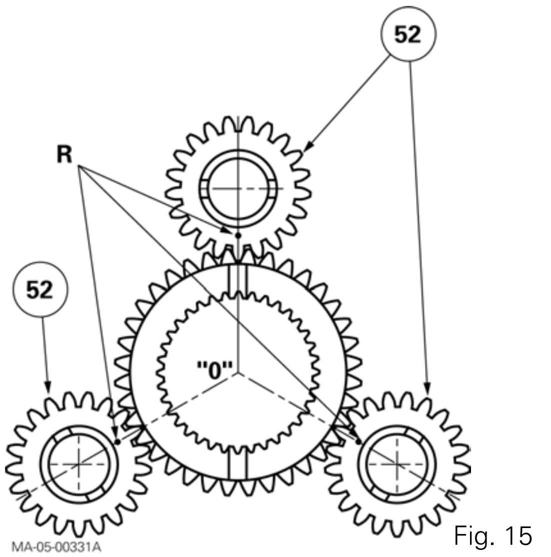

Fig. 15

84. Slide the output sun gear (58), correctly turned as shown in Fig. 2, on to the primary shaft (55), making sure that the punch marks of each pinion gear remain in the required position.

85. Fit the front snap ring (61).

86. Soak the discs (47) in a transmission oil bath for approximately 1 hour. Check that they are correctly impregnated.

87. Fit the discs (47) and the intermediate plates (46) depending on the type of tractor (Fig. 16).

Power (CV)	N° of discs	N° of intermediate plates
65 to 105	3	2
110	4	3

88. Check the presence of the locating pin (17) (Fig. 12).

89. Refit the cover (34). Check that it is correctly positioned on the pins (50) of the pinion gears and in the locating pin (Fig. 12).

90. Immobilise the planet carrier, using the same method as used during disassembly.

91. Install and tighten the screw (99) Fig. 12) to 36 - 46 Nm with its thread lightly greased with Loctite 242 or equivalent.

92. On cover (38), check for the presence of rivets (40) at the end of the channels.

Refit:

- piston (39) with new lubricated seals (36) (41), gradually and alternately striking around the piston rim with a plastic mallet. Check that no fragments of the seal remain after assembly,
- plate (43) with a new lubricated seal (42), aligning the holes of the plate with those in the cover (38). Insert the plate using the same method as used for piston (39).

  Note: *The thickness of the plate (43) differs according to the number of discs and intermediate plates.*

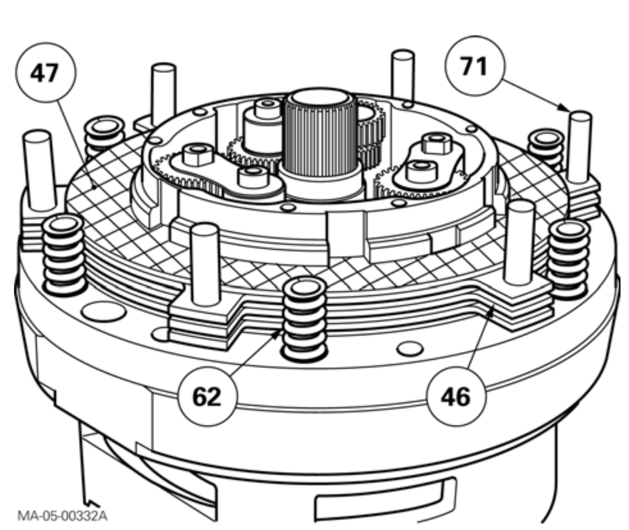

Fig. 16

93. Install the pins (71) and the springs (62) (Fig. 17) in their respective location on the input unit.

94. Smear the spools (44) and the springs (45) with miscible grease. Fit and stick the spools in each compartment of the cover (38), with the points towards the unions (72) (Fig. 2). Slide and stick a spring (45) in each spool.

95. On the external face of the cover (38), place three sufficiently long and equally spaced studs in the holes provided for screws (64).

96. Install and position the cover, with the valve port (1) directed upwards (Fig. 18).

97. Before fitting screws (70), it is **mandatory** to check that the spools (44) slide freely in each compartment of the front cover on the input unit. To do this, compress the springs (45), using a screwdriver passed through the tapped holes of the unions (72). If the springs cannot be compressed, investigate the cause..

98. Pretighten screws (70).

99. During pretightening, check that the spools (44) still slide freely. Also check that each end of the (large) springs (62) is correctly housed in its respective seat.

100. Tighten screws (70) to a final torque of 36 - 46 Nm (Fig. 12).

After completing the tightening, check again that each spool can move freely and restore its initial position.

IMPORTANT: *A spool valve blocked open can limit or interrupt lubrication of the forward clutch when operating.*

101. It is **mandatory** to install and tighten the valve (1) fitted with its seal to 6 - 8 Nm max. (Fig. 18). Fit and tighten the unions (72).

102. Install the input unit (see section 5) and the forward clutch (see § B).

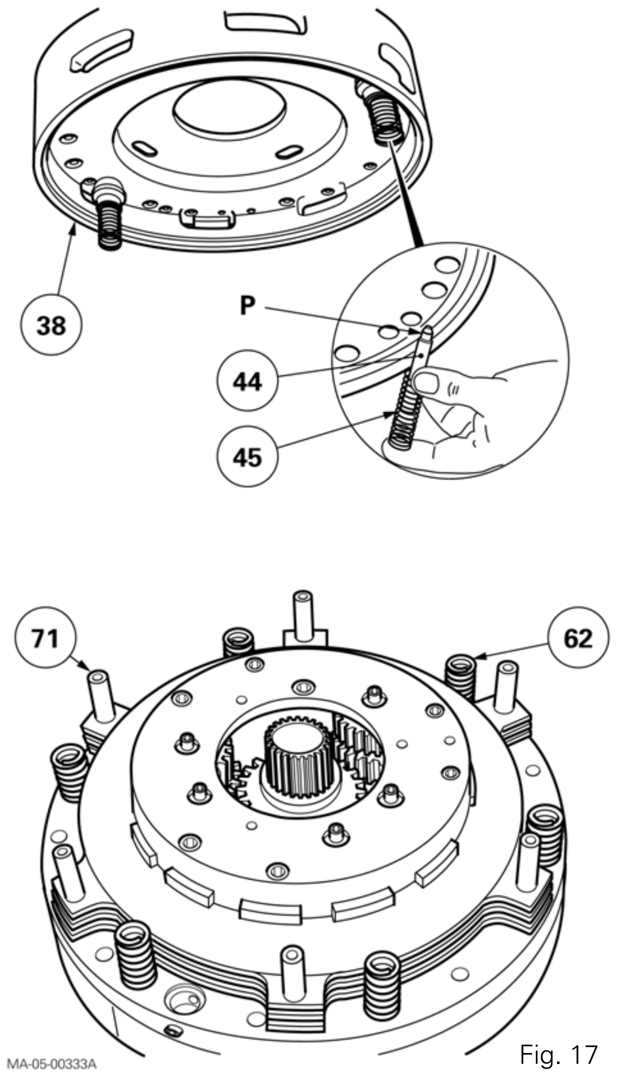

Fig. 17

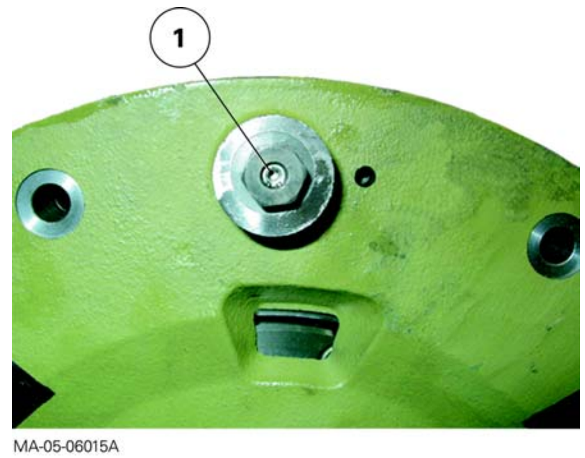

Fig. 18

F . Disassembling and reassembling the driving pinion - Shimming the shaft

Preliminary operations

103. Remove the forward clutch (see § B).

104. Remove the input unit (see section 5).

105. Remove the reverse clutch (see § E).

106. Remove the Speedshift unit (see section 5).

Disassembly (Fig. 19)

107. Remove the screws (5) and the stop plate (8).

108. Recover the shims (3) and the cup (4).

109. Pull out the secondary shaft (1), fitted with the bearing cone, (6) and the unit (7).

110. Note and mark the assembly order of thedriving pinion (2). Remove the pinion.

111. Recover the bearing cone (9). Extract the cup (10).

Reassembly

112. Check that the ports of the secondary shaft (1) and the housing channels (7) are not blocked.

113. Clean and check all components. Replace any defective parts.

114. Lubricate the cones and the cups of the bearing before assembling.

115. Fit the cup (10) in the housing. Fit the bearing cone (9) in the cup.

116. Position the pinion (2), correctly turned in the housing (Fig. 19).

117. Fit the bearing cone (6) against the shoulder on shaft (1). Slide the shaft through the pinion (2) and bearing (9).

118. Position the cup (4).

Determine the thickness of shims (3) to obtain a temporary clearance of 0.10 to 0.15 mm approx. for final shimming with pre-loading. Position the shims and the stop plate (8). Tighten the screws to a torque of 25 - 32 Nm.

119. Put the unit (7) in a vice.

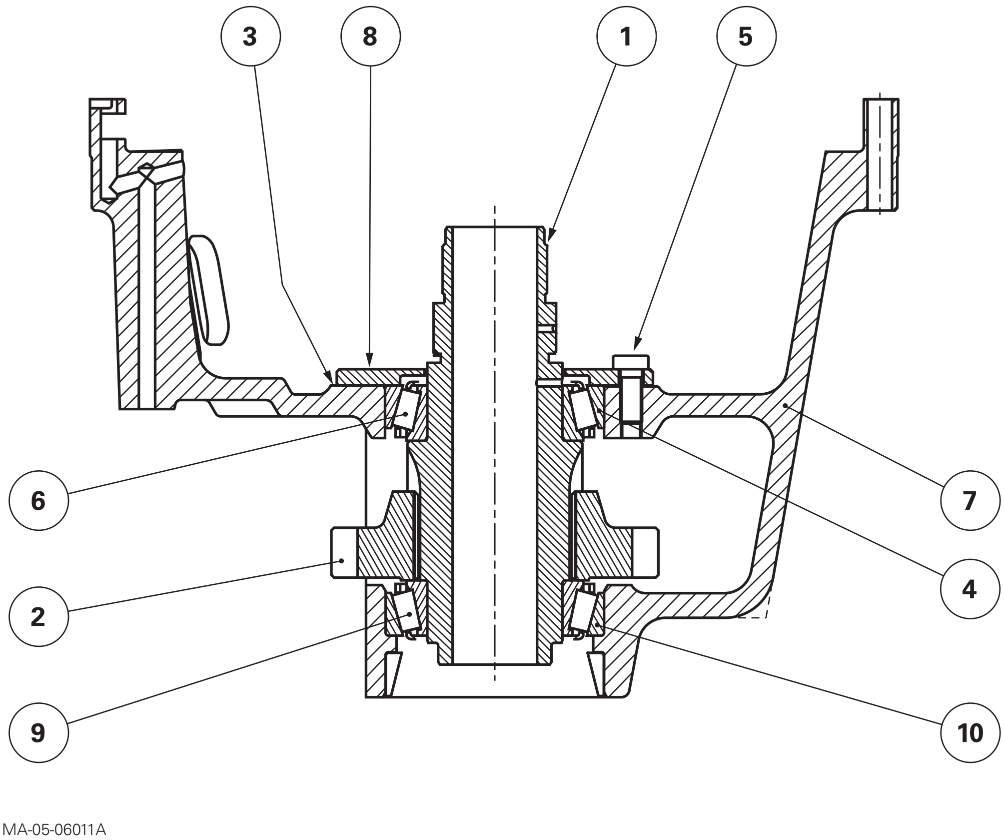

Fig. 19

Shimming the shaft (1) (Fig. 20)

120. Position the dial gauge feeler pin on the end of the shaft (Fig. 20).

121. Pull the shaft, turning it to and fro from left to right to correctly “seat” the cones in the bearing cups.

122. Set the dial gauge to zero.

123. Repeat the operation 121, this time by pushing.

124. Depending on the clearance reading, select a thickness of shims (3) to obtain the following P1 preload: **P1 = 0.05 to 0.15 mm** (Fig. 20).

NOTE : *If possible, shim to the maximum tolerance.*

125. Take out the screws (5). Remove stop plate (8).

126. Position the final shims (3) selected during operation 124 on the unit (7). Install the plate (8). Install and definitively tighten the screws (5) to a torque of 25 - 35 Nm, with their threads lightly greased with Loctite 242 or equivalent.

127. Manually check the rotation of the shaft (1).

Final operations

128. Refit the Speedshift unit (see section 5).

129. Refit the reverse clutch (see § E).

130. Refit the input unit (see section 5).

131. Refit the forward clutch (see § B).

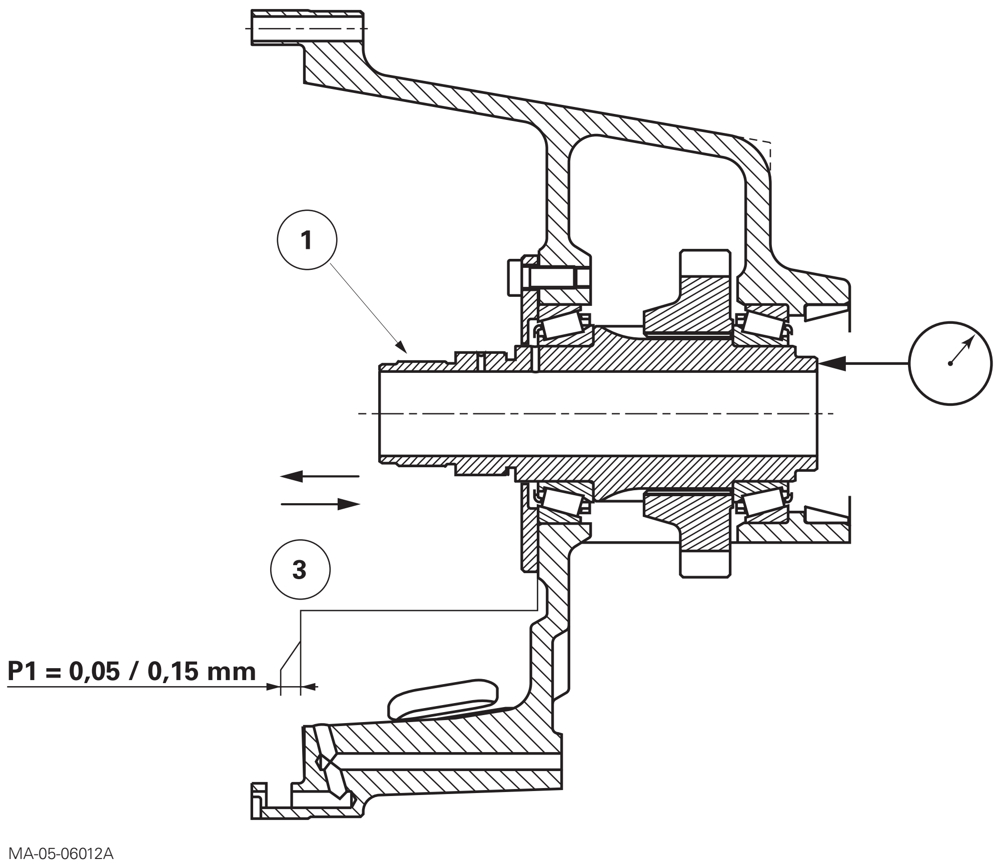

Fig. 20

G . Service tools

Tool available in the AGCO network

- **3378240M1:** Planet carrier holding tool (Fig. 21)

Locally made tools

- **Belleville washer compression tool** (Fig. 22)
  (1) U iron profile: 60
  (2) Threaded rod: Ø 8
  (3) Round iron machined with the following dimensions: Ø = 36, L = 60

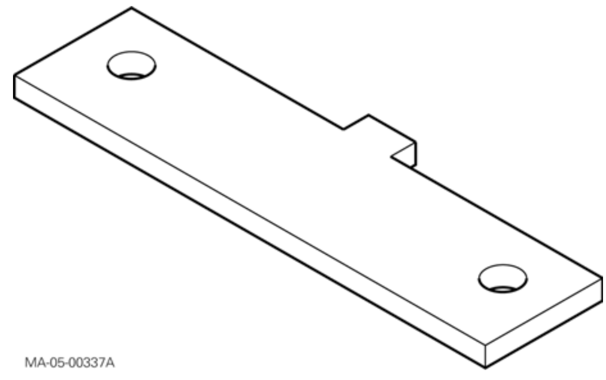

Fig. 21

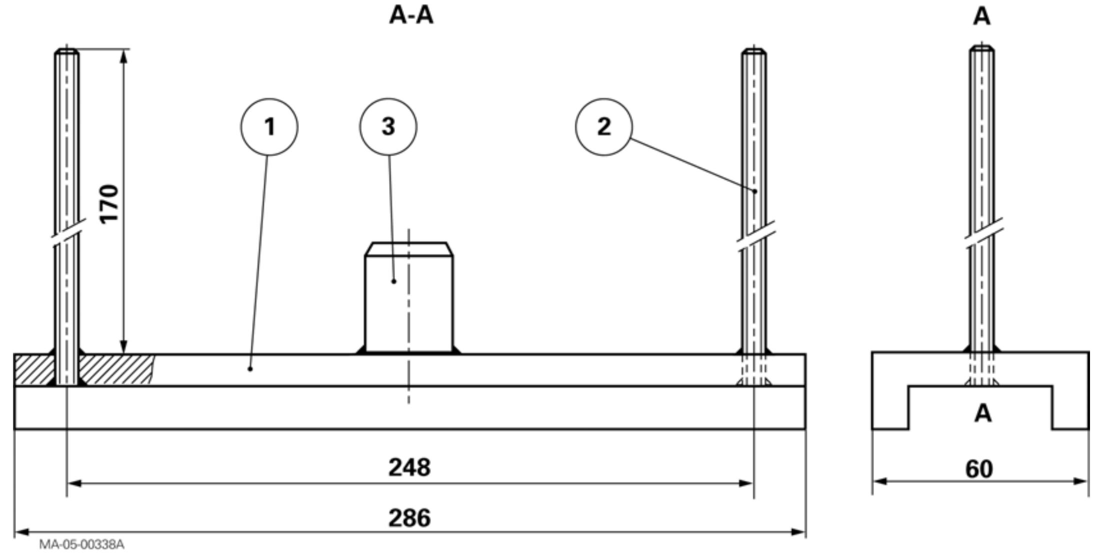

Fig. 22

- **Sleeve for removing and refitting the clutch assembly** (Fig. 23)
  (1) Pipe: Tu52B outer Ø 42.4 thickness 5
  (2) Pipe: Tu52B outer Ø 48.3 thickness 2.9

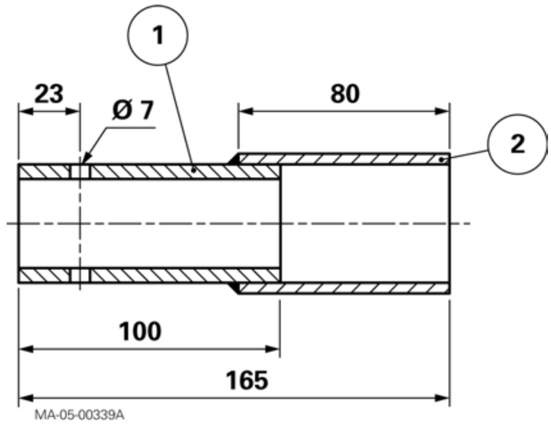

Fig. 23

05D02 - GBA20 Speedshift with Power Shuttle

CONTENTS

A . General

The Speedshift unit is mounted between the reverse clutch of the power shuttle and the mechanical unit consisting of the drive pinion (see chapter 5).

This is a hydraulic controlled gear shift system providing two input gear ratios to the gearbox. This function is provided by:

- a multidisc hydraulic clutch;
- an epicyclic gear train consisting of a planet carrier with three double pinion gears, an input sun gear and an output sun gear.
- a planet-carrier hydraulic braking system.

The design of the Speedshift allows for gear shifting while driving without declutching, even at full load.

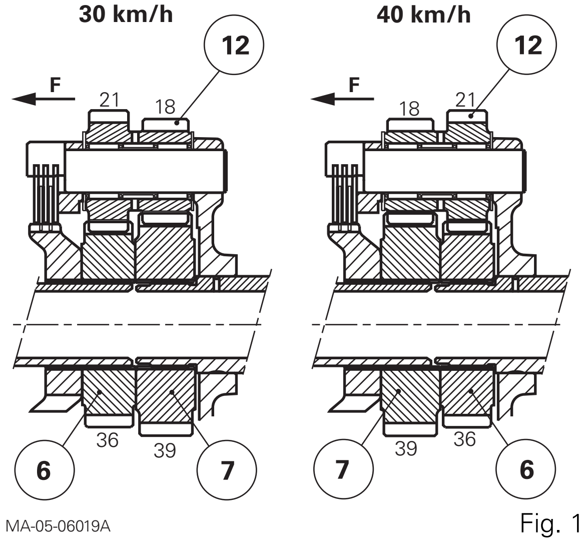

Fig. 1

Specific feature of epicyclic gear train assembly

Legislation in force in certain countries limits speed to 30 kph. In this case, the sun gears (6) and (7) and pinion gears (12) of the Speedshift epicyclic gear train should be positioned as in Fig. 1.

Parts list (Fig. 2 and Fig. 3)

(1) Seals
(2) Rivets
(3 Screw
(4) Ring
(5) Secondary shaft
(6) Input sun gear (30 kph)
Output sun gear (40 kph)
(7) Input sun gear (40 kph)
Output sun gear (30 kph)
(8) Pinion gear pins
(9) Planet carrier cover
(10) Friction washer
(11) Rivet
(12) Double pinion gears
(13) Unit
(14) Spacers
(15) Hub
(16) Needle bearings
(17) Friction washers
(18) Spring washer (Belleville)
(19) Ring restrictor
(20) Clutch plate
(21) Brake disc
(22) O'ring
(23) O'ring
(24) Screw
(25) Hydraulic cover
(26) O'ring
(27) Front cover
(28) Clutch piston
(29) O'ring
(30) Intermediate plates
(31) Rings
(32) Needle bearing
(33) Ring carrier
(34) Screw
(36) Primary shaft
(37) Circlip
(38) Tab washer
(39) Washer
(40) Ball
(41) Screw
(42) Discs
(43) Spring washers
(48) Brake piston
(50) Planet carrier assembly

Overall view

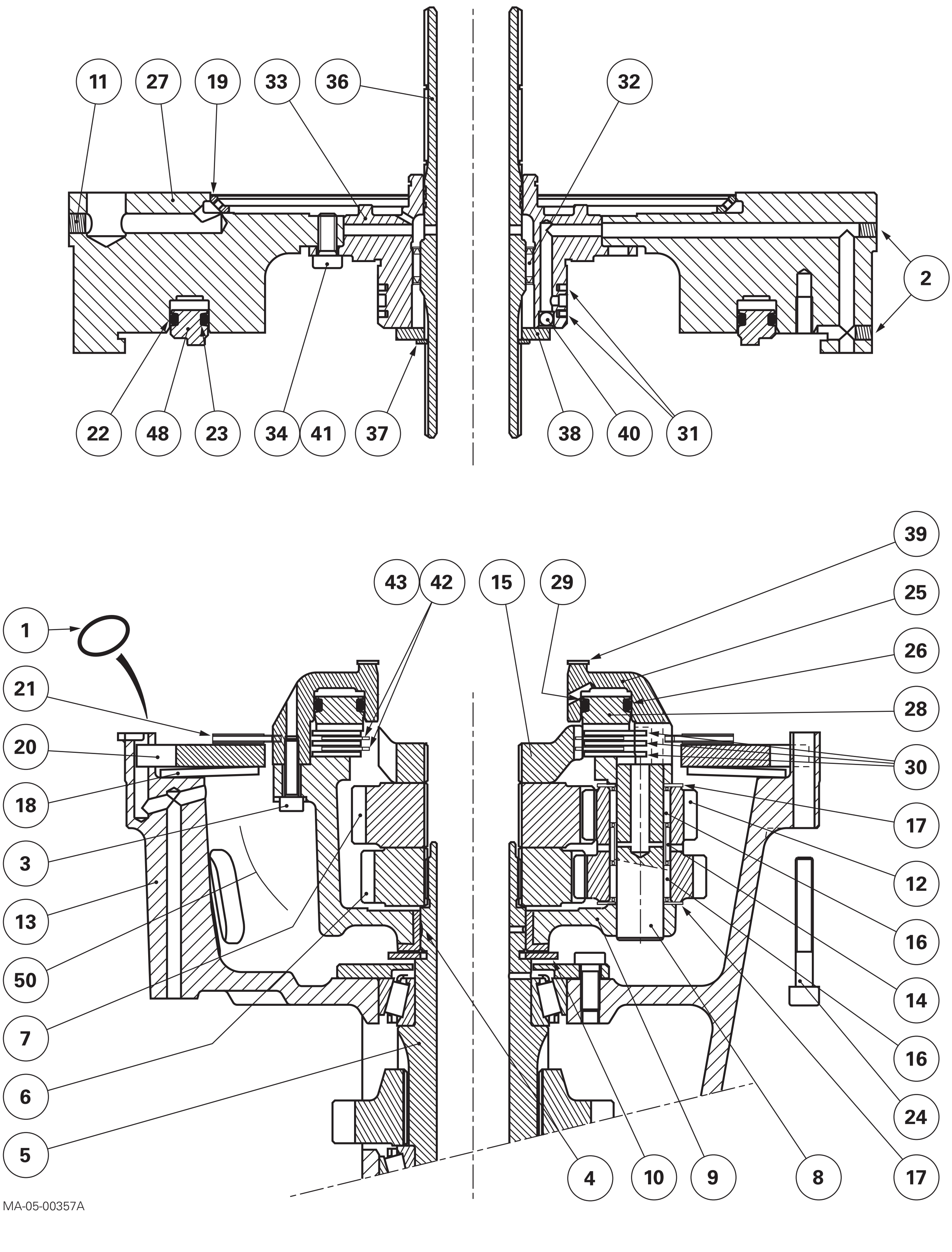

Fig. 2

Parts list (Fig. 2 and Fig. 3)

(1) Seals
(2) Rivets
(3 Screw
(4) Ring
(5) Secondary shaft
(6) Input sun gear (30 kph)
Output sun gear (40 kph)
(7) Input sun gear (40 kph)
Output sun gear (30 kph)
(8) Pinion gear pins
(9) Planet carrier cover
(10) Friction washer
(11) Rivet
(12) Double pinion gears
(13) Unit
(14) Spacers
(15) Hub
(16) Needle bearings
(17) Friction washers
(18) Spring washer (Belleville)
(19) Ring restrictor
(20) Clutch plate
(21) Brake disc
(22) O'ring
(23) O'ring
(24) Screw
(25) Hydraulic cover
(26) O'ring
(27) Front cover
(28) Clutch piston
(29) O'ring
(30) Intermediate plates
(31) Rings
(32) Needle bearing
(33) Ring carrier
(34) Screw
(36) Primary shaft
(37) Circlip
(38) Tab washer
(39) Washer
(40) Ball
(41) Screw
(42) Discs
(43) Spring washers
(48) Brake piston
(50) Planet carrier assembly

Exploded view

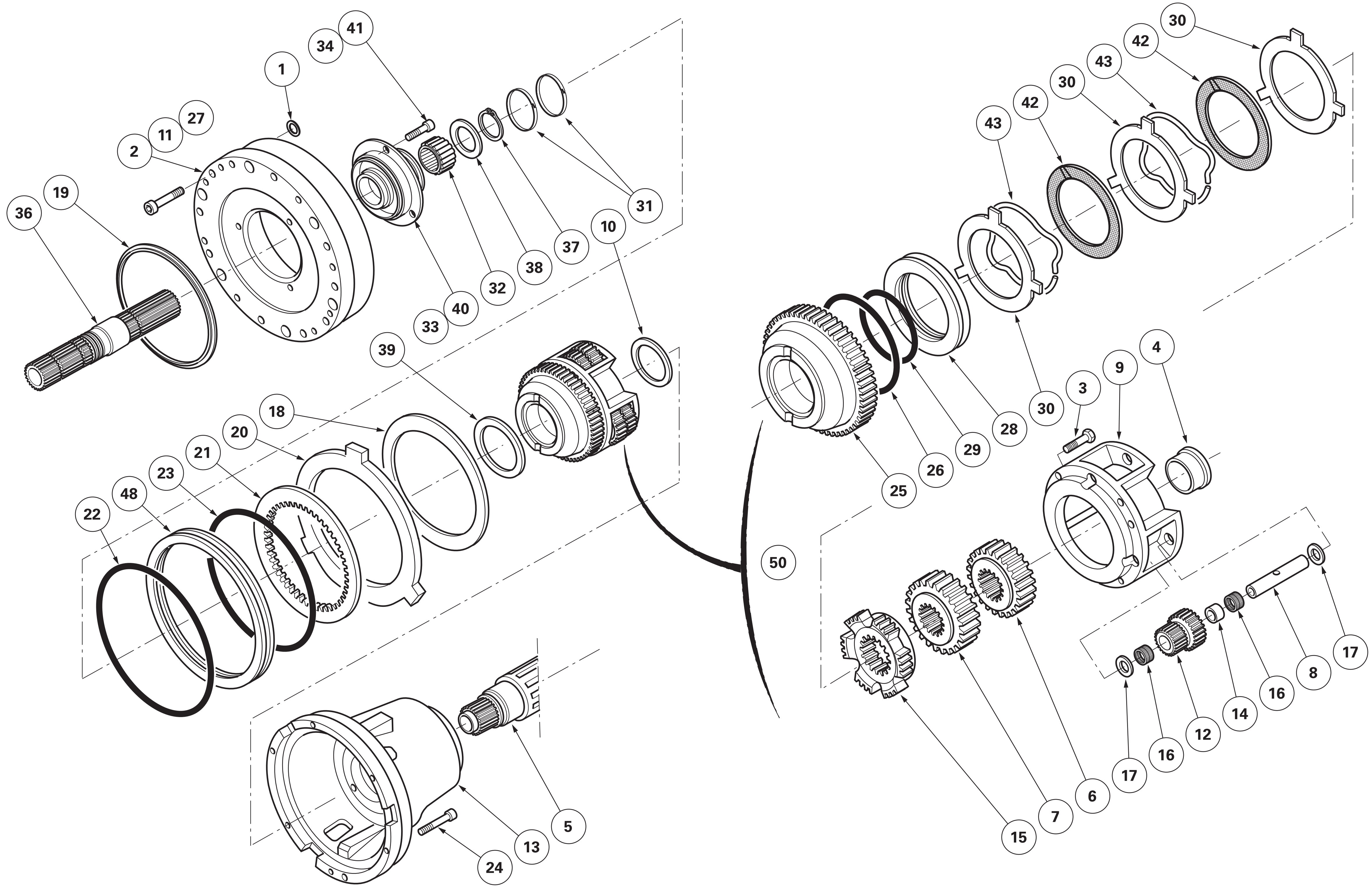

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Fig. 3

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B . Operation

Mechanical action: boosting

In this position (Fig. 4), the hydraulic devices are not supplied and the Speedshift operates in a mechanical manner. The oil in the chamber of pistons (28) and (48) returns to the housing via channel "C" and the solenoid valve mounted on the power shuttle clutch unit. This clutch unit is located to the front right-hand side of the gearbox (see chapter 9).

As the oil pressure has dropped, the planet carrier (50) is locked in rotation by the Belleville washer (18) which compresses the intermediate plate (20) and immobilises disc (21) splined with the planet carrier assembly.

Drive from the primary shaft (36) is fed to the input sun gear (7) splined to the shaft. The sun gear (7) drives the double pinion gears (12) idle-mounted on shafts (8). The pinion gears in turn drive the output sun gear (6) firmly attached to the secondary shaft (5), gear ratio 1.26.

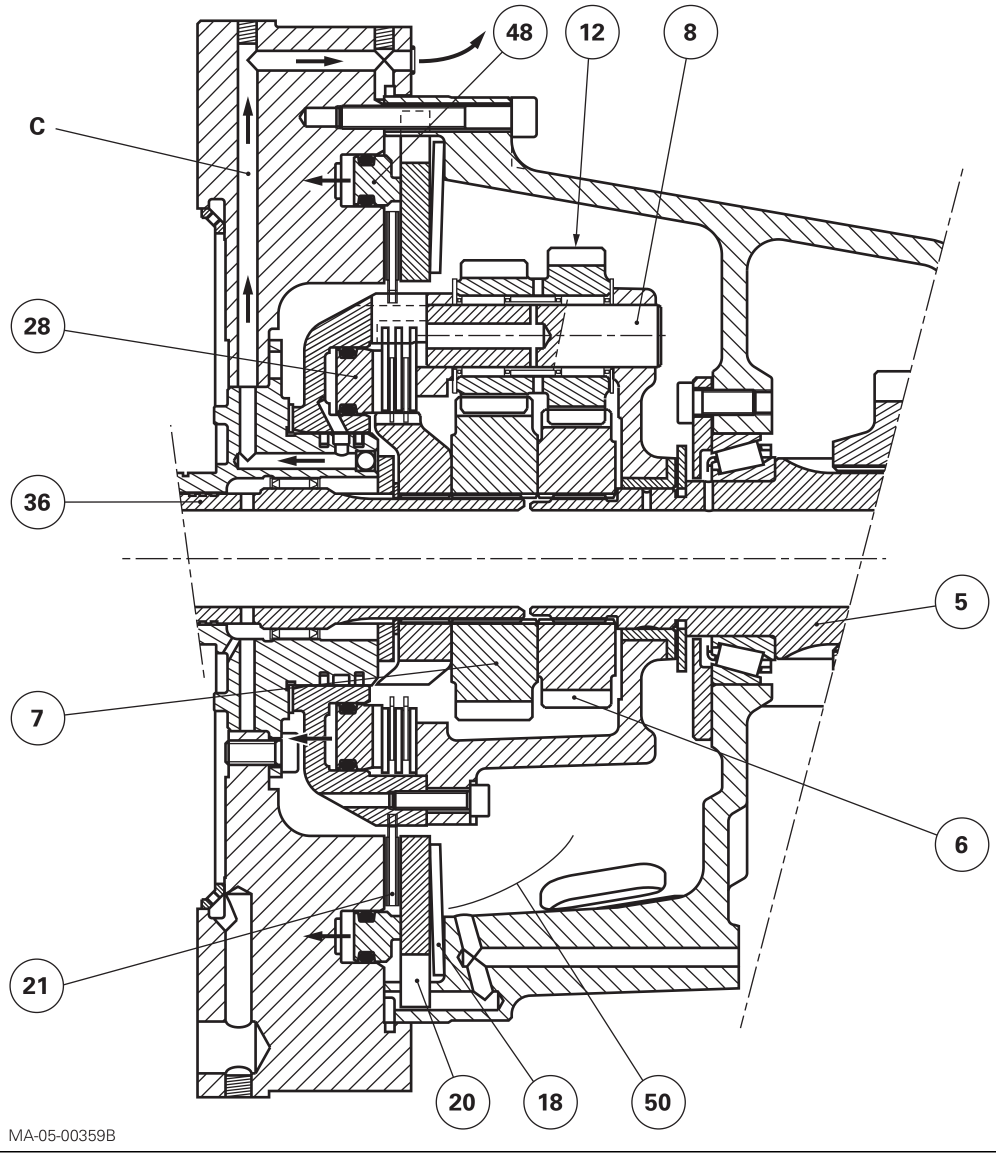

Fig. 4

Hydraulic action: direct drive reduction (Fig. 5)

The range shifting is carried out via a pulse button integrated into the pommel of the gear shift lever. This button activates the solenoid valve mounted on the power shuttle clutch unit located to the right and to the front of the gearbox. The solenoid valve simultaneously supplies the chamber of pistons (48) and (28). The brake piston (48) then presses against the intermediate plate (20) which compresses the Belleville washer (18) thus releasing disc (21) and the planet carrier assembly (50). At the same time, the clutch piston (28) joins the intermediate plates (30) and the discs (42) driven by hub (15). As the intermediate plates are firmly secured to the planet carrier with three tabs, the driving movement is transferred from the input shaft (36) to the hub (15) and to the clutch unit which drives the planet carrier (50). The primary shaft (36), the planet carrier assembly and the sun gears turn at the same speed as the secondary shaft (5), thus ensuring direct drive, gear ratio 1.

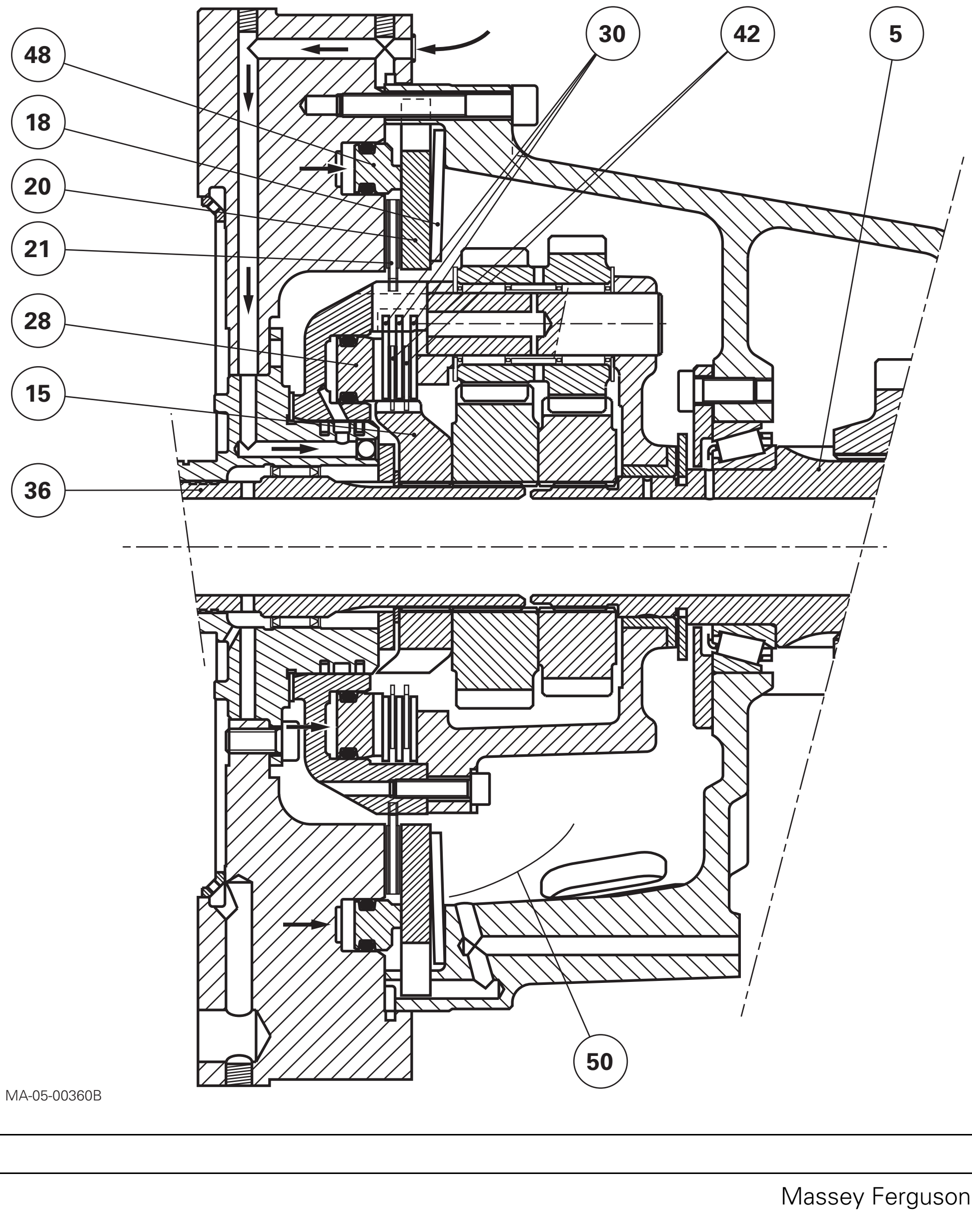

Fig. 5

C . Preliminary operations

1. Disassemble the tractor between the engine and the gearbox (see chapter 2).
2. Drain the gearbox and the rear axle. Remove the spacer (4) (see chapter 3).
3. Remove the forward clutch from the Power Shuttle (see chapter 5).
4. Remove the input unit (see chapter 5).
5. Separate the Power Shuttle reverse clutch from the input box unit (see chapter 5).
6. Position the unit vertically.

D . Removing and disassembling the front cover

Removal (Fig. 6)

7. Take out the screws (24).
8. Using two tabs or two locally made rings, remove the shaft (36), ring carrier (33) and front cover (27) assembly.
9. Take out and discard seals (1).
10. Remove and discard the seal rings (31).

Disassembly (Fig. 8)

11. Take off circlip (37). Remove the tab washer (38) and washer (39).
12. Separate the shaft (36) from the ring carrier (33).
13. If necessary, remove screws (34) (41). Separate and put aside the ring carrier (33) from the cover.
14. Remove piston (48) (Fig. 7) by lightly tapping the cover with a wooden wedge or using a jet of compressed air.
15. Remove seals (22) and (23) and discard them.

Note 1: *The annular restrictor (19) is held in the cover by a Loctite 648 product or similar.*

Note 2: *Rivets (2) and (11) ensure that the oil pipe is sealed.*

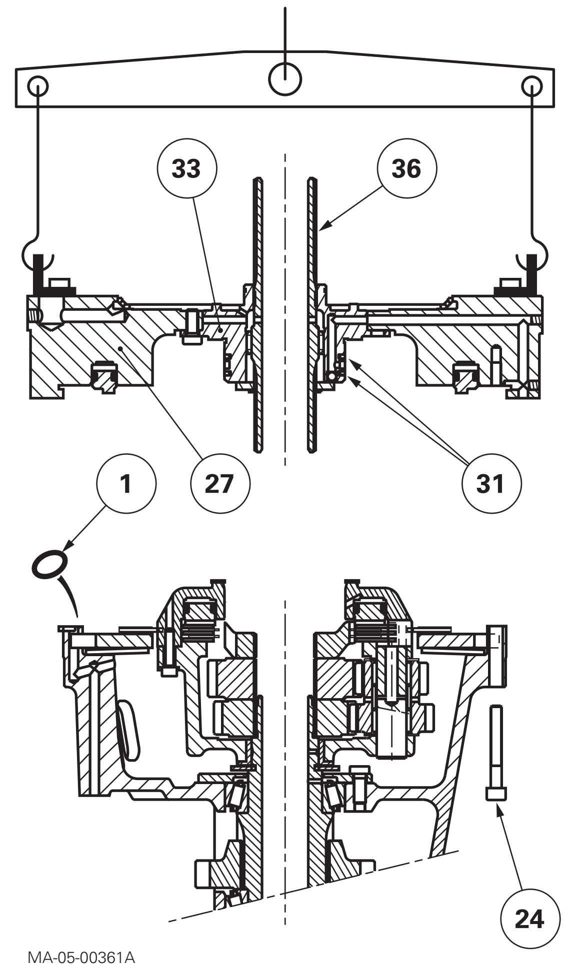

Fig. 6

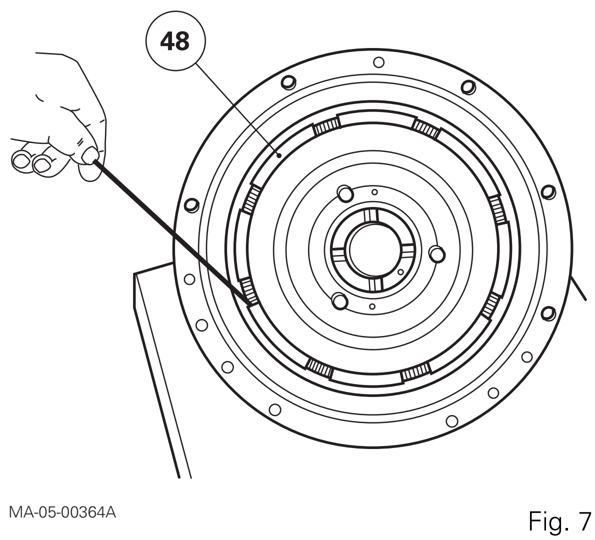

Fig. 7

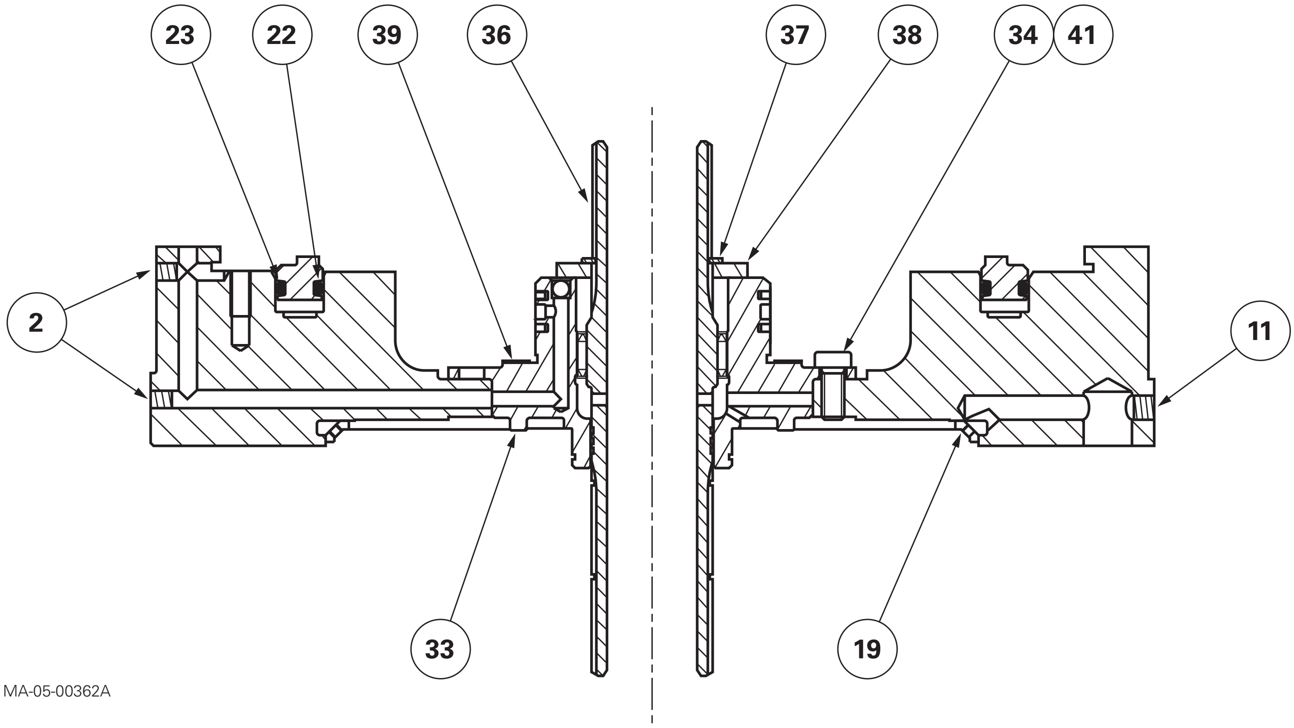

Fig. 8

E . Removing, splitting and disassembling the planet carrier assembly

Removal (Fig. 11)

16. Remove brake disc (21), intermediate plate (20), Belleville washer (18) and planet carrier assembly (50).

Splitting

17. Put the planet carrier assembly on a workbench with the unit (9) turned upwards.

18. Remove the screws (3).

19. Separate the unit (9) from the hydraulic cover (25) while holding sun gears (6) and (7) (Fig. 9).

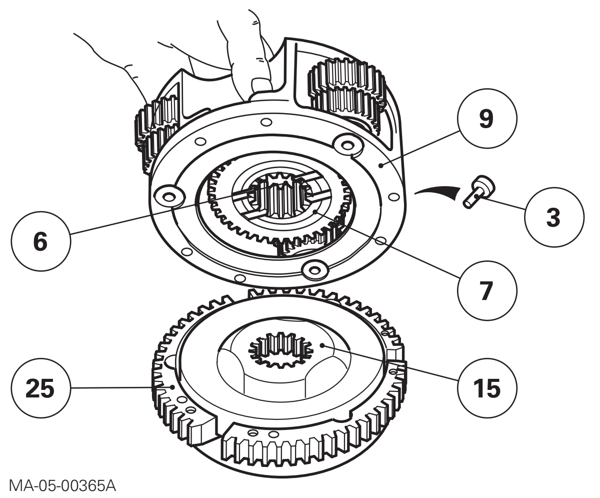

Fig. 9

Disassembly

NOTE: *The text and figures in this paragraph concern the disassembly of a planet carrier for a ground speed of* ***40 kph****.*

20. Remove the input sun gear (7), visually identifying the direction of the lubricating grooves.

21. Drive out shafts (8) using a drift or a mallet (Fig. 10).

NOTE: *Shafts are tight fitted in the thickest part of the planet carrier with the lubrication hole turned towards the hydraulic cover (25).*

22. Remove pinion gears (12).

23. Recover needle bearings (16), spacers (14) and washers (17).

24. Remove the output sun gear (6).

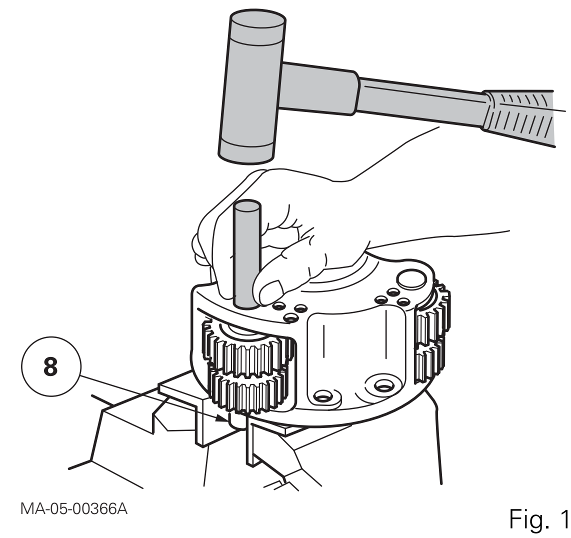

Fig. 10

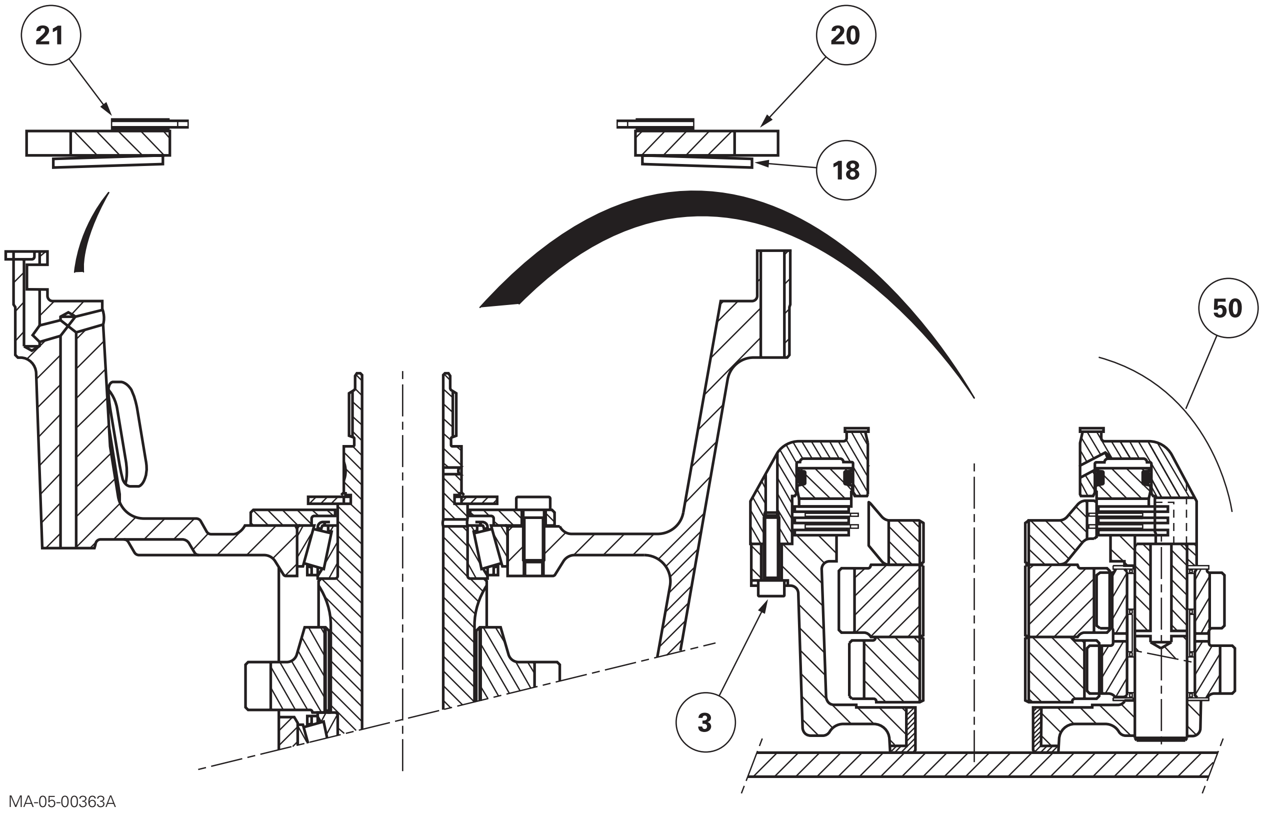

Fig. 11

F . Disassembling the hydraulic cover

25. Remove the splined hub (15).

26. Remove intermediate plates (30), discs (42) and spring washers (43).

NOTE:

The clutch consists of:

- *two friction discs;*
- *two spring washers;*
- *three intermediate plates.*

27. Remove piston (28) by lightly tapping the cover (25) on a wooden wedge or using a jet of compressed air (Fig. 12).

28. Remove seals (26) and (29) and discard them.

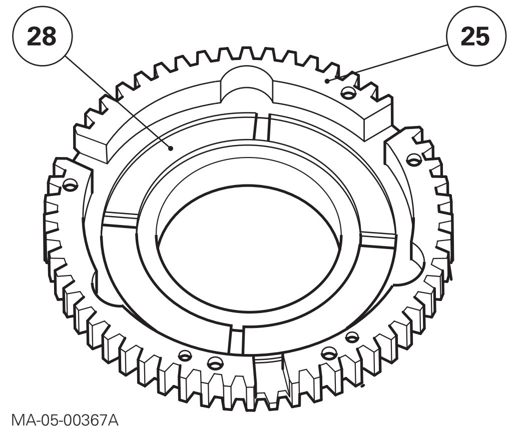

Fig. 12

G . Assembling the planet carrier

29. Clean and check all components. Replace any defective parts.

30. Lubricate needle bearings (16).

31. Make sure that the radial ports and axial channels for lubrication of shafts (8) are not blocked.

Reminder

Tractor speed can be between 30 and 40 kph.

Other speeds are obtained by turning the pinion gears and sun gears of the Speedshift epicyclic gear train (Fig. 1).

All sun gears do not have the same number of teeth:

- *sun gear (6): 36 teeth;*
- *sun gear (7): 39 teeth.*

Note: *The text and figures in this paragraph concern reassembling a planet carrier for a ground speed of **40 kph**.*

32. Put the output sun gear (6) in the gearbox (9), turning the sun gear lubricating grooves towards side "F" of the unit (Fig. 13).

33. Install the needle bearings (16), with a spacer (14) inserted in a pinion gear (12).

34. Put an “assembled” pinion gear in the unit, the 18 tooth pinion turned as in Fig. 1.

Note: *Each double pinion gear is identified with one, two or three punchmarks on one of its sides which is not necessarily the 18 tooth pinion. In this case, make the same marks on the previously mentioned pinion using an appropriate pen. A punchmark corresponds to the alignment of two teeth.*

35. Position washers (**17**).

36. Centre the pinion gears and washers with a guide pin Ø 16 mm, L = 80 mm (Fig. 14).

37. Insert the pin (8) into the free bore on side "F" of the unit (9) (Fig. 14). Fit it partially retracted (Fig. 15), with the radial lubricating port “a” turned outwards and the end of central channel “C” turned towards side “F” (Fig. 14).

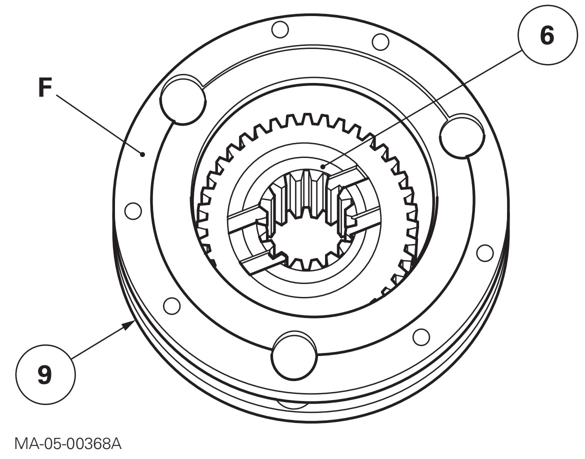

Fig. 13

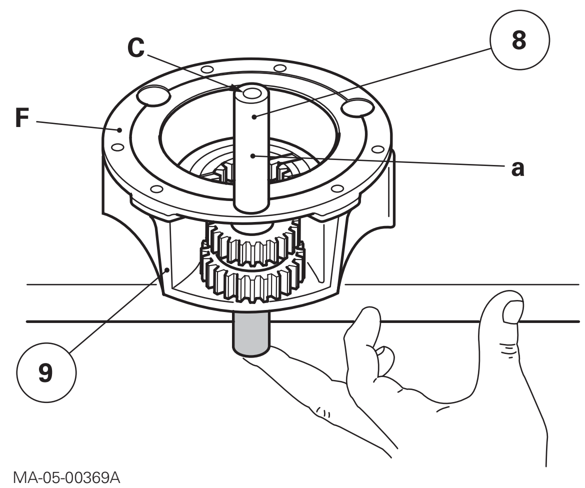

Fig. 14

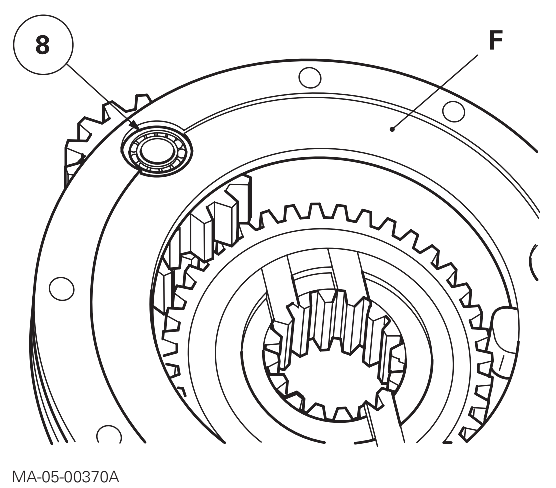

Fig. 15

38. Repeat operations 35 to 37 to assemble the two other pinion gears.

During these operations, position the two pinion gears according to marks "R" so that they run in a line corresponding with "O" (Fig. 16).

39. After final assembly of shafts (8), check again that marks are correctly aligned.

IMPORTANT: *Incorrect alignment may make it impossible to assemble combined parts or cause damage to the epicyclic gear train.*

40. Fit the input sun gear (7) turning the lubricating grooves towards the output sun gear (6).

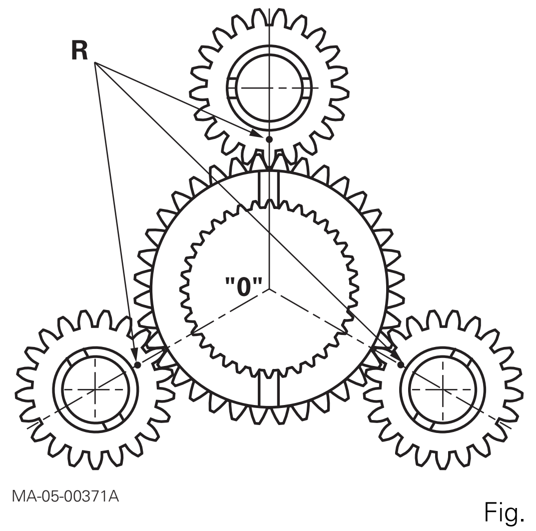

Fig. 16

H . Refitting the hydraulic cover

41. Clean and check all components. Replace any defective parts.

42. Make sure that the three ports of the 17 bar pipe on the hydraulic cover (25) are not blocked (Fig. 17).

43. Lubricate seals (26) and (29) and fit them on piston (28).

44. Lubricate the mating face of piston seals in the hydraulic cover.

45. Position the piston in the cover, turning the grooves towards the operator.

46. Fit the piston (28) using a plastic mallet, gradually and alternately striking around the circumference of piston (Fig. 18).

Check that there are no fragments of O'rings after fitting.

47. Install the splined hub (15) as shown in Fig. 9.

48. Install an intermediate plate (30), a disc (42) and a spring washer (43). Continue stacking parts, ending with an intermediate plate.

NOTE: *Put the cut section of spring washers opposite.*

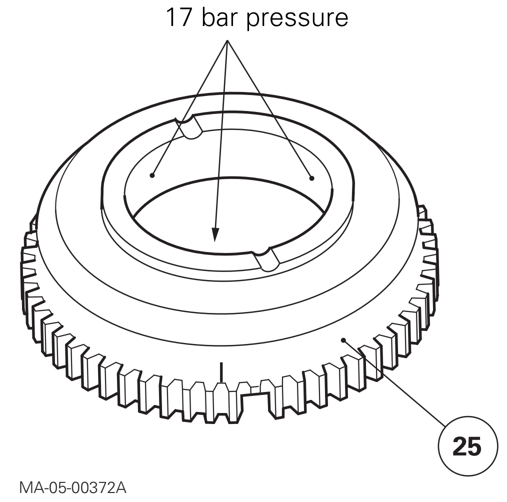

Fig. 17

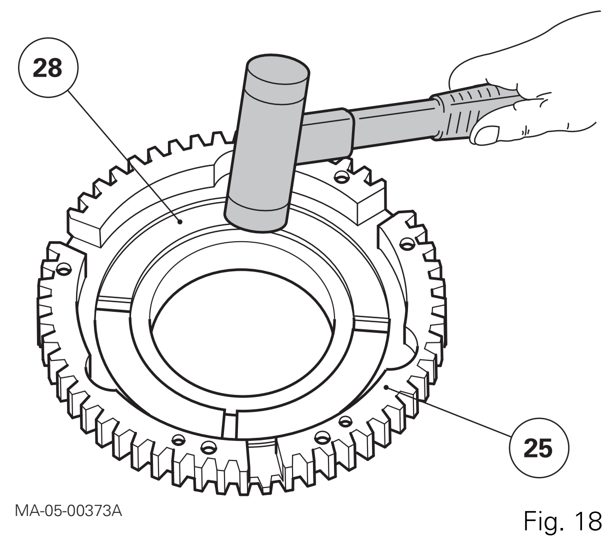

Fig. 18

I . Assembling the planet carrier

49. Screw two diametrically opposed guide studs in the hydraulic cover (25).

50. Assemble the planet carrier unit (9) on the hydraulic cover (25) while holding the sun gears (6) and (7) (Fig. 9).

***NOTE:** Position the planet carrier unit and the cover so that the balancing marks (ground marks) are as far as possible on opposite sides (Fig. 19).*

51. Refit the screw (3). They **must** be tightened to a torque of 14 - 20 Nm.

52. Strike pins (8) definitively home against the hydraulic cover (25) with a pin drift.

53. Check that:

- the discs (42) are not compressed;
- the pinion gears (12) and sun gears (6) and (7) turn freely.

54. Install the planet carrier (50) on shaft (5).

55. Position a Belleville washer (18) as per Fig. 2.

56. Position intermediate plate (20) in housing (13).

57. Install the brake disc (21) on the planet carrier.

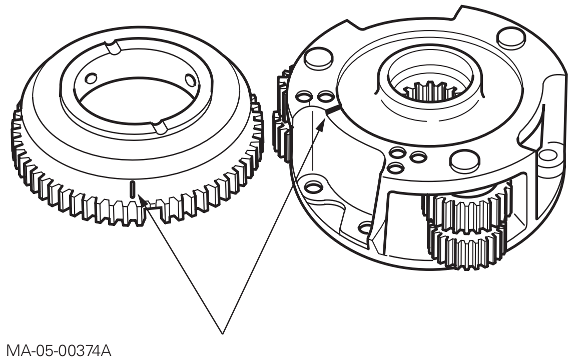

Fig. 19

J . Assembling and refitting the front cover

Reassembly

58. Clean the cover. Make sure that the 17 bar channel and the lubricating channel are not blocked. Check that sealing rivets (2) and (11) are fitted.

59. Fit seals (22) and (23) on piston (48).

60. Lubricate the mating faces of the piston seals in the cover (27).

61. Position the piston in the cover, turning the grooves towards the operator.

62. Fit the piston (48) home using a plastic mallet, gradually and alternately striking around the circumference of piston (Fig. 20).

Check that there are no fragments of O'rings after fitting.

63. If work is necessary on the ring carrier (33):

- check that channels are not blocked and that the ball (40) is correctly crimped in its port (Fig. 21). If necessary, force fit the needle bearing (32) 18.13 to 18.33 mm from side "F" (Fig. 21);
- position the ring carrier on the cover, making sure that the low pressure port (17 bar) and the lubricating port correspond respectively to those in the cover;
- fit and tighten screws (34) and (41), lightly smeared with Loctite 242 or similar, to a torque of 25 - 35 Nm.

64. Check that the lubricating ports on shaft (36) are not blocked.

65. Slide the shaft in the ring carrier.

66. Install washer (38) and circlip (37).

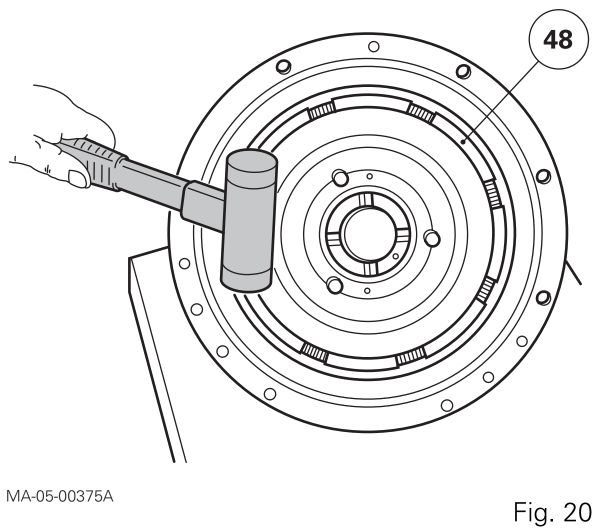

Fig. 20

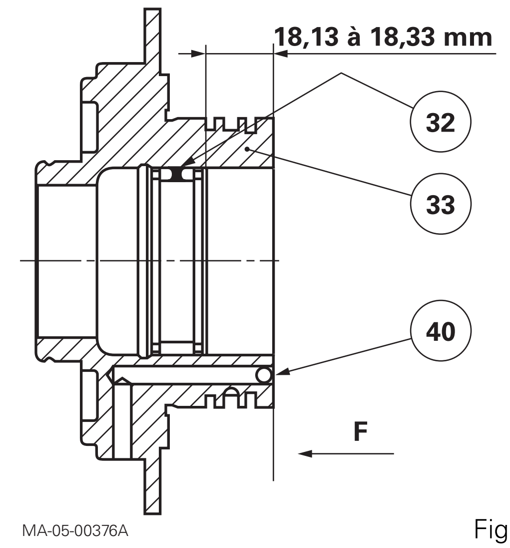

Fig. 21

67. Temporarily fit new rings (31), making sure they turn freely in the grooves.

68. After this check, remove the rings and coat with miscible grease.

69. Install rings in their respective grooves making sure:

- that they do not exceed the circumference of the ring carrier;
- their ends overlap correctly (Fig. 22).

IMPORTANT: *The slightest damage to rings may cause a leak followed by pressure drop and incorrect operation of the Speedshift.*

70. Smear washer (39) with grease and put it on the ring carrier (33).

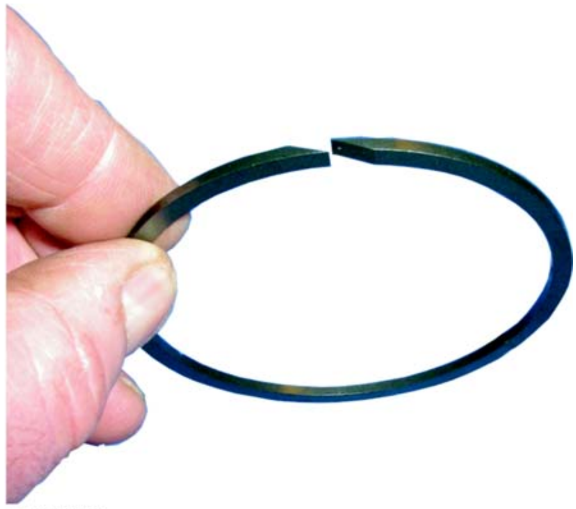

Fig. 22

Refitting

71. Install new seals (1) on housing (13).

72. Refit the shaft (36), ring carrier (33) and front cover (27) assembly using the same procedure as for removal.

73. Install and tighten the screws (24) to a torque of 36 - 46 Nm, with thread lightly greased with Loctite 242 or similar.

74. Remove the locally made lifting tool.

K . Final operations

75. Refit the power shuttle reverse clutch (see chapter 5).

76. Install the input unit (see chapter 5) and the forward clutch of the power shuttle (see chapter 5).

77. Refit the spacer (see chapter 3).

78. Assemble the tractor between the engine and the gearbox (see chapter 2).

05E02 - Selector cover - GBA20 with Power Shuttle

CONTENTS

A . General

5400 series tractors are equipped with a selector cover fitted with a single control lever. This lever is located to the rear of the cover and allows to select the four basic gears and the Hare / Tortoise (Hi - Lo) function.

The changing of the Hare / Tortoise range is carried out via a pulse button integrated into the pommel of the gear shift lever. The gear change action is only validated when the gear shift lever is in the Neutral position.

A cell “C” fitted to the selector cover buzzes to inform the user if a gear is engaged when the handbrake is on.

Selector cover - GBA20 with Power Shuttle

Parts list (Fig. 1 - Fig. 2)

(1) Oil return port
(2) Grounding lug
(3) Screw
(4) Screw
(5) Temperature probe
(6) Stud and nut
(9) Selector cover
(10) Return ports
(13) Gear shift control finger
(14) Gear Selector grid
(15) Screw
(16) Support
(17) Centring bush
(18) Ball
(19) Screw
(20) Spring
(21) Washer
(22) Circlip
(25) Seal
(26) Guide bush
(27) Seal
(28) Neutral position switch
(29) Hexagonal spacers
(31) Plunger
(33) Washer
(34) Toggle
(35) Indexing pin

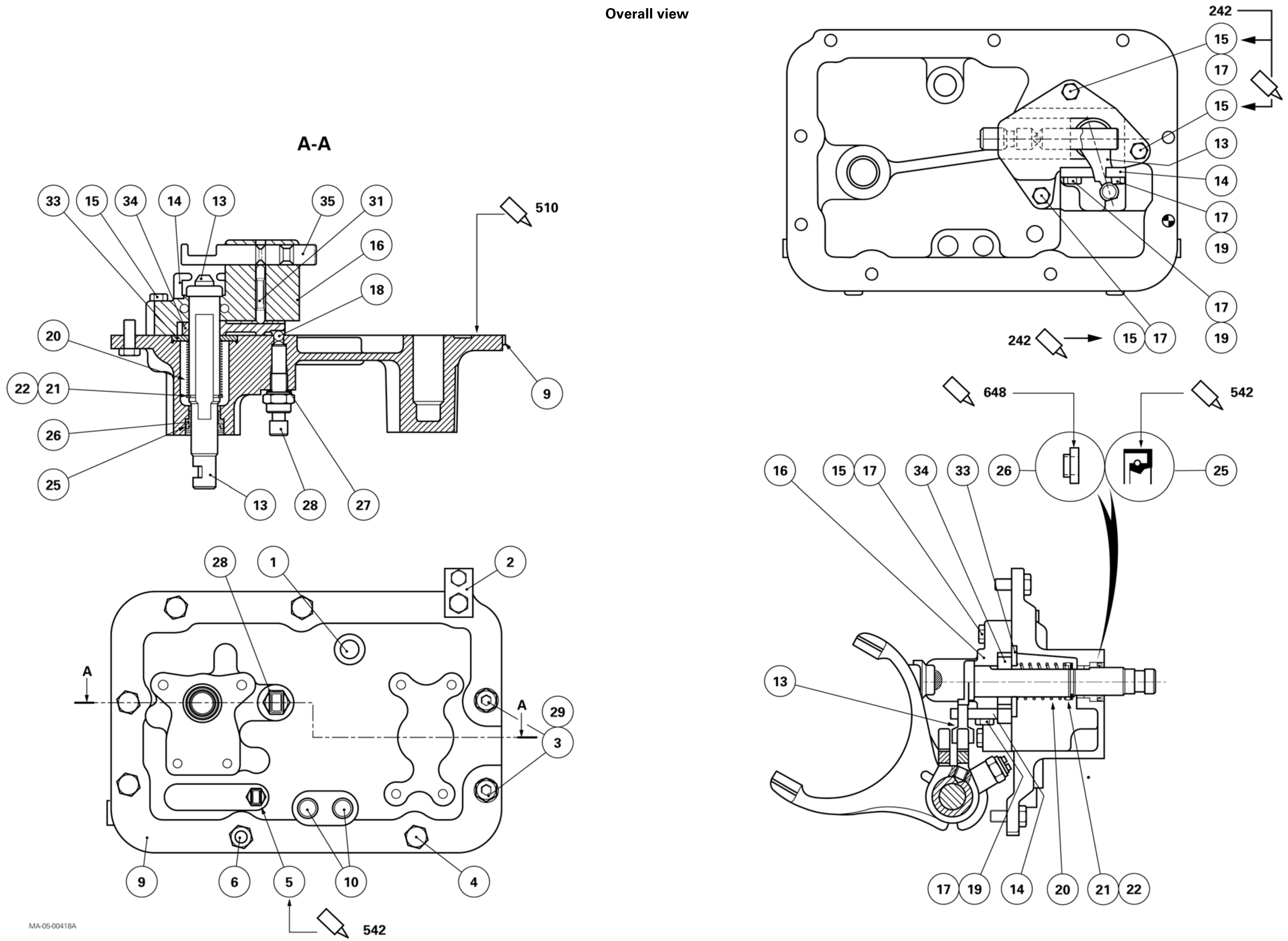

Fig. 1

Parts list (Fig. 1 - Fig. 2)

(1) Oil return port
(2) Grounding lug
(3) Screw
(4) Screw
(5) Temperature probe
(6) Stud and nut
(9) Selector cover
(10) Return ports
(13) Gear shift control finger
(14) Gear Selector grid
(15) Screw
(16) Support
(17) Centring bush
(18) Ball
(19) Screw
(20) Spring
(21) Washer
(22) Circlip
(25) Seal
(26) Guide bush
(27) Seal
(28) Neutral position switch
(29) Hexagonal spacers
(31) Plunger
(33) Washer
(34) Toggle
(35) Indexing pin

Exploded view

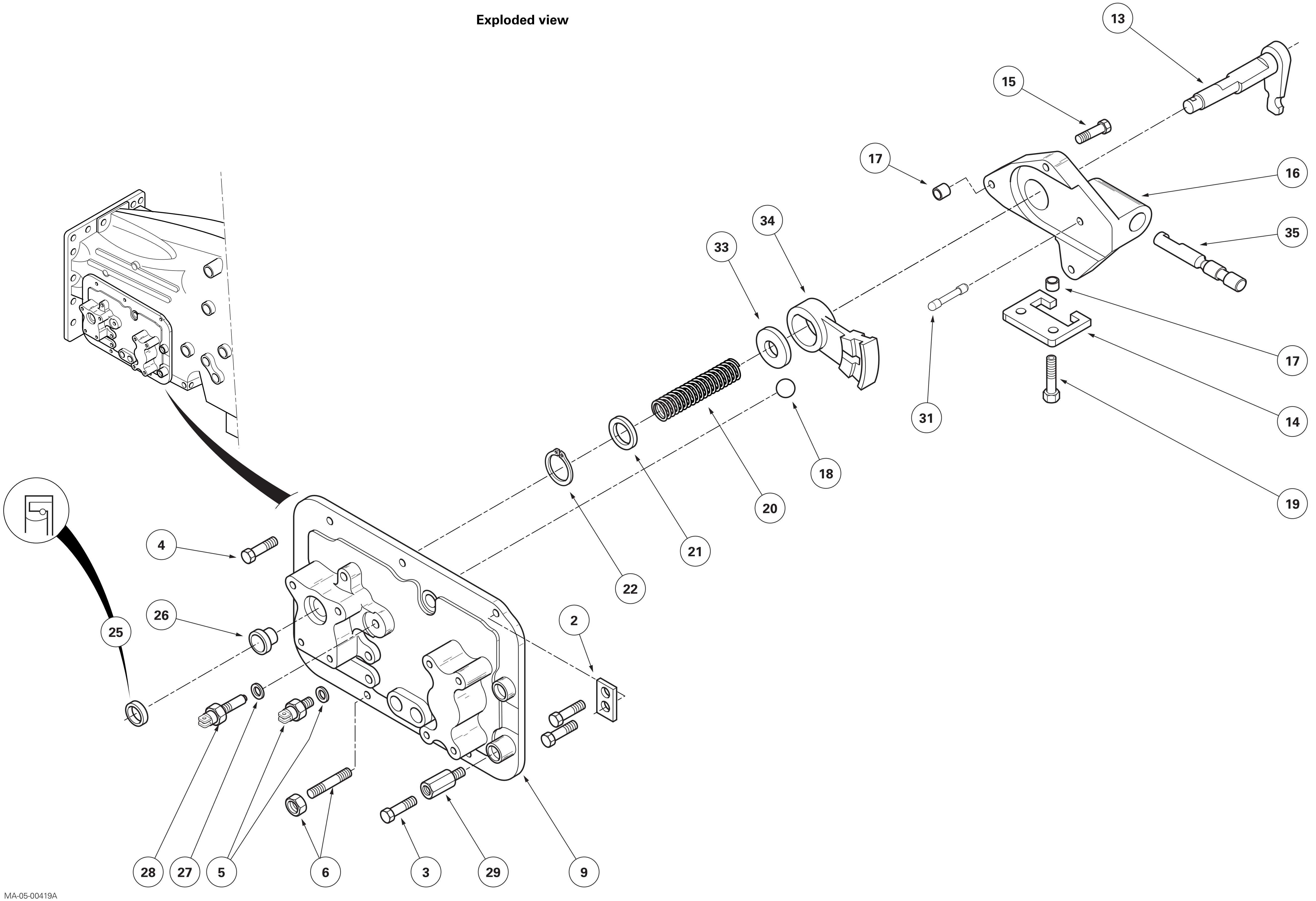

Fig. 2

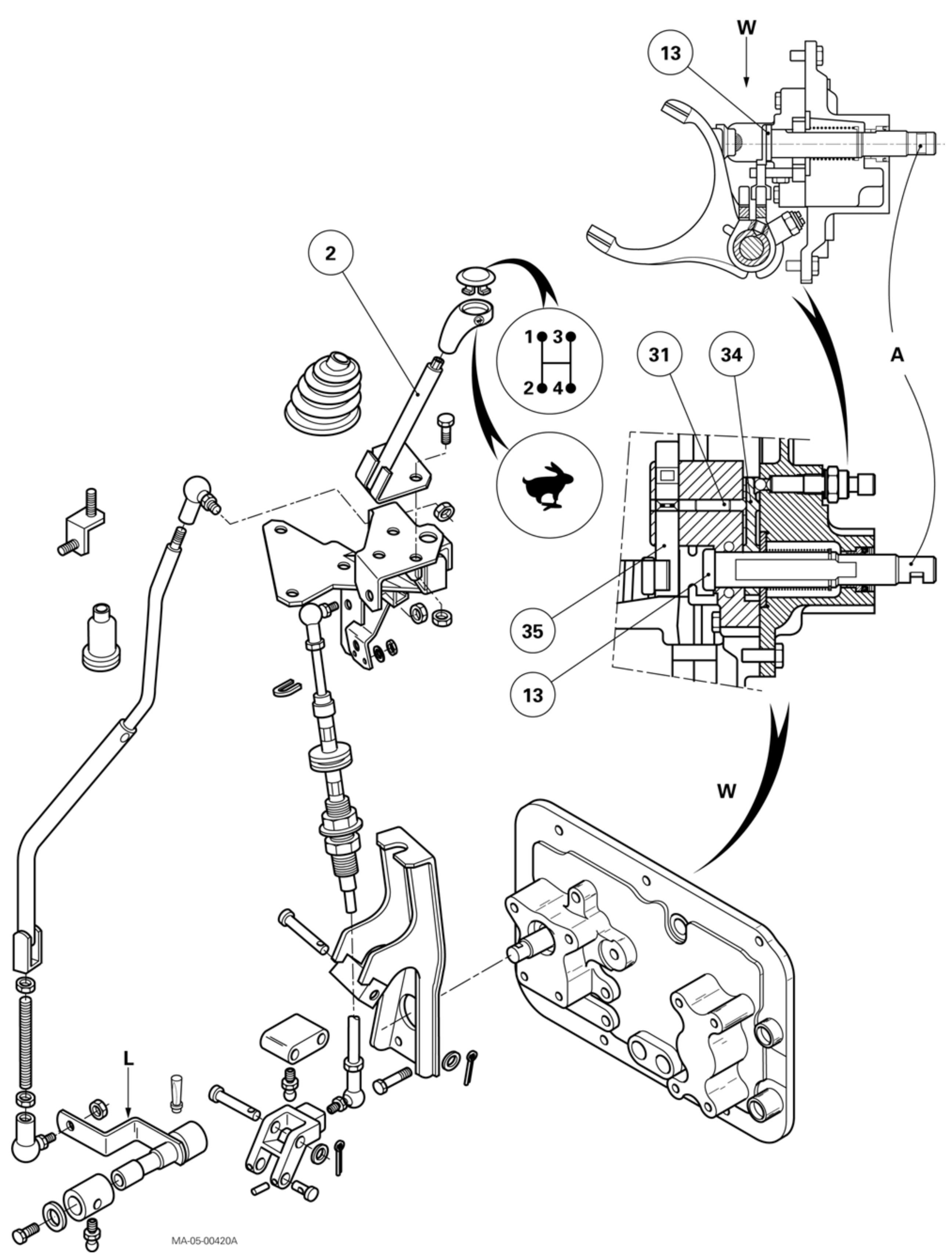

Fig. 3

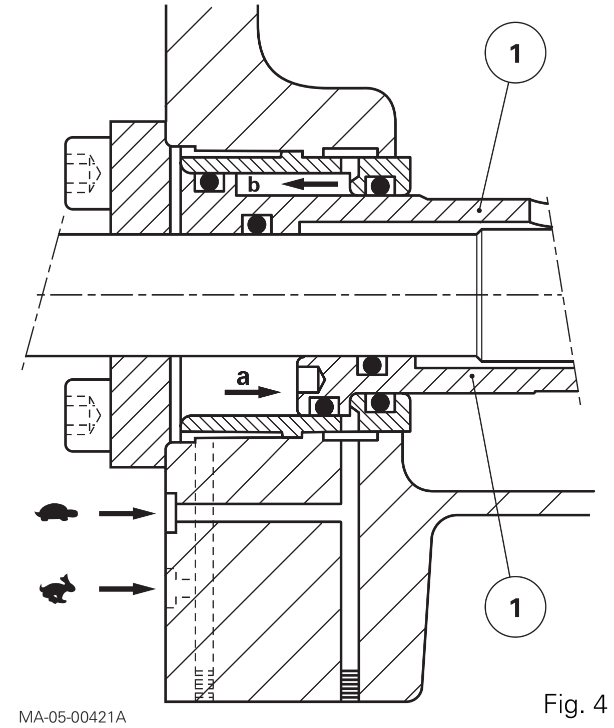

Fig. 4

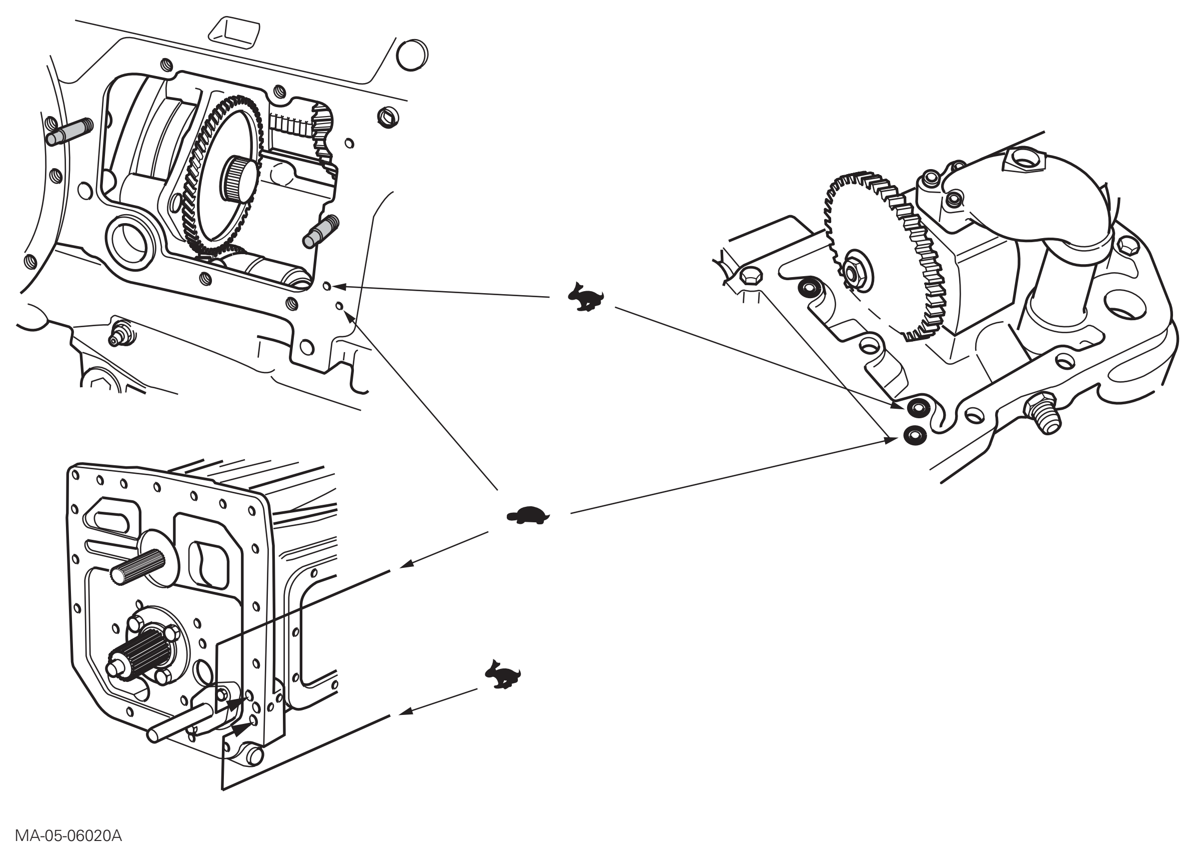

Fig. 5

B . Operation

Gear shift lever (Fig. 3)

Selecting 1st - 2nd gear ratios

The gear shift lever (2) operates lever L and engages the finger (13) in the 1st - 2nd gear fork.

The first ratio is obtained by moving lever L upwards and the second ratio downwards (Fig. 3). Simultaneously, the toggle (34) integral with pin A pivots and moves plunger (31) which thus locks the indexing pin (35) and the Hare / Tortoise fork.

Selecting 3rd - 4th gear ratio

In this configuration, the finger (13) integral with pin A is engaged in 3rd - 4th gear fork.

The third ratio is obtained by moving lever L upwards and the fourth ratio downwards (Fig. 3).

The locking principle of the indexing pin (35) and Hare / Tortoise fork is identical to that used for the 1st - 2nd ratios.

Hare / Tortoise range

The shifting of the Hare / Tortoise range is validated when the gear shift lever is in the Neutral position.

If the button located on the pommel of the gear shift lever is pressed and if switch (28) has confirmed the Neutral position of the lever, the electronic system of the tractor enables the supply or cutting off of voltage to the Hare / Tortoise solenoid valve in order to obtain movement of the fork in the required range.

Hare position

The Hare/Tortoise solenoid valve, fitted on the lower part of the right-hand cover (see section 9) opens and feeds chamber "a" located behind piston (1) (Fig. 4). The piston moves forward, and pushes the fork (Hare / Tortoise).

The oil contained in chamber "b" is discharged into the Tortoise channel, and returns in the 17 bar circuit.

Tortoise position

A fresh activation of the pulse switch (Fig. 3) results in closure of the solenoid valve, and a drop in pressure in chamber “a” (Fig. 4). The piston (1) moves back under the action of the 17 bar pressure exerted on the annular face.

The oil contained in chamber “a” returns to the housing via the Hare channel and the solenoid valve.

Identification of Hare / Tortoise function ports

See Fig. 5.

Identification and function of Hare/Tortoise range locking elements

Toggle (34)

This is one of the main elements of the Hare/Tortoise range locking system. It runs free on pin A (Fig. 3) and pivots with it by means of a flat section.

Function

- It moves the plunger (31) towards the indexing pin (35) and locks it during gear engagement
- Using its other face it controls the Neutral position of pin A (gear shift lever) by means of a switch (28).

Indexing pin (35)

At one end there are two different locking grooves:

- the narrow groove: Hare position,
- the wide groove: Tortoise position.

The other end is designed to house the stop of the Hare/Tortoise fork.

Function

It avoids any unwanted reverse movement of the Hare/Tortoise fork in case of electronic or hydraulic malfunction.

Plunger (31)

Spherically shaped at each end, it moves between toggle (34) and indexing pin (35).

Function

It acts as the system lock, whatever range is engaged.

Switch (28)

It is controlled by a toggle.

Function

It informs the tractor electronic system when the gear shift lever is in Neutral position.

C . Removing and refitting the cover

Preliminary operations

1. Immobilise the tractor. Chock the left rear wheel.
2. Apply the handbrake.
3. Chock between the frame and the front axle.
4. Drain the gearbox.
5. Raise the rear right-hand side of the tractor with a suitable jack.
6. Disassemble the wheel. Position an axle stand.
7. Remove the right-hand footstep and any surrounding elements that might hinder the cover removal.

Removal (Fig. 6)

8. Disconnect the harness of the cell "C" (Fig. 6). Remove the ball joint (4). Remove screw (3).
9. Remove pins (11). Remove the ball joint (5).
10. Note the adjustment of the cable (6). Slightly loosen the top nut (12) and separate the cable from the bracket (2).
11. Disconnect the control cable (1) from the creeper unit on tractors fitted with this option (Fig. 7).
12. Remove the screws (3) (4) and the nut (6), marking the location of the grounding lug (2) (Fig. 1).
13. If fitted, remove the bracket (2) of the creeper unit control cable (Fig. 7).
14. Loosen and remove the selector cover.

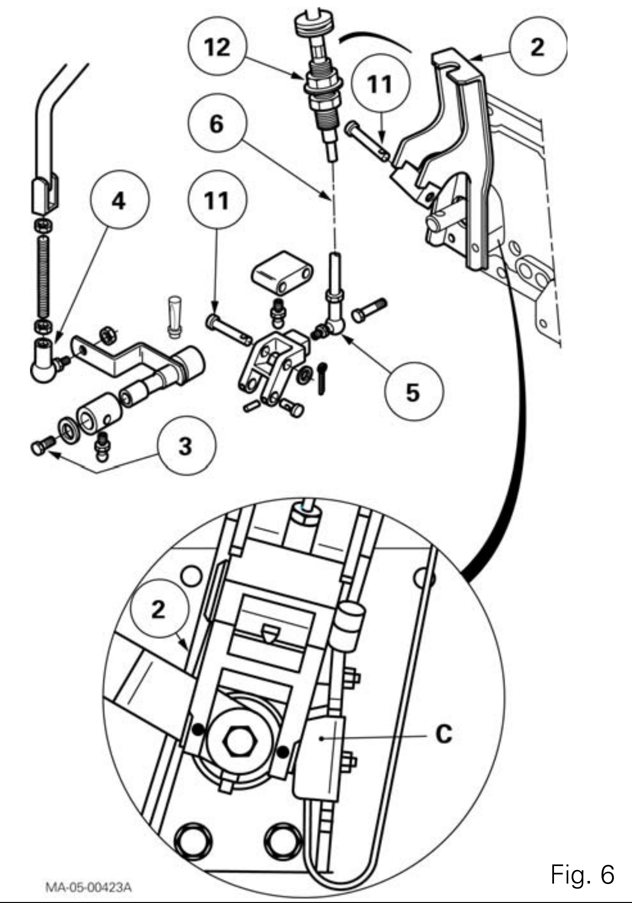

Fig. 6

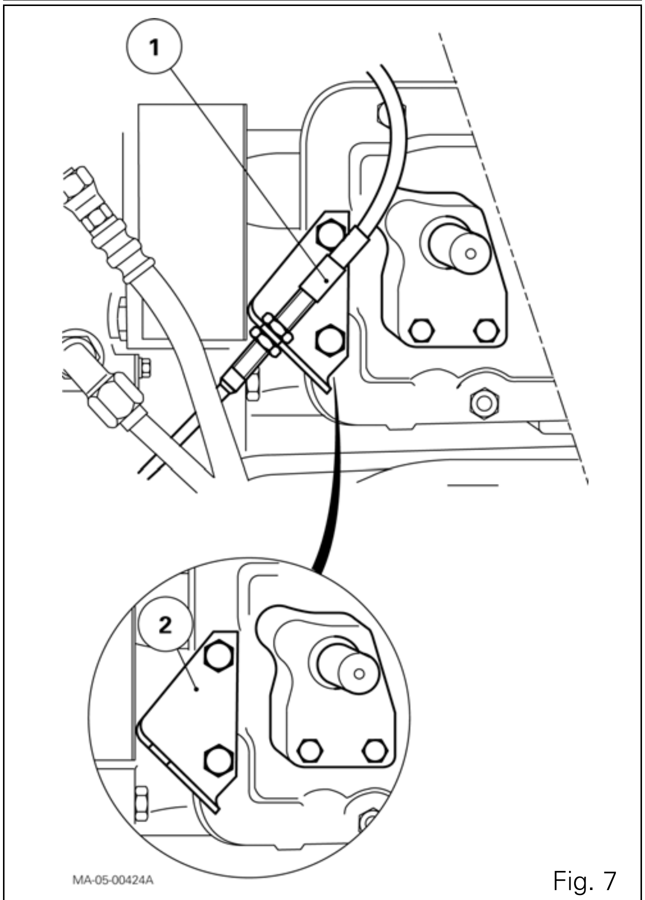

Fig. 7

Refitting (Fig. 1)

15. Clean the mating faces of the gearbox and the cover.

16. Place the 3rd - 4th gear fork in ratio 3 (Fig. 8)

IMPORTANT: Before refitting the cover, check for the presence of the screw (1) (Fig. 8).

17. Coat the mating face of the housing with a sealing product such as Loctite 510 or equivalent.

18. Turn the finger (13) (Fig. 8) toward the left.

19. Position the cover on the gearbox, checking that the finger is correctly placed in the forks.

20. Refit the creeper control cable bracket (if fitted).

21. Refit the grounding lug (2). Fit and tighten screws (3) (4) and the nut (6) to a torque of 50 - 70 Nm.

22. Depending on the option, reconnect and adjust the creeper control (see section 5).

23. Reconnect the wiring harnesses to the temperature probe (5) and the Neutral position switch.

24. Reconnect the gear shift lever and reconnect the cell. Carry out the operations 8 to 10 in reverse order.

25. Using a grease gun, grease the links of the gear shift control on the selector cover.

Legend Fig. 8

A Indexing pin for locking of Hare / Tortoise fork
L Synchronising the Hare / Tortoise system in Hare
(3) Gear engaged: 3rd gear, for example
(1) Screw
(9) Selector cover
(13) Finger
(18) Stop

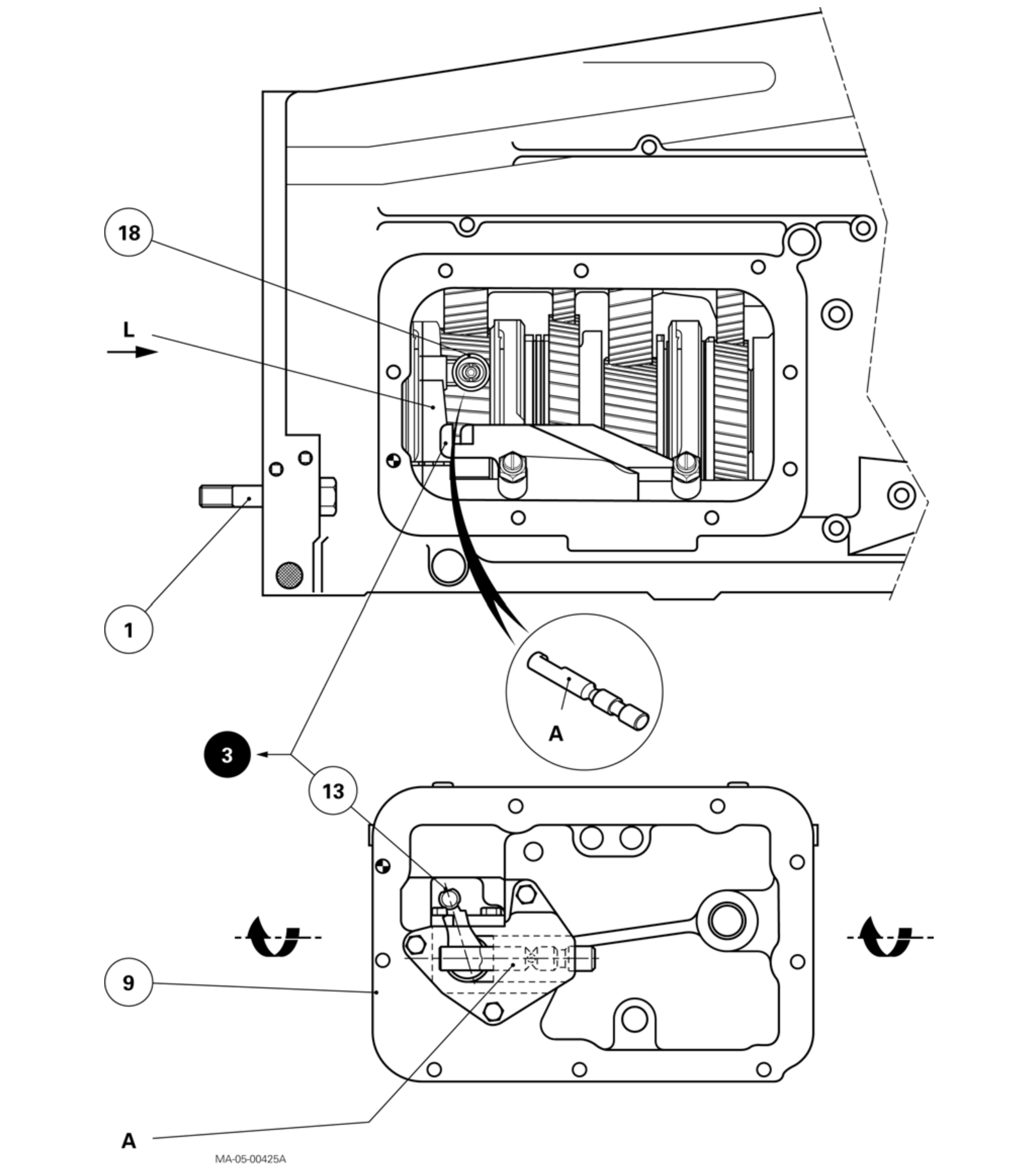

Fig. 8

Final operations

26. Check the smooth engagement of all gears. If required, adjust the control (see § E).

27. As necessary, refit those components removed previously from around the cover.

28. Refit the wheel. Tighten the wheel nuts to a torque of 400 - 450 Nm.

29. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

30. Remove the shims between the frame and the front axle. Release the handbrake.

31. Check that the buzzer of the safety cell vibrates correctly (ignition on, handbrake on and gear engaged).

32. Start the engine.

On the road, check the correct changing up and down of the gear ratios, as well as the operation of the Hare / Tortoise range using the pulse button located on the gear shift lever pommel.

33. Check the oil tightness of the selector cover mating face and of the hydraulic unions.

D . Disassembling and reassembling the selector mechanisms

Preliminary operations

34. Take off the cover (see § C). Secure it in a clamp fitted with soft jaws.

Disassembly (Fig. 1)

35. Take out the screws (1). Remove the key (4) and selector (3). Separate the bracket (2) from the cover (Fig. 9).

36. Take out the screws (15). Separate the cover (9) and bracket (16) comprising the gear shift assembly. If necessary, extract the locating rings (17).

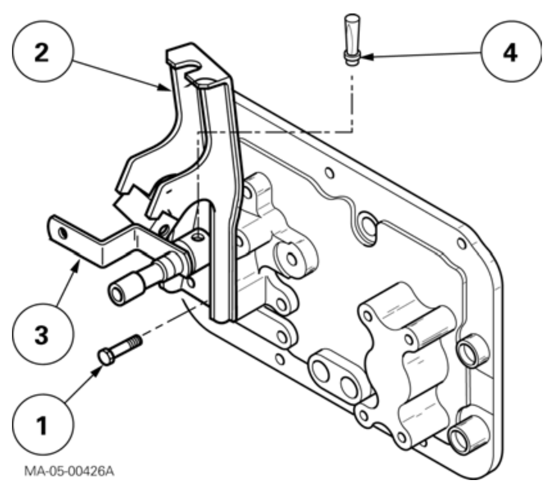

Fig. 9

On the cover (9)

37. Take off the Neutral position switch (28). Recover seal (27) and ball (18).

38. If necessary, remove the temperature probe (5) and the unions screwed on the return ports (1) (10).

39. Extract and discard seal (25).

On the bracket (16)

40. Take off circlip (22), washer (21) and remove spring (20).

41. Release washer (33) and toggle (34), marking its position and profile.

42. Recover the plunger (31). Extract the indexing pin (35).

43. If necessary:
- remove the screws (19),
- remove the gearbox grid (14),
- extract the locating rings (17).

Reassembly (Fig. 1)

44. If it was necessary to remove the guide bush (26), lightly smear its rim with Loctite 648 or equivalent. Fit it up against the shoulder of the cover.

On the bracket (16)

45. If necessary:
- fit home the locating rings (17),
- refit the gearbox grid (14) on the bracket (16),
- tighten screws (19), lightly smeared with Loctite 270 or equivalent, to a torque of 29 - 37 Nm.

46. Check that:
- the plunger (31) and indexing pin (35) move freely in support (16),
- the flat section of the toggle (34) slides normally on the finger (13).

47. Slide the pin of the finger (13) into the bracket (16).

48. Turn the toggle (34) as required. Fit it onto the finger (13). Fit washer (33).

49. Refit spring (20) and washer (21). Fit the circlip (22).

50. Slide the plunger (31) into its cavity in the bracket (16).

51. Place finger (13) in the Neutral position. Turn the indexing pin (35) as required and fit it.

On the cover (9)

52. Check for the presence of locating rings (17).

53. Refit the bracket (16) and gear shift assembly on the cover (9).

54. Lightly smear the thread of the screws (15) with Loctite 242 or equivalent. Tighten to a torque of 29 - 37 Nm.

55. Protect the lip of the seal (25) by surrounding the cylindrical end of the finger (13) with a flexible protection. Lightly smear the external rim of the seal with Loctite 542 or equivalent and slide it onto the protection. Remove the protection. Insert the seal into the cover using a suitable fixture.

56. Check that finger (13) is in the Neutral position.

57. Slide ball (18) into the depression on the toggle (34).

Checking the Neutral position switch (28)

58. Press manually on the button located at the end of the switch. Release the button and check that the button returns freely to its initial position. Repeat the operation several times. The check must be carried out using a multimeter.

59. Refit the switch complete with its seal and tighten to a torque of 15 - 25 Nm.

60. Refit the bracket (2), allowing a distance of **29 mm** between the bracket and the 22 mm diameter of the pin A (Fig. 10).

Lightly smear the screws (1) with Loctite 270 and tighten them to a torque of 25 - 35 Nm.

***IMPORTANT:** This dimension must be met for the cell to operate correctly, see § A.*

61. Refit the selector (3). Fit home and tighten the key (4) (Fig. 9).

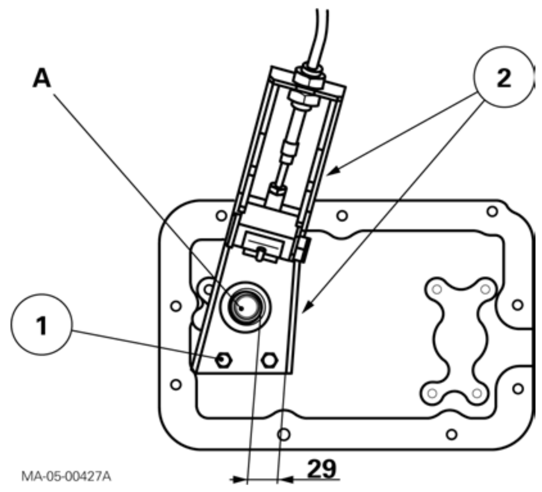

Fig. 10

Checking the locking system of the indexing pin (35)

62. In the grid (14), move the finger (13) from 1st to 4th gear ratio using the selector (3) (Fig. 9) and manually check for the correct locking of the indexing pin in each of its positions.

***IMPORTANT:** This indexing pin is linked to the Hare / Tortoise fork by an adjustable stop. If the replacement of certain components of the locking system was necessary, it is mandatory to readjust this stop (see section 5).*

Final operation

63. Remove the cover from the clamp. Refit it on the gearbox (see § C).

E . Fitting and adjusting the gear linkage

Cab side

Preparation (Fig. 11)

64. On the end of the link control rod (1) shaped with an angle of 166°, position the ball joint (2) as shown in Fig. 11. Tighten nut (3).

65. Tighten the ball joint (4) up against the cable (6). Tighten nut (5).

Assembly (Fig. 11)

66. Place the bracket (7) on a workbench.

67. On the bracket, fit and tighten:
- the gear shift lever,
- the previously prepared link control rod and cable.

68. Refit and secure the bracket onto the right-hand wheel housing of the cab. During this operation, ensure the link control rod and cable are inserted through the ports in the compartments.

Fit the protection rings.

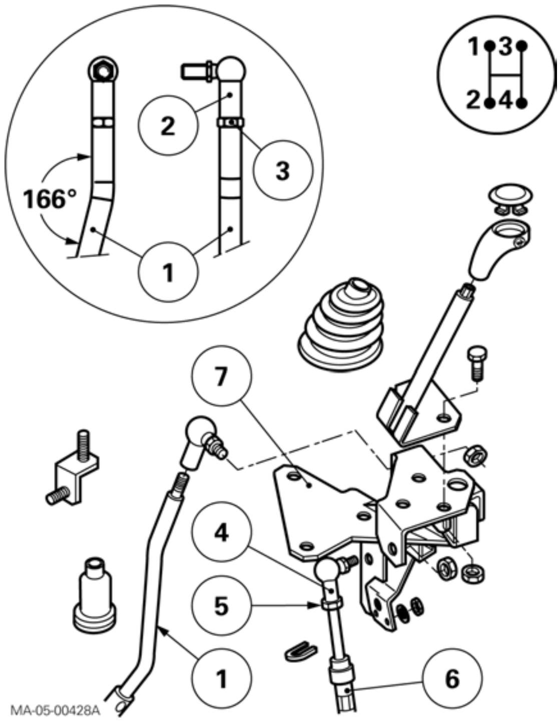

Fig. 11

Selector cover side

Preparation (Fig. 12)

69. Screw the threaded rod (9) (fitted with nuts (3) and the ball joint (4)) onto the link control rod (1).

70. Tighten the ball joint (5) up against the cable (6). Tighten nut (7).

Assembly (Fig. 12)

71. Tighten and lock the other end of the ball joint (5) onto the cam (8).

72. On the previously fitted bracket (2) and lever L , position the cam (8) and its extension piece (10). Fit the pins (11), and lock them in place with new pins.

73. Fit the ball joint (4) on the lever L. Fit the washer and tighten the locknut.

Adjusting the link control rod (1) (Fig. 12)

74. Turn the threaded rod (9) and ball joint (4) to obtain a dimension X of **17 ± 1 mm** between the two nuts (3) when they are tightened.

Adjusting the cable (6) (Fig. 12)

75. Adjust the end-point to balance (as far as possible) dimensions "C" and "D". Tighten nuts (12) without altering the adjustment.

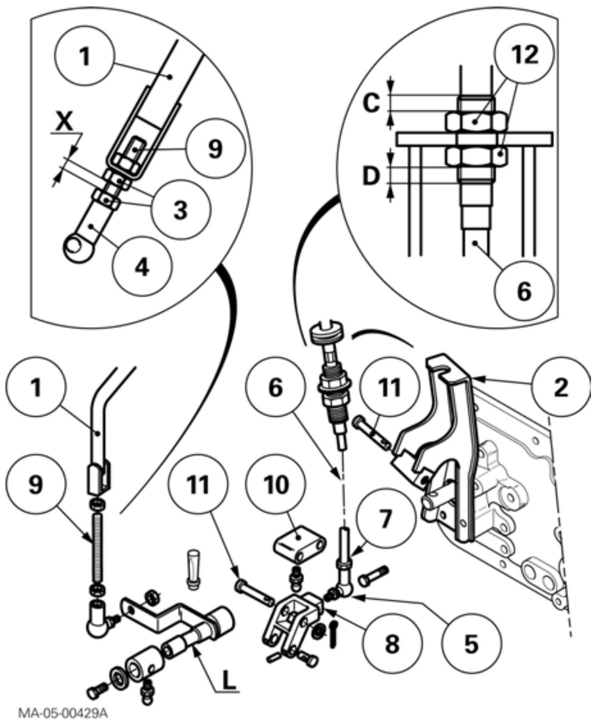

Fig. 12

Check for the proper engagement of each gear ratio and the position of the gear shift lever in the opening of the console.

***IMPORTANT:** This check should be performed with the dust cover of the gear shift lever temporarily removed.*

76. Engage each gear ratio. During this operation, check that the lever is **never closer than 5 mm** from the edge of the console (Fig. 13 - Fig. 14).

Results

- **Lever movement is not hindered in any way by the console**

  Adjustment is correct. Refit the boot.
- **Lever movement is hindered by the console**

  The lever is positioned incorrectly. Readjust the link control rod (1) (Fig. 12) on the selector cover side according to the following instructions:
  - If the problem concerns the 1st or 3rd gears (Fig. 13), reduce dimension X (Fig. 12).
  - If the problem concerns the 2nd or 4th gears (Fig. 13), increase dimension X (Fig. 12).
  - If the problem concerns lateral movement of the lever between the 1-2 and 3-4 gear paths (Neutral position) (Fig. 14), adjust the cable end-point(6) (dimensions C and D) (Fig. 12). Tighten nuts (12).

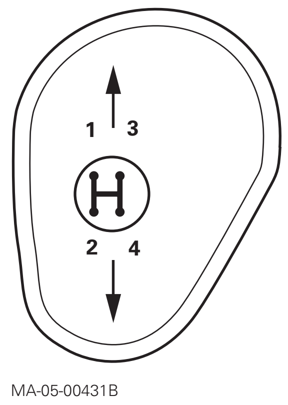

Fig. 13

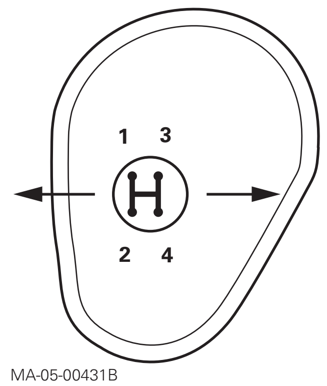

Fig. 14

05F01 - GBA20 selector rails with mechanical reverse shuttle

CONTENTS

A . General

On the gearbox

The selector rail (7) holding the different forks is located on the right-hand side of the gearbox, on the selector cover side (Fig. 1). It passes through the gearbox housing and the control piston of the Hare / Tortoise range (13).

It is held in position by a set screw (8). A cup plug (9) closes off the bore at the front and a cover (15) closes the rear end.

The 1st - 2nd (5) and 3rd - 4th (6) forks are not adjustable.

The creeper fork (28) is adjustable by mechanical pressure.

Two adjustments are necessary to obtain the correct functioning of the fork (20) in both ranges (Hare / Tortoise):

- adjustment of the space between the fork pads and the synchromesh sliding coupler;
- adjustment of the stop (18), in relation to the position of the indexing pin mounted on the selector cover.

An optional creeper unit may be fitted (see Fig. 1 and chapter 5).

An optional super-creeper unit may also be fitted (see chapter 5). In this case, the locating pin (29) is not fitted.

On the input unit (Fig. 1)

The mechanical reverse shuttle synchromesh is controlled by:

- a selector;
- a selector rail;
- a fork.

The selector and fork are non-adjustable.

MA-05-05027A

Fig. 1

GBA20 selector rails with mechanical reverse shuttle

Parts list (Fig. 2)

(1) Plug
(2) Spring
(3) Locking stud
(5) 1st - 2nd Fork
(6) 3rd - 4th Fork
(7) Guide pin
(8) Set screw
(9) Cup cap
(10) Cylinder
(11) O'ring
(12) O'ring
(13) Hare and Tortoise range piston
(14) O'ring
(15) Cover
(16) Screw
(17) Screw
(18) Stop
(19) Adjusting screw
(20) Hare / Tortoise fork
(26) Nut
(27) Locking screw
(28) Creeper fork
(29) End-of-travel pin

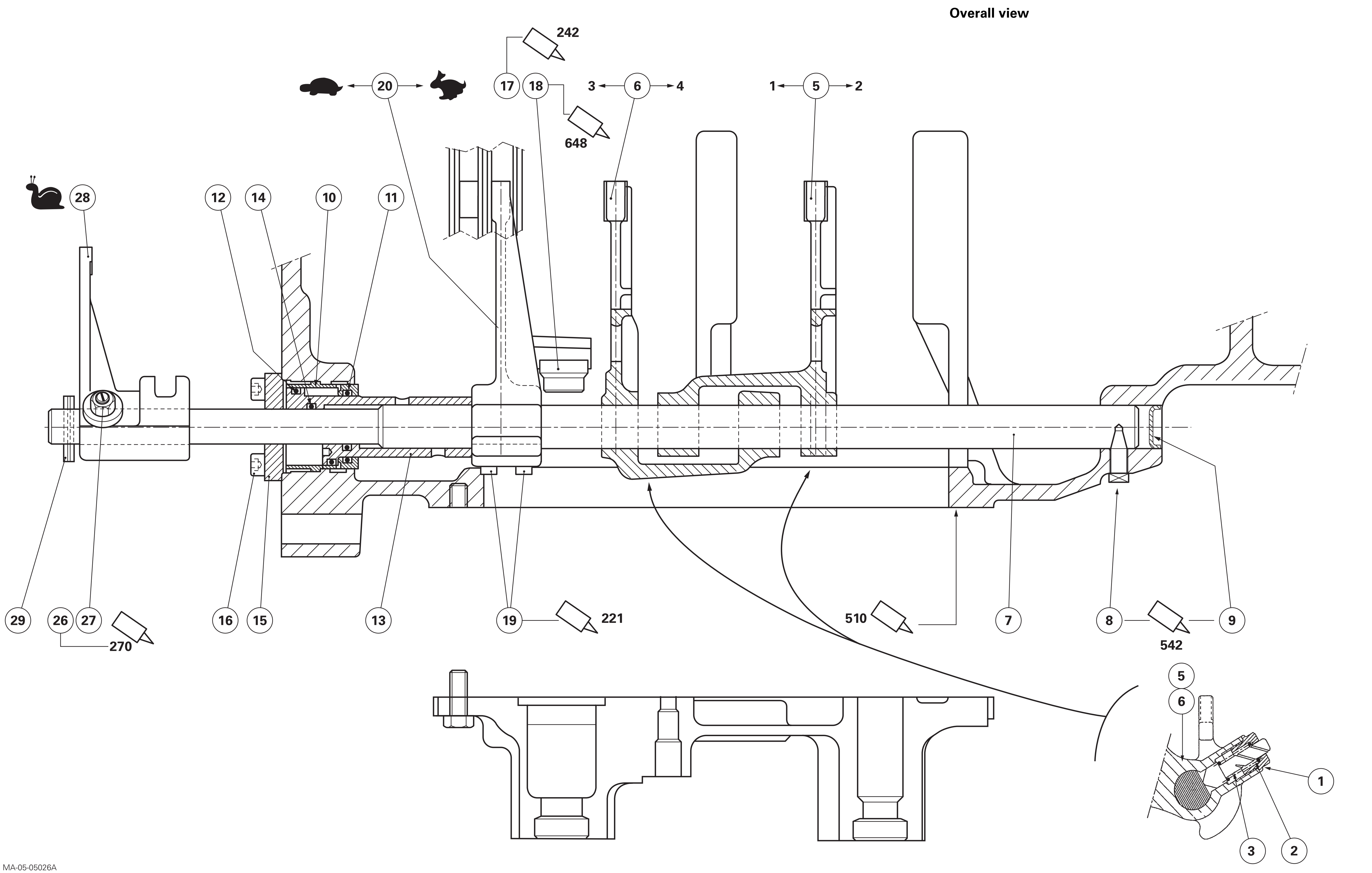
Overall view
242
20
17
18
3
6
4
1
5
2
648
28
12
14
10
11
29
26
27
270
16
15
13
19
221
510
7
8
9
542
5
6
1
3
2
MA-05-05026A

Fig. 2

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Parts list (Fig. 3)

(1) Plug
(2) Spring
(3) Locking stud
(5) 1st - 2nd Fork
(6) 3rd - 4th Fork
(7) Guide pin
(8) Set screw
(9) Cup cap
(10) Cylinder
(11) O'ring
(12) O'ring
(13) Hare and Tortoise range piston
(14) O'ring
(15) Cover
(16) Screw
(17) Screw
(18) Stop
(19) Adjusting screw
(20) Hare / Tortoise fork
(26) Nut
(27) Locking screw
(28) Creeper fork
(29) End-of-travel pin

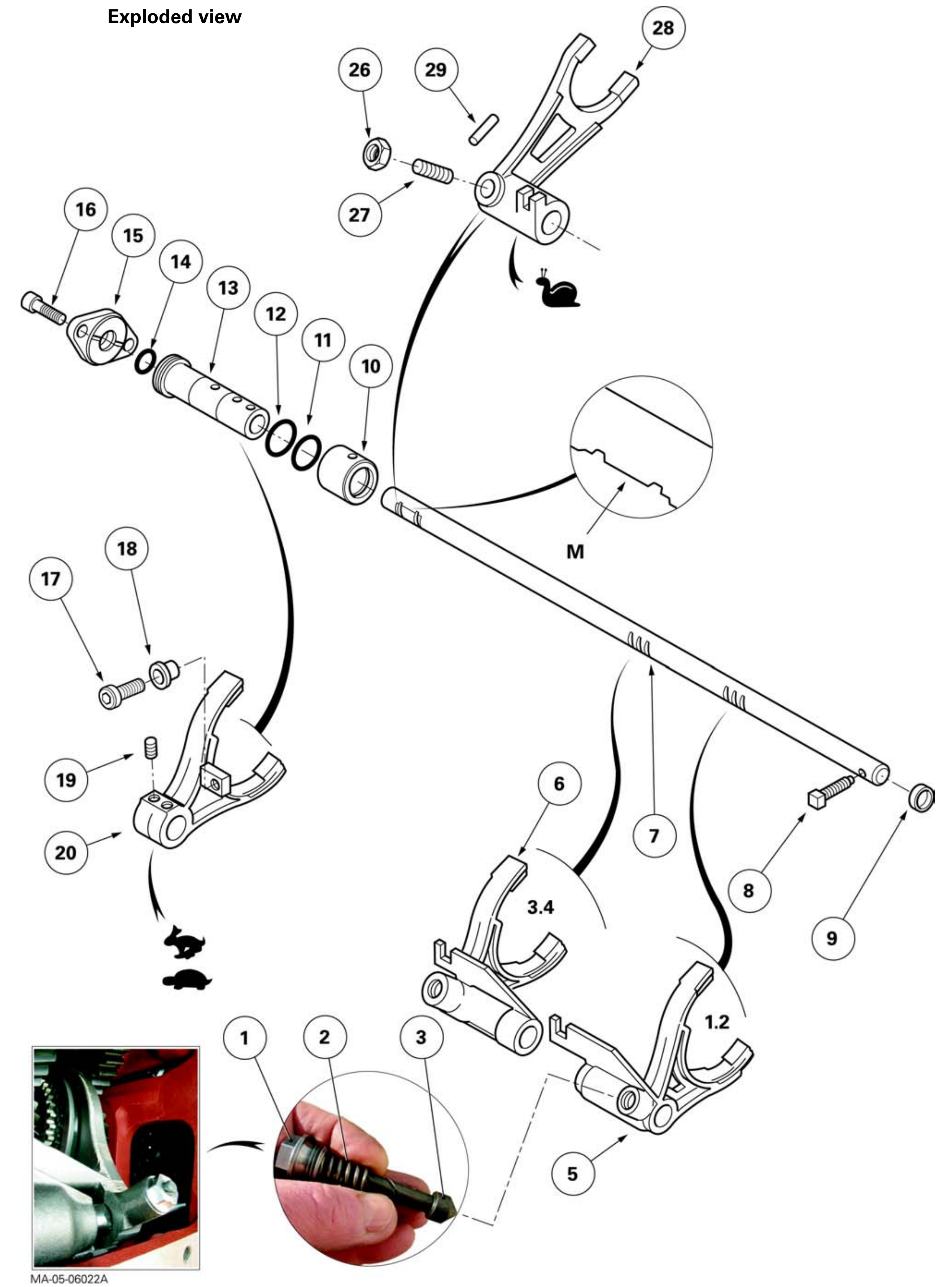

Fig. 3

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B . Servicing guide

This guide describes a succession of operations to be followed depending on the mechanical component to be worked on.

Creeper fork

- Remove the selector cover (see chapter 5).
- Remove the right-hand hydraulic cover (see chapter 9).
- Remove the creeper fork.

Hare / Tortoise fork

- Remove the selector cover (see chapter 5).
- Remove the right-hand hydraulic cover (see chapter 9).
- Remove the creeper fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic parts (ram) of the Hare / Tortoise mechanism.
- Take out the range fork.

1st-2nd and 3rd-4th gear fork

- Remove the selector cover (see chapter 5).
- Remove the right-hand hydraulic cover (see chapter 9).
- Remove the creeper fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic parts (ram) of the Hare / Tortoise mechanism.
- Take out the range fork.
- Move the selector rail backwards.
- Take out the 1st-2nd and 3rd-4th gear forks.

Main selector rail

- Remove the selector cover (see chapter 5).
- Remove the right-hand hydraulic cover (see chapter 9).
- Remove the creeper fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic components of the Hare / Tortoise mechanism.
- Take out the range fork.
- Take out the 1st-2nd and 3rd-4th gear forks.
- Move the selector rail backwards as far as it will go and disengage it through the selector cover aperture.

Tractors with no creeper unit

The selector rail can also be removed through the front on tractors not fitted with a creeper unit. To do this it is necessary to:

- split the tractor between the engine and the gearbox (see chapter 2);
- remove the gearbox spacer (only on tractors fitted with 6-cylinder engine) (see chapter 3).

Reverse shuttle selector

- Remove the selector cover (see chapter 5).
- Remove the reverse shuttle selector.

Reverse shuttle fork

- Disassemble the tractor between the engine and the gearbox (see chapter 2).
- Remove (see chapter 5):
  - the selector cover;
  - the reverse shuttle selector;
  - the input unit;
  - the reverse shuttle fork.

Reverse shuttle selector rail

The selector rail is removed using the same procedure as for the fork.

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C . Creeper fork

Disassembly

1. Disassemble the right rear wheel.
Chock the tractor wheels.

2. Disconnect the rear axle creeper unit control cable.

3. Remove the selector cover (see chapter 5). Take out the plugs (1), the springs (2) and the locking studs (3) to release the selector rail (Fig. 3).

4. Remove the hydraulic cover(s) (see chapter 9).

5. Remove screw (1). Pull the guide rod link (2) and the lever (3) outwards to release the finger of the fork (Fig. 4).

6. Unscrew the nut (26) and the locking screw (27) on the fork (28).

7. Take out set screw (8).

8. Turn the selector rail (7) and drive out the pin (29) (Fig. 5 - Fig. 6) without dropping it into the housing.
Move the selector rail forward.

Remove the pin (1) from the coupling sleeve (2) on a 2 or 4WD tractor (operations 9 to 12)

Note: *Depending on the angle of the coupling sleeve (2) located between the gearbox output shaft and the drive pinion, the pin (1) is accessible or inaccessible.*

2WD tractor

9. If the pin (1) is accessible, drive it from the sleeve (2) (Fig. 7).

10. If the pin (1) is not accessible:
- raise the tractor rear axle beam with a trolley jack;
- turn the drive pinion to correctly position the coupling sleeve (2) (Fig. 7);
- drive out the pin (1) (Fig. 7).

4WD tractor

11. If the pin (1) is accessible, drive it from the sleeve (2) (Fig. 7).

12. If the pin (1) is not accessible:
- disconnect the front differential lock control hoses;
- remove the guard (1). Separate the rear sleeve (5) from the transmission shaft (3) (Fig. 8);
- turn the drive pinion to correctly position the coupling sleeve (2) (Fig. 7);
- drive out the pin (1) (Fig. 7).

13. Provisionally fit the set screw (8) in order to hold the selector rail in place to remove the fork (28).

14. Slide the sleeve (2) and coupler (1) closer together on the linkage shaft (3) (Fig. 9).

15. Note and mark the assembly order of the sleeve (2) (Fig. 9).
Disengage the sleeve / link shaft / coupler assembly towards the outside left-hand side.
Take it out of the fork (28) (Fig. 9) and remove it through the right-hand cover.

16. Remove the fork (28) on the selector rail (7) (Fig. 10).

17. Disassemble the lever (3) (Fig. 4).

18. To remove the creeper unit control link (1), turn it so it passes beneath the selector rail (7) (Fig. 11).
Discard the O'ring (3).

Reassembly

19. Clean and check all components. Replace any defective parts.

20. Refit the control link and pull it as far to the right as possible. Install a new lubricated O'ring (Fig. 12).

21. Reassemble the lever (3) (Fig. 13). Tighten the screw.

22. Refit the fork on the selector rail.

***IMPORTANT:** Ensure that the finger (1) of the creeper gear control linkage points towards the front of the tractor (Fig. 13).*

23. Couple the sleeve / link shaft / coupler assembly inside the housing. Place it in the fork, turning the machined groove on the sleeve (2) towards the rear of the tractor (Fig. 14).

24. Slide the sleeve and coupler onto the link shaft.

25. Force fit a new double pin (1) into the sleeve (2) (Fig. 7).

26. Take out set screw (8).

27. Force fit a new pin (29) and turn the selector rail (7) (Fig. 5 - Fig. 6).

28. Clean the set screw (8). Smear its thread with Loctite 542 and tighten to a torque of 38 - 43 Nm.

29. Ensure that the ball mounted at the end of the locking screw (27) returns correctly to its initial position after pressure has been applied manually by the locking screw. Position the fork (28) and locking screw on flat section “M” of the selector rail (7) (between the two locking catches) (Fig. 3).

Fully tighten the screw without forcing it in order to compress the ball.

Loosen the screw by one-quarter turn. Clean the nut (26) and smear with Loctite 270 or similar. Tighten to a torque of 15 - 20 Nm while holding the locking screw in place.

Check the fork locks correctly.

30. Turn and push the rod (2) in order to engage the finger in the fork. Fit the screw (1) smeared with Loctite 542 or similar (Fig. 4).

31. Check that the rod operates correctly.

32. Check that the O’rings of the internal hydraulic pipes are not damaged (see chapter 9).

33. Refit the right-hand cover (see chapter 9).

34. Attach the electrical harnesses with a clip retainer.

35. Refit the trailer braking valve (if fitted, open centre), checking that the O’rings are not damaged. Tighten the screws to a torque of 25 - 35 Nm.

36. Reconnect the pipes and hoses of the hydraulic cover.

37. Refit the strainer, support and filter (open centre).

38. If necessary, on 4WD tractors:

- assemble the rear sleeve (5) of the transmission shaft (3) (Fig. 8);
- refit the guard (1) (Fig. 8);
- reconnect the front differential lock control hoses.

39. Refit the plugs (1), the springs (2) and the locking studs (3) (Fig. 3). Refit the selector cover (see chapter 5). Reconnect and adjust the creeper unit control cable (see chapter 5).

40. Refit the wheel.

41. Remove the axle stand and the jack.

42. Tighten the wheel nuts to a torque of 400 - 450 Nm.

43. Top up the oil level in the rear axle and gearbox.

44. Start the tractor.

45. Check the correct operation of electrical and electronic circuits. Check the oil tightness of the cover mating face and of hydraulic unions.

46. Carry out a road test of the creeper unit controls and 1st-2nd, 3rd-4th gears of the Hare / Tortoise ranges.

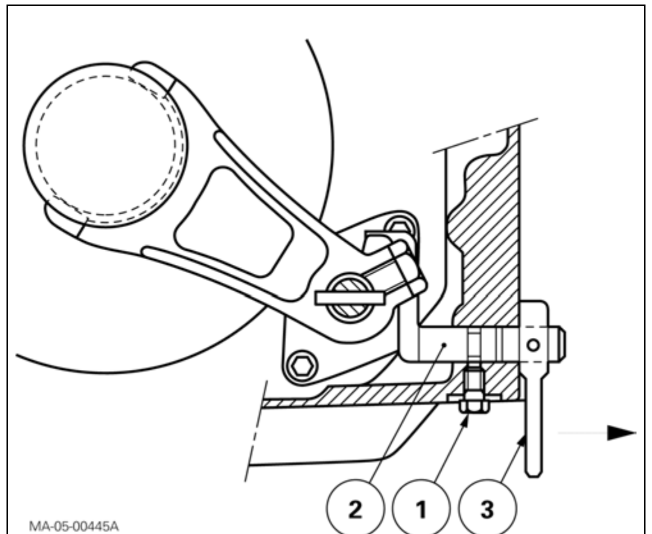

Fig. 4

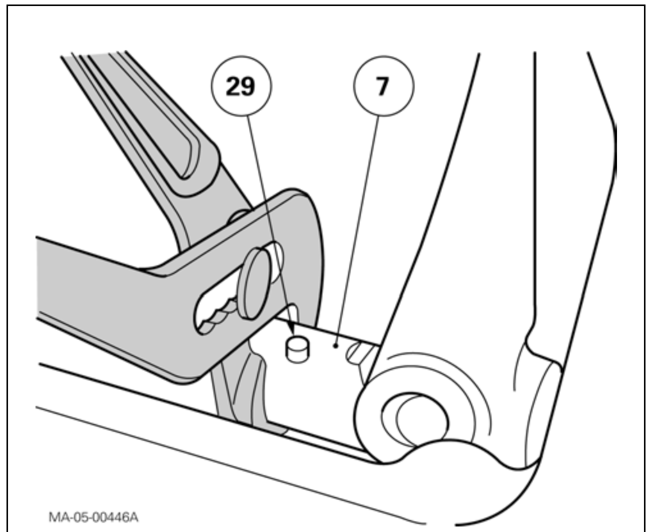

Fig. 5

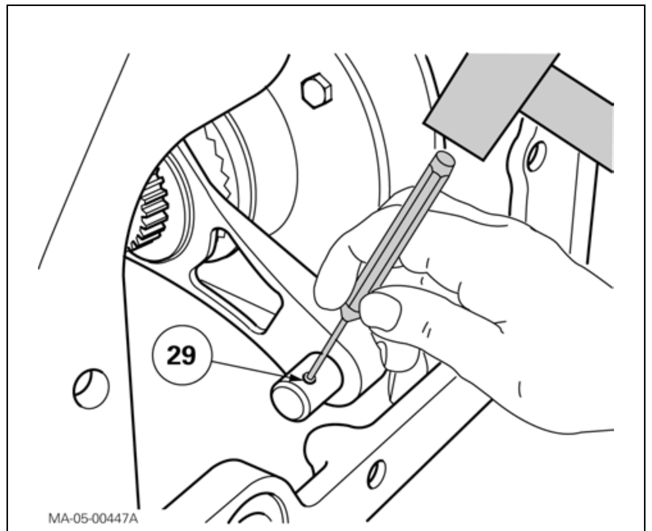

Fig. 6

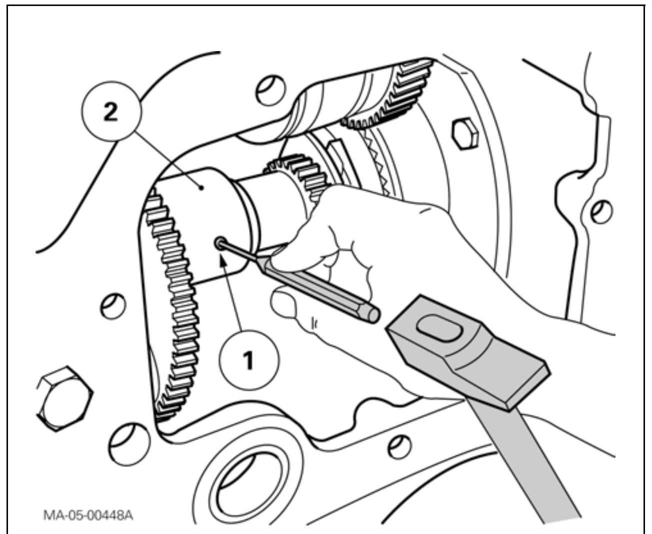

Fig. 7

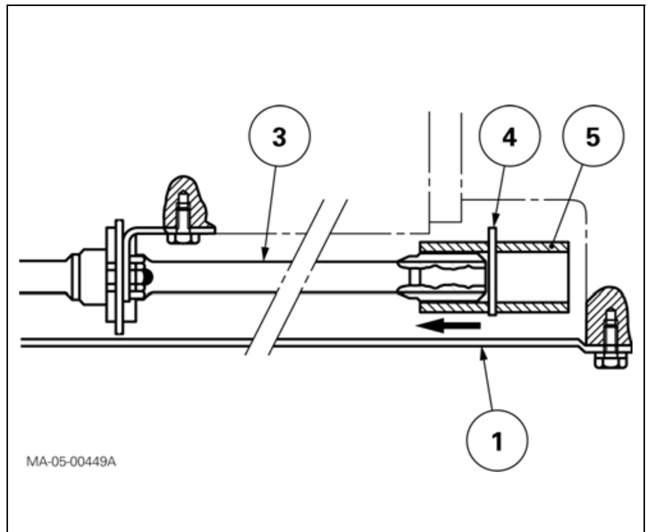

Fig. 8

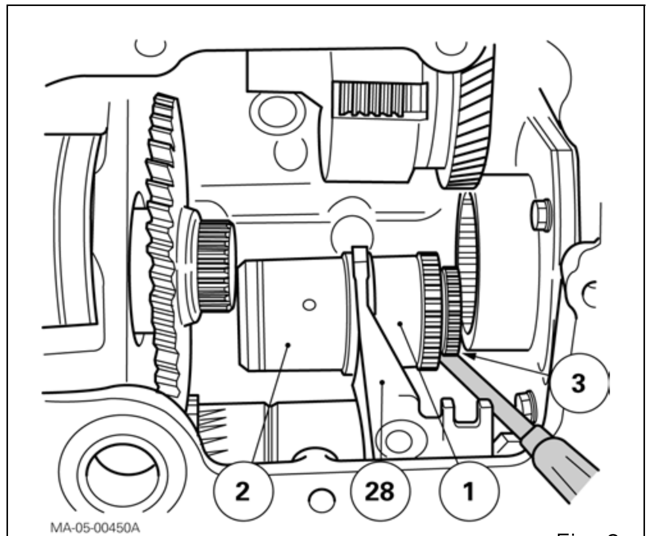

Fig. 9

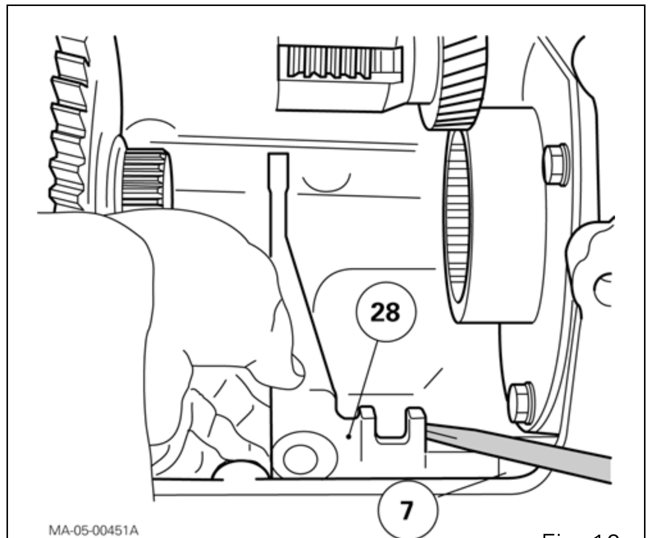

Fig. 10

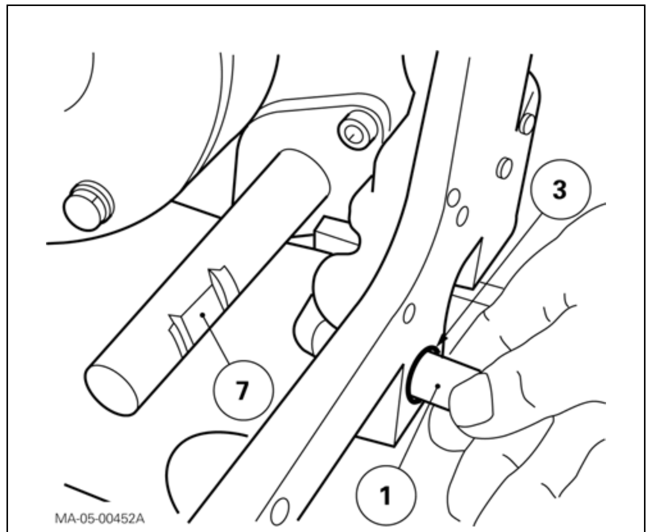

Fig. 11

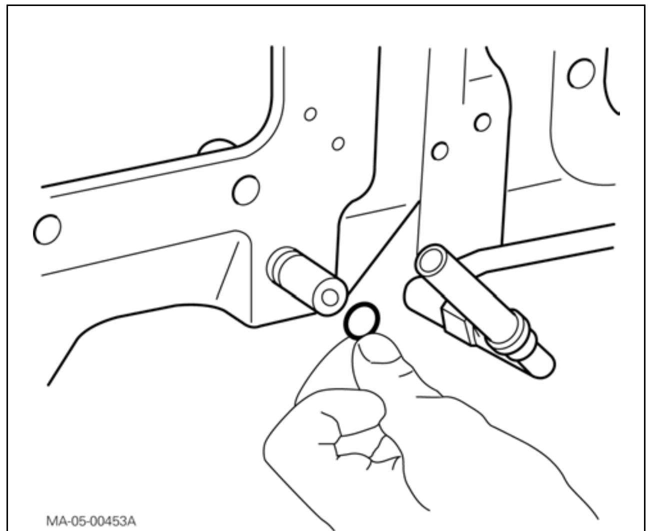

Fig. 12

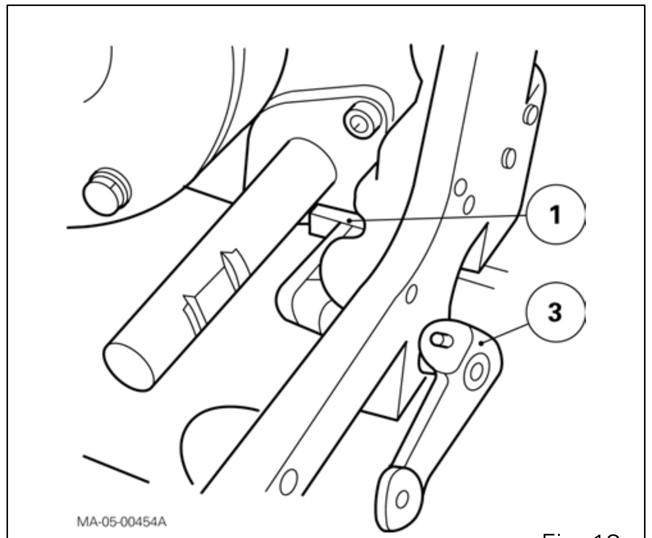

Fig. 13

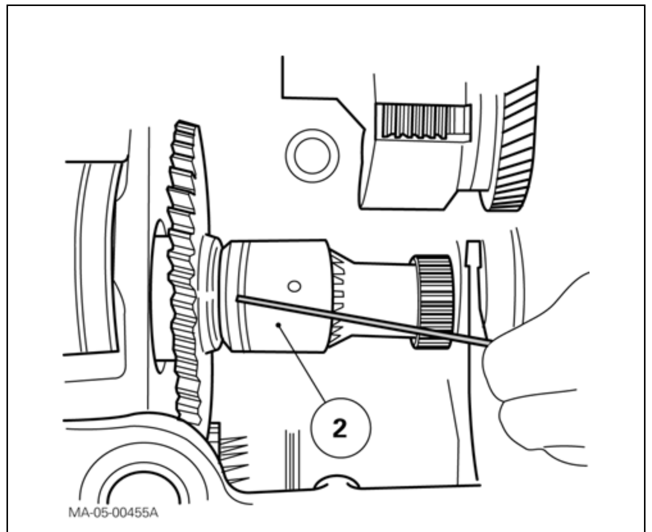

Fig. 14

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D . Hare / Tortoise fork and lock- 1st /2nd - 3rd / 4th fork assembly and selector rail

Preliminary operations

47. Remove the right-hand rear wheel. Chock the tractor wheels.

48. Remove the selector cover (see chapter 5).

Remove the right-hand hydraulic cover (see chapter 9).

Disassembly

49. Remove the plugs (1), the springs (2) and the locking studs (3) (Fig. 2 and Fig. 3).

Note 1: *The locking studs are now extended (Fig. 2 and Fig. 3). This modification improves their guiding into the forks (5) and (6) and also into the buttons (1).*

Note 2: *To optimise operation, a decompression spring on the locking stud drives out the oil enclosed in the spring chamber (2). This design allows the stud to enter and exit the fork more smoothly, thus improving gear shifting.*

50. Take out set screw (8) (Fig. 15).
51. Drive out the cup plug (9) forwards by striking the rear of the selector rail (7) (Fig. 15).
52. Place the Tortoise and Hare fork (20) in the Hare position.
53. Remove the adjusting screws (19).
54. Remove the screws (16) and the cover (15).
55. Take out the Hare and Tortoise piston (13) and discard the O' rings.
56. Take off the cylinder (10) and discard the O' ring.
57. Turn the pump breather pipe (1) upwards (open centre Fig. 16).
58. Move the selector rail (7) to the rear in order to release the forks.

Slide the selector rail under the rear axle housing reinforcement (Fig. 16).

59. Extract the 1st - 2nd and 3rd - 4th forks.
60. Extract the Hare and Tortoise fork.
61. If necessary, disassemble the stop (18).
62. Take the selector rail out through the selector cover aperture by passing it through the Hare / Tortoise cylinder bore (Fig. 17).

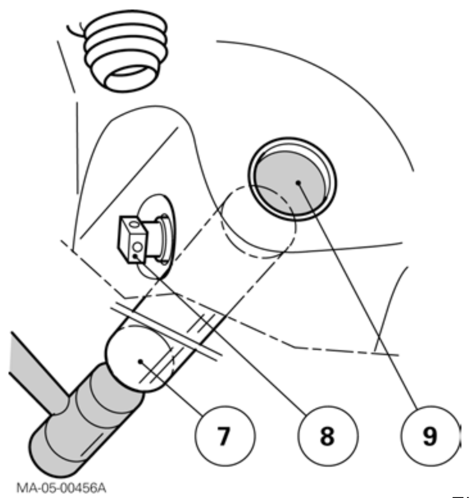


Fig. 15

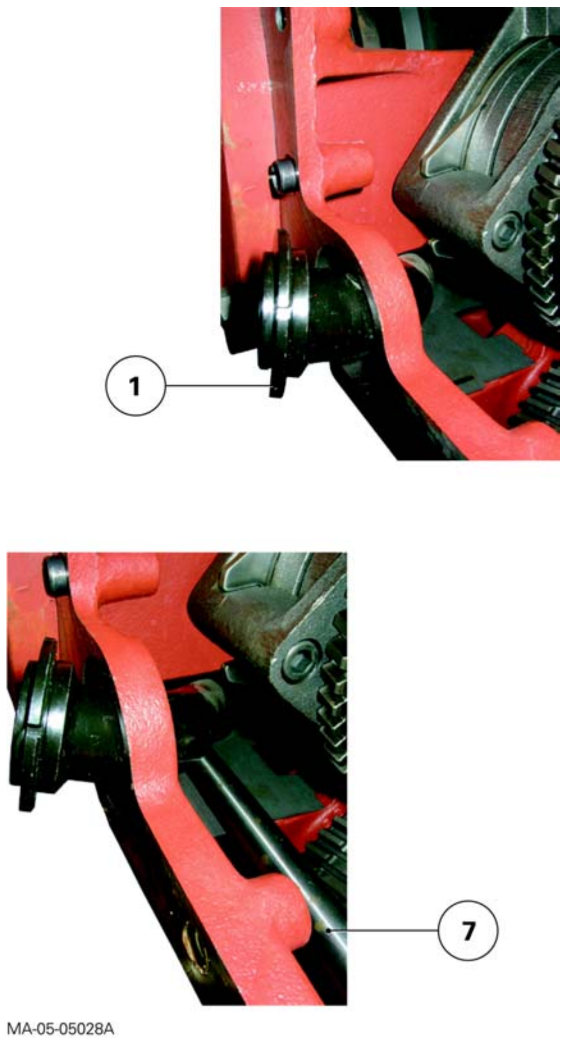


Fig. 16

Reassembly

63. Clean and check all components. Replace any defective parts.

64. Refit the selector rail through the selector cover aperture by passing it through the Hare / Tortoise cylinder bore (Fig. 17).

Refit the forks.

65. Check that the hydraulic ports in the Hare / Tortoise cylinder (10) are not obstructed. Refit the cylinder fitted with a new O' ring (11) (Fig. 18).

NOTE:

The cylinder (10) is held in position (Fig. 18):

- *at the front, by the shoulder machined on its outer diameter;*
- *at the rear, by the cover (15).*

66. Slide the selector rail forwards into the Hare / Tortoise fork and the 3rd, 4th and 1st, 2nd forks.

67. On the piston (13), fit O' rings (12) (14), then introduce it into the cylinder bore (10) and onto the selector rail (7) (Fig. 18).

Turn the adjusting screw holes towards the tapped holes on the fork. Temporarily lock the piston with a screw (19).

68. Fit the cover (15) with the screws (16). Tighten the screws to a torque of 25 - 35 Nm.

69. Clean the set screw (8). Smear its thread with Loctite 542 or equivalent. Tighten to a torque of 38 - 43 Nm.

70. Smear the cup plug (9) with Loctite 542 or equivalent. Fit it flush with the housing.

71. Fit the locking studs, springs and locking plugs.

Tighten the plugs to a torque of 50 - 70 Nm.

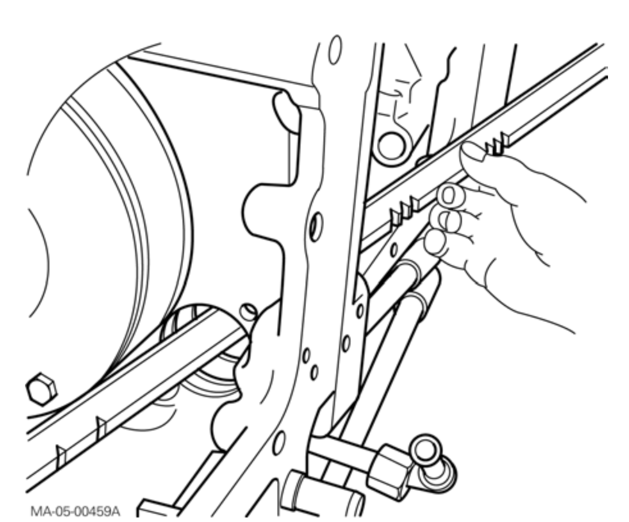


Fig. 17

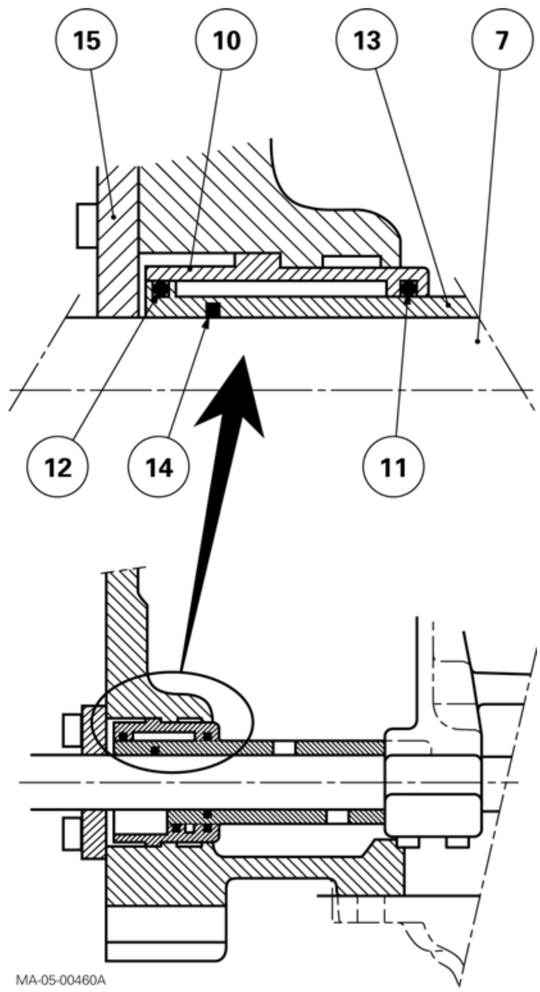


Fig. 18

Adjusting the clearance of the Hare / Tortoise fork pads and the synchromesh sliding coupler

Principle

The positioning of fork (20) is obtained by acting upon the difference between the distance between the centre lines of the tapped holes "Y" and the centre lines of the receiving indents "Z" on piston (13).

A different fork movement is obtained by acting either on the front screw or on the rear screw according to the adjustment required (Fig. 19).

Adjustment

72. Position the control piston (13) and the sliding coupler "C" in the high range (Hare) (Fig. 21).

73. Maintain the sliding coupler manually against pinion "L" of the high range (Fig. 21).

74. Adjust the position of the fork (20) using the two adjusting screws (19) previously cleaned in solvent and lightly smeared with Loctite 221 or equivalent, in order to obtain a clearance of **J1 = 0.3 mm** between the rear face of the pad and the sliding (Fig. 20 - Fig. 21).

Note: *For this adjustment, use the locally made tool (see § F).*

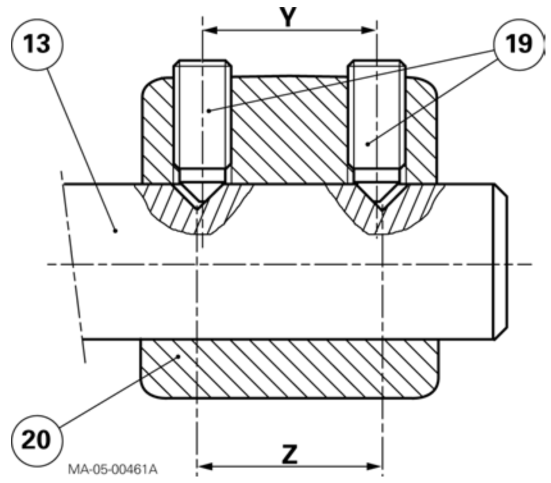


Fig. 19

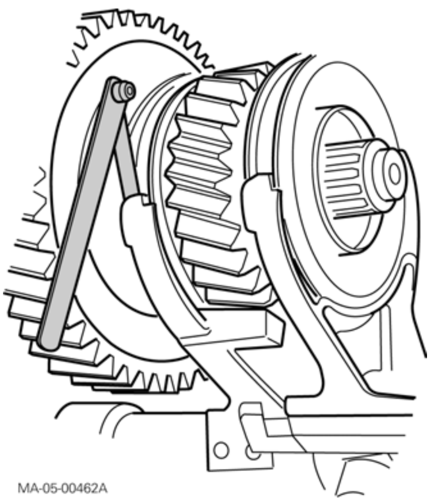


Fig. 20

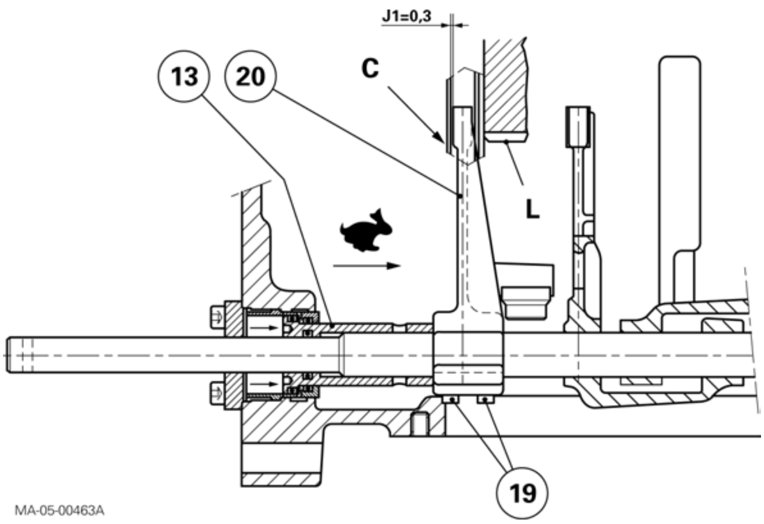


Fig. 21

75. Position the control piston (13) and the sliding coupler "C" in the low range (Tortoise) (Fig. 22).

76. Check that there is a clearance of **J2 = 0.3 minimum** (this value is determined by the clearance J1) between the pad and the sliding coupler when the latter rests against the pinion "T" of the low range (Fig. 22)

Alternatively and progressively tighten the screws (19) to a torque of 25 - 35 Nm taking care not to modify the adjustment.

IMPORTANT: *In the Tortoise position, if face "X" of the fork pad (20) is driven against the sliding coupler "C", increase clearance J1 (Fig. 21).*

77. Check for the correct operation of the fork.

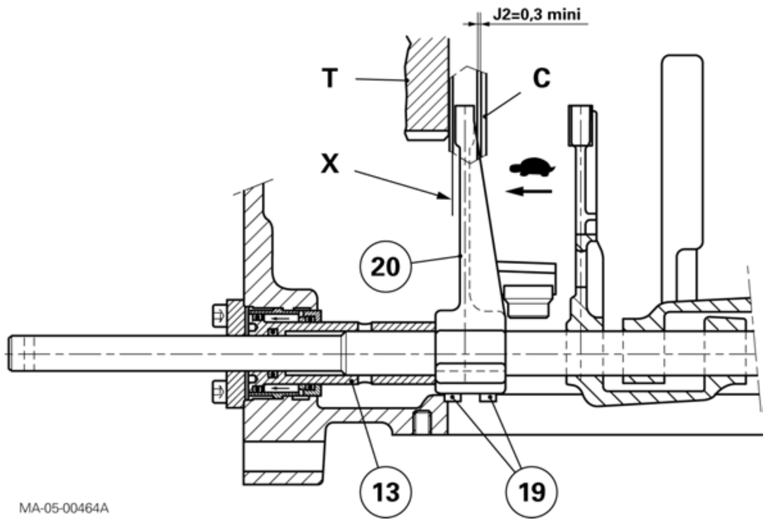


Fig. 22

Adjusting the the Hare / Tortoise fork stop

Principle

locking is adjusted by an adjustable stop (18) located on the Hare / Tortoise fork. This adjustment is obtained using a tool (see § F) whose role consists of conveying to the stop the positioning of the indexing pin, mounted on the selector cover.

The aim of this adjustment is to provide safety to the Hare / Tortoise mechanism, during operation, by mechanically immobilising the fork in the Hare or Tortoise position.

IMPORTANT: *Before adjusting the stop (18), it is essential to adjust the clearance between the Hare / Tortoise fork pads and the synchromesh sliding coupler.*

On the cover (Fig. 25)

78. Place the indexing pin (35) in the high range (Hare).
79. Engage 3rd gear.
80. Place the tool on the selector cover (Fig. 23).
81. It is **essential** to equally share the clearance between the indexing pin and the plunger (31) (Fig. 25, detail A).
82. Using the tool, measure dimension X according to Fig. 23 and Fig. 25.

On the gearbox (Fig. 25)

83. Engage 3rd gear. Using the tool, set dimension X to the gearbox.
84. Apply manual pressure on the fork towards the Hare range.
85. Adjust the stop (18) (Fig. 24 - Fig. 25) by placing it in contact with the tool.
86. Lightly smear the thread of the screw (17) with Loctite 242 or equivalent. Tighten to a torque of 40 - 50 Nm.

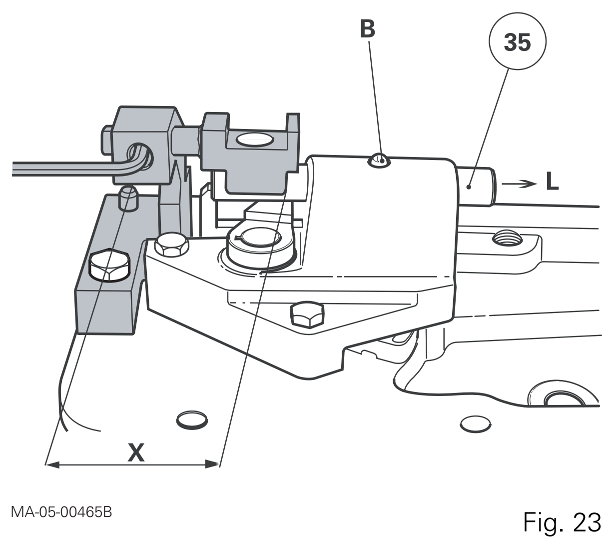


Fig. 23

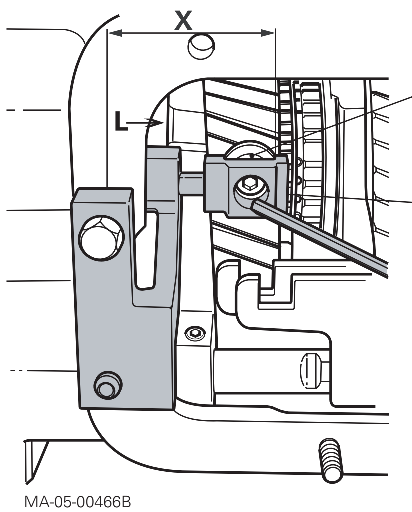
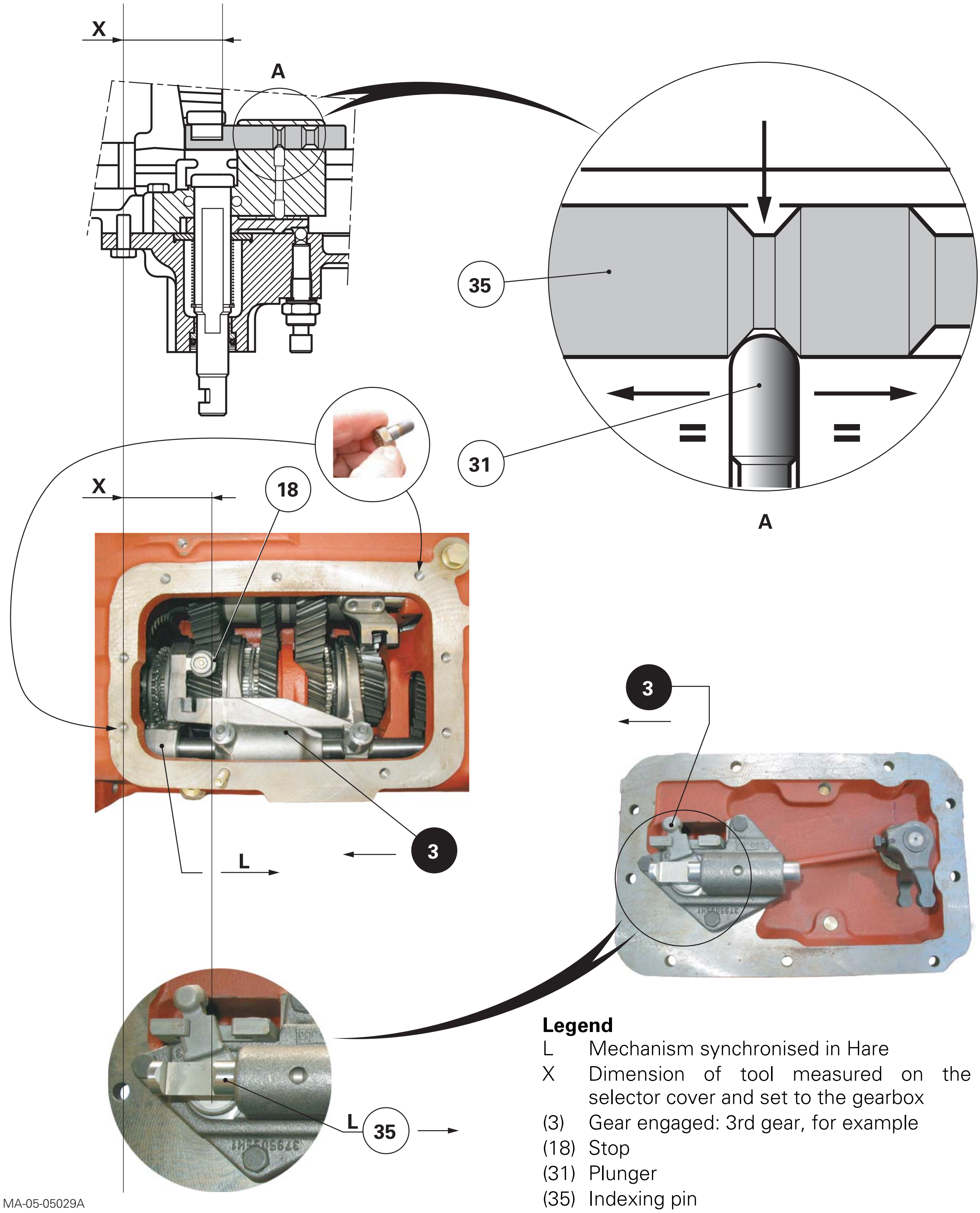


Fig. 24



Legend

L	Mechanism synchronised in Hare
X	Dimension of tool measured on the selector cover and set to the gearbox
(3)	Gear engaged: 3rd gear, for example
(18)	Stop
(31)	Plunger
(35)	Indexing pin

Fig. 25

Check

87. Check the operation of the Hare and Tortoise ranges.

88. Check the smooth operation of all gears.

Final operations

89. Refit the right-hand hydraulic cover (see chapter 9).

90. Refit the selector cover (see chapter 5).

91. Reconnect and adjust the creeper unit control (if fitted) (see chapter 5).

92. Refit the rear wheel. Tighten the wheel nuts to a torque of 400 - 450 Nm.

93. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

94. Carry out a road test:
- of gears from 1st to 4th and vice versa;
- of the Hare and Tortoise ranges;
- of the creeper unit (if fitted).

95. Check for the oil tightness of the cover mating faces and the hydraulic unions.

E . Mechanical reverse shuttle selector - Fork and selector rail

Reverse shuttle selector (2)

Disassembly

96. Remove the selector cover (see chapter 5).

97. Remove screws (1) (Fig. 26).
Remove the selector (2).

Preparing the selector

98. Clean the thread of screws and tapped holes in the selector. Check that the screws turn freely in the tapped holes.

99. Slide the selector onto the selector rail and adjust it.

100. Engage the forward then reverse positions, and vice versa, using the selector rail to position the synchromesh components.

101. Next, position the selector rail (3) in neutral (Fig. 26).

102. Fit the tool ref. 3378054M1 (see Fig. 27 and § F) on the gearbox housing. Tighten it using two locally obtained screws.

Adjusting the selector (Fig. 27)

103. Lightly smear the thread of the screws (1) with Loctite 242 or equivalent.

104. Bring face "F" of the selector (2) flush with the tool, using the screws (1).

105. Alternately and gradually tighten the screws (1) to a torque 35 Nm without modifying the selector position.

Reassembly

106. Refit the selector cover (see chapter 5).

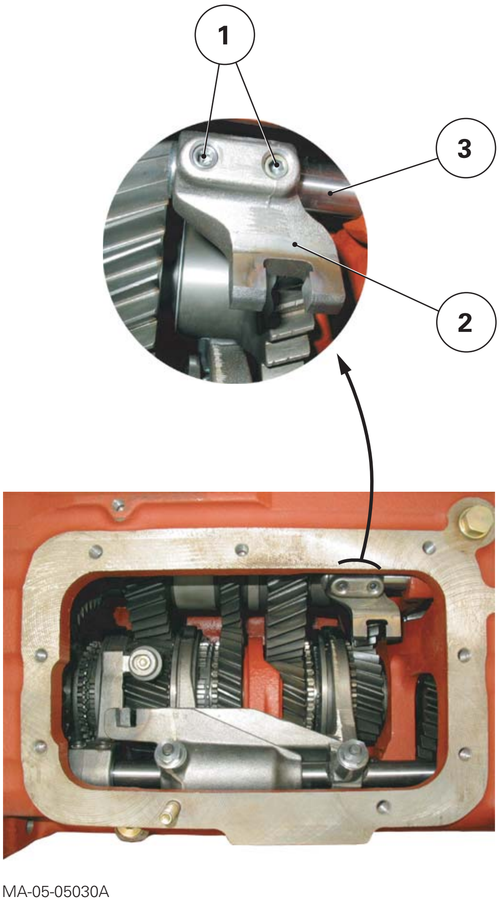


Fig. 26

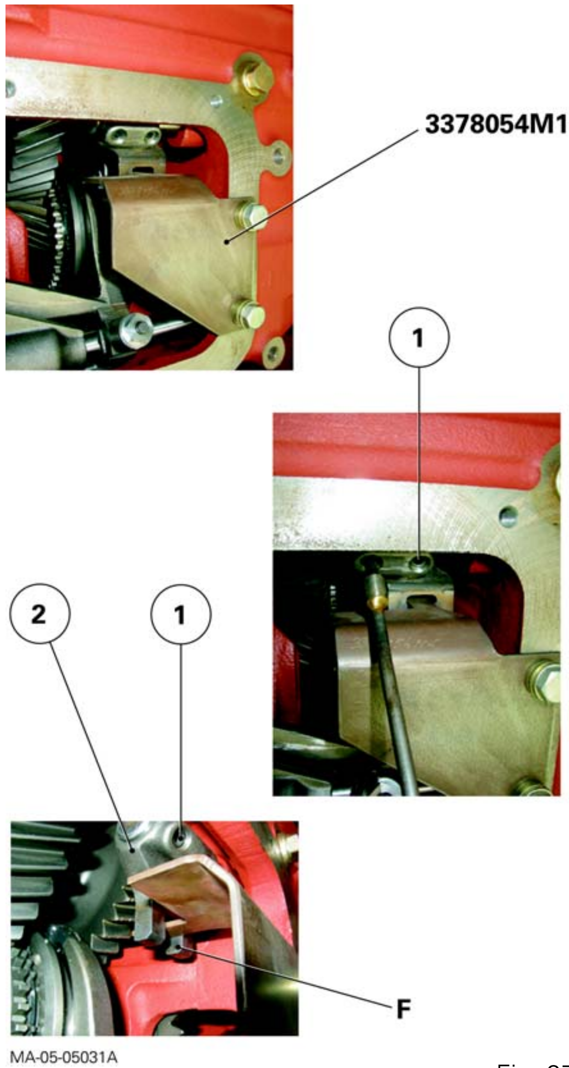


Fig. 27

Fork (6) and selector rail (4)

Preliminary operations

107. Disassemble the tractor between the engine and the gearbox (see chapter 2).

108. Remove the selector cover (see chapter 5).

109. Remove the input unit (see chapter 5).

Disassembly

110. Remove the plug (7), the spring (8) and the locking stud (5).

REMINDER: *The locking stud (5) of the reverse shuttle fork (6) has a different shape from those fitted on the 1st / 2nd and 3rd / 4th forks of the gearbox.*

111. Take out the screws (3) from the fork (6).

Remove the pin (4) and the fork.

Reassembly

112. Clean the thread of screws and tapped holes in the fork. Check that the screws turn freely in the tapped holes.

113. Slide the fork into the synchromesh slider.

114. Slide the guide pin (4) into the fork (6).

Adjust the fork.

Adjusting the fork (Fig. 28 and Fig. 29)

Adjusting principle

The positioning of the fork (6) is obtained by the difference between the centre line "Y" of the holes and the centre line "Z" of the indents on the selector rail (5). A different fork movement is obtained by acting either on the front screw or on the rear screw (3) according to the adjustment required (Fig. 29).

115. Fit the locking stud (5), spring (8) and plug (7).

Tighten the plug to a torque of 50 - 70 Nm.

***Important**: When disassembling all locking studs (gearbox and input unit), the positioning of the reverse shuttle selector rail locking stud must be respected (see operation 110).*

116. Lightly smear the thread of the fork screws with Loctite 242 or equivalent. Fit the screws.

117. Position the locked fork towards the front.

Maintain the synchromesh sliding coupler up against the pinion.

Pre-adjust the fork using the above-mentioned principle.

118. Check that the front pads of the fork are not driven hard against the synchromesh sliding coupler.

119. Repeat the operation (fork locked at rear).

Check that the pads of the fork are not driven hard against the synchromesh sliding coupler.

The correct adjustment is obtained when the clearance of both (front and rear) fork pads are nearly equal in the synchromesh sliding coupler, in both the forward and reverse positions.

120. Alternately and gradually tighten the screws (3) to a torque 35 Nm without modifying the fork adjustment.

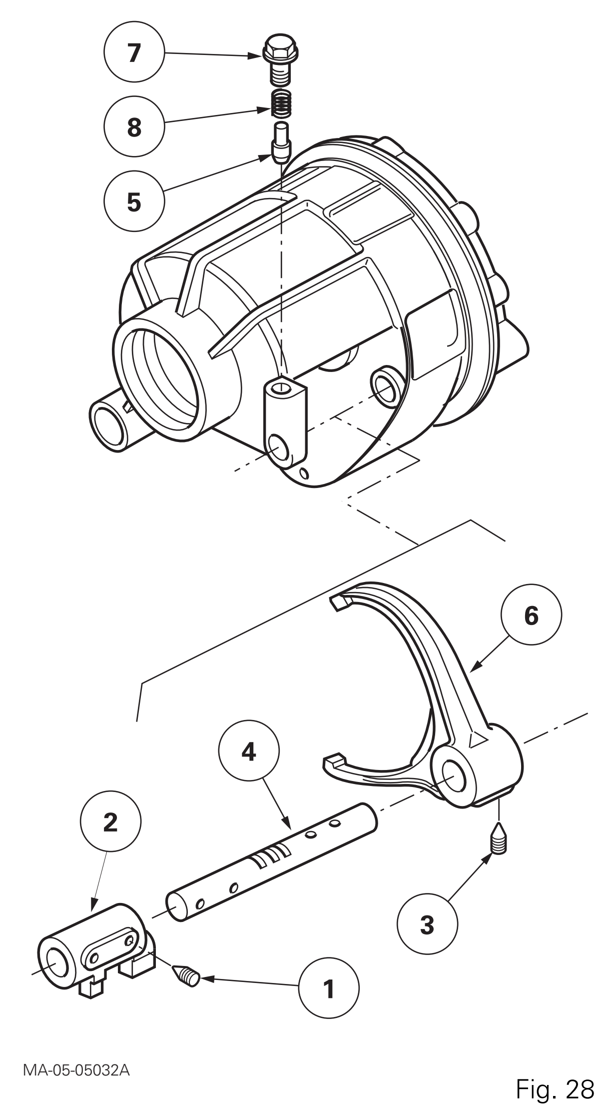


Fig. 28

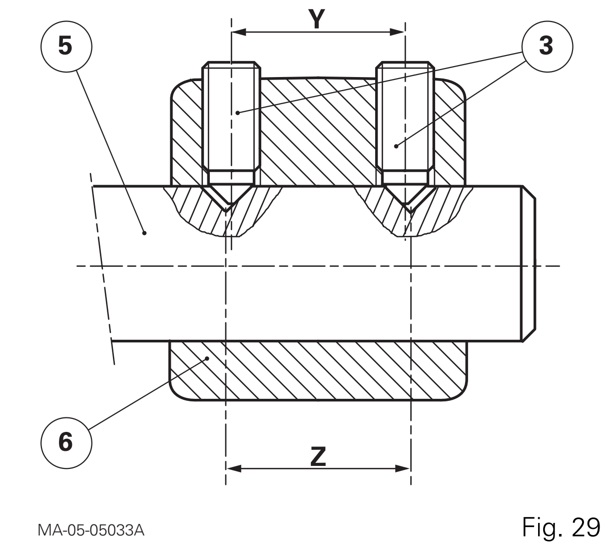


Fig. 29

Final operations

121. Refit the input unit (see chapter 5).
122. Adjust the selector (2) (see § E).
123. Refit the selector cover (see chapter 5).
124. Assemble the tractor between the engine and the gearbox (see chapter 2).
125. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.
126. Bleed the hydraulic unit of the engine clutch (see chapter 9).
127. Carry out a road test of the reverse shuttle (forward and reverse positions) and the control assembly.
128. Check the oil tightness of the mating faces and hydraulic unions.

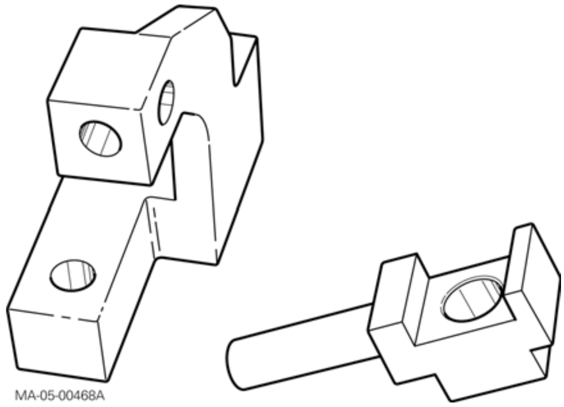


Fig. 30

F . Service tools

Tools available in the AGCO network

- **3378325M11:** Hare / Tortoise fork lock adjustment tool (Fig. 30)
- **3378054M1:** Adjusting gauge (Fig. 31)

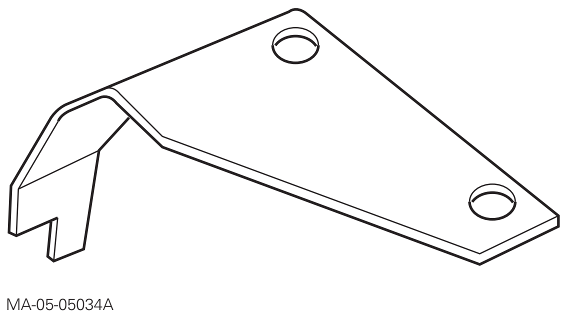


Fig. 31

Locally made tool

- **Shim hinged on suitable fixture** (Fig. 32)

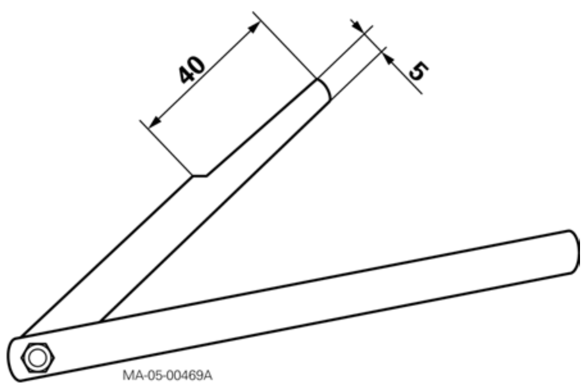


Fig. 32

05F02 - GBA20 selector rail with Power Shuttle

CONTENTS

A . General

The selector rail (7) holding the different forks is located on the right-hand side of the gearbox, on the selector cover side. It passes through the gearbox housing and the control piston of the Hare and Tortoise range (13).

It is held in position by a set screw (8). A cup plug (9) closes off the bore at the front and a cover (15) closes the rear end.

The 1st - 2nd (5) and 3rd - 4th (6) forks are not adjustable.

The creeper fork (28) is adjustable by mechanical pressure.

Two adjustments are necessary to obtain the correct functioning of the fork (20) in both ranges (Hare / Tortoise):

- adjustment of the space between the fork pads and the synchromesh sliding coupler;
- adjustment of the stop (18), in relation to the position of the indexing pin mounted on the selector cover.

An optional creeper unit may be fitted (see chapter 5).

An optional super-creeper unit may also be fitted (see chapter 5). In this case, the locating pin (29) is not fitted.

Parts list (Fig. 1)

(1) Plug
(2) Spring
(3) Locking stud
(5) 1st - 2nd Fork
(6) 3rd - 4th Fork
(7) Guide pin
(8) Set screw
(9) Cup cap
(10) Cylinder
(11) O'ring
(12) O'ring
(13) Hare and Tortoise range piston
(14) O'ring
(15) Cover
(16) Screw
(17) Screw
(18) Stop
(19) Adjusting screw
(20) Hare / Tortoise fork
(26) Nut
(27) Locking screw
(28) Creeper fork
(29) End-of-travel pin

Overall view

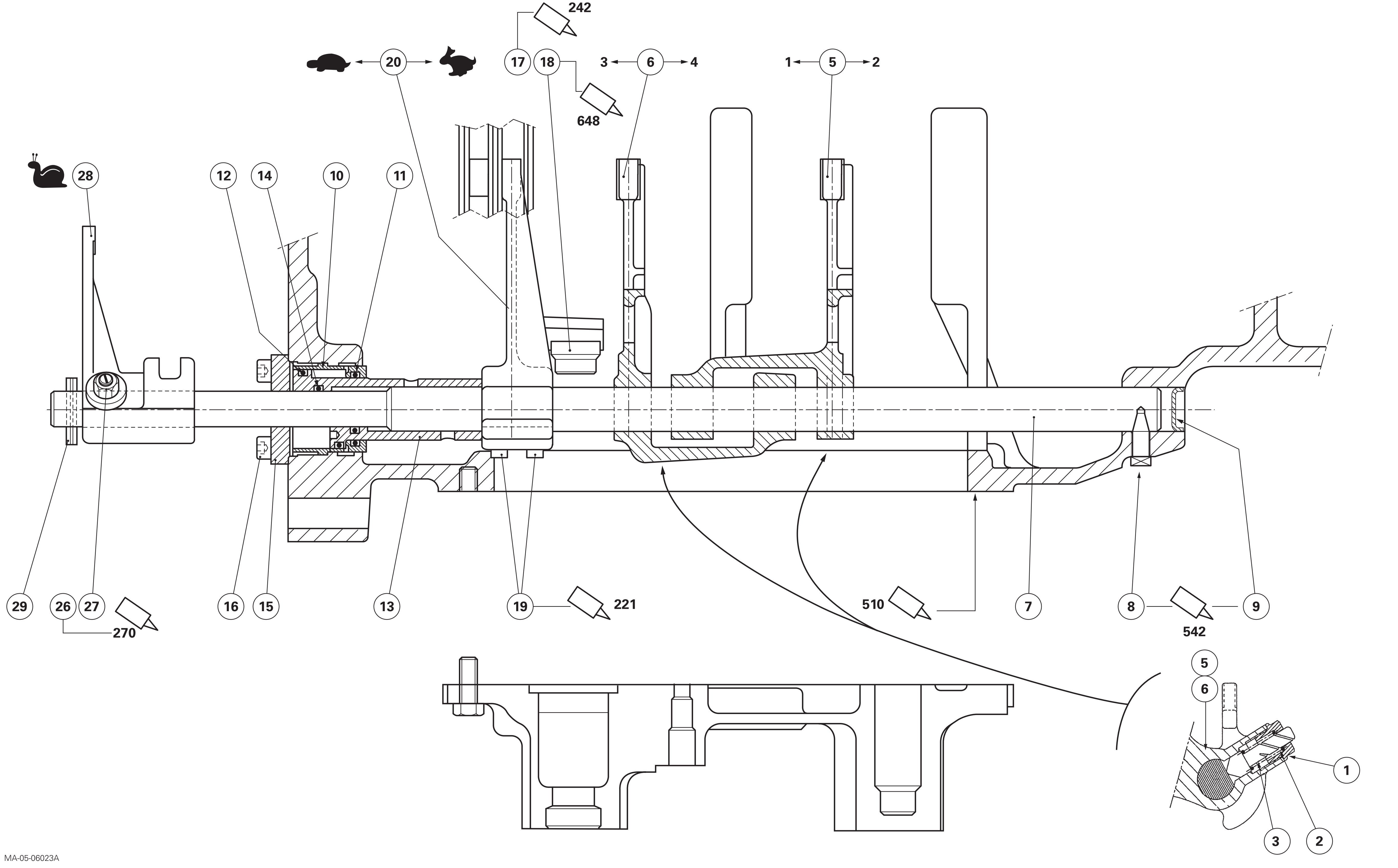


Fig. 1

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Parts list (Fig. 2)

(1) Plug
(2) Spring
(3) Locking stud
(5) 1st - 2nd Fork
(6) 3rd - 4th Fork
(7) Guide pin
(8) Set screw
(9) Cup cap
(10) Cylinder
(11) O'ring
(12) O'ring
(13) Hare and Tortoise range piston
(14) O'ring
(15) Cover
(16) Screw
(17) Screw
(18) Stop
(19) Adjusting screw
(20) Hare / Tortoise fork
(26) Nut
(27) Locking screw
(28) Creeper fork
(29) End-of-travel pin

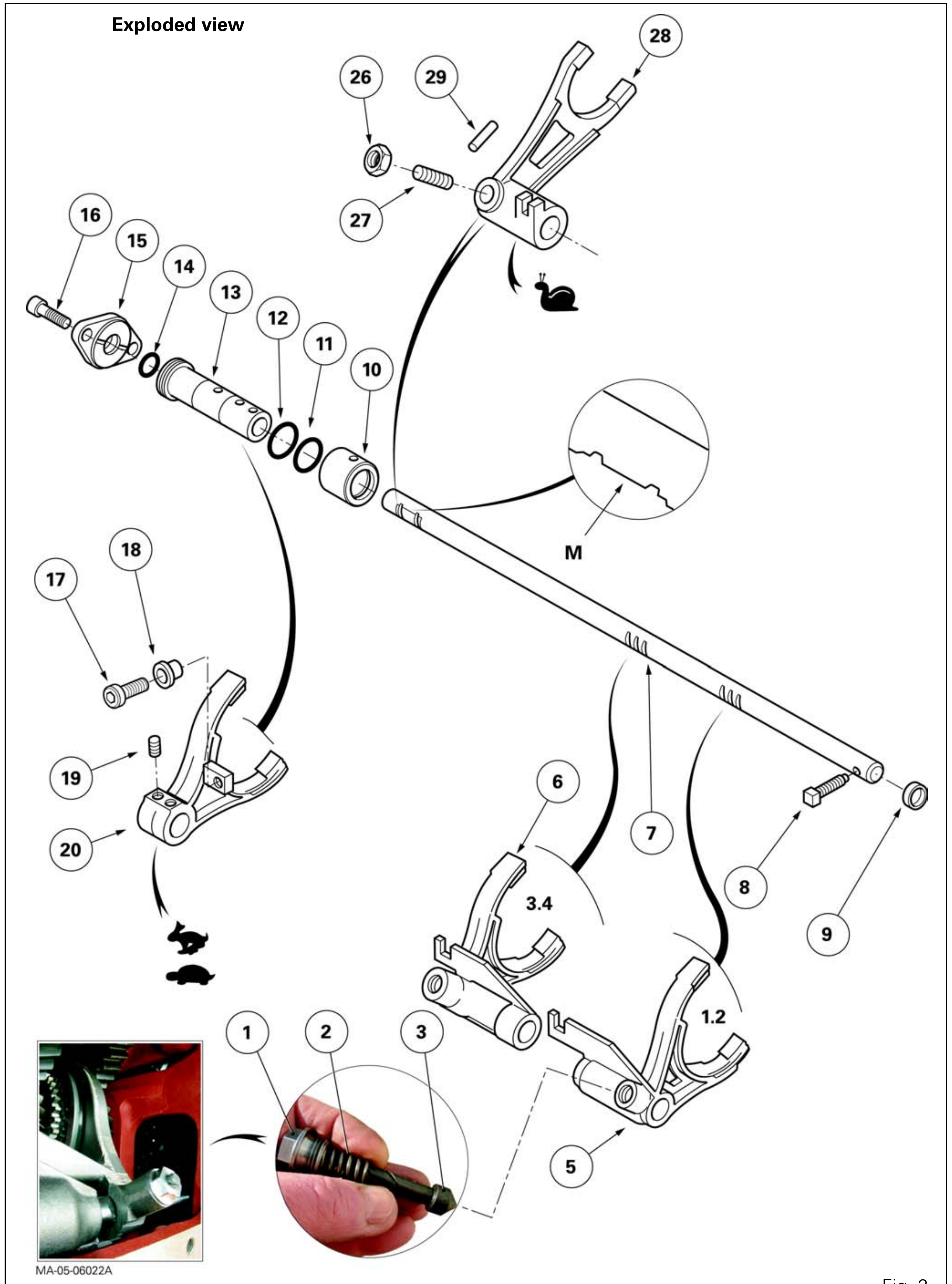

Fig. 2

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B . Servicing guide

This guide describes a succession of operations to be followed depending on the mechanical component to be worked on.

Creeper fork

- Remove the selector cover (see chapter 5).
- Remove the right-hand hydraulic cover (see chapter 9).
- Remove the creeper fork.

Hare / Tortoise fork

- Remove the selector cover (see chapter 5).
- Remove the right-hand hydraulic cover (see chapter 9).
- Remove the creeper fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic parts (ram) of the Hare/ Tortoise mechanism.
- Take out the range fork.

1st-2nd and 3rd-4th gear fork

- Remove the selector cover (see chapter 5).
- Remove the right-hand hydraulic cover (see chapter 9).
- Remove the creeper fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic parts (ram) of the Hare/ Tortoise mechanism.
- Take out the range fork.
- Move the selector rail backwards.
- Take out the 1st-2nd and 3rd-4th gear forks.

Guide pin

- Remove the selector cover (see chapter 5).
- Remove the right-hand hydraulic cover (see chapter 9).
- Remove the creeper fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic components of the Hare / Tortoise mechanism.
- Take out the range fork.
- Take out the 1st-2nd and 3rd-4th gear forks.
- Move the selector rail backwards as far as it will go and disengage it through the selector cover aperture.

Tractors with no creeper unit

The selector rail can also be removed through the front on tractors not fitted with a creeper unit. To do this it is necessary to:

- split the tractor between the engine and the gearbox (see chapter 2);
- remove the gearbox spacer (only on tractors fitted with 6-cylinder engine) (see chapter 3).

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C . Creeper fork

Disassembly

1. Disassemble the right rear wheel.
Chock the tractor wheels.

2. Disconnect the rear axle creeper unit control cable.

3. Remove the selector cover (see chapter 5). Take out the plugs (1), the springs (2) and the locking studs (3) to release the selector rail (Fig. 2).

4. Remove the hydraulic cover(s) (see chapter 9).

5. Remove screw (1). Pull the guide rod link (2) and the lever (3) outwards to release the finger of the fork (Fig. 3).

6. Unscrew the nut (26) and the locking screw (27) on the fork (28).

7. Take out set screw (8).

8. Turn the selector rail (7) and drive out the pin (29) (Fig. 4 - Fig. 5) without dropping it into the housing.
Move the selector rail forward.

Remove the pin (1) from the coupling sleeve (2) on a 2 or 4WD tractor (operations 9 to 12)

***Note:** Depending on the angle of the coupling sleeve (2) located between the gearbox output shaft and the drive pinion, the pin (1) is accessible or inaccessible.*

2WD tractor

9. If the pin (1) is accessible, drive it from the sleeve (2) (Fig. 6).

10. If the pin (1) is not accessible:
- raise the tractor rear axle beam with a trolley jack;
- turn the drive pinion to correctly position the coupling sleeve (2) (Fig. 6);
- drive out the pin (1) (Fig. 6).

4WD tractor

11. If the pin (1) is accessible, drive it from the sleeve (2) (Fig. 6).

12. If the pin (1) is not accessible:
- disconnect the front differential lock control hoses;
- remove the guard (1). Uncouple the rear sleeve (5) from the transmission shaft (3) (Fig. 7);
- turn the drive pinion to correctly position the coupling sleeve (2) (Fig. 6);
- drive out the pin (1) (Fig. 6).

13. Provisionally fit the set screw (8) in order to hold the selector rail in place to remove the fork (28).

14. Slide the sleeve (2) and coupler (1) closer together on the linkage shaft (3) (Fig. 8).

15. Note and mark the assembly order of the sleeve (2) (Fig. 8).
Disengage the sleeve / link shaft / coupler assembly towards the outside left-hand side.
Take it out of the fork (28) (Fig. 8) and remove it through the right-hand cover.

16. Remove the fork (28) on the selector rail (7) (Fig. 9).

17. Disassemble the lever (3) (Fig. 3).

18. To remove the creeper unit control link (1), turn it so it passes beneath the selector rail (7) (Fig. 10).
Discard the O'ring (3).

Reassembly

19. Clean and check all components. Replace any defective parts.

20. Refit the control link and pull it as far to the right as possible. Install a new lubricated O'ring (Fig. 11).

21. Reassemble the lever (3) (Fig. 12). Tighten the screw.

22. Refit the fork on the selector rail.

***IMPORTANT:** Ensure that the finger (1) of the creeper gear control linkage points towards the front of the tractor (Fig. 12).*

23. Couple the sleeve / link shaft / coupler assembly inside the housing. Place it in the fork, turning the machined groove on the sleeve (2) towards the rear of the tractor (Fig. 13).

24. Slide the sleeve and coupler onto the link shaft.

25. Force fit a new double pin (1) into the sleeve (2) (Fig. 6).

26. Take out set screw (8).

27. Force fit a new pin (29) and turn the selector rail (7) (Fig. 4 - Fig. 5).

28. Clean the set screw (8). Smear its thread with Loctite 542 and tighten to a torque of 38 - 43 Nm.

29. Ensure that the ball mounted at the end of the locking screw (27) returns correctly to its initial position after pressure has been applied manually by the locking screw. Position the fork (28) and locking screw on flat section "M" of the selector rail (7) (between the two locking catches) (Fig. 2)

Fully tighten the screw without forcing it in order to compress the ball.

Loosen the screw by one-quarter turn. Clean the nut (26) and smear with Loctite 270 or equivalent. Tighten to a torque of 15 - 20 while holding the locking screw in place.

Check the the fork locks correctly.

30. Turn and push the rod (2) in order to engage the finger in the fork. Fit the screw (1) smeared with Loctite 542 or equivalent (Fig. 3).

31. Check that the rod operates correctly.

32. Check that the O'rings of the internal hydraulic pipes are not damaged (see chapter 9).

33. Refit the right-hand cover (see chapter 9).

34. Attach the electrical harnesses with a clip retainer.

35. Refit the trailer braking valve (if fitted, open centre), checking that the O'rings are not damaged. Tighten the screws to a torque of 25 - 35 Nm.

36. Reconnect the pipes and hoses of the hydraulic cover.

37. Refit the strainer, support and filter (open centre).

38. If necessary, on 4WD tractors:

- couple the rear sleeve (5) of the transmission shaft (3) (Fig. 7);
- refit the guard (1) (Fig. 7);
- reconnect the front differential lock control hoses.

39. Refit the plugs (1), the springs (2) and the locking studs (3) (Fig. 2). Refit the selector cover (see chapter 5). Reconnect and adjust the creeper unit control cable (see chapter 5).

40. Refit the wheel.

41. Remove the axle stand and the jack.

42. Tighten the wheel nuts to a torque of 400 - 450 Nm.

43. Top up the oil level in the rear axle and gearbox.

44. Start the tractor.

45. Check the correct operation of electrical and electronic circuits. Check the oil tightness of the cover mating face and of hydraulic unions.

46. Carry out a road test of the creeper unit controls and 1st-2nd, 3rd-4th gears of the Hare / Tortoise ranges.

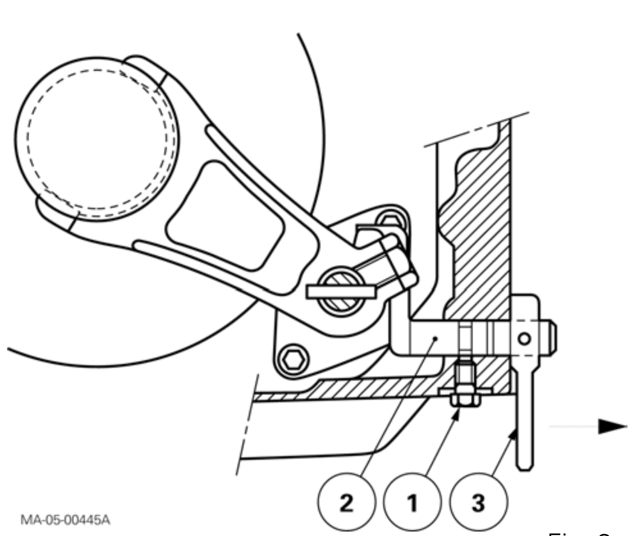

Fig. 3

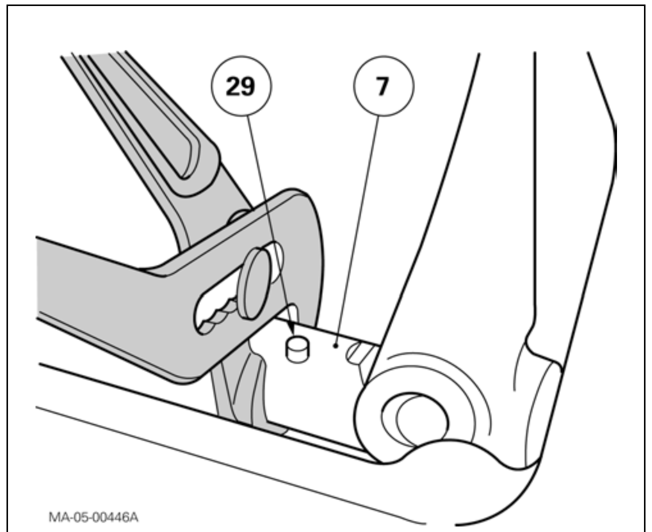

Fig. 4

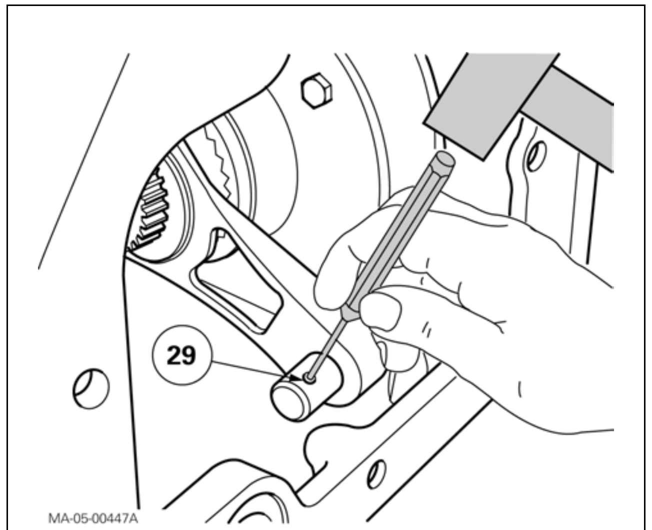

Fig. 5

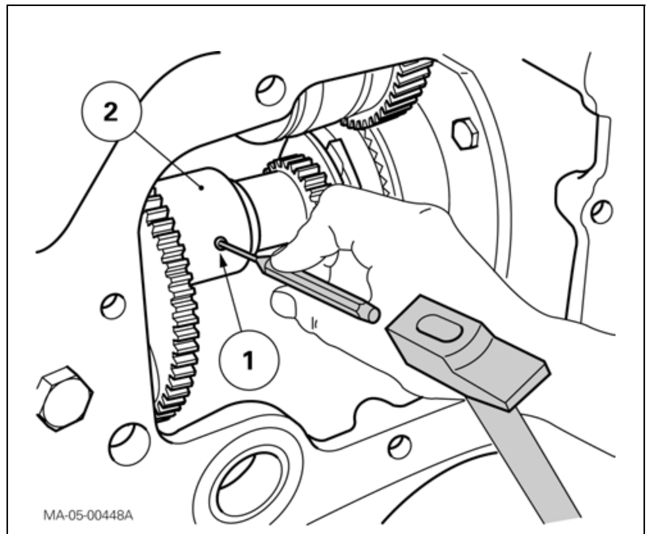

Fig. 6

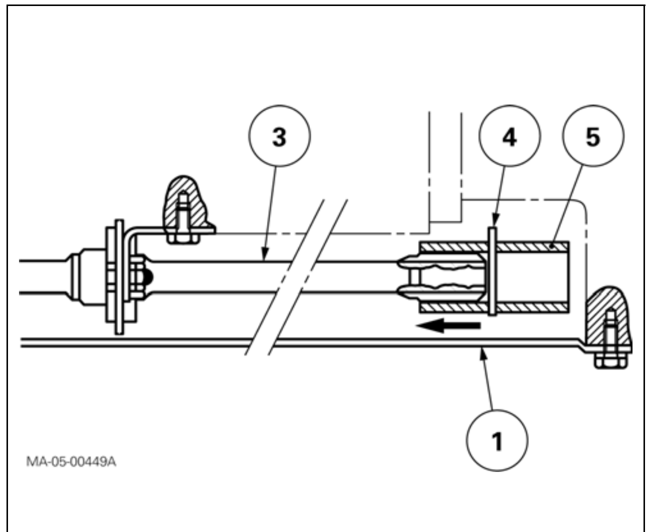

Fig. 7

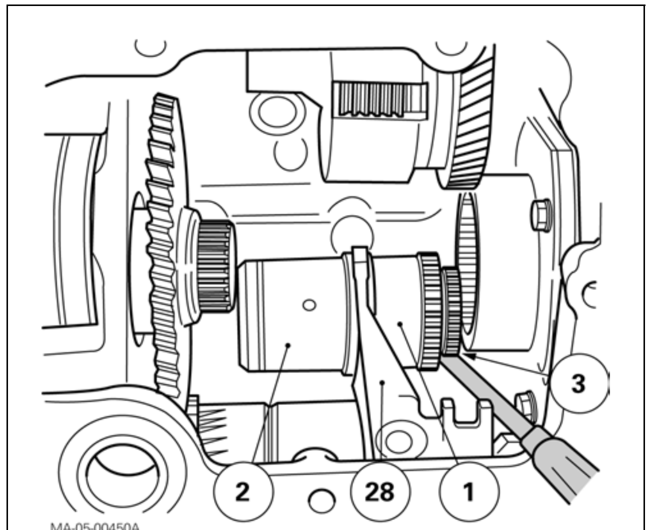

Fig. 8

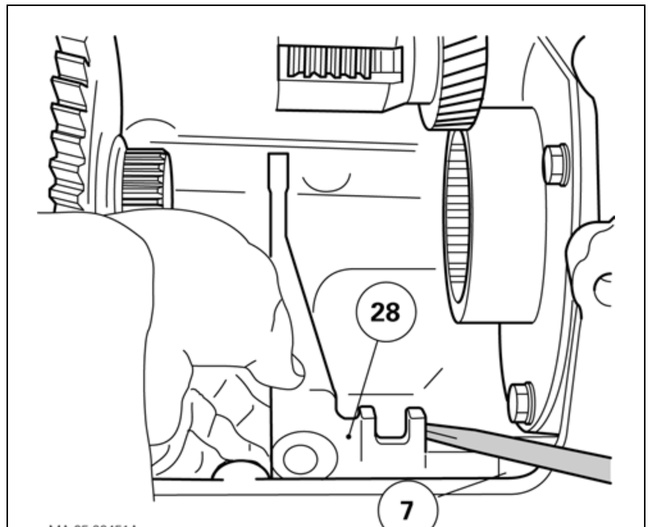

Fig. 9

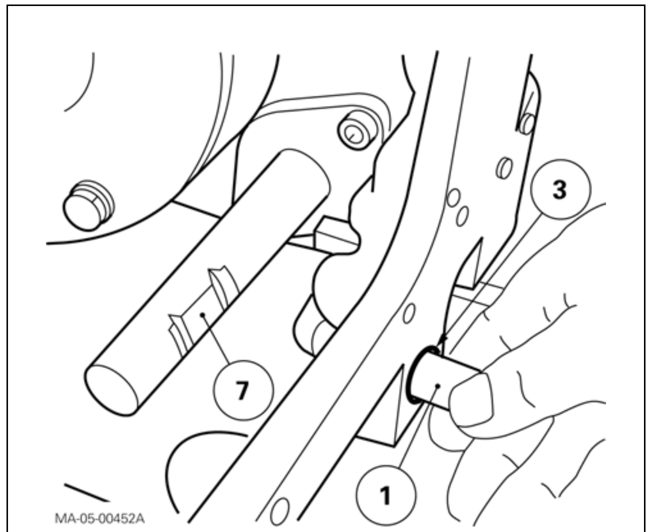

Fig. 10

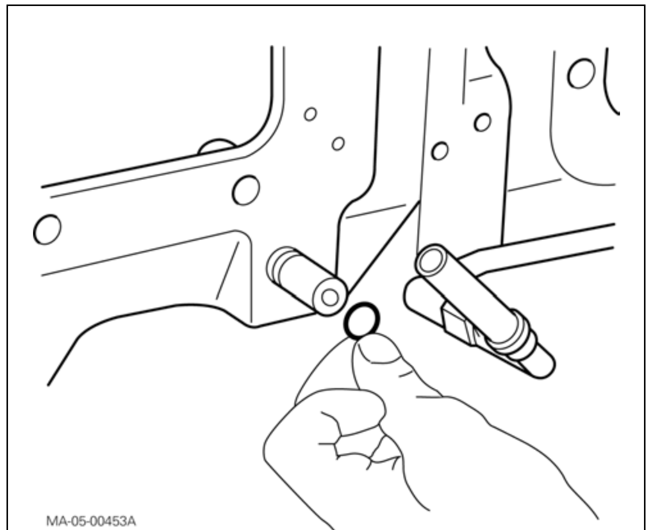

Fig. 11

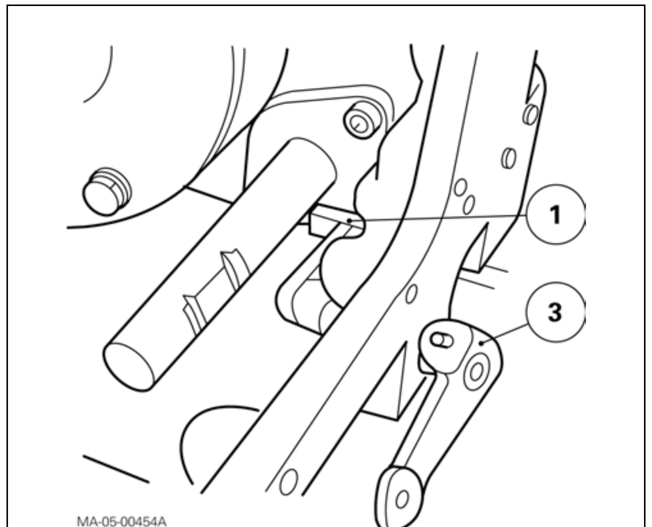

Fig. 12

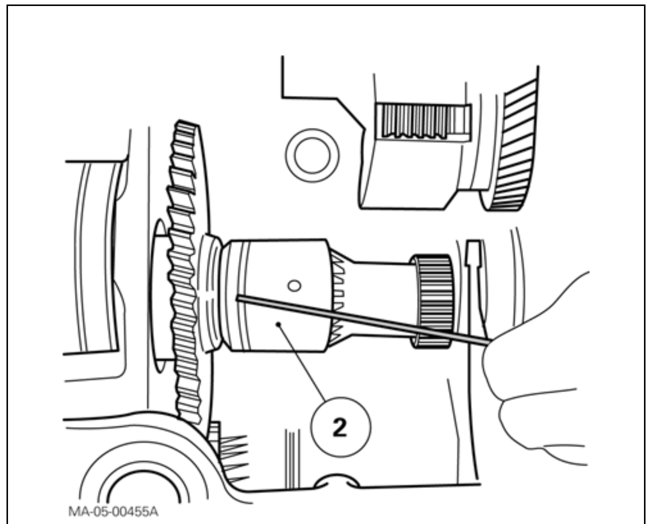

Fig. 13

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D . Hare / Tortoise fork and lock- 1st /2nd - 3rd / 4th fork assembly and selector rail

Preliminary operations

47. Remove the right-hand rear wheel. Chock the tractor wheels.

48. Remove the selector cover (see chapter 5).

Remove the right-hand hydraulic cover (see chapter 9).

Disassembly

49. Remove the plugs (1), the springs (2) and the locking studs (3) (Fig. 1 and Fig. 2).

Note 1: *The locking studs are now extended (Fig. 1 and Fig. 2). This modification improves their guiding into the forks (5) and (6) and also into the buttons (1).*

Note 2: *To optimise operation, a decompression spring on the locking stud drives out the oil enclosed in the spring chamber (2). This design allows the stud to enter and exit the fork more smoothly, thus improving gear shifting.*

50. Take out set screw (8) (Fig. 14).

51. Drive out the cup plug (9) forwards by striking the rear of the selector rail (7) (Fig. 14).

52. Place the Tortoise and Hare fork (20) in the Hare position.

53. Remove the adjusting screws (19).

54. Remove the screws (16) and the cover (15).

55. Take out the Hare and Tortoise piston (13) and discard the O' rings.

56. Take off the cylinder (10) and discard the O' ring.

57. Turn the pump breather pipe (1) upwards (open centre).

58. Move the selector rail (7) to the rear in order to release the forks.

Slide the selector rail under the rear axle housing reinforcement (Fig. 16).

59. Extract the 1st - 2nd and 3rd - 4th forks.

60. Extract the Hare and Tortoise fork.

61. If necessary, disassemble the stop (18).

62. Take the selector rail out through the selector cover aperture by passing it through the Hare / Tortoise cylinder bore (Fig. 17).

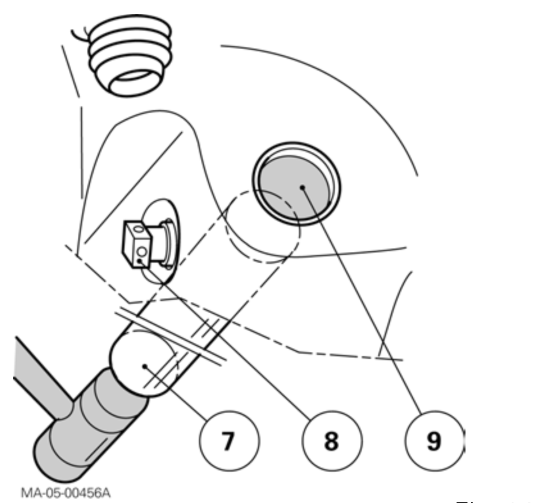


Fig. 14

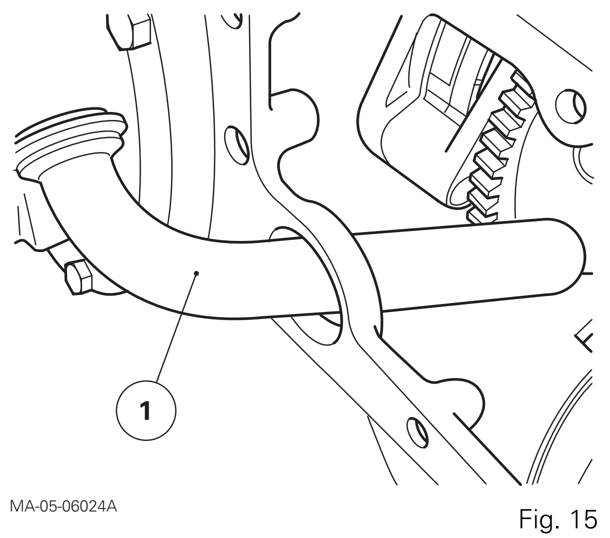


Fig. 15

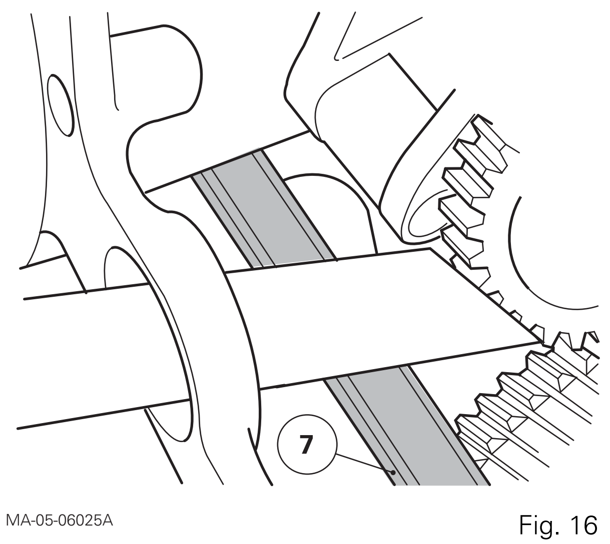


Fig. 16

Reassembly

63. Clean and check all components. Replace any defective parts.

64. Refit the selector rail through the selector cover aperture by passing it through the Hare / Tortoise cylinder bore (Fig. 17).

Refit the forks.

65. Check that the hydraulic ports in the Hare / Tortoise cylinder (10) are not obstructed. Refit the cylinder fitted with a new O' ring (11) (Fig. 18).

NOTE:

The cylinder (10) is held in position (Fig. 18):

- *at the front, by the shoulder machined on its outer diameter;*
- *at the rear, by the cover (15).*

66. Slide the selector rail forwards into the Hare / Tortoise fork and the 3rd, 4th and 1st, 2nd forks.

67. On the piston (13), fit O' rings (12) (14), then introduce it into the cylinder bore (10) and onto the selector rail (7) (Fig. 18).

Turn the adjusting screw holes towards the tapped holes on the fork. Temporarily lock the piston with a screw (19).

68. Fit the cover (15) with the screws (16). Tighten the screws to a torque of 25 - 35 Nm.

69. Clean the set screw (8). Smear its thread with Loctite 542 or equivalent. Tighten to a torque of 38 - 43 Nm.

70. Smear the cup plug (9) with Loctite 542 or equivalent. Fit it flush with the housing.

71. Fit the locking studs, springs and locking plugs.

Tighten the plugs to a torque of 50 - 70 Nm.

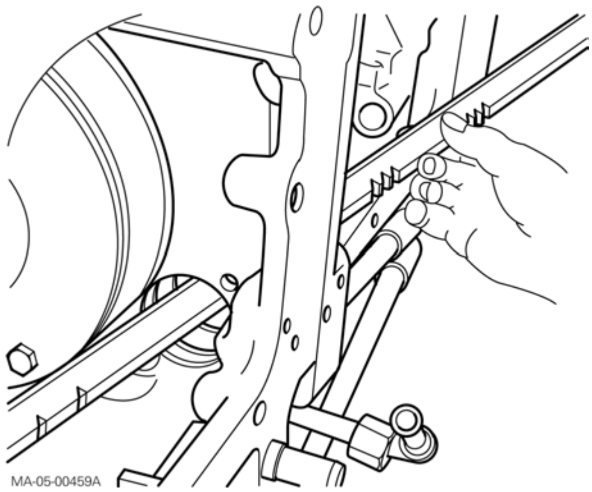


Fig. 17

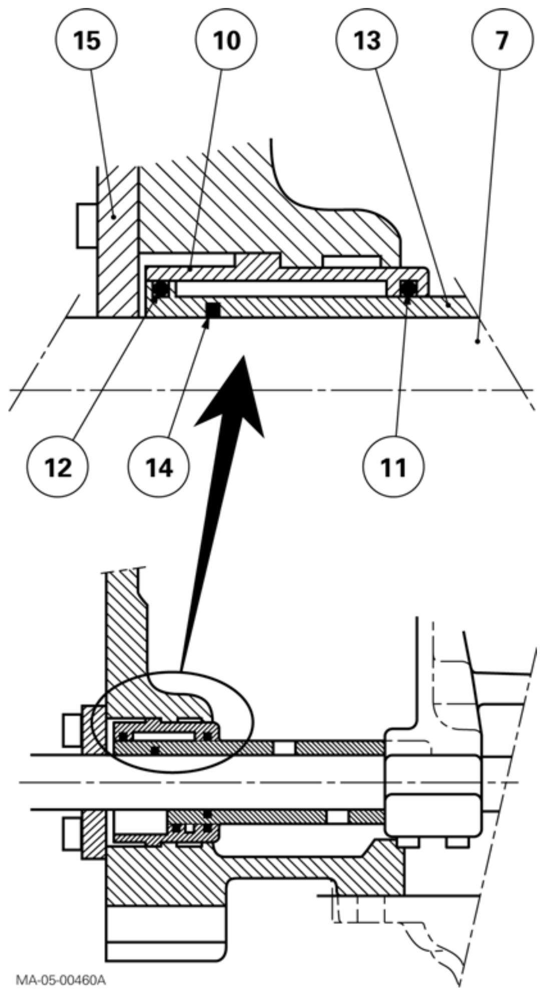


Fig. 18

Adjusting the clearance of the Hare / Tortoise fork pads and the synchromesh sliding coupler

Principle

The positioning of fork (20) is obtained by acting upon the difference between the distance between the centre lines of the tapped holes "Y" and the centre lines of the receiving indents "Z" on piston (13).

A different fork movement is obtained by acting either on the front screw or on the rear screw according to the adjustment required (Fig. 19).

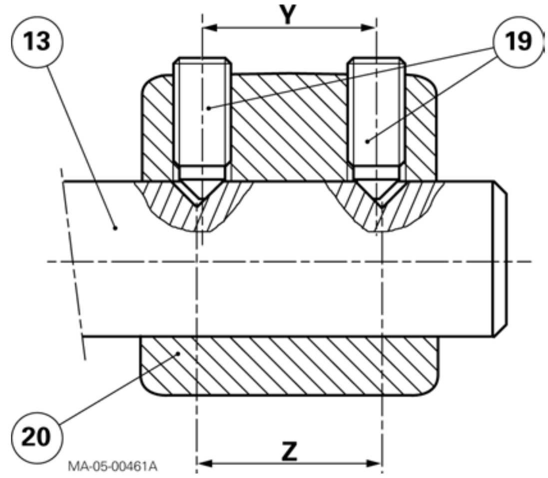


Fig. 19

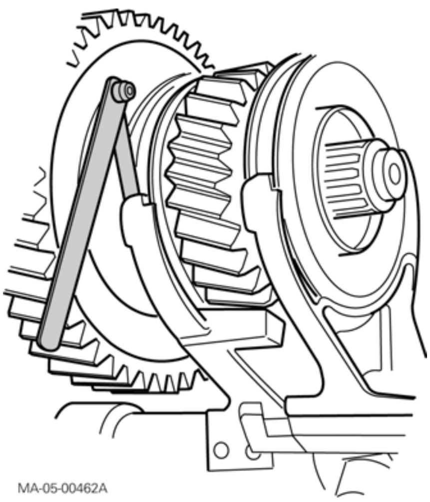


Fig. 20

Adjustment

72. Position the control piston (13) and the sliding coupler "C" in the high range (Hare) (Fig. 21).

73. Maintain the sliding coupler manually against pinion "L" of the high range (Fig. 21).

74. Adjust the position of the fork (20) using the two adjusting screws (19) previously cleaned in solvent and lightly smeared with Loctite 221 or equivalent, in order to obtain a clearance of **J1 = 0.3 mm** between the rear face of the pad and the sliding (Fig. 20 - Fig. 21).

***NOTE:** For this adjustment, use the locally made tool (see § E).*

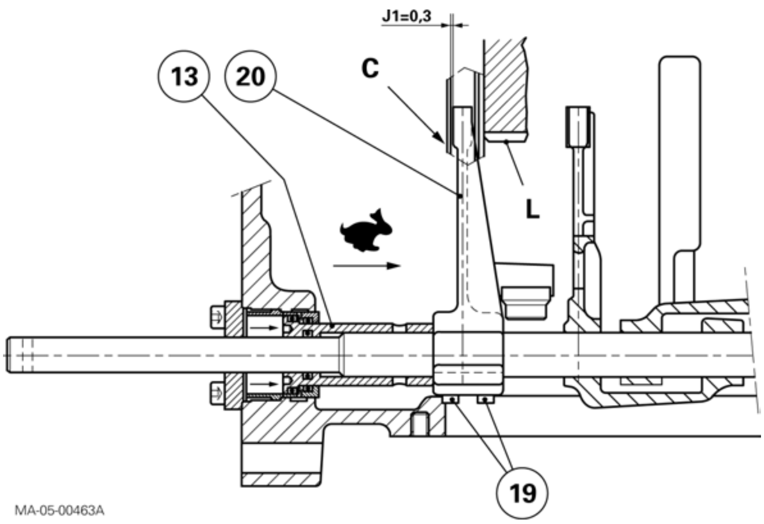


Fig. 21

75. Position the control piston (13) and the sliding coupler "C" in the low range (Tortoise) (Fig. 22).

76. Check that there is a clearance of **J2 = 0.3 minimum** (this value is determined by the clearance J1) between the pad and the sliding coupler when the latter rests against the pinion "T" of the low range (Fig. 22)

Alternatively and progressively tighten the screws (19) to a torque of 25 - 35 Nm taking care not to modify the adjustment.

IMPORTANT: *In the Tortoise position, if face "X" of the fork pad (20) is driven against the sliding coupler "C", increase clearance J1 (Fig. 21).*

77. Check for the correct operation of the fork.

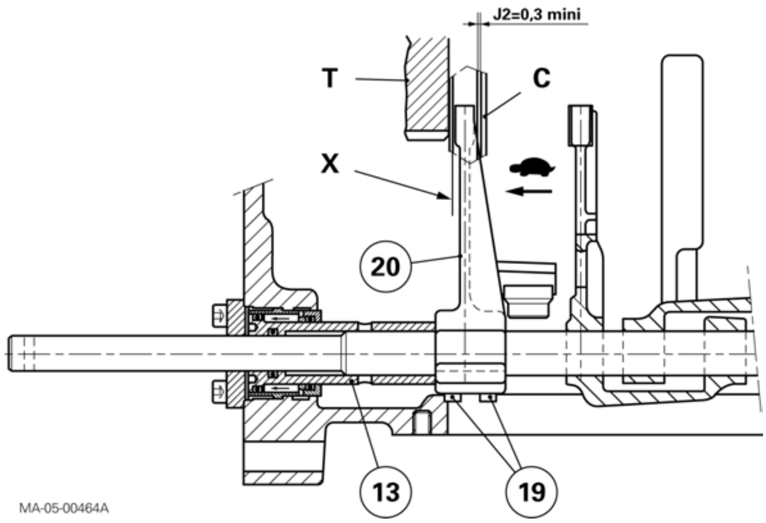


Fig. 22

Adjusting the the Hare / Tortoise fork stop

Principle

locking is adjusted by an adjustable stop (18) located on the Hare / Tortoise fork. This adjustment is obtained using a tool (see § E) whose role consists of conveying to the stop the positioning of the indexing pin, mounted on the selector cover.

The aim of this adjustment is to provide safety to the Hare / Tortoise mechanism, during operation, by mechanically immobilising the fork in the Hare or Tortoise position.

***IMPORTANT:** Before adjusting the stop (18), it is essential to adjust the clearance between the Hare / Tortoise fork pads and the synchromesh sliding coupler.*

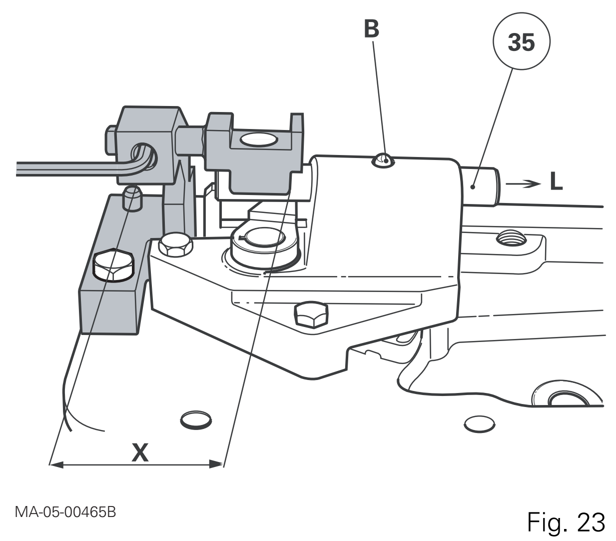


Fig. 23

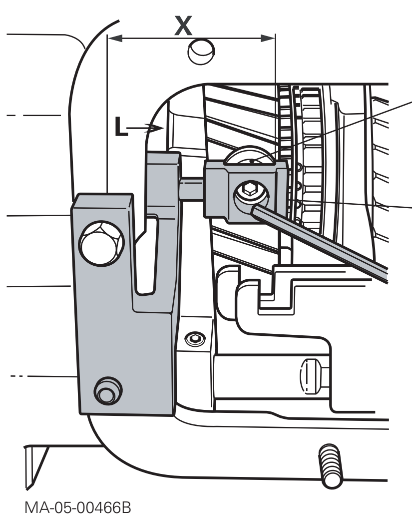


Fig. 24

On the cover (Fig. 25)

78. Place the indexing pin (35) in the high range (Hare).

79. Engage 3rd gear.

80. Place the tool on the selector cover (Fig. 23).

81. It is **essential** to equally share the clearance between the indexing pin and the plunger (31) (Fig. 25, detail A).

82. Using the tool, measure dimension X according to Fig. 23 and Fig. 25.

On the gearbox (Fig. 25)

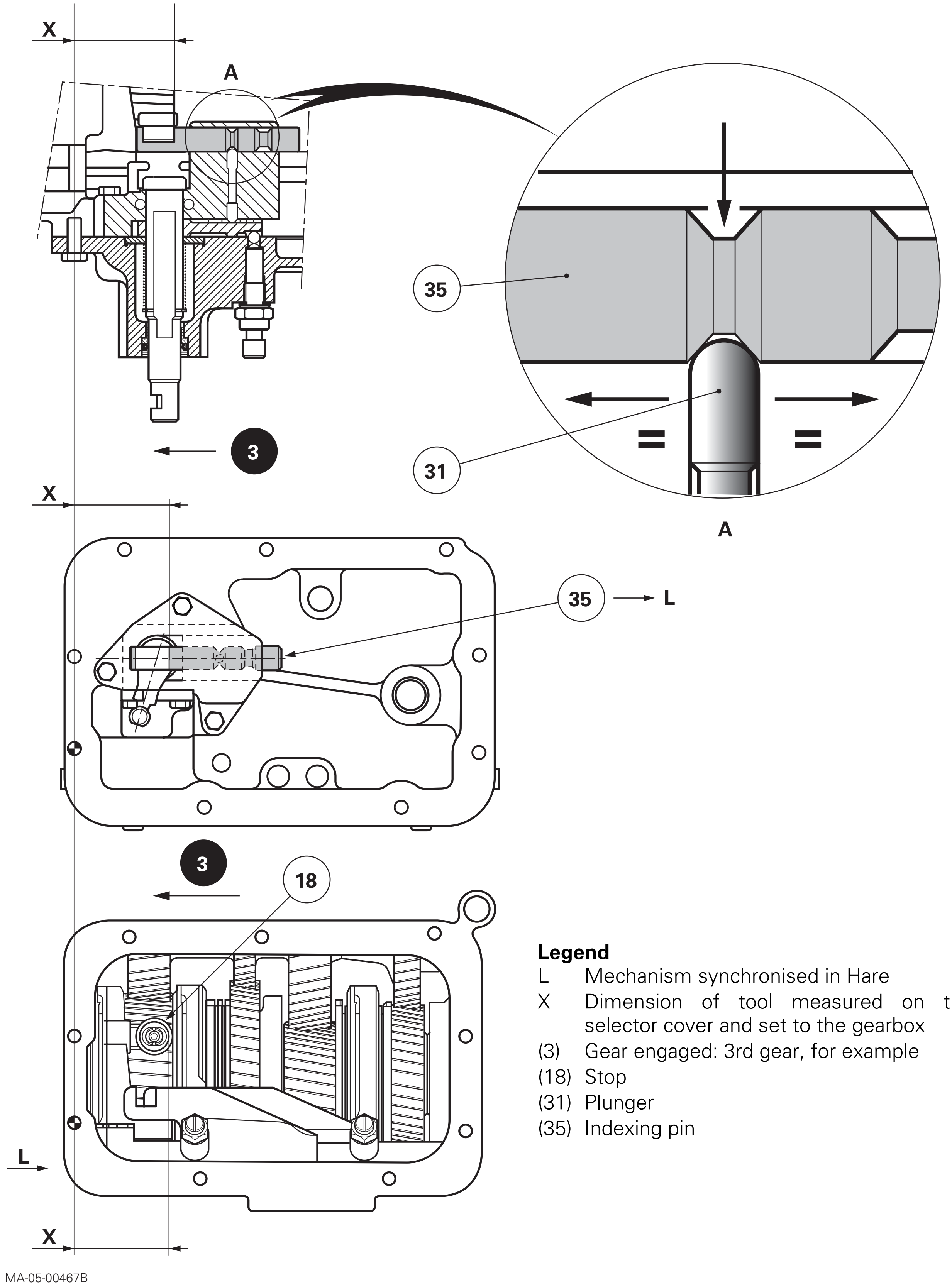
83. Engage 3rd gear. Using the tool, set dimension X to the gearbox.

84. Lightly smear the mating face of the stop (18) on the fork with Loctite 648 or equivalent.

Apply manual pressure on the fork towards the Hare range.

85. Adjust the stop (18) (Fig. 24 - Fig. 25) by placing it in contact with the tool.

86. Lightly smear the thread of the screw (17) with Loctite 242 or equivalent. Tighten to a torque of 40 - 50 Nm.



Legend

L Mechanism synchronised in Hare
X Dimension of tool measured on the selector cover and set to the gearbox
(3) Gear engaged: 3rd gear, for example
(18) Stop
(31) Plunger
(35) Indexing pin

Fig. 25

Check

87. Check the operation of the Hare and Tortoise ranges.

88. Check the smooth operation of all gears.

Final operations

89. Refit the right-hand hydraulic cover (see chapter 9).

90. Refit the selector cover (see chapter 5).

91. Reconnect and adjust the creeper unit control (if fitted) (see chapter 5).

92. Refit the rear wheel. Tighten the wheel nuts to a torque of 400 - 450 Nm.

93. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

94. Carry out a road test:
- of gears from 1st to 4th and vice versa;
- of the Hare / Tortoise ranges;
- of the creeper unit (if fitted).

95. Check for the oil tightness of the cover mating faces and the hydraulic unions.

E . Service tools

Tools available in the AGCO network

- **3378325M11:** Hare / Tortoise fork lock adjustment tool (Fig. 26)

Locally made tool

- **Shim hinged on suitable fixture** (Fig. 27)

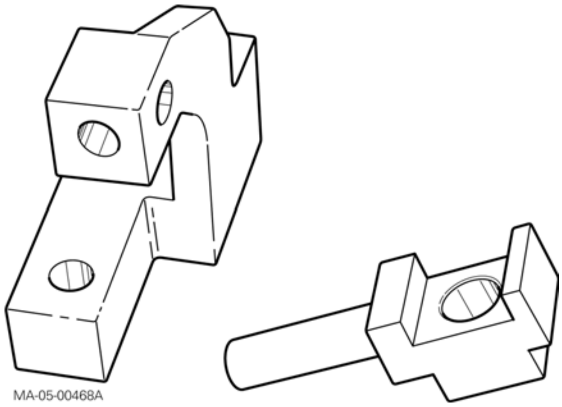


Fig. 26

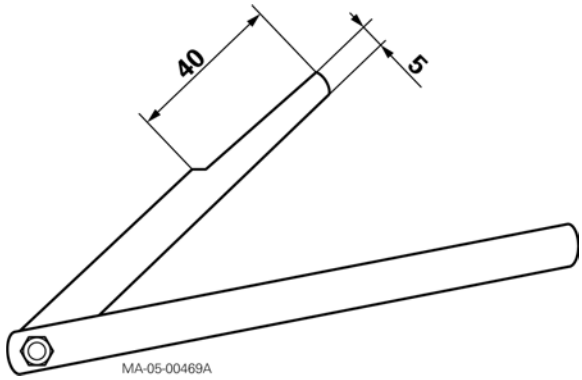


Fig. 27

05G02 - GBA20 output shaft with Power Shuttle

CONTENTS

A . General

Bearings (28) (30) separated by a spacer (80) rotate drive pinion (29) on the shaft. Bearings (79) (81) operate as axial stops.

A double cone synchromesh enables gear range shifting between pinions (29) (Hare) and (36) (Tortoise).

Preloading, or the clearance between bearing cones (39) (40) and their respective cups (48) (37) is adjusted depending on the thickness of circlip (49).

Description

The output shaft transmits movement from the different ranges to the rear axle transfer shaft. It is fitted on the lower transmission line at the rear of the unit.

It is supported at the front by a needle bearing fitted in the mainshaft bore and at the rear by two opposing taper roller bearings.

The shaft (44) supports:
- the drive pinion (29) fitted idle onto the combined bearings (28) (30);
- the idle-mounted pinion (36) and ring (35) assembly;
- the Hare / Tortoise synchromesh (31), held in rotation by splines.

To ensure correct operation of the assembly depending on the load applied to the transmission, several adjustments are required:
- **J3 clearance**: via the circlip (49), this cancels the clearance between the bearing cones (39) (40) and their respective bearing cups.
- **J4 clearance**: the shim(s) (38) positioned between the shoulder of the shaft (44) and the bearing cone (39) allow(s) end play for the pinion (29).
- **J5 clearance**: the shim(s) (42) between the bearing cone (40) and the laminated shim (43) cancel the end play of the cones (39) (40) on the shaft (44).

***Note:** The output shaft of the GBA20 gearbox without creeper speeds can be replaced by two other shafts corresponding respectively to the following options: creeper or super-creeper unit.*

Parts list (Fig. 1)

(21) Synchromesh cone (Hare)
(22) Synchromesh cone (Tortoise)
(24) Needle bearing
(27) Thrust washer
(28) Needle bearing
(29) 3rd driving pinion (Hare)
(30) Needle bearing
(31) Hare / Tortoise double cone synchromesh
(32) Thrust washer
(35) Ring
(36) Tortoise pinion
(37) Bearing cup
(38) Shim(s)
(39) Bearing cone
(40) Bearing cone
(41) Screw
(42) Shim(s)
(43) Laminated shim
(44) Output shaft
(45) Circlip
(46) Stop plate
(48) Bearing cup
(49) Circlip
(79) Needle bearing
(80) Spacer
(81) Needle bearing

Overall view

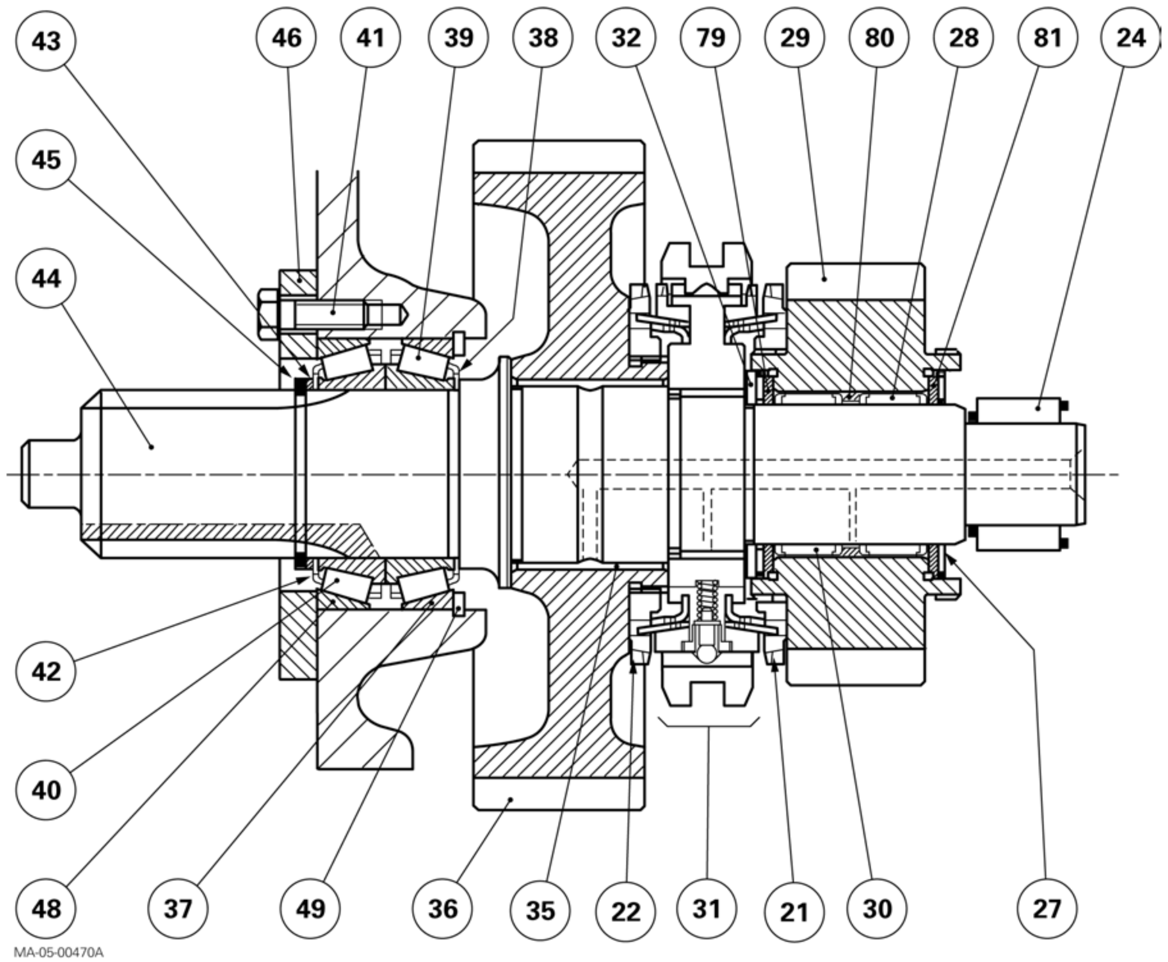


Fig. 1

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Parts list (Fig. 2)

(21) Synchromesh cone (Hare)
(22) Synchromesh cone (Tortoise)
(24) Needle bearing
(27) Thrust washer
(28) Needle bearing
(29) 3rd driving pinion (Hare)
(30) Needle bearing
(31) Hare / Tortoise double cone synchromesh
(32) Thrust washer
(35) Ring
(36) Tortoise pinion
(37) Bearing cup
(38) Shim(s)
(39) Bearing cone
(40) Bearing cone
(41) Screw
(42) Shim(s)
(43) Laminated shim
(44) Output shaft
(45) Circlip
(46) Stop plate
(48) Bearing cup
(49) Circlip
(79) Needle bearing
(80) Spacer
(81) Needle bearing

Exploded view

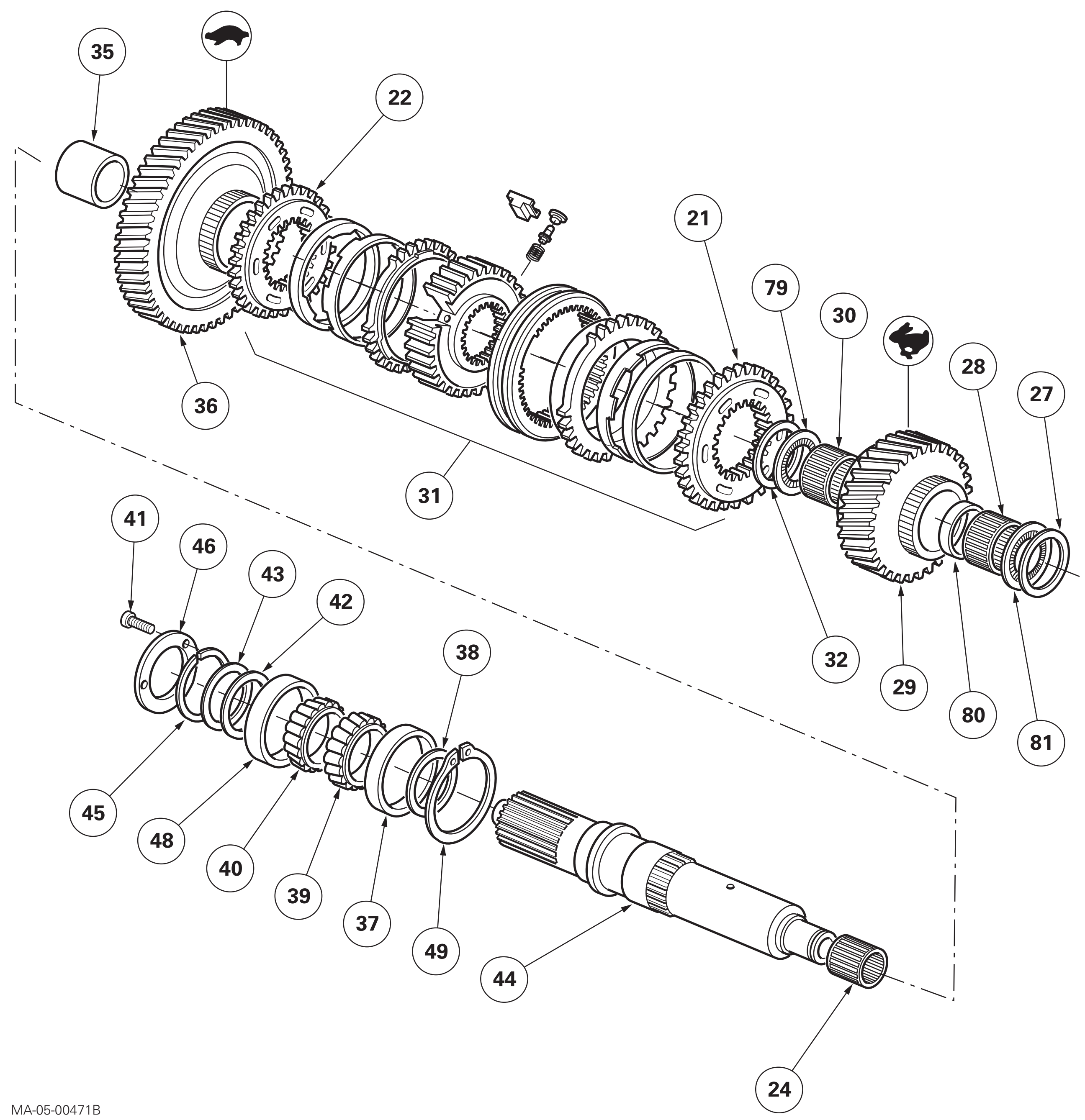

Fig. 2

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B . Preliminary operations

1. Split the tractor between the gearbox and the rear axle (see chapter 2).
2. Remove the selector cover (see chapter 5).
3. If necessary, remove screw (1) (Fig. 11).

C . Removing and refitting the selector rail and the forks

***Note:** The tractor is split. Consequently, the sensor rail removal is made easier following separation which is to be made from the rear side of the gearbox housing. Apart from this point, the procedure remains unchanged.*

Disassembly

4. If the tractor is fitted with a creeper unit, remove pin (1), locknut (2), adjustable lock (3), fork (4) with sleeve (5) (Fig. 3).

   If the tractor is fitted with a super-creeper unit, the fork and its lock are removed as described above, except for the absence of the pin (1).
5. Remove the selector rail and the forks (see chapter 5).

Reassembly

6. Clean and check all components. Replace any defective parts.
7. Refit the selector rail and the forks (see chapter 5).
8. Depending on the equipment, install sleeve (5), fork (4), adjustable lock (3) and pin (1) (Fig. 3).

   To adjust the fork, see chapter 5.

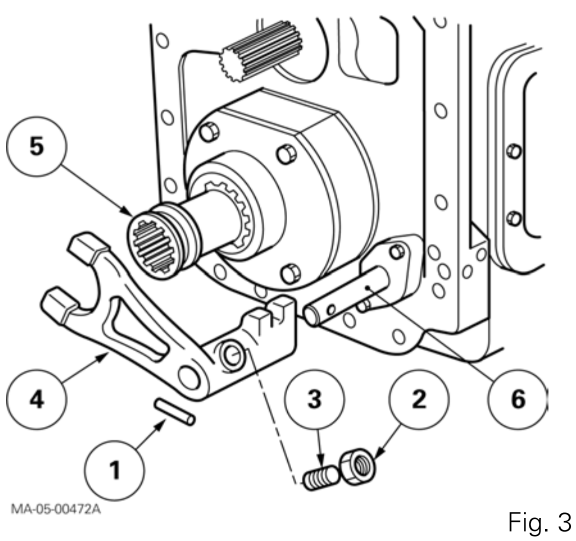

Fig. 3

D . Removing, refitting and shimming the shaft

9. If the tractor is fitted with a creeper unit or super-creeper unit, remove the unit (see chapter 5).

Disassembly

IMPORTANT: *Bearing cones and cups shall be paired if reused.*

10. Take out the screws (41).
11. Remove stop plate (46).
12. Remove bearing cup (48).
13. Remove circlip (45).
14. Remove laminated shim (43) and shims (42).
15. Remove bearing cones (40) (39).
16. Remove the shims (38) and the cup (37).
17. Remove circlip (49).
18. Pull and remove shaft (44) backwards while holding the gear train assembly.
19. Through the selector cover aperture, remove:
- the synchromesh (31);
- the Hare / Tortoise synchromesh rings;
- the pinion assembly (29) and needle roller bearings (28) (30);
- the 3rd synchromesh ring;
- the two needle bearings (79) (81);
- the stops (27) (32).

20. If necessary, remove the Tortoise pinion (36).
NOTE: *If work is necessary on this pinion, first remove the input unit (see chapter 5) to gain access to the layshaft of the gearbox in order to remove the pinion involved through the gear selector cover aperture.*
21. Remove needle bearing (24). Identify the assembly direction.

Reassembly

22. Check and clean the components. Replace any defective parts.

23. Put needle bearing (24) in the bore of mainshaft "R", taking care to position the smaller diameter of the flexible bush towards the 3rd drive pinion (Hare) (29) (Fig. 4).

24. Fit the shaft in the housing without the pinions.

25. Fit a temporary circlip (49), minimum thickness.

26. Place bearing cup (37).

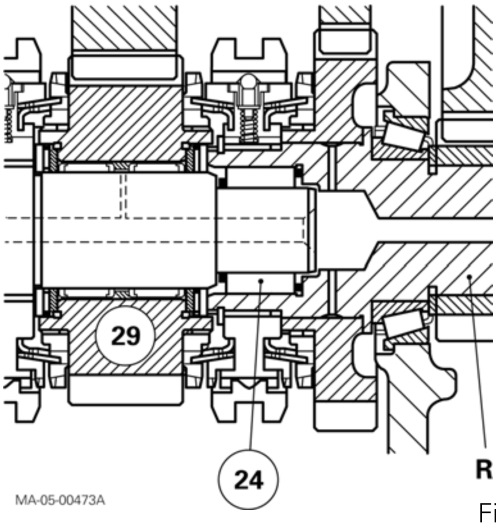

Fig. 4

Preparing for J3 clearance adjustment (Fig. 5)

27. Slide cones (39) (40) and hold them against the shoulder of shaft (44) by applying pressure by hand. Fill space Y between the rear of cone (40) and the groove of circlip (45) with shims (42) and laminated shim (43) which will be placed against circlip (45). Take a new circlip. The circlip must be held closed in the groove under a slight pressure (Fig. 6).

28. Fit cup (48) and stop plate (46). Tighten screws (41) to a torque of 25 - 35 Nm.

IMPORTANT: *For gearboxes fitted with creeper unit, use unit plate (1) (Fig. 9) to replace stop plate (46) (Fig. 8). Tighten the screws to a torque of 33.8 - 51.5 Nm.*

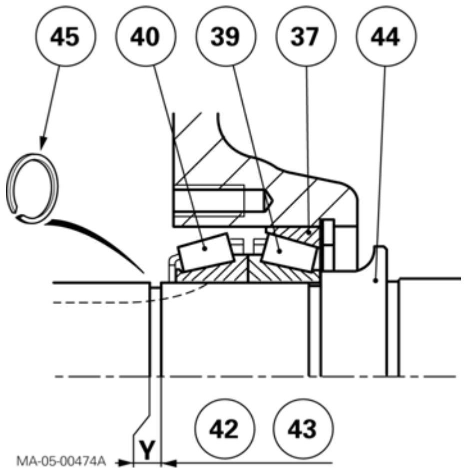

Fig. 5

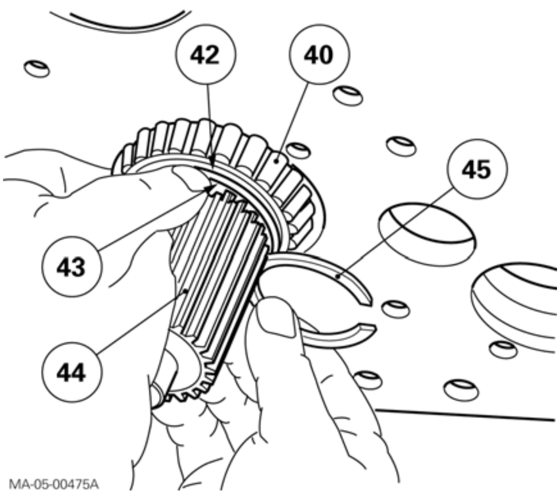

Fig. 6

Adjusting J3 clearance (Fig. 7)

29. Put the feeler pin of a dial gauge against the end of shaft (44) (Fig. 8 or Fig. 9).

30. Push the shaft, turning it alternately from right to left to correctly seat the cones in the cups.

31. Reset the dial gauge to zero.

32. Repeat operation 30 this time pulling.

33. If the axial freeplay is greater tha 0.05 mm, set a definitive thickness of circlips (49), qui to be fitted later at operation 42, to obtain **J3 = -0.05 to +0.05 mm.**

34. Take off circlip (45).

35. Remove laminated shim (43) and shims (42).

36. Remove screws (41) and stop plate (46).

37. Remove:
- the cup (48);
- the bearing cones (40) (39), pairing them with their cups;
- the cup (37);
- the provisional circlip (49) fitted at operation 25;
- The shaft (44).

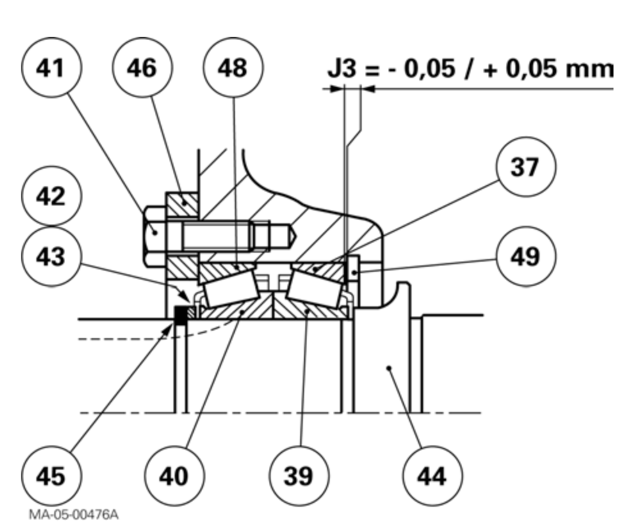

Fig. 7

Assembling the pinions and the shaft

38. On a workbench, preassemble 3rd drive pinion (29) with synchromesh rings (21) and 3rd gear, bearings (79) (81), washers (27) (32) and synchromesh (31).

39. If removed, put the Tortoise pinion (36) with its synchromesh ring (22) in the housing.

***IMPORTANT:** If ring (35) of the Portoise pinion (36) is damaged, replace the pinion assembly (the ring is rebored after force-fitting).*

Refit the input unit (see chapter 5).

40. In the housing, install:
- 3rd driving pinion (29) fitted with needle roller bearings (28) (30) (recess "R" turned towards the 3rd - 4th synchromesh (Fig. 10);
- the synchromesh (31).

***REMINDER**: Needle bearings (28) (30) are force-fitted and separated by spacer (80).*

41. Fit output shaft (44) holding the gear train assembly (Fig. 11).

Fig. 8

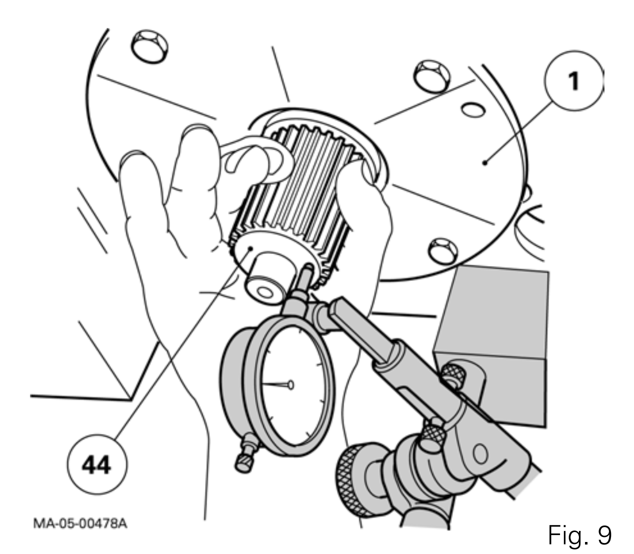

Fig. 9

Adjusting J4 clearance (Fig. 12)

42. Fit the circlip (49) defined at the operation 33. Slide the cones and cups paired during operation 37 onto the shaft.

43. Install stop plate (46). Tighten screws (41) to a torque of 25 - 35 Nm.

***IMPORTANT:** For gearboxes fitted with creeper unit, use unit plate (1) (Fig. 9) to replace stop plate (46) (Fig. 8). Tighten the screws to a torque of 33.8 - 51.5 Nm.*

44. Put the feeler pin of a dial gauge against the end of shaft (44) (Fig. 8 or Fig. 9).

45. Push the shaft, turning it alternately from right to left to correctly seat the cones in the cups.

46. Reset the dial gauge to zero.

47. Repeat operation 45 this time pulling.

Depending on the value read on the dial gauge, determine the thickness of shim Z (38) to obtain: **J4 = 0.20 to 0.40 mm** (Fig. 12)

48. Remove screws (41) and stop plate (46).

49. Take off bearing cup (48).

50. Remove cones (40) (39).

51. Slide the required thickness of shims Z (38), and cones (39) (40) onto the shaft.

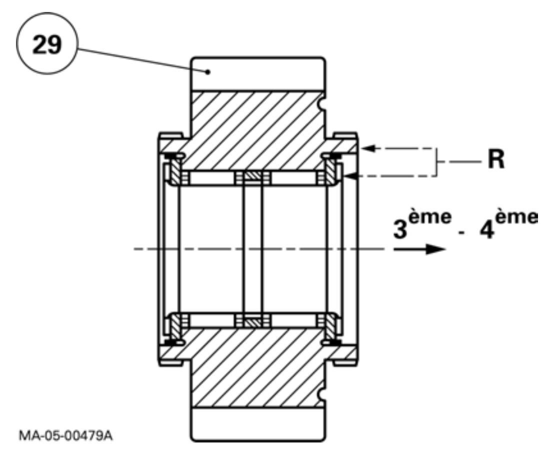

Fig. 10

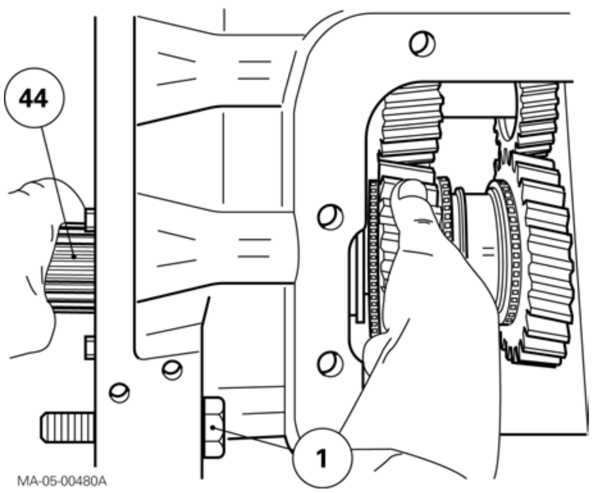

Fig. 11

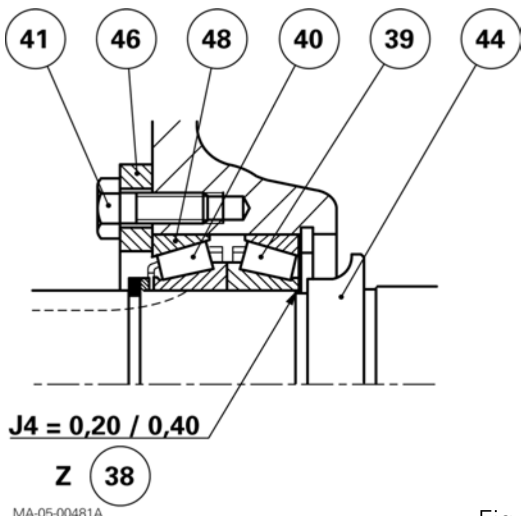

Fig. 12

Adjusting J5 clearance (Fig. 13)

52. Carry out shimming to obtain clearance **J5 = 0**.

53. Using the thickness of shims Y (42) (43), determined during operation 27, determine the thickness of shims Z (38) to obtain clearance **J5 = Y - Z**.

54. Fit cup (48) and stop plate (46). Tighten screws (41) to a torque of 25 - 35 Nm.

55. Slide the thickness of shims selected during operation 53 on the shaft.

56. Position laminated shim (43) on circlip groove side.

Place circlip (45): it must be held closed in the groove under slight pressure. Check that it is correctly positioned.

57. Refit the creeper or super creeper gearbox (depending on option).

58. Manually check the rotation of the shaft and its gear train.

59. Install the forks and the selector rail (see § C).

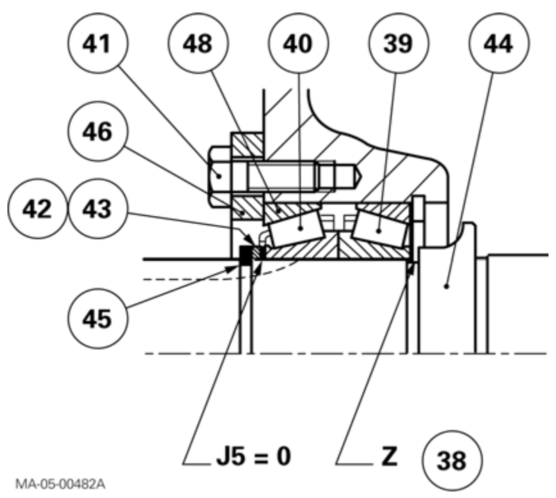

Fig. 13

E . Final operations

60. Refit the selector cover (see chapter 5), previously checking the presence of the screw (1) (Fig. 11).

61. Assemble the tractor between the gearbox and the rear axle (see chapter 2).

62. Check:

- hydraulic tightness of the circuits;
- correct operation of electrical circuits.

63. Carry out a road test of controls.

64. Check oil tightness of mating faces (gear selector cover, gearbox on rear axle).

05H02 - GBA20 mainshaft with Power Shuttle

CONTENTS

A . General

The mainshaft (69) is mounted on two taper roller bearings (1) (17) with bearing cups (2) (16), resting in the two lower bearings of the main unit. Each bearing cup has a root face giving it maximum contact with the housing.

At the front it receives the drive pinion (67).

Between the two lower bearings, it holds the 1st (7) and 2nd (14) idle mounted drive pinions, as well as the 1st and 2nd gear synchromesh assembly (11), whose hub is held by splines. At the rear, it holds the 4th gear drive pinion (18) and the 3rd and 4th gear synchromesh assembly (23).

The 1st, 2nd (11) and 3rd, 4th (23) synchronizers are of the double cone type.

The rear bore contains a needle bearing that holds the front end of the output shaft. The turning parts are lubricated by a central channel and radial bores.

The taper roller bearings are mounted with preload obtained by shim(s) (3) inserted between the serrated washers (6) positioned against the drive pinion (67) and the ring (8). A washer (77) with flat sections acts as a stop for the 1st drive pinion (7).

Parts list (Fig. 1)

(1) Bearing cone
(2) Bearing cup
(3) Shim(s)
(6) Serrated washers
(7) 1st driving pinion
(8) Ring
(11) 1st, 2nd double cone synchronizer
(14) 2nd driving pinion
(16) Bearing cup
(17) Bearing cone
(18) 4th driving pinion
(23) 3rd, 4th double cone synchronizer
(26) Circlip
(33) 4th synchromesh cone
(47) 3rd synchromesh cone
(67) Drive pinion
(68) Nut
(69) Mainshaft
(70) Snap ring
(71) Lubricating pipe
(72) Spring
(73) 1st synchromesh cone
(74) 2nd synchromesh cone
(77) Washer with flat sections
(78) Tab washer

Overall view

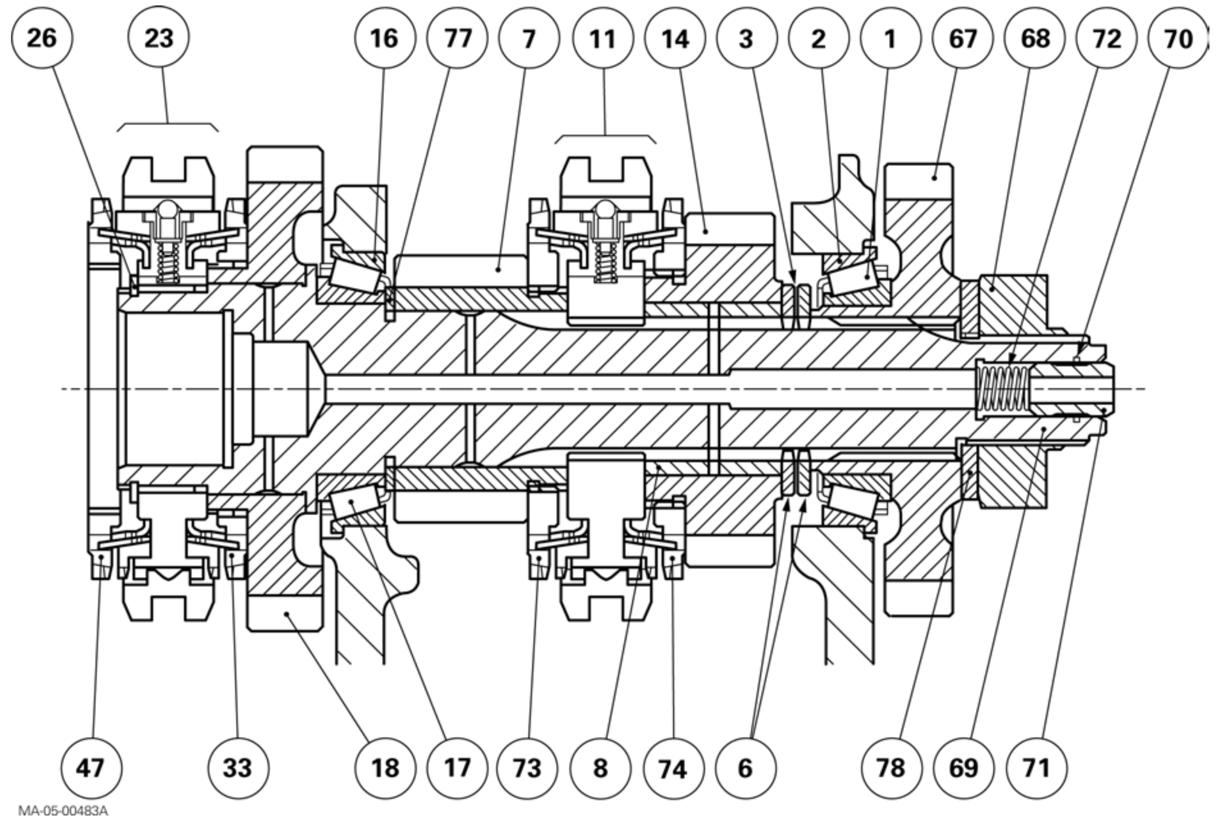

Fig. 1

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Parts list (Fig. 2)

(1) Bearing cone
(2) Bearing cup
(3) Shim(s)
(6) Serrated washers
(7) 1st driving pinion
(8) Ring
(11) 1st, 2nd double cone synchronizer
(14) 2nd driving pinion
(16) Bearing cup
(17) Bearing cone
(18) 4th driving pinion
(23) 3rd, 4th double cone synchronizer
(26) Circlip
(33) 4th synchromesh cone
(47) 3rd synchromesh cone
(67) Drive pinion
(68) Nut
(69) Mainshaft
(70) Snap ring
(71) Lubricating pipe
(72) Spring
(73) 1st synchromesh cone
(74) 2nd synchromesh cone
(77) Washer with flat sections
(78) Tab washer

Exploded view

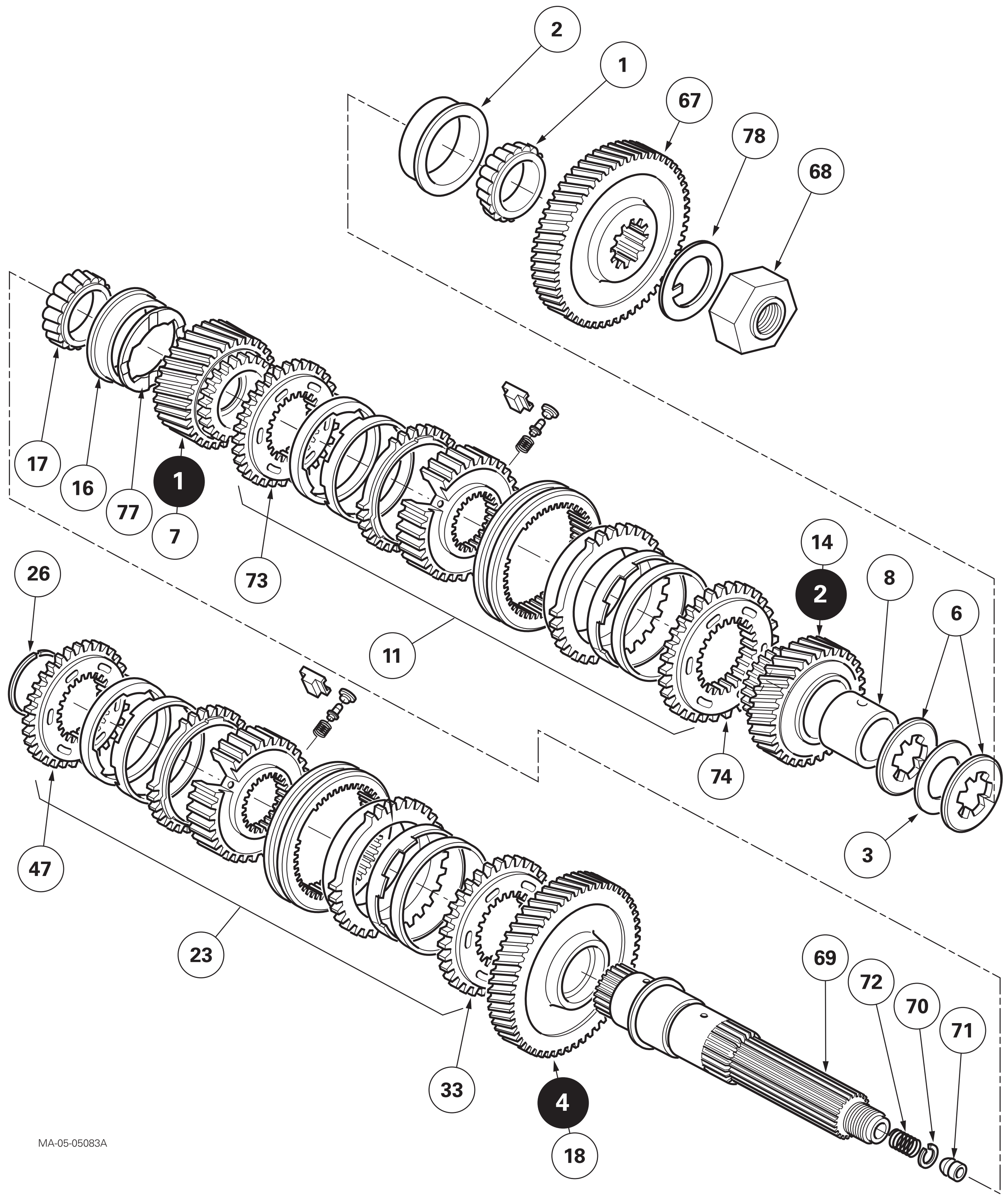

Fig. 2

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B . Preliminary operations

1. Split the tractor between the gearbox and the rear axle (see chapter 2).
2. Split the gearbox from the engine (see chapter 2).
3. Remove the selector cover (see chapter 5).
4. Remove the input unit assembly (see chapter 5).
5. Remove the layshaft (see chapter 5).
6. Remove the selector rail and the forks (see chapter 5).
   Remove the output shaft (see chapter 5).
7. Remove the mainshaft.

C . Disassembling and reassembling the shaft

Disassembly

***NOTE:** If work is only carried out on drive pinion (67), hold the pinion and 1st, 2nd synchronizer assembly in a straight line using a screwdriver so as not to move the washer with flat sections (77).*

8. Take off circlip (26).

9. Remove 3rd, 4th synchromesh (23) and cones (33) and (47). Note the assembly order.
Remove the 4th gear pinion (18).

10. Position locking tool 3378082M1 (Fig. 3) and the holding sleeve of shaft (69) (Fig. 4), made locally (see § E).

11. Remove lubricating pipe (71) and spring (72).

12. Remove the safety device from nut (68) and loosen with socket 3378010M1 (Fig. 5 et § E).

13. Remove drive pinion (67) with cone (1).

14. Remove washers (6) and shim(s) (3).

15. Remove the tool and sleeve (Fig. 3 - Fig. 4).

16. Pull the shaft out of the housing backwards, while holding the 1st, 2nd pinion assembly together.

17. Remove 1st, 2nd pinion and synchromesh (11) assembly with ring (8). Remove cups (16) and (2).
***NOTE:** Keep cups and cones paired if reused.*

18. If the drive pinion (67), shaft (69) or taper roller bearings (1) (2) and (16) (17) need to be replaced:
- remove the flat sided washer (77);
- extract the bearings cones (1) and (17);
- remove snap ring (70).

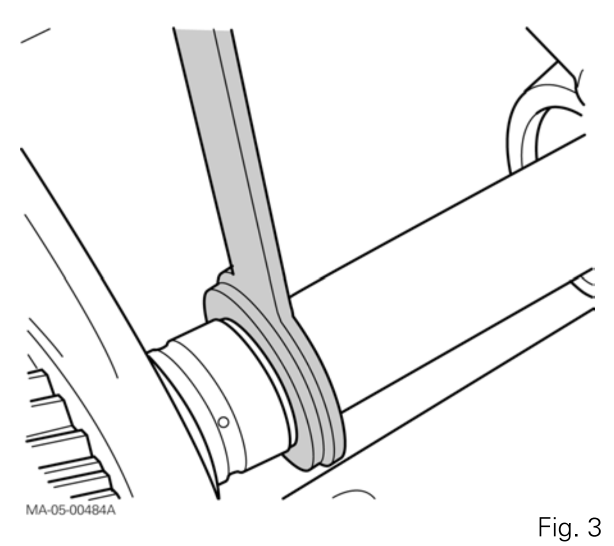


Fig. 3

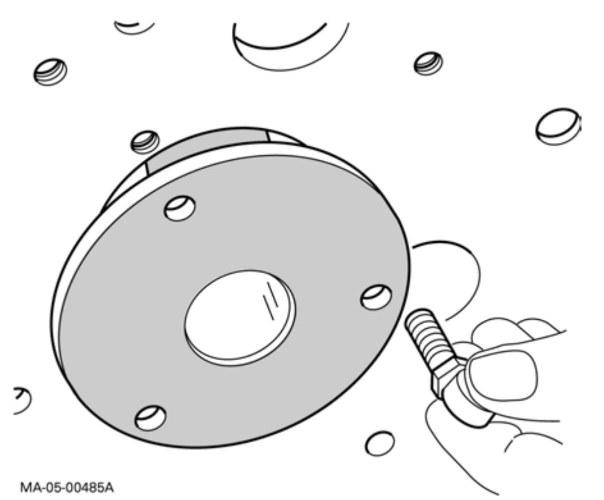


Fig. 4

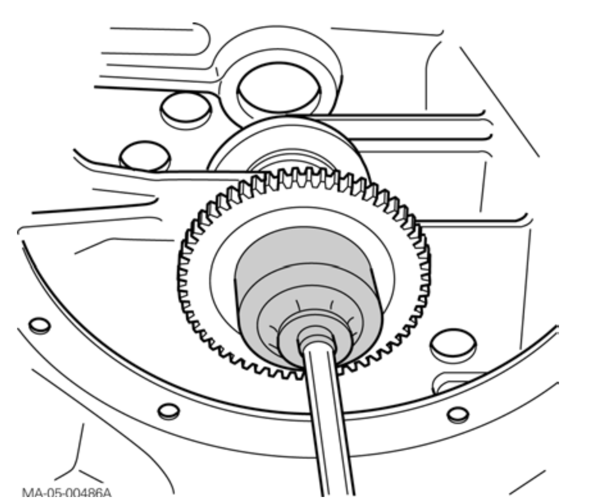


Fig. 5

Reassembly

19. Clean the housing and the mating faces.

20. With compressed air, check that no channels in the gearbox or in the shaft are clogged.

21. Clean and check all components. Replace any defective parts.

22. Lubricate cones, cups, bearings bores and the ring.

23. If disassembled:
- fit bearing cone (17) onto shaft (69) using a press and a suitable fixture;
- refit the flat sided washer (77), with the lubricating grooves turned towards the 1st gear pinion (7);
- refit snap ring (70).

24. Assemble the cups (2) and (16) inside the housing.

25. Refit the 1st, 2nd pinion, synchromesh (11), cones (73) (74) and ring (8) assembly in the housing.

26. Fit the shaft from the rear of the housing while holding the pinion / synchronizer assembly together (Fig. 6), making sure that ring (8) is correctly fitted in pinion (14).

27. Install locking tool 3378082M1 (see § E) and locally made holding sleeve (Fig. 3 - Fig. 4).

28. If removed, fit the cone (1) on the pinion (67), using a press and a suitable tool.

29. Install washers (6) separated by a number of shims (3) sufficiently thick to obtain a temporary clearance of **0.10 to 0.15 mm** approx in preparation for shimming with preload (see later).

30. Install pinion (67) on shaft (69).

31. Screw in the nut (68) using the socket 3378010M1. Tighten to a torque of 130 - 170 Nm (Fig. 5).

32. Remove the tool and sleeve (Fig. 3 - Fig. 4).

33. Shim the shaft.

34. Position the dial gauge feeler pin at the end of the shaft (Fig. 7).

35. From the front of the housing, pull hard on the shaft, turning alternately from left to right to correctly seat the cones in their bearing cups.

36. Reset the dial gauge to zero.

37. Repeat the operation 35, this time by pushing.

38. Depending on the clearance measured, select the thickness of final shims required to obtain a preload of **P1 = 0.14 to 0.20 mm.** If possible, shim towards the maximum tolerance.

39. Install the locking tool and the holding sleeve (Fig. 3 - Fig. 4).

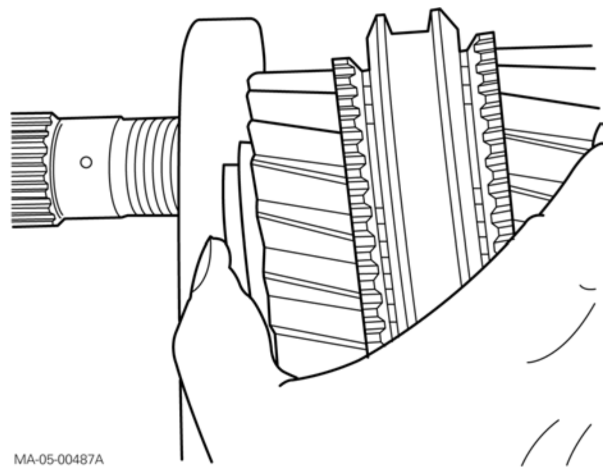


Fig. 6

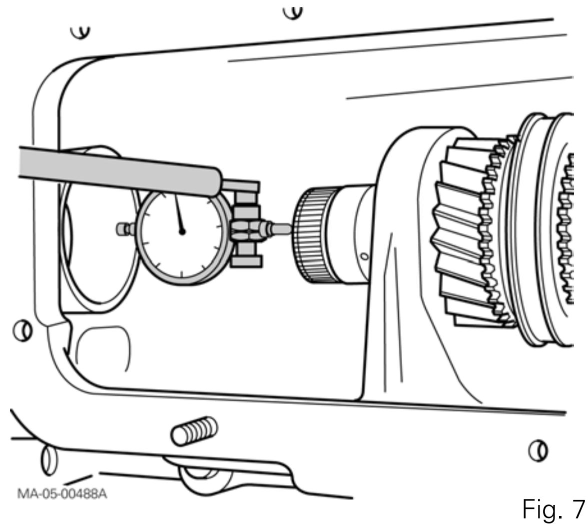


Fig. 7

40. Loosen nut (68).
41. Remove pinion (67).
42. Position shims (3) selected during operation 38 between two washers (6).
43. Install the pinion.
44. Degrease the thread of the shaft with a solvent.
45. Lightly smear new nut (68) with Loctite 270 then tighten to a torque of 130 - 170 Nm.
46. Lock the nut by bending its collar, without breaking it, into the grooves of the shaft using a suitable pin punch.
47. Insert spring (72) and lubricating pipe (71) in the shaft.
48. Remove the tool and the holding sleeve.
49. Fit pinion (18), 4th, 3rd synchromesh cones (33) and (47) and 3rd, 4th synchromesh (23). The lubricating grooves should be turned towards the 4th pinion (18).
50. Fit a new circlip (26), opening it as little as possible. After assembly, check that the circlip is not bent.
51. Manually check:
- the axial clearance of the pinions;
- the rotation of the shaft and its pinions.

52. Check that the 1st, 2nd synchromesh operates properly.

D . Final operations

53. Install and shim the output shaft (see chapter 5).
54. Refit the layshaft (see chapter 5).
55. Refit the input unit assembly (see chapter 5).
56. Shim the layshaft (see chapter 5).
57. Refit the selector rail and the forks (see chapter 5).
58. Refit the selector cover (see chapter 5).
59. Couple the gearbox to the engine (see chapter 2).
60. Couple the gearbox and the rear axle (see chapter 2).
61. Check operation of electric circuits.
62. Carry out a road test of controls.
63. Check for hydraulic tightness of the unions and mating faces (selector cover, gearbox on rear axle).

E . Service tools

Tools available in the AGCO network

- **3378010 M1:** Socket for nut - Mainshaft (Fig. 8)
- **3378082 M1:** Locking tool - Mainshaft (Fig. 9)

Locally made tool

- **Holding sleeve for the mainshaft** (Fig. 10)

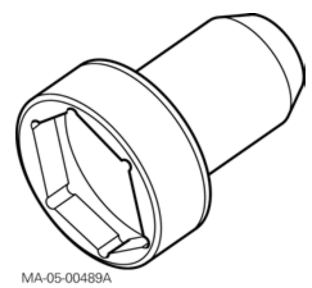


Fig. 8

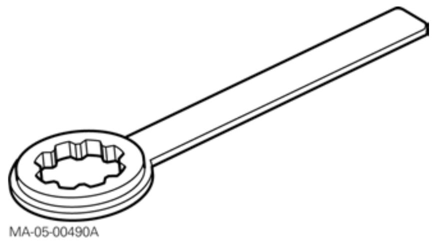


Fig. 9

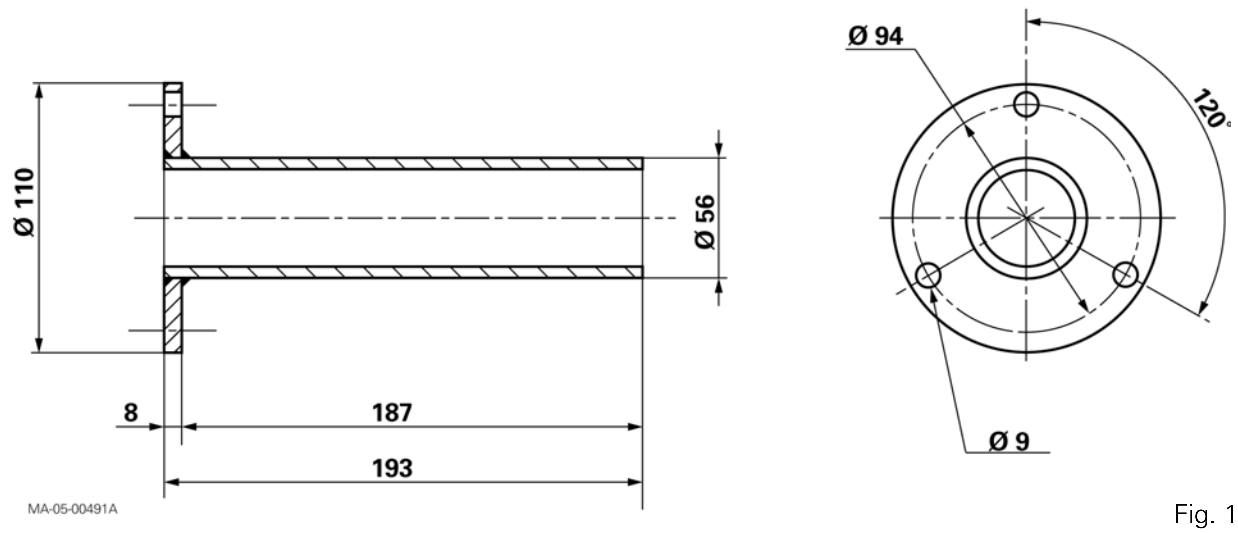


Fig. 10

05I02 - GBA20 layshaft with Power Shuttle

CONTENTS

A . General

The layshaft and its pinions (Fig. 1) form the upper line of the GBA20 gearbox with power shuttle.

It supports the driven pinions of the 1st and 4th gears.

The shaft teeth (54) are constantly meshed with the Tortoise pinion.

The shaft is supported by:

- the taper roller bearing (63) and (64) housed in the rear bearing of the input unit;
- the taper roller bearing (52) and (53) located in the rear bearing of the gearbox.

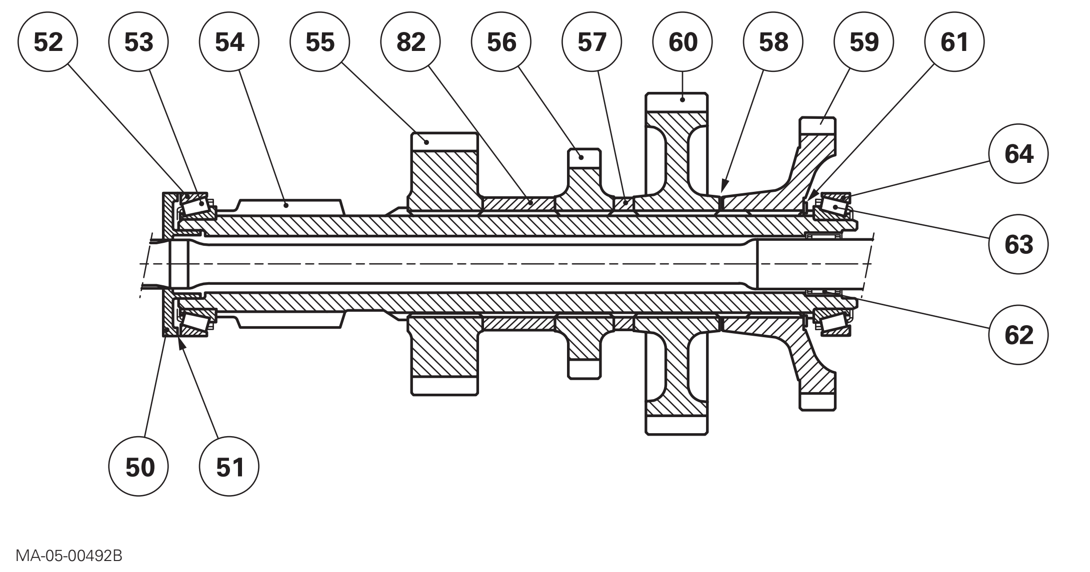
The four pinions are held in position by the spacers (57) and (82).

The operating clearance of these pinions is obtained by inserting shims (58) between the driven pinions of the 1st (60) and 2nd (59).

Parts list (Fig. 1)

(50) Oil deflector
(51) Shim(s)
(52) Bearing cup
(53) Bearing cone
(54) Shaft
(55) 3rd driven pinion
(56) 4th driven pinion
(57) Spacer
(58) Shim(s)
(59) 2nd driven pinion
(60) 1st driven pinion
(61) Circlip
(62) Needle bearing
(63) Bearing cone
(64) Bearing cup
(82) Spacer

Overall view



Exploded view

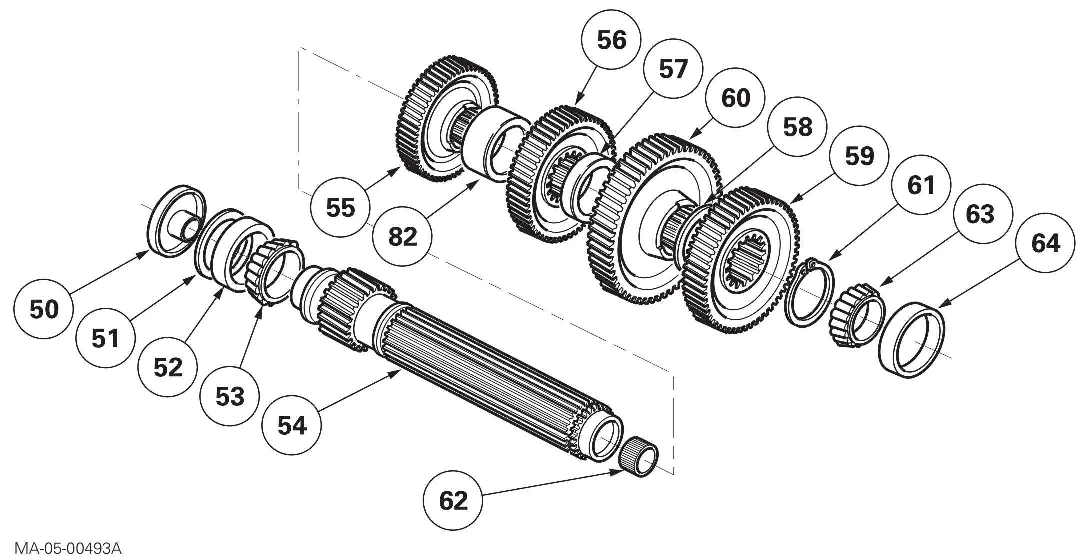


Fig. 1

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B . Preliminary operations

IMPORTANT: *To correctly shim the taper roller bearings of the layshaft it is necessary to remove the gearbox.*

1. Split the tractor between the gearbox and the rear axle (see chapter 2).
2. Split the gearbox from the engine (see chapter 2).
3. Place the gearbox on a workbench or a suitable fixture.

   Remove the forward clutch from the Power Shuttle (see chapter 5).
4. Remove the selector cover (see chapter 5).
5. Remove the input unit (see chapter 5).

IMPORTANT: *After removing the input unit, pair the bearing cup housed in the input unit rear bearing with the layshaft of the front bearing cone.*

C . Removing and refitting the shaft and pinion assembly

Removal

6. To release the rear end of the shaft, remove oil deflector (50), using an inertia extractor, shims (51) and cup (52) (Fig. 2).
7. Pull out the shaft and related pinion assembly from the front side of the housing (Fig. 3) by tilting it so that the set of pinions come out of the lower shafts.

   IMPORTANT: *To remove the shaft, do not put the handling bar in the bore so as not to damage needle bearing (62) (Fig. 3). If necessary, carry out the operation with the help of an assistant.*

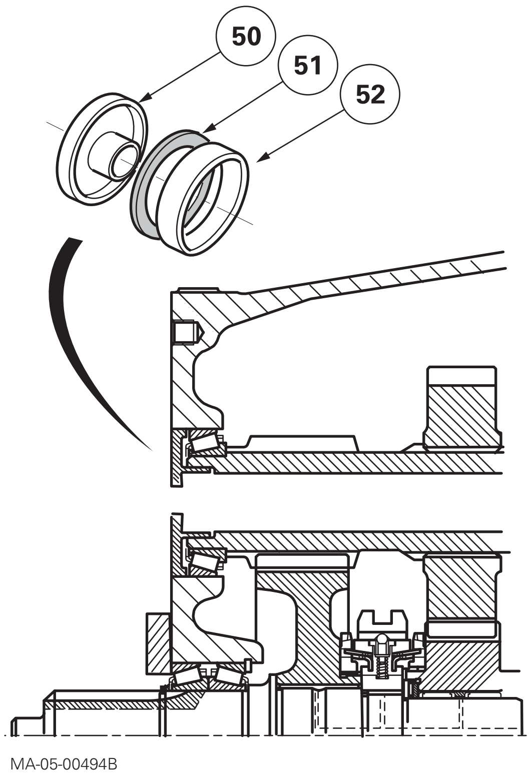

Fig. 2

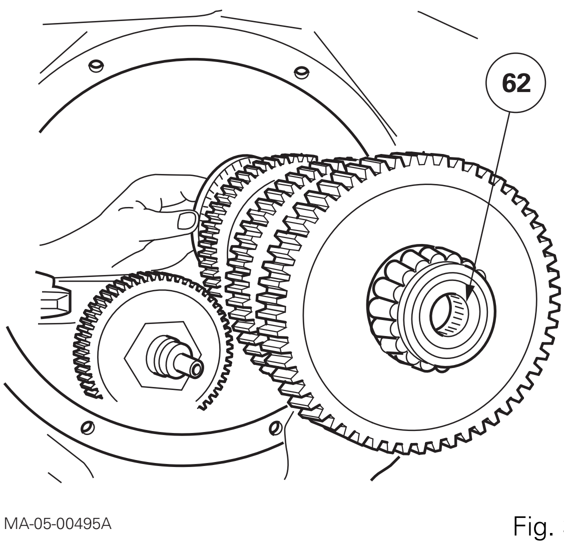

Fig. 3

Refitting

8. Clean and check all components. Replace any defective parts.

9. In the housing, position the assembled shaft with its related pinions.

10. If necessary, check the shimming of the shaft or carry it out (see § G). Otherwise, install cup (52), initial shims and oil deflector (50).

D . Removing and refitting pinions

Disassembly (Fig. 1)

11. Remove the bearing cone (63).

12. Remove circlip (61) by opening it up as little as possible.

13. Remove 2nd pinion (59), shims (58), 1st pinion (60) and spacer (57).

14. Remove 4th pinion (56), spacer (82) and 3rd pinion (55).

Reassembly (Fig. 1)

15. Clean and check all components. Replace any defective parts.

16. Install 3rd pinion (55), spacer (82) and 4th pinion (56).

17. Fit the spacer (57). Install 1st pinion (60) and 2nd pinion (59) **, temporarily without the shims (58)**.

18. Fit the circlip (61).

19. Shim the pinions (see § F).

20. Install the shaft, assembled with related pinions, in the housing (see § C).

E . Replacing the taper roller bearings and the layshaft

Disassembly

21. Remove the shaft (54) and pinion assembly (see § C).

22. Extract the bearings cones (53) and (63); Discard them.

23. If necessary, replace the shaft.

Reassembly

24. If the shaft (54) has been replaced:

Using a suitable fixture and a press, insert a new needle roller bearing (62) thrust up against the shoulder of the shaft. Check needle rotation after assembly.

25. Reassemble the pinions (see § D).

26. Fit bearing cones (63) and (53) using a press and a suitable fixture.

27. Position the shaft, assembled with related pinions, in the housing (see § C).

28. Shim the shaft (see § G).

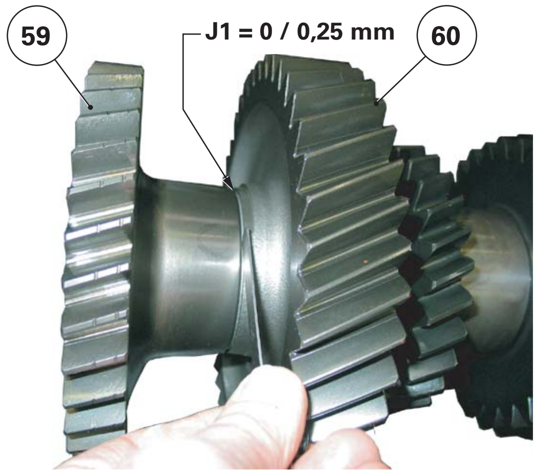

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Fig. 4

F . Shimming the pinions

Reminder: *Pinions shall be stacked temporarily without shims (58).*

29. Measure the space between the 1st pinion (60) and the 2nd pinion (59) using a set of shims (Fig. 4).

30. Depending on the measured distance, choose shims of an appropriate thickness to obtain clearance **J1 = 0 to 0.25 mm** (Fig. 4).

31. Remove circlip (61), opening it up as little as possible, and remove pinion (59).

32. Slide the final shims, previously selected, onto the shaft. Install the pinion and correctly fit the circlip.

33. Fit bearing cone (63) (see § E).

34. Install the shaft, assembled with related pinions, in the housing (see § C).

G . Shimming the shaft

***IMPORTANT:** To carry out shimming on the mainshaft, the new unit must be refitted (see chapter 5).*

35. Carry out the shimming on the shaft to obtain clearance of **J2 = 0 to 0.08 mm** (Fig. 6)
36. Install the locally made tool (Fig. 7 and § I) in the shaft.
37. Slightly compress the spring, while tightening the nut of the tool, to correctly seat the bearing cones in their cups.
38. Rotate the shaft a few turns. Check spring compression again.
39. Using a depth gauge (Fig. 5), measure dimension X between side A of bearing cup (52) and side B of the housing (Fig. 6).
40. Measure thickness Y of oil deflector (50).
41. Calculate the difference between X and Y.
42. Determine the thickness of shims required to obtain J2.
__NOTE:__ If possible, shim so as to obtain minimum tolerance.
43. Remove the compression tool.
44. Fit shims (51) selected in operation 42.
45. Fit the oil deflector in the housing.

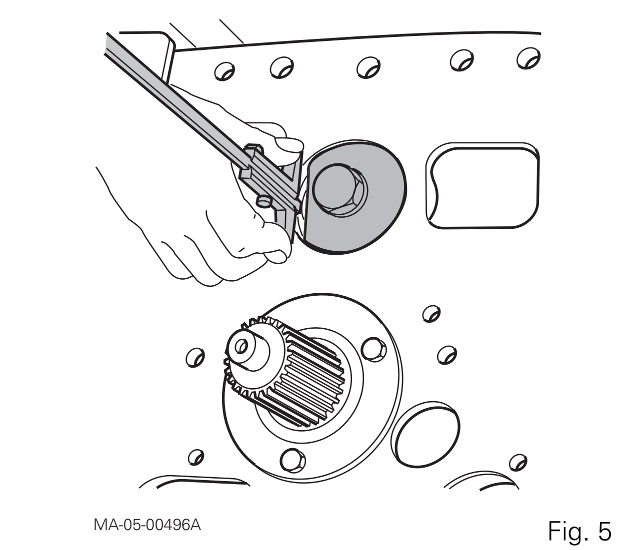

Fig. 5

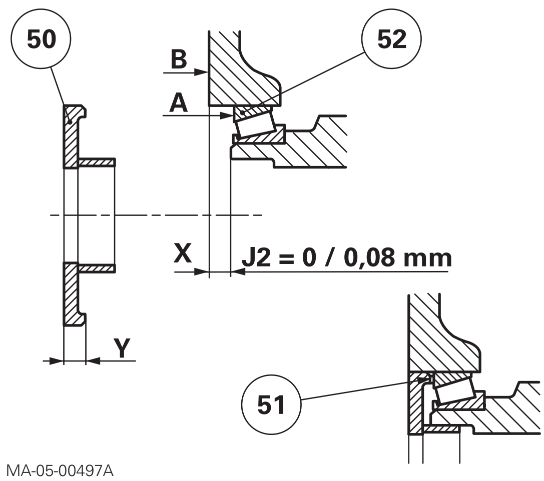

Fig. 6

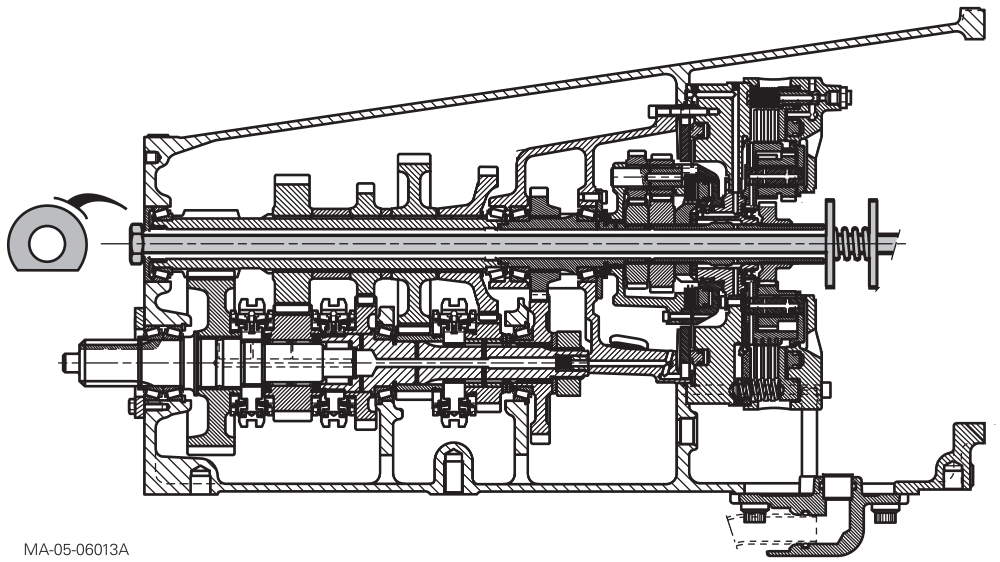

Fig. 7

H . Final operations

46. Refit the input unit (see chapter 5).

47. Refit the selector cover (see chapter 5).

48. Refit the forward clutch of the Power Shuttle (see chapter 5).

Attach a sling to the gearbox. Lower it from the workbench or suitable fixture.

49. Couple the gearbox and the engine (see chapter 2).

50. Assemble the tractor between the gearbox and the rear axle (see chapter 2).

51. Check:
- oil tightness of the hydraulic circuits;
- correct operation of electrical circuits.

52. Carry out a road test of all controls.

53. Check oil tightness of unions and mating faces (gear selector cover, gearbox on rear axle).

I . Service tool

Locally made tool

- **Shaft holding tool (Fig. 8)**
  - (1) Locally adapted washer MF 1610037M2
  - (2) Washer MF 3619200M2 to be machined
  - (3) Washer LL 2U:
    - int. Ø = 12.5
    - ext. Ø= 40
    - thickness= 2.5
  - (4) Nut HM10
  - (5) ext. Ø = 79.7 + 0 / - 0.2
  - (6) Threaded rod M10 x 150: L = 1150
  - (7) Spring:
    - int. Ø = 40
    - thread Ø= 4
    - L = 95

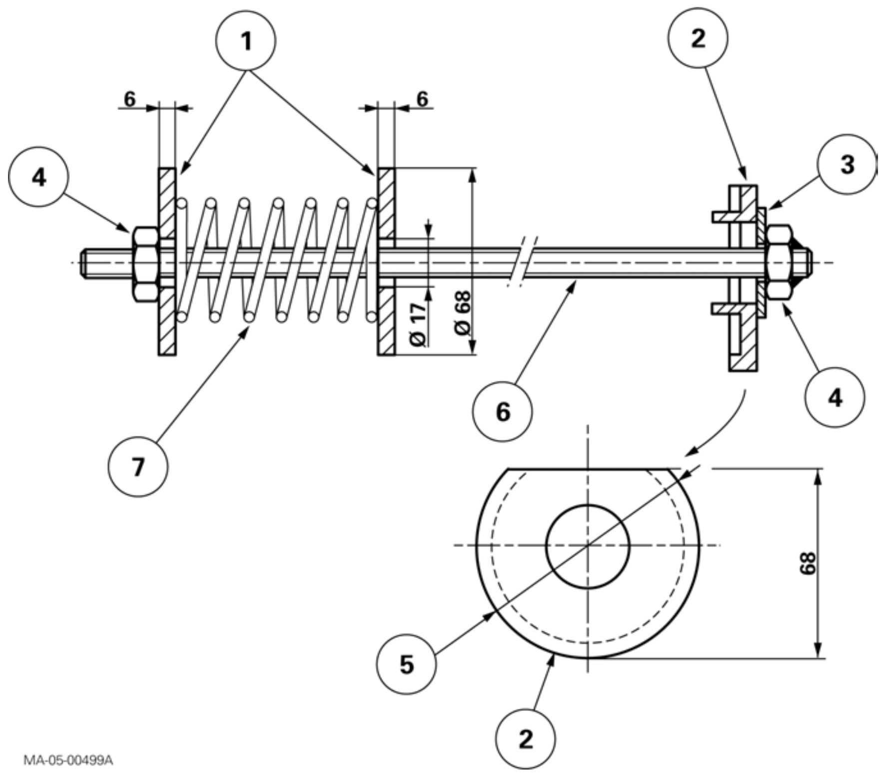

Fig. 8

05J01 - GBA20 Creeper unit

CONTENTS

A . General

The creeper gear reduction unit consists of an epicyclic gear train with a planet carrier and ring gear assembly mounted to the rear of the main gearbox. This unit is controlled by a lever located on the cab console and linked by a cable to an guide rod link mounted to the front right-hand side of the centre housing. This link moves the coupler control fork.

***IMPORTANT:** Creeper gears shall only be selected if the main gearbox is in the Tortoise range.*

B . Operation

The coupler (8) is splined to the connecting shaft (21). Movement of lever "A" to Snail position (Fig. 4) moves the coupler (8) backwards and firmly joins it to the planet carrier (1) via its external teeth. The speed of the shaft (21) is 1/4 in relation to the output shaft.

In normal gears, the gearbox output shaft is secured to the link shaft (21) when the coupler (8) is moved forward, thus ensuring direct drive.

When the creeper gear range is selected, the Snail indicator light is lit on the instrument panel.

When the Hare range indicator light flashes, the engine is in Hare position and must be shifted to Tortoise position.

The electrical signal corresponding to selection of the creeper range is sent via switch "C" fitted on the control unit (Fig. 4).

Parts list (Fig. 1)

(1) Planet carrier
(2) Friction washer
(3) Closing plate
(4) Grower washer
(5) Screw
(6) Snap ring
(7) Coupler ring
(8) Sleeve
(9) Pinion gear
(10) Needle bearings
(11) Spacer
(12) Pin
(13) Plate
(14) Plate
(15) Stop plate
(16) Circlip
(17) Planet carrier assembly
(18) Friction washer
(19) Ring gear
(20) Locating pin
(21) Link shaft

Overall view

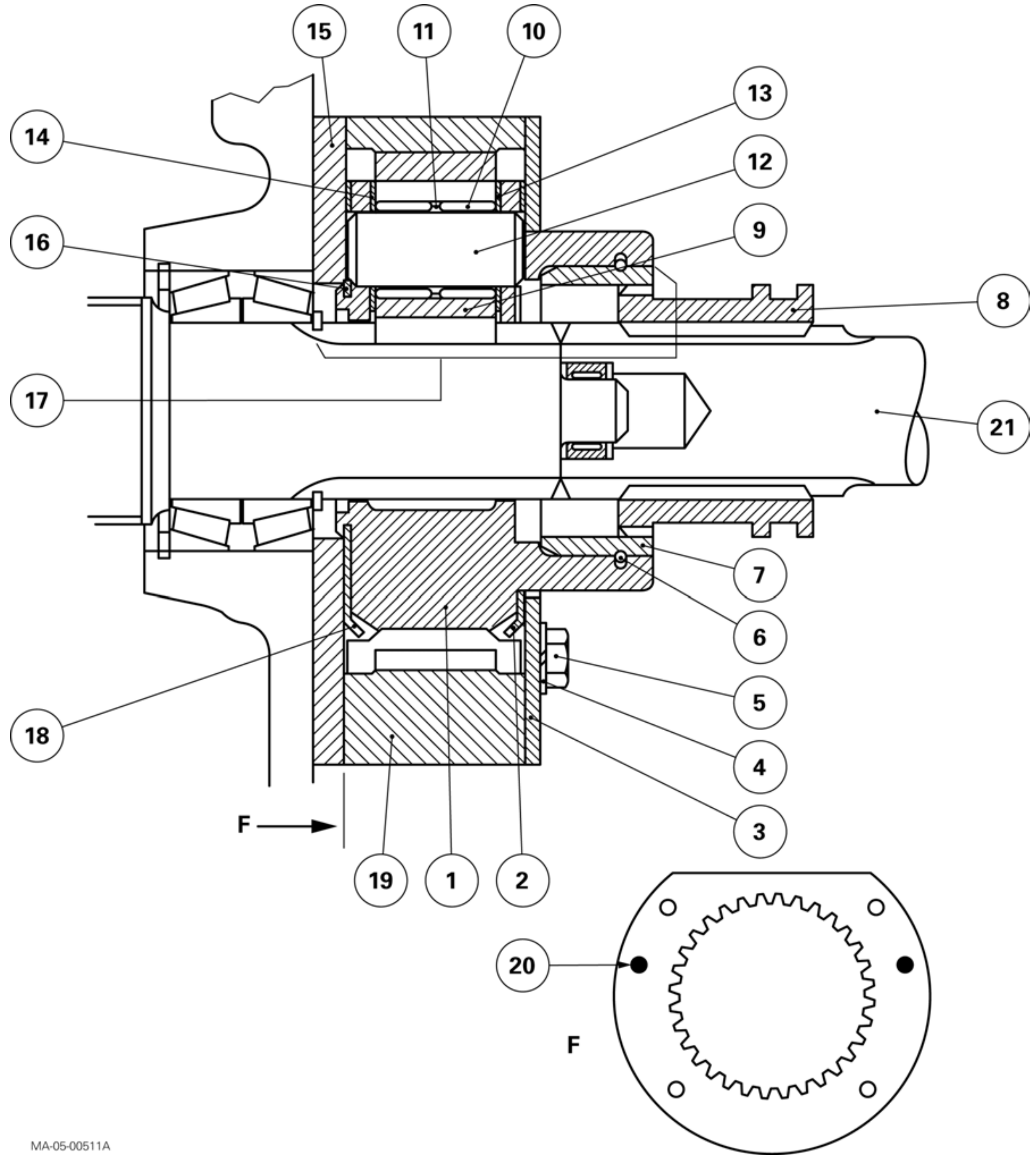

Fig. 1

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Parts list (Fig. 2)

(1) Planet carrier
(2) Friction washer
(3) Closing plate
(4) Grower washer
(5) Screw
(6) Snap ring
(7) Coupler ring
(8) Sleeve
(9) Pinion gear
(10) Needle bearings
(11) Spacer
(12) Pin
(13) Plate
(14) Plate
(15) Stop plate
(16) Circlip
(17) Planet carrier assembly
(18) Friction washer
(19) Ring gear
(20) Locating pin

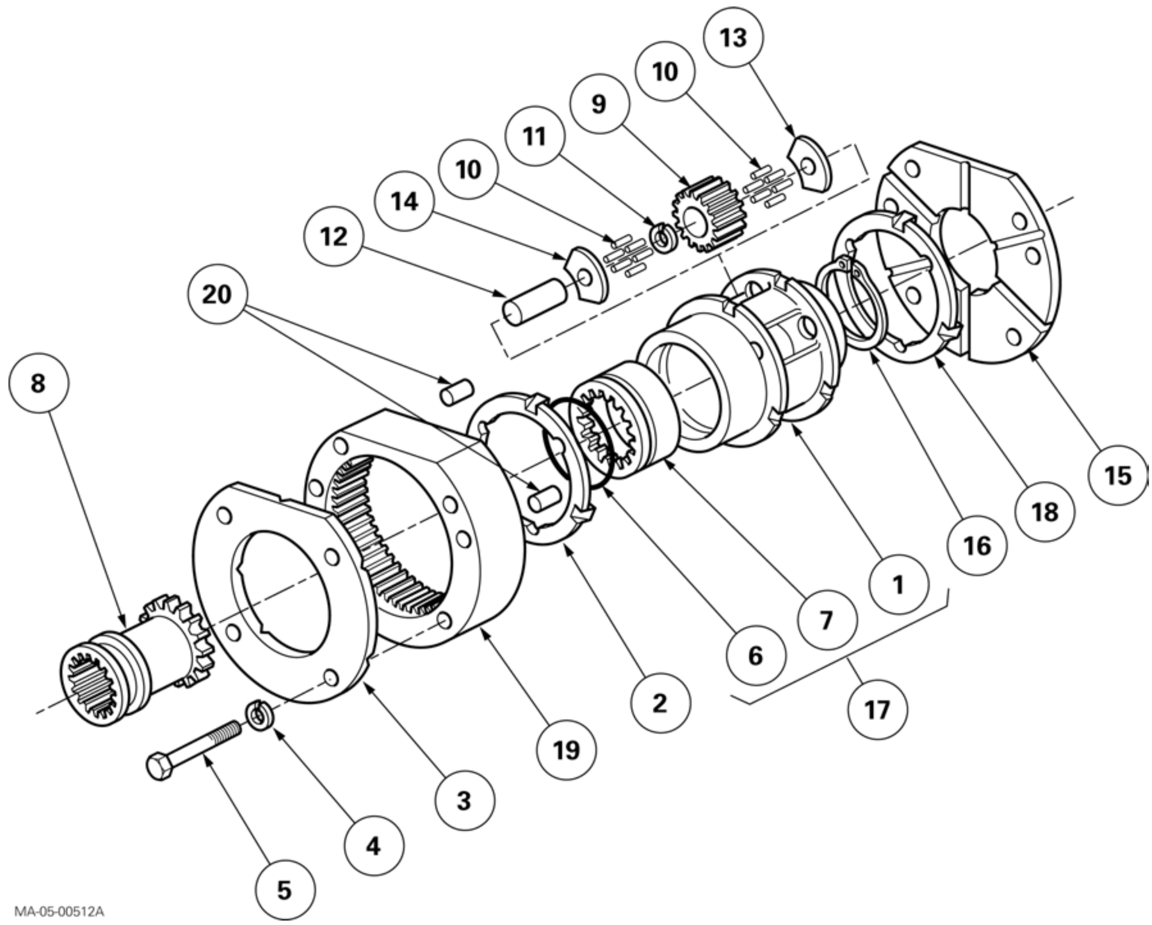


Fig. 2

C . Removing the creeper unit and the ring gear

1. Take off the right-hand hydraulic cover and, if required, the left-hand hydraulic cover (see chapter 9).
2. Disassemble the PTO assembly.
   - **2-speed PTO**
     Remove (see chapter 7):
     - the PTO top cover located at the back of the centre housing;
     - the driving pinion;
     - the layshaft;
     - the PTO clutch
   - **4-speed LSPTO**
     Remove (see chapter 7):
     - the PTO top cover located at the back of the centre housing;
     - the driving pinion;
     - the layshaft;
     - the PTO clutch.
3. Disassemble the sleeve / connecting shaft / coupler / assembly and the fork (see chapter 5).

Removing the creeper unit and the reducer ring gear

4. Remove the screws (5) and the washers (4).
5. Remove the closing plate (3).
6. Pull out the planet carrier (17) and the friction washers (2) (18).
7. Remove ring gear (19).
   Note: *The locating pins (20) remain in the ring gear.*
8. Remove the stop plate (15) without pulling the output shaft.

D . Removing the planet carrier

9. Take off circlip (16).
10. Drive out pins (12).
11. Remove the plates (13) (14).
12. Remove pinion gears (9).
    Important: *Replace the planet carrier (1) if the dog ring (7) is damaged.*

E . Reassembling the planet carrier, refitting the ring gear and the unit

13. Check and clean the components. Replace any defective parts.
14. Install the sun gears (9). Use miscible grease in oil to fit the needles (10).
15. Assemble the plates (13) (14).
16. Assemble the shafts (12), directing them as required for assembling the circlip (16).
17. Fit the circlip (16). Manually check the axial clearance and rotation of each pinion gear.
18. Position the stop plate (15) and the ring gear (19) on the housing (Fig. 3).
19. Position the friction washers (2) (18) coated with miscible grease on the planet carrier (4).
20. Slide the planet carrier on the output shaft.
21. Position the closing plate (3). Tighten screws (5) to a torque of 34 - 52 Nm.

F . Final operations

22. Reasassemble the fork and the rear sleeve / link shaft / coupler assembly (see chapter 5).
23. Reassemble the PTO assembly.
- **2-speed PTO**
  - Refit the power take-off clutch (see chapter 7).
  - Refit the layshaft, the driving pinion and the PTO top cover (see chapter 7).
- **4-speed PTO**
  - Refit the power take-off clutch (see chapter 7).
  - Refit the layshaft, the driving pinion and the PTO top cover (see chapter 7).

24. Refit the left-hand hydraulic cover (if removed) and the right-hand hydraulic cover (see chapter 9).
25. Carry out a road test of the creeper unit.
26. Check PTO and PTO brake operation.

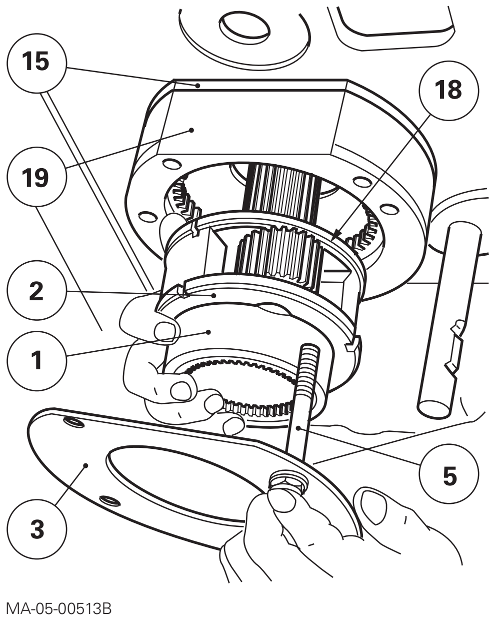


Fig. 3

G . Adjusting the control

27. Place control lever "A" in the "Snail" position (Fig. 4).

__REMINDER:__ The control lever can be located in two positions on the right-hand instrument panel, depending on whether or not an autohitch is fitted.

28. Screw the clevis (1) flush with the threaded end of the cable (6) (Fig. 4).

29. Fit the clevis (1) on to lever "A" with clip (7). Tighten nut (2) (Fig. 4).

30. Screw nut (3) on the sheath end (5).

31. Fit the sheath end and Grower washer on the support. Tighten nut (4).

__IMPORTANT:__ Check that the cable is not pinched.

32. Position guide rod link "B" on "creeper unit" position (Fig. 5) (reducer dog (8) engaged towards the rear (Fig. 1), fork locked.

33. Screw the clevis (9) flush with the threaded end of the cable (6) (Fig. 5).

34. Fit clevis (9) on link B using clip (10). Tighten nut (11) (Fig. 5).

35. Adjust the stop (12) with the nut (13), making sure that guide rod link "B" is still effectively locked.

36. Tighten nut (14).

__IMPORTANT:__ After tightening, check that there is no tension on the cable.

37. Check that the "direct drive" position is locked.

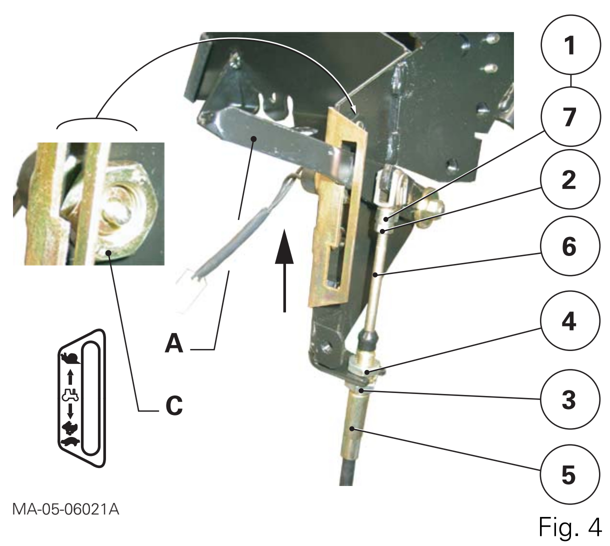


Fig. 4

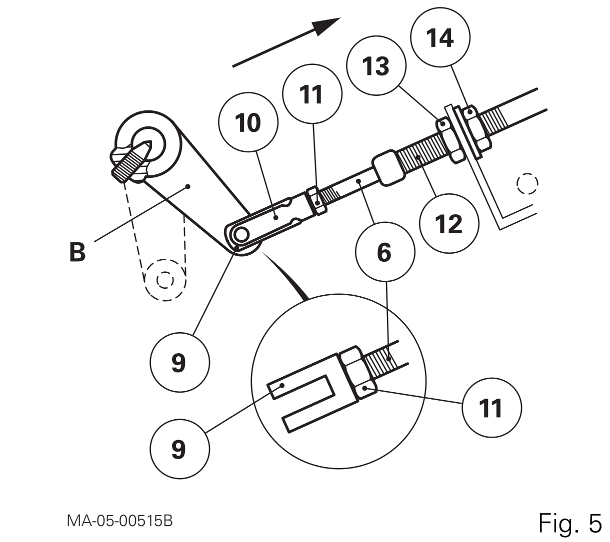


Fig. 5

06 - Rear axle

CONTENTS

06A01 - General - GPA20 operation

CONTENTS

A . General

The rear axle comprises four main housings:
- the centre housing which contains the bevel gear, the power take-off gear in all variants and the 4-wheel drive transmission, the handbrake and main brake control unit. It also supports the two trumpet housings, the lift cover, and the side covers (see section 9)
- the right and left trumpets fixed to each side of the centre housing, and housing the rear wheel drive axle (see section 6)
- The lift cover fitted to the top of the centre housing supporting the lift arms which are attached to the tractor linkage (see section 6).

B . Centre housing assembly

Differential

The drive pinion is driven by the gearbox output shaft, integral via splined sleeves with the link shaft. The helical bevel gear assembly transmits the drive to the trumpet final drive units. A differential lock system fitted with a coupler and activated by hydraulic pressure is incorporated into the unit (see section 6).

The differential lock controlled either by the Autotronic 5 for models fitted with a power shuttle, or by an electric circuit for models fitted with a mechanical reverse shuttle.

4-wheel drive clutch

A driving pinion integral with the drive pinion drives the counterdriven pinion of the 4 WD clutch assembly. Drive is then transmitted via Belleville washers to the clutch output shaft (see section 8).

The 4WD clutch is hydraulically activated.

There is therefore no possibility of accidental disengagement of the 4WD clutch in the event of hydraulic failure.

Power take-off driveline

The rotation of the shaft passing through the gearbox, proportional to engine speed, is transmitted to the hydraulic clutch located at the front of the centre housing (see section 7).

In the engaged position, drive is transmitted by a layshaft and a set of driving and driven pinions to the 540 or 1000 rpm PTO shaft. Speeds are selected by a system of interchangeable shafts (see section 7) or by coupler (see section 7).

A hydraulic braking device stops the rotation of the PTO shaft in the disengaged position.

Two additional options are offered:
- 4 speed LSPTO (see section 7)
- GSPTO (see section 7).

Handbrake assembly

A brake assembly comprising three discs and an expander mechanism is fitted to the drive pinion (see section 6).

Main brakes

Two pistons fitted laterally in two cavities in the centre housing act on two discs integral with the trumpet input sun gears. The brake pistons are activated hydraulically (see section 6).

Legend

J Clearance
P Preload
E Apex distance

E = Z + T - (X + Y)

E = 184.955 + T - (X +90.520).

when:

Z: Nominal drive pinion dimension = 184.955 mm

T: Correction of the nominal dimension engraved on the end of the drive pinion; this may be a positive or negative value.

X: Dimension of the centre housing stamped on the rear right-hand side of the housing, behind the lift ram.

Y: Dimension of the drive pinion with bearing = 90.520 mm.

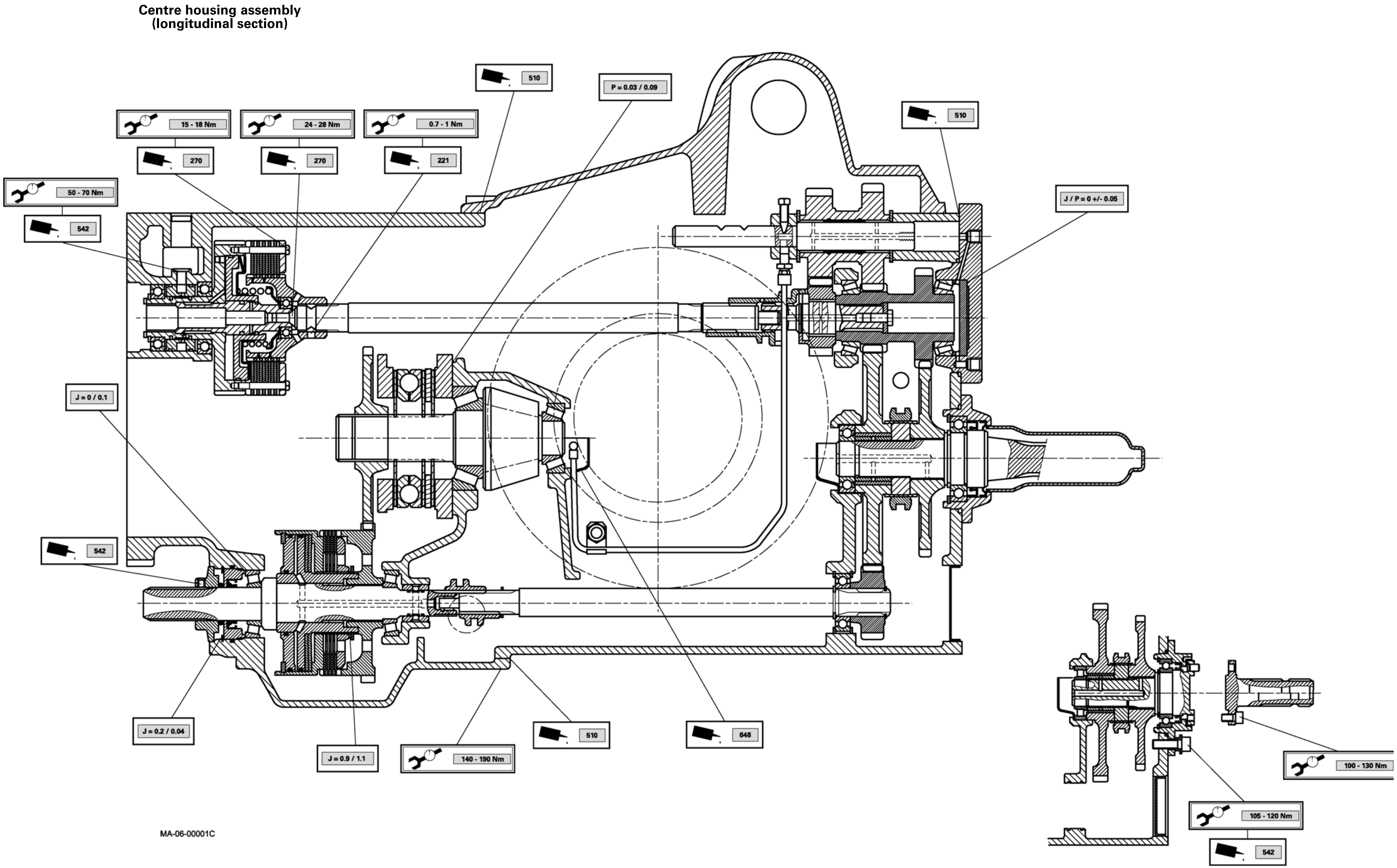

Centre housing assembly
(longitudinal section)
510
P = 0.03 / 0.09
15 - 18 Nm
24 - 28 Nm
0.7 - 1 Nm
270
270
221
510
50 - 70 Nm
542
J / P = 0 +/- 0.05
J = 0 / 0.1
542
J = 0.2 / 0.04
J = 0.9 / 1.1
140 - 190 Nm
510
648
100 - 130 Nm
105 - 120 Nm
542
MA-06-00001C

Fig. 1

Rear transmission assembly (cross section)

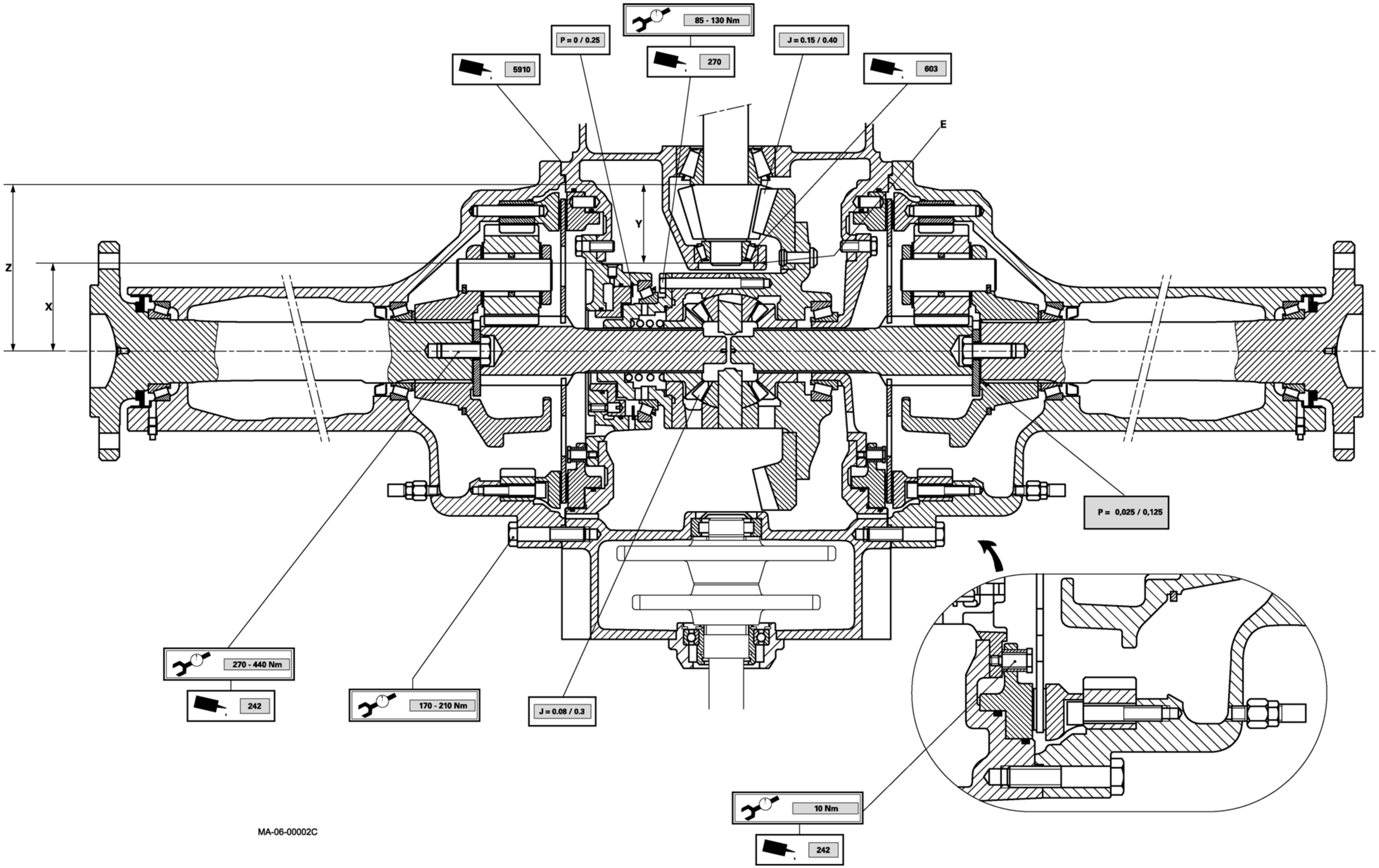


Fig. 2

06B01 - GPA20 Normal Duty Trumpet housings

CONTENTS

A . General

Description

The trumpet housings support the right- and left-hand side axle shafts and contain the final drive units that transmit the rotation from the differential assembly.

Both trumpet housings are symmetrical and fitted on either side of the centre housing.

Construction

The axle shaft (2) is supported by two opposing taper roller bearings (5) (8). External tightness is ensured via a three-lipped seal (3) and internal tightness by a single-lip seal (7). The three-pinion final drive unit (14) planet carrier assembly (10) is integral in rotation with the shaft (2) via splines.

The Normal Duty planet carriers have a single row of needles (16). The internal surfaces of the planet carrier (10) are rough cast and therefore require adjustment using friction shims (13). Shims (25) placed at the end of the shaft allow for preloading of taper roller bearings. Axle shaft (2) and planet carrier (10) are held in place by the washer (24) and screw (23). The final drive ring gear (21) is force fitted into the trumpet and held in place via three screws (16). It has three pins (20) ensuring centring of the brake plate (17).

Differential rotation is transmitted to the pinion gears of the drive unit via a sun gear shaft (22) on the teeth of which the brake disc (18) is placed.

The brake discs are lubricated by a continuous flow of oil from the lift control valve (see section 9).

Parts list

(1) Lug stud
(2) Axle shaft
(3) Three-lipped seal
(4) Seal cage
(5) Bearing cup
(5A) Bearing cone
(6) Trumpet housing
(7) Seal
(8) Bearing cup
(8A) Bearing cone
(9) Tab washer
(10) Planet carrier
(11) Snap ring
(12) Pinion gear pin
(13) Friction shim(s)
(14) Pinion gear
(15) Needle bearings
(16) Screw
(17) Brake plate
(18) Brake disc
(19) Screw
(20) Pin
(21) Final drive ring gear
(22) Sun gear
(23) Screw
(24) Washer
(25) Shim(s)
(26) Pin
(27) Plug

GPA20 Normal Duty Trumpet housings

Overall view

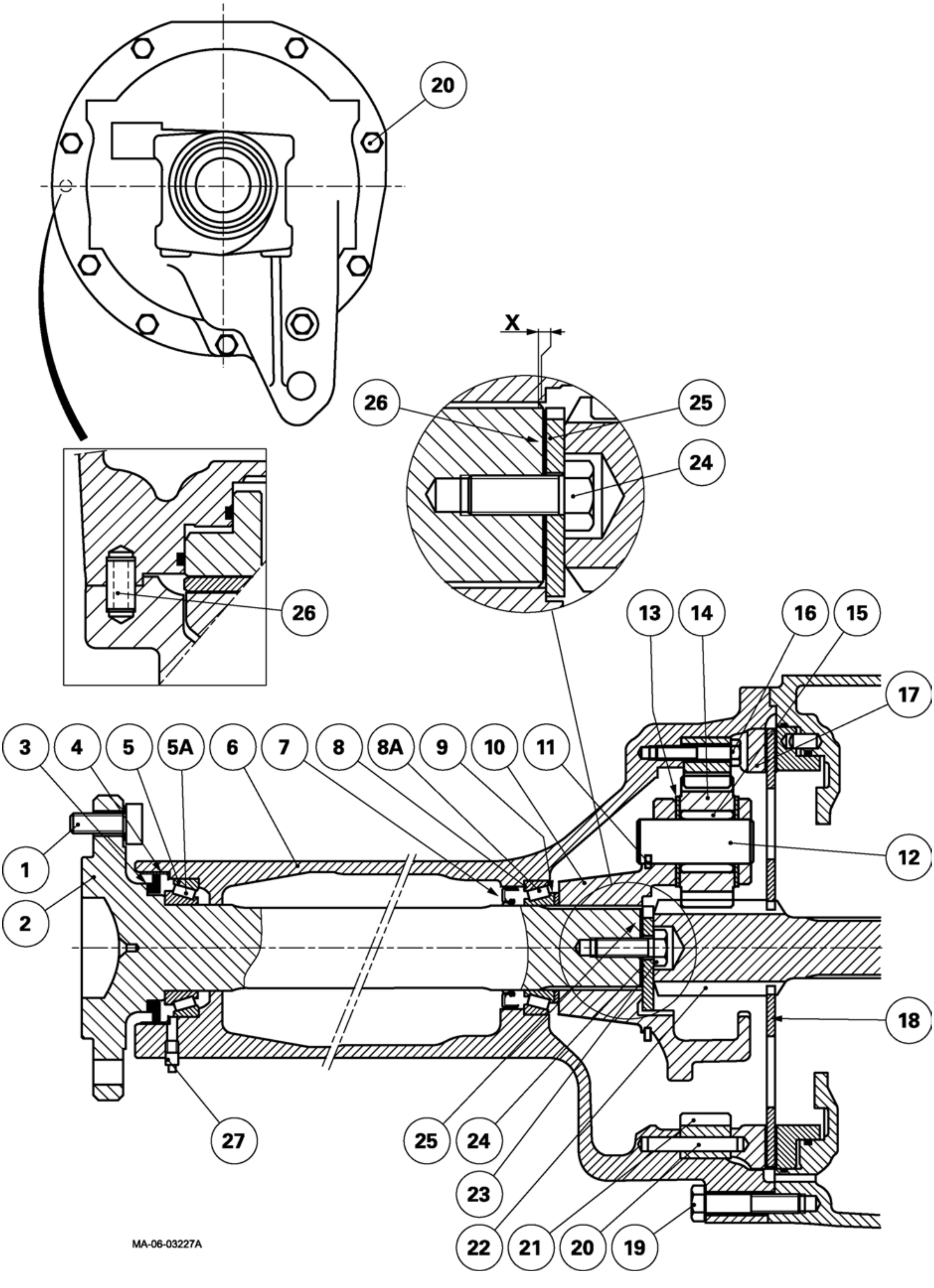


Fig. 1

Exploded view

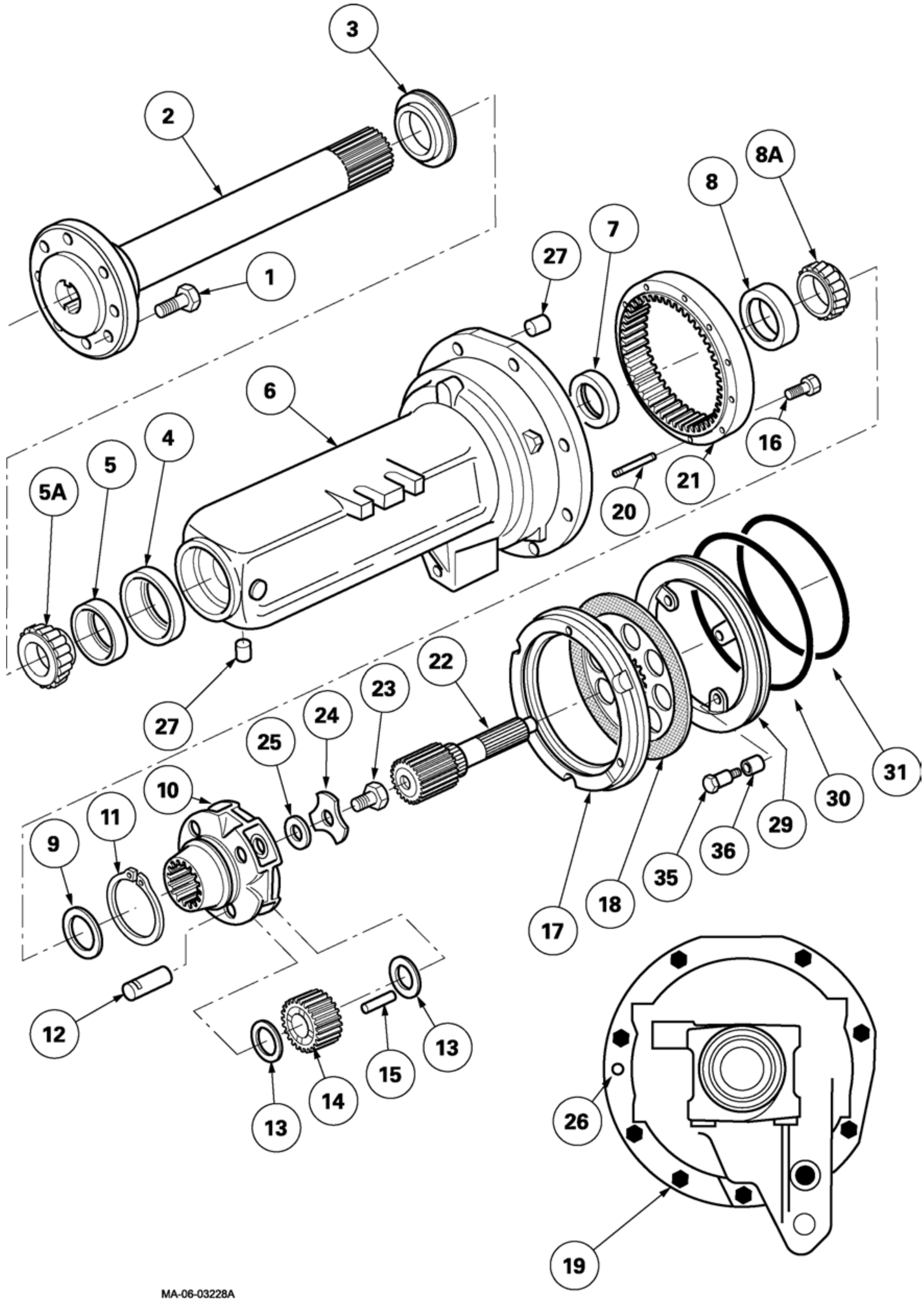


Fig. 2

B . Trumpet assembly

Removal

1. Immobilise the tractor. Apply the handbrake. Fit shims between the frame and the front axle beam (see section 2).
2. Drain the rear axle.
3. With the help of a trolley jack, raise the relevant side of the tractor.
4. Position an axle stand.
5. Disassemble the wheel.
6. Remove the stabilising support.
7. Disconnect the hose (1) or (3) and the brake lubricating pipe(s) (Fig. 3).
8. Remove cab attachment screw A (cab with transmission shaft tunnel Fig. 4, flat floor cab Fig. 5).
9. Raise the cab enough to allow trumpet housing removal (shim the cab).

   IMPORTANT: *Check the gap between the bonnet and the windshield (remove the body if required).*
10. If the trumpet is replaced, remove shims C by taking out screws B (Fig. 4 and Fig. 5).
11. Install a suitable fixture under the trumpet and place it on a trolley jack.
12. For the left-hand trumpet, disconnect the feed pipe from the lift control valve (block channels).
13. Loosen the attachment screws (19).
14. With the help of an operator and in compliance with safety regulations, split the trumpet from rear axle housing.
15. Remove:
    - brake disc (18)
    - sun gear (22)
    - locating pin (26)
16. Remove the brake plate (17).

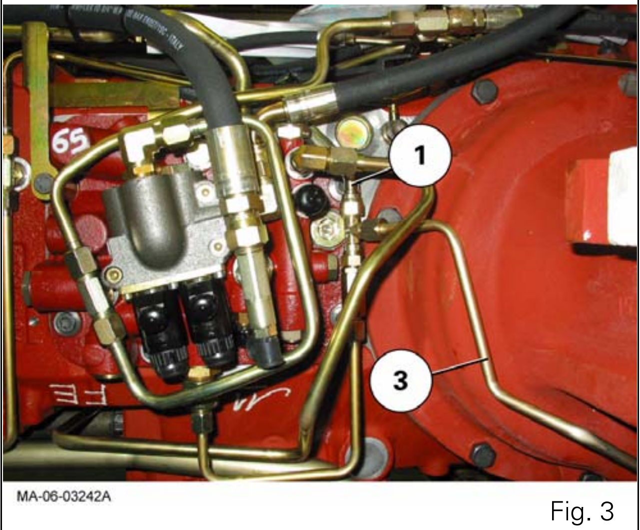


Fig. 3

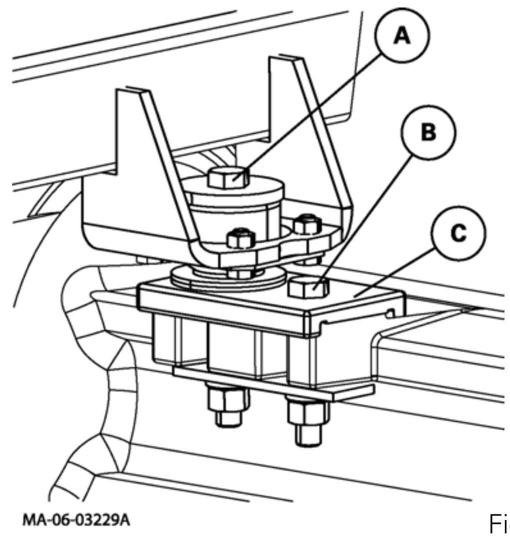


Fig. 4

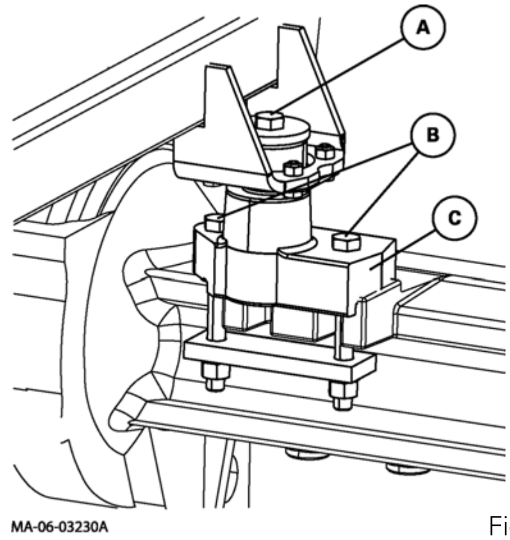


Fig. 5

Refitting

17. Clean the mating faces on the rear axle housing and on the trumpet housing with a non-greasy solvent.

18. Apply a bead of oil resistant silicone (Silicomet type) to the inner edge of the centre housing (Fig. 6).

19. Check that the disc (18) slides freely on the sun gear (22) (Fig. 7)

20. Refit the locating pin (26), the sun gear (22) and the brake disc (18).

21. Screw two diametrically opposed guide studs into the centre housing.

22. Refit the brake plate (17) in the trumpet housing.

NOTE: *In order to hold the plate in place, apply a small amount of miscible grease to the face of the ring gear (21).*

23. Couple the trumpet housing to the rear axle, following the safety procedures used during its removal.

NOTE: *Turn the shaft (2) to engage the sun gear (22) in the pinion gears.*

24. Clean the screws (19) and smear them with Plastex, Hylomar or an equivalent gasket seal paste.

25. Fit and tighten the screws (19) to a torque of 170 - 210 Nm.

26. Carry out operations 11 and 12 in reverse order.

27. Carry out operations 9 and 10 in reverse order.

28. Refit the cab attachment screws.

29. Refit the other removed parts.

30. Top up the oil level in the rear axle.

31. Refit the wheel. Tighten to a torque of 400 - 450 Nm.

32. Remove the axle stand.

33. Test the lift mechanism and braking circuit.

34. Check for tightness:

- between the trumpet and rear axle housing
- of the lift control valve feed pipe
- of brake lubricating pipes.

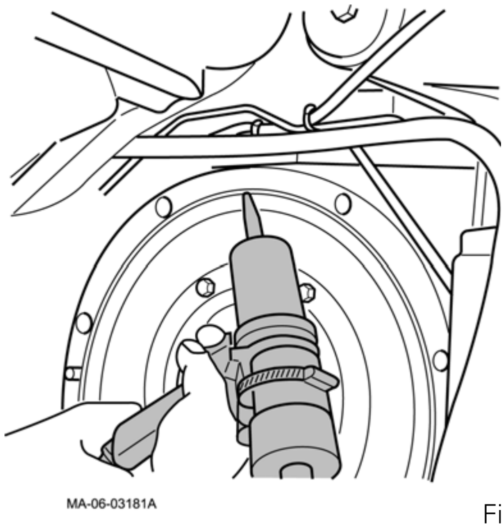


Fig. 6

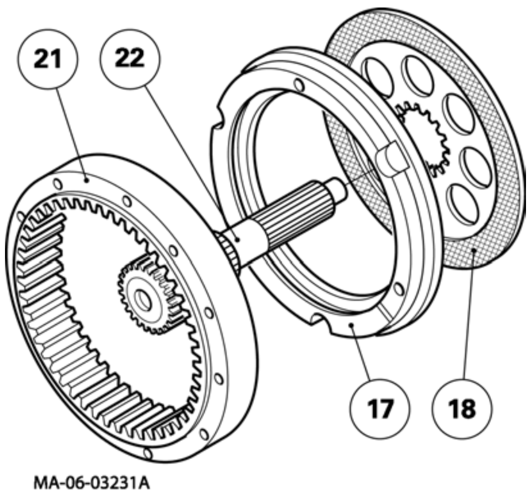


Fig. 7

C . Planet carrier

Disassembly

35. Remove the trumpet housing (see § B).
36. Remove screw (23).
37. Take off the lock washer (24) and the shim(s) (25) (Fig. 8).
38. Remove the planet carrier (10).
39. Open the snap ring (11).
40. With a hammer, lightly tap on the three pins (12).
41. Take out the three pins (12) and the snap ring (11).
42. Remove the three pinion gears (14), the needles (15) and the shims (13).

Reassembly

43. Clean the planet carrier (10), the pins (12) and the pinion gears (14). Check the components.
44. Smear the needles with miscible grease. Fit a row of needles in each pinion gear (Fig. 8).
45. Shim the pinion gears.

__Note:__ Shims (13) are available in three different thicknesses.

46. Fit the pinion gears (14) with shims (13) of medium thickness on either side.
47. Engage the three pins (12).
48. Use a set of shims to determine a thickness of shims (13) to fit to obtain axial clearance between 0.15 and 0.55 mm on each pinion gear (Fig. 9).
49. Pull gently on the three pins, and fit the shims (13) selected at operation 48.
50. Drive out the three pins and the snap ring (11).
51. Open the snap ring (11) (Fig. 10).
52. Tap lightly on the three pins so that the snap ring fits into the groove of the planet carrier (Fig. 10).
53. Ensure that the tab washer (9) is present.
54. Refit the planet carrier.
55. Fit shims to obtain the required preload (see § E).
56. Refit the trumpet housing (see § B).

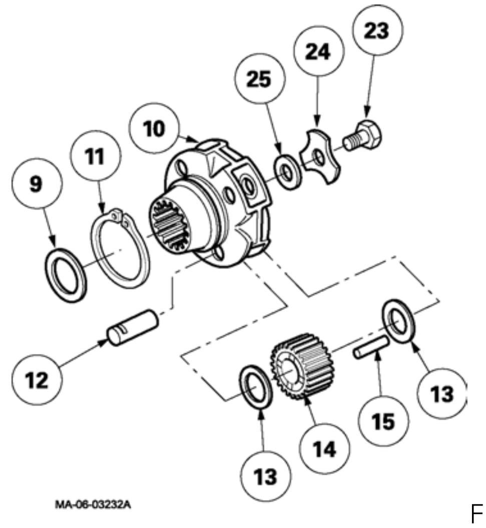


Fig. 8

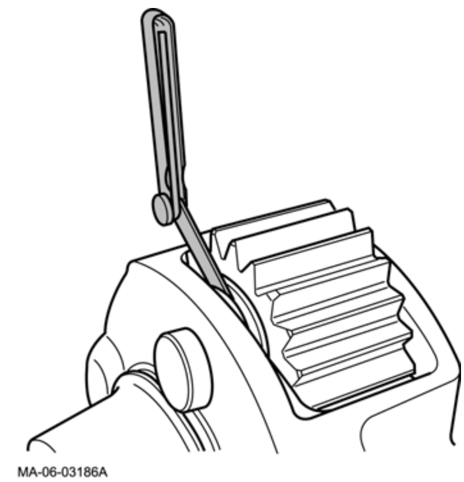


Fig. 9

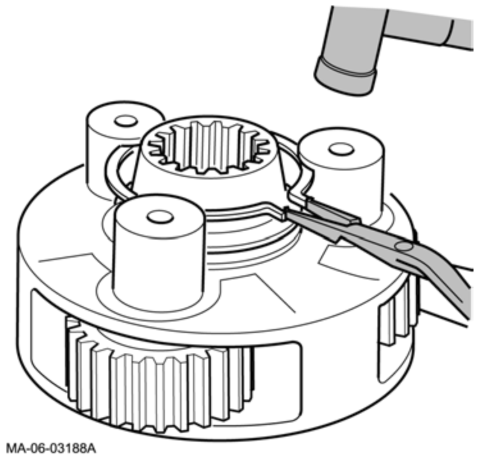


Fig. 10

D . Bearings and seals

Disassembly

57. Remove the trumpet housing from the rear axle housing (see § B).

58. Remove the planet carrier (see § C).

59. Remove:
- the tab washer (9)
- the cone (8A) (idle-mounted on shaft).

60. Take the shaft (2) out of the trumpet housing.

61. Extract the cone (5A).

62. Drive off the lip seal (3).

63. Using an extractor, take out:
- the cup (5)
- the cage (4) from the seal (3)
- the cup (8).

64. Drive off the seal (7).

Reassembly

NOTE: *The ring gear (21) is force fitted in the trumpet housing (6). It is centred by the three pins (20) (Loctite 638) and tightened by the screws (16). Tighten to a torque of 79 - 90 Nm (Loctite 242).*

65. Clean the seal mating faces and the location of cups and cones inside the trumpet and on the shaft. Seal, cup and cone mating faces should be free of burrs and dents.

66. Smear the external diameter of the seal (7) with Loctite 542 (metal cage).

NOTE: *Follow the assembly order of the seal.*

67. Replacing the seal (7):

without shaft replacement (2): to avoid the seal lip from bearing on the same place on the shaft, insert the seal 4 mm from the shoulder of the cup (8) (Fig. 11).

with shaft replacement (2): position the seal 5 mm from the shoulder of the cup (8) (Fig. 12).

68. Lubricate the cups (8) (5) and fit them home against the shoulder.

69. Fit the cage (4) into the base of the shoulder (Fig. 13).

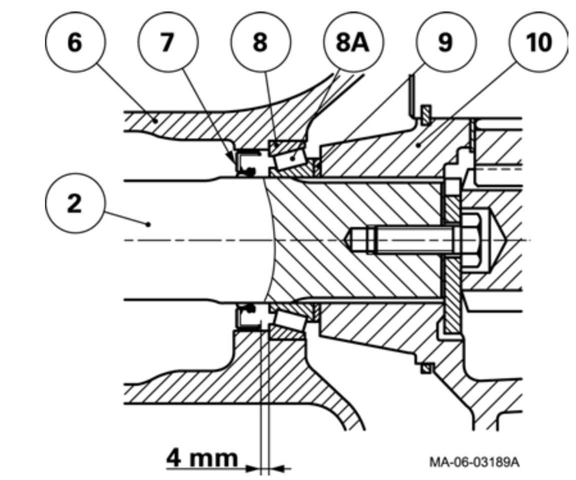


Fig. 11

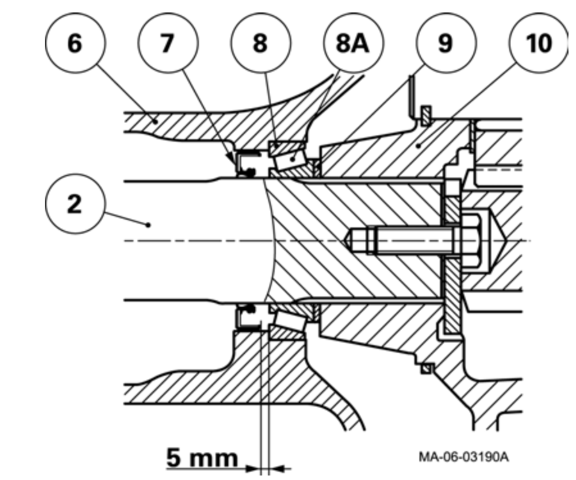


Fig. 12

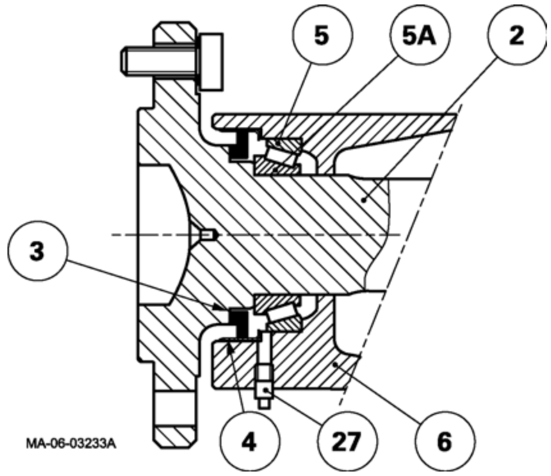


Fig. 13

70. Fit the three-lipped seal (3) home against the shoulder of the shaft.

NOTE: *Follow the assembly order of the seal (Fig. 13).*

71. Lubricate the shaft (2) and fit the cone (5A) home against the shoulder.

72. Moderately grease the cone (5A) and seal lips (3) (7) (BP Agricharge grease or equivalent).

73. Protect the shaft splines (2) and insert it into the trumpet housing.

NOTE: *The seal lips (3) must be turned outwards.*

74. Take off the shaft protection and lightly lubricate the cone (8A).

75. Refit the cone (8A), washer (9) and planet carrier (10).

76. Fit shims to obtain the required preload (see § E).

77. Replace plug (27) with a grease nipple. Partially fill the trumpet cavity between the cone (5A) and the seal (3) with BP Agricharge grease or equivalent. Take off the grease nipple and tighten the plug again (Fig. 13).

E . Preloading the axle shaft bearings

78. Place trumpet assembly in vertical position.

79. Remove the screw (23) and washer (24).

80. Seat the cones (5A) (8A) in their cups by turning the trumpet on its pin.

81. Set a thickness of shims (25) greater than dimension X in order to obtain clearance (Fig. 14).

82. Fit the washer (24) and screw (23) and tighten to a torque of 270 - 440 Nm.

83. Using a dial gauge, check the clearance by moving the planet carrier axially (Fig. 15).

84. Remove the screw (23) and washer (24).

Depending on the dial gauge reading, take off the surplus shim thickness (25) in order to obtain a preload of:

P1 = 0.025 to 0.125 mm

85. Clean the tapping at the end of the shaft (2).

86. Refit the washer (24).

87. Clean the screw (23) and smear it with Loctite 241.

Tighten to a torque of 270 - 440 Nm.

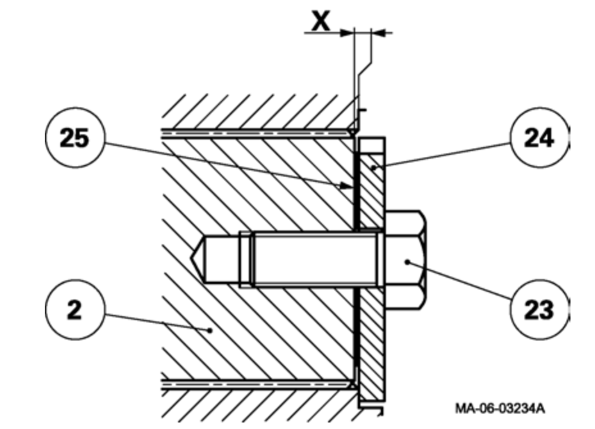


Fig. 14

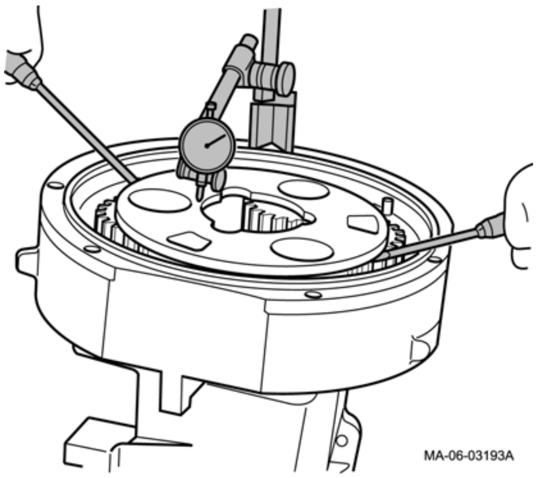


Fig. 15

F . Replacing a lug stud

88. Drive off the defective stud with the help of a bronze drift and a hammer.

89. Use a brush and solvent to clean the streak marks left by the stud on the shaft flange.

90. Dry using compressed air.

91. Place several drops of Loctite 270 on the new stud serration.

92. Place the new stud over the serration marks left by the former stud.

93. After checking that splines are properly engaged, bring the stud head towards the inner flange of the axle shaft with a bronze hammer.

06B02 - GPA20 Heavy Duty Trumpet housings

CONTENTS

A . General

Description

The trumpet housings support the right- and left-hand side axle shafts and contain the final drive units that transmit the rotation from the differential assembly.

Both trumpet housings are symmetrical and fitted on either side of the centre housing.

Construction

The axle shaft (2) is supported by two opposing taper roller bearings (5) (8). External tightness is ensured via a three-lip seal (3) and internal tightness by a single-lip seal (7). The three-pinion final drive unit (14) planet carrier assembly (10) is integral in rotation with the shaft (2) via splines.

The reinforced Heavy Duty planet carriers have a double row of needles (16). The internal surfaces of the planet carrier (10) are rough cast and therefore require adjustment using friction shims (13). Shims (26) placed at the end of the shaft allow for preloading of taper roller bearings. The axle shaft (2) and planet carrier (10) are held in place by the washer (25) and screw (24). The final drive ring gear (22) is force fitted into the trumpet and held in place via three screws (17). It has three pins (21) ensuring centring of the brake plate (18).

Differential rotation is transmitted to the pinion gears of the drive unit via a sun gear shaft (22) on the teeth of which the brake disc (18) is placed.

The brake discs are lubricated by a continuous flow of oil from the lift control valve (see section 9).

Parts list

(1) Wheel stud
(2) Axle shaft
(3) Three-lipped seals
(4) Seal cage
(5) Bearing cup
(5A) Bearing cone
(6) Trumpet housing
(7) Seal
(8) Bearing cup
(8A) Bearing cone
(9) Tab washer
(10) Planet carrier
(11) Snap ring
(12) Pinion gear pin
(13) Friction shim(s)
(14) Pinion gear
(15) Spacer
(16) Needle bearings
(17) Screw
(18) Brake plate
(19) Brake disc
(20) Screw
(21) Pin
(22) Final drive ring gear
(23) Sun gear
(24) Screw
(25) Washer
(26) Shim(s)
(27) Pin
(28) Plug

Overall view

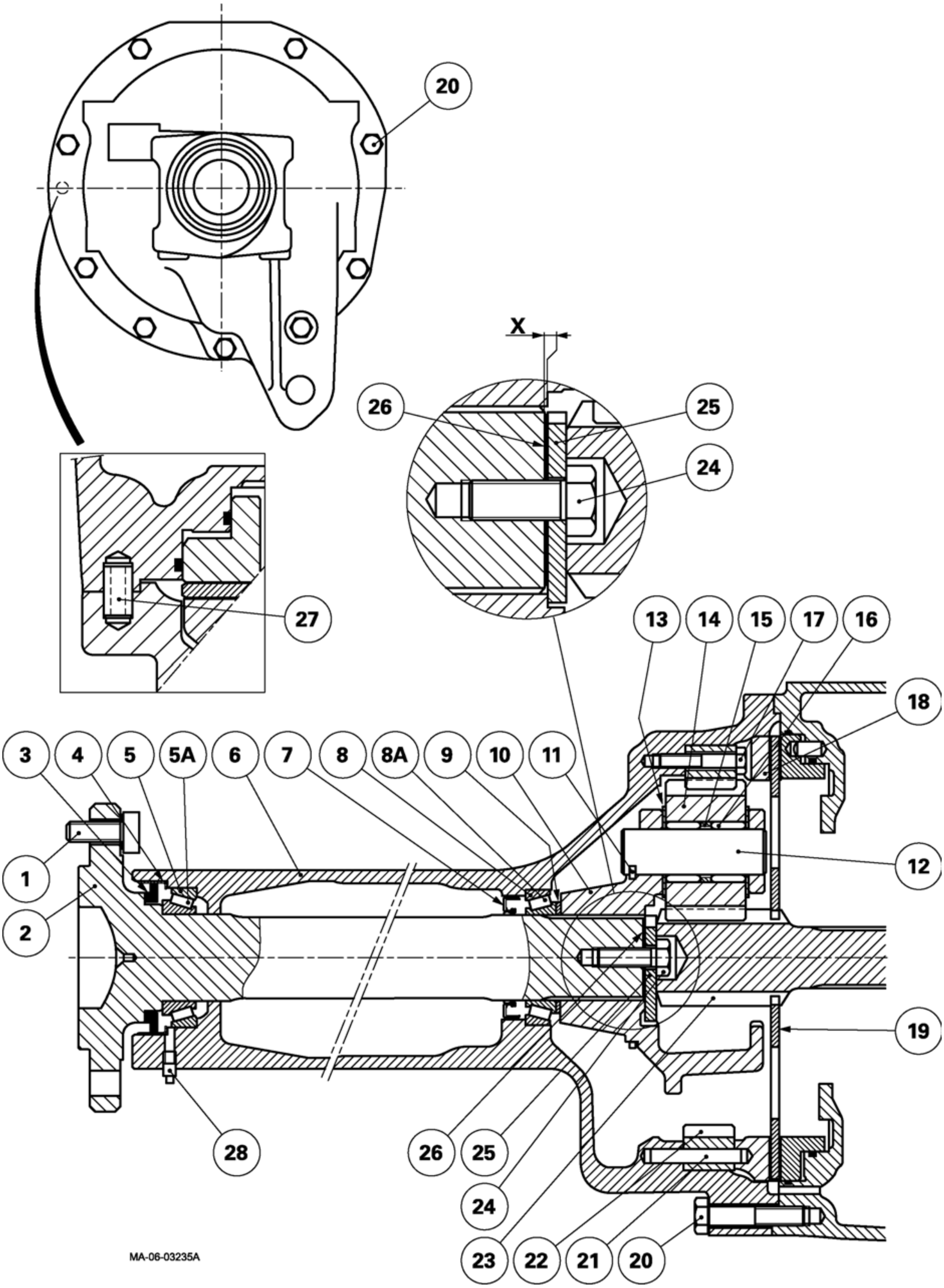


Fig. 1

Exploded view

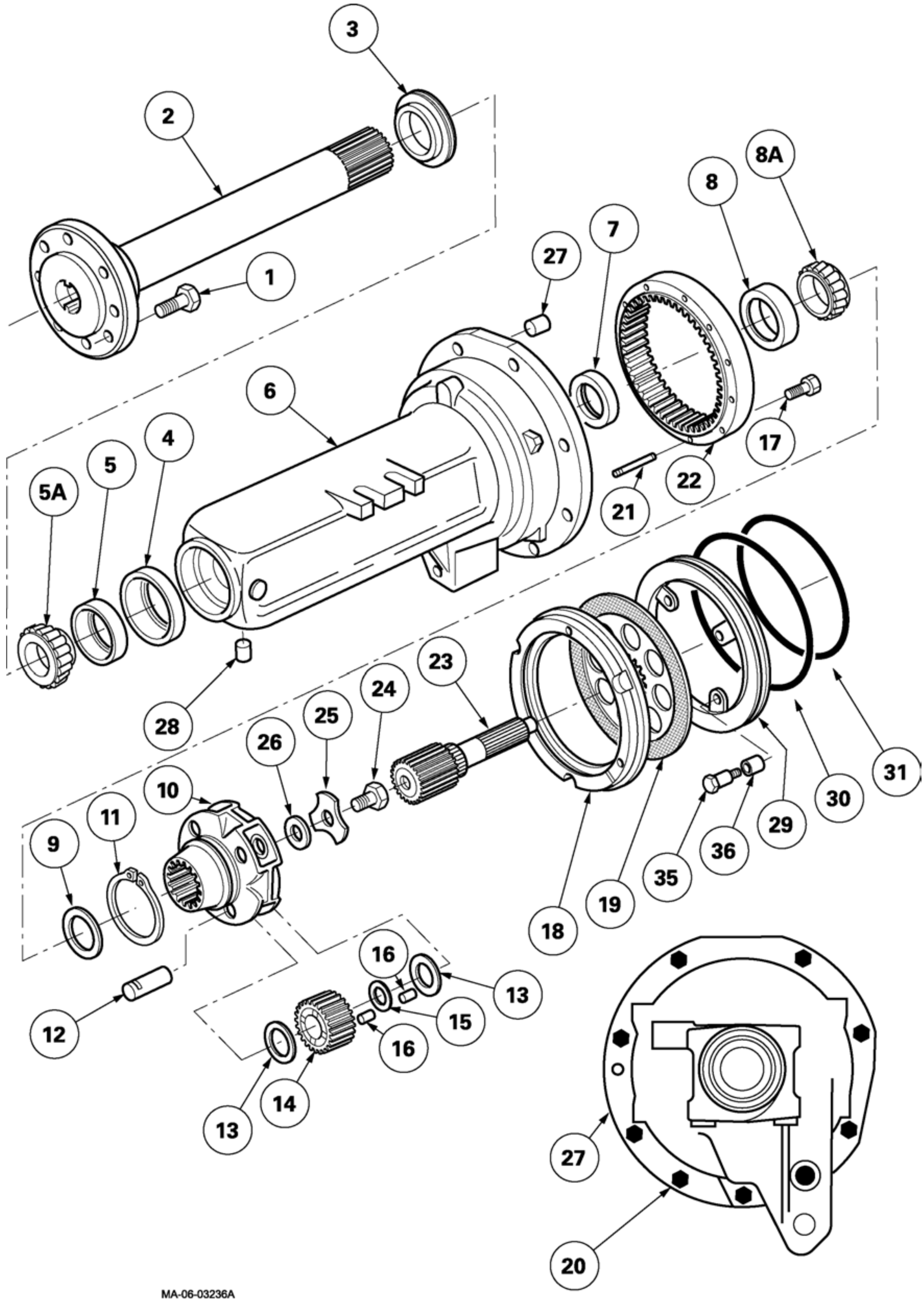


Fig. 2

B . Trumpet assembly

Removal

1. Immobilise the tractor. Apply the handbrake. Fit shims between the frame and the front axle beam (see section 2).
2. Drain the rear axle.
3. With the help of a trolley jack, raise the relevant side of the tractor.
4. Position an axle stand.
5. Disassemble the wheel.
6. Remove the stabilising support.
7. Disconnect the hose (1) or (3) and the brake lubricating pipe(s) (Fig. 3).
8. Remove cab attachment screw A (cab with transmission shaft tunnel Fig. 4, flat floor cab Fig. 5).
9. Raise the cab enough to allow trumpet housing removal (shim the cab).

   Important: *Check the gap between the bonnet and the windshield (remove the body if required).*
10. If the trumpet is replaced, remove shims C by taking out screws B (Fig. 4 and Fig. 5).
11. Install a suitable fixture under the trumpet and place it on a trolley jack.
12. For the left-hand trumpet, disconnect the feed pipe from the lift control valve (block channels).
13. Loosen the attachment screws (20).
14. With the help of an operator and in compliance with safety regulations, split the trumpet from rear axle housing.
15. Remove:
    - brake disc (19)
    - sun gear (23)
    - locating pin (27)
16. Remove the brake plate (18).

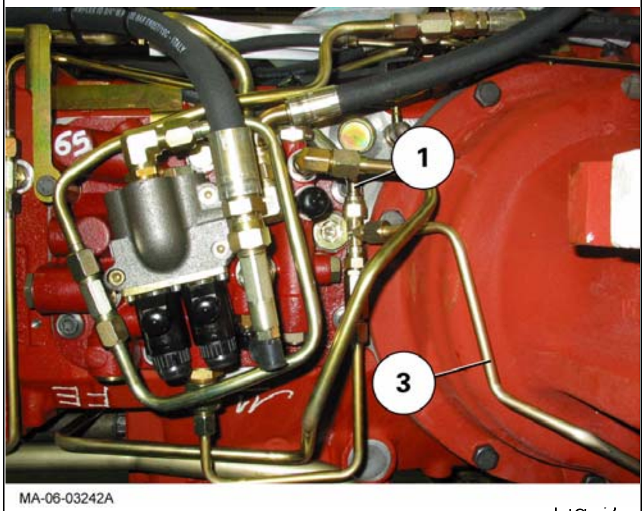


Fig. 3

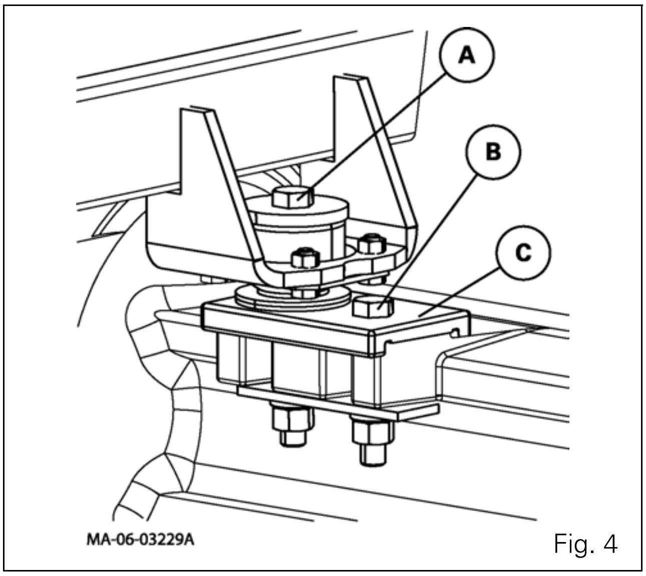


Fig. 4

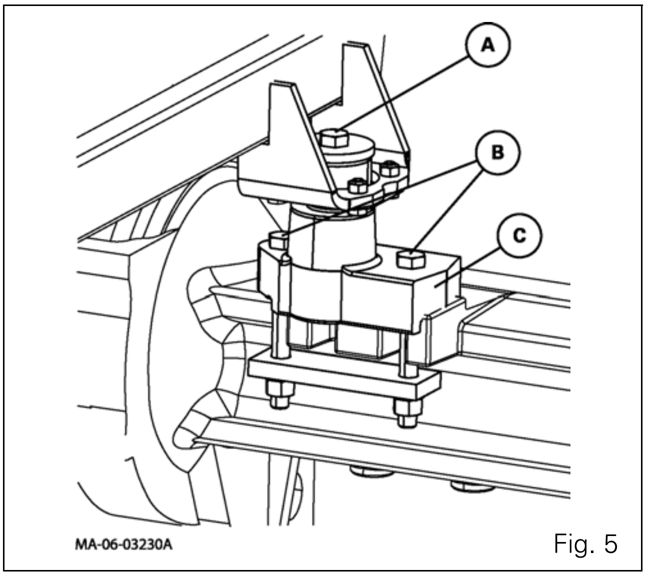


Fig. 5

Refitting

17. Clean the mating faces on the rear axle housing and on the trumpet housing with a non-greasy solvent.

18. Apply a bead of oil resistant silicone (Silicomet type) to the inner edge of the centre housing (Fig. 6).

19. Check that the disc (19) slides freely on the sun gear (23) (Fig. 7)

20. Refit the locating pin (27), the sun gear (23) and the brake disc (19).

21. Screw two diametrically opposed guide studs into the centre housing.

22. Refit the brake plate (18) in the trumpet housing.

NOTE: *In order to hold the plate in place, apply a small amount of miscible grease to the face of the ring gear (22).*

23. Couple the trumpet housing to the rear axle, following the safety procedures used during its removal.

NOTE: *Turn the shaft (2) to engage the sun gear (23) in the pinion gears.*

24. Clean the screws (20) and smear them with Plastex, Hylomar or an equivalent gasket seal paste.

25. Fit and tighten the screws (20) to a torque of 170 - 210 Nm.

26. Carry out operations 11 and 12 in reverse order.

27. Carry out operations 9 and 10 in reverse order.

28. Refit the cab attachment screws.

29. Refit the other removed parts.

30. Top up the oil level in the rear axle.

31. Refit the wheel. Tighten to a torque of 400 - 450 Nm.

32. Remove the axle stand.

33. Test the lift mechanism and braking circuit.

34. Check for tightness:

- between the trumpet and rear axle housing
- of the lift control valve feed pipe
- of brake lubricating pipes.

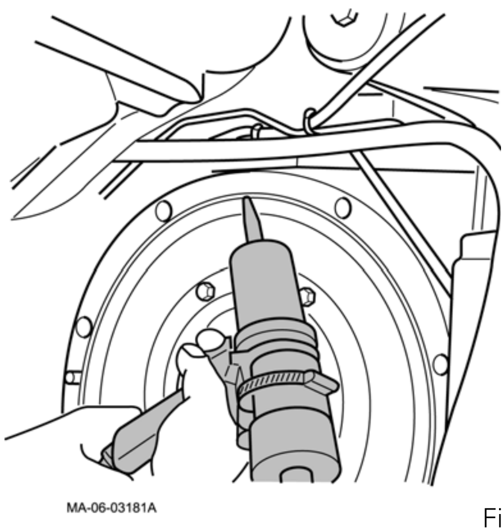


Fig. 6

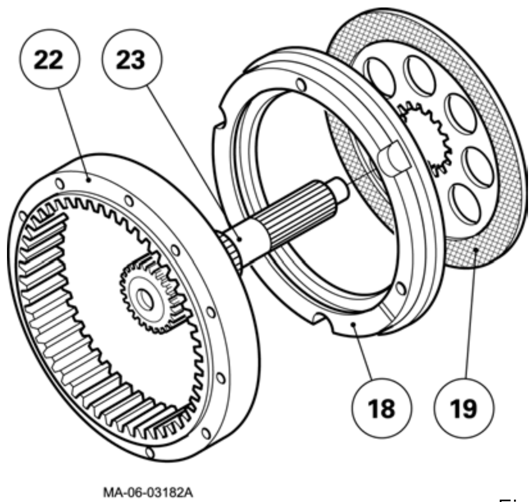


Fig. 7

C . Planet carrier

Disassembly

35. Remove the trumpet housing (see § B).
36. Remove screw (24).
37. Take off the lock washer (25) and the shim(s) (26) (Fig. 8).
38. Remove the planet carrier (10).
39. Open the snap ring (11).
40. With a hammer, lightly tap on the three pins (12).
41. Take out the three pins (12) and the snap ring (11).
42. Remove the three pinion gears (14), needles (16), spacers (15) and shims (13).

Reassembly

43. Clean the planet carrier (10), the pins (12) and the pinion gears (14). Check the components.
44. Smear the needles with miscible grease. On each pinion gear, place two rows of needles (16) separated by a spacer (15) (Fig. 8).
45. Shim the pinion gears.
NOTE: Shims (13) are available in three different thicknesses.
46. Fit the pinion gears (14) with shims (13) of medium thickness on either side.
47. Engage the three pins (12).
48. Use a set of shims to determine a thickness of shims (13) to fit to obtain axial clearance between 0.15 and 0.55 mm on each pinion gear (Fig. 9).
49. Pull gently on the three pins, and fit the shims (13) selected at operation 48.
50. Drive out the three pins and the snap ring (11).
51. Open the snap ring (11) (Fig. 10).
52. Tap lightly on the three pins so that the snap ring fits into the groove of the planet carrier (Fig. 10).
53. Ensure that the tab washer (9) is present.
54. Refit the planet carrier.
55. Fit shims to obtain the required preload (see § E).
56. Refit the trumpet housing (see § B).

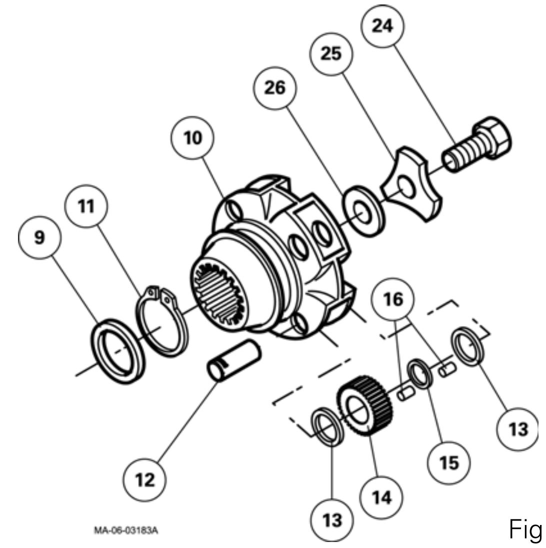


Fig. 8

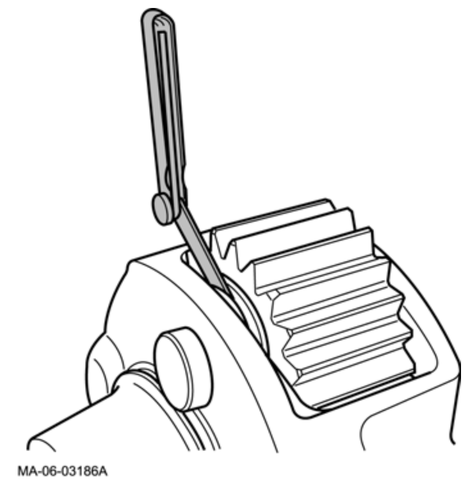


Fig. 9

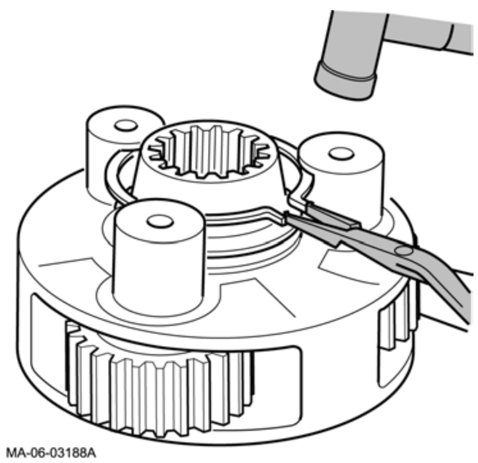


Fig. 10

D . Bearings and seals

Disassembly

57. Remove the trumpet housing from the rear axle housing (see § B).
58. Remove the planet carrier (see § C).
59. Remove:
- the tab washer (9)
- the cone (8A) (idle-mounted on shaft).

60. Take the shaft (2) out of the trumpet housing.
61. Extract the cone (5A).
62. Drive off the lip seal (3).
63. Using an extractor, take out:
- the cup (5).
- the cage (4) from the seal (3)
- the cup (8).

64. Drive off the seal (7).

Reassembly

Note: *The ring gear (22) is force fitted in the trumpet housing (6). It is centred by the three pins (21) (Loctite 638) and tightened by the screws (17). Tighten to a torque of 79 - 90 Nm (Loctite 242).*

65. Clean the seal mating faces and the location of cups and cones inside the trumpet and on the shaft. Seal, cup and cone mating faces should be free of burrs and dents.
66. Smear the external diameter of the seal (7) with Loctite 542 (metal cage).

Note: *Follow the assembly order of the seal.*

67. Replacing the seal (7):

without shaft replacement (2): to avoid the seal lip from bearing on the same place on the shaft, insert the seal 4 mm from the shoulder of the cup (8) (Fig. 11).

with shaft replacement (2): position the seal 5 mm from the shoulder of the cup (8) (Fig. 12).

68. Lubricate the cups (8) (5) and fit them home against the shoulder.
69. Fit the cage (4) into the base of the shoulder (Fig. 13).

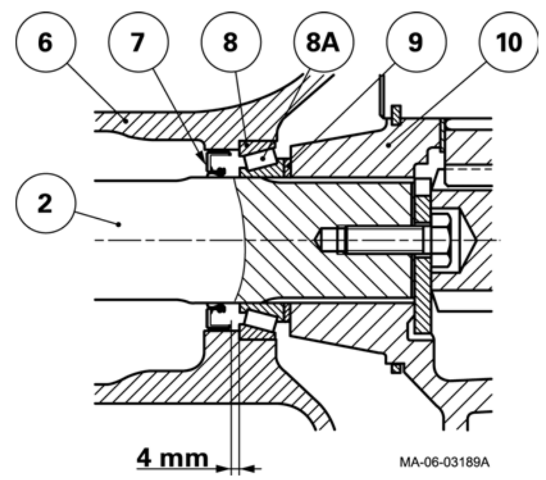


Fig. 11

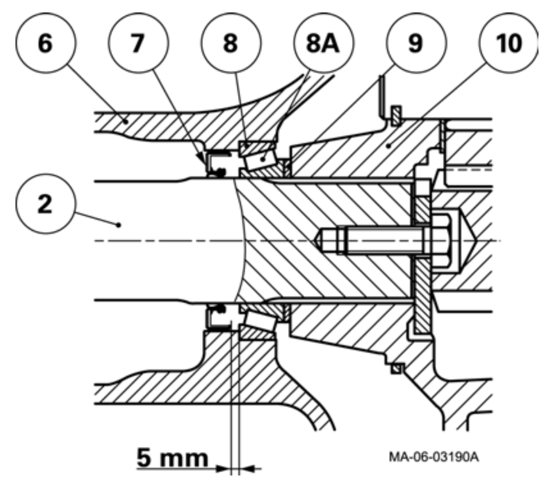


Fig. 12

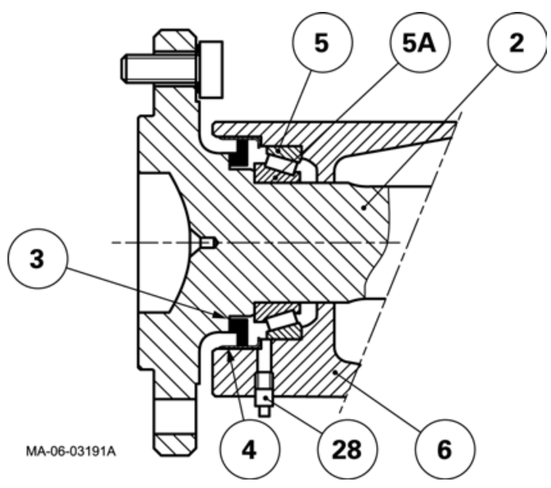


Fig. 13

70. Fit the three-lipped seal (3) home against the shoulder of the shaft.

__NOTE:__ Follow the assembly order of the seal (Fig. 13).

71. Lubricate the shaft (2) and fit the cone (5A) home against the shoulder.

72. Moderately grease the cone (5A) and seal lips (3) (7) (BP Agricharge grease or equivalent).

73. Protect the shaft splines (2) and insert it into the trumpet housing.

__NOTE:__ The seal lips (3) must be turned outwards.

74. Take off the shaft protection and lightly lubricate the cone (8A).

75. Refit the cone (8A), washer (9) and planet carrier (10).

76. Fit shims to obtain the required preload (see § E).

77. Replace plug (28) with a grease nipple. Partially fill the trumpet cavity between the cone (5A) and the seal (3) with BP Agricharge grease or equivalent. Take off the grease nipple and tighten the plug again (Fig. 13).

E . Preloading the axle shaft bearings

78. Place trumpet assembly in vertical position.

79. Remove the screw (24) and washer (25).

80. Seat the cones (5A) (8A) in their cups by turning the trumpet on its pin.

81. Set a thickness of shims (26) greater than dimension X in order to obtain clearance (Fig. 14).

82. Fit the washer (25) and screw (24) and tighten to a torque of 270 - 440 Nm.

83. Using a dial gauge, check the clearance by moving the planet carrier axially (Fig. 15).

84. Remove the screw (24) and washer (25).

Depending on the dial gauge reading, take off the surplus shim thickness (26) in order to obtain a preload of:

P1 = 0.025 to 0.125 mm

85. Clean the tapping at the end of the shaft (2).

86. Refit the washer (25).

87. Clean the screw (24) and smear it with Loctite 241.

Tighten to a torque of 270 - 440 Nm.

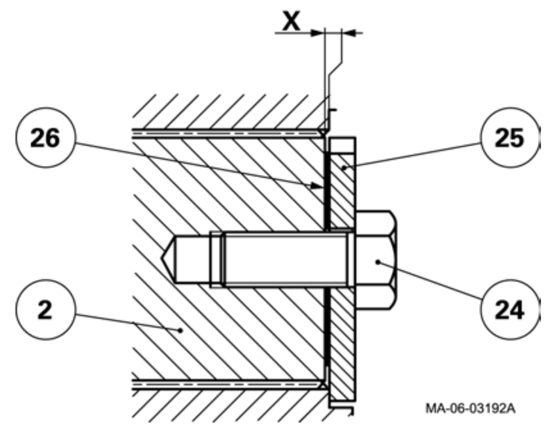


Fig. 14

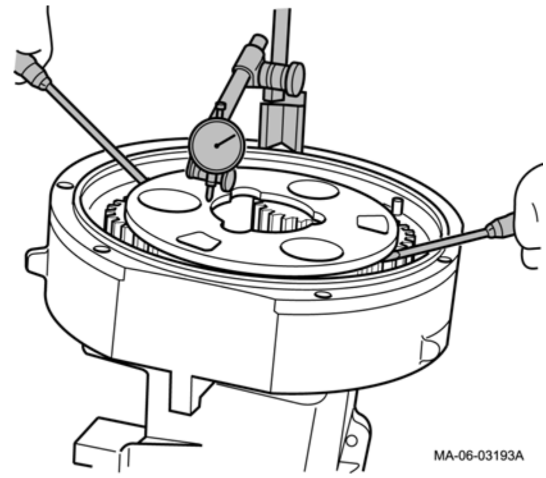


Fig. 15

F . Replacing a wheel stud

88. Drive off the defective stud with the help of a bronze drift and a hammer.

89. Use a brush and solvent to clean the streak marks left by the stud on the shaft flange.

90. Dry using compressed air.

91. Place several drops of Loctite 270 on the new stud serration.

92. Place the new stud over the serration marks left by the former stud.

93. After checking that splines are properly engaged, bring the stud head towards the inner flange of the axle shaft with a bronze hammer.

06C01 - GPA20 brake piston

CONTENTS

A . General

The brake pistons are housed in two lateral cavities of the rear axle housing, concentric with the mating face of each trumpet housing (see chapter 6).

They comprise a shouldered part and are guided by 3 locating pins force-fitted in the housing.

Sealing is ensured by two O'rings fitted in grooves of the rear axle housing. Each piston is controlled by a master cylinder topped by a tank whose level is kept constant by the residual oil flow from the 17 bar valve.

Each piston acts directly on a friction disc with inserted hub, fitted to the trumpet input sun gear and a plate centred by pins and bearing on the ring gear of the final drive unit. When the brake is released, a self-adjusting device ensures a minimal clearance between the piston and the brake disc and maintains a constant pedal travel.

The brake discs are lubricated by an oil flow. This continuous flow from the lift valve is directed to the brake discs via a pipe and a restrictor union screwed onto the trumpet housing. The oil circulating between the discs and the pistons lubricates the braking surfaces when they are not in use and cools the brakes when they are used.

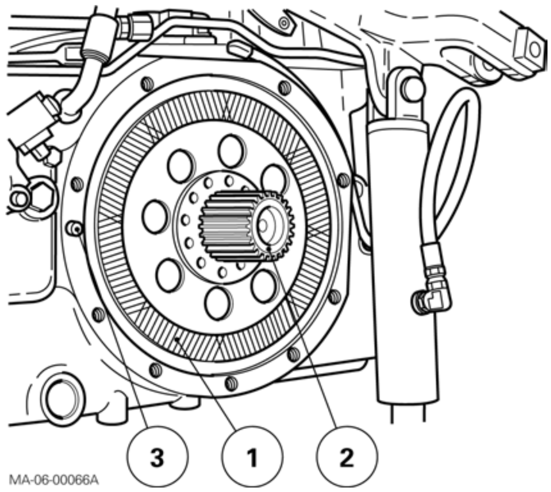


Fig. 1

B . Disassembly

1. Remove the trumpet housing. (see chapter 6).
2. Remove the disc (1), the sun gear (2), and locating pin (3) (Fig. 1).
3. Remove the brake plate (1) (inside the trumpet housing) (Fig. 2).
4. Remove the screws (3) (Fig. 3) with a locally made socket.

   Take the piston (1) out of the housing with a jet of compressed air applied to the union (2) (Fig. 4).

   NOTE: *To facilitate access to the union (2), if necessary, disconnect the 4-speed LSPTO control (if fitted) and position the union correctly.*
5. Remove the O'rings (1) (2) on the housing and discard them (Fig. 5).

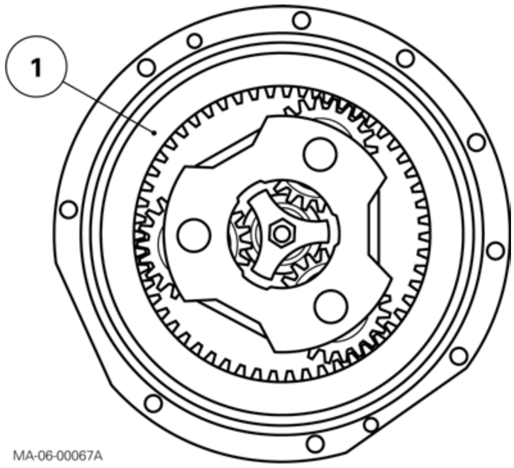


Fig. 2

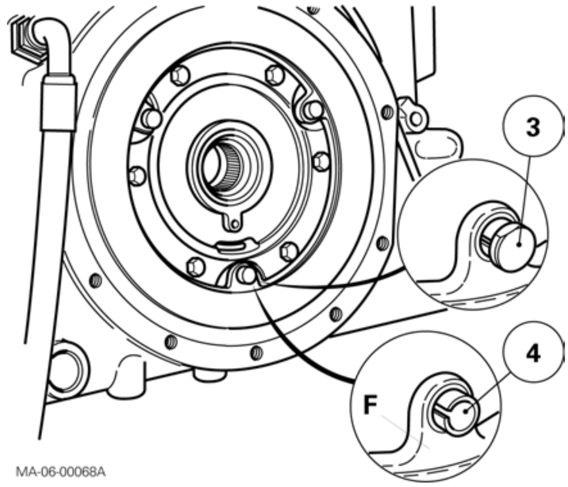


Fig. 3

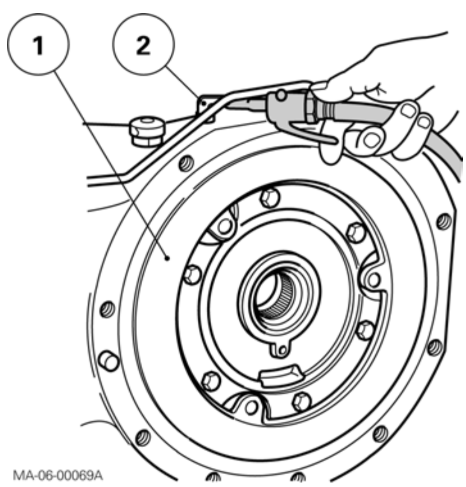


Fig. 4

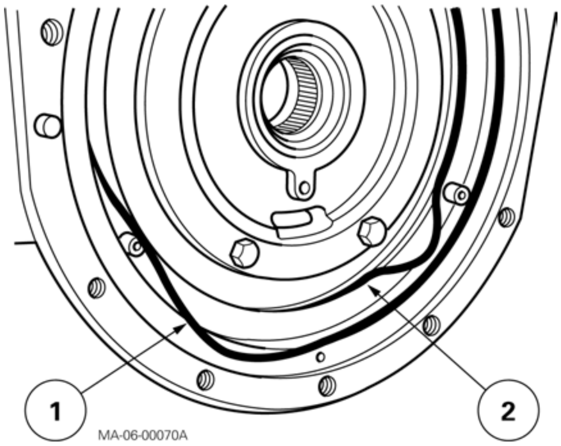


Fig. 5

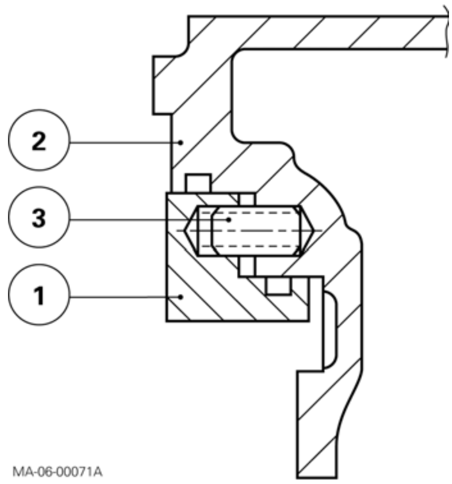


Fig. 6

C . Reassembly

6. Check and clean all components. Replace any defective parts.

NOTE: *To ensure that the brake self-adjusting system operates correctly, it is mandatory to centre the right- and left-hand differential flanges with a locally made tool (see chapter 6).*

7. Fit the piston (1) without seals in the housing (2) (Fig. 6) and check that it slides freely in the bore of the housing and that it fits onto the locating pins (3) without any friction points. Remove the piston after carrying out this check.

8. Fit spring pins (4) about 8 mm from machined face "F" of the piston (3) (Fig. 7).

Fit new O'rings (1) (2) (Fig. 5) after smearing them with a moderate quantity of miscible grease so that they remain at the bottom of the groove.

9. Position the piston over the locating pins, then fit it in place using a plastic mallet, striking in alternate points around the circumference (Fig. 8).

Fit the screws (3) (Fig. 9) after lightly smearing them with Loctite 241 and tighten them to a torque of 10 Nm with the locally made socket.

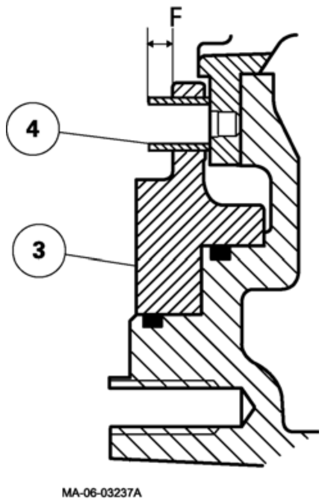


Fig. 7

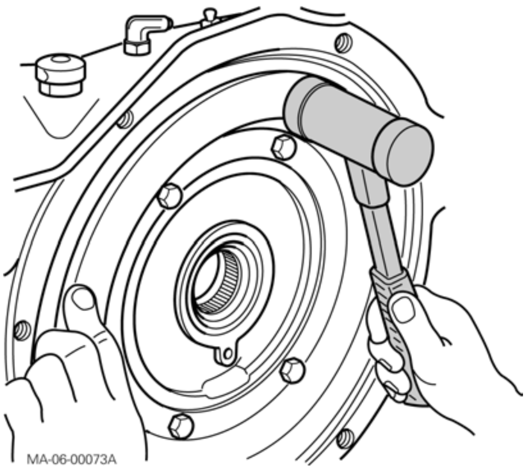


Fig. 8

Hydraulic test

***NOTE:** If work is carried out on the brake piston and O'rings, it is necessary to check for leaks.*

10. Check the condition of the supply union fitted on the centre housing.

11. Fit a pressure gauge to the union.

12. Supply the circuit with compressed air at approx. 5 bar to ensure that the piston and O'rings are positioned correctly. Reduce pressure to 0.3 bar to carry out the test.

13. Close the pressure relief valve. For one minute, no drop in pressure must be observed on the pressure gauge.

14. Remove the pressure gauge and reconnect the brake hose.

Refitting the trumpet housing

15. Clean the mating faces on the rear axle housing and on the trumpet housing with a non-greasy solvent. Apply a bead of oil resistant silicone (Silicomet type) to the inner edge of the centre housing (Fig. 10). Refit the sun gear (2), the disc (1), and locating pin (3) (Fig. 11).

***NOTE:** Check that the disc slides freely on the sun gear.*

16. Refit the trumpet housing (see chapter 6).

17. Bleed the main brake circuit and trailer brake circuit (if fitted) (see chapter 9).

18. Test:
- linkage
- braking on the road

19. Check for tightness:
- between the trumpet and rear axle housing
- of the lift control valve feed pipe.

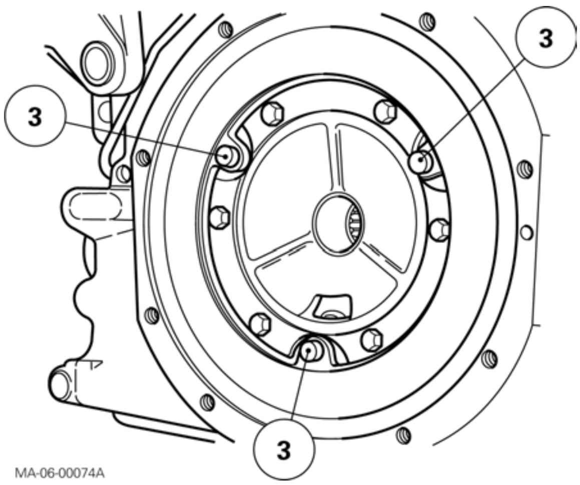


Fig. 9

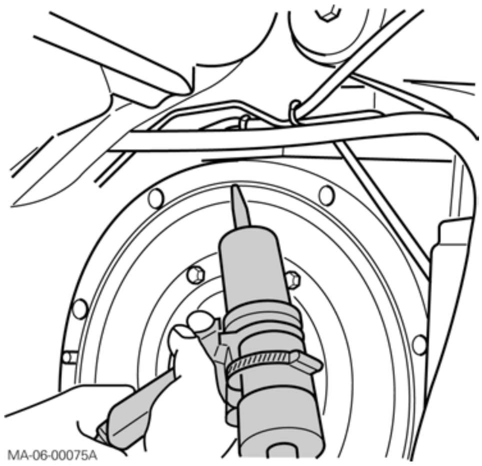


Fig. 10

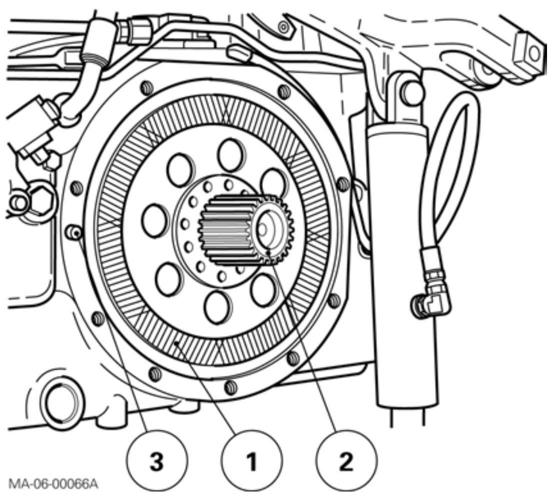


Fig. 11

06D01 - GPA20 handbrake unit and control

CONTENTS

A . General

The handbrake assembly is fitted on the drive pinion. It consists of a mechanism placed between three friction discs splined to the drive pinion.

The mechanism comprises two cast iron plates held by springs and separated by balls housed in ramps.

The three discs are fitted to the drive pinion as follows:
- two discs separated by an intermediate plate between the thrust plate (29) and the mechanism,
- a disc between the mechanism and the closing plate (24).

B . Operation

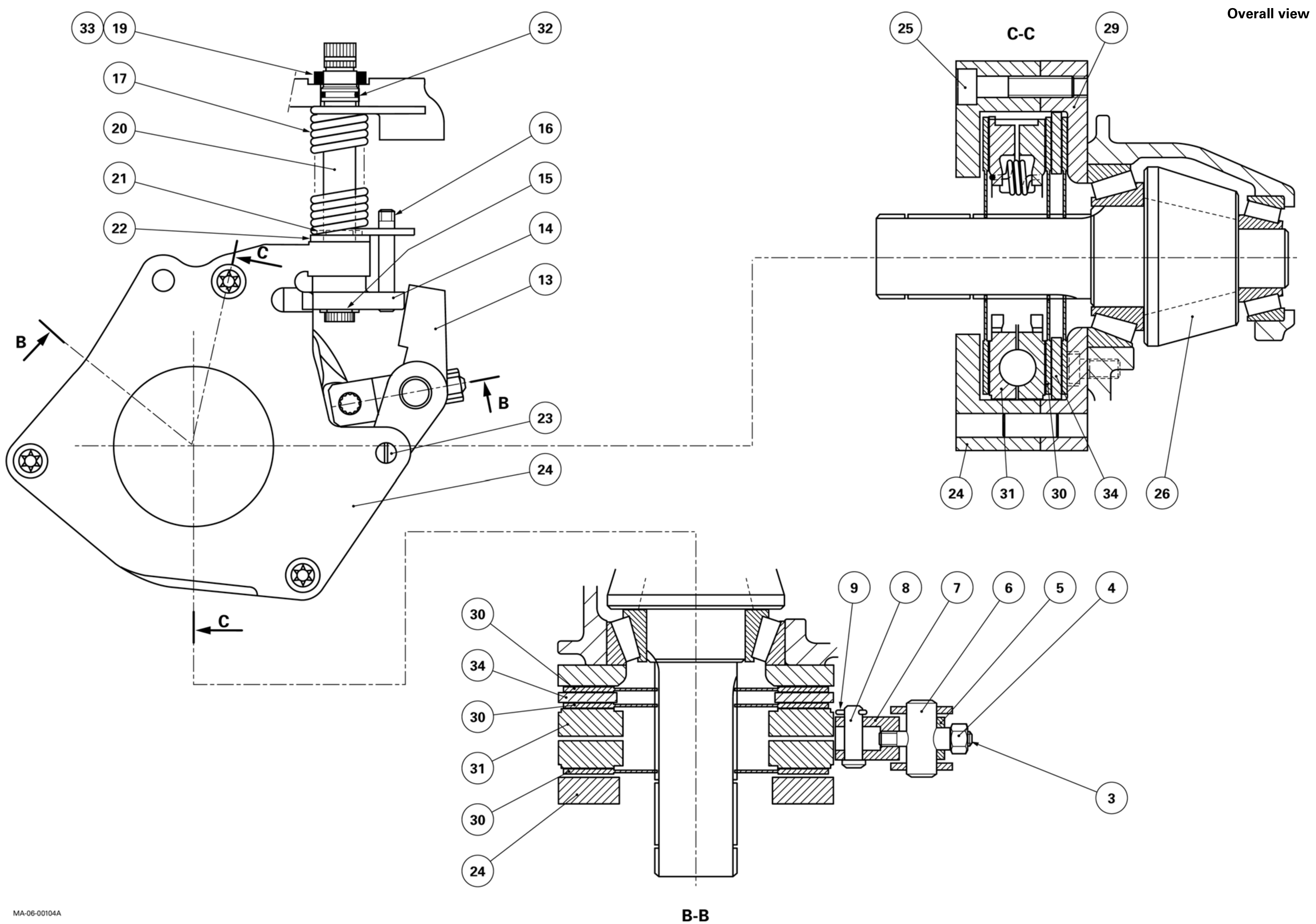
When the handbrake lever in the cab is pulled, the cam (14) is moved via the pin (20). The cam pushes the guide rod link (13) which causes the plates of the mechanism (31) to rotate and move apart. The discs (30) are thus compressed between the moving plates (31), the intermediate plate (34), the closing plate (24) and the thrust plate (29), preventing the drive pinion from rotating.

When the handbrake lever is released, the spring (17) moves the cam (14) to the rest position and the mechanism is closed by its springs.

GPA20 handbrake unit and control

Parts list

(1) Circlip
(2) Pinion
(3) Stud
(4) Nut
(5) Plate
(6) Pin
(7) Clevis
(8) Pin
(9) Cotter pin
(10) Left-hand cover
(11) Plug
(12) Seal
(13) Link
(14) Cam
(15) Circlip
(16) Finger
(17) Spring
(18) Locating pin
(19) Seal
(20) Control pin
(21) Snap ring
(22) Washer
(23) Finger
(24) Closing plate
(25) Screw
(26) Drive pinion
(27) Shim(s)
(28) Screw
(29) Thrust plate
(30) Discs
(31) Mechanism
(32) O'ring
(33) Retainer ring
(34) Intermediate plate



Overall view
33
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C
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B
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C
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C-C
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31
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26
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MA-06-00104A
B-B

Fig. 1

Exploded view

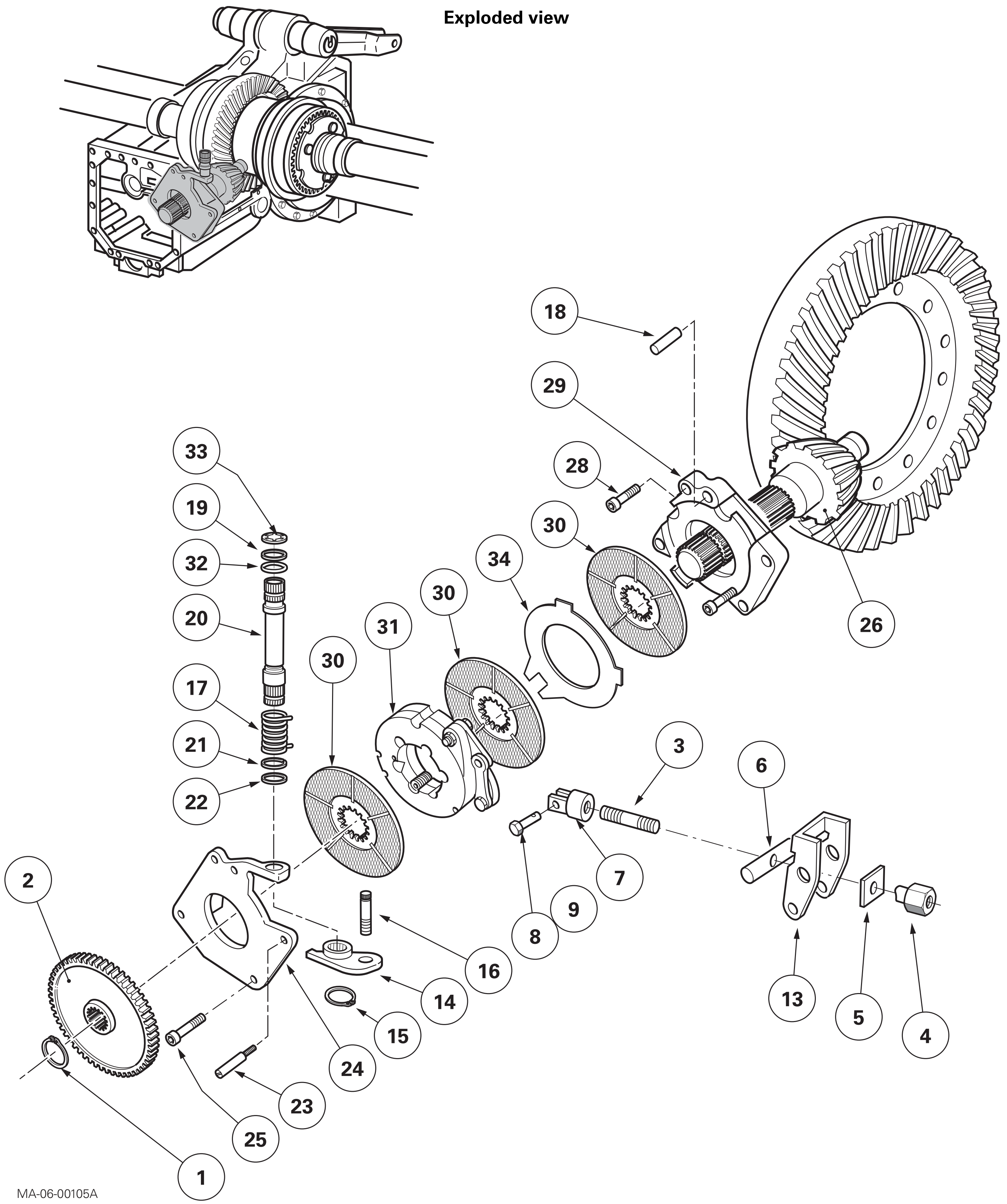


Fig. 2

C . Disassembly

1. Drain the rear axle housing.
2. Chock:
   - the front wheels of the tractor
   - between the frame and the front axle (Fig. 3)
3. Raise the tractor using a jack.
4. Place stands.
5. Remove the rear wheels.
6. Remove the right- and left-hand hydraulic casing covers (see chapter 9).

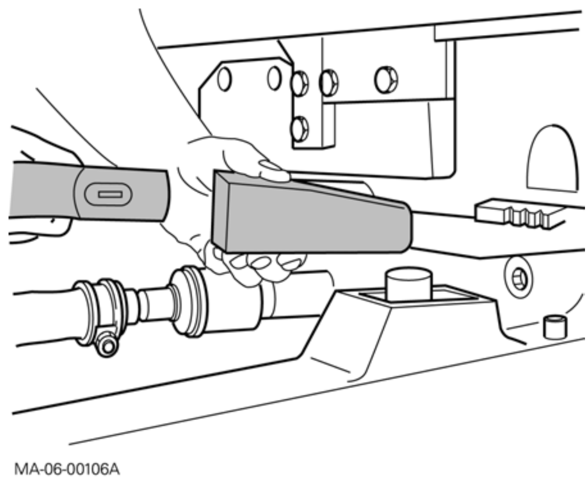


Fig. 3

Tractor with no creeper unit A (Fig. 4)

7. Drive out the double pins (2) (4) from the coupling sleeves (1) (5) (Fig. 4). Slide the sleeves towards each other on the shaft (3) linking the drive pinion (26) and the gearbox ouptut shaft.

   Remove the shaft and sleeves assembly (Fig. 4).

   On 4WD tractors: if the pins are not accessible, separate the front axle shaft by sliding the rear sleeve and manually turning the front axle clutch shaft to position the shaft (3).
8. Take off circlip (1) (Fig. 2).
9. Remove the pinion (2) (if fitted).

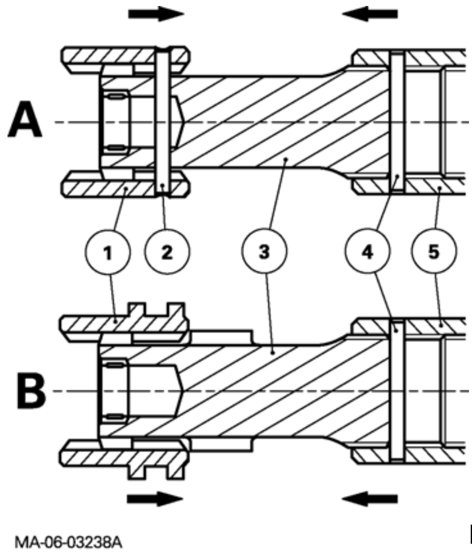


Fig. 4

Tractor with creeper unit B (Fig. 4)

10. Remove the creeper unit fork and the sleeve assembly (link shaft and coupler).
11. If the pins are not accessible, see operation 7.
12. Carry out operations 8 and 9.

Tractors with or without creeper unit

13. If necessary, remove the cab attachment screws. Raise and chock the cab.

    Check that there is enough space between the bonnet and the windscreen (if the space is insufficient, remove the bodywork).
14. Disconnect the cable (3). Take out the pin (1) and remove the control linkage (2) (Fig. 5).

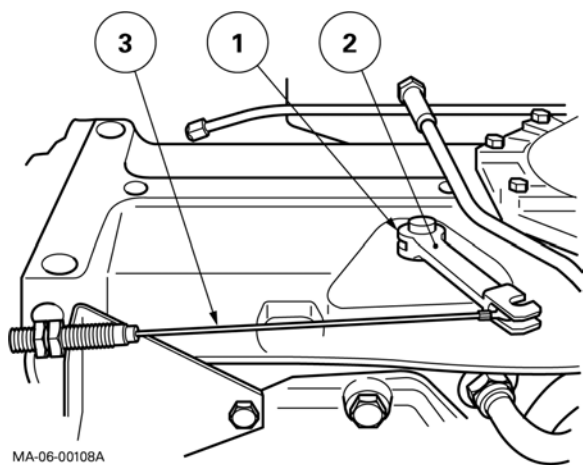


Fig. 5

15. Remove the retainer ring (33) and remove the seal (19).

16. Release the spring (17) using pliers.

17. Loosen the nut (4) to release the guide rod link (13) from the cam (14).

18. Take off circlip (15).

19. Remove the cam (14) with the finger (16).

20. Remove screw (25).

21. Remove the closing plate (24) and the control pin (20).

Note: Keep the mechanism (31) and the brake discs (30) towards the rear. Extract the closing plate (24) (Fig. 6), tilting it to disengage it from the pin (18), finger (23) and drive pinion (26) and to release the pin (20) from the housing.

22. Remove the spring (17) and the washer (22).

23. Remove the snap ring (21) (if necessary) on the control pin (20).

24. Remove the discs (30) and the mechanism (31).

If the mechanism needs to be replaced

25. Unscrew the nut (4), remove the plate (5) and the pin (6).

26. Take out the pin (9), remove the pin (8) and the clevis (7).

Note: The stud (3) is smeared with Loctite 270 and locked in the clevis (7).

If the thrust plate (29) needs to be replaced

27. Remove two diametrically opposed screws (28) and screw in two guide studs (A) (Fig. 7). The purpose of this operation is to hold the shims (27) (Fig. 8).

28. Loosen the two remaining screws.

29. Remove the thrust plate (29).

Note: Check that the shims have all remained on the housing.

The finger (16) smeared with Loctite 270 is screwed into the cam (14). The finger (23) smeared with Loctite 270 is screwed into the thrust plate (29).

The locating pin (18) is fitted fully home on the shoulder of the closing plate (24).

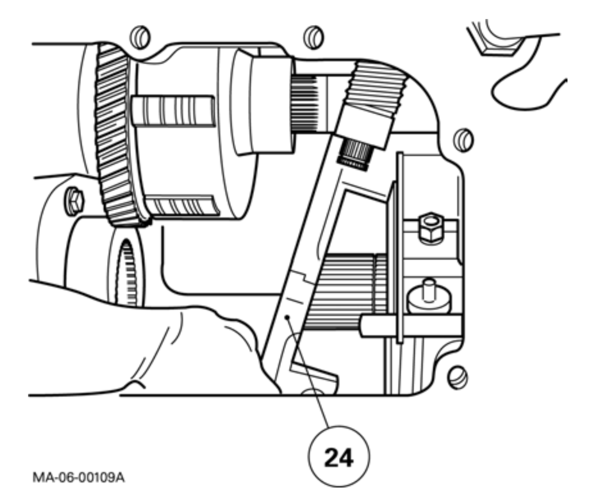


Fig. 6

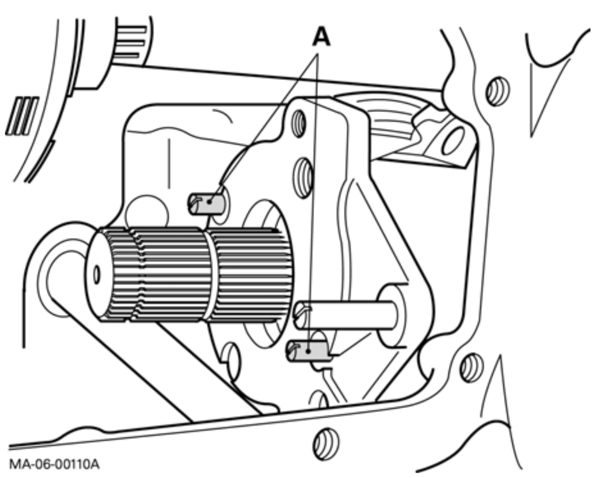


Fig. 7

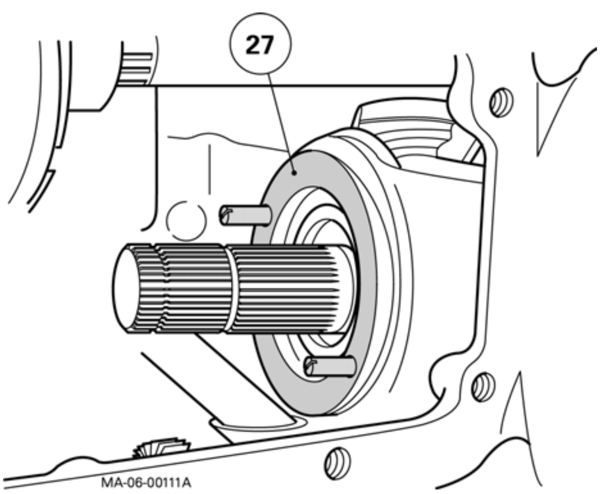


Fig. 8

D . Reassembly

30. Check and clean all components. Replace any defective parts.

If the thrust plate (29) has been replaced

31. Refit the plate.

32. Smear two screws (28) with Loctite 270, then tighten to a torque of 90 - 120 Nm.

If the mechanism has been replaced

33. Refit the clevis (7) prepared with the stud (3) and the pin (8). Replace the pin (9).

34. Fit the guide rod link (13) with its pin (6) on the stud (3) of the clevis.

35. Refit the plate (5), tighten the nut (4).

NOTE: *The plate (5) is rectangular. It must be positioned horizontally so that the pin (6) fits correctly on the link (13) (Fig. 9).*

36. Refit the discs (30), placing the mechanism (31) between them.

NOTE: *Fit the guide rod link (13) on the finger (23). Check that the discs slide freely on the shaft of the drive pinion (26).*

37. Place the snap ring (21) (if removed) on the pin (20).

38. Fit the pin (20) in the closing plate (24) with the washer (22), the spring (17) and the seal (32).

39. Carry out operation 21 in reverse order.

40. Check that the discs (30) and the mechanism (31) are correctly positioned.

41. Fit and tighten the screws (25) to a torque of 90 -120 Nm.

42. Fit the cam (14) with its finger (16).

43. Place circlip (15). Tension the spring (17), positioning its ends E as indicated (Fig. 10).

44. Lightly smear the pin (20) with AS 767 Anti-Seize grease or equivalent. Fit the seal (19) on the housing and compress it to 5.8 ± 0.15 mm using a retainer ring (33) (Fig. 11).

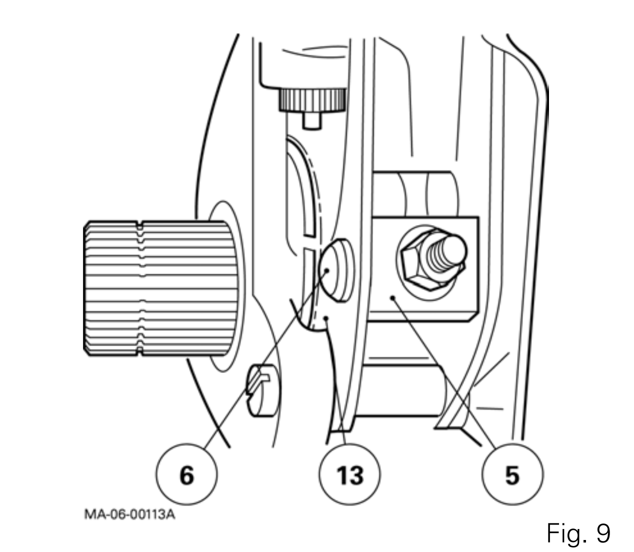


Fig. 9

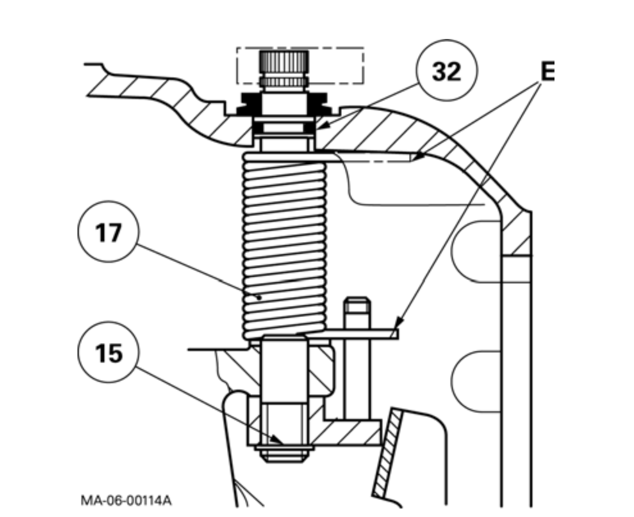


Fig. 10

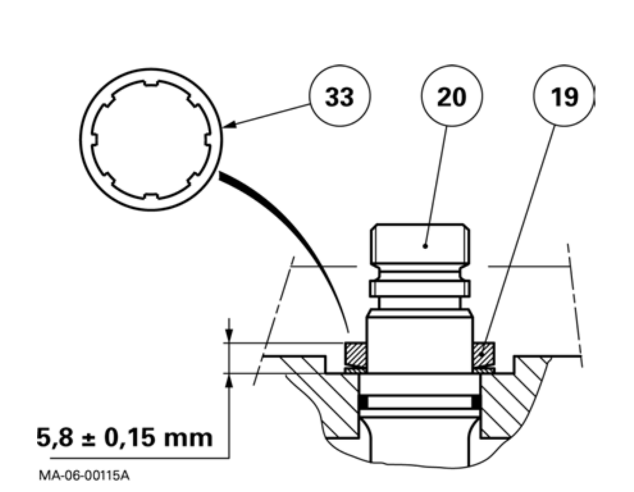


Fig. 11

45. Refit the pinion (2) (if fitted).

46. Position the circlip (1).

47. Depending on the model:

- with creeper unit: refit the sleeve assembly (link shaft and coupler) and the creeper unit fork. Turn the groove on the drive pinion sleeve towards the rear of the tractor. Replace the pins. Adjust the forks (see chapter 5).
- without creeper unit: refit the sleeve assembly (link shaft and coupler). Turn the groove on the drive pinion sleeve towards the rear of the tractor. Replace the pins.

48. Refit the left-hand cover (see chapter 9).

49. Position the guide rod link (2) (Fig. 12) with the cam (14) in contact with the guide rod link (13) to obtain a distance of 315 mm ± 12mm between the cable attachment pin and the support (3). Fit the pin (1) (Fig. 12).

50. Adjust the mechanism (31) with the adjusting nut, so that cam displacement from rest position "a" to maximum position "b" is 60° (Fig. 13).

***Note:** The adjusting nut (4) is accessed via the plug port (3) on the left-hand cover (Fig. 14).*

51. Reconnect the control.

52. Adjust the handbrake control.

See out operations 63 to 69.

If the rear of the cab is raised, carry out operation 13 in reverse.

53. Refit the right-hand hydraulic cover (see chapter 9).

54. Raise the tractor using a jack.

55. Refit the wheels.

56. Remove the stands and the jack.

57. Tighten wheels to a torque of 400 - 450 Nm.

58. Remove the chocks at the front of the tractor between the frame and the front axle.

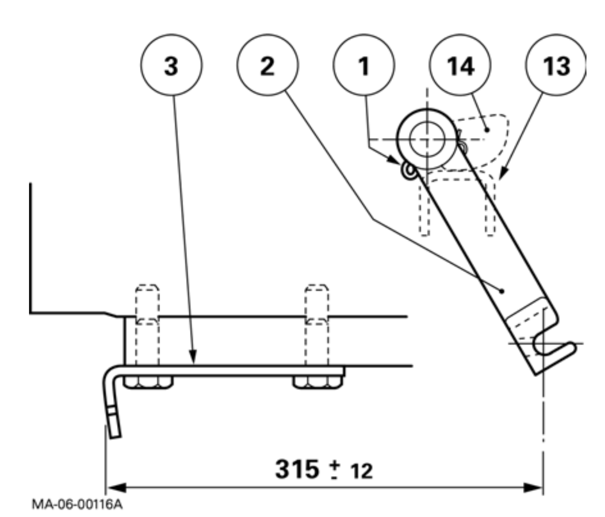


Fig. 12

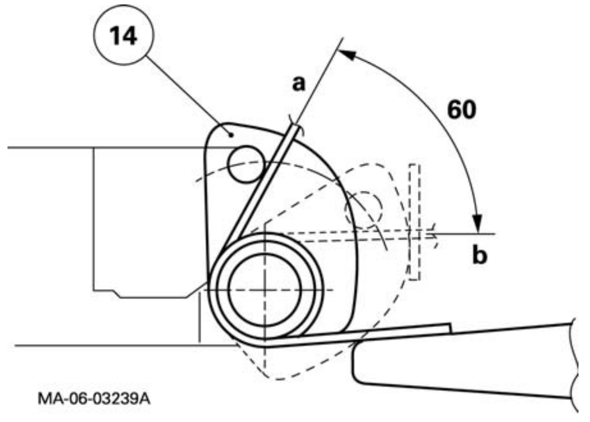


Fig. 13

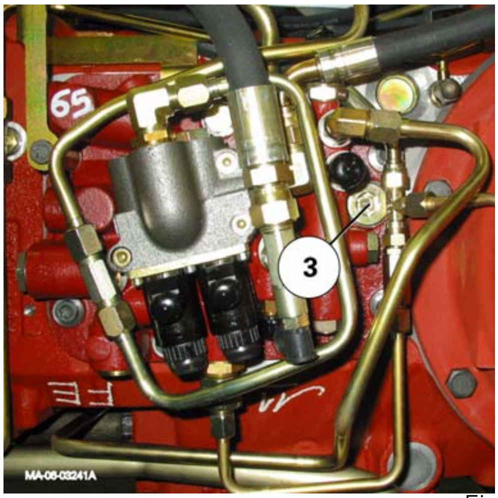


Fig. 14

59. Top up the rear axle housing with oil.

60. Check the operation of the electrical circuits, low pressure switch, solenoids, and clogging indicator.

61. Check the operation of the linkage and handbrake.

62. Check for the oil tightness of the mating faces, covers and hydraulic unions.

E . Assembling and adjusting the control

63. Introduce the cable (1) from below towards the cab interior and fasten with the clip (2) (Fig. 15).

64. Fix the clevis (7) on the brake lever (4) with the pin (5), the washer (6) and the pin (3) (Fig. 16).

***NOTE:** Check that the cable is not pinched.*

65. Fit the sheath end (2) in the clamp (1) (Fig. 15).

66. Attach the end of the cable (7) to the lever (6) (Fig. 16).

67. Place the handbrake lever in the released position. Adjust imperatively to obtain a distance of 315 mm ± 12 mm between the nut (5) and the cable end axis (7) (Fig. 16).

68. Tighten the nut (3) on the washer (4) (Fig. 16).

69. Check the operation of the control.

- Tighten the lever. Initial braking travel should be approximately 8 notches. The indicator light on the instrument panel should come on and the buzzer ring if a gear is engaged.
- Release the lever. The control must return freely to the rest position. In this position, the buzzer and the indicator light on the instrument panel should switch off.

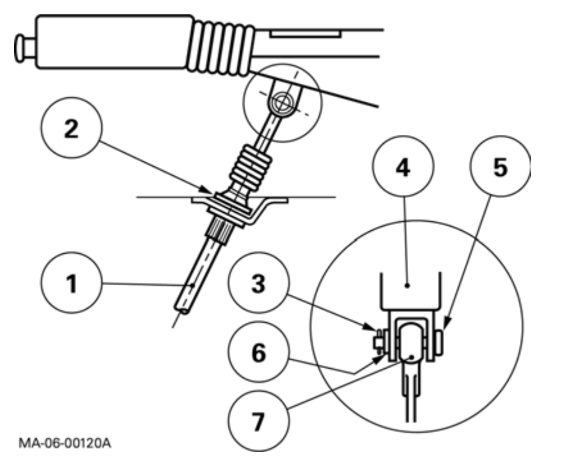


Fig. 15

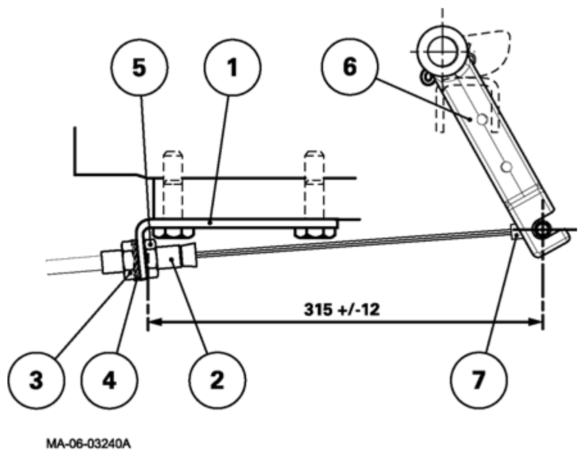


Fig. 16

06E01 - GPA20 differential

CONTENTS

A . General

The bevel gear rotation is provided by the output shaft of the gearbox and drives the rear axle. The helical drive pinion is supported on either side of its teeth by two taper roller bearings fitted in opposition. Lubrication of the bearing (30)(37) is ensured by a flow of transmission oil from the PTO upper cover located at the rear of the tractor (see section 7). The bearing cones are force fitted to the drive pinion and the rear cup, smeared with Loctite 603, is also force fitted in the rear axle housing. The front cup is free in its bore to allow for shimming of the drive pinion.

The ring gear is fixed to the differential unit by rivets. The differential assembly turns on two taper roller bearings supported by two lateral flanges centred by rings and screwed to the rear axle housing.

The differential assembly comprises two half-housings holding two pinion gears for models up to 75 hp and 4 pinion gears for models whose power exceeds 75 hp. The housing also holds two sun gears. The drive pinion is fitted in the rear axle housing.

The bevel gear is adjusted using shims fitted between the centre housing and the bearing cup (37).

The pre-loading of the taper roller bearings (31) (33) and (30) (37) is obtained by shim(s) placed between the handbrake plate and the centre housing.

The pre-load shimming of the differential assembly is carried out by deflectors (13) of different thicknesses placed behind the left-hand bearing cup (14). If needed, an additional shim (49) can be fitted between flange (9) and the deflector.

Differential lock

The left-hand flange contains the differential lock mechanism. The system consists of a piston and a mobile coupler integral via splines with the input sun gear in the left-hand trumpet housing. The mobile coupler is moved by the piston which is supplied by the 17 bar hydraulic circuit via a solenoid valve fitted on the right-hand cover. The piston moves and pushes against the mobile coupler, compressing the spring.

The teeth of the mobile coupler engage with a fixed coupler that is integral with the differential unit. In this position, the input sun gears of the left- and right-hand side trumpet housings turn at the same speed. When the pressure is released, the mobile coupler is forced backwards by the spring.

GPA20 differential

Parts list

(1) O'ring
(2) Stud
(3) O'ring
(4) Circlip
(5) Piston
(6) Spring
(7) Mobile coupler
(8) O'ring
(9) Left-hand flange
(10) Differential lock hydraulic assembly
(11) Friction washer
(12) Finger
(13) Deflector
(14) Bearing cup
(15) Screw
(16) Fixed coupler
(17) Bearing cone
(18) Washer
(19) Sun gear
(20) Pinion gear
(21) Washer
(22) Spider
(23) Ring gear
(24) Rivets
(25) Right-hand flange
(26) Screw
(27) Bearing cup
(28) Bearing cone
(29) Unit
(30) Bearing cone
(31) Bearing cone
(32) Screw
(33) Bearing cup
(34) Drive pinion
(35) Thrust plate
(36) Shim(s)
(37) Bearing cup
(38) Shim(s)
(39) Union
(40) Differential lock feed pipe
(41) Lubricating plug
(42) Locking nut (differential support)
(44) Washer
(45) Locating ring (differential support)
(46) Stud
(47) Pipe
(48) Union
(49) Shim(s)
(50) Shim(s)
(51) Nut (holds lubricating pipe)
(52) Lubricating union
(53) Spool valve tank return pipe
(54) Locking nut
(55) Locking nut (differential support)
(56) Screw

Overall view

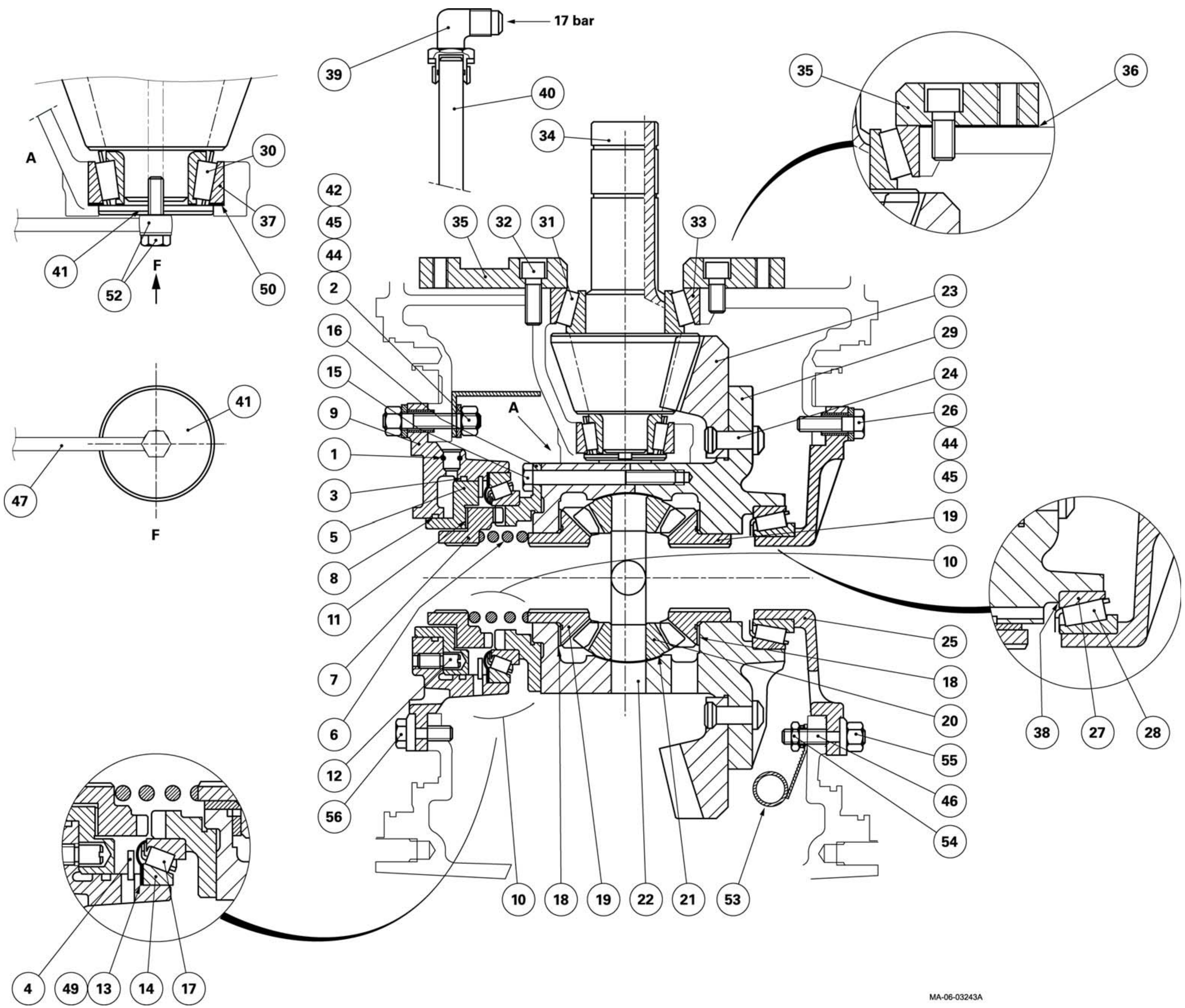


Fig. 1

Exploded view

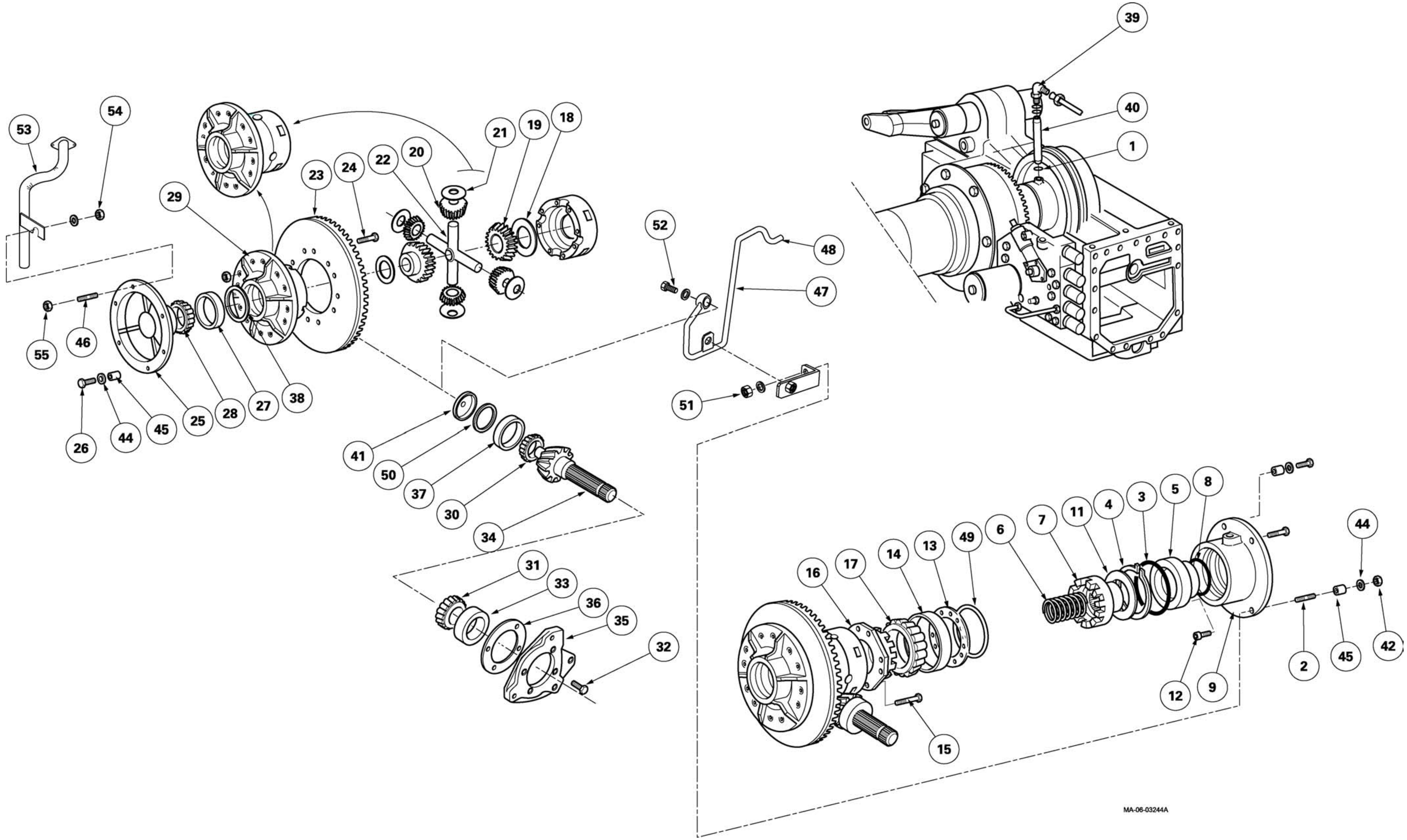


Fig. 2

B . Removing the left-hand flange and differential lock assembly

Note: *It is possible to carry out servicing on the differential lock hydraulic assembly (10) by removing only the left-hand trumpet housing.*

1. Remove the left-hand trumpet housing (see section 6).

2. Disconnect the supply pipe (2), unscrew the union (39) and take out the pipe (40) (Fig. 3).

Note: *If access to the union (39) is difficult on tractors fitted with 4-speed LSPTO, remove the control (1) (Fig. 3).*

3. Remove the brake piston (see section 6).

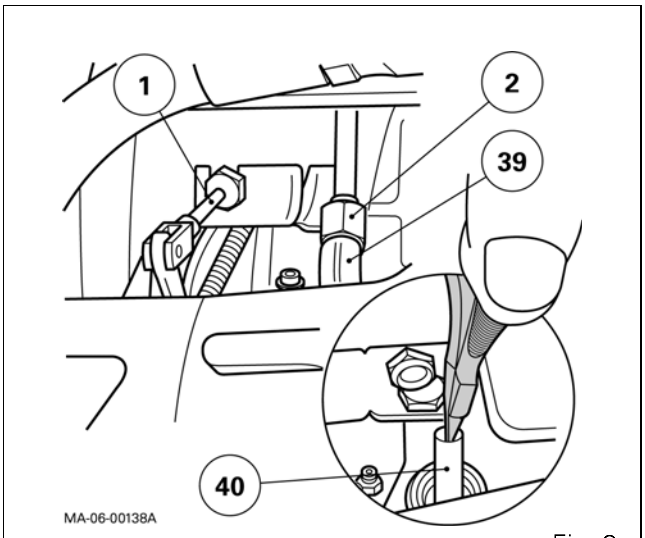


Fig. 3

Special points

Purpose of studs (2) and (46)

- Stud (2) (Fig. 2):
  - helps attach the left-hand side flange (9),
  - it holds the lubricating pipe (47) of the drive pinion (34).

Note: *To reach the nut (3), remove the auxiliary spool valve support and work through the resulting opening.*

Note: *If this operation has to be carried out on a tractor fitted with 4-speed LSPTO, it is necessary to also remove the hitch support and the top PTO cover located at the rear of the tractor, the double pinion and control fork.*

- Stud (46) (Fig. 2):
  - attaches the right-hand flange (25).
  - supports the return pipe (53) of the hydraulic spool valves (see section 9).

The two studs (2) and (46) are fitted in the housing with a locking product (Loctite 242 or equivalent). The nuts on either side are tightened like the other screws holding the flanges, to a torque of 85 - 100 Nm.

Removal

4. Remove the flange (9), the locating ring (45), and if necessary, the friction washer (11), mobile coupler (7) and spring (6).

C . Disassembling and reassembling the differential lock assembly

Disassembly

5. Take out cup (14), deflector (13) and shim (49) (if fitted).

NOTE: Carefully note the assembly direction of the deflector and the location of the shim (49).

6. Take off circlip (4).

7. Drive out the piston (5) using a compressed air jet (Fig. 4).

8. Take off the O'rings (3) (8) (1).

9. Unscrew finger (12) (if necessary).

Reassembly

10. Check the components and replace any found to be defective.

11. Clean finger (12), smear it with Loctite 542, then fit it and tighten it on flange (9).

12. Smear the O'rings (3) (8) with miscible grease (Amber technical or equivalent), and place them correctly at the end of their respective grooves.

13. Using a plastic hammer, insert the piston (5) into the flange (9) (Fig. 5) while respecting the location of the finger (12).

14. Fit circlip (4), shim (49) (if necessary) (Fig. 2), and deflector (13), respecting its assembly direction, and cup (14) (Fig. 6).

***IMPORTANT:** The shim (49) (if used) must be placed between flange (9) and deflector (13).*

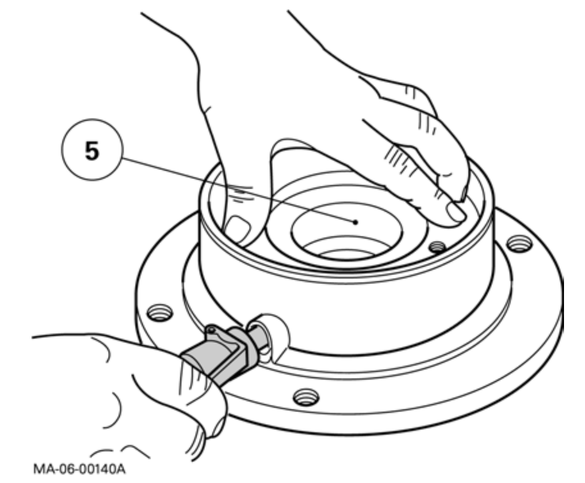


Fig. 4

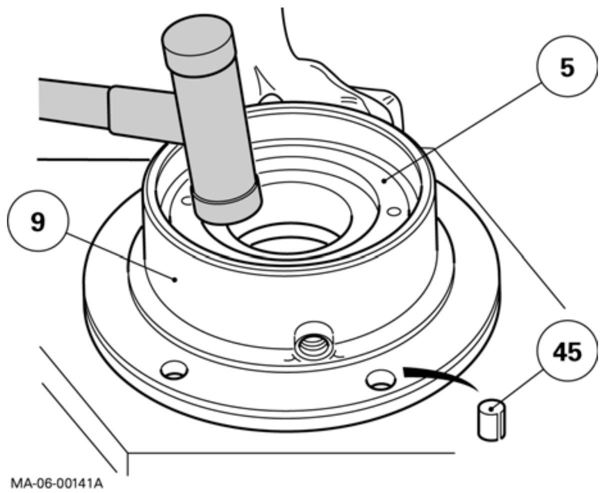


Fig. 5

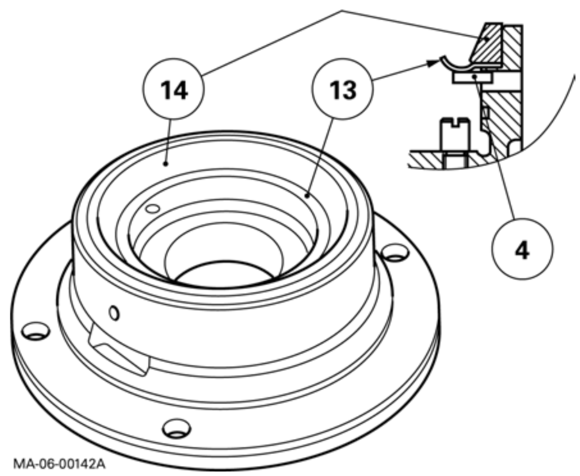


Fig. 6

D . Refitting the left-hand flange and the differential lock assembly

15. Fit the O'ring (1).

16. Assemble washer (11), mobile coupler (7) and spring (6).

17. Refit the assembly in the left-hand flange (9).

Flange fitting method (9) (Fig. 7)

18. Screw two guide studs “G” (L = 60 mm approx.) to the centre housing (Fig. 7).

Check for the presence of the ring (45) (Fig. 8). Position the flange assembly (9) turning it so that the oil passage is at the bottom.

Fit washer (44). Tighten alternately and uniformly the screw (56) and nut (42) to a torque of 85 - 100 Nm.

REMINDER: *See special points § B.*

Replace the guide studs with two other screws and tighten them to the previously indicated torque.

19. Fit pipe (40) and union (39) (Fig. 3).

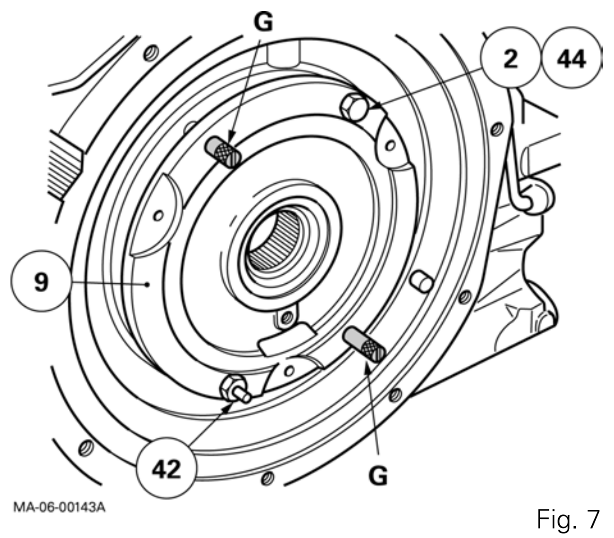


Fig. 7

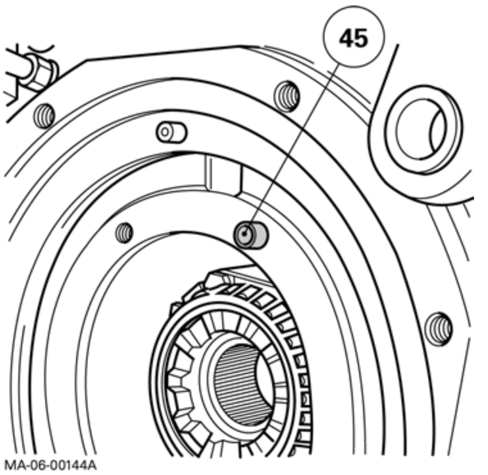


Fig. 8

Hydraulic test

If servicing has been carried out on piston (5), seals (3) (8), or flange (9), it is necessary to check the tightness of the assembly.

20. Fit a pressure gauge that has been previously tested for air tightness to the supply union (39) (Fig. 9).

21. Supply the circuit with compressed air at approximately 5 bar so as to correctly place the piston and O'rings in the left-hand flange (9).

Redue the pressure to 0.3 bar and carry out the tightness test.

22. Close the valve. For approximately 1 minute, no drop in pressure must be observed on the pressure gauge.

23. Disconnect the pressure gauge and reconnect the supply pipe (2) (Fig. 3).

If removed, reconnect the 4-speed LSPTO control (Fig. 3) and set the control (see section 7).

24. Refit the brake piston and left-hand trumpet housing (see section 6).

25. Start the engine.

Check the oil tightness of the supply pipe (2) (Fig. 3) and the correct operation of the differential lock.

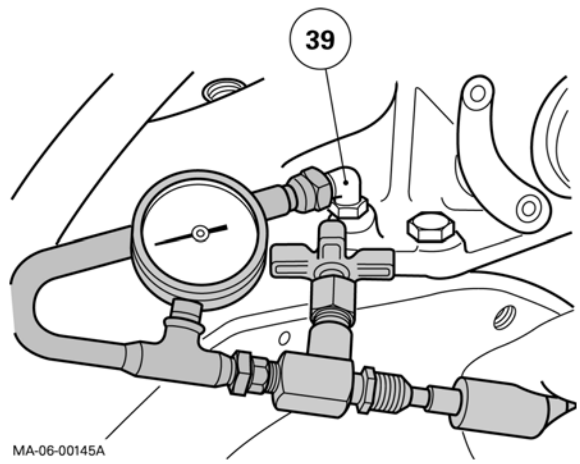


Fig. 9

E . Removing the differential assembly

Preliminary operations

26. Split the tractor between the gearbox and the rear axle (the cab remains integral with the gearbox) (Fig. 10).
27. Remove the wheels.
28. Separate the left- and right-hand trumpet housings from the centre housing (see section 6).
29. Remove the lift cover (see section 6).
30. Disassemble the hitch support (see section 6). Remove the upper PTO cover, the drive pinion and the layshaft (see section 7).
31. Take off the pipe (40) (Fig. 11).

Removal

32. Remove the brake pistons (see section 6).
33. Carefully place a sling on the differential assembly using a clamp (Fig. 12).
34. Before working on the screws (56) and the nut (42). Loosen the screws (56) and nut (42) alternately to gradually release the spring (6).
REMINDER: *See special points § B.*
35. Remove the flange (9), spring (6), coupler (7) and washer (11).
36. Take out the screws (26).
37. Take off the flange (25).
38. Take out the differential assembly from the centre housing (Fig. 12).

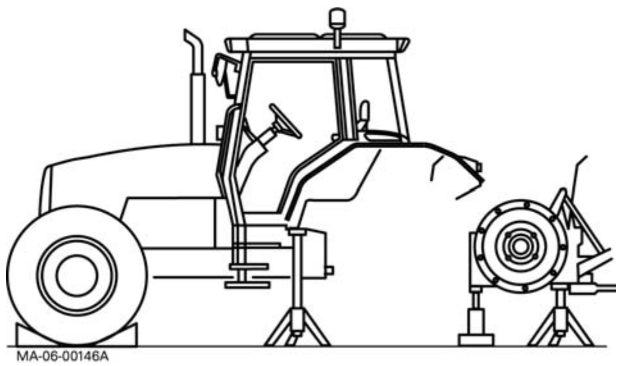


Fig. 10

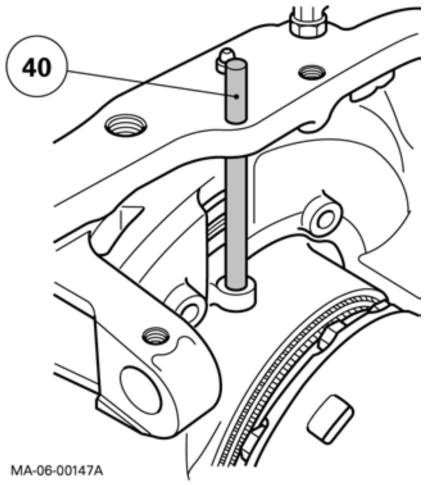


Fig. 11

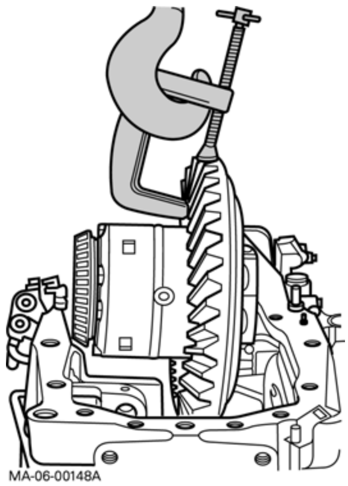


Fig. 12

F . Disassembling the differential assembly and the ring gear

Disassembling the differential assembly

39. Place the differential assembly on a workbench.

40. Extract the cones (17) (28) and cup (27), recover shims (38).

41. Mark the two half-housings (29) with joining paint lines. Take out the screws (15).

42. Remove the fixed coupler (16).

43. Separate the two half-housings (29).

NOTE: These components both display the same number. They must always be fitted as pairs.

44. Remove washers (18), sun gears (19), pinion gears (20), washers (21) and spider (22) (Fig. 13).

NOTE: Replacement of the ring gear automatically requires replacement of the drive pinion. These components both bear the same number. They must always be fitted as pairs. In the factory, the ring gear and unit are assembled using rivets. During repairs, these rivets are replaced by nuts and screws.

Disassembling the ring gear (23)

45. Remove the ring gear from the unit.

46. Centre punch each rivet (24) (on toothed side of ring gear).

47. Using a 5 mm drill, drill out the rivets to a depth of 10 mm (Fig. 14).

48. Carry out a second drilling operation with a 12 mm drill to the same depth.

49. Drive out the rivets using a suitable drift punch (Fig. 15).

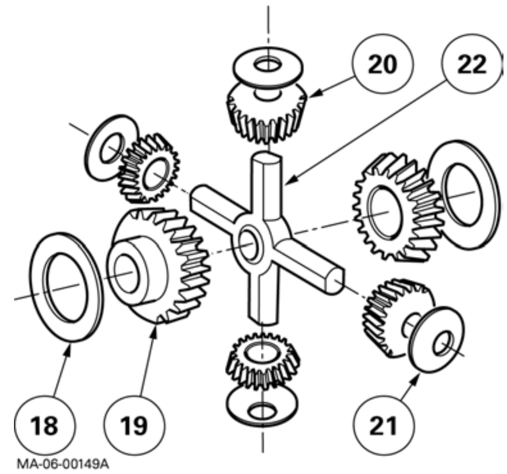


Fig. 13

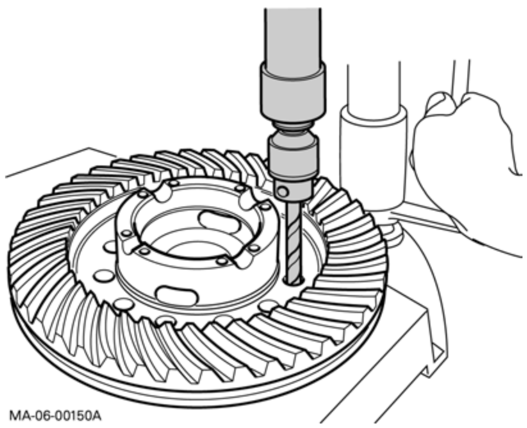


Fig. 14

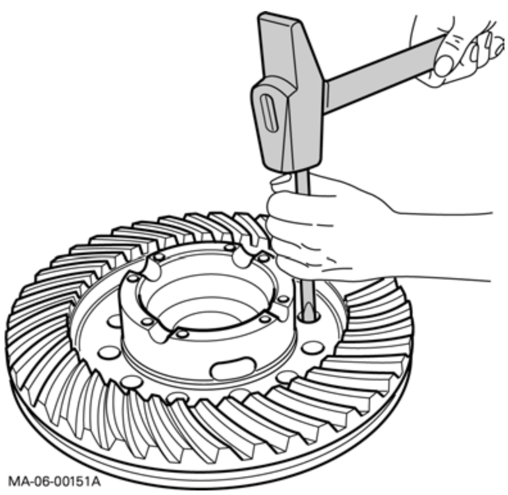


Fig. 15

G . Removing and disassembling the drive pinion

50. Remove the right- and left-hand hydraulic cover (see section 9).
51. Take off the circlip (1) (Fig. 16).
52. Remove the pinion (2) (if fitted) (Fig. 16).
53. Remove the handbrake mechanism assembly (see section 6).

Removing the drive pinion

54. Remove screws (32), thrust plate (35) and shims (36).
55. Remove the bearing cup (33) and the drive pinion complete with cones (30) (31).
56. Remove lubricating pipe (47). Remove and discard the cap (41), extract the cup (37) and recover the shims (50).

Disassembling the drive pinion

57. Extract the bearing cones (30) (31).

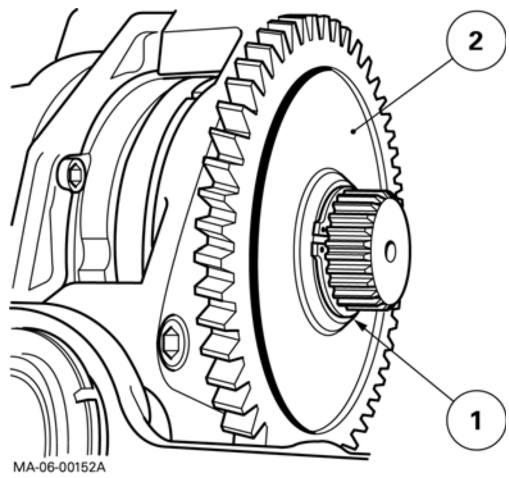


Fig. 16

H . Reassembling the ring gear and differential assembly

Refitting the ring gear

58. Check that the ring gear and drive pinion display the same serial number.

59. Clean the mating faces of the new ring gear (23) and unit (29), the nuts and the screws referenced in the spare parts catalogue.

60. Smear the first threads of the screws (1) (Fig. 17) with Loctite 270 and place them in the ring gear and unit.

61. Tighten and lock the nuts (2) (Fig. 17) to a torque of 150 - 160 Nm.

Reassembling the differential assembly

62. Check the components and replace any found to be defective.

63. Reassemble the differential assembly. Carry out the operations 42 to 44 in reverse order.

64. Smear the screws (15) with Loctite 270 then tighten to a torque of 85 - 130 Nm.

__NOTE:__ The clearance "__J1__" between the pinion gears and sun gears must be between 0.08 mm and 0.30 mm.

65. Insert bearing cones (17) (28) respectively in the bottom of the shoulder of the fixed coupler (16) and the left-hand flange (25), using a press and a suitable fixture.

Special point

Place shim(s) (38) in the half-housing (29) to pre-adjust the backlash and then insert the bearing cup (27) (see § K).

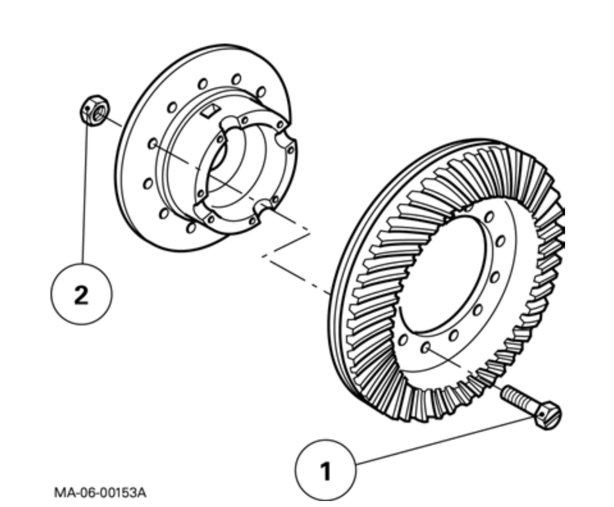


Fig. 17

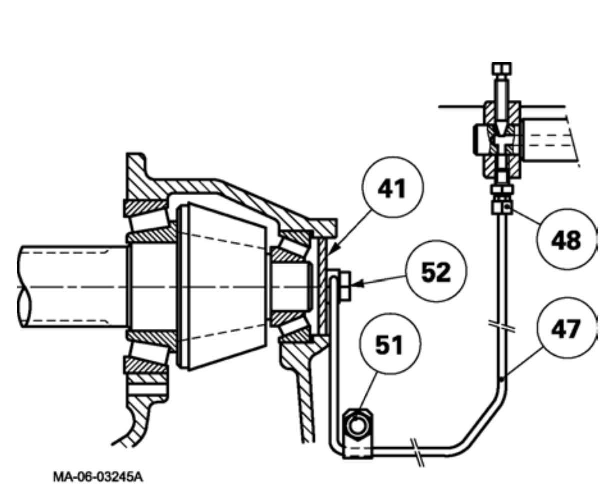


Fig. 18

I . Adjusting the bevel gear distance, refitting and shimming of the drive pinion

Preparation

66. Check the components and replace any defective parts.

67. Using a press and a suitable fixture, insert the cone (30) fully into the drive pinion shoulder.

Adjusting the bevel gear distance

IMPORTANT: *The bevel gear distance must be adjusted before the pre-load shimming of the drive pinion bearings.*

*The thickness of shims "**E**" (50) (Fig. 19) required to position the drive pinion is calculated as follows:*

E = Z + T - (X + Y)

E = 184.955 + T - (X +90.520).

Legend:

- **Z** Nominal drive pinion dimension = 184.955 mm
- **T** Correction of the nominal dimension engraved on the drive pinion; this may be a positive or negative value.
- **X** Dimension of the centre housing stamped on the rear right-hand side of the housing, behind the lift ram.
- **Y** Dimension of the drive pinion with bearing = 90.520 mm.

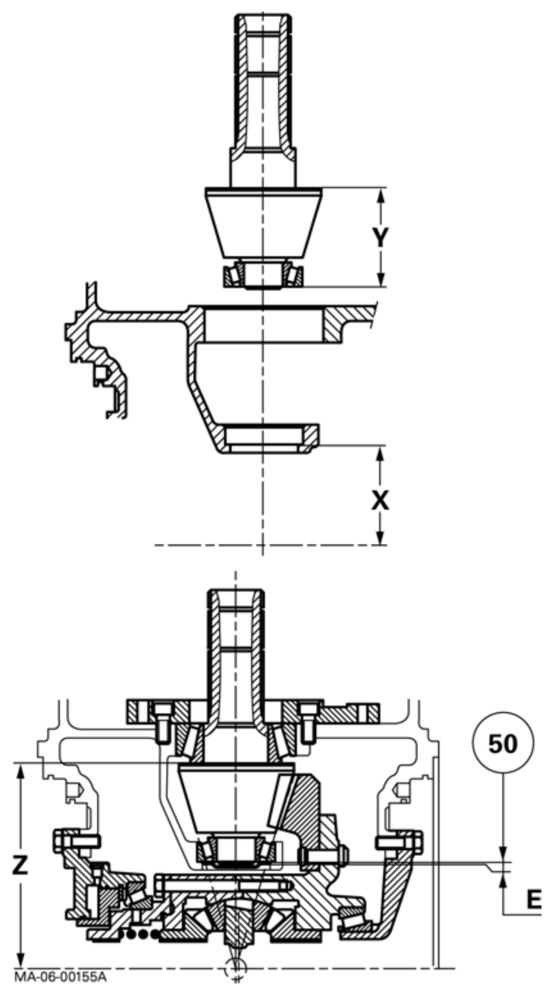


Fig. 19

Refitting

68. Using a press and a suitable fixture, insert the bearing cone (31) fully into the drive pinion shoulder.

69. Place shims (50), their thickness determined by the above formula.

70. Lightly smear the external diameter of the cup (37) with Loctite 603 or equivalent and insert it to make contact with shims (50) using a suitable fixture. Eliminate any traces of Loctite.

***NOTE:** Cones and bearings must be clean and lubricated after fitting.*

71. Fit the drive pinion and bearing cup (33).

Preparing for drive pinion shimming

72. Set a thickness of shims greater than the overhang dimension "**a**" on the bearing cup (33) measured in relation to the housing face (Fig. 20) to obtain a provisional clearance of 0.10 mm to 0.15 mm maximum for the pre-load shimming that follows.

73. Screw two diametrically opposed guide studs on to the housing. Place the shims (36) determined in operation 72 and fit the thrust plate (35).

74. Fit and tighten the screws (32) to 90 - 120 Nm after removing the studs.

Shimming the drive pinion

1st method: preload adjusting

75. Place the dial gauge feeler pin on the end of the drive pinion (Fig. 22).

76. Pull hard on the pinion through the front of the centre housing and turn it alternately from left to right in order to correctly seat the bearing cones in their cups.

77. With the assistance of another operator, set the dial gauge to zero.

78. Repeat the operation 76, this time by pushing.

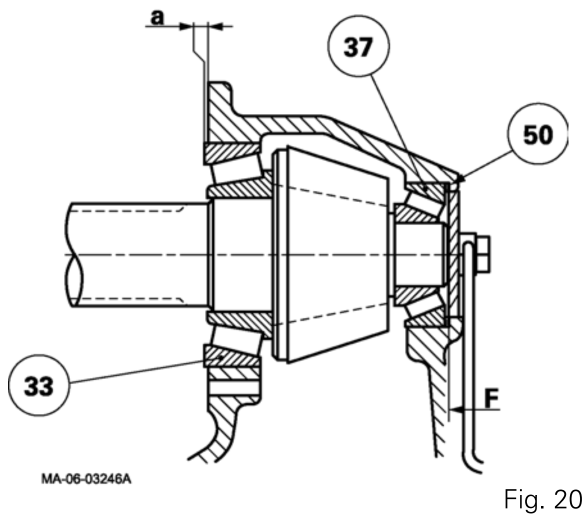


Fig. 20

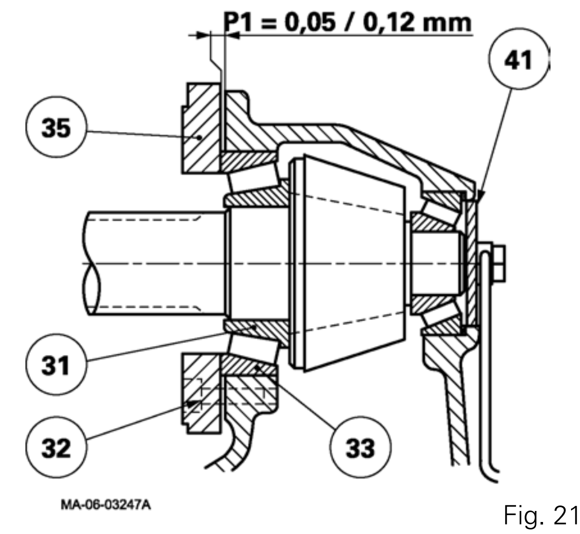


Fig. 21

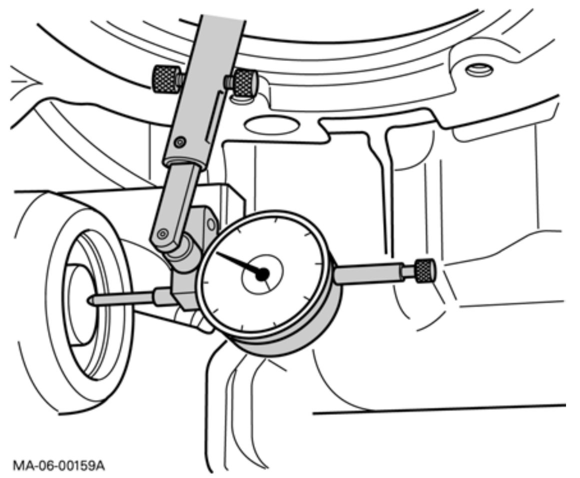


Fig. 22

79. Depending on the clearance measured, select a definitive thickness of shims in order to obtain the following preload:

P1 = 0.03 to 0.09 mm

Note: *If possible, shim to the maximum tolerance.*

80. Take out the two diametrically opposed screws (32) and replace them with two guide studs.

Remove the two other screws and thrust plate (35).

81. Fit the shims selected in operation 79 and replace the thrust plate.

82. Fit the screws (32) lightly smeared with Loctite 270 or its equivalent and tighten to a torque of 90 - 120 Nm, having first removed the guide studs.

2nd method: torque adjusting

83. Remove or add shims (36) to obtain a drive pinion rotational torque of 0.80 to 2 Nm, measured using a dial torque wrench, with the drive pinion turning at approximately 1 to 5 rpm.

Note: *Where possible, shim to obtain the maximum torque value.*

Once the correct torque has been obtained, refit the screws (32) lightly smeared with Loctite 270 or equivalent, then tighten to a torque of 90 - 120 Nm.

84. Position the cap (41) (Fig. 21) in the housing, then refit the union (52) and lubricating pipe locking nut.

J . Refitting and shimming of the differential assembly

Refitting the right-hand flange (25)

85. Carefully place the differential assembly in the housing (Fig. 23).

Note: *The right-hand flange (25) is assembled on the centre housing in a similar way to the left hand flange (9). The positioning is ensured out by the locating ring (45).*

86. Use the assembly method described in § D.

Refitting the left-hand flange (9)

87. Remove the bearing cup (14) and deflector (13) from the flange (9).
88. Place the bearing cup on the cone (17).
89. Fit the tool ref. 3376847M91 on the housing, using two screws (56) tightened to a torque of 85 - 100 Nm (Fig. 24).
90. Tighten the central screw to a torque of 10 Nm.
Note: *Check that the ring gear is not constrained by the drive pinion and turn it several times to correctly seat the bearing cones in their cups. Check the tightening torque of the central screw of the tool once again.*
91. Assemble and moderately tighten the hexagonal calibrated spacers “A” (Fig. 24) in the other two holes. Check that they are in contact with the housing.

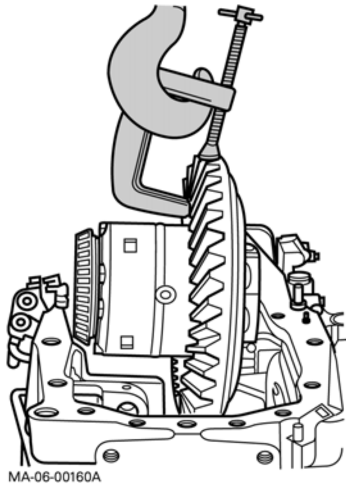


Fig. 23

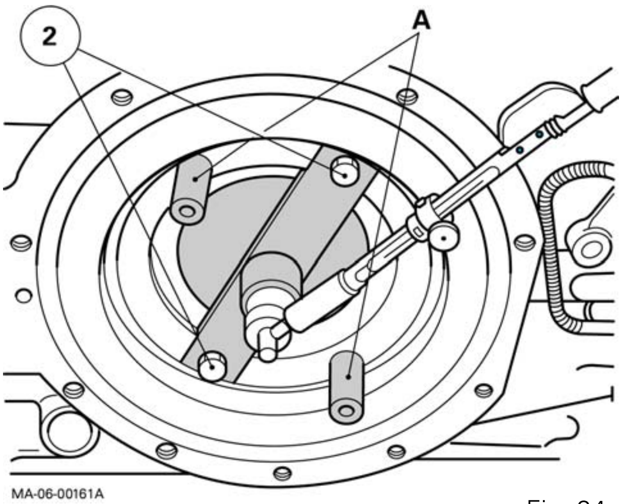


Fig. 24

Shimming

92. Carry out shimming to obtain:
P2 = 0 to 0.25 mm(Fig. 25)

93. Place a steel ruler edge against the two calibrated spacers (Fig. 26).

94. Using a set of laminated shims, measure the clearance "**J**" between the finger of the tool and the ruler "**B**" (Fig. 26).

95. Calculate dimension "**C**" between bearing cup (14) and the mating face of the flange (9) (Fig. 27).
C = (114 + J) - 70

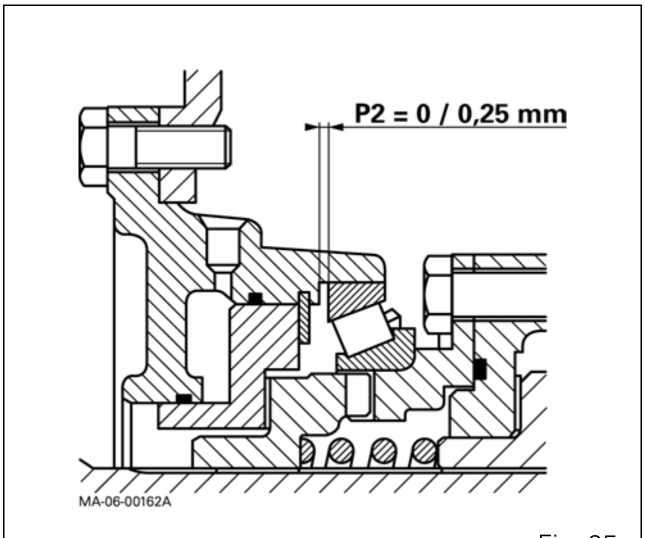


Fig. 25

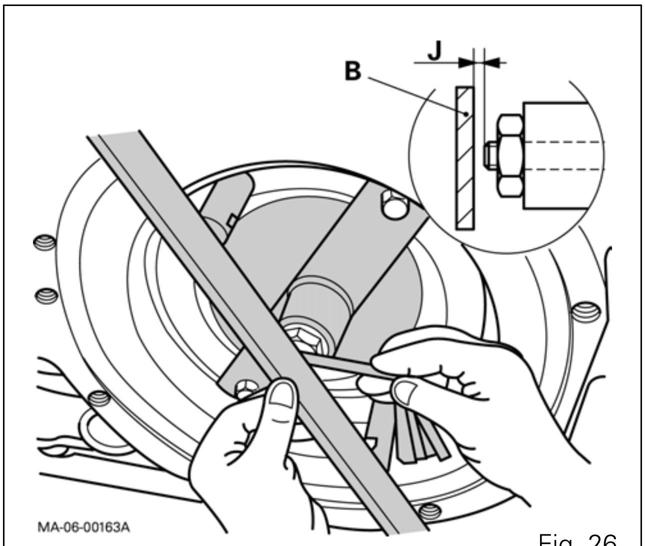


Fig. 26

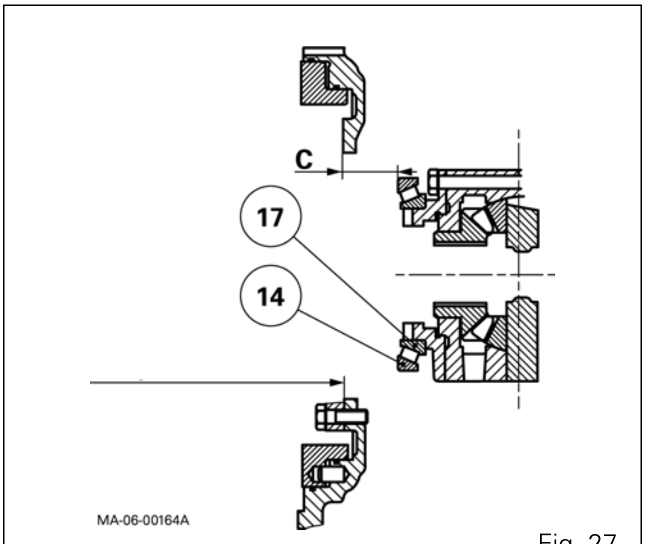


Fig. 27

96. On flange (9), measure dimension "**Y**" using a depth gauge and a ruler (Fig. 28).

97. Select the thickness "**E**" of the deflector (13) and shim (49) (if used) (see table) to obtain:

E = P2 + (C - Y)

NOTE: *To carry out "**P2**" shimming, nine different deflector thicknesses are available.*

NOTE: *If possible, shim to the maximum tolerance.*

98. Remove the shimming tool and cup (14).

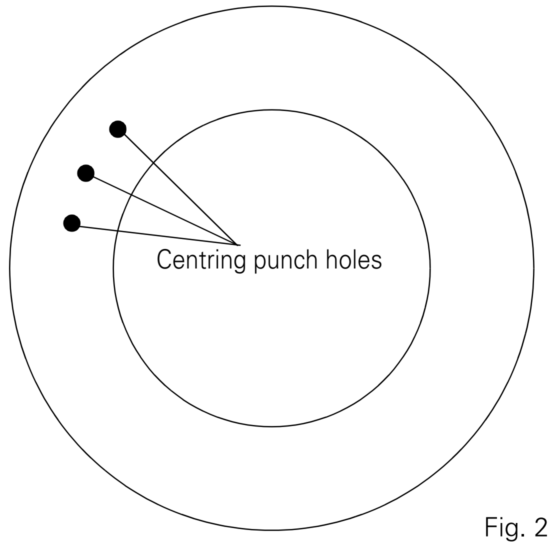


Fig. 29

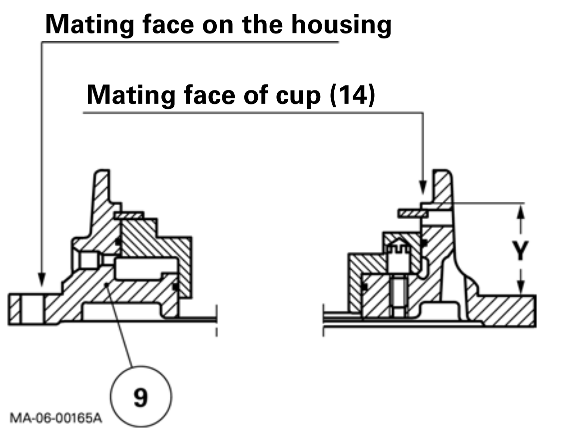


Fig. 28

	Reference	Number of centring punch holes (Fig. 29)	mm
Deflectors	187,689 M2	0	0,73 - 0,78
	892,173 M2	1	0,864 - 0,914
	892,172 M2	2	0,991 - 1,041
	892,171 M2	3	1,118 - 1,168
	892,170 M2	4	1,245 - 1,295
	191,124 M2	5	1,37 - 1,42
	191,125 M2	6	1,49 - 1,54
	521,401 M2	7	0,61 - 0,66
	1 686 054 M2	8	0,50
Shim	3794403H1	-	0,70

99. In flange (9), place deflector (13) and shim (49) (if used) selected during operation 97, and bearing cup (14).

NOTE: *The shim (49) (if used) must be placed between flange (9) and deflector (13). Ensure correct direction of assembly of the deflector (Fig. 30).*

100. Refit flange (9). Carry out final operations in § D.

101. Fit the pipe (40).

102. Check the backlash (see § K).

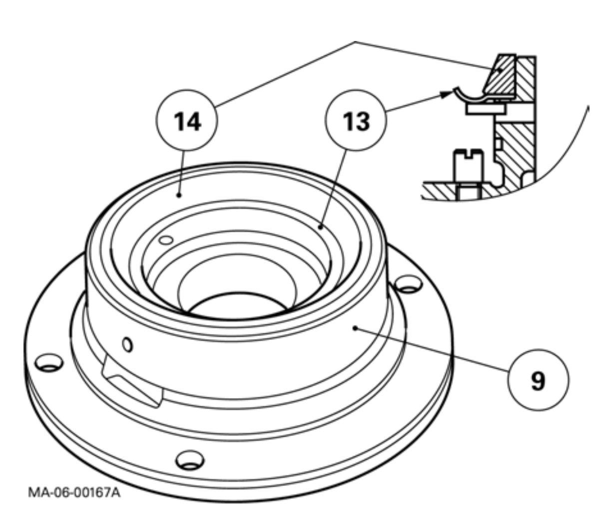


Fig. 30

K . Adjusting and checking the backlash

Reminder

- The backlash between the ring gear and drive pinion ensures reliability of the bevel gear and the correct operation of the assembly.
- This clearance must be checked or adjusted after:
  - adjusting the bevel gear distance
  - shimming the differential unit.

Preparation

103. Remove the differential assembly (see § E).

104. Using a standard reversible flange extractor, remove bearing cup (27) (Fig. 31).

Pre-adjustment

105. Prepare a thickness of shims (38) of 0.30 mm.

NOTE:

- *Do not take into consideration the DC (ring gear offset, e.g.: -0.20) embossed on the external diameter of the ring gear after the pairing number (Fig. 31).*
- *The pre-adjustment can be followed by an adjustment, if the backlash is incorrect during the final check.*

106. Place the previously prepared shim(s) in the cavity of half housing (29). Lubricate and insert cup (27) (Fig. 31).

107. Refit and shim the differential assembly unit (see § J).

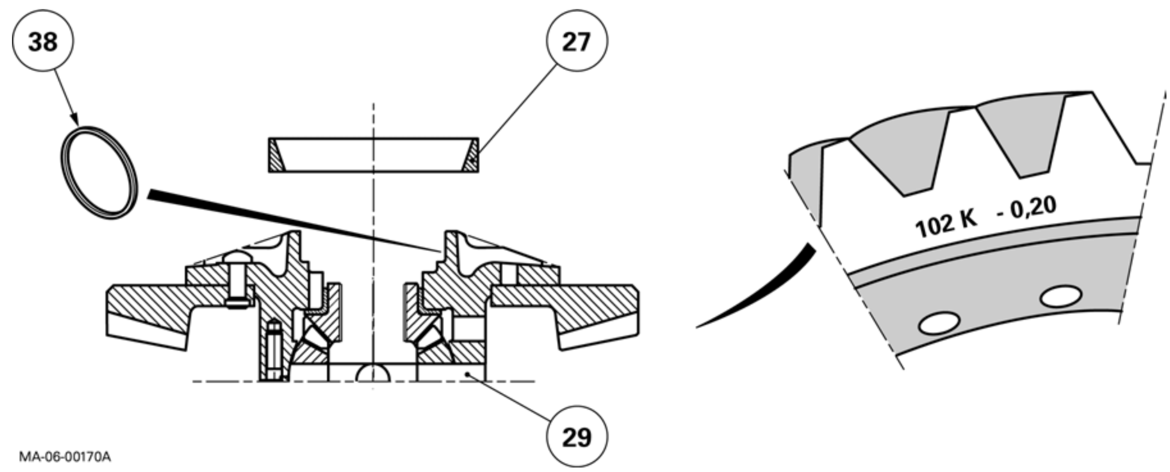


Fig. 31

Checking J2 backlash

J2 = 0.15 to 0.40 mm

108. Place the dial gauge feeler pin half-way along a ring gear tooth (Fig. 32).

109. Check that the backlash remains between 0.15 and 0.40 mm. Carry out this check at three points of the ring gear separated approximately by 120°.

IMPORTANT:

- *If the backlash is incorrect, select and fit a new thickness of shim(s).*
- *Then offset the ring gear (23) in the desired direction, by increasing the value of shims (38) and by reducing by the same amount the value of the deflector (13) or vice versa, in order to obtain the required backlash, without modifying the differential unit preload.*

NOTE: *If possible, set J2 backlash to its minimum value.*

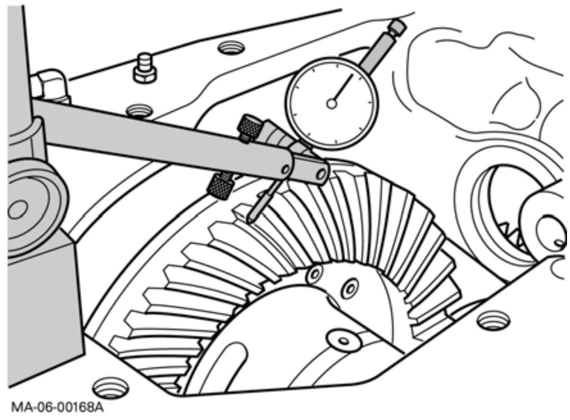


Fig. 32

Final operations

110. Refit the handbrake mechanism assembly (see section 6).

NOTE: *The plate (5) is rectangular. It must be positioned horizontally, along its length, so that the shaft (6) is correctly positioned in the link (13) (Fig. 33).*

111. Refit the pinion (2) (if fitted) and circlip (1) (Fig. 34).

112. Refit the left-hand side cover (see section 9).

Fit the handbrake control support, the GSPTO support (if fitted on the cover), remove the guide studs, fit and tighten the screws to a torque of 72 - 96 Nm.

113. Position the control link and adjust the handbrake mechanism (see section 6).

114. Refit the right-hand hydraulic cover (see section 9).

115. Refit the intermediate shaft, the driving pinion and the 3rd point hitch support.

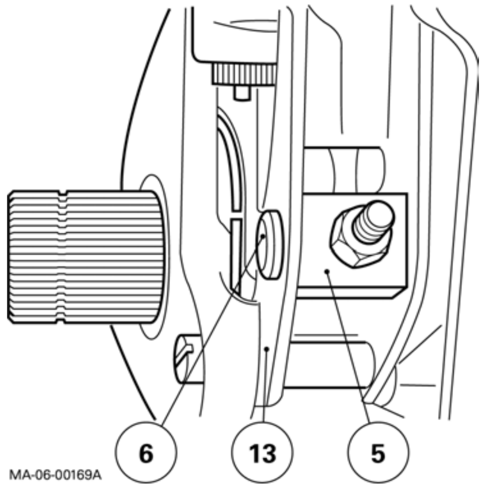


Fig. 33

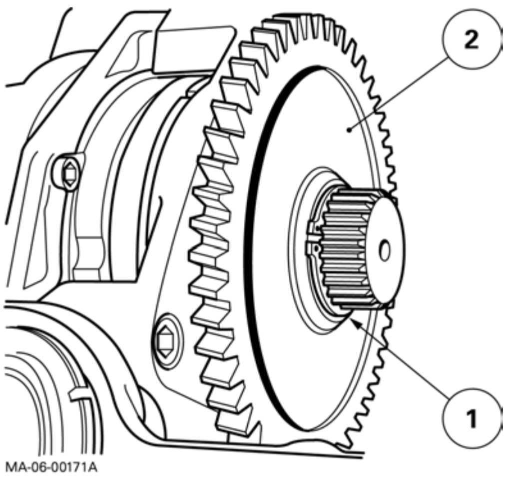


Fig. 34

116. Refit the lift cover and brake pistons (see section 6).
117. Refit the left- and right-hand trumpet housings (see section 6).
118. Refit the stabiliser supports.
119. Refit the hitch support (see section 6).
120. Refit the wheels. Tighten to a torque of 400 - 450 Nm.
121. Couple the tractor between the gearbox and rear axle.
122. Top up the oil level in the housings and check it on the gauge located at the rear of the rear axle. Remove the safety chocks. Refit the body (if removed).
123. Prepare for service. Bleed the main brakes and trailer brake (if fitted) (see section 9). Carry out a road test. Check the correct operation of controls and electrical circuits.
124. Check the oil tightness of the trumpet housing mating faces with the housing, covers and hydraulic unions.

L . Service tools

Tool available in AGCO SA network

- 3376 847 M91 - Shimming tool (Fig. 35)

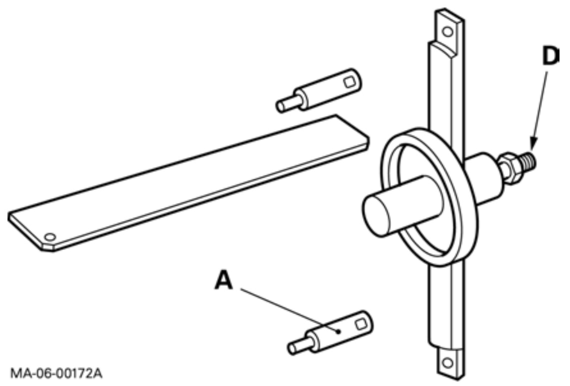


Fig. 35

06F01 - GPA20 hitch / Linkage

CONTENTS

A . General

The lift cover is fitted on the upper face of the rear axle housing. Via two bushes (8), it supports the shaft (4), which has the two lift arms (5) (11) splined to it.

A cam (9), screwed on the shaft, inside the cover, shows the different positions taken by the lift arms. This information is recorded and sent by a sensor (26) to the Electronic Linkage Control (ELC) system.

To ensure correct clearance between the lift arms and the cover, shims (12) are fitted on the left-hand end of the shaft.

Two friction washers (30) are fitted between the lift arms and the linkage cover to avoid their direct contact.

The rear face of the linkage cover supports the auxiliary spool valves. The ground speed sensor (15) is screwed in the front of the cover, which also supports the 4-speed PTO control linkage (21), if fitted.

Parts list

(1) Washer
(2) Screw
(3) Lockwasher
(4) Lift shaft
(5) Right-hand lift arm
(6) Nylon ring
(7) O'ring
(8) Ring
(9) Cam
(10) Lift cover
(11) Left-hand lift arm
(12) Shim(s)
(13) Ring
(14) Set screw
(15) Ground speed sensor
(16) Nut
(17) Cup plug (2-speed PTO)
(18) Screw (4-speed PTO)
(19) Control finger (4-speed PTO)
(20) O'ring (4-speed PTO)
(21) Linkage (4-speed PTO)
(22) Screw (4-speed PTO)
(23) Elbow union
(24) Screw
(25) Nut
(26) Position sensor
(27) Cup plug (version without linkage)
(28) Threaded plug (version without linkage)
(29) Seal
(30) Friction washers

Overall view

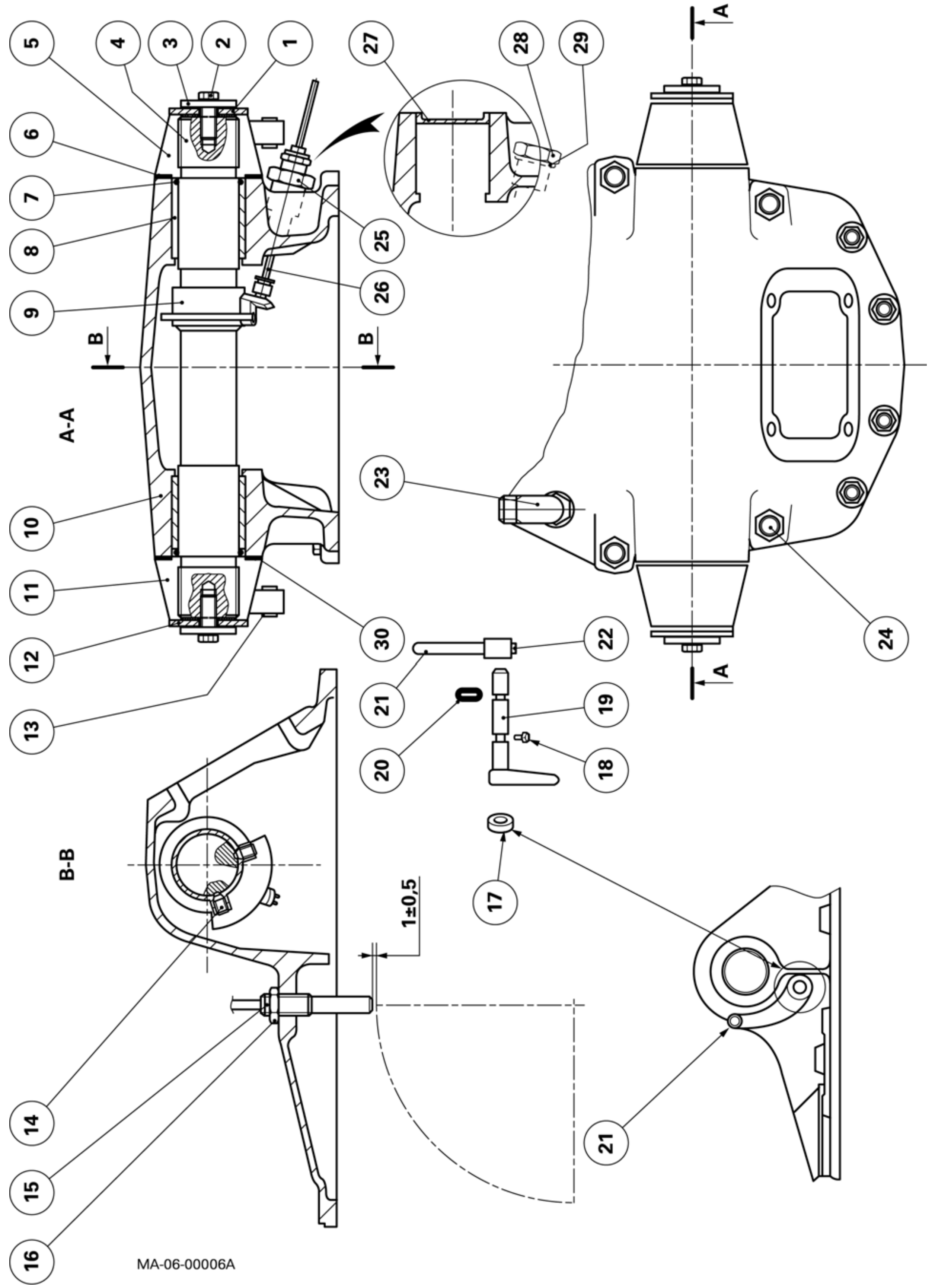


Fig. 1

Exploded view

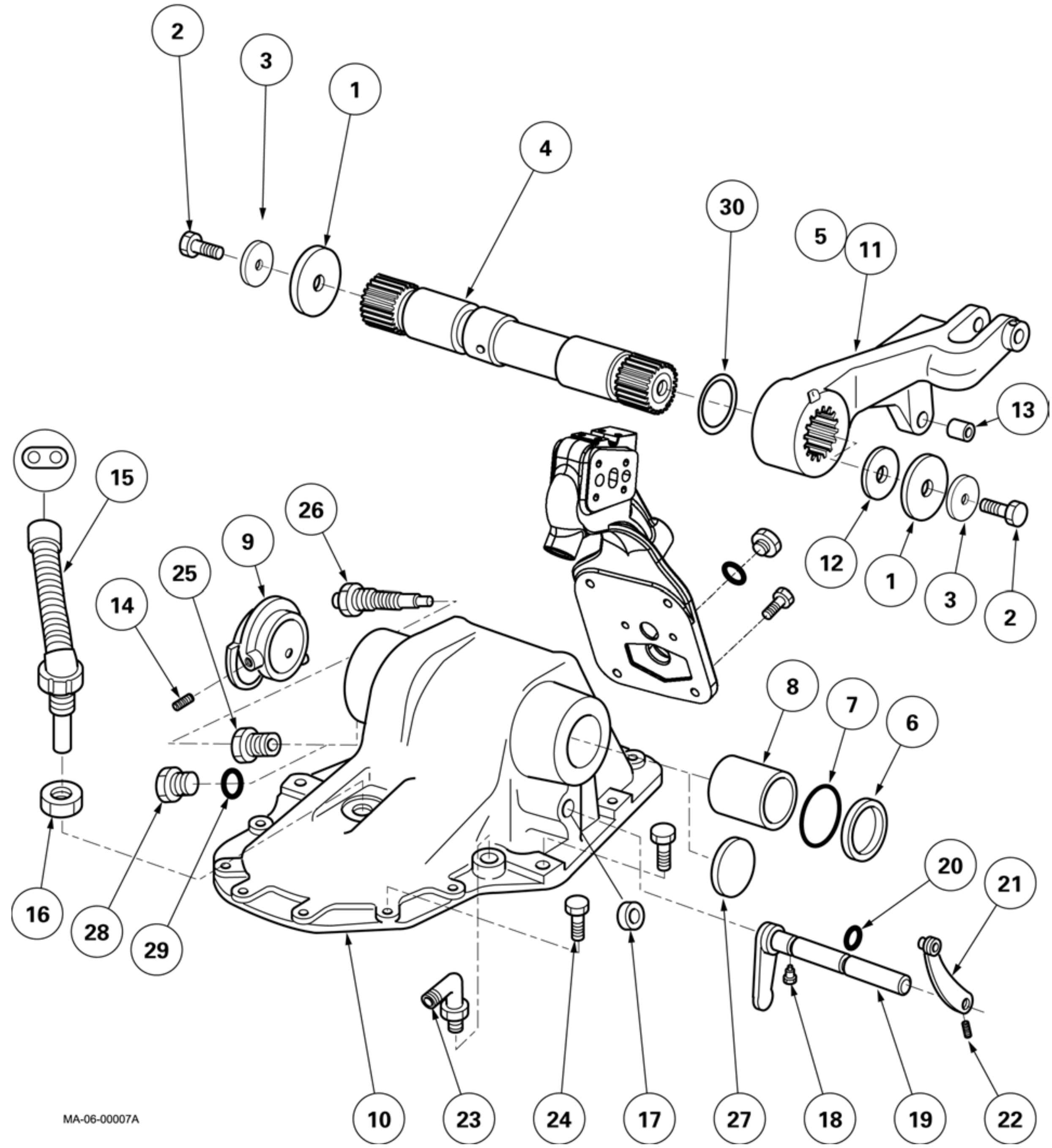


Fig. 2

B . Removal

1. Remove (Fig. 3):
   - the trailer electronic connector (1),
   - the spool valve control cables (2),
   - the hydraulic unions connected to the spool valves (3),
   - the trailer brake take-off an dits support, by loosening the unions at both ends (Fig. 4),
   - the lift rams supply pipes,
2. Disconnect (Fig. 1 and Fig. 2)
   - the ground speed sensor harness (15),
   - the position sensor harness (26),
   - the PTO control cable 4-speed PTO, if fitted).
3. Remove the four screws from the spool valve support.
4. Remove the spool valve support with the spool valves.
5. Remove the upper pins from the rams and lift rods.
6. Remove the attachment screws (24) from the lift cover (10).
7. Sling the cover and remove it.

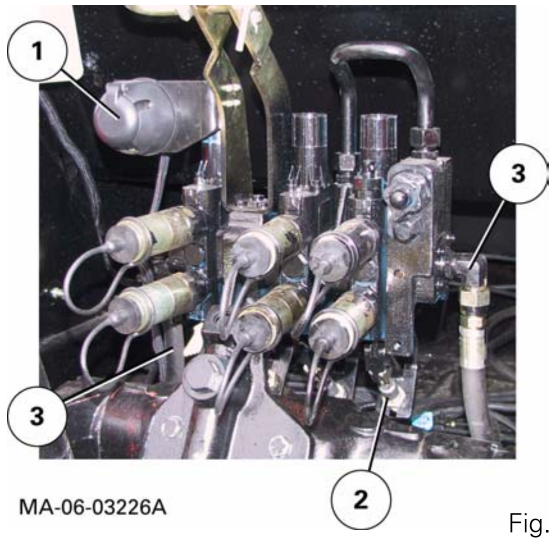


Fig. 3

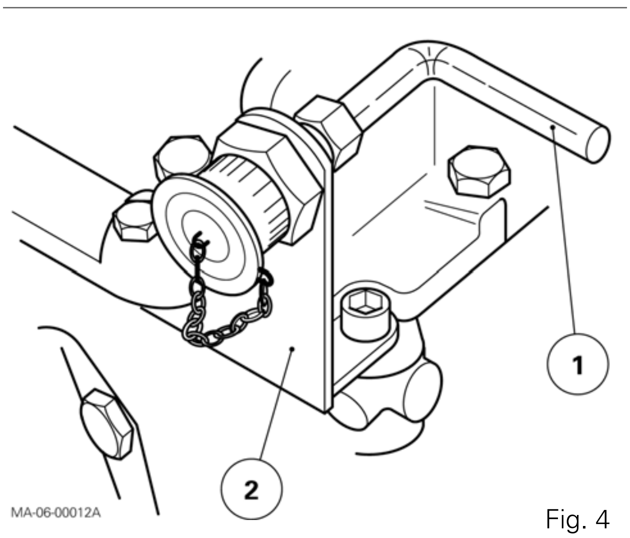


Fig. 4

C . Disassembly

8. Place the cover on a workbench.
9. Remove the elbow union (23).
10. Unscrew the nut (16) and remove the ground speed sensor (15).
11. Unscrew the nut (25) and remove the position sensor (26).

For tractors fitted with 4-speed LSPTO (Fig. 5), carry out operations 12 to 15.

12. Loosen the Allen screw (22) in the linkage (21).
13. Remove screw (18).
14. Remove the control finger (19).
15. Remove the O'ring (20).
16. Unlock the screws (2) retaining the lift arms.
17. Loosen the screws.
18. Remove the washers (1).
19. Remove shims (12).
20. Remove the lift arms (5) (11) and the washers (30).
21. Remove the nylon rings (6) and the O'rings (7).
22. Remove the set screws (14) from the cam (9).
23. Extract the lift shaft (4) from the cover.
24. Remove the cam (9).
25. Remove the rings (8) (Fig. 6).
26. Remove the cup plug (17) (2-speed PTO).

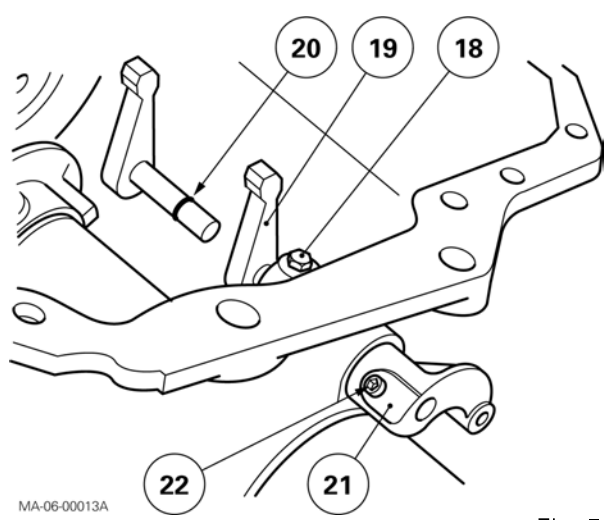


Fig. 5

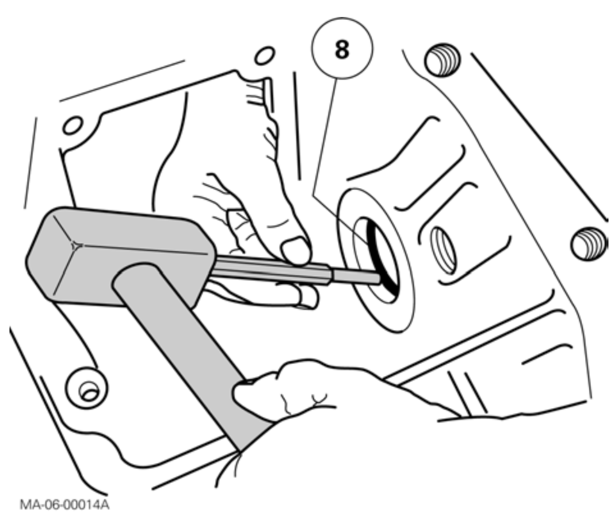


Fig. 6

D . Reassembly

Note: *Fit the rings (13) up against face "A" (Fig. 7).*

27. Check and clean all components. Replace any defective parts.
28. Clean the mating faces of the lift cover and of the spool valve support.
29. Fit the rings (8) home in the cover.
30. Fit the cup plug (17) smeared with Loctite 542 flush with the cover (2-speed PTO).
31. Fit the lift shaft (4) and the cam (9) in the cover (*Fig. 8*).
Note: *Ensure that the direction of the shaft and the position of the cam are correct.*
32. Tighten the set screws (14) smeared with Loctite 241 to a torque of 5 Nm.
Note: *Protect the splines of the shaft. Lubricate the O'rings before fitting (Fig. 9).*
33. Grease the splines of the shaft (4) (Anti-Seize Grease or equivalent).
34. Fit the lift arm (5) (sensor side), the washer (1), the lockwasher (3) and the screw (2).
Note: *Grease the face of the cover (*Anti-Seize Grease or equivalent) before fitting the arms.
35. Tighten screws (2) to a torque of 360 - 470 Nm.

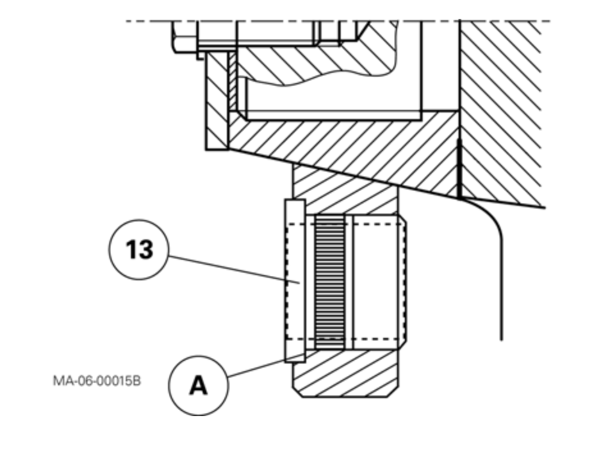


Fig. 7

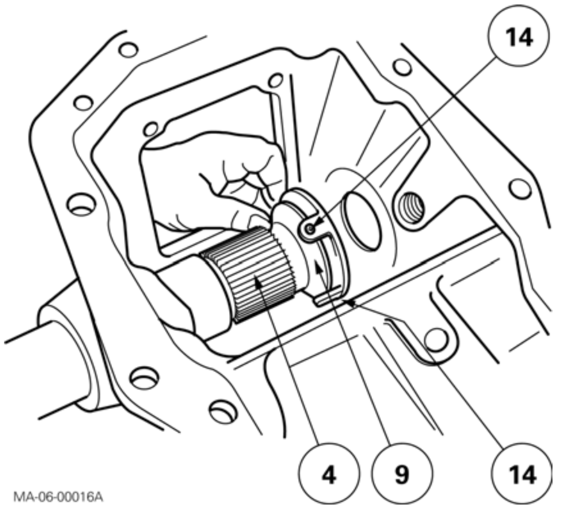


Fig. 8

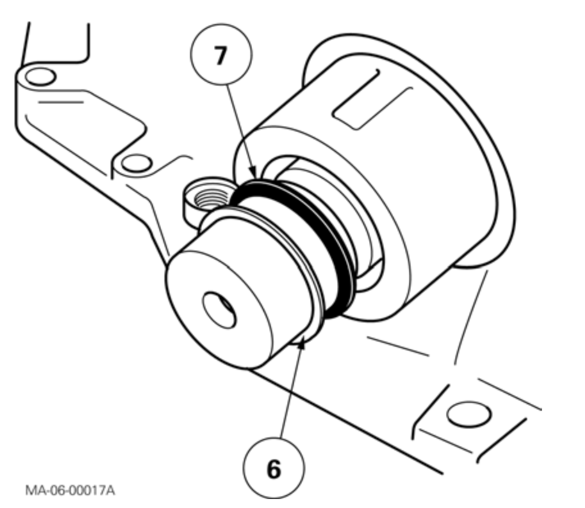


Fig. 9

***Note:** If work has been carried out but it was not necessary to carry out J1 shimming (e.g.: replacement of seals), shims (12) must be fitted at the left-hand end (factory assembly) to secure the cam in the correct position and to avoid adjusting the sensor (26).*

36. Carry out shimming of the shaft (4) (Fig. 11) to obtain end play:

J1 = 0.10 to 0.20 maximum

Fit the arm (11), the washer (1) and the screw (2).

***Note:** grease the face of the cover* (Anti-Seize Grease or equivalent) *before fitting the arms.*

37. Tighten the screw to position the lift arms (5) and (11) correctly on the shaft.

38. Measure the distance between face "**A**" of the shaft and face "**B**" of the arm using a depth gauge (Fig. 10 and Fig. 11).

39. By measuring dimension "**X**", determine the thickness of shims "**Y**" needed to obtain (Fig. 11):

J1 = 0.10 to 0.20 maximum

Y = X + J1

40. Fit the shims (12) selected previously (Fig. 11), the washer (1), the lockwasher (3) and the screw (2).

41. Tighten the screw (2) to a torque of 360 - 470 Nm.

For tractors fitted with 4-speed PTO, carry out operations 42 to 46.

42. Refit the finger (19) (Fig. 12).

43. Fit the O'ring (20) from the external side of the cover (Fig. 12).

44. Smear the screws (18) (22) with Loctite 241 and tighten.

45. Check that the control functions smoothly.

46. Fit the elbow union (23).

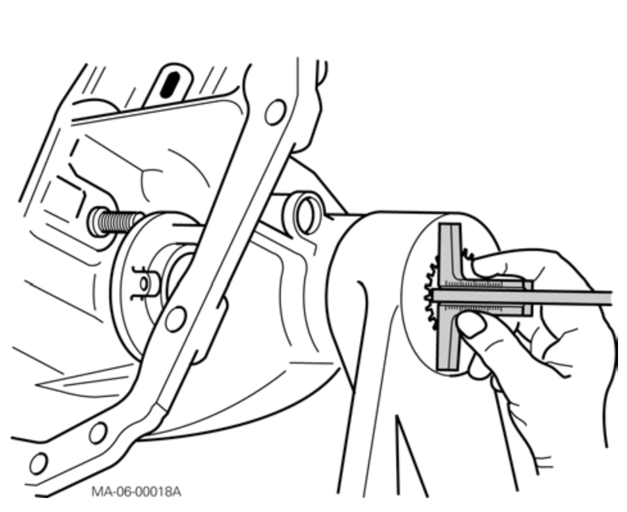


Fig. 10

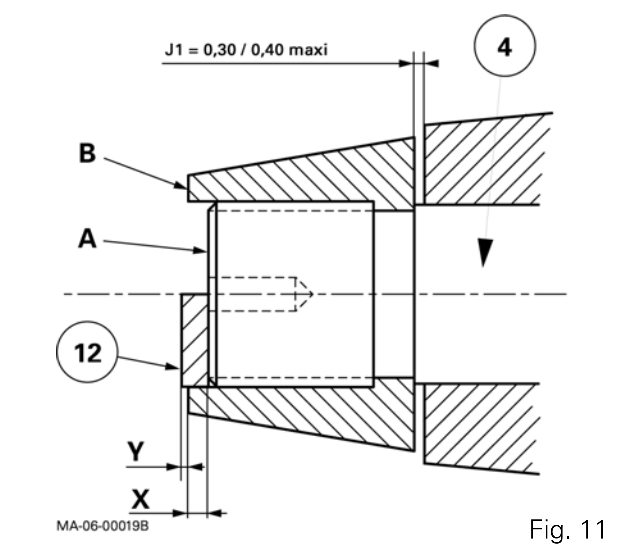


Fig. 11

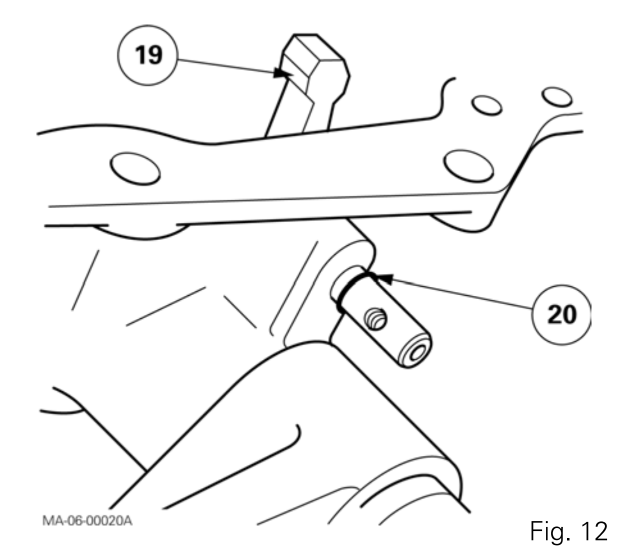


Fig. 12

E . Refitting

47. Clean the mating face of the cover on the rear axle housing.

48. Smear the mating face with a sealing product (Master Joint 510 Loctite or equivalent).

49. Sling the cover and refit it.

NOTE: when refitting the cover, ensure that the differential lock supply tube and the 4-speed PTO control finger engage properly in their respective positions (Fig. 13).

50. Fit the PTO control cable support (depending on the version) and fit the attachment screws (24) on the cover (10). Tighten to the following torque:

- screws Ø 12 = 72 - 96 Nm
- screws Ø 16 = 160 - 200 Nm

51. Refit the upper pins of the lift rams. Refit the trailer brake valve support if fitted. Retighten the tube at both ends.

52. Refit (Fig. 1):

- the feed pipe on the differential lock union (23)
- the control cable (21) (4-speed PTO, if fitted).

53. Fit the ground speed sensor (15) with Loctite 577 Sensor Sealing or equivalent (Fig. 14).

54. Screw home the speed sensor without forcing it until it touches the differential ring gear.

55. Unscrew the sensor 3/4 of a turn to obtain a clearance of approx. 1 mm between the sensor and the ring gear (Fig. 14).

56. Tighten the nut (16) to a maximum torque of 5 Nm (Fig. 14).

57. Connect the sensor harness.

58. Fix the harness with a clip retainer.

59. Clean the mating face of the spool valve support.

60. Smear the mating face of the spool valve support cover with a sealing compound (Master Joint 510 Loctite or equivalent).

61. Refit the spool valve support.

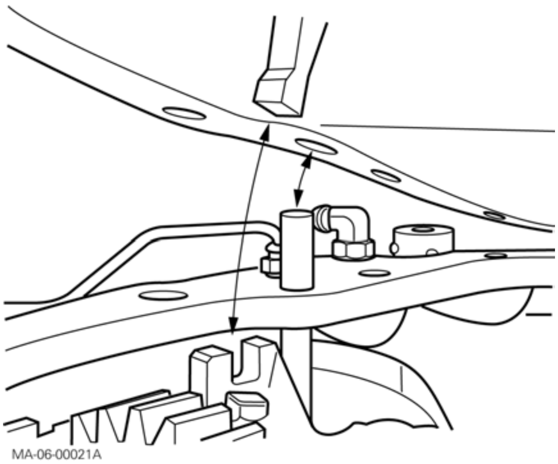


Fig. 13

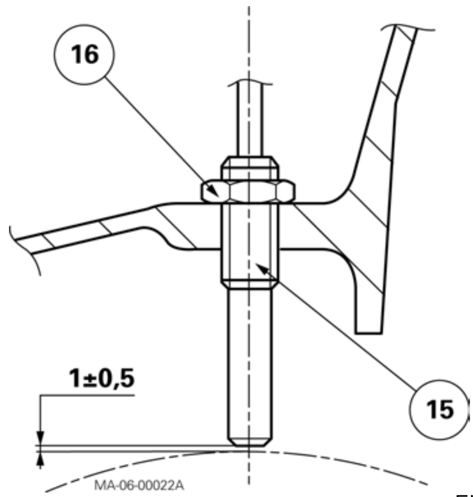


Fig. 14

62. Refit the 4 screws to the spool valve support after smearing their thread with Loctite 510. Tighten the screws to a torque of 50 - 70 Nm.

63. Refit the parts that were removed at operation 1.

64. Adjust the PTO control (4-speed) (see section 7).

65. Smear the thread of the position sensor (26) with a sealing compound (Hylomar or equivalent), then screw the sensor in a few turns.

66. Start the engine.

67. Using the external controls, ensure that the lift arms are in raised position (continuous pumping). Stop the engine.

68. Screw in the sensor (without forcing it) up against the cam (9). Connect the sensor to the female connector using a locally made harness (Fig. 15). Connect the other test harness connector to the tractor harness. Connect terminals 1 and 2 to a multimeter.

Start the engine.

Lower the hitch by 3 to 5 cm between the hook and ground.

Unscrew the sensor to obtain a voltage between **6.92 and 6.96 volts**.

Reconnect the tractor harness.

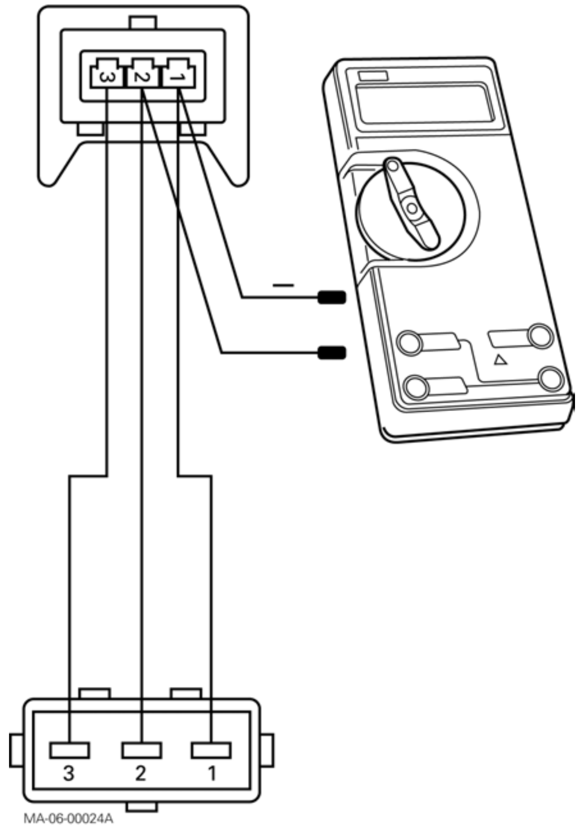
Stop the engine.

69. Tighten the nut (25) to a torque of 25 Nm using a locally made wrench (Fig. 16).

70. Check for tightness of:
- the mating faces of the lift cover and the spool valve support,
- the hydraulic unions.

Version without lift

- The ports of the shaft (4) are plugged with cup plugs (27) sealed with Loctite 542.
- The position sensor (26) is replaced with a threaded plug fitted with a sealing ring (29).



1 : Ground
2 : Signal
3 : Sensor power supply 9.5 V

Fig. 15

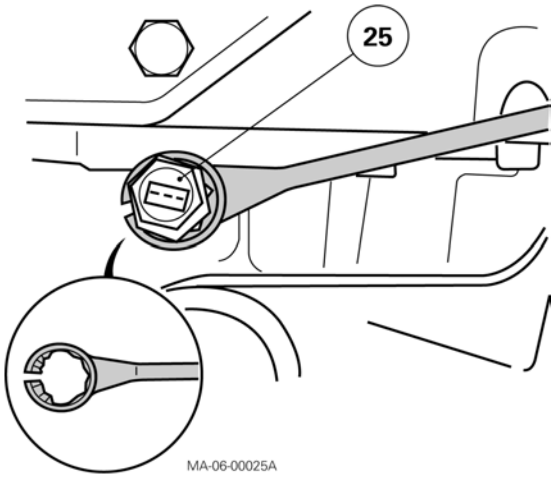


Fig. 16

F . Rear Hitch

The hitch consists of several elements, depending on the country:

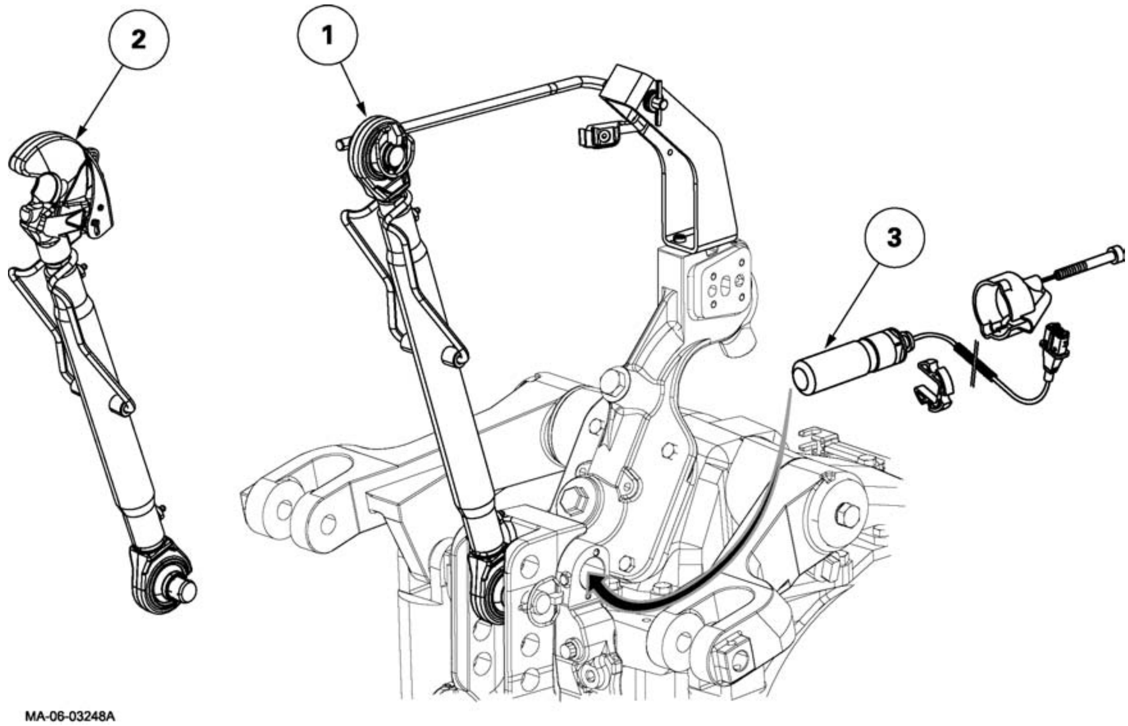
- a hook or ball joint 3-point hitch,
- two lower links with ball joints, automatic hitch or telescopic end-pieces (depending on version),
- two levelling units,
- 2 tube type blades
- a perforated bar

G . Presentation of the hitch

- 3-point hitch (Fig. 17):
  - (1) ball joint 3-point hitch
  - (2) hook 3-point hitch
  - (3) draft sensor
- Levelling unit (4) (Fig. 17)
- Lower drawbars (Fig. 18):
  - (5) hook drawbar
  - (6) fixed ball joint drawbar
  - (7) telescopic drawbar
- Telescopic stabiliser (8) (Fig. 18)
- Perforated bar (Fig. 18)

Special point

For the adjustment of tube type blades, see the Operator Instruction Book supplied with the tractor.



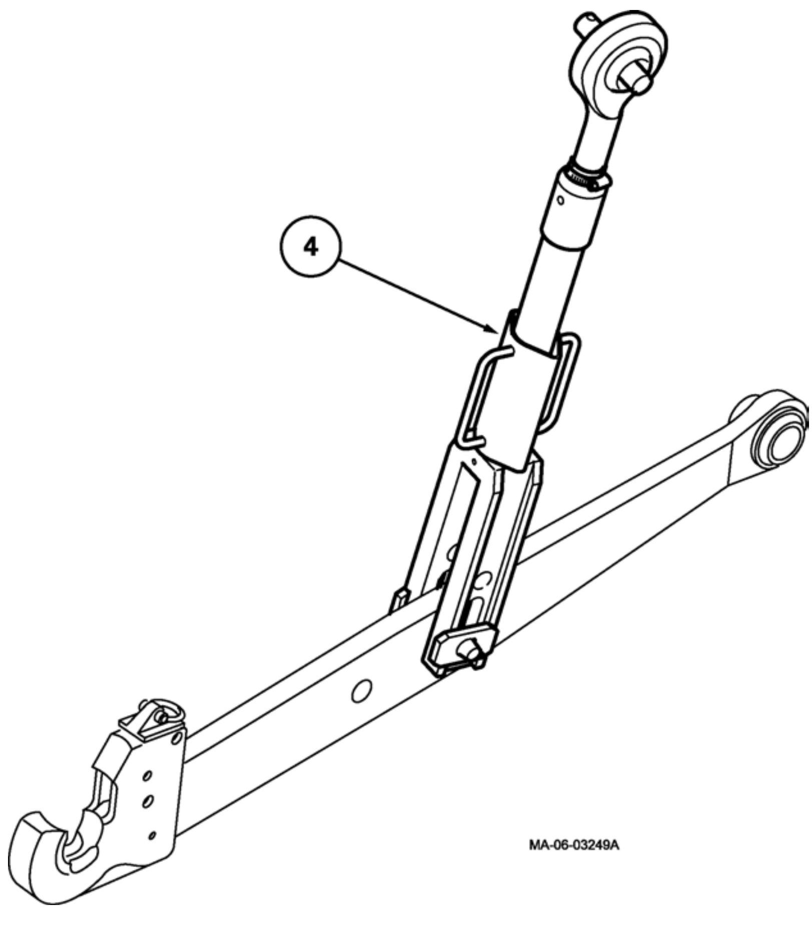


Fig. 17

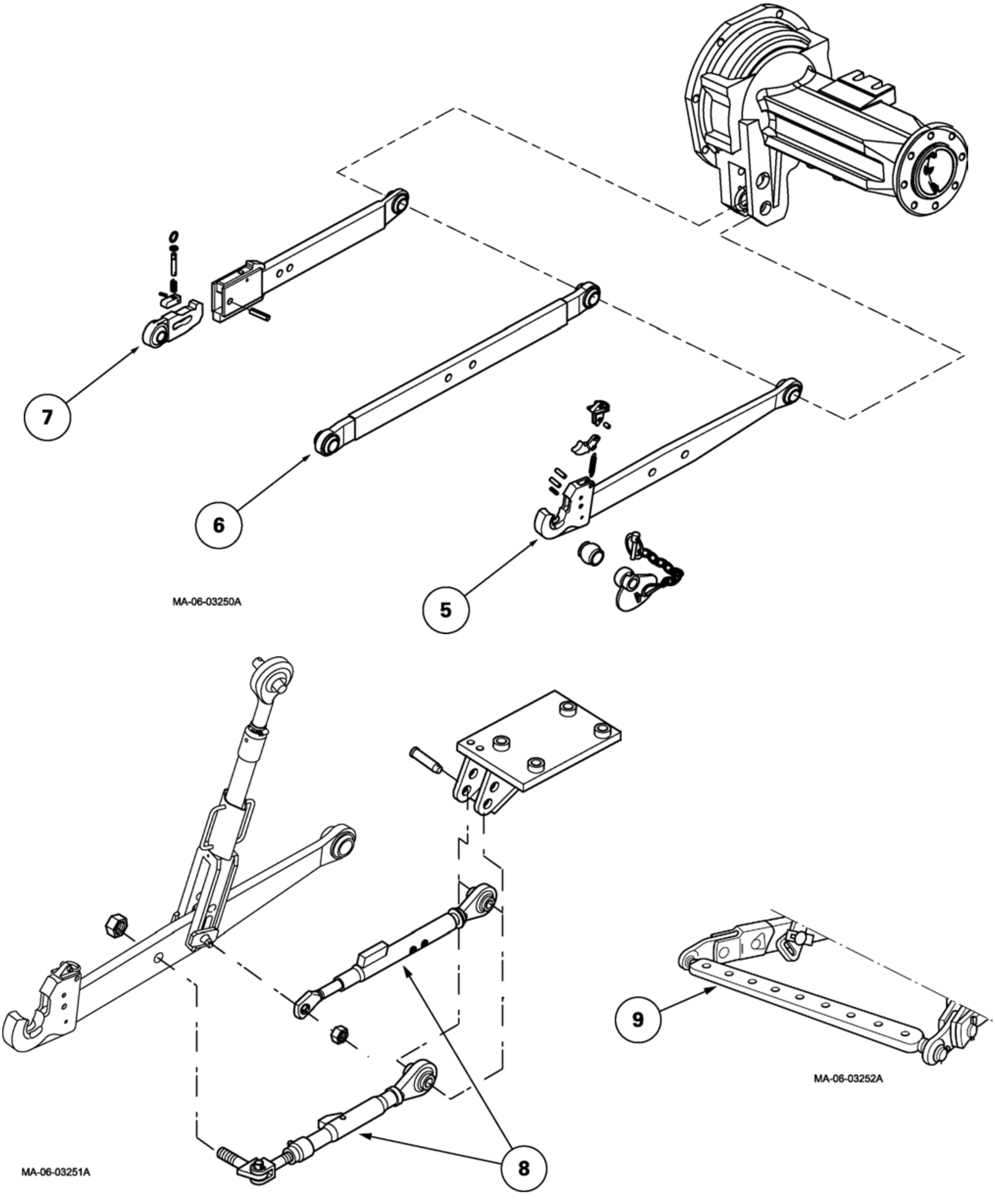


Fig. 18

H . Disassembling and reassembling a lift ram

Preliminary operations

71. Run the engine and lower the lower drawbars to their maximum using the ELC.

72. Disconnect the feed pipe, and remove and drain the ram of its oil.

Disassembly (Fig. 19)

73. Remove the 90° union (1) fitted with its O'ring.

74. Pull the shaft of the ram (5) until the snap ring (4) appears in port O of the union.

75. Insert a screwdriver into this port and while turning the cylinder ram push the snap ring into the V-shaped recess.

76. Remove the ram and the snap ring (4). Drive off scraper seal (2) and sealing ring (3) (systematically discard these three parts).

Reassembly

IMPORTANT: *Carefully clean all components. Replace any components found to be scratched or distorted. In case of jamming or serious scratching of the functional components, replace the hydraulic ram.*

77. Dry all components using compressed air.

78. Lubricate the components with clean transmission oil.

79. Carry out the assembly of the ram. Carry out the operations 72 to 76 in reverse order.

IMPORTANT:

- *Always fit new snap rings and new seals.*
- *Use a suitable fixture to fit the parts home without damaging the seals.*
- *Fit the ram into the ram body with care.*

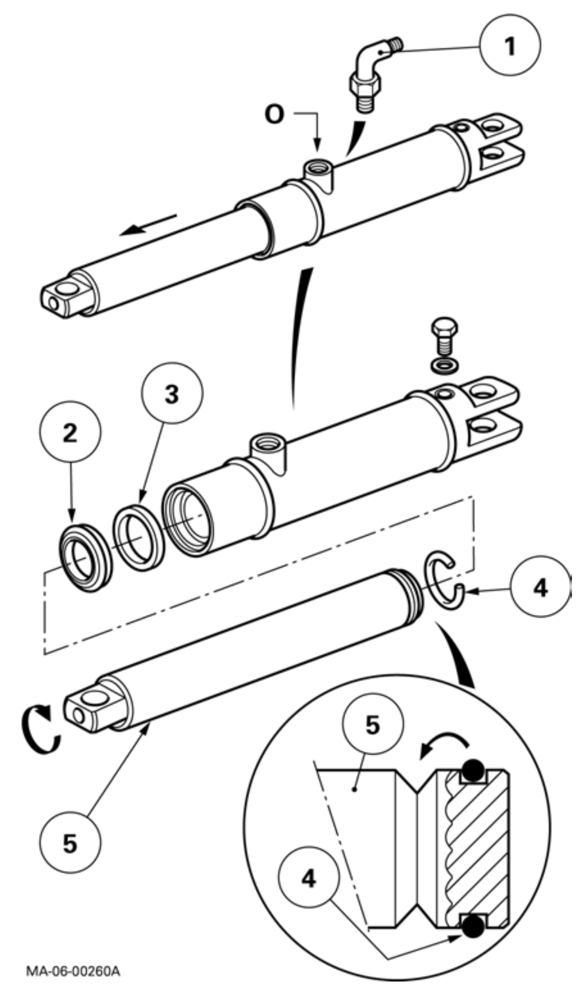


Fig. 19

Final operations

80. Lubricate the upper and lower pins of the ram with "Anti-Seize" grease and refit them. Reconnect the feed pipe.

81. Run the engine. Using the ELC, raise and lower the lift arms to their maximum positions several times.

82. Check that the hitch is operating correctly and that there are no oil leaks around either cylinder or ram.

06G01 - GPA20 hitch hooks

CONTENTS

A . General

Tractor hitches can be attached to different types of hitches or hooks:
- Swinging drawbar (different types)
- Clevis on adjustable scale (different types)
- Closed eye bolt for balanced full trailer
- Pick-up hook

Some equipment can be fitted simultaneously depending on technical possibilities, options and countries.

B . Presentation of the different hitch hooks

(See Fig. 1)

A Hitch bracket with quick-adjusting scale
B Hitch bracket with pin-adjusting scale
C Hitch bracket for SAE swinging drawbar
D Hitch bracket with Dromone pick-up hook
E SAE swinging drawbar
F Swinging drawbar with closed eye bolt
G Standard swinging drawbar
H Roller swinging bar
I Quick-adjust clevis with standard pin
J Quick-adjust clevis with automatic pin (Cramer)
K Clevis for standard hook scale
L Clevis for 20 T hook scale
M Clevis for 6 T hook scale

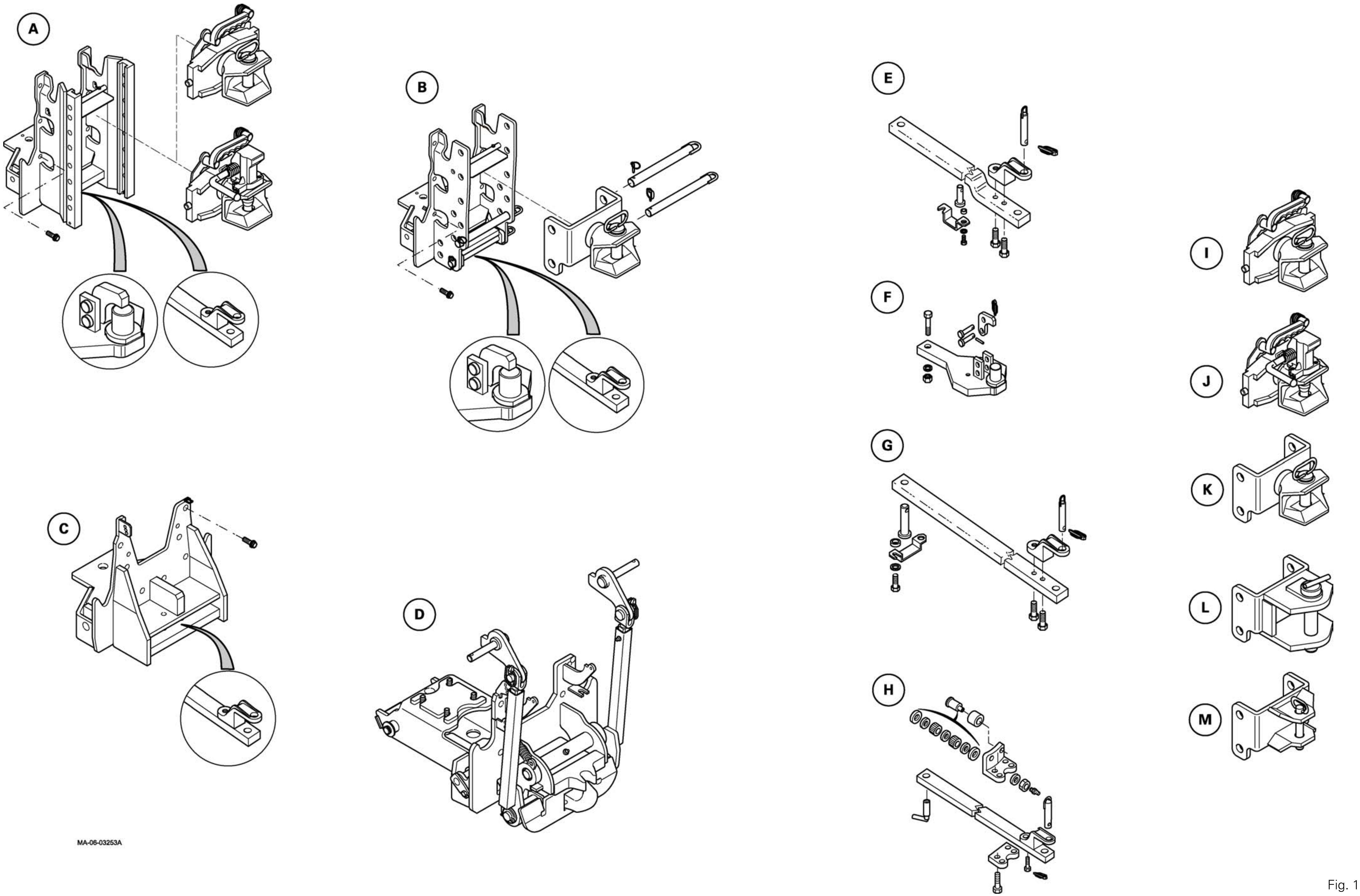
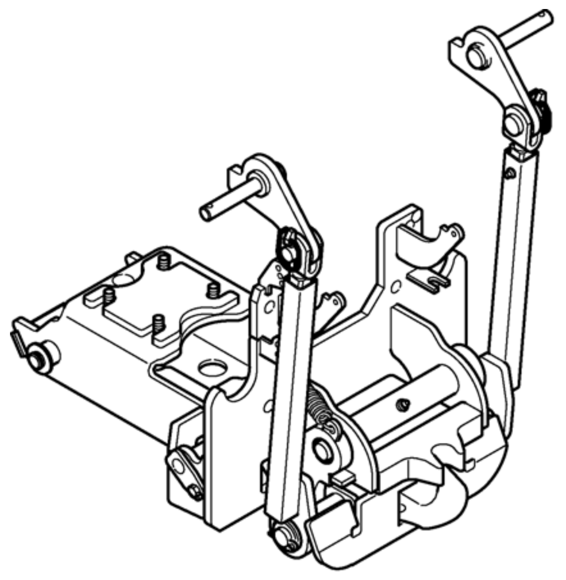


Fig. 1



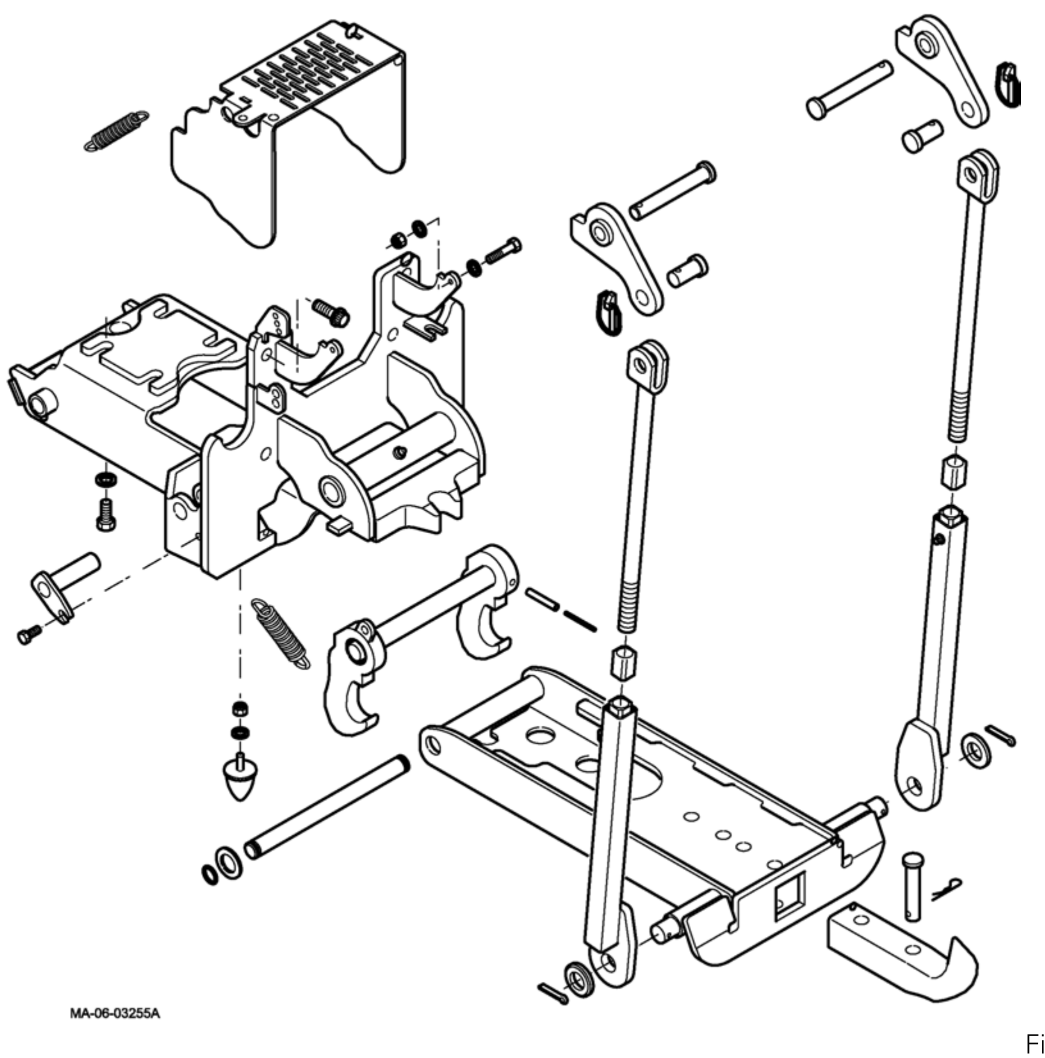


Fig. 2

C . Adjusting automatic hook tie-rods and controls

Adjusting the tie-rods

1. On the bracket, disconnect the lower clevises of the tie-rods and the control cable.
2. Start the engine.
3. Helped by an operator, activate the internal or external lift control (if fitted) so that the lift arms are in the maximum lifting position (continuous pumping).
4. Compress the lower part of the hook along the axis of the tractor, as shown by "F" (Fig. 3) using a trolley jack, in order to obtain a dimension **X** of 6 to 14 mm between the top of the main bracket and the top of the mobile plate (Fig. 4).
5. Adjust the length of the rods by turning their sliding square section (1) in order to engage the clevises on the axle pins (3) of the bracket (Fig. 4).
6. Fit the pins.
7. Remove the jack.
8. Reconnect the control.
9. Check the operation of the mobile plate and the hook lock mechanism using the lever (1) (Fig. 5).

   ***NOTE:** If the lock does not operate correctly, the control must be adjusted.*

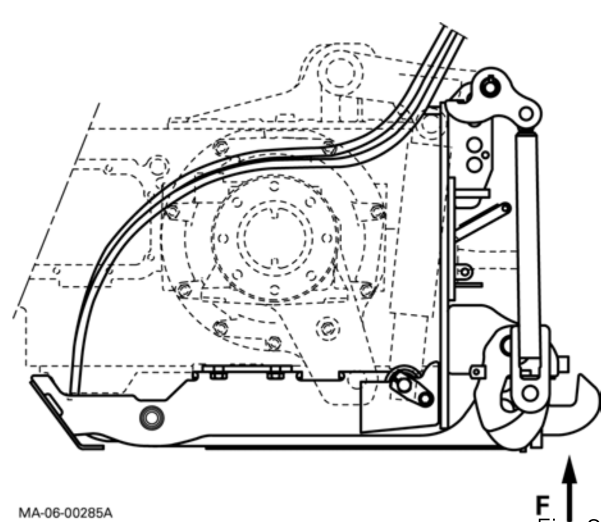


Fig. 3

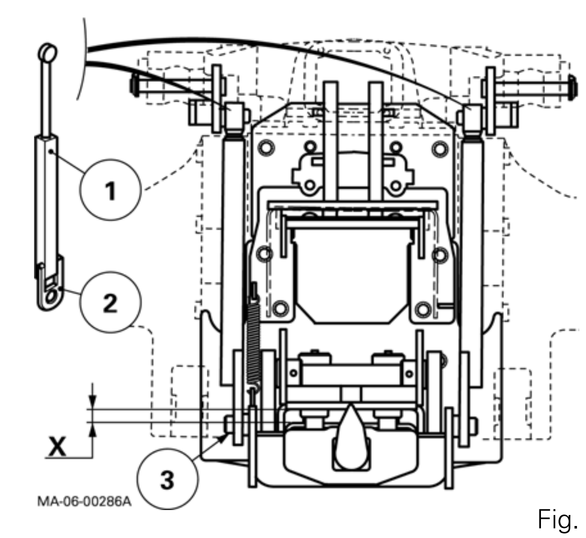


Fig. 4

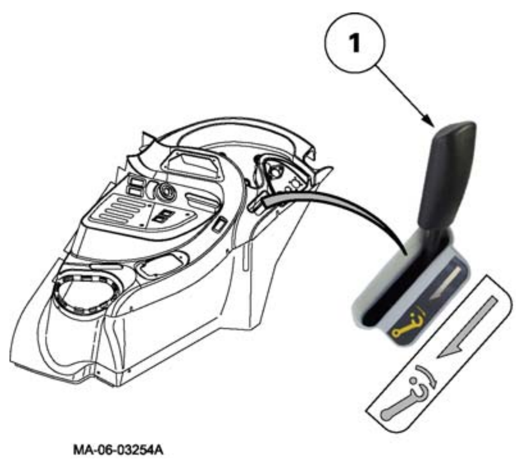


Fig. 5

Adjusting the control

On the lever (Fig. 6)

10. Place the lever (1) in the "neutral" position.

11. Adjust the nuts to obtain the same thread length (2) on either side of the bracket (3).

__Note:__ Check that the cable is not pinched.

On the auto-hitch control (Fig. 7)

12. Screw the clevis (1) flush with the threaded end of the cable (2).

13. Fit the clevis on link B using the clip (3) and check that the link is in the locked position. Tighten nut (4).

14. Assemble the sheath end (5) in the bracket (6) and tighten the nuts (7) (8) so that there is no play in the cable (2) and the cable is not pinched.

__Note:__ During adjustment, ensure that link B remains locked.

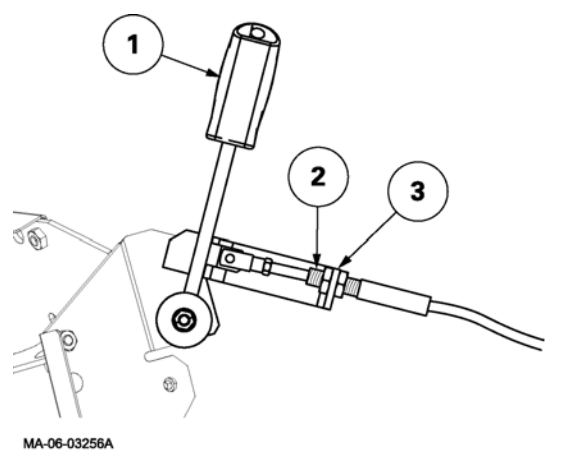


Fig. 6

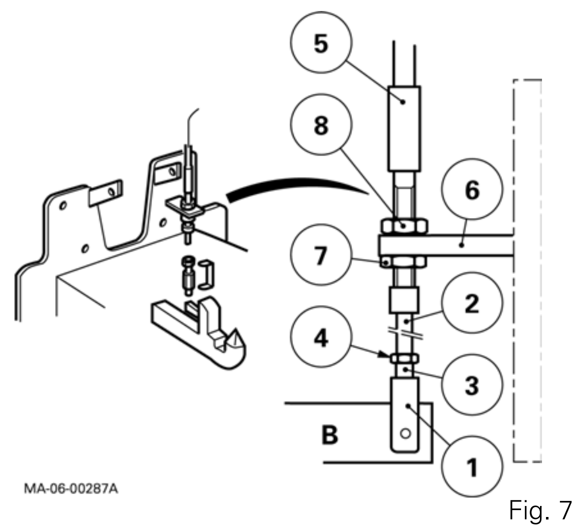


Fig. 7

D . Operating principle of the Dromone retractable hook

Construction (Fig. 8)

The auto-hitch assembly comprises a main bracket (2) attached to the centre housing and a mobile plate (1) that can be raised or lowered via the adjustable tie-rods (3) of the linkage system.

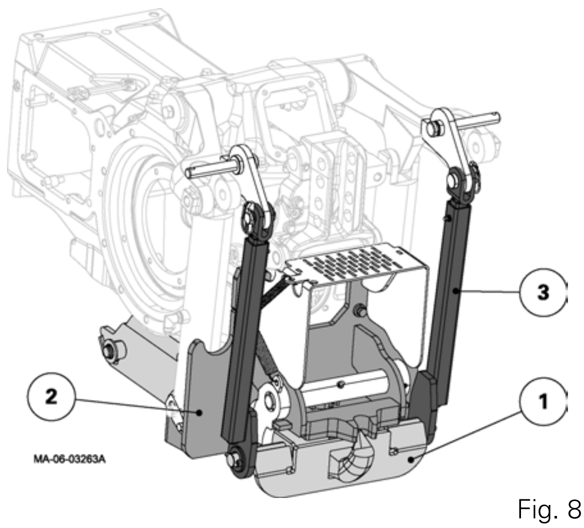


Fig. 8

Operation

Plate lowered

When the system is unlocked by the lever in the cab (Fig. 5), the mobile plate (1) can be lowered to ground level by the linkage system. Once the tractor is in position, the trailer can be hitched on.

Plate raised

In this configuration, the locking safety of the retractable hook is ensured at maximum retraction, with the plate (1) (Fig. 8) previously raised and engaged.

The principle involves two mechanical locks located at the rear of the main bracket. When the previously stated conditions exist, the lock screws enter their respective recesses in the retractable hook and prevent any untimely movement.

NOTE: *When entering the safety position, the locks must audibly click during maximum hook retraction.*

NOTE: *When retracting of the hook, the operator in the driving seat should check that the gear shift and handbrake levers are in neutral position. This facilitates the tractor / trailer hooking manoeuvre and frees it from any constraints.*

NOTE: *Periodically grease the safety lock mechanism and the mobile plate control cable.*

06H01 - GPA20 rear wheels / hubs

CONTENTS

A . General

GPA20 rear axles are fitted with Normal Duty or Heavy Duty trumpets with a flanged shaft. Two rim types are available:

- rims with steel discs, wheel track adjusted by reversing the disc on the brackets
- rims with welded steel discs, wheel track adjusted by reversing the rim and inserting spacers.

B . Description of rear axle wheel assembly

Parts list (Fig. 1)

(1) Axle shaft flange (all ND and HD models)
(2) Spacer for steel wheel with welded disc
(3) Bracket

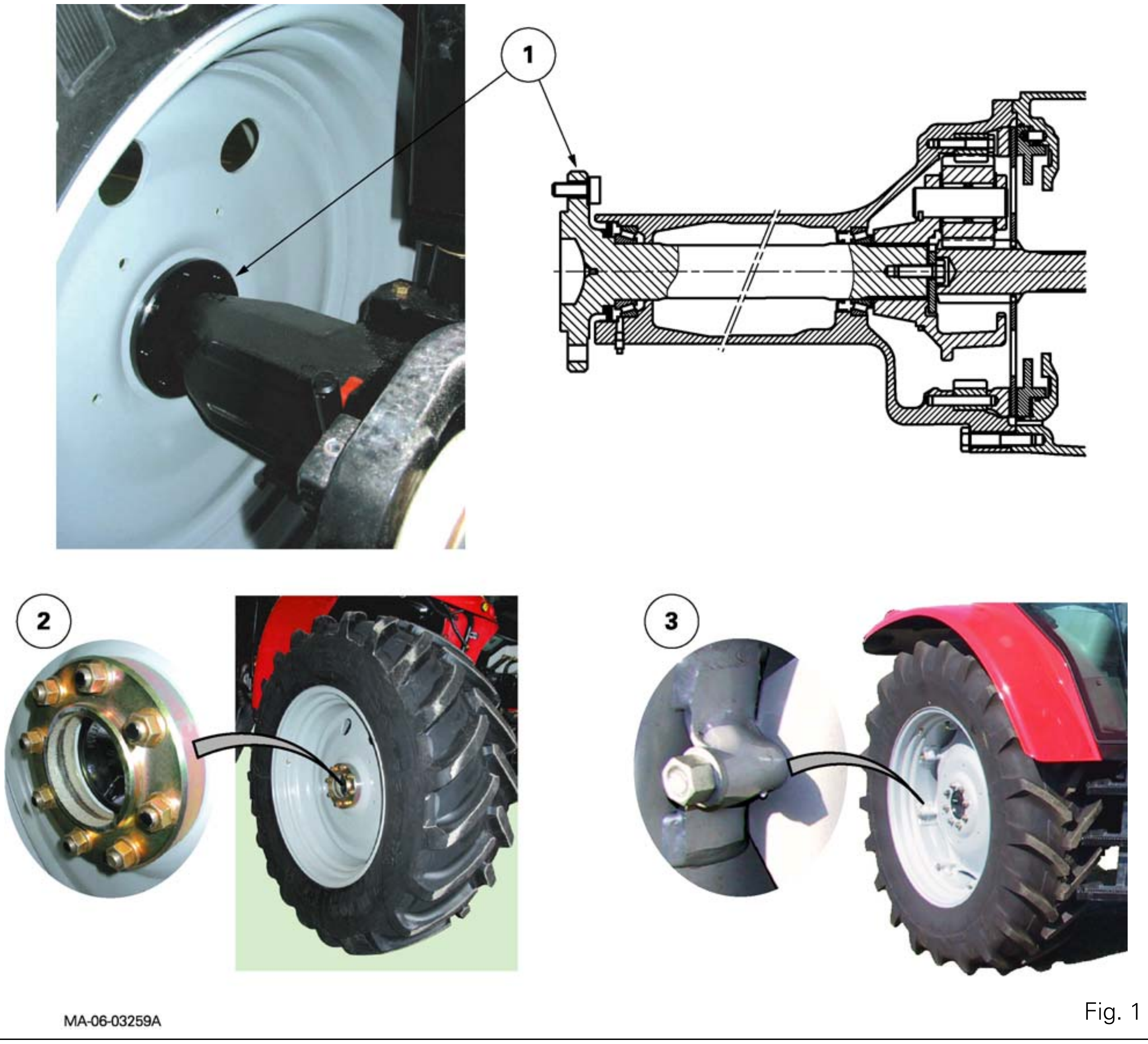


Fig. 1

C . Changing wheel track spacing

Preliminary operation

1. Engage the parking brake in order to immobilise the tractor. Thoroughly chock the front wheels.

Removing the wheel

2. Unlock the wheel nuts (1) (Fig. 2) and lift the relevant side of the tractor.

3. Remove the nuts and the wheel.

Adjustment

4. According to the wheel track required for the flanged shaft, change the position of the rim and/or disc:
- rim with welded disc and spacer: 4 positions (Fig. 2)
- rim with brackets: 8 positions (Fig. 3).

Reminder

The rim spacer (2) (if fitted) can be positioned in different ways (Fig. 2):
- either on the outside of the rim disc,
- or for functional purposes between the shaft flange and the disc.

5. Refit the wheel and tighten the nuts (see §B).

Tightening torques

Rim on hub: 400 - 450 Nm (Fig. 2).

Rim on disc (wheel with brackets): 180 - 250 Nm (Fig. 3).

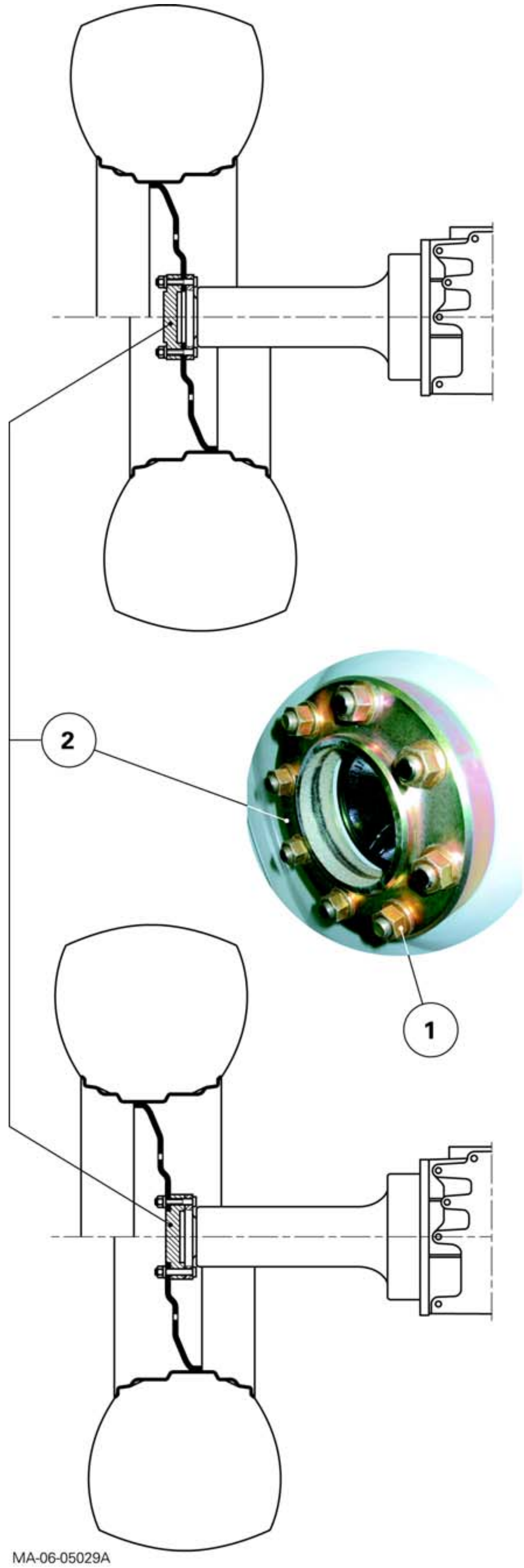


Fig. 2

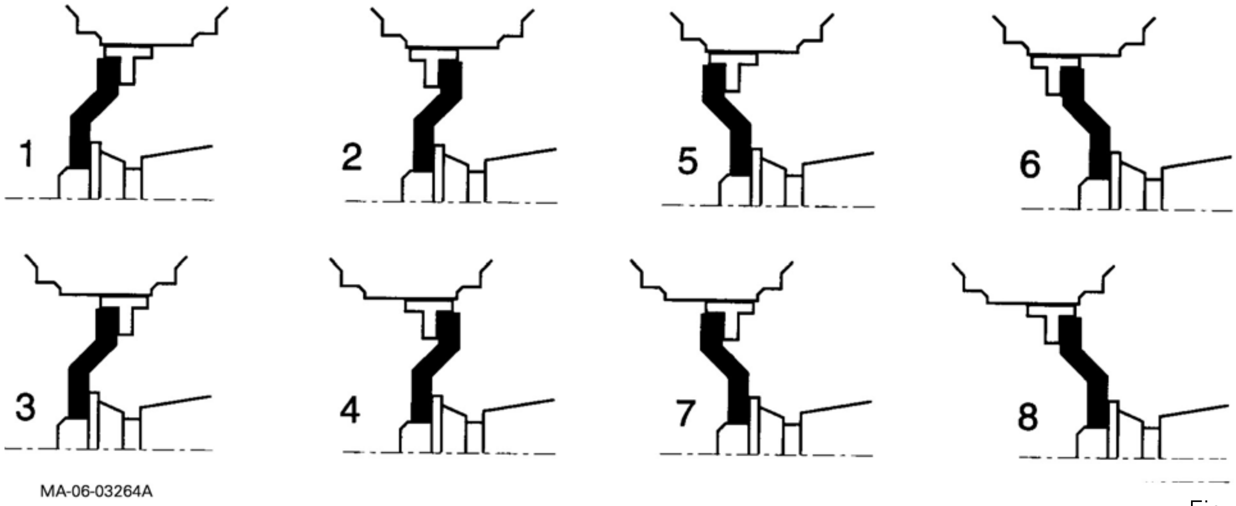


Fig. 3

Tyres / Position		16.9R30	16.9R34 18.4R34 480.70R34	520.70R34	600.65R34	13.6R38 16.9R38 18.4R38 480.70R38	520.70R38 540.65R38 600.65R38
Wheel disc facing inwards	1						
	2	1538				1636	
	3	1626	1626	●		1532	●
	4	1740	1744	●	●	1736	●
Wheel disc facing outwards	5	1824	1824	●	●	1832	●
	6	1928	1942	●	●	2036	●
	7	2026	2026	●	●	1932	●
	8	2140	2144	●	●	2136	●

D . Replacing a wheel stud

6. Drive off the defective stud with the help of a bronze drift and a hammer.

7. Clean the stud and its housing on the flange.

8. Dry using compressed air.

9. Place several drops of Loctite 270 or equivalent on the new stud serration.

10. Place the stud in the flange housing, and use a bronze sledgehammer and suitable hammer to knock it in until its head meets the inside flange of the wheel shaft.

07 - Power take off

CONTENTS

07A01 - General - GPA20 operation

CONTENTS

A . General

Description

- The PTO drive mechanism is fitted in the rear part of the axle, behind the differential. The pinion assembly rests on taper roller bearings supported by the axle housing at the front and by the PTO cover at the rear.
- The assembly is driven by the engine via a shaft that passes through the gearbox primary shaft.

Clutch

- The clutch is located on the upper power take-off shaftline at the front of the centre housing.
- It is supported by two bearings fitted in the housing.

Upper shaftline

- The PTO upper shaftline transmits drive from the engine to the driving pinions, either directly or via a coupler / sliding sleeve allowing to select the economy speeds (depending on version).
- The system is comprised mainly of 2 shafts (3 if economy version):
  - mainshaft
  - secondary shaft
  - layshaft (if economy version).
- **Standard PTO**
  The mainshaft drives a double pinion, which transmits drive to two pinions on the secondary shaft. The PTO speed is selected by securing one of the two pinions to the secondary shaft via internal splines or by coupling (depending on option).
- **Standard and economy PTO**
  The mainshaft drives:
  - either a double pinion via the coupler / sleeve slid forwards, transmitting drive like the standard PTO,
  - or a series of idle-mounted pinions driving the double pinion when the coupler / sleeve is slid to the rear. Drive speed is therefore multiplied, allowing to obtain PTO speeds when engine speed is 1550 rpm.

- The bearings supporting the driving pinion shaft are adjusted with clearance using (a) shim(s) inserted between the rear cup and the removable cover.
- An internal channel system carries lubricating oil to the bearings and drive pinions via an oil gallery in the housing and radial bores in the shaft.

Lower shaftline

- The lower shaftline is supported at the front by a bearing force fitted into the housing, and at the rear by a bearing.
- The lower shaftline output shaft is lubricated at the front bearing by a deflector and by radial bores in the output shaft.
- Shaft tightness is ensured by a lip seal fitted firmly to the rear cover of the housing.
- The PTO shaft type depends on the model:

• **Removable PTO (Fig. 1):** the shaft can be extracted by removing a circlip. Two shafts are available; each one corresponds to a different PTO speed (540/1000 rpm).

The splines of these shafts match with the splines of the 540 and 1000 rpm pinions. Each shaft is driven by the pinion that corresponds with its operating speed.

• **Shiftable PTO (Fig. 2):** the 540 and 1000 rpm pinions are idle-mounted on the PTO shaft. The speed is selected using a coupler located between the two pinions. Depending on the option, the shaft can be a flange shaft (3) holding an end fitting with 6 or 21 splines, or a non-removable shaft (2) comprising a number of fixed splines.

These criteria clearly change according to the implement to be fitted and the rotational speed to be used.

Power take-off brake

- The rear power take-off is equipped with a brake located in the rear housing (see chapter 7).

Proportional PTO

- The GSPTO is driven by a shaft coupled to the front axle clutch by a sliding sleeve. This shaft then drives the 540 rpm pinion on the lower shaftline.
- The sleeve sliding on the splines secures the front axle clutch shaft or allows it to rotate freely.

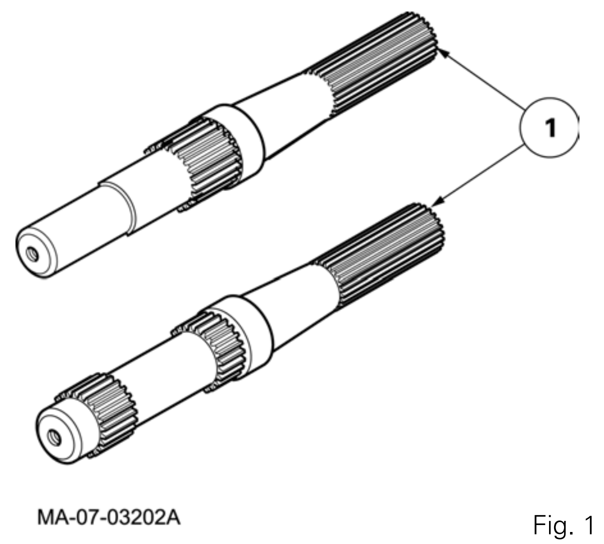


Fig. 1

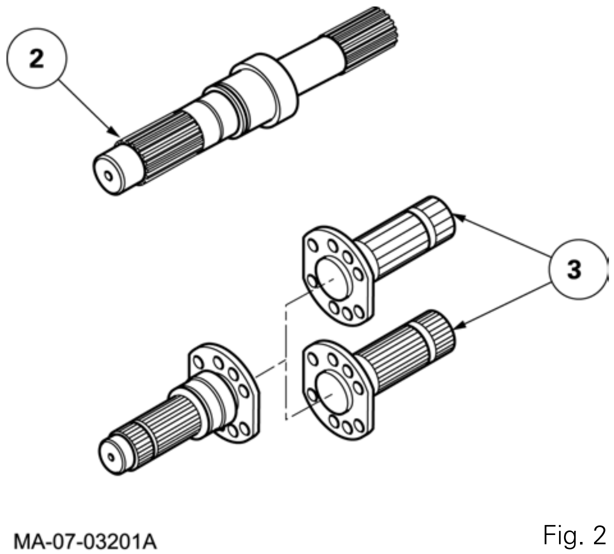


Fig. 2

B . Existing power take-off types

Removable PTO

- The drive shaft is secured to the double driving pinion.
- The ratio is chosen by changing the PTO output shaft, which is provided either with splines to be driven by the 540 rpm pinion or with splines to be driven by the 1000 rpm pinion. When the 1000 rpm pinion drives the shaft, the 540 rpm pinion turns idle on the shaft.
- The shaft used for the 540 rpm speed has 6 splines. The shaft used for the 1000 rpm speed has 21 splines.
- The PTO brake acts on the rear bearing cup of the double driving pinion.

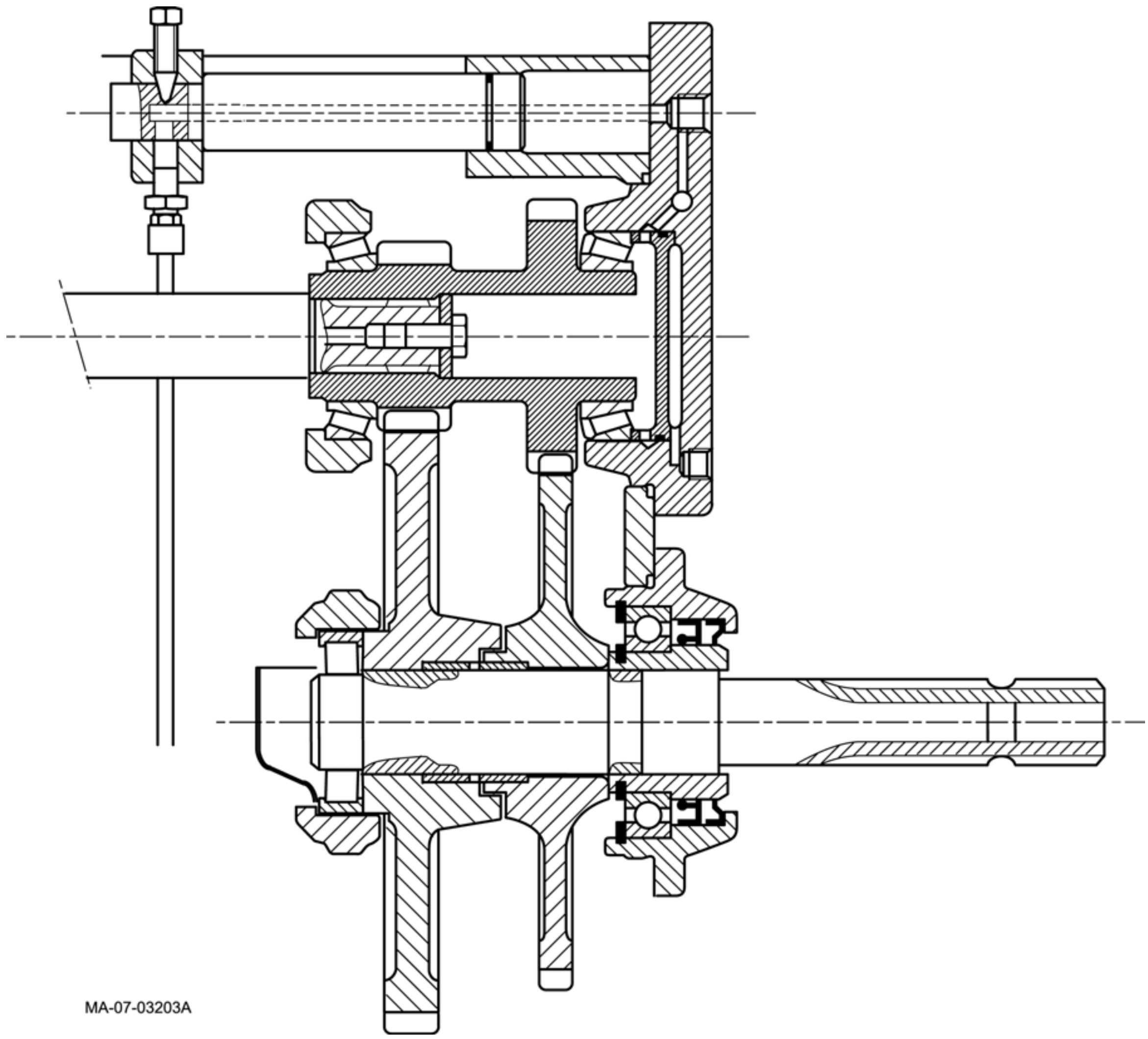


Fig. 3

Shiftable PTO

- The drive shaft, linked to the PTO clutch, is integral with a sleeve / coupler which selects the standard or economy speeds.
- The double drive pinion drives both the 540 and 1000 rpm pinions. These pinions are then secured to the PTO output shaft by a coupler.
- The PTO brake acts on the rear bearing cup of the double driving pinion.

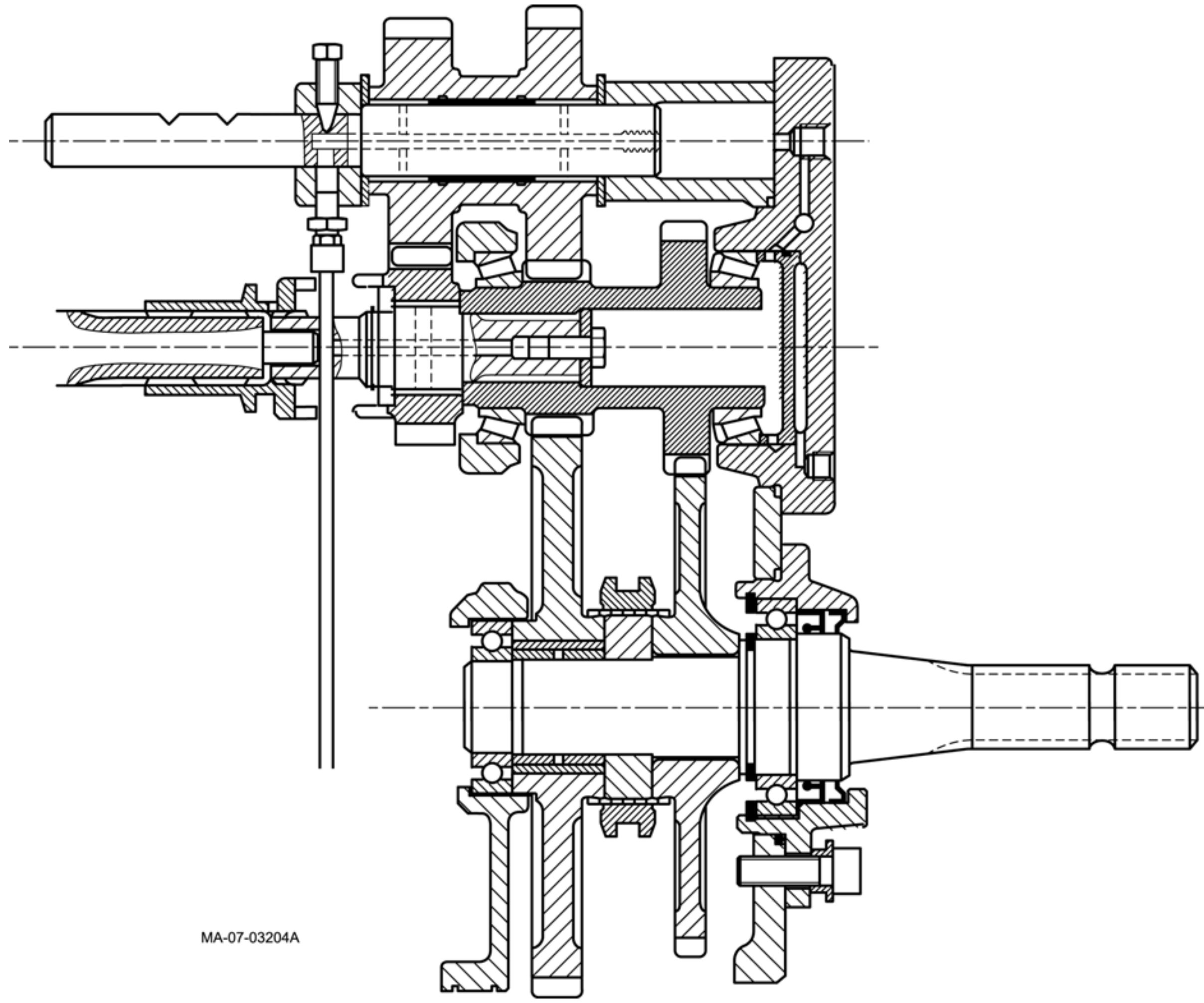


Fig. 4

Shiftable PTO and flange shaft

- Operation is the same as for the shiftable PTO.
- The PTO output shaft has an interchangeable end fitting to adapt the number of splines to the requirements of the drawn implement (6 or 21 splines).

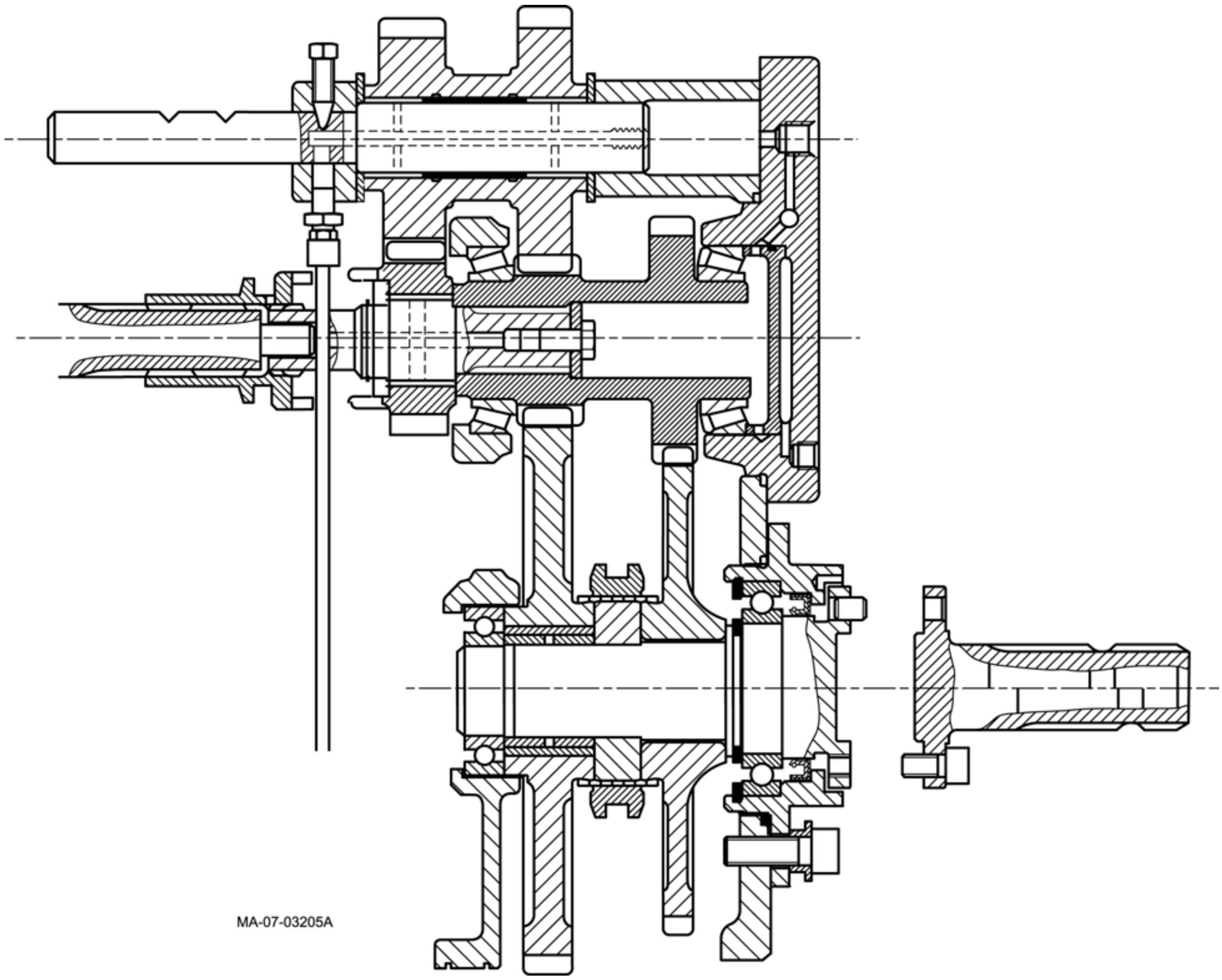


Fig. 5

Economy power take-off (LSPTO)

- LSPTO mode is selected by moving a sleeve / coupler. Drive is no longer transmitted directly to the double pinion, but via an intermediate pinion.
- The ratio of the additional double pinion allows to obtain PTO speeds when the engine speed is 1550 rpm.

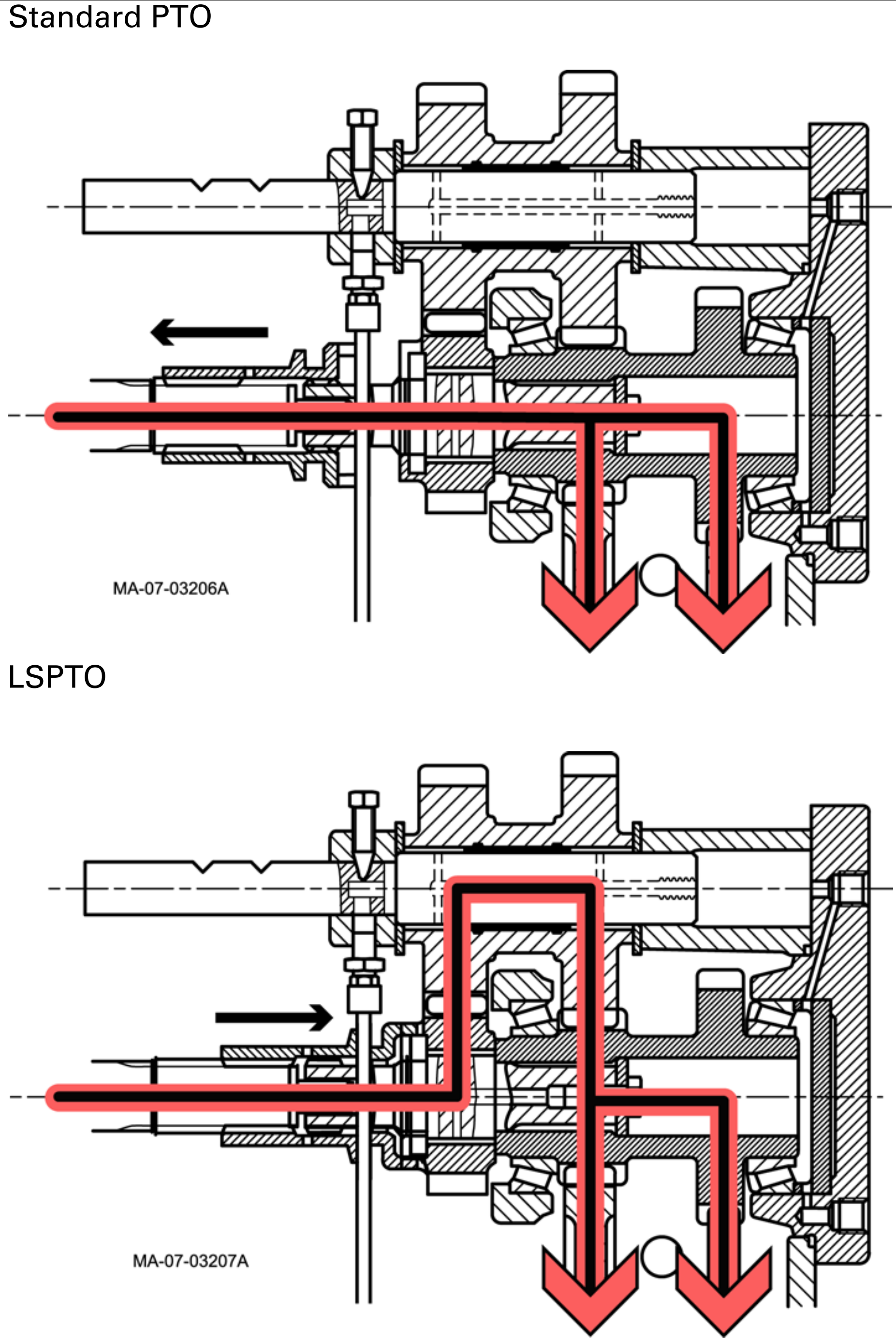


Fig. 6

Ground speed power take-off (GSPTO)

- GSPTO is obtained via the front axle clutch. A sliding sleeve (1) on the splines secures the front axle clutch cover (2). Drive is transmitted to the 540 rpm PTO pinion.

***Remark:** for 2WD tractors equipped with a creeper unit, a pinion is fitted instead of the front axle clutch.*

- The speed of the PTO output shaft is then proportional to the tractor ground speed.

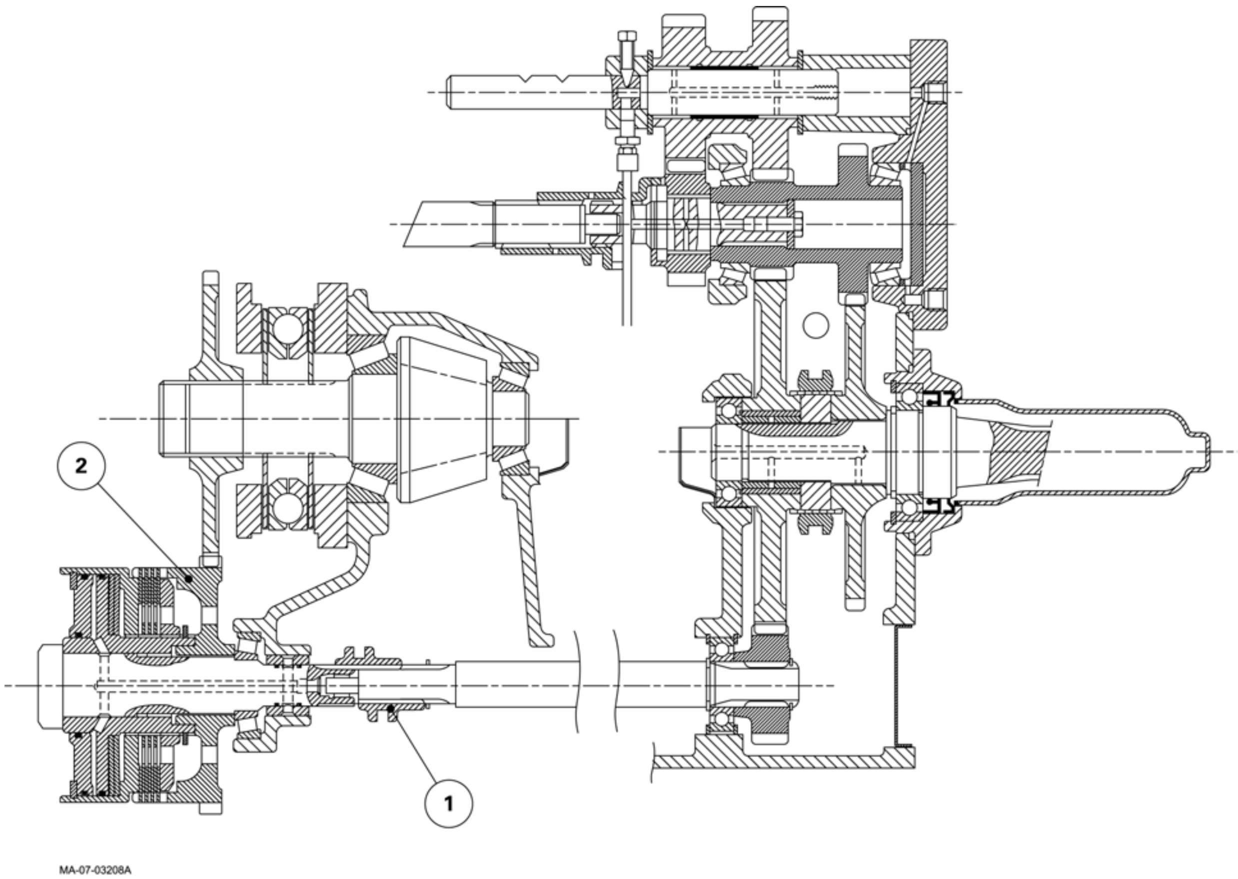


Fig. 7

PTO with reinforced sealing

- This PTO type has reinforced sealing at the PTO output shaft.
- The output shaft turns at the rear on two taper roller bearings. A sealing ring is fitted behind these bearings.
- The PTO operates exactly the same as the other shiftable versions.

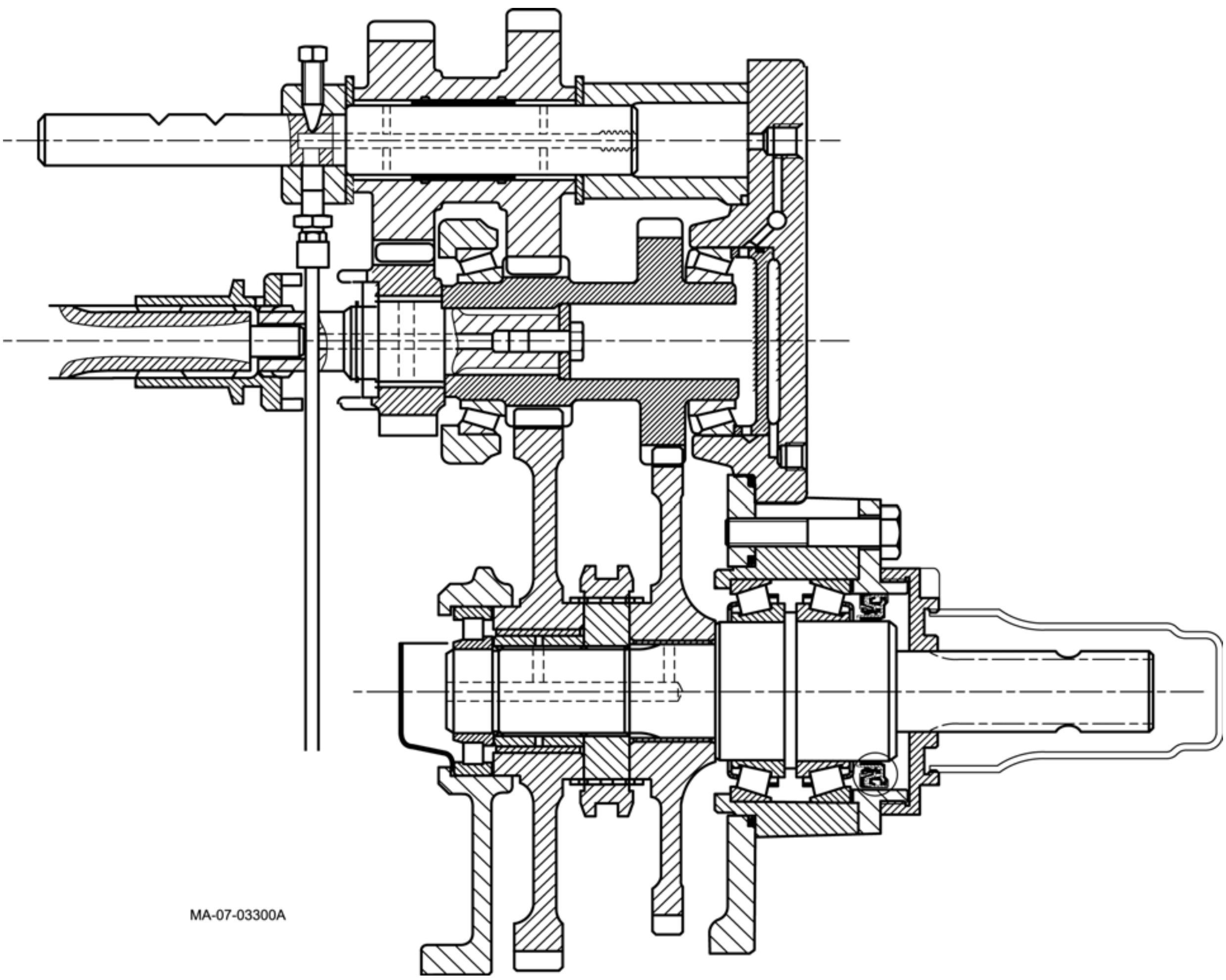


Fig. 8

07B01 - Intermediate shaft - Driving pinions - GPA20 brake

CONTENTS

A . General

Engine speed is transmitted to the PTO clutch (1) fitted at the front of the centre housing.

The layshaft (2) is linked via splines at one end to the clutch and at the other end either to the double pinion (13) in the 2-speed PTO version, or to the coupler sleeve (31) in the economy 4-speed PTO version.

The double pinion (13) rotates on two taper roller bearings (3) (4) and (7) (8) respectively mounted in the bore of the centre housing and the cover (10).

A piston (9), housed in the cover and controlled by the 17 bar hydraulic circuit, allows braking of the double pinion (13) when the control lever is placed in the PTO brake position.

B . Operation

2-speed PTO

When the knob is pressed and turned clockwise, the PTO solenoid valve supplies the clutch, and the layshaft (2) is driven. It in turn drives the double driving pinion (13) which is in permanent contact with the 540 rpm and 1000 rpm pinions on the lower shaftline.

4-speed PTO

This feature allows speeds of 540 rpm or 1000 rpm to be obtained with an engine speed of 1550 rpm.

Standard position

The sleeve (31) being moved forwards, the layshaft (2) is secured to the shaft (35) that drives the double driving pinion (13). This configuration is identical to the 2-speed PTO version.

Economy position

By moving the sleeve (31) backwards, drive is transmitted to the coupler pinion (34) (which rotates freely on the shaft (35)) and to the double pinion (18) which drives the driving pinion (13). The gear ratio of the double pinion (18) is 1.292.

Power take-off brake

When the knob is in the PTO brake position, it allows the opening of the PTO brake solenoid valve mounted on the right-hand cover. The chamber behind the piston (9) is supplied. The piston moves, compressing the cup (8) on the cone (7) thus progressively immobilising the driving pinion (13), constantly engaged with the 540 rpm and 1000 rpm pinions.

Intermediate shaft - Driving pinions - GPA20 brake

Parts list

		Power take-off 4-speed	Power take-off 2-speed
(1)	Clutch	●	●
(2)	Layshaft	●	●
(3)	Cup	●	●
(4)	Cone	●	●
(5)	Washer	●	●
(6)	Screws	●	●
(7)	Cone	●	●
(8)	Cup	●	●
(9)	Brake piston	●	●
(10)	Cover	●	●
(11)	Shims	●	●
(12)	O'ring	●	●
(13)	Driving pinion	●	●
(14)	Double pinion assembly	●	
(15)	Deflector	●	●
(16)	Washer	●	
(17)	Needle bearing	●	
(18)	Double pinion	●	
(19)	Spacer	●	
(20)	Needle bearing	●	
(21)	Washer	●	
(22)	Set screw	●	●
(23)	Pin	●	
(24)	Locking screw	●	
(25)	Nut	●	
(26)	Fork	●	
(27)	Screws	●	
(28)	Needle bearing	●	
(29)	Circlip	●	
(30)	Ring	●	
(31)	Coupler sleeve	●	
(32)	Circlip	●	
(33)	Washer	●	
(34)	Coupler pinion	●	
(35)	Shaft	●	
(36)	Pin		●
(37)	Seal		●

Overall view

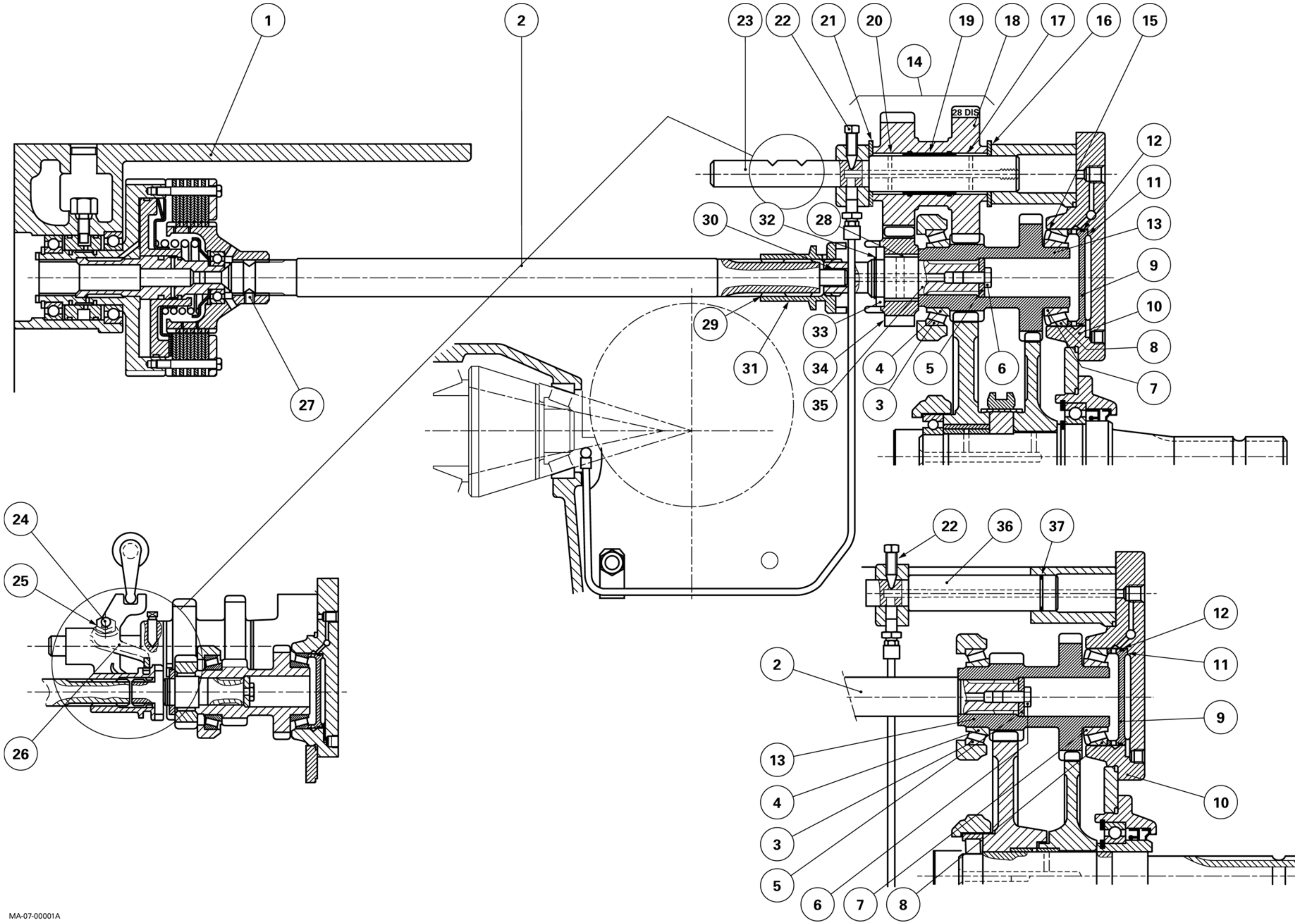


Fig. 1

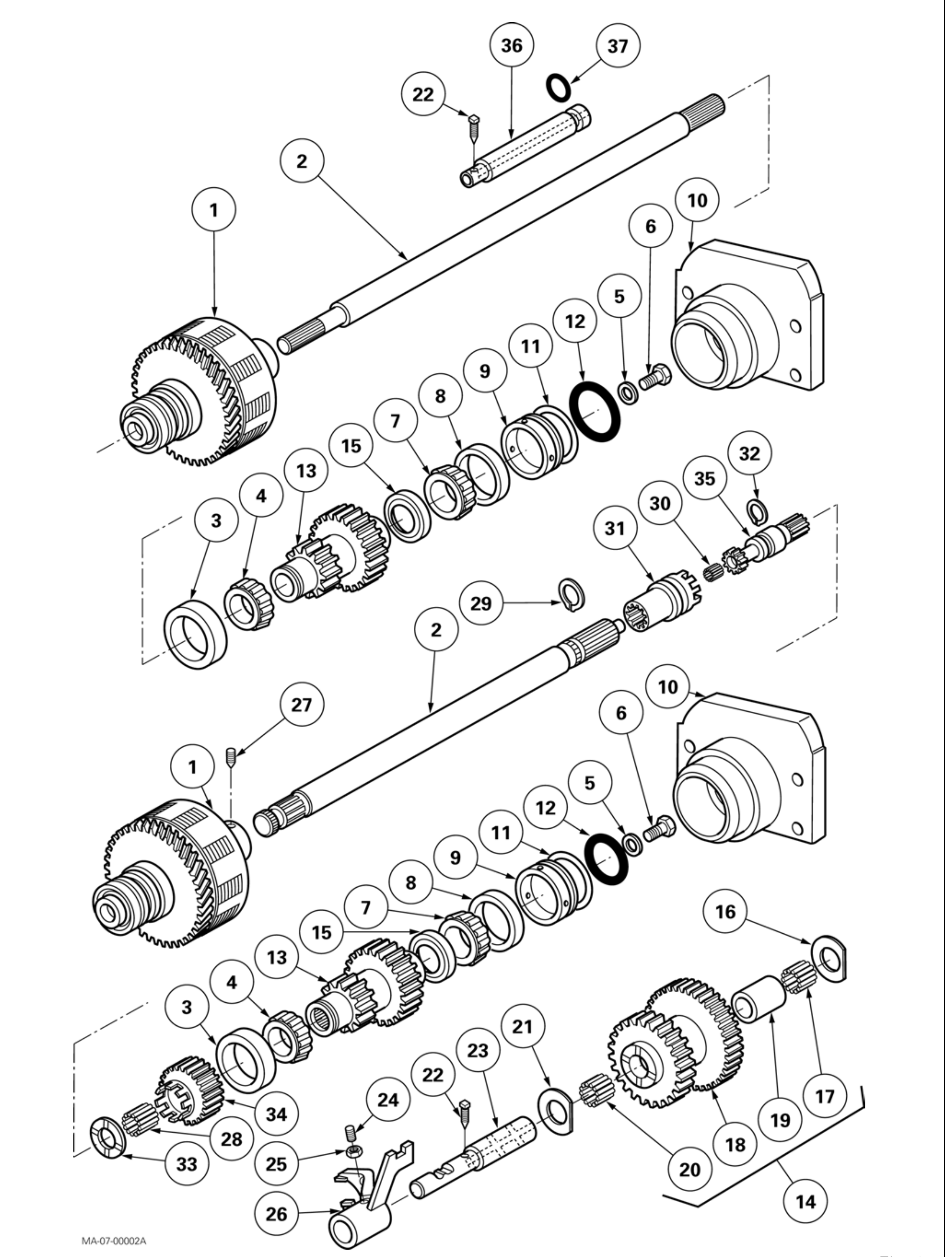

Overall view
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Fig. 2

C . 2-speed PTO (without shimming)

Disassembly

1. Remove the linkage and 3rd point support (see chapter 6).
2. Remove (Fig. 3):
   - the trailer electric connector (1),
   - the spool valve control cables (2),
   - the hydraulic unions connected to the spool valves (3),
   - the trailer brake take-off (if fitted) and its support, by loosening the unions at both ends.
3. Take out the spool valve support screws and remove the spool valve support.
4. Disconnect the power take-off brake supply pipe (1) (Fig. 4).
5. Remove lubricating pipe (2) (Fig. 4).
6. Remove the 6 screws (3) and the cover (10) (Fig. 4).
7. Take out the pinion assembly (13) and the shaft (2) held in place by the washer (5) and the screw (6). Take off bearing cone (4).

Note: *The shaft (2) is fitted into the clutch (1) without a locking screw.*

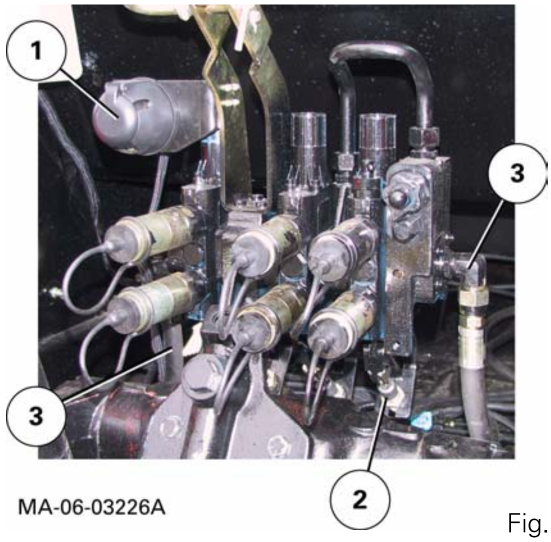


Fig. 3

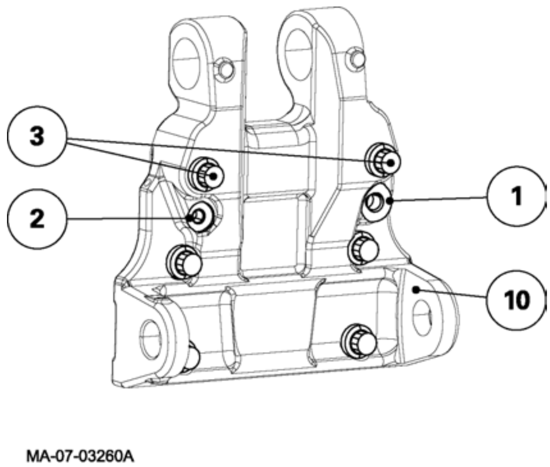


Fig. 4

Reassembly

8. Check and clean all components. Replace any defective parts.

9. Refit the cone (4). Assemble the pinion (13) and the shaft (2) held by washer (5) and screw (6).

10. Clean the mating face of the cover (10) (Fig. 4).

11. Smear the mating face of the housing with a sealing product (Loctite 510 or equivalent).

NOTE: *In order to ensure lubrication of the cone (7), a pin (36) fixed by a set screw (22) is fitted at the location of the pin (23) in the 4-speed LSPTO.*

The oil tightness of the pin is ensured by the seal (37), the central channel in the pin being used to lubricate the front bearing of the drive pinion.

12. Refit the cover (10). Tighten the 6 screws (3) to a torque of 130 - 170 Nm (Fig. 4).

NOTE: *Check for the presence of the bearing cup (8).*

13. Reconnect the power take-off supply pipe (1) and lubrication supply pipe (2) (Fig. 4).

14. Clean the mating face of the spool valve support.

15. Smear the mating face of the spool valve support with a sealing product (Loctite 510 or equivalent).

16. Refit the support. Coat the thread of the two lower screws with Loctite 510. Fit and tighten to a torque of 50 -70 Nm.

17. Carry out operations 1 and 2 in reverse order.

18. Check that the PTO and PTO brake operate correctly.

19. Check for the oil tightness of:

- the mating faces (spool valve support, cover)
- the hydraulic unions.

D . 2-speed PTO (with shimming)

Note: *The shimming (preloading or clearance of 0.05) (Fig. 8) must be carried out in cases of operations on the following components: pinion (13), deflector (15), bearing cones (4) (7), bearing cups (3) (8); the lift cover must be removed.*

For correct shimming of cone bearings (4) (7) and bearing cups (3) (8), it is necessary to remove the lift cover.

Disassembly

20. Remove the lift cover (see chapter 6).

21. Remove the linkage and 3rd point support (see chapter 6).

22. Disconnect the PTO brake supply pipe (1) and lubricating supply pipe (4) (Fig. 4).

23. Take the screws (3) out of the cover (10) (Fig. 4) and remove it.

24. Extract the pinion assembly (13) and the shaft (2) held by the washer (5) and the screw (6).

Note: *The shaft (2) is fitted into the clutch (1) without a locking screw.*

25. Take out screw (6) and washer (5).

26. Separate the pinion (13) from the shaft (2).

Note: *A deflector (15) is fitted between pinion (13) and the bearing cone (7) in contact with the bearing cup (8) (Fig. 5).*

27. Extract the cone (7) and the deflector (15) (*Fig. 6*) then remove cone (4).

Note: *To extract the bearing cup (3) the 540 / 1000 rpm pinions must be removed. Partially drain the rear axle housing (see chapter 7).*

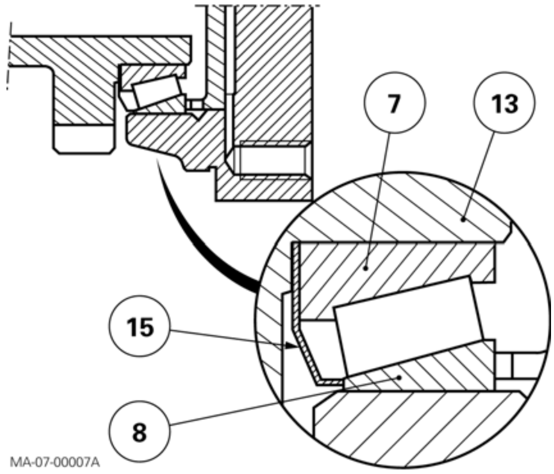


Fig. 5

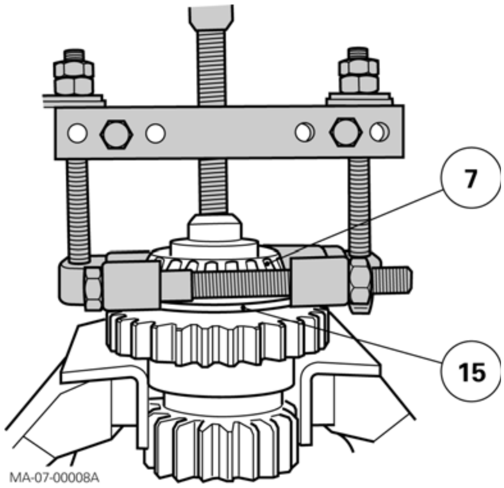


Fig. 6

Reassembly

28. Check and clean all components. Replace any defective parts.

29. Place the deflector (15) on pinion (13), and press-fit the bearing cone (7) fully home into the shoulder (Fig. 7). Lubricate the cone bearing (4) and place it in the bearing cup (3).

NOTE: *If the bearing cup (3) has been replaced, refit the 540 / 1000 rpm pinions (see chapter 7). Top up the oil level in the rear axle.*

30. Extract the piston (9) through the cover (10).

31. Remove the shims (11) and the O'ring (12) to prepare for the shimming operation.

32. Assemble piston (9) and bearing cup (8) in the cover (10).

33. Lubricate the bearing cup and the bearing cone (7).

34. Assemble the pinion (13) inside the housing.

NOTE: *In order to ensure lubrication of the cone (7), a pin (36) fixed by a set screw (22) is fitted at the location of the pin (23) in the 4-speed LSPTO.*

The oil tightness of the pin is ensured by the seal (37), the central channel being used to lubricate the front bearing of the drive pinion.

35. Refit the cover. Tighten the screws to a torque of 130 -170 Nm.

36. Carry out the **J/P** shimming (Fig. 8) to obtain a preloading of 0.05 with a clearance of 0.05.

37. Place the feeler pin at the end of the pinion (13) (Fig. 9).

38. Pull on the pinion while turning it alternatively left and right in order to compress the deflector (15) and correctly seat the bearing cone (7) in the bearing cup (8).

39. Reset the dial gauge to zero.

40. Push on the pinion while turning it alternatively left and right in order to seat the bearing cone (4) correctly in the bearing cup (3).

41. According to the value read on the dial gauge, select the thickness of shims in order to obtain **J/P**.

42. Remove the cover (10), take out the bearing cup (8) and the piston (9).

43. Place the shims (11) selected in operation 41 in the cover (10).

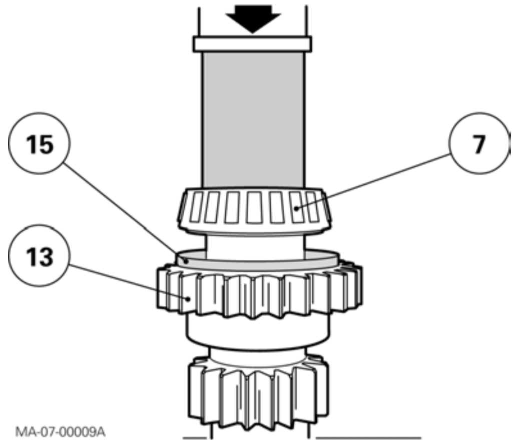


Fig. 7

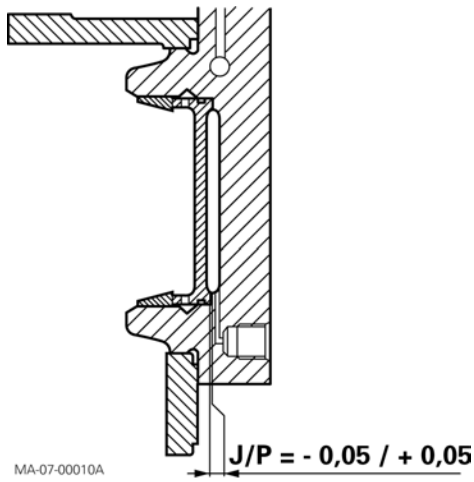


Fig. 8

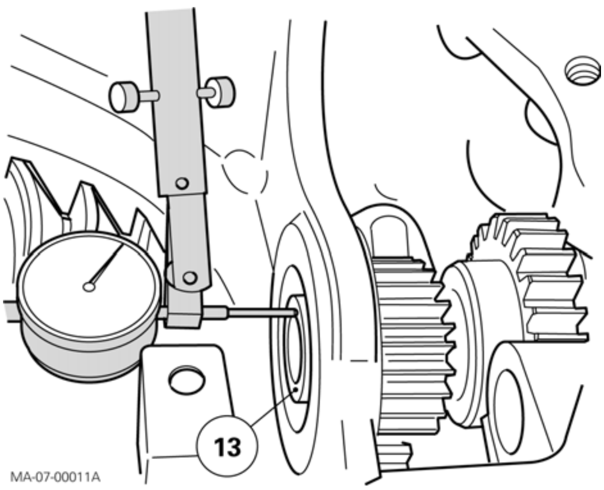


Fig. 9

44. Fit the piston (9) with a new O'ring (12).

NOTE: *Turn the lubricating holes on the piston towards the bearing (Fig. 10).*

45. Fit the bearing cup (8) into the support.

46. Take out the pinion (13) and assemble it with the shaft (2), washer (5) and screw (6). Tighten to a torque of 50 Nm.

47. Refit the cone bearing (4). Assemble the pinion (13) and shaft (2) assembly.

48. Coat the mating face of the cover (10) on the rear axle housing with a sealing product (Master joint 510 or equivalent).

49. Refit the cover (10). Fit and tighten the screws (3) to a torque of 130 -170 Nm (Fig. 11).

NOTE: *Check for the presence of the bearing cup (8).*

50. Reconnect the power take-off supply pipe (1) and lubricating supply pipe (4) (Fig. 11).

51. Refit the lift cover (see chapter 6).

Refit the linkage support (see chapter 6).

52. Check that the PTO and PTO brake operate correctly.

53. Check for the oil tightness of:

- the mating faces (spool valve support, cover, lift cover)
- the hydraulic unions.

E . 4-speed economy PTO (without shimming)

Disassembly

54. Remove the left-hand side cover. When disassembling the screw (27) and the layshaft.

55. Repeat the operations 1 to 3.

56. Disconnect the power take-off brake supply pipe (1) (Fig. 11).

57. Remove lubricating pipe (4) (Fig. 11).

58. Take the screws (3) out of the cover (10) and remove it (Fig. 11).

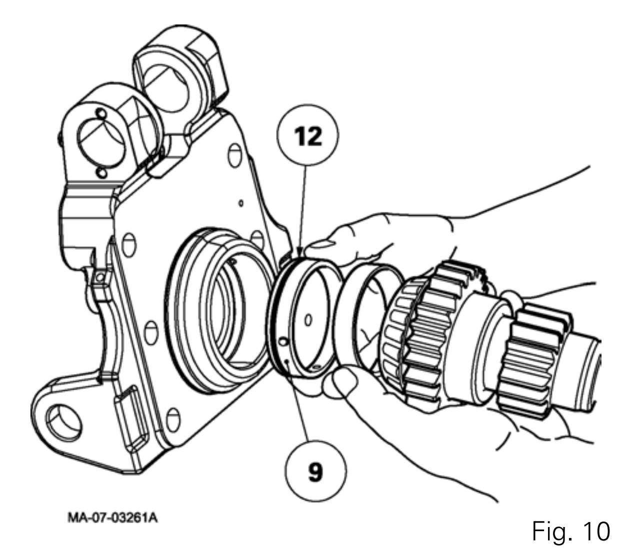


Fig. 10

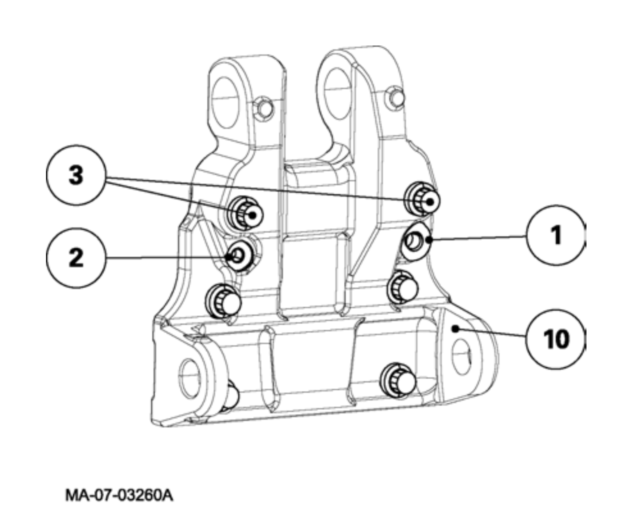


Fig. 11

59. Take off nut (25) and locking screw (24) from the fork (26).

60. Take out set screw (22) (Fig. 12).

61. Take out the pin (23) from the double pinion assembly (14) in order to disengage the fork (26).

Note: *To release only the fork, pull pin (23) slightly rearwards.*

62. Remove the friction washers (16) (21).

Note: *Be careful not to let the washers fall inside the housing.*

63. Take out the double pinion assembly (14) (through the spool valve support aperture, only for the version without shimming) (Fig. 13).

64. Remove the needle bearings (17) (20) and the spacer (19) from the pinion (18).

65. Take off the circlip (32) (Fig. 14).

Note: *To facilitate access to the circlip, use short handled circlip pliers.*

66. Take out the pinion assembly (13) and the shaft (35) held in place by the washer (5) and the screw (6).

67. Remove the flat sided washer (33).

Note: *Take care not to let the washer or the circlip fall inside the housing.*

Hold in place the coupler pinion (34) and the needle bearing (28).

The cone bearing (4) remains in the bearing cup (3) during removal of the pinion.

68. Remove the coupler pinion (34) and the needle bearing (28).

69. Remove the bearing cone (4).

70. Remove the Allen screw (27) (where necessary).

71. Take out the shaft (2) and the coupler sleeve (31) (where necessary).

Note: *The circlip (29) remains on the shaft (2).*

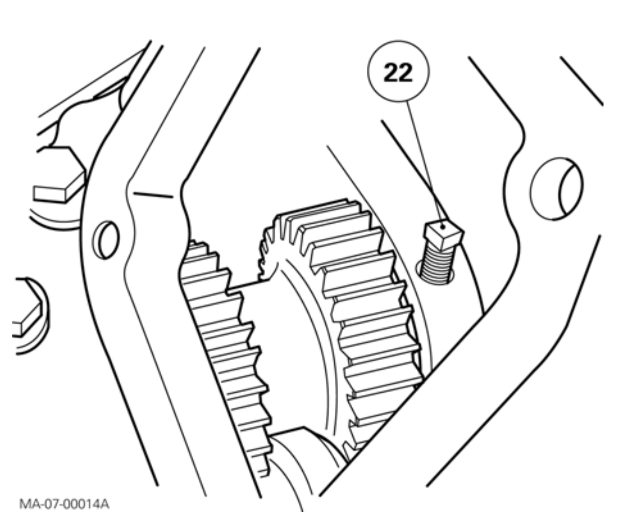


Fig. 12

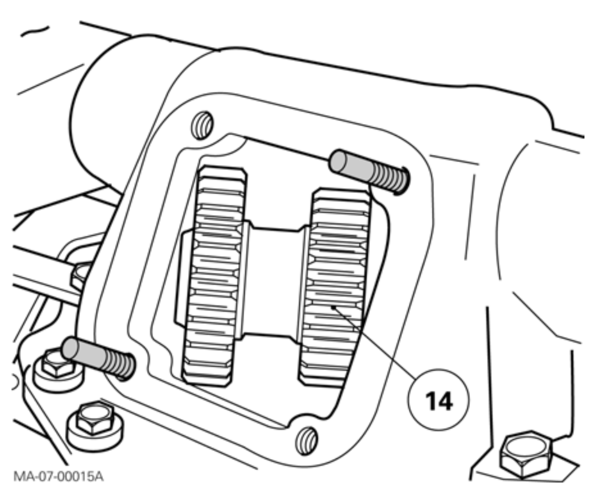


Fig. 13

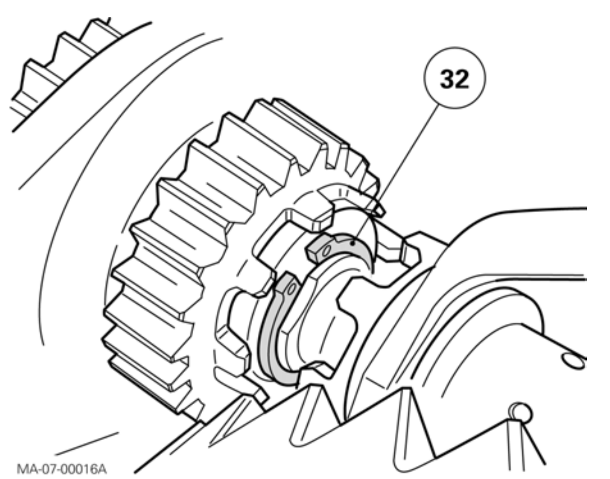


Fig. 14

Reassembly

72. Check and clean all components. Replace any defective parts.
73. Refit the shaft (2) and the coupler sleeve (31) (if disassembled).
74. Smear the screw (27) with Loctite 221 and tighten (if disassembled).
75. Refit the cone bearing (4). Position the pinion (13) prepared with the shaft (35). Place the coupler pinion (34), the needle bearing (28), the washer (33), and the circlip (32). Push on the pinion (13). Position the washer (33). Fit the circlip (32).
76. In the pinion (18), place the spacer (19) and the needle bearings (17) (20). Position the double pinion assembly (14). Place the washer (16) smeared with miscible grease (Amber technical or equivalent).
77. Check that the channels in pin (23) are not obstructed. They are used for lubricating the needle bearings (17) (20) and the front bearing of the driving pinion. Slightly engage the pin (23) in order to hold the washer (16) in place. Place the washer (21) coated with miscible grease. Centre the double pinion assembly (14).
78. Definitively fit the pin (23) into the pinion assembly (14) and into the fork (26) while ensuring the correct positioning of the set screw hole (22).
79. Smear screw (22) with Loctite 542 and tighten to a torque of 28 - 43 Nm.
80. Clean the cover (10) mating face.
81. Smear the mating face of the housing with a sealing product (Loctite 510 or equivalent).
82. Check for the presence of the bearing cup (8). Tighten screws (3) to a torque of 130 -170 Nm.
83. Reconnect the pipes (1) (4) (Fig. 16).
84. Refit the screw (24) and nut (25) on the fork (26).
85. Adjust the locking of the fork (26) (Fig. 15):
- Position the fork (26), with the locking screw (24) on flat “M” of pin (23) (between the two locking grooves), tighten the screw to compress the ball.
- Loosen the screw by one-quarter turn. Smear the nut (25) with Loctite 241. Tighten to a torque of 15 - 20 Nm.
- Check that the fork locks correctly.

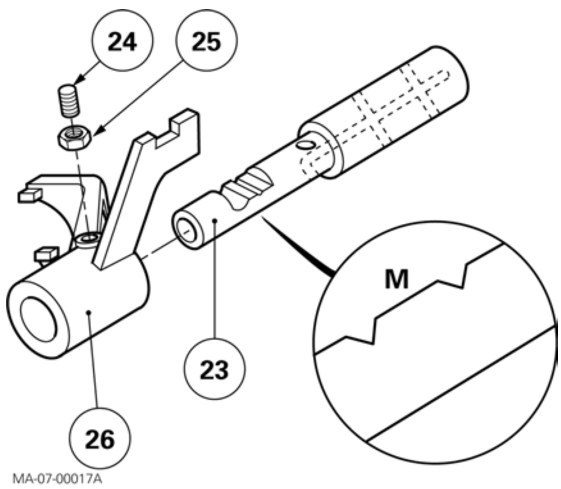


Fig. 15

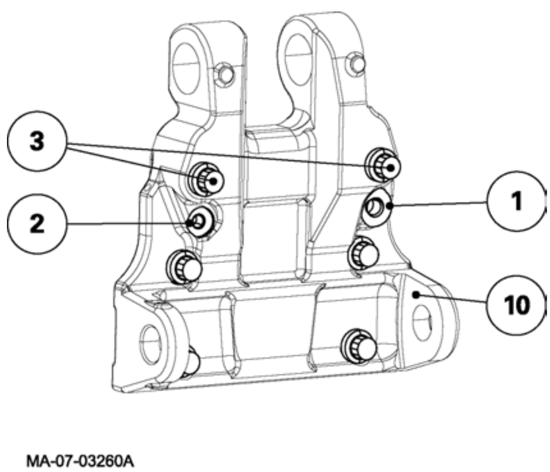


Fig. 16

86. Adjust the control (see § E).

87. Clean the mating face of the spool valve support.

88. Smear the mating face of the spool valve support cover with a sealing product (Loctite 510 or equivalent).

89. Refit the spool valve support (Fig. 3).

90. Smear the threads of the two lower screws (4) with Loctite 510. Tighten the 4 screws to a torque of 50 - 70 Nm.

91. Carry out operations 1 and 2in reverse order.

92. Check that the PTO and PTO brake operate correctly.

93. Check for the oil tightness of:

- the mating faces (spool valve support, cover, lift cover)
- the hydraulic unions.

F . 4-speed LSPTO (with shimming)

NOTE: *The J/P shimming is to be carried out when servicing on the following components: pinion (13), deflector (15), cone bearings (4) (7), bearing cups (3) (8), piston (9) and cover (10).*

For a correct shimming of cone bearings (4) (7) and bearing cups (3) (8), it is necessary to remove the lift cover.

Disassembly

94. Remove the lift cover (see chapter 6).

95. Remove the PTO pinions, carry out operations 56 to 69.

96. Separate the pinion (13) from the shaft (35) using a press and a suitable fixture (Fig. 17).

NOTE: *The friction ring (30) is force fitted into the shaft (35).*

97. Extract the bearing cone (7) and deflector (15) (Fig. 18).

NOTE: *To extract the bearing cup (3) the 540 / 1000 rpm pinions must be removed.*

Partially drain the axle housing (see chapter 7).

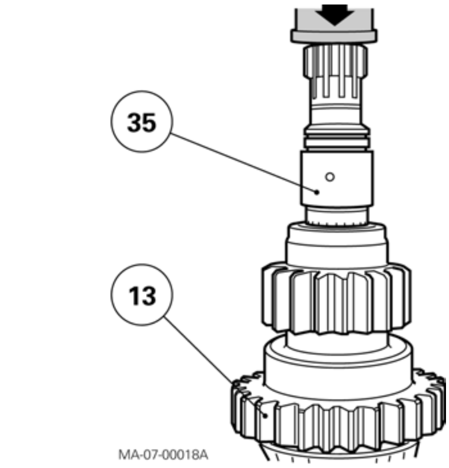


Fig. 17

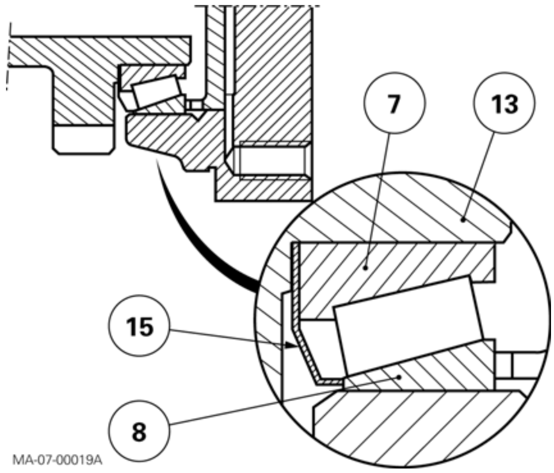


Fig. 18

Reassembly

98. Check and clean all components. Replace any defective parts.

Note: *For correct lubrication of the ring (30), a deflector (15) is fitted between the pinion (13) and the bearing cone (7), in contact with the bearing cup (Fig. 18).*

99. Place the deflector (15) on pinion (13), and force-fit the bearing cone (7) fully home into the shoulder (Fig. 7). Fit the cone (4) into the bearing cup (3).

Note: *If the bearing cup (3) has been replaced, refit the 540 / 1000 rpm pinions (see chapter 7). Fill the housing to the correct oil level.*

100. Preparing and shimming the pinion (13). Carry out operations 30 to 45.

101. Take out the pinion (13) and assemble it with the shaft (35) (Fig. 19), then fit the washer (5) and screw (6). Tighten the screw to a torque of 50 Nm.

102. Refit the bearing cone (4), the coupler pinion (34) and the needle bearing (28).

103. Fit the pinion assembly (13) and the shaft (35).

Note: *Check for the presence of the coupler sleeve (31).*

104. Position the washer (33), fit the circlip (32).

105. In the pinion (18), place the spacer (19) and the needle bearings (17) (20).

Position the double pinion assembly (14).

Place the washer (16) smeared with miscible grease ("Amber technical" or equivalent).

106. Ensure that the channels in the pin (23) are not obstructed; they are used for lubricating needle bearings (17) (20) and the front bearing of the drive pinion. Slightly engage the pin (23) in order to hold the washer (16) in place. Place the washer (21) coated with miscible grease. Centre the double pinion assembly (14).

107. Definitively fit the pin (23) into the pinion assembly (14) and into the fork (26) while ensuring the correct positioning of the set screw hole (22).

108. Smear the set screw (22) with Loctite 542. Tighten to a torque of 28 - 43 Nm.

109. Clean the cover (10) mating face.

110. Smear the mating face of the housing with a sealing product (Loctite 510 or equivalent).

111. Check for the presence of the bearing cup (8), fit the cover (10) with screws (3) and tighten to a torque of 130 - 170 Nm (Fig. 16).

112. Reconnect the pipes (1) (4) (Fig. 16).

113. Fit the locking screw (24) and the nut (25). Adjust the fork (26), carry out operation 85.

114. Refit the lift cover (see chapter 6).

115. Adjust the economy PTO control (see § E).

116. Check the correct operation of the PTO and its brake.

117. Check for the oil tightness of:

- the mating faces (spool valves support, cover)
- the hydraulic unions.

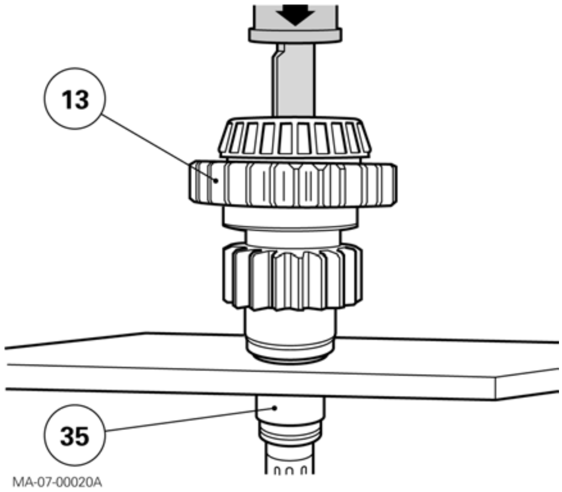


Fig. 19

G . Assembling and adjusting the 4-speed LSPTO control

118. Move the control lever L (Fig. 20) to the 1550 rpm economy position.

119. Screw the clevis (1) flush with the threaded end of the cable (6) (Fig. 21).

120. Fit clevis (1) on lever L using the clip (7).

121. Adjust the sheath end (5) so that the nut (3) is flush with the end of the threaded part.

122. Tighten nut (4) and check that the cable is not constrained in any way.

123. Place lever M in the 1550 rpm economic position (a) (Fig. 22) (sleeve locked with the coupler pinion, the fork locked).

124. Screw the clevis (1) flush with the threaded end of the cable (6) and fit it onto lever M with the clevis pin (7).

Tighten nut (2).

125. Adjust the sheath end piece (5), checking that lever M remains locked.

126. Tighten nuts (3) (4) and check that the cable is not trapped in any way.

127. Check the locking of the control in the 2000 rpm position (b) and check for the correct operation of the indicator light on the instrument panel.

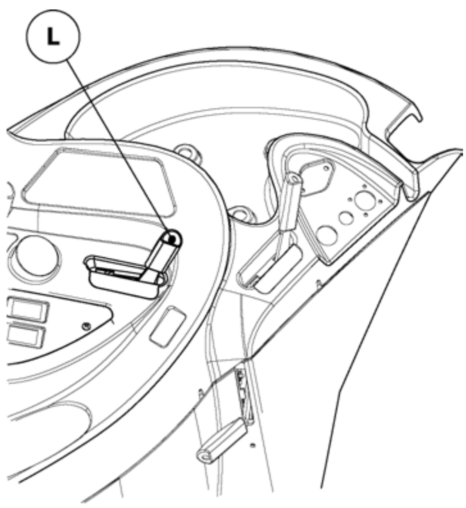


Fig. 20

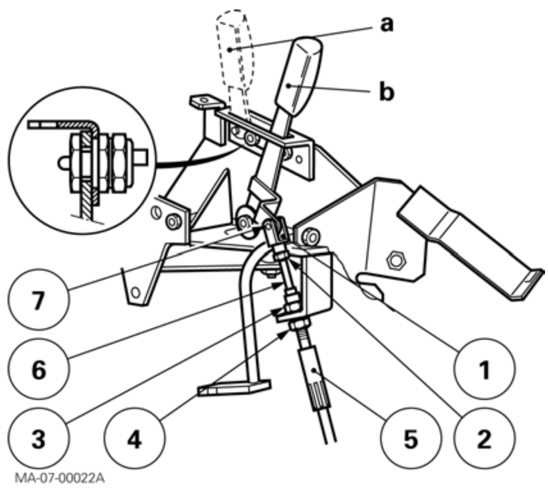


Fig. 21

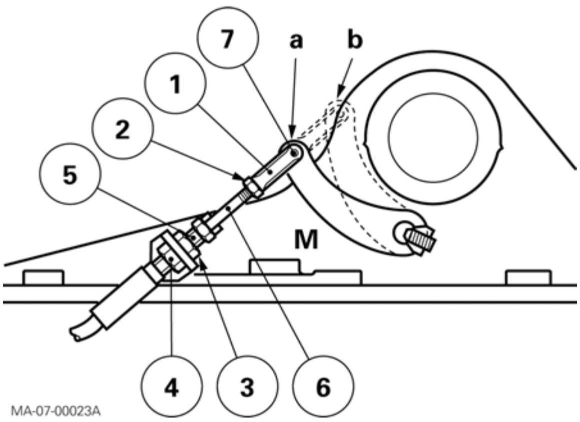


Fig. 22

07C01 - GPA20 removable shaft

CONTENTS

A . General

The driven pinions (5) (6) are fitted on the PTO shaft located on the lower part of the axle housing. These pinions are constantly meshed with the double driving pinion driven by the top shaft line whose speed is transmitted by the PTO clutch.

The PTO shaft (10) is fitted, at the front, on a roller bearing (1) force-fitted in the axle housing, and at the rear, on a hub (9) rotating on a roller bearing (15).

The 540 rpm version has 6 splines, and the 1000 rpm version has 21 splines.

In the 540 rpm configuration, the shaft (10) is integral with the pinion (5) via splines. The pinion (6) and ring (4) assembly rotate freely on the shaft (10).

In the 1000 rpm configuration, the shaft is splined to the pinion (6). The pinion (5) and ring (3) assembly rotate freely on the shaft (10).

The snap ring (20) holds the shaft in place.

The seal is ensured by the ring (14) and O'rings (11) (19).

Parts list

(1) Bearing
(2) Deflector
(3) Ring
(4) Ring
(5) Pinion (540 rpm)
(6) Pinion (1000 rpm)
(7) Circlip
(8) Snap ring
(9) Hub
(10) 540 or 1000 rpm PTO shaft
(11) O’ring
(12) Unit
(14) Sealing ring
(15) Bearing
(16) Screw
(17) PTO speed sensor
(18) Nut
(19) O’ring
(20) Snap ring

Overall view

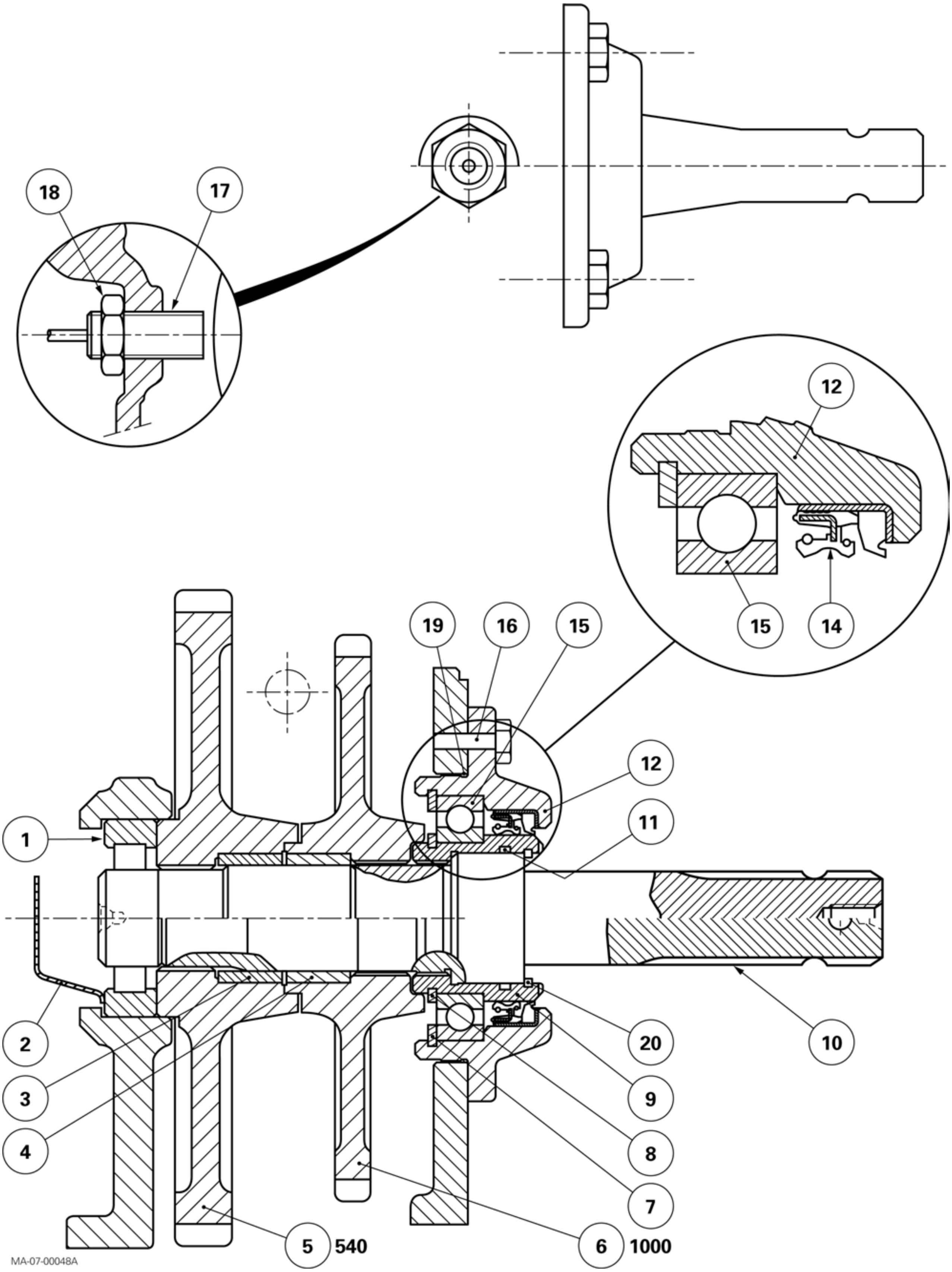


Fig. 1

Exploded view

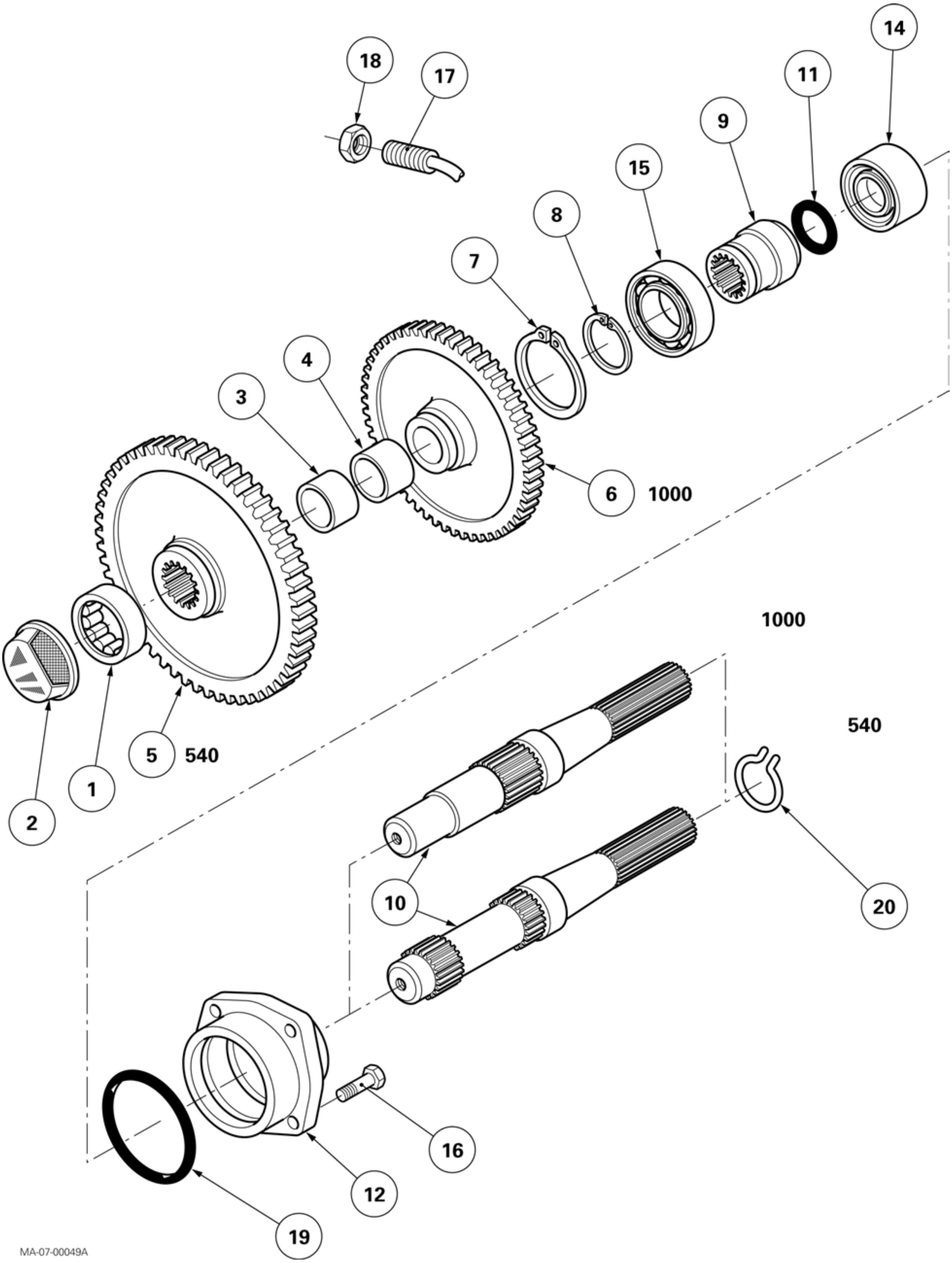


Fig. 2

B . Replacing the 540 or 1000 rpm shaft

Disassembly

1. Raise the rear of the tractor to avoid oil spillage.
2. Remove snap ring (20) (Fig. 3).
3. Take out the shaft (10).
4. Remove the O'ring (11) and discard it.

Reassembly

5. Install a new O'ring (11).
6. Clean and reinstall the shaft (10).
7. Refit the snap ring (20) and lower the rear of the tractor

C . Removing and refitting the rear bearing

8. Partially drain the rear axle housing. Remove the two opposing screws (16) (Fig. 5).
9. Screw two guide studs (Fig. 4) in abutment against the pinion (6). The purpose of this operation is to hold the pinions (5) (6) in line when removing the shaft (10) and the rear bearing assembly (Fig. 6).
10. Remove the other two screws (16) (Fig. 5).
11. Remove the shaft and the rear bearing assembly (Fig. 5).

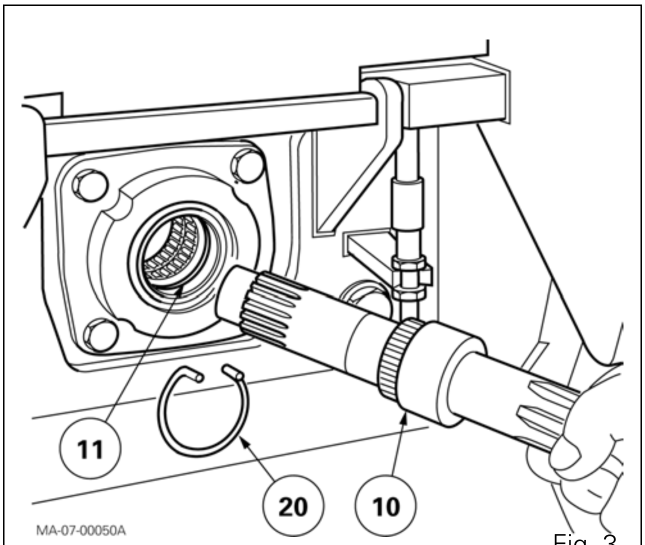


Fig. 3

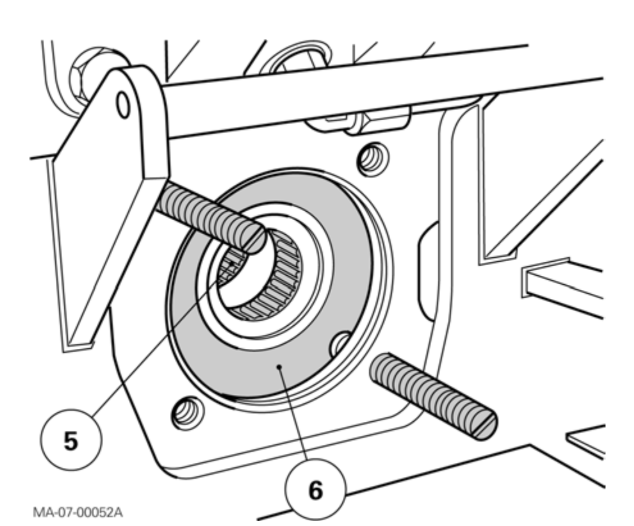


Fig. 4

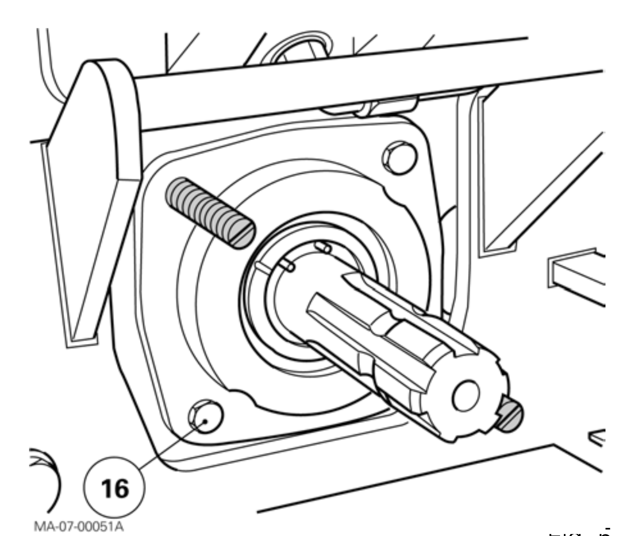


Fig. 5

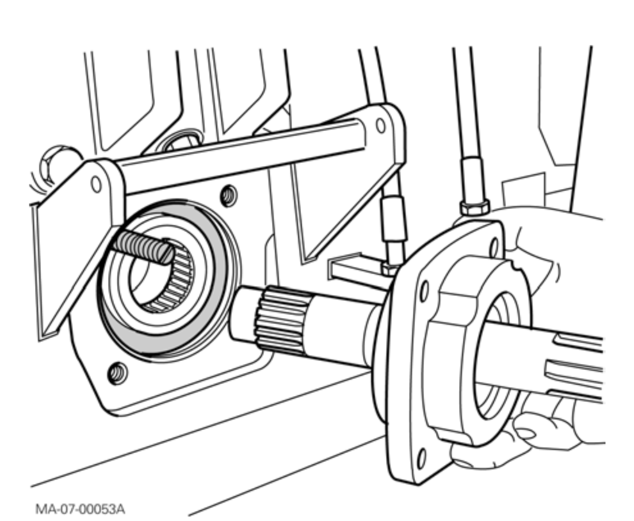


Fig. 6

Refitting

12. Fit the shaft and the rear bearing assembly (Fig. 6).

13. Smear two screws (16) with Loctite 542, then tighten to a torque of 105 - 120 Nm.

14. Take out two guide studs.

15. Coat the two other screws (16) with Loctite 542, then tighten to a torque of 105 - 120 Nm.

16. Top up the rear axle housing with oil.

D . Disassembling and reassembling the rear bearing

17. Remove the rear bearing and repeat operations 8 to 11.

Disassembly

18. Remove the O'ring (19).

19. Remove snap ring (20).

20. Separate the shaft (10) from the bearing assembly.

21. Remove the O'ring (11).

22. Take off circlip (7).

23. Separate the unit (12) from the roller bearing (15) (Fig. 7).

24. Remove the snap ring (8).

25. Extract the roller bearing (15) from the hub (9).

26. Remove the sealing ring (14).

Reassembly (Fig. 7)

27. Smear the external diameter of the sealing ring (14) with Loctite 542.

28. Using a press and a suitable tool, install the sealing ring (14) in abutment against the shoulder of the unit (12). The double lip must be turned towards the roller bearing (15).

29. Assemble the bearing. Reverse operations 17 to 24 and install it. Repeat operations 12 to 16.

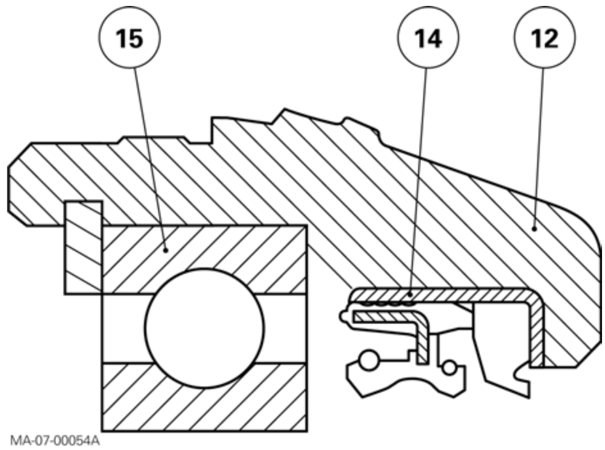


Fig. 7

E . Disassembling and assembling the 540 and 1000 rpm pinions and the front bearing

Disassembly

To remove the pinions (5) (6), it is necessary to remove:

- the lift cover (see section 6)
- top cover at the rear PTO drive shaft, the driving pinion and the layshaft (see section 7).

30. For access to the sensor, remove the left-hand ram by removing the lower attachment and by disconnecting the feed pipe. Remove the PTO sensor.

31. Remove the rear bearing and repeat operations 8 to 11.

32. Remove the pinions (5) (6).

33. Extract the roller bearing (1) and the deflector (2).

Reassembly

34. Check and clean all components. Replace any defective parts.

35. Smear the deflector (2) with Loctite 648 on the mating surface with the housing and put it with its bore. Turn the opening upwards (Fig. 8).

36. Fit the roller bearing (1) in the housing, in abutment with the deflector (2).

37. Lubricate the rings (3) (4).

38. Refit the pinions (5) (6) and screw two guide studs in abutment on the pinion (6). The purpose of this operation is to maintain the pinions (Fig. 4) in line while refitting the rear bearing.

***Note:** If the rings (3) (4) are damaged, replace the pinions (5) (6).*

39. Refit the rear bearing and repeat operations 12 to 15.

40. Smear the thread of the PTO sensor with Loctite "Form A gasket 2" (sensor sealing or equivalent). Adjust the sensor:

- Tighten the sensor home, without forcing, until it comes in contact with the pinion (6).
- Unscrew the sensor by 3/4 turn.
- Tighten the nut (18) moderately and connect the harness.

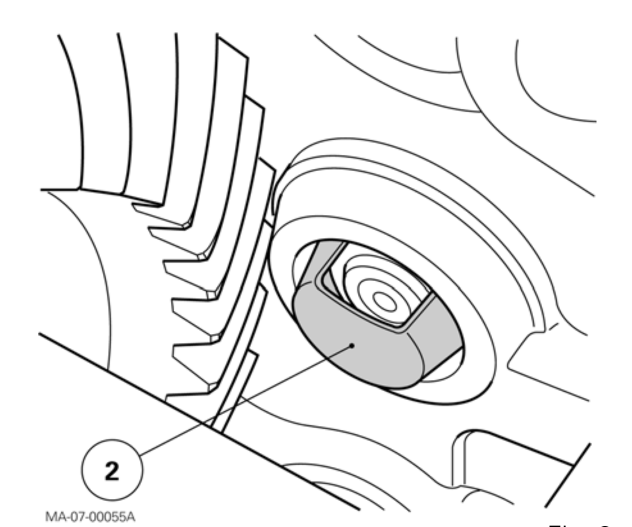


Fig. 8

41. Refit the left-hand ram, install the lower attachment and reconnect the feed pipe.

42. Refit the driving pinion assembly.

43. Refit the lift cover (see section 6).

44. Top up the oil level in the rear axle.

45. Check the correct operation of the PTO and its brake.

46. Check for the oil tightness of:

- mating faces of seals (spool valve support, lift cover, cover, PTO rear bearing).
- the hydraulic unions.

07D01 - GPA20 shiftable shaft

CONTENTS

A . General

The driven pinions (4) (7) are fitted on the PTO shaft (13) located on the lower rear part of the axle housing. These driven pinions are constantly meshed with the double driving pinion driven by the upper shaftline whose drive is transmitted by the power take-off clutch.

The power take-off shaft is freely mounted into the bearing (2) and force fitted into the bearing (10). The bearings are fitted into the rear axle housing and housing unit respectively (14).

The coupler hub (5) is integral with the shaft (13) via splines. These pinions (4) (7) drive the shaft when the coupler (5) is moved either forwards (540 rpm) or backwards (1000 rpm). When one of the pinions (4) or (7), equipped with rings (19) (20) is passive, it turns either on the ring (3) or on the shaft (13).
A control fork (25) fitted to the pin (22) makes it possible to select speeds of 540 or 1000 rpm.

Tightness is obtained via the sealing ring (11) and the O'ring (18). The deflector (12) prevents contamination by foreign particles.

Depending on the version, the power take-off shaft may be supported by taper roller bearings.

Another version provided with a flange shaft makes it possible to rapidly change the end-fitting (32) (6 or 21 splines).

Lubricating the pinions (4) (7)

The transmission oil provides lubrication for the two pinions.
The bearing (2) has a sealed face turned towards the 540 rpm pinion. Lubrication of pinions is obtained via the oil slave device (1) and the shaft (13) provided with an axial channel and drilled radial ports.

GPA20 shiftable shaft

Parts list

(1)(1) Oil slave device
(2) Bearing
(3) Ring
(4) Pinion (540 rpm)
(5) Coupler
(6) Hub
(7) Pinion (1000 rpm)
(8) Circlip
(9) Snap ring
(10) Bearing
(11) Sealing ring
(12) Deflector
(13) PTO shaft
(14) Unit
(15) Screw
(15A)Screw
(16) Sensor
(17) Nut
(18) O’ring
(19) Ring
(20) Ring
(21) Link
(22) Pin
(23) O’ring
(24) Pads
(25) Fork
(26) Set screw
(27)(27) Special spacers
(28) Plug
(29) "Bayonet" cap
(30) Twist cap
(31) Flange shaft
(32) End-fitting (6 or 21 splines)
(33) Locating pins
(34) Screw

Legend

A : Internal control via lever and cable
B : External control

Overall view

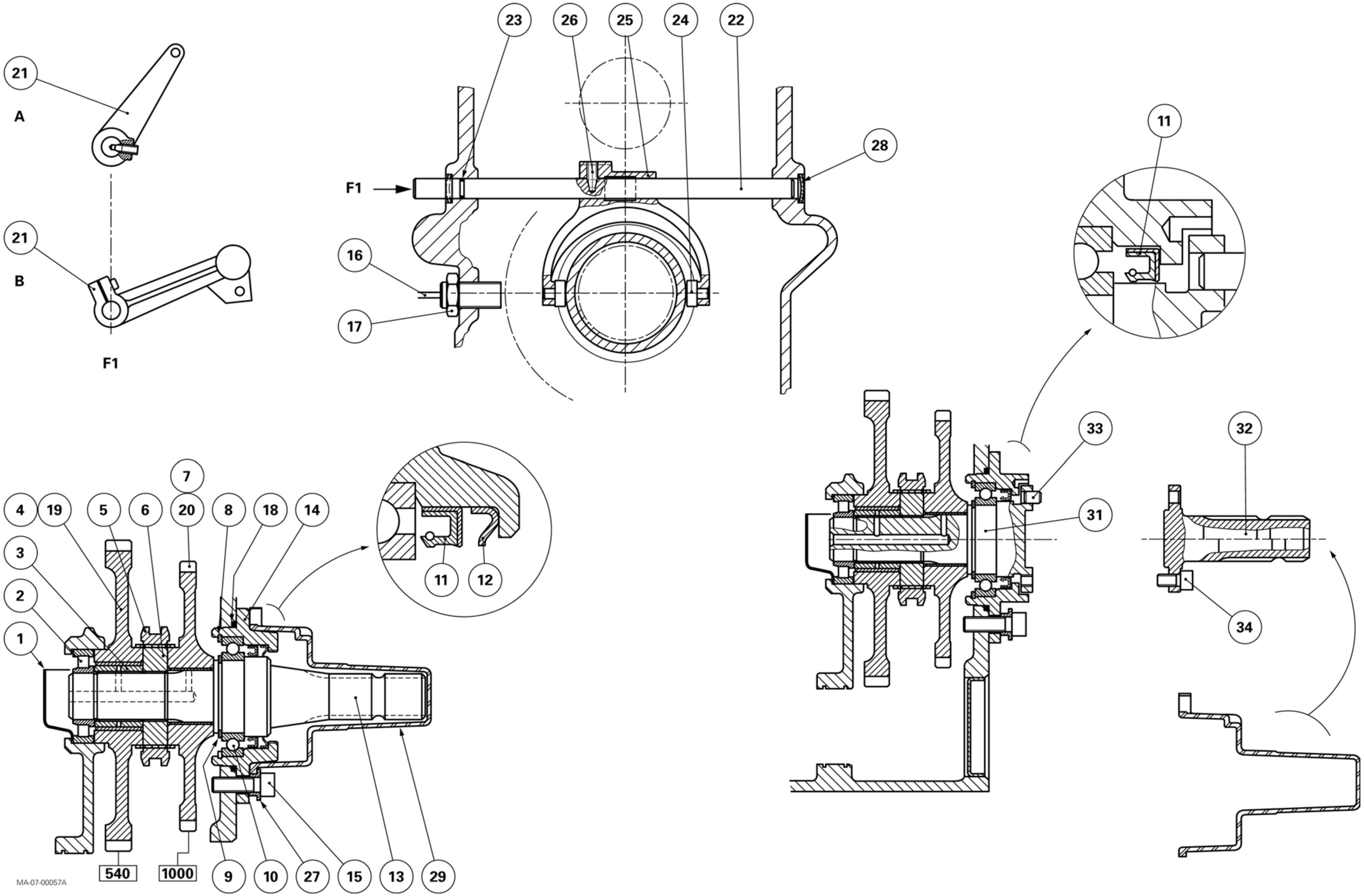


Fig. 1

B . Layout of components and different versions

Legend

A : with 2-speed PTO
B : with 4-speed LSPTO
C : with GSPTO
D : with flange shaft (540 - 1000 rpm) and inter-changeable end-fitting
E : with standard shaft (540 - 1000 rpm)

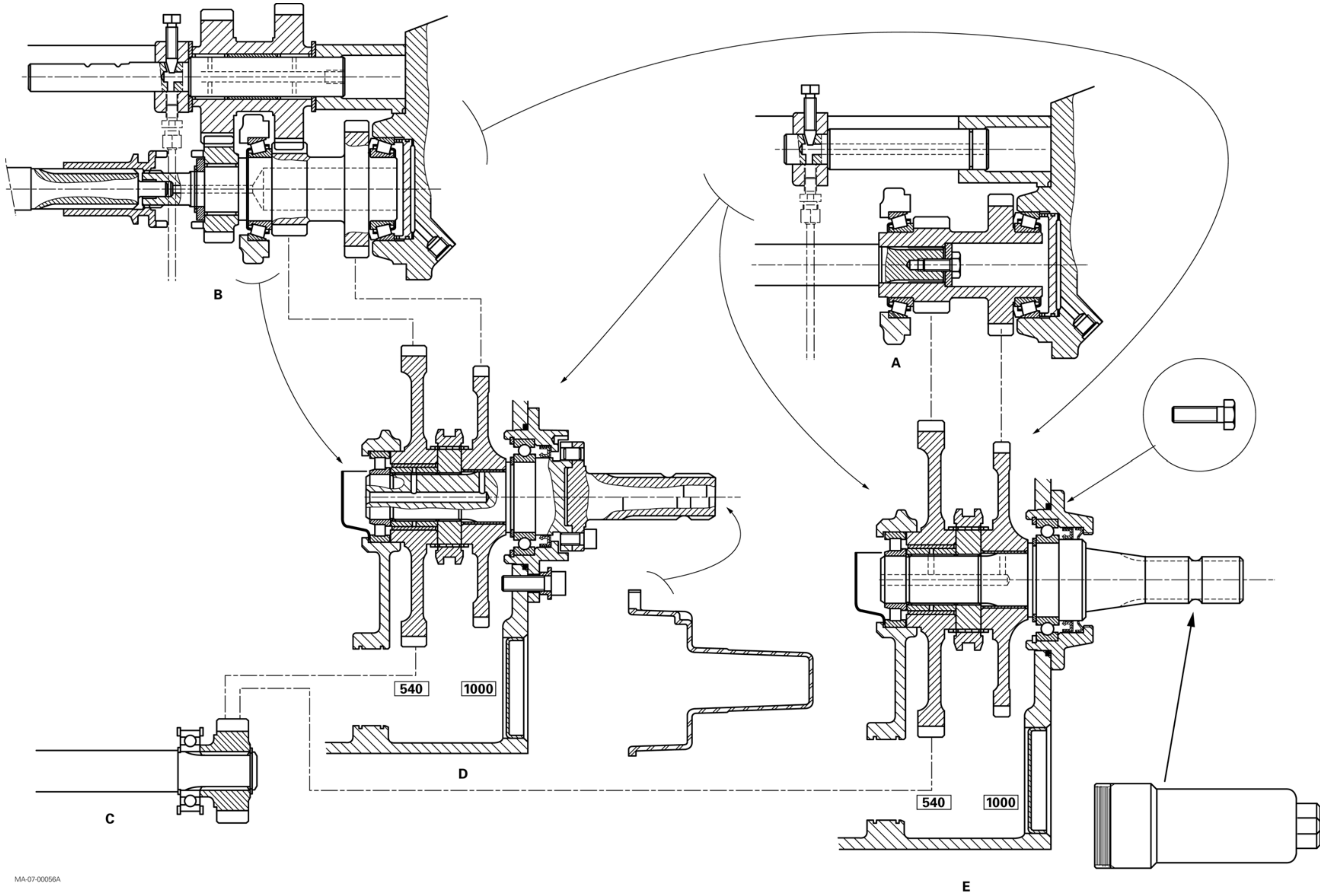


Fig. 2

Overall view

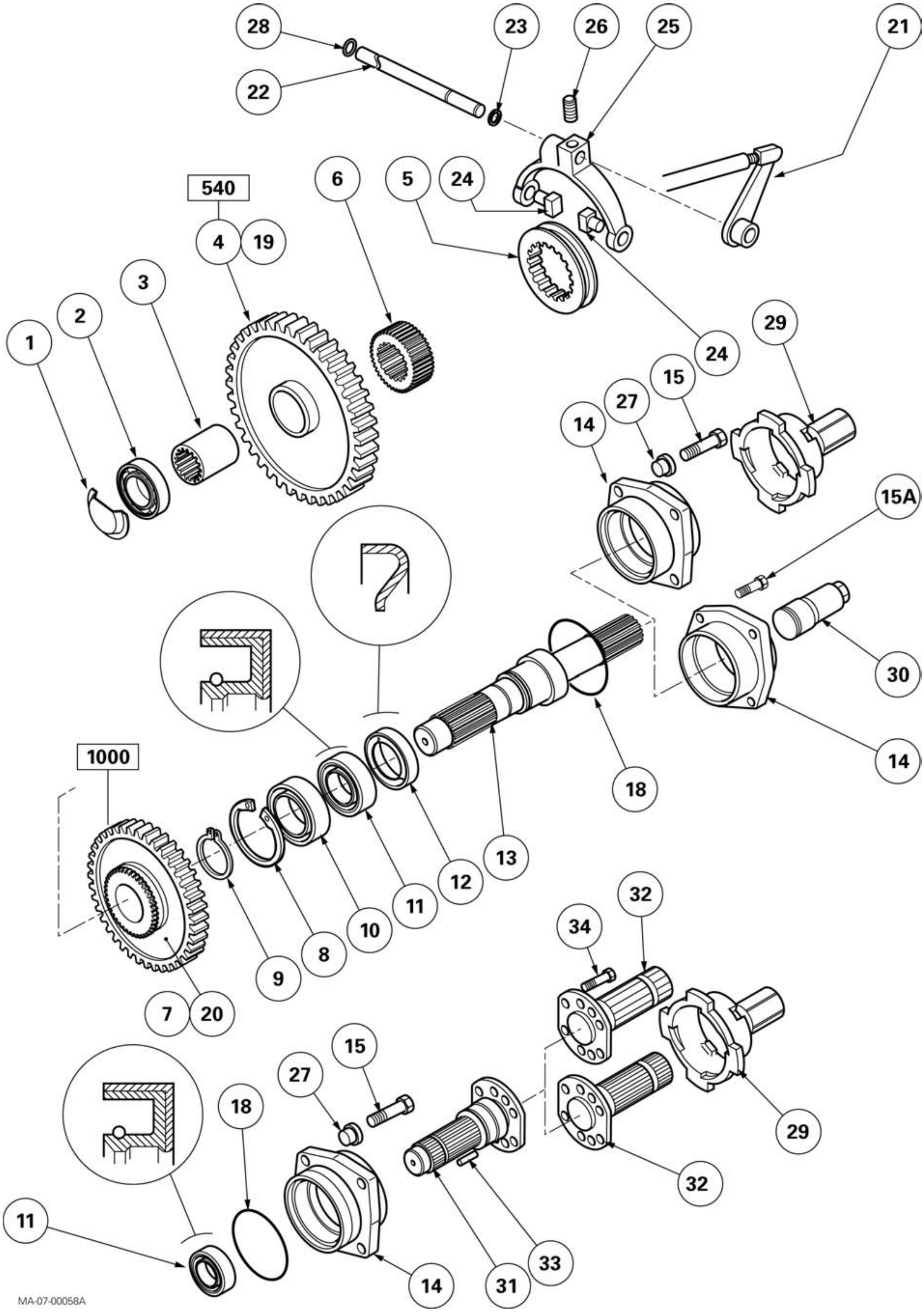


Fig. 3

C . Removing and refitting the rear bearing

Removal

1. Partially drain the rear axle housing.
2. Insert the coupler (5) into the pinion (7).
3. Remove the two opposing screws (15) (Fig. 4).
4. In the location of the two removed screws, tighten two guide studs home against the pinion (7). The aim of this operation is to keep the pinions (4) (7) (Fig. 5), hub and coupler aligned during removal of shaft (13) and bearing assembly.
5. Remove the other two screws (15).
6. Remove the shaft and the bearing assembly (Fig. 6). Discard seal (18).

Refitting

7. Refit the seal (18). Fit the shaft and the bearing assembly (Fig. 6).
8. Smear two screws (15) with Loctite 542 and tighten them to 105 - 120 Nm.
9. Remove the two guide studs.
10. Smear with grease and tighten the two other screws following the instructions described earlier.
11. Top up the oil level of the rear axle housing and check its level using a gauge located to the rear of the centre housing.

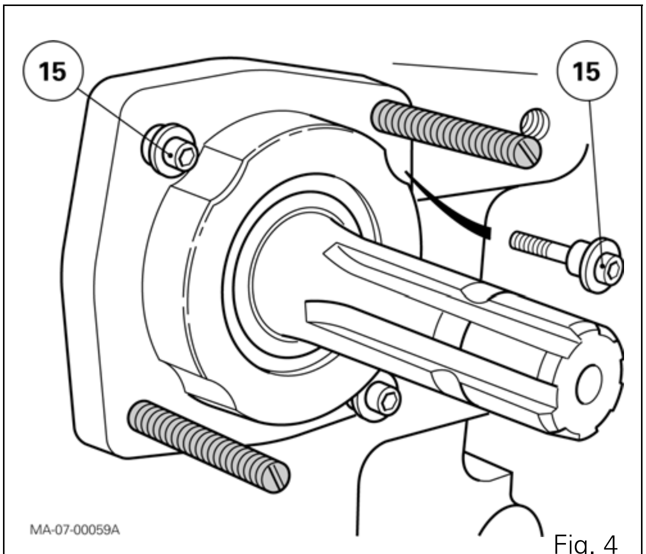


Fig. 4

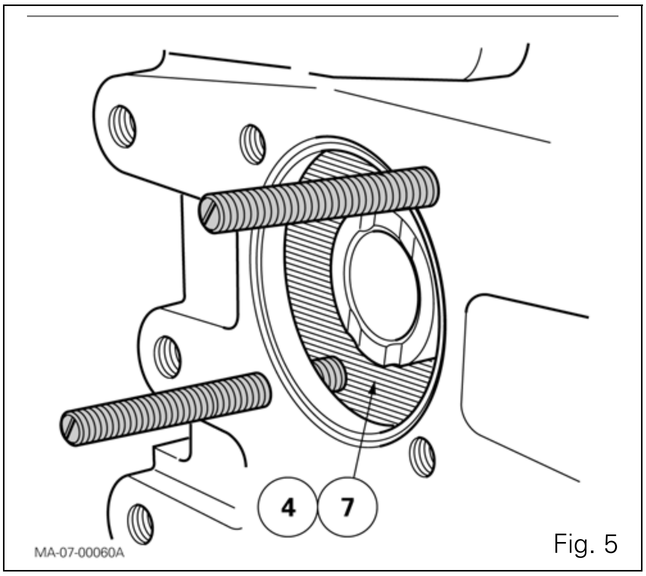


Fig. 5

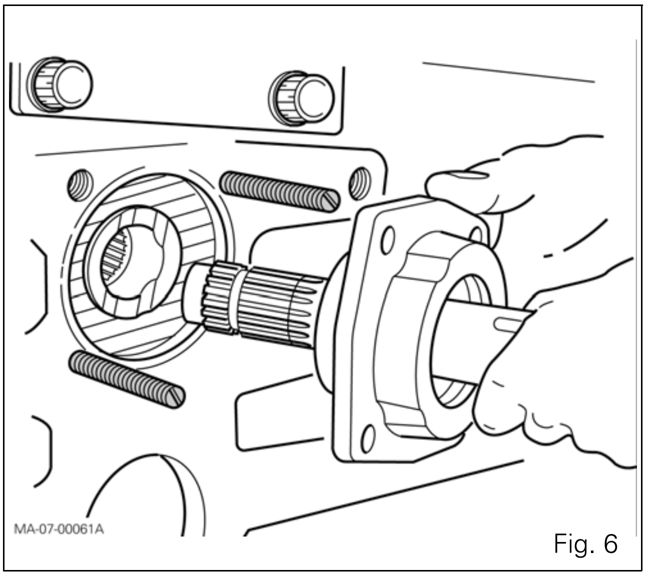


Fig. 6

D . Disassembling and reassembling the rear bearing

Preliminary operations

12. Remove the rear bearing. Carry out operations 1 to 6.

Disassembly

13. Remove the O'ring (18).
14. Take off circlip (8).
15. Separate cover (14) from bearing (10).
16. Remove snap ring (9).
17. Extract bearing (10) from shaft (13).
18. Extract sealing ring and deflector (12).

Reassembly

19. Using a press and a suitable fixture, fit deflector (12) up against the cover, carefully following the direction of assembly (Fig. 7).
20. Using a press and a suitable fixture, insert the sealing ring (11) flush with the chamfer machined onto the cover (14), with its lip turned towards the bearing (10) (Fig. 7).
21. Install the housing unit (14) components, carry out operations 13 to 17 in reverse order, and refit the rear bearing.

Final operation

22. Refit the rear bearing and repeat operations 7 to 11.

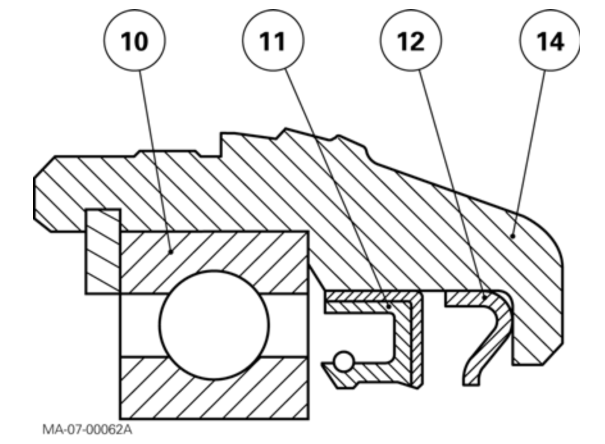


Fig. 7

E . Disassembling and reassembling the pinions (540 and 1000 rpm) and the front shaft bearing

Preliminary operations

Before removing pinions (4) (7), the following should be removed:

- the lift cover (see chapter 6)
- the hitch support (see chapter 6).
- the top cover of power take-off at the rear of tractor, the double driving pinion and, if applicable, the control fork (4-speed LSPTO).

Disassembly

23. Remove the left lift ram and take off the PTO sensor.

24. Undo the set screw (26).

25. Take out the pin (22) with the link (21) on the left-hand side of the tractor, and discard the O'ring (23).

NOTE: *The plug (28) stays inside the housing.*

26. Take out the control fork (25) with the pads (24) without letting them fall into the housing.

27. Remove the rear bearing and repeat operations 1 to 6.

28. Remove the hub (6) with the coupler (5), the pinions (4) (7) and the ring (3).

29. Extract the bearing (2) and oil slave device (1).

Reassembly

30. Check and clean all components. Replace any defective parts.

31. Lightly smear the oil slave device (1) with Loctite 648 or equivalent on the face turned towards the centre housing. Insert the slave device with its open end facing up (Fig. 8).

32. Insert the bearing (2) into the housing thrust up against the oil slave device (1) (Fig. 8).

NOTE: *Turn the sealed part of the bearing towards the pinion (4).*

33. Using a jet of compressed air, check that the oil channel in the shaft (13) is not obstructed. Lubricate the rings (19) (20). Refit the pinions (4) (7), the coupler (5) with the hub (6), the ring (3), with the opening of the teeth turned towards the rear of the tractor (Fig. 9).

NOTE: *If rings (19) (20) (no reference code given in spare parts catalogue) are damaged, replace the pinions (4) (7).*

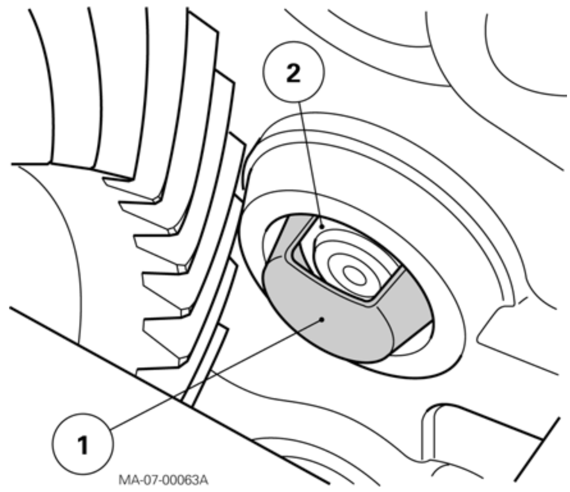


Fig. 8

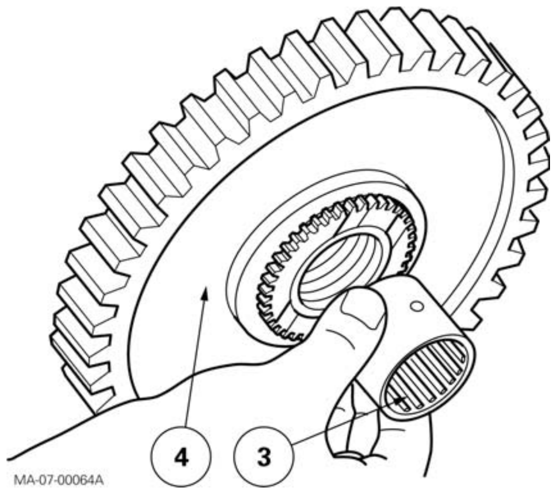


Fig. 9

34. Insert the coupler (5) into the pinion (7). Tighten two guide studs up against the pinion (7) following the method described in operation 4.

35. Refit the rear bearing and repeat operations 7 to 11.

36. Smear the thread of the PTO sensor (16) with Loctite 577 (Sensor Sealing or equivalent). Assemble and adjust the sensor:
- Tighten the sensor home, without forcing, until it comes in contact with the pinion (7),
- Unscrew the sensor by 3/4 turn,
- Tighten the nut (17) moderately and connect the connector.

37. Reassemble the control fork (25) with the pads (24) held up by two points of miscible grease (Amber Technical or equivalent).

38. Fit a new O'ring (23). Fit the pin (22) equipped with a link (21).

39. Tighten the screw (26) smeared with Loctite 221. Manually check correct operation of the fork and coupler (5) in the 540 - 1000 rpm positions respectively.

Final operations

40. Refit the left-hand ram.

41. Reinstall the driving pinion, the control fork (LSPTO, if fitted) and top cover (see chapter 7).

42. Refit the lift cover (see chapter 6).

43. Adjust the LSPTO control (see chapter 7).

44. Top up the oil level of the real axle housing by checking with a gauge located at the rear of the centre housing.

45. Check that the PTO and PTO brake operate correctly.

46. Check for the oil tightness of:
- mating faces (spool valve support, top cover, PTO rear bearing, and lift cover)
- the hydraulic unions.

F . Controls

Internal (Fig. 10)

(1) Lever
(2) Cable
(21) Link

Check
After adjusting the control cable, check that the coupler (5) fits correctly with the 540 and 1000 rpm pinions.

External (Fig. 11)

(2) Screw
(21) Link

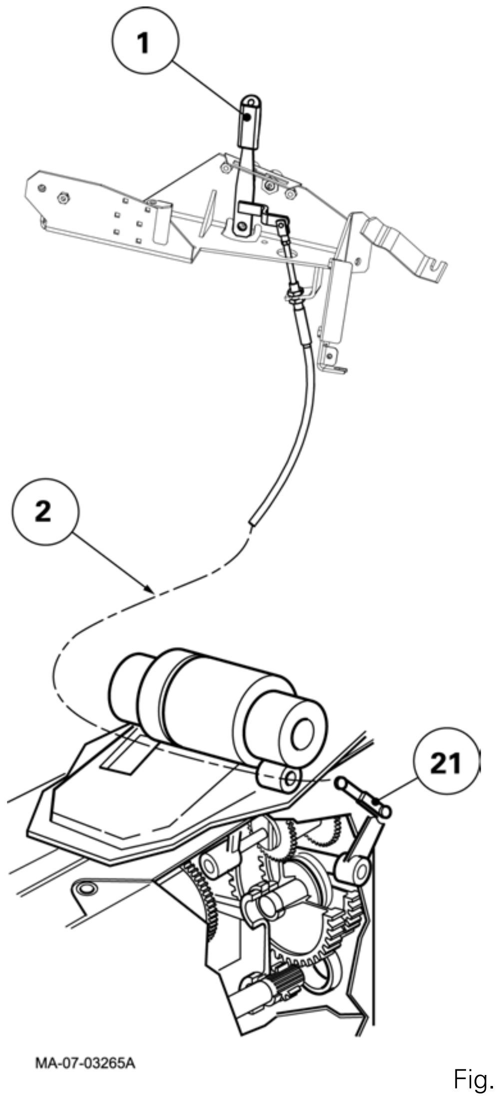


Fig. 10

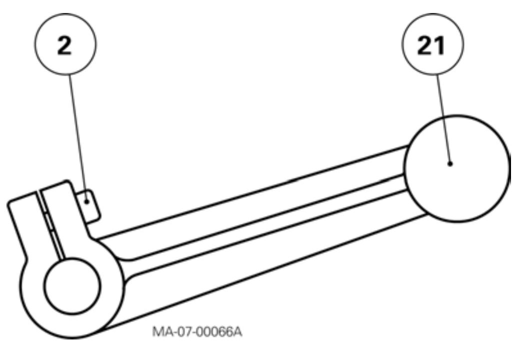


Fig. 11

G . Flange shaft

Special points

- The flange shaft (31) makes it possible to interchange the end-fitting (32) (6 or 21 splines).
- This end-fitting is integral with the shaft (31) via pins (33) and screws (34).
- When the power take-off is not in use, the coupling end is masked (depending on option):
  - either by a bayonet cap (29) held in place by special spacers (27),
  - or by a twist cap (30) (Fig. 12).

REMARK: *To allow for the removal of the end-fitting, introduce a measuring rod into one of the two holes drilled into the housing unit (14). Lock by gently turning the end-fitting. Take out the screws (34).*

Tightening torque

Screw (34): 100 - 130 Nm

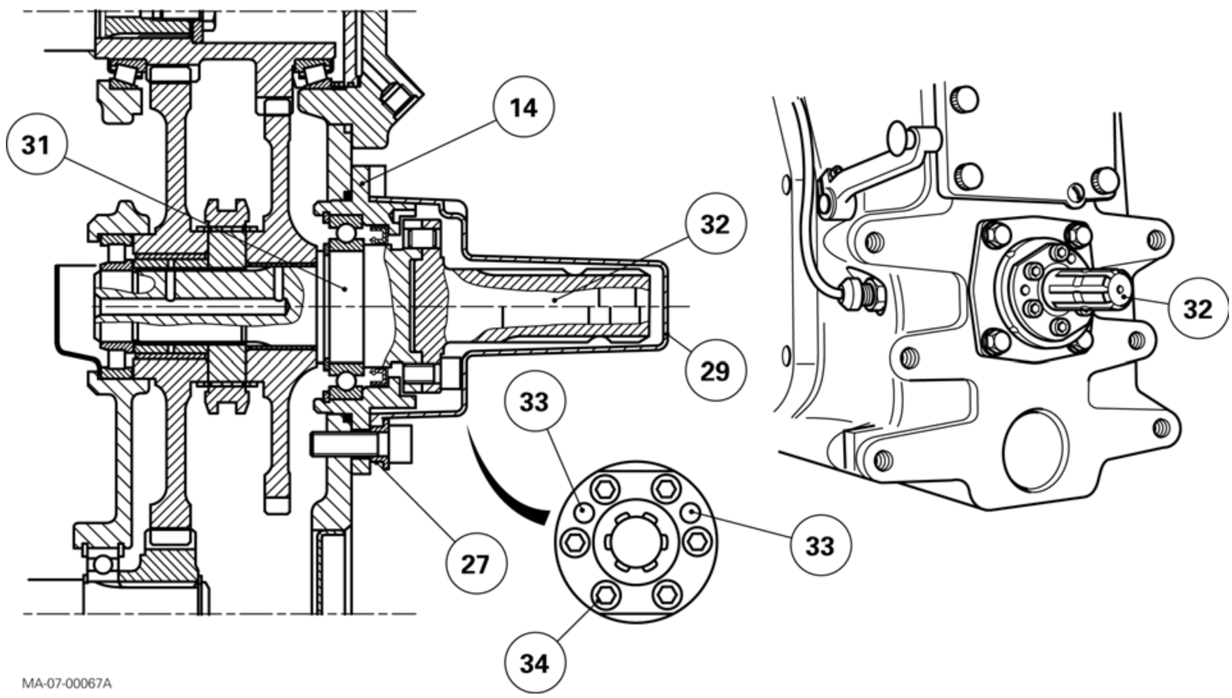


Fig. 12

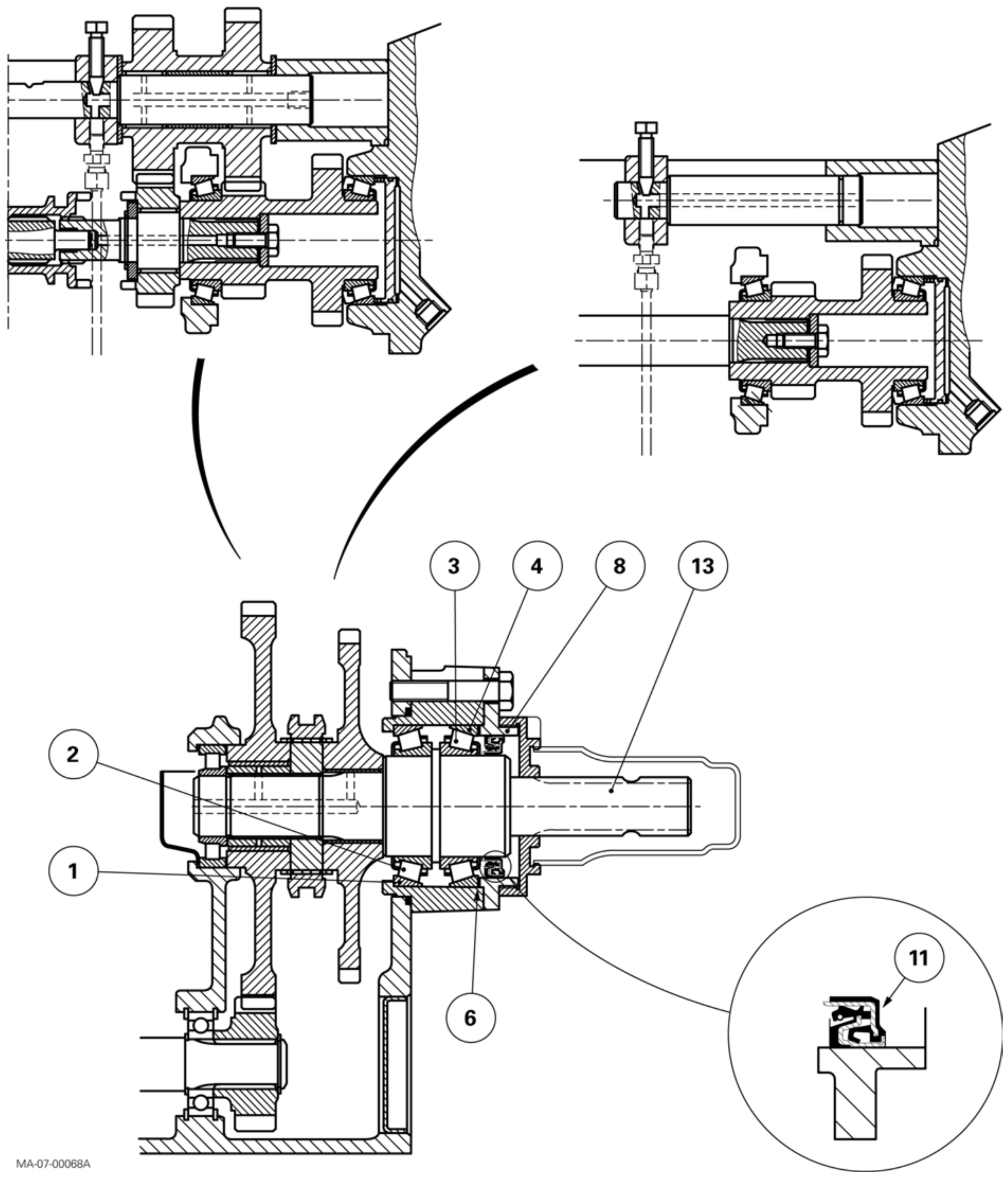


Fig. 13

H . Shaft with reinforced sealing

Construction (Fig. 14)

The output shaft (13) receives drive from the upper line of the power take-off and, via the different engaged pinions, transmits it to the implement that needs to be driven.

At the front, it is supported by a straight roller bearing force fitted into the centre housing and at the rear by two taper roller bearings (1) (2) and (3) (4) installed opposite one another.

Taper roller bearing clearance is obtained via shim(s) (6) placed between the rear bearing cup (4) and the seal holder (8).

As with the other PTO versions, it supports the 540 and 1000 rpm driven pinions.

When operating in rice fields or in particularly damp farming conditions, the rear bearing seal is reinforced by a "cassette" seal (11).

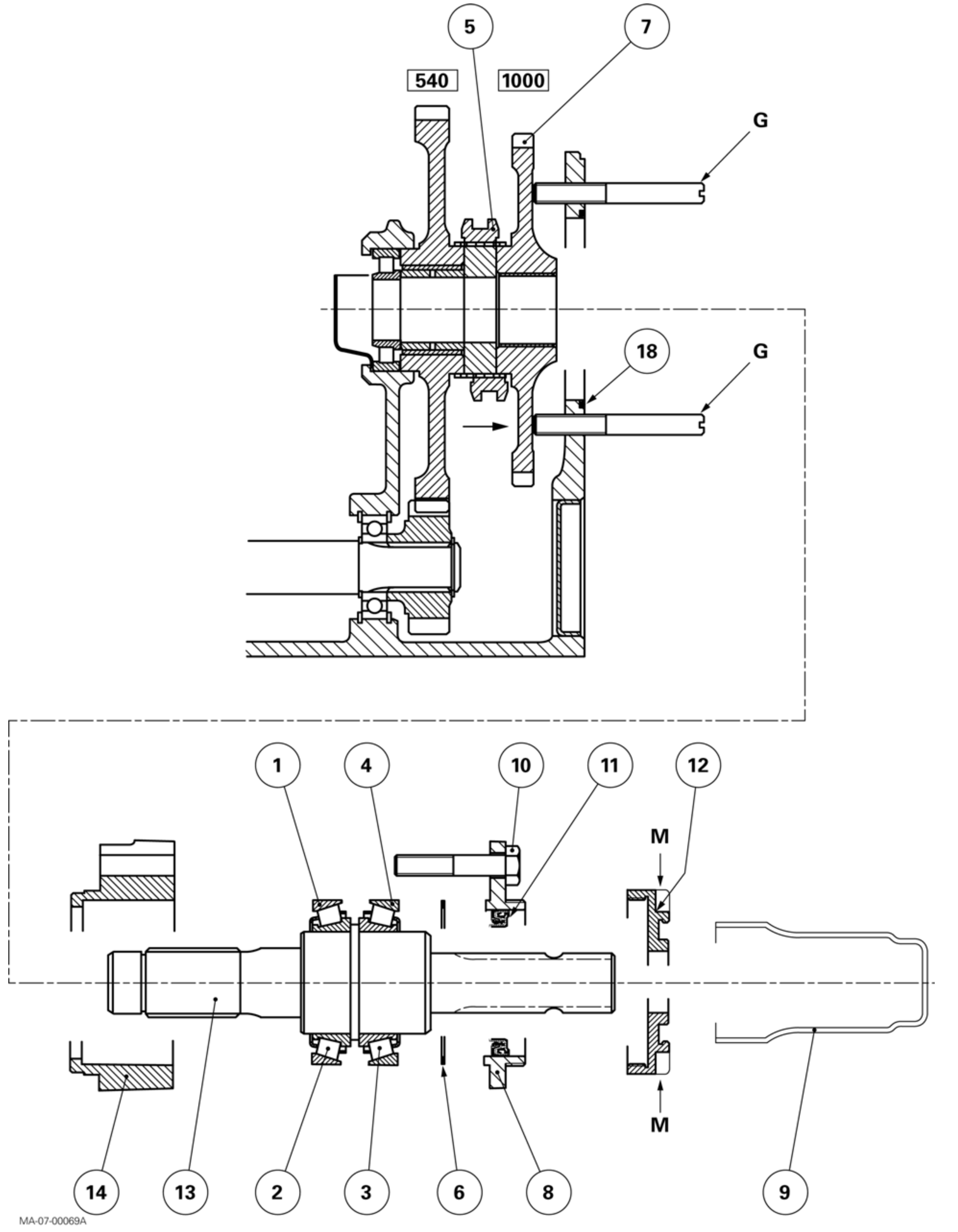


Fig. 14

Removing and refitting the shaft and housing unit

Removing the shaft (Fig. 14)

47. Take off the cap (9).

48. Using a wrench placed on the "M" flats, unscrew and remove the support (12).

49. Use the control to move the coupler to engage the 1000 rpm pinion.

REMARK: *Once engaged, the coupler holds the pinion in place.*

50. Take off the two diametrically opposed screws (10) and replace them with two locally made "G" guide studs of suitable length, their ends resting on the pinion (1000 rpm).

REMARK: *The guide studs should be kept slightly under pressure over the pinion (1000 rpm) which, in turn, transmits pressure to the other stacked elements.*

51. Remove the other two screws. Separate and lift the cover (8) equipped with a sealing ring (11).

52. Disengage the shaft (13) and bearings (1) (2) and (3) (4) from the 540 and 1000 rpm driven pinions.

REMARK: *Pair up the cones and bearing cups in case of reuse.*

53. If necessary, extract the bearing cones from the shaft.

Removing

54. Separate the housing unit (14) from the centre housing.

55. Discard the O'ring (18).

Refitting the unit

56. Clean and check all components. Replace any defective parts.

NOTE: *The bearing cones and cups should be lubricated with clean transmission oil before fitting.*

57. Fit an O'ring (18) onto the housing unit and slide it onto the guide studs and into the bores of the centre housing.

58. Temporarily tighten the two diametrically opposed screws (10) in order to secure the housing unit.

Refitting the shaft (Fig. 14)

59. Slide the bearing cup (1) into the housing unit.

60. As required, insert the bearing cones (2) (3) up against the shaft collar using a press and a suitable fixture.

61. Introduce the shaft (13) into the 540 - 1000 rpm driven pinions.

62. Position the rear bearing cup (4).

63. If necessary, carry out the shimming of bearings (see later).

64. Replace the sealing ring (11) (see later).

65. Take off the two screws previously installed. Smear the rear face of the housing unit (14) with Loctite 510 or equivalent and refit the cover (8) fitted with a sealing ring.

66. Fit two screws, their thread lightly smeared with Loctite 542 or equivalent and tighten to a torque of 100 - 130 Nm.

67. Take off the guide studs and install two more screws, following the previous instructions.

68. Refit the support and tighten it to 30 - 50 Nm.

69. Tighten the cap moderately.

Shimming the bearings

Preparing for shimming

70. Remove the cover (8), without Loctite, eliminating the shims and sealing ring (11).

__NOTE:__ By eliminating the shims, there is the risk of creating excessive clearance. In this case, fit a thickness of shims to reduce the clearance to approximately 0.35 mm.

71. Position the dial gauge feeler pin on the end of the shaft (Fig. 15).

72. Pull hard on the shaft, turning it to and fro from left to right to correctly “seat” the cones in the bearing cups.

73. Reset the dial gauge to zero.

74. Repeat the operation 72, this time by pushing.

75. Depending on the value read on the dial gauge, prepare a thickness of shim(s) (6) in order to obtain a final clearance of:

J1 = 0.05 to 0.15 mm (Fig. 15)

__NOTE:__ If possible, shim to obtain minimum tolerance.

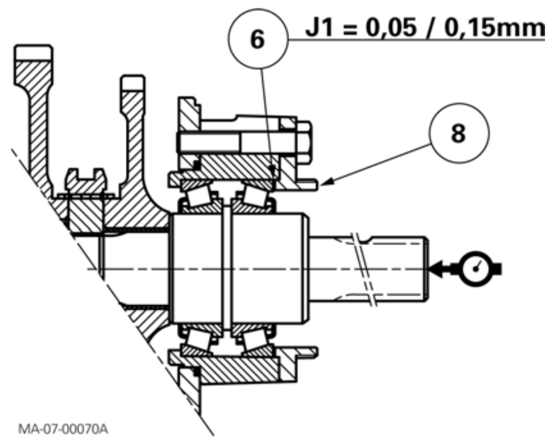


Fig. 15

Replacing the sealing ring

REMINDER: *The sealing ring (11) is also known as a "cassette" seal.*

Removal

76. Remove cap (9) and support (12).

77. Take out the two diametrically opposed screws (10) and replace them with two guide studs (Fig. 16).

78. Take off other two screws, separate and remove the cover (8) (Fig. 16).

79. Drive off the seal from the cover.

Replacement

80. Clean the cover and check that it is free of dents or burrs at the location of the seal.

81. Insert the new seal correctly turned with its external face 9.25 mm from the rim of the cover (8) (Fig. 16), using a locally made drift.

Refitting

82. Smear the rear face of the housing unit (14) with Loctite 510 or equivalent and refit the cover (8) after checking for the presence of shim(s) (6).

83. Insert the screws (10) and repeat operations 66 and 67.

Test

84. Start the engine. Activate the power take-off and check the tightness of the rear bearing.

85. Refit and tighten the support as well as the cap, then repeat operations 68 and 69.

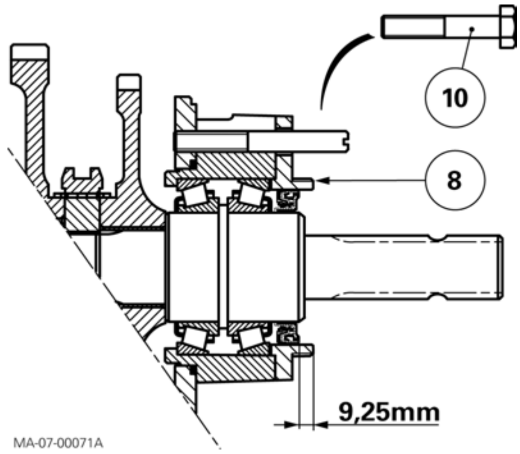


Fig. 16

07E01 - GPA20 - GSPTO

CONTENTS

A . General

Tractors can be fitted with GSPTO.

Unlike the independent PTO system where PTO speed depends on the engine speed, GSPTO is driven by the rear differential drive pinion and the PTO shaft speed is proportional to the ground speed of the tractor.

B . Operation

The drive pinion comprises a pinion (31) constantly meshed with either the pinion (16) (2WD), or the bell gear (33) (4WD). The sliding gear (10) allows to mesh the shaft (8) in rotation with shaft (18) (2WD) or shaft (32) (4WD). The pinion (3) fitted at the end of shaft (8) drives the 540 rpm pinion of the rear PTO shaftline.

The movement of the sliding gear (10) is obtained by a pad articulated on a pin fitted to the left in the lower part of the rear axle housing and controlled by a link and a cable operated by a lever in the cab.

Parts list

		2WD	4WD
(01)	Plug	●	●
(02)	Circlip	●	●
(03)	Pinion	●	●
(04)	Circlip	●	●
(05)	Bearing	●	●
(06)	Circlip	●	●
(07)	Circlip	●	●
(08)	Shaft	●	●
(09)	Circlip	●	●
(10)	Sliding gear	●	●
(11)	Screws	●	●
(12)	Cover	●	●
(13)	Needle bearing	●	●
(14)	Cup	●	
(15)	Cone	●	
(16)	Pinion	●	
(17)	Circlip	●	
(18)	2WD shaft	●	
(19)	Cone	●	
(20)	Cup	●	
(21)	Shim(s)	●	
(22)	Spacer	●	
(23)	Circlip	●	
(24)	Plug	●	
(25)	Double pin	●	●
(26)	Double pin	●	●
(27)	Sleeve	●	●
(28)	Sleeve	●	●
(29)	Shaft	●	●
(30)	Circlip	●	●
(31)	Pinion	●	●
(32)	4WD shaft		●
(33)	Bell gear		●

Overall view

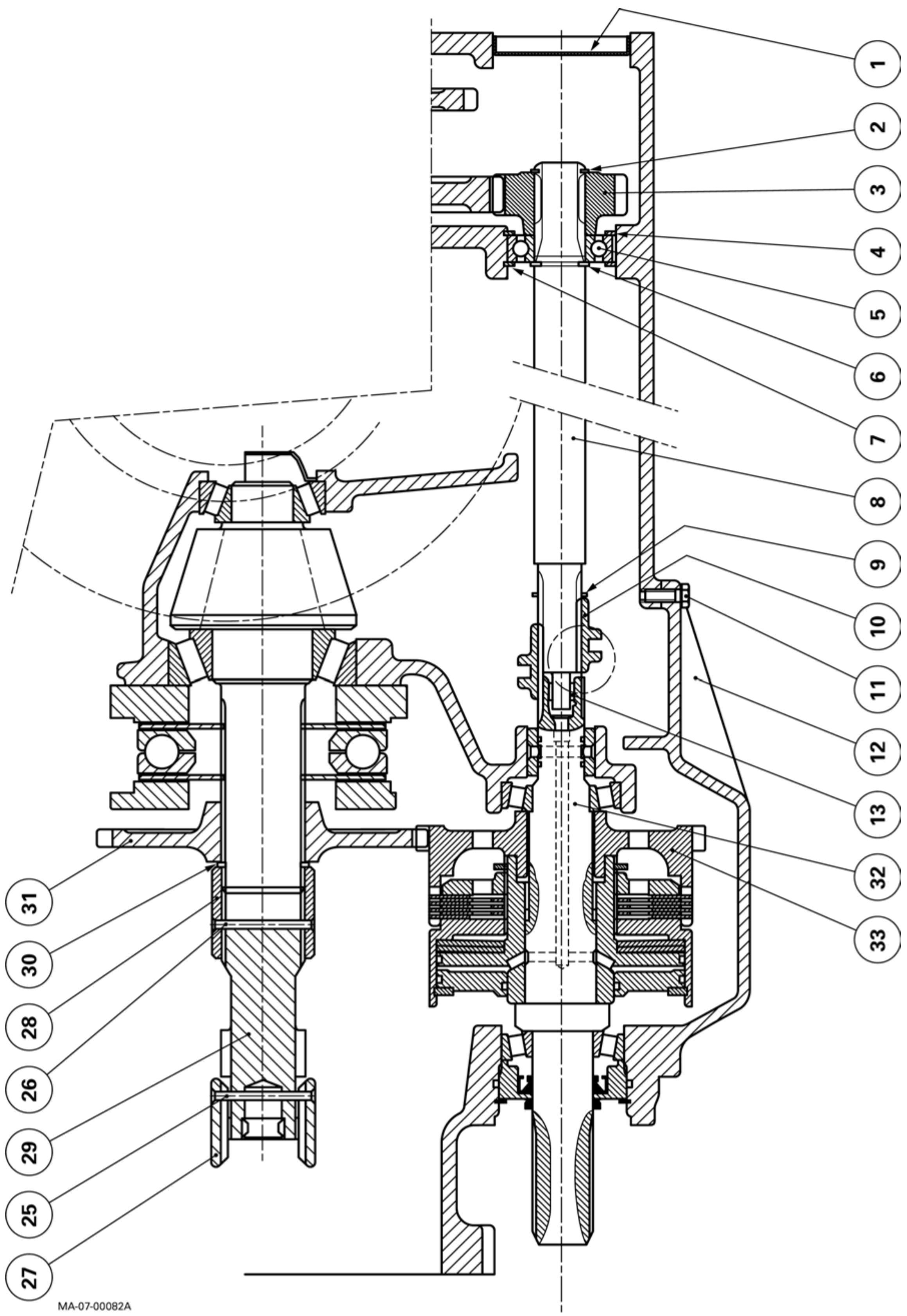


Fig. 1

Overall view

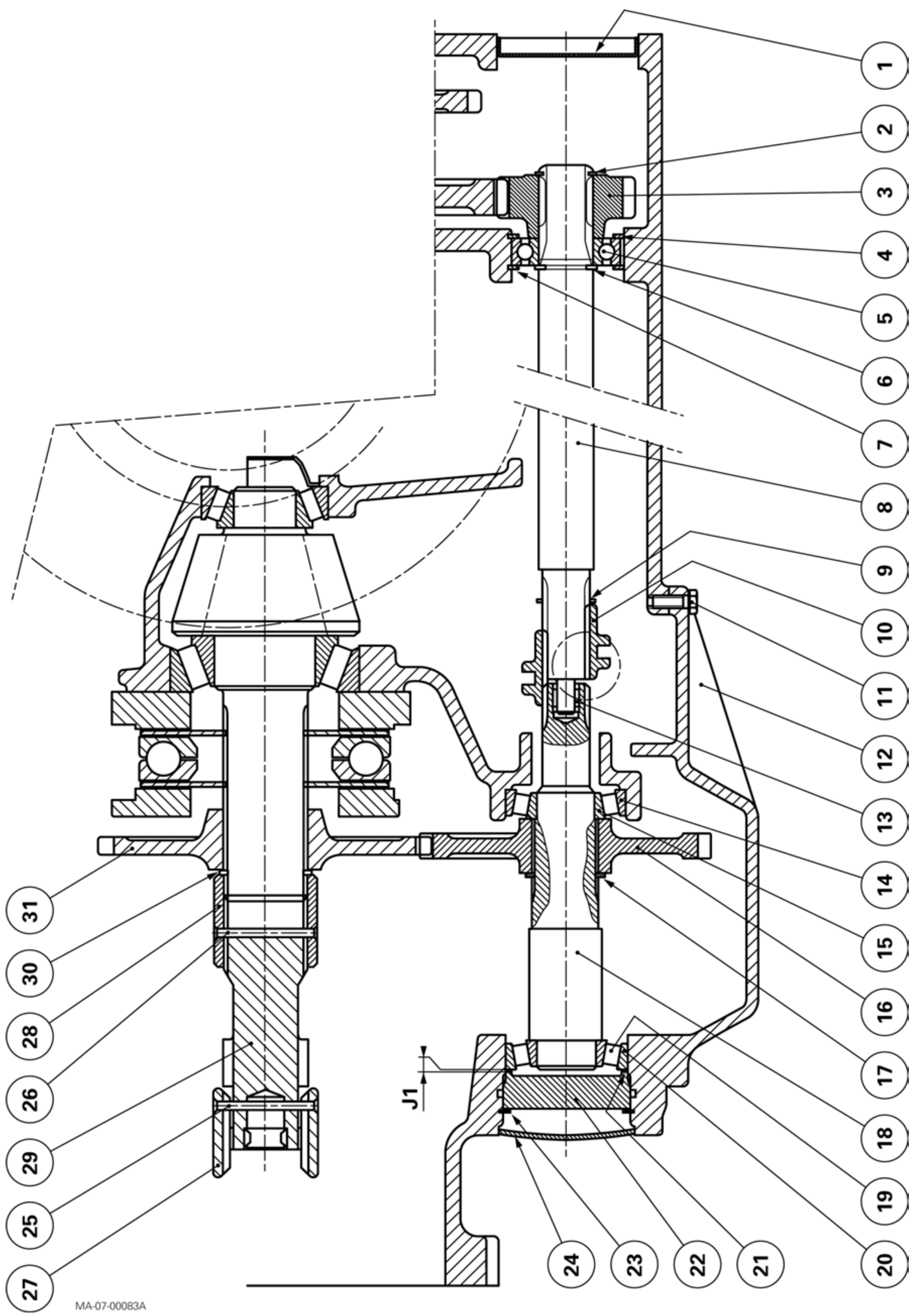


Fig. 2

Exploded view

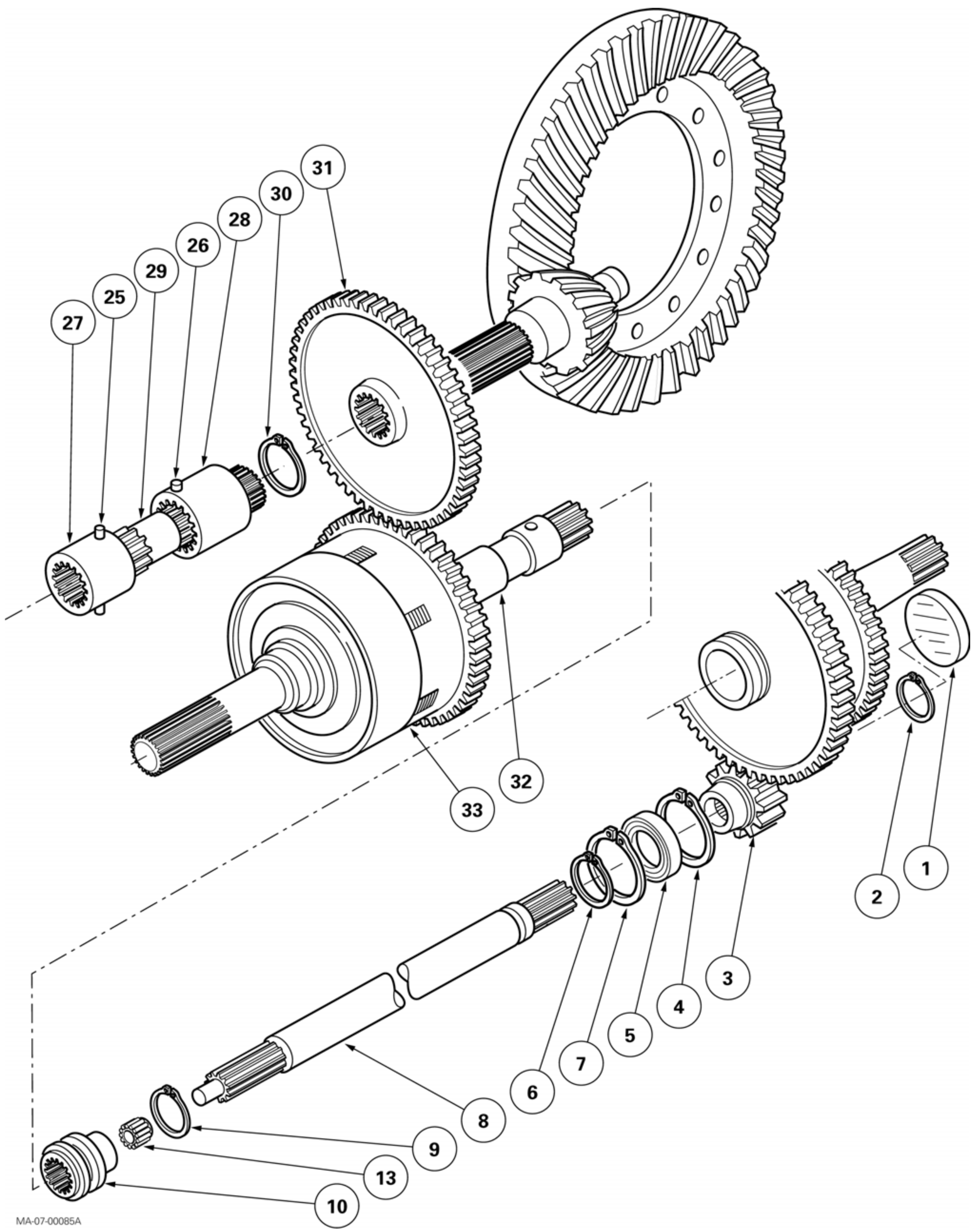


Fig. 3

Exploded view

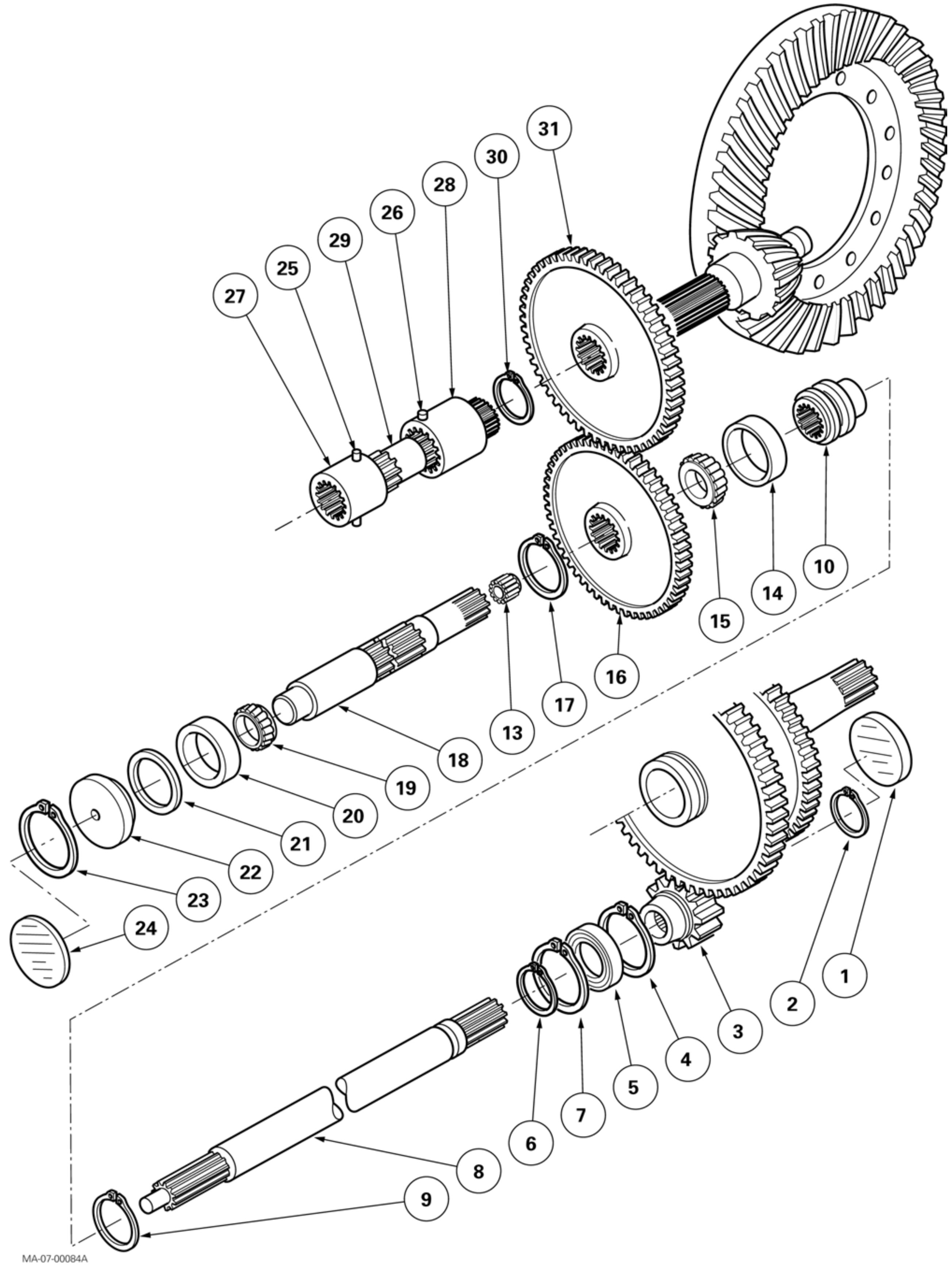


Fig. 4

C . Disassembling the power take off (2WD version)

1. Chock the wheels of the tractor. Drain the rear axle housing. Remove the lubricating pipe of the engine clutch or Power Shuttle (depending on version) that is fitted to the lower covers of the centre housing and the gearbox.
2. Take out the screws (11).
3. Take off cover (12).

   NOTE: *Recover the spring (3) (Fig. 5).*
4. Remove the retainer pipe (4) from the control link (7) and the locking stud (2) (Fig. 5).
5. Disconnect the control cable (1) and remove the link (7) (Fig. 6).

   NOTE: *The pad (1) turns free in the link pin (7) (Fig. 5).*
6. Remove the O'ring (5) (Fig. 5).
7. Remove the hook.
8. Extract plug (1) (Fig. 7).
9. Take off circlip (2).
10. Take off pinion (3) (Fig. 8).

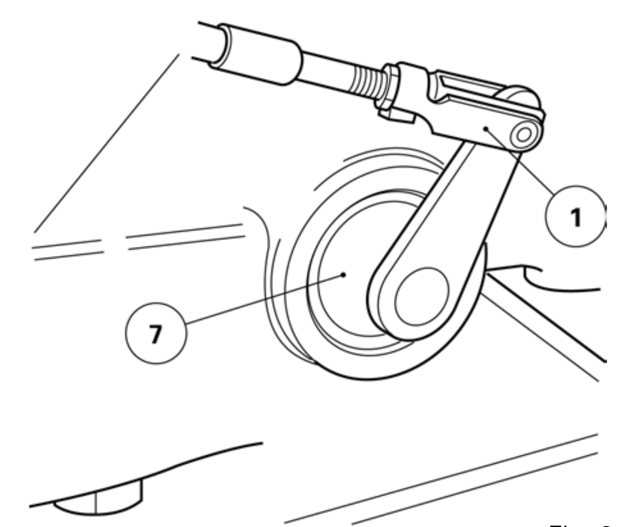


Fig. 6

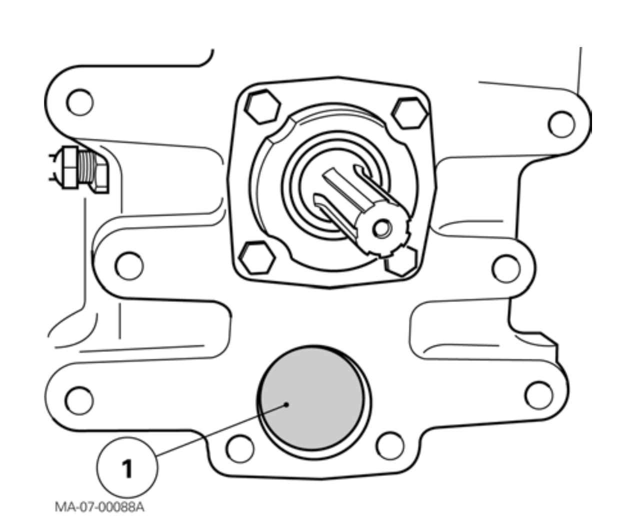


Fig. 7

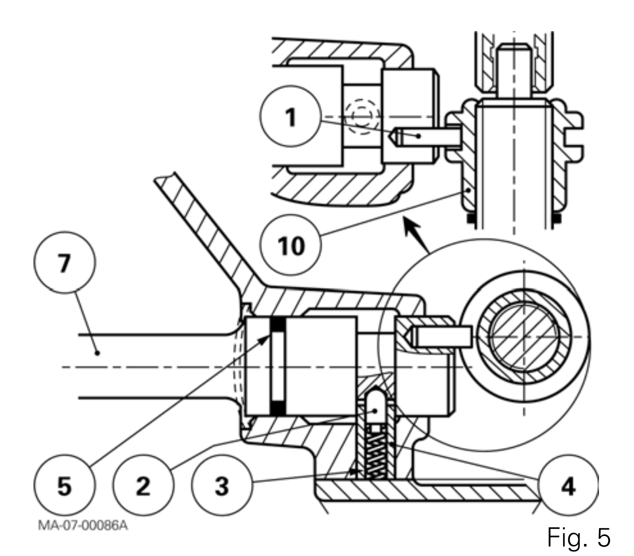


Fig. 5

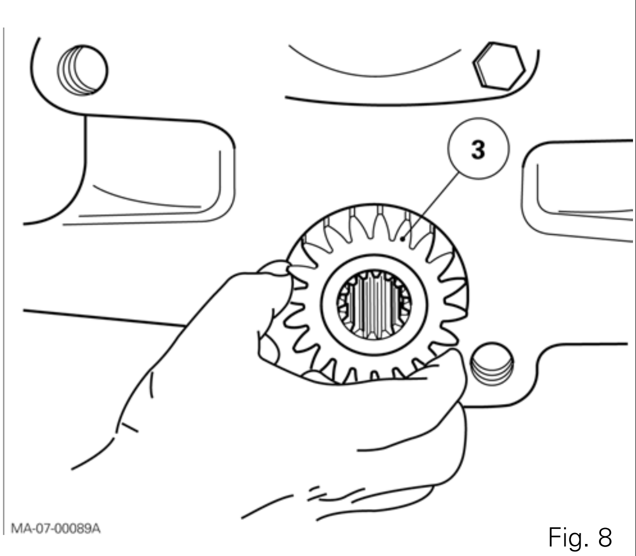


Fig. 8

11. Take off the circlip (4) (Fig. 9).
12. Take out shaft (8) with bearing (5) then remove sleeve (10).
NOTE: *If necessary, remove circlip (7).*
13. Take off circlips (6) (9).
14. Extract bearing (5) using a press.
15. Extract plug (24).
16. Take off the circlip (23) and spacer (22).
17. Remove shims (21).
18. Remove cup (20).
19. Take out shaft (18) complete with bearing cone (19).
20. Take off circlip (17) and hold pinion (16).
21. Remove pinion (16) and bearing cone (15).
22. Extract the cone (19) and take the circlip (17) off the shaft (18).
NOTE: *Match the cones and cups if they are to be reused. Bearing (13) is force fitted in shaft (18).*
23. Extract cup (14) using a suitable extractor.
NOTE: *If pinion (31) is removed, it is necessary to remove the right-hand hydraulic cover.*
24. Chock the wheels of the tractor.
25. Apply the handbrake.
26. Raise the tractor using a jack.
27. Position the axle stand.
28. Disassemble the wheel.
29. Remove the right-hand hydraulic cover (see section 9).

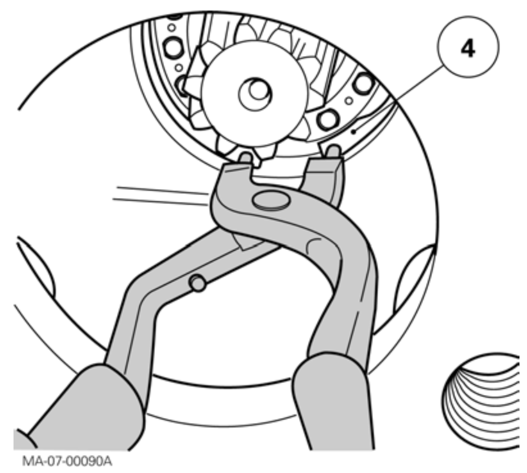


Fig. 9

Tractors with no creeper unit

30. Drive out the double pins (25) (26) from the coupling sleeves (27) (28).
31. Slide the sleeves towards each other on the shaft (29).
32. Remove the shaft and sleeves assembly.
33. Take off circlip (30).
34. Remove pinion (31).
NOTE: *On 2WD tractors (without a GSPTO) the pinion (31) is absent, but circlip (30) must be fitted.*

Tractors with a creeper unit

35. Remove the fork, the sleeve assembly, the link shaft and the coupler.
36. Take off circlip (30).
37. Remove pinion (31).

D . Reassembling the power take off (2WD version)

38. Check and clean all components. Replace any defective parts.

In case of servicing on the pinion (31)

Tractors with a creeper unit

39. Refit the pinion (31).

40. Refit the circlip (30).

41. Refit the fork, the sleeve assembly (28) (the long offset between the pin and the pinion positioned as shown in Fig. 10), the link shaft and the coupler. Replace the pins. Adjust the fork (see section 5).

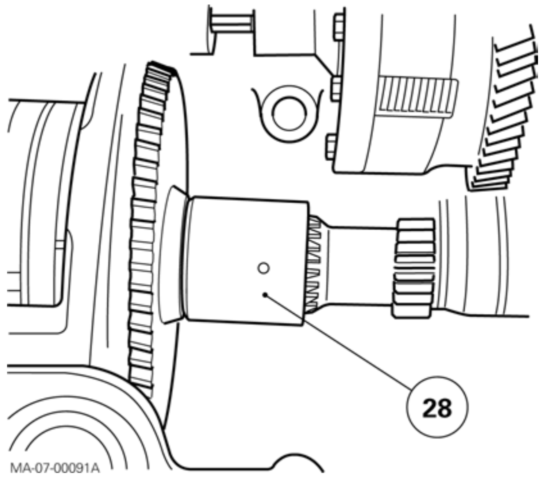


Fig. 10

Tractors with no creeper unit

42. Refit the pinion (31).

43. Refit the circlip (30).

44. Refit the assembly (link shaft and sleeves) then position the coupler sleeves (27) (28) on the shaft (29).

45. Fit the double pins (25) (26) on the coupling sleeves.

***Note:** Turn the sleeve (28) as in operation 41. Replace the pins. The long pin is fitted in sleeve (27).*

Tractors with or without creeper unit

46. Insert cup (14) in abutment on the shoulder of the housing.

47. Insert cone (19) on shaft (18) in abutment on the shoulder, using a press and a suitable fixture, then position circlip (17).

48. Check for the presence of the needle bearing (13).

49. In order to turn the shaft to carry out **J1** shimming, do not fit pinion (16).

Position cone (15). Fit shaft (18) assembled with the cone (19) and circlip (17).

50. Refit cup (20), spacer (22) and circlip (23).

***NOTE:** For correct shimming, make sure that the spacer moves freely in the bore of the housing.*

51. Carry out shimming of the shaft (18) in order to obtain:

J1 = 0 to 0.10 mm.

52. Put a dial gauge feeler pin against the end of spacer (22) (Fig. 11).

53. Through the opening of the cover (12), pull on the shaft, turning it to the left and right alternately to correctly seat the cones in their cups.

54. Reset the dial gauge to zero.

55. Repeat the operation 53, this time by pushing.

56. Depending on the clearance measured, select the correct thickness of shims.

57. Take off the circlip (23) and spacer (22). Take out shaft (18) assembled with the cone (19) and circlip (17) while holding the cone (15). Refit the pinion (16), the shaft (18) and cup (20).

58. Apply two dots of grease to shims (21) selected during operation 56 and place them against the cup (20).

59. Fit the spacer (22) and circlip (23).

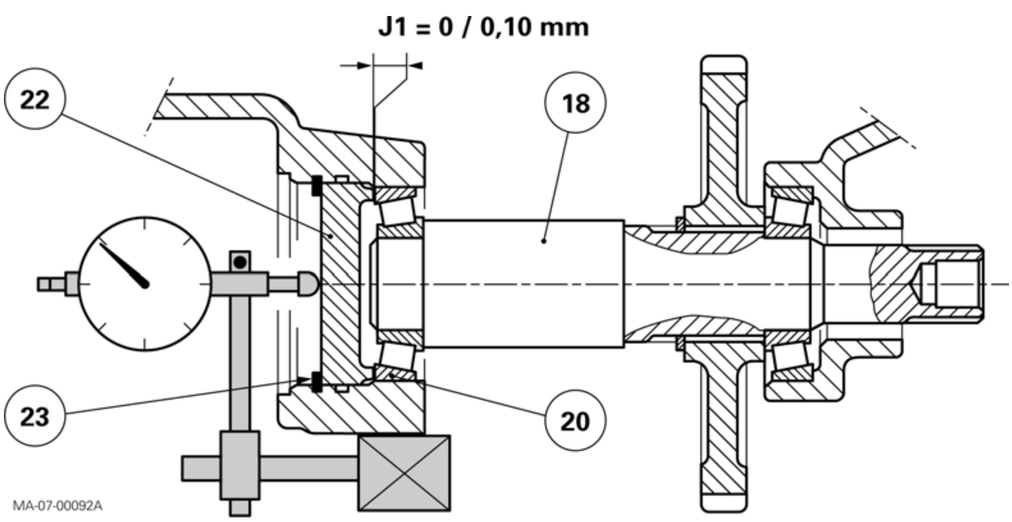


Fig. 11

60. Replace or clean the plug (24) and its mating face on the housing.

61. Smear the corner of the plug housing with Loctite 542 and then insert the plug.

62. Place the sliding gear (10) on shaft (18).

NOTE: *Turn the small shoulder E towards the shaft (18) (Fig. 12).*

63. Fit circlips (6) (9) on shaft (8).

64. Using a suitable fixture, insert bearing (5) using a press, on shaft (8), in contact with circlip (6).

65. Check for the presence of circlip (7).

66. Fit the shaft assembly (8) in the housing (Fig. 13).

67. Fit the circlip (4).

68. Place pinion (3).

69. Fit the circlip (2) (Fig. 14).

70. Check the movement of the sliding gear (10) through the opening of the cover (12).

71. Replace or clean the plug (1) and its mating face on the housing.

72. Smear the plug with Loctite 542, then insert it slightly recessed from the face of the housing.

73. Fit the link (7) (fitted with a new O'ring (5)) by placing pad (1) in the groove of the sliding gear (10) (Fig. 5).

74. Clean and degrease the mating faces (cover and housing).

75. Smear the mating face of the cover with a sealing product (Masterjoint 510 or equivalent).

76. Screw two opposing guide studs into the housing.

77. Fit the retainer pipe (4), control link, locking stud (2) and spring (3) (Fig. 5).

78. Refit the cover (12) and the lubricating pipe of the engine clutch or Power Shuttle (depending on version).

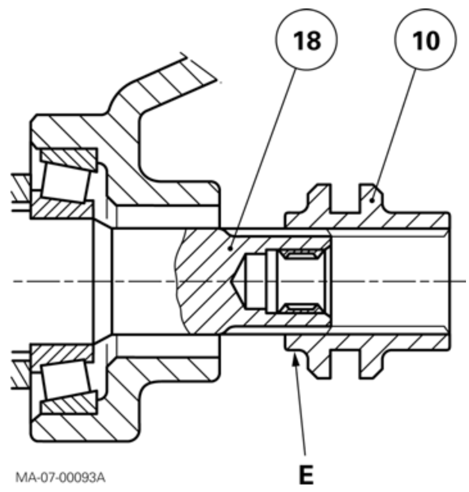


Fig. 12

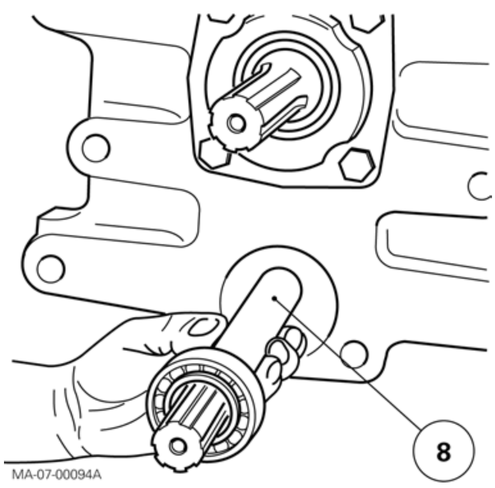


Fig. 13

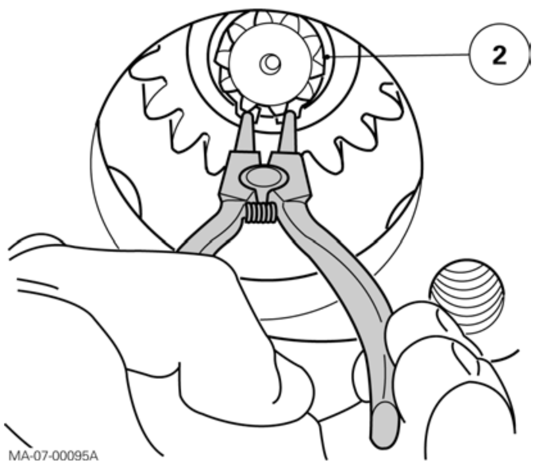


Fig. 14

79. Take out the guide studs. Tighten the screws to a torque of 130 - 170 Nm.

80. Reconnect the GSPTO control cable (1) (Fig. 6).

81. Adjust the control (see § G).

82. Top up the oil level in the rear axle.

83. Refit the hook (for tractors fitted with an auto-hitch, check correct operation). If adjustment is necessary, see section 6.

84. Check GSPTO operation.

85. Check for the oil tightness of:

- the mating faces
- the cover beneath rear axle housing
- the hydraulic unions.

E . Disassembling the power take off (4WD version)

86. Remove the guard, the 4WD shaft and the lubricating pipe of the engine clutch or Power Shuttle. Disassemble shaft (8). Carry out operations 1 to 14.

Note: *If servicing is required on the 4WD clutch assembly, the cones and cups, the shaft and needle bearing, see section 8.*

If the pinion (31) is removed, it is necessary to remove the right-hand hydraulic cover.

87. Raise the tractor using a jack. Position an axle stand. Disassemble the wheel.

Tractors with no creeper unit

88. Drive out the double pins (25) (26) from the coupling sleeves (27) (28).

89. Slide the sleeves towards each other on the shaft (29).

90. Remove the assembly (shaft and sleeves).

91. Take off circlip (30) and remove the pinion (31).

Tractors with a creeper unit

92. Remove the fork, the sleeve assembly, the link shaft and the coupler.

93. Take off circlip (30) and remove the pinion (31).

F . Reassembling the power take off (4WD version)

94. Check and clean all components. Replace any defective parts.

In case of servicing on the pinion (31)

Tractors with a creeper unit

95. Refit the pinion (31). Refit the circlip (30).

96. Refit the fork, the sleeve assembly, the link shaft and the coupler. Fit the sleeve (28) with the long offset between the pin and the 4WD pinion turned as shown in Fig. 15. Replace the pins. Adjust the fork (see section 5).

Tractor with no creeper unit

97. Refit the pinion (31). Refit the circlip (30).

98. Refit the assembly (link shaft and sleeves) then position the coupling sleeves (27) (28) on the shaft (29).

99. Fit two new double pins (25) (26) on the coupling sleeves.

Note: *Fit the sleeve (28) with the long offset between the pin and the 4WD pinion turned as shown in Fig. 15. The long double pin is fitted on the sleeve (27).*

Tractors with or without creeper unit

100. Refit the right-hand hydraulic cover (see section 9).

Note: *If you have disassembled the 4WD clutch assembly, the cones and cups, the shaft and roller bearings, see section 8 for reassembly.*

101. Place the sliding gear (10) on the shaft (32).

Note: *Turn the small shoulder E towards the shaft (32) (Fig. 16).*

102. Refit shaft (8). Carry out operations 63 to 81.

103. Top up the oil level in the rear axle. Refit the hook (if adjustment is necessary, see section 6). Check correct operation of the GSPTO.

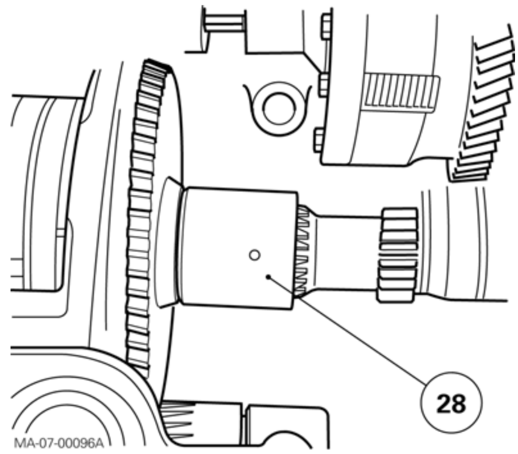


Fig. 15

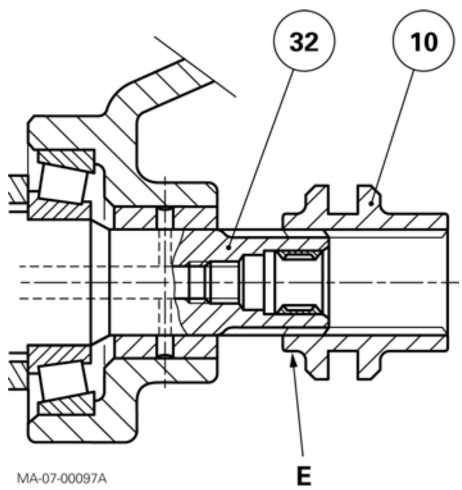


Fig. 16

104. Check for the oil tightness of:
- the mating face of the cover under the rear axle housing
- the right-hand hydraulic cover (if removed)
- the hydraulic unions.

G . Assembling and adjusting the control

105. Place lever L (Fig. 17) in GSPTO position (clutch engaged) (Fig. 18).

106. Screw the clevis (1) flush with the threaded end of the cable (6).

107. Fit the clevis (1) to lever L using the clip (7). Tighten nut (2).

108. Adjust the sheath end (5) so that the nut (3) is flush with the end of the threaded part.

109. Tighten nut (4) and check that the cable is not constrained in any way.

110. Place the link (8) in "clutched" position "a" (Fig. 19) and ensure that it is correctly locked.

111. Screw clevis (1) flush with the threaded part of cable (6) (Fig. 19).

112. Fit clevis (1) to link (8) using clip (7). Tighten nut (2).

113. Adjust sheath end (5) using nut (4) while ensuring that link (8) is still locked in position "a".

114. Tighten nut (3). Check correct operation of the control in "declutched" position "b" and check that the cable is not constrained in any way when in position "a".

115. Check for correct operation of the instrument panel indicator light.

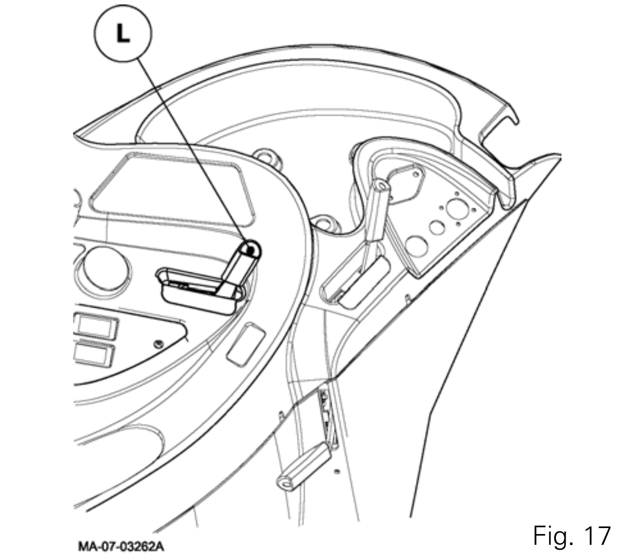


Fig. 17

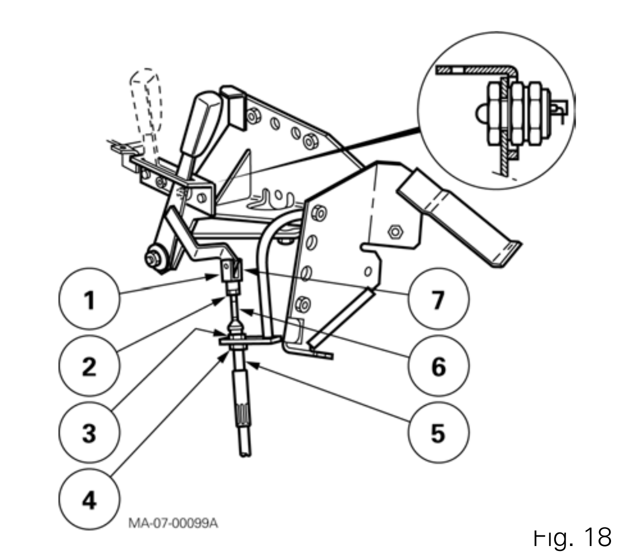


Fig. 18

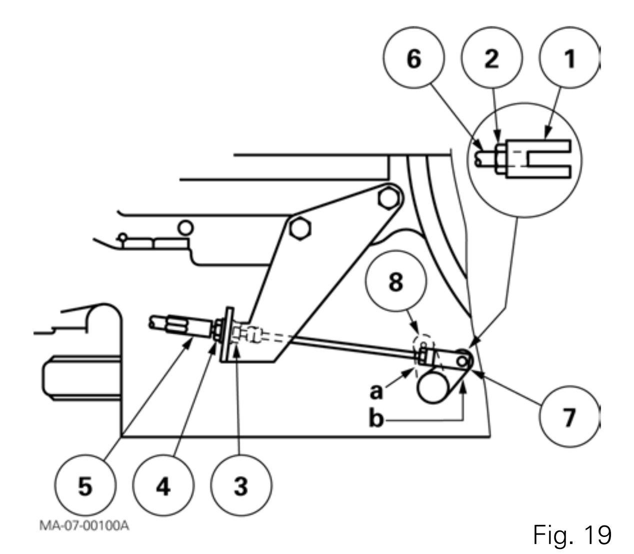


Fig. 19

08 - Front axle

CONTENTS

08A01 - General

CONTENTS

A . General description

The tractors may be equipped or not according to the engine front axle model. The front axles mounted on the 4WD tractors consist of:

- a centre housing containing the differential unit and the differential lock system, as well as the transmission shafts,
- at each end, a hub assembly containing the epicyclic final drive units.

The front axle is assembled to the front frame of the tractor by means of a pivot which adapts to the uneveness of the ground. Drive from the rear axle is transmitted to the front axle through a fixed transmission shaft in case of DANA front axles or via a universal drive shaft for CARRARO front axles. Engagement is ensured by an electrohydraulically controlled multidisc clutch.

The differential unit is held by two half-bearings mounted on a suitable support which allows to adjust the bevel gear.

The bevel gear is supported by two bearings, and is adjusted using shims.

The wheel hubs containing the epicyclic drive units are held in place by two taper roller bearings and driven a hydraulically controlled steering unit.

Parts list (Fig. 1 and Fig. 2)

DANA AG 85 - 105CD front axle

(1) Axle housing
(2) Final drive units
(3) steering pivot
(4) Input shaft
(5) Drive pinion
(6) Differential

CARRARO 20.19 front axle

(1) Axle housing
(2) Final drive units
(3) Flange
(4) Drive pinion
(5) Differential
(6) Bearing
(7) Steering ram

Overall view

DANA AG 85 and 105CD front axle

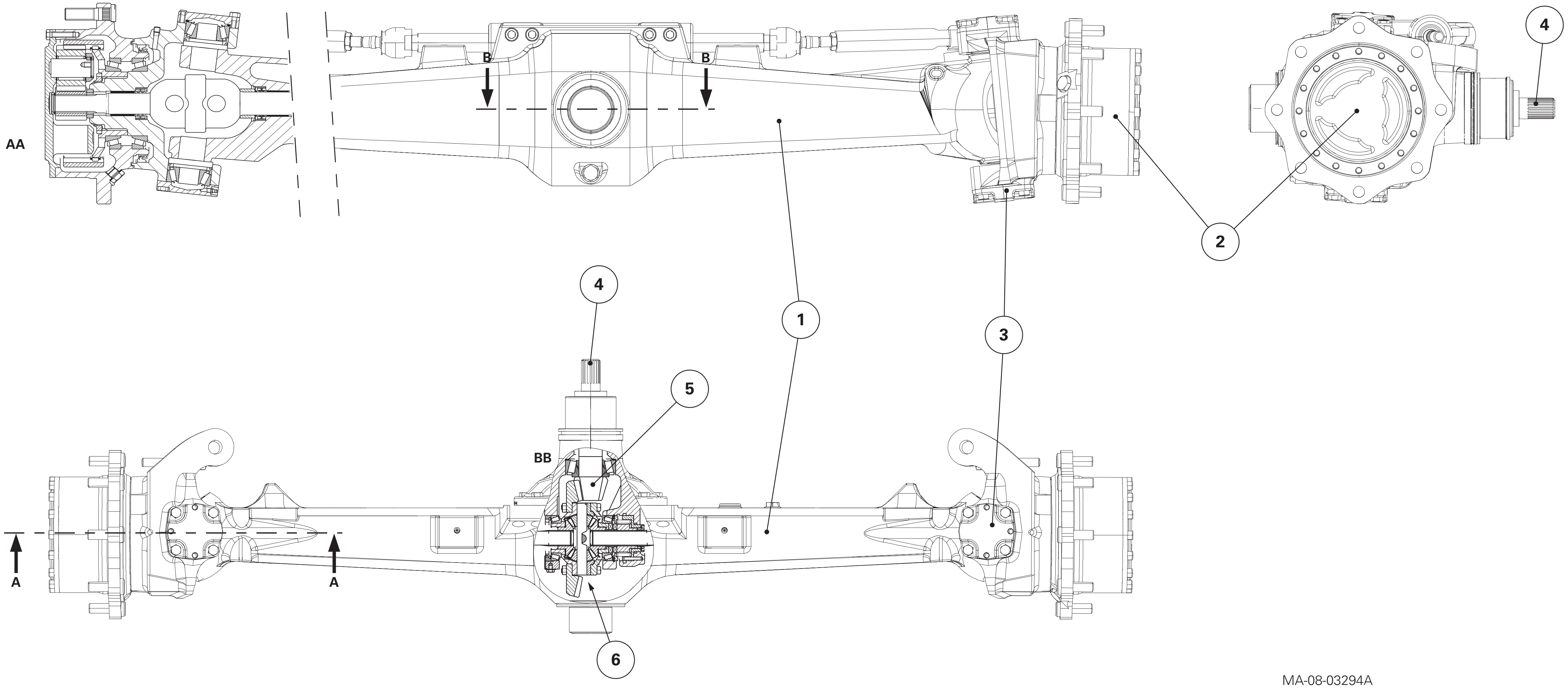


Fig. 1

Overall view

CARRARO 20.19 front axle

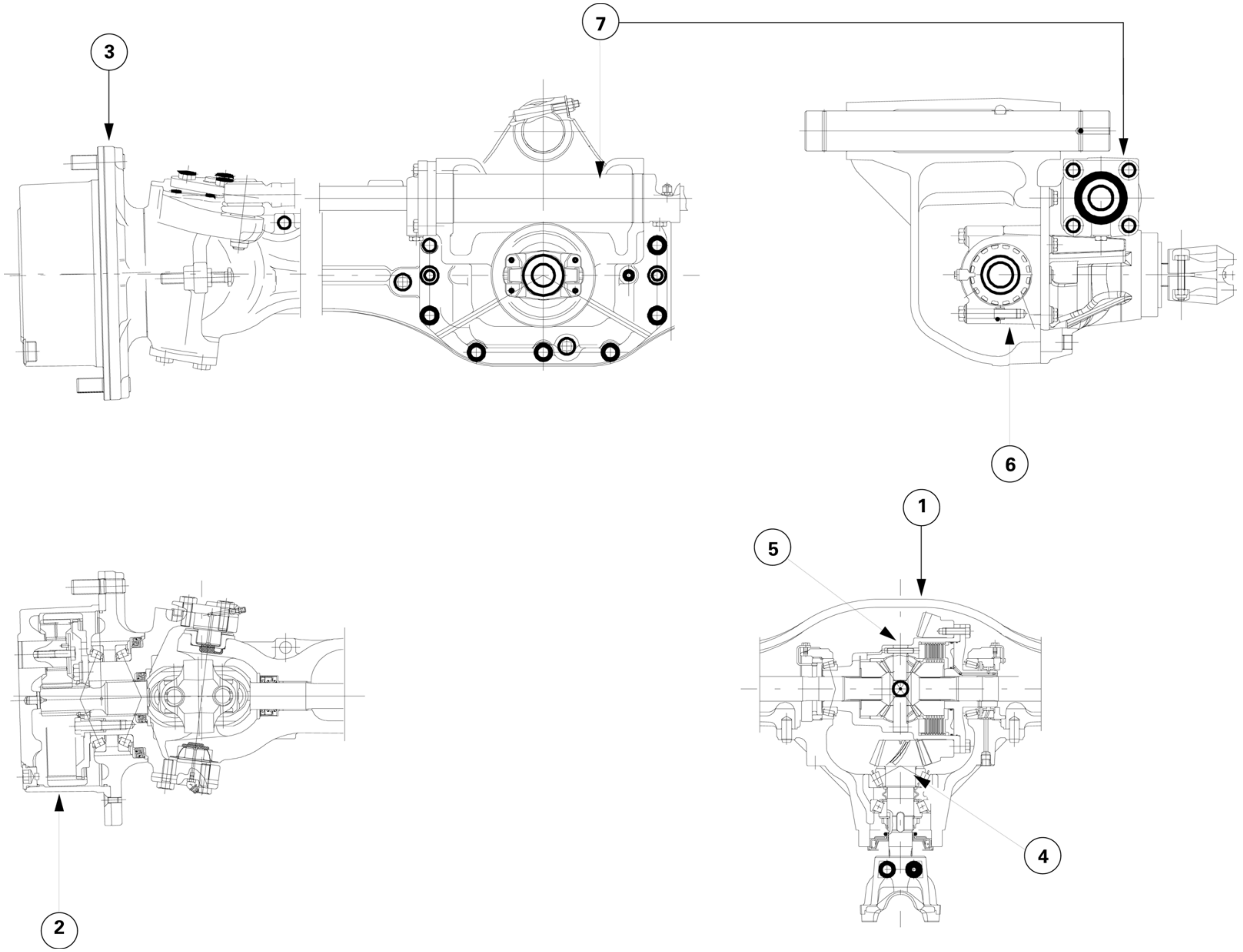


Fig. 2

B . Characteristics and dimensions

All values in the following tables are given in millimetres.

Dimensions for DANA AG 85 models

A = 1869	E = M18 x 1.5
B = Ø 220.8	F = 275
C = Ø 315	G = Ø 79.90
D = 1669	H = Ø 95

Dimensions for DANA AG 105CD models

A = 2020	E = M18 x 1.5
B = Ø 220.8	F = 275
C = Ø 315	G = Ø 79.90
D = 1800	H = Ø 95

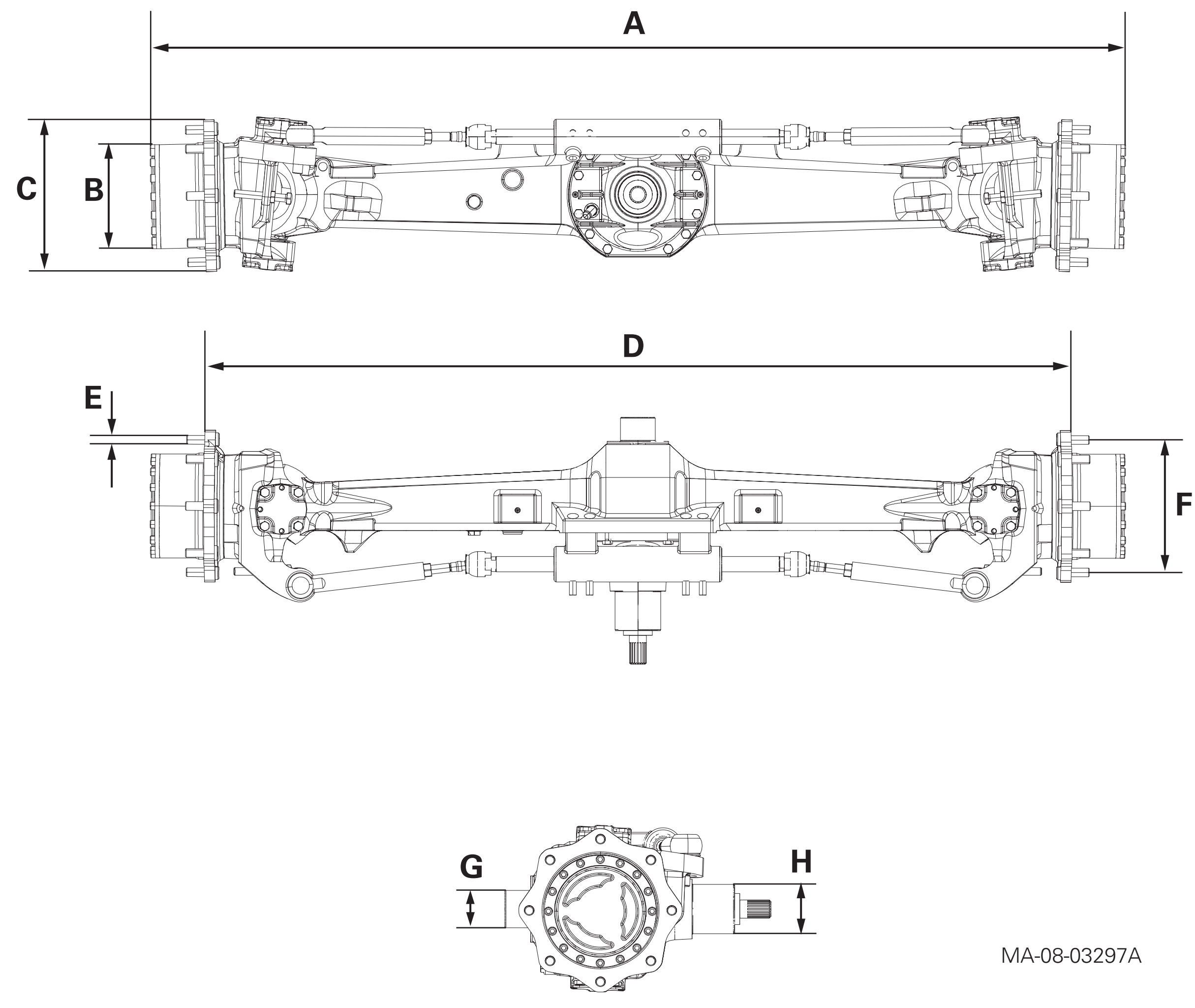


Fig. 3

Dimensions for CARRARO 20.19 models

A = 2045	F = 275	K = 136
B = Ø 320	G = 456	L = 134
C = Ø 220.8	H = 90	M = 347
D = 1800	I = 49	N = 481
E = M18 x 1.5	J = 215	O = 115

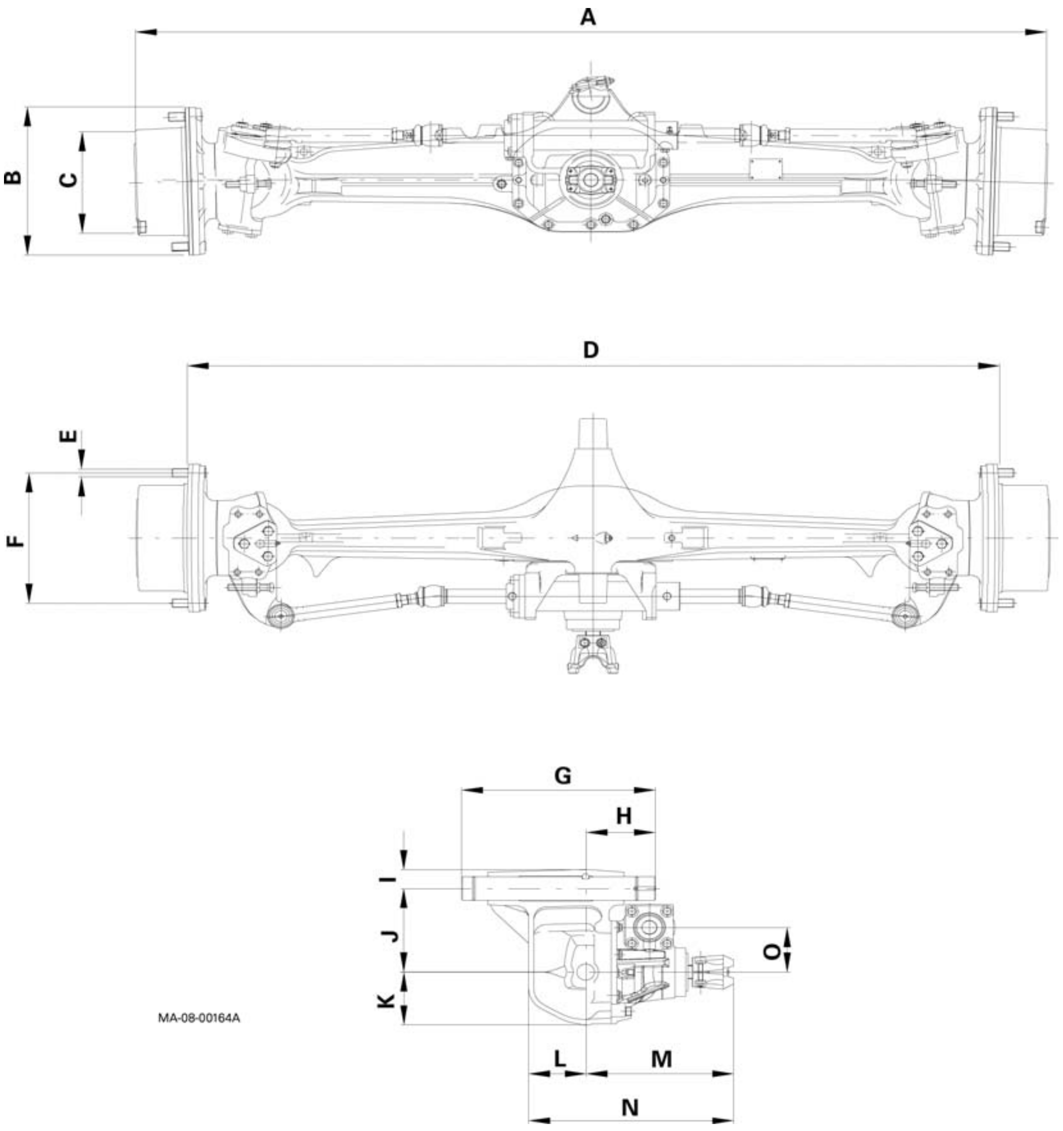


Fig. 4

C . Product identification

The front axles are identified by a plate fitted on them.

DANA (Fig. 5)

(1) Axle type
(2) Reduction ratio
(3) Differential type
(4) Serial number
(5) Axle number

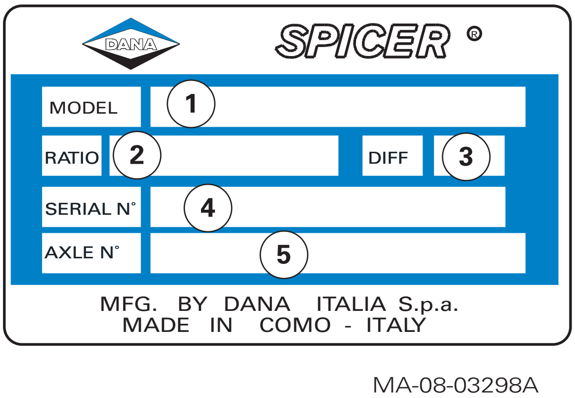


Fig. 5

CARRARO (Fig. 6)

(1) Axle type
(2) Serial number
(3) Carraro number
(4) Customer code
(5) Total reduction ratio
(6) Rotational direction
(7) Differential type
(8) Differential oil type
(9) Differential oil quantity
(10) Epicyclic drive unit oil type
(11) Epicyclic drive unit oil quantity

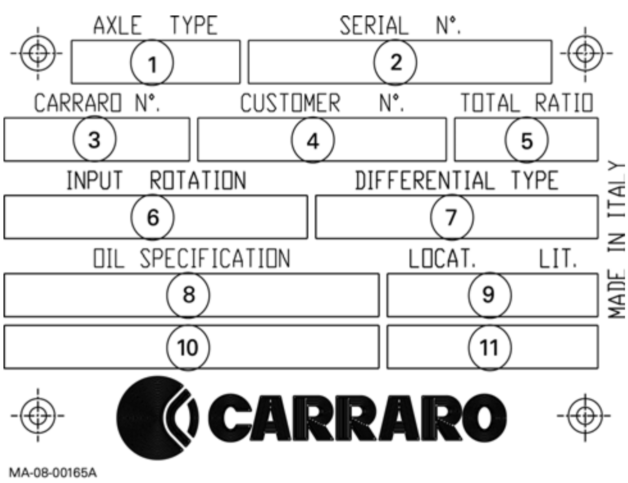


Fig. 6

Technical characteristics

DESCRIPTION	VALUES		
	AG 85	AG 105CD	20.19
Drive unit with bevel gear	8 / 33 (1 / 4.125)	8 / 33 (1 / 4.125)	9 / 32 (1 / 3.55)
Epicyclic drive unit	1 / 4.6	1 / 4.6	1 / 6.0
Total reduction ratio	1 / 18.975	1 / 18.975	1 / 21.33
Unladen weight	260 Kg	270 Kg	320 Kg
Input rotational direction	Counter-clockwise		
Differential type	Coupler lock, hydraulically controlled		Multidisc lock
Max. inner / outer steering lock angle	55° / 39°		55° / 42°
Oil specifications	SAE 85W90 In compliance with standards API GL4 - GL5 MIL 2105 and MIL 2105B		SAE 85W90 In compliance with standards API GL4 - GL5 MIL 2105 and MIL 2105D
Differential oil capacity	5.5 L	6.8 L	6 L
Epicyclic drive unit oil capacity	0.9 + 0.9 L	1.1 L	0.7 +0.7 L
Lubrication	POLYMER 400/L DIN = KHER1R ISO-I-XMR-XM2		

08E01 - GPA20 multidisc 4WD clutch

CONTENTS

A . General

The front axle clutch assembly is fitted in the lower part of the rear axle housing. An inspection cover located under the housing provides access to the mechanism, which comprises:

- a shaft (25) turning on two taper roller bearings fitted in the groove of the axle housing,
- a hydraulic clutch assembly integral with the rotating shaft,
- a bell gear (15) centred on the shaft by a ring (43), driving the clutch discs (36).

The helical bell gear (15) is constantly meshed to the pinion (7) on the drive pinion.

The shaft is shimmed to obtain an operating clearance between 0 and 0.1 mm using shims (20) positioned between the cap (22) and the cup (18).

B . Operation

Declutching

The 4WD solenoid valve sends the 17 bar pressure into the shaft (25) via a channel drilled in the shaft housing, and the ring (11).

The cover (30) moves on the hub (40) and pulls the bell (42) which compresses the Belleville washers (34) and (35), releasing the discs (36). The bell gear (15) integral with the ring (43) turns idle on the shaft.

Clutch

The pressure drop releases the Belleville washers, which push the bell (42) so that it meshes with the bell gear (15), which in turn drives the shaft (25). The oil then returns to the housing via the solenoid valve.

GPA20 multidisc 4WD clutch

Parts list

(1) Sleeve
(2) Double pin
(3) Shaft
(4) Double pin
(5) Sleeve
(6) Circlip
(7) Pinion
(8) Plug
(9) Needle bearing
(10) Screw
(11) Ring
(12) Sealing rings
(13) Cup
(14) Cone
(15) Bell gear
(16) Clutch assembly
(17) Cover
(18) Cup
(19) Cone
(20) Shim(s)
(21) O'ring
(22) Cap
(23) Circlip
(24) Seal
(25) 4WD drive shaft
(26) Seal
(27) Stop screw
(28) Flange
(29) O'ring
(30) Cover
(31) Circlip
(32) O'ring
(33) O'ring
(34) Belleville washer
(35) Belleville washer
(36) Disc
- A: 4-disc clutch
- B: 5-disc clutch

(37) Clutch plate
- A: 4-disc clutch
- B: 5-disc clutch

(38) Cover
(39) Circlip
(40) Hub
(41) Shim(s)
(42) Bell housing
(43) Ring

Overall view

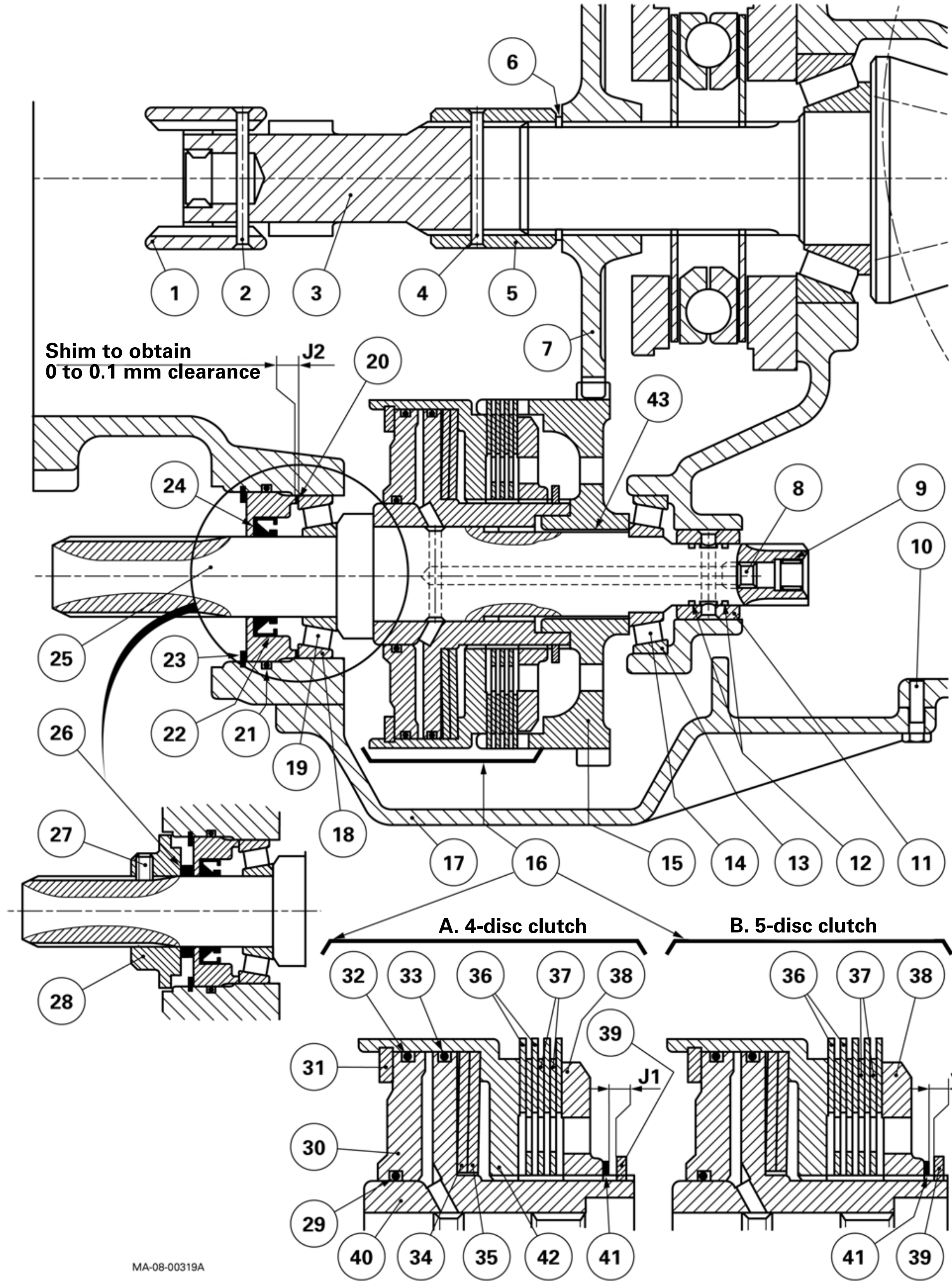
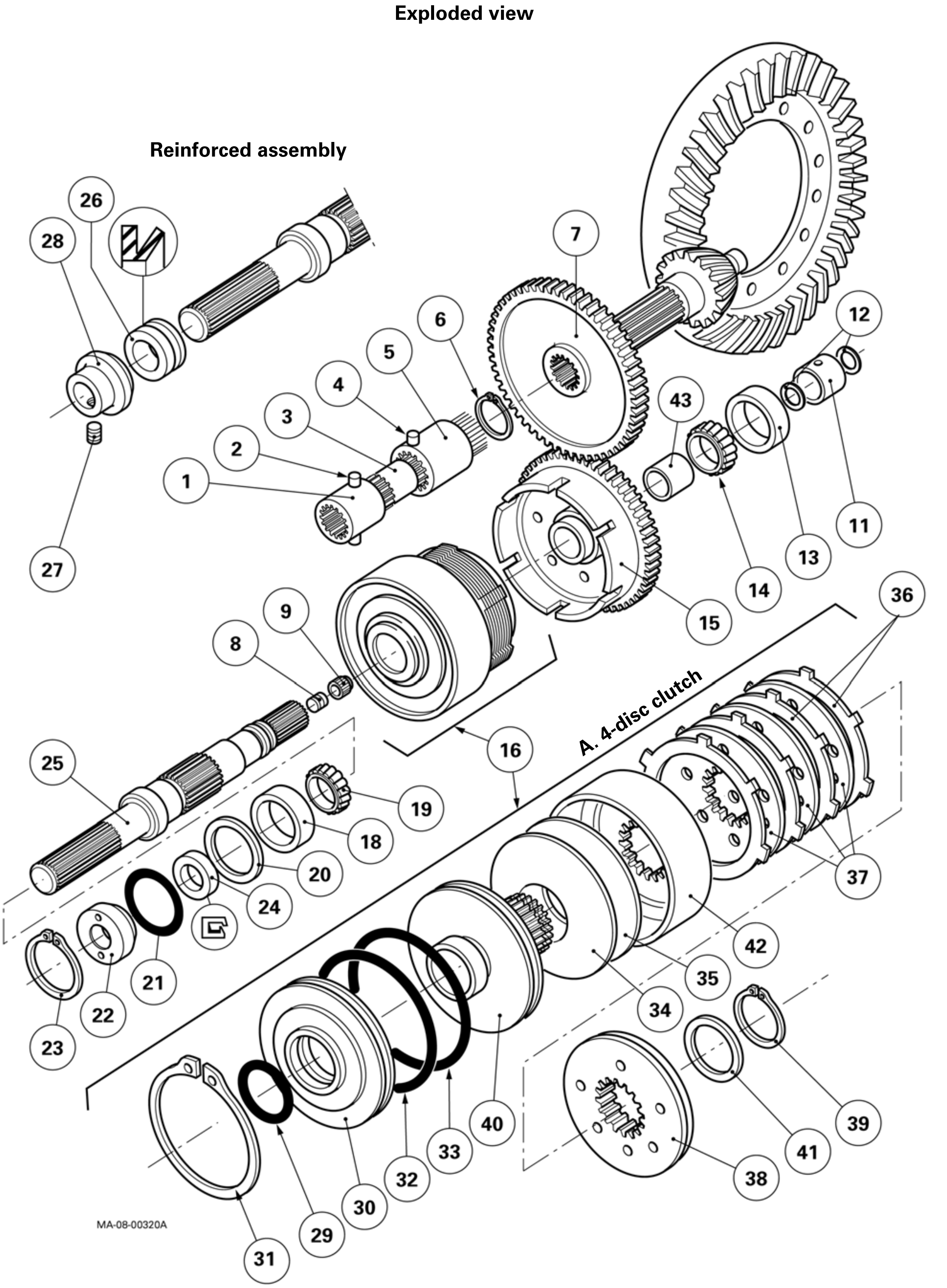


Fig. 1


Exploded view
Reinforced assembly
A. 4-disc clutch
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MA-08-00320A

Fig. 2

C . Removing the clutch assembly

1. Chock the wheels of the tractor. Drain the rear axle housing.
2. Disconnect the two front differential lock control hoses (plug the pipe channels). Remove the guard and the transmission shaft. Remove the engine clutch or power shuttle (depending on the version) lubricating pipe that is fitted to the lower centre housing covers and the gearbox.
3. Remove the screws (10) and the cover (17).

   NOTE: *On tractors fitted with GSPTO, recover the spring (3), locking stud (2) and retainer pipe (1) (Fig. 3).*

   On tractors fitted with a reinforced sealed protector, remove the screw (27), flange (28) and seal (26).
4. Take off circlip (23).
5. Protect the splined part of the shaft (25). Extract the cap (22) with its seal (24) with locally made tool (Fig. 4) (see § G). Remove seal (24).
6. Remove the O'ring (21).
7. Remove the shims (20) and the cup (18).

   NOTE: *On tractors fitted with GSPTO, place the control in declutched position.*
8. Extract the shaft assembly (25) and bearing cone (19), holding the clutch assembly (16) and bell gear (15).
9. Remove the clutch assembly (16) with the bell gear (15) and cone (14).
10. Using a locally made tool (see § G), extract the ring (11) (Fig. 5). This tool is mandatory for tractors with GSPTO. If necessary, also remove the cup (13) with a suitable extractor.

    NOTE: *When pinion (7) has been removed, it is necessary to remove the right-hand hydraulic cover (see chapter 9, depending on hydraulic equipment).*

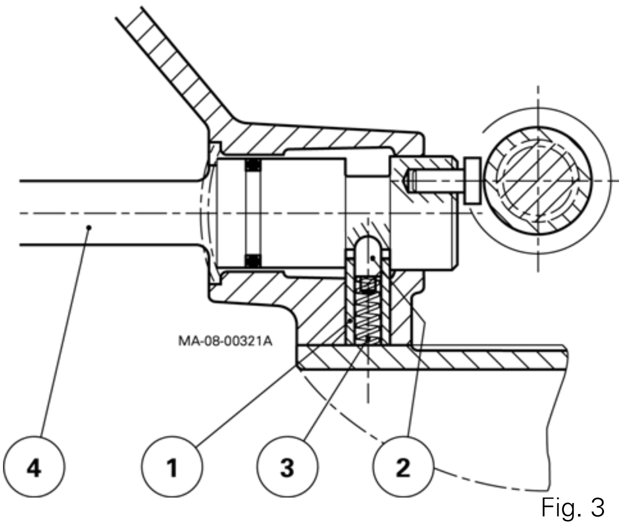


Fig. 3

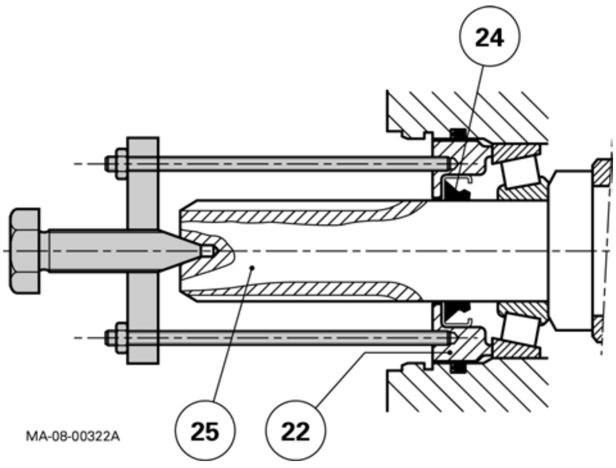


Fig. 4

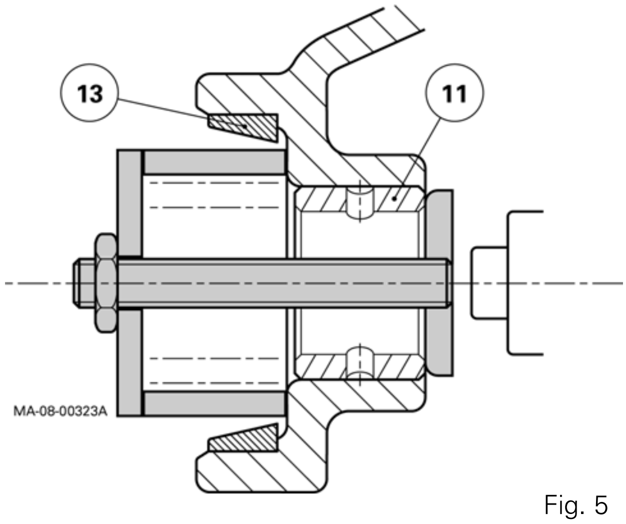


Fig. 5

Tractors with no creeper unit

11. Drive out the double pins (2) (4) from the coupling sleeves (1) (5).
12. Slide the sleeves towards each other on the shaft (3) and remove the shaft - sleeve assembly.
13. Take off circlip (6) and remove the pinion (7).

Tractors with a creeper unit

14. See chapter 5.
15. Take off circlip (6) and remove the pinion (7).

D . Disassembling the clutch

16. Split bell gear (15) from the clutch assembly (16).
17. Take off circlip (31).
18. Take off cover (30).
19. Remove the O'rings (29) (32).
20. Using a suitable fixture and a press, compress the Belleville washers (34) (35) (Fig. 6).
21. Take off circlip (39) and the shim(s) (41) (Fig. 6).
22. Remove the suitable fixture.
23. Remove cover (38), discs (36) and intermediate plates (37).
24. Separate the hub (40) from the bell (42).
25. Remove the O'ring (33).
26. Remove the Belleville washers (34) (35).

Disassembling the shaft

27. Remove the two seals (12).
28. Extract the cone (19) using a press and a suitable fixture.
29. Extract needle bearing (9). Take out plug (8).

Reassembling the shaft

NOTE: *Check that the channel in the shaft is not blocked.*
30. Tighten the plug (8) smeared with Loctite 542 to a torque of 10 Nm.
31. Fit the needle bearing (9) 2.5 mm short of the face F (Fig. 7).
32. Fit the bearing cone (19) against the shoulder on shaft (25).

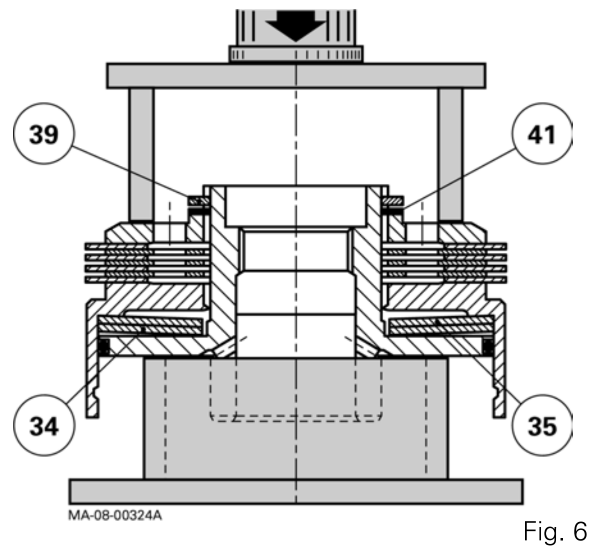


Fig. 6

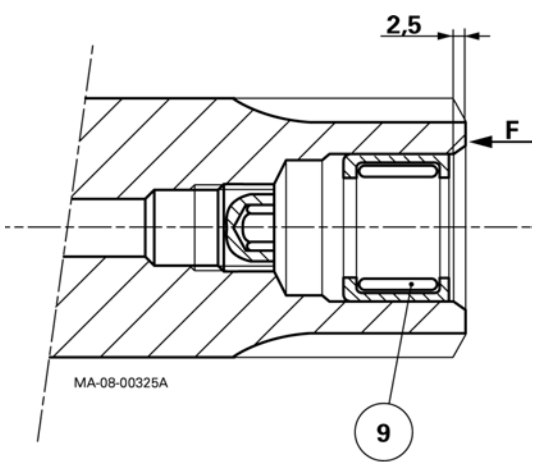


Fig. 7

E . Reassembling the clutch

33. Check and clean all components. Replace any defective parts. Check that the 17 bar channel in the hub (40) is not blocked.

34. Position the Belleville washers (35) (34) in the bell (42) (Fig. 8).

Note: *Two types of Belleville washers with different markings and different loading efforts can be fitted:*

- 3619147M1 marked 147
- 3619473M1 marked 473.

The clutch assembly is normal or reinforced depending on the tractor types.

35. Lubricate and fit the O'ring (33) on the hub (40).

36. Position the hub (40) in the bell (42) thrust against the Belleville washers.

37. Fit the discs (36), aligning the catches and intermediate plates (37), and fit the cover (38).

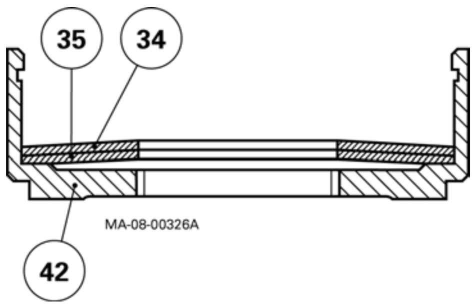


Fig. 8

38. Adjusting J1 clearance (Fig. 9)

Using a press and suitable fixture (Fig. 6) apply a load of 2000 daN to fully compress the Belleville washers (35) (34).

Fit the circlip (39). Use a set of shims to increase the distance X between the cover (38) and circlip (39). Select the shim(s) (41) to obtain clearance **J1 = 0.9 to 1.1 mm**.

39. Remove circlip (39).

40. Position the shim(s) chosen at operation 38 between the cover and circlip (splined shim on the circlip side).

41. Refit the circlip.

42. Lubricate and fit the O'rings (32) (29) on the cover (30) and refit the latter.

43. Fit the circlip (31).

44. Fit the clutch assembly (16) on the bell gear (15).

Note: *The ring (43) is force fitted in the bell gear (15) and then rebored.*

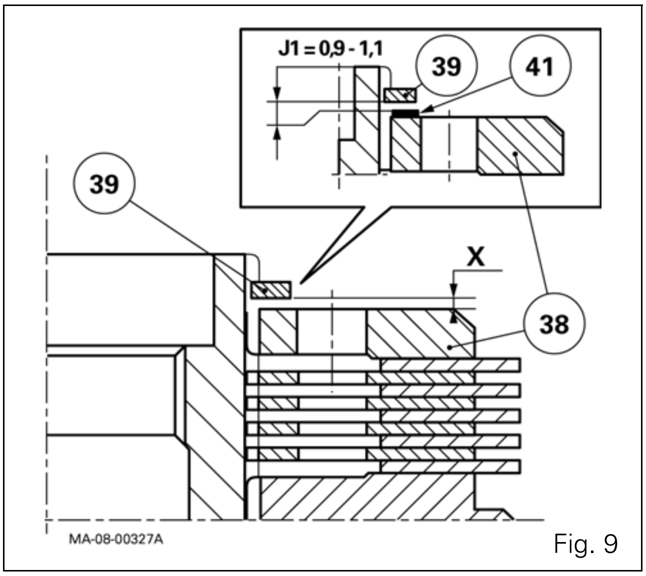


Fig. 9

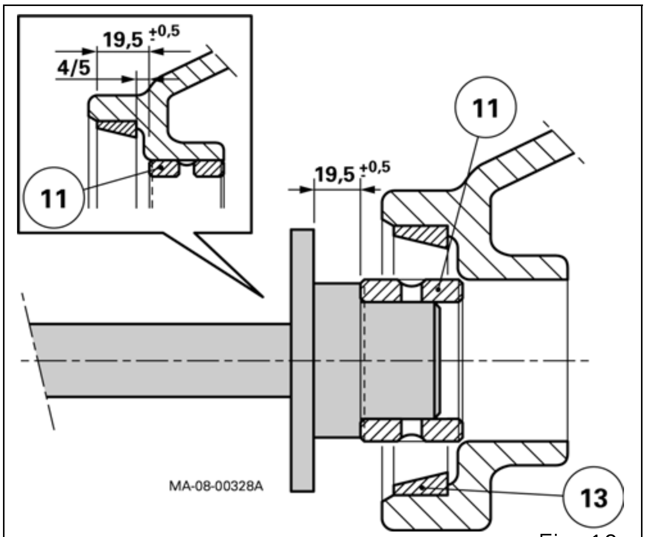


Fig. 10

F . Refitting the clutch assembly

Tractor with no creeper unit

45. Refit the pinion (7) (if removed).

46. Position the circlip (6).

47. Refit the link shaft and coupling sleeves. Carry out operations 11 and 12 in reverse order. Replace the double pins.

Tractors with a creeper unit

48. Refit the pinion (7) (if removed).

49. Position the circlip (6).

50. See chapter 5.

51. Refit the right-hand hydraulic cover (see chapter 9).

52. Fit the cup (13) (if removed).

53. Fit the ring (11) with a locally made drift (see § G), so that the ring is positioned 4 to 5 mm short of the cup mating face (13) (Fig. 10). Move the ring until one of its holes opens into the clutch supply channel in the housing.

54. Fit the seal (24) in the cap (22).

55. In order to correctly "seat" the cones in their bearing cups, to obtain clearance:
J2 = 0 to 0.10 mm, fit the cone (14), the shaft (25), and the cup (18).

56. Protect the splines of the shaft.

57. Fit the bearing (22) and circlip (23).

58. Put a dial gauge feeler pin against the end of shaft (25) (Fig. 11).

59. Pull the shaft, turning it alternately from right to left to correctly seat the cones in the cups.

60. Reset the dial gauge to zero.

61. Repeat the operation 59, this time by pushing.

62. Depending on the clearance measured, select the thickness of shim(s) (20) required to obtain J2.

63. Remove the circlip (23), cap (22), cup (18) and the shaft (25).

64. Fit the seal rings (12) in the shaft grooves (25) and hook their ends. Ensure that they turn freely.

65. Fit the cone (14) into the bearing cup (13). Install the shaft (25) after positioning the clutch assembly (16) and bell gear (15) in the housing.

66. Fit the cup (18) and shim(s) (20) (smeared with grease) selected at operation 62.

67. Fit the O'ring (21) in the housing groove.

68. Fit the cap (22) and circlip (23), remove the spline protection on the shaft.

69. On tractors with reinforced sealing, grease and position the seal (26), with the lip turned towards the cap (22). Remove the protection.

70. Fit the flange (28), ensuring that operational clearance remains between the flange and housing.

71. Tighten the screw (27) after coating it with Loctite 241.

72. Clean and degrease the mating face of the cover (17) and housing.

73. Smear the mating face of the cover with a sealing product (Loctite 510 or equivalent).

74. Screw two opposing guide studs into the housing.

75. On tractors fitted with GSPTO, check the position of the lever (4). Fit the retainer pipe (1), locking stud (2) and spring (3) (Fig. 3).

76. Refit the cover (17).

77. Remove the guide studs, and fit and tighten screws (10) to a torque of 130 - 170 Nm.

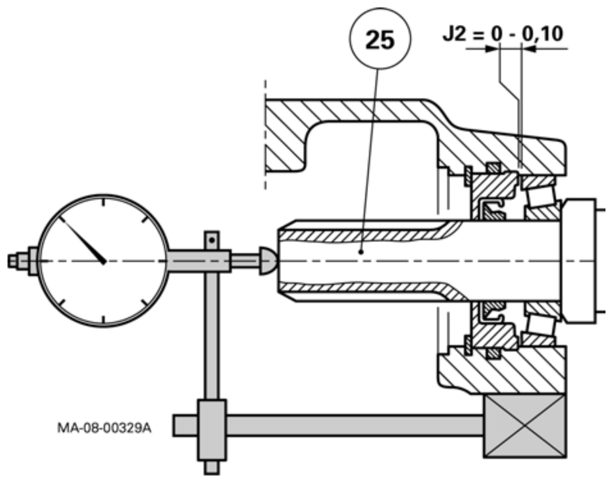


Fig. 11

78. Smear the two sleeves of the 4WD transmission shaft with "Anti Seize" grease or equivalent.
Refit the transmission shaft and guard, and reconnect the two front differential lock hoses.
Refit the lubricating pipe of the power shuttle or engine clutch.

79. Top up the rear axle oil level and remove shims.

80. Check clutch operation and GSPTO control adjustment (if fitted).

81. Check for tightness:
- the mating faces of the cover under the rear axle housing
- the right-hand hydraulic cover (if removed)
- the hydraulic unions.

G . Locally made tools

Cap extractor (Fig. 12)

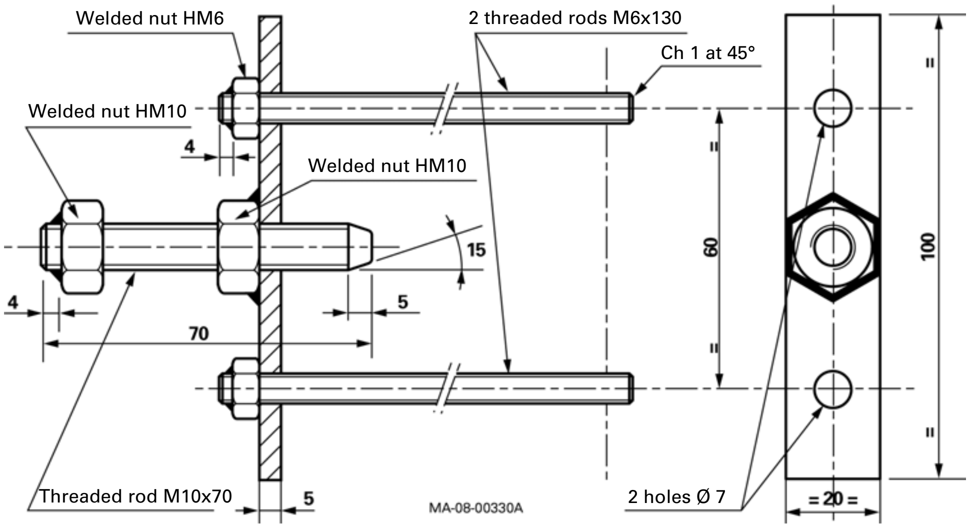


Fig. 12

Ring extractor (Fig. 13)

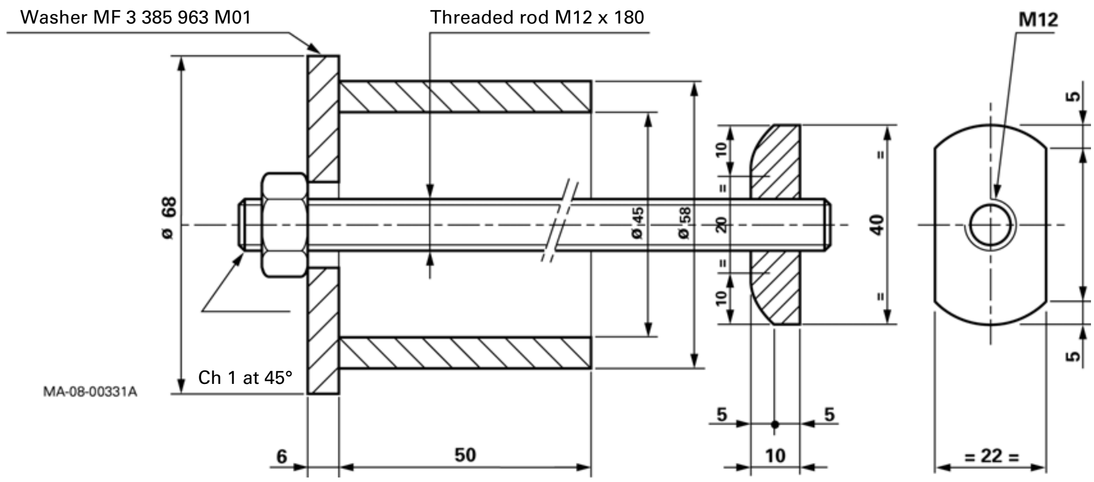


Fig. 13

Ring fitting drift (Fig. 14)

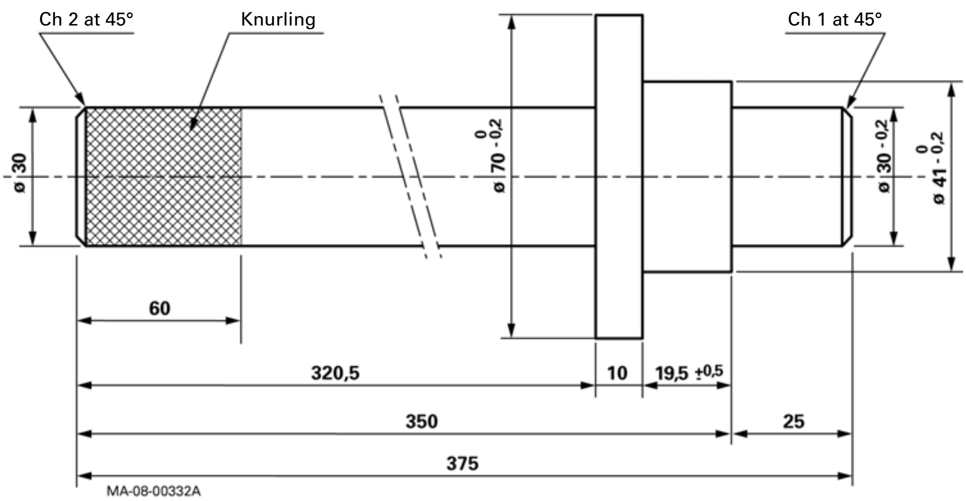


Fig. 14

09 - Hydraulics

CONTENTS

09A01 - Description of circuit open centre 57 l/mn

CONTENTS

A . General

The Open Centre hydraulic circuit is comprised of two separate circuits.

These two circuits are supplied by a two-stage gear pump (1) (Fig. 1) fitted on the internal face of the right-hand hydraulic cover. The pump sucks transmission oil from the common tank formed by the centre housing and the gearbox through a 150 micron filter (1) (Fig. 2), also fitted on the right-hand cover.

One or two 15 micron main filter(s) (39) (depending on option) and a clogging indicator (40) are fitted on the low flow rate circuit upstream from the Orbitrol steering spool valve (Fig. 2).

The hydraulic pump is driven by the ring gear of the PTO clutch unit (Fig. 1).

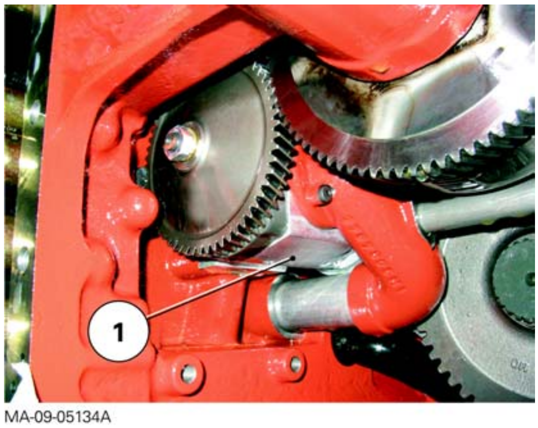


Fig. 1

B . Low flow rate, low pressure circuit

Reminder : *The first stage of the pump supplies the hydrostatic steering where pressure can reach 170 bar.*

Hydraulic flow

After supplying of the Orbitrol steering spool valve as required, the oil is directed to the left-hand cover attached to the centre housing.

This cover performs several low pressure functions.

It ensures:

- operating pressure for the various transmission components via a 17 bar valve (2) (Fig. 3) fitted downstream from the Orbitrol unit;
- cooling and lubrication of the gearbox and connected components;
- booster pressure for brake master cylinders (excluding MERITOR master cylinders)

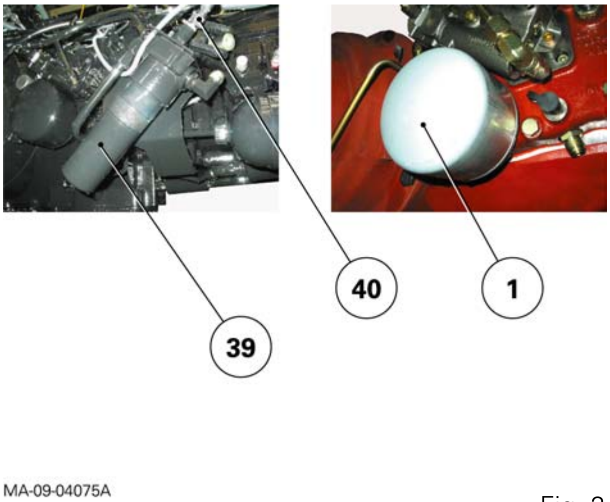


Fig. 2

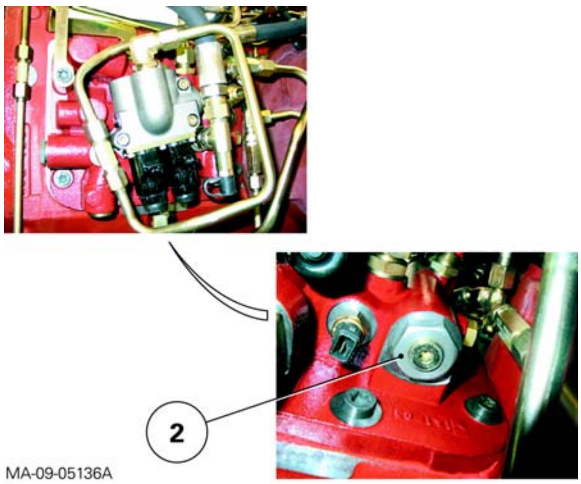


Fig. 3

Description of circuit open centre 57 l/mn

Transmission components

The 17 bar circuit supplies, in parallel, the various transmission functions via flanged solenoid valves on the clutch / reverse shuttle unit, on the Dynashift control and in the main channel of the right-hand cover.

None of these functions has priority and they may be activated simultaneously.

Some of the solenoid valves (4WD, power take-off, Dynashift and reverse shuttle (proportional solenoid valves)) are linked to the electronic control system of the tractor.

The functions supplied by the low flow rate circuit are as follows:

- the hydrostatic steering;
- the Hare / Tortoise range shifting (Hi / Lo);
- the differential lock (front and rear);
- the 4WD clutch;
- the Speedshift;
- the clutch unit of the reverse shuttle;
- the power take-off system:
  - clutch,
  - brake,
  - front PTO (depending on options).

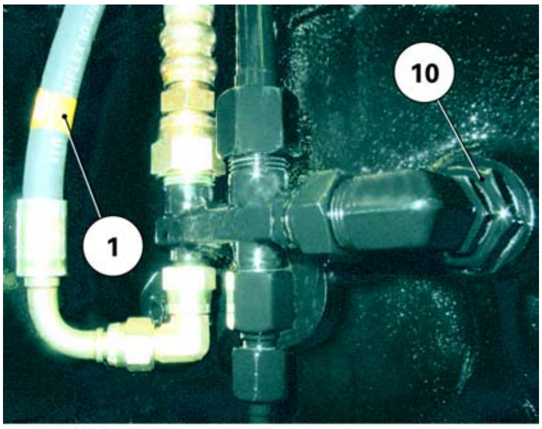


Fig. 4

Cooling and lubrication

When the various components of the transmission are supplied, the left-hand cover directs oil towards the radiator when it is hot, or directly towards to the gearbox and PTO when it is cold.

The lubricating pressure is maintained by a valve (10) calibrated to 1.5 bar and fitted on the front left-hand side of the gearbox (Fig. 4).

Booster pressure for brake master cylinders

Reminder : *Only unassisted master cylinders receive booster pressure from the hose (1) connected upstream to the 1.5 bar valve (10) (Fig. 4).*

C . Layout of main components of Power shuttle and Speedshift circuit

Parts list (Fig. 5)

(1) Front differential lock
(2) Steering ram
(3) Pressure connector
(4) Orbitrol steering unit
(5) Forward clutch (reverse shuttle)
(6) Reverse clutch (reverse shuttle)
(7) Accumulator (assisted master cylinders)
(8) Speedshift unit
(9) Left-hand cover
(10) 1.5 bar valve
(11) Temperature switch
(12) Hare / Tortoise unit
(13) PTO clutch
(14) Pump suction pipe
(16) Restrictor
(17) Suction strainer (Reverse shuttle clutch lubricating pump)
(18) 4WD clutch
(19) Brake lubricating pipes
(20) Rear differential lock
(23) Oil cooler
(24) Brake master cylinders
(25) FTE valve
(26) Bleed connector
(27) Diagnostics connector (reverse shuttle lubrication)
(28) Proportional solenoid valves (reverse shuttle)
(30) Speedshift solenoid valve
(31) Gearbox control unit
(32) Accumulator
(33) 60 micron filter
(34) Hare / Tortoise solenoid valve
(35) Differential lock solenoid valve
(36) PTO solenoid valve
(37) PTO brake solenoid valve
(38) 4 WD solenoid valve
(39) 15 micron filters
(40) Clogging indicator
(43) Two-stage hydraulic pump
(44) 150 micron suction filter
(45) Left and right brakes
(47) PTO brake

Legend

- High pressure
- Low pressure
- Trumpet housing
- Suction
- Return
- Brakes
- Steering

Power shuttle and Speedshift

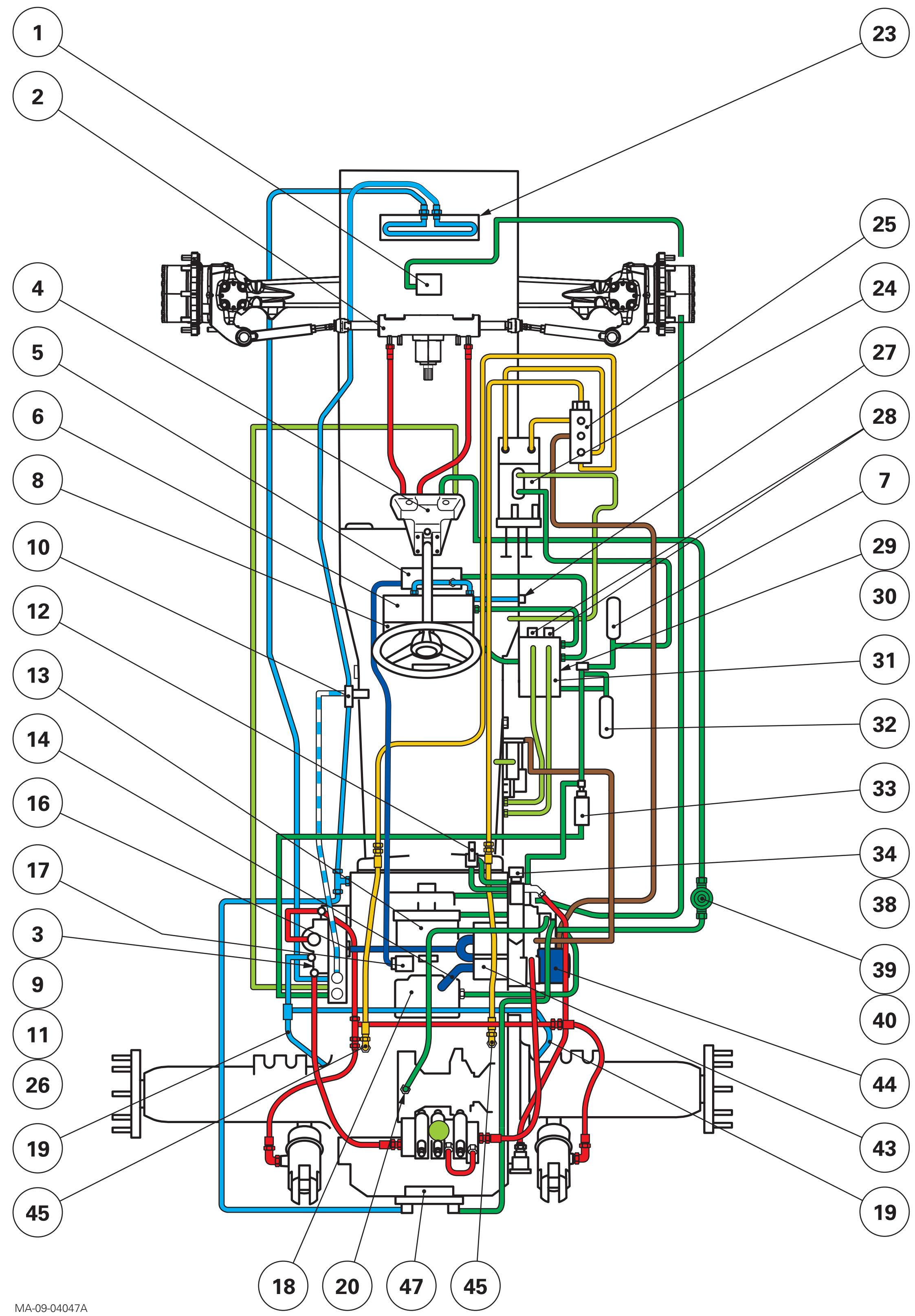


Fig. 5

Page left blank intentionally

D . Layout of main components of Mechanical reverse shuttle Speedshift circuit

Parts list (Fig. 6)

(15) Lift control valve
(21) Auxiliary spool valves
(22) Lift rams
(41) Trailer brake valve (spool valve)
(42) High pressure safety valve
(46) Trailer power take-off
(49) Valve 1,5 bar
(50) Pressure load clutch master cylinder
(61) Speedshift unit
(62) Speedshift valve

Legend

- High pressure
- Low pressure
- Trumpet housing
- Suction
- Return
- Brakes
- Steering

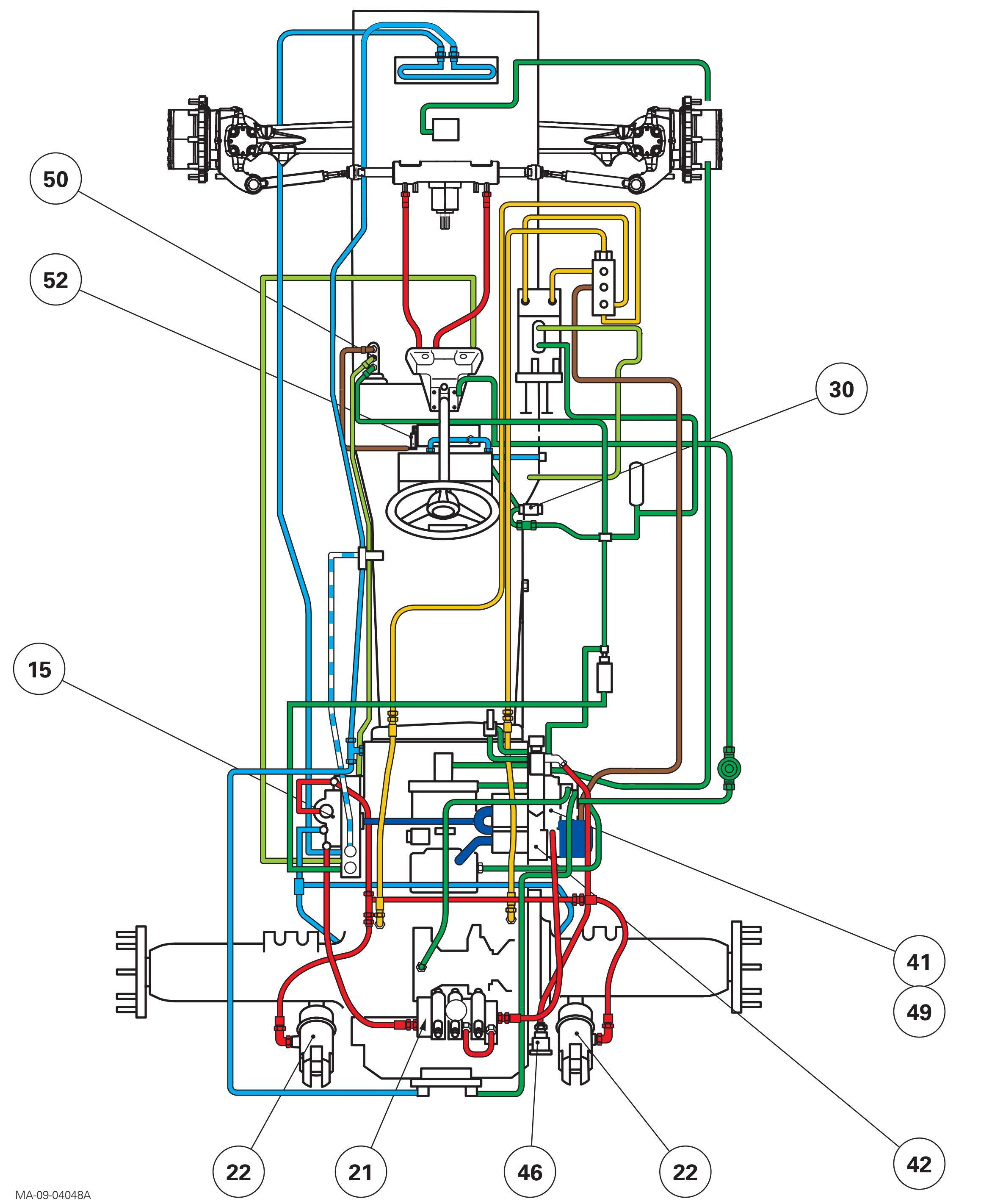


Fig. 6

E . High flow rate, high pressure circuit

Reminder

The second stage of the pump supplies, in the following order:

- the trailer brake spool valve, which is priority (if fitted);
- the auxiliary spool valves;
- the lift control valve.

The oil not used by the trailer brake spool valve feeds the auxiliary spool valves fitted to the rear of the lift cover.

Starting at the auxiliary spool valves, a line supplies the lift control spool valve located on the left-hand side cover.

The excess flow rate from the spool valves returns to the pump suction pipe via a restrictor (16) (Fig. 5) without passing through the 150 micron filter.

A safety valve, calibrated at 200 bar, is fitted in the delivery channel on the right-hand cover to protect the high pressure circuit.

The hydraulic unit of the suspended front axle (if fitted) is also connected to the high pressure circuit. It supplies the control ram via a valve fitted to the right-hand hydraulic cover. A pressure relief valve fitted on the selector cover controls overpressure.

F . Diagram of mechanical reverse shuttle Speedshift

(Fig. 7)

Parts list

(1) Front differential lock
(2) Steering ram
(3) Pressure take-off (approximately 5 bar)
(4) Orbitrol hydrostatic spool valve
(5) Front clutch (power shuttle)
(6) Rear clutch (power shuttle)
(8) Speedshift unit
(9) Gearbox
(10) 1.5 bar valve
(11) Temperature switch
(12) Hare / Tortoise unit
(13) PTO clutch
(14) Pump suction pipe
(15) Lift control spool valve
(16) Restrictor
(18) 4WD clutch
(19) Brake lubricating pipes
(20) Rear differential lock
(21) Auxiliary spool valves
(22) Lift rams
(23) Oil cooler
(24) Brake master cylinders
(25) Tank (excluding MERITOR master cylinders)
(26) Connector to assist brake bleeding
(28) Proportional solenoid valves (reverse shuttle)
(31) Clutch unit (reverse shuttle)
(32) Accumulator
(33) 60 micron filter
(34) Hare / Tortoise solenoid valve
(35) Differential lock solenoid valve
(36) PTO solenoid valve
(37) PTO brake solenoid valve
(38) 4 WD solenoid valve
(39) 15 micron filters
(40) Clogging indicator
(41) Trailer brake valve (spool valve)
(42) High pressure safety valve
(43) Two-stage hydraulic pump
(44) 150 micron suction filter
(45) Left and right brakes
(46) Trailer power take-off
(47) PTO brake
(48) Valve (reverse shuttle, reverse clutch, opening at 13 bar)
(49) 1,5 bar valve
(50) Left-hand hydraulic cover
(61) Speedshift unit
(62) Speedshift valve
(63) Front PTO solenoid valve
(64) Clutch release bearing
(65) Clutch master cylinder with hydraulic power
(66) No-return valve (clutch control)
(67) accumulator

Description of circuit : Mechanical reverse shuttle Speedshift

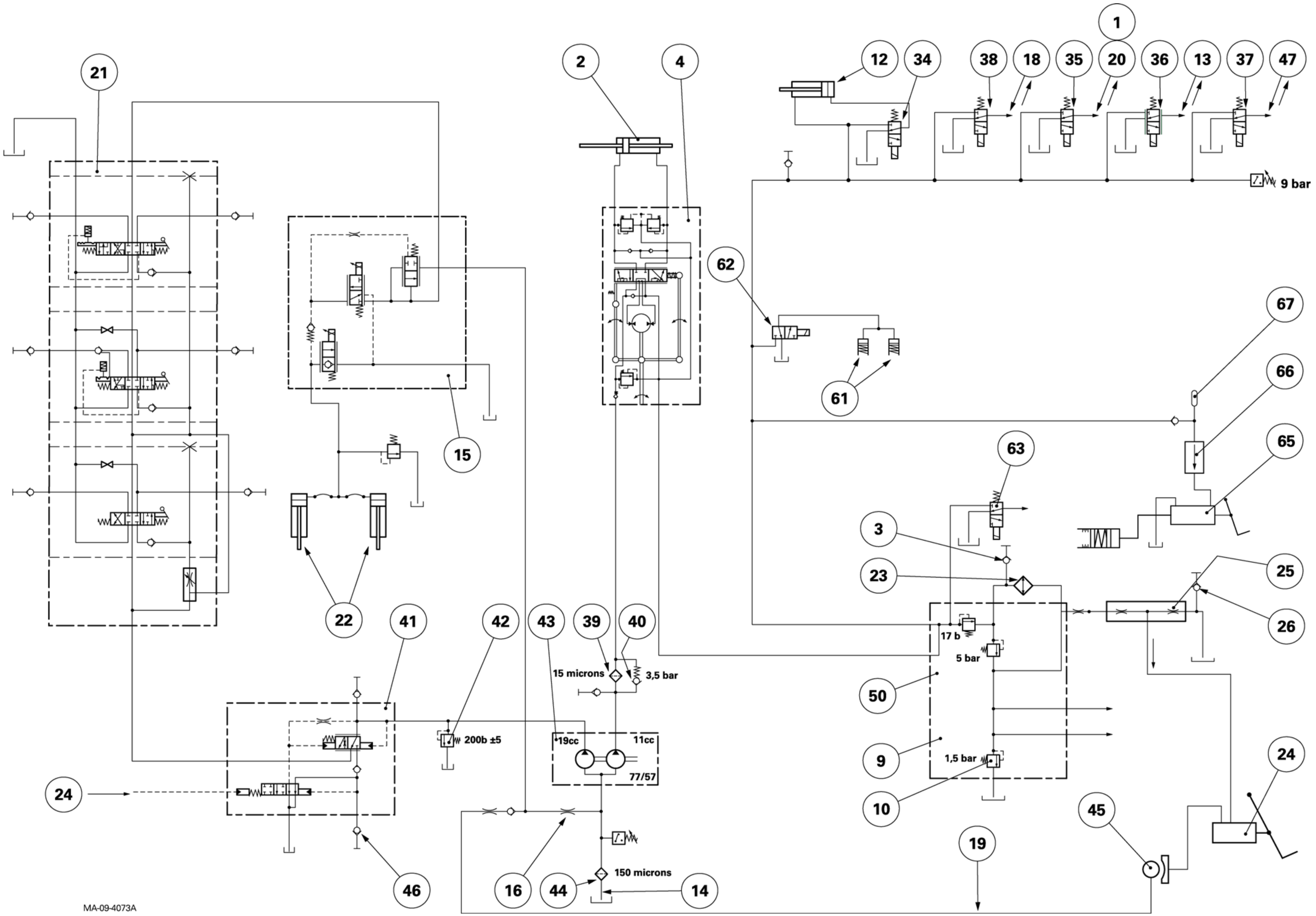


Fig. 7

reverse shuttle (Fig. 8)

Lubricate

(5) To lubricate of front clutch
(6) To lubricate of rear clutch
(7) Lubricate pump
(17) Suction strainer
(27) diagnostic port
(49) 1,5 bar valve

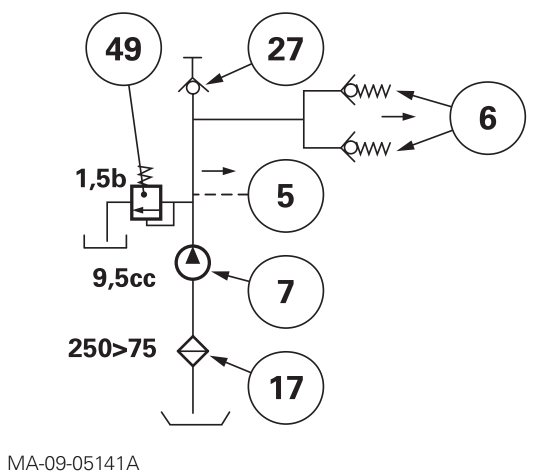


Fig. 8

G . Diagram of Power shuttle Speedshift

(Fig. 9)

Parts list

(1) Front differential lock
(2) Steering ram
(3) Pressure take-off (approximately 5 bar)
(4) Orbitrol hydrostatic spool valve
(5) Front clutch (power shuttle)
(6) Rear clutch (power shuttle)
(8) Speedshift unit
(9) Gearbox
(10) 1.5 bar valve
(11) Temperature switch
(12) Hare / Tortoise unit
(13) PTO clutch
(14) Pump suction pipe
(15) Lift control spool valve
(16) Restrictor
(18) 4WD clutch
(19) Brake lubricating pipes
(20) Rear differential lock
(21) Auxiliary spool valves
(22) Lift rams
(23) Oil cooler
(24) Brake master cylinders
(25) Tank (excluding MERITOR master cylinders)
(26) Connector to assist brake bleeding
(28) Proportional solenoid valves (reverse shuttle)
(31) Clutch unit (reverse shuttle)
(32) Accumulator
(33) 60 micron filter
(34) Hare / Tortoise solenoid valve
(35) Differential lock solenoid valve
(36) PTO solenoid valve
(37) PTO brake solenoid valve
(38) 4 WD solenoid valve
(39) 15 micron filters
(40) Clogging indicator
(41) Trailer brake valve (spool valve)
(42) High pressure safety valve
(43) Two-stage hydraulic pump
(44) 150 micron suction filter
(45) Left and right brakes
(46) Trailer power take-off
(47) PTO brake
(48) Valve (reverse shuttle, reverse clutch, opening at 13 bar)
(49) 1,5 bar valve
(50) Left-hand hydraulic cover
(61) Speedshift unit
(62) Speedshift valve
(63) Front PTO solenoid valve

Description of circuit : Power shuttle and Speedshift

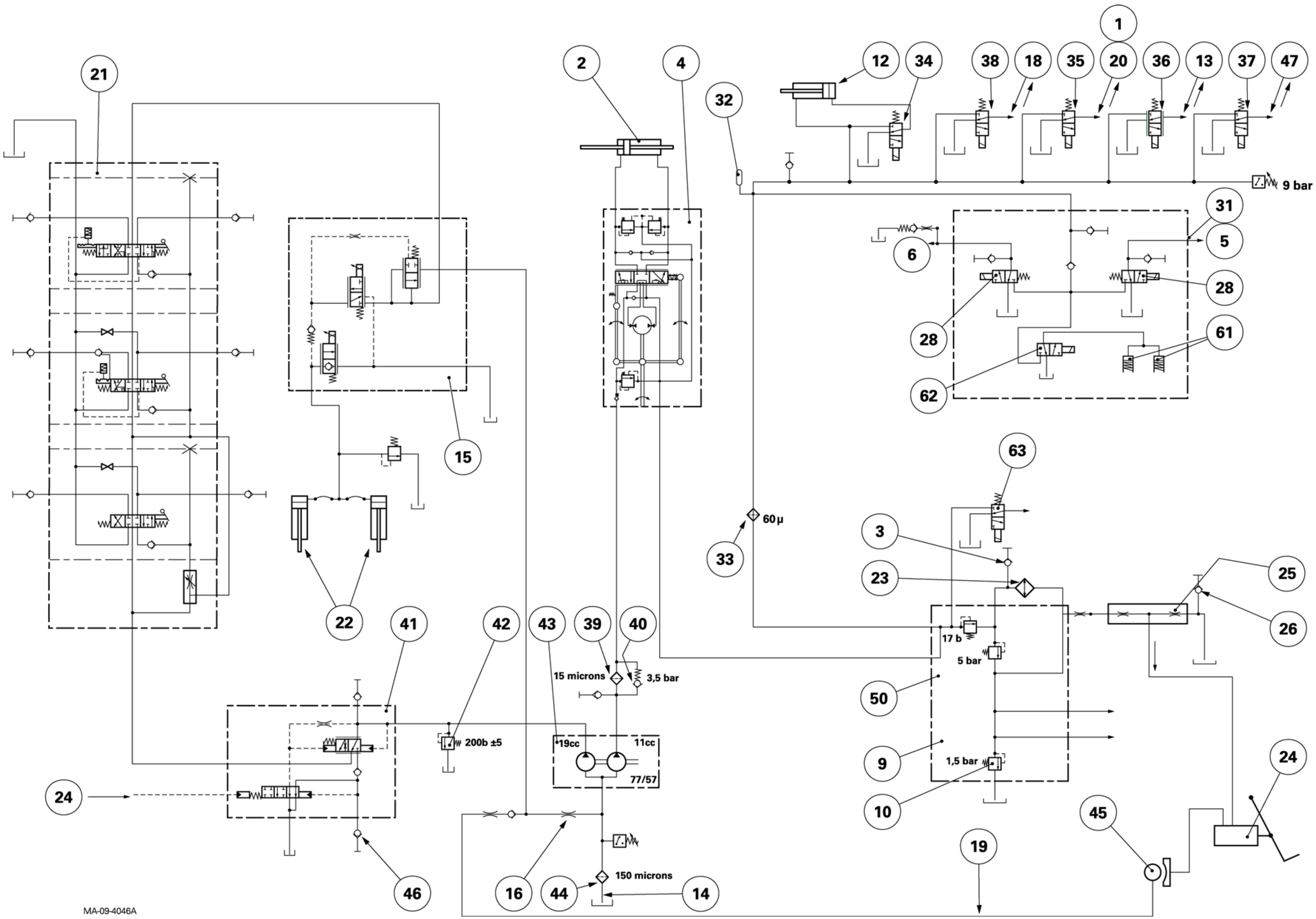


Fig. 9

09B01 - Right-hand cover – 57 l/min Open Centre

CONTENTS

A . General

The right-hand cover is fitted to the rear axle housing and has two main functions:
- it supports numerous hydraulic system components
- it incorporates various suction and cooling channels of the high and low flow circuits (high and low pressure).

On its internal face, the cover contains:
- two-stage hydraulic pump and its drive pinion
- suction pipe
- inlet manifold
- left-hand cover transfer pipe.

On its external faces, the cover is fitted with:
- the four or five control solenoid valves of the low pressure functions (depending on option).

Note: *There is a diode in the solenoid of the PTO brake solenoid valve.*
The PTO clutch is controlled by a on/off solenoid valve.

- safety valve in the high pressure circuit
- valve for the suspended front axle (if fitted).
- trailer brake valve (if fitted) or a closing plate (depending on option)
- three “diagnostics” connectors
- strainer
- support and main 15 micron filter(s).
- filter switch
- engine speed sensor.

Right-hand cover – 57 l/min Open Centre

Parts list

(1) Cover
(2) Screw
(3) High pressure (high flow rate) valve
(4) Screw
(5) Low pressure 17 bar diagnostics connector
(7) On/off solenoid valve (PTO clutch)
(8) to (10)
Solenoid valves: PTO brake, front and rear differential lock, 4WD
(11) Hare / Tortoise solenoid valve
(12) Clogging indicator
(13) Support
(14) Filters
(15) 15 micron filter elements
(16) Engine speed sensor
(17) Low flow rate diagnostics connector
(18) Strainer
(19) Filter switch
(20) High flow rate, high pressure diagnostics connector
(21) Locating pins
(22) O'ring
(23) O'ring
(24) Seal
(25) Transfer pipe
(26) O'rings
(27) Nut
(28) Washer
(29) Pinion
(30) Key
(31) Screw
(32) Hydraulic pump
(33) Cotter pin
(37) Deflector
(38) Suction pipe
(39) Seal
(40) Inlet manifold
(41) O'rings
(42) Pipe
(43) Threaded end-piece
(44) Seal

External overall view

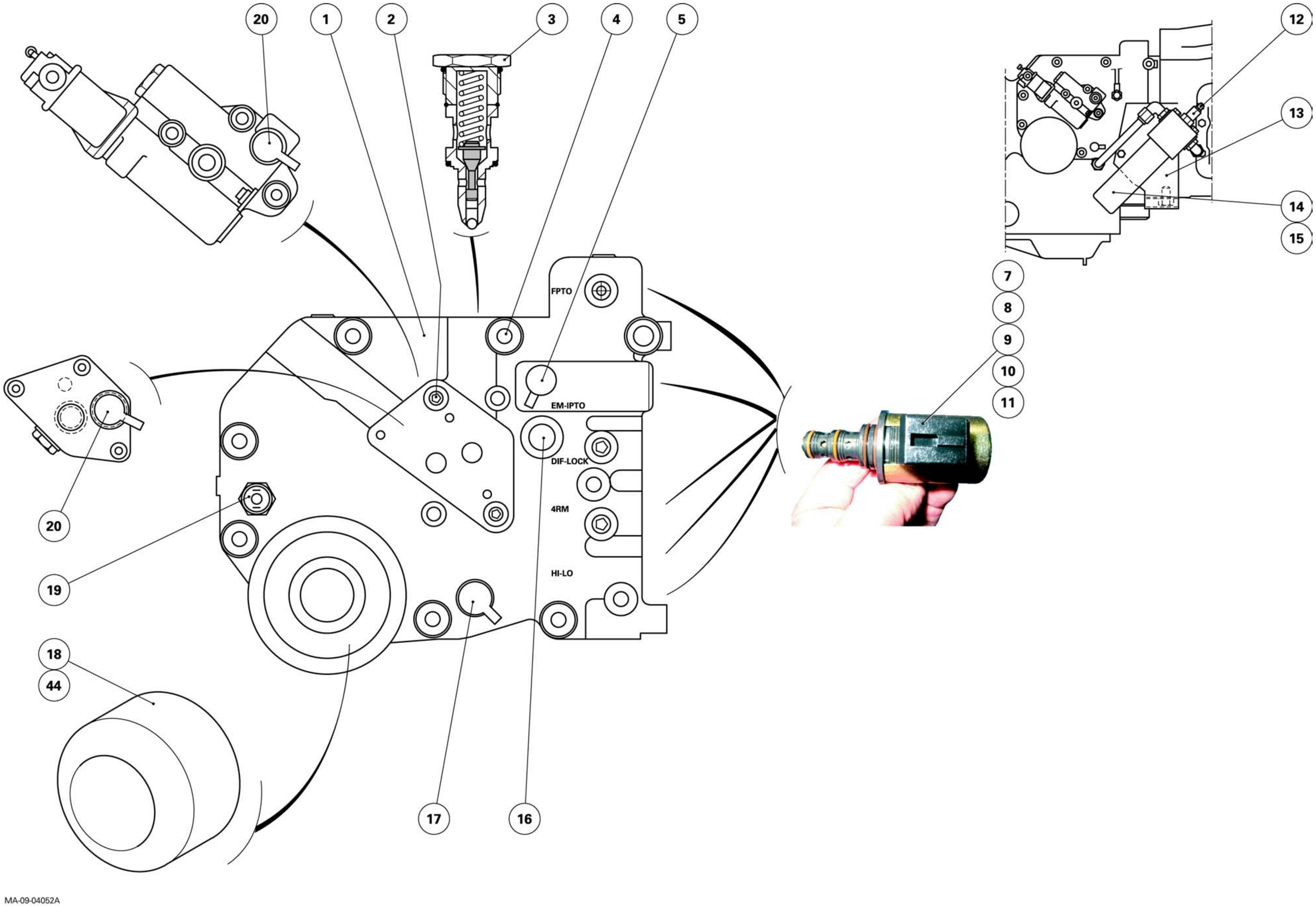


Fig. 1

Internal overall view

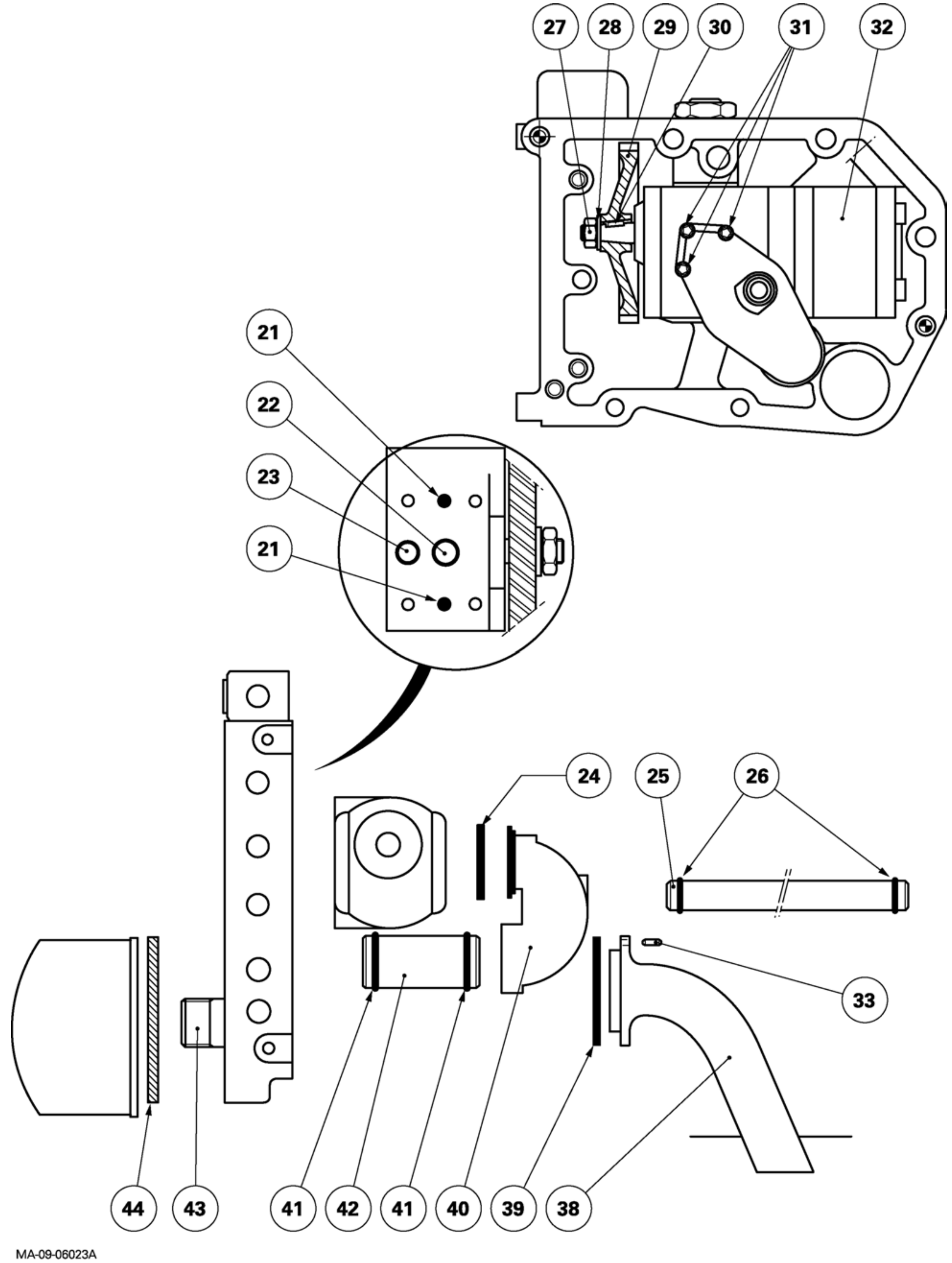


Fig. 2

Exploded view

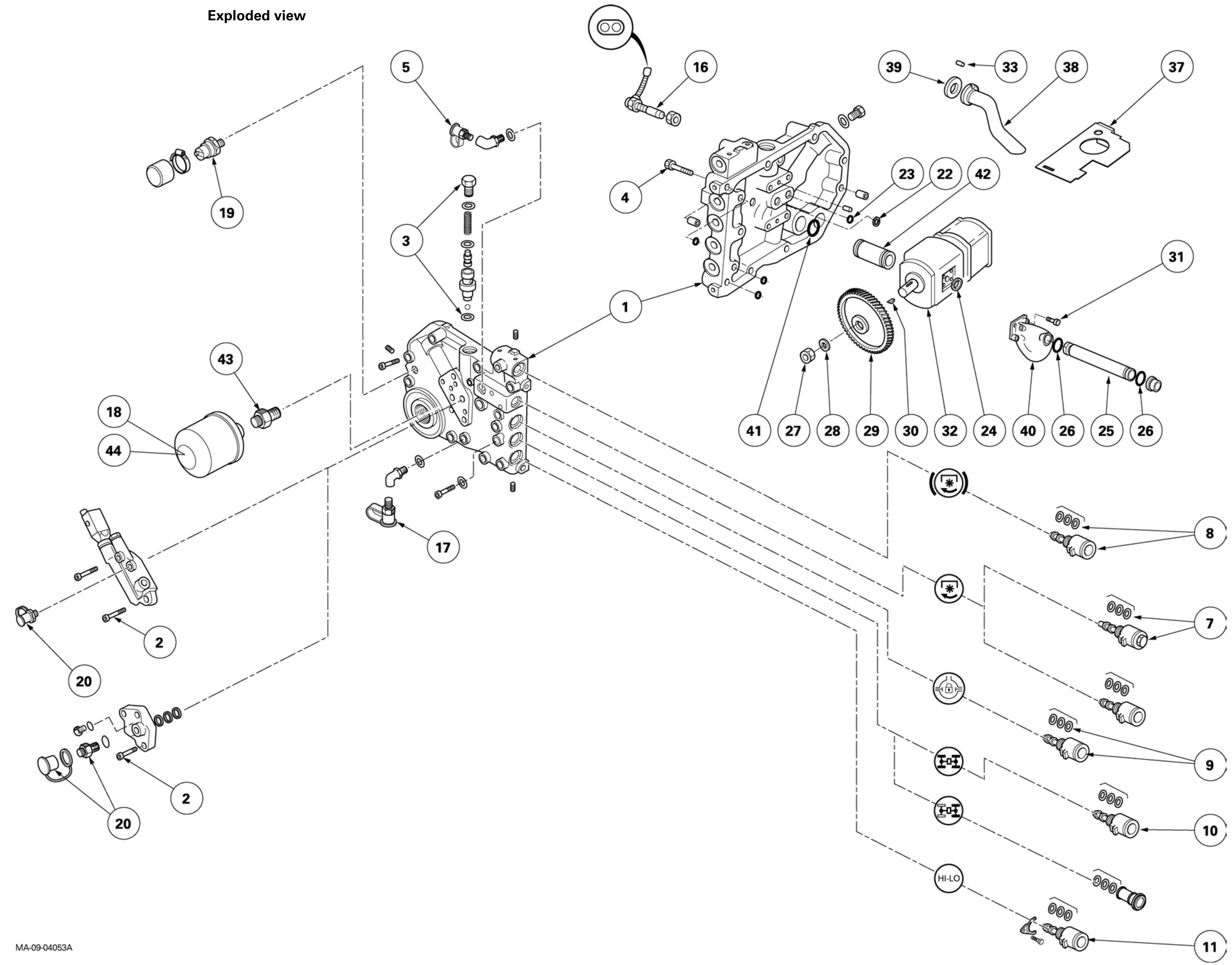


Fig. 3

B . Identification of channels and ports

On the cover (1) (Fig. 6)

A Channel to auxiliary spool valves
B Port to front and rear differential locks (if fitted)
C 17 bar pressure inlet from left-hand hydraulic cover
D Low flow rate channel to main filters (15 microns) and Orbitrol steering unit
E Port to 4WD clutch port (if fitted)
F Suction
G Oil outlet to pump via strainer
H Port for filter switch
I Continuity port towards auxiliary spool valves
J High pressure port, pump outlet
K Port to PTO brake
L Port to PTO clutch

On the solenoid valves

ON - OFF solenoid valves (8 to 11) (Fig. 4).

***Note:** Only the solenoid valve (8) (PTO brake) has a diode (+/-).*

A Supply ports to pressurised parts
P 17 bar low pressure inlet
R Port to return line

On the high pressure, low flow rate valve (3) (Fig. 5)

P 200 bar high pressure inlet
R Port to return line

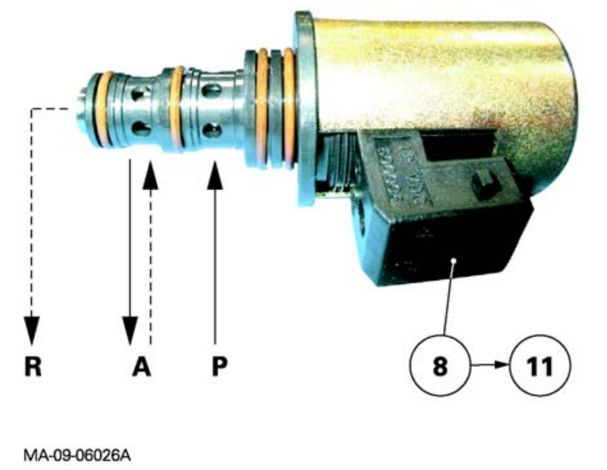


Fig. 4

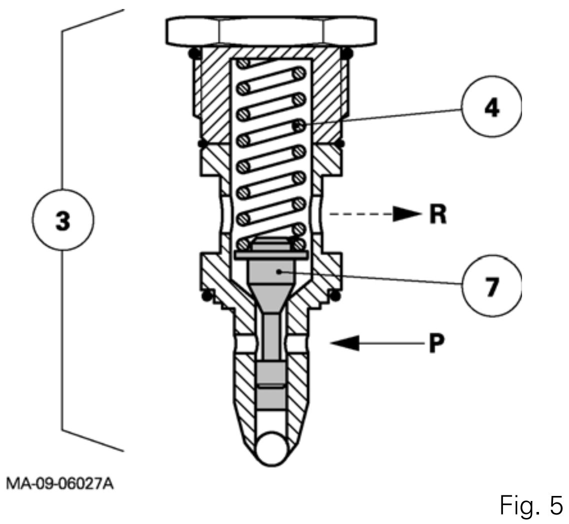


Fig. 5

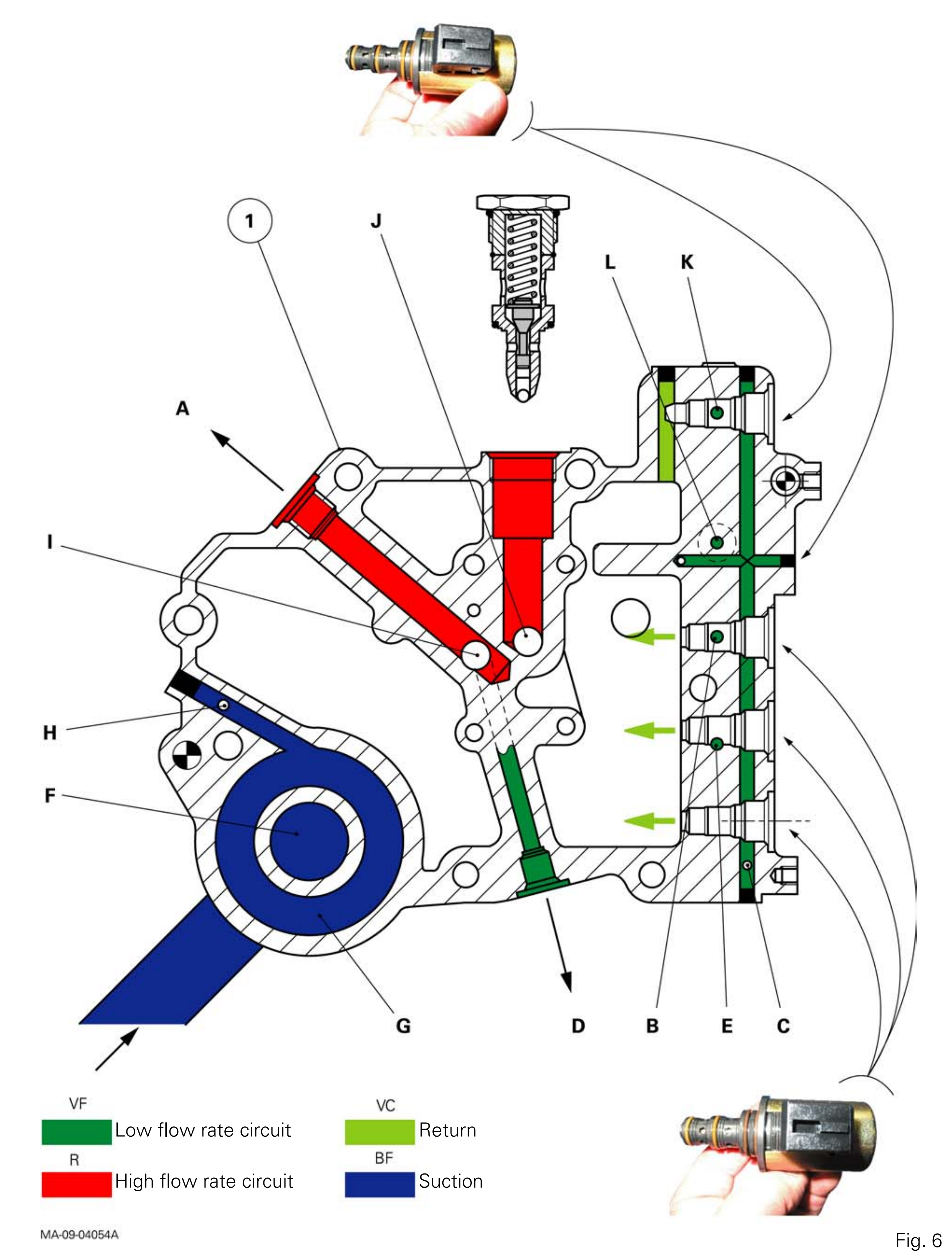

1
J
L
K
A
I
H
F
G
D
B
E
C
VF
Low flow rate circuit
VC
Return
R
High flow rate circuit
BF
Suction
MA-09-04054A

Fig. 6

C . Removing and refitting the cover

Preliminary operations

1. Immobilise the tractor. Chock the left rear wheel.
2. Apply the parking brake.
3. Chock between the frame and the front axle (optional).
4. Partially bleed the rear axle housing.
5. Take off the wheel concerned. Position an axle stand.

Removal (Fig. 7)

6. Disconnect the clogging indicator harness (12).
7. Remove the 15 micron filter(s) (14) and the support (depending on option).
8. Remove the strainer (18) to access the partially hidden screw (4).
9. If the tractor is fitted with a trailer braking mechanism, remove the spool valve.
10. Disconnect and block:
    - the hose (1) to the auxiliary circuit
    - the rear differential lock tube (2) and the hose (8) from the front differential lock control (if fitted)
    - the 4WD clutch supply pipe (10) for tractors fitted with this option
    - the PTO brake supply pipe (3).
    - the Orbitrol spool valve supply pipe (9) via the 15 micron filter(s) (14)
    - the 17 bar hydraulic cover supply pipe.
11. Disconnect the harness of the engine speed sensor (16) and filter switch (19) (Fig. 7).

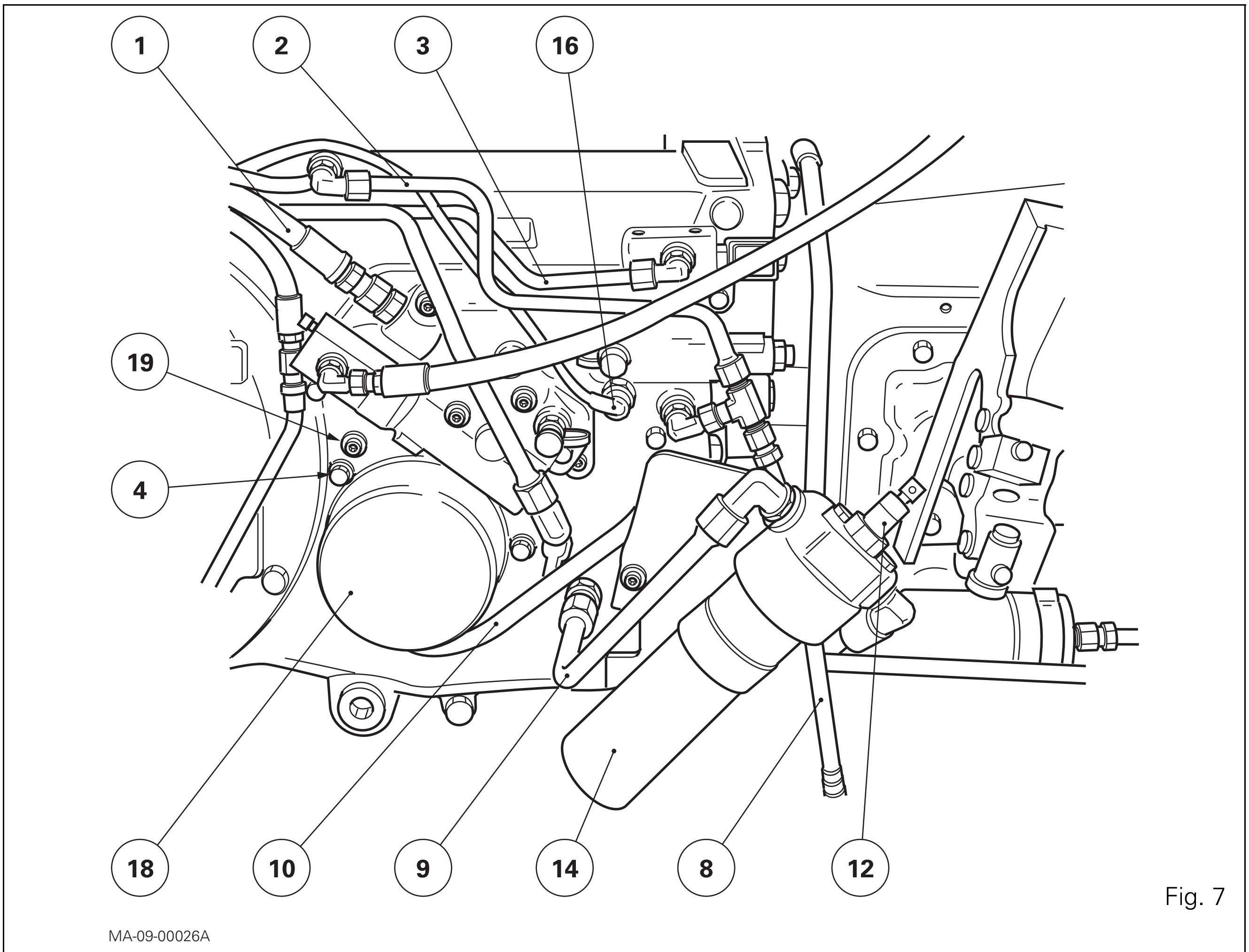


Fig. 7

12. Disconnect the solenoid valves, marking their connections.

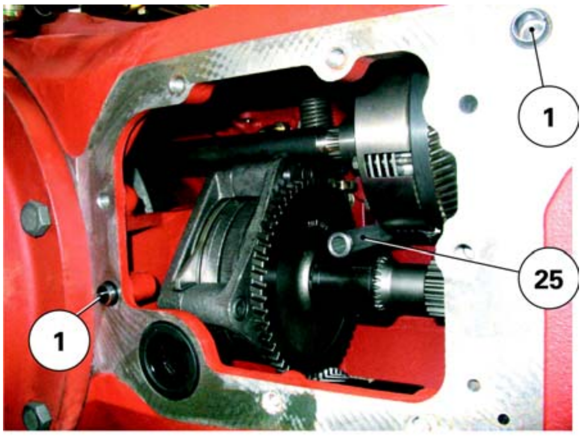
Note: The function of each solenoid valve is moulded on the external face of the hydraulic cover casing.

The cover is fitted with two different types of solenoid valves.

The solenoid valve (8) (Fig. 1) of the PTO brake has a solenoid valve with a diode and is represented by the following symbol (+/-).

13. Take out the screws (4) and remove the cover.

14. After removing the cover, if necessary remove from the housing the transfer pipe (25) (Fig. 8), ensuring hydraulic continuity with the pump manifold.



MA-09-06030A

Fig. 8

Refitting

15. Clean the mating faces of the housing and the cover.

16. Check for the presence of the two locating pins (1) and rivets at the ends of the channels on the cover (Fig. 6 and Fig. 8).

17. Fit new seals:
- on the Hare / Tortoise channels (2) (Fig. 9)
- on the power take-off clutch channel (3) (Fig. 9).

18. Fit and position the suction pipe (38) (Fig. 10), with its notch along the axis of the pin. Put in place seal (39).

19. Screw two locally made guide pins into opposing holes on the housing.

20. Fit the transfer tube (if removed), previously checking that seals are in a good condition.

21. Smear the mating faces of the cover with a sealing product (Loctite 510 or equivalent) taking care not to block the hydraulic ports of the Hare / Tortoise mechanism.

22. Refit the cover. Take out the guide studs. Fit and tighten the screws (4) (Fig. 7) to a torque of 72 -96 Nm.

23. Reconnect (according to the markings made):
- solenoid valves
- filter switch
- engine speed sensor.

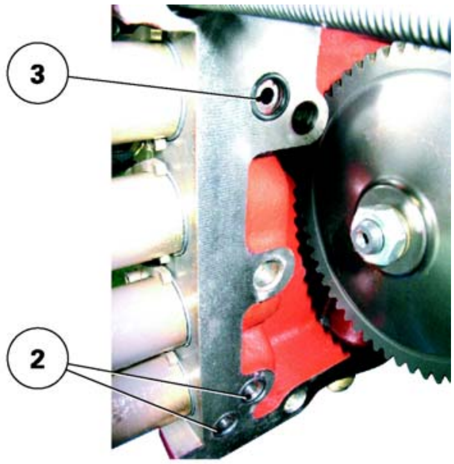


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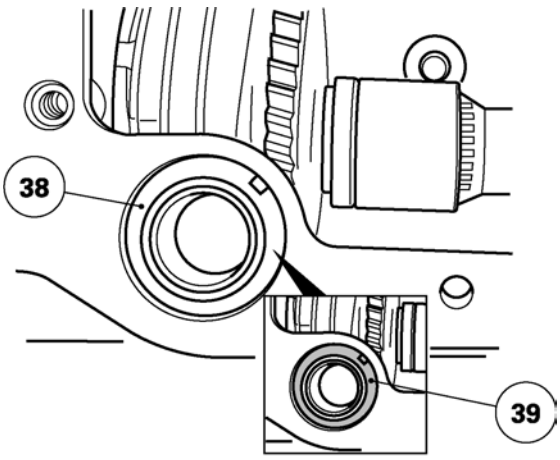
Fig. 9



MA-09-06032A

Fig. 10

Right-hand cover – 57 l/min Open Centre

24. Attach the electrical harnesses using a cable clip.

25. Reconnect the pipes and hose.

26. Refit the trailer braking spool valve (if fitted - see chapter 9).

27. Check the condition of the strainer seal (18) and lubricate it. Refit the strainer and tighten it an additional quarter turn after it contacts with the seal.

28. Refit the 15 micron filter(s) and the support. Reconnect the clogging indicator.

Final operations

29. Lift the tractor. Refit the wheel.

Take out the stand and tighten the nuts (see chapter 6).

Remove the chocks.

30. Top up the transmission oil level of the rear axle and check it using the gauge located to the rear of the centre housing.

31. Check the operation of the electrical circuits, the low pressure switch, the solenoid valves, the filter switch and the filter clogging indicator.

32. If the pump has been replaced, or if the disassembly of one or several hydraulic component(s) was necessary, check the hydraulic circuit by carrying out the relevant tests (voir chapter 9).

33. Check the tightness of the cover mating face, the strainer and the hydraulic unions.

D . Disassembling and reassembling the high pressure valve

Operation (Fig. 5)

If pressure "P" rises above 200 bar ± 5 bar, the spring (4) is compressed, opening the valve (7) to allow oil to pass into the housing via port R.

Preliminary operation

If necessary, take off the right-hand side rear wheel. Position a safety stand.

Disassembly (Fig. 11)

34. Unscrew the plug (1). Recover the shims (2) and take out the spring (4).

35. Remove the O'ring (5), extract the body (6) with the valve (7) and the washer (8) from the right-hand cover.

__Note:__ The ball (9) is crimped in the body of the valve.

Reassembly (Fig. 11)

36. Check that the valve (7) slides freely in the valve body (6).

37. Place the washer (8), fit the valve body (6) with the valve (7) into the cover. Position the O'ring (5).

38. Fit the spring (4), the shims (2) and tighten the plug (1) to a torque of 50 - 60 Nm.

Final operation

Refit the wheel (if removed). Tighten nuts (see chapter 6).

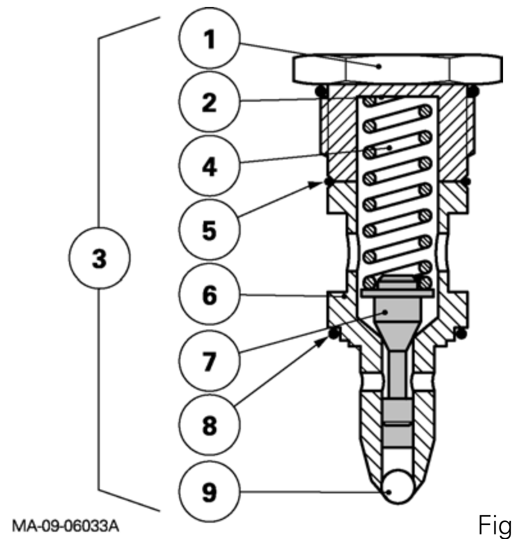


Fig. 11

E . Disassembling and reassembling the cover

Disassembly

39. Take off the cover (see § C).

40. Place the cover in a vice fitted with plastic jaws.

On the external face (Fig. 1)

41. Mark the locations and types of solenoid valves (7) to (11) and remove them.

42. Note the position of the switch (19) and remove it.

43. Remove the engine speed sensor.

44. Remove the hydraulic unions and plugs (depending on version).

45. Remove the diagnostics connectors and if necessary the plate replacing the brake spool valve (tractor with no trailer brake).

46. Take off the high pressure valve (3).

On the internal face (Fig. 2)

47. Take out the screws (31) and remove the inlet manifold (40), seal (24) and pipe (42). Remove seals (41).

Removing the drive pinion

48. Unscrew nut (27). Take off washer (28), pinion (29) and key (30).

49. Take off the pump (see § F).

Reassembly

50. Clean the cover mating faces.

51. Check that no channels (low and high flow rate) are blocked. Check for the presence of the rivets ensuring oil tightness at the end of each channel.

On the internal face (Fig. 2)

52. Refit the pump (see § F).

Refitting the drive pinion

53. Position the key (30). Fit the pinion (29) on the shaft while ensuring that the key is correctly engaged. Fit washer (28).

54. Smear the nut (27) with Loctite 242 or equivalent and tighten to a torque of 50 - 60 Nm.

55. Replace the O'rings (41) on the pipe (42).

56. Refit the seal (24), the pipe and the inlet manifold (40). Refit and tighten the screws (31) to 1.2 – 1.6 Nm.

On the external face (Fig. 1)

57. Refit the high pressure valve (3). See tightening torque in § D.

58. Refit the diagnostics connectors and the plate cited in operation 45, if it was removed.

59. Refit the plugs and hydraulic unions.

60. Refit and adjust the engine speed sensor (see § H).

61. Refit the switch (19), having lightly smeared the sensor thread with Loctite 542 or equivalent.

62. Refit the solenoid valves according to the type and locations marked during disassembly.

REMARK: *The flanged solenoid valves are not screwed onto their support. They are only pushed into their housing and held on the cover by a flange.*

Tightening torque

Solenoid (7) nut: 1.7 -2.8 Nm.

IMPORTANT: *Do not exceed the maximum tolerance value.*

63. Refit the cover (see § C).

F . Removing and refitting the pump

Removal (Fig. 12)

64. Remove and disassemble the cover (see § C and E).

65. Take out the screws (2) and disengage and remove the pump (32). Remove the O'rings (22) (23).

***NOTE:** The locating pins (21) are force fitted into the cover.*

Refitting

66. Clean the components, replace any found to be defective. Check that none of the channels in the cover are obstructed.

67. Fit the locating pins (21) (if necessary) to the cover (Fig. 13).

68. On the cover, fit new O'rings (22) (23) in the recesses of the high and low flow rate channels (Fig. 13).

69. Inside the cover, apply a bead C of Loctite 574 or equivalent around the four pump fixing screw holes (Fig. 13).

70. Refit the pump on the locating pins (Fig. 12).

71. Lightly smear screws (2) with Loctite 221 or its equivalent (Fig. 12) and tighten them to a torque of 10 -12 Nm.

72. Reassemble and refit the cover (see § E and C).

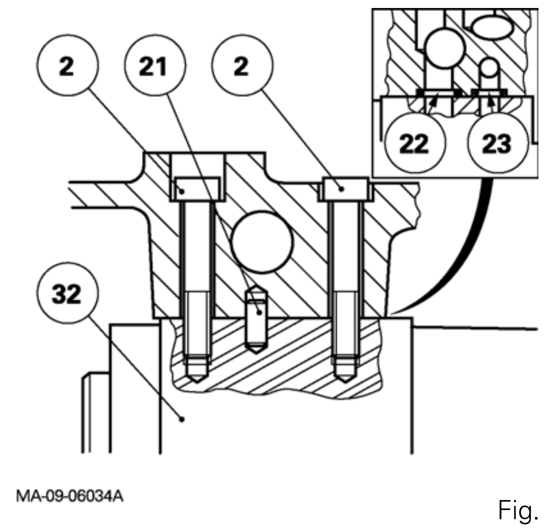


Fig. 12

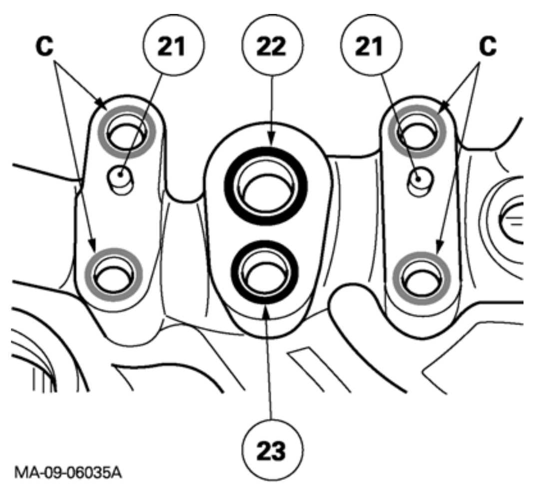


Fig. 13

Exploded view of the pump

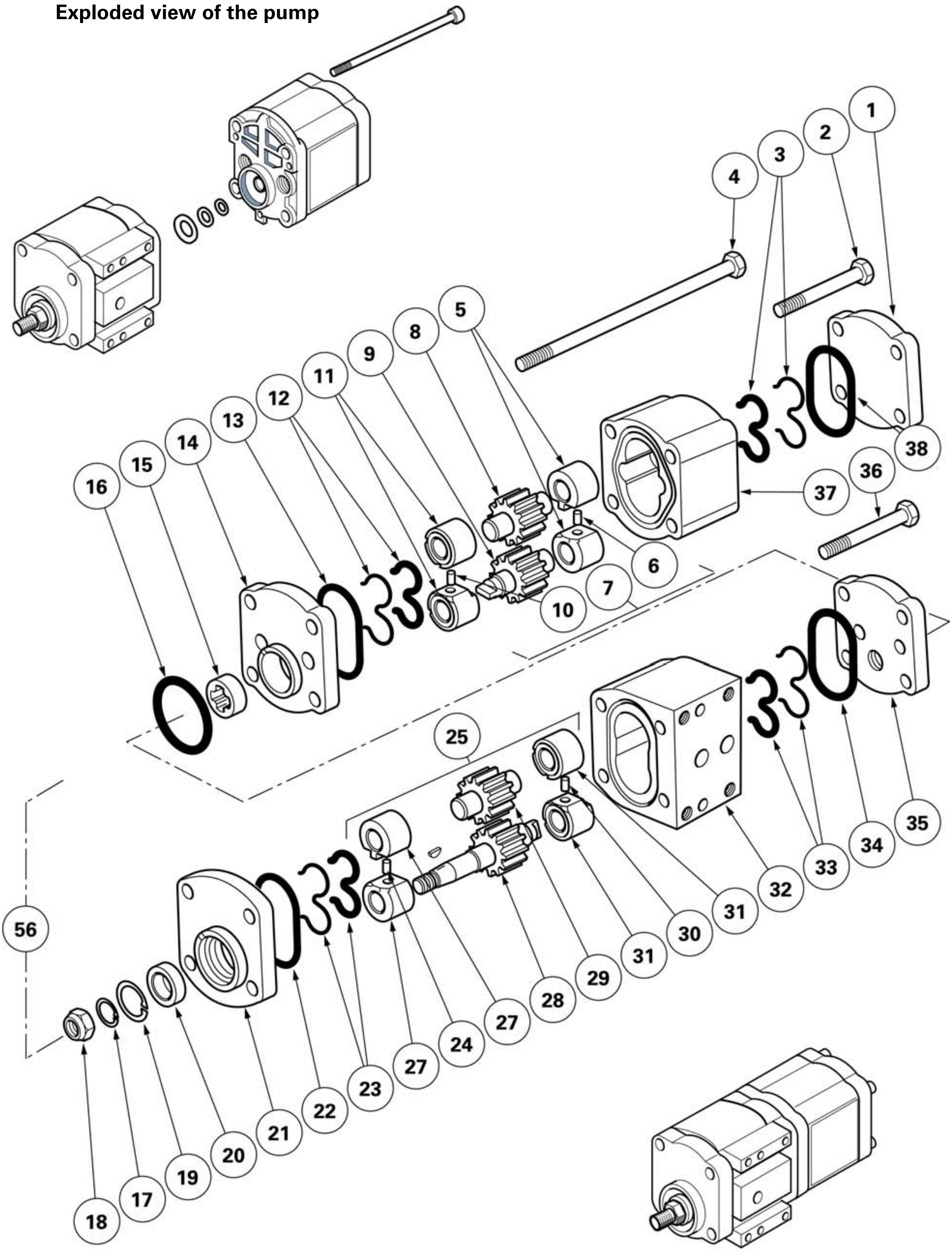


Fig. 14

G . Disassembling and reassembling the pump

73. Remove and disassemble the cover (see § C and E).

Disassembly (Fig. 14)

74. Clamp the pump in a vice (Fig. 15).

75. Using paint, mark the positioning of: pump stages, flange and plates.

76. Take out the screws (2) (4).

77. Remove the closing plate (1).

78. Remove the composite seal (3) and seal (38). Split the low flow rate stage (37) from the flange (14).

79. Take out the stage and the pinion / bearings assembly (7).

80. Remove the pinions (8) (9) from the bearing assemblies (5) (11).

Pair the bearing assemblies.

***NOTA:** Each bearing is linked by a locating pin P (Fig. 16).*

81. Remove the composite seal (12) and seal (13).

82. Take off the flange (14), catchdog (15) and seal (16).

83. Loosen and remove screws (36).

84. Take off the flange (35).

85. Remove the composite seal (33) and seal (34).

86. Split the high flow rate stage (32) from the flange (21).

87. Take out the bearing / pinion assembly.

88. Remove the pinions (28) (29) from the bearing assemblies (27) (31).

Pair the bearing assemblies.

89. Remove the composite seal (23).

90. Remove seal (22).

91. Remove circlip (19) and drive out the bush (20).

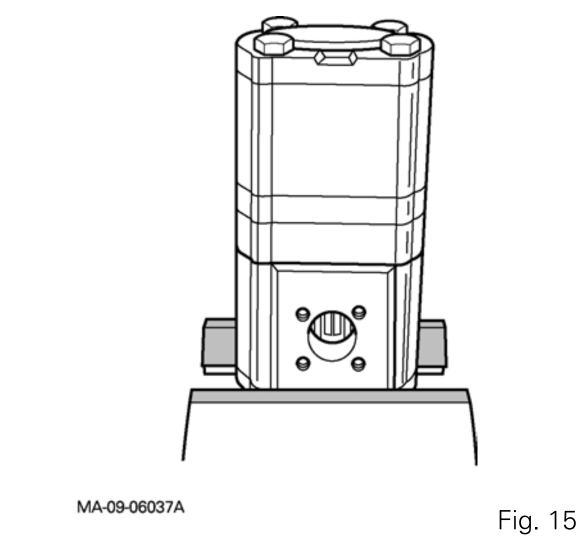


Fig. 15

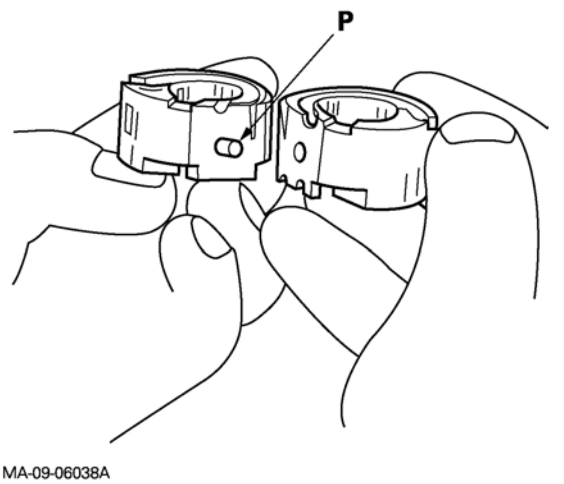


Fig. 16

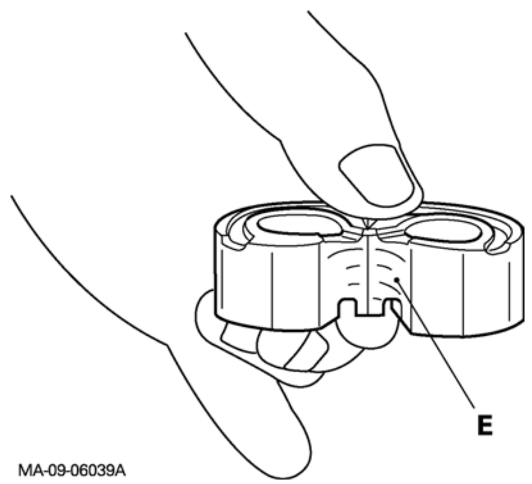


Fig. 17

Reassembly (Fig. 14)

92. Check and clean all components. Replace any defective parts.

IMPORTANT: *During reassembly, the bush (20) and the seals must be systematically replaced.*

93. Insert the bush (20) in the flange (21) using a suitable fixture and fit and correctly position the circlip (19).

94. Fit the bearing assembly (27) (without recess), centred by the pin (24), in the high flow rate stage (32). Turn lubricating grooves G towards inlet port O and groove R of the composite seal (23) towards the flange (21) (Fig. 18).

NOTA: *The pump comprises four bearing assemblies. The intermediary bearings (11) (31) possess a recess (E) (Fig. 17) to allow oil to pass to the low flow rate stage (37).*

95. Place pinions (28) (29) of the high flow rate stage in the bearing assembly (27).

REMARK: *The high flow rate pinions are larger.*

96. Position the composite seal (23) and seal (22) (Fig. 20).

97. Assemble the high flow rate stage (23) on the flange (21) according to the marks made during disassembly.

98. Fit the bearing assembly (31) (with recess), centred by the pin (30), in the high flow rate stage (32). Turn lubricating grooves G and recess E towards inlet port O, and groove R of the composite seal (33) upwards (Fig. 19).

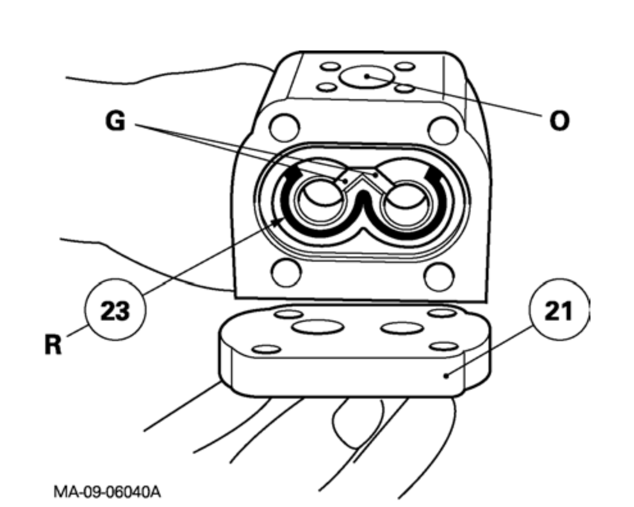


Fig. 18

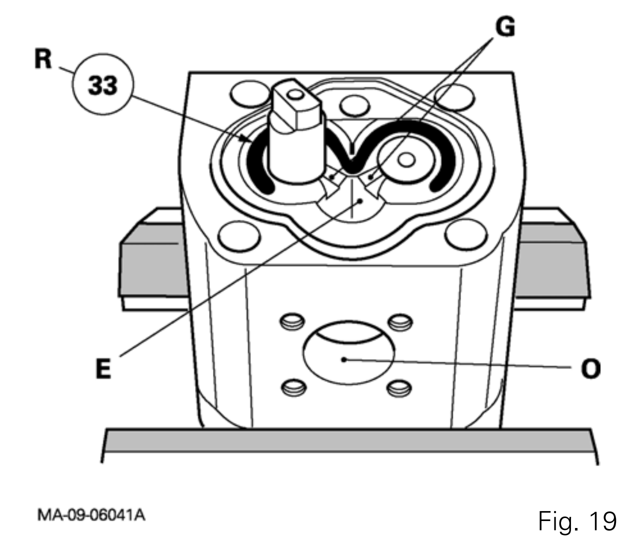


Fig. 19

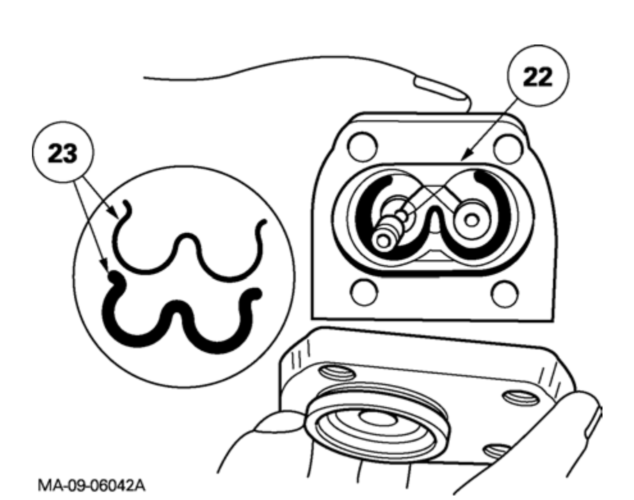


Fig. 20

99. Position the composite seal (33) and seal (34). Assemble the flange (35) on the high flow rate stage (32) (Fig. 21) according to the marks made during disassembly.

100. Centre the flange (35). Tighten the screws (36) to: 40 - 47 Nm.

101. Refit the catchdog (15) on the flat of the driving pinion (28). Position the seal (16).

102. Assemble the flange (14) according to the marks made before disassembly.

103. Fit the bearing assembly (11) (with recess), centred by the pin (10), in the low flow rate stage (37). Turn lubricating grooves G and recess E towards inlet port O, and groove R of the composite seal (12) towards the flange (Fig. 22).

104. Position the composite seal (12) and seal (13) (Fig. 22).

105. Assemble the low flow rate stage (37) on the flange (14) according to the marks made during disassembly.

106. Place the pinions (8) (9) in the low flow rate stage while ensuring that the flat of the drive pinion (9) is correctly positioned in the catchdog (15).

107. Fit the bearing assembly (5) (without recess), centred by the pin (6), in the low flow rate stage (37). Turn lubricating grooves G towards inlet port O and groove R of the composite seal (3) towards the closing plate (1) (Fig. 23).

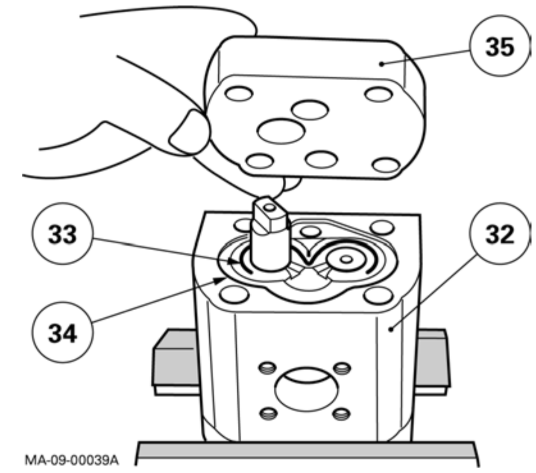


Fig. 21

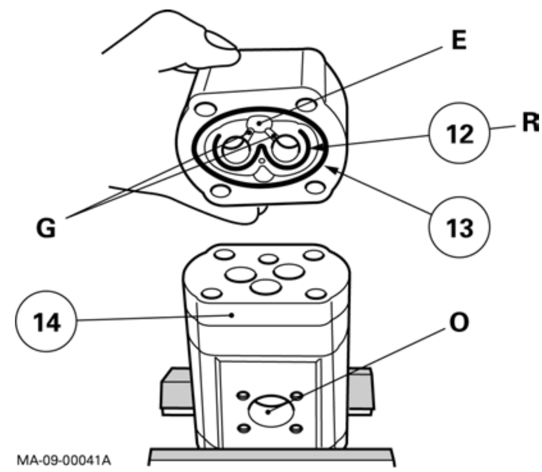


Fig. 22

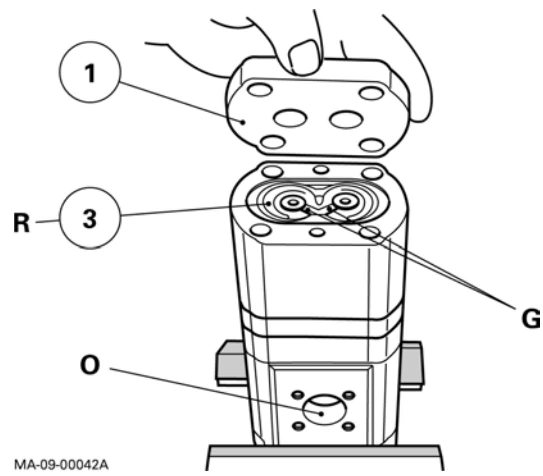


Fig. 23

108. Position the composite seal (3) and seal (38) (Fig. 24).

109. Centre the low flow rate stage (37) and assemble the closing plate (1) according to the marks made during disassembly.

110. Tighten screws (2) (4) to a torque of 40 - 47 Nm.

111. Manually check for the free rotation of the pump.

112. Reassemble and refit the cover (see § E and C).

H . Adjusting the engine speed sensor

113. Fit the engine speed sensor (16), having lightly smeared the threads with Loctite 577 or equivalent (Fig. 25).

114. Screw the sensor fully home without forcing it until it makes contact with the pump pinion (29). Then unscrew it three quarters of a turn so as to obtain a gap of approximately 1mm between the sensor and the pump pinion.

Tighten the nut (1) to a torque of 5 - 7 Nm.

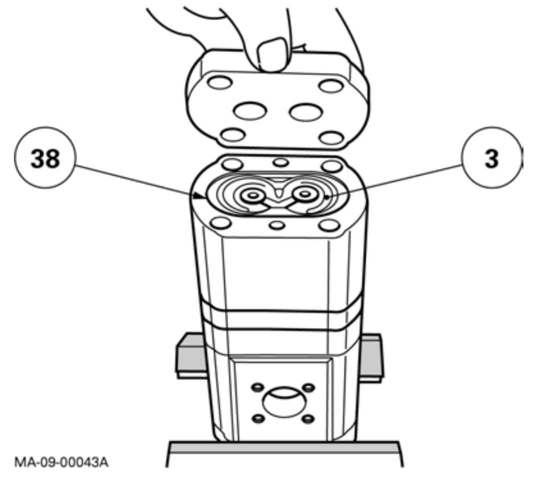


Fig. 24

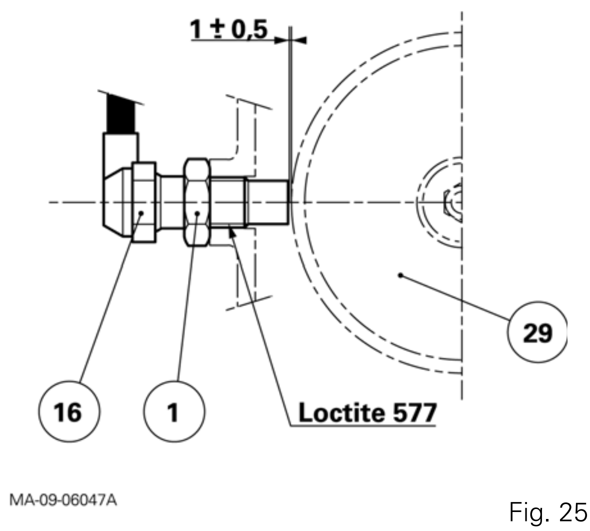


Fig. 25

09C01 - Left-hand cover - 57 l/min Open Centre

CONTENTS

A . General

The left-hand cover fitted to the centre housing acts as a support to the lift spool valve.

On its external face, the cover is fitted with various channels:

- low pressure to the right-hand cover
- cooler and lubrication, to the gearbox
- high pressure to lift control system.

On its internal face, a reducer (1) maintains a pressure of approximately 5 bar to lubricate the braking mechanism in the trumpet housings (Fig. 1).

A version without hydraulic lift is available. In this case, a plate replaces the lift spool valve.

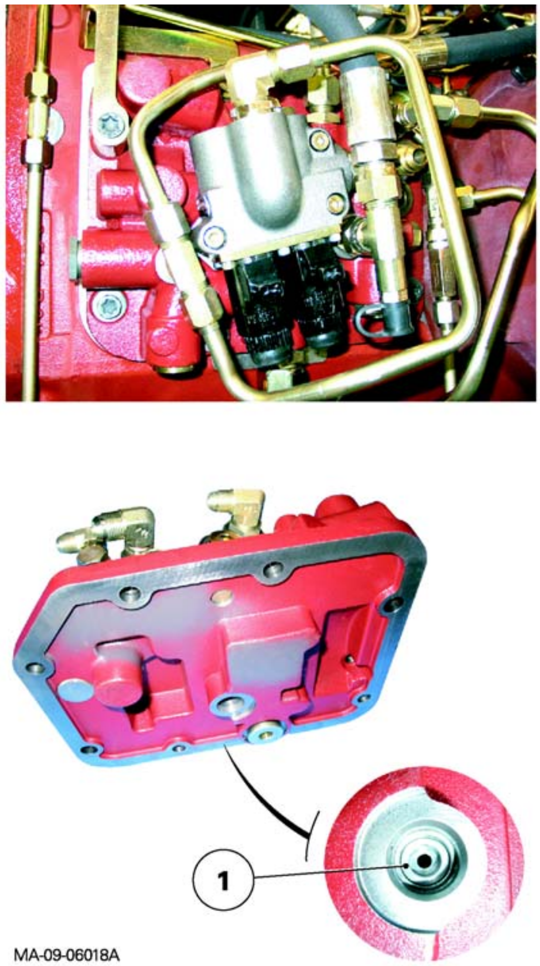


Fig. 1

B . Removing - Refitting

Preliminary operations

1. Immobilise the tractor. Chock the front wheels. Take off the rear wheel concerned. Position a safety stand.

2. Partially bleed the rear axle housing.

3. Detach the fuel tank from the gearbox or, if necessary, remove it after draining.

Removal (Fig. 2)

4. Mark and disconnect the harnesses:
- of the lift (1) and lower (2) solenoid valves,
- of the low pressure switch (17 bar) (12),
- of the temperature switch (7).

5. Mark, disconnect and block:
- the hose (15) from the steering spool valve (Orbitrol),
- the lubricating hose (14) to the cooler (hot oil),
- the hose (3) from the lift spool valve,
- the lift rams supply pipes (4),
- the lubricating pipe (13) to the gearbox (cold oil),
- the pipe (17 bar) (10) to the right-hand cover.

6. Disconnect the following controls:
- handbrake,
- GSPTO (8) (if fitted).

7. Disconnect the pipe (11) to the trumpet housing lubrication (all types). Take out the screws (5). Remove the support (6), support (9) (if mounted) (Fig. 3) and the cover.

8. If necessary, remove the transfer pipe (1) (Fig. 4).

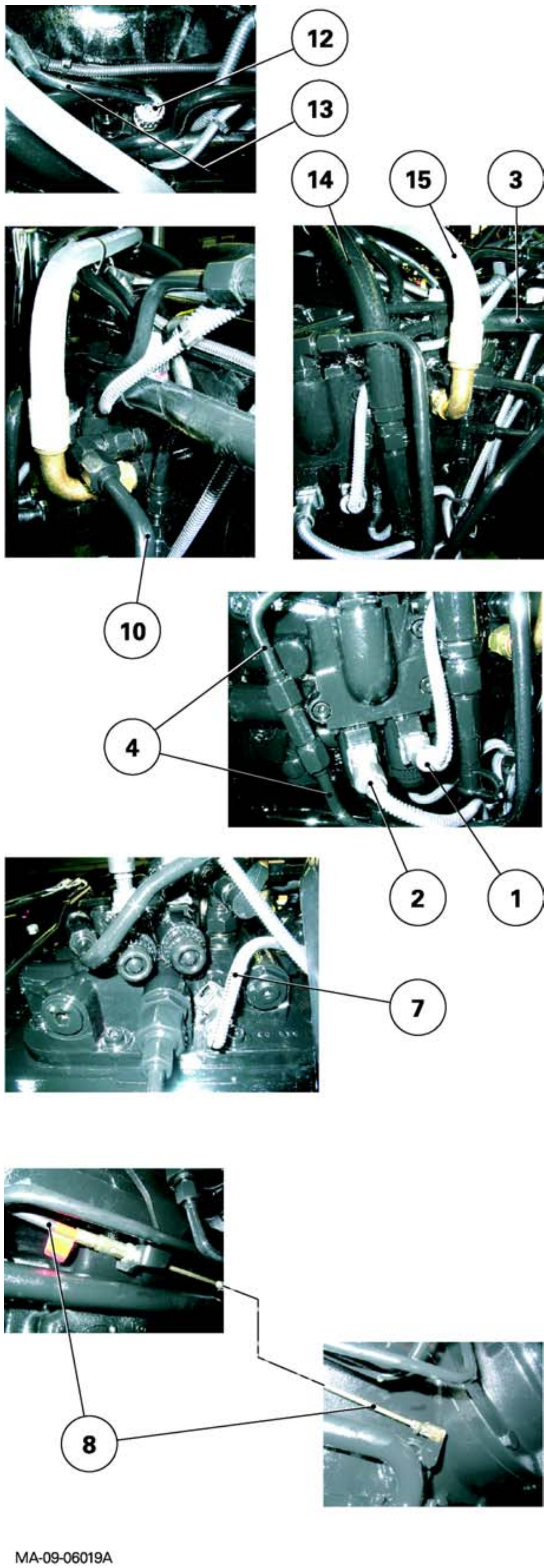


Fig. 2

Preparing for refitting

9. Clean the mating faces of the housing and the cover.

10. Check that the O'rings of the transfer pipe (11) are not damaged and refit it on the right-hand cover (Fig. 4).

11. Lightly smear the mating face of the housing with a sealing product (Loctite 510 or equivalent).

12. Screw two locally made guide studs "G" into opposing holes on the housing (Fig. 4).

Refitting

13. Refit the cover.

14. Fit the handbrake control support (6) and the proportional PTO support (9) (if fitted) (Fig. 3). Take out the guide studs. Fit and tighten the screws (5) to a torque of 72 - 96 Nm.

15. Reconnect the pipes, hoses and harnesses removed previously, according to their marks.

16. Attach the harnesses using one or more clip retainers.

IMPORTANT : *Check that they can move freely and easily.*

17. Use cables to connect the controls.

18. Check the control setting for:

- handbrake,
- GSPTO (if fitted).

Final operations

19. Attach or refit the fuel tank (see operation 2).

20. Refit the wheel. Remove the axle stand and trolley jack. Tighten nuts (see chapter 6).

21. Top up the oil level in the rear axle and check it on the gauge located at the rear of the centre housing.

22. Start the engine.

23. Check the operation of the lifting system and the oil tightness of the mating face, cover and hydraulic unions.

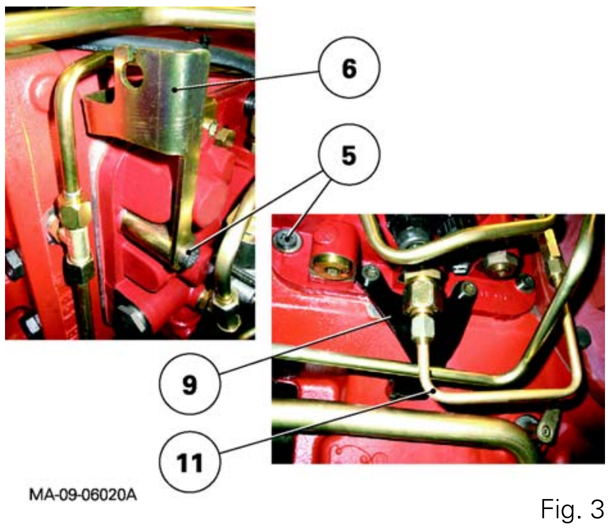


Fig. 3

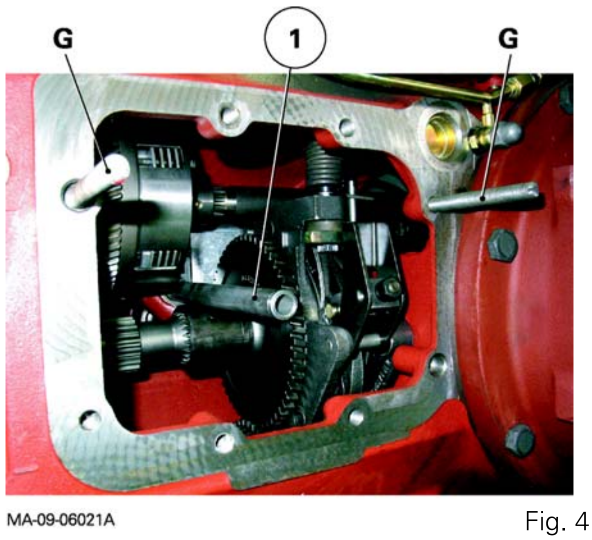


Fig. 4

09D01 - Trailer braking - Open centre

CONTENTS

A . General

5400 series tractors equipped with an open centre hydraulic circuit can be fitted with a trailer braking mechanism comprised of:

- a valve unit (6) (Fig. 1) (spool valve) fitted on the right-hand side hydraulic cover,
- a pipe linking the spool valve to a connector (1) (Fig. 1) located at the rear of the tractor,
- a pilot flow pipe connected to the master cylinders.

The valve receives its priority supply from the high pressure circuit. The oil not used for braking the trailer is directed to the spool valves (auxiliary and lift control spool valves).

The valve regulates the flow rate and pressure to the trailer brakes. It is controlled by the tractor braking circuit pressure, generated by the master cylinders, so as to obtain progressive tractor / trailer braking that is proportional to the force applied to the pedal. The trailer brake only operates if the two brake pedals are latched.

Identification of pipes, hoses and ports (Fig. 1)

Legend

B : Supply to the trailer brake connector
N : Continuity to spool valves (auxiliary and lift control spool valves)
P : Pressure
R : Return to housing
Y Pilot flow from tractor braking unit (master cylinders)

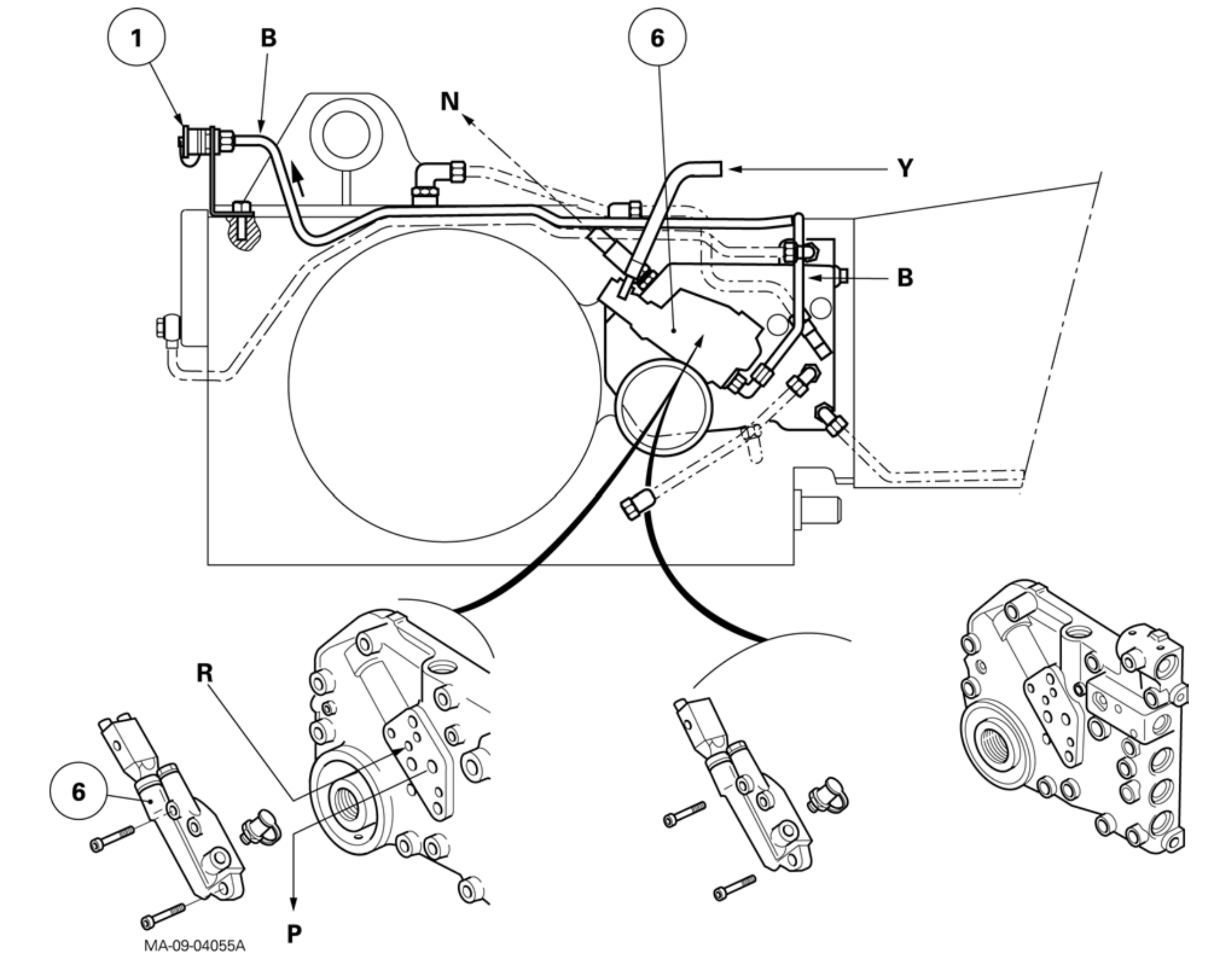


Fig. 1

Description of the braking valve (Fig. 2)

Flow control valve (1) ensures control of the **Qx** flow rate and adjusts the hydraulic flow, transmitting the pressure to the trailer brakes (Fig. 5 - Fig. 6, Fig. 8 and Fig. 9).

Control spool assembly (2) ensures the control of the flow control valve and adjusts the pressure in the trailer brakes

Non-return valve (3) stops the return of oil from brake pipe B to port N (Fig. 5 to Fig. 10)

Pressure relief-valve (4) with loaded springs (8) limits brake pressure

Pilot flow housing (5) with piston (6) and bleed screw (7), controls the trailer brake valve via the tractor braking system.

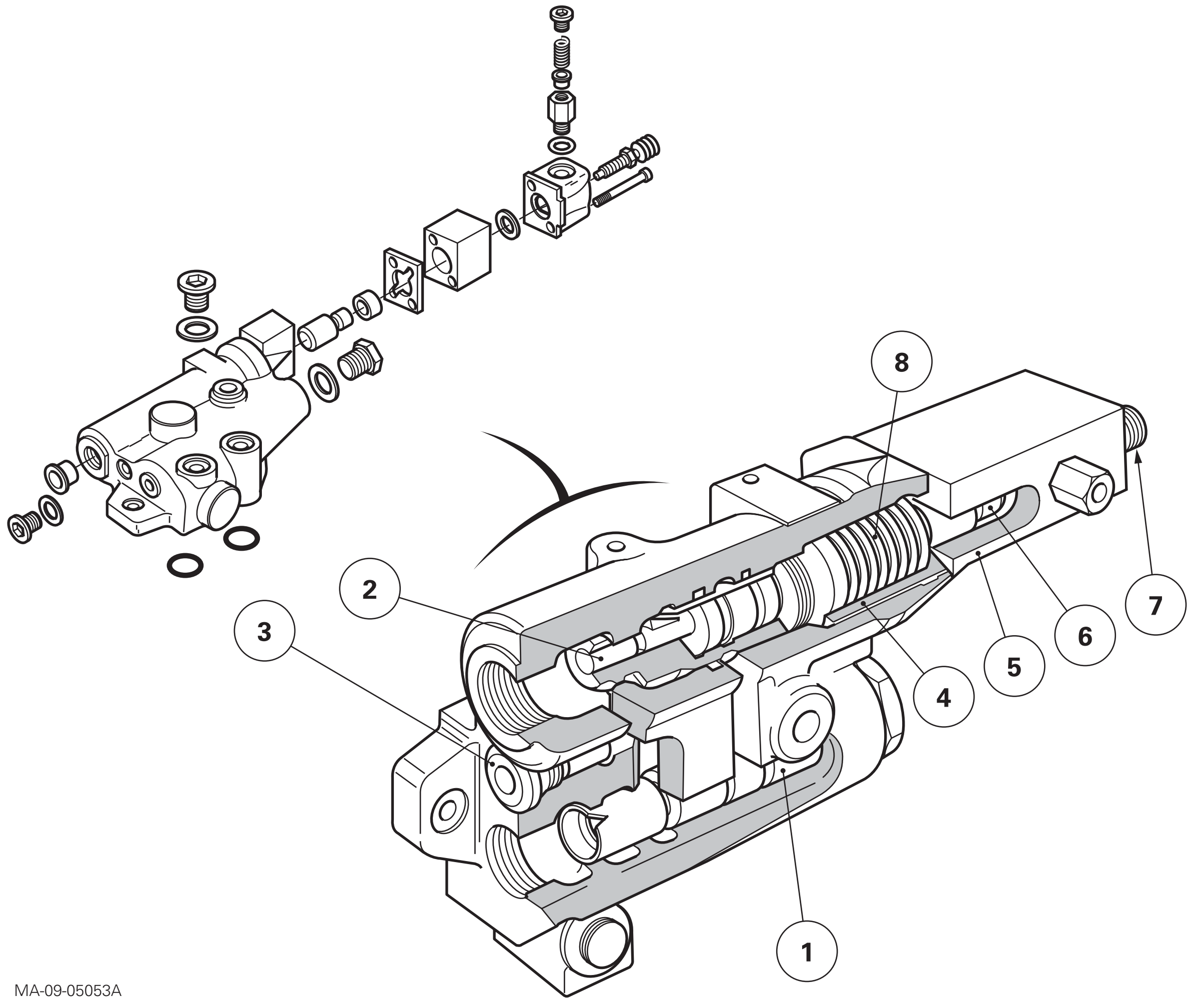


Fig. 2

B . Removing and refitting the brake spool valve

Preliminary operation

1. Immobilise the tractor. Take off the wheel concerned. Position a safety stand.

Removal (Fig. 3)

2. Disconnect and block:

- the hose pipe (2) of pilot flow housing (5)

  NOTE : *If the removal of the valve does not concern its replacement, do not disconnect the hose (2) (Fig. 3) in order to avoid draining the system.*

- the supply hose (1) from the auxiliary spool valve and the pipe (4) from the trailer brake connector.

3. Take out the screws (3) and remove the valve (6).

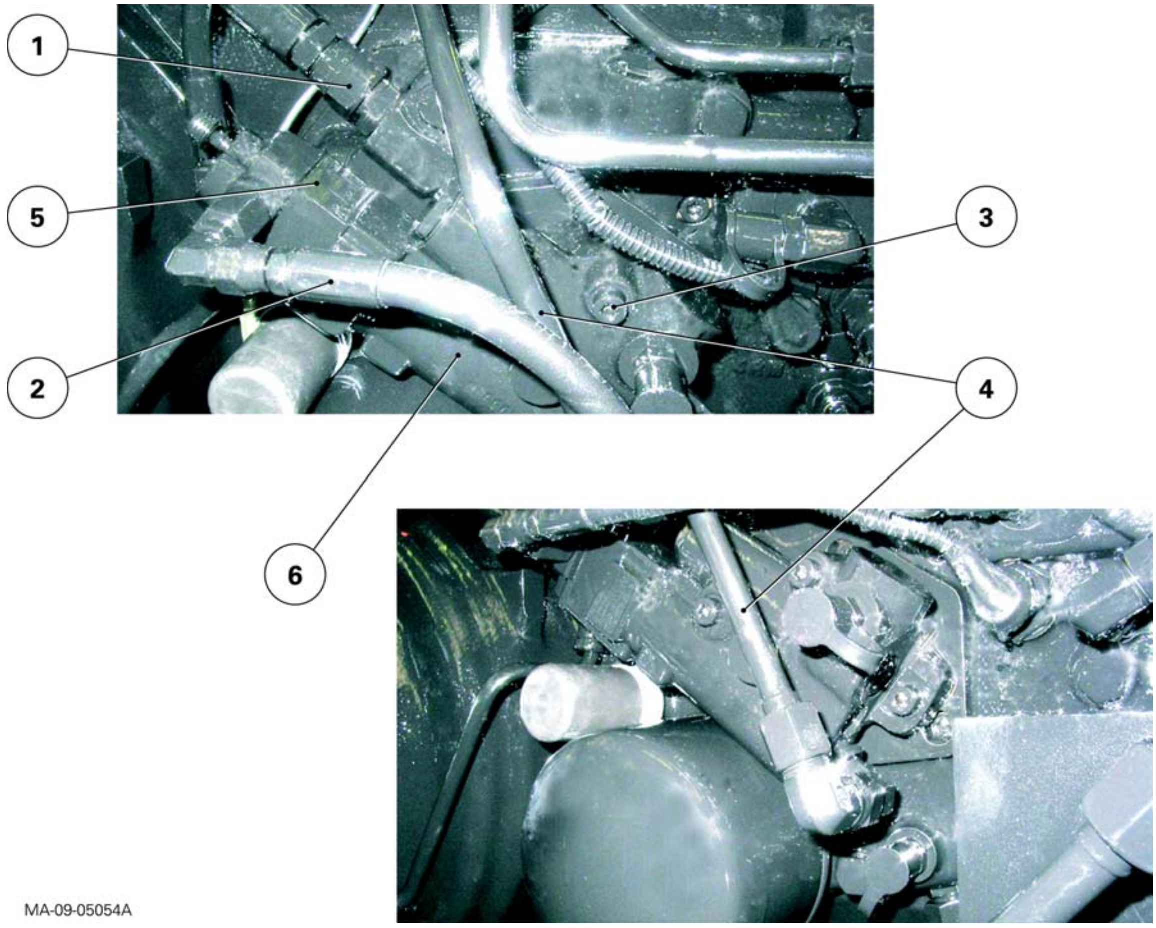


Fig. 3

Refitting

4. Clean the mating faces of the hydraulic cover and the valve.

5. Replace the O'rings (1) (2) (Fig. 4).

6. Refit the valve, place and tighten the screws (3) to a torque of 21 -24 Nm.

7. Reconnect:
- the pipe (4) of the trailer brake connector and the supply hose (1) from the auxiliary spool valve,
- the hose pipe (2) of the pilot flow housing.

8. If necessary, bleed the main brakes and the trailer brake, and check the pressure in the trailer brake mechanism (see chapter 9).

Final operation

9. Refit the wheel. Remove the safety stand. Tighten the wheel nuts or screws (depending on assembly) (see chapter 6).

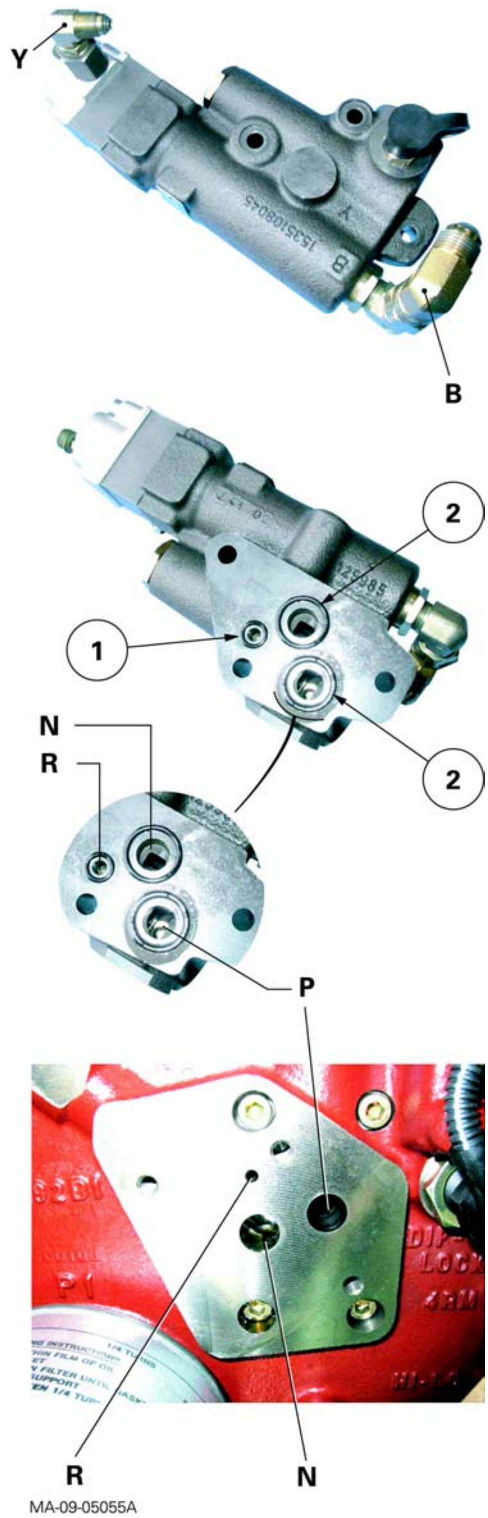
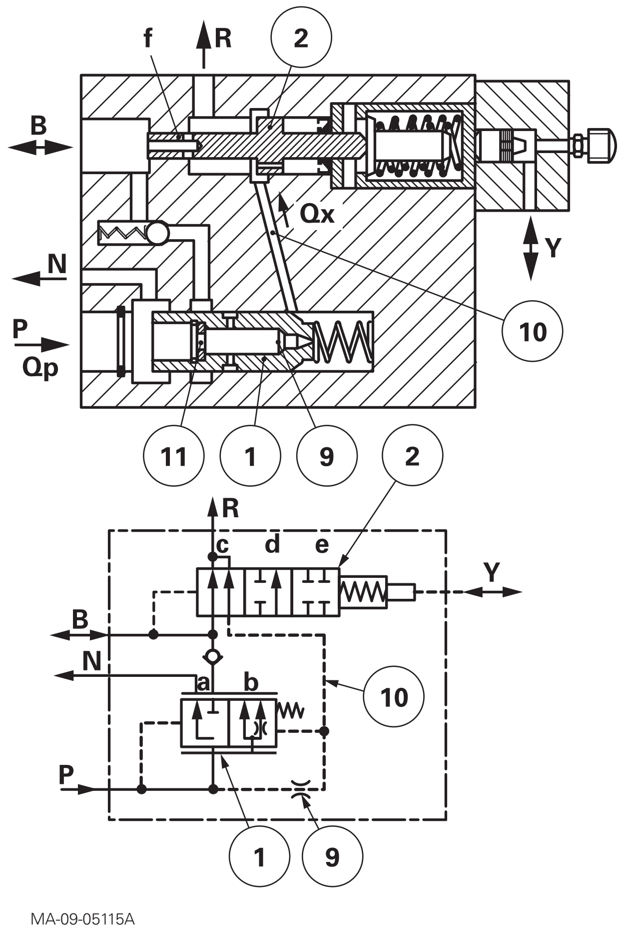
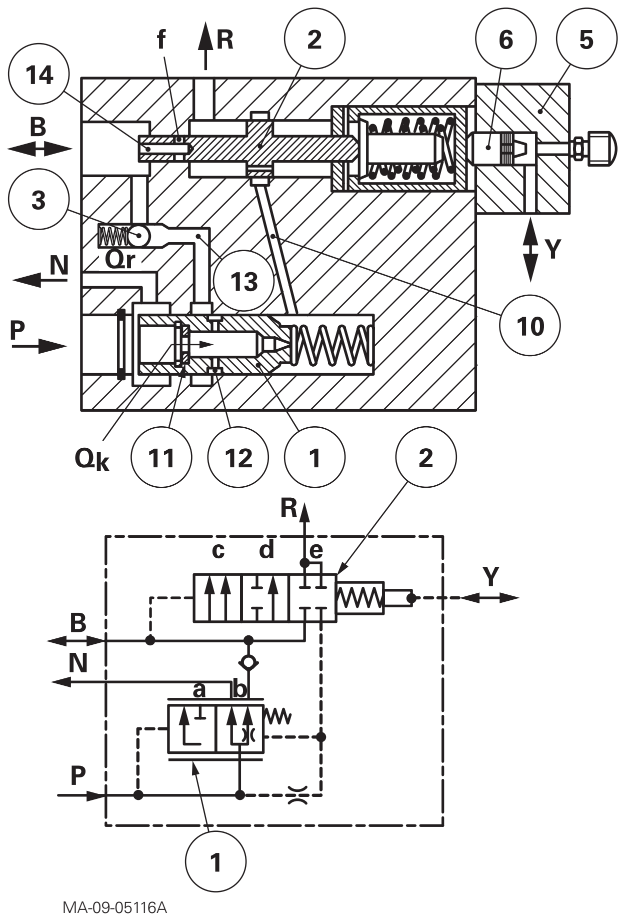


Fig. 4



Trailer brakes released Fig. 5



Partial trailer braking:
start of the braking process Fig. 6

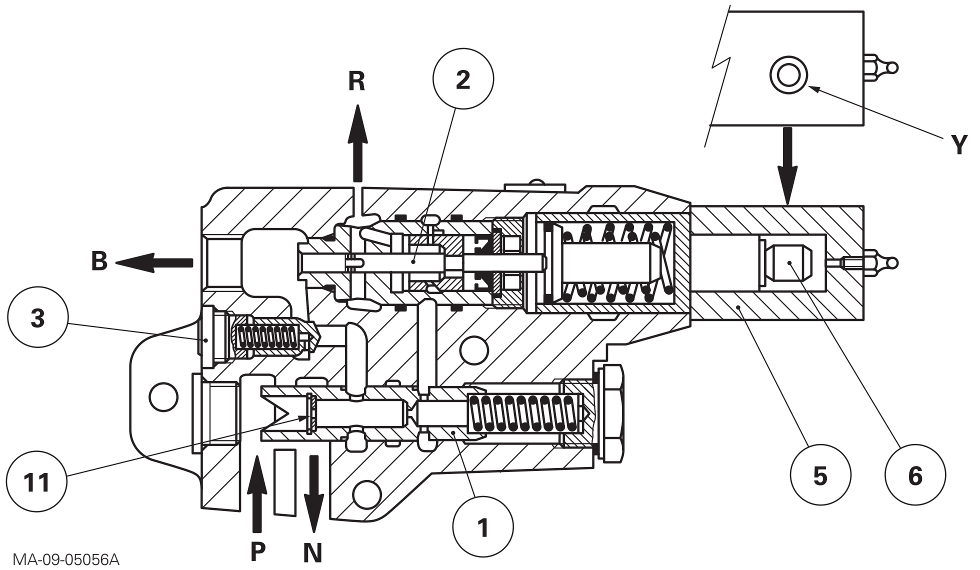


Fig. 7

C . Operation, trailer brakes released and partial braking

Trailer brakes released (Fig. 5)

The control channel Y is not under pressure (no action on brake pedals).

Port B (supply to the trailer brake connector) is linked to return channel R via the drilled hole f of the control spool (2).
Flow QP from the pump flows via port P to the flow control valve (1).

Flow QP - QX is directed towards port N (continuity towards auxiliary spool valve and lift spool valve).
Partial flow QX (approximately 0.6 l/min) from port P is directed towards the diaphragm (11), the reducer (9), the drilled hole (10) and the control spool (2) to join channel R.

Consequently, the pressure drop produced by the reducer (9) maintains the flow control valve (1) in open position a, the position in which it does not ensure a regulating function.

Partial trailer braking

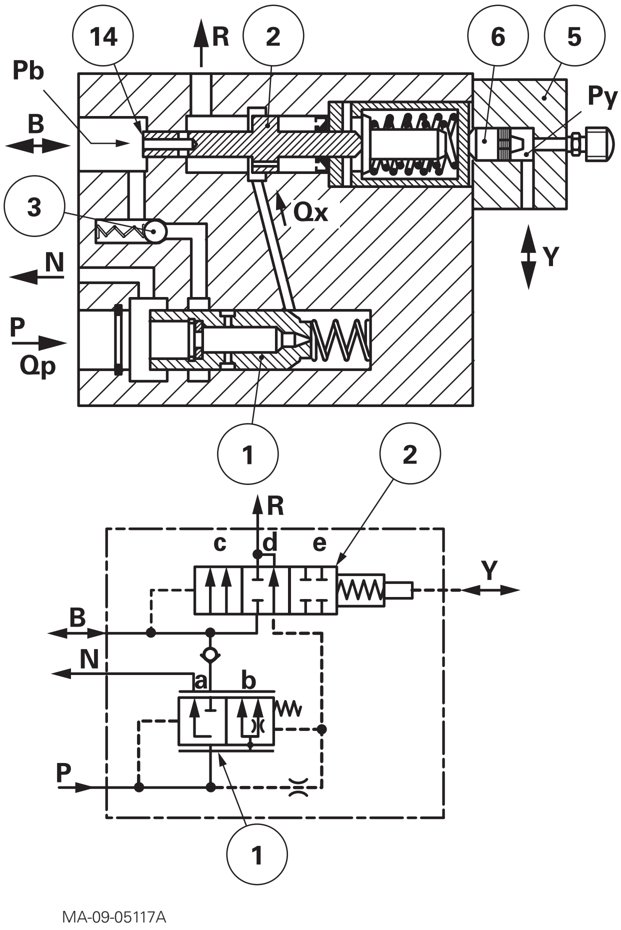
Start of the braking process (Fig. 6)

The piston (6) of the pilot flow housing (5) is pressure fed by the tractor braking system (action on the brake pedals).

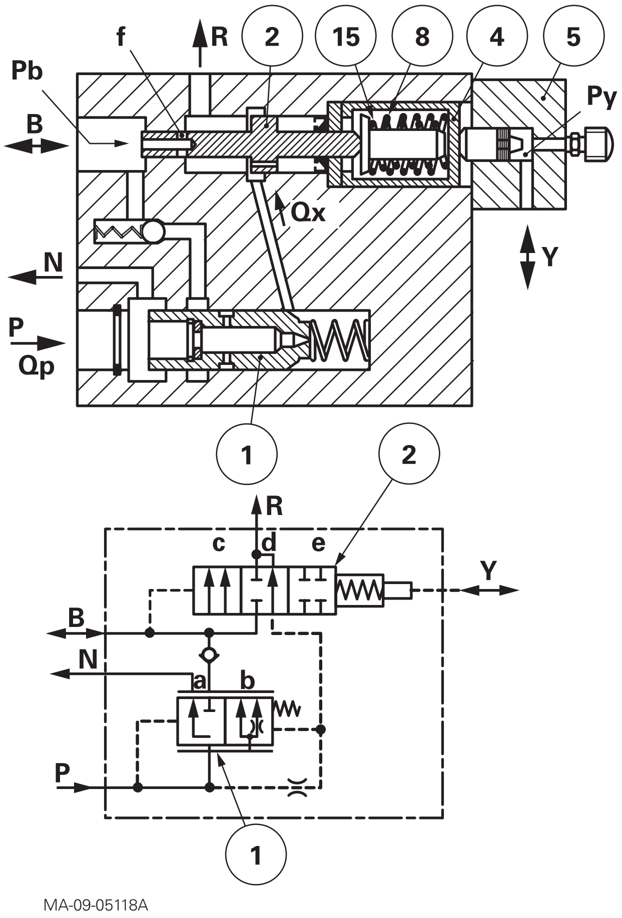
The pressure arrives via port Y, the control spool assembly (2) is then pushed to the left, obstructing the drilled hole f and cutting off the communication of port B (towards the trailer brake connector) with the return channel R, then the link with the drilled hole (10).
The control spool (2) moves from position c to position e. The QX control flow is cut and the flow control valve (1) moves to position b (regulating position).
A constant flow QK flows from port P to port B (towards the trailer brake connector) via the diaphragm (11), the drilled hole (12), the channel (13) and the non-return valve (3). The diaphragm (11) has a surface area calculated in relation to the constant flow rate QK.

The residual flow QR goes via the flow control valve (1) and is directed to port N (continuity with the auxiliary spool valve and the lift spool valve).

The channel of port B (towards the trailer brake connector) is placed under pressure and acts upon the surface (14) of the control spool (2) against the pressure on piston (6) by the tractor braking system.



Partial trailer braking Fig. 8



Maximum trailer braking:
limited braking pressure Fig. 9

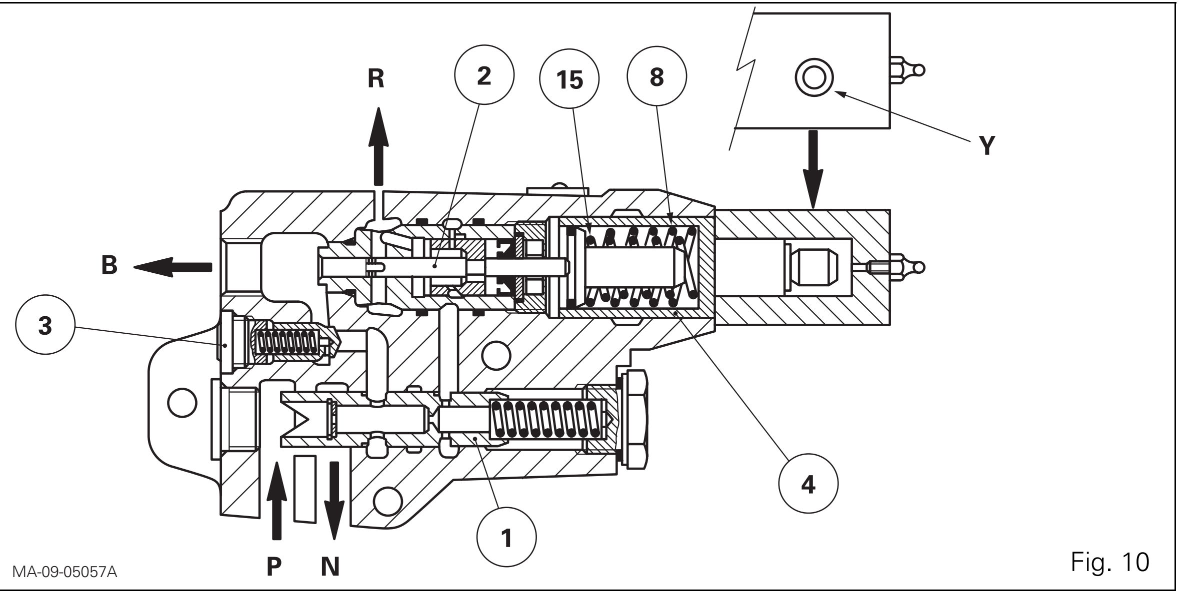


Fig. 10

D . Partial and maximum trailer braking

Partial trailer braking (Fig. 8)

The pressure Pb in the trailer braking line (pressure acting on the active surface (14) of control spool (2)) is in balance with pressure Py (coming from the tractor braking system) which acts upon piston (6) of the pilot flow housing (5).

The channel from port B (to the trailer brake connector) is cut off from the return port R. Consequently, the oil is trapped in the trailer braking unit. When the pressures are balanced, the control spool (2) is in position d.

The flow control valve (1) then moves to position a, an open position in which it does not ensure a regulating function.

As when the trailer brakes are released, the flow Qp - Qx is directed to port N (continuity with the auxiliary spool valve and the lift spool valve) and the control flow Qx is directed to return channel R by the control spool (2).

Maximum trailer braking (Fig. 9)

Limited braking pressure

The flow control valve (1) and the control spool (2) are in the same switching positions (a and d) as for partial braking.

The flow rates Qp and Qx are the same as for partial braking. The maximum allowable braking pressure is reached (Pb = 150 bar). An increase in the trailer braking pressure cannot take place, even if the tractor braking pressure continues to increase.

The pressure relief valve (4) is then pushed to the left.

The springs (8) (15) pre-loaded with the maximum admissible braking pressure (Pb = 150 bar) for the trailer, are compressed.

If, due to external conditions, the trailer braking pressure Pb continues to rise, the control spool (2) momentarily opens the communication f between port B (supply to the trailer brake connector) and the return channel R.

In all operating positions of the trailer braking valve, the auxiliary spool valve and the lift spool valve are used

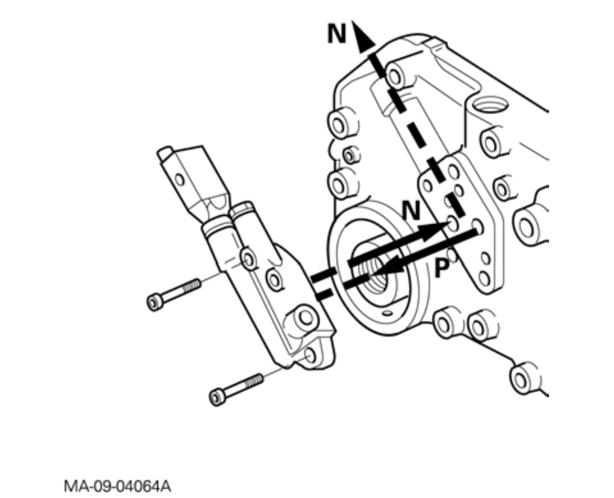


Fig. 11

when required by port N (Fig. 11) without causing significant effect on the trailer brake system, which has priority on the high flow rate hydraulic circuit.

E . Version without trailer braking

- For this tractor version, the braking valve (spool valve) is replaced by a cover plate (3) (Fig. 12).

- As with the trailer braking version, the oil tightness between components is ensured by O'rings (1) (2).

- A test connector (4) also allows to check the high pressure of the pump.

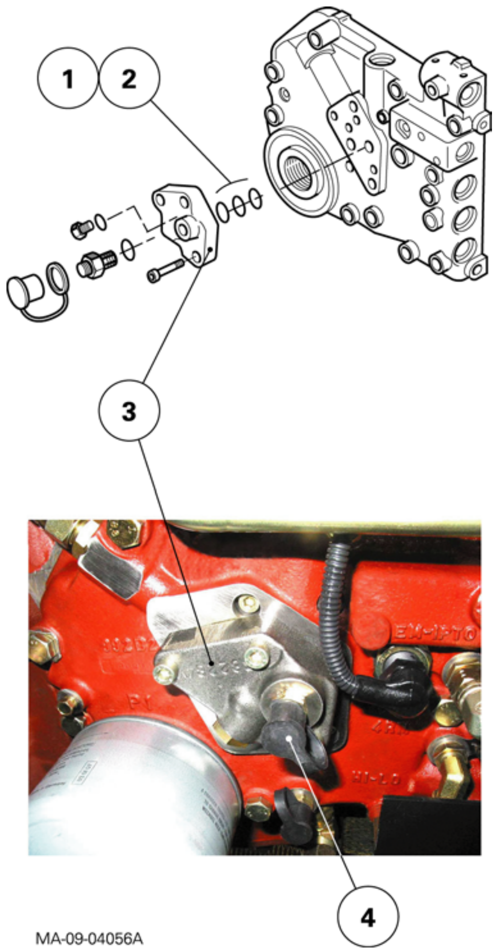


Fig. 12

09E01 - Auxiliary spool valve

CONTENTS

A . General

The Rexroth SM12 auxiliary spool valves are fitted on the high flow rate circuit. They are fed by oil coming from the trailer braking valve or the closing plate fitted in its place (depending on version).

When the spool valves are not activated, the oil is available for the lift control valve fitted downstream.

The auxiliary spool valves are mounted on a support which is itself fitted to the rear of the lift cover. Quick-disconnect couplings are fitted directly on the spool valve body. To obtain sufficient distance between couplings, the spool valves are fitted with blocks serving as spacers. These blocks are also used to let the oil flow to the next spool.

Characteristics

Functions: Double acting; Single and double acting (convertible)

These functions are also recognised via the abbreviations SA and DA.

Positions : Three; Four with one in floating position.

Return to neutral: By spring or by an automatic system.

Zero leak: With or without.

Each spool valve is activated by a lever in the cab and it has three phases of travel:

- 35% reduced flow rate;
- 45% progressive increase of flow rate and pressure;
- 20% full flow rate.

The progressive increase of flow rate and pressure ensures uniform operation of the implements.

This characteristic also allows two spool valves to be activated simultaneously, the total flow rate being shared. The flow rate to each quick-disconnect coupling is proportional to the position of the control lever.

The spool valve placed against the flow divider is spool valve No. 1.

Available sets of spool valves (Fig. 1)

Set A - 2 spool valves

- Spool valve 1 and 2: 3-position, SA / DA with spring loaded return to neutral

Set B - 2 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with automatic return to neutral
- Spool valve 2: 4-position, DA with automatic return to neutral

Set C - 2 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with automatic return to neutral
- Spool valve 2: 3-position, SA / DA and zero leakage

Set D - 3 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with spring loaded return to neutral
- Spool valve 2: 3-position, SA / DA with automatic return to neutral and zero leakage
- Spool valve 3: 4-position, DA with automatic return to neutral

Set E - 3 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with automatic return to neutral
- Spool valve 2 and 3: 4-position, DA with automatic return to neutral

Set F - 4 spool valves and flow divider

- Spool valve 1: 3-position, SA / DA with spring loaded return to neutral
- Spool valve 2 and 3: 3-position, SA / DA with automatic return to neutral and zero leakage
- Spool valve 4: 4-position, DA with automatic return to neutral

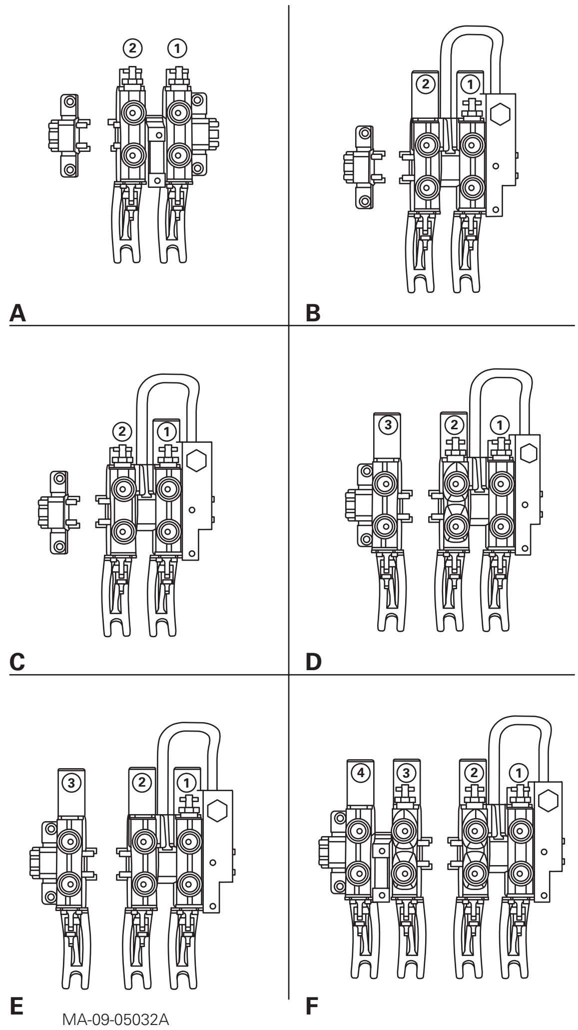


Fig. 1

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Parts list (Fig. 2)

(1) Inlet unit with flow control valve
(2) Plates with seals
(3) Excess flow rate pipe
(4) Adjustment knob (flow divider)
(5) Single / double acting (SA / DA) change-over screw
(6) Spool valves (all versions)
(7) Intermediate block (excess flow rate)
(8) Set (2, 3 or 4 spool valves)
(9) Intermediate block
(10) Support
(11) End plate (connection with lift control valve)
(12) Screw
(13) Plug and seal (provisional return)
(14) Screw
(15) Cap and seal (filling)
(16) Plug and seal (provisional return)
(17) Studs and nuts
(18) Pin
(19) Stirrup
(20) Pin
(21) Support (control cable)
(22) Screw

Exploded view

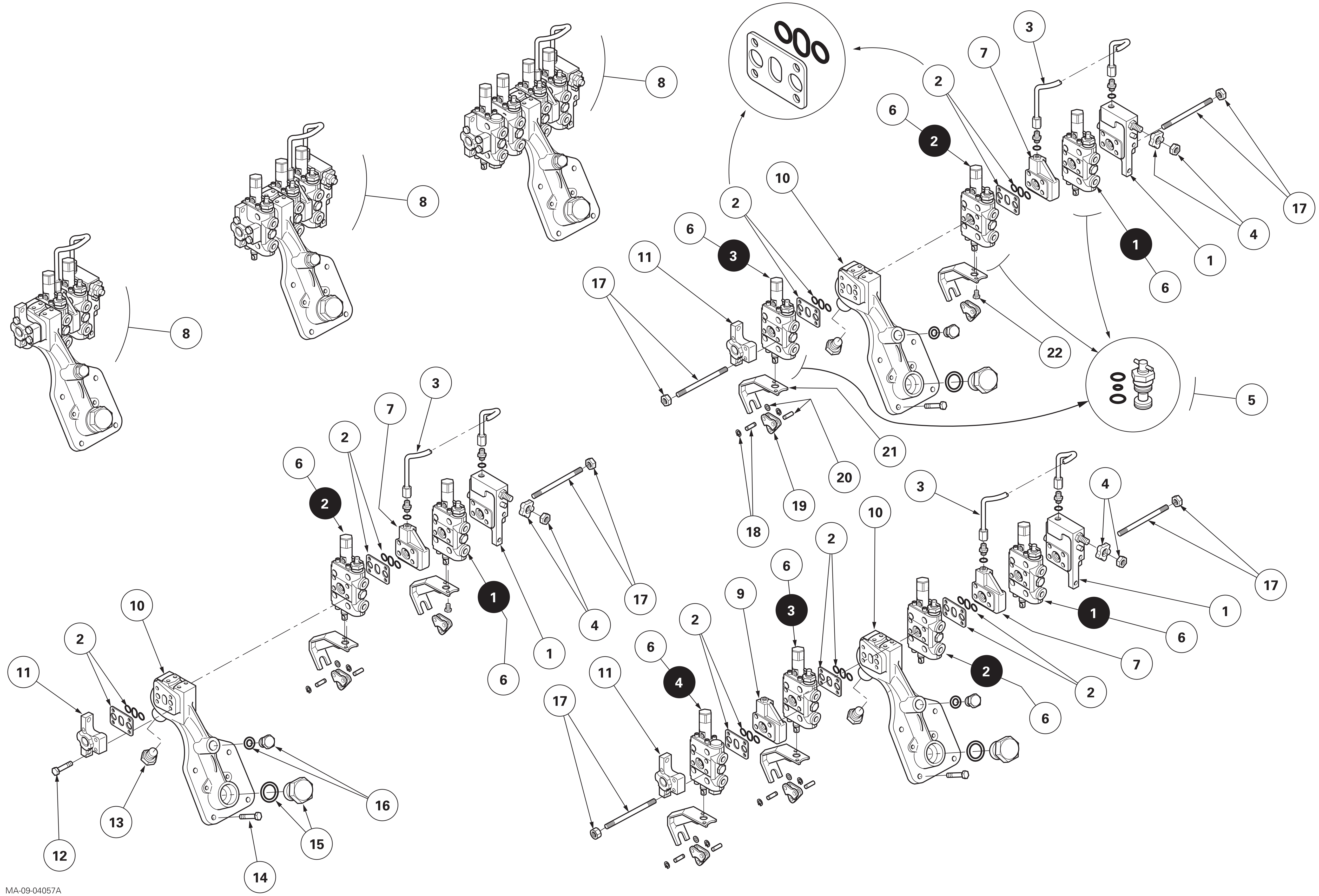

Fig. 2

B . Layout of channels and ports

Legend (Fig. 3, Fig. 4, Fig. 5)

A - B	Outlets or returns going to or coming from hydraulic slave device
N	Oil connection to lift control valve
P	Pressure (HP)
QX	Outlet port for excess flow rate
R	Return
X	Flow rate regulated to 1st spool valve
Vr	Outlet port to lift control valve

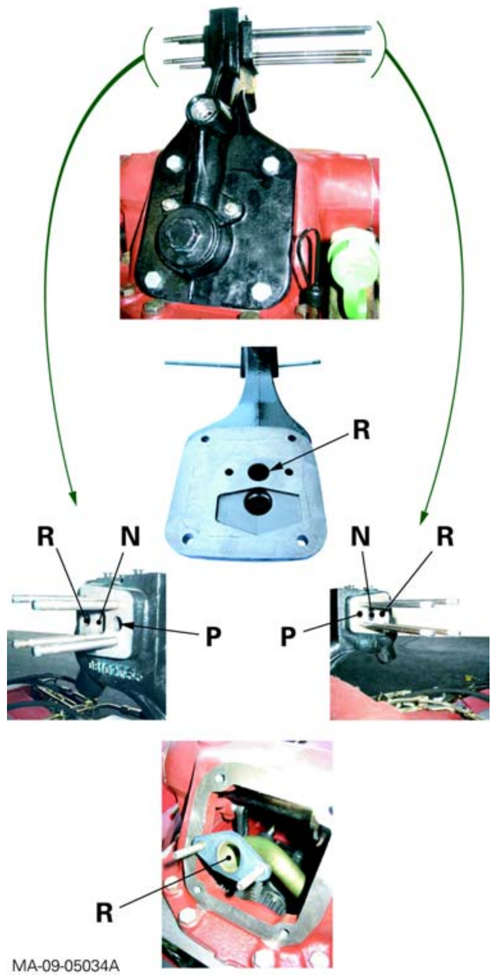

Fig. 3

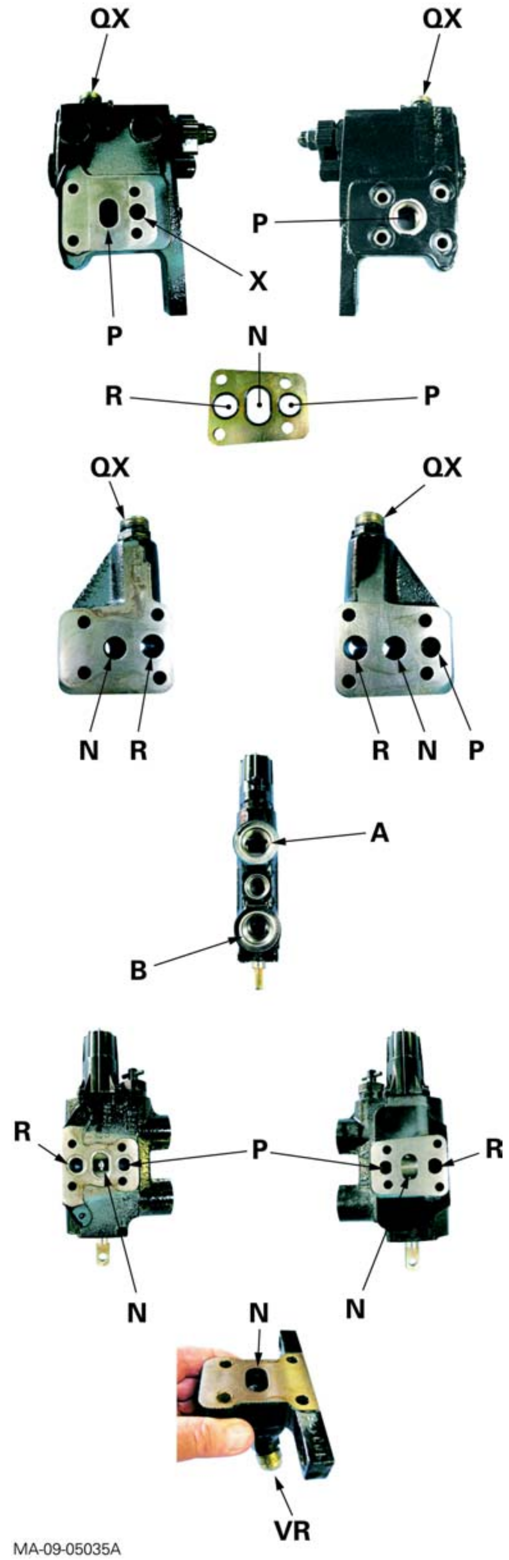

Fig. 4

Diagram

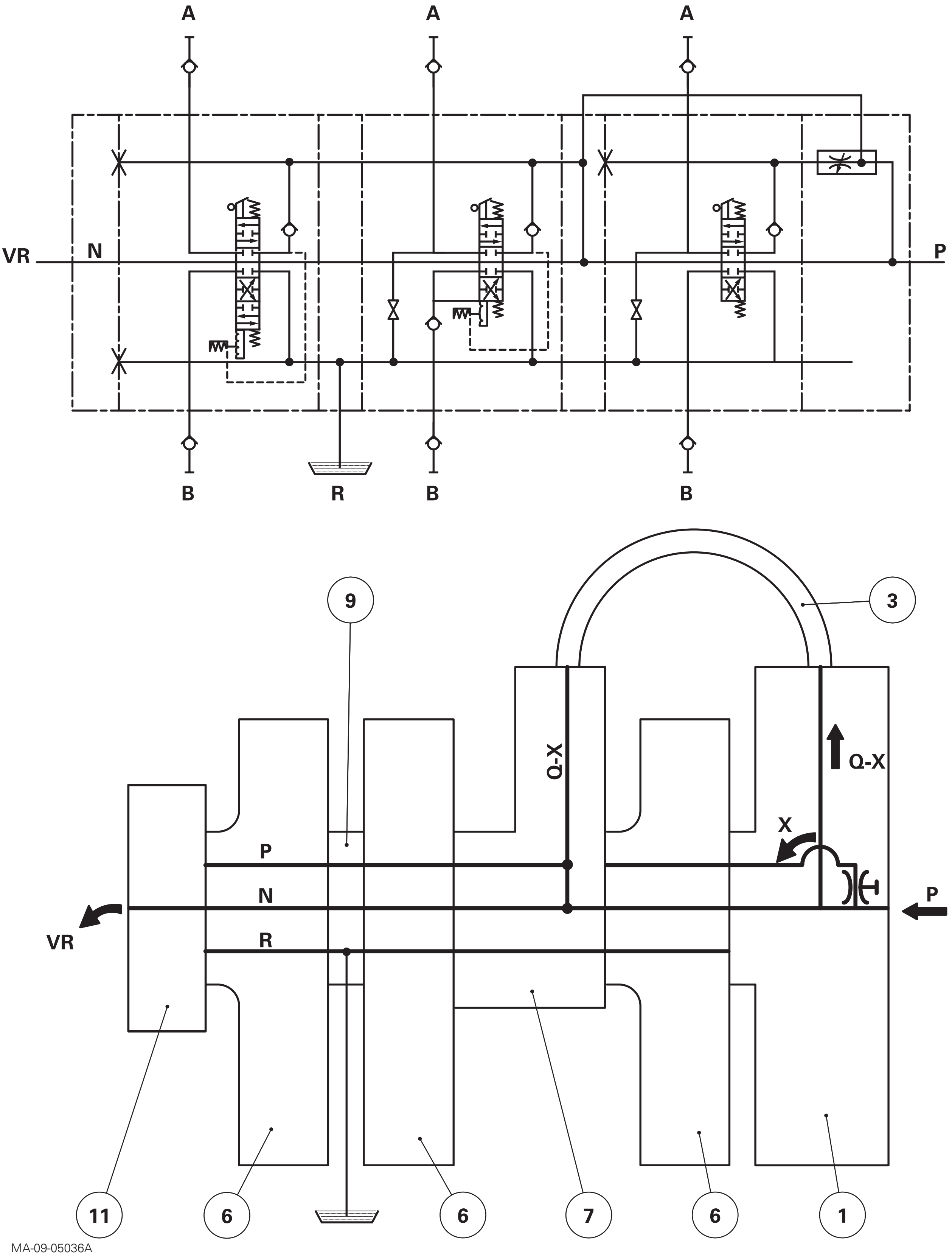

Fig. 5

C . Operating and adjusting the flow divider

Function of the flow divider

For operations requiring low oil flow rate, the flow divider allows to vary supply to the hydraulic slave device via a knob (4) used to adjust flow rate between “maximum stop” and “minimum stop” (Fig. 6). It is fitted at the inlet of the auxiliary spool valve assembly. It is supplied by oil from the high flow rate circuit passing through the trailer braking valve or the closing plate (depending on version).

Operation (Fig. 6)

The oil coming from port (P) is directed to port (X) and supplies the first spool valve. The flow is regulated according to the position of the knob (4).

Simultaneously, the pressure in channel (P) allows oil to pass through drilled hole (a) and restrictor (b).

The piston (1) is then moved to the right, allowing oil to be directed towards port (Qx). The intermediate block (7) receives the excess flow rate via the pipe (3) (Fig. 7).

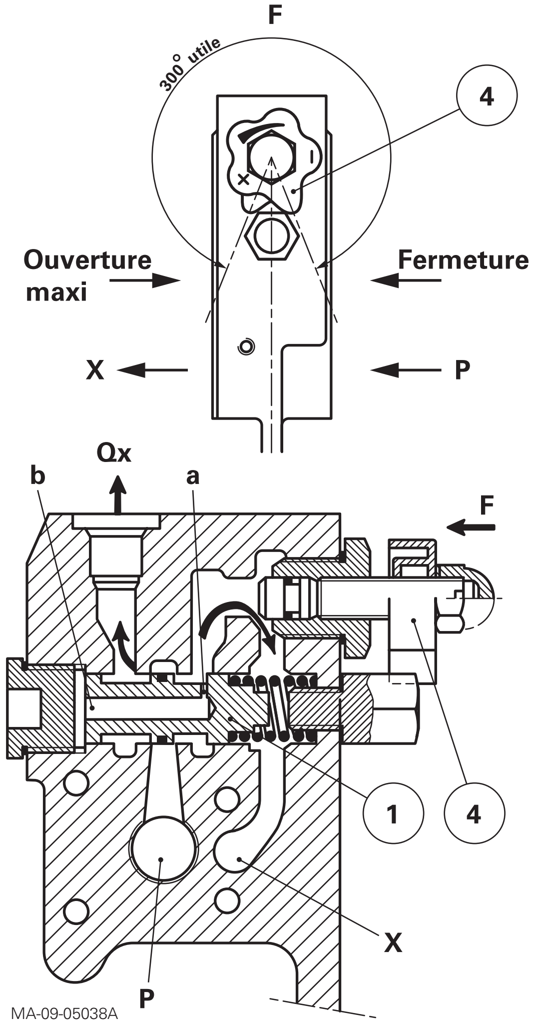

Fig. 6

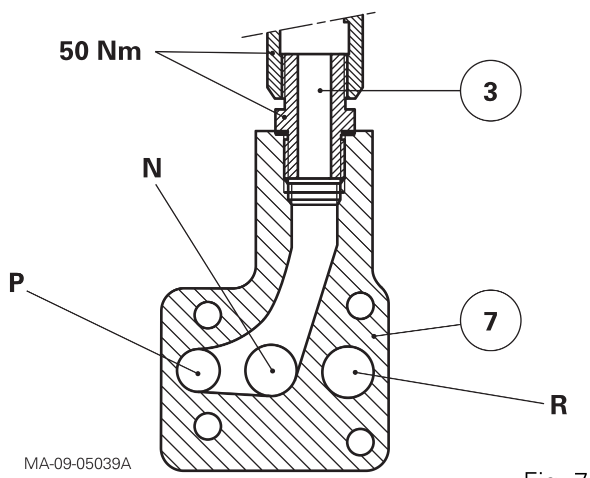

Fig. 7

Adjustment (Fig. 8)

1. Remove the stop screw (6), the locknut (1) and the washer (2).
2. Unscrew and remove the knob (4).
3. Without forcing the screw (3), tighten it until the valve (7) abuts against its seat.
4. Place the knob (4) in contact with the sleeve (5).
5. Unscrew the knob two full turns.
6. Fit and tighten the stop screw (6) to a torque of 20 Nm.
7. Turn the knob to its closed position (Fig. 6).
8. Fit washer (2) and tighten the locknut (1) to a torque of 30 - 40 Nm.

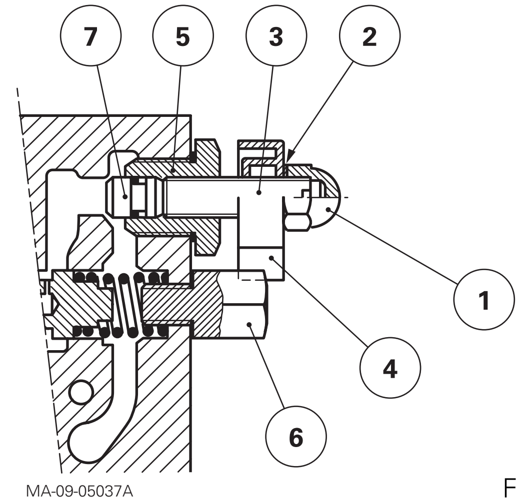

Fig. 8

D . Removing and refitting spool valves

Auxiliary spool valves can be removed and refitted directly on the tractor by removing each unit and leaving only the main support fitted to the lift cover (Fig. 3).

Preliminary operations

9. Remove unit(s) close to the auxiliary spool valves which might obstruct access to them.
(Example: hydraulic valve for automatic hook).

10. Disconnect:
- the supply hose (3) from the right-hand hydraulic cover (Fig. 9);
- the outlet hose (2) to the lift control spool valve (Fig. 9).

11. Separate the control cables of the supports and spool valves.

Removal

12. Remove the locknuts (1) located at the end of the spool valve set (Fig. 9).

13. Release and remove each hydraulic component after visually noting its position.
IMPORTANT: *Do not discard or lose plates and seals.*
NOTE: *The spool valves are fitted either side of the main support.*

14. If necessary (Fig. 10):
- Remove quick-disconnect couplings (A) and (B).
- Remove pins (1) and screws (2). Separate the cable support (3) from the spool valve.

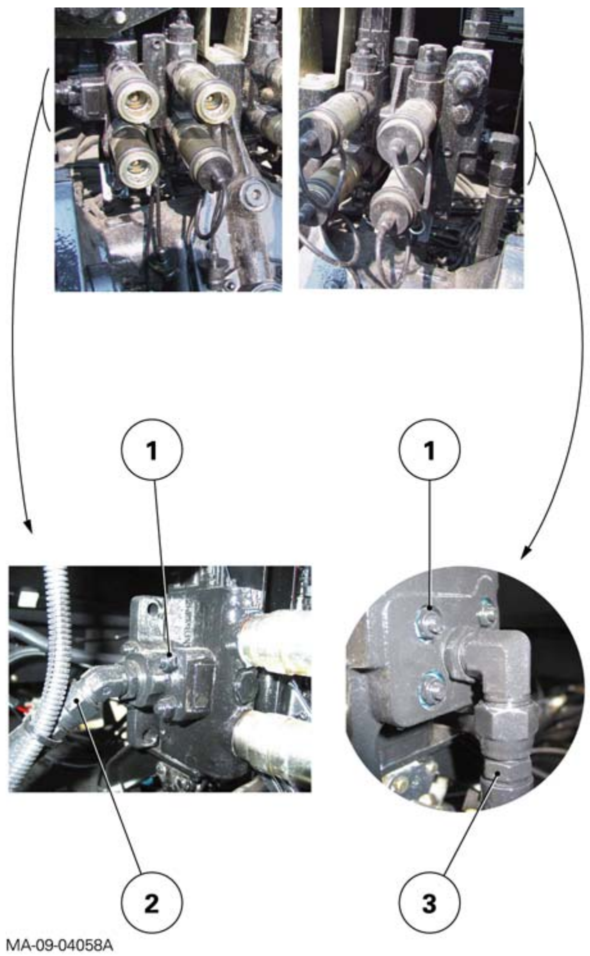

Fig. 9

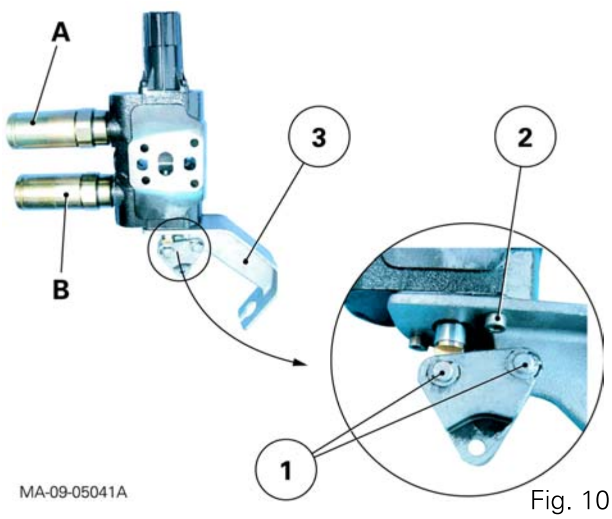

Fig. 10

Refitting

Refitting operations are not difficult. They therefore require carrying out the removal operations in reverse order.

However, during refitting it is necessary to ensure that:

- parts to be assembled are not dirty, corroded, dented, etc.
- seals are oiled.

The locknuts fitted at the end of the spool valve set should be tightened to a torque of 30 - 33 Nm.

Final operations

15. Check the correct operation of each spool valve on the two, three or four positions (depending on model).

16. Check the pressure on quick-disconnect couplings (see Hydraulic tests, section 9).

E . 3-position spool valve, SA / DA with spring loaded return to neutral

Operation (Fig. 11)

Oil from the high flow rate circuit passes through the trailer braking valve (3) (if fitted) or closing plate fitted to the right-hand hydraulic cover and supplies the various spool valves via the continuity channel (N).

The spool valves are fitted in series in priority over the linkage.

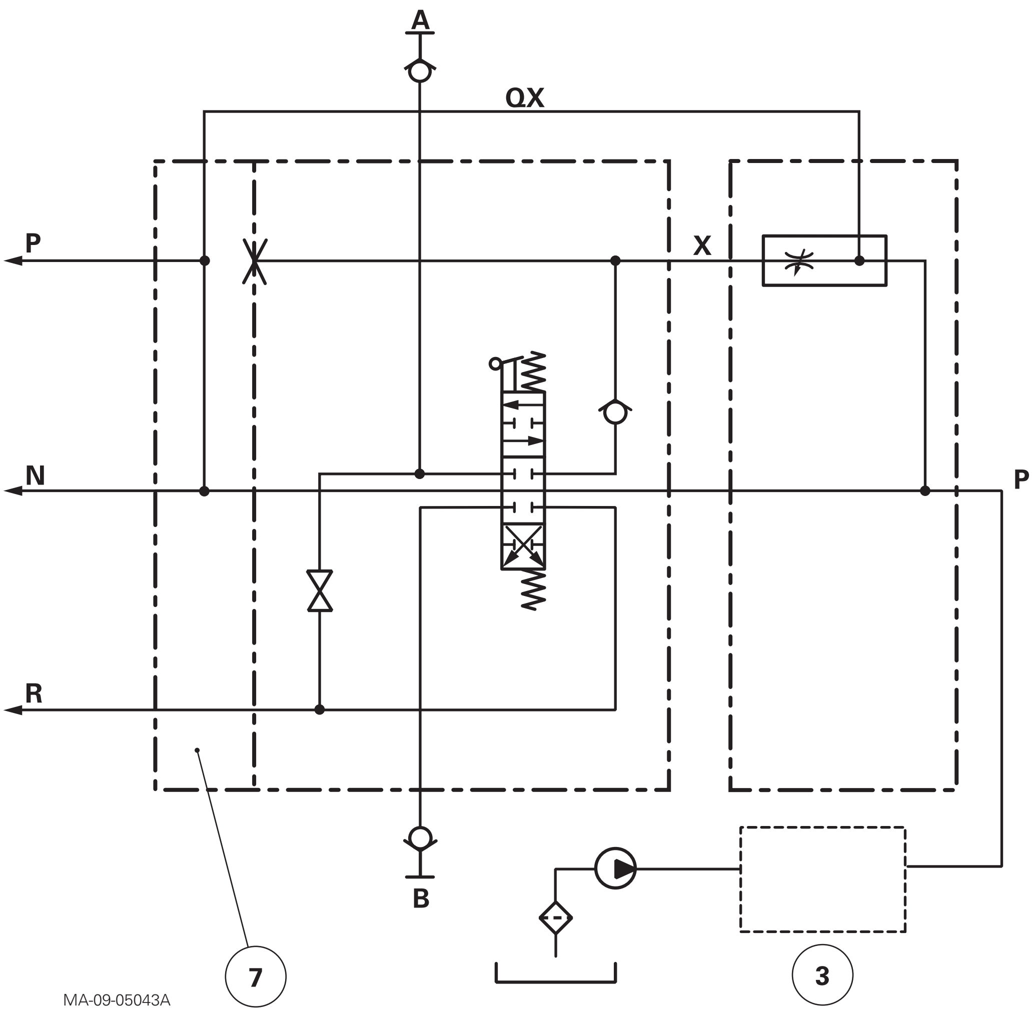

Fig. 11

Neutral position (Fig. 12)

Oil is not available from outlets (A) or (B). Oil is directed via the continuity channel (N) to the lift control valve and passes directly to the suction manifold of the pump when the linkage is in neutral position.

Channels (N) and (P) are linked in the intermediate block (7) (Fig. 7) to supply the subsequent spool valves.

Inlet - outlet position (Fig. 12)

When the spool (2) is moved upwards or downwards, the continuity channel is cut, the pressure increases and raises the valve (1).

The oil is then directed to the internal channels via grooves located on the spool. Depending on the spool position, outlets (A) or (B) are supplied.

Simultaneously, the oil returning from the ram is directed depending on the position of the spool, to outlets (A) or (B) to reach the return channel (R).

Single / double acting change-over (Fig. 12)

To obtain the single acting position, unscrew the valve (4). The outlet (A) then opens into the channel (R), and the outlet (B) supplies the hydraulic slave device.

To obtain the double acting position, screw in the valve (4).

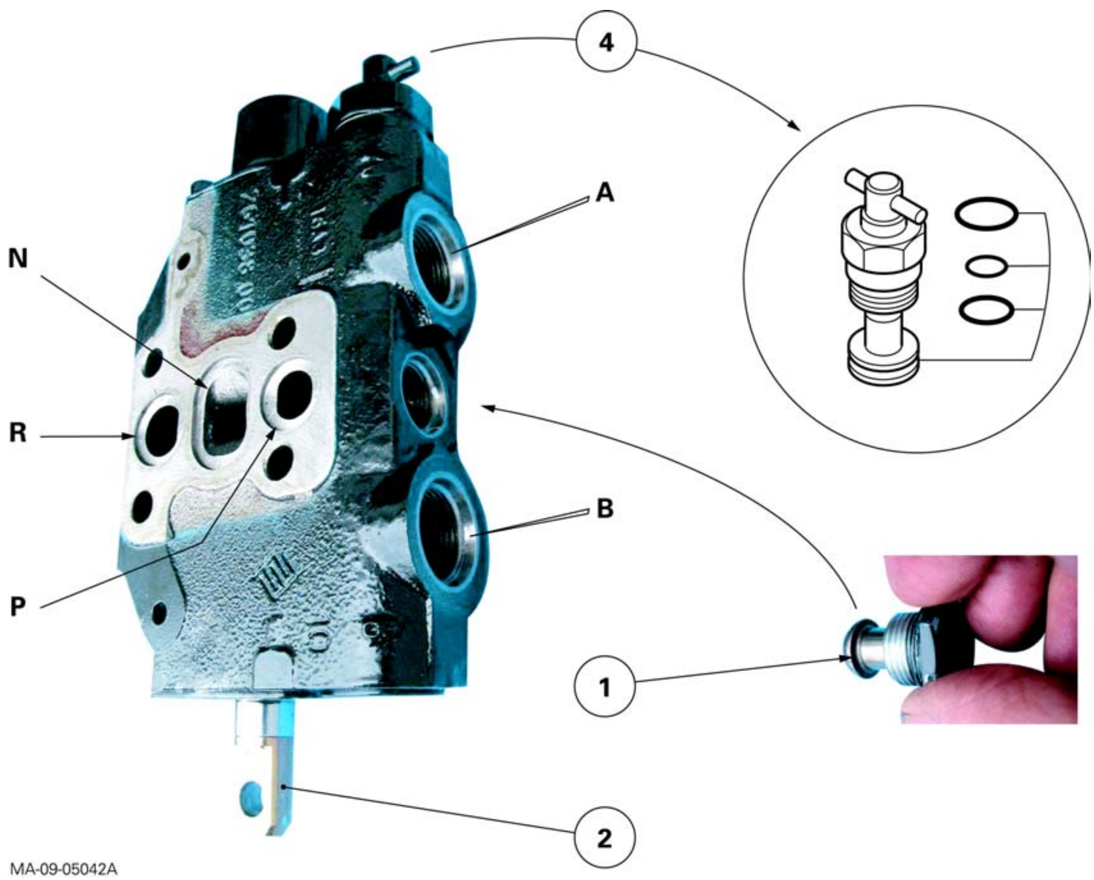

Fig. 12

F . 3-position spool valve, SA / DA with automatic return to neutral

Operation

Neutral position

The operating principle of the 3-position single or double acting spool valve with automatic return to neutral, is the same as for the previous 3-position SA / DA spool valve with spring loaded return to neutral.

Inlet - outlet position (Fig. 13)

Operation is identical to the 3-position SA / DA spool valve with spring loaded return to neutral, with automatic return to neutral as an added feature.

A system placed in the unit (1) locks when the spool (2) is activated.

The spool returns automatically when the pressure reaches 150 - 170 bar.

The pressure passes through bores machined in the spool. It then releases a system comprised of balls and springs allowing the automatic return of the spool to neutral.

The unit (1) is joined to channel (R).

Note: *A residual pressure in the unit (greater than 2 bar) may cause undue return of the spool to neutral.*

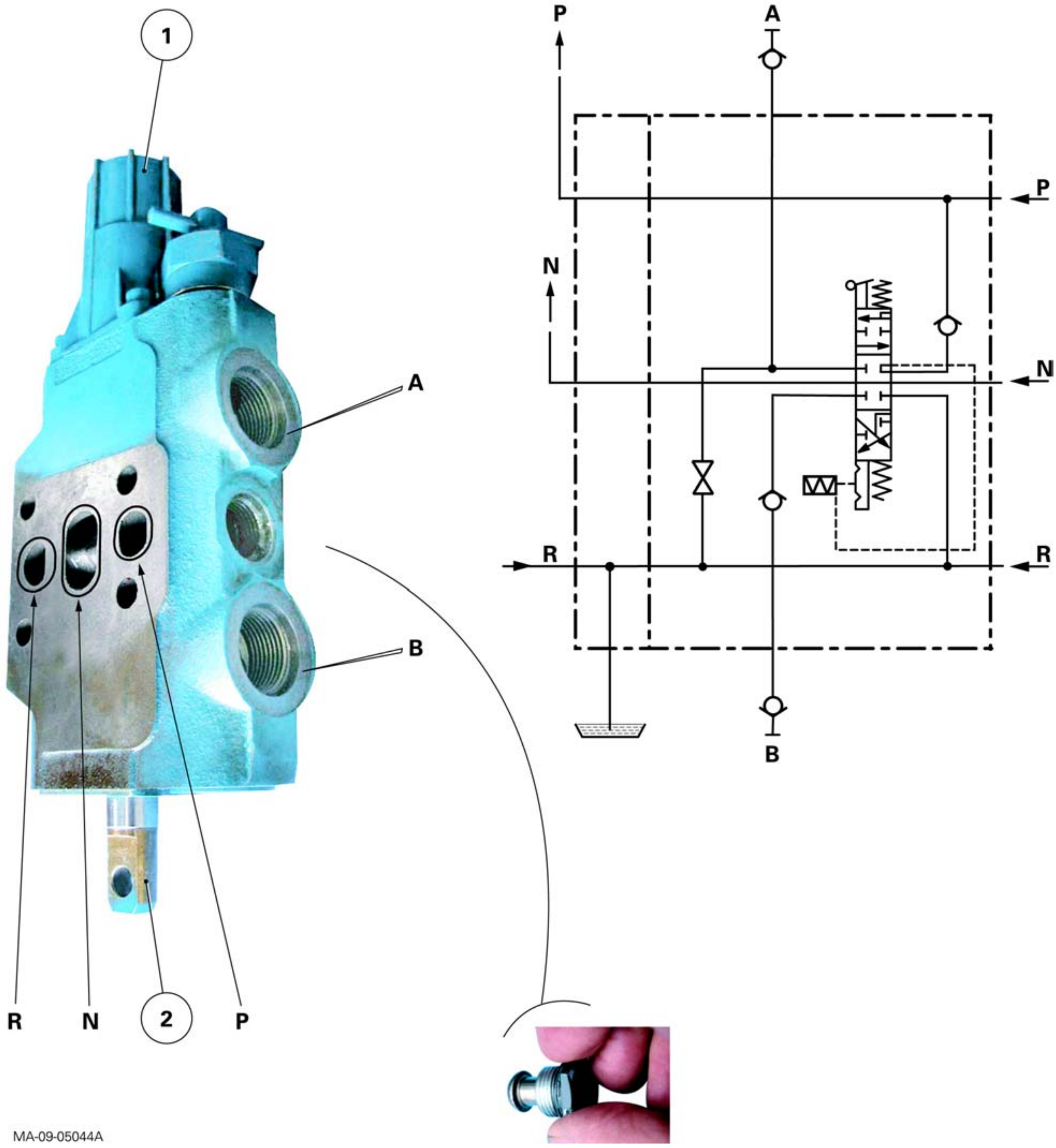

Fig. 13

G . 3-position SA / DA spool valve with non-return valve and automatic return

The operation of this spool valve is identical to those explained previously.

Operation of the non-return valve (Fig. 14)

When the spool (2) is moved upwards, the oil coming from channels (N) and (P) is directed to outlet (B) by lifting the non-return valve (3) which supplies the slave device.

In the neutral position, the non-return valve ensures the oil tightness of the circuit.

When the spool is moved upwards, the oil coming from the channels (N) and (P) lifts the valve (1). It is then directed to an internal channel via grooves machined on the spool, and supplies the slave device via the outlet (A).

The movement of the spool shifts the pushrod (4). This raises the ball, causing a drop in pressure on the slave device side, which allows the valve (3) to rise from its seat and oil to flow through to the channel (R).

Important: *During disassembly of the spool (2), it is essential to first disassemble the non-return valve (3) and pushrod (4).*

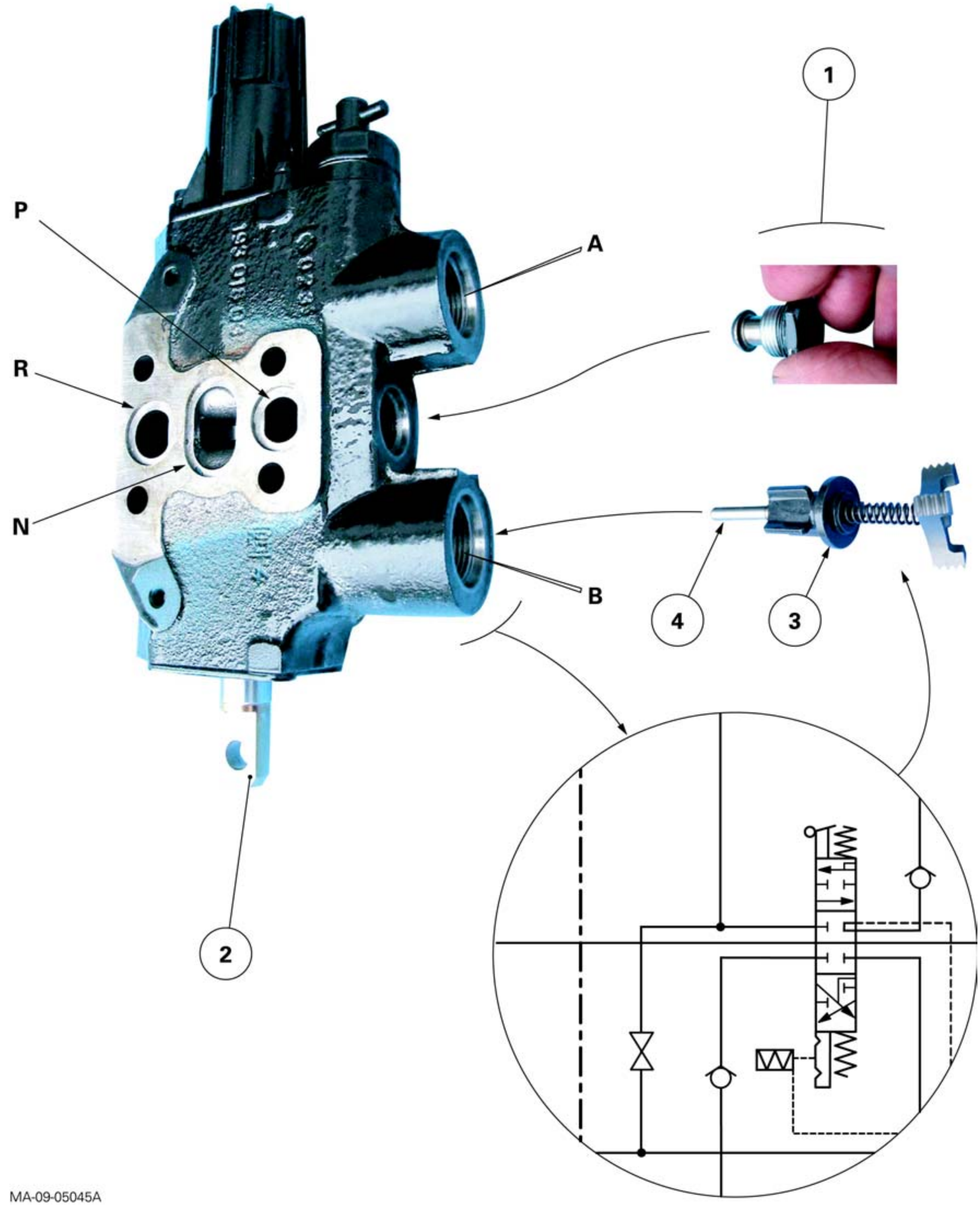

Fig. 14

H . 4-position DA spool valve, with automatic return to neutral and floating position

Operation (Fig. 15)

When the spool (2) is moved upwards or downwards, the same positions are obtained as in the previous spool valves.

The 4-position DA spool valve with automatic return to neutral and floating position has an added feature: a floating position (F) when the spool has moved its maximum distance out of the automatic return to neutral position (Fig. 16).

In this position (F), the outlet channels (A) and (B) open into the return channel (R). The oil then circulates freely.

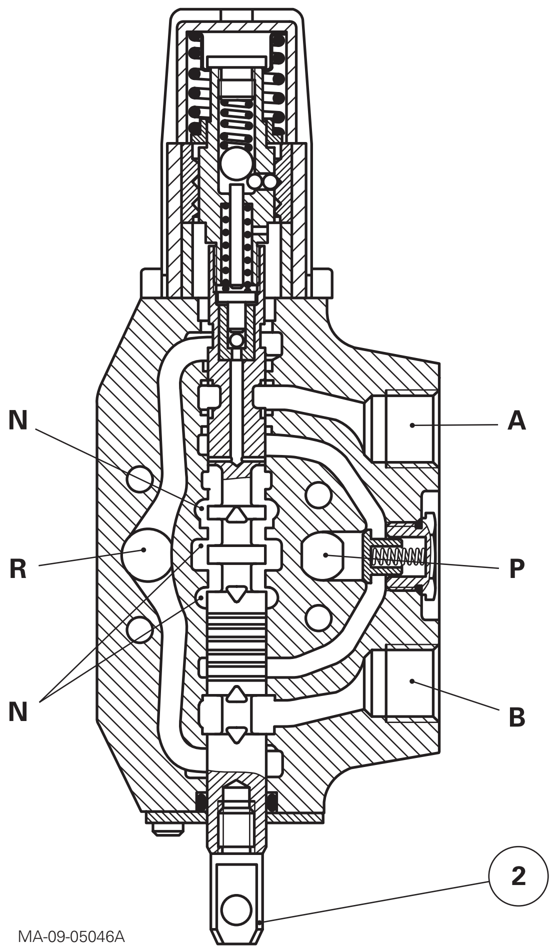

Fig. 15

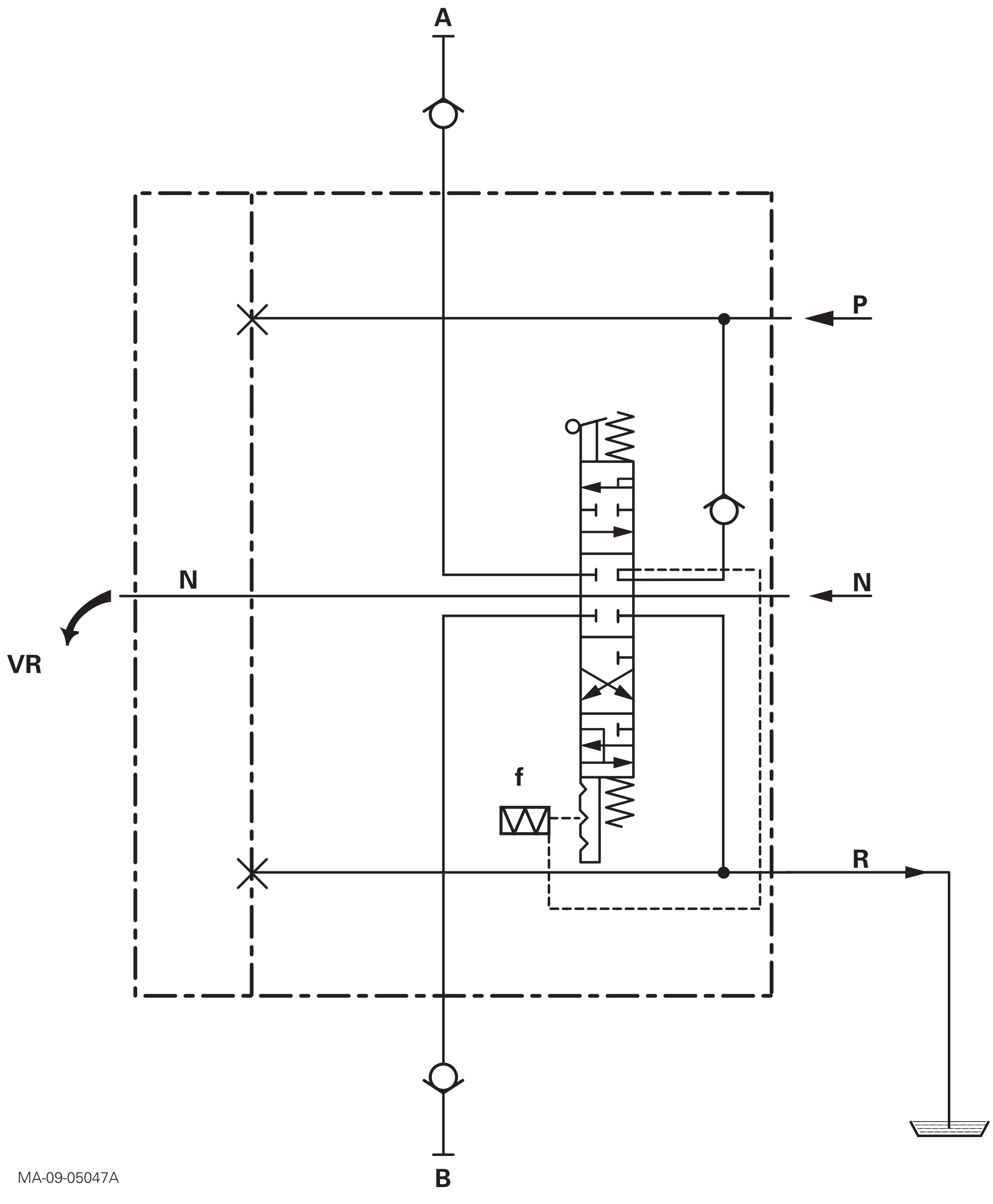

Fig. 16

I . Fitting and adjusting a control cable

Cab side

Special points

- The pins (2) should be fitted with the threads slightly smeared with loctite 241 or equivalent. (Fig. 17).
- The figures in the dark circles 1 to 3 show the assembly order of the levels which control the spool valves.
- The fitting of a fourth control level is provided for on the cab consol. It must be placed to the left of lever 1 (viewed from the driver's seat)
- The friction washers (1) should be smeared with molybdenum disulphide grease before fitting.
- The nuts (3) must be tightened so oas to obtain a slight resistence for the levers during operation.

On base plate (6) and levers ()

***Note:** Depending on the type of spool valve, the clevis (4) may be fitted on link "A" or "B".*

Fitting A : Normal spool valves

Fitting B : Spool valves with floating position.

17. Pass the cable through the flange (9) located at the rear right of the cab and then through the yoke (8).

__Note:__ The hole in yoke (8) is eccentric (Fig. 17). To lift a control for a spool valve with floating position, the hole must be at the top as to correctly align the cable and its fastenning.

18. Scew the clevis (4) flush with the threaded part of the cable (7) and fit it on link "A" or "B" of lever concerned. Fit the clip (5).

19. Tighten the nut on the clevis and check that the cable is not constrained in any way.

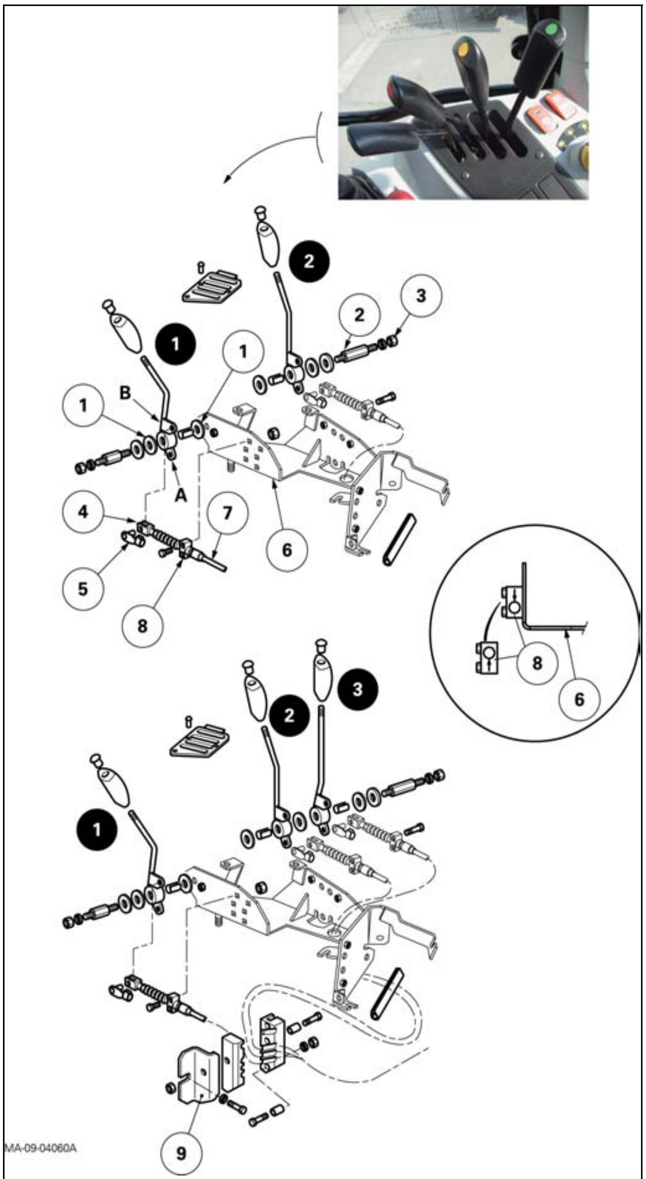

Fig. 17

Spool valve side (Fig. 19)

Special points (Fig. 18)

- If a stirrup (4) needs to be replaced, remove and replace it without turning the spool (2) of the spool valve.
- When assembling, the pins (3) should be lightly smeared with molybdenum disulfide or AS767 grease or equivalent.

20. Screw the clevis (1) to the threaded part of the cable (2).

21. Attach the clevis to the stirrup (4) using the hook (3). Tighten nut.

22. Adjust the stop (5) with the nut (6).

23. Tighten nut (7) and check that the cable is not constrained in any way.

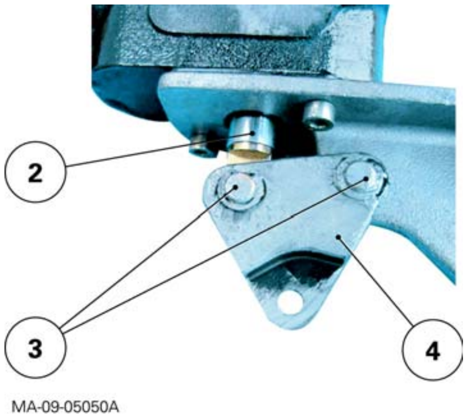

Fig. 18

Check

24. Start the tractor engine. Using the relevant lever (2) (Fig. 17), check that the three or four positions of the spool valve (depending on model) engage correctly.

In case of faulty operation, separate the spool valve control and check the movement of the spool. If it operates correctly, check the cable adjustment again.

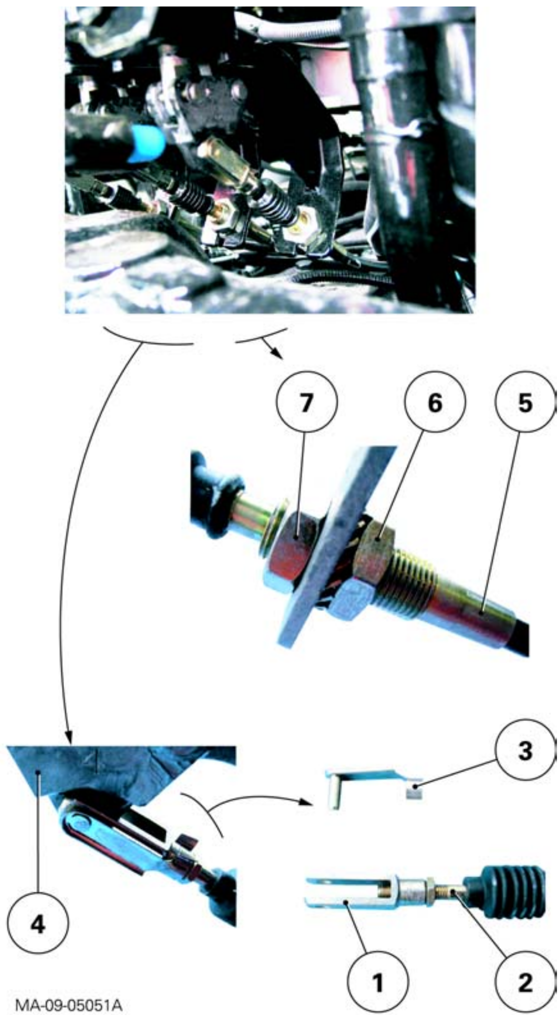

Fig. 19

09F01 - Lift control spool valve - Open Centre

CONTENTS

A . General

The BOSCH ELC (EHR5) lift control spool valve is fitted to 5400 tractors equipped with an open centre hydraulic system.

It is fitted to the left-hand hydraulic cover of the centre housing (Fig. 1).

It regulates the flow rate of oil to and from the lift rams, according to the signals that it receives from the electronic linkage calculator (ELC).

It comprises a series of spools and valves, most of which cannot be repaired as separate parts.

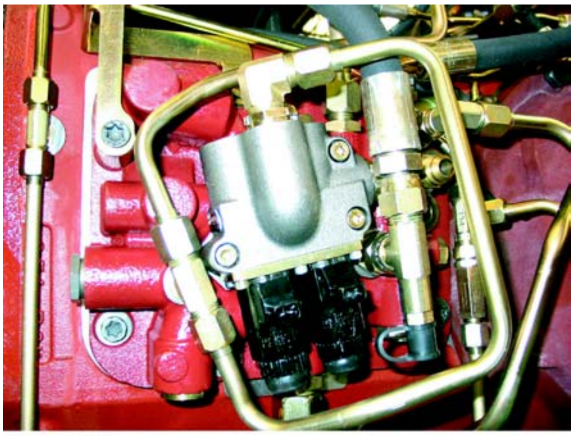

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Fig. 1

Lift control spool valve - Open Centre

B . Layout of components and identification of ports

Layout of components

The BOSCH ELC (EHR5) hydraulic spool valve comprises two parts:

Hydraulic part

(1) Non-return valve
(2) Lifting spool valve
(3) Lowering spool vlave
(4) Flow rate control spool
(5) Shock valve (200 to 210 bar)
(6) Flow control spool spring
(9) Lifting spool spring
(10) Lowering spool spring
(11) Restrictor
(12) Lift control spool valve

Identification of ports:

N Continuity channel
P : Pressure
R, R1 Return to housing
V Port to lift rams

Electric part

(7) Lowering solenoid valve
(8) Lifting solenoid valve

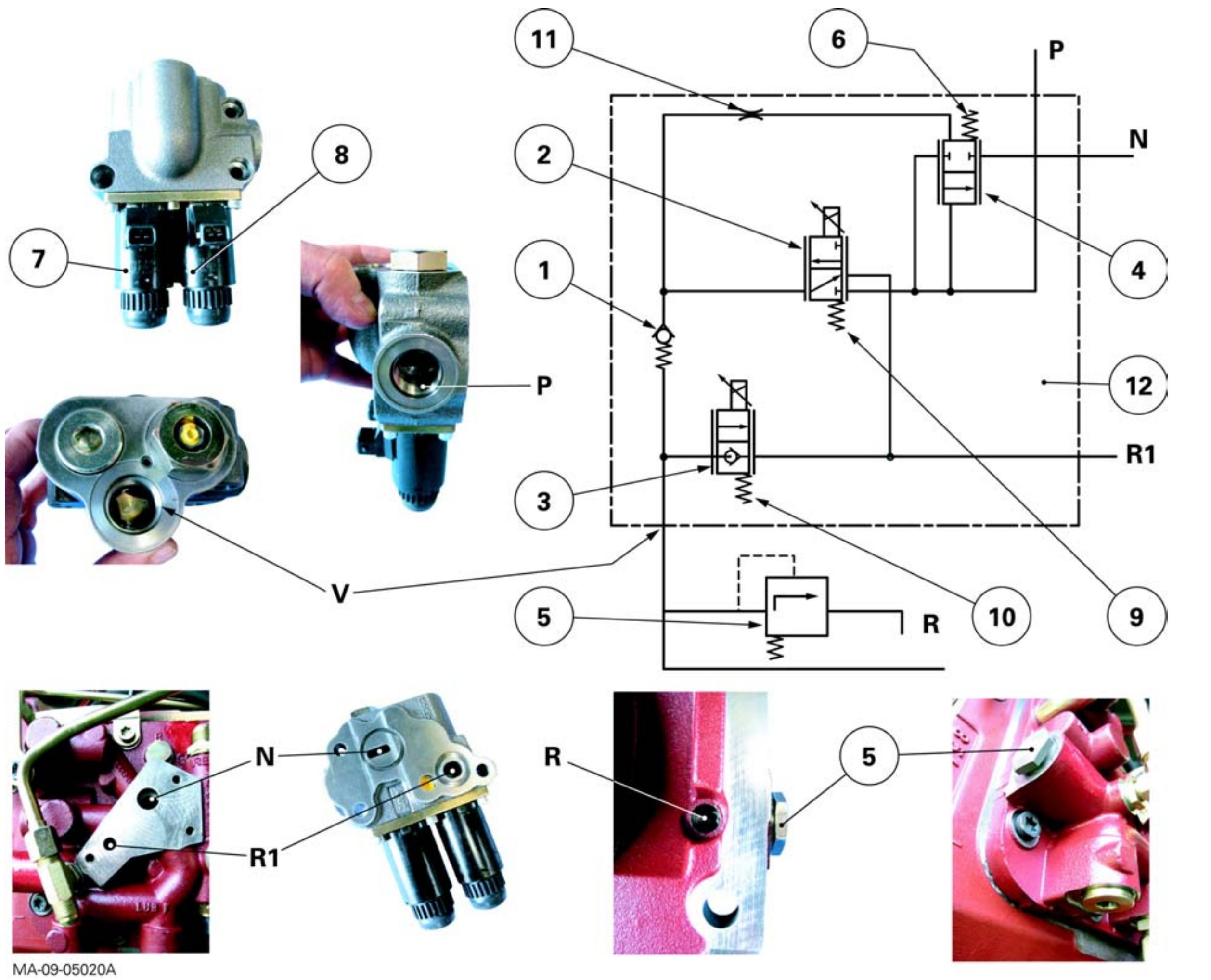

Fig. 2

Determining the hydraulic or electric cause of a problem

To determine whether a problem is due to a hydraulic or electric cause, operate the push-buttons at the end of the solenoid valves (Fig. 3). This allows to manually control solenoid valve movement.

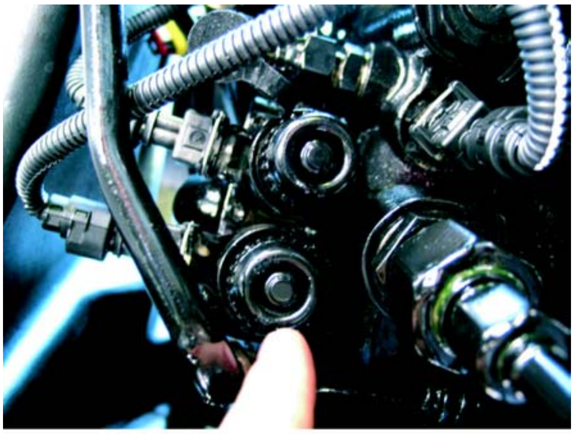

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Fig. 3

C . Neutral position

When the engine is stopped (Fig. 4):

- the lift control spool valve (12) is in neutral position;
- the lifting and lowering solenoid valve spools (2) and (3) are held in position by their respective springs;
- the flow rate control spool (4) is held down by its own spring.

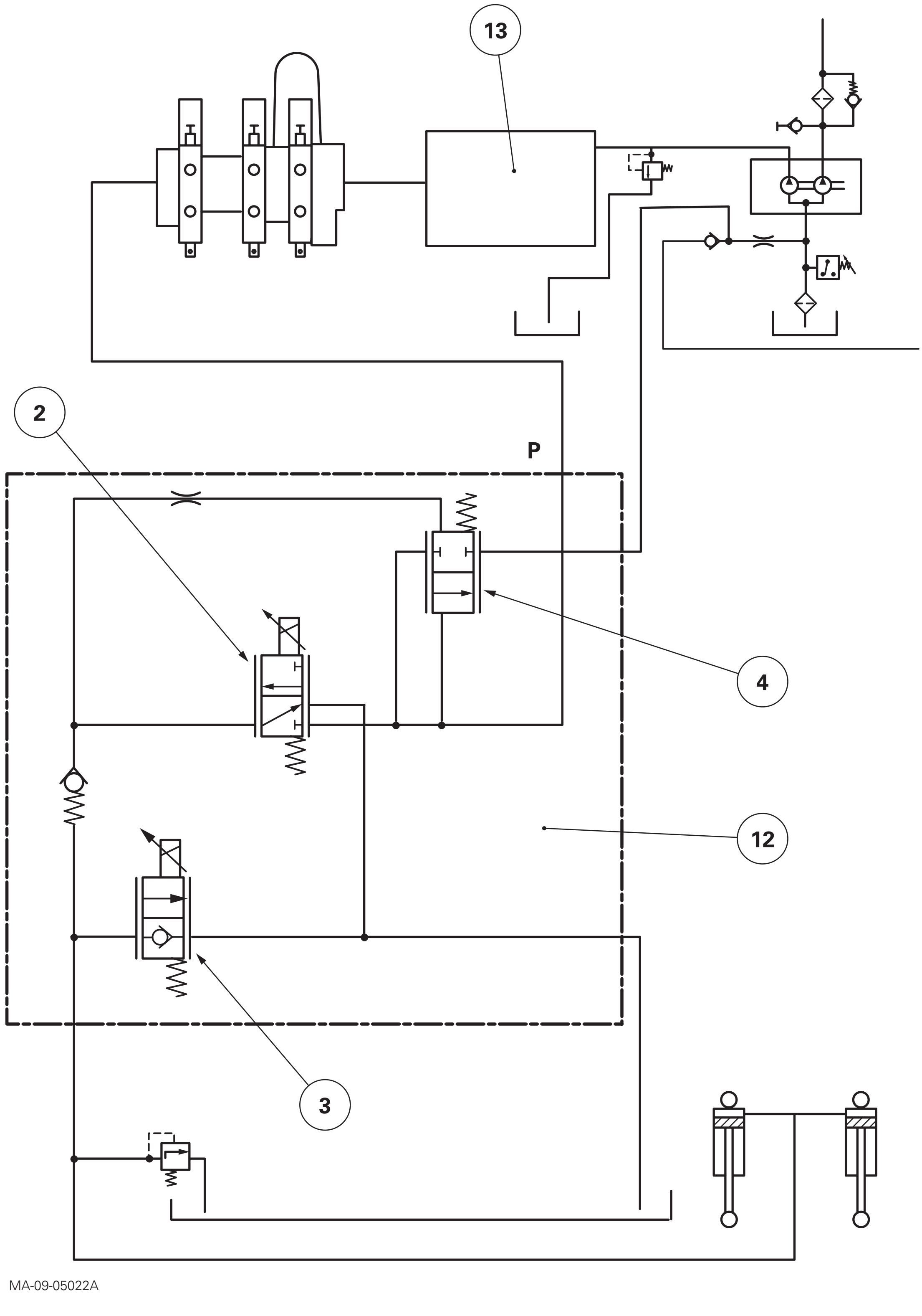


Fig. 4

Lift control spool valve - Open Centre

When the engine is running (Fig. 5):

The hydraulic pump supplies the lift control spool valve (12) via the trailer braking spool valve (13) (if fitted) and the auxiliary spool valves.

The pressure arriving from the port (P) moves the flow rate control spool (4) upwards, thus allowing the oil to flow into the continuity channel (N) and the hydraulic pump via the transfer pipe.

NOTE: *The continuity channel (N) connects the oil flowing in the Open Centre system and also controls the hydraulic flow of brake lubricant via a restrictor and a valve.*

Legend (Fig. 5, Fig. 6, Fig. 7, Fig. 9)

- High pressure (red)
- Return (green)
- Suction (blue)

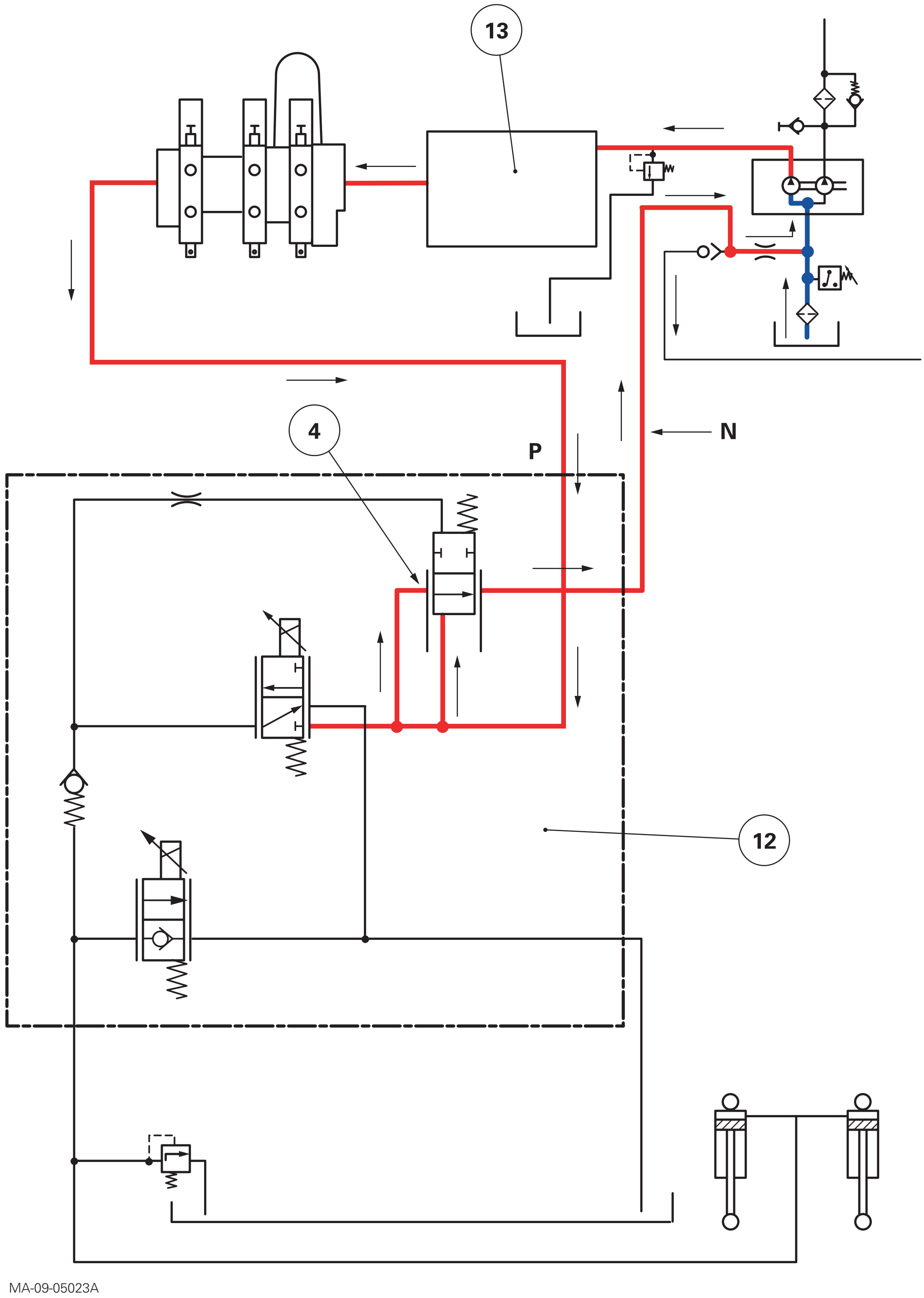


Fig. 5

D . Lifting position

The solenoid valve (8) is activated to lift the drawbars (Fig. 6). The lifting spool (2) is moved downwards, thus directing the main flow to the non-return valve (1). As soon as the pressure acting on the valve exceeds the pressure in the rams, the valve opens and the flow enters the port (V) to raise the hitch.

When the hitch is in the required position, the tractor electronic system stops the supply to the solenoid valve (8).

As a result:

- the non-return valve closes;
- the lifting spool valve is positioned on the return channel R1;
- the flow rate control spool (4) is fixed in raised position, allowing the oil to flow again in the continuity channel N.

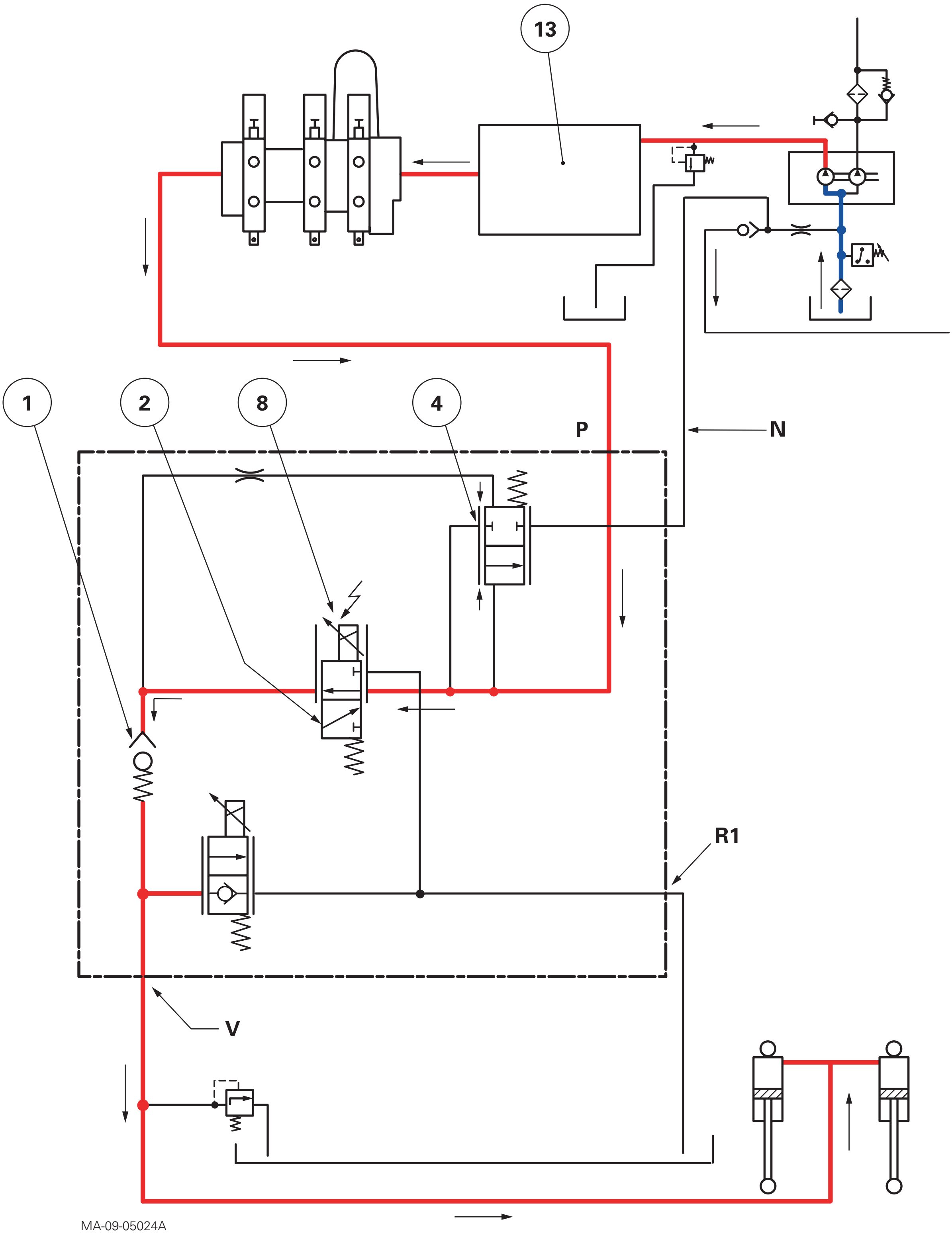


Fig. 6

E . Lowering position

The solenoid valve (7) is activated to lower the draw-bars (Fig. 7).

The lowering spool (3) is moved downwards. Its position allows oil to return from the rams via the port (V) to the return R1.

NOTE: *The lowering phase has no effect on the flow rate control spool (4). The continuity flow rate N is thus directed to the pump via the transfer pipe.*

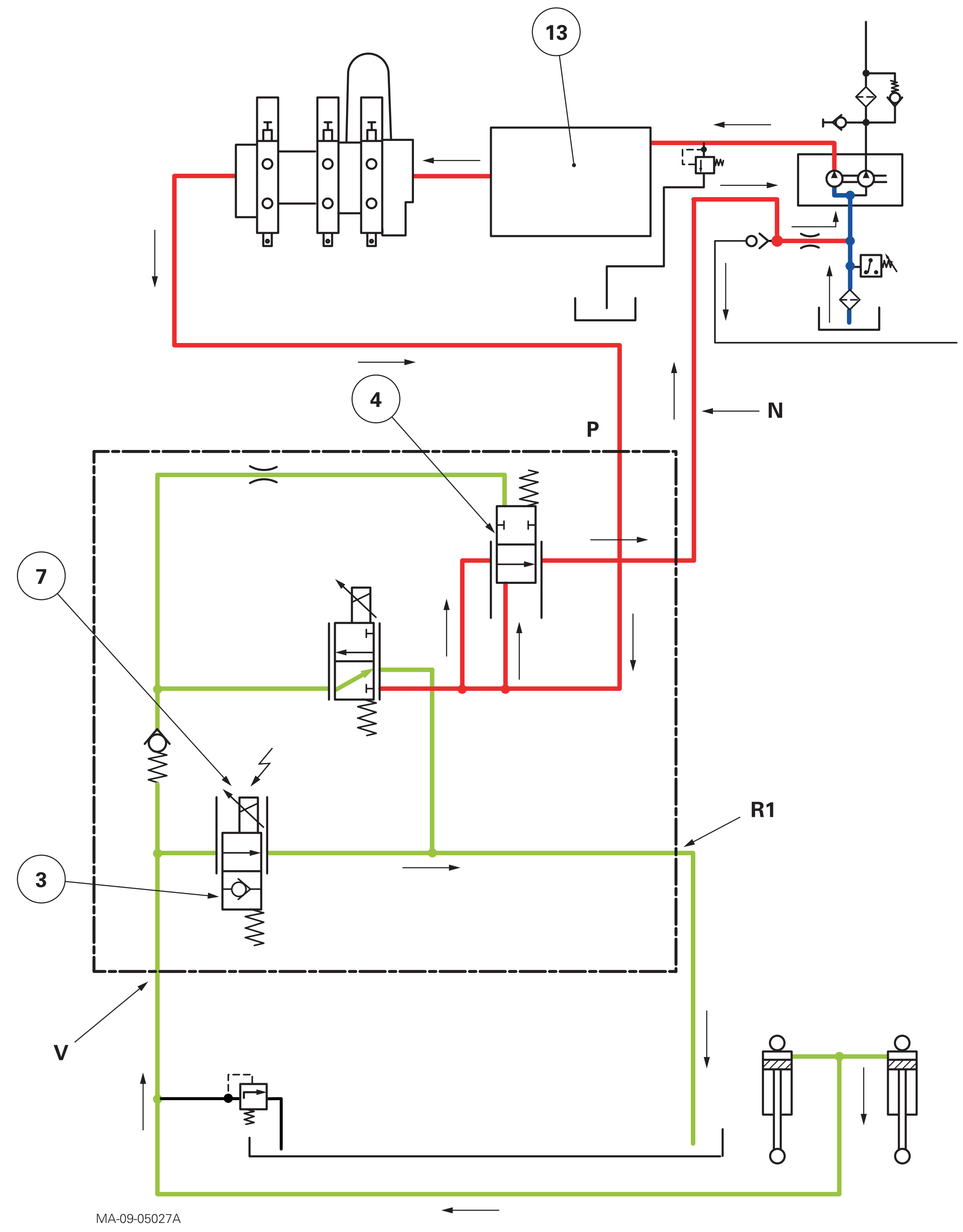


Fig. 7

F . Shock valve

Location

The shock valve (5) is housed at the front bottom of the left-hand hydraulic cover, (Fig. 8).

Function

It directs oil from the rams to the return in case of over-pressure in the circuit (Fig. 9).
Example: Hitch bounces when transporting an implement.

Characteristics

The shock valve is calibrated at 200 to 210 bar.

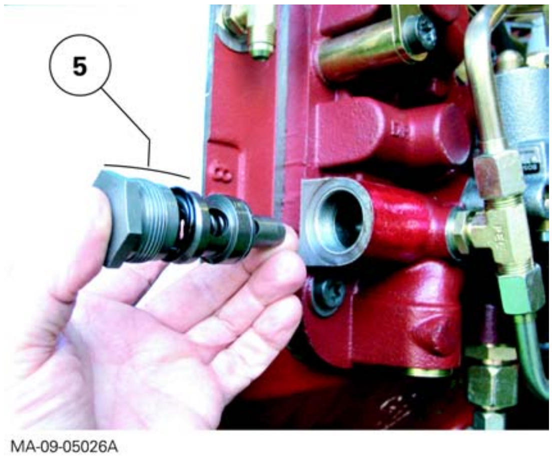


Fig. 8

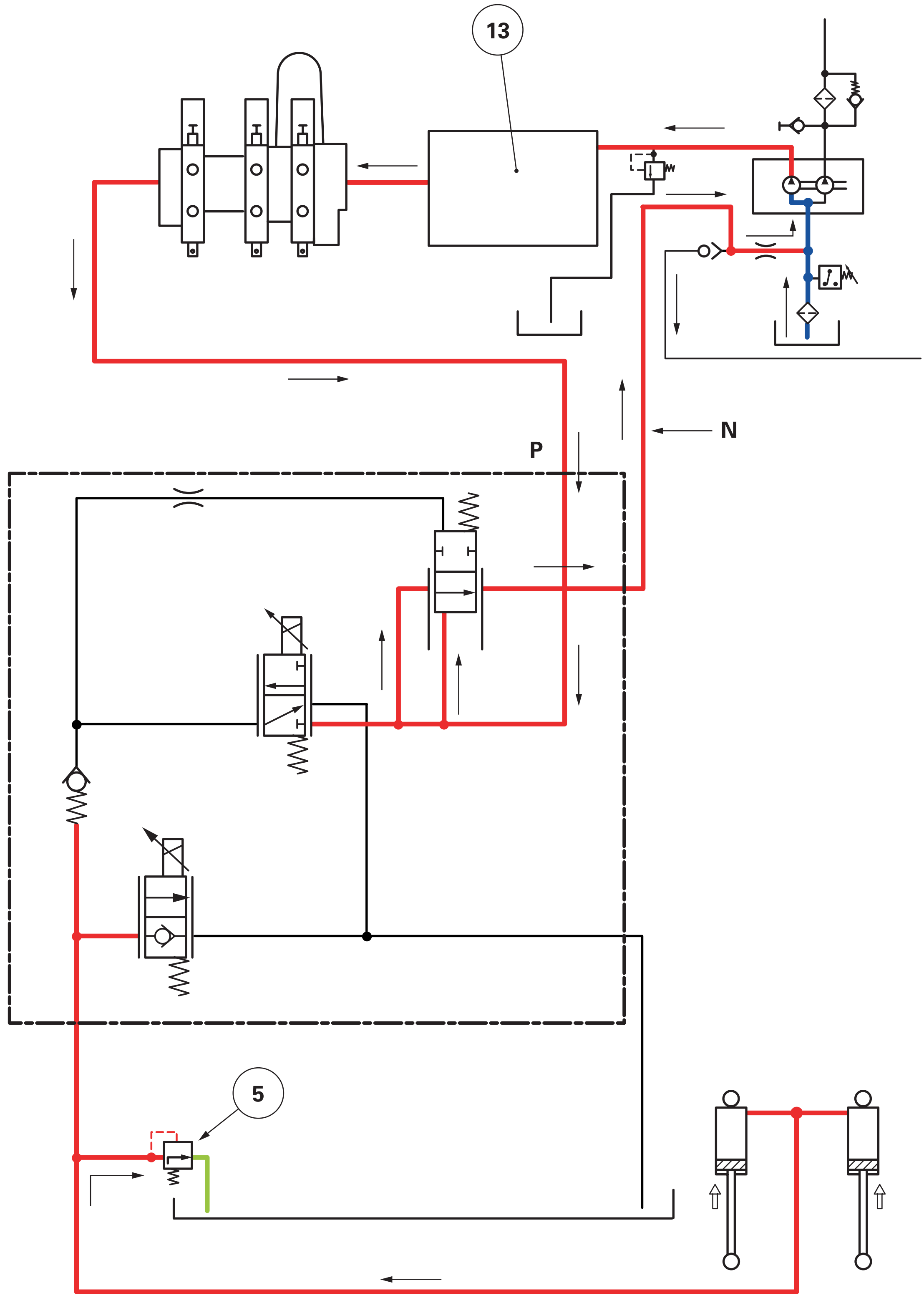


Fig. 9

G . Removing and refitting the spool valve

Preliminary operations

1. Immobilise the tractor. Chock the front wheels. Take off the rear wheel concerned.
2. Position a safety stand.
3. Detach the fuel tank from the gearbox or, if necessary, remove it after draining.

Removal

4. Identify then disconnect the wiring harnesses from the lifting (8) and lowering (7) solenoid valves (Fig. 10).

   ***Note:** The lowering solenoid valve is turned towards the front of the tractor.*
5. Mark, disconnect and block (Fig. 11):
   - the hose (1) from the auxiliary spool valves;
   - the supply or return pipe (2) from the lift rams.
6. Extract the screws (1) and remove the lift control spool valve (12) without losing the O'rings (2) and (3) (Fig. 12).

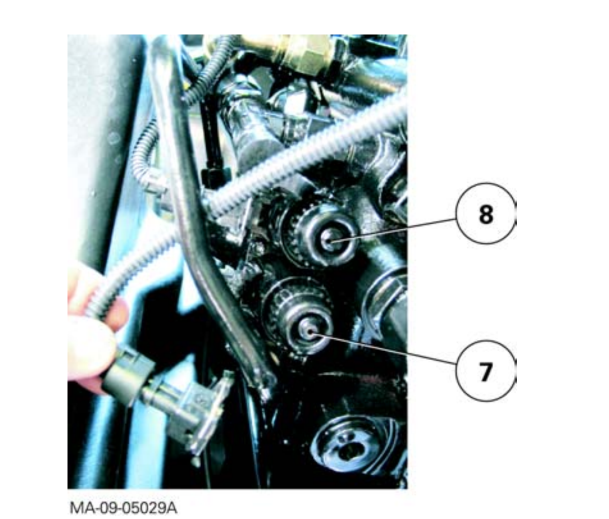


Fig. 10

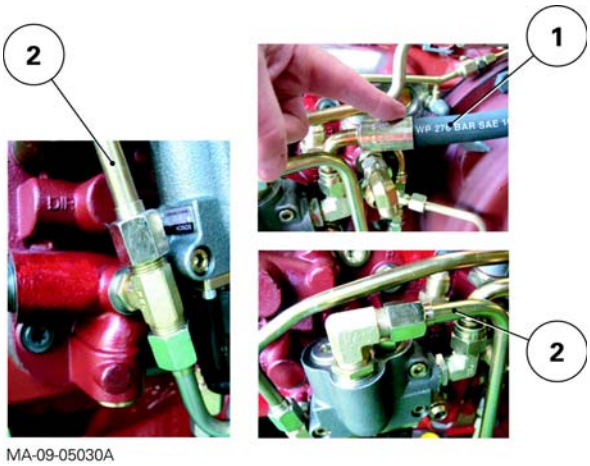


Fig. 11

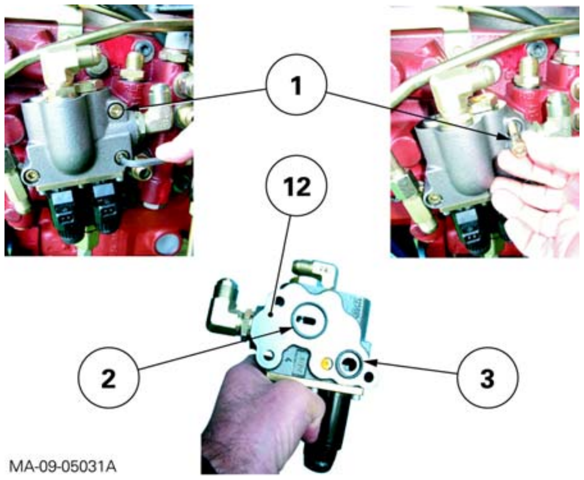


Fig. 12

Preparing for refitting

7. Clean the mating faces of the cover and lift control spool valve.

8. Replace the O'rings (if necessary).

Refitting

9. Refit the spool valve.

10. Fit and tighten the screws to a torque of 36 - 46 Nm.

11. Reconnect:

- the pipes and hoses (see operation 5);
- the solenoid valve harnesses (see operation 4).

12. Attach the harnesses using one or more clip retainers, if necessary.

Final operations

13. Attach or refit the fuel tank (see operation 3).

14. Refit the wheel. Remove the safety stand and trolley jack (see chapter 6).

15. Start the engine.

16. Check the operation of the lift control system and the oil tightness of the seals and unions.

09H01 - 17 bar - 5 bar and 1.5 bar valves - Open centre

CONTENTS

A . General

The 17 bar valve (2) (Fig. 1) is screwed onto the left-hand hydraulic cover. It performs the following functions:

- it supplies oil and maintains pressure in the 17 bar low pressure circuit
- it supplies the cooling system (5 bar) and lubricating system (1.5 bar).

Parts list

(2) 17 bar valve
(3) O'ring
(4) Plug
(5) Spring
(6) Ball
(7) Spool
(8) Shim(s)
(9) Spring
(10) O'ring
(11) Seal
(12) Plug
(13) Valve sleeve

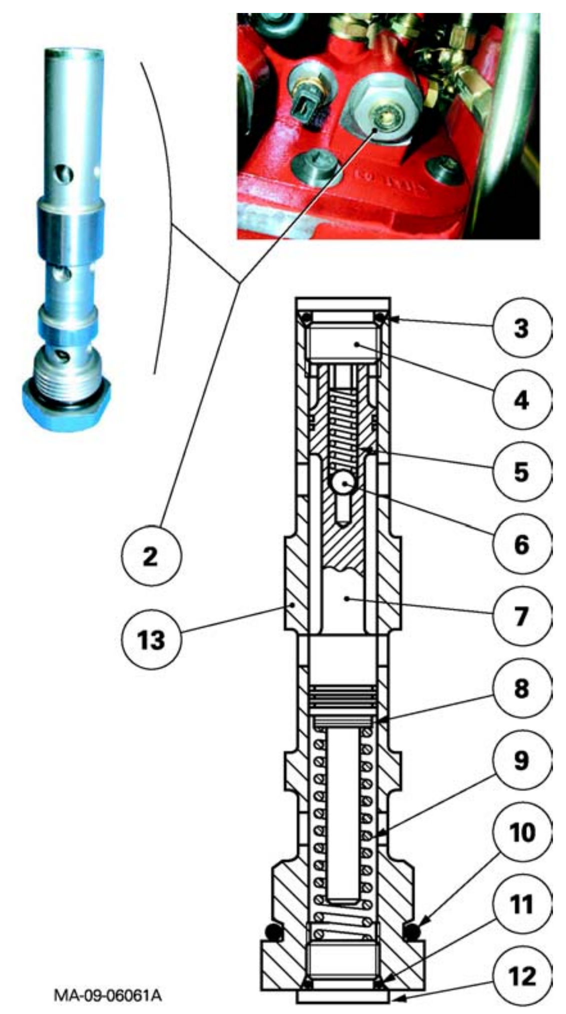


Fig. 1

17 bar - 5 bar and 1.5 bar valves - Open centre

Identification of ports (Fig. 2)

G Brake master cylinder booster (excluding Meritor type)
O Valve supply via the steering spool valve return (Orbitrol)
P Outlet to low pressure parts
R1 Return (1.5 bar valve)
BV Lubrication to 1.5 bar valve (cold oil)
RR Lubrication - cooling system return
VR Lubrication to cooling system
PDF Lubricating line to rear PTO

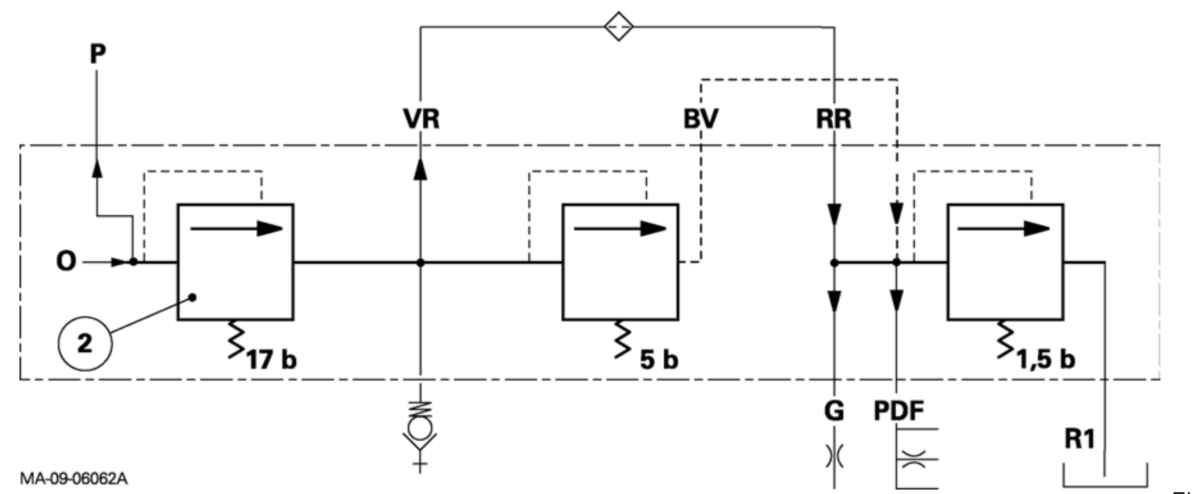


Fig. 2

B . Description of the 17 bar low pressure valve

Supply (Fig. 3)

As soon as the engine is started, the return oil from the steering unit (Orbitrol) enters port O and exits by port P of the left-hand cover; then it is directed towards the low pressure circuit of the right-hand hydraulic cover in order to supply:

- power shuttle (if fitted)
- speedshift unit
- changing between Hare / Tortoise range
- 4WD clutch
- front and rear differential locks
- rear PTO brake and clutch
- front power take off (if fitted).

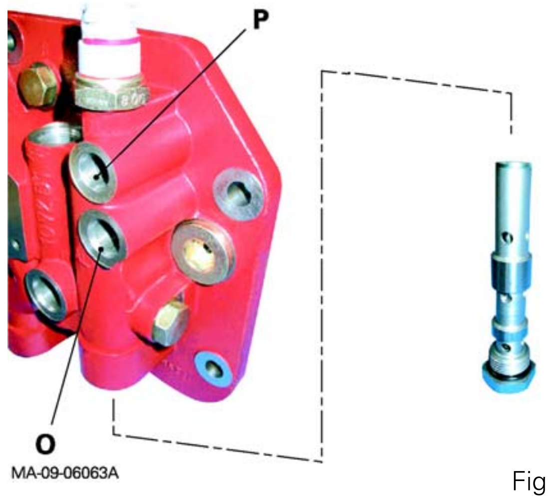


Fig. 3

17 bar - 5 bar and 1.5 bar valves - Open centre

Operation (Fig. 4)

A back pressure is generated in the low pressure circuit, forcing the ball (6) from its seating and thereby compressing the spring (5). The oil passes into the rear of the spool (7), creating a pressure which progressively moves it downwards by compressing the spring (9) which thrusts against the shims (8).

When one of the low pressure functions is activated, the momentary drop in pressure returns the ball (6) to its seating through the action of the spring (5). The oil contained in the chamber at the front of the plug (4) flows through a drain port located at the end of the spool (7).
Leaks return to the housing via port R in the cover (Fig. 5).

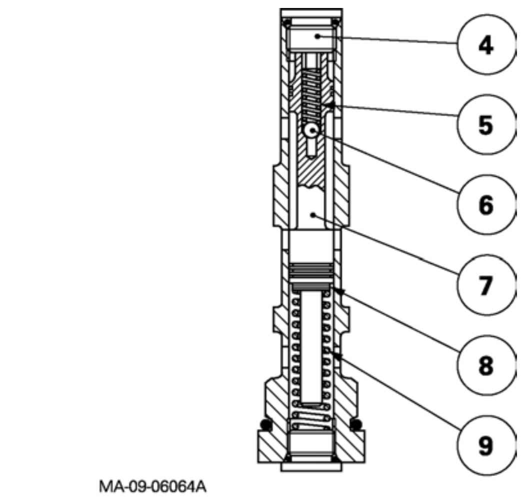


Fig. 4

Identification of components and ports (Fig. 5)

(1) 17 bar low pressure switch
(2) Plug (provision for outlet).
O Valve supply via the steering spool valve return
P Outlet to low pressure parts of the right-hand hydraulic cover
R Return port

Legend

17 bar low pressure

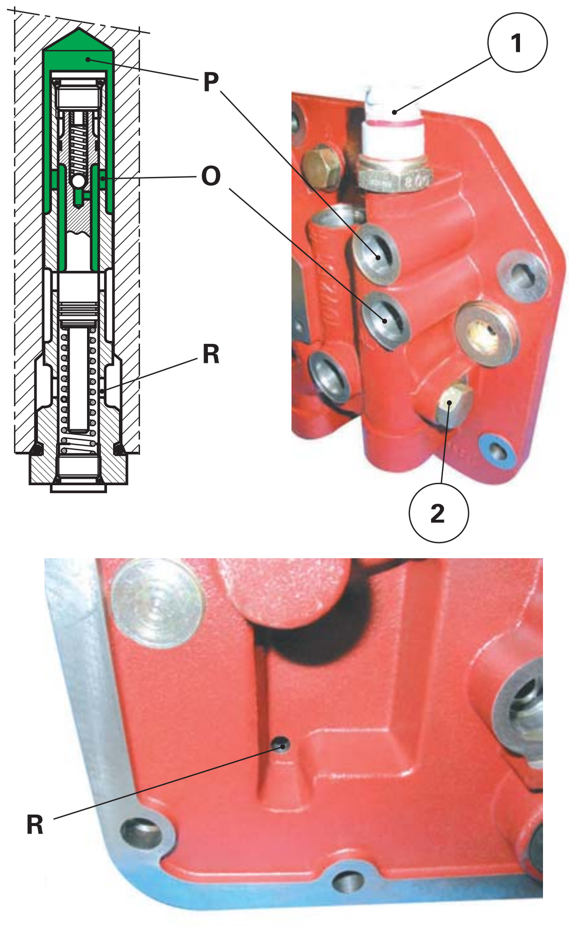


Fig. 5

C . Removing - refitting and disassembling - reassembling the 17 bar valve

***NOTE:** It is not necessary to remove the left-hand hydraulic cover to carry out work on the valve.*

Removal

1. Remove any parts around the valve that may obstruct work.
2. Remove and separate the valve (2) from the left-hand hydraulic cover (Fig. 1).

Refitting

3. Check the condition of the O'ring (10) and replace if necessary.
4. Screw the valve back onto the cover and tighten to 40 - 55 Nm.

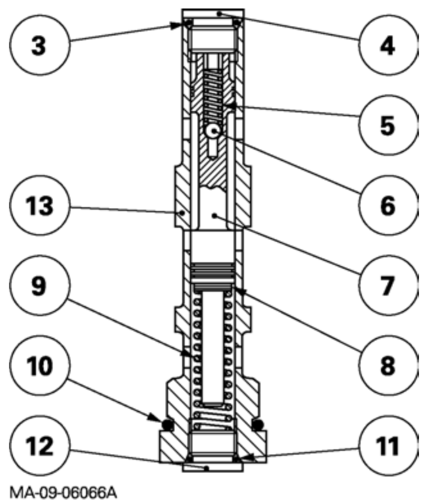


Fig. 6

Disassembly (Fig. 6)

***NOTE:** The valve comprises several hydraulic parts (spool, springs and ball) which cannot be replaced separately.*

5. Remove the O'ring (10).
6. Tighten the hexagonal head of the valve in a vice with protective jaws.
7. Gradually unscrew the plug (12) and discard the O'ring (11).
8. Recover:
   - spring (9),
   - shim(s) (8).
9. Gradually unscrew the plug (4) and discard the O'ring (3).
10. Recover:
    - spring (5)
    - ball (6).
11. Remove the spool (7) by carefully tapping the shaft (13) against a wooden shim.

Reassembly

***IMPORTANT:** The hydraulic parts must be reassembled on a clean work surface clear of filings and dirt.*

12. Check:
- the condition of the springs and O'rings
- the absence of scratches or seizing on the moving parts of the valve
- the sliding of the spool in its sleeve
- the cleanliness of the ports.

Conclusion

If the valve is defective, replace it. If not, reassemble it by carrying out the disassembly operations in reverse order.

D . Adjusting the 17 bar valve

It is not necessary to remove the left-hand hydraulic cover to adjust the valve.

When the valve is removed, it can be adjusted inserting shims (8) between the spool (7) and the spring (9).

E . Operation of the cooling system

The pressure acting on the back of the spool (7) pushes it towards the bottom of the valve, pressing in the spring (9) (Fig. 4). It then allows oil to pas to port VR (Fig. 7) and the cooler. When it leaves the cooler, the oil is directed to the transmission lubricating system via the 1.5 bar valve.

5 bar valve

When the oil is cold, the 5 bar valve (1) (2) (3) (Fig. 7) opens partially. It then allows some oil to pass directly to port BV of the left-hand cover (Fig. 7), and to supply the transmission lubricating system, without really entering the cooler.

Legend

17 bar low pressure

Return to the housing via the cover

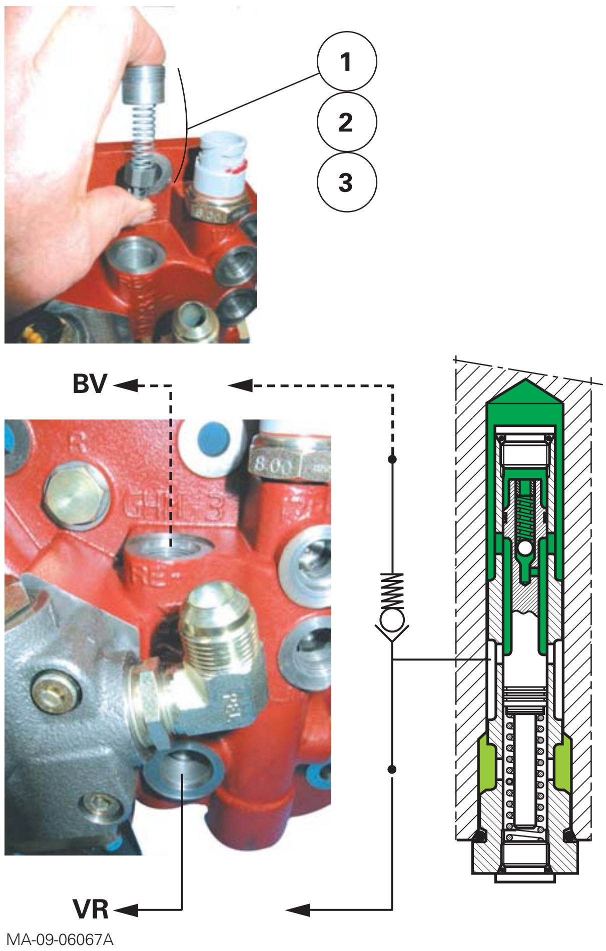


Fig. 7

F . Assembling the 5 bar valve

***Nota:** It is not necessary to remove the left-hand hydraulic cover to carry out work on the valve.*

13. Remove the pipe and union.
14. Place the valve (1), spring (2) and threaded ring (3) in the cover (Fig. 8).
15. Compress the spring, tightening the threaded bush until it reaches a "hard point" (Fig. 8 - the bush has reached the cover shoulder).
16. After assembly, check that free movement of the valve and the compression of the spring, entering a screwdriver through the port provided for screwing in the temperature switch, located on the lower part of the cover.

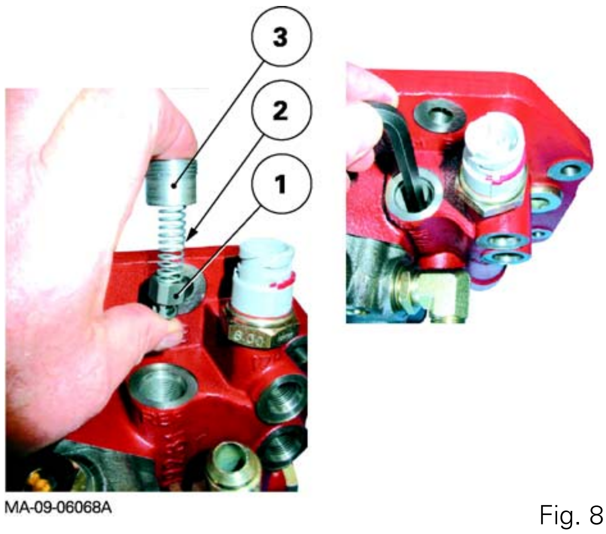


Fig. 8

G . Description of the 1.5 bar lubricating valve

Location

The 1.5 bar valve (1) is hidden behind the fuel tank, and is located at the front left-hand side of the gearbox (Fig. 9).

Operation

It controls the oil coming from the cooling circuit, and maintains a lubricating pressure of approximately 1.5 bar in the circuit, due to the valve setting. If the pressure exceeds 1.5 bar, the spring (8) compresses, the valve (2) moves and oil flows to the return R1 (Fig. 10).

***Reminder :** For identification of pipes and hoses (see § A).*

***Note 1:** When the requirements of the low pressure circuit are met, oil is channelled towards the booster port of the brake master cylinders in order to ensure a constant oil level.*

***Note 2:** Considering the available hydraulic options, other assemblies can be carried out on the union (2) (Fig. 9). Example: Front PTO - Meritor brake master cylinders)*

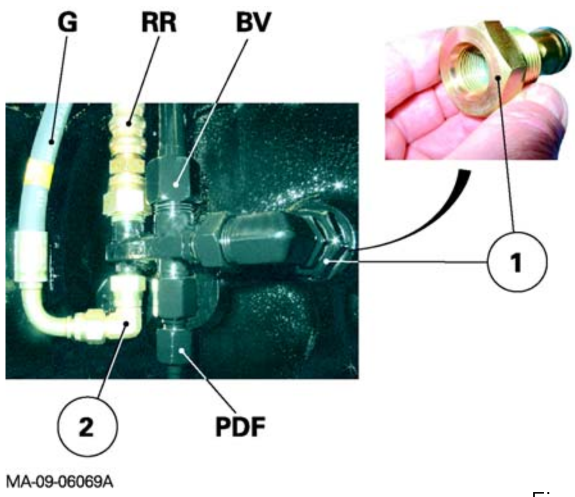


Fig. 9

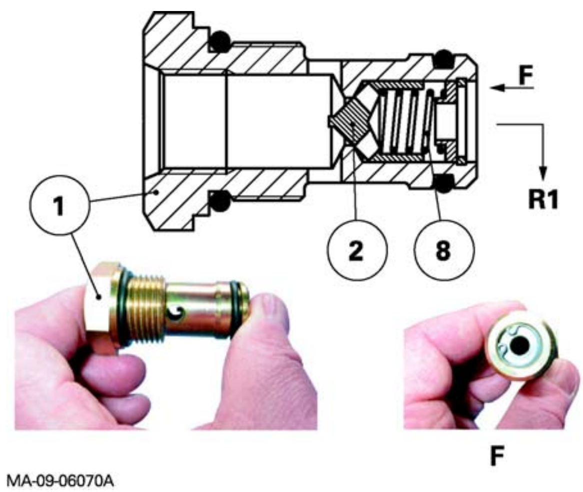


Fig. 10

H . Removing - refitting and disassembling - reassembling the 1.5 bar valve

Removal (Fig. 11)

17. Remove the part(s) that may obstruct work on the valve (1).

18. Mark and disconnect the pipes (5) (6), hoses (7) (8) and unions (2) (3) (4).

19. Remove the housing valve from the gearbox.

Refitting

20. Replace the O'rings if necessary.

21. Refit the valve, unions, hoses and pipes.

22. Replace any part(s) removed at operation 17.

Disassembly

23. Take off circlip (5). Remove the bush (2), spring (3) and valve (4) from the valve body (6).

Reassembly

***NOTE** (Fig. 12): The valve (1) consists of several hydraulic parts (valve, spring) listed in the spare parts catalogue.*

24. Check that the hydraulic parts are clean.

25. Reassemble the valve, carrying out operation 23 in reverse order.

26. Manually check the free movement of the valve.

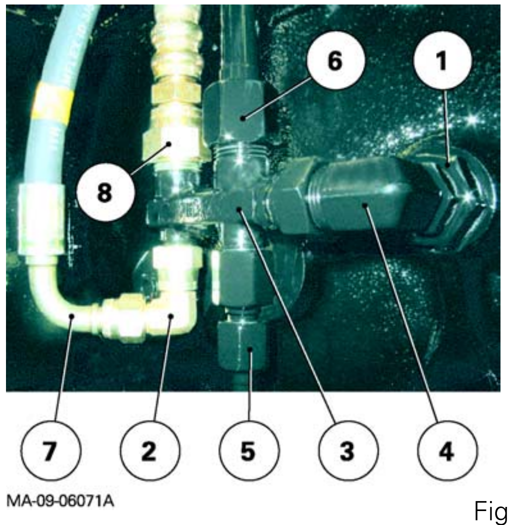


Fig. 11

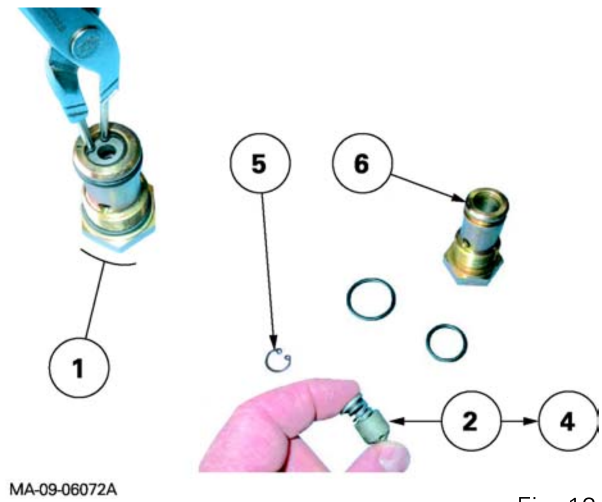


Fig. 12

09I01 - Unassisted brake master cylinders

CONTENTS

A . General

The brake master cylinders are attached to the pedal console and are housed to the right of the front firewall in the cab (Fig. 1 - Option described: single circuit).

They act on the tractor main brake located in the centre housing.

Depending on user requirements, the master cylinders can be activated separately or in coupled mode via a pedal locking mechanism (1) (Fig. 2).

The master cylinders have different characteristics depending on the option fitted on the tractor:

- **Tractor without trailer brake**
  Single circuit master cylinders assembly
- **Tractor with trailer brake**
  Double circuit master cylinders assembly

The master cylinders are kept at a constant level by a residual oil flow coming from hose (1) (Fig. 3). This hose is connected to the lubricating and booster circuit by a distribution block located at the front left-hand side of the gearbox (Fig. 3).

Fig. 1

Fig. 2

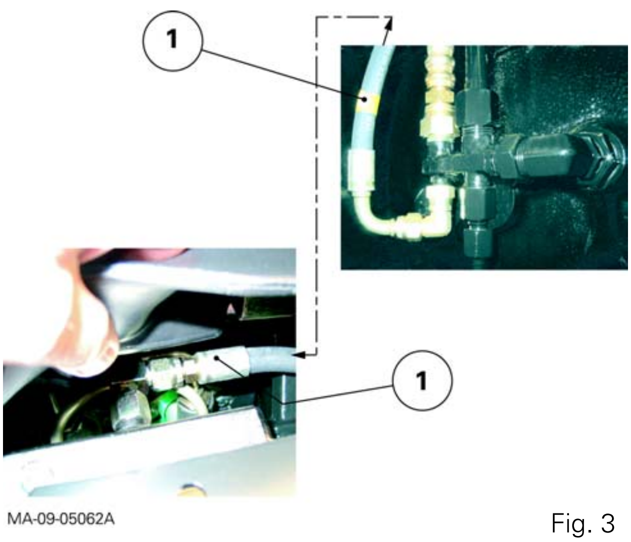


Fig. 3

B . Layout of hydraulic lines

Hydraulic lines with single circuit master cylinders

Parts list (Fig. 4)

(2) Booster tank
(3) Main brake left- and right-hand supply lines
(4) Pressure balancing junction line
(5) Brake master cylinders
(10) Connector to assist bleeding
(11) Inlet port (booster oil)

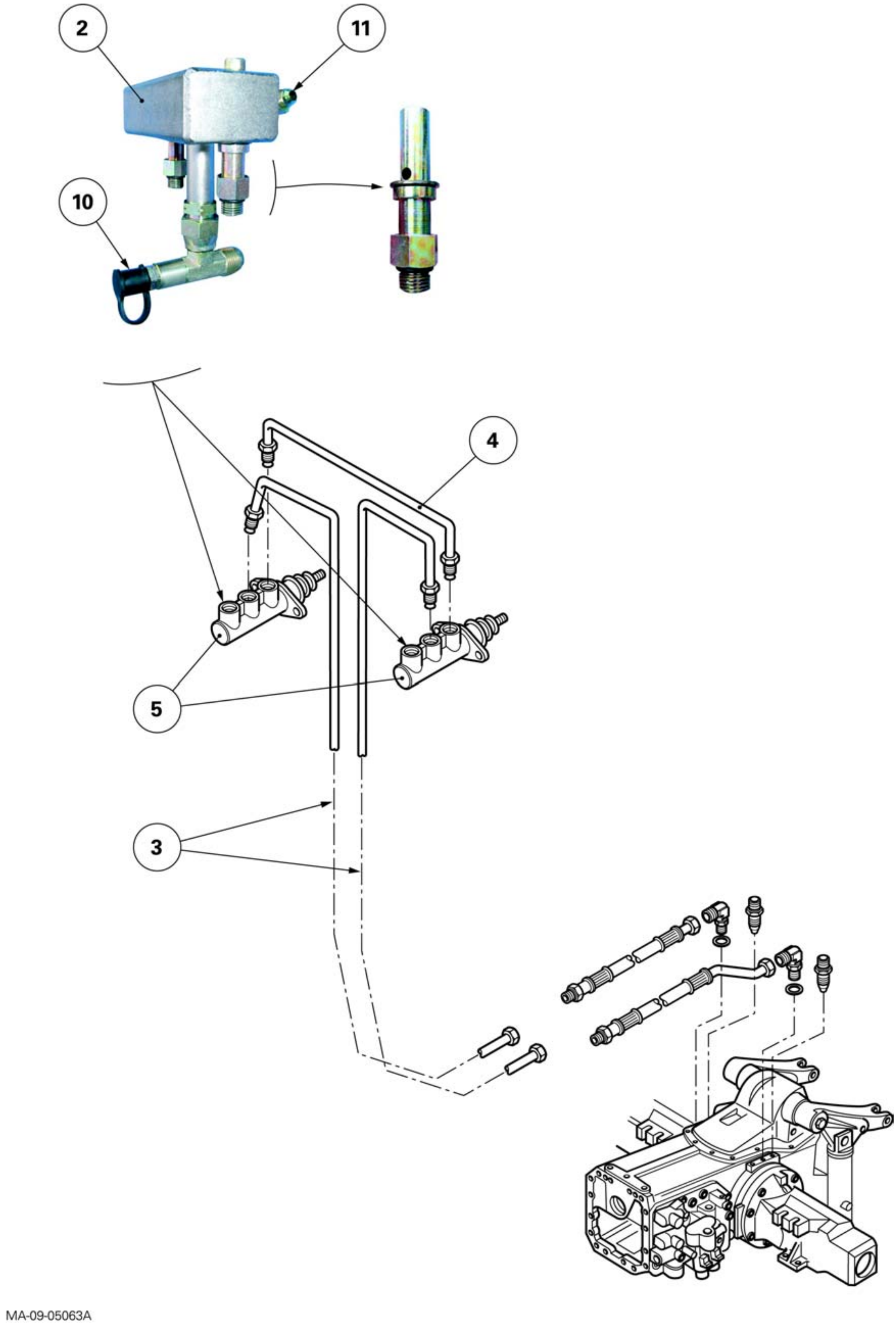


Fig. 4

Hydraulic lines with double circuit master cylinders (trailer brake)

Parts list (Fig. 5)

(1) Braking spool valve control line
(2) Booster tank
(3) Main brake left- and right-hand supply lines
(4) Pressure balancing junction line
(5) Brake master cylinders
(6) Trailer braking spool valve
(7) Trailer brake quick-disconnect coupling
(10) Connector to assist bleeding
(11) Inlet port (booster oil)

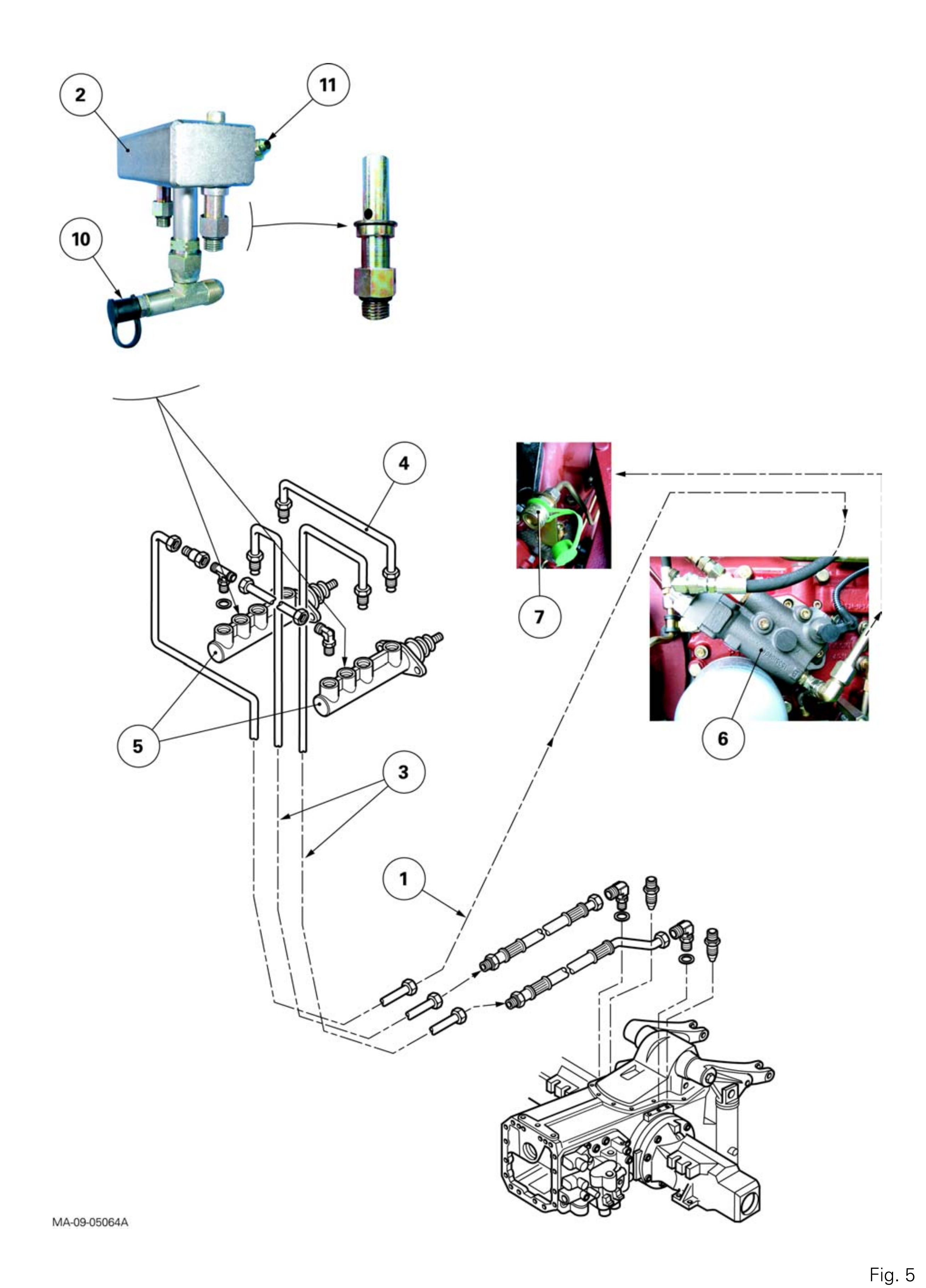


Fig. 5

C . Practical servicing advice

Repair kits

Repair kits for brake master cylinders are listed in the spare parts catalogue.

Disassembly

If it is necessary to disassemble the master cylinders, carry out the operation on a clean workbench free of dirt and corrosion.

Carefully clean all components.

Replace any components found to be scratched or distorted.

After disassembling or replacing

After disassembling or replacing the brake master cylinders:

- bleed the main brake circuit and trailer brake circuit (if fitted);
- check, if necessary, pedal adjustment and the operation of the brake coupled mode locking device.

D . Single circuit master cylinders (without trailer brake)

Operation

Pedals uncoupled (Fig. 7)

The effort applied to a pedal is transmitted by the rod (5) to the piston (4) which moves in the bore of the active master cylinder. The valve (1) closes the supply port. The balancing valve (3) is opened by the piston (4) and valve ball (2). Oil under pressure is directed to the main brake ports (C) and the pressure balancing junction (D).

Via the balancing junction, the pressure closes the valve (3) of the passive master cylinder .

Pedals coupled

- *Braking and pressure balancing*

  The effort applied to the two pedals is transmitted by the rods (5) to the pistons (4) which move in the bores of the two master cylinders. The two valves (1) close the supply ports. The two balancing valves (3) are opened by the pistons (4) and valve balls (2). Pressure balancing is ensured in the two master cylinders by the balancing junction (D).

  Oil under pressure is also directed to the ports (C) and (C') of the main brake circuit.

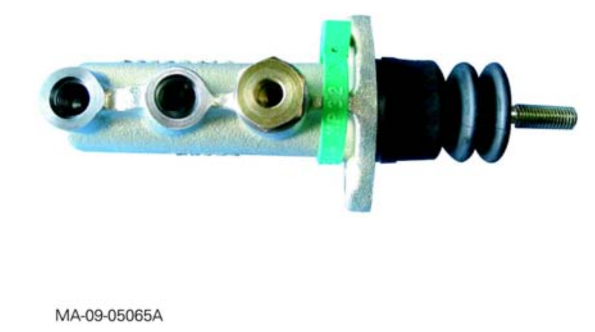


Fig. 6

Legend (Fig. 7)

B Master cylinder level kept constant by the lubricating and booster circuit (Fig. 3)
C Supply to main brake
D Pressure balancing junction

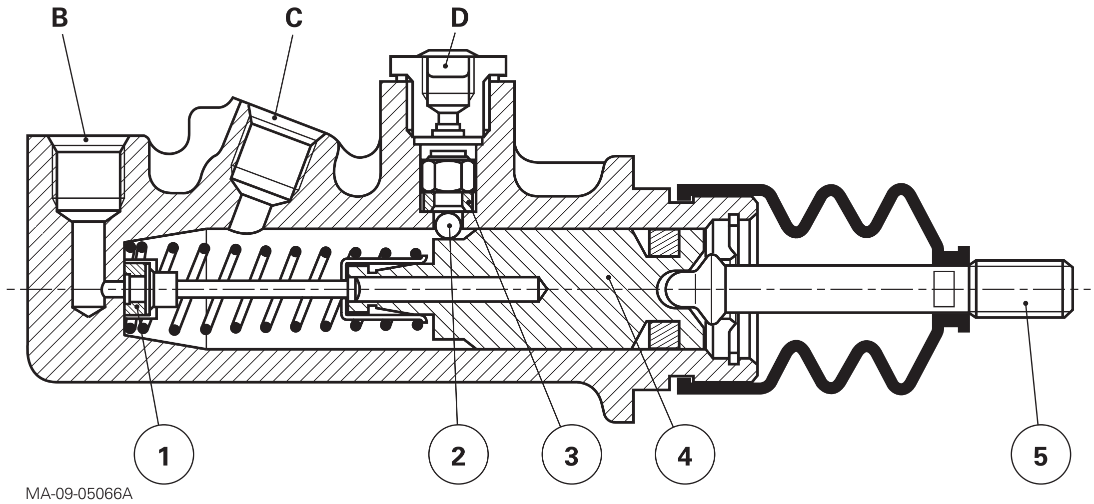


Fig. 7

E . Double circuit master cylinders (with trailer brake)

Operation

Pedals uncoupled (Fig. 9)

The effort applied to a pedal is transmitted by the rod (5) to the piston (4) which moves in the bore of the active master cylinder. The valve (1) closes the supply port. The balancing valve (3) is opened by the piston (4) and valve ball (2). Oil under pressure is directed to the main brake ports (C) and the pressure balancing junction (D).

Via the balancing junction, the pressure closes the valve (3) of the passive master cylinder .

The pressure acting on the piston (4) also makes the piston (6) move, closing the valve (F).

The oil contained in the chamber (E) is channelled by connecting pipes to the chamber (E') and to the port (B') via the open valve (F') of the passive master cylinder.

The valve (F) and piston (6) assembly quickly reaches the stop at the base of the active master cylinder.

In this position only the tractor brake is activated; trailer brake is not activated.

Fig. 8

Legend (Fig. 9)

- A Trailer brake spool valve control (double circuit)
- B Master cylinder level kept constant by the lubricating and booster circuit (Fig. 3)
- C Supply to main brake
- D Pressure balancing junction
- A Trailer brake pressure chamber (double circuit)
- F valve (double circuit)

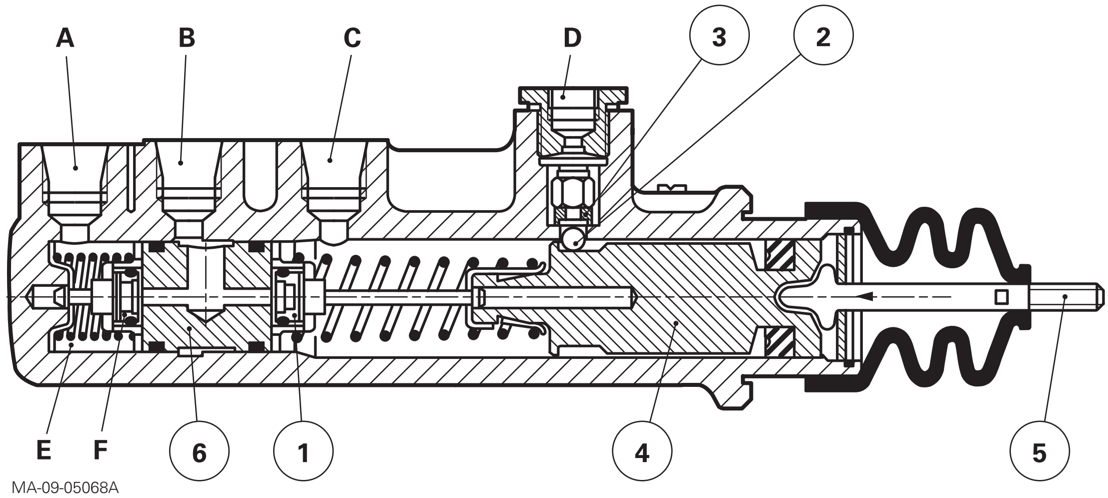


Fig. 9

Pedals coupled

- *Braking and pressure balancing*

  The effort applied to the two pedals is transmitted by the rods (5) to the pistons (4) which move in the bores of the two master cylinders. The two valves (1) close the supply ports. The two balancing valves (3) are opened by the pistons (4) and valve balls (2). Pressure balancing is ensured in the two master cylinders by the balancing junction (D).

  Oil under pressure is also directed to the ports (C) and (C′) of the main brake circuit.

- *Trailer braking*

  The continuous movement of the pistons (4) and (6) closes the valves (F) et (F′). The pressurised chambers (E) and (E′) supply the trailer brake control valve via ports (A) and (A′).

F . Adjusting brake pedals

Preparing for adjusting

1. If the pins (5) and (6) are removed, smear them lightly with molybdenum disulfide or AS767 grease or equivalent (Fig. 10).
2. Screw the locknut (8) and clevis (1) onto the rod (2).
3. Fit the return spring (3).

Adjustment

4. Adjust clevis (1) to obtain distance X = 115 ± 0.5 mm (Fig. 10) between the support (4) and attachment pin.

   Lock the locknut.
5. Carry out the same procedure on the second clevis and ensure that the coupled mode locking device (1) (Fig. 11) operates smoothly.
6. Check pedal for correct operation. Ensure they are at the same height when not activated and that they return freely to their initial position.

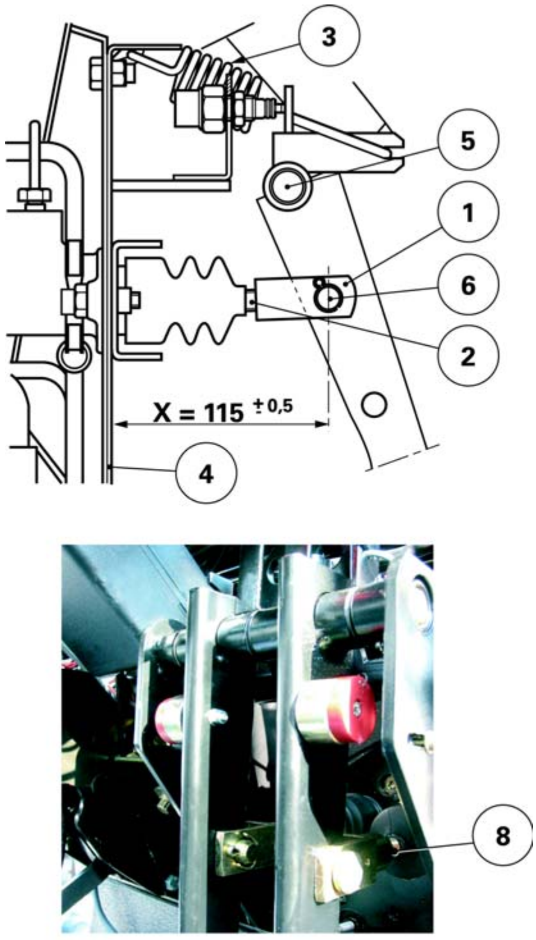


Fig. 10

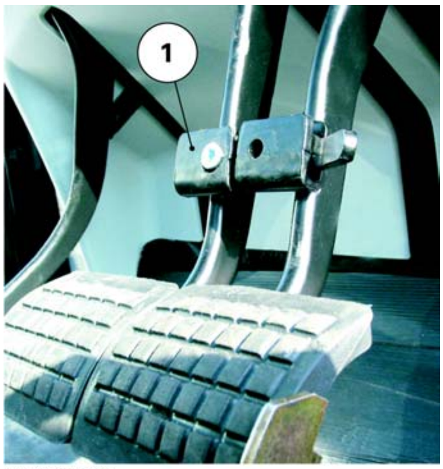


Fig. 11

G . Bleeding the main brake circuit

Installation

***Note:** A male quick connector (3) is fitted as standard on the 5 bar line of the left-hand hydraulic cover (Fig. 13). It facilitates the bleeding of the pressurised brake system.*

7. Join the connector (3) to the connector (10) with a locally made hose (2) fitted at each end with a female connector ref.3582045M1 (Fig. 13).

8. Connect a transparent pipe to the right- and left-hand bleed screws (1) of the centre housing (Fig. 12).

9. Immerse the ends of the two pipes into a container partially filled with clean transmission oil.

10. Using soft pliers, pinch the return hose shut (1) without flattening it excessively (Fig. 13).

__Important:__ Some hoses may be difficult to pinch shut due to their rigid sheath. Consequently, it will be necessary to disconnect the hose from union (10) and temporarily replace it with a plug.

Legend (Fig. 13)

D Movement of pressurised fluid through brake master cylinders during bleeding

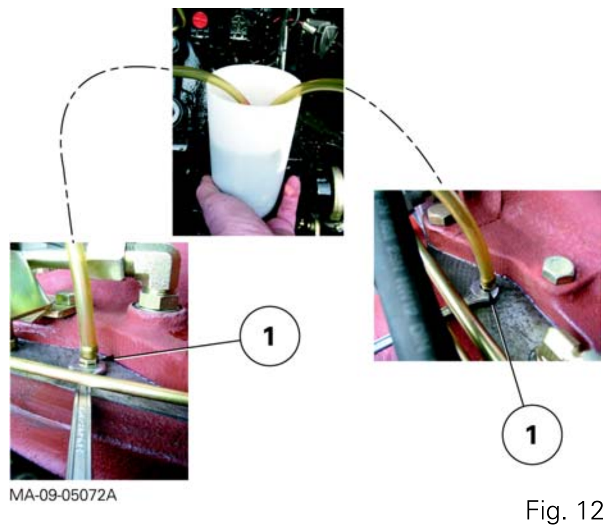


Fig. 12

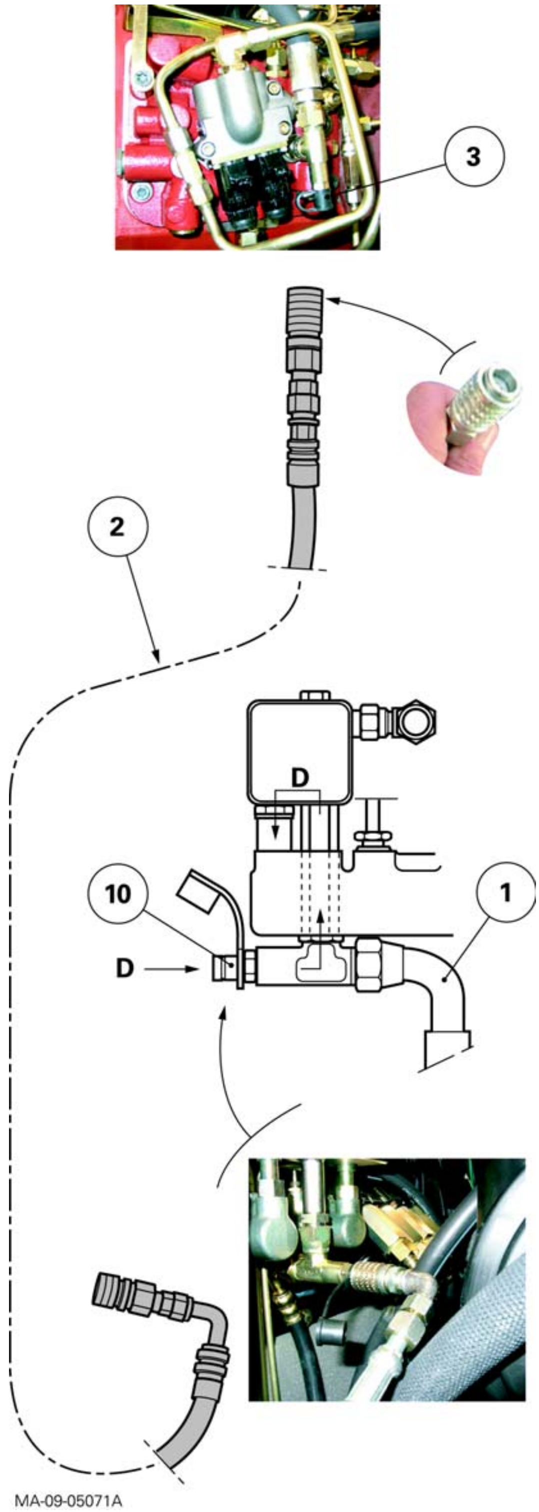


Fig. 13

Bleeding procedure

11. Run the engine at approximately 1300 rpm and heat the oil to operating temperature.

12. Open the two bleed screws by one turn and wait 5 minutes.

- Pedals coupled:

  Fully press down and slowly release the pedals 8 times until the oil flows free of air bubbles.

- Pedals uncoupled:

  Fully press down and slowly release each pedal 8 times until the oil flows free of air bubbles.

- Pedals coupled:

  Fully press down and slowly release the pedals 5 times until the oil flows free of air bubbles.

13. First close the left-hand bleed screw and then the right-hand bleed screw.

14. Remove:

- the hose (2) used at operation 7 (Fig. 13);
- the pliers clamping the hose (1) (see remark at operation 10).

Check

15. Press very hard (approximately 60 to 80 kg) on each pedal to correctly position the brake pistons.

16. Check the load strength of each pedal. Coupled pedals should not travel more than 120 mm for the force stated above.

17. Stop the engine.

In case of operating problems

If a there is a problem when operating the brakes, carry out the bleed sequence a second time.

If the problem remains, check tightness of:

- circuit;
- master cylinders;
- piston seals.

H . Bleeding the trailer brake circuit

If the tractor is fitted with trailer braking, it is strongly recommended to simultaneously bleed the main brake and trailer brake circuits.

To carry out this bleeding procedure, use the same equipment and methods as described in paragraph G for the bleeding of the main brake circuit, but respect the following additional points:

- Open (Fig. 14):
  - the two bleed screws (1) of the main brake;
  - the trailer brake screw (2).
- When the bleeding is complete, tighten in the following order (Fig. 14):
  - the left-hand brake bleed screw (1);
  - the right-hand brake bleed screw (1);
  - the trailer brake bleed screw (2).
- Check the trailer braking pressure on the quick disconnect coupling located at the rear of the tractor (see chapter 9). If this pressure is not correct, eliminate any air leaks in the circuit and repeat the bleeding procedure.
- Carry out a road test.

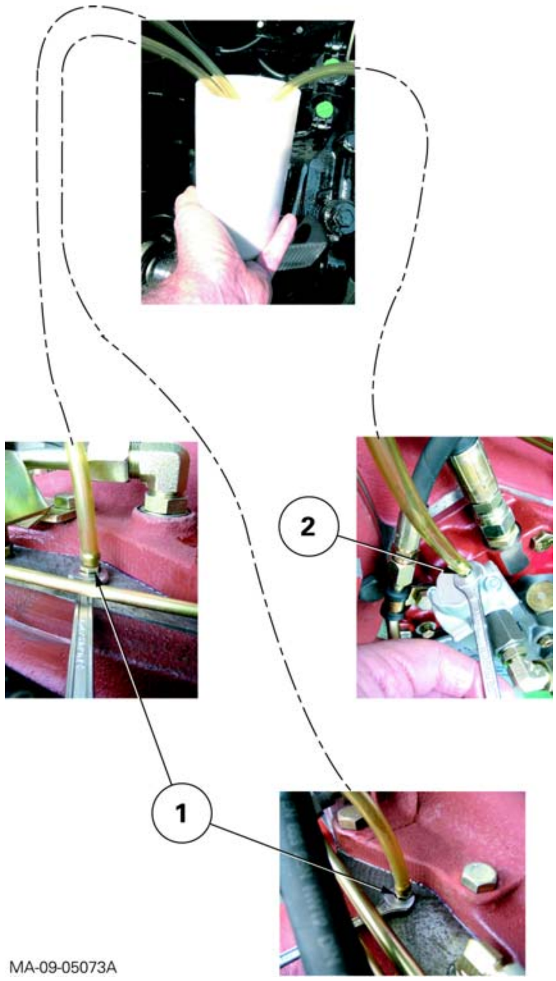


Fig. 14

09I02 - Assisted brake master cylinders

CONTENTS

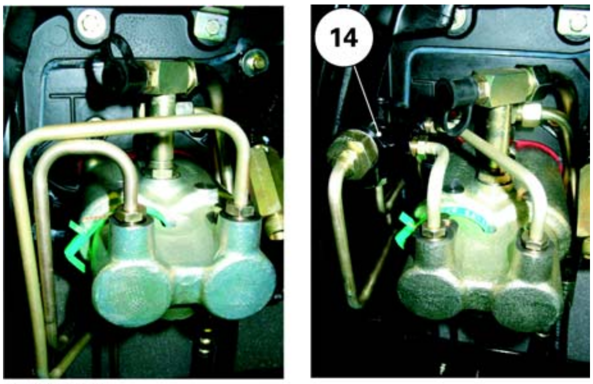
A . General

The MERITOR brake master cylinders are attached to the pedal console and are housed to the right of the front firewall in the cab (Fig. 1).

They act on the tractor main brake located in the centre housing.

Depending on user requirements, the master cylinders can be activated separately or in coupled mode via a pedal locking mechanism (1) (Fig. 2).

The master cylinder characteristics are similar whether the requested option includes trailer brake or not. However, if the trailer brake option has been selected, a FTE valve (14) is added to the circuit to perform this function (Fig. 1).



MA-09-05074A

Fig. 1

MA-09-05061A

Fig. 2

Assisted brake master cylinders

The accumulator (1) fitted upstream of the master cylinders (5) (Fig. 3 and Fig. 4) is supplied by the low pressure circuit (17 bar).

It allows a faster responsiveness of the assistance mechanism.

It also maintains the pressure in the master cylinders via the non-return valve (2) in the line (4) when the engine has been stopped (Fig. 3).

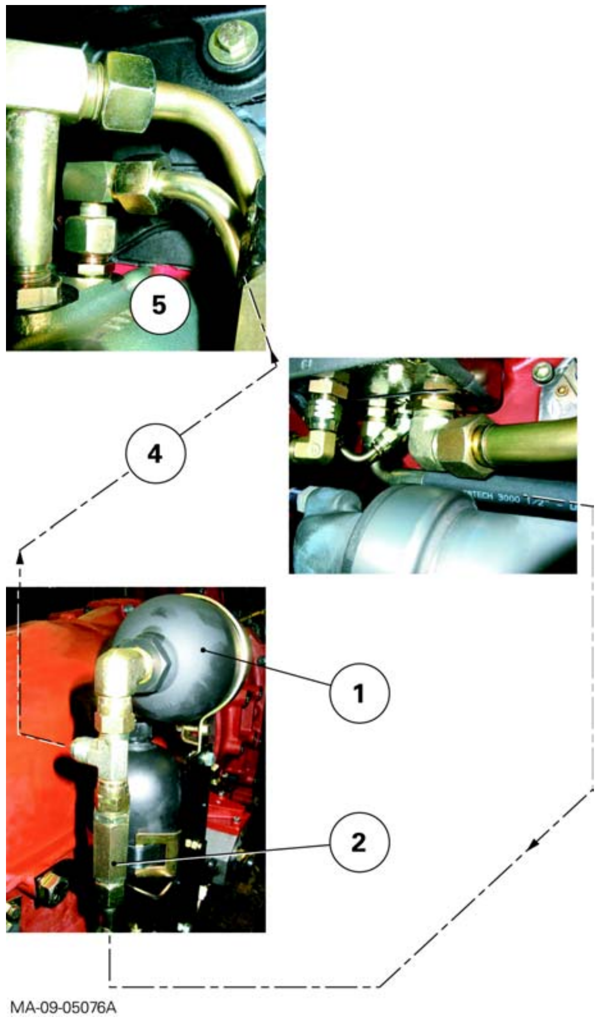


Fig. 3

B . Layout of hydraulic lines

Characteristics

(1) Accumulator (Fig. 4)
- Manufacturer .... Olaer
- Type 1/20
- Capacity .... 1 litre
- Gas.................................. Nitrogen
- Inflation pressure .... 9 ± 1 bar

NOTE: *The pressure should be checked every 6 months, with the engine stopped.*

(2) Non-return valve (Fig. 4)
- Manufacturer .... Parker

NOTE: *When reassembling the non-return valve, turn the arrow engraved on its body so that it points in the direction of fluid flow.*

(3) Main accumulator for Speedshift unit (Fig. 4)

(4) To brake hydraulic power assistance (Fig. 4)

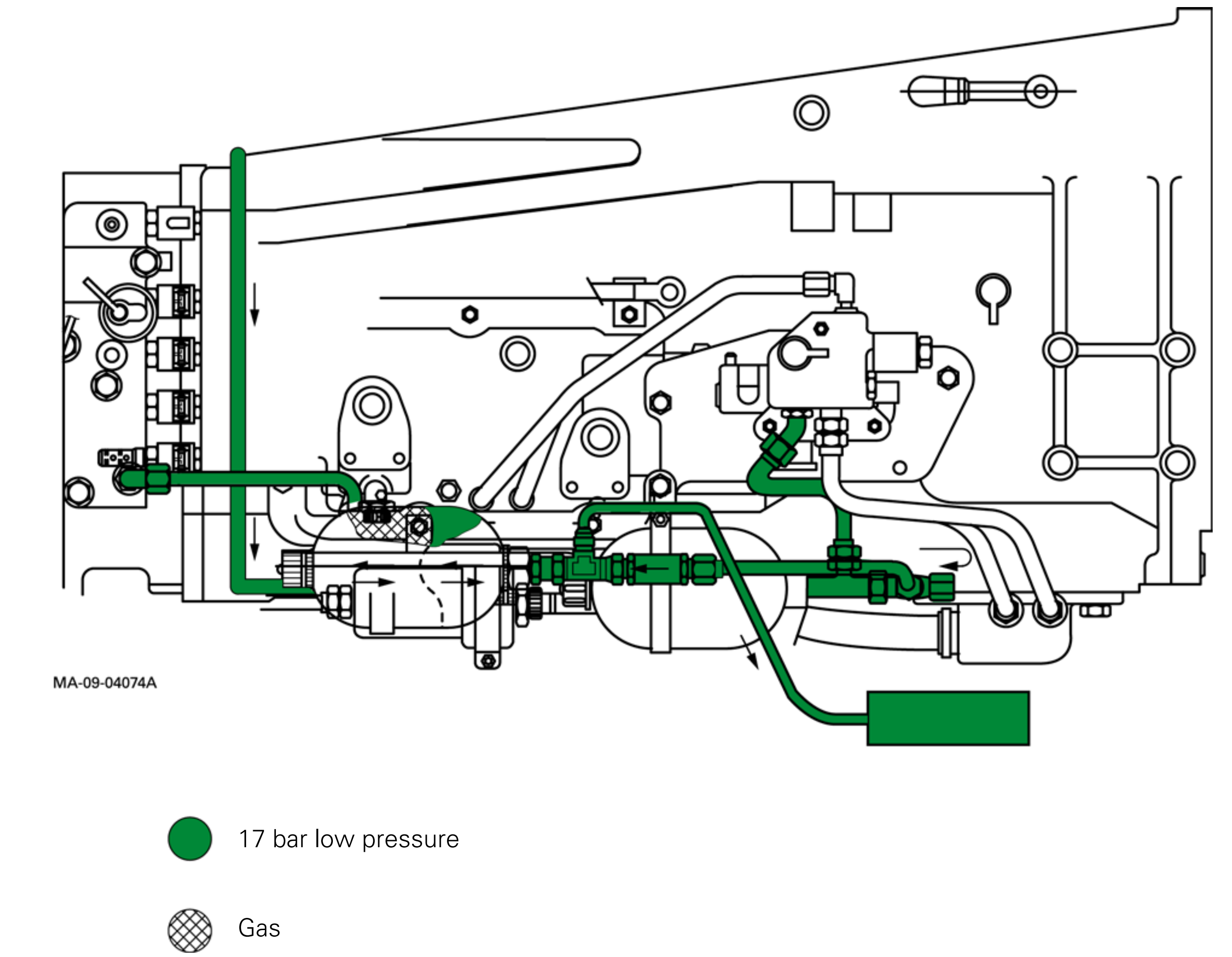


Fig. 4

Parts list (Fig. 5)

(3) Main brake left- and right-hand supply lines
(5) Brake master cylinders
(10) Connector to assist bleeding
(12) Main brake bleed lines
(13) 17 bar low pressure supply line

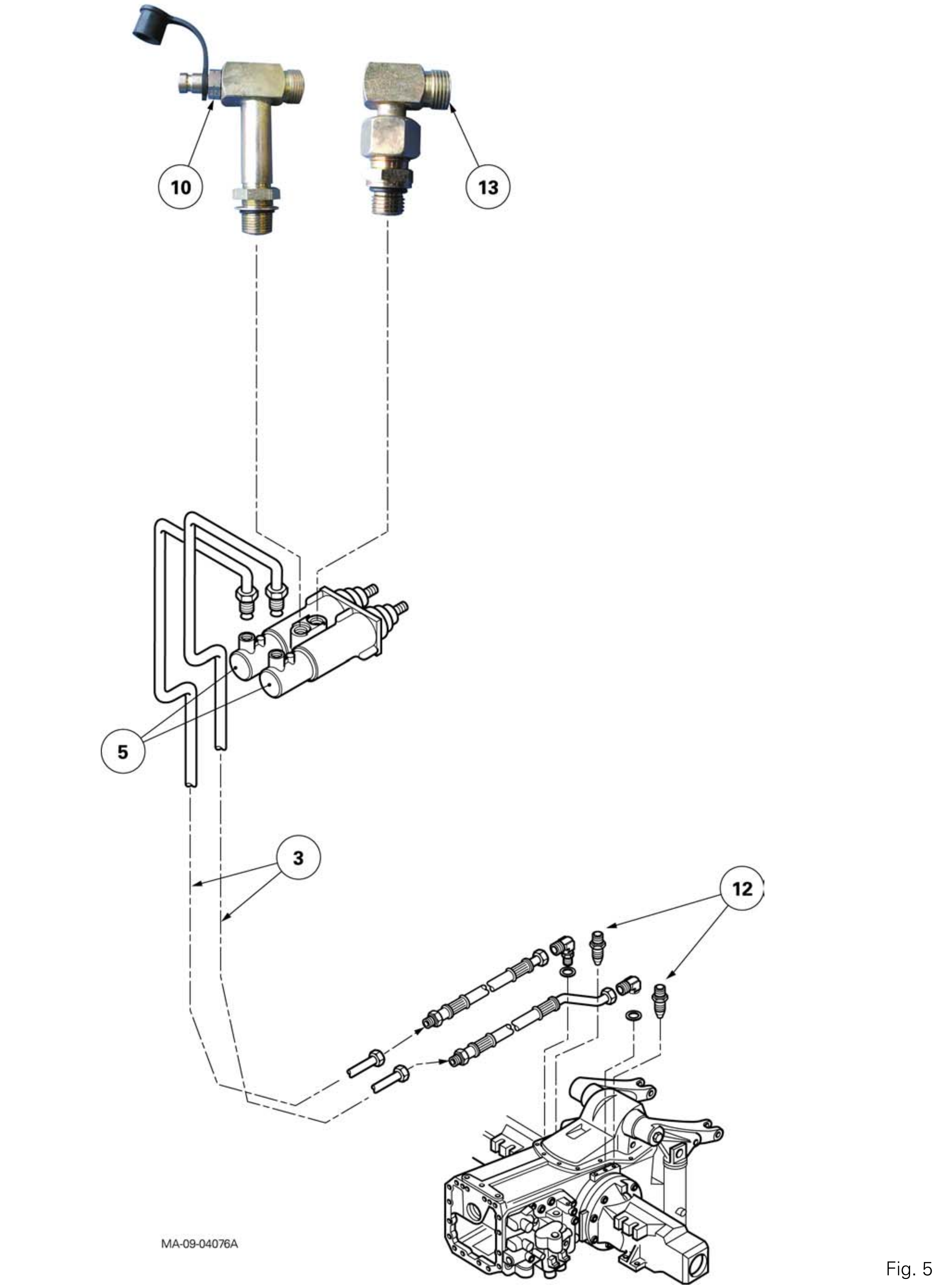


Fig. 5

Parts list (Fig. 6)

(3) Main brake left- and right-hand supply lines
(5) Brake master cylinders
(7) Trailer brake quick-disconnect coupling
(10) Connector to assist bleeding
(12) Main brake bleed lines
(13) 17 bar low pressure supply line
(14) Trailer brake FTE valve
(15) Trailer brake supply line

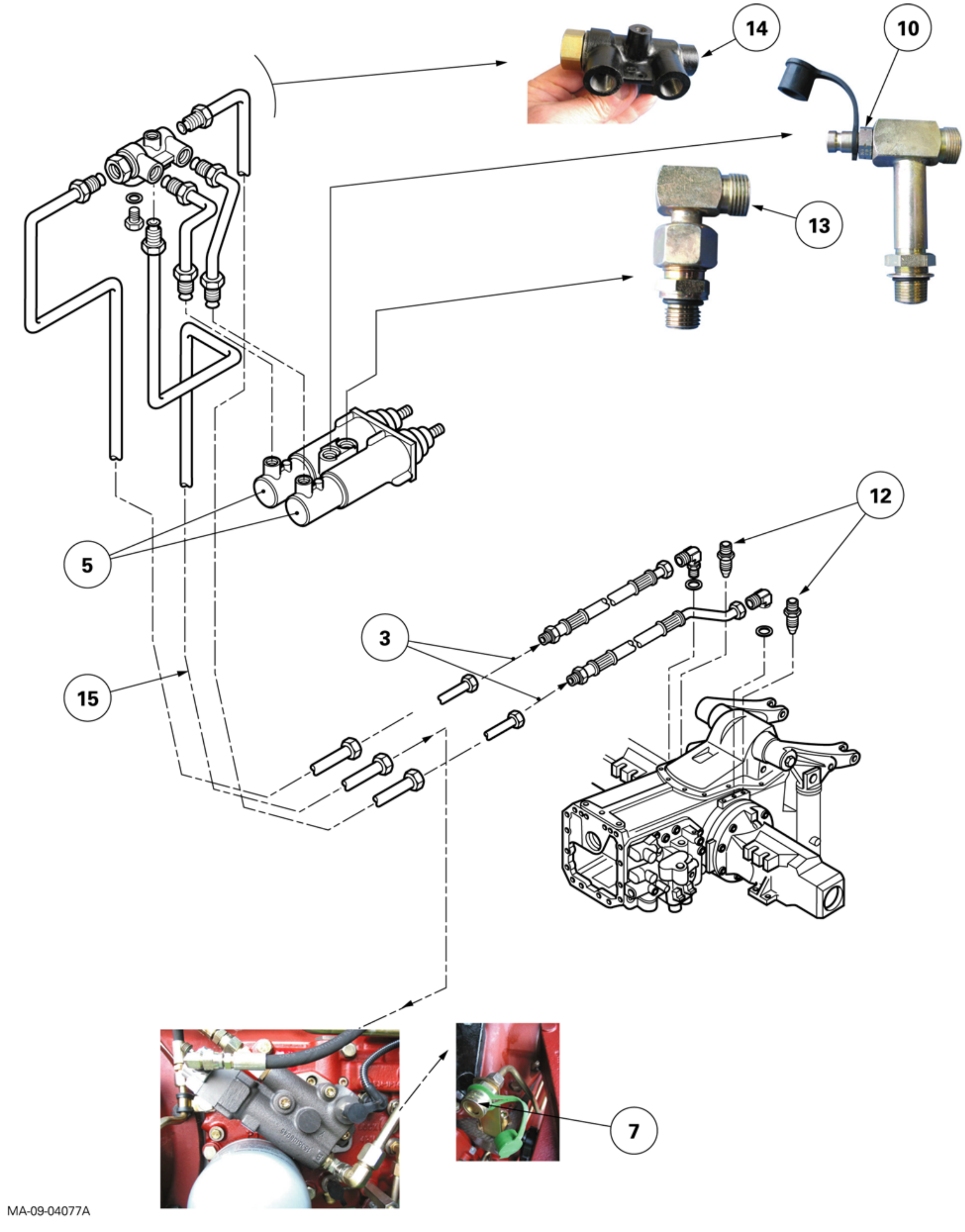


Fig. 6

C . Practical servicing advice

NOTE: *The spare parts catalogue does not include any spare parts to repair MERITOR master cylinders or the FTE valve.*

In case of incorrect operation, systematically replace the faulty assembly.

Special points after replacement

After replacing the brake master cylinders or FTE valve:

- bleed the main brake circuit and trailer brake circuit (if fitted);
- check, if necessary, pedal adjustment and the operation of the brake coupled mode locking device.

D . Brake master cylinders

Operation (Fig. 1 and Fig. 8)

The force applied to the brake pedal is transmitted by rod (2) and moves the spool (3) in the bore of the piston (4).

The oil under pressure coming from the port (A) enters the bores (10) and the groove (12).

The piston (4) is then pushed to the left, compressing the master cylinder oil (8) which is then directed through port (D) to the brake or FTE valve (if fitted).

The screw (7) guides the piston (4) along its movement axis.

Note: *Under no circumstances should this screw (7) be removed.*

When the brake pedal is released, the spool (3) tries to return to its initial position. The oil under pressure thus no longer reaches piston (4) and it therefore likewise returns to its rest position.

The valve (6) allows the pressure between master cylinder (8) and the tank (5) to be balanced only once the piston has returned.

The port (9) allows oil flow in order to maintain a constant level in the master cylinder.

The oil under pressure (17 bar) in chamber B also tends to fill tank (5) by passing through the bore (11).

Port C removes any excess oil and directs it to the tank.

Note: *Under no circumstances should the master cylinders be disassembled: they should be systematically replaced.*

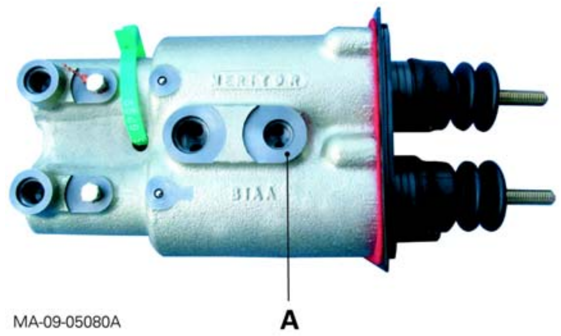


Fig. 7

Assisted brake master cylinders

Parts list (Fig. 8)

(1) Master cylinder assembly
(2) Rod
(3) Spool
(4) Piston
(5) Braking circuit supply tank
(6) Pressure balancing valve
(7) Piston guide screw
(8) Master cylinder capacity
(9) Port
(10) Port
(11) Bore
(12) Groove

A Supply
B Chamber in piston (4)
C To return to housing
D To main brake or FTE valve (if fitted)

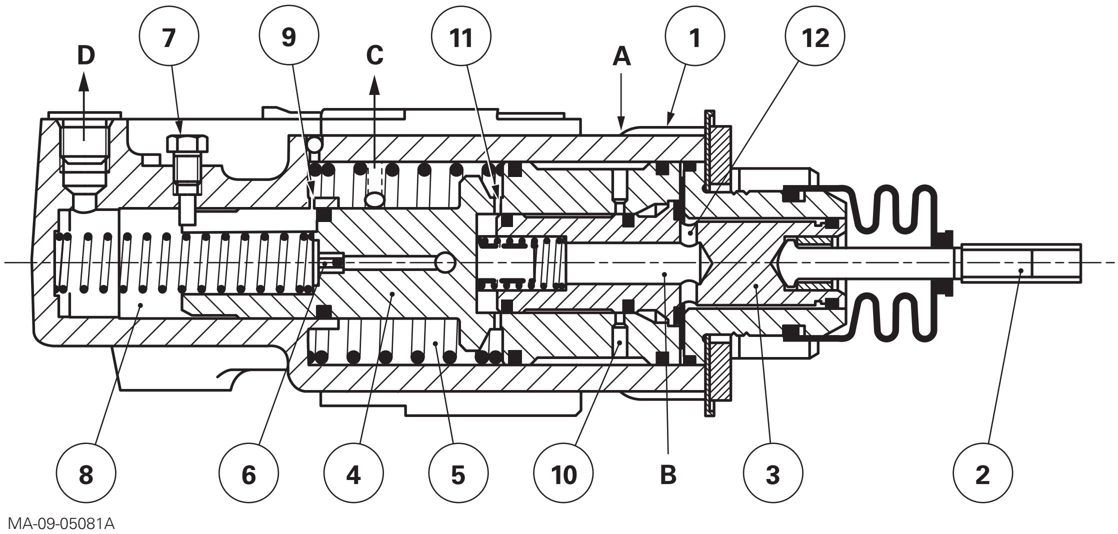


Fig. 8

E . FTE valve

Operation

The FTE valve (14) (Fig. 9) is an essential component of the trailer braking system.

It performs a logical "AND" function, i.e. it allows oil to flow to the braking valve only when both brake pedals are activated at the same time.

If only one brake pedal is pressed, the trailer braking valve is not activated.

Note: *The FTE valve cannot be adjusted.*

Parts list (Fig. 9)

(1) Spool
(2) Ball
(3) Plunger
(4) Spring

A To trailer braking valve
B From right-hand master cylinder
C From left-hand master cylinder
D To right-hand tractor brake
E To left-hand tractor brake

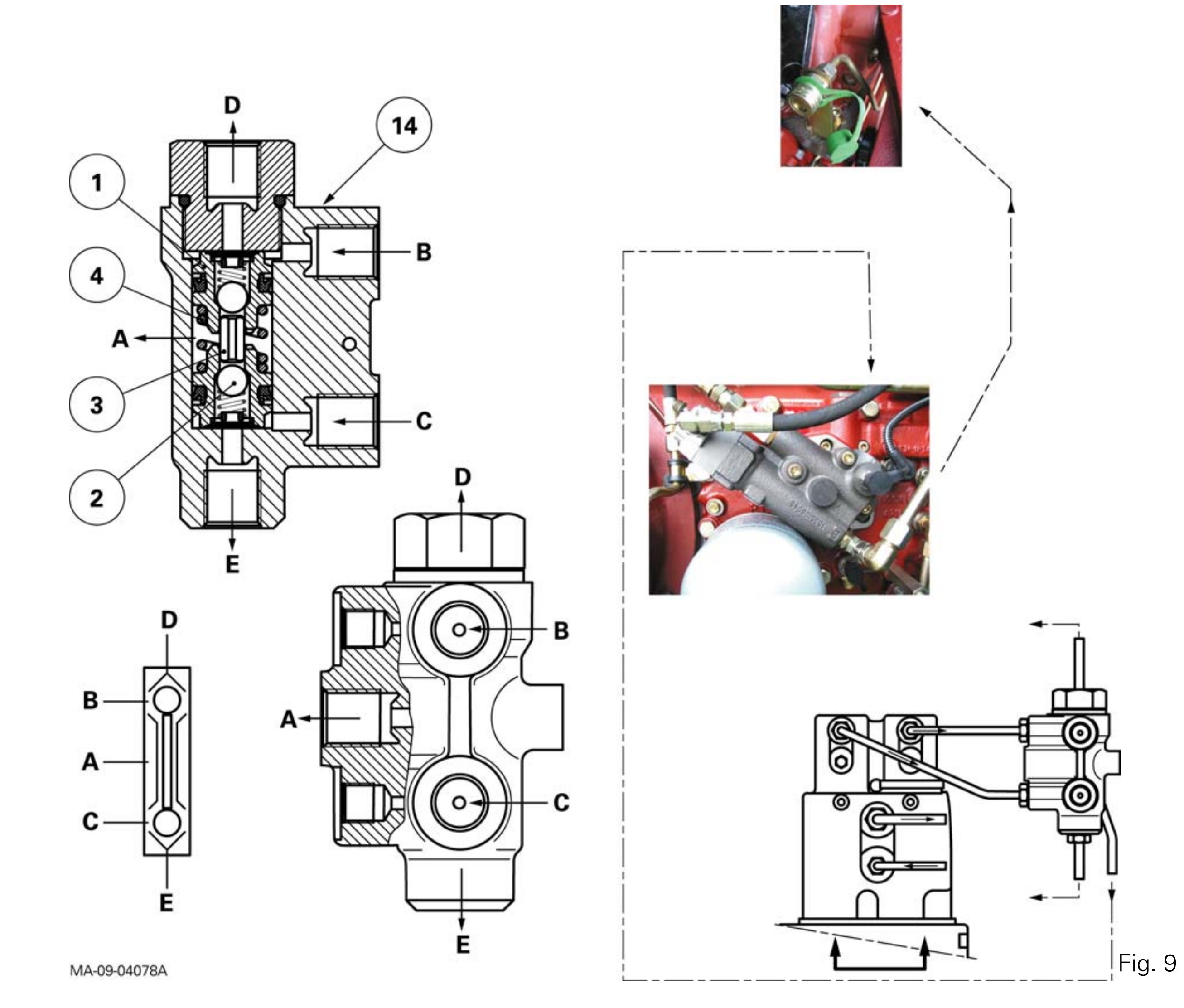


Fig. 9

Pedals uncoupled (Fig. 10)

When force is applied to only one brake pedal, the oil under pressure coming from the master cylinders to the port (B) moves the spool (1) and presses the ball (2) against the spool to block the connection (D) and (A). Therefore, there is only one possible way for oil to flow from (B) to (D).

Pedals coupled (Fig. 11)

When force is applied to both pedals simultaneously, the spools (1) are thrust against each other and compress spring (4). The plunger (3) then forces the balls (2) apart lifting them from their seats in the spool. In this way all the ports are directly connected, i.e. there is a braking pressure supplied to tractor brakes (D) and (E) and to the braking valve (A).

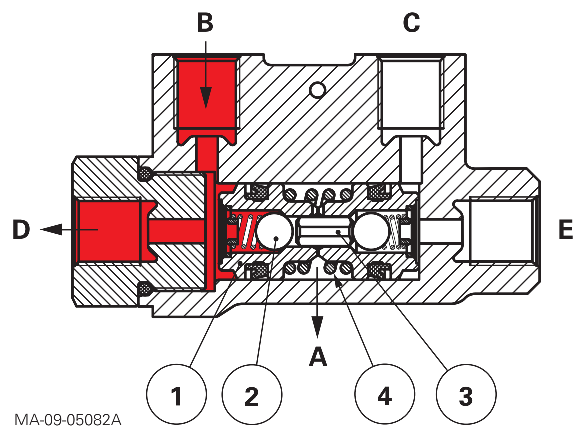


Fig. 10

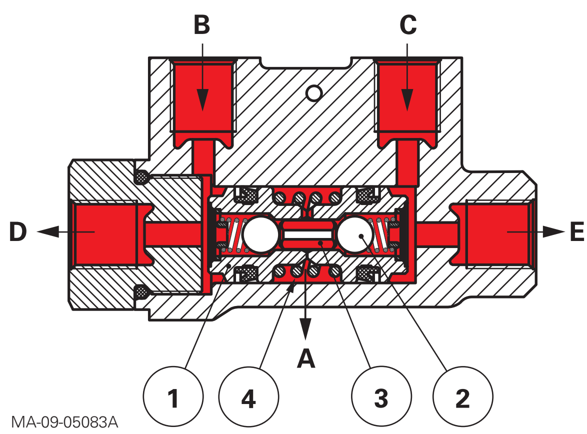


Fig. 11

F . Adjusting brake pedals

Preparing for adjustment (Fig. 12)

1. If the pins (5) and (6) are removed, smear them lightly with molybdenum disulfide or AS767 grease or equivalent.
2. Screw the locknut (8) and clevis (1) onto the rod (2).
3. Fit the return spring (3).

Adjustment

4. Adjust clevis (1) to obtain distance X = 135 ±0.5 mm (Fig. 12) between the support (4) and attachment pin.

   Lock the locknut.
5. Carry out the same procedure on the second clevis and ensure that thethe coupled mode locking device (1) (Fig. 13) operates smoothly.
6. Check pedal for correct operation. Ensure they are at the same height when not activated and that they return freely to their initial position.

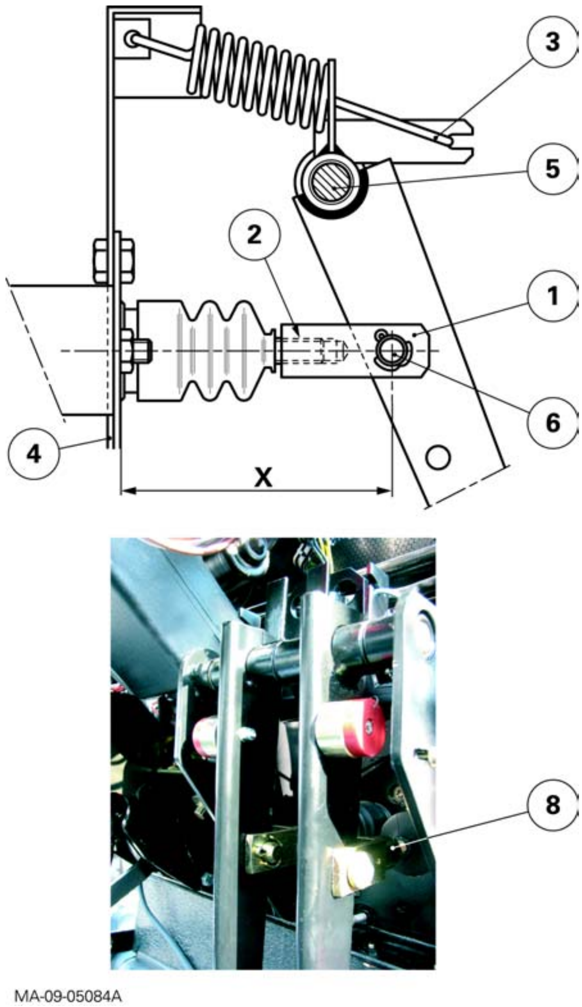


Fig. 12

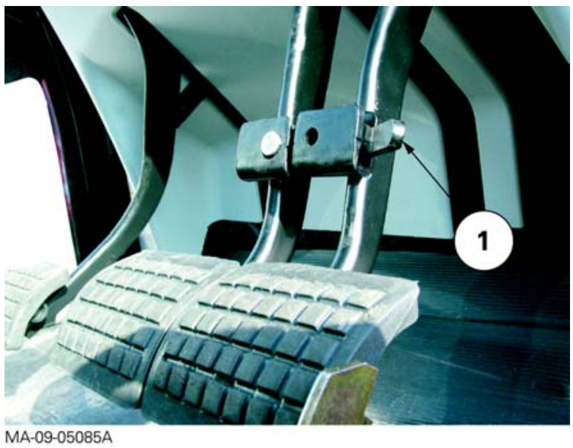


Fig. 13

G . Bleeding the main brake circuit

Right-hand hydraulic cover

A male connector (3) fitted as standard on the booster and lubricating line (5 bar) of the right-hand hydraulic cover (Fig. 14), must be used to facilitate the bleeding under pressure of the brake circuit.

Brake master cylinders

Two types of bleed connector (10) and (11) can be present on the brake master cylinders (Fig. 14).

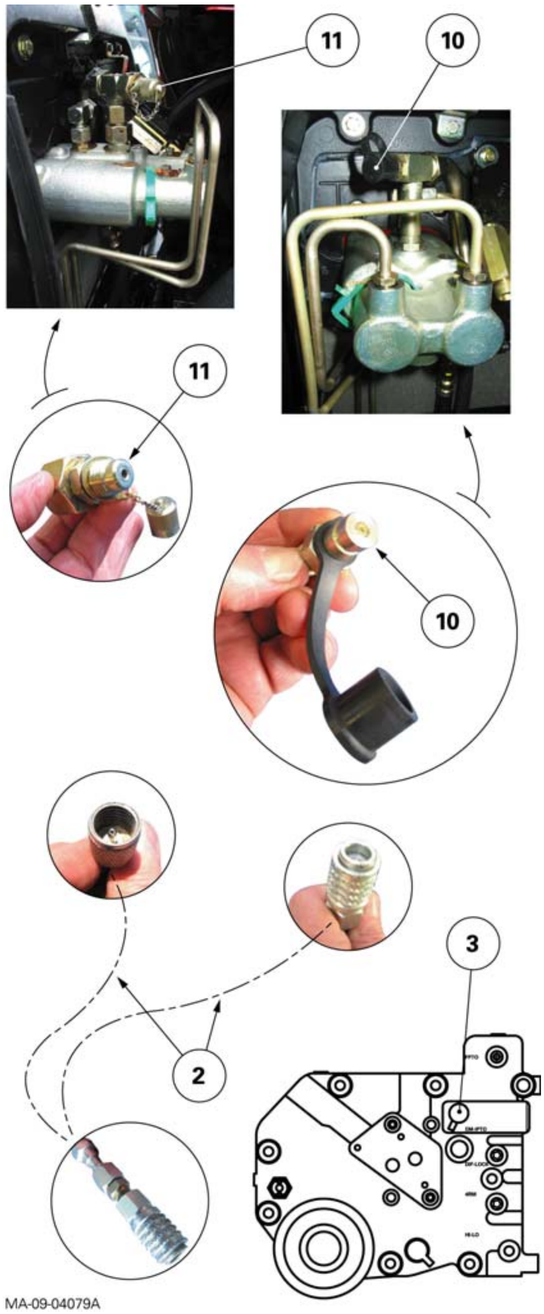


Fig. 14

Installation

7. Locally make a hose (2) for couplers as follows:
- one end must be fitted with a female connector suitable for attachment to the male connector of the brake master cylinders;
- the other end must be fitted with a female connector suitable for attachment to the male connector (3) of the right-hand hydraulic connector (Fig. 14).

8. Connect a transparent pipe to the right- and left-hand bleed screws (1) (Fig. 15) of the centre housing.

9. Dip the ends of the two pipes into the oil filling pipe of the housings.

***NOTE:** Check that the PTO is switched off and take care not to insert the transparent pipes deep into the oil filling pipe.*

10. Locate the return hose (1) of the brake master cylinders and pinch it shut without flattening it excessively (Fig. 16).

***NOTE:** Some hoses may be difficult to pinch shut due to their rigid sheath. Consequently, it is recommended to disconnect the hose from union (10) or (11) (Fig. 14) and temporarily screw a plug in its place.*

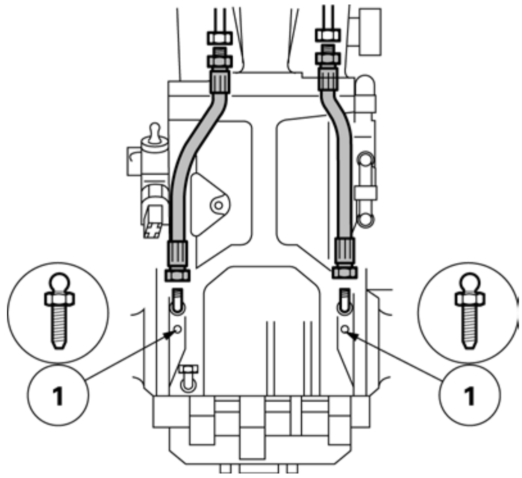


Fig. 15

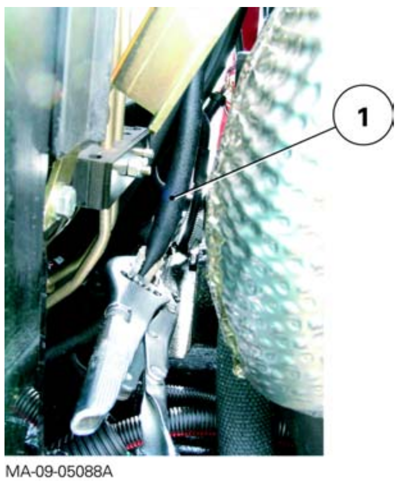


Fig. 16

Bleeding procedure

11. Run the engine at approximately 1300 rpm and heat the oil to operating temperature.

12. Open the two bleed screws by one turn and wait 5 minutes.

- Pedals coupled:

  Fully press down and slowly release the pedals 8 times until the oil flows free of air bubbles.

- Pedals uncoupled:

  Fully press down and slowly release each pedal 8 times until the oil flows free of air bubbles.

- Pedals coupled:

  Fully press down and slowly release the pedals 5 times until the oil flows free of air bubbles.

13. First close the left-hand bleed screw and then the right-hand bleed screw.

14. Press very hard (approximately 60 to 80 kg) on each pedal to correctly position the brake pistons.

15. Check the load strength of each pedal. Coupled pedals should not travel more than 120 mm for the force stated above.

16. Stop the engine.

17. Remove:

- the connector and hose assembly (2) (Fig. 14);
- the pliers clamping the hose (1) (see remark at operation 10).

In case of operating problems

If a there is a problem when operating the brakes, carry out the bleed sequence a second time.

If the problem remains, check tightness of:

- circuit;
- master cylinders;
- piston seals.

H . Bleeding the trailer brake circuit

If the tractor is fitted with an FTE valve (14) (Fig. 17), it is strongly recommended to simultaneously bleed the main brake and trailer brake circuits.

To carry out this bleeding procedure, use the same equipment and methods as described in paragraph G for the bleeding of the main brake circuit while complying with the following additional points:

- Open (Fig. 18):
  - the two screws (1) of the main brakes;
  - the trailer brake screw (2).
- When the bleeding is complete, tighten in the following order (Fig. 18):
  - the left-hand brake bleed screw (1);
  - the right-hand brake bleed screw (1);
  - the trailer brake bleed screw (2).
- Check the trailer braking pressure on the quick disconnect coupling located at the rear of the tractor (see chapter 9).

  If this pressure is not correct, eliminate any air leaks in the circuit and repeat the bleeding procedure.
- Carry out a road test.

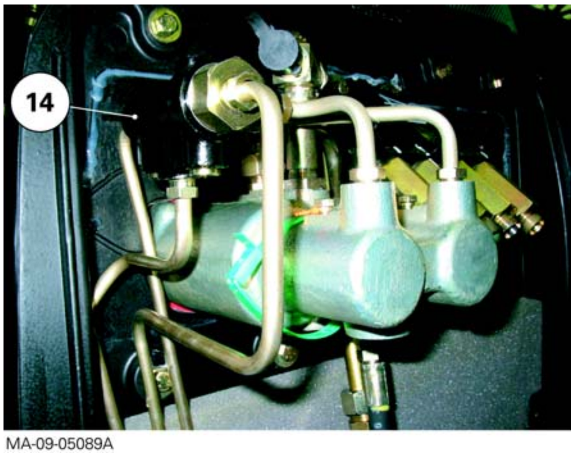


Fig. 17

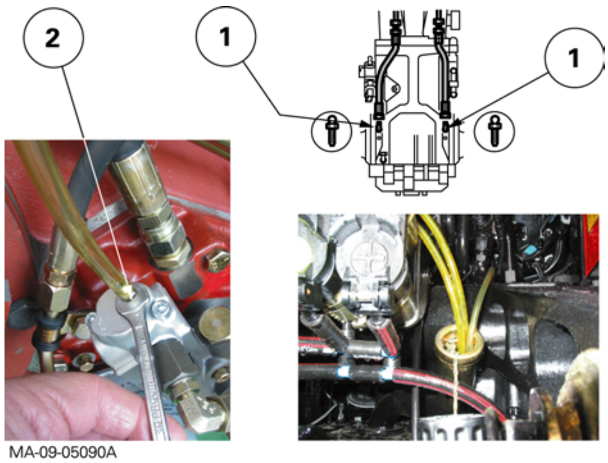


Fig. 18

09J01 - GBA20 Power Shuttle control unit

CONTENTS

A . General

The unit (1) fixed to the right-hand side and front of the gearbox (Fig. 1) carries out two hydraulic functions quite separate to the input unit.

It controls:

- the Power Shuttle,
- Speedshift.

The channels and ducts machined in the unit allow oil under pressure to be directed to the reverse shuttle proportional solenoid valves and the Speedshift solenoid valve EV2.

All solenoid valves are controlled respectively by the tractor electronic system.

A 60 micron filter element (8) (Fig. 1) is located under the right-hand hydraulic cover, upstream of the control unit. This additional filter supplies clean oil to the spool of each solenoid valve.

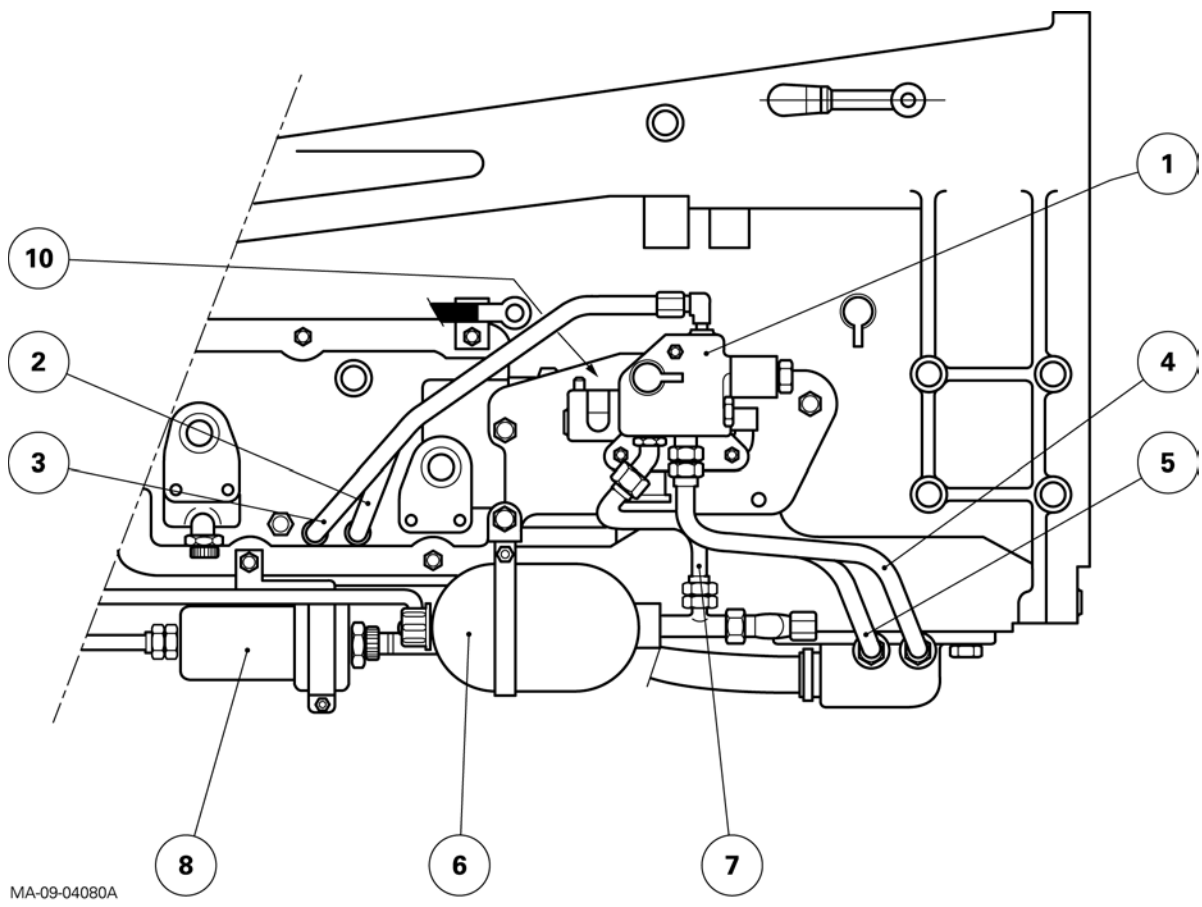


Fig. 1

B . Presentation of control unit and hydraulic lines

Parts list (Fig. 2)

(1) Control unit
(2) Return to reverse clutch housing
(3) Return to forward clutch housing
(4) Reverse shuttle: 17 bar supply line to forward clutch
(5) Reverse shuttle: 17 bar supply line to reverse clutch
(6) Accumulator (Nitrogen)
(7) Main 17 bar supply line
(8) 60 micron filter element
(10) Speedshift: to internal reverse clutch line (17 bar)

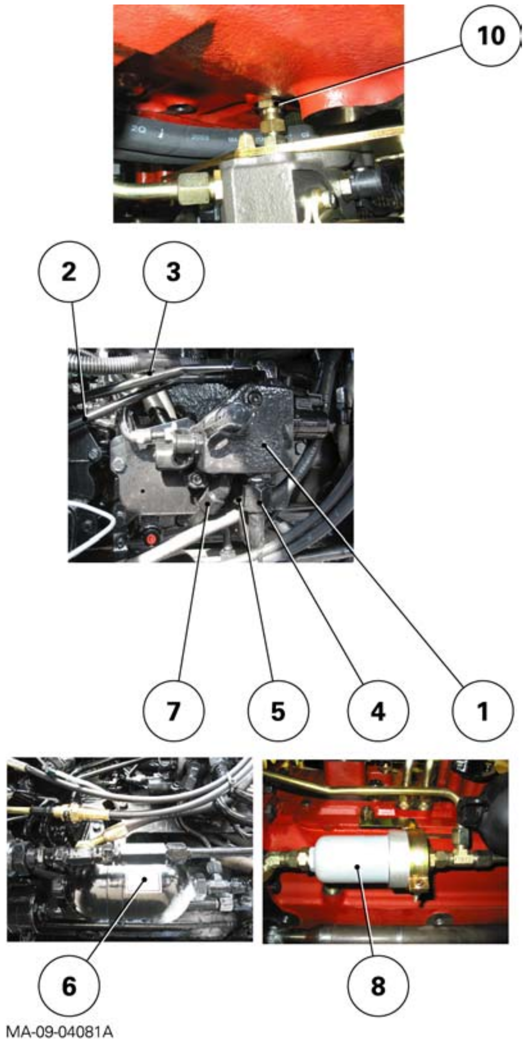


Fig. 2

C . Power Shuttle control

Identification of ports on control unit (Fig. 3).

(1) Control unit
(2) Return to reverse clutch housing
(3) Return to forward clutch housing
(4) Outlet pressure to forward clutch
(5) Outlet pressure to reverse clutch
(7) Control unit main supply (17 bar)
(11) Forward solenoid valve
(12) Reverse solenoid valve
(13) Control unit pressure connector
(14) Reverse clutch pressure connector
(15) Forward clutch pressure connector

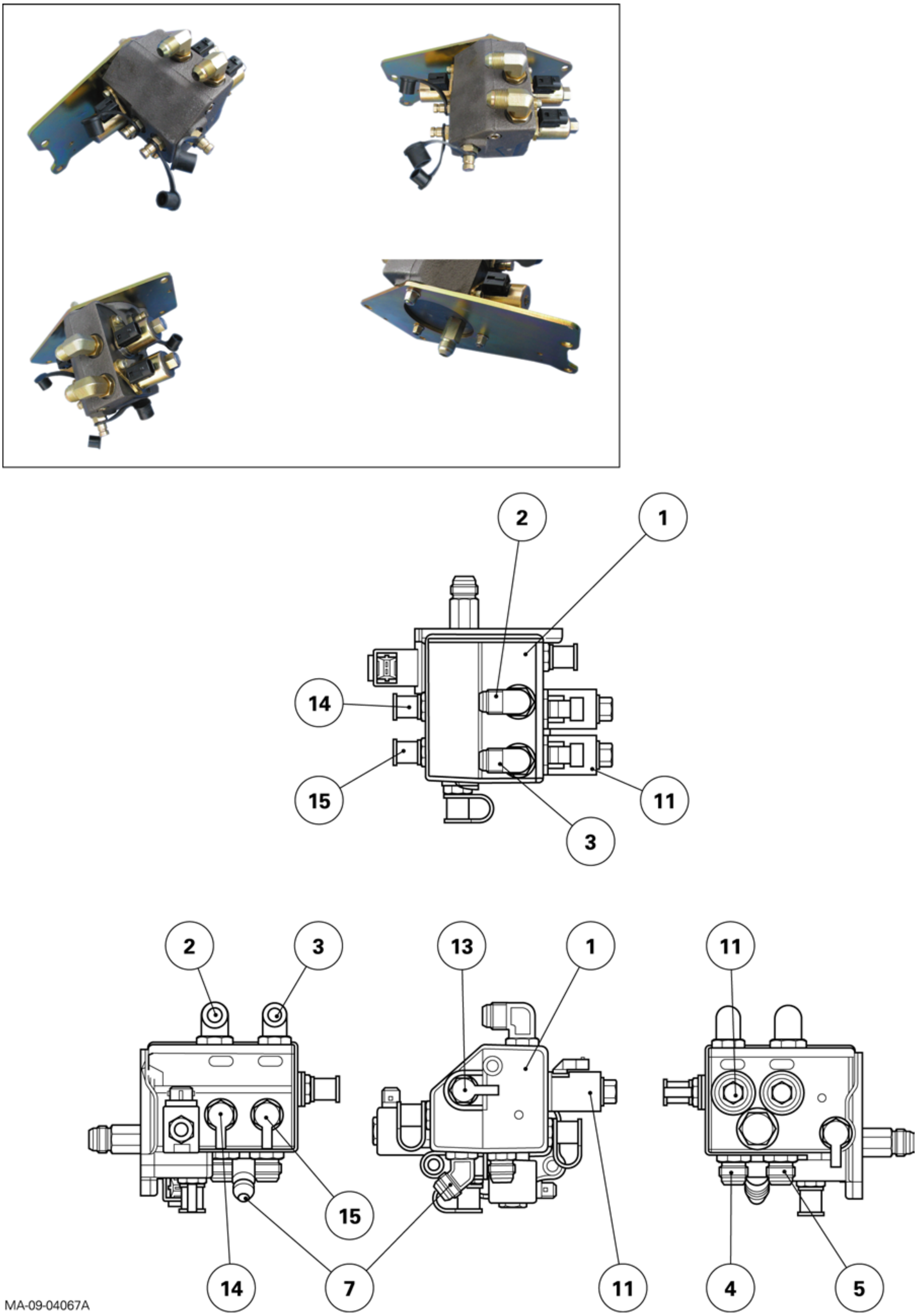


Fig. 3

Proportional solenoid valve

Removal (Fig. 4)

1. Remove flange (1).
2. Drive off the solenoid valve (11) or (12) by gently applying pressure with a screwdriver between the valve and the unit.

Refitting

3. Check the condition and cleanliness of the O'rings fitted on the solenoid valve.
4. Position and manually drive the solenoid valve into its housing, beyond the resistance point (O'rings squeezing).
5. Position the flange.
   Tighten the screw from 8 to 11 Nm.

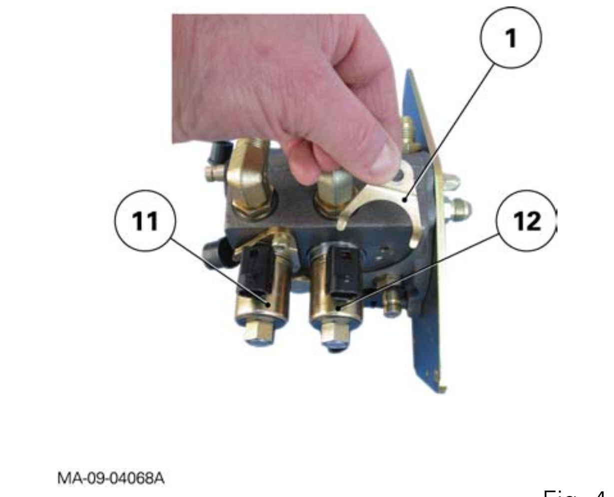


Fig. 4

Identification of ports on a proportional solenoid valve (Fig. 5)

A: Clutch supply ports
B: Clutch return ports
P: 17 bar pressure

Electrical connection (Fig. 5)

C: Solenoid supply

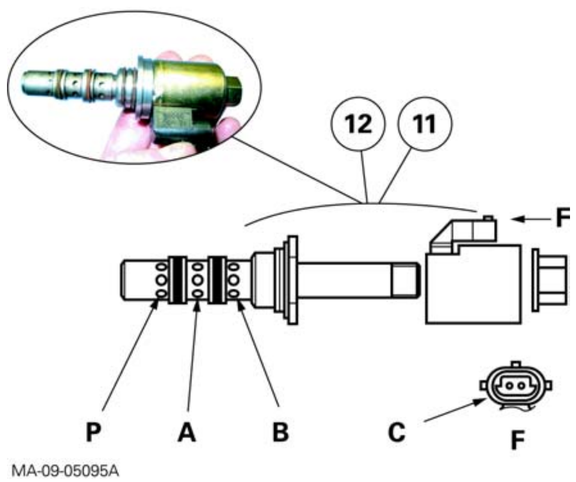


Fig. 5

D . Speedshift control

Identification of ports on control unit (Fig. 7 and Fig. 8)

(1) Control unit
(9) Outlet pressure to forward clutch
(10) Outlet pressure to reverse clutch
(16) Forward clutch pressure connector
(17) Reverse clutch pressure connector

Characteristics of the solenoid valve (Fig. 9)

Solenoid valve	Characteristics
EV2 (3 x 2) solenoid valve	3 ports 2 positions

Identification of ports (Fig. 9)

A To port F
B Non-return valve
F Port to Speedshift pistons
P 17 bar pressure
R Return

Remark

The EV2 solenoid valve removal and refitting procedure is identical to that of a proportional solenoid valve.

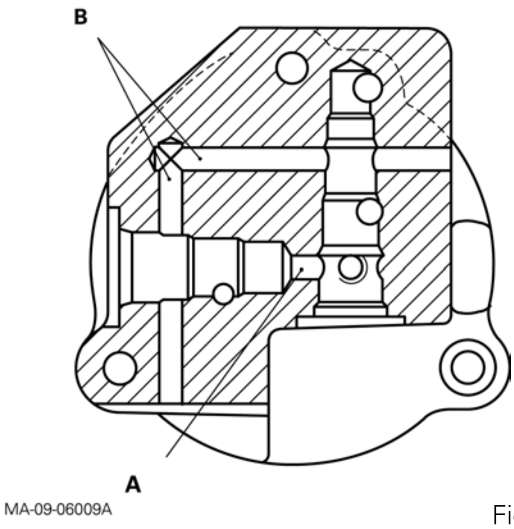


Fig. 6

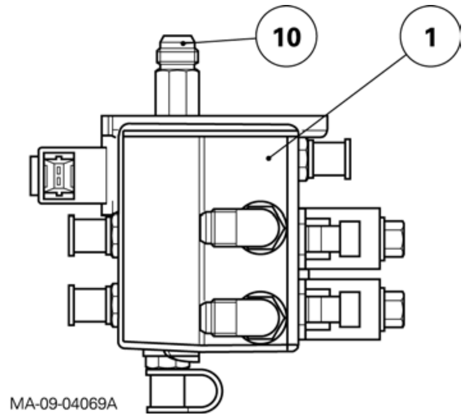


Fig. 7

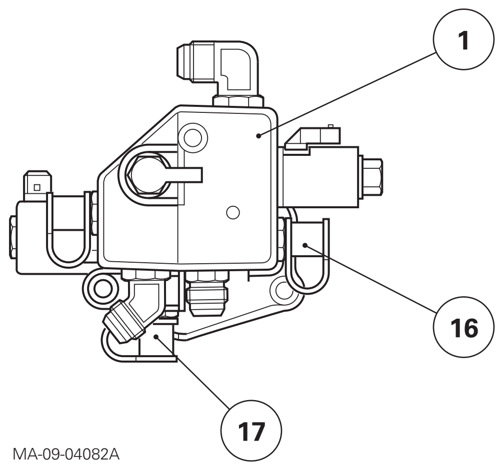


Fig. 8

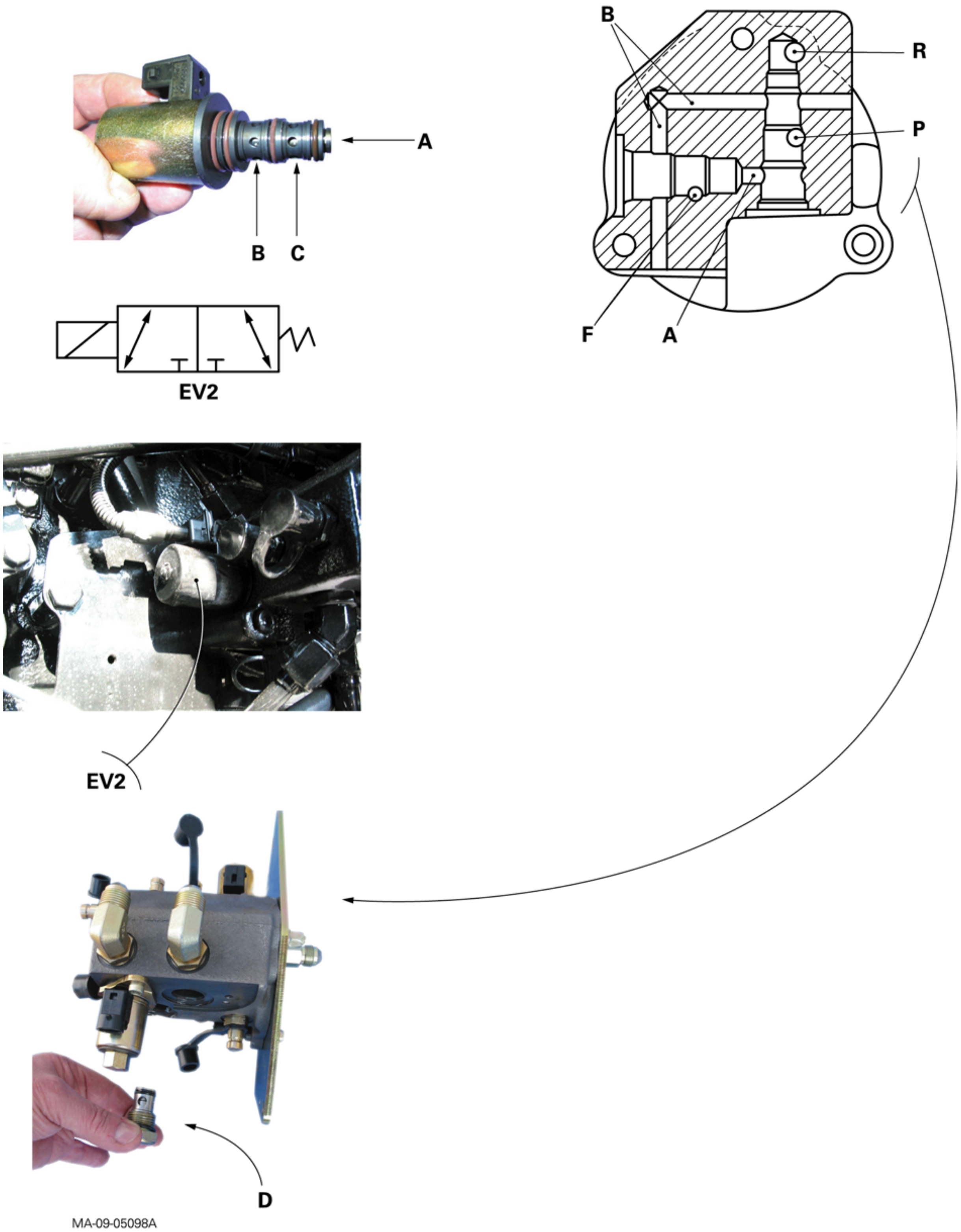


Fig. 9

E . Explanation of Speedshift ratios

Note: *For design operation and mechanical explanation of ratios, see chapter 5.*

Ratio C (Fig. 10)

Ratio C is obtained by switching on the EV2 solenoid valve. The oil flows to the Speedshift pistons via solenoid valve EV2.

Ratio D (Fig. 11)

Ratio D is obtained by switching off EV2. The solenoid valve is at rest. The two pistons are connected to the housing.

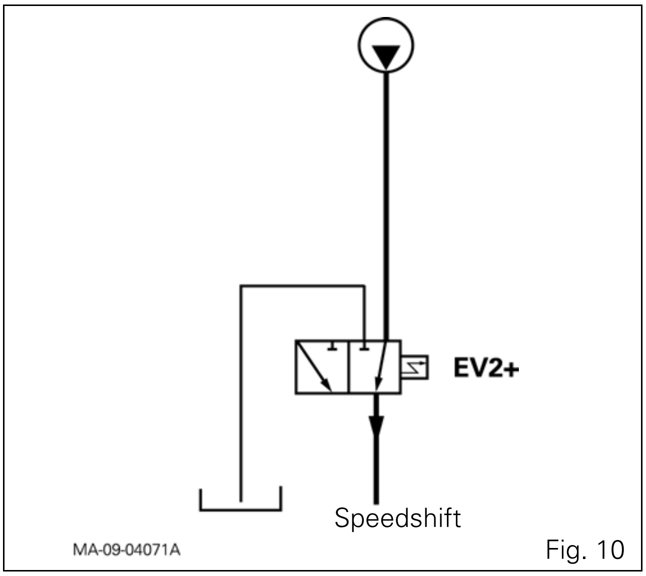


Fig. 10

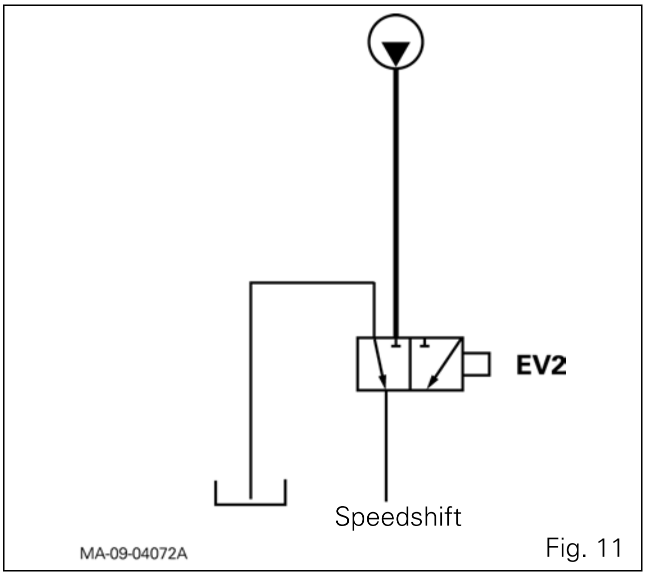


Fig. 11

F . Removing - Refitting the control unit

If you work on the 17 bar hydraulic circuit immediately after stopping the engine, drop the pressure stored in the accumulator or wait a while before working on the circuit.

Removal

6. Mark and disconnect the connector on solenoid valve EV2 of the Speedshift (Fig. 9) as well as those of the proportional solenoid valves (12) (11) of the power shuttle forward and reverse clutches (Fig. 3).

7. Disconnect and remove pipes (2), (3), (4), (5), and (7) (Fig. 12).

Note: *To prevent oil flowing from the gearbox, it is advised to disconnect the return pipes (2) and (3) at their higher connections.*

8. Unscrew the support (1) from the gearbox. Remove the "support and unit" assembly by gradually unscrewing the union (10) (Speedshift clutch supply) (Fig. 12).

Refitting

9. Refit the "support and unit" assembly.

Tighten:

- the screws fixing the support to the gearbox to 50 - 70 Nm,
- the screws fixing the unit to the support to 25 - 35 Nm.

10. Reconnect the pipes and connectors.

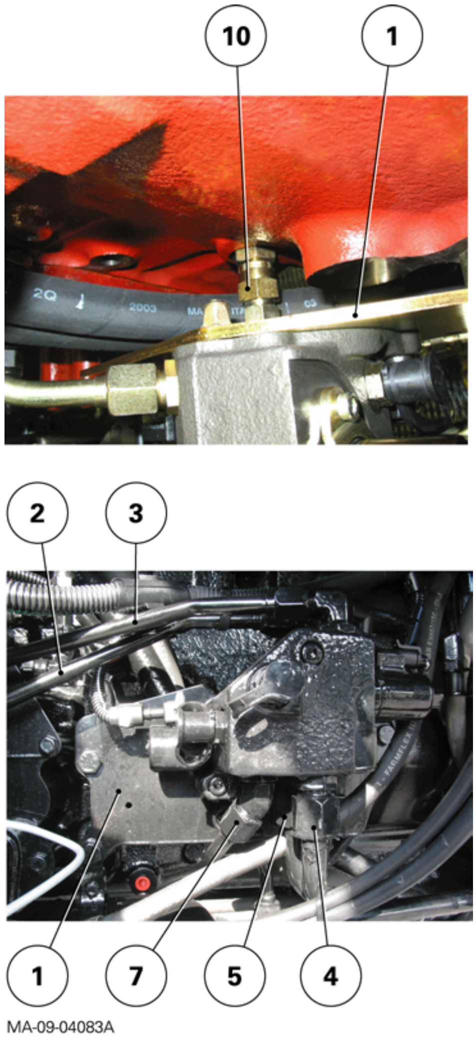


Fig. 12

Reminder

If it was necessary to replace the control unit or proportional solenoid valves, test:

- the 17 bar pressure of the unit,
- the pressure of the Speedshift clutches;
- the pressure of the reverse shuttle forward and reverse clutches.

Important: *When pressurised, the reverse shuttle clutches must be calibrated using Wintest.*

Final operations

11. Carry out a road test of the hydraulic functions affected by the repair work.

12. Check the oil tightness of the hydraulic unions.

09K01 - 57 l/min Open Centre tests

CONTENTS

A . General

The open centre hydraulic circuit comprises two circuits: the low flow rate circuit and the high flow rate circuit.

Preliminary operations

Before starting the checks, run the engine at 2000 rpm to raise the oil temperature to 60 °C (132 °F) minimum.

To make the rise in temperature easier, connect a flowmeter to one of the auxiliary spool valves other than the one supplied by the flow rate divider (if fitted) and limit the flow through the flowmeter.

As soon as the oil temperature exceeds 60 °C (132 °F), release the lever of the auxiliary spool valve and open the flowmeter valve to the maximum.

To carry out the tests indicated in this section, the use of the following equipment, available in the AGCO network, is recommended:

- **MF 3001**: Pressure gauge kit;
- **MF 3016**: 4 - 160 l/min (0.9 - 36 Gal/min) turbine flowmeter kit, or standard MF 3003 flowmeter;
- **MF 3017**: Pipe assembly for MF 3016 flowmeter;
- **3582045M1**: Female diagnostics coupler.

If the above is not available, use equivalent equipment.

IMPORTANT: *In all cases, ensure the direction of oil flow is correct in order to avoid any damage to the flowmeter.*

Also choose pressure gauges, pipes and unions of sufficient capacity and strength for the tests to be carried out.

B . High flow rate circuit

Safety valve test

- Connect a pressure gauge with a coupler ref. 3582045M1 to the diagnostics connector (1) (Fig. 1).

  This diagnostics connector is located:
  - either on the trailer braking valve (if fitted);
  - or on the closing plate (2) fitted to the right-hand hydraulic cover.
- Run the engine at 2200 rpm.
- Activate an auxiliary spool valve to open the valve.
- Check **P1 = 195 ± 5 bar**.

  If pressure P1 is not correct, adjust the safety valve using shim(s) (see chapter 9).
- At 1000 rpm, the pressure should not drop.

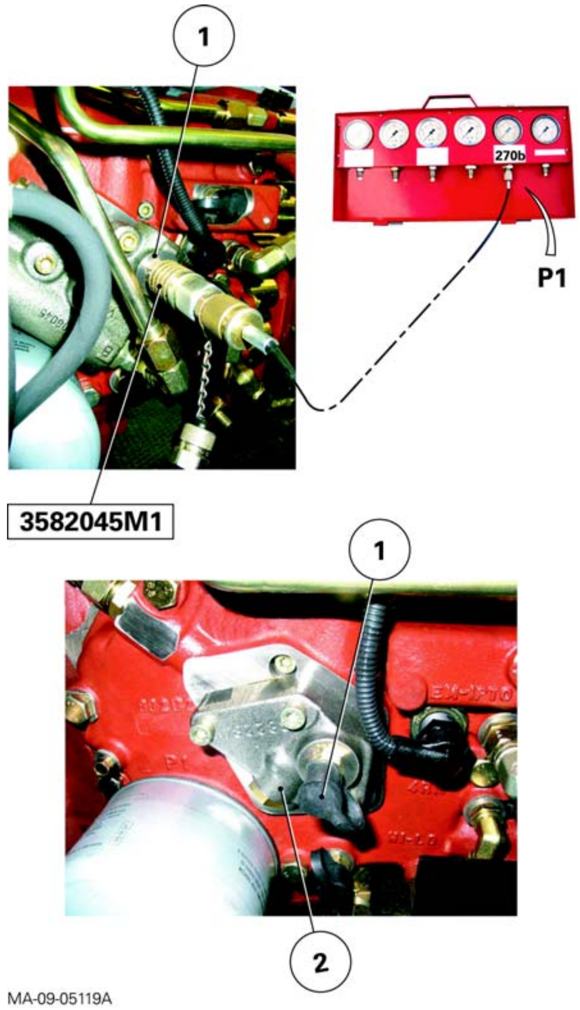


Fig. 1

Checking the flow rate of the pump (Fig. 2)

- Connect a flowmeter to the quick-disconnect coupling of an auxiliary spool valve other than the one supplied by the flow divider.

  Connect the return directly to the housing via the transmission filler port.
- Connect a suitable pressure gauge to the diagnostics connector (1) (Fig. 1).

  IMPORTANT: *Check that the flowmeter load valve is open fully.*
- Activate the spool valve.
- Adjust the flowmeter load valve to obtain **P1**.

  NOTE: *Do not consider the value of the pressure gauge fitted to the flowmeter. Look at the separate pressure gauge connected to the diagnostics connector (1) (Fig. 1).*
- Check **Q1**.

Engine speed (rpm)	P1 (bar)	Q1 (l/min)
1000	0	30,0 ± 2
1000	100	28,0 ± 2
2200	0	55,5 ± 2
2200	100	52,2 ± 2

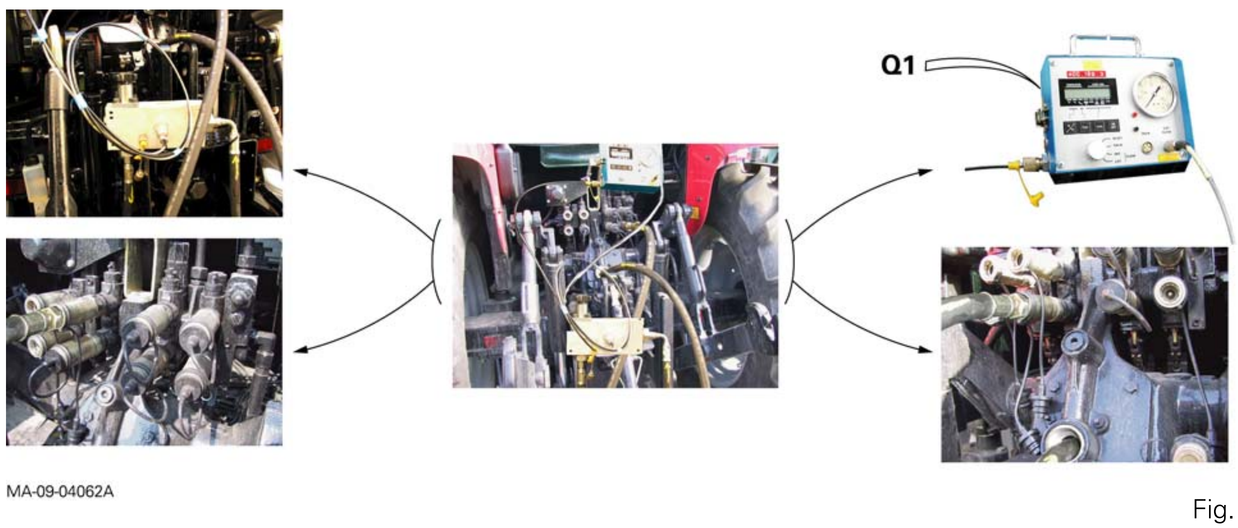


Fig. 2

Testing the flow divider (if fitted)

- Connect a flowmeter to a quick-disconnect coupling on auxiliary spool valve no.1 located by flow divider "D" (Fig. 3).

  Connect the return directly to the housing via the transmission filler port.
- Connect a suitable pressure gauge to the diagnostics connector (1) (Fig. 1).

  IMPORTANT: *Check that the flowmeter load valve is open fully.*
- Activate the spool valve.
- Adjust the flowmeter load valve to obtain **P1**.
- Check the flow rate of the divider by turning the adjusting knob shown (Fig. 3).
- Check **Q2**.

Engine speed (rpm)	P1 (bar)	Q2 (l/min)
2200	0 to 150	0 to 53

NOTE: *Do not consider the value of the pressure gauge fitted to the flowmeter. Look at the separate pressure gauge connected to the diagnostics connector (1) (Fig. 1).*

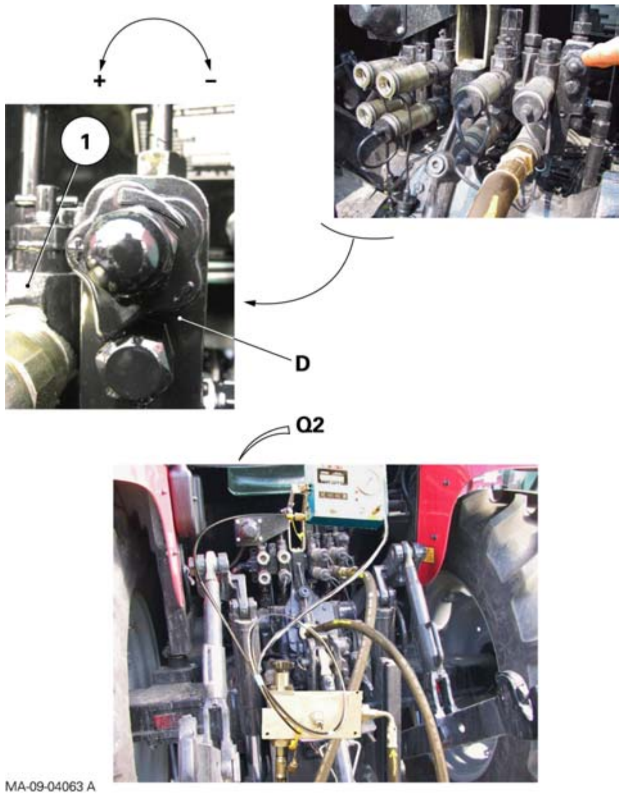


Fig. 3

Checking kick-out pressure on an auxiliary spool valve fitted with automatic return to neutral

- Connect a flowmeter to the relevant spool valve (no.3 for example) (Fig. 4).
- Connect a suitable pressure gauge to the diagnostics connector (1) (Fig. 1).
- Run the engine at 2200 rpm.
- Activate the spool valve in automatic return position. Release the lever and gradually shut the flowmeter load valve until the lever returns to neutral position.
- Check the kick-out pressure:

  P1 = 150 - 170 bar.

  IMPORTANT: *Make sure that the spool valve is in the automatic return position and not in the floating position.*

  NOTE: *Do not consider the value of the pressure gauge fitted to the flowmeter. Look at the separate pressure gauge connected to connector (1) (Fig. 1).*

High flow rate

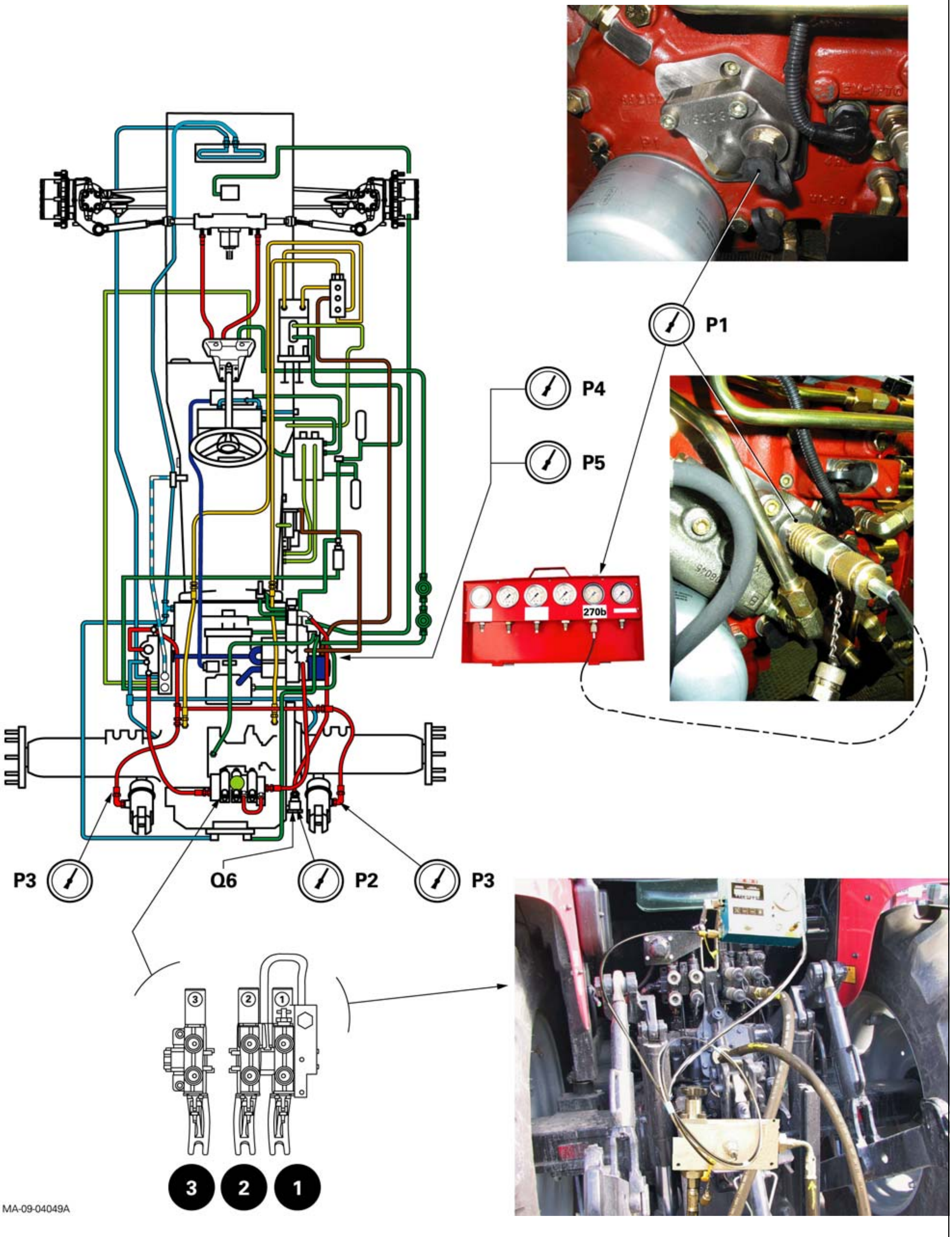


Fig. 4

Checking the pressure and flow rate of the trailer brake

Pressure

- Connect a pressure gauge to the trailer brake connector (1) (Fig. 5).
- Run the engine at 2200 rpm.
- Latch the brake pedals and apply a progressive force. The pressure read should increase gradually until it reaches **P2 = 130 - 150 bar maximum** (Fig. 4).

Flow rate

- Connect a pressure gauge to the trailer brake connector (1) (Fig. 5).
  Connect the return directly to the housing via the transmission filler port.
- Run the engine at 2200 rpm.
- Activate the latched brake pedals.
- Check **Q6 = 24 - 31 l/min** (Fig. 4).

Checking the lift control shock valve (1) (Fig. 6)

- Disconnect the supply hose pipes on the rams and connect them to a hand calibrating pump.
- With the engine stopped and the lift control valve in neutral position, inject pressure into the circuit.
- Check the valve opening pressure:
  P3 = 200 - 210 bar (Fig. 4).

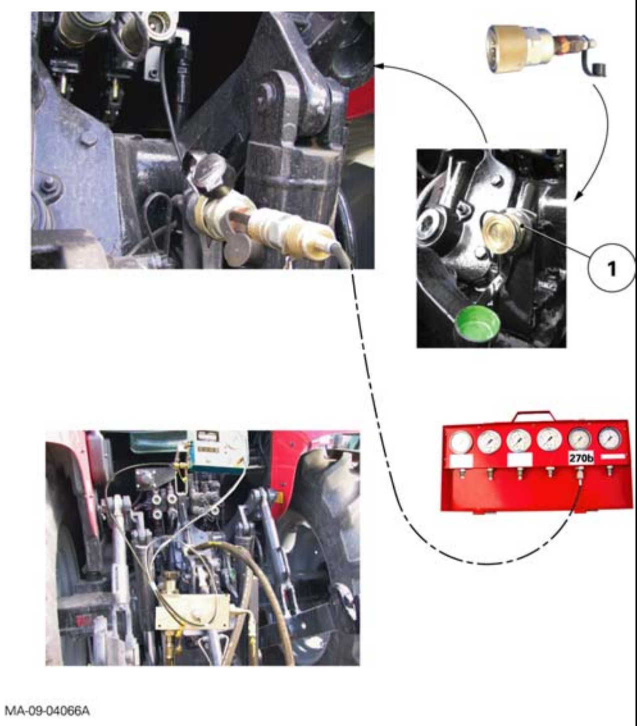


Fig. 5

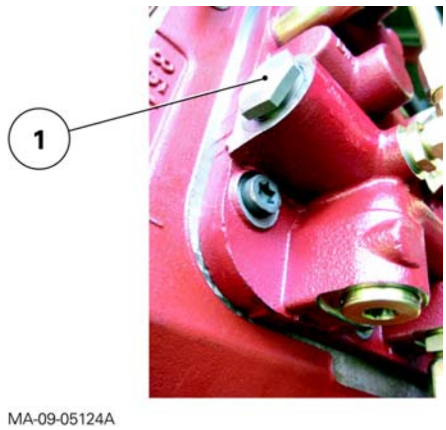


Fig. 6

C . Low flow rate circuit

The low flow rate circuit supplies:

- the steering spool valve;
- the Power Shuttle;
- the Speedshift and its control;
- the power shuttle hydraulic control block;
- the Hare / Tortoise unit located at the rear right-hand side of the gearbox;
- the 4WD unit located in the lower part of the centre housing;
- the front and rear differential locks;
- the PTO clutch located at the front of the centre housing;
- the PTO brake located in the top cover at the back of the centre housing.

An additional function ensures the lubrication of mechanical components and maintains the oil level in the brake master cylinders (except Meritor).

57 l/min Open Centre tests

Checking the flow rate of the pump

CAUTION : When carrying out tests, the rear axle must not be placed on chocks with the front axle (4WD) engaged.

- Connect a flowmeter between the 15 micron filter(s) (1) outlet located to the front right-hand side of the rear axle, and the supply pipe (2) to the Orbitrol spool valve (Fig. 7).

  IMPORTANT: *Check that the flowmeter load valve remains fully open throughout the test.*
- Also connect a pressure gauge to the low pressure diagnostics connector (1) screwed to the top of the right-hand hydraulic cover, at the front (Fig. 8).
- Check**Q3**.

Engine speed (rpm)	P4 (bar)	Q3 (l/min)	Correct position
1000	18 ± 1	16,0 ± 1	steering at neutral
2200	18 ± 1	32,7 ± 2	steering at neutral

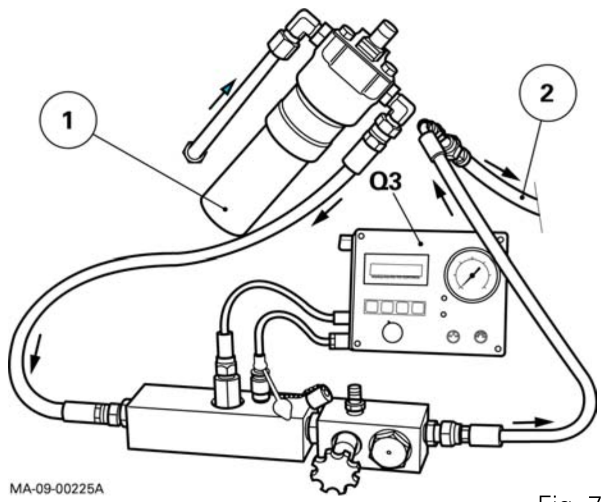


Fig. 7

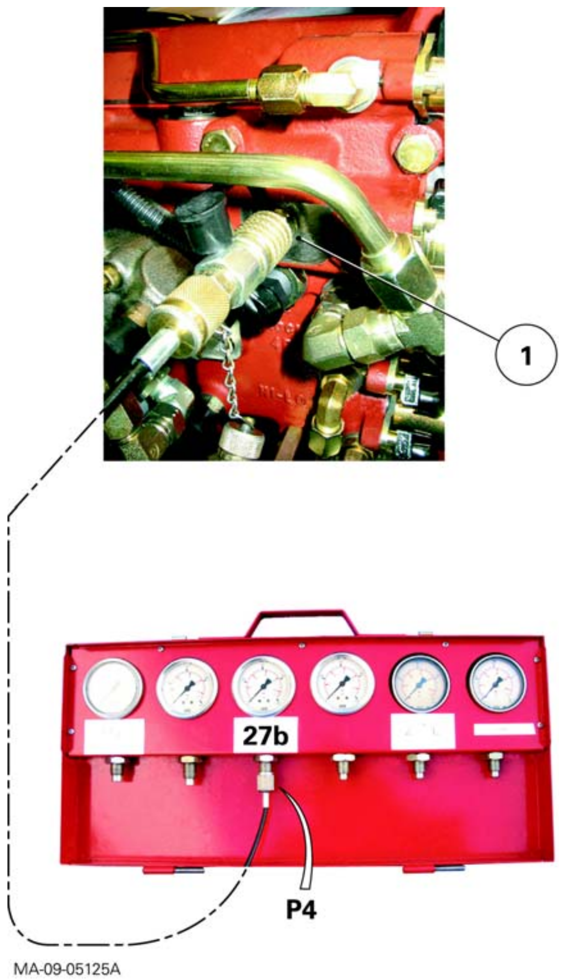


Fig. 8

Checking for leaks at clutch and slave devices

To adjust reference flow rate Q4:

- all low pressure functions should be at neutral;
- the front axle should be engaged (clutch not supplied, indicator light on);
- the range lever should be in Tortoise position (icon);
- the reverse shuttle control should be in neutral position (letter N on instrument panel);
- Speedshift should be in D range;
- the differential lock should be disengaged (indicator light on);
- the power take-off should be disengaged (indicator light out).

Check (Fig. 9 or Fig. 10)

The flowmeter can be connected:

- either to the cooler outlet (Fig. 9);
- or where the pipe joins the hoses on the right-hand side of the tractor (Fig. 10).
- The flowmeter should be connect using locally made unions.
- Connect the flowmeter as is convenient (see previous remark).

  Important: *Check that the flowmeter load valve remains fully open throughout the test.*
- Connect a pressure gauge set to approximately 30 bar to the low pressure connector (1) (Fig. 8).
- Note the **Q4** reference flow rate at 1000 rpm.
- Activate each function separately and note the **Q5** flow rate.
- The difference **Q4 - Q5** represents the leak detected.

  The value read should not exceed the values indicated in the "Identifying leaks at clutch and slave devices" *table* below.

  Examples of the test on the clutch and PTO.
  - Example 1

    Q4 = 15 l/min Q5 = 14.5 l/min

    leak detected = 0.5 l/min

    Conclusion: Test OK
  - Example 2

    Q4 = 15 l/min Q5 = 13 l/min

    leak detected = 2 l/min

    Conclusion: Leak exceeds allowable value

- Before checking the following function and to avoid misreading the Q5 flow rate, bring the control of that element back to the neutral position or to the above neutral positions.

Note: *When all clutch and slave devices are activated, the low pressure* ***P4*** *should remain at* ***18 ± 1 bar****.*

The leaks in the single control systems can be detected according to the values in the table.

Note: *For the differential lock function, an additional test is necessary to determine the difference between the front and rear.*

Checking method

- *Disconnect and block one of the piston supplies.*
- *Check if the leak persists.*

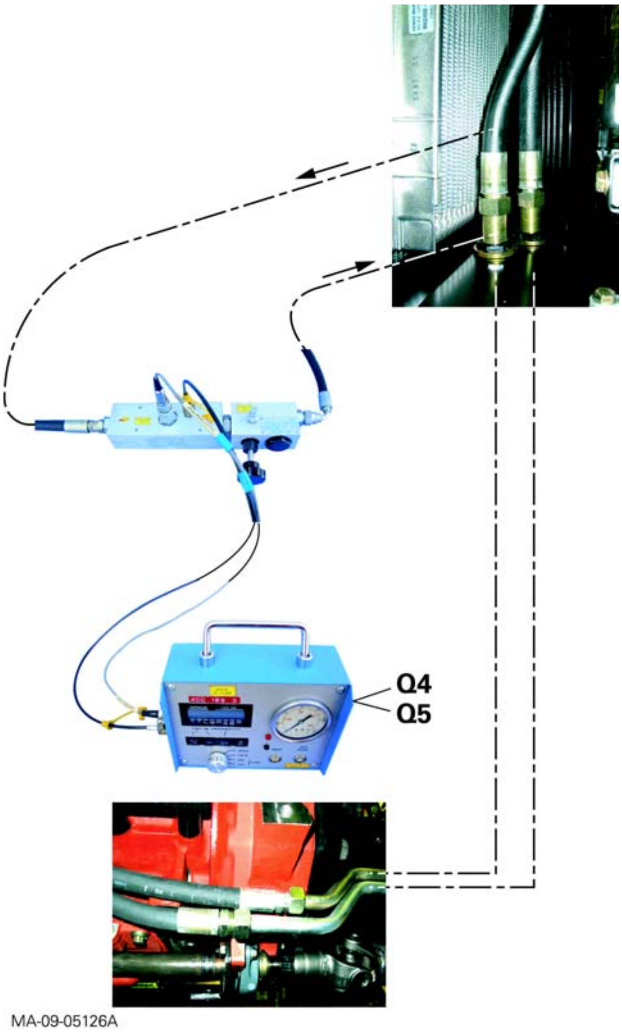


Fig. 9

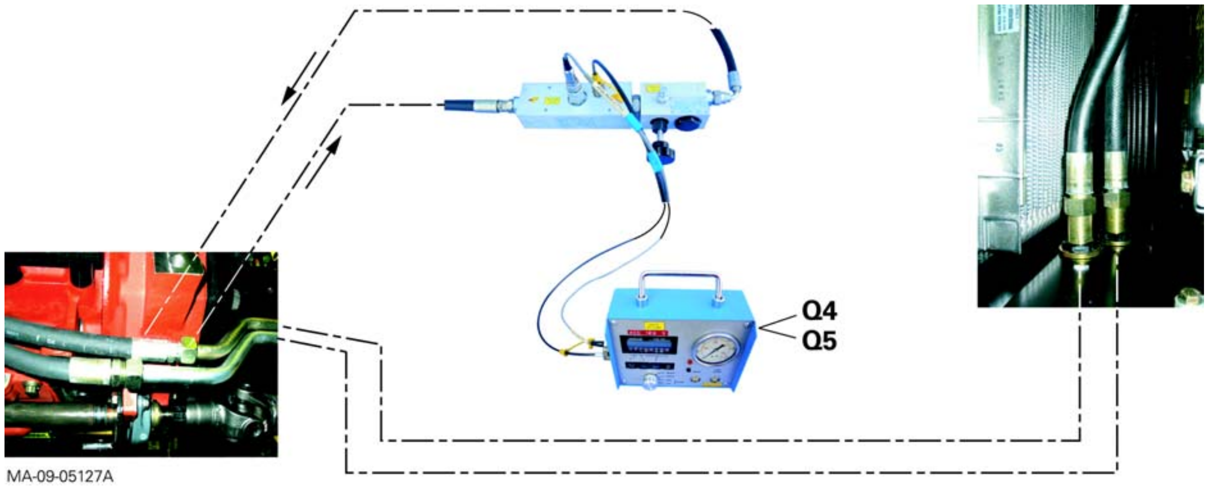


Fig. 10

	Control unit Power shuttle Forward clutch	**Control unit Power shuttle** Reverse clutch	**Speedshift**
Reference flow rate **Q4**			
Measured flow rate **Q5**			
Detected leak (l/min) **Q4 - Q5**			
Maximum allowable leak (l/min)	1,5	1,5	2
Pressure **P4** (bar)	18 ± 1		

	Hare range	**Power take-off clutch**	**Power take-off brake**	**Differential lock** Front	**Differential lock** Rear	**4WD clutch (front axle)**	**Front power take-off** *optional*
Reference flow rate **Q4**							
Measured flow rate **Q5**							
Detected leak (l/min) **Q4-Q5**							
Maximum allowable leak (l/min)	0,5	1,5	2	0,5	0,5	1,5	1,5
Pressure **P4** (bar)	18 ± 1						

Identifying leaks at clutch and slave devices

Supply to the steering spool valve

- Connect a pressure gauge fitted with a coupler ref. 3582045M1 to the diagnostics connector (1) of the right-hand hydraulic cover (Fig. 11).
- Turn the steering to full lock and check that:
  P5 = 170 bar at 1000 rpm and at 2200 rpm.

Supply to the steering ram

Test (Fig. 12)

- Connect a pressure gauge by-pass to each hose pipe of the steering ram.
- With steering at neutral, check that **P6 = 18 bar**.
- Turn the steering wheel.
  Pressure P6 should be:
  - **between 18 and 170 bar** at the ram supply side ;
  - **18 bar** in the return line.

Steering circuit leak test

- Run the engine at 1000 rpm.
- Turn the steering on full lock and apply a torque of 4 Nm to the axis of the steering wheel. The wheel must not turn more than 2 rpm.
  If the wheel turns more than 2 rpm, disconnect the pipes that supply the rams, block the two ports and then apply the same torque (4 Nm) to the steering wheel. If it turns less than 2 rpm, there is a leak at the level of the ram.

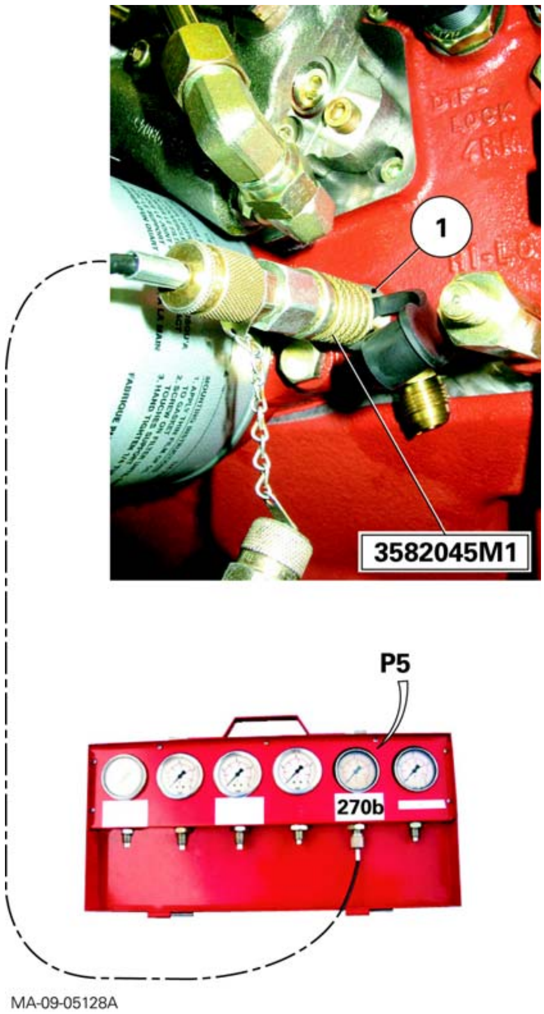


Fig. 11

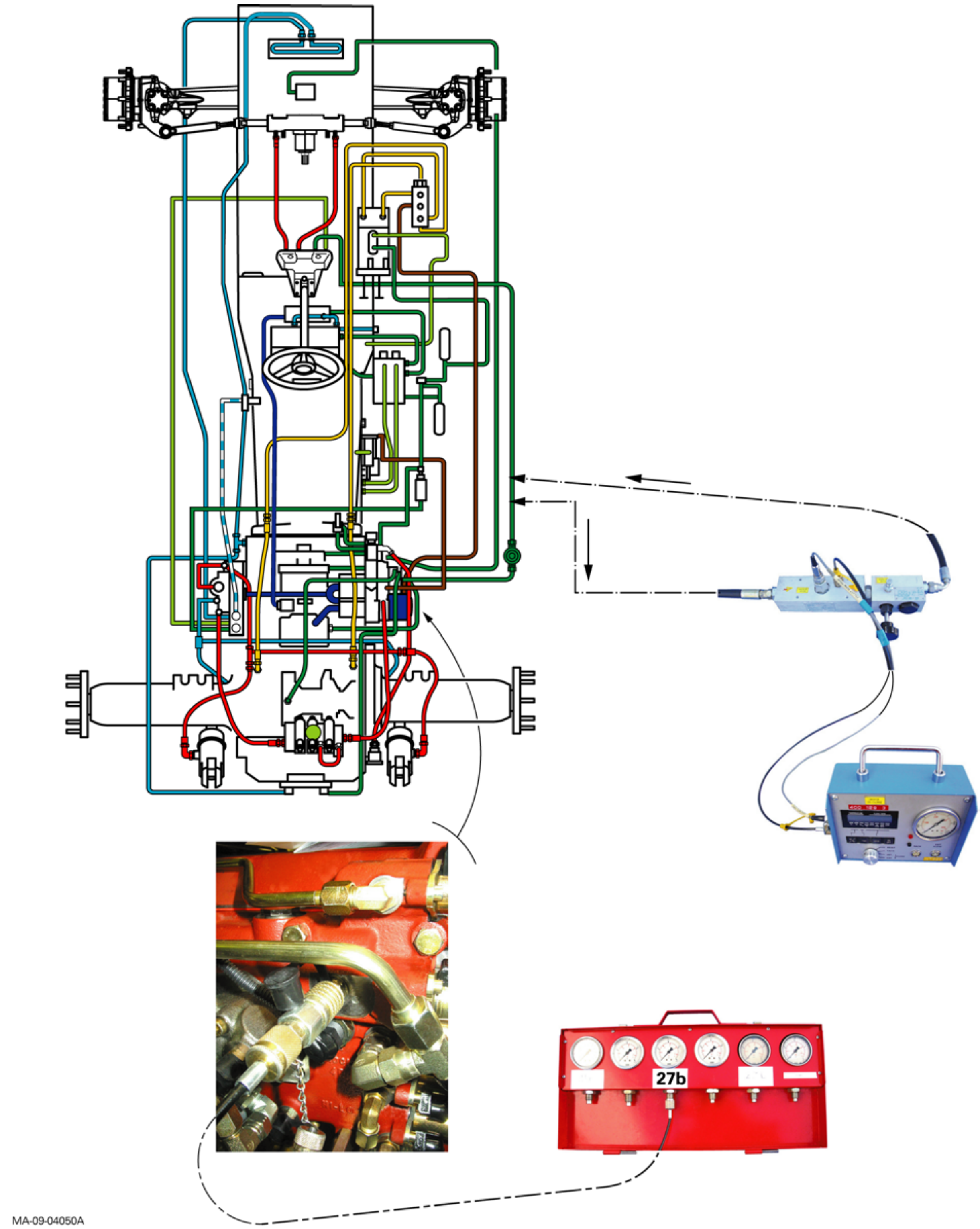


Fig. 12

Checking the supply pressure of the Power Shuttle control unit

- Connect a pressure gauge with a capacity of aapproximately 30 bar to the diagnostics connector (1) of the control unit located at the front right of the gearbox (Fig. 13).
- Check **P7**.

Engine speed (rpm)	P7 (bar)
1000	18 ± 1
2200	18 ± 1

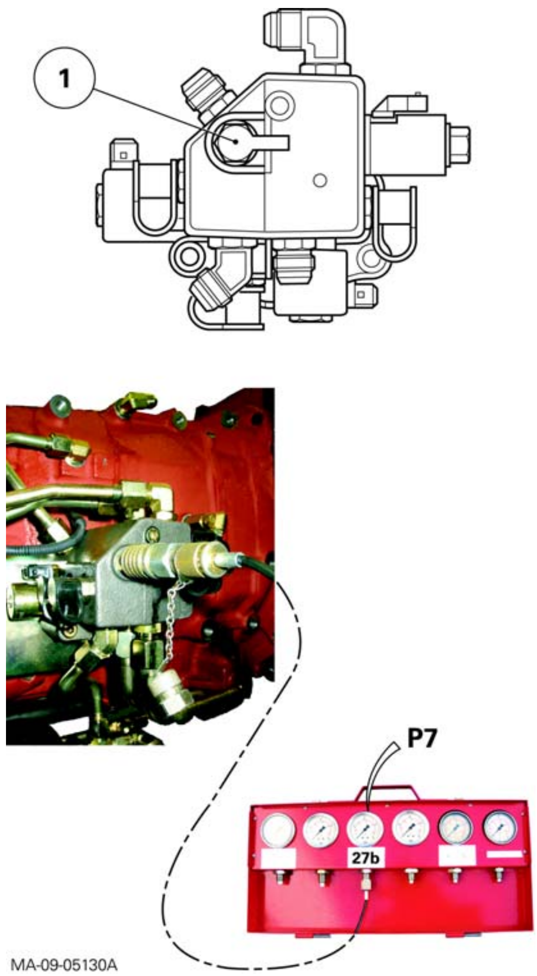


Fig. 13

Checking the (forward and reverse) clutch pressure of the Power Shuttle

CAUTION: To keep the tractor stationary, ensure that the gear lever is in neutral.

- The diagnostics connectors (1) (forward) and (2) (reverse) of the Power Shuttle clutches are on the control unit fitted to the front right of the gearbox (Fig. 14).
- The control lever of the Power Shuttle is located to the left beneath the steering wheel:
- lever upwards: forward position (the letter F is displayed on the instrument panel);
- lever downwards: reverse position (the letter R is displayed on the instrument panel);

Test (Fig. 14)

- Connect a pressure gauge with a capacity of approximately 30 bar to each diagnostics connector (1) and (2).
- Run the engine at 1000 rpm.
- Activate the lever to select the direction (forward / reverse) and the neutral position.
- Check **P8** and **P9**.

Position of lever	Forward clutch (1) P8 (bar)	Reverse clutch (2) P9 (bar)
Forward	18 ± 1	0
Neutral or declutche d	0	0
Reverse	0	18 ± 1

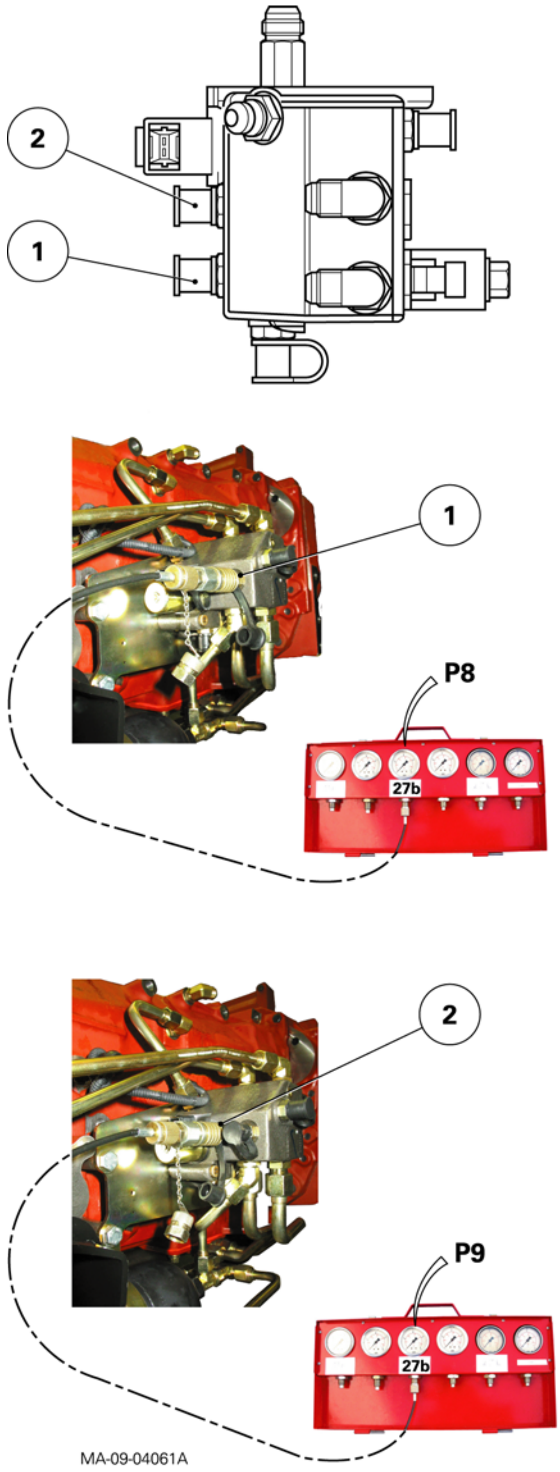


Fig. 14

Checking the lubricating pressure of the Power Shuttle clutches (forward and reverse)

- These clutches are lubricated by a gear pump that is independent from that used for the conventional lubricating circuit.
- This pump has two additional spools which act as valves and are fitted in the front cover of the Power Shuttle. They thus lubricate the reverse position (see chapter 5).
- The test is carried out with the assistance of another operator seated at the tractor controls.

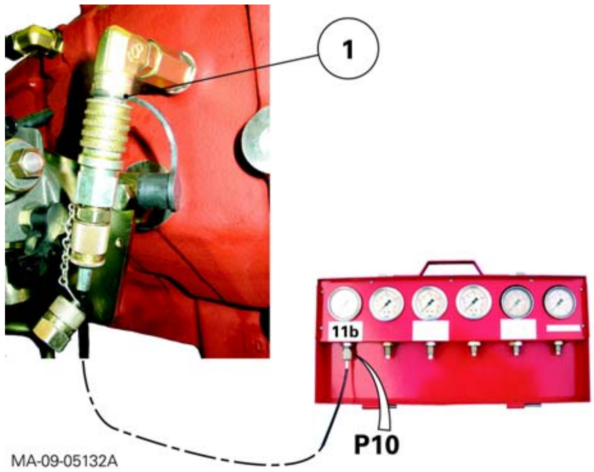


Fig. 15

Check

- Connect a pressure gauge with a capacity of approximately 11 bar to the diagnostics connector (1) located at the front right of the gearbox (Fig. 15).
- Check **P10** as indicated in the table.

Position of lever	Engine speed (rpm)	P10 (bar)	
		Pedal engaged	Pedal disengaged
Forward ratio (letter F)	1000	0,5 ± 0,1	1,5 ± 0,1
	2200	0,9 ± 0,1	2,0 ± 0,1
Neutral	1000	1,5 ± 0,1	1,5 ± 0,1
	2200	2,0 ± 0,1	2,0 ± 0,1
Reverse ratio (letter R)	1000	0,4 ± 0,1	1,5 ± 0,1
	2200	0,8 ± 0,1	2,0 ± 0,1

Checking the pressure on the Speedshift supply line

- Run the engine at 1000 rpm.
- Connect a pressure gauge with a capacity of approximately 30 bar to the low pressure diagnostics connector (1) screwed into the upper part of the right-hand hydraulic cover (Fig. 16).
- Measure the pressure:

  P4 = 18 bar ± 1 bar

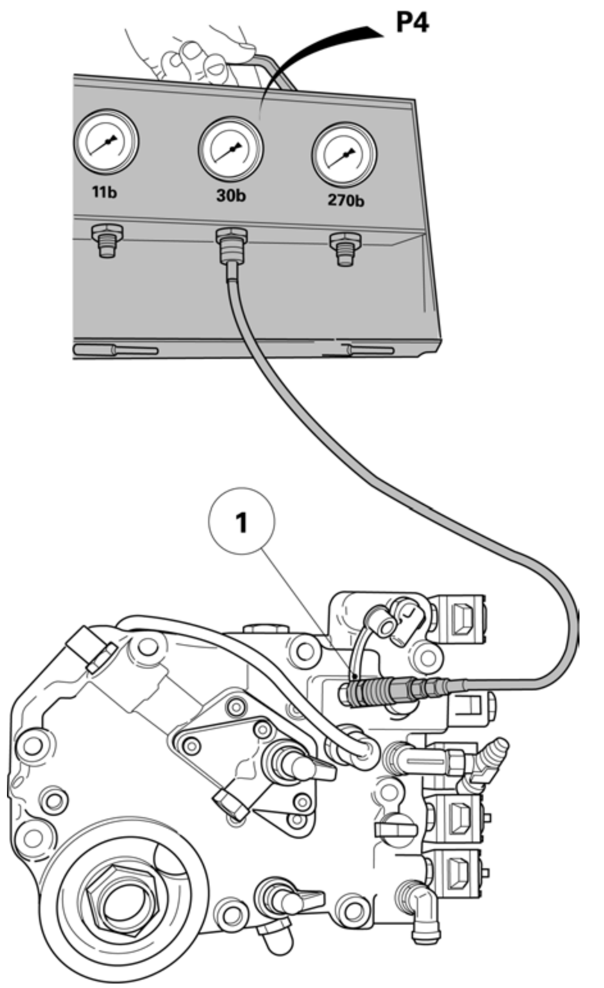


Fig. 16

Checking the dry clutch pressure

CAUTION: The pressure can reach 30 bar when the pedal is pressed down; it is therefore necessary to connect the pressure gauge after starting the engine.

- Connect a pressure gauge with a capacity of 30 bar fitted with a coupler ref. 3582045M1 to the diagnostics connector (1) located on the right-hand side of the gearbox (Fig. 16).
- Run the engine at 1000 rpm.
- Measure the pressure:

  P8 = 1.5 bar maximum clutch engaged

  P8 = 13-15 bar clutch disengaged: new disc

  P8 = 18-20 bar clutch disengaged: worn disc

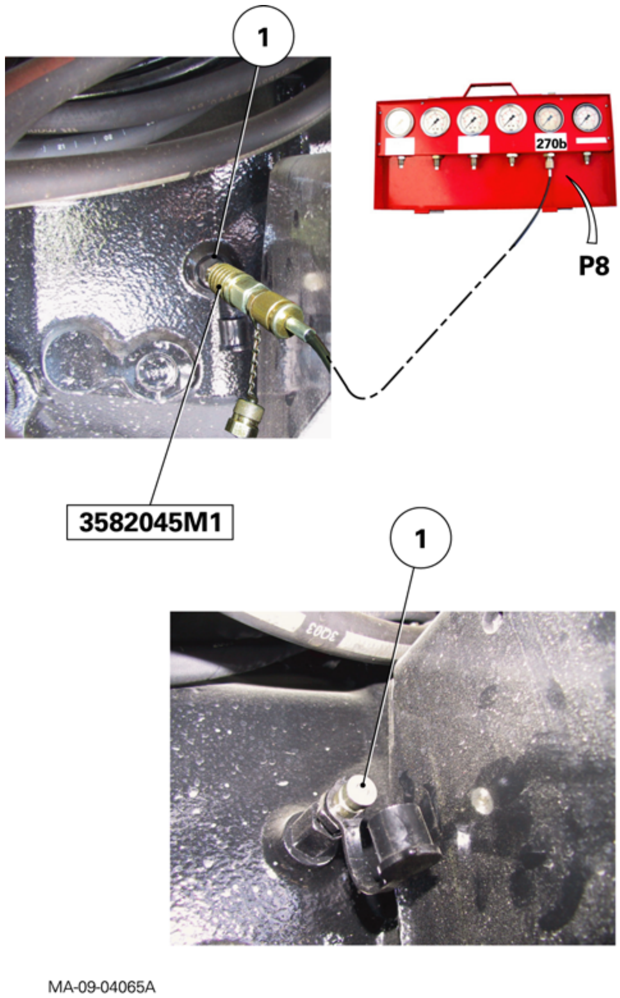


Fig. 17

10 - Electrical equipment

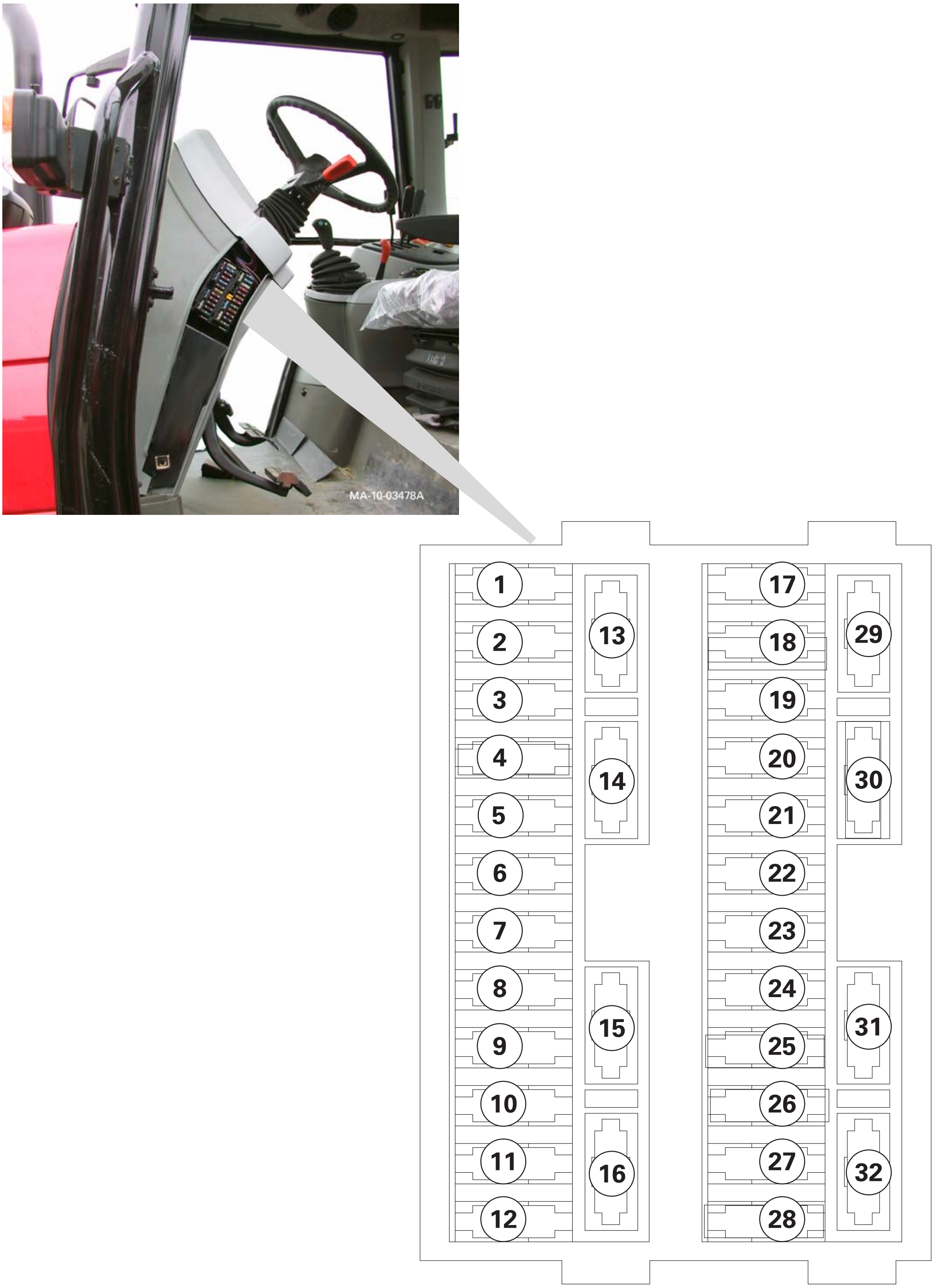
CONTENTS

10A01 - Fuse box and relays

CONTENTS

A . Fuse box

Ref.	Amperage	Description
F1	30 A	Accessories electrical socket
F2	7.5 A	Linkage, EHRB, AUTO 5
F3	10 A	Pneumatic seat
F4	10 A	Front PTO, mechanical reverse shuttle + reversing light, EEM, Thermostart
F5	30 A	Fuel booster pump (4 cylinders)
F6	10 A	Instrument panel, PTO, Hare / Tortoise, Creeper unit
F7	N A	
F8	7.5 A	Starting relay
F9	10 A	Cab relay
F10	25 A	Wiper timer
F11	15 A	Radio, front and rear wipers
F12	10 A	Speedshift, 4WD, differential lock
F13	25 A	Front work headlights - Europe and NAO
F14	30 A	EEM Electronic injection
F15	15 A	Thermostart
F16	25 A	Rear work headlights - Europe and NAO
F17	30 A	
F18	7.5 A	Alternator charge
F19	7.5 A	Horn
F20	10 A	Reversing lights (mechanical reverse shuttle), road and dim beam lights on handrails, electrical socket
F21	10 A	Direction indicator light unit
F22	5 A	Stop lights
F23	7.5 A	Power shuttle, Linkage, AUTO 5
F24	N A	EEM Electronic injection
F25	10 A	Front right-hand and rear left-hand sidelights, instrument panel backlighting, registration plate
F26	7.5 A	Front left-hand and rear right-hand sidelights
F27	15 A	Flashing beacon
F28	20 A	Warning light
F29	25 A	Fender and handrail work headlights
F30	15 A	Stop lights
F31	15 A	Road lights
F32	10 A	Dim beam



MA-10-03409A

Fig. 1

B . Relays - Europe

Without electronic injection

Connector reference	Description	Layout
CAB-36	Ground authorisation	Left-hand side of instrument panel
CAB-37	Front work headlights	Left-hand side of instrument panel
CAB-38	Rear work headlights	Left-hand side of instrument panel
CAB-39	Air conditioning compressor	Left-hand side of instrument panel
CAB-40	Stop lights	Left-hand side of instrument panel
CAB-41	Speedshift	Left-hand side of instrument panel
CAB-62	Differential lock	Gear lever support
CAB-65	4-wheel drive	Gear lever support
CAB-71	Cab relay	Right-hand side of instrument panel
CAB-72	Mechanical reverse shuttle reversing lights	Right-hand side of instrument panel
CAB-76	Wiper timer relay	Right-hand side of instrument panel
CAB-77	Direction indicator light unit	Right-hand side of instrument panel
CAB-78	Air conditioning ventilation relay	Right-hand side of instrument panel

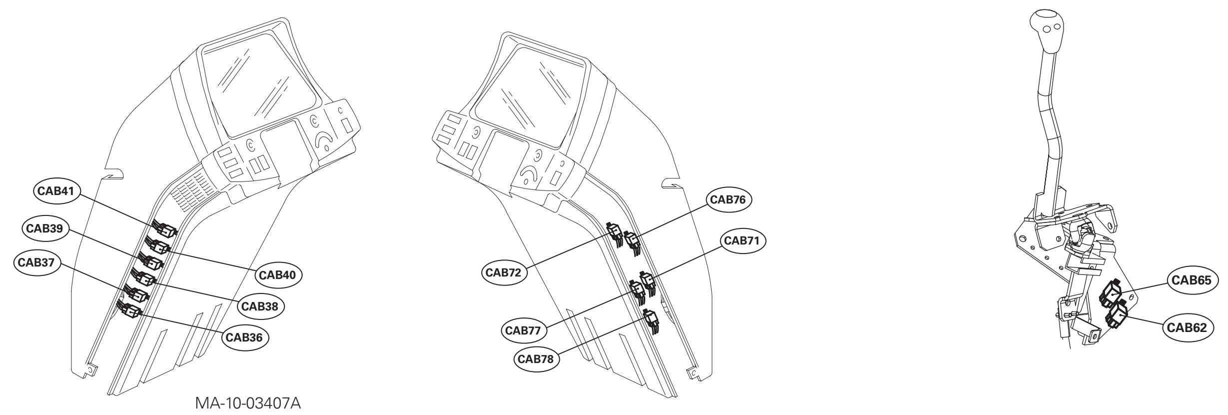


Fig. 2

Fuse box and relays

With electronic injection

Connector	Description	Layout
CAB-28	Injection pump relay	Left-hand side of instrument panel
CAB-29	Thermostart relay	Left-hand side of instrument panel
CAB-36	Ground authorisation	Left-hand side of instrument panel
CAB-37	Front work headlights	Left-hand side of instrument panel
CAB-38	Rear work headlights	Left-hand side of instrument panel
CAB-39	Air conditioning compressor	Left-hand side of instrument panel
CAB-40	Stop lights	Left-hand side of instrument panel
CAB-41	Speedshift	Left-hand side of instrument panel
CAB-62	Differential lock	Gear lever support
CAB-65	4-wheel drive	Gear lever support
CAB-71	Cab relay	Right-hand side of instrument panel
CAB-72	Mechanical reverse shuttle reversing lights	Right-hand side of instrument panel
CAB-76	Wiper timer relay	Right-hand side of instrument panel
CAB-77	Direction indicator light unit	Right-hand side of instrument panel
CAB-78	Air conditioning ventilation relay	Right-hand side of instrument panel

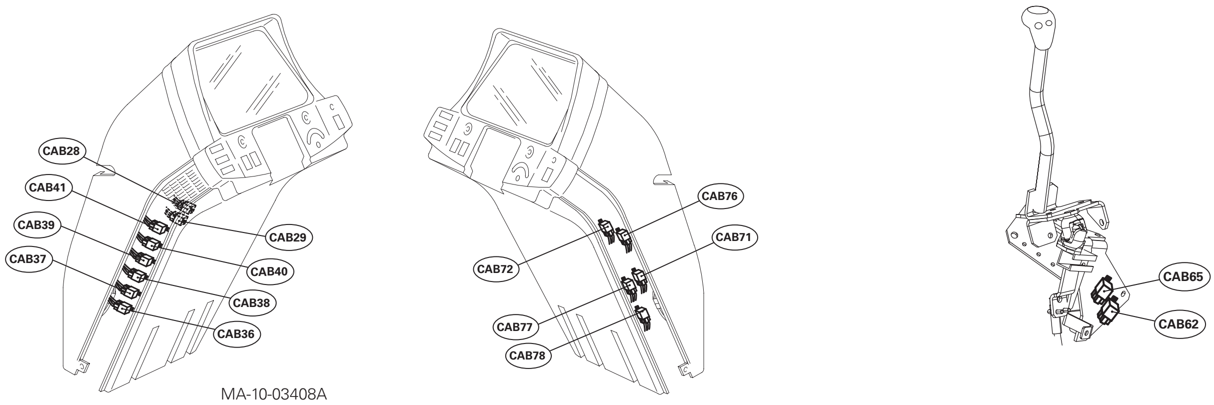


Fig. 3

C . Relays - North America

Without electronic injection

Connector reference	Description	Layout
CAB-36	Ground authorisation	Left-hand side of instrument panel
CAB-37	Front work headlights	Left-hand side of instrument panel
CAB-38	Rear work headlights	Left-hand side of instrument panel
CAB-39	Air conditioning compressor	Left-hand side of instrument panel
CAB-40	Stop lights	Left-hand side of instrument panel
CAB-41	Speedshift	Left-hand side of instrument panel
CAB-62	Differential lock	Gear lever support
CAB-65	4-wheel drive	Gear lever support
CAB-71	Cab relay	Right-hand side of instrument panel
CAB-72	Mechanical reverse shuttle reversing lights	Right-hand side of instrument panel
CAB-76	Wiper timer relay	Right-hand side of instrument panel
CAB-77	Direction indicator light unit	Right-hand side of instrument panel
CAB-78	Air conditioning ventilation relay	Right-hand side of instrument panel
CAB-131	Indicator lights	Gear lever support
CAB-132	Indicator lights	Gear lever support
CAB-133	Indicator lights	Gear lever support
CAB-134	Indicator lights	Gear lever support

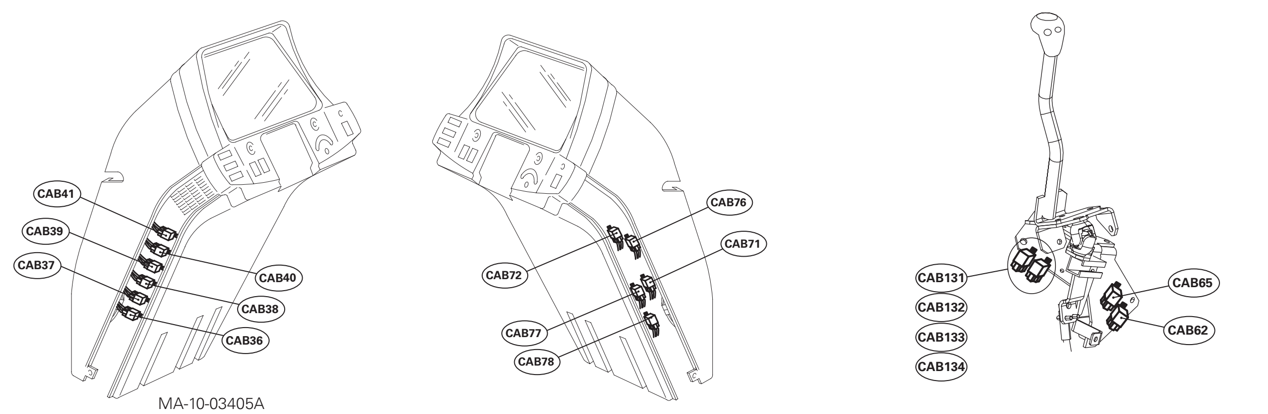


Fig. 4

Fuse box and relays

With electronic injection

Connector	Description	Layout
CAB-28	Injection pump relay	Left-hand side of instrument panel
CAB-29	Thermostart relay	Left-hand side of instrument panel
CAB-36	Ground authorisation	Left-hand side of instrument panel
CAB-37	Front work headlights	Left-hand side of instrument panel
CAB-38	Rear work headlights	Left-hand side of instrument panel
CAB-39	Air conditioning compressor	Left-hand side of instrument panel
CAB-40	Stop lights	Left-hand side of instrument panel
CAB-41	Speedshift	Left-hand side of instrument panel
CAB-62	Differential lock	Gear lever support
CAB-65	4-wheel drive	Gear lever support
CAB-71	Cab relay	Right-hand side of instrument panel
CAB-72	Mechanical reverse shuttle reversing lights	Right-hand side of instrument panel
CAB-76	Wiper timer relay	Right-hand side of instrument panel
CAB-77	Direction indicator light unit	Right-hand side of instrument panel
CAB-78	Air conditioning ventilation relay	Right-hand side of instrument panel
CAB-131	Indicator lights	Gear lever support
CAB-132	Indicator lights	Gear lever support
CAB-133	Indicator lights	Gear lever support
CAB-134	Indicator lights	Gear lever support

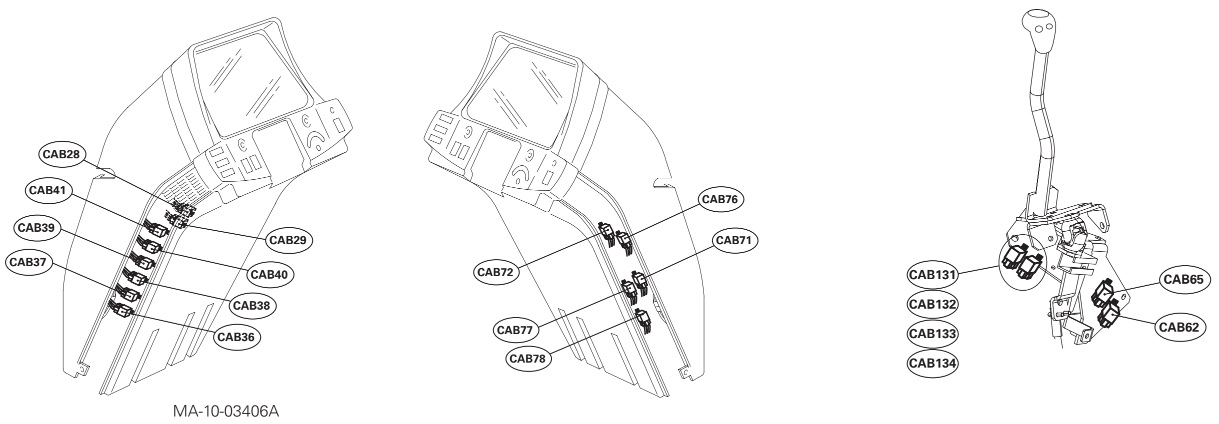


Fig. 5

D . Relays - Germany

Without electronic injection

Connector	Description	Layout
CAB-36	Ground authorisation	Left-hand side of instrument panel
CAB-37	Front work headlights	Left-hand side of instrument panel
CAB-38	Rear work headlights	Left-hand side of instrument panel
CAB-39	Air conditioning compressor	Left-hand side of instrument panel
CAB-40	Stop lights	Left-hand side of instrument panel
CAB-41	Speedshift	Left-hand side of instrument panel
CAB-62	Differential lock	Gear lever support
CAB-65	4-wheel drive	Gear lever support
CAB-71	Cab relay	Right-hand side of instrument panel
CAB-72	Mechanical reverse shuttle reversing lights	Right-hand side of instrument panel
CAB-76	Wiper timer relay	Right-hand side of instrument panel
CAB-77	Direction indicator light unit	Right-hand side of instrument panel
CAB-78	Air conditioning ventilation relay	Right-hand side of instrument panel
CAB-140	Handrail road lights	Gear lever support
CAB-141	Handrail road lights	Gear lever support

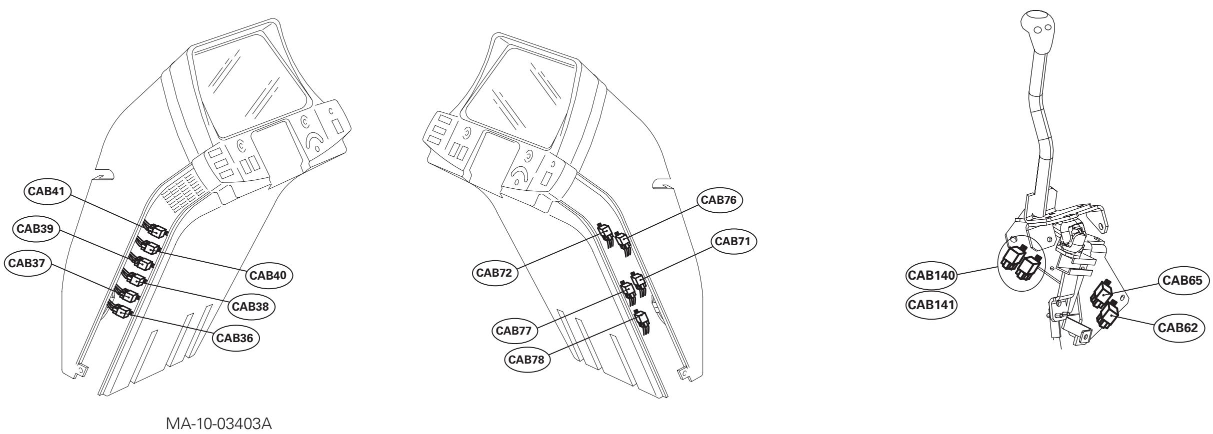


Fig. 6

Fuse box and relays

With electronic injection

Connector	Description	Layout
CAB-28	Injection pump relay	Left-hand side of instrument panel
CAB-29	Thermostart relay	Left-hand side of instrument panel
CAB-36	Ground authorisation	Left-hand side of instrument panel
CAB-37	Front work headlights	Left-hand side of instrument panel
CAB-38	Rear work headlights	Left-hand side of instrument panel
CAB-39	Air conditioning compressor	Left-hand side of instrument panel
CAB-40	Stop lights	Left-hand side of instrument panel
CAB-41	Speedshift	Left-hand side of instrument panel
CAB-62	Differential lock	Gear lever support
CAB-65	4-wheel drive	Gear lever support
CAB-71	Cab relay	Right-hand side of instrument panel
CAB-72	Mechanical reverse shuttle reversing lights	Right-hand side of instrument panel
CAB-76	Wiper timer relay	Right-hand side of instrument panel
CAB-77	Direction indicator light unit	Right-hand side of instrument panel
CAB-78	Air conditioning ventilation relay	Right-hand side of instrument panel
CAB-140	Handrail road lights	Gear lever support
CAB-141	Handrail road lights	Gear lever support

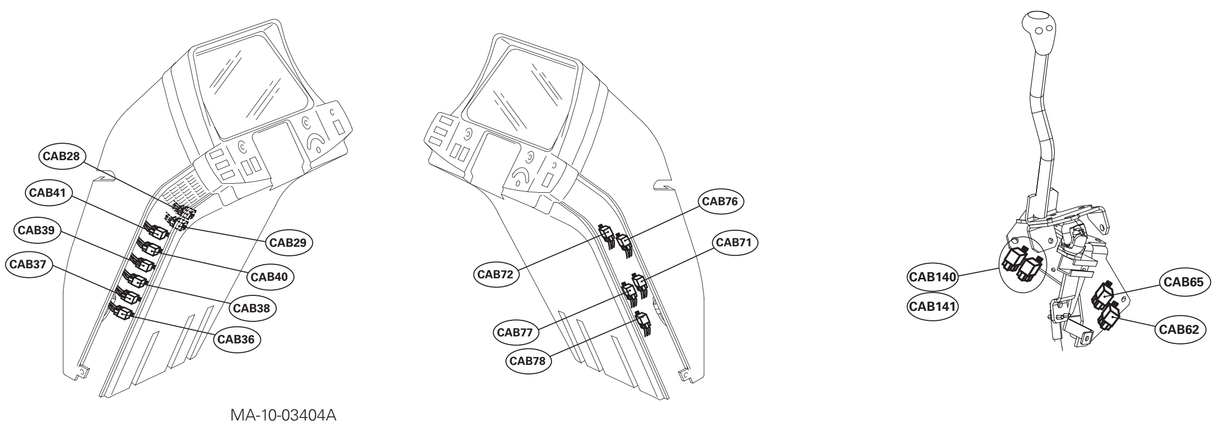


Fig. 7

10A02 - GBA20 electronic equipment

CONTENTS

A . General

Description

The harnesses fitted on the tractor allow data to be exchanged and power to be supplied to the electrical and electronic systems.

The tractor is fitted with 3 different types of power supply:

- +12V Battery (Permanent)
- +12V APC (Ignition key ON)
- +12V ACC (Accessories)

Most harnesses have a maximum of six different wire colours:

- Black: Ground
- Brown: +12V Permanent
- Red: +12V APC and Accessories
- White: Information
- Yellow: CAN High
- Green: CAN Low

  The CAN network wires (yellow and green) are twisted together.

- Components with only one connector are identified by the connector name:

  CAB16: Clutch pedal progressivity sensor (Fig. 1).
- Harnesses performing the same funtions have the same colour on the diagram (Fig. 1):
  - FAI90: Cab Power Shuttle option harness (pink)
  - FAI102: Platform Power Shuttle option harness (pink)
- All wires can be identified by the pins of the outgoing and incoming connectors of the harness:

  CAB11.2/CAB18.1: The wire connects pin 2 of the CAB11 connector to pin 1 of the CAB18 connector
- The detail of pins allocation for each connector is shown on the harness side
- The wire colour is indicated: CAB11.2/CAB18.1 B, the wire is white

  List of colours:
  - N: Black
  - M: Brown
  - R: Red
  - B: White
  - J: Yellow
  - V: Green
- The splices inside the harnesses are indicated by a dot and the letter S (S1).

In general, the components or connectors are named in order to indicate the corresponding elements of the tractor:

CA##	Automatic air conditioning
CAB##	Cab
ENG##	Engine
LIG##	Lighting
R##	Roof
TR##	Transmission and linkage
CDX#	External controls

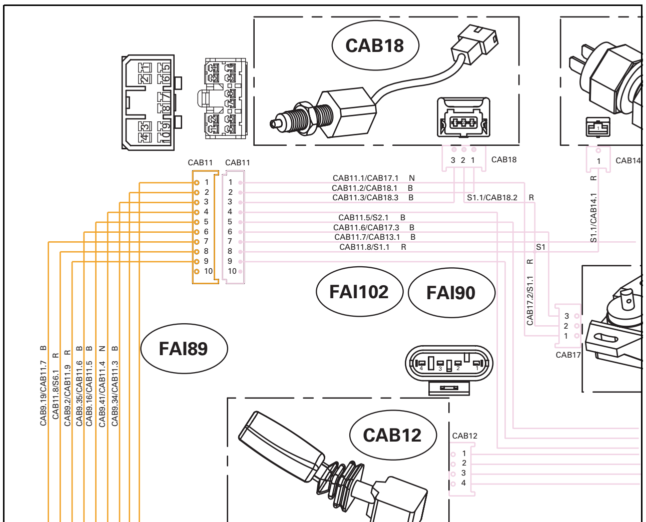
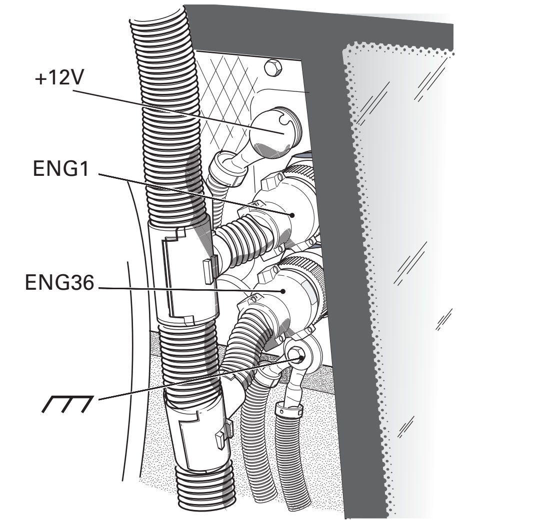


Fig. 1

Layout

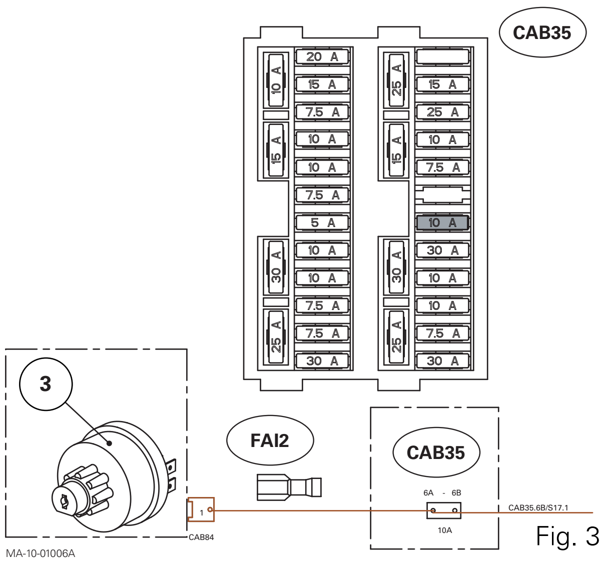
1 or 2 Deutsch connectors (31-way) are connected on the front wall of the cab (according to model) Fig. 2.

All these connectors belong to the engine harness. ENG2 is dedicated to information relating to the electronic injection (only present on the relevant models).



MA-10-01004A Fig. 2

The fuses of the electrical or electronic board (Fig. 3) are indicated by a grey mark on their locations on the fuse box (CAB35).



MA-10-01006A Fig. 3

B . Cab equipment

Instrument panel

FAI 84 Cab instrument panel harness (all countries except US)
CAB35 Fuse box
3 Start switch
49 X2 instrument panel

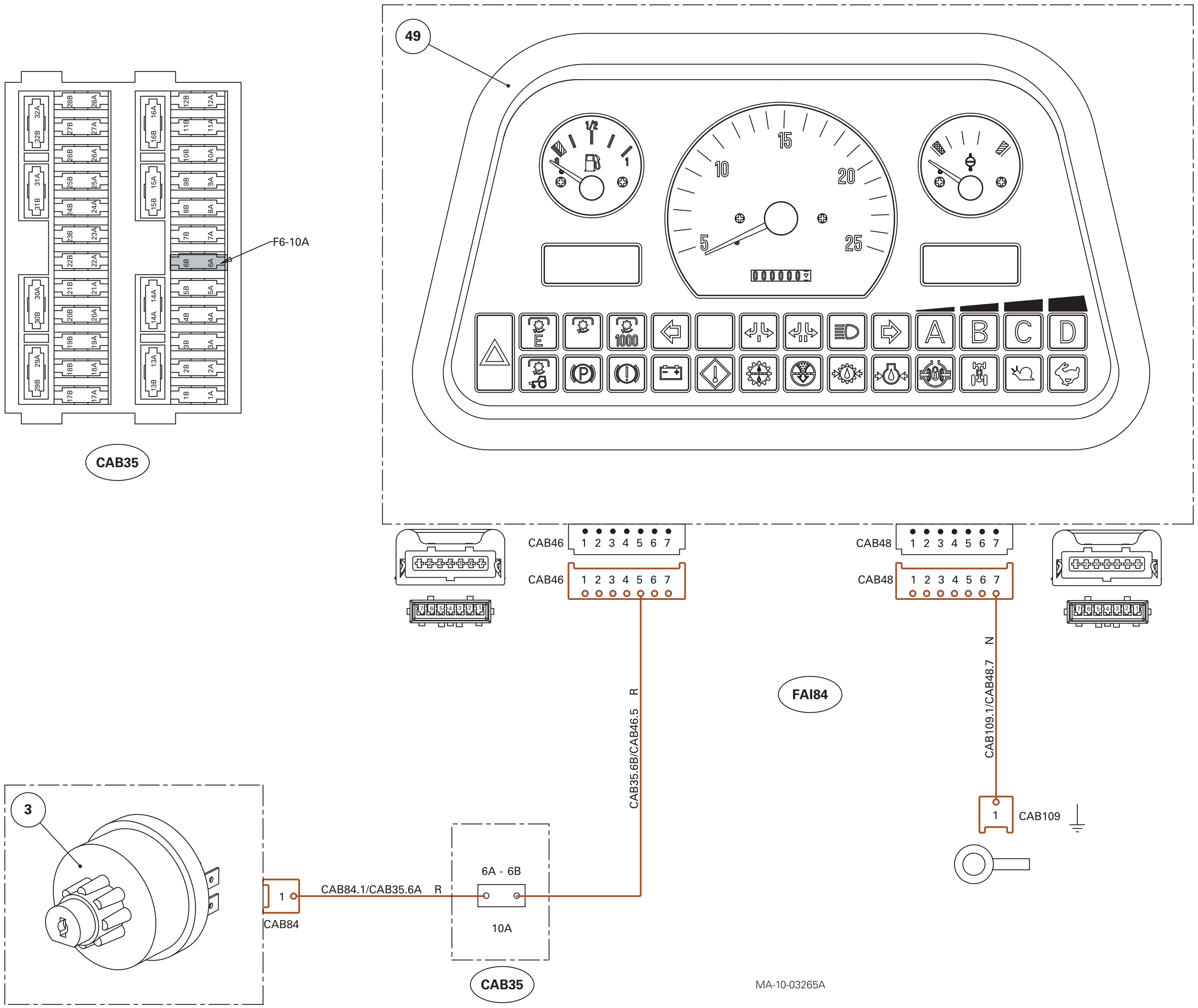


Fig. 4

Cab and instrument panel backlighting

FAI 73 Linkage harness
FAI 74 Cab console harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 94 Standard roof harness - EU
FAI 101 Handrail road lights control harness
FAI 109 Handrail work headlights control harness
CAB 02 Linkage console
CAB 05 UP/DOWN switch
CAB 35 Fuse box
CAB 42 Light switch
CAB 44 Front work headlights switch
CAB 45 Rear work headlights switch
CAB 63 4WD switch
CAB 64 Differential switch
CAB 144 Handrail lights switch
CAB 147 Additional headlights switch
R6 Manual air conditioning unit
R7 Rear windscreen wiper switch
R51 Flashing beacon switch
36 Laser radio
49 X2 instrument panel

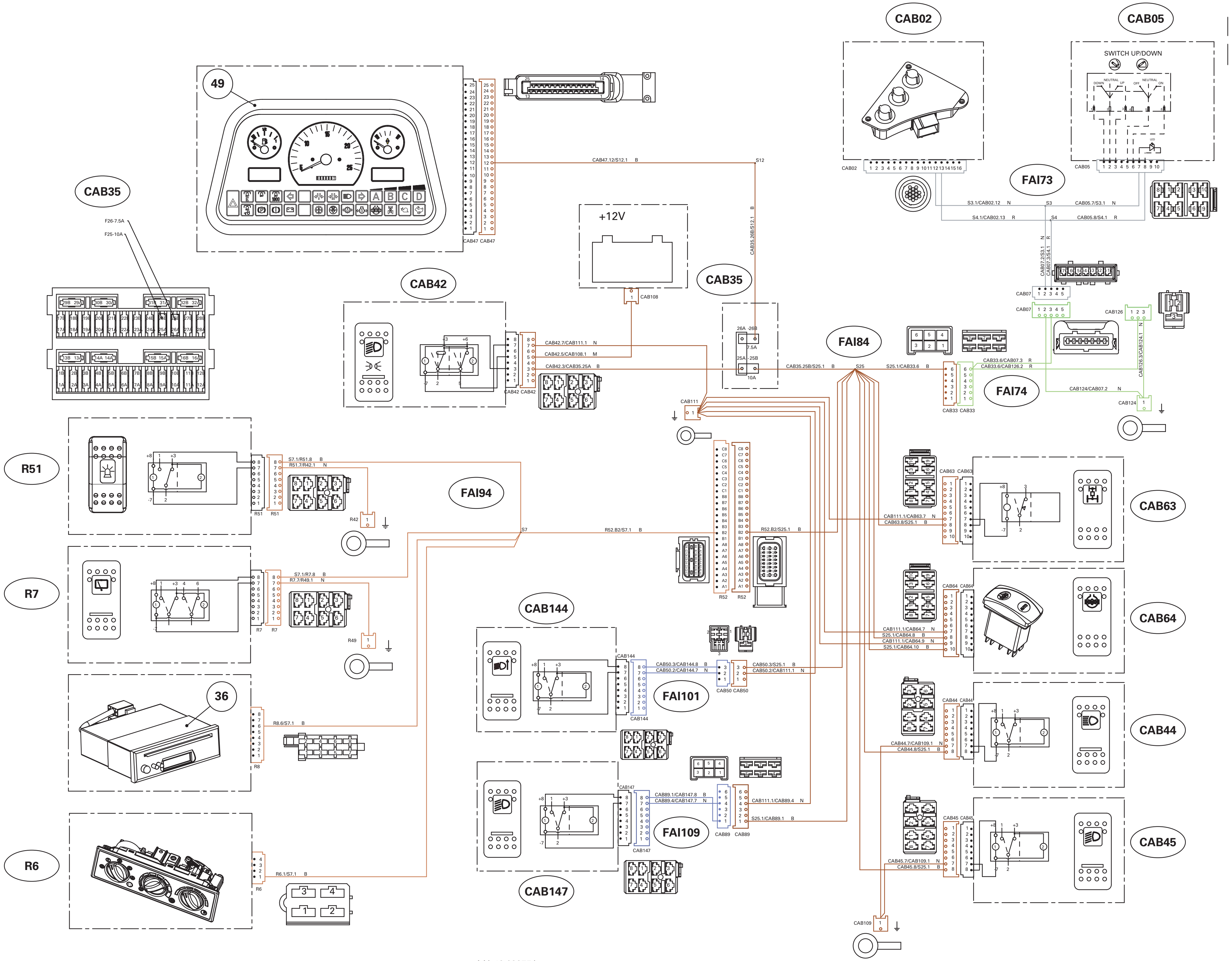


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Fig. 5

Instrument panel and platform console backlighting

FAI 73 Linkage / cab interior harness
FAI 85 Platform instrument panel harness - NAO
FAI 101 Handrail road lights harness
FAI 109 Additional headlights harness
CAB 02 Linkage console
CAB 05 UP/DOWN switch
CAB 35 Fuse box
CAB 42 Light switch
CAB 44 Front work headlights switch
CAB 45 Rear work headlights switch
CAB 63 4WD switch
CAB 64 Differential switch
CAB 144 Handrail lights switch
CAB 147 Additional headlights switch
CAB 139 Flashing beacon switch
49 X2 instrument panel

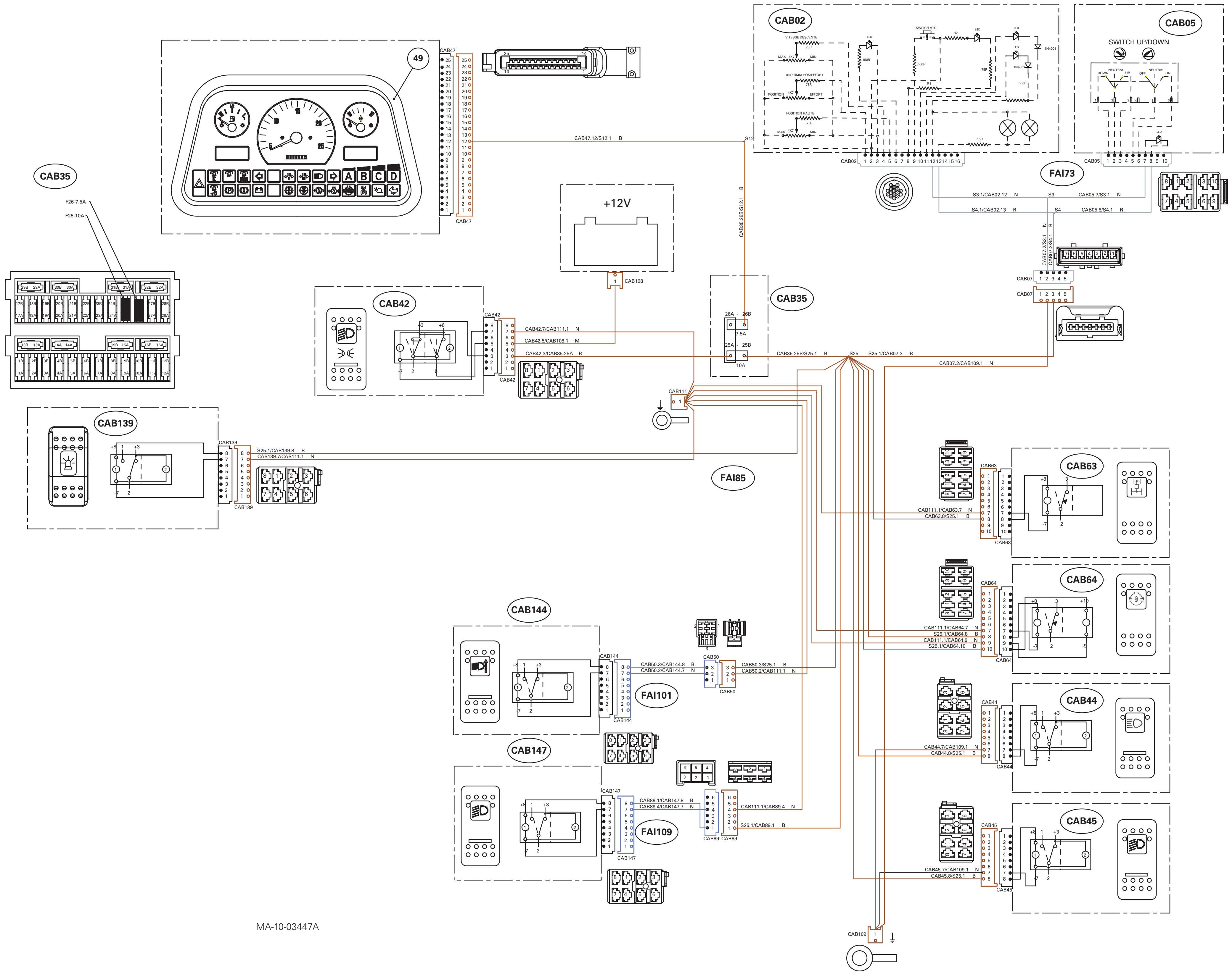

Fig. 6

Standard roof ventilation

FAI 84 Cab instrument panel harness (all countries except US)
FAI 94 Standard roof harness
CAB 35 Fuse box
CAB78 Air conditioning relay
CAB 79 Maximum fuse holder
R 6 Manual air conditioning
3 Start switch

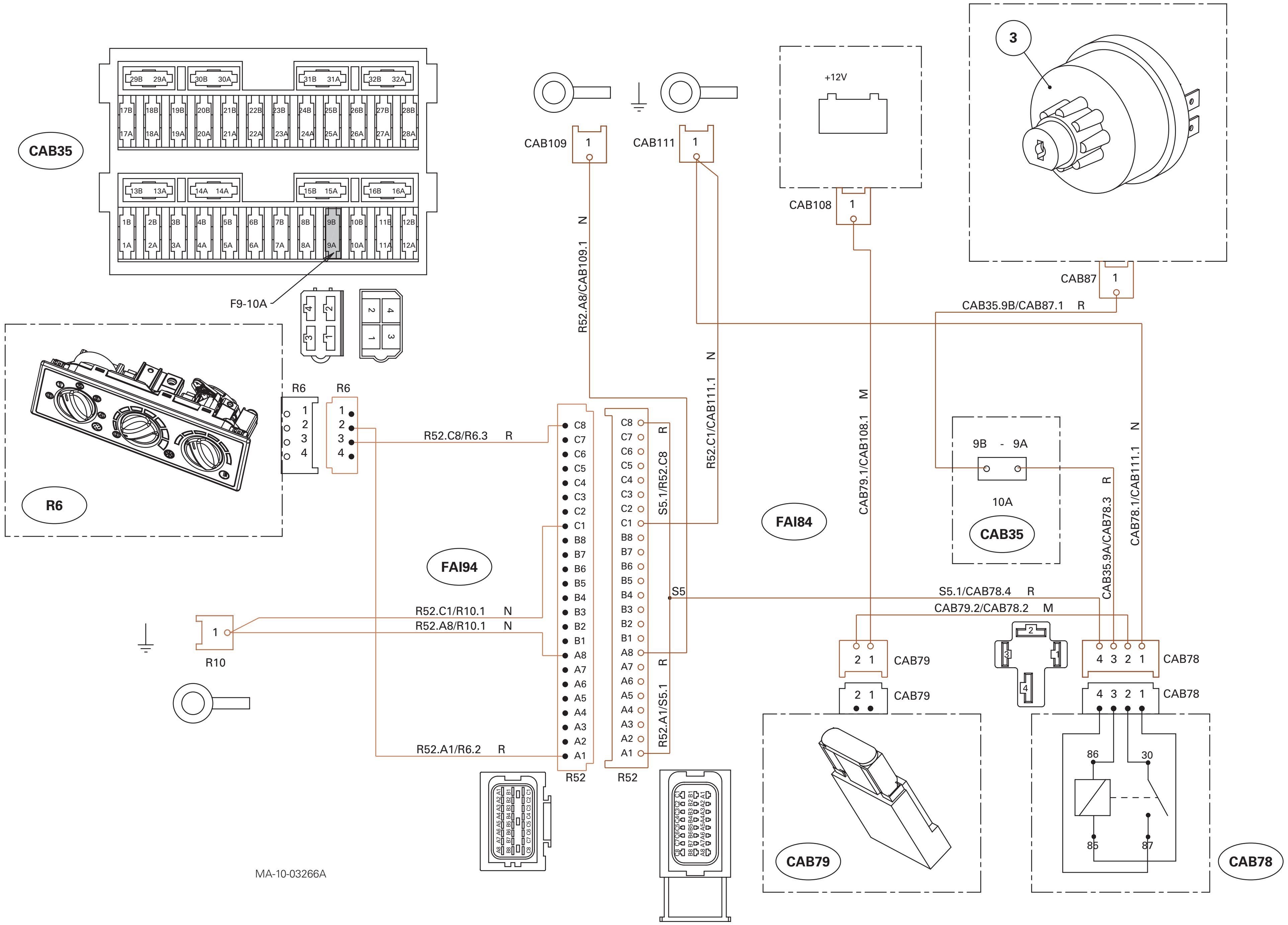

Fig. 7

High visibility roof ventilation

FAI 78 High visibility roof harness
FAI 84 Cab instrument panel harness (all countries except US)
CAB 35 Fuse box
CAB78 Air conditioning relay
CAB 79 Maximum fuse holder
R 6 Manual air conditioning
3 Start switch

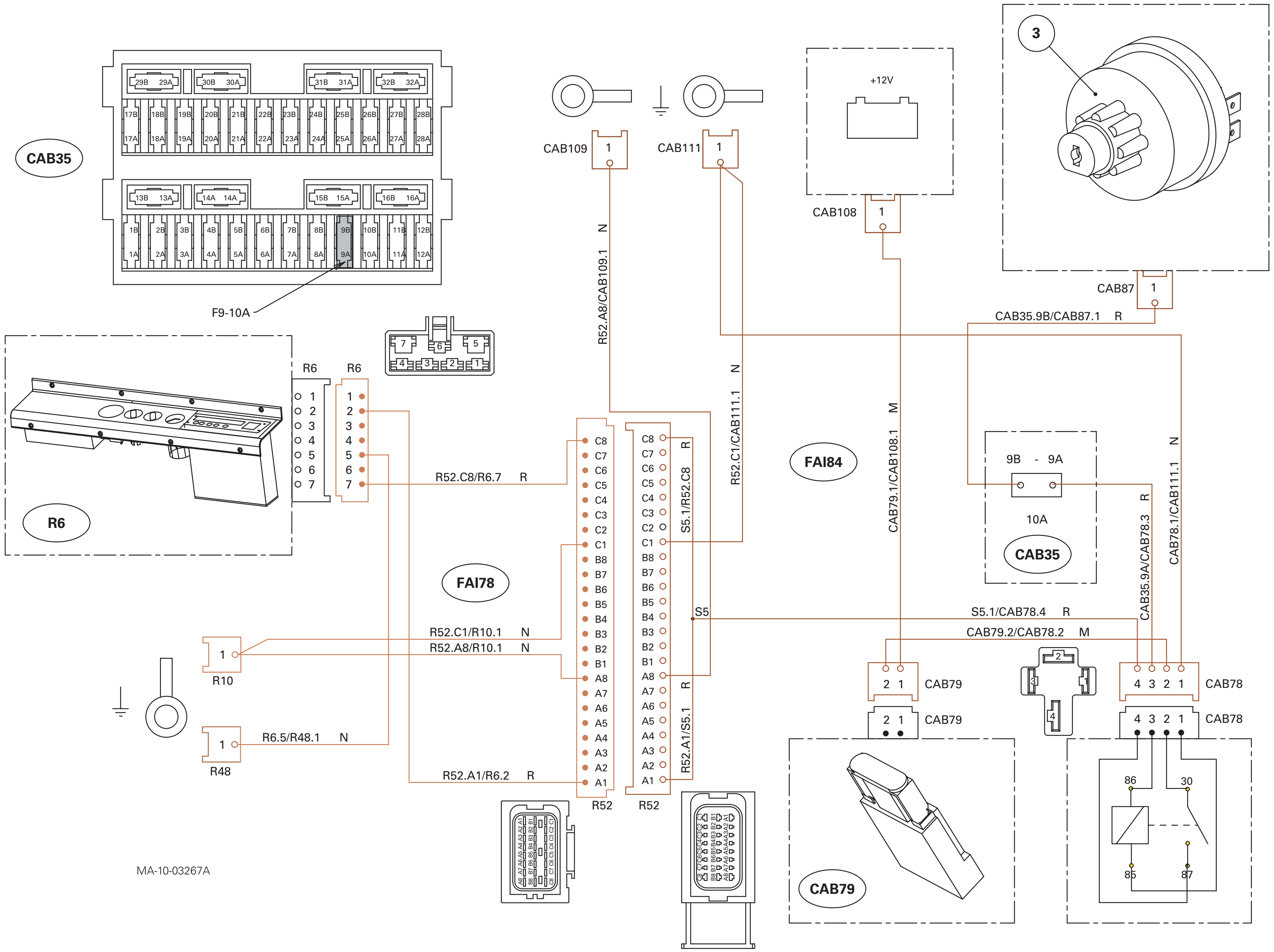

Fig. 8

Standard roof extreme cold ventilation

FAI 84 Cab instrument panel harness (all countries except US)
FAI 94 Standard roof harness
CAB 35 Fuse box
CAB 79 Maximum fuse holder
R 6 Manual air conditioning
R 33 Heating accelerator pump
3 Start switch

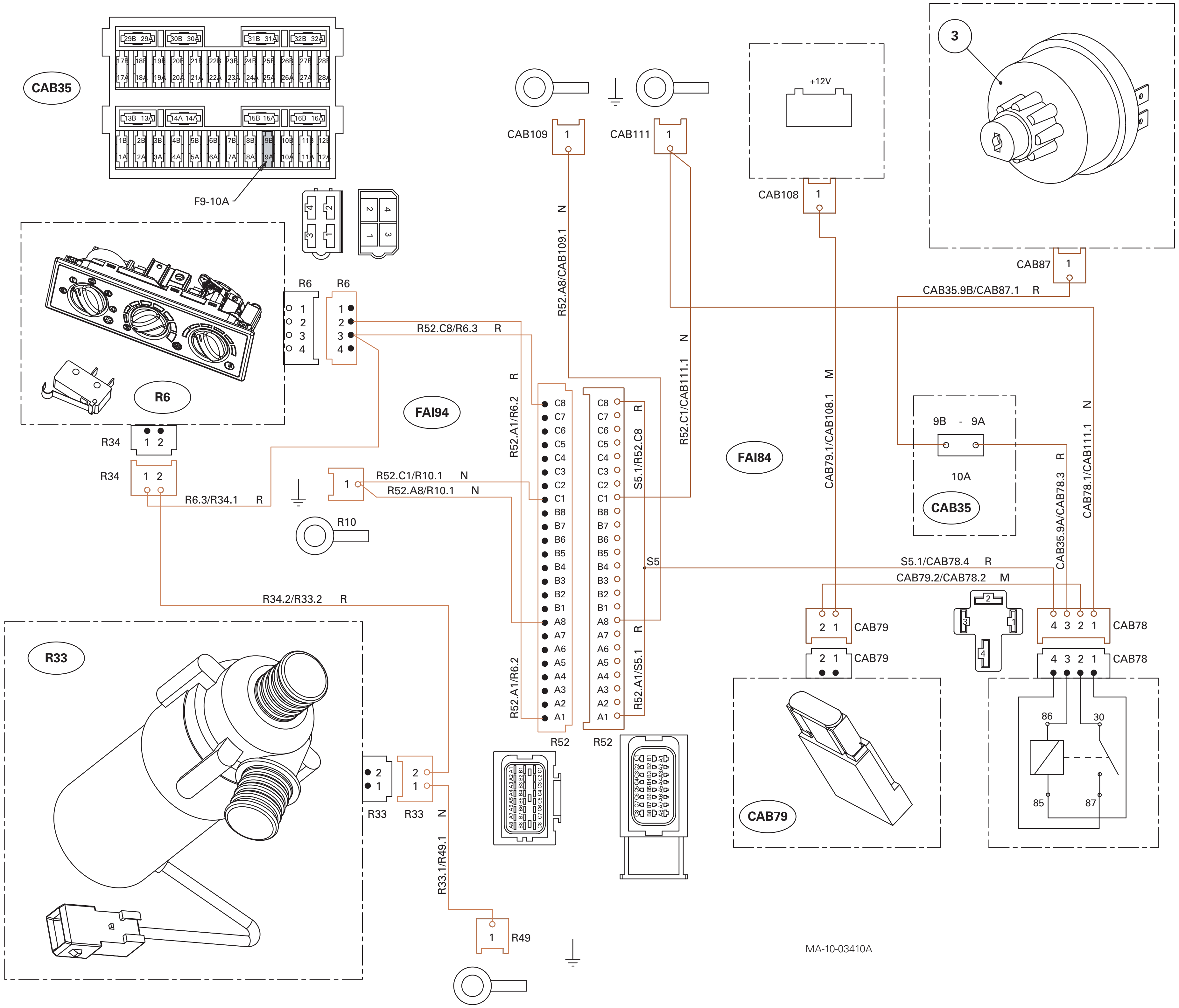

Fig. 9

High visibility roof extreme cold ventilation

- FAI 78 High visibility roof harness
- FAI 84 Cab instrument panel harness (all countries except US)
- CAB 35 Fuse box
- CAB 79 Maximum fuse holder
- R 6 Manual air conditioning
- R 33 Heating accelerator pump
- 3 Start switch

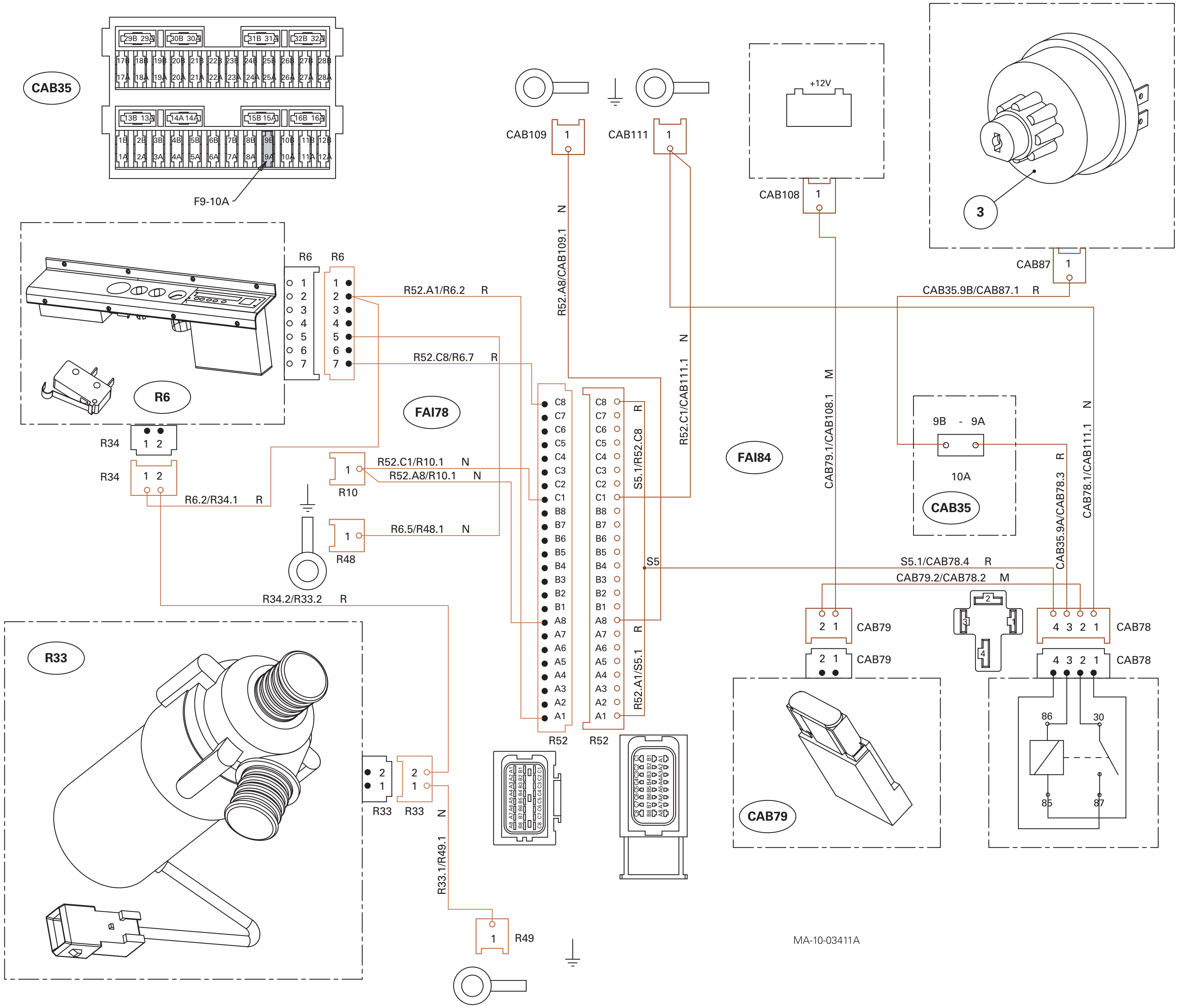

Fig. 10

Manual air conditioning for standard roof

FAI 82 Engine harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 94 Standard roof harness
CAB 35 Fuse box
CAB 78 Maximum fuse holder
ENG 15 Air conditioning condensor pressure switch
ENG 16 Air conditioning compressor
R 6 Manual air conditioning
3 Start switch

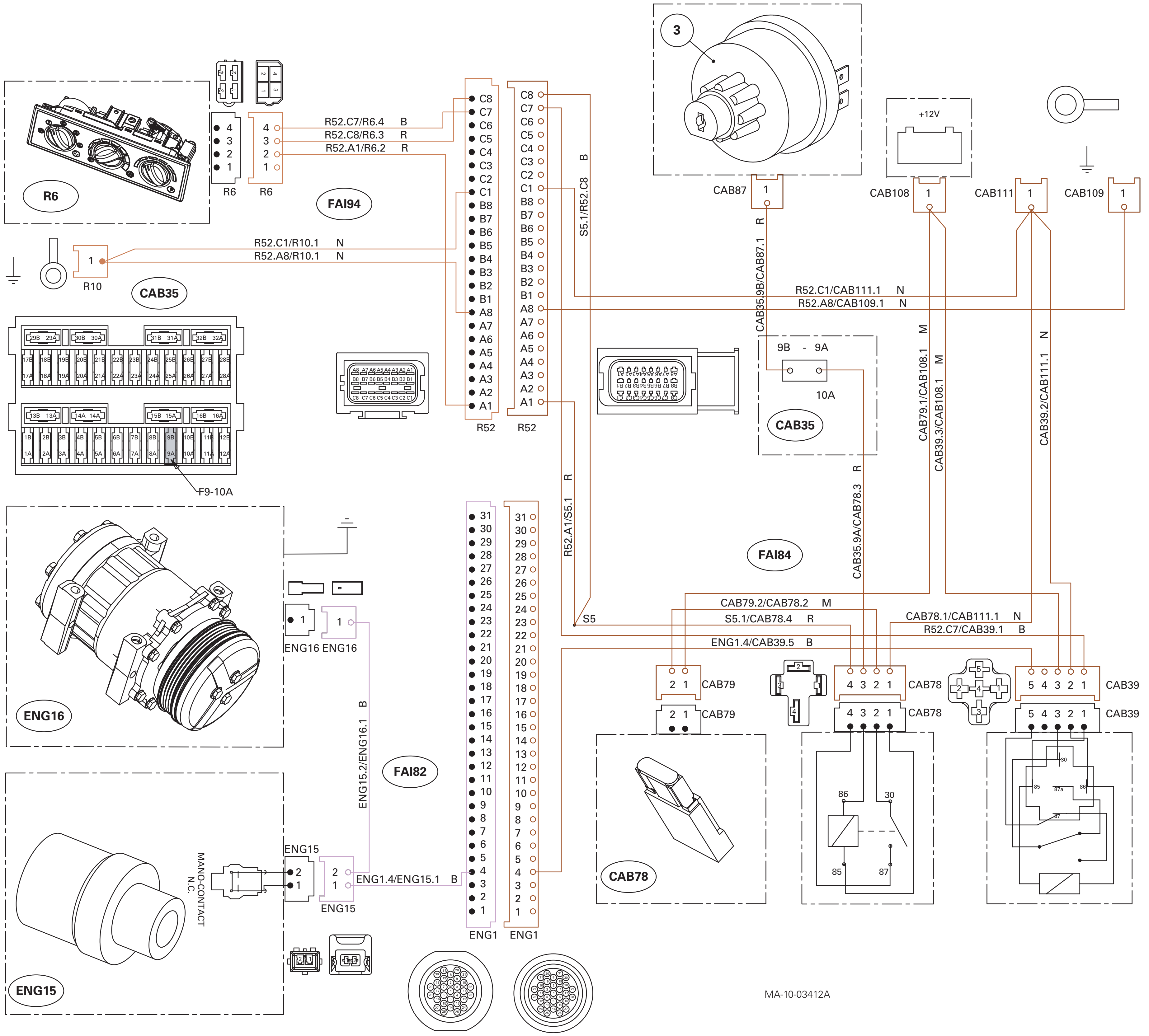

Fig. 11

Manual air conditioning for high visibility roof

FAI 78 High visibility roof harness
FAI 82 Engine harness
FAI 84 Cab instrument panel harness (all countries except US)
CAB 35 Fuse box
CAB 78 Maximum fuse holder
ENG 15 Air conditioning condensor pressure switch
ENG 16 Air conditioning compressor
R 6 Manual air conditioning
3 Start switch

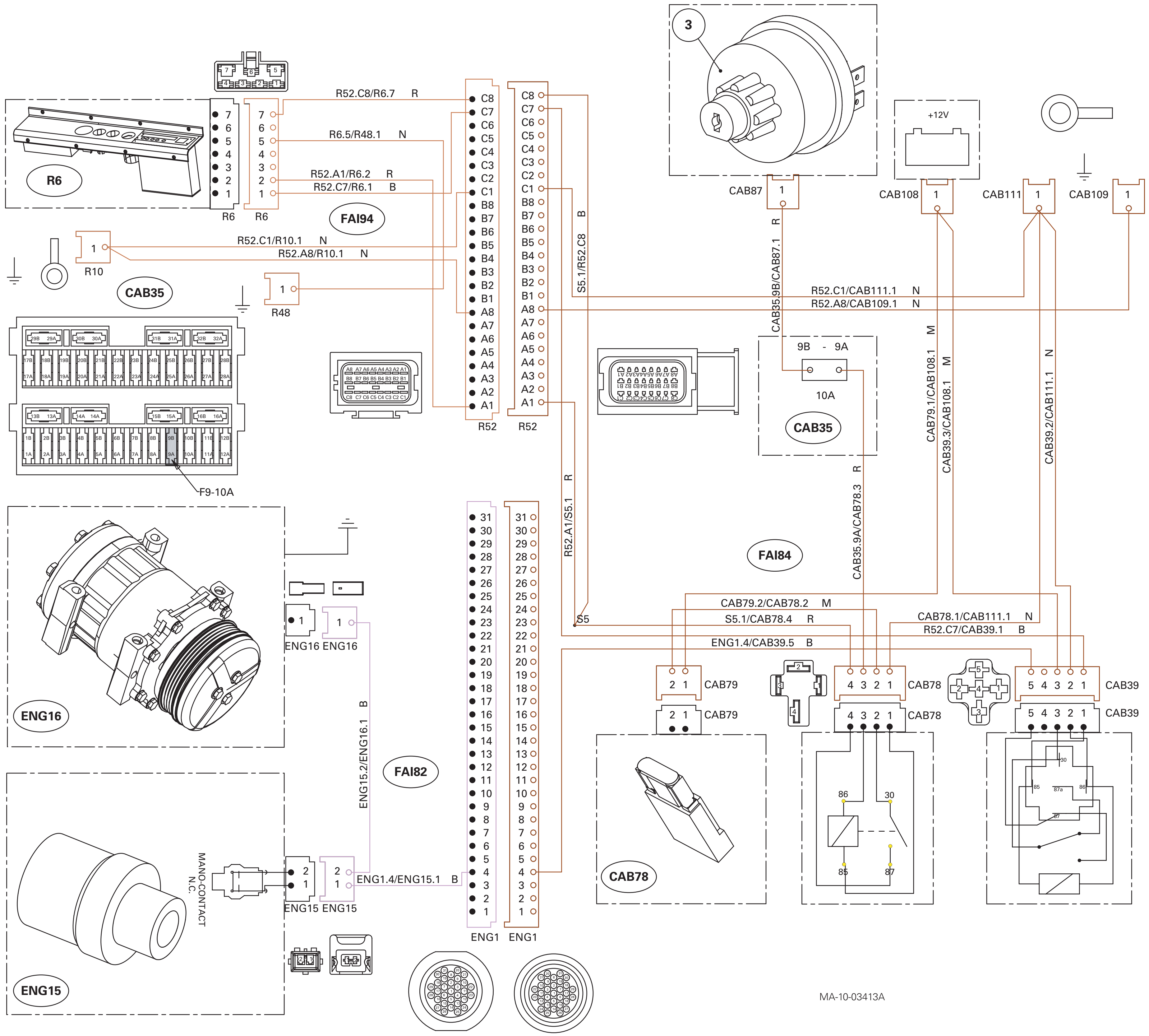

Fig. 12

Radio - Europe

FAI 16 Battery circuit-breaker harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 94 Standard roof harness - EU
CAB 35 Fuse box
CAB 42 Light switch
CAB 71 Cab relay
3 Start switch
20 Circuit breaker
36 Laser radio
37 Loudspeaker
47 Battery

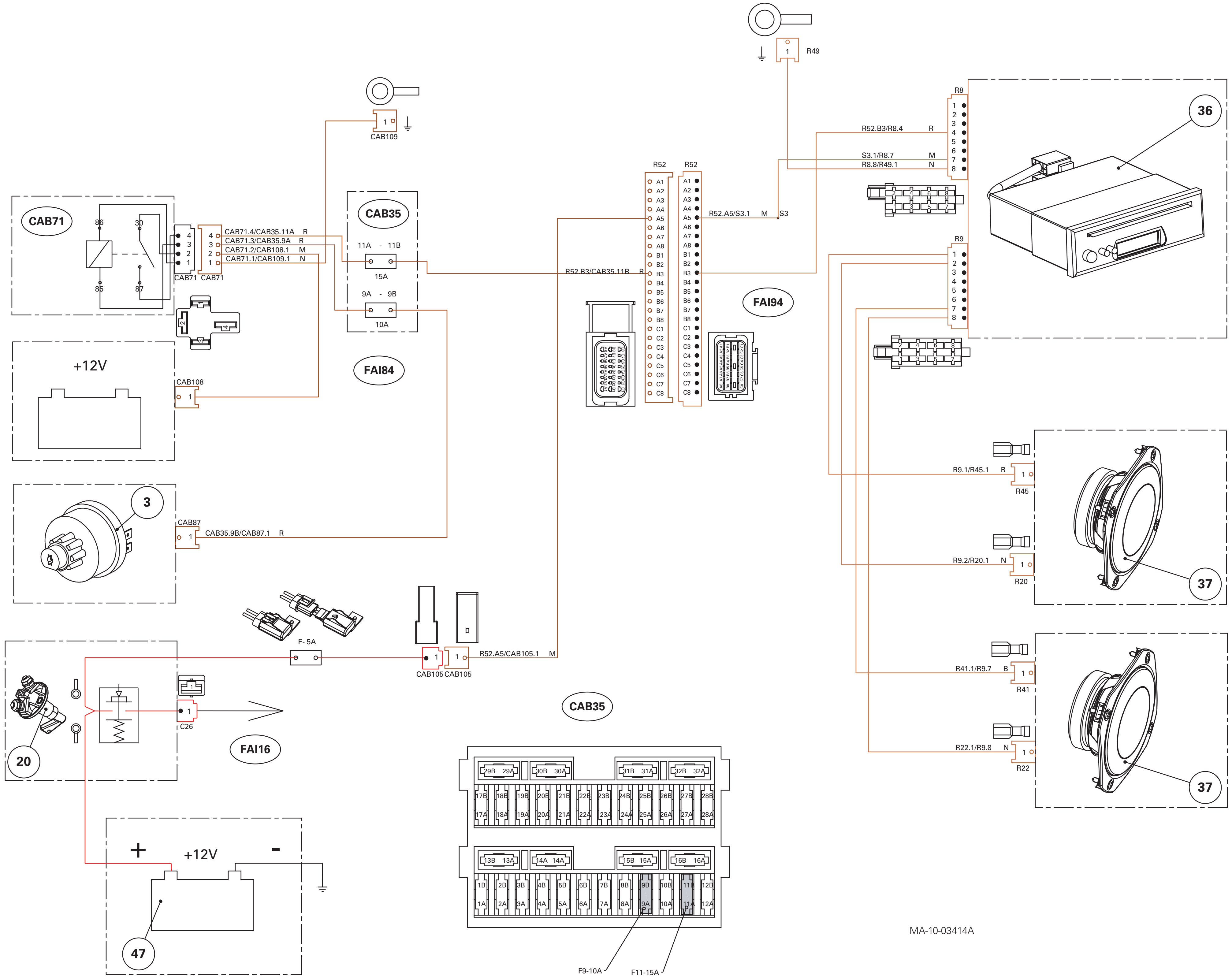

Fig. 13

Radio - Germany

FAI 16 Battery circuit-breaker harness
FAI 22 Radio harness
FAI 75 Standard roof harness - US
FAI 84 Cab instrument panel harness (all countries except US)
CAB 35 Fuse box
CAB 42 Light switch
CAB 71 Cab relay
3 Start switch
20 Battery circuit breaker
36 Laser radio
37 Loudspeaker
47 Battery

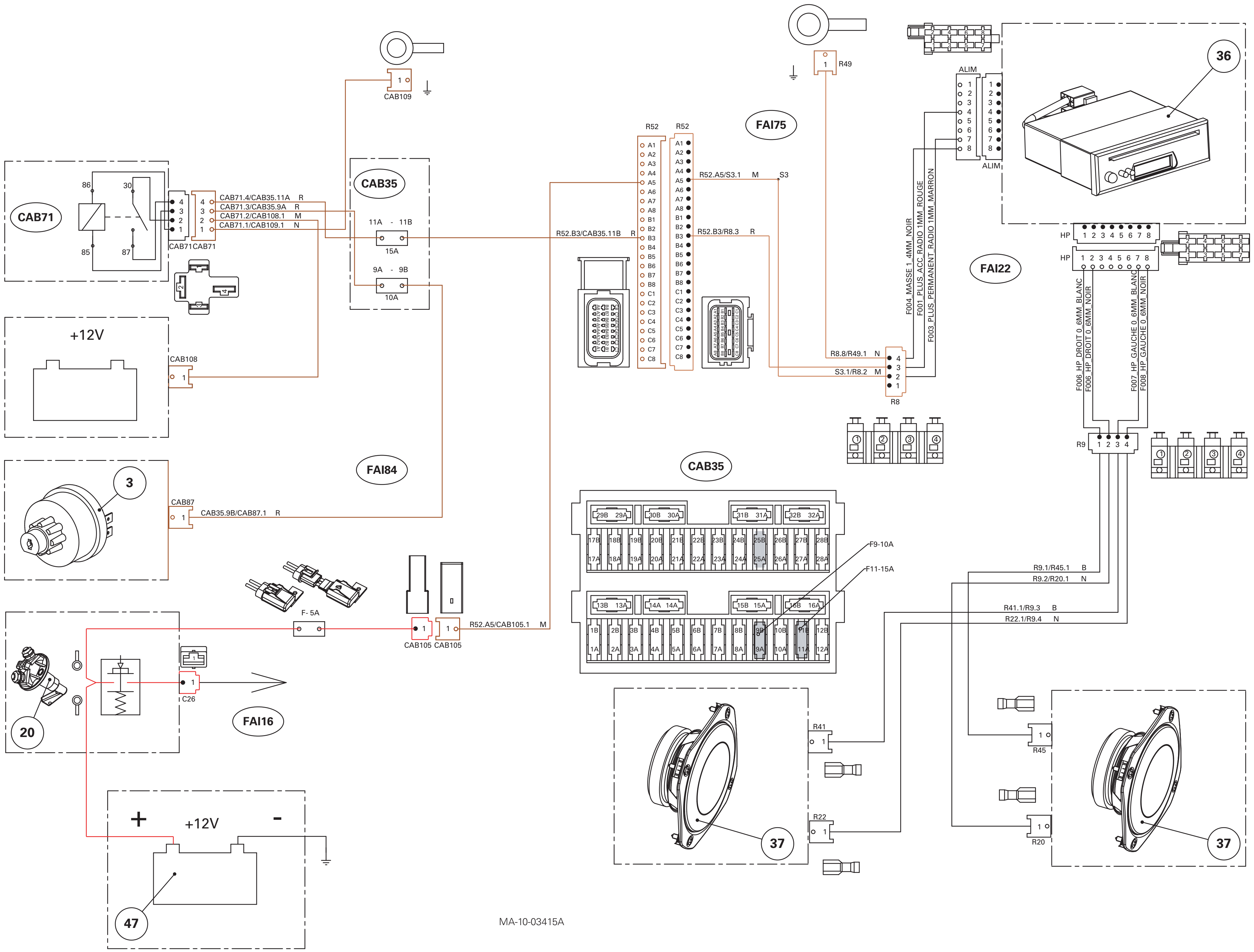

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Fig. 14

Radio - North America

FAI 16 Circuit-breaker harness
FAI 75 Standard roof harness - US
FAI 83 Cab instrument panel harness - US
CAB 35 Fuse box
CAB 42 Light switch
CAB 71 Cab relay
3 Start switch
20 Battery circuit breaker
36 Laser radio
37 Loudspeaker
47 Battery

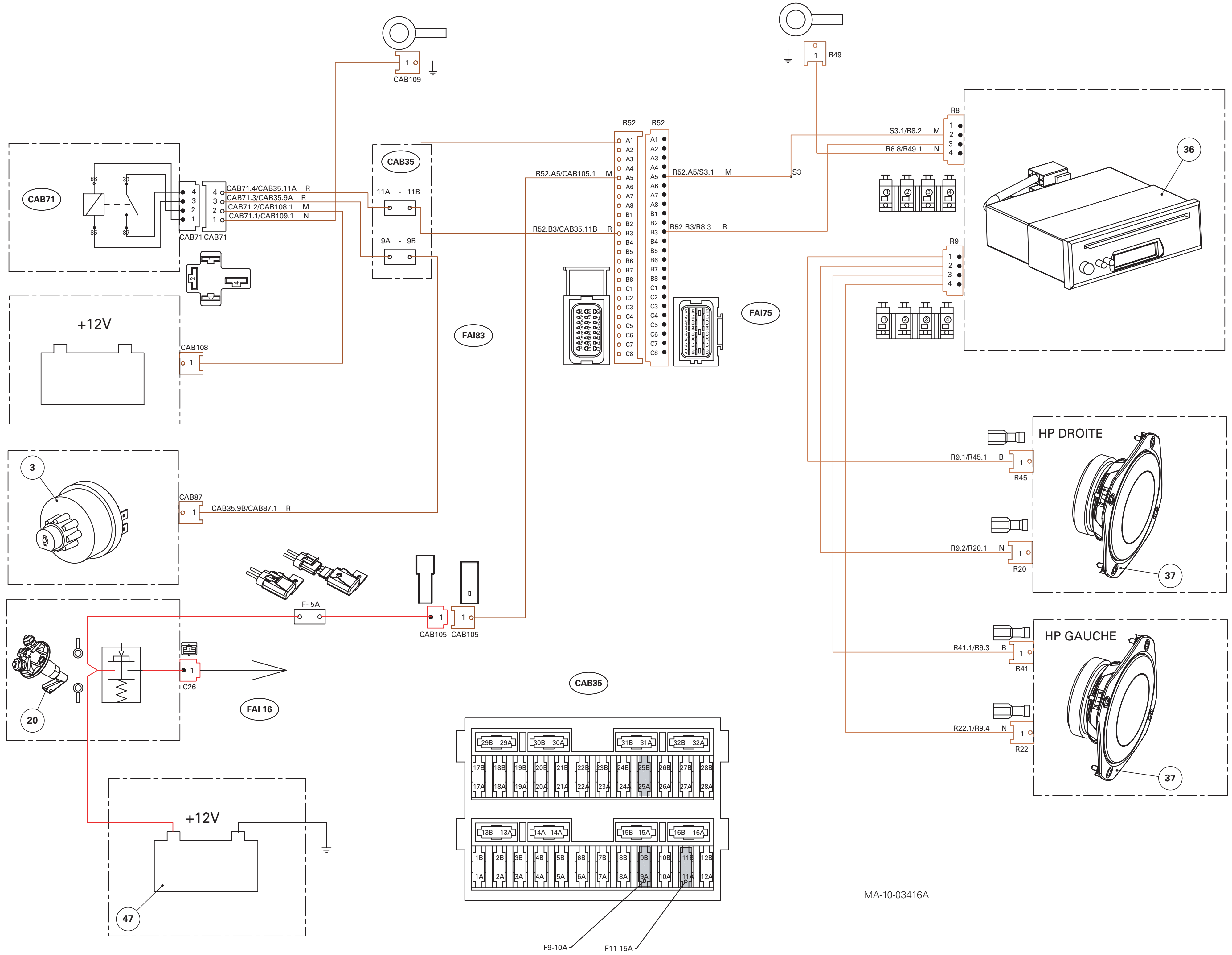

Fig. 15

Windscreen wiper for standard front windscreen

FAI 84 Cab instrument panel harness (all countries except US)
FAI 91 Cab lighting harness (all countries except US)
FAI 103 Top windscreen wiper - Instrument panel harness
CAB 35 Fuse box
CAB 71 Cab relay
CAB 76 Windscreen wiper timer relay
CAB 90 Windscreen wiper control unit
CAB 145 Front windscreen wiper motor
LIG 3 Windscreen washer pump
3 Start switch

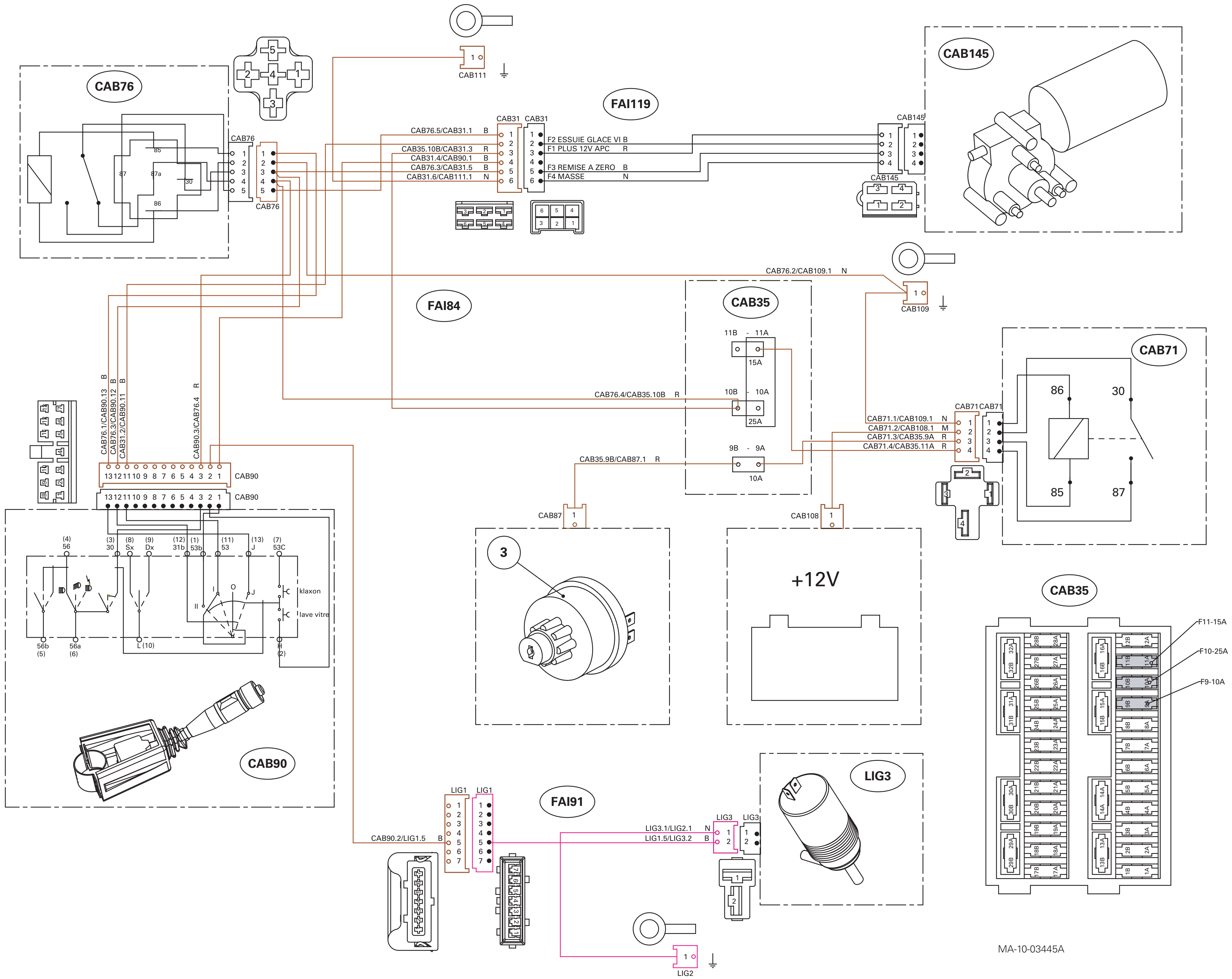

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Fig. 16

Windscreen wiper for opening front windscreen

FAI 84 Cab instrument panel harness (all countries except US)
FAI 91 Cab lighting harness (all countries except US)
FAI 103 Top windscreen wiper - Instrument panel harness
FAI 104 Top windsscreen wiper - Roof harness
CAB 35 Fuse box
CAB 71 Cab relay
CAB 76 Windscreen wiper timer relay
CAB 90 Windscreen wiper control unit
CAB 146 Front windscreen wiper motor
LIG 3 Windscreen washer pump
3 Start switch

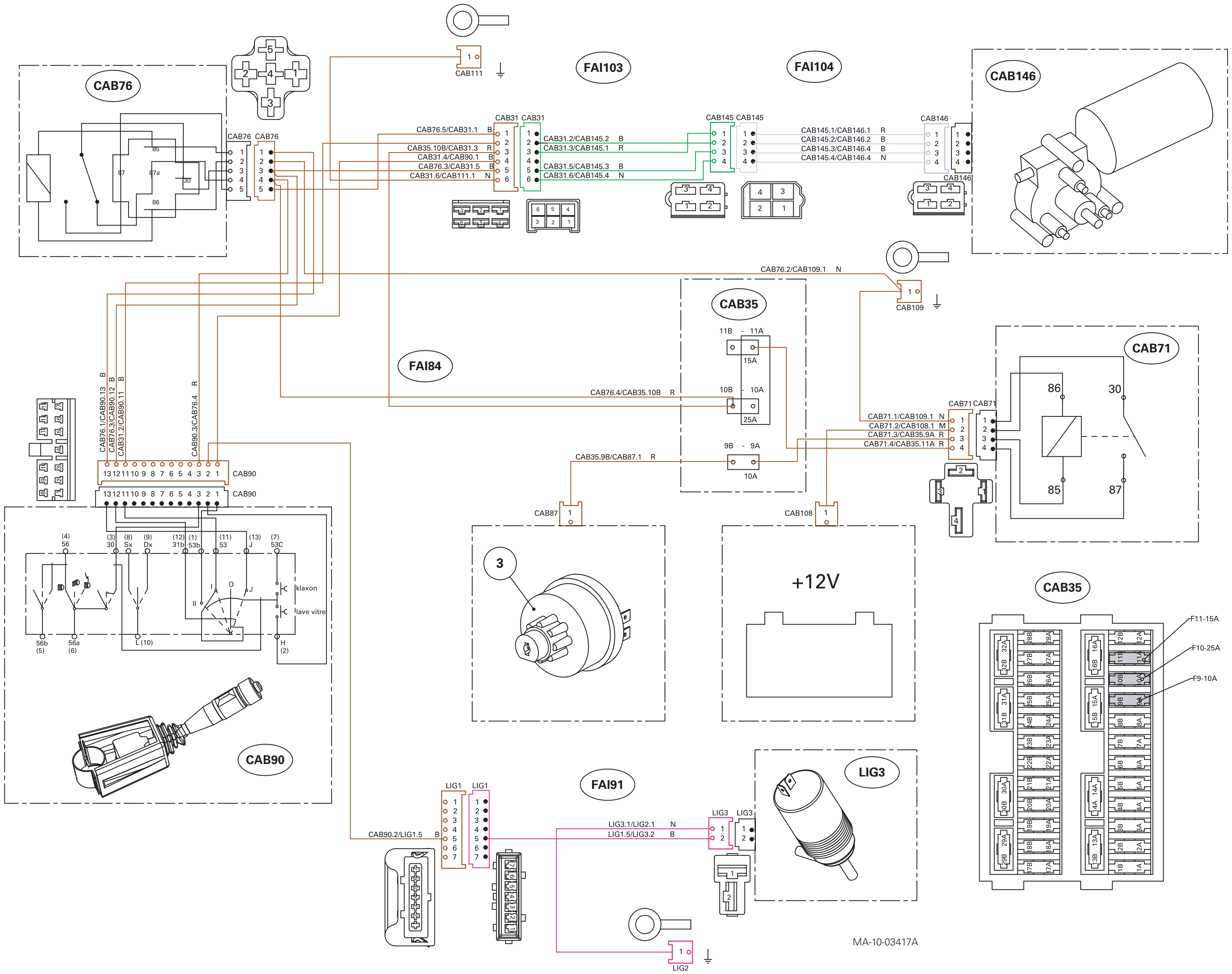


Fig. 17

Rear windscreen wiper

FAI 84 Cab instrument panel harness (all countries except US)
FAI 94 Standard roof harness - EU
CAB 35 Fuse box
CAB 71 Cab relay
R7 Rear windscreen wiper switch
R21 Rear windscreen wiper motor
3 Start switch

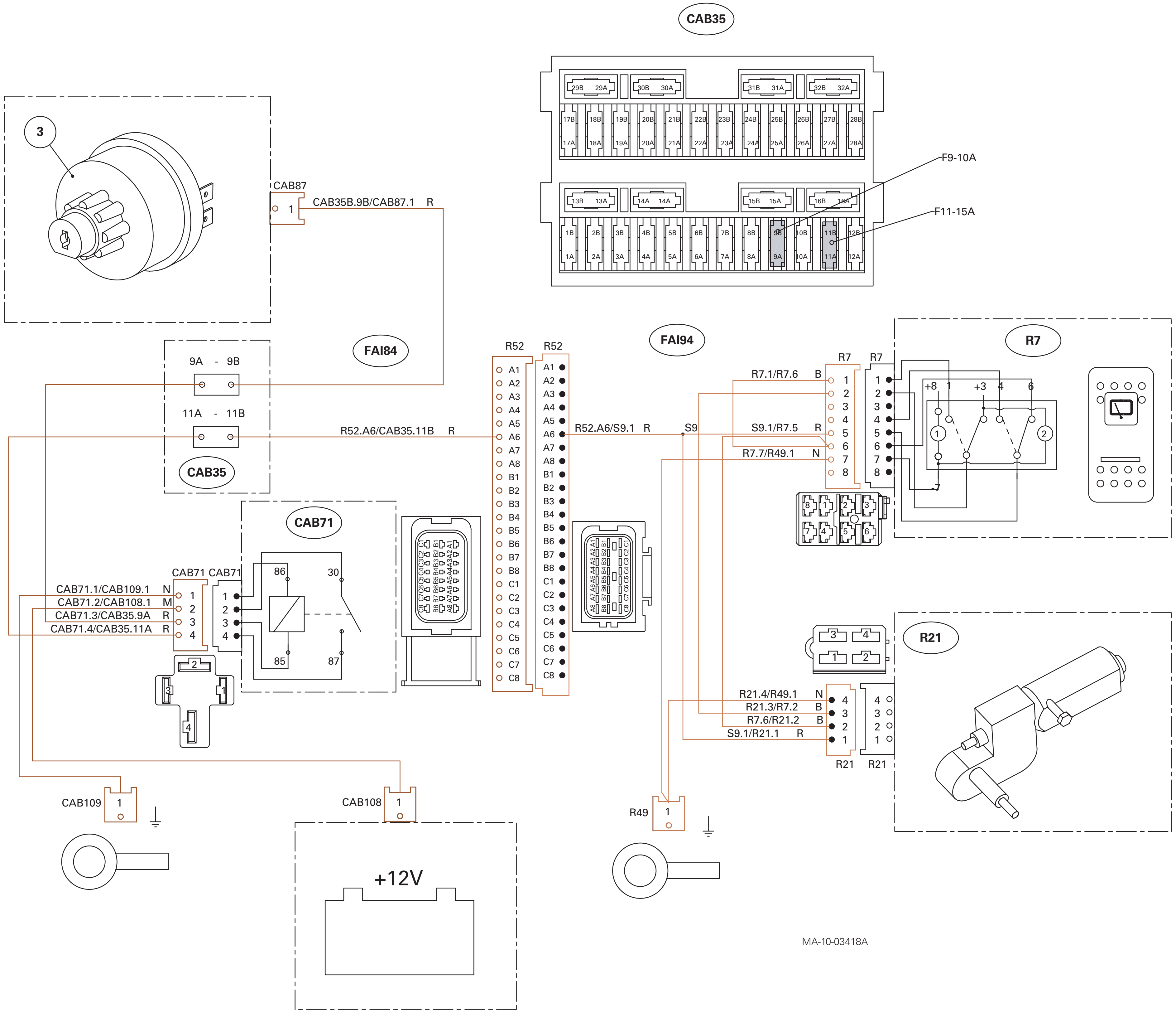


Fig. 18

Cab accessories electrical socket

FAI 71 Cab interior electrical socket harness - EEC standard
FAI 74 Cab console harness
FAI 84 Cab instrument panel harness (all countries except US)
CAB 35 Fuse box
3 Start switch
63 Cab internal socket

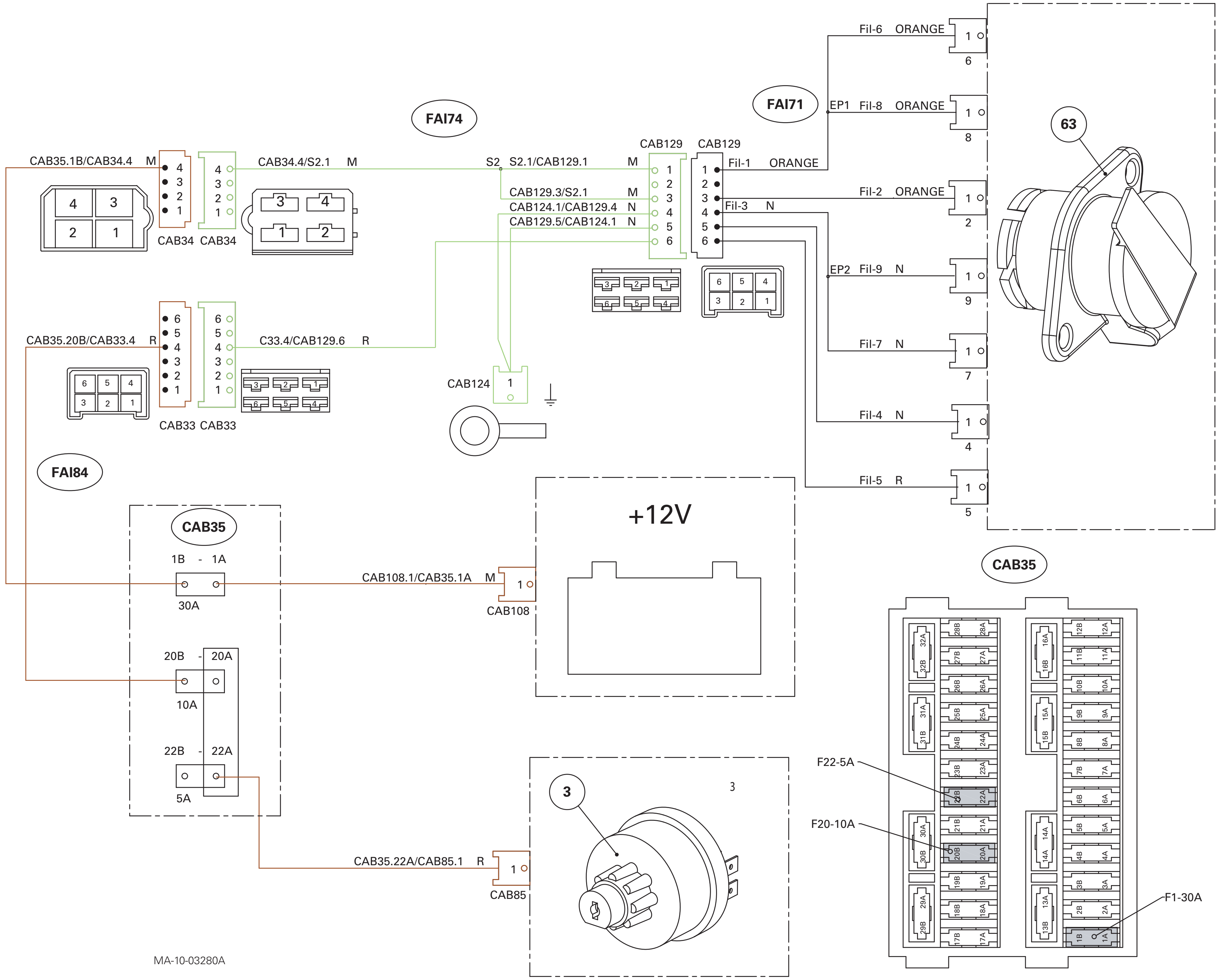


Fig. 19

Platform accessories electrical socket

FAI 71 CEE electrical socket harness
FAI 117 X2 Platform instrument panel harness - EU
CAB 35 Fuse box
3 Start switch
63 Cab internal socket

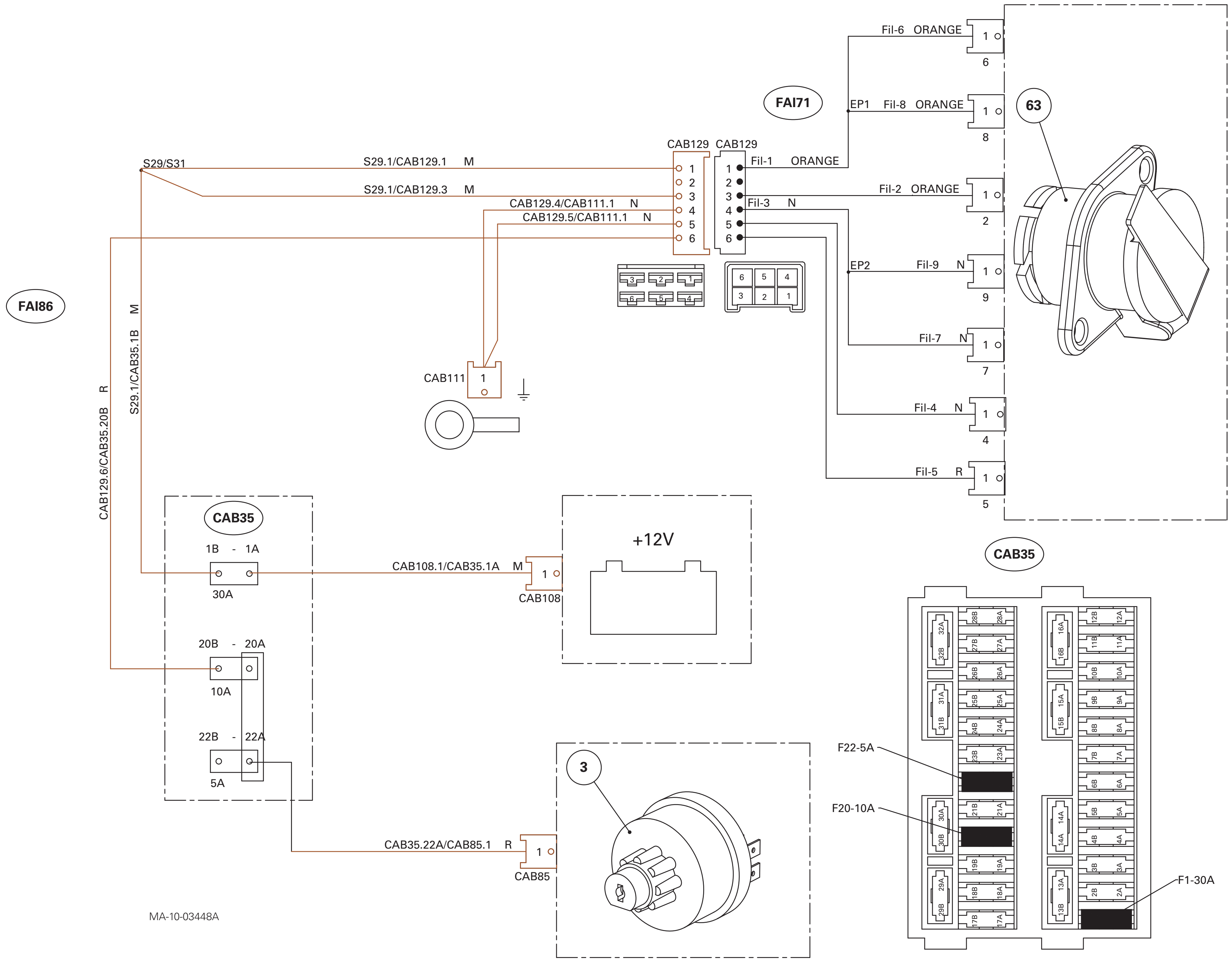


Fig. 20

Cab internal roof light

FAI 16 Circuit-breaker harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 94 Standard roof harness - EU
R24 Door switch
20 Battery circuit breaker
47 Battery
48 Roof light

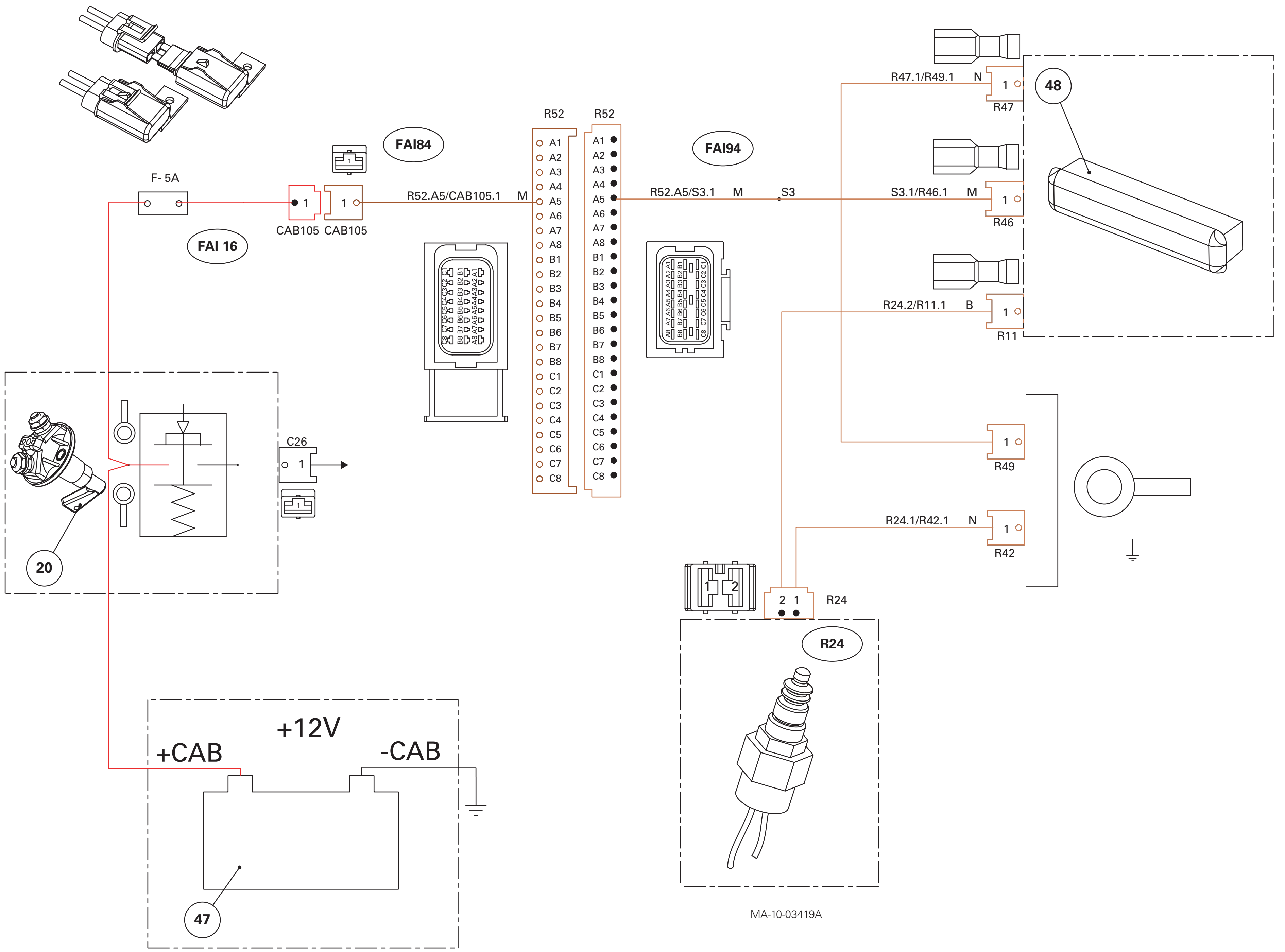


Fig. 21

Pneumatic seat

FAI 74 Cab console harness
FAI 84 Cab instrument panel harness (all countries except US)
CAB 35 Fuse box
CAB 123 Seat with pneumatic suspension
3 Start switch

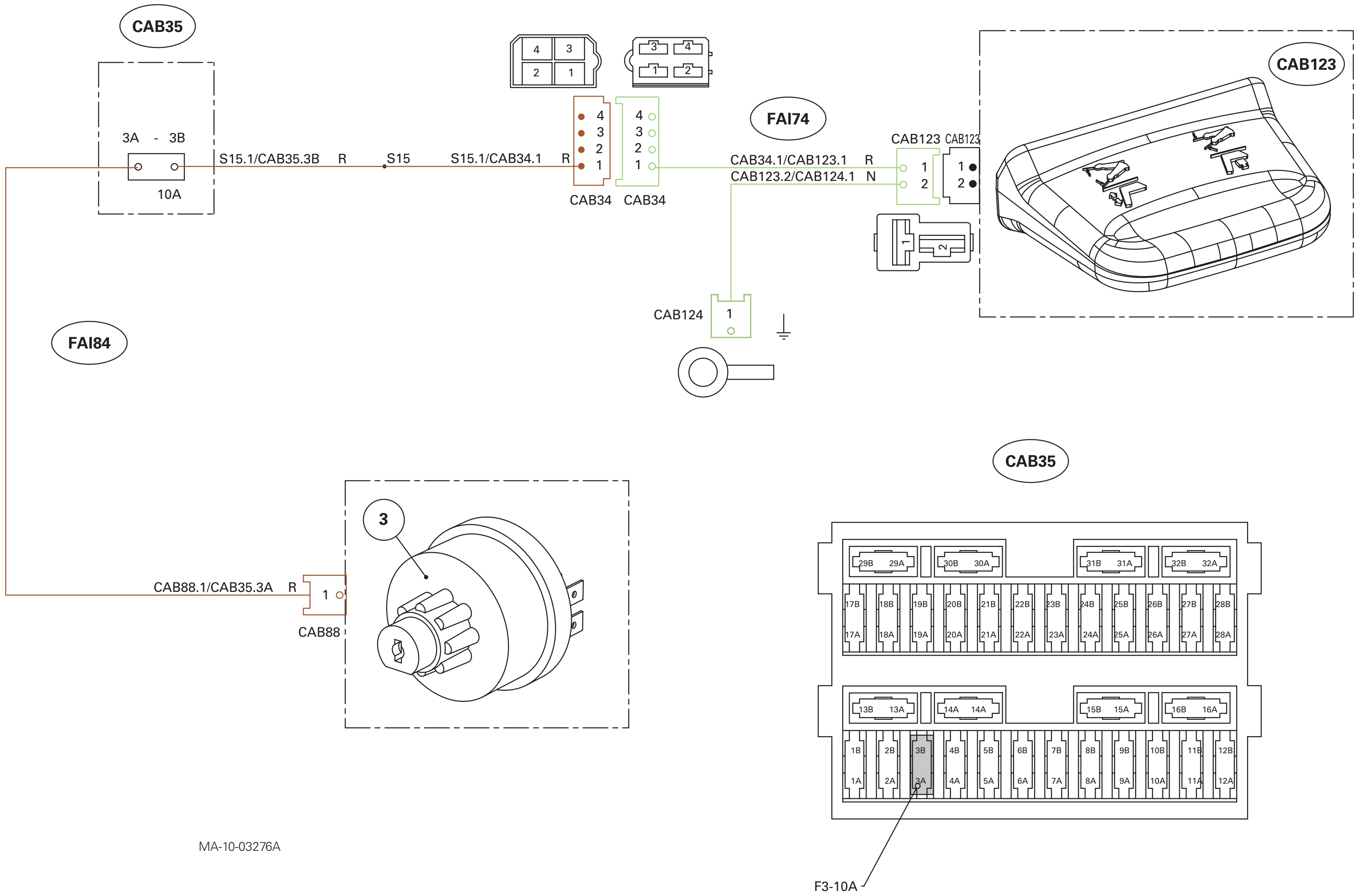


Fig. 22

Horn

FAI 82 Perkins engine mechanical injection harness
FAI 83 Cab instrument panel harness - US
CAB 35 Fuse box
CAB 71 Windscreen wiper timer relay
CAB 76 Cab relay
22 Wiper control unit
55Horn

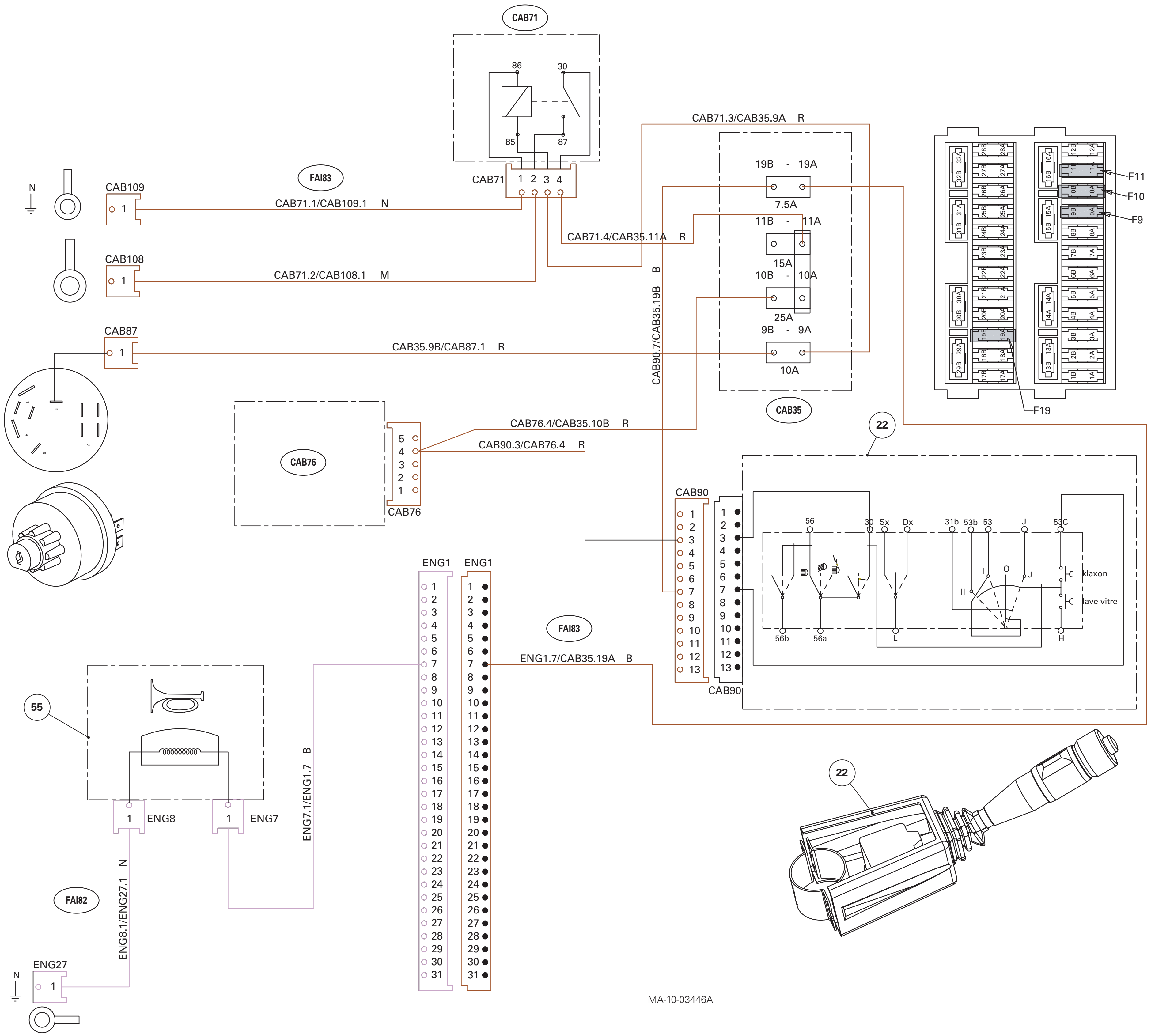


Fig. 23

C . Engine equipment

Air filter vacuum sensor

FAI 82 Perkins engine mechanical injection harness
FAI 83 Cab instrument panel harness - US
24 Air filter vacuum sensor
49 X2 instrument panel

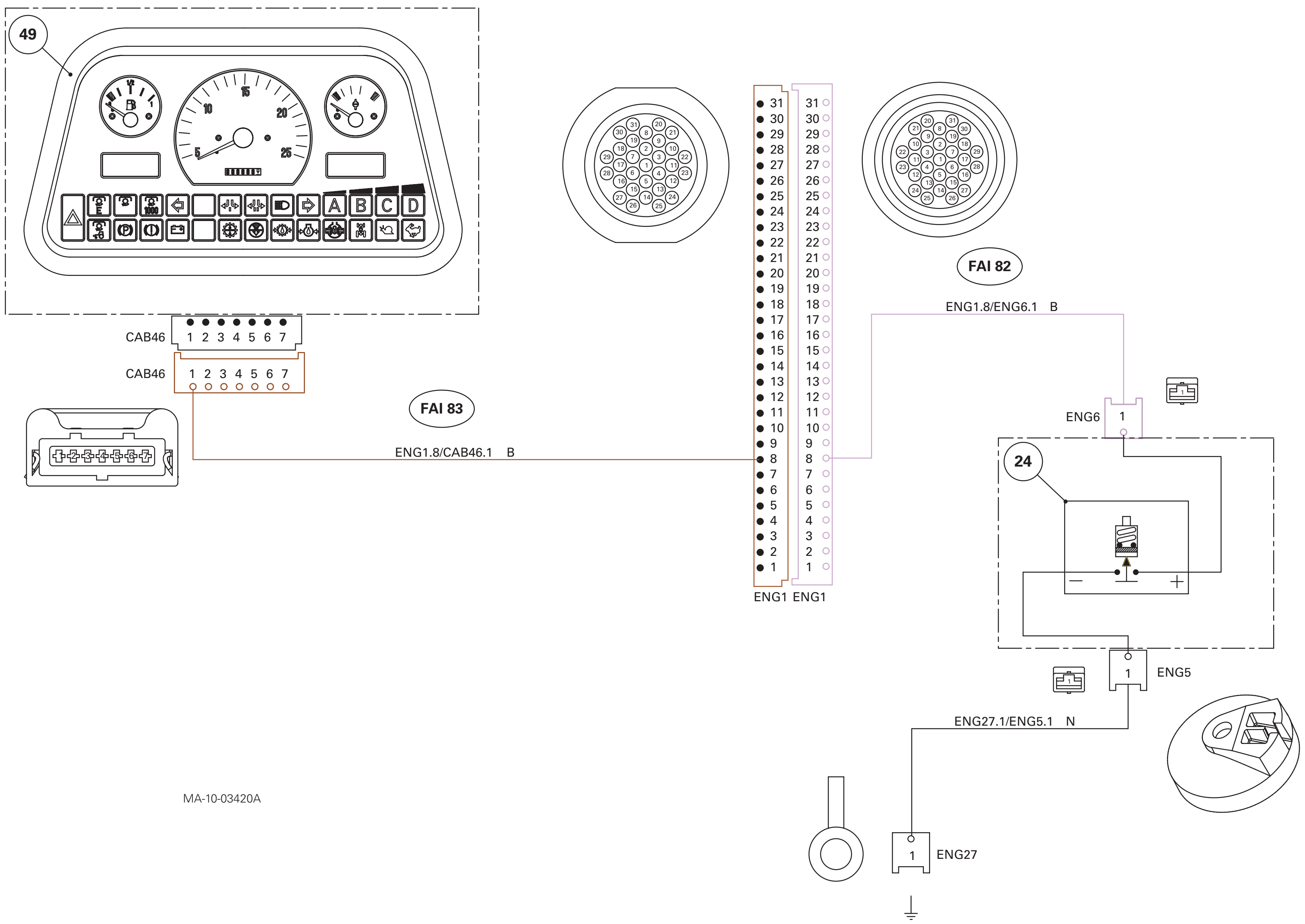


Fig. 24

Engine oil pressure sensor

FAI 82 Perkins engine mechanical injection harness
FAI 83 Cab instrument panel harness - US
23 Oil pressure sensor
49 X2 instrument panel

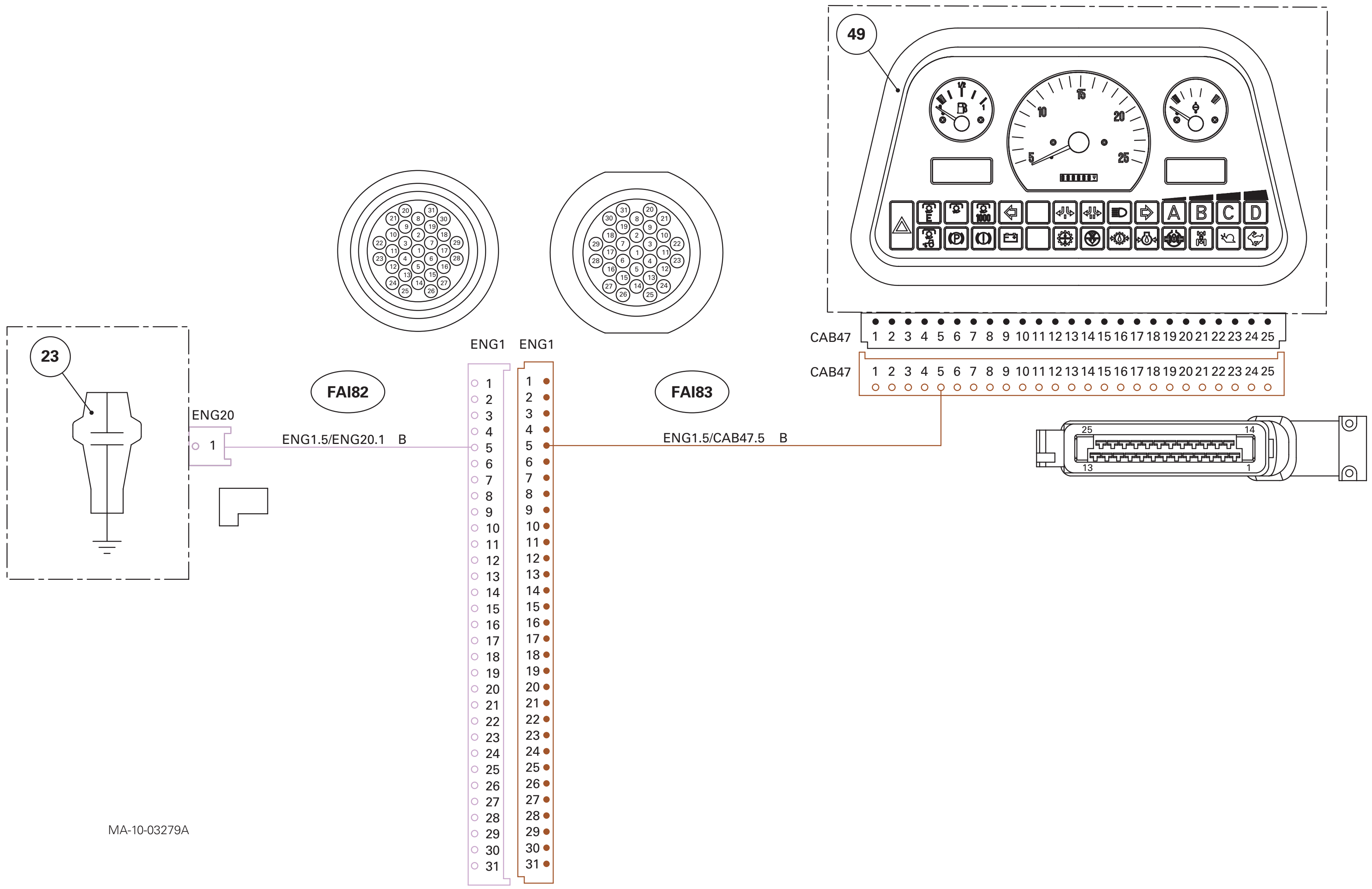


Fig. 25

Coolant Temperature

FAI 82 Perkins engine mechanical injection harness
FAI 83 Cab instrument panel harness - US
28 Coolant Temperature
49 X2 instrument panel

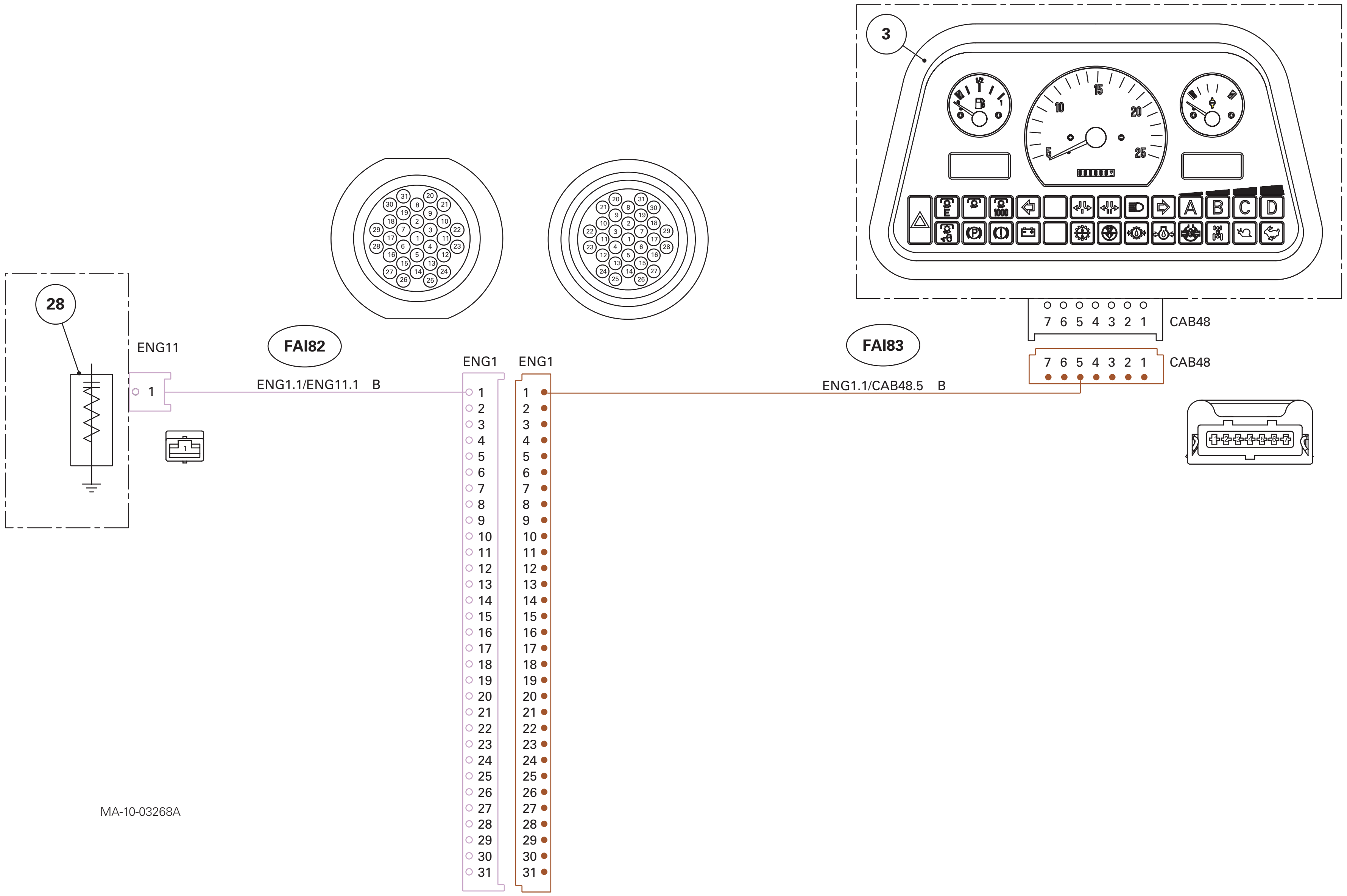


Fig. 26

Perkins 4-cylinder engine pre-heater

FAI82	Perkins engine mechanical injection harness
FAI84	Cab instrument panel harness (all countries except US)
ENG12	Preheater relay
ENG31	Preheater spark plug
3	Start switch
5	Cab interior
21	In line fuse
25	Starter motor
47	Battery

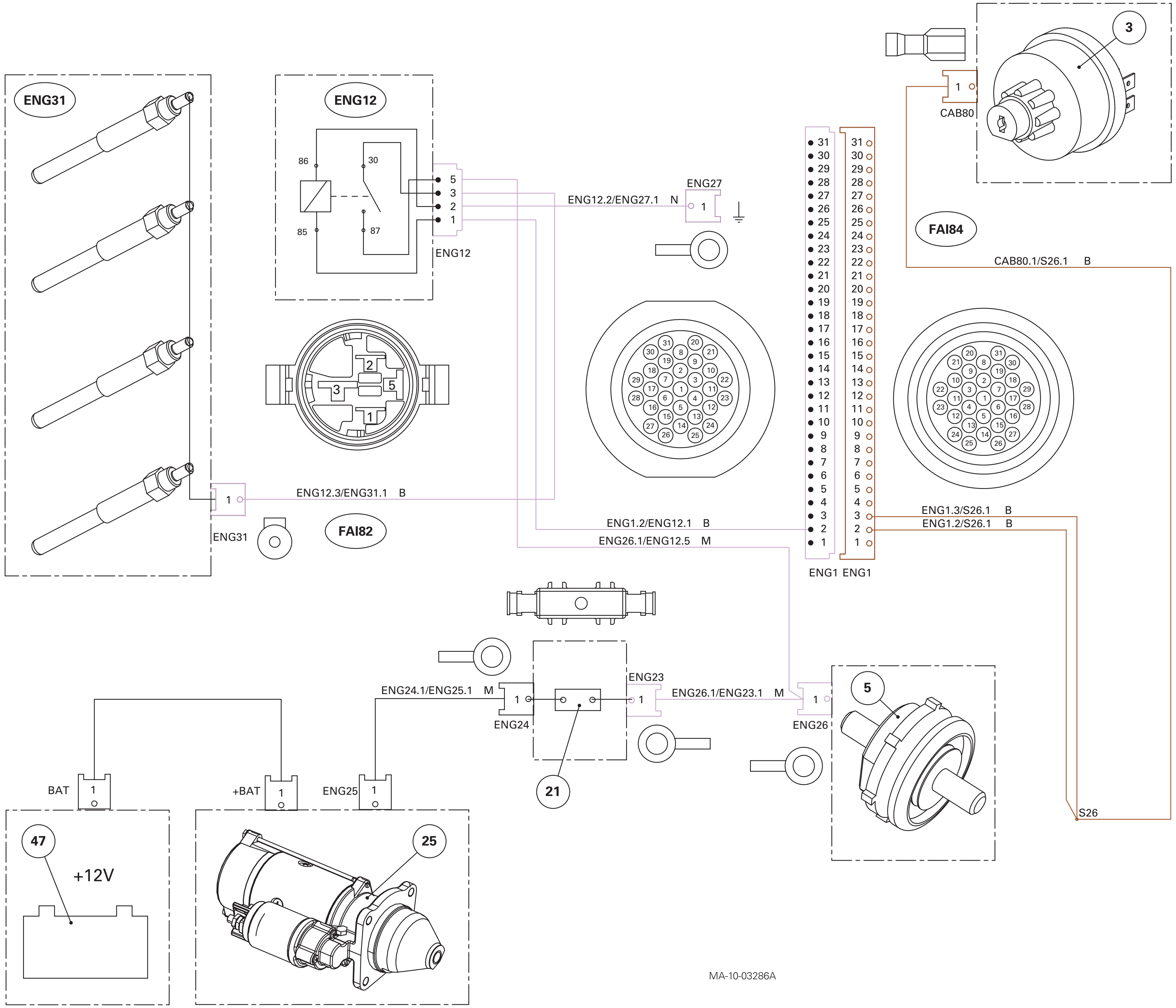


Fig. 27

Perkins 4-cylinder engine booster pump

FAI82 Perkins engine mechanical injection harness
FAI84 Cab instrument panel harness (all countries except US)
ENG12 Preheater relay
ENG31 Preheater spark plug

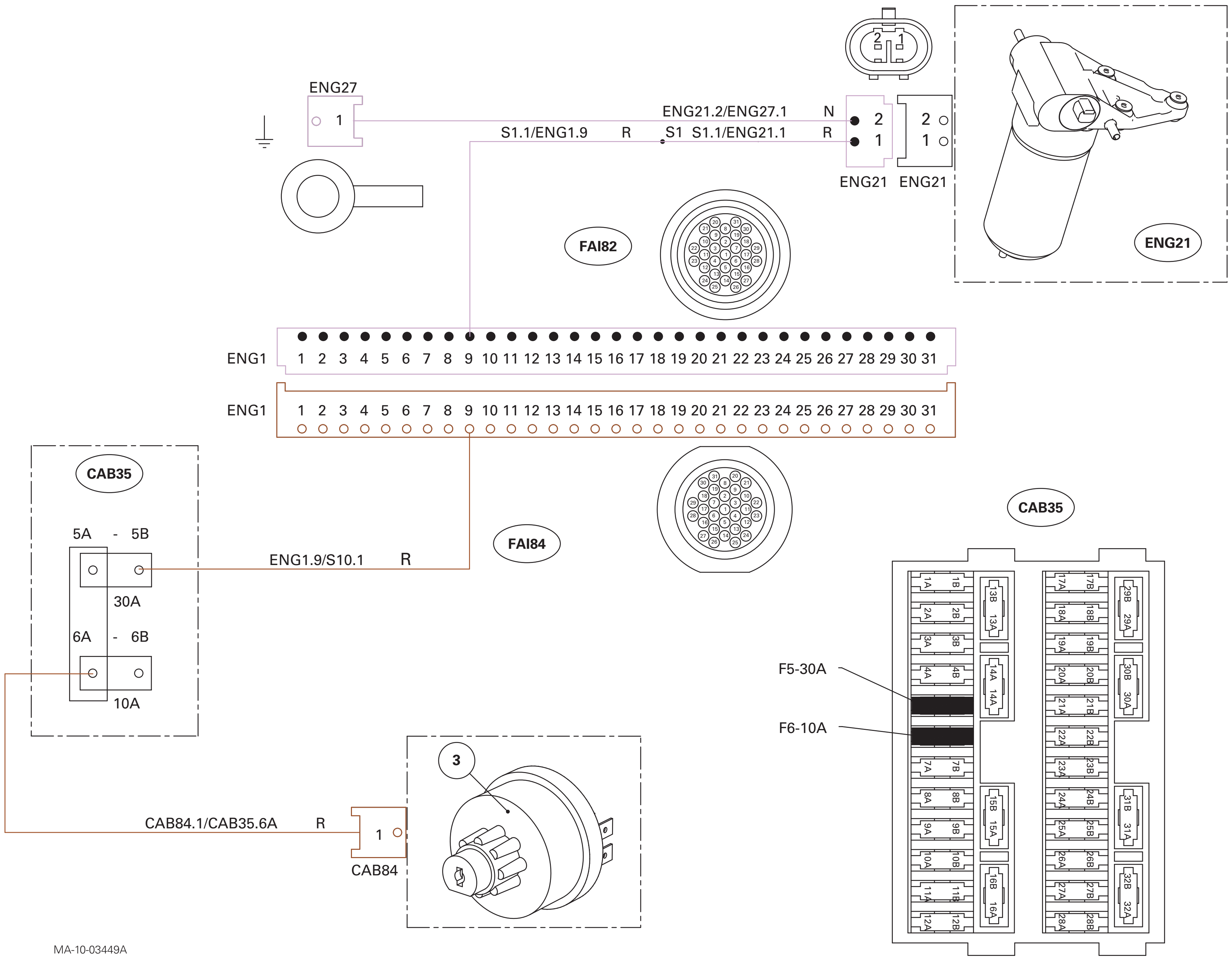


Fig. 28

Perkins 6-cylinder engine thermostart

- FAI 81 Perkins EEM engine harness
- FAI 84 Cab instrument panel harness (all countries except US)
- FAI 93 EEM option adapter harness
- CAB 29 Thermostart relay
- CAB 35 Fuse box
- ENG 35 Perkins EEM unit
- ENG 37 Thermostart
- 3 Start switch

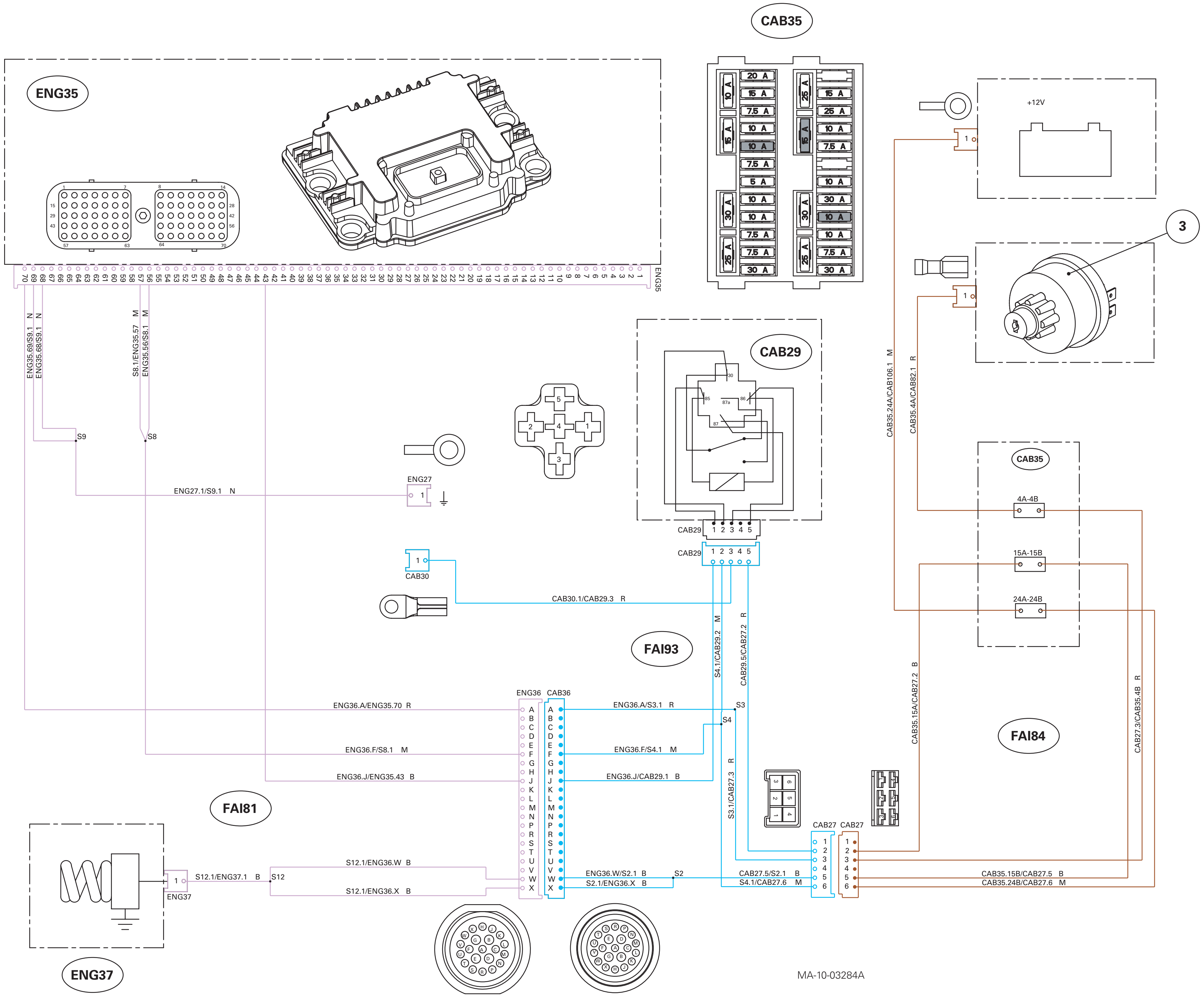


Fig. 29

Cummins engine power relay

FAI84 Cab instrument panel harness (all countries except US)
FAI115 Cummins engine mechanical injection harness
3 Start switch
5 Cab interior
21 In line fuse
25 Starter motor
47 Battery
60 Grid Heater
61 Grid Heater relay

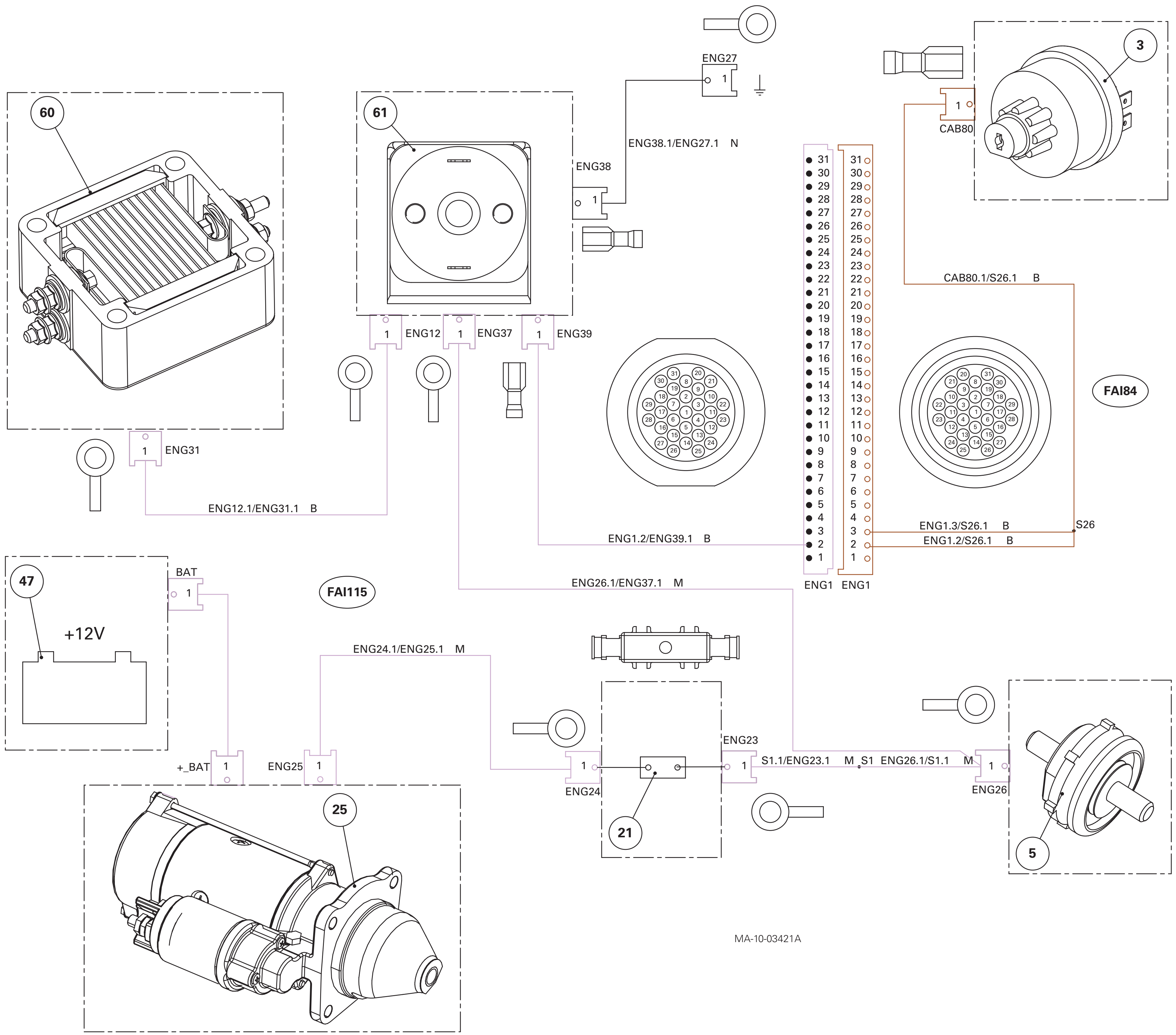


Fig. 30

Fuel gauge

FAI 81 Perkins EEM engine harness
FAI 84 Cab instrument panel harness (all countries except US)
49 X2 instrument panel
62 X2 fuel gauge

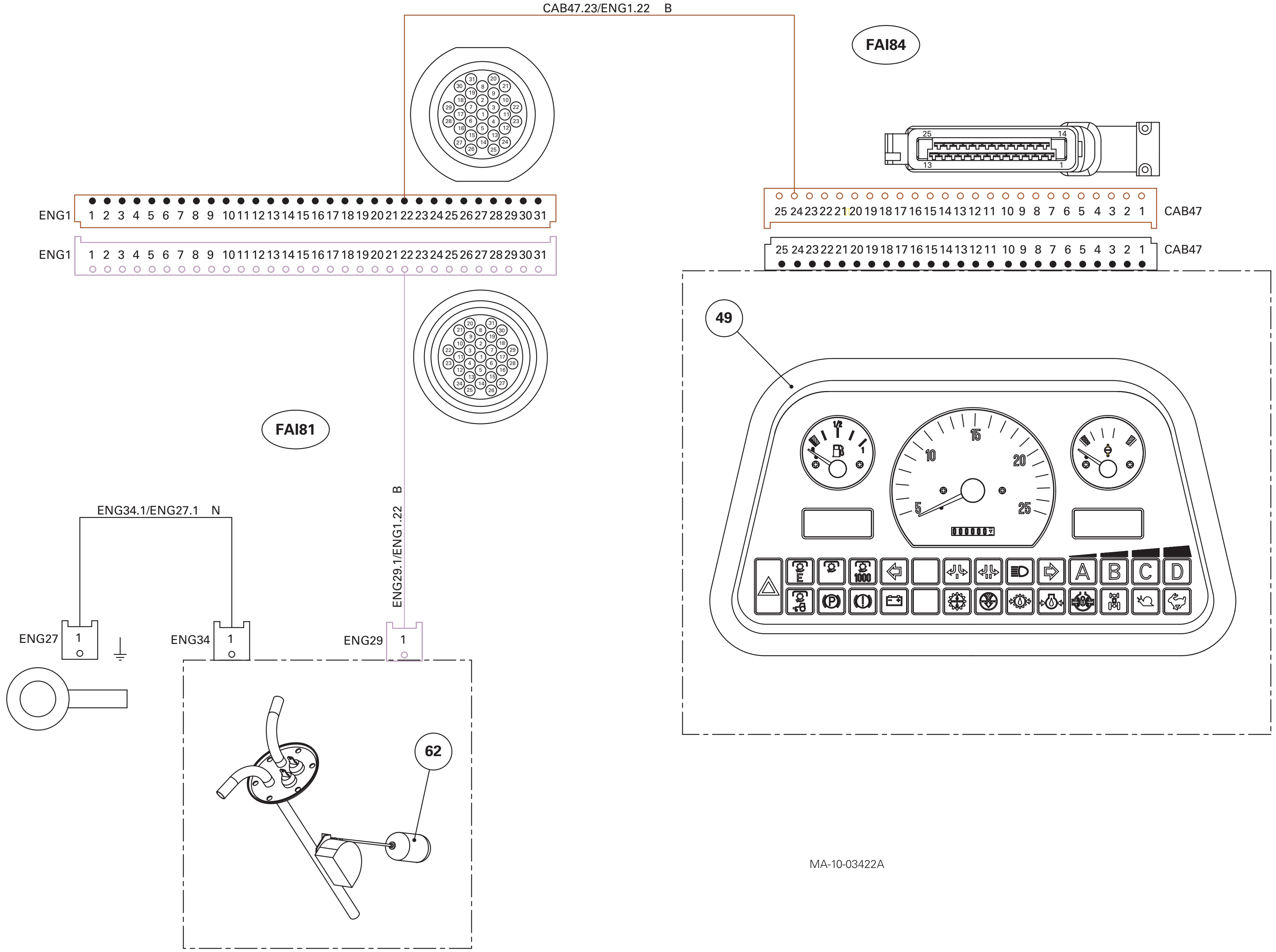


Fig. 31

Battery charge and engine start

FAI 73 Linkage harness
FAI 74 Cab console harness
FAI 81 Perkins EEM engine harness
FAI 84 Cab instrument panel harness (all countries except US)
CAB 01 EHRB linkage calculator
CAB 35 Fuse box
46 Alternator
47 Battery
49 X2 instrument panel

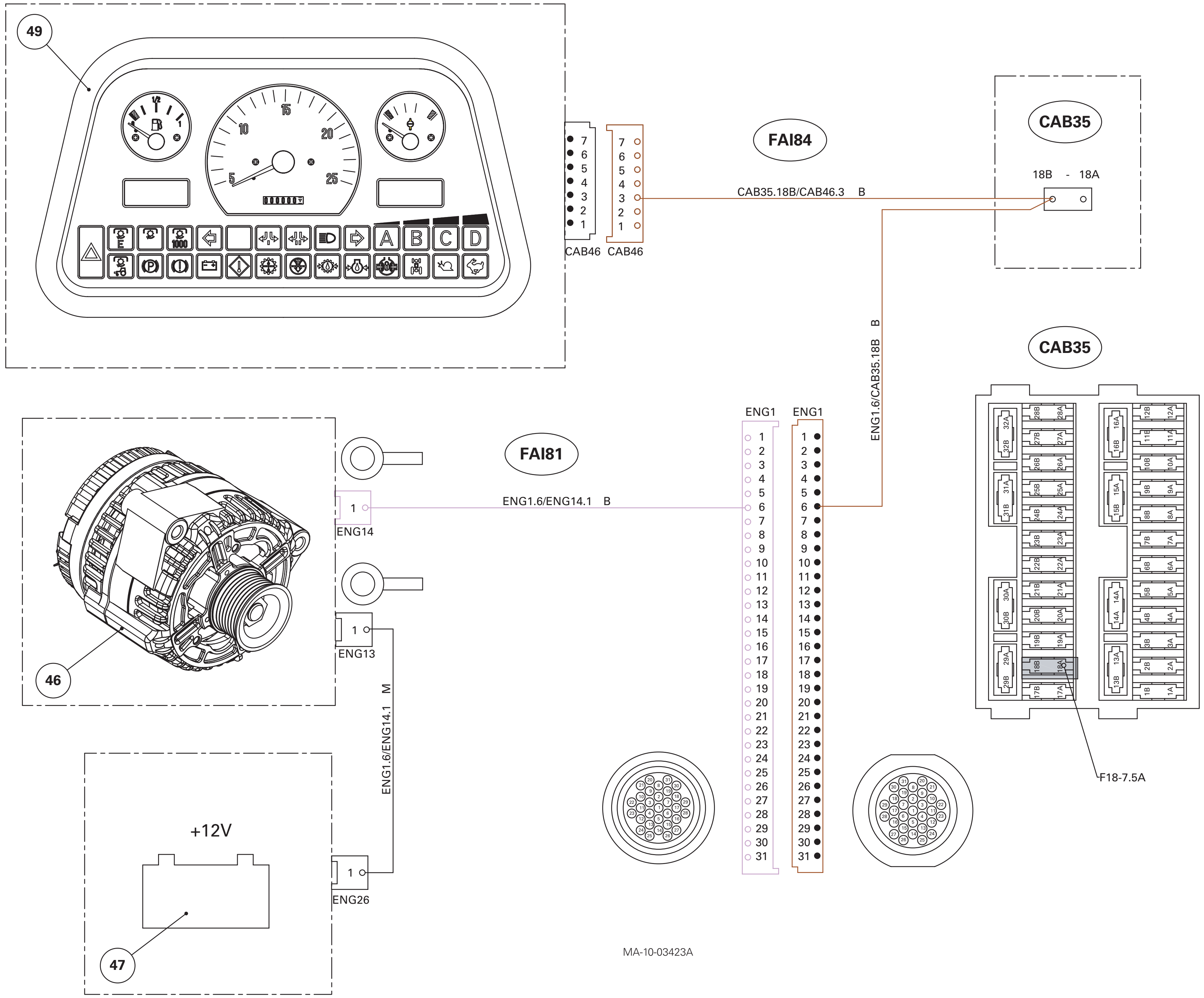


Fig. 32

D . Transmission

30 kph Speedshift

FAI 83 Cab instrument panel harness - US
FAI 88 Power Shuttle GBA20 transmission - 57 l/min hydraulics harness
FAI 105 30 kph Speedshift shunt
CAB 35 Fuse box
CAB 41 Speedshift relay
CAB 66 Speedshift switch
TR18 Speedshift solenoid valve
3 Start switch
49 X2 instrument panel

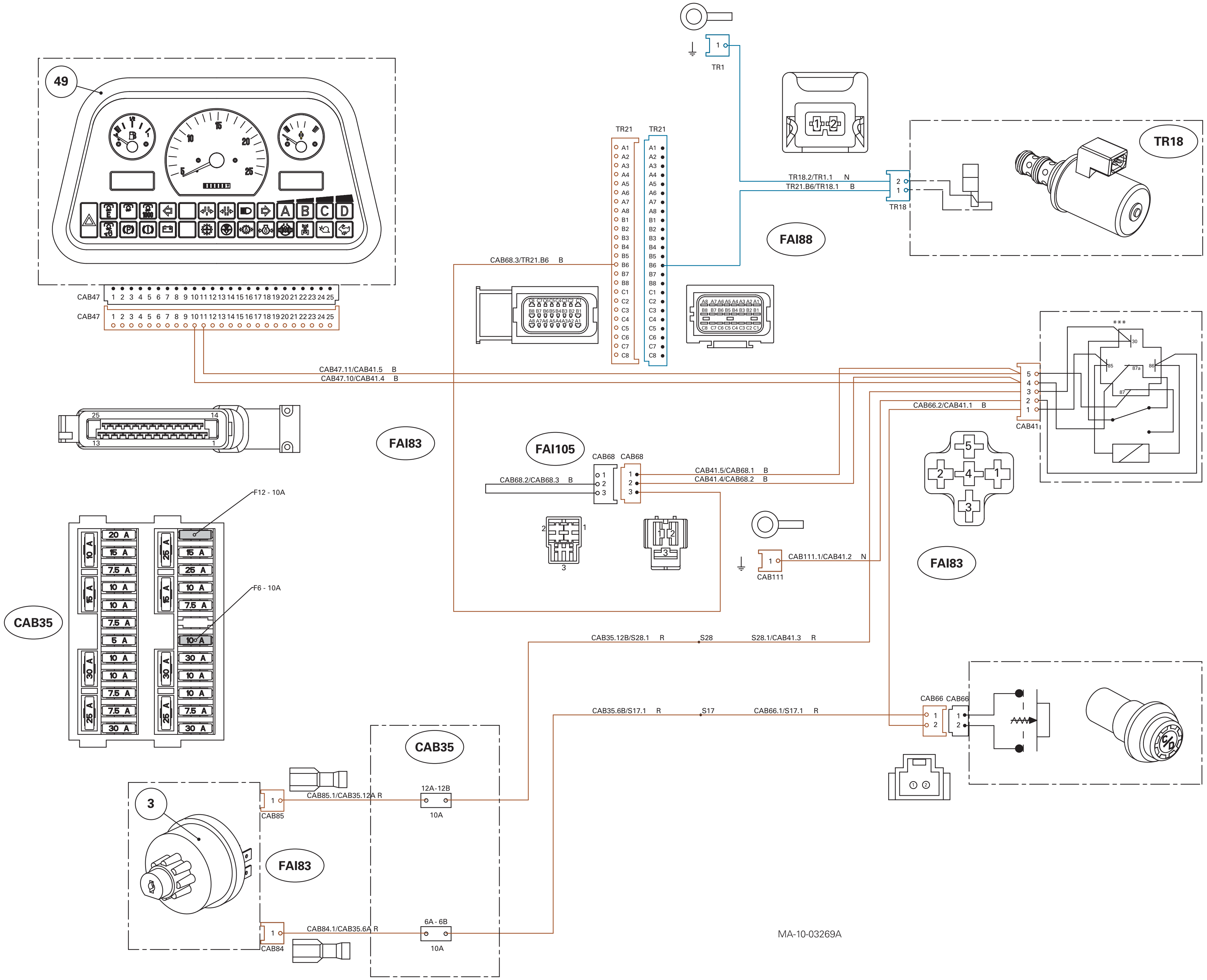


Fig. 33

40 kph Speedshift

FAI 83	Cab instrument panel harness - US
FAI 88	Power Shuttle GBA20 transmission - 57 l/min hydraulics harness
FAI 106	40 kph Speedshift shunt
CAB 35	Fuse box
CAB 41	Speedshift relay
CAB 66	Speedshift switch
TR18	Speedshift solenoid valve
3	Start switch
49	X2 instrument panel

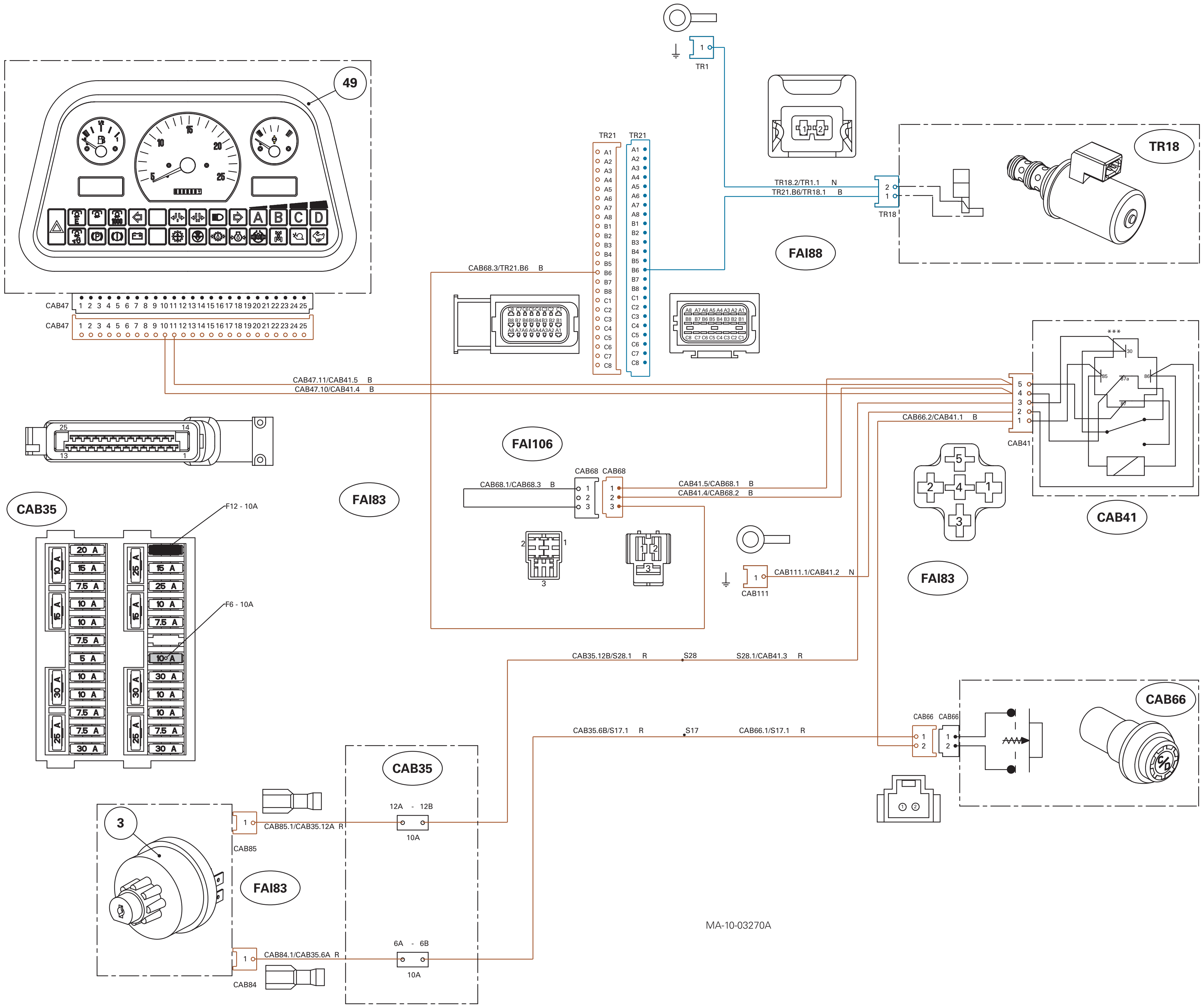


Fig. 34

4 Wheel drive

FAI 83 Cab instrument panel harness - US
FAI 88 Power Shuttle GBA20 transmission - 57 l/min hydraulics harness
CAB 63 4WD switch
CAB 65 4WD relay
CAB 73 Right-hand brake pedal
CAB 74 Left-hand brake pedal
CAB 35 Fuse box
TR10 4WD solenoid valve
3 Start switch
49 X2 instrument panel

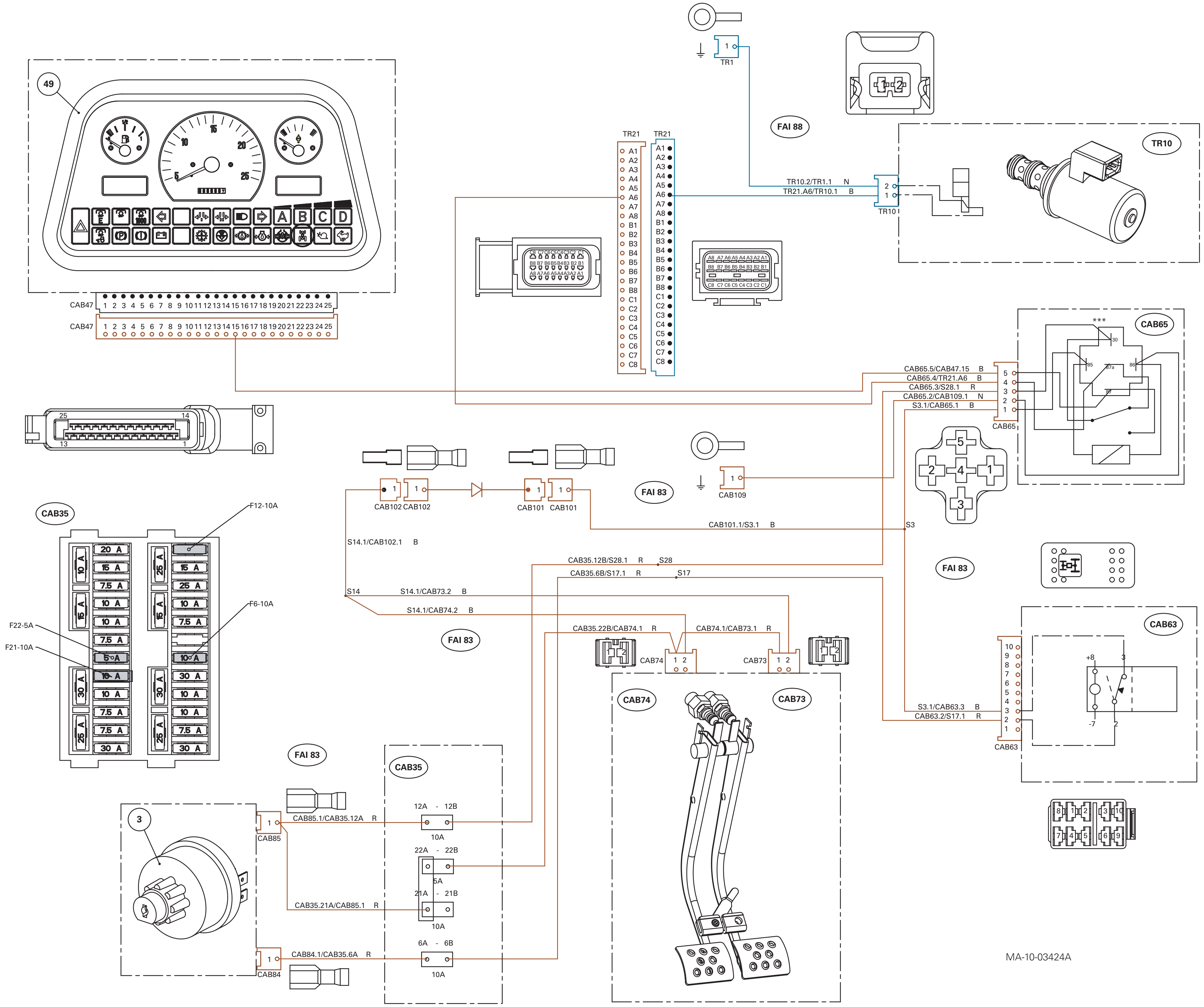


Fig. 35

Differential lock (without Auto 5)

FAI 73 Linkage harness
FAI 83 X2 instrument panel harness
FAI 88 X2 OC 57 litre transport harness
CAB 05 Linkage switch
CAB 35 Fuse box
CAB 55 Right-hand brake pedal switch
CAB 56 Left-hand brake pedal switch
CAB 62 Differential lock relay
CAB 64 Differential lock switch
TR 6 Differential lock solenoid valve
49 X2 instrument panel

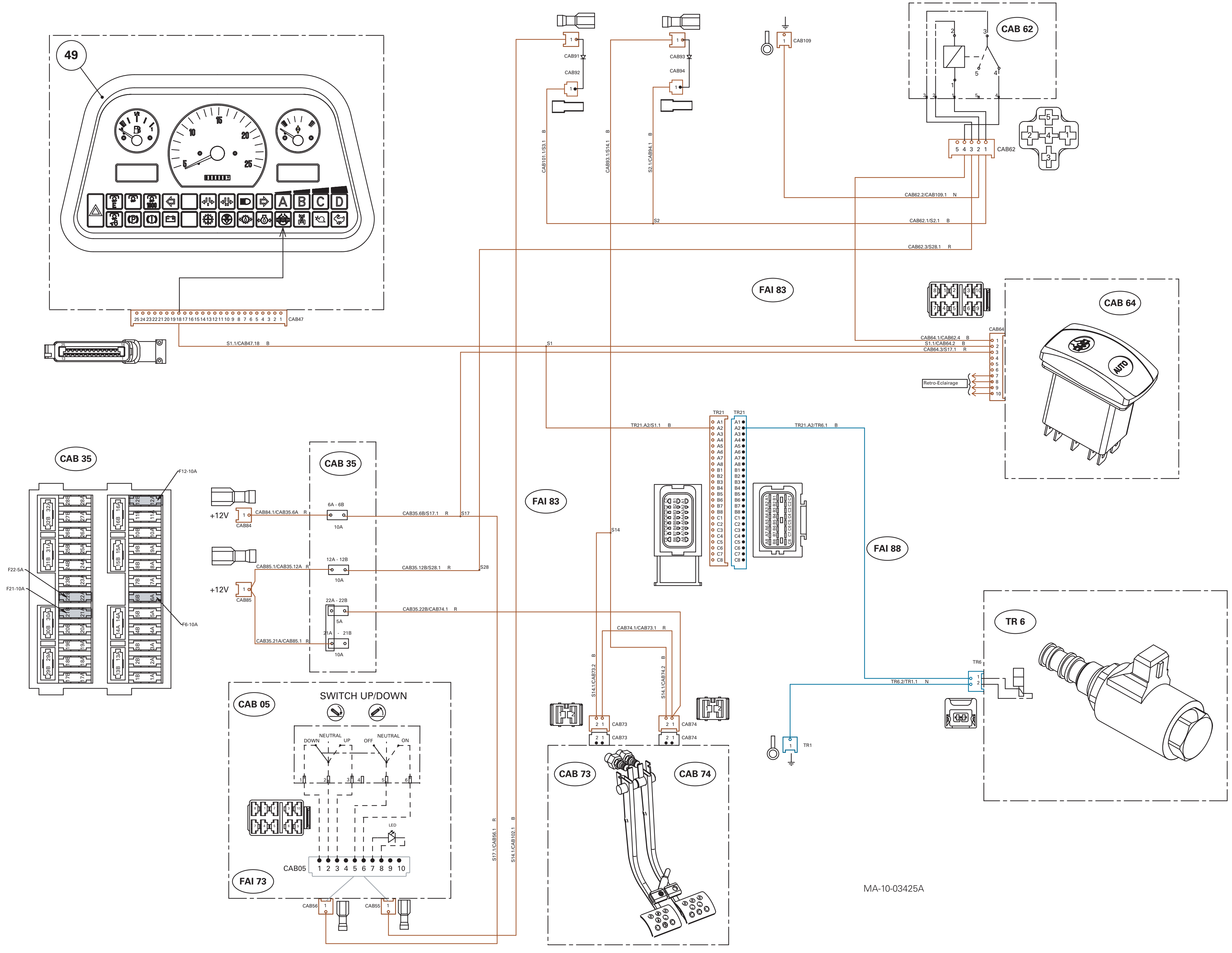


Fig. 36

Rear PTO (without Auto 5)

FAI 74 Cab console harness
FAI 83 Cab instrument panel harness - US
FAI 87 GBA20 transmission mechanical reverse shuttle - 57 l/min hydraulics harness
CAB 35 Fuse box
TR3 Rear PTO speed sensor
TR5 Engine speed sensor
TR11 Rear PTO solenoid valve
TR12 Rear PTO brake solenoid valve
TR14 X2 PTO module
3 Start switch
49 X2 instrument panel
50 X2 PTO switch
51 X2 PTO lever switch

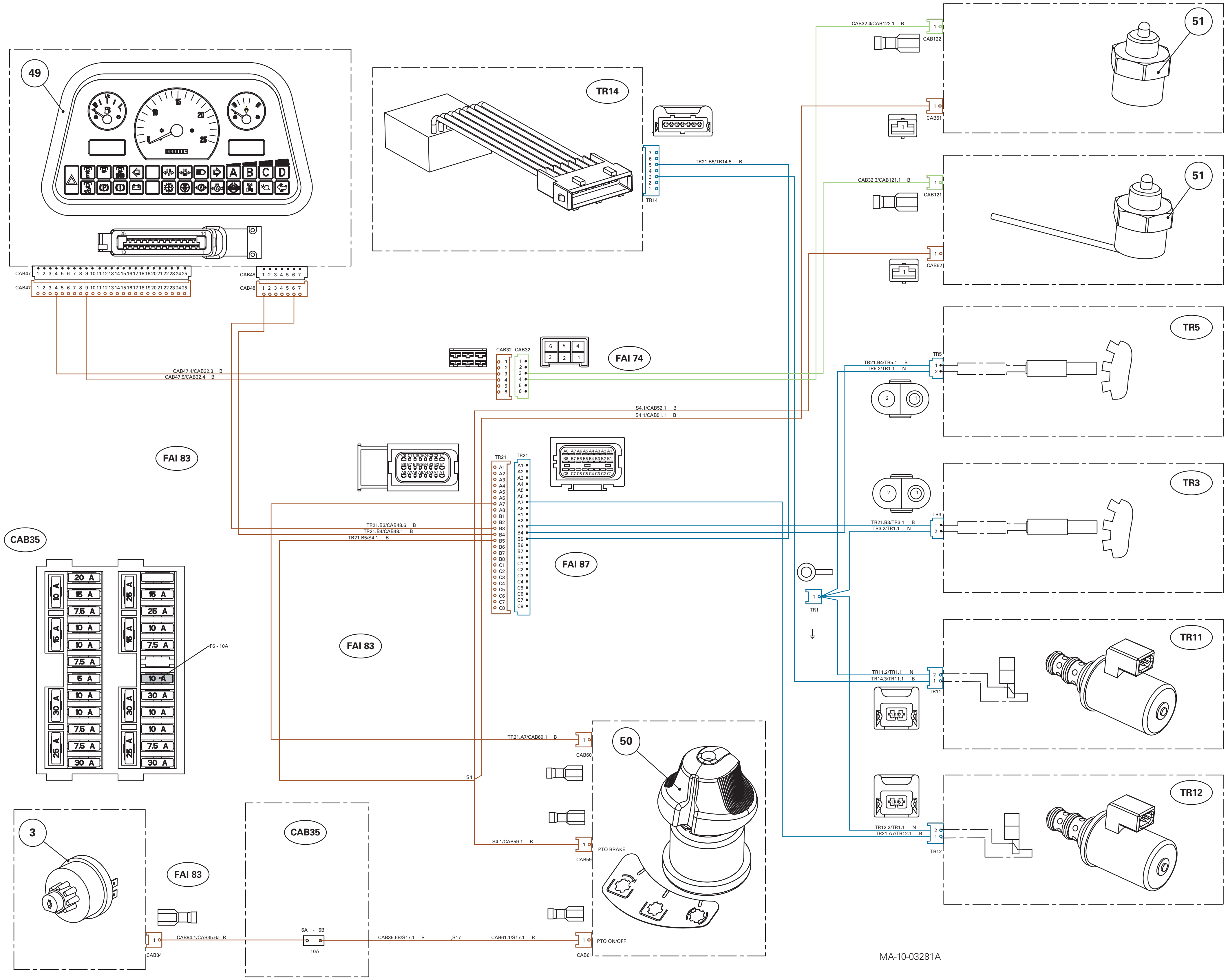


Fig. 37

Platform rear PTO (without Auto 5)

FAI 86 X2 Platform instrument panel harness - EU
FAI 87 MECA OC 57 litre transport harness
CAB 35 Fuse box
TR3 Rear PTO speed sensor
TR5 Engine speed sensor
TR11 Rear PTO solenoid valve
TR12 Rear PTO brake solenoid valve
TR14 X2 PTO module
3 Start switch
49 X2 instrument panel
50 X2 PTO switch
51 X2 PTO lever switch

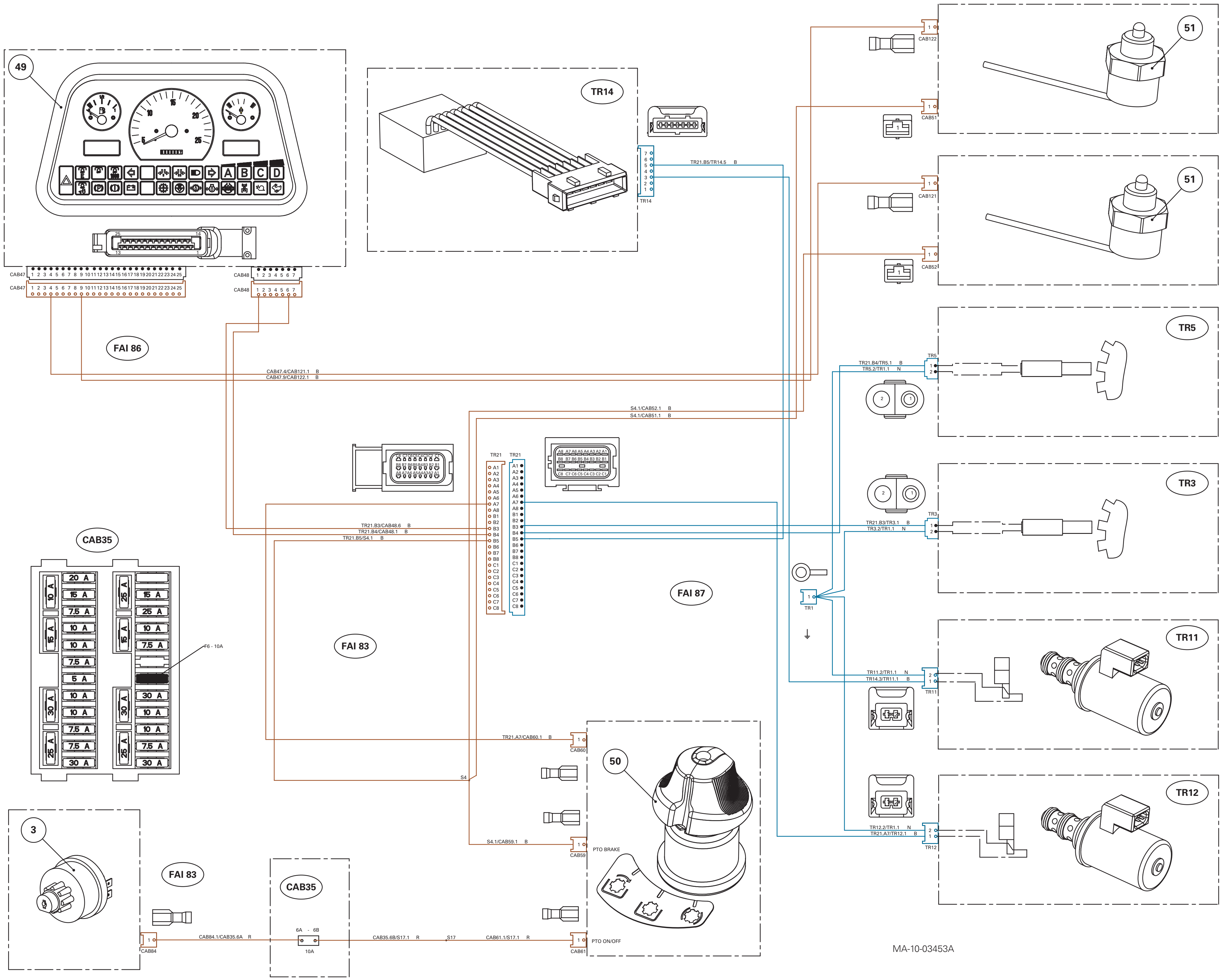


Fig. 38

Load sensing PTO (without Auto 5)

FAI 74 Cab console harness
FAI 83 Cab instrument panel harness - US
FAI 87 GBA20 transmission mechanical reverse shuttle - 57 l/min hydraulics harness
CAB 35 Fuse box
TR3 Rear PTO speed sensor
TR5 Engine speed sensor
TR11 Rear PTO solenoid valve
TR12 Rear PTO brake solenoid valve
TR14 X2 PTO module
3 Start switch
49 X2 instrument panel
50 X2 PTO switch
51 X2 PTO lever switch
53 X2 LSPTO switch

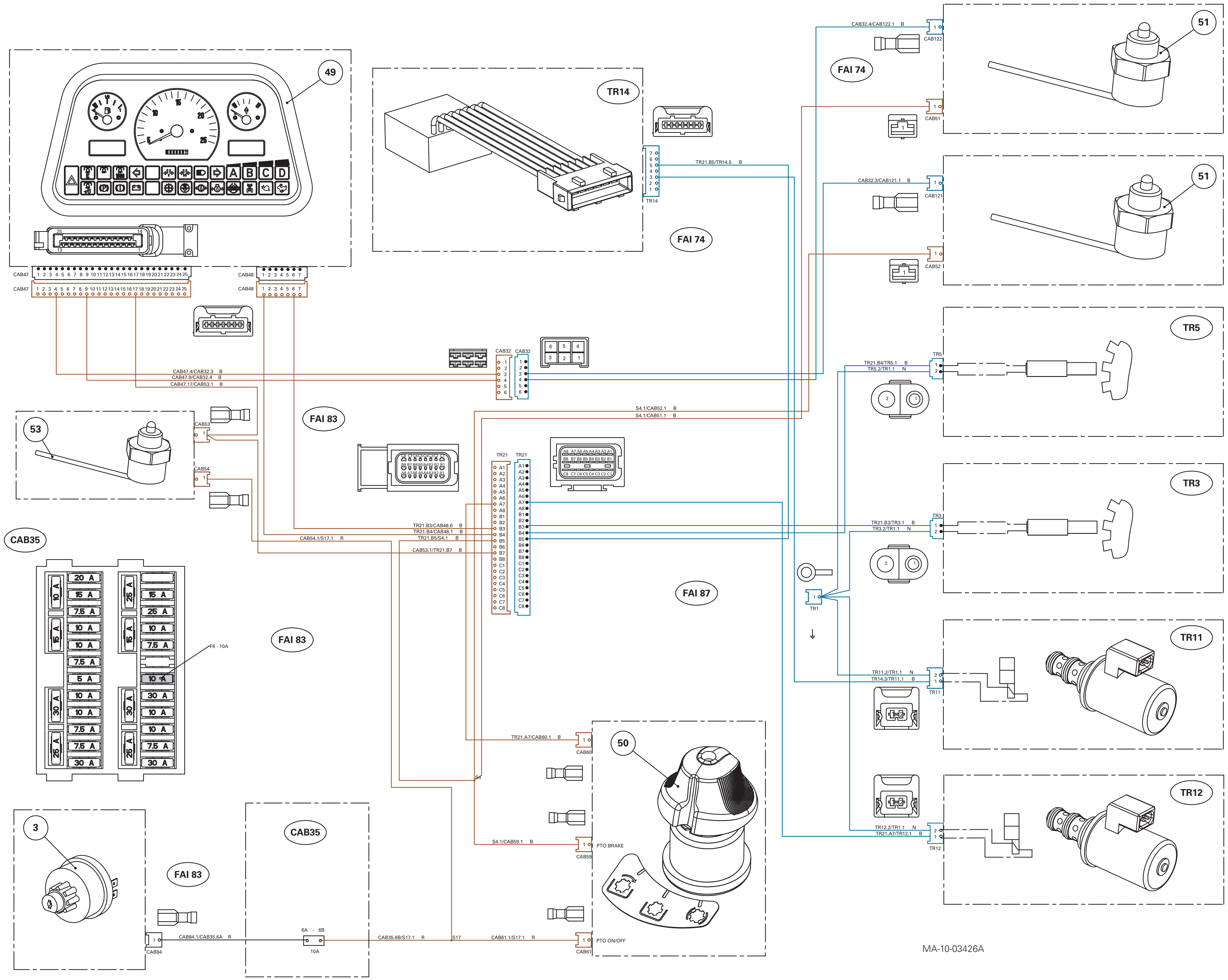


Fig. 39

Platform load sensing PTO (without Auto 5)

FAI 85	Platform instrument panel harness - NAO
FAI 87	MECA OC 57 litre transport harness
CAB 35	Fuse box
TR3	Rear PTO speed sensor
TR5	Engine speed sensor
TR11	Rear PTO solenoid valve
TR12	Rear PTO brake solenoid valve
TR14	X2 PTO module
3	Start switch
49	X2 instrument panel
50	X2 PTO switch
51	X2 PTO lever switch
53	X2 LSPTO switch

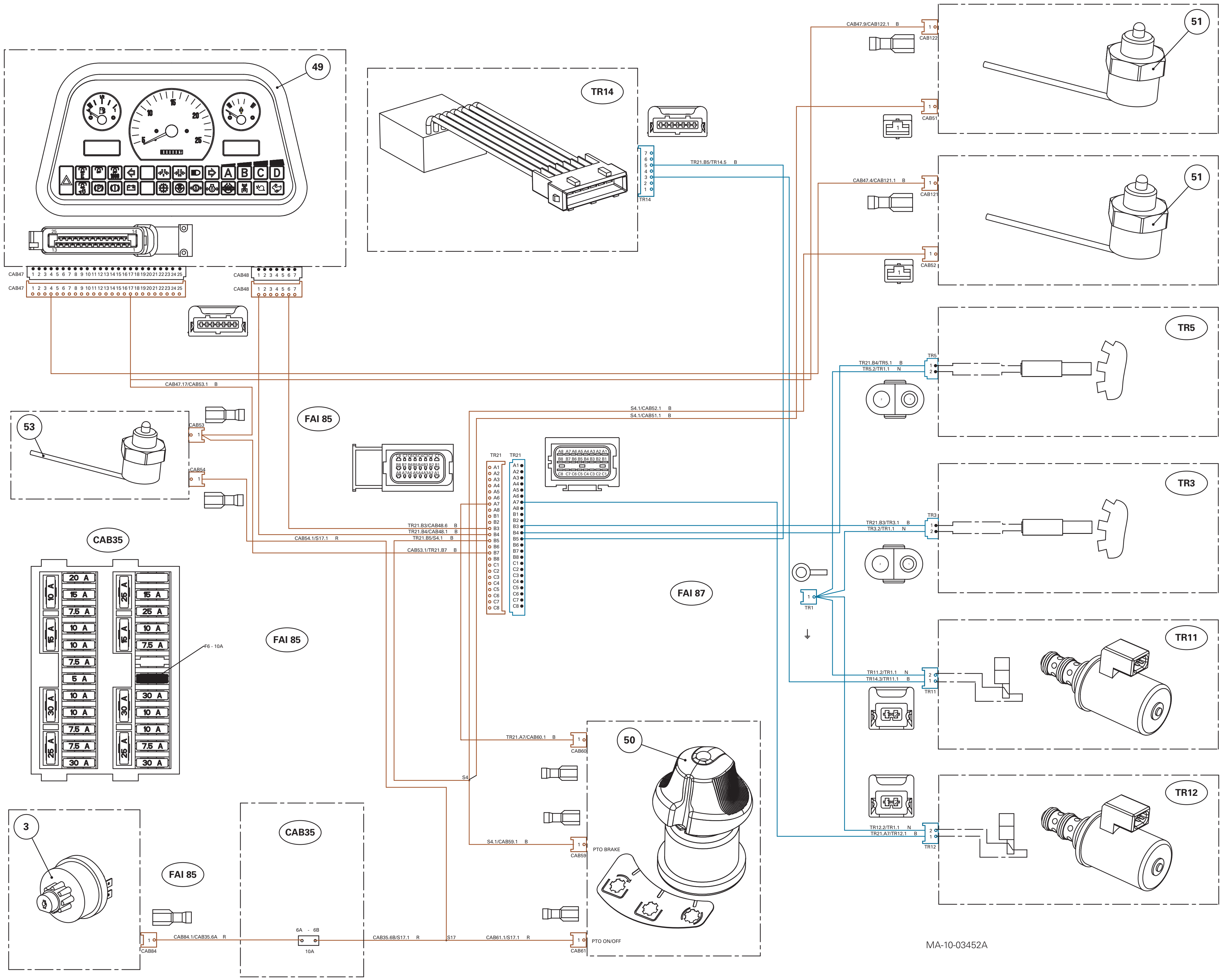


Fig. 40

Proportional PTO (without Auto 5)

- FAI 07 GSPTO harness
- FAI 74 Cab console harness
- FAI 83 Cab instrument panel harness - US
- FAI 87 GBA20 transmission mechanical reverse shuttle - 57 l/min hydraulics harness
- FAI 111 Proportional PTO switch harness
- CAB 35 Fuse box
- TR3 Rear PTO speed sensor
- TR5 Engine speed sensor
- TR11 Rear PTO solenoid valve
- TR12 Rear PTO brake solenoid valve
- 3 Start switch
- 49 X2 instrument panel
- 50 X2 PTO switch
- 51 X2 PTO lever switch

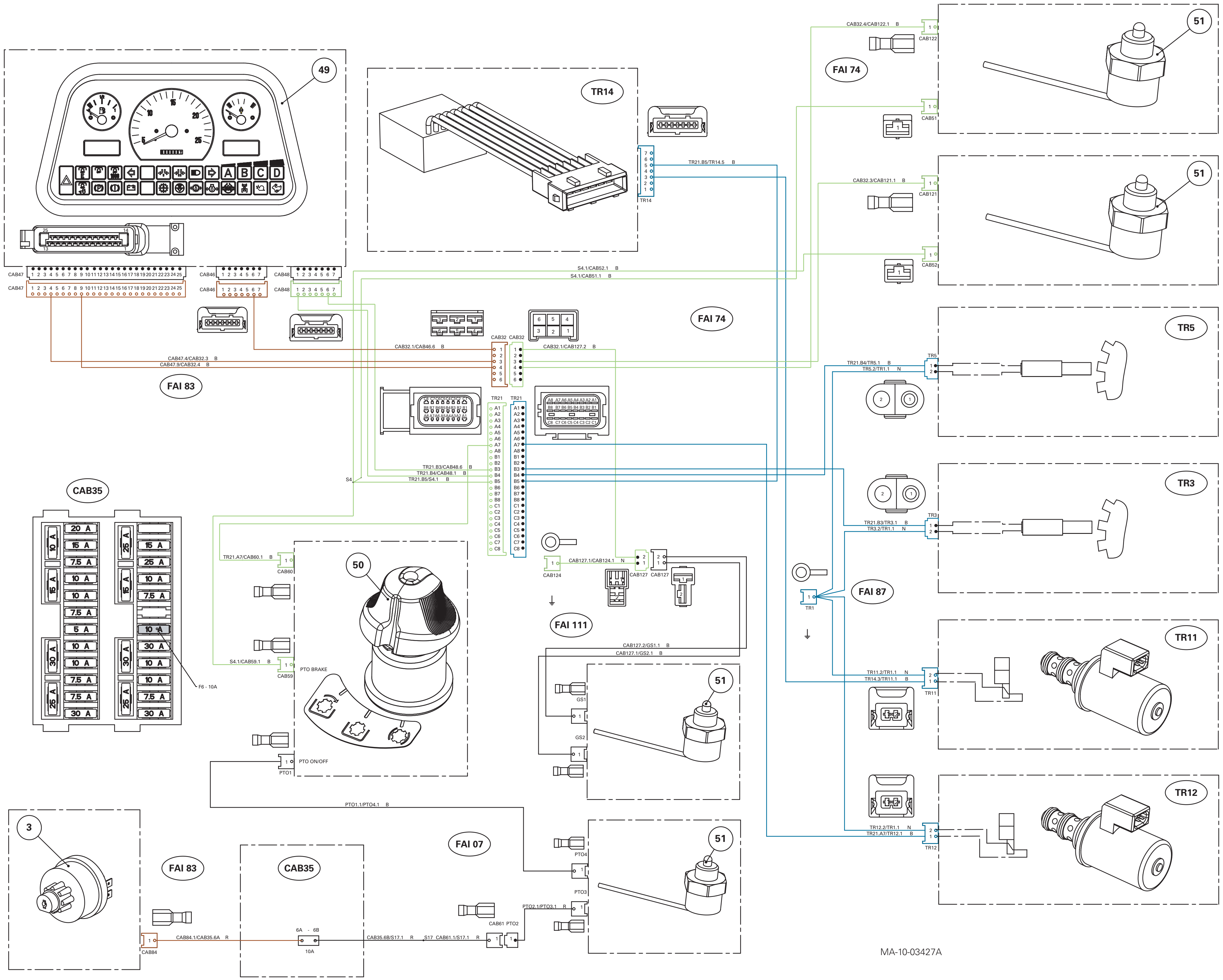


Fig. 41

Platform proportional PTO (without Auto 5)

FAI 07 GSPTO harness
FAI 85 X2 Platform instrument panel harness - NAO
FAI 87 MECA OC 57 litre transport harness
FAI 111 GSPTO switch harness
CAB 35 Fuse box
TR3 Rear PTO speed sensor
TR5 Engine speed sensor
TR11 Rear PTO solenoid valve
TR12 Rear PTO brake solenoid valve
3 Start switch
49 X2 instrument panel
50 X2 PTO switch
51 X2 PTO lever switch

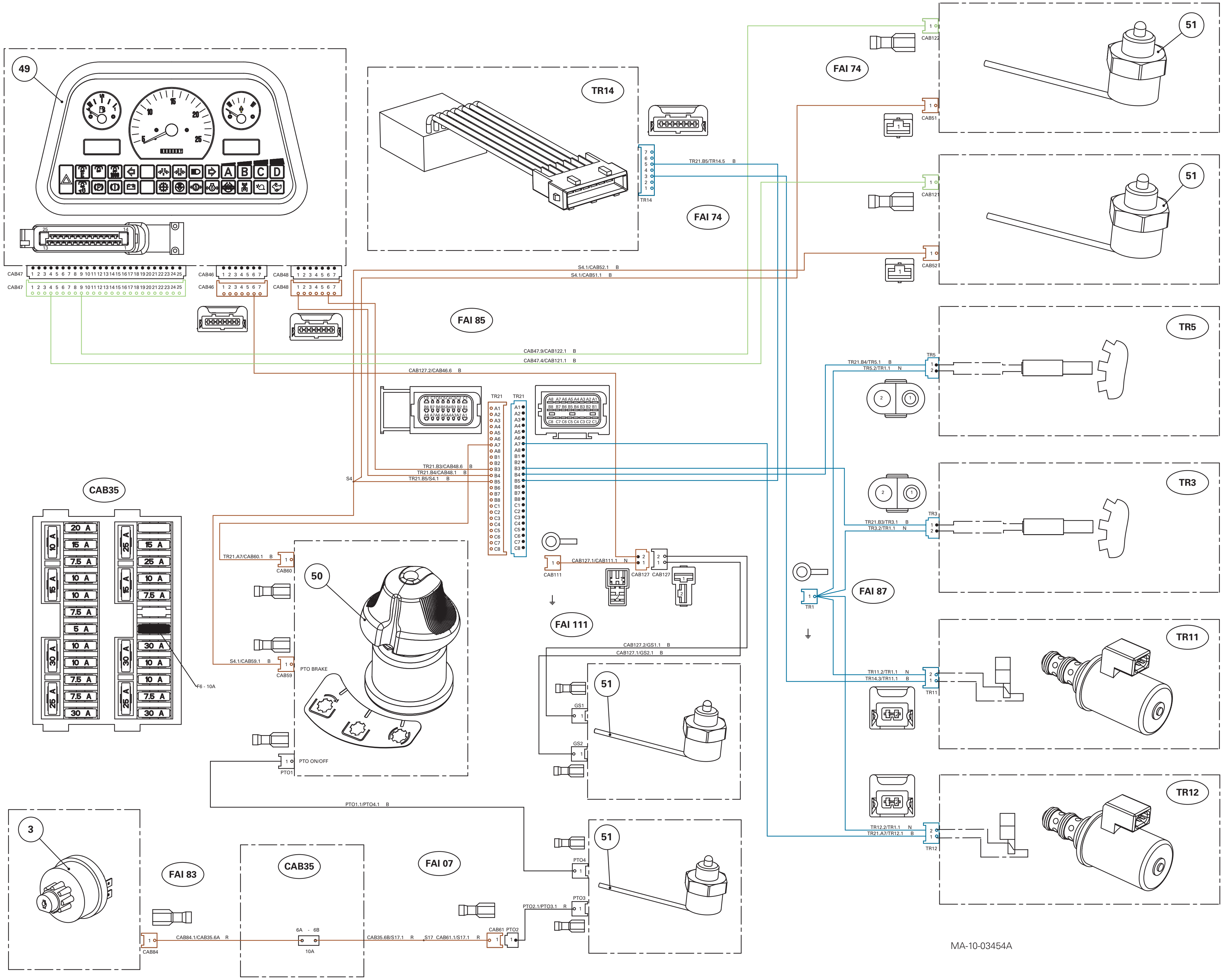


Fig. 42

Hare / Tortoise (without Auto 5)

FAI 83 Cab instrument panel harness - US
FAI 87 GBA20 transmission mechanical reverse shuttle - 57 l/min hydraulics harness
CAB 35 Fuse box
CAB 67 Hi/Lo Switch
TR13 Hi/Lo solenoid valve
TR14 X2 PTO module
TR13 Hi/Lo switch
3 Start switch
49 X2 instrument panel

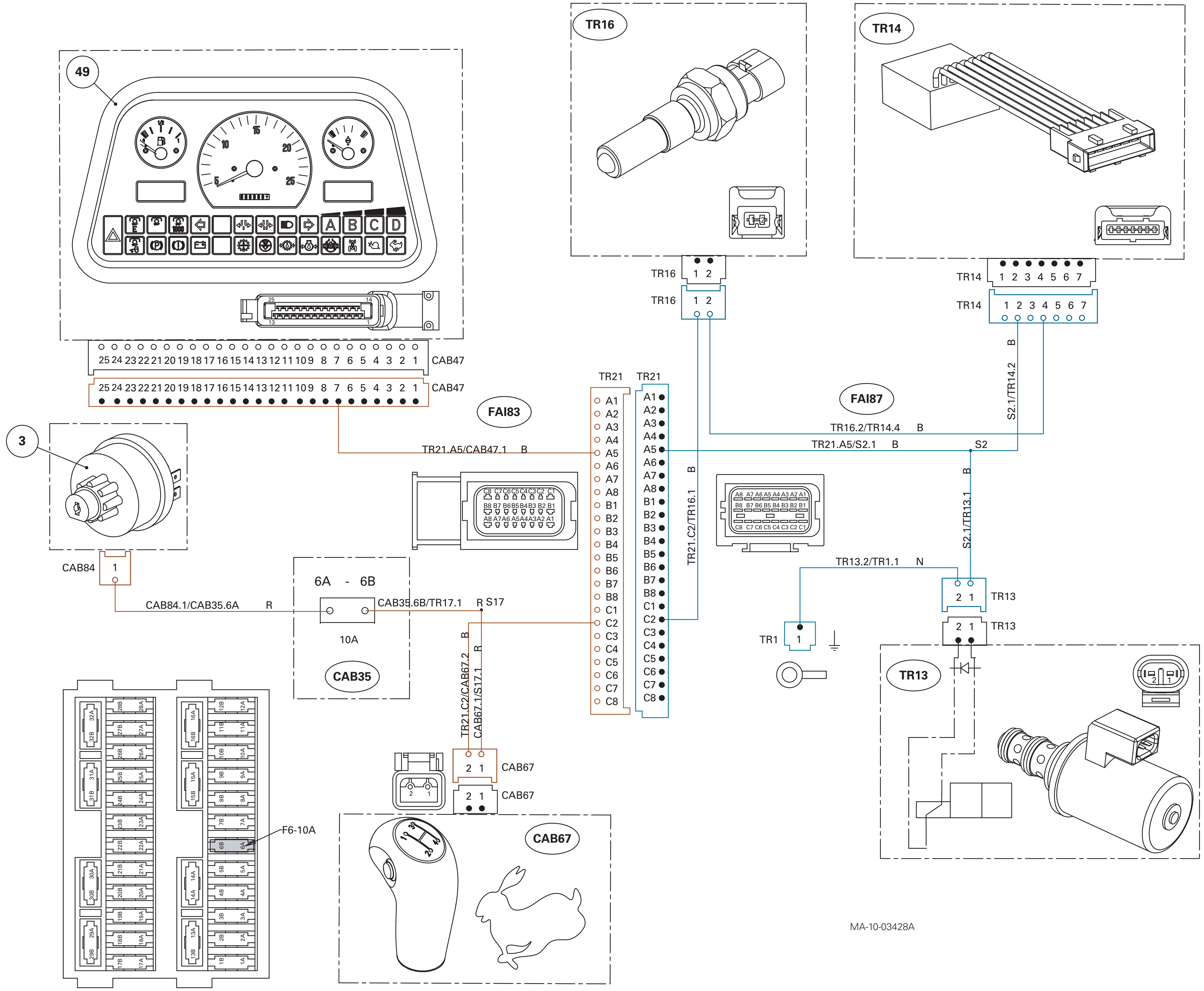


Fig. 43

Creeper unit

FAI 83 Cab instrument panel harness - US
CAB 35 Fuse box
3 Start switch
49 X2 instrument panel
57 Creeper switch

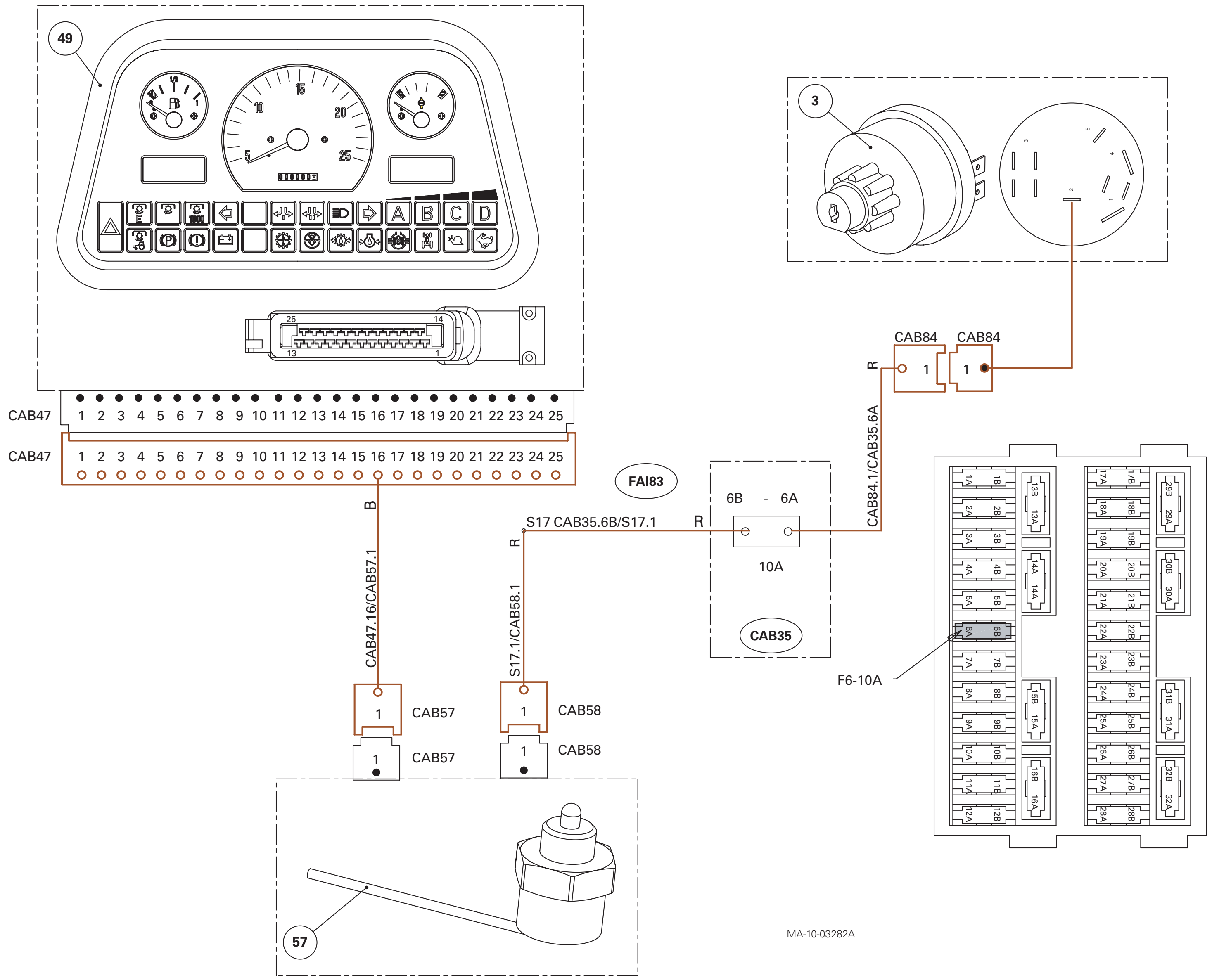


Fig. 44

Safety (without Auto 5)

FAI 83 Cab instrument panel harness - US
FAI 87 GBA20 transmission mechanical reverse shuttle - 57 l/min hydraulics harness
CAB 35 Fuse box
TR7 HP filter clogging indicator
TR8 Hydraulic filter vacuum switch
TR9 Low pressure switch
TR15 Temperature switch
TR26 Sealed relay
3 Start switch
49 X2 instrument panel

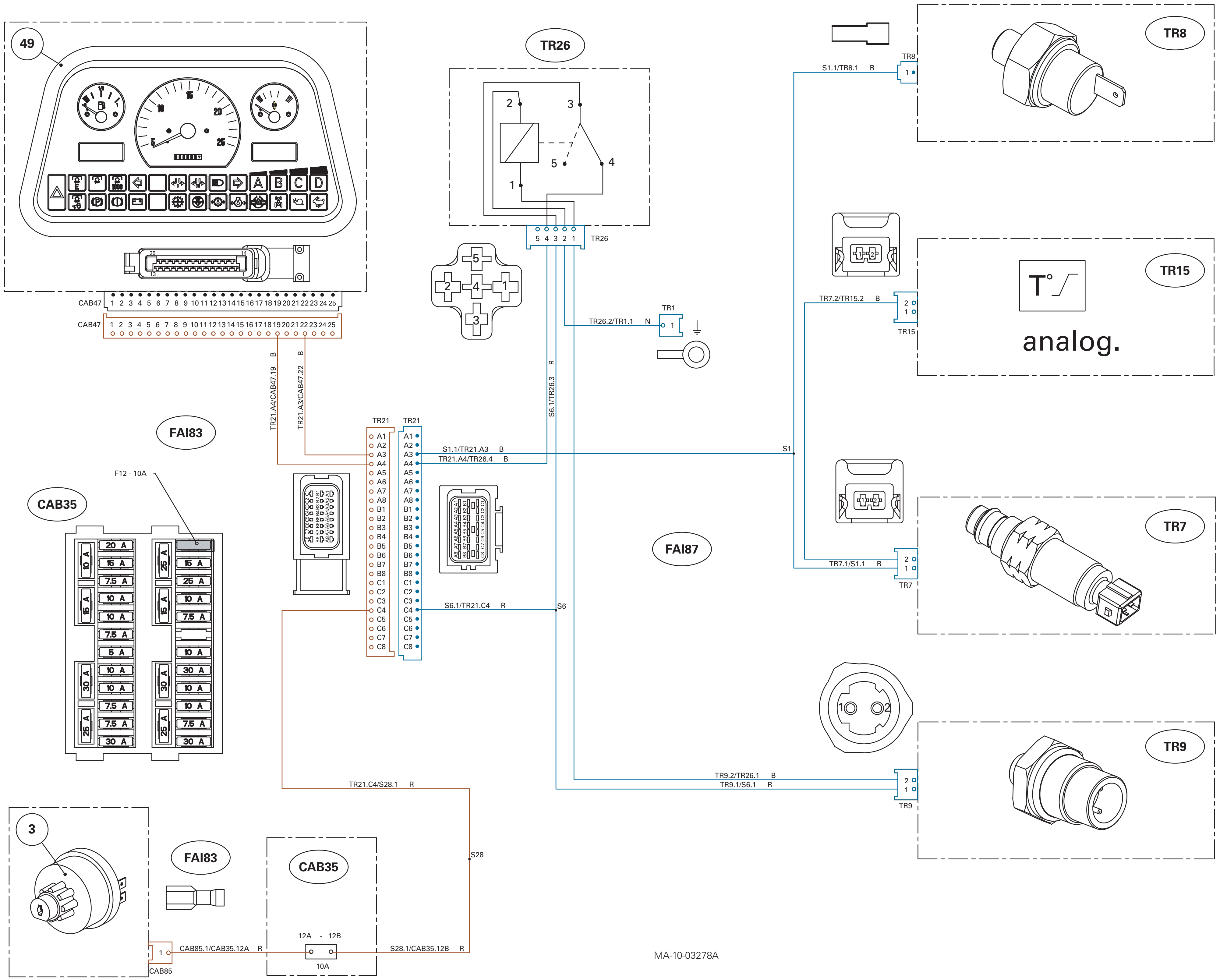


Fig. 45

Mechanical reverse shuttle

FAI 83	Cab instrument panel harness - US
FAI 87	GBA20 transmission mechanical reverse shuttle - 57 l/min hydraulics harness
TR2	Ground speed sensor
TR5	Engine speed sensor
49	X2 instrument panel

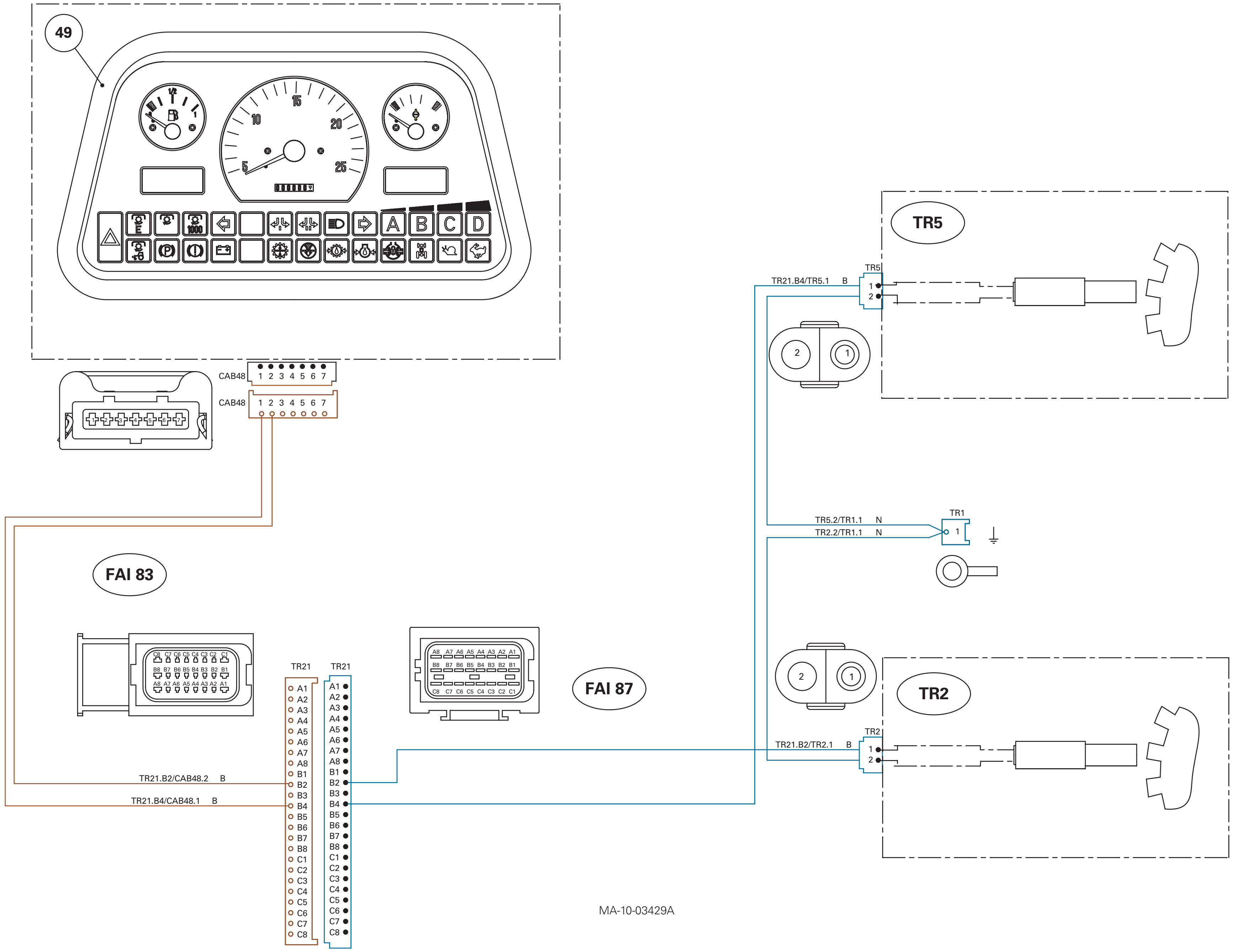


Fig. 46

Mechanical reverse shuttle with reversing lights

FAI 74	Cab console harness
FAI 84	Cab instrument panel harness (all countries except US)
FAI 87	GBA20 transmission mechanical reverse shuttle - 57 l/min hydraulics harness
FAI 91	Lighting harness - Europe
FAI 112	Mechanical reverse shuttle reversing lights harness
CAB35	Fuse box
CAB72	Reversing lights relay
TR2	Ground speed sensor
TR5	Engine speed sensor
TR29	Reverse position sensor
LIG13	Reversing light
3	Start switch
38	Trailer connector - Europe
49	X2 instrument panel

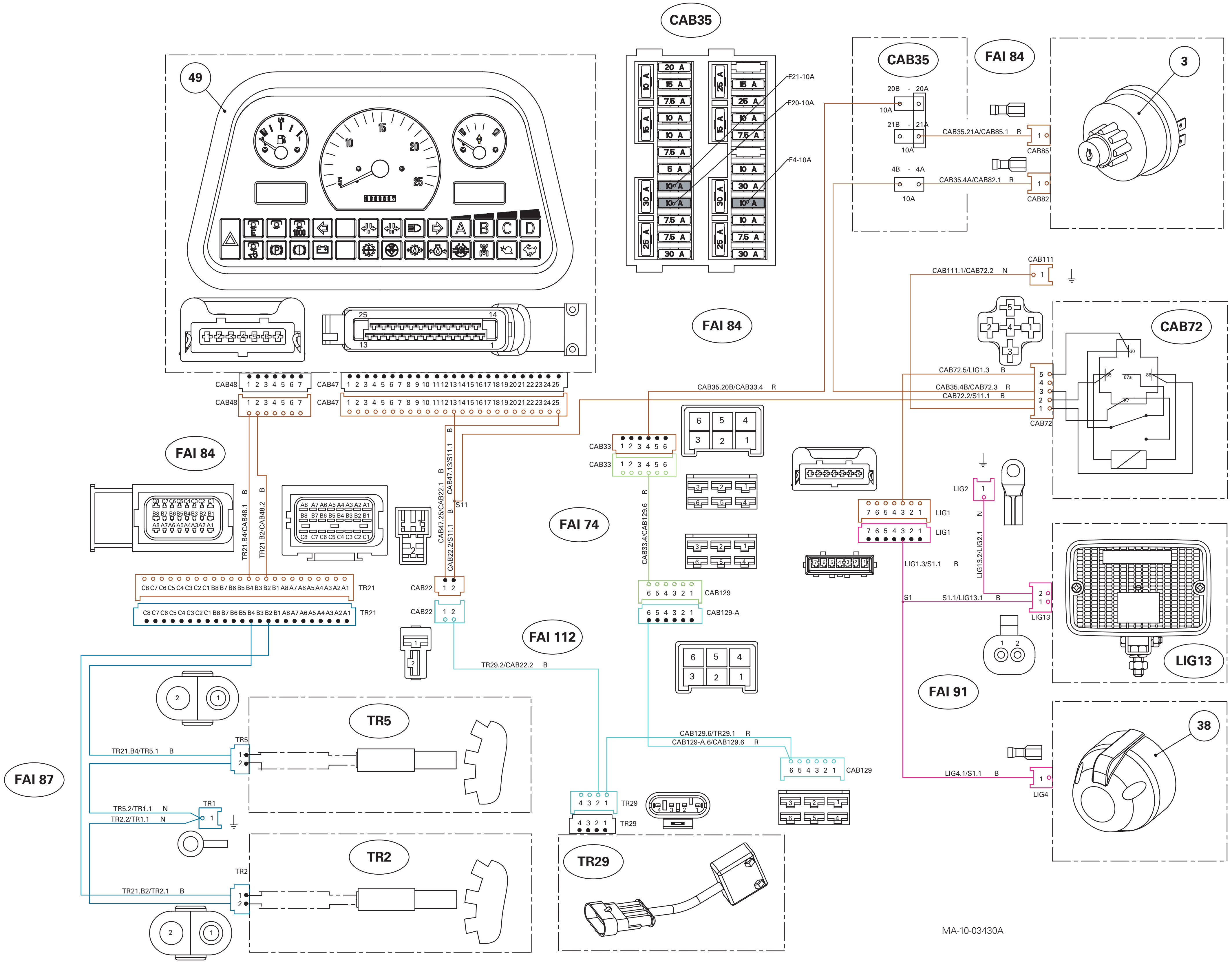


Fig. 47

Mechanical reverse shuttle - platform reversing lights

FAI 74 Cab console harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 87 GBA20 transmission mechanical reverse shuttle - 57 l/min hydraulics harness
FAI 91 Lighting harness - Europe
FAI 112 Mechanical reverse shuttle reversing lights harness
CAB35 Fuse box
CAB72 Reversing lights relay
TR2 Ground speed sensor
TR5 Engine speed sensor
TR29 Reverse position sensor
LIG13 Reversing light
3 Start switch
38 Trailer connector - Europe
49 X2 instrument panel

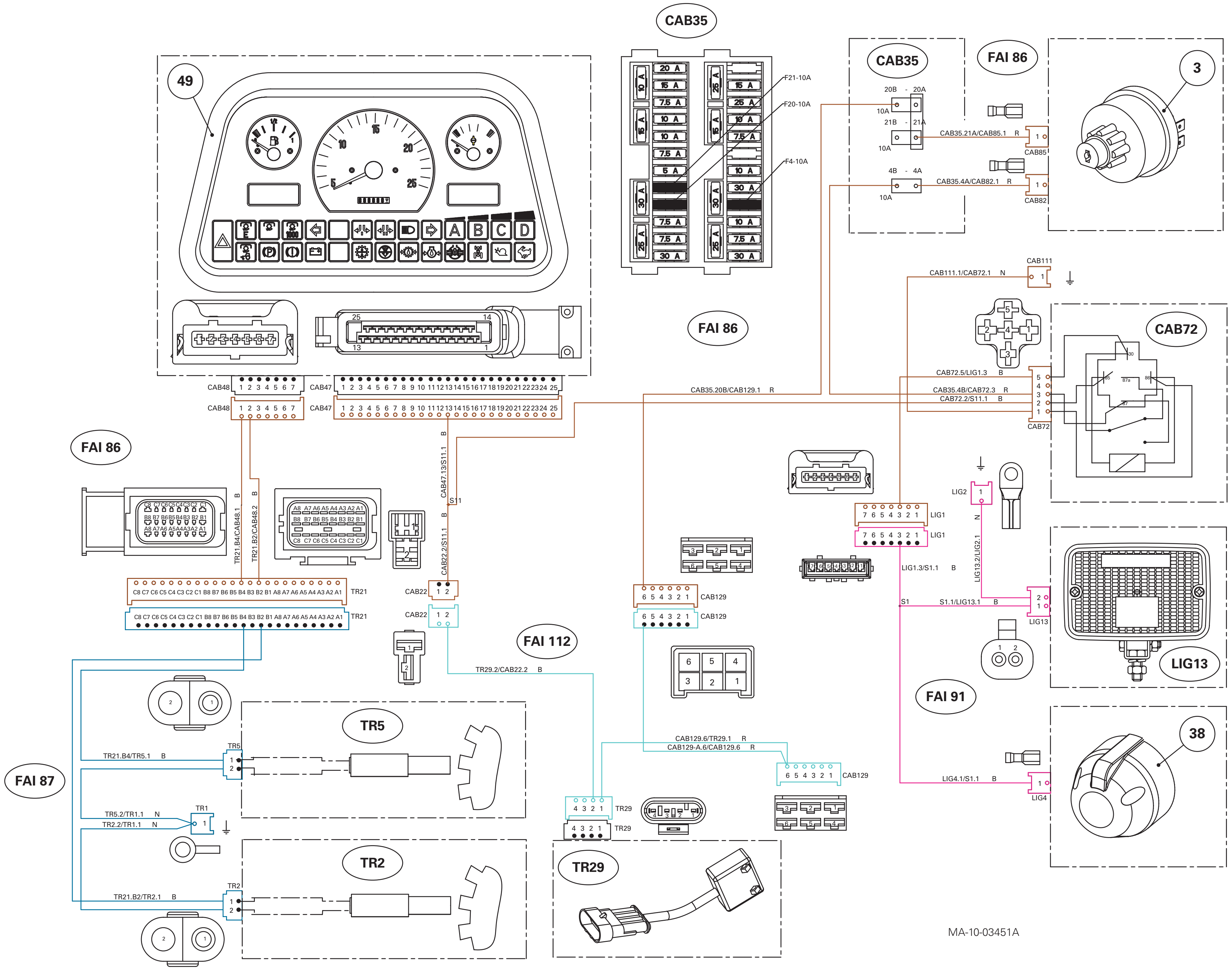


Fig. 48

Parking brake

FAI 74 Cab console harness
FAI 84 X2 instrument panel harness - Europe
FAI 87 MECA OC 57 litre transport harness
CAB 35 Fuse box
CAB 120 Parking brake switch
TR 28 Gearbox neutral switch
3 Start switch
41 Parking brake buzzer
49 X2 instrument panel

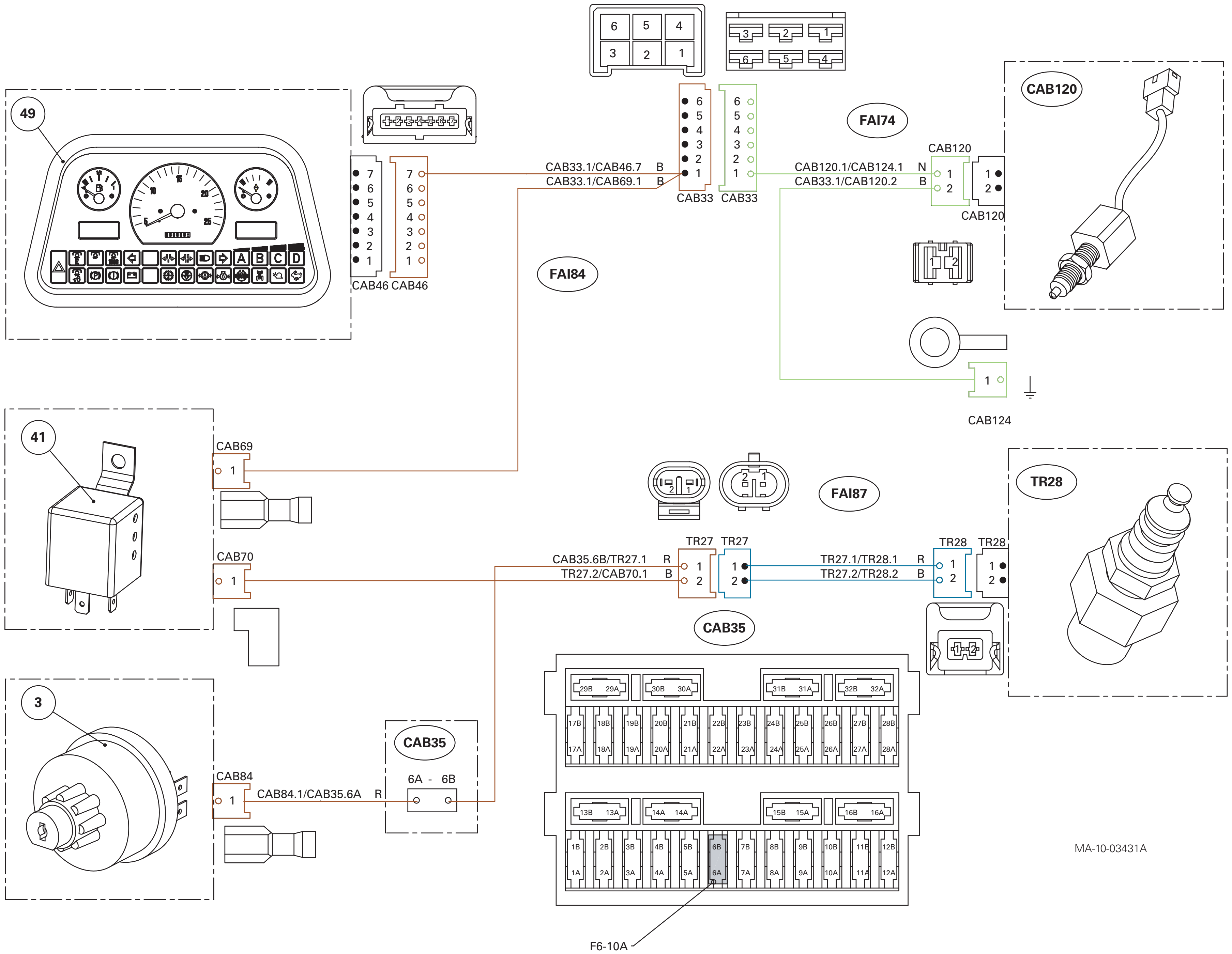


Fig. 49

Platform parking brake

FAI 87 MECA OC 57 litre transport harness
FAI 117 X2 Platform instrument panel harness - EU
CAB 35 Fuse box
CAB 120 Parking brake switch
TR 28 Gearbox neutral switch
3 Start switch
41 Parking brake buzzer
49 X2 instrument panel

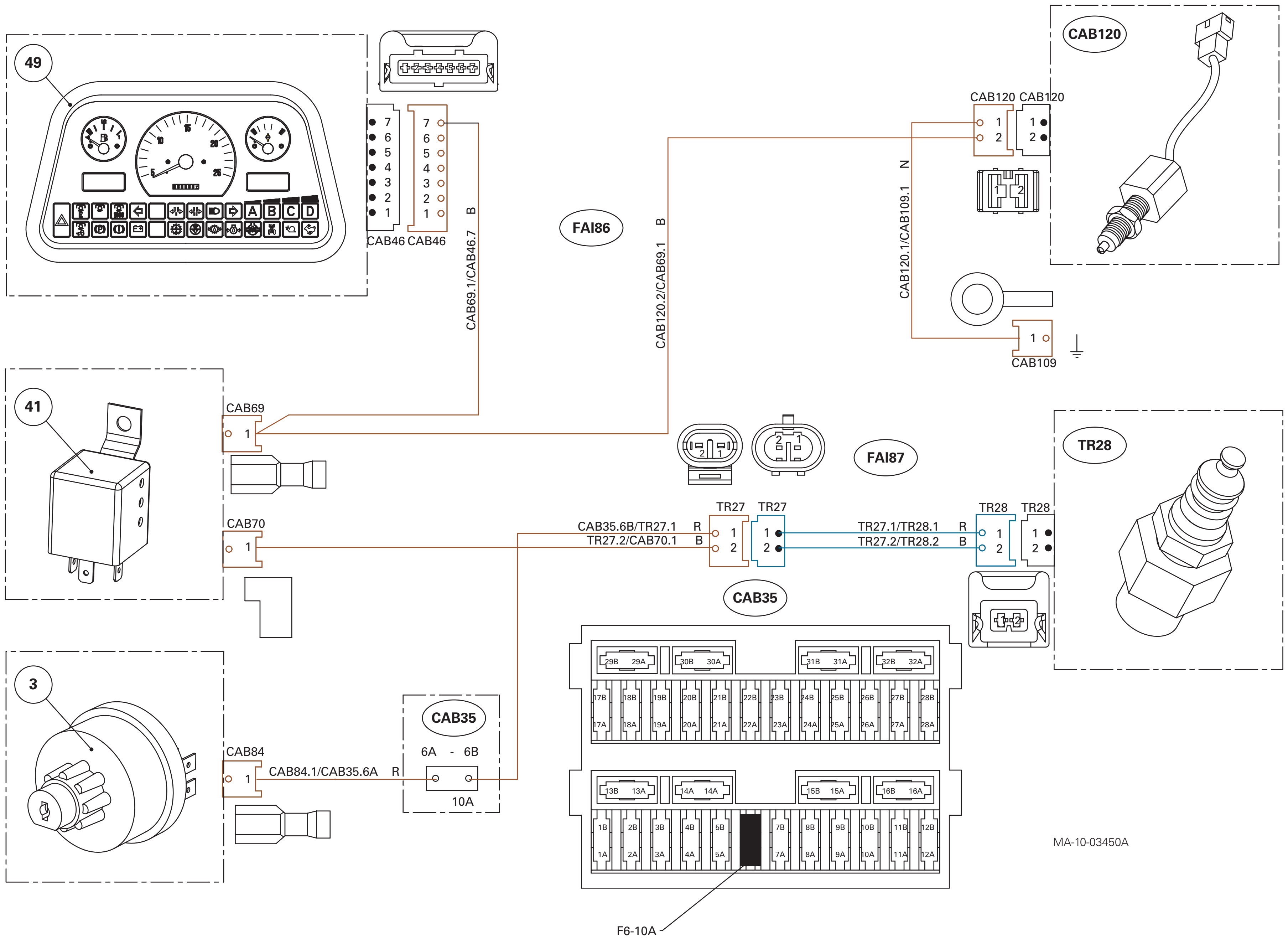


Fig. 50

Front PTO (4-cylinder version)

FAI 82 Perkins engine mechanical injection harness
FAI 83 Cab instrument panel harness - US
ENG 2 X2 Front PTO solenoid valve
CAB 35 X2 fuse box
CAB 112 Front PTO switch
3 Start switch
52 X2 front PTO brake

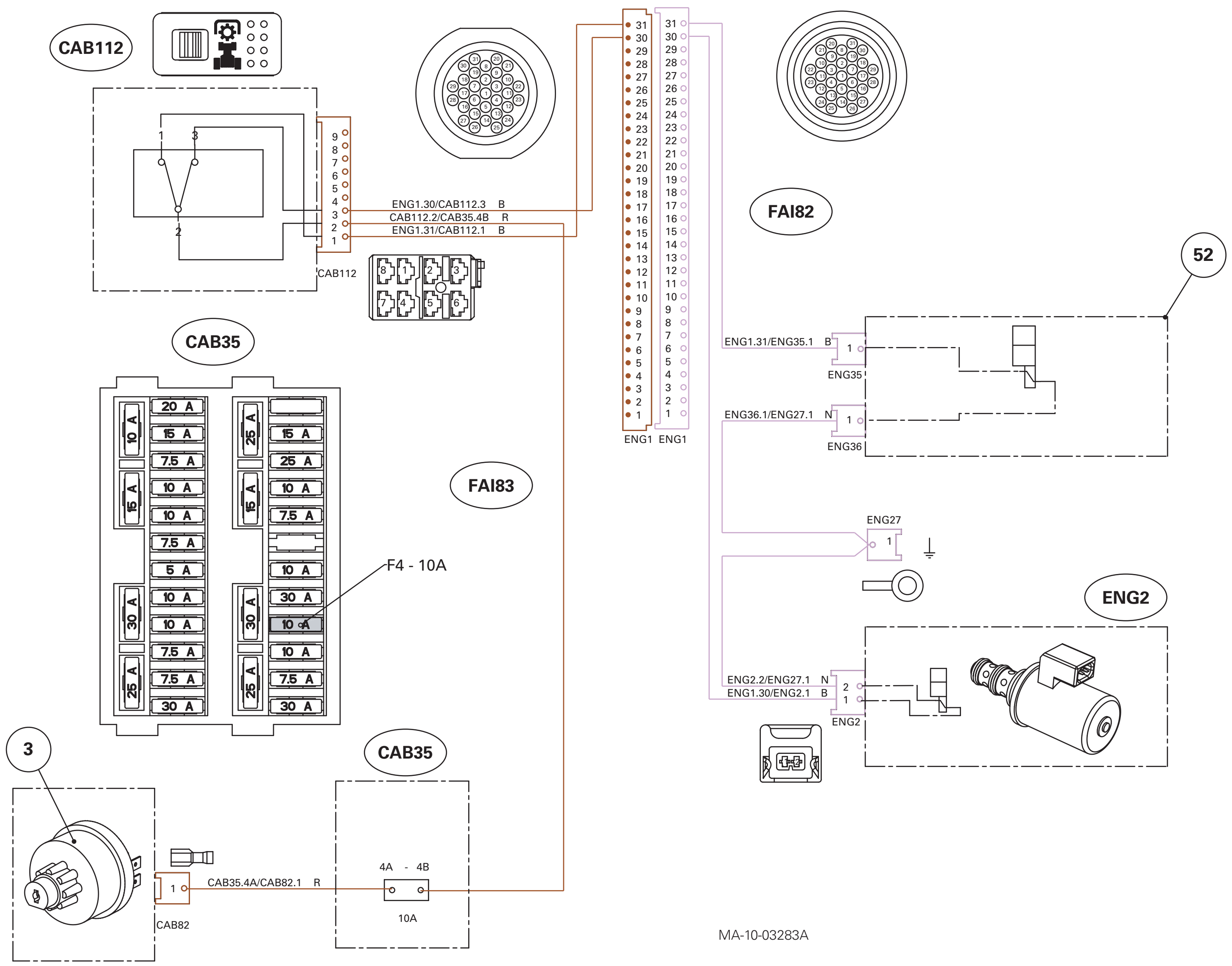


Fig. 51

Front PTO (6-cylinder version)

FAI 81 X2 6-cylinder engine harness
FAI 83 Cab instrument panel harness - US
ENG 2 X2 Front PTO solenoid valve
CAB 35 X2 fuse box
CAB 112 Front PTO switch
3 Start switch

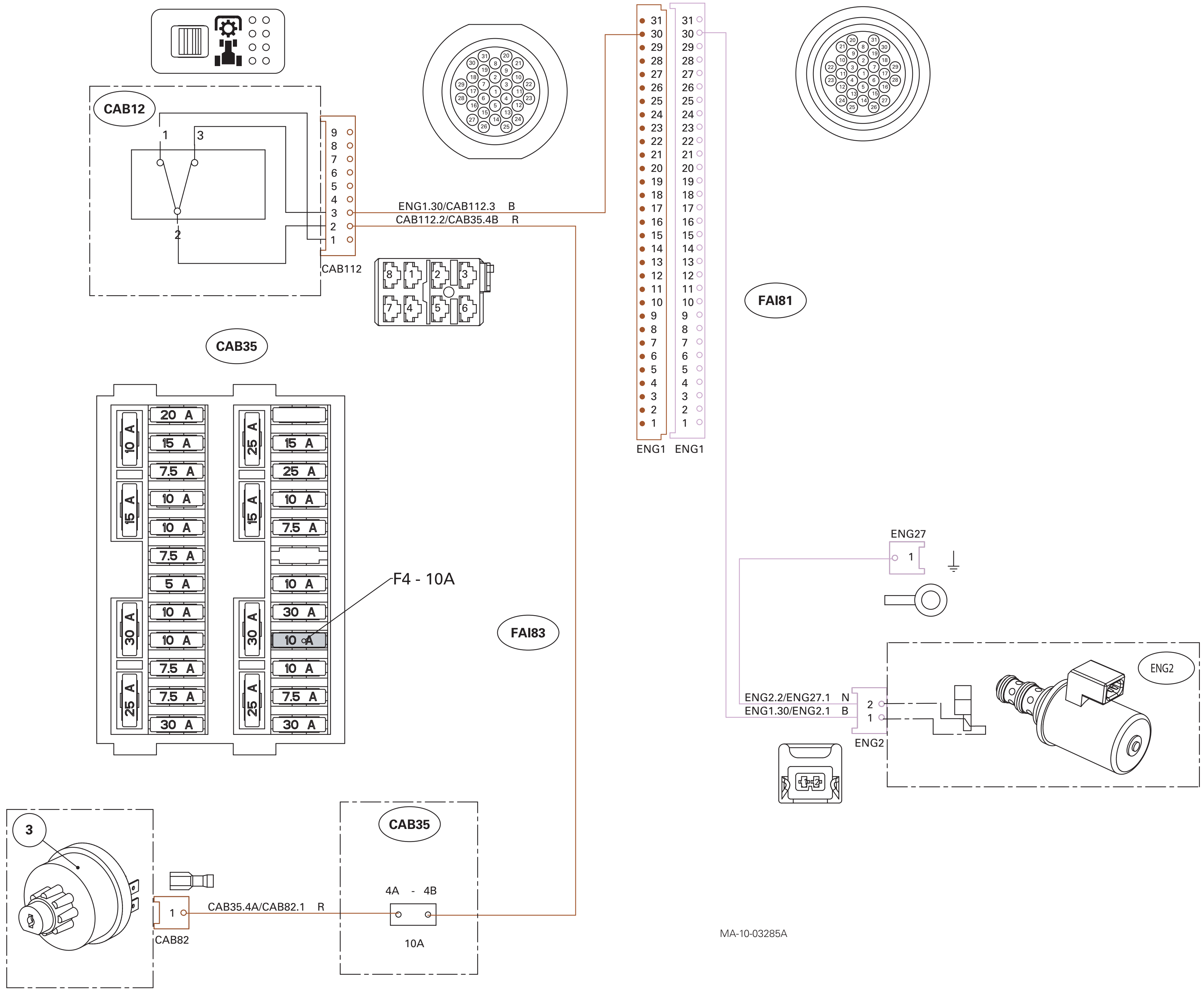
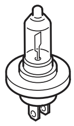
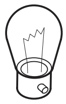
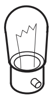
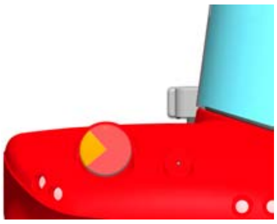
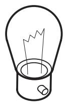
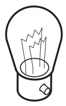
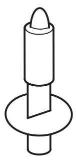
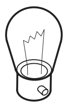
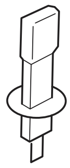
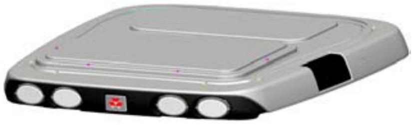
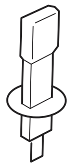
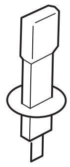
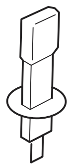
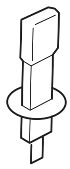
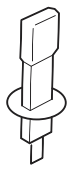
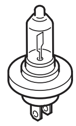
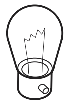
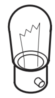
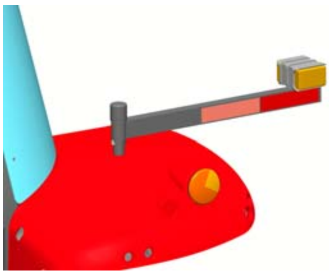
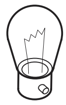
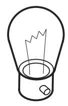
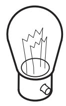
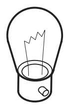
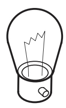
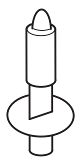


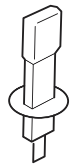
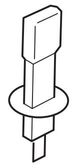
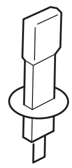
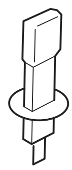
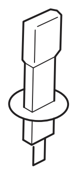
Fig. 52

E . Bulb types

Road lights - Europe		
Lighting	Bulb(s)	Type
Road lights and dim lights 		H4 12V / 60W/55W
Sidelights and front direction indicator lights 	Direction indicator light 	12V / 21W
	Position light 	12V / 5W
Sidelights / stop lights and rear direction indicator lights 	Direction indicator light 	12V / 21W
	Position / Stop light 	12V / 21W/5W
Flashing beacon(s) 	Flashing beacon 	H1 12V / 55W
Reversing light 	Direction indicator light 	12V / 21W

Work headlights - Europe models			
Lighting	Description	Bulb(s)	Type
Two front roof lights (single, double or Xenon bulb) 	Single bulb	Work headlight 	H3 12V / 55W
	Double bulb		H3 12V / 55W
	Xenon bulb		Xenon GDL D2S / 35W
Four front roof lights 	Single bulb	Work headlight 	H3 12V / 55W
	Double bulb		H3 12V / 55W
	Xenon bulb		Xenon GDL D2S / 35W
Two rear roof lights 	Double bulb	Work headlight 	H3 12V / 55W
	Xenon bulb		Xenon GDL D2S / 35W
Handrail lights 	Single bulb	Work headlight 	H3 12V / 55W
	Double bulb		H3 12V / 55W
Fender lights 	Single bulb	Work headlight 	H3 12V / 55W
Footstep lights 	Single bulb	Work headlight 	H3 12V / 55W

Road lights - North America		
Lighting	Bulb(s)	Description
Road lights and dim lights 	Headlight 	H4 12V / 60W/55W
Sidelights and front direction indicator lights 	Direction indicator light 	12V / 21W
	Position light 	12V / 5W
Sidelights / Rear stop and direction indicator lights with fender extension (North America) 	Direction indicator light 	12V / 21W
	Fender extension 	12V / 21W
	Position / Stop light 	12V / 21W/5W
Roof front direction indicator lights 	Direction indicator light 	12V / 21W
Roof rear direction indicator lights 	Direction indicator light 	12V / 21W
Flashing beacon(s) 	Flashing beacon 	H1 12V / 55W

<table>
<tr><th colspan="4">Work headlights - North America</th></tr>
<tr><th>Lighting</th><th>Description</th><th>Bulb(s)</th><th>Type</th></tr>
<tr><td rowspan="3">Two front roof lights
</td><td>Single bulb</td><td rowspan="3">Work headlight
</td><td>H3 12V / 55W</td></tr>
<tr><td>Double bulb</td><td>H3 12V / 55W</td></tr>
<tr><td>Xenon bulb</td><td>Xenon GDL D2S / 35W</td></tr>
<tr><td rowspan="2">Two rear roof lights
</td><td>Double bulb</td><td rowspan="2">Work headlight
</td><td>H3 12V / 55W</td></tr>
<tr><td>Xenon bulb</td><td>Xenon GDL D2S / 35W</td></tr>
<tr><td rowspan="2">Handrail lights
</td><td>Single bulb</td><td rowspan="2">Work headlight
</td><td>H3 12V / 55W</td></tr>
<tr><td>Double bulb</td><td>H3 12V / 55W</td></tr>
<tr><td>Fender lights
</td><td>Single bulb</td><td>Work headlight
</td><td>H3 12V / 55W</td></tr>
<tr><td>Footstep lights
</td><td>Single bulb</td><td>Work headlight
</td><td>H3 12V / 55W</td></tr>
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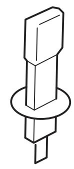
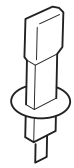
Work headlights - High Visibility model			
Lighting	Description	Bulb(s)	Type
Two front roof lights 	Single bulb	Work headlight 	H3 12V / 55W
	Double bulb		H3 12V / 55W
Two rear roof lights 	Single bulb	Work headlight 	H3 12V / 55W
	Double bulb		H3 12V / 55W

F . Lighting

Road lights and dim lights - Europe

FAI 82 Perkins engine mechanical injection harness
FAI 83 Cab instrument panel harness - US
CAB 35 Fuse box
CAB 42 Light switch
CAB 90 Windscreen wiper control unit
49 X2 instrument panel

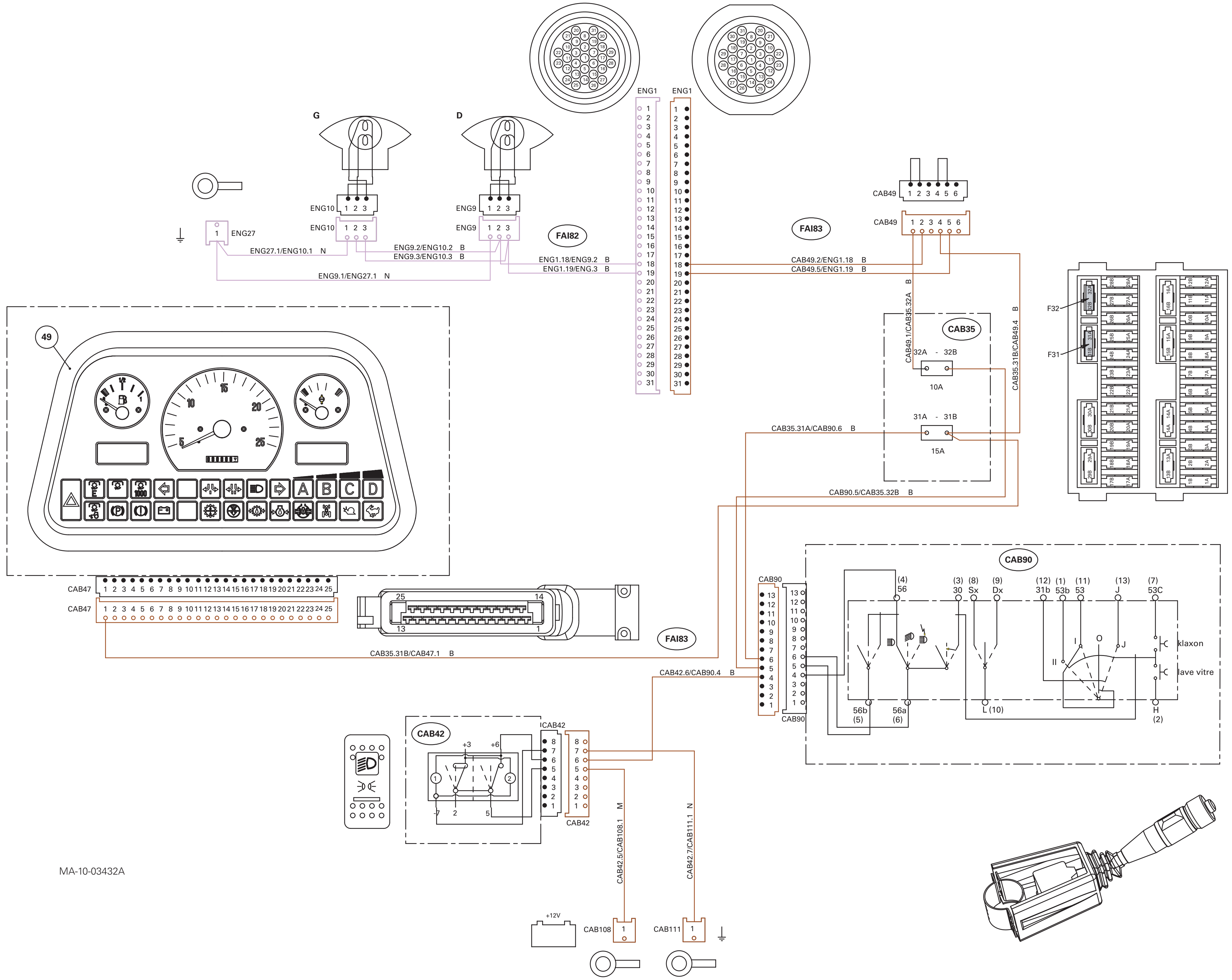


Fig. 53

Handrail road lights and dim lights

FAI34 Handrail lighting harness
FAI75 Standard roof harness - US
FAI 82 Perkins engine mechanical injection harness
FAI 84 Cab instrument panel harness (all countries except US)
CAB 35 Fuse box
CAB 42 Light switch
CAB 90 Windscreen wiper control unit
FAI 140 Handrail road lights relay
FAI 141 Handrail road lights relay
FAI 144 Handrail road lights switch
3 Start switch

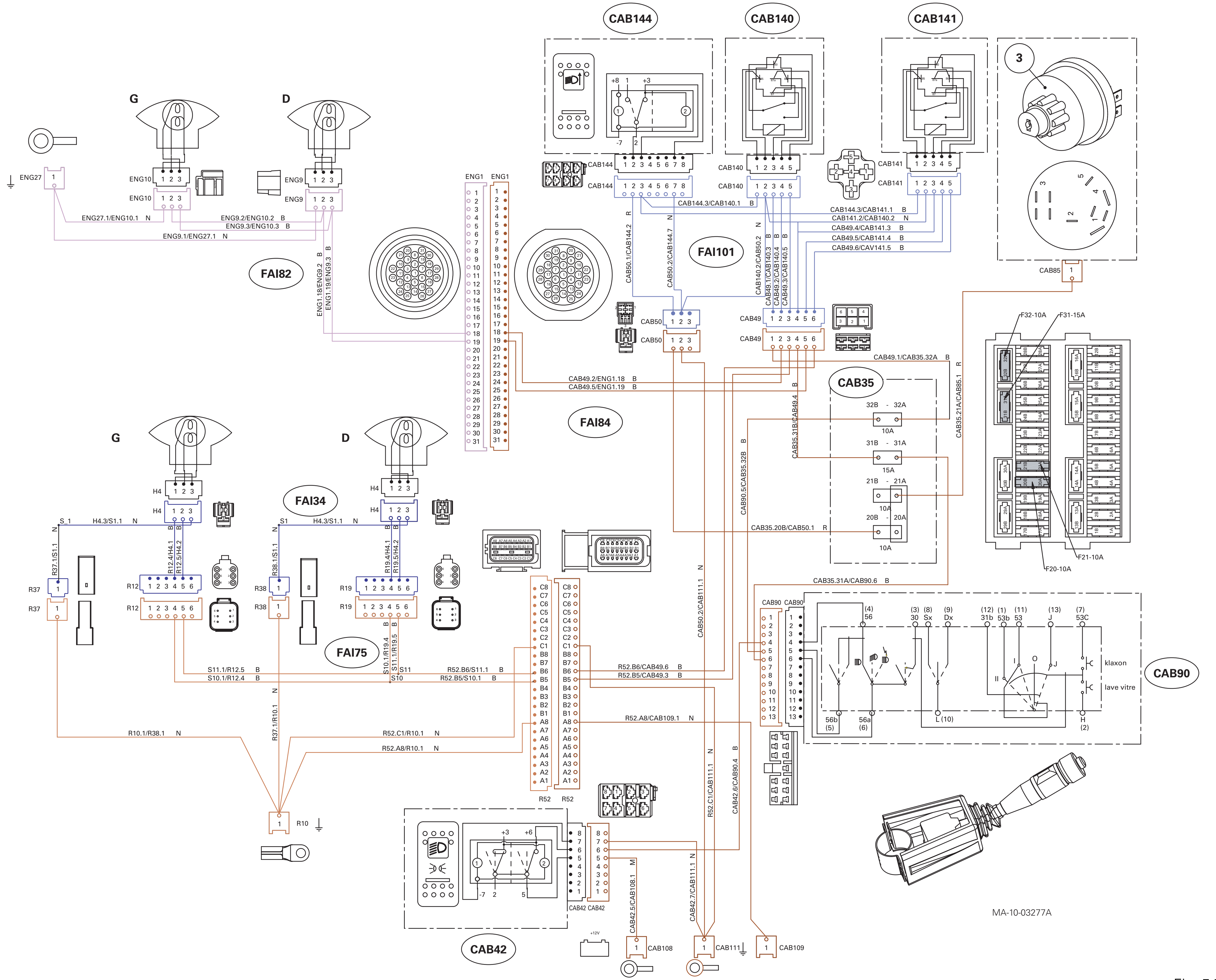


Fig. 54

Standard roof side lights - Europe

FAI 61 Simplified handrail harness - Europe
FAI 84 Cab instrument panel harness (all countries except US)
FAI 91 Cab lighting harness (all countries except US)
FAI 94 Standard roof harness - EU
CAB 35 Fuse box
CAB 42 Light switch
H1 Front right- and left-hand side lights
LIG4 Rear right-hand side lights
LIG5 Rear left-hand side lights

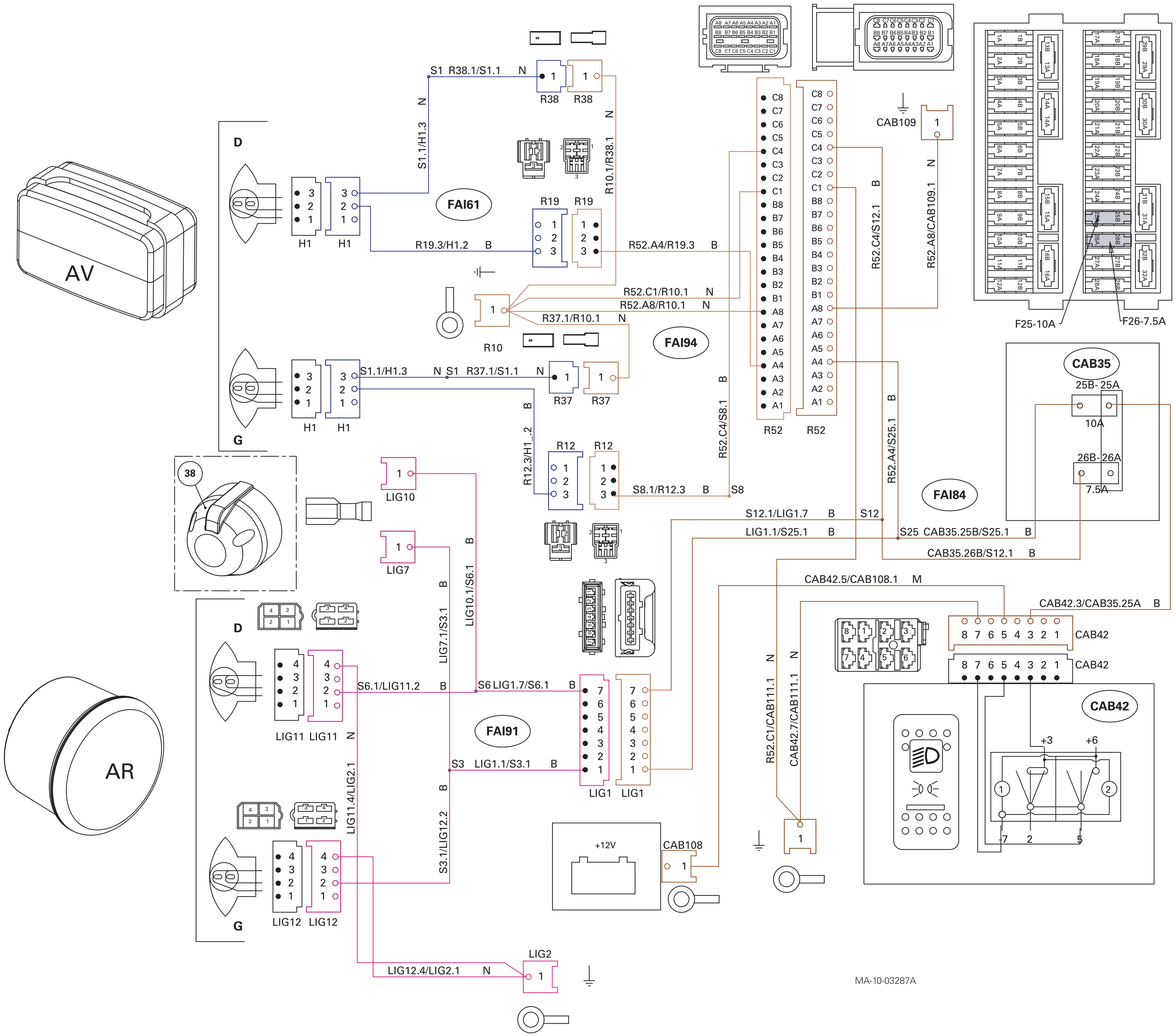


Fig. 55

Slim Line roof side lights - Europe

FAI 34 Handrail lighting harness
FAI 77 Flat roof harness (Slim Line)
FAI 84 Cab instrument panel harness (all countries except US)
FAI 91 Cab lighting harness (all countries except US)
FAI 110 Flat roof ground harness (Slim Line)
CAB 35 Fuse box
CAB 42 Light switch
H1 Front right- and left-hand side lights
LIG4 Rear right-hand side lights
LIG5 Rear left-hand side lights

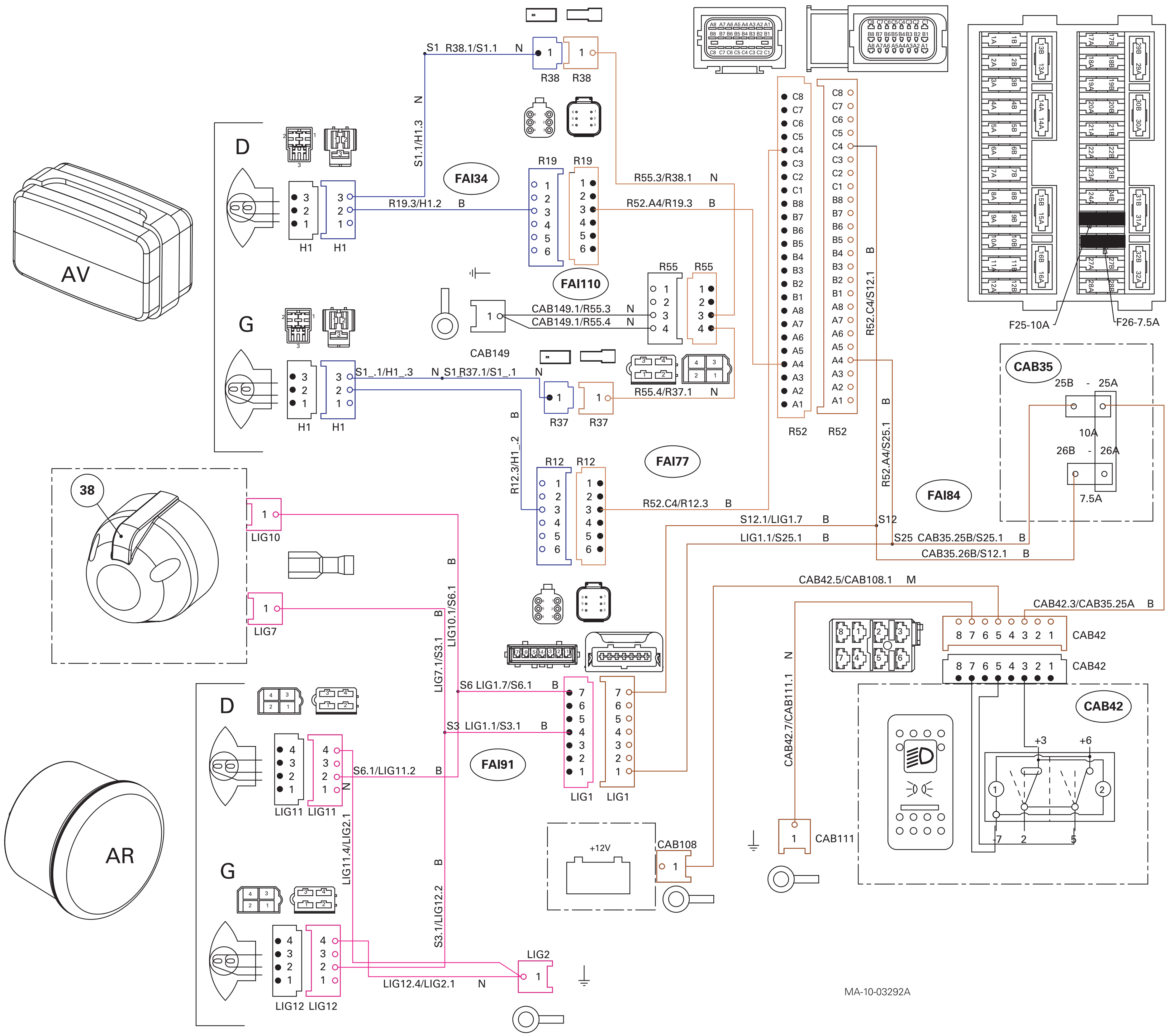


Fig. 56

Platform side lights - Europe

FAI 86 Platform instrument panel harness - EU
FAI 92 Platform lighting harness - EU
FAI 98 Platform handrail harness
CAB 35 Fuse box
CAB 42 Light switch
38 Trailer connector - EU

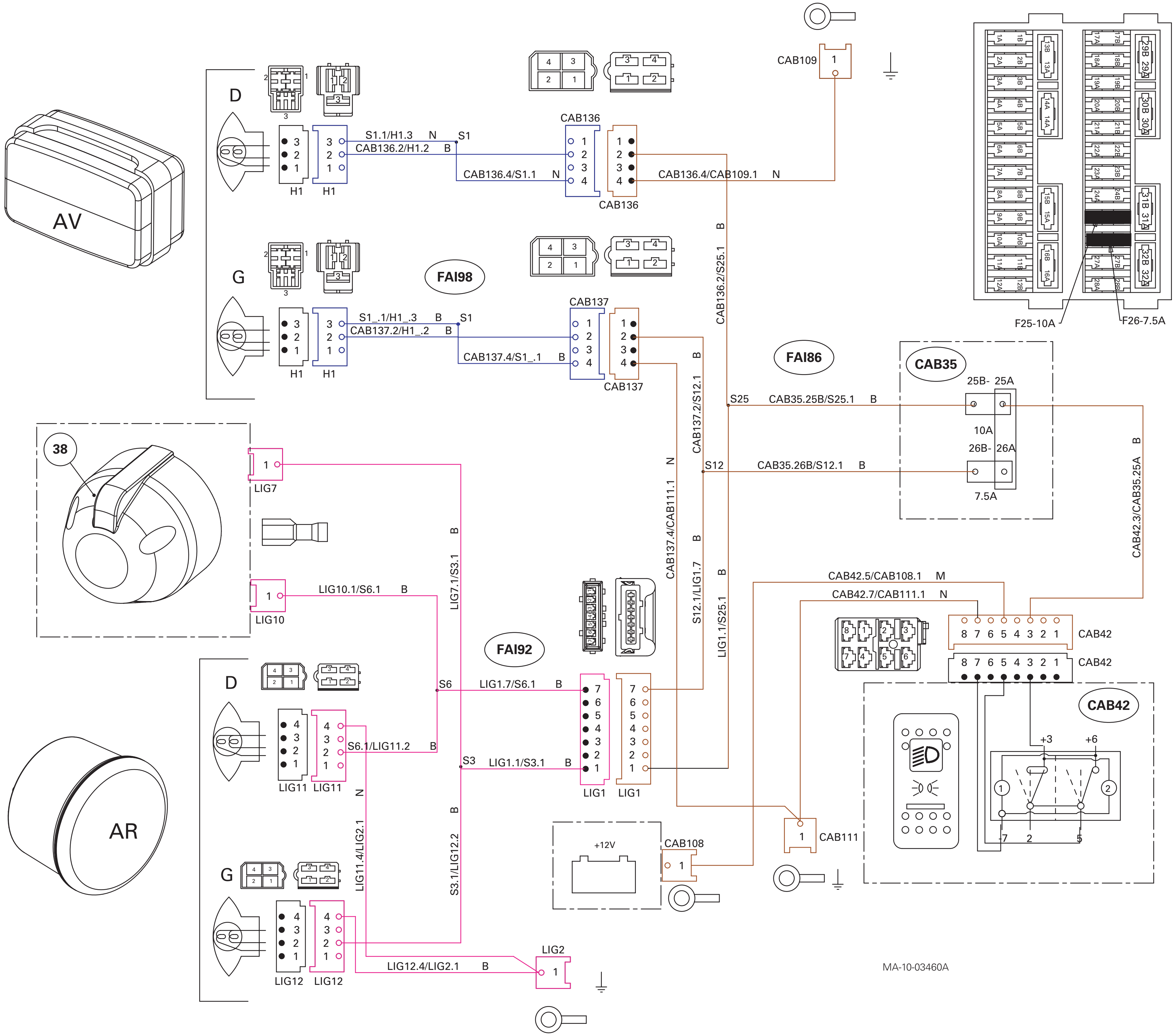


Fig. 57

Standard and high visibility roof side lights - North America

FAI 34 Handrail lighting harness
FAI 78 High visibility roof harness
FAI 83 Cab instrument panel harness - US
FAI 95 Cab lighting harness - US
CAB 35 Fuse box
CAB 42 Light switch
H1 Front right- and left-hand side lights
LIG4 Rear right-hand side lights
LIG5 Rear left-hand side lights

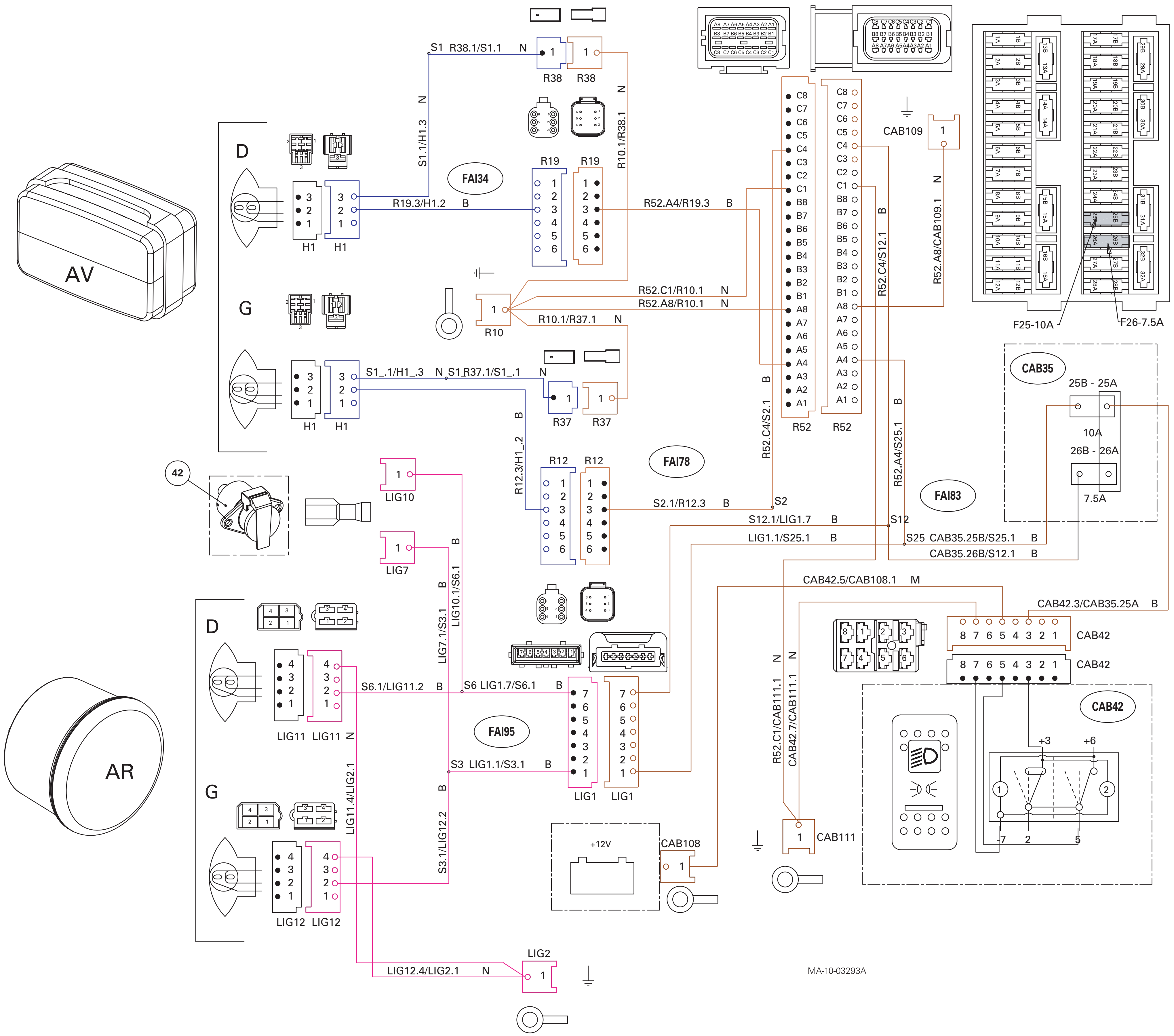


Fig. 58

Platform side lights - North America

FAI 85 Platform instrument panel harness - NAO
FAI 97 Platform lighting harness - NAO
FAI 98 Platform handrail harness
CAB 35 Fuse box
CAB 42 Light switch
42 Trailer connector - NAO

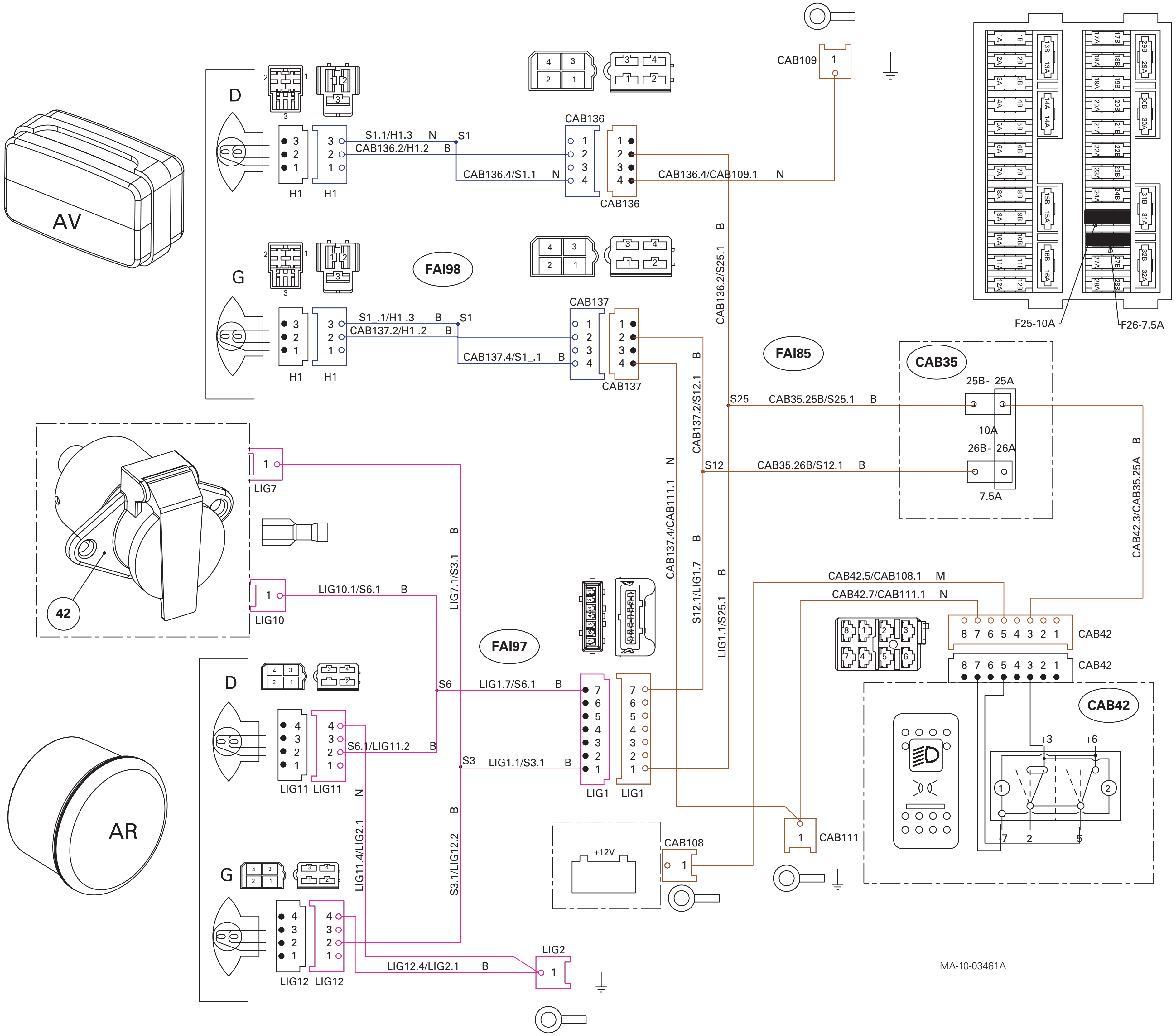


Fig. 59

Standard roof number plate lighting

FAI 18 Number plate lighting harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 94 Standard roof harness - EU
CAB 35 Fuse box
CAB 42 Light switch
58 Number plate lighting

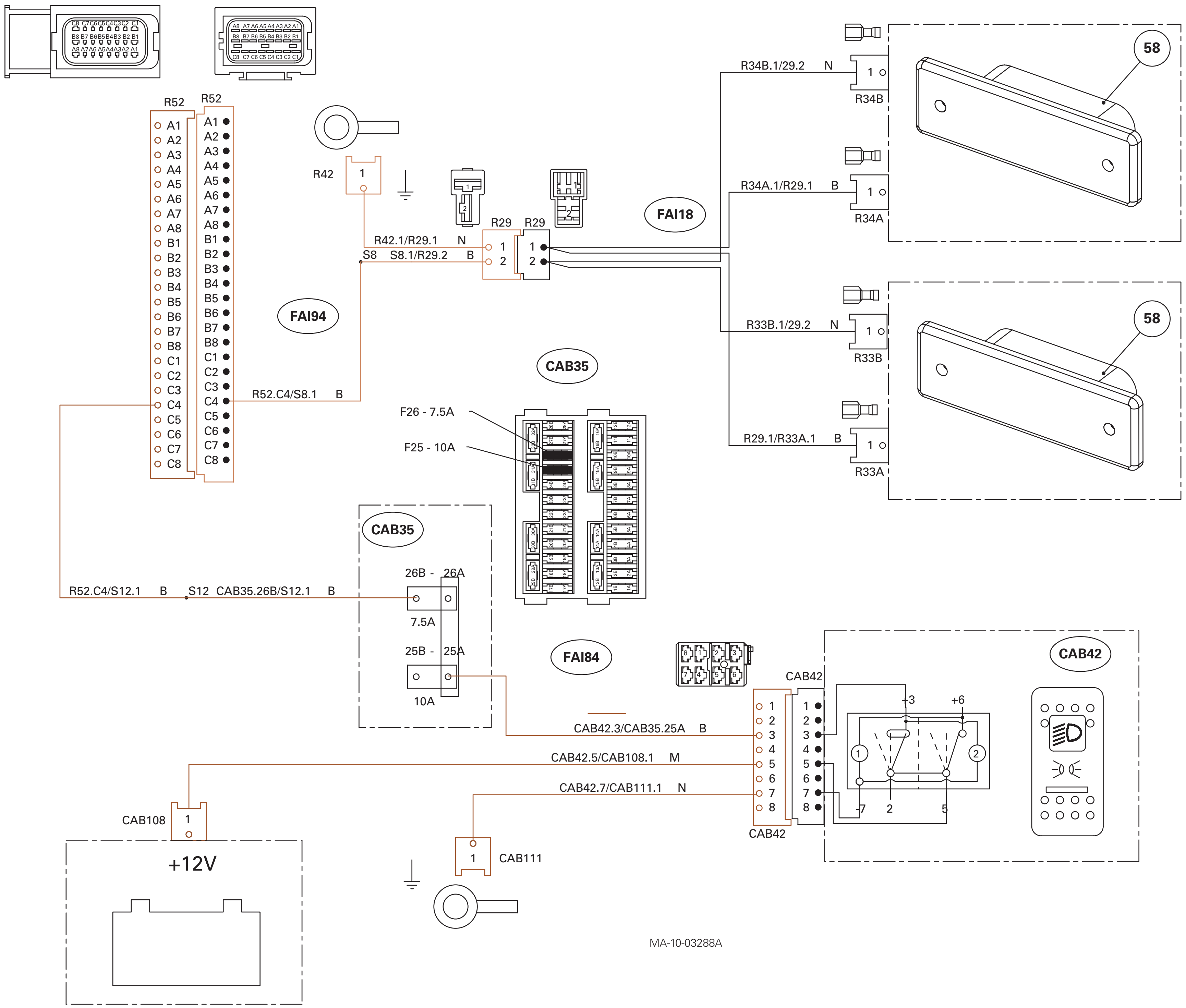


Fig. 60

Number plate lighting for high visibility roof

FAI 78 High visibility roof harness
FAI 84 Cab instrument panel harness (all countries except US)
CAB 35 Fuse box
CAB 42 Light switch
R35 HV roof number plate lighting
R36 HV roof number plate lighting

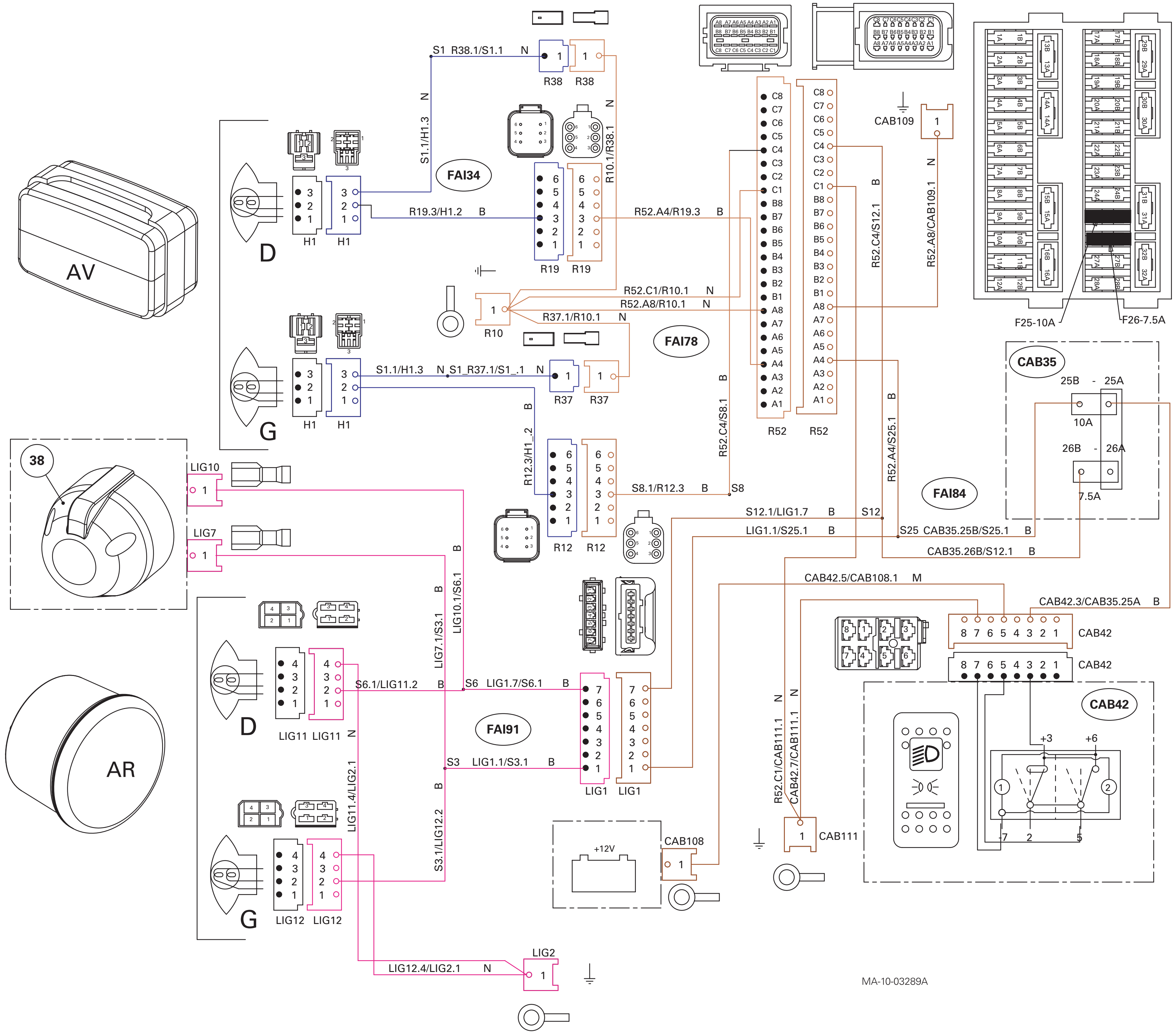


Fig. 61

Slim line roof number plate lighting

FAI 37 Lighting harness - Europe
FAI 84 Cab instrument panel harness (all countries except US)
FAI 114 Flat roof number plate lighting harness (Slim Line)
CAB 35 Fuse box
CAB 42 Light switch
LIG12A Rear left-hand side light
LIG22 Number plate lighting

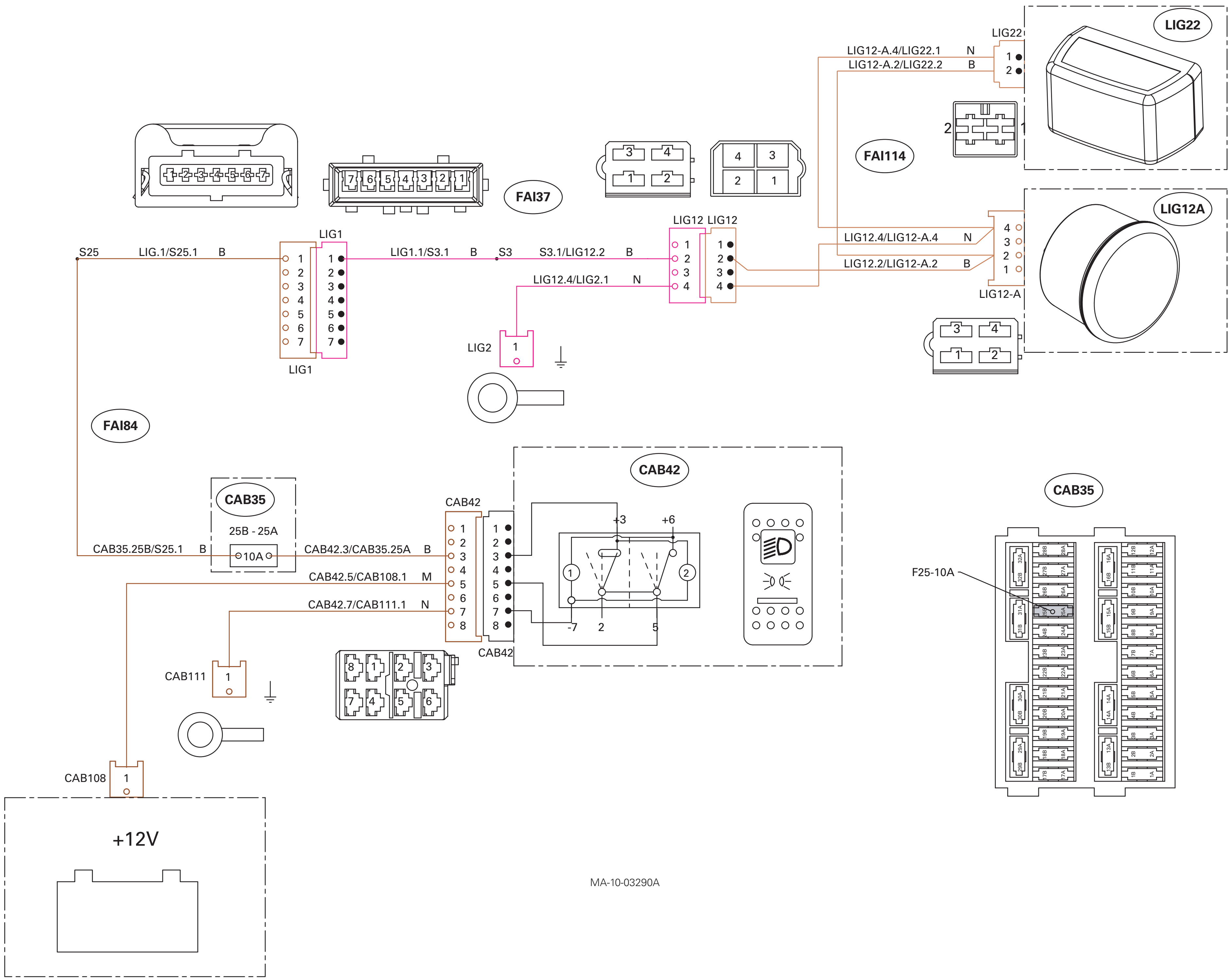


Fig. 62

Platform number plate lighting

FAI 86 X2 Platform instrument panel harness - EU
FAI 92 Platform lighting harness - EU
CAB 35 Fuse box
CAB 42 Light switch
LIG 16 Number plate lighting

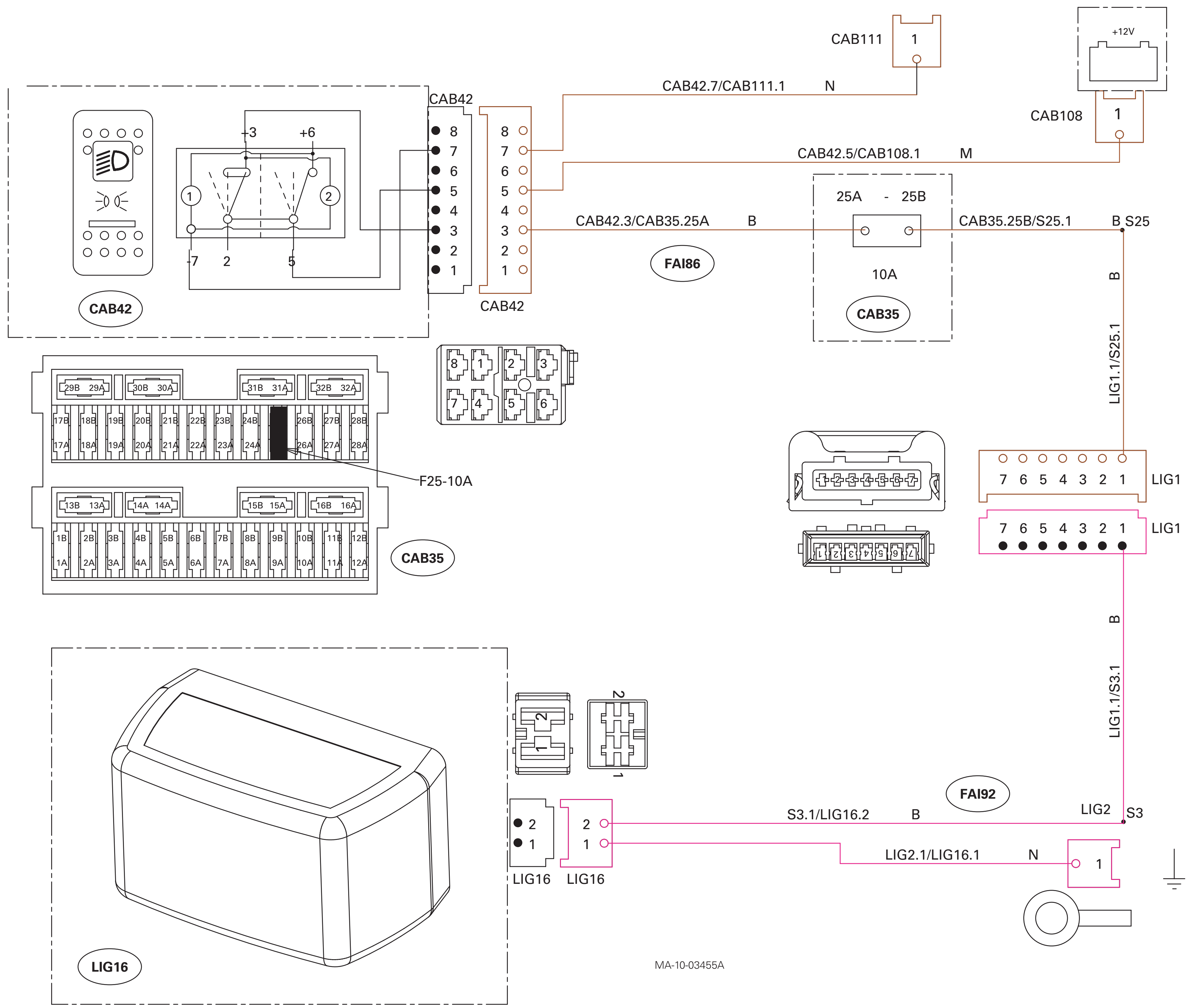


Fig. 63

Standard roof flashing beacon

FAI 84 Cab instrument panel harness (all countries except US)
FAI 94 Standard roof harness - EU
CAB 35 Fuse box
R23 Left-hand flashing beacon
R39 Right-hand flashing beacon
R51 Flashing beacon switch

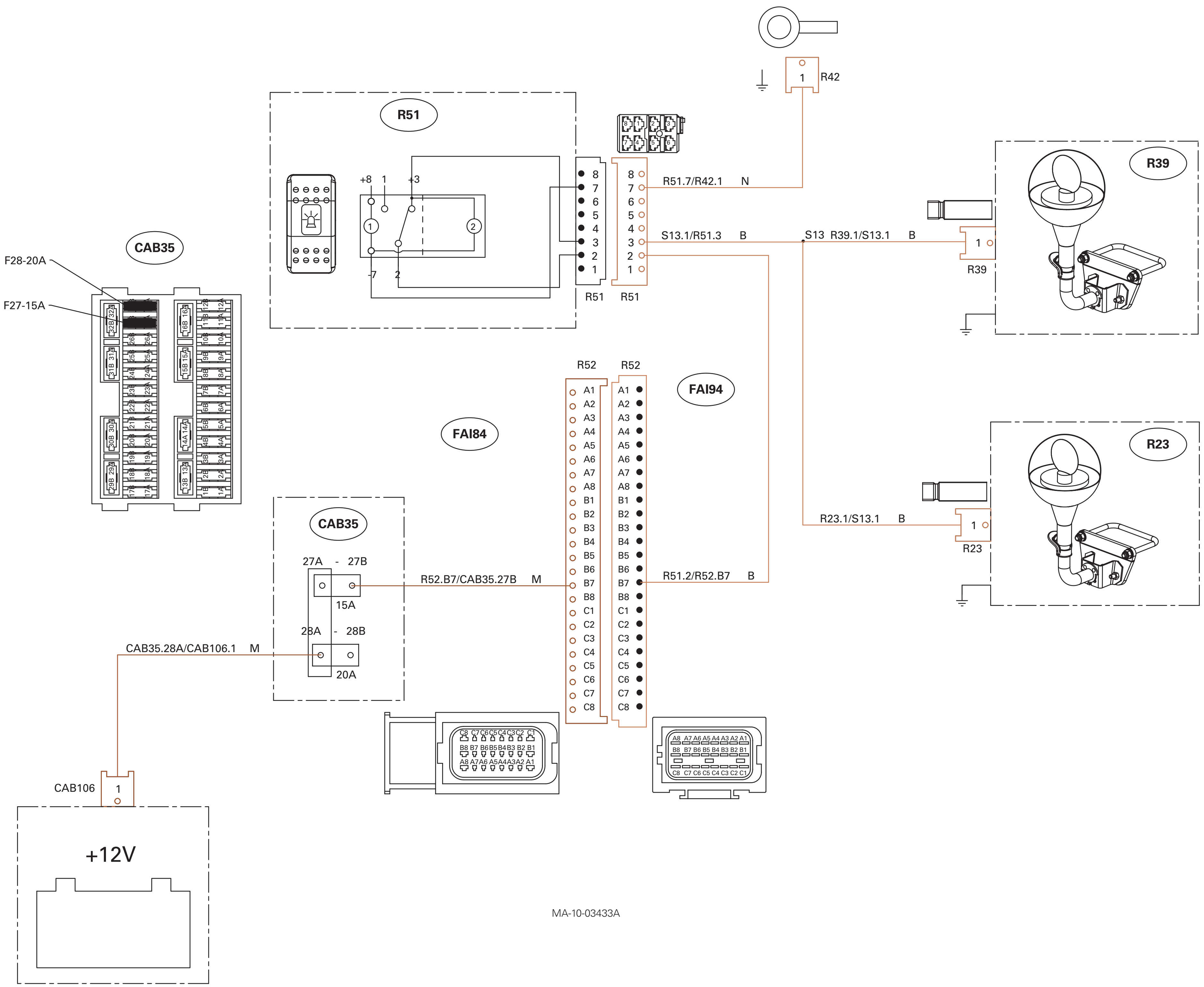


Fig. 64

Slim Line roof flashing beacon

FAI 77 Flat roof harness (Slim Line)
FAI 84 Cab instrument panel harness (all countries except US)
FAI 110 Flat roof ground harness (Slim Line)
CAB 35 Fuse box
59 Left-hand flashing beacon
59 Right-hand flashing beacon
R51 Flashing beacon switch

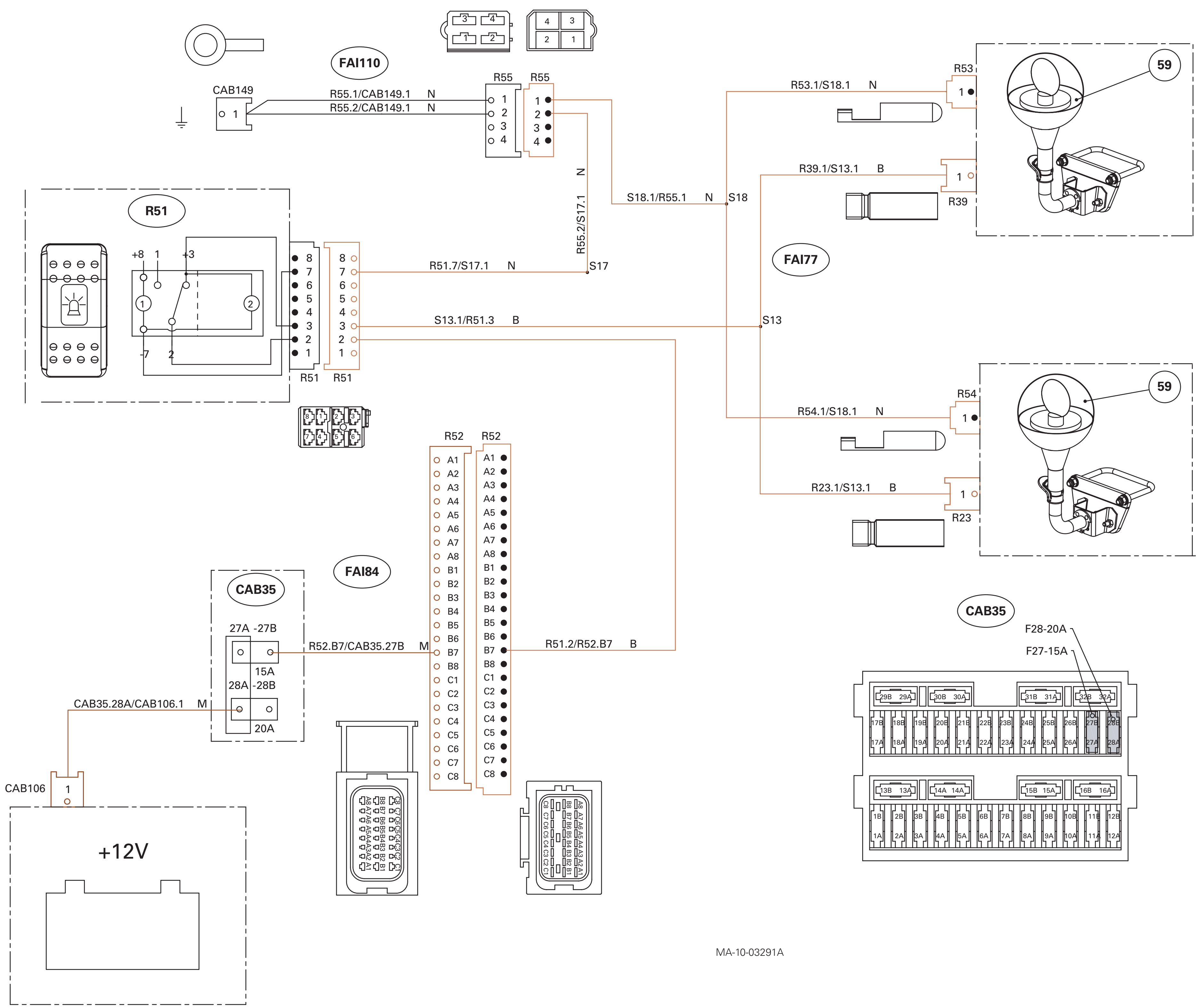


Fig. 65

Platform flashing beacon

FAI 79 Platform flashing beacon harness
FAI 95 Platform instrument panel harness - NAO
CAB 35 Fuse box
CAB 139 Flashing beacon switch
59 Flashing beacon

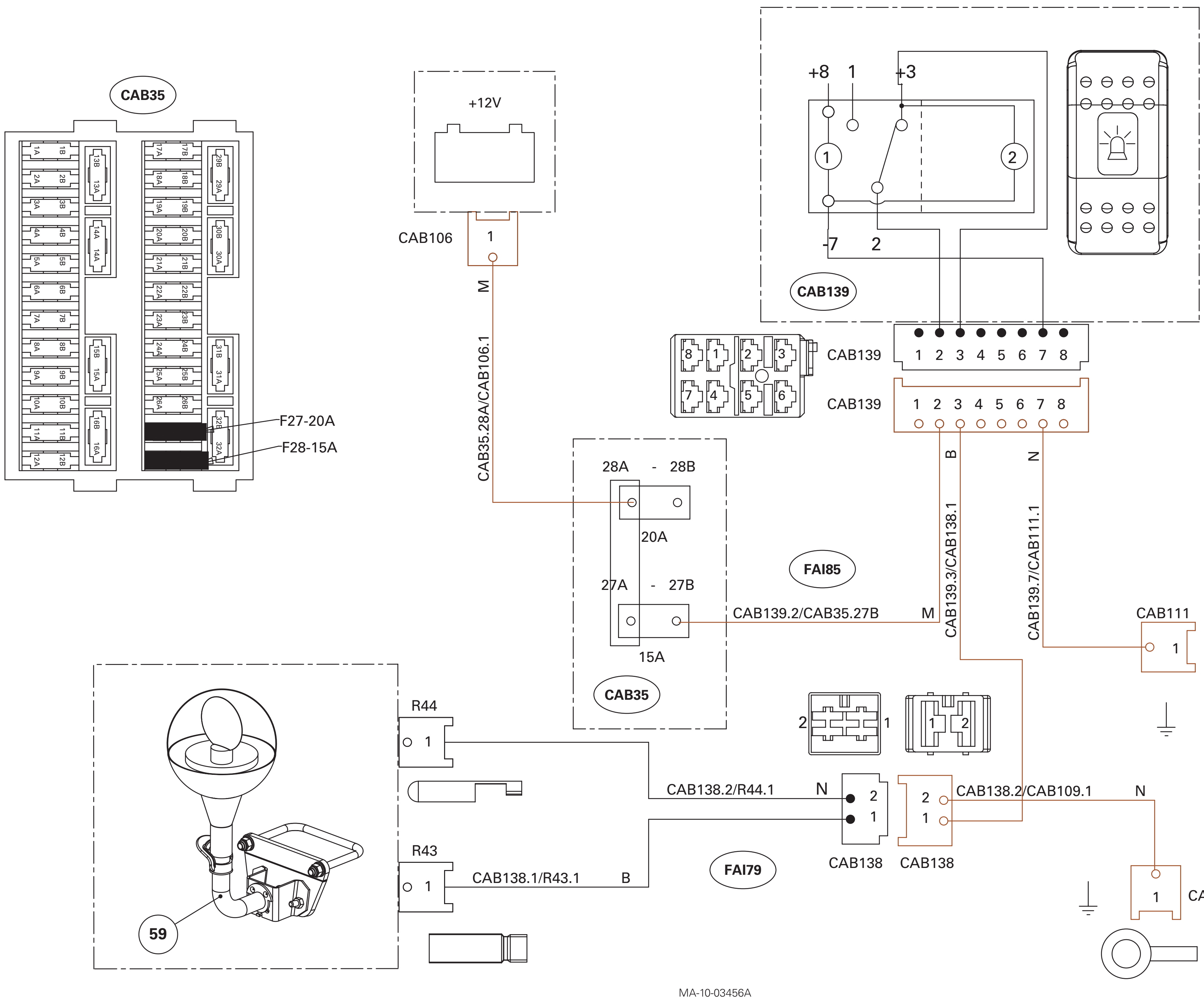


Fig. 66

Standard roof direction indicator and warning lights - Europe

FAI 61 Simplified handrail harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 91 Cab lighting harness (all countries except US)
FAI 94 Standard roof harness EU
CAB 35 Fuse box
CAB 43 Warning switch
CAB 90 Windscreen wiper control unit
CAB 91 Flashing light unit
3 Start switch
49 X2 instrument panel

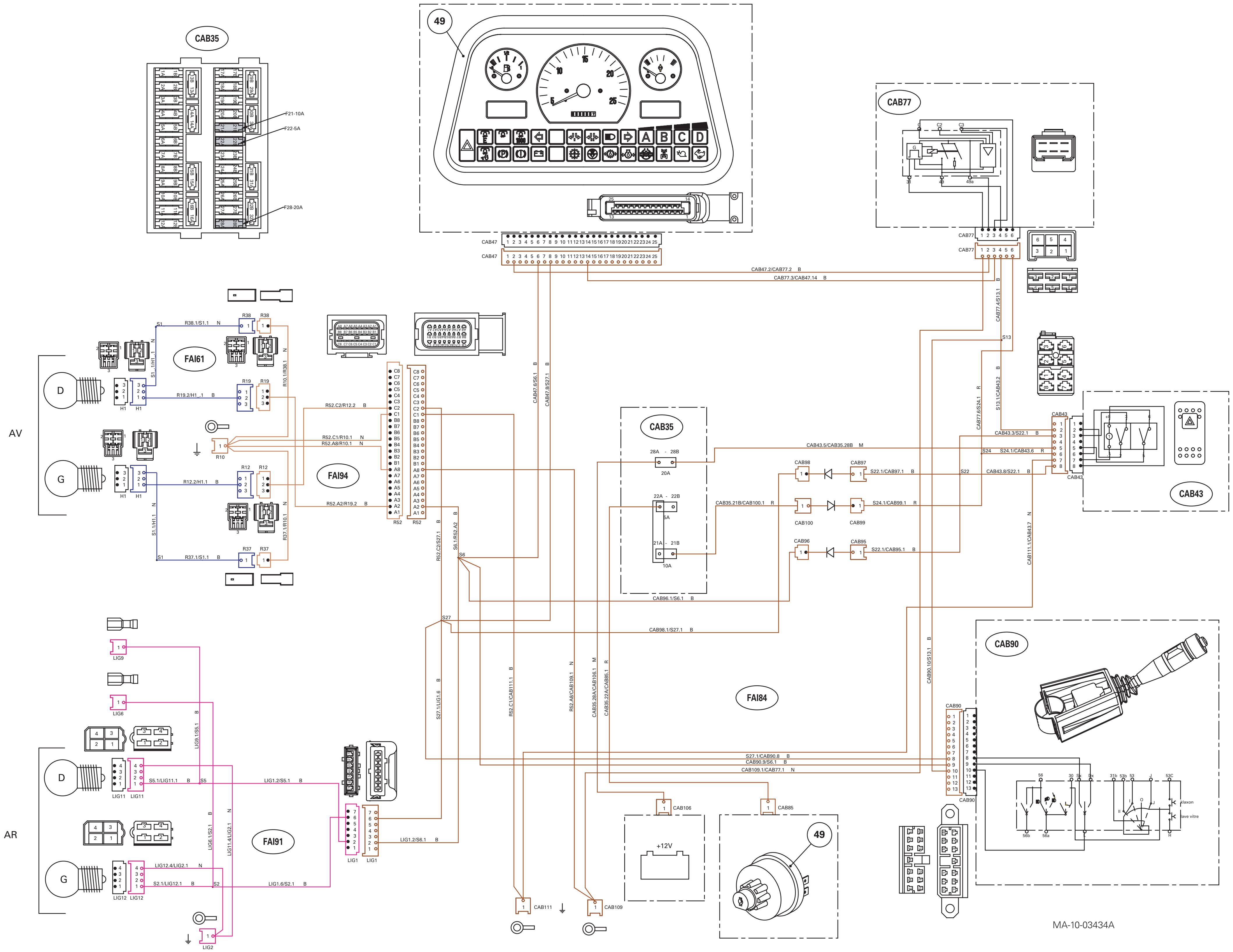


Fig. 67

High visibility roof direction indicator and warning lights - Europe and Germany

FAI 34 Handrail lighting harness
FAI 78 High visibility roof harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 91 Cab lighting harness (all countries except US)
CAB 35 Fuse box
CAB 43 Warning switch
CAB 90 Windscreen wiper control unit
CAB 91 Flashing light unit
3 Start switch
49 X2 instrument panel

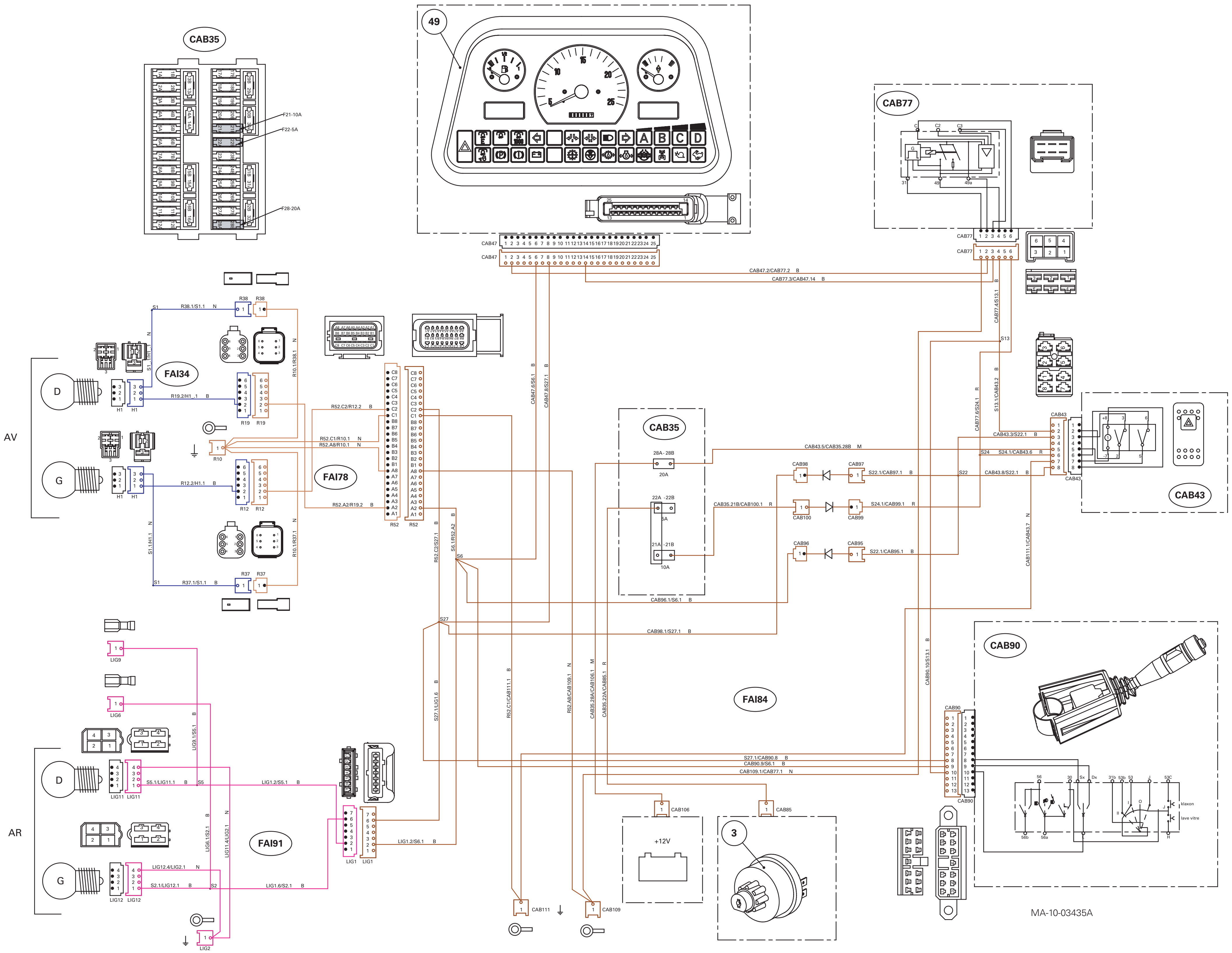


Fig. 68

Slim line roof direction indicator and warning lights - Europe

FAI 34 Handrail lighting harness
FAI 77 Flat roof harness (Slim Line)
FAI 84 Cab instrument panel harness (all countries except US)
FAI 91 Cab lighting harness (all countries except US)
FAI 110 Slim Line roof ground harness
CAB 35 Fuse box
CAB 43 Warning switch
CAB 90 Windscreen wiper control unit
CAB 91 Flashing light unit
3 Start switch
49 X2 instrument panel

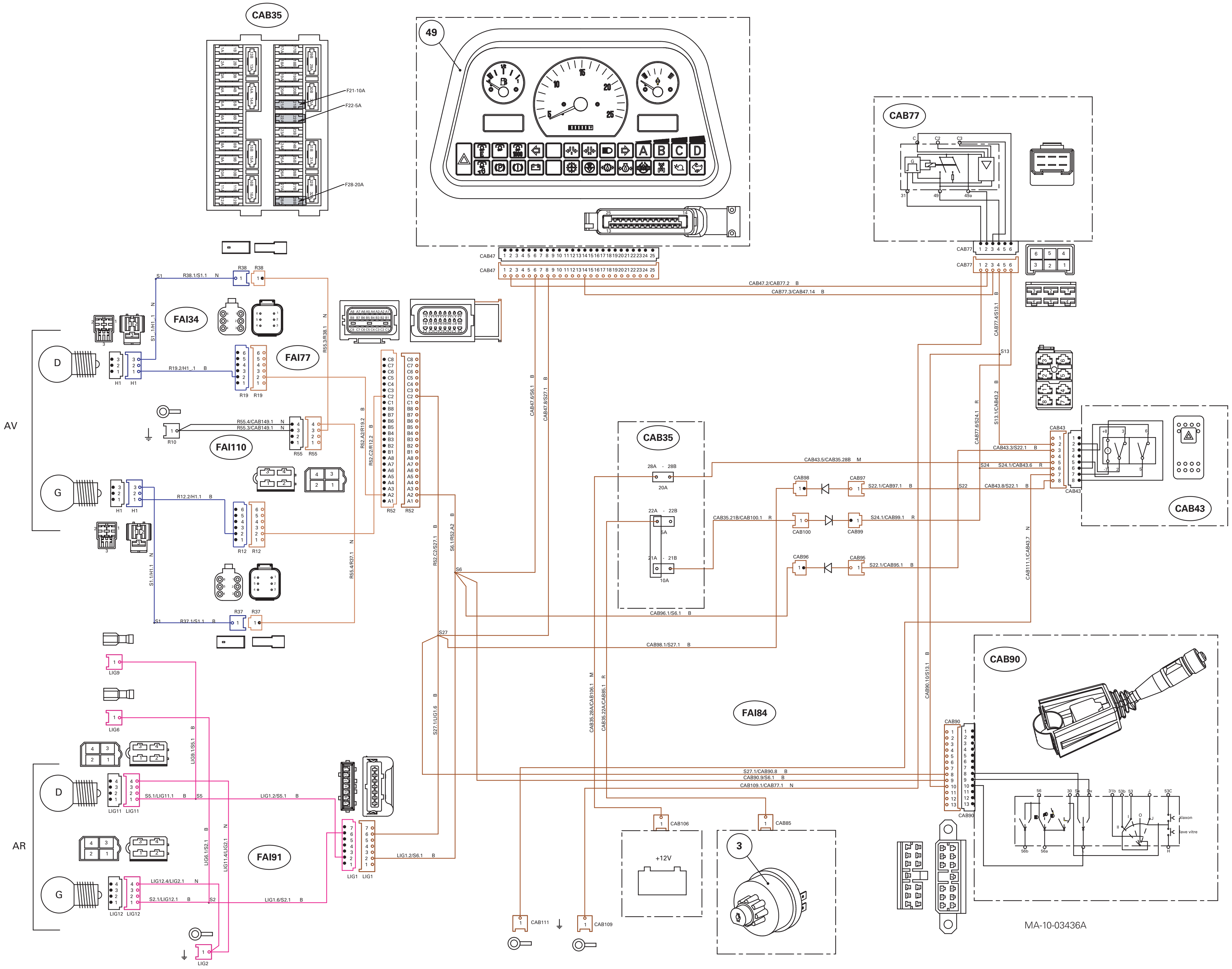


Fig. 69

Platform indicator and warning lights - Europe

FAI 86 X2 platform instrument panel harness - EU
FAI 92 X2 platform lighting harness - EU
FAI 98 Platform handrail harness
CAB 35 Fuse box
CAB 43 Warning switch
CAB 77 Flashing light unit
CAB 90 Windscreen wiper control unit
3 Start switch
38 Trailer connector - Europe
49 X2 instrument panel

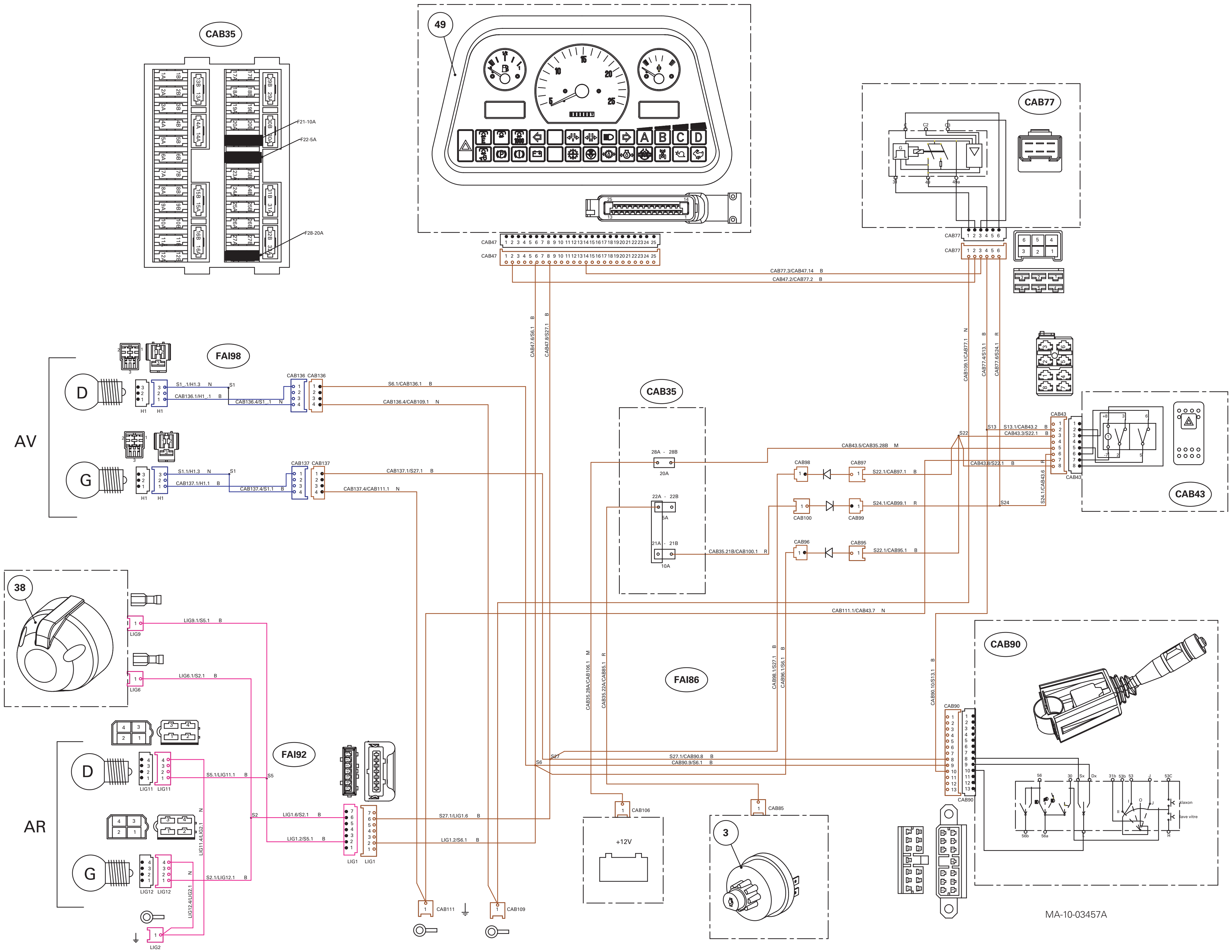


Fig. 70

Standard roof direction indicator and warning lights - North America

FAI 75 Standard roof harness - US
FAI 83 Cab instrument panel harness - US
FAI 95 Cab lighting harness - US
CAB 35 Fuse box
CAB 43 Warning switch
CAB 90 Windscreen wiper control unit
CAB 91 Flashing light unit
3 Start switch
49 X2 instrument panel

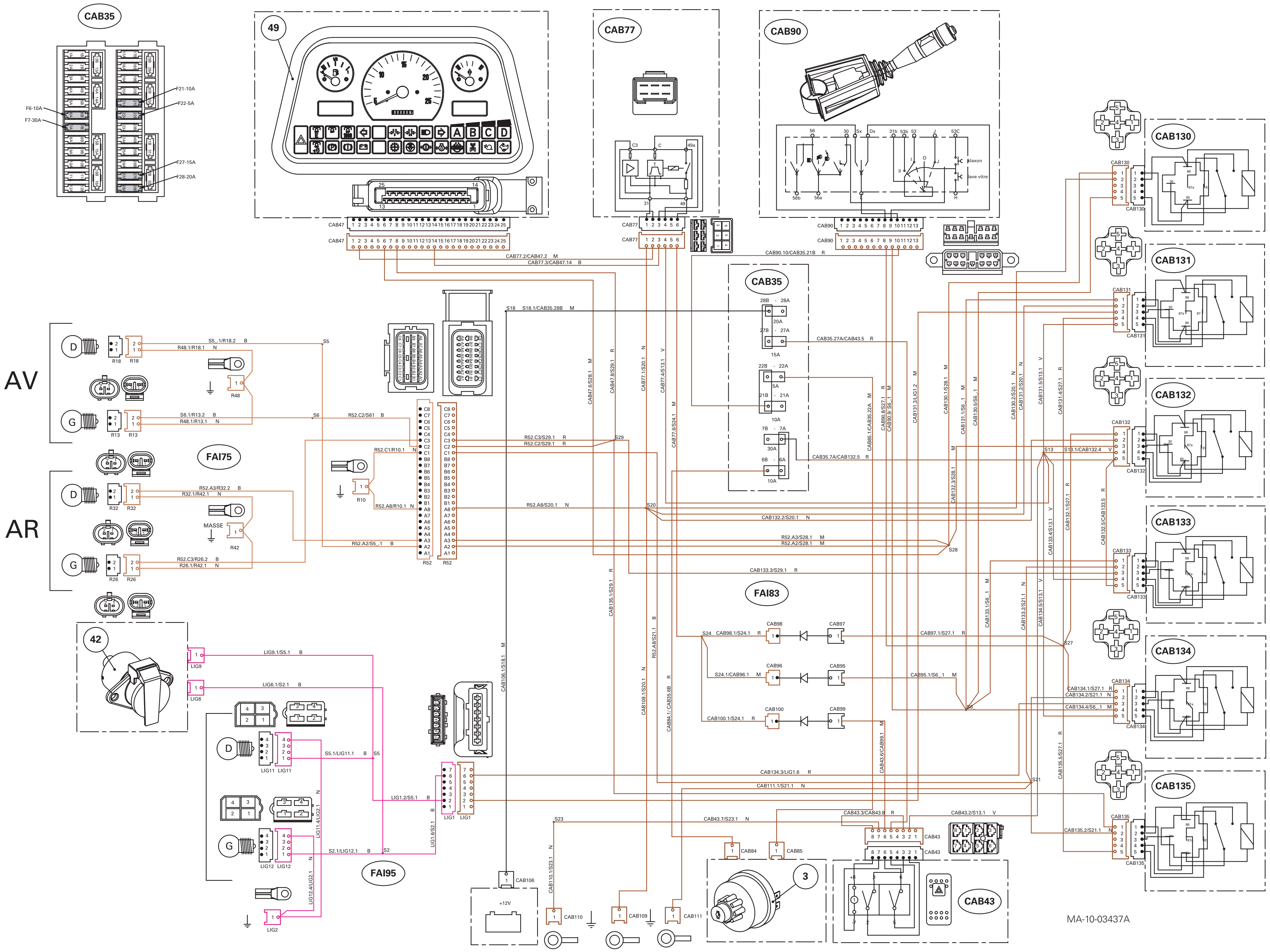


Fig. 71

High visibility roof direction indicator and warning lights - North America

FAI 34 Handrail lighting harness
FAI 78 High visibility roof harness
FAI 83 Cab instrument panel harness - US
FAI 95 Cab lighting harness - US
CAB 35 Fuse box
CAB 43 Warning switch
CAB 90 Windscreen wiper control unit
CAB 91 Flashing light unit
3 Start switch
49 X2 instrument panel

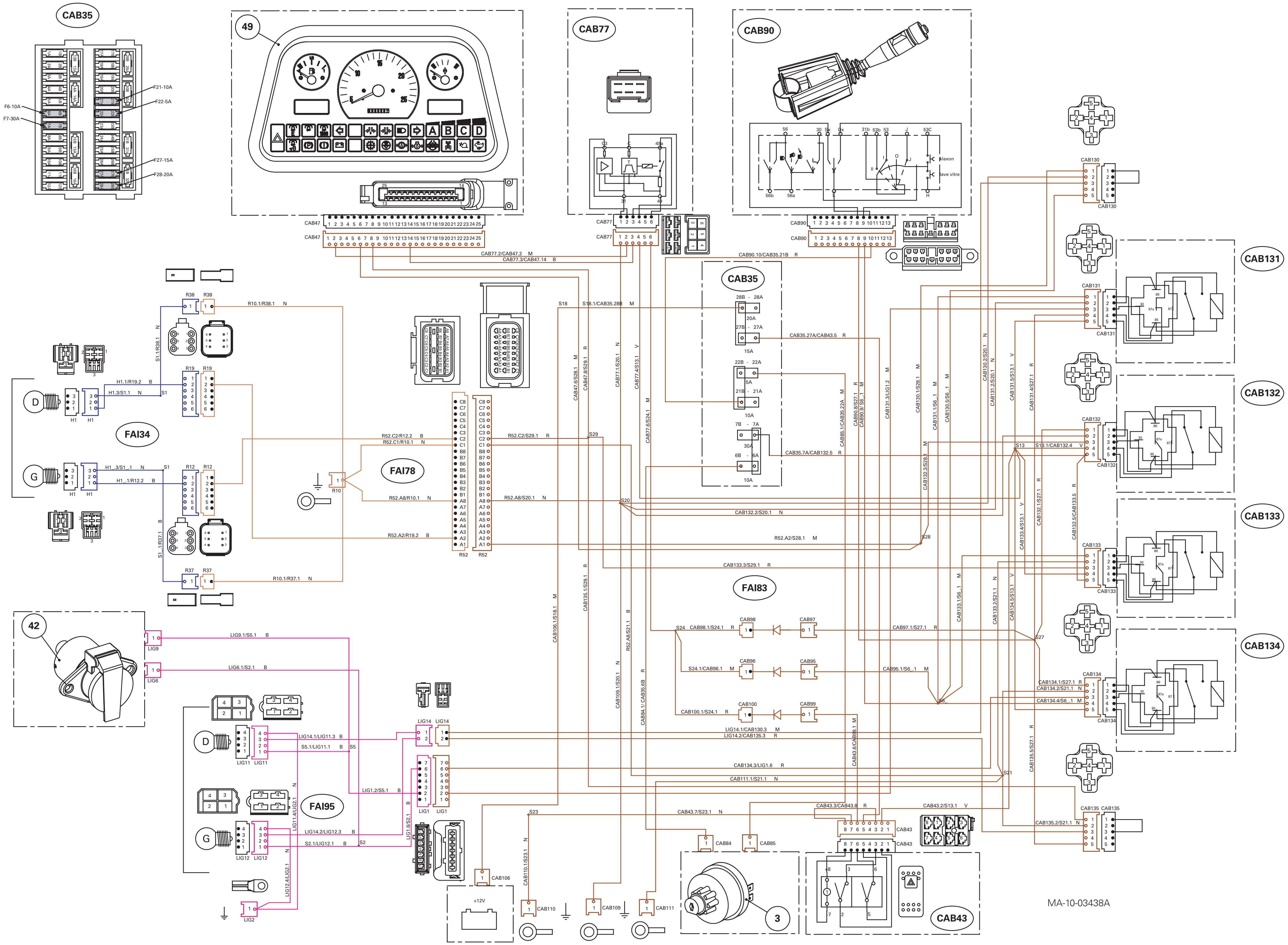


Fig. 72

Platform indicator and warning lights - North America

FAI 85 Platform instrument panel harness - US
FAI 97 Platform lighting harness - US
FAI 98 Handrail platform lighting harness (all countries except US)
CAB 35 Fuse box
CAB 43 Warning switch
CAB 90 Windscreen wiper control unit
CAB 91 Flashing light unit
3 Start switch
42 Trailer connector - NAO
49 X2 instrument panel

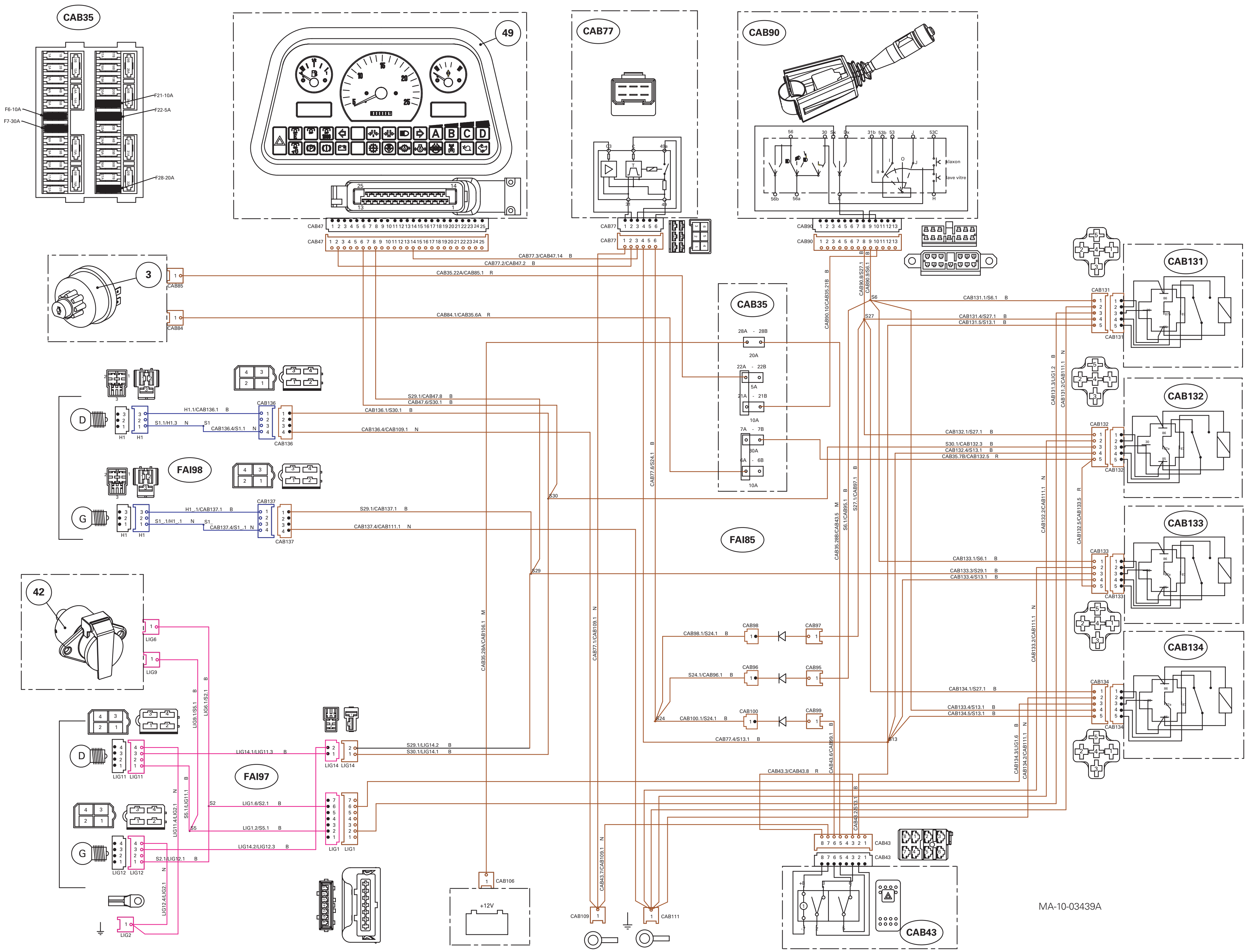
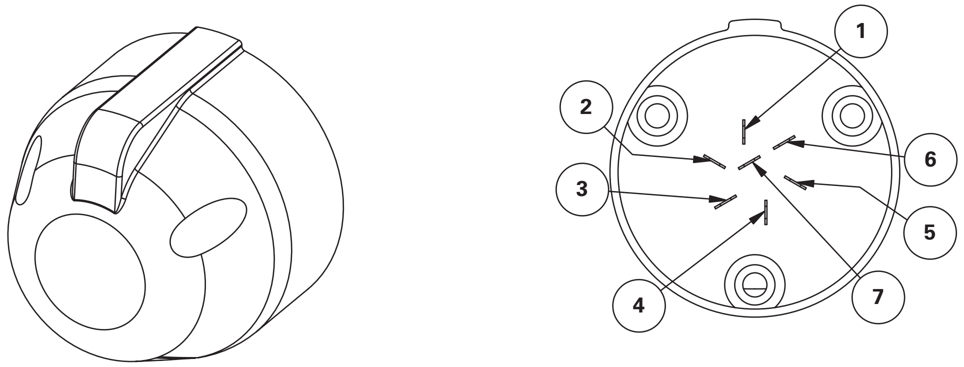


Fig. 73

Trailer connector - Europe



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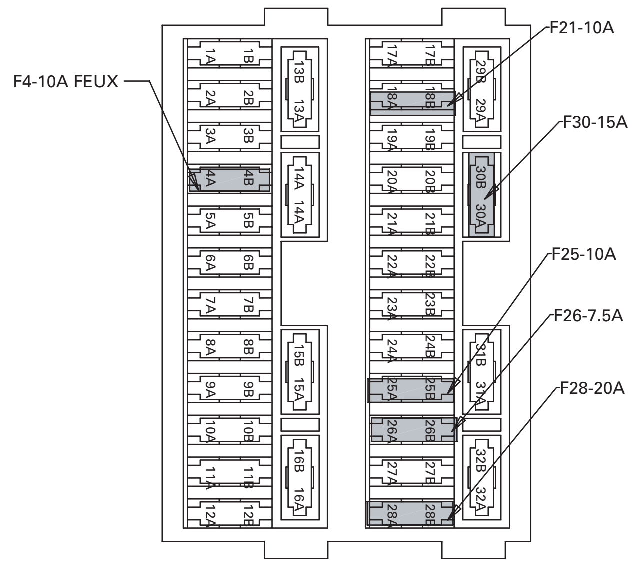
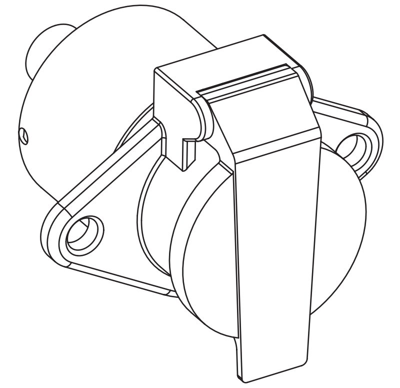
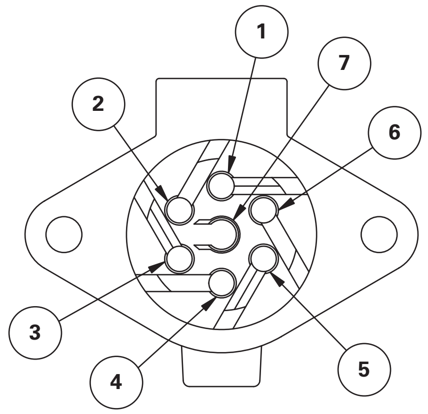


Fig. 74

Trailer connector - North America





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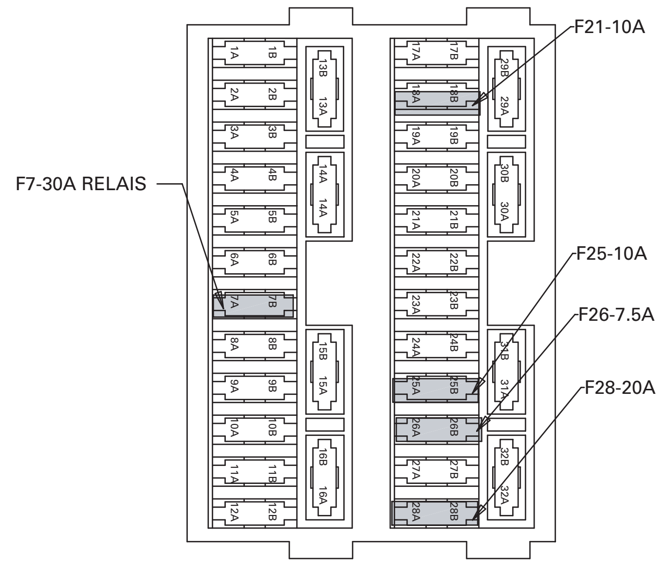

Fig. 75

Standard and high visibility work headlights - Europe

FAI 94 Standard roof harness - EU
FAI 84 Cab instrument panel harness (all countries except US)
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 37 Front work headlights relay
CAB 38 Rear work headlights relay
CAB 42 Light switch
CAB 44 Front work headlights switch
CAB 45 Rear work headlights switch

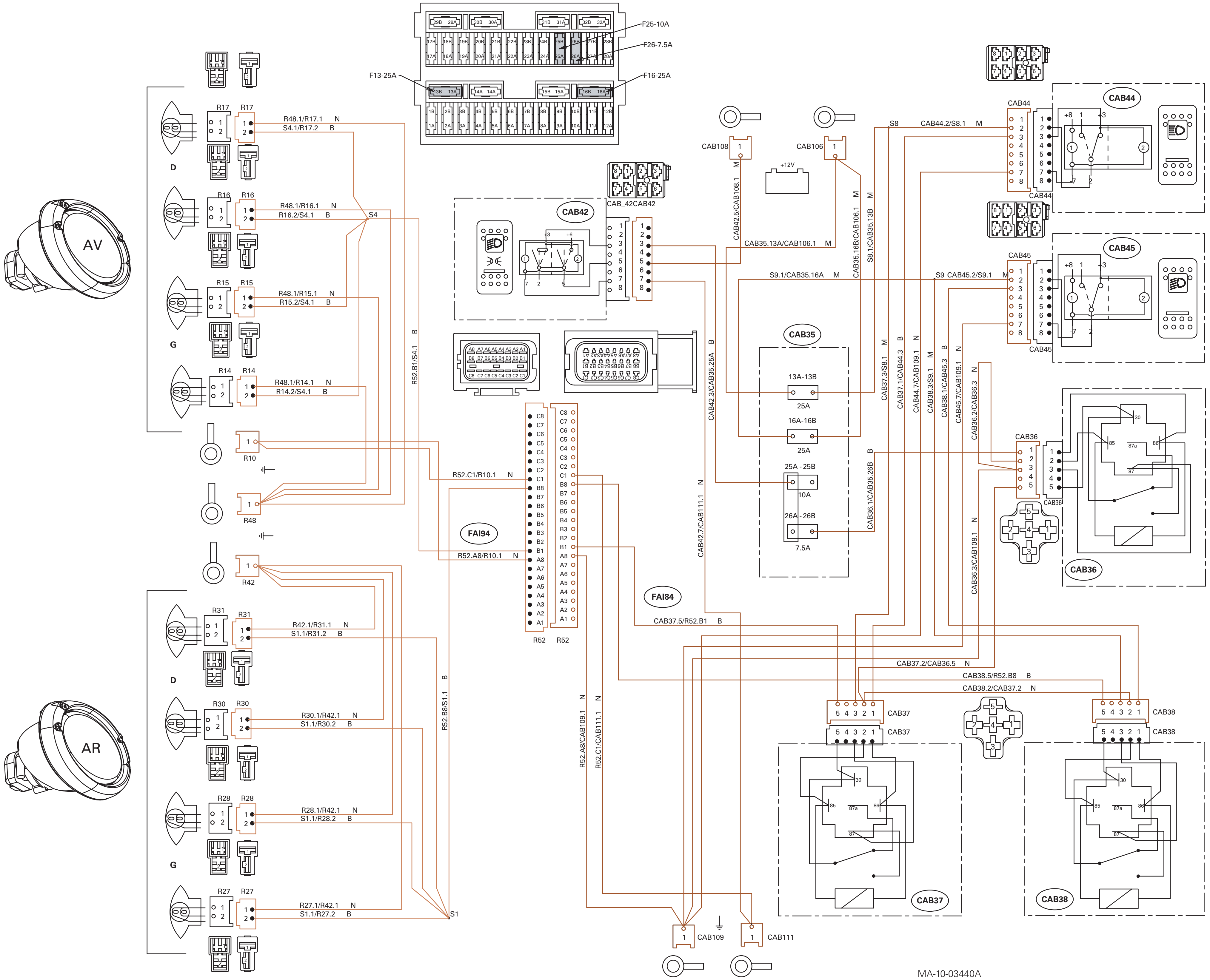

Fig. 76

Slim Line roof work headlights - Europe

FAI 75 Standard roof harness - US
FAI 77 Flat roof harness (Slim Line)
FAI 110 Slim Line roof ground harness
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 37 Front work headlights relay
CAB 38 Rear work headlights relay
CAB 42 Light switch
CAB 44 Front work headlights switch
CAB 45 Rear work headlights switch

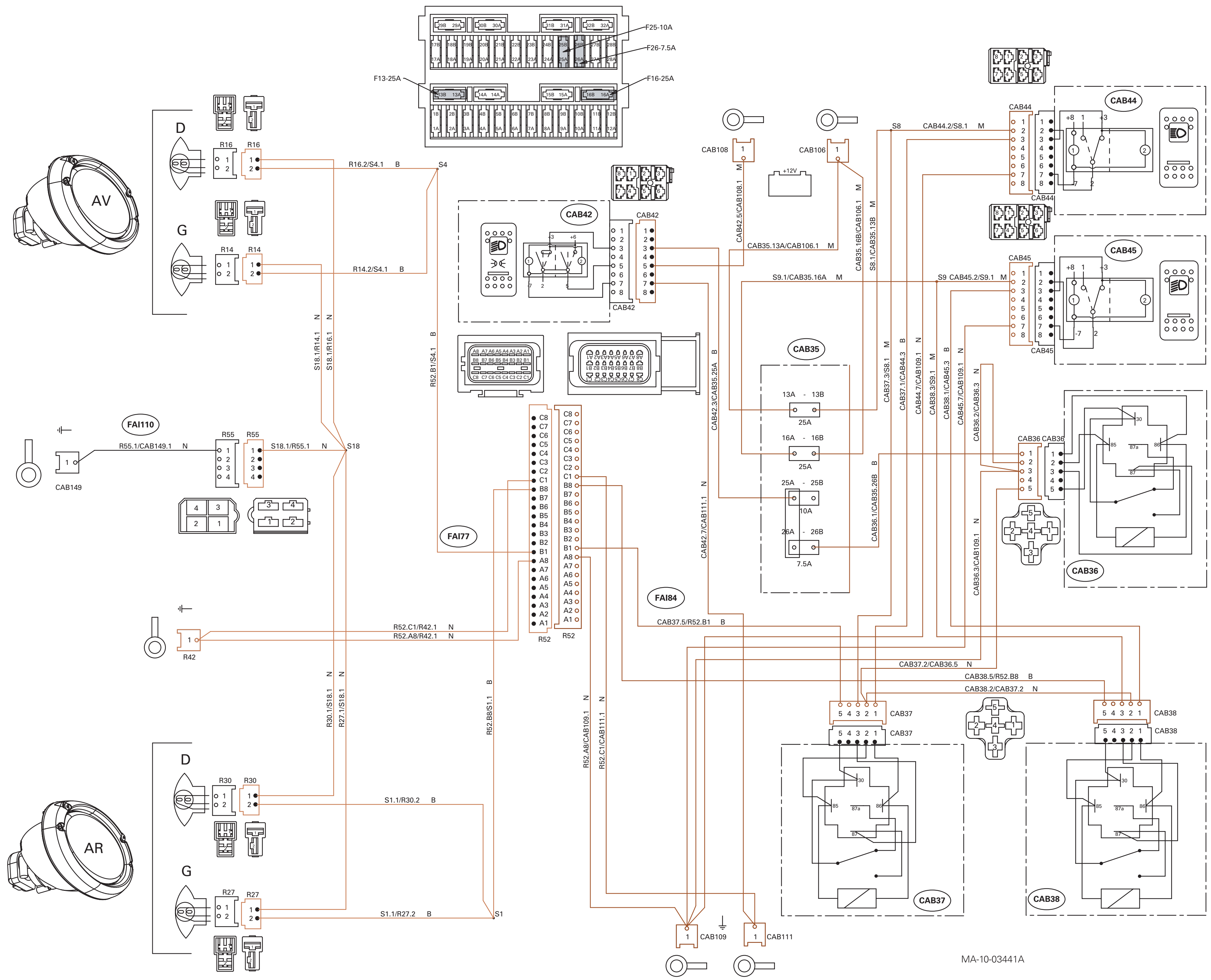

Fig. 77

Platform work headlights - Europe

FAI 86 Platform instrument panel harness - EU
FAI 92 Platform lighting harness - EU
FAI 98 Platform handrail harness
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 37 Front work headlights relay
CAB 38 Rear work headlights relay
CAB 42 Light switch
CAB 44 Front work headlights switch
CAB45 Rear work headlights switch
H2 Front work headlights
LIG 15 Rear work headlights

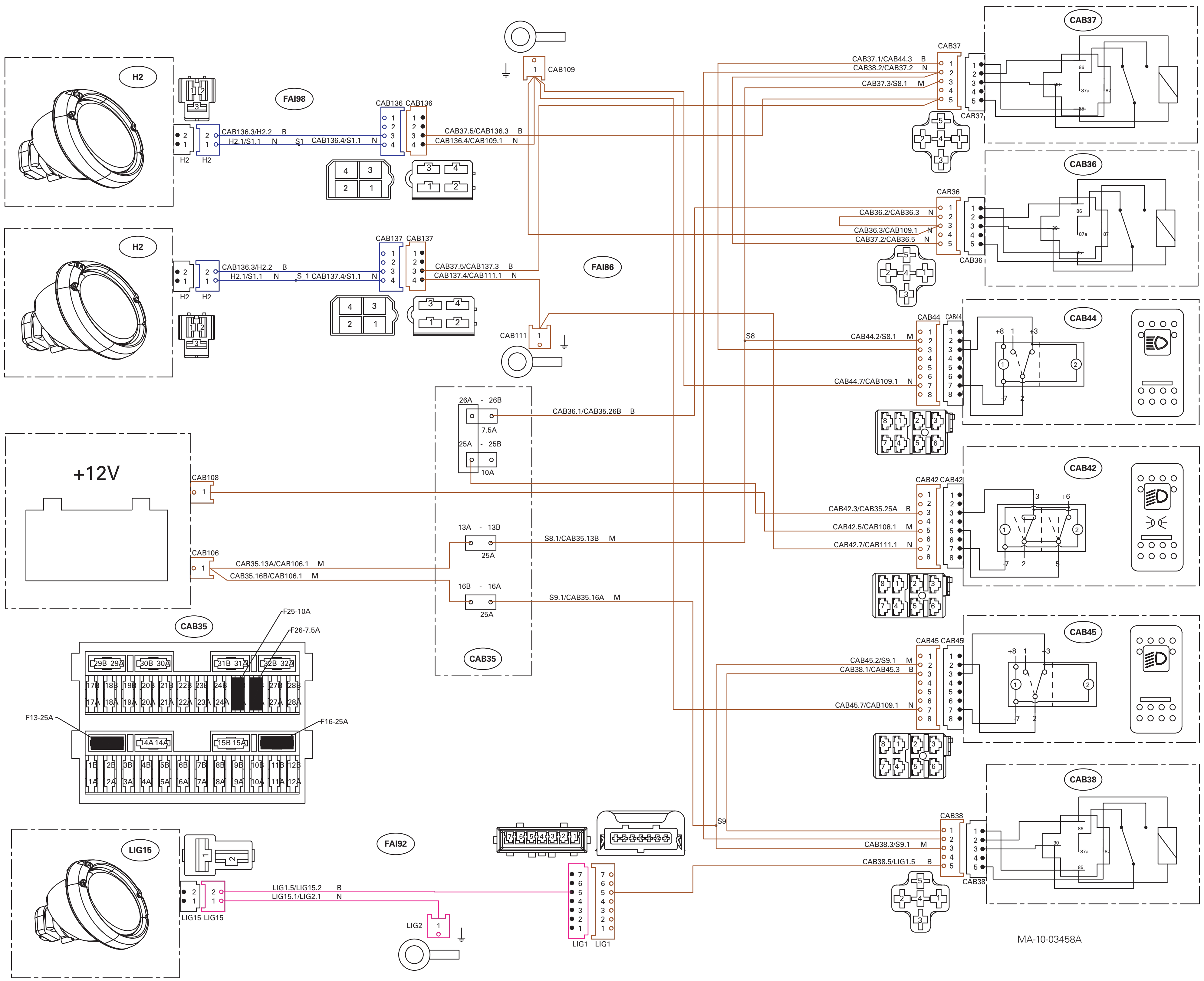

Fig. 78

Standard and high visibility roof work headlights - North America

FAI 75 Standard roof harness - US
FAI 83 Instrument panel harness - NAO
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 37 Front work headlights relay
CAB 38 Rear work headlights relay
CAB 43 Warning switch
CAB 44 Front work headlights switch
CAB 45 Rear work headlights switch

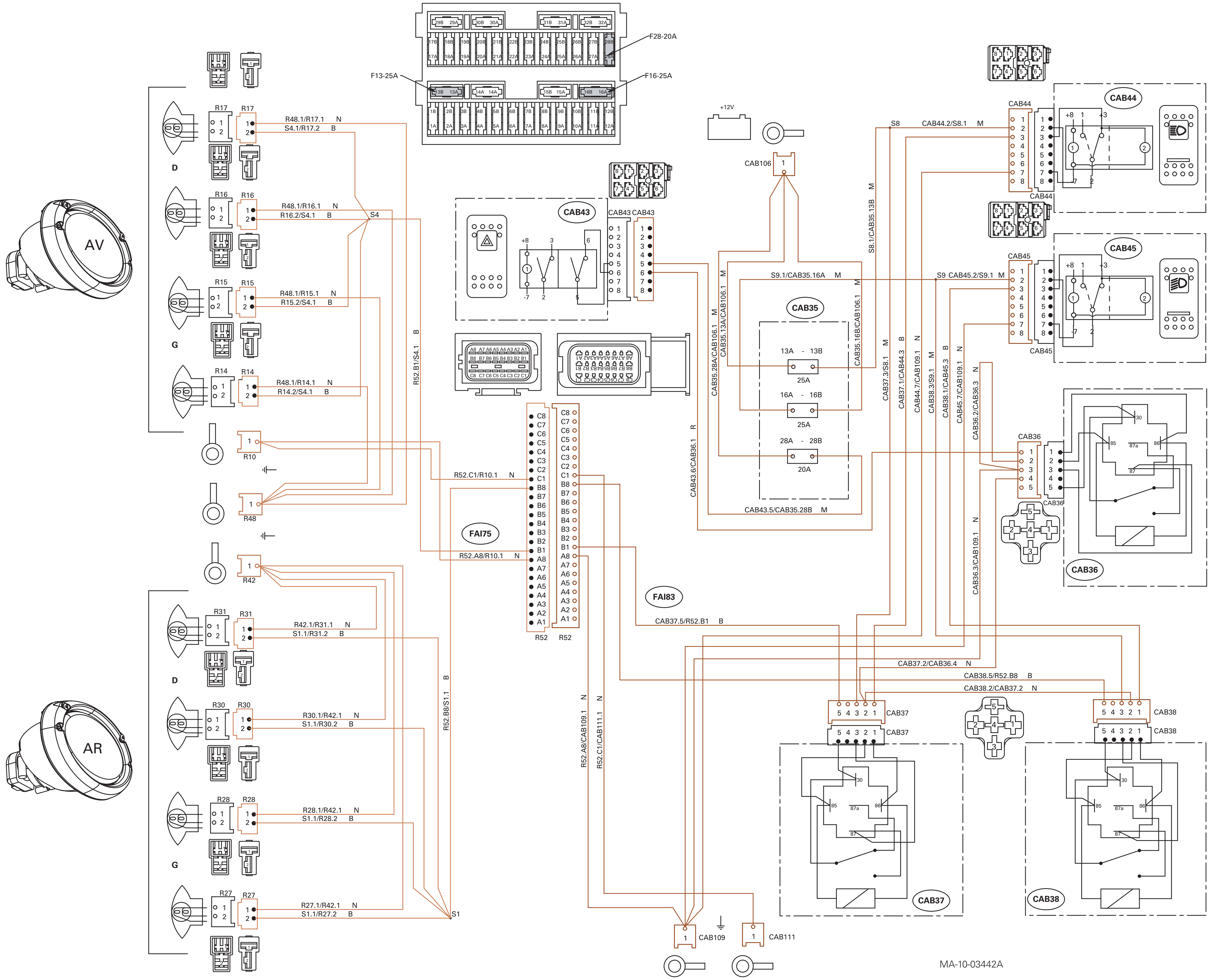

Fig. 79

Slim Line roof work headlights - North America

FAI 77 Flat roof harness (Slim Line)
FAI 83 Instrument panel harness - NAO
FAI 110 Slim Line roof ground harness
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 37 Front work headlights relay
CAB 38 Rear work headlights relay
CAB 43 Warning switch
CAB 44 Front work headlights switch
CAB 45 Rear work headlights switch

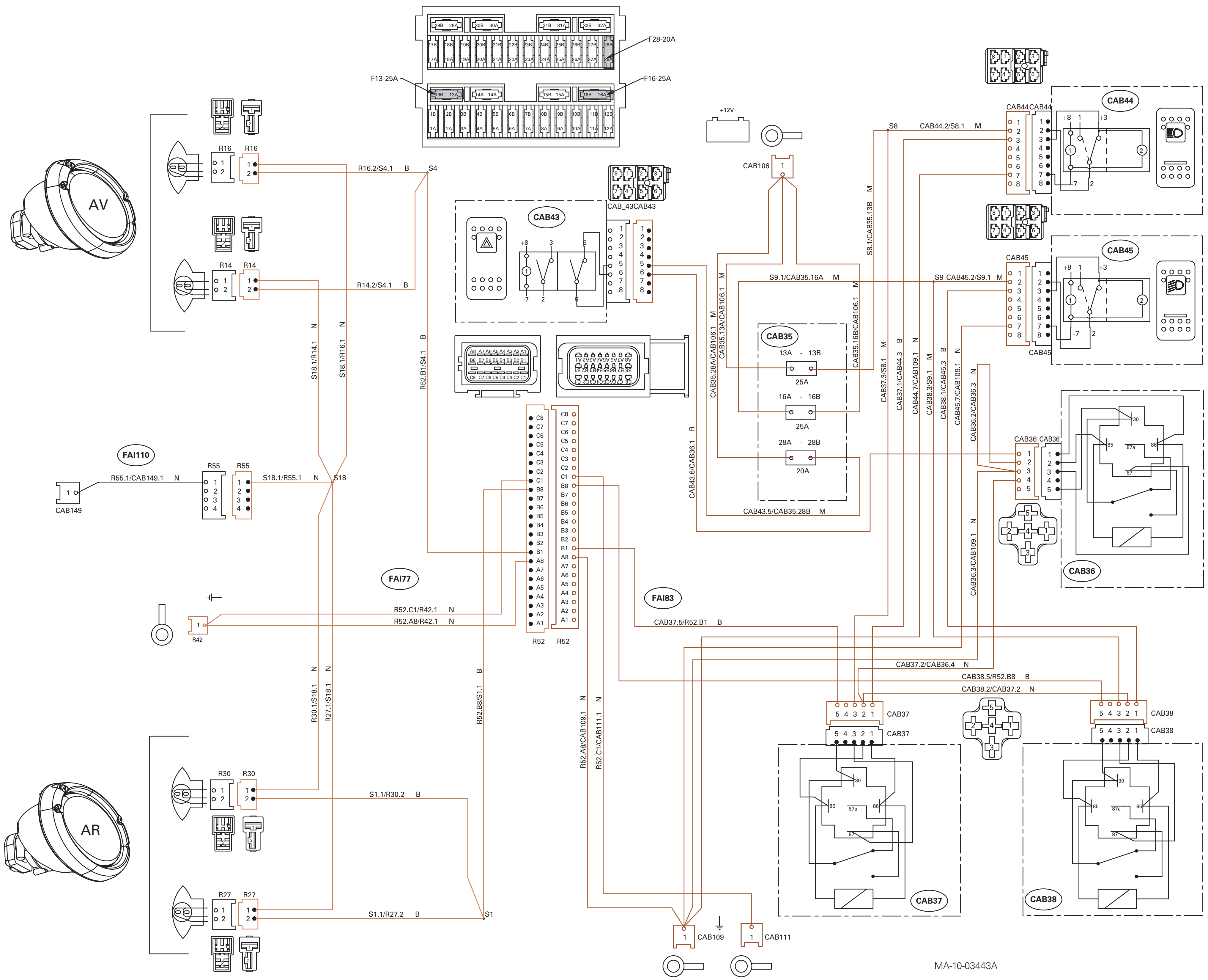

Fig. 80

Platform work headlights - North America

FAI 85 NAO Platform instrument panel harness
FAI 97 Platform lighting harness - NAO
FAI 98 Platform handrail harness
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 37 Front work headlights relay
CAB 38 Rear work headlights relay
CAB 43 Warning switch
CAB 44 Front work headlights switch
CAB45 Rear work headlights switch
H2 Front work headlights
LIG 15 Rear work headlights

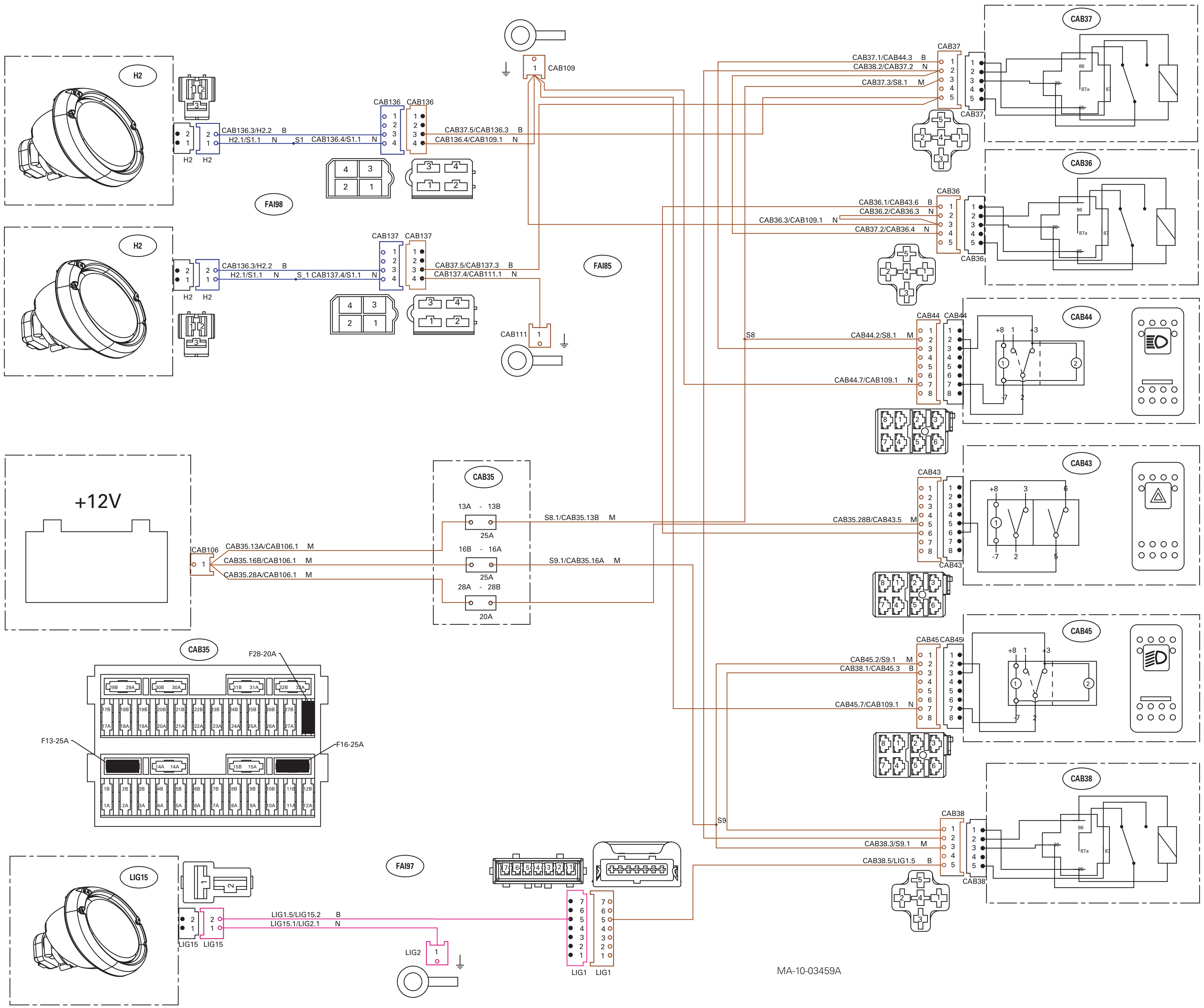

Fig. 81

Work headlights on handrails - standard roof - Europe

FAI 61 Simplified handrail harness - Europe
FAI 84 Instrument panel harness - EU
FAI 94 Standard roof harness - EU
FAI 109 Handrail headlights control harness
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 42 Light switch
CAB 147 Additional headlights switch
CAB 148 Additional headlights relay

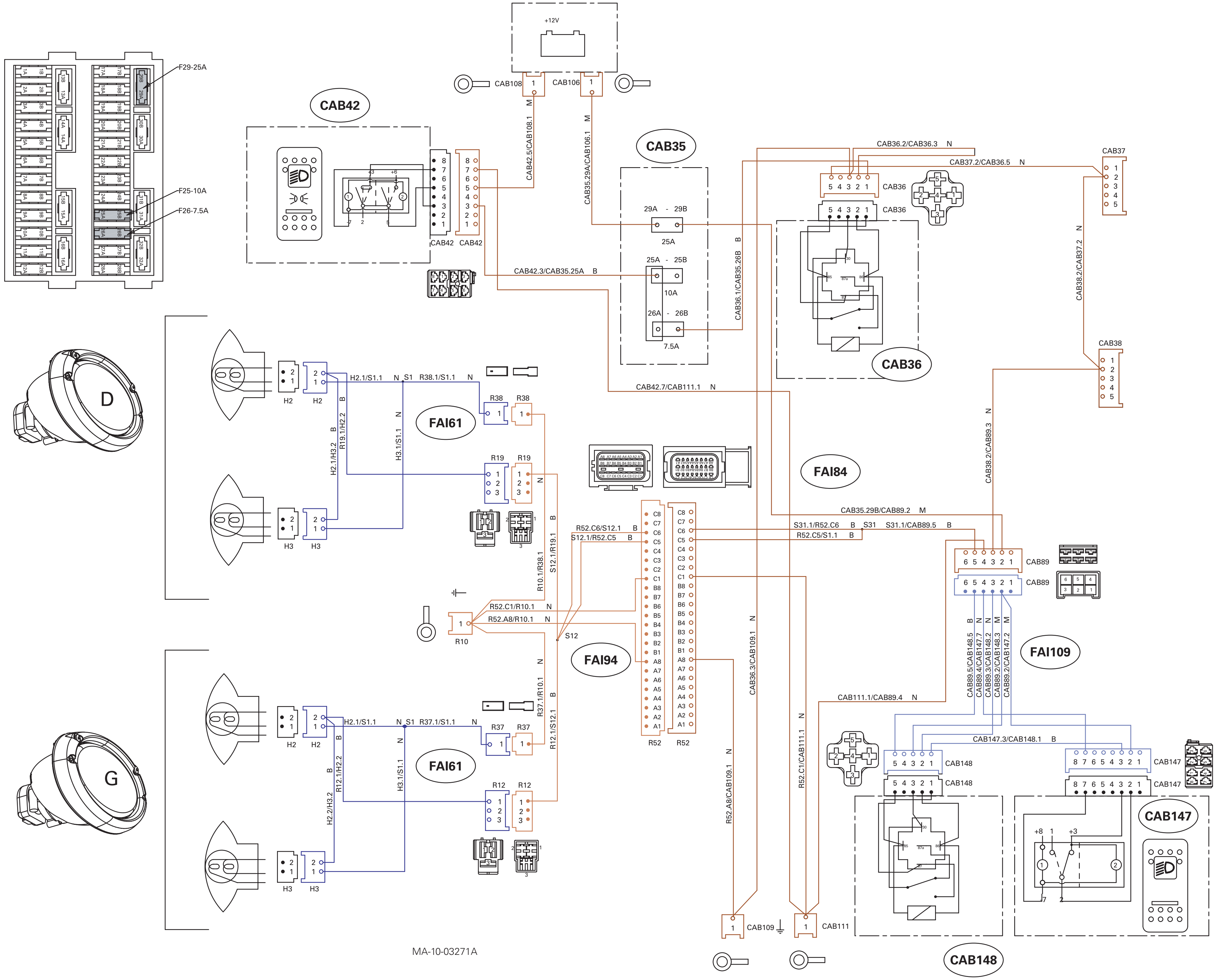

Fig. 82

Work headlights on handrails – High Visibility roof - Europe

FAI 34 Handrail lighting harness
FAI 59 High visibility roof harness
FAI 84 Instrument panel harness - EU
FAI 109 Handrail headlights control harness
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 42 Light switch
CAB 147 Additional headlights switch
CAB 148 Additional headlights relay

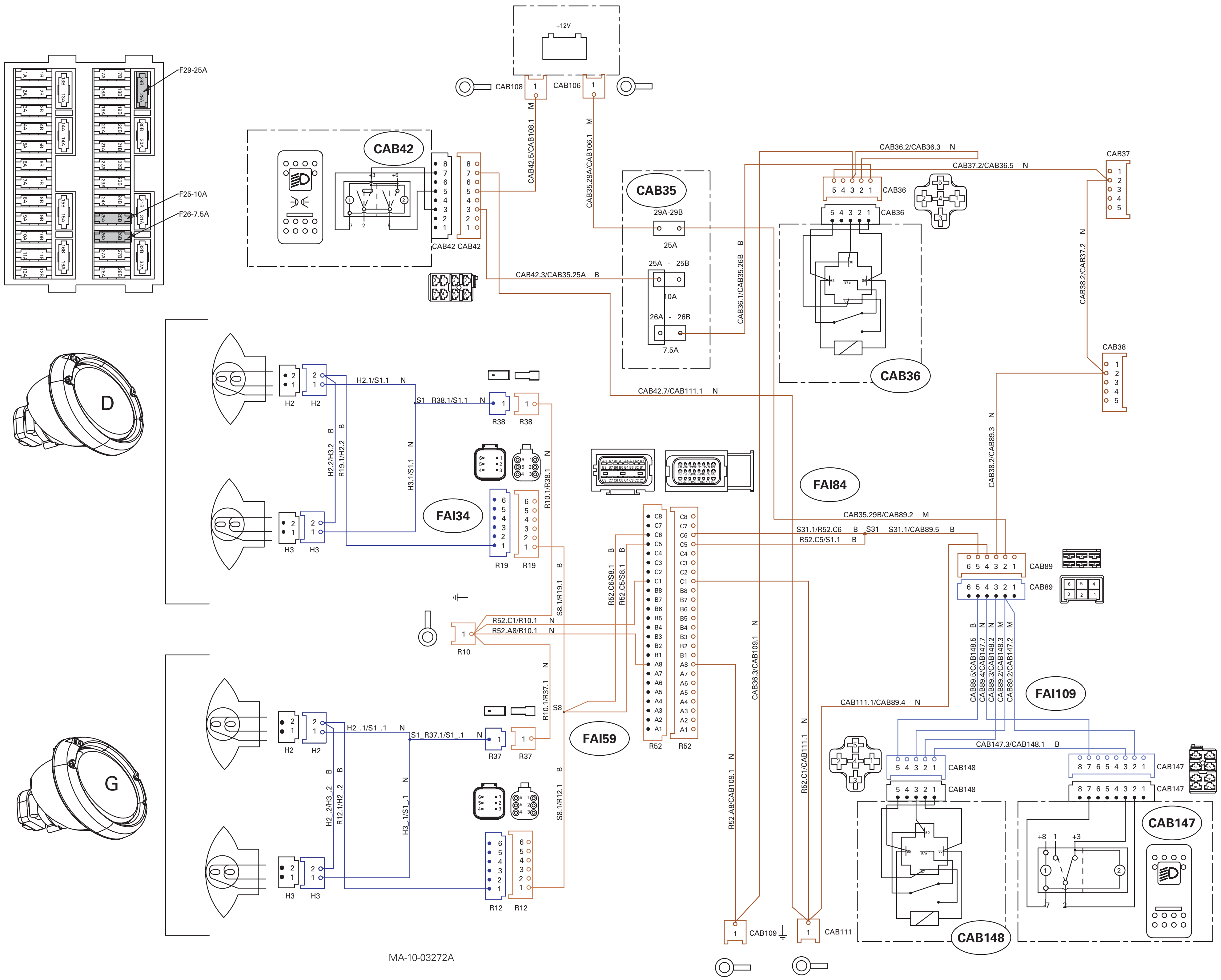

Fig. 83

Work headlights on handrails - Slim Line roof - Europe

FAI 34 Handrail lighting harness
FAI 77 Flat roof harness (Slim Line)
FAI 84 Instrument panel harness - EU
FAI 109 Handrail headlights control harness
FAI 110 Flat roof ground harness (Slim Line)
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 42 Light switch
CAB 147Additional headlights switch
CAB 148Additional headlights relay

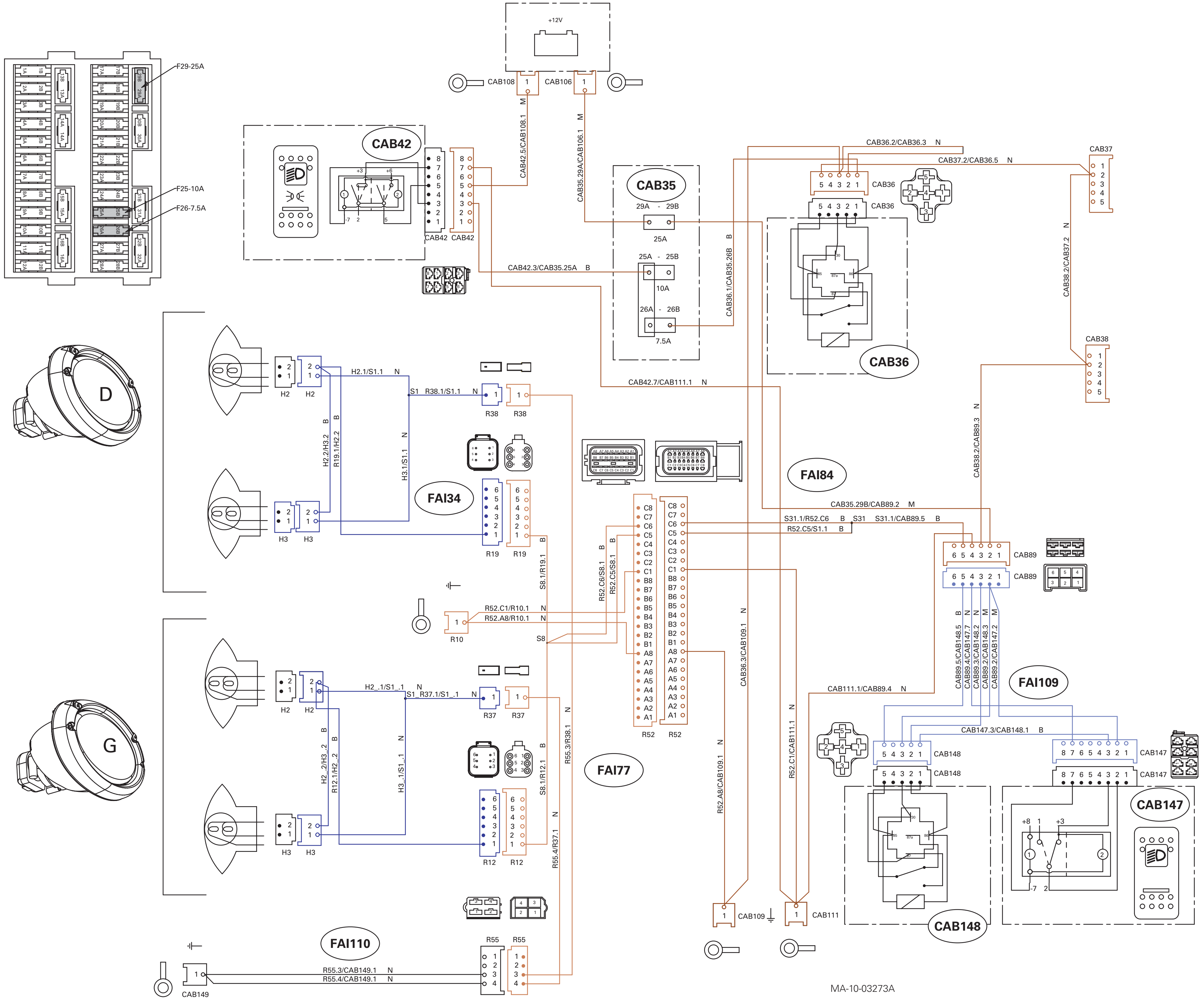

Fig. 84

Work headlights on handrails - standard and high visibility roof - North America

FAI 34 Handrail lighting harness
FAI 75 Standard roof harness - US
FAI 83 Instrument panel harness - NAO
FAI 109 Handrail headlights control harness
CAB 35 Fuse box
CAB 36 Ground authorisation relay
CAB 43 Warning switch
CAB 147 Additional headlights switch
CAB 148 Additional headlights relay

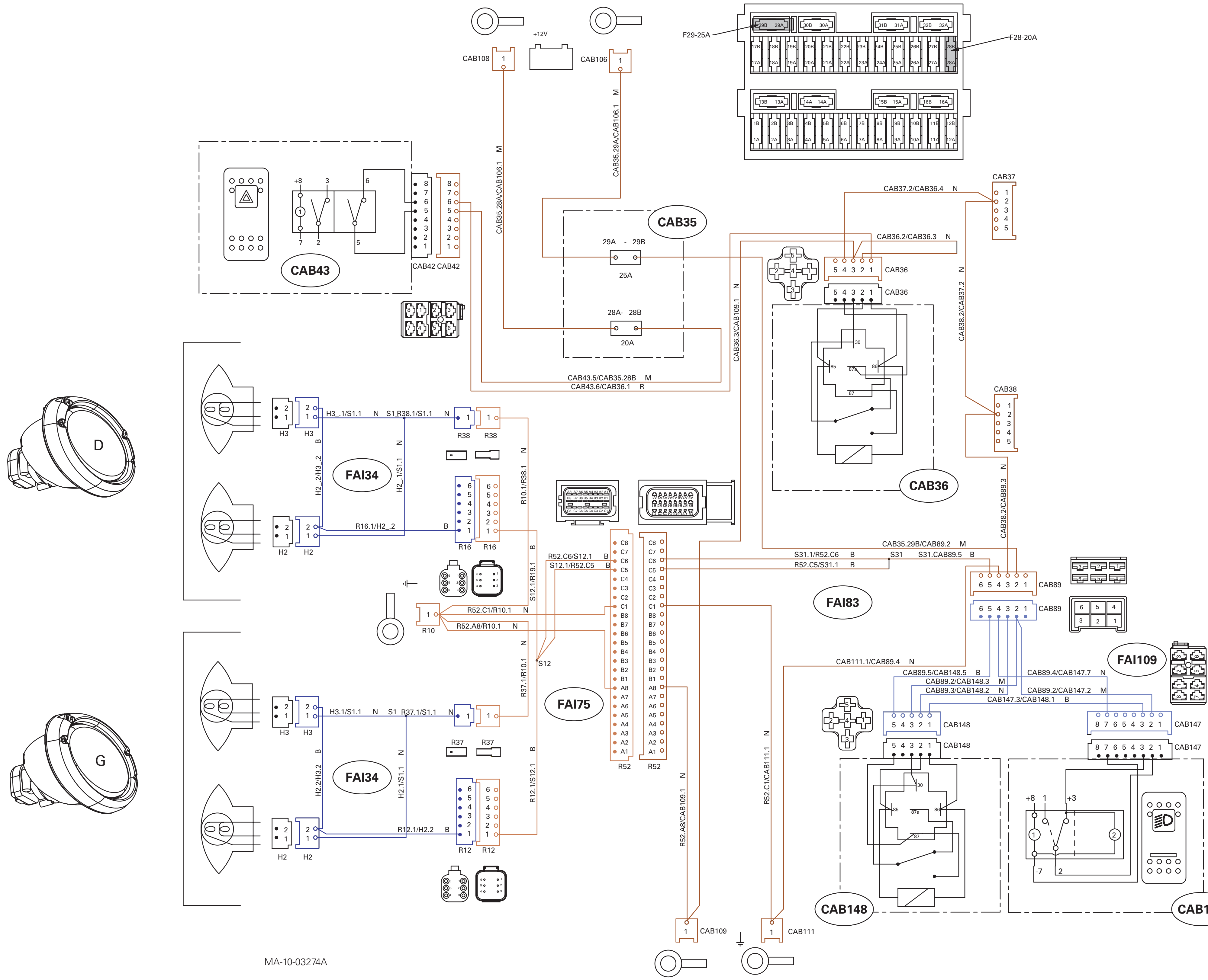

Fig. 85

Stop lights

FAI 84 Cab instrument panel harness (all countries except US)
FAI 91 Cab lighting harness (all countries except US)
CAB 35 Fuse box
CAB 40 Brake relay
CAB 73 Right-hand stop switch
CAB 74 Left-hand stop switch
LIG 11 Rear right-hand light
LIG 12 Rear left-hand light
3 Start switch
38 Trailer connector - Europe

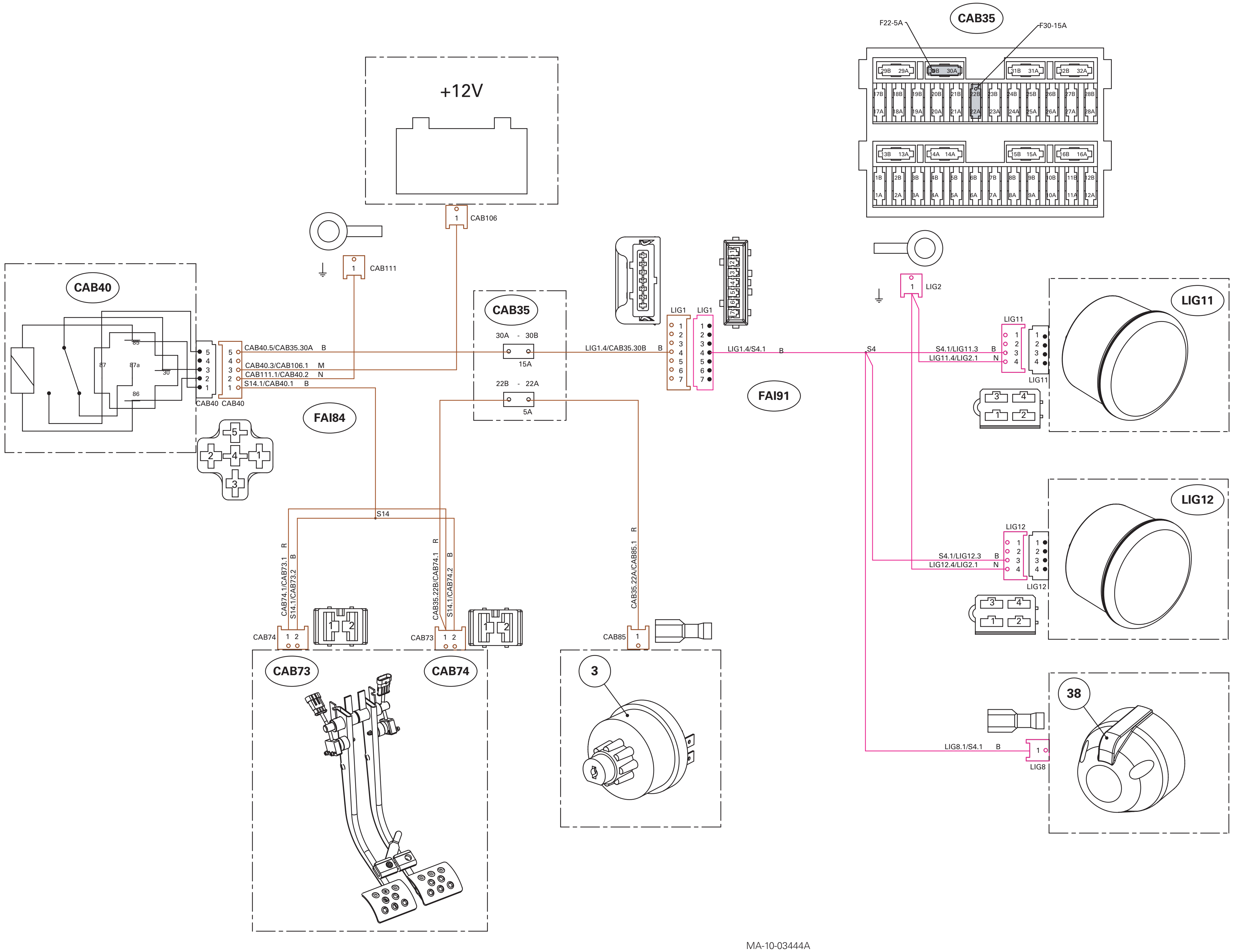

Fig. 86

G . Calculator supply

EHRB ELC Calculator

FAI 73 Linkage harness
FAI 74 Cab console harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 89 Autotronic 5 Power Shuttle harness
CAB 01 EHRB linkage calculator
CAB 35 Fuse box
3 Start switch

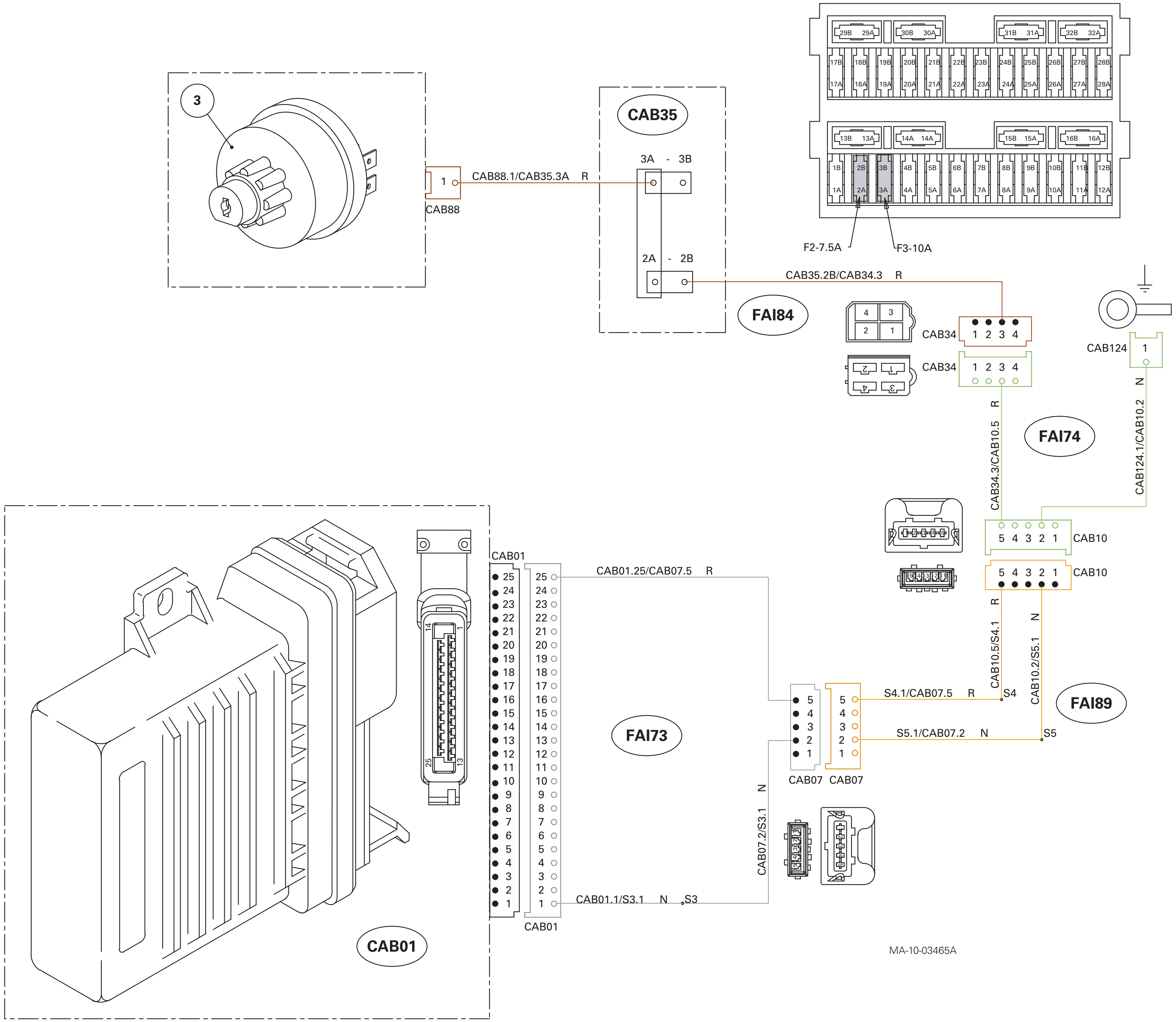

Fig. 87

Platform EHRB ELC Calculator

FAI 73 Cab internal / linkage harness
FAI 85 Platform instrument panel harness - NAO
FAI 89 Cab Auto 5 adaptation harness
CAB 01 EHRB linkage calculator
CAB 35 Fuse box
3 Start switch

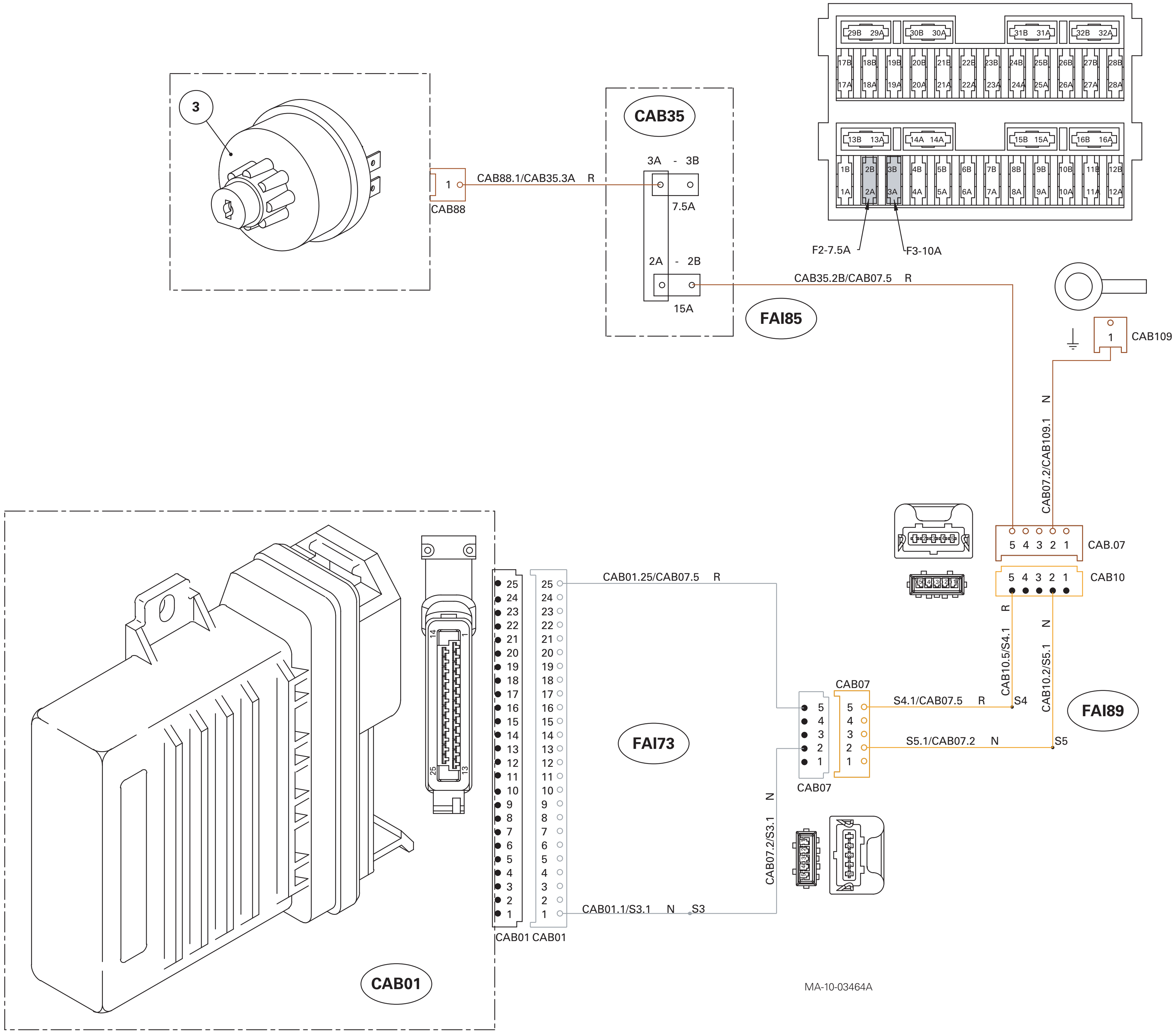

Fig. 88

AUTO 5 calculator

FAI 74 Cab console harness
FAI 84 Cab instrument panel harness (all countries except US)
FAI 89 AUTO 5 adapter harness
CAB 35 Fuse box
3 Start switch
9 AUTO 5 calculator

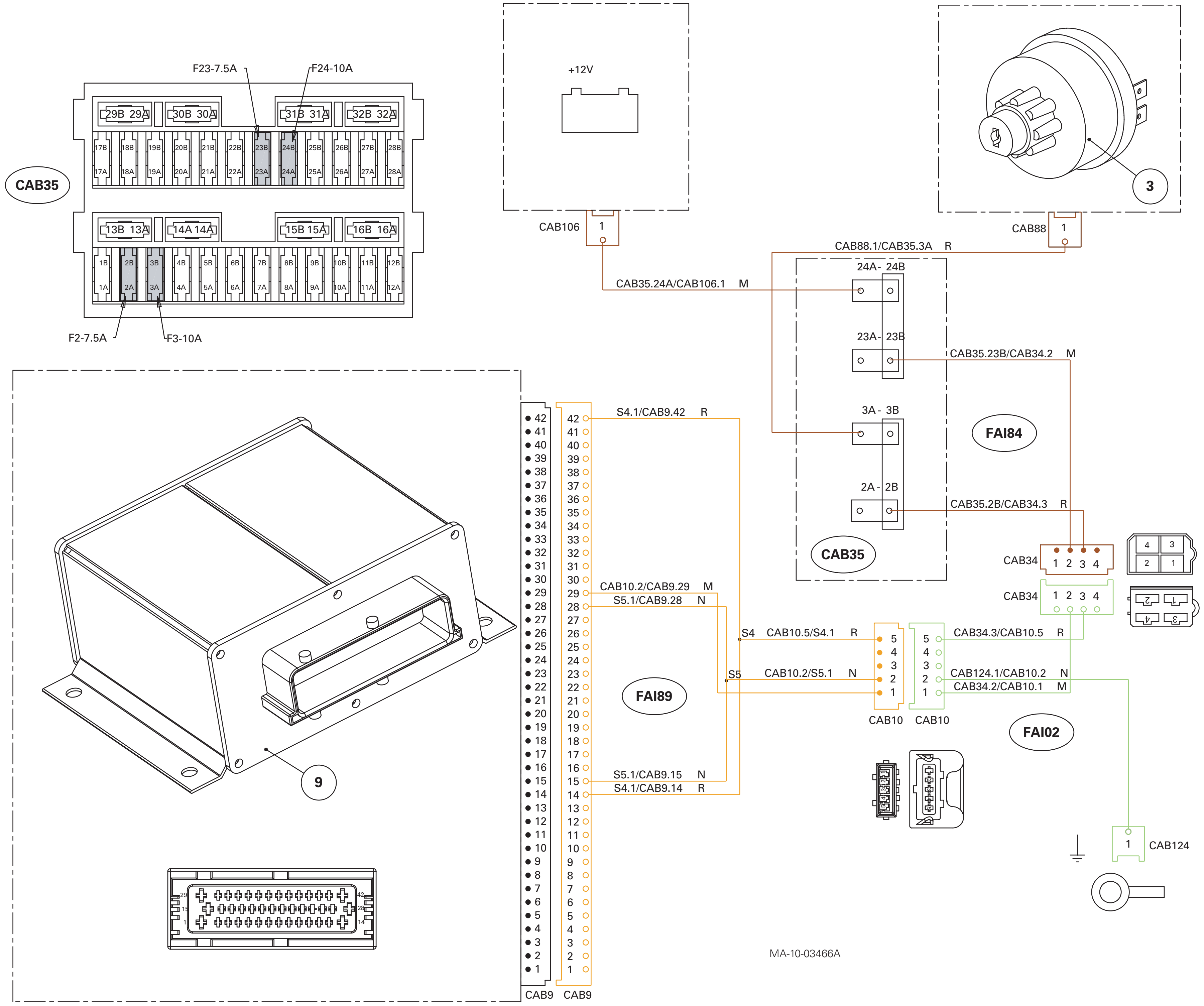

Fig. 89

AUTO 5 linkage calculator

FAI 74 Cab console harness
FAI 84 X2 instrument panel harness - EU
FAI 89 AUTO 5 cab adapter harness
FAI 116 AUTO 5 cab linkage harness
CAB 01 AUTO 5 linkage calculator
CAB 35 Fuse box

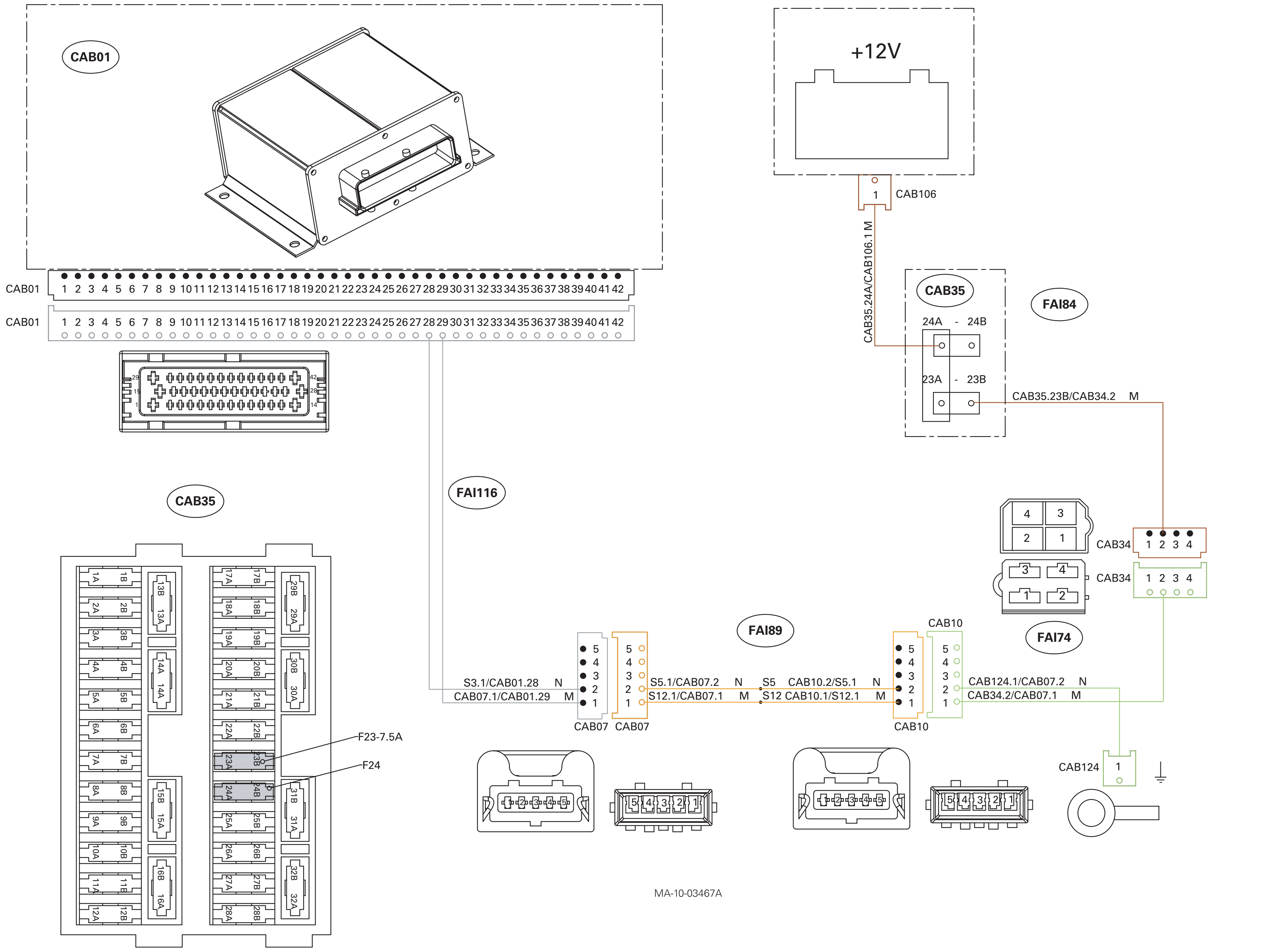

Fig. 90

11 - Electronics

CONTENTS

11B10- AUTOTRONIC 5 - Description

CONTENTS

A . General

The Autotronic 5 is the transmission controller fitted to 5400 tractors with PowerShuttle.

The Autotronic 5 controls the automatic functions of the transmission according to the driver's actions and information from the various sensors.

The Autotronic 5 controls:
- PowerShuttle
- Hare / Tortoise range
- Power take-off

With Wintest, the Autotronic 5 can be :
- programmed: updating of functions control
- parameterised: identified by a 8-digit code indicating the model of the tractor it is fitted to.
- tested: testing the Autotronic 5 inputs, outputs and functioning.

The Autotronic 5 is fitted inside the cab right hand side console, it is fixed between the hand throttle lever and the hydraulic spoolvalves control levers.

Important: *The Autotronic 5 case must be connected to earth.*

The Autotronic 5 is easily identified by its label (Fig. 1). and possesses one 42-pin connector.

Parst list (**Fig. 1**)

(**1**) Autotronic 5 part number
(**2**) Hardware program version
(**3**) Software program version
(**4**) Autotronic5 serial number
(**5**) Date of production (09 03 = 9th week of 2003).

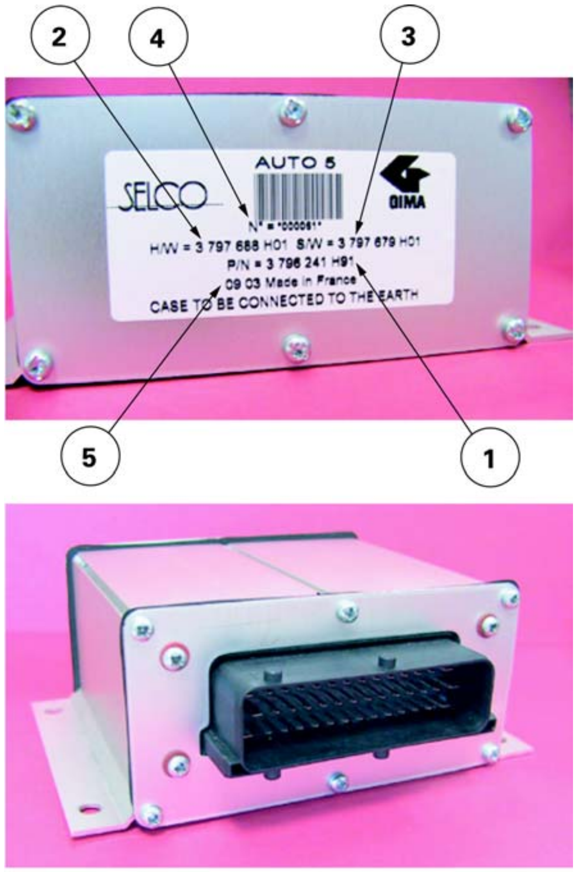

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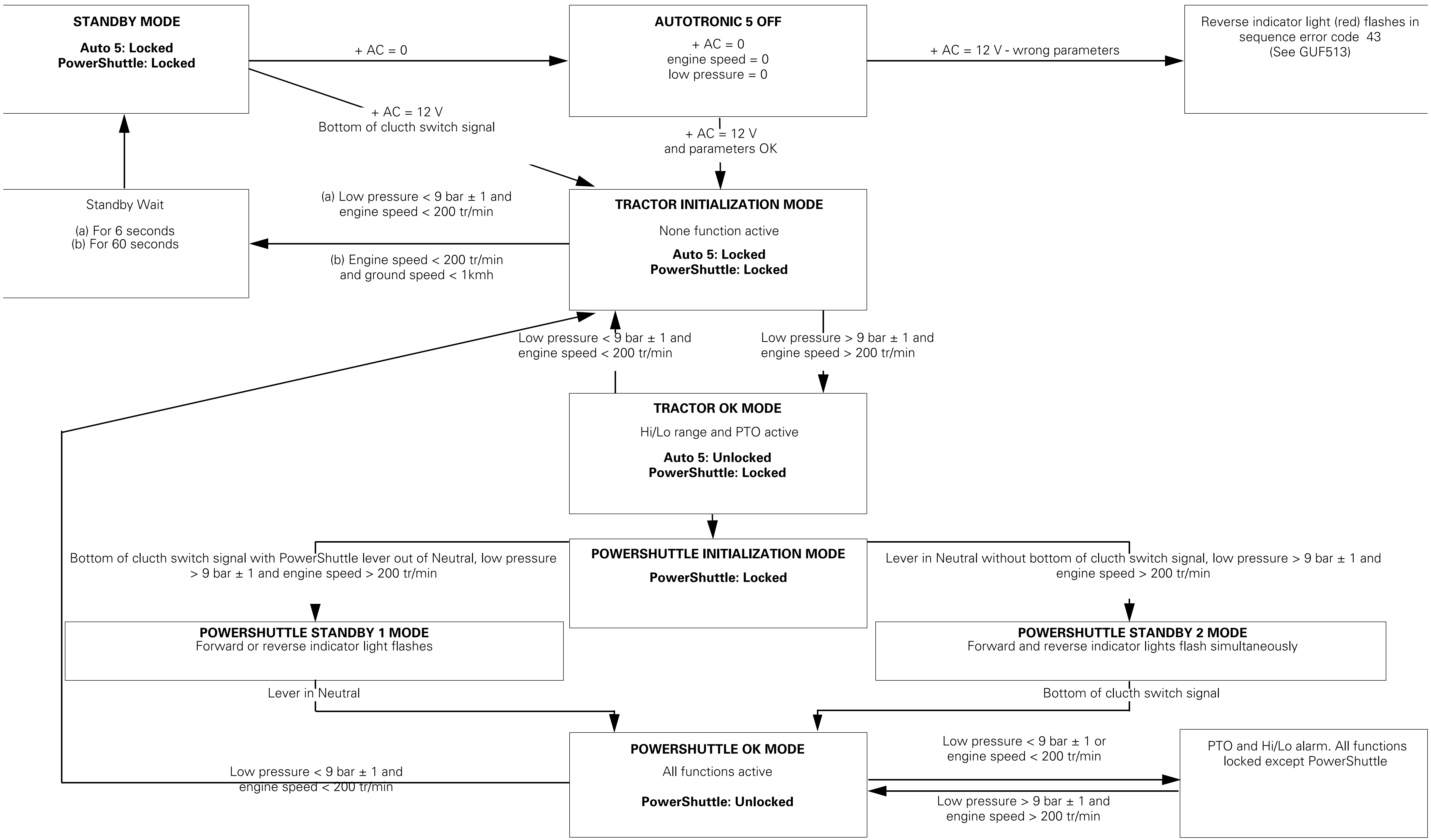
Fig. 1

B . Autotronic 5 status flowcharts

The Autotronic 5, to operate correctly, must receive safety information allowing it to manage its automatic functions. The Autotronic 5 has different status depending on the information it receives.

***Note :** If the battery tension is upper than 16 V, the Autotronic 5 functions remain active, except the Hi/Lo range that is locked.*



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C . Autotronic 5 connector pin allocation

The Autotronic 5 includes a 42 pin connector of which the input/output signals are described below.

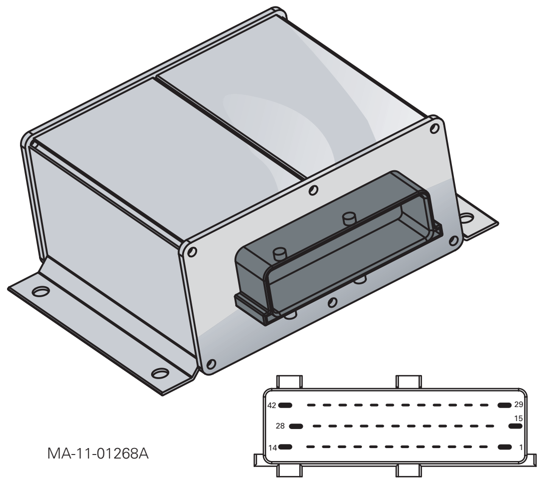


Fig. 2

Pin	Description		Signal
1	CAB18	Bottom of clutch switch (BOC)	Initialization
2	CAB12	PowerShuttle lever	10V output
3	TR22	Reverse solenoid valve	Return of the output (4A)
4	TR23	Forward solenoid valve	Return of the output (4A)
5	TR23	Forward solenoid valve	Output (4A)
6	TR22	Reverse solenoid valve	Output (4A)
7	Not used		
8	51	Economic PTO control	Digital input (2A)
9	50	ON/OFF/ PTO brake switch	Supply to PTO control transistor
10	Not used		
11	TR13	Hare / Tortoise solenoid valve	Output (2A)
12	49	Dashboard (PTO indicator light)	Output (2A)
13	49	Dashboard (Reverse indicator light)	Output (2A)
14	+12V ignition on supply to Autotronic 5		
15	Autotronic 5 ground		
16	CAB12	PowerShuttle lever	Analog input
17	Not used		
18	TR16	Hare / Tortoise switch	Digital input
19	56	Top of clutch switch (TOC)	Digital input
20	TR9	17 bar pressure switch	Digital input
21	TR24	Transmission oil temperatur sensor	Analog input
22	Not used		
23	TR11	PTO solenoid valve	Output (2A)
24	Not used		

AUTOTRONIC 5 - Description

Pin	Description		Signal
25	Not used		
26	49	Dashboard (Forward indicator light)	Output (2A)
27	49	Dashboard (17 bar pressure indicator light)	Output (2A)
28	Autotronic 5 ground		
29	+12V battery supply to Autotronic 5		
30	Not used		
31	Not used		
32	50	ON/OFF/ PTO brake switch	Digital input
33	Not used		
34	CAB18	Bottom of clutch switch (BOC)	Digital input
35	CAB17	Clutch pedal potentiometer	Analog input
36	TR2	Theoretical ground speed sensor	Frequency input
37	TR25	Gearbox input speed sensor	Frequency input
38	TR5	Engine speed sensor	Frequency input
39	Can Low		
40	Can High		
41	Analog reference ground		
42	+12V ignition on supply to Autotronic 5		

D . Automatic responses of the Autotronic 5

Note: *The Autotronic 5 can only control all its functions in PowerShuttle OK mode (see § B).*

Functions	Driver action	Automatic response of the Autotronic 5
PowerShuttle	Declutches and starts engine (activates bottom of clutch switch) with the PowerShuttle lever in Neutral.	Unlocks if Autotronic 5 receives at least the 17 bar low pressure signal or engine speed is above 200 rpm.
	Selects a PowerShuttle position: - Forward - Neutral - Reverse without action on the clutch pedal.	Automatically manages the progressivity of the PowerShuttle.
	Selects a PowerShuttle position and lets in clutch using clutch pedal.	Manages the progressiveness of the clutch in relation to the pedal potentiometer value. **Supply to indicator lights and solenoid valves** Forward: - forward indicator lamp = 12 V - forward solenoid valve = 12 V Neutral: - forward & reverse indicator lamps = 0 V - forward & reverse solenoid valve = 0 V Reverse: - reverse indicator lamp = 12 V - reverse solenoid valve = 12 V PowerShuttle locked: - forward or reverse indicator lamp flashes - solenoid valve = 0 V. ***Note:*** *The PowerShuttle continues to operate with a low pressure or engine speed fault, or battery voltage above 16 V.*

Functions	Driver action	Automatic response of the Autotronic 5
Hare / Tortoise (Hi / Lo)		On passing into Tractor OK mode, it selects the range engaged when placed on standby.
	Wants to change range using gear lever switch	Prohibits shifting from Hare to Tortoise above 8 kph, and from Tortoise to Hare above 13 kph

Functions	Driver action	Automatic response of the Autotronic 5
Power Take Off (PTO)	Starts tractor with the PTO engaged	On passing into Tractor OK mode: - solenoid valve = 0 V if the cab control is engaged - The PTO indicator light flashes in sequence the error code 55 (see GUF513)
	Starts the PTO	Manages the engagement progressivity for 7 seconds maximum in relation to the engine speed. PTO indicator light flashes slowly. PTO ON/OFF solenoid valve pulsed. **PTO engaged** : - indicator light is ON - solenoid valve = 12 V **PTO disengaged** : - if engine speed drops more than 50% or below 500 rpm: - indicator light flashes in sequence the error code 54 (see GUF513) - solenoid valve = 0 V
	Starts economic PTO	Disengages the PTO if engine speed above 1780 rpm - indicator light flashes in sequence the error code 57 (see GUF513) - solenoid valve = 0 V

E . Power Shuttle principles

Block diagram

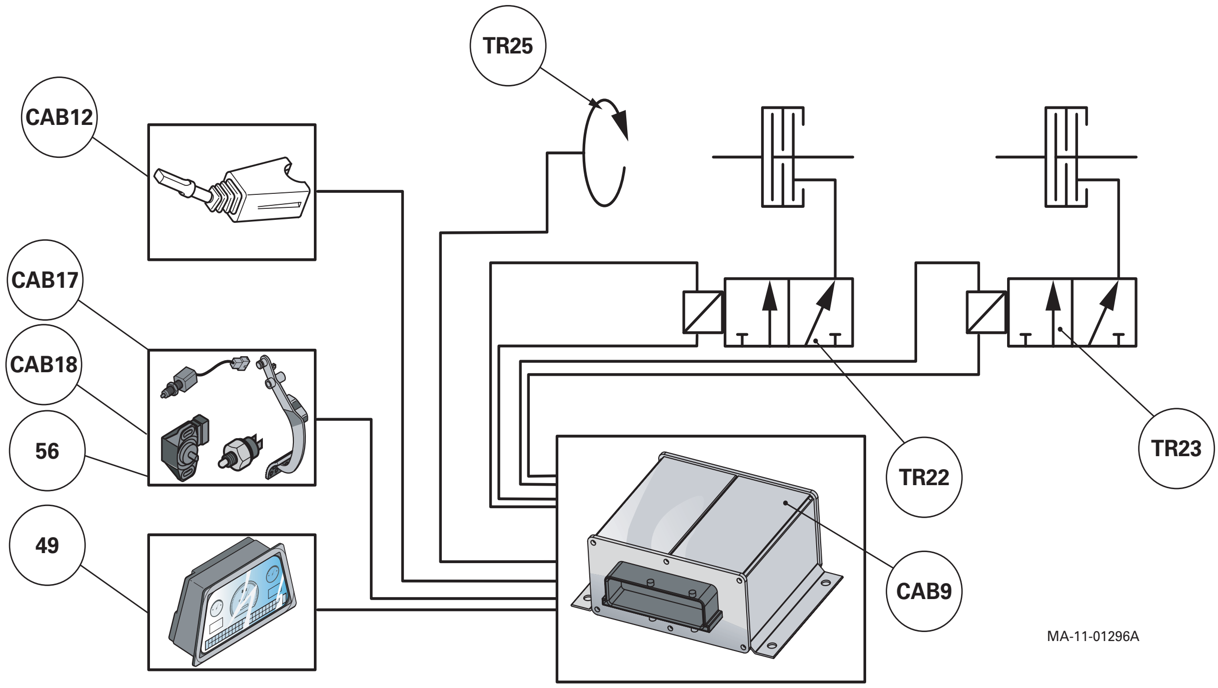


Fig. 3

Part list (Fig. 3)

(CAB9) Autotronic 5
(TR25) Gearbox input speed sensor
(56) Top of clutch pedal switch
(CAB18) Bottom of clutch pedal switch
(CAB17) Clutch pedal potentiometer
(49) Dashboard indicator lights (Forward and Reverse)
(CAB12)Power Shuttle 3-position analog shift lever
(TR22) Reverse solenoid valve
(TR23) Forward solenoid valve

The Autotronic 5 automatically controls the Power-Shuttle according to information received from various sensors and the request from the driver.

Several mechanical, hydraulic and electrical components being involved in the operation of the Power-Shuttle; it may be necessary to carry out a clutch calibration (see GUF514) when replacing one of them.

A permanent autodiagnostics carried out by the Autotronic 5 in relation to the Power Shuttle allows an idea of any fault to be indicated by the flashing of the reverse indicator light on the dashboard (see GUF513).

Operating modes of the Power Shuttle

Note : *The user does not choose the mode of operation*

The information received by the Autotronic 5 allows it to automatically select one of the two operating modes.

USE	
- Start-up and / or - Power Shuttle shifting	- Manual shifting using the pedal or lever
OPERATING CONDITIONS	
- Speed below 2 kph	- Speed above 2 kph and - Previous clutch pressure was at least 7.5 bar.
AUTOTRONIC 5 ACTIONS	
Without pedal signal - Automatic pressure increase in clutch limited to 3 bar	**Without pedal signal but with lever signal** - Automatic pressure increase in clutch limited to 7.5 bar
With pedal signal - Pressure increase in the clutch determined by position of the pedal and limited to 6 bar	**With pedal signal but no lever signal** - Pressure increase in the clutch determined by position of the pedal and limited to 10 bar **With pedal and lever signals** - Pressure increase in the clutch determined by position of the pedal and limited to 7.5 bar

GUF511 - AUTOTRONIC 5 - PowerShuttle - Programming and setting parameters

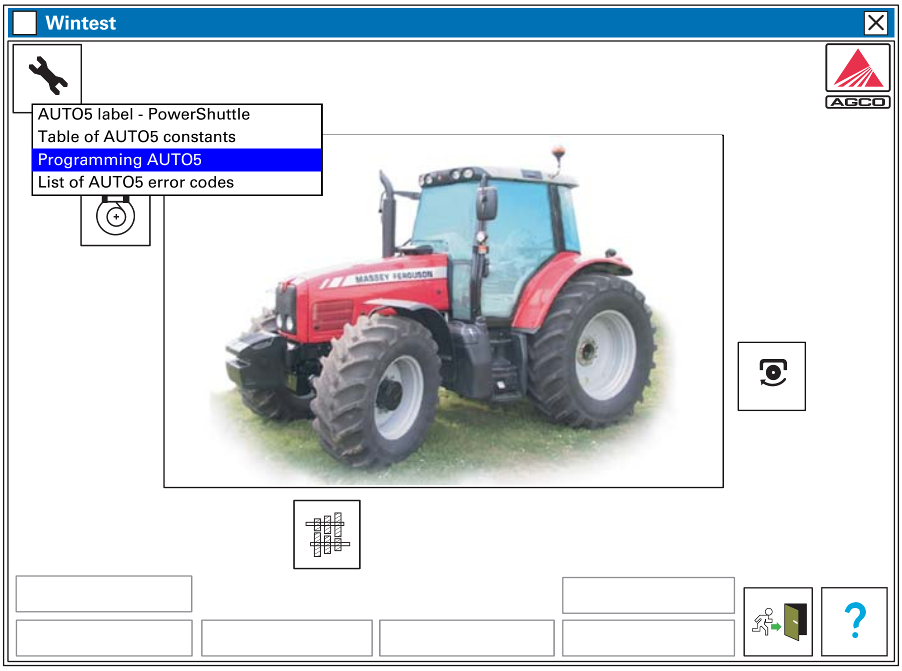
CONTENTS

A . Programming

- Switch on the ignition key to carry out this operation. The engine must be stopped.
- The programming of the Autotronic 5 is necessary:
  - if the former Autotronic 5 has been replaced by a new one,
  - when a new program becomes available to improve the product,
  - if the Autotronic 5 was programmed in a different configuration (ParkLock, suspended front axle, etc.).

Note: *It is necessary to set Autotronic 5 parameters after programming.*

- Click on the "Tools" icon and then on "Programming AUTO5" icon.



MA-11-01281A

AUTOTRONIC 5 - PowerShuttle - Programming and setting parameters

Autotronic 5 programming is a 3-step process:

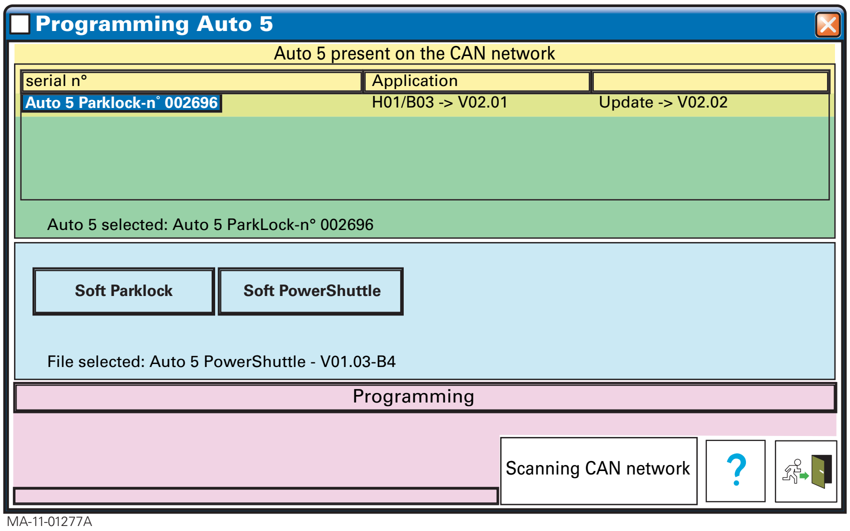
1. Searching for calculators present on CAN network

2. Selecting a calculator to be programmed

3. Selecting a soft to integrate into the calculator

4. Starting programming

The following screen is displayed:



1. Searching for calculators present on CAN network

2. Selecting a calculator to be programmed

3. Selecting a soft to integrate into the calculator

4. Starting programming

Fig. 1

Note: *Each stage must be validated to progress to the following stage.*

If a stage is dimmed, the previous stage has not been validated.

Searching for calculators present on CAN network

When the window is opened, Wintest automatically starts an Autotronic 5 search on the CAN network. However, this search can be refreshed at any time by clicking on “Scanning CAN network”.

The list of calculators appears as follows:

serial n°	**Application**	
Auto 5 ParkLock-n°002696	H01/B03 -> V02.01	Update -> V02.02
Soft integrated into calculators ***(1)*** with unique calculator serial number Fig. 2	• H01: Calculator hardware version (calculator version) • B03: Calculator boot version (central hub of programs) ***(2)*** • V02.01: Soft version integrated into Autotronic 5	Program update possible with new soft version included in Wintest

Note:

(1) *A blank Autotronic 5 is provided as standard with ParkLock soft in the spare parts*

(2) *A new Boot version can be included in the new soft version; however, 2 different software items will often carry the same Boot version.*

MA-11-01295A

Fig. 2

Selecting a calculator to be programmed

Double click in the left-hand column of the line of the calculator you wish to program.

The line turns blue and at the base of the left-hand column, Wintest specifies which Autotronic 5 has been selected.

Selecting a soft to integrate into the calculator

Click on the button of the required soft.

The line under the buttons specifies which soft has been selected.

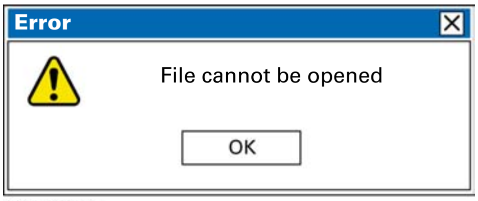
Starting programming

Click on the “Programming” button

A gauge indicates the progression of the programming.

At the end of the programming, Wintest automatically starts a scanning of CAN network.

During programming, several error messages may be displayed.



MA-11-00014A

Message:
- File cannot be opened
- Select a soft
- Select a calculator
- Calculator cannot be unlocked
- Bank 1 cannot be erased
- Bank 2 cannot be erased
- Bank 3 cannot be erased
- Bank 4 cannot be erased (Boot)
- Programming error
- End-of-programming error
- Reboot error
- Table change reset error
- File name length error
- File run error

Correction method:
- Depending on the type of message, try to follow the requested indications.
- Cut the ignition and turn it back on.
- Check the CAN BOX interface connections with the 16-pin diagnostics connector.
- The AUTOTRONIC 5 unit is defective.
- If necessary, reinstall the Wintest software on your PC.

IMPORTANT: *When programming with a Boot update, unexpected interruption of programming can be fatal for Autotronic 5.*

To avoid Autotronic 5 breakdown:

Do not disconnect the calculator.

Restart programming (Wintest will offer to reprogram only the faulty calculator to make it operational).

NOTE:*If the l'Autotronic 5 programming is interrupted unexpectedly, switch off the ignition key and then switch it on again. This enables you to resume programming.*

AUTOTRONIC 5 - PowerShuttle - Programming and setting parameters

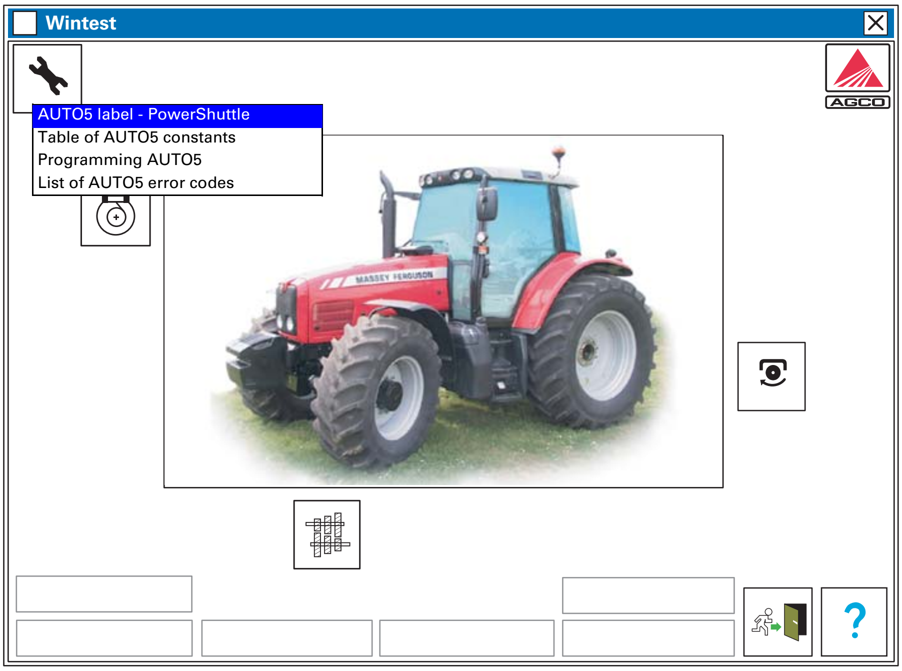
B . Setting parameters

Switch on the ignition key to carry out this operation. The engine must be stopped.

Parameter setting is necessary:

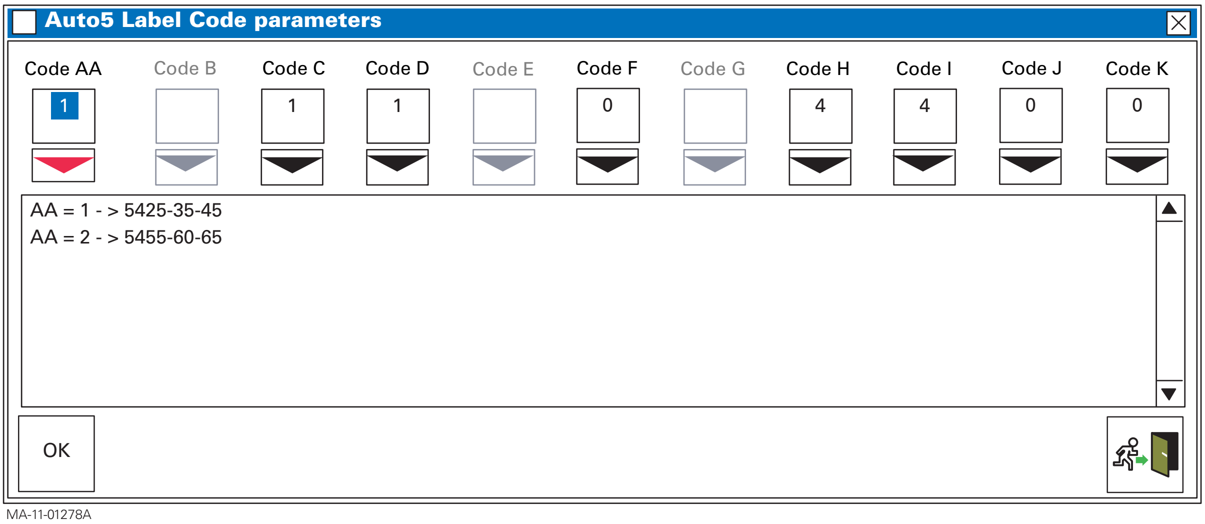
- if the former Autotronic 5 has been replaced by a new one,
- when improvements to one or more functions have been made through parameter setting,
- if a programming has been carried out.

Click on the “Tools” icon and then on “AUTO5 label - PowerShuttle”.



MA-11-01281A

The following screen is displayed:



The tractor label code can be modified either by:
- moving the mouse cursor directly into the relevant box and entering the appropriate code (it is also possible to navigate between codes by pressing the "tabulation" key on the keyboard).
- clicking on the arrow under the code concerned; you can then scroll down the scroll bar and double-click on the desired parameter.

Confirm the code by clicking on "OK".

Models with Autotronic 5 - PowerShuttle	Instrument panel Switch n° (*)							Code AA
	1	2	3	4	5	6	7	
5425 - 5435 - 5445	1	1	1	0	1	0	0	**01**
5455 - 5460 - 5465	0	1	1	0	1	0	0	**02**
(*) Switch n°8, units: 0 for Miles or 1 for Kilometres								

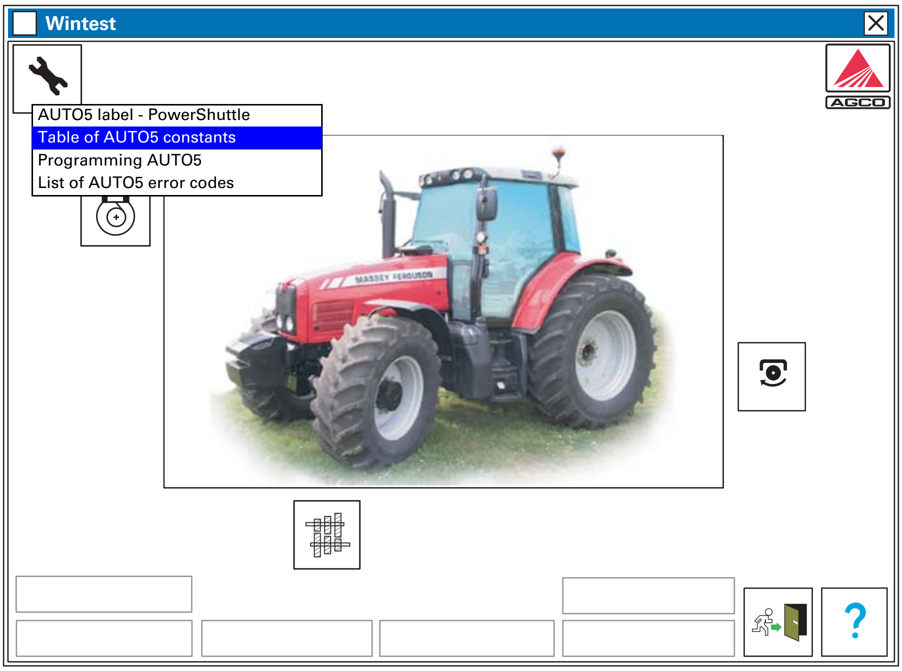
CODE B Inactive	CODE C Hare / Tortoise	CODE D Gearbox type
	1 = Synchronised, controlled by button on gear shift lever	**1** = SpeedShift,4 x 2

CODE E Inactive	CODE F Speedshift	CODE G Inactive
	0 = With Speedshift	

CODE H Reverse shuttle	CODE I Factory code	CODE J Creeper unit
4 = PowerShuttle	**4** = MF 5400	**0** = Without **1** = With creeper speeds (min. speed 0.6 kph approx.) **2** = With super creeper speeds (min. speed 0.2 kph approx.)

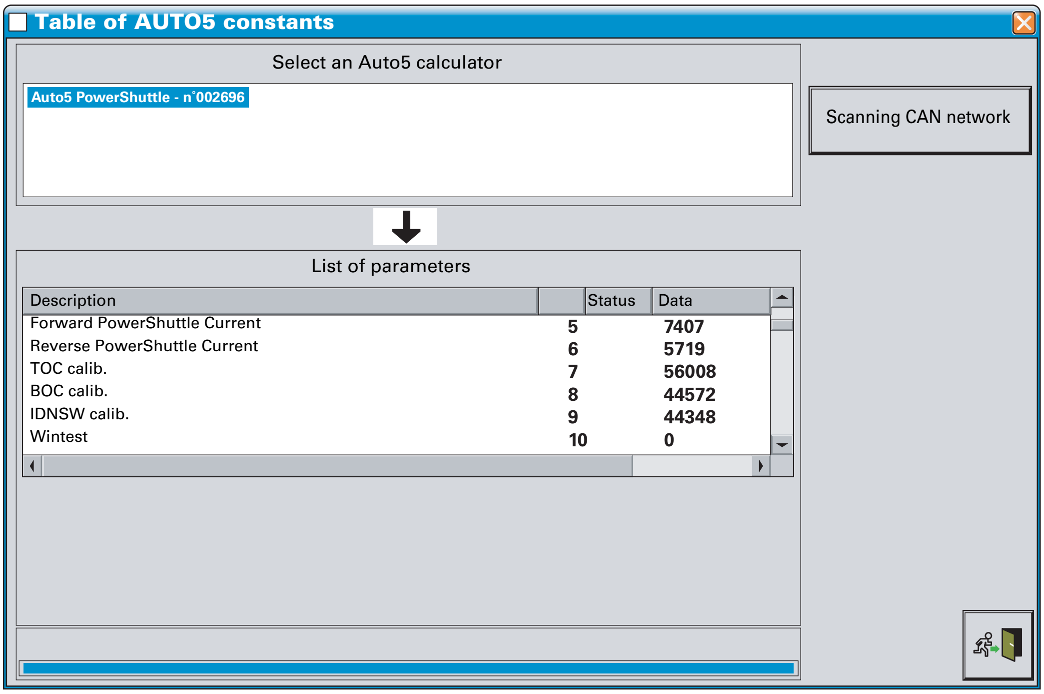
CODE K PTO
1 = With or without

- Another screen allows you to display the constants entered during parameter setting and stored after calibration.
- Click on the “Tools” icon and on “Table of AUTO5 constants”.



MA-11-01281A

The following screen is displayed:



As with Autotronic 5 programming, reading constants is a 3-step process:

1. Searching for calculators present on CAN network.
   This search can be refreshed at any time by clicking on “Scanning CAN network”.
2. Selecting the required calculator.
3. Reading searched constants (table title: list of parameters).

-

GUF512 - AUTOTRONIC 5 - PowerShuttle - Tests and diagnostics

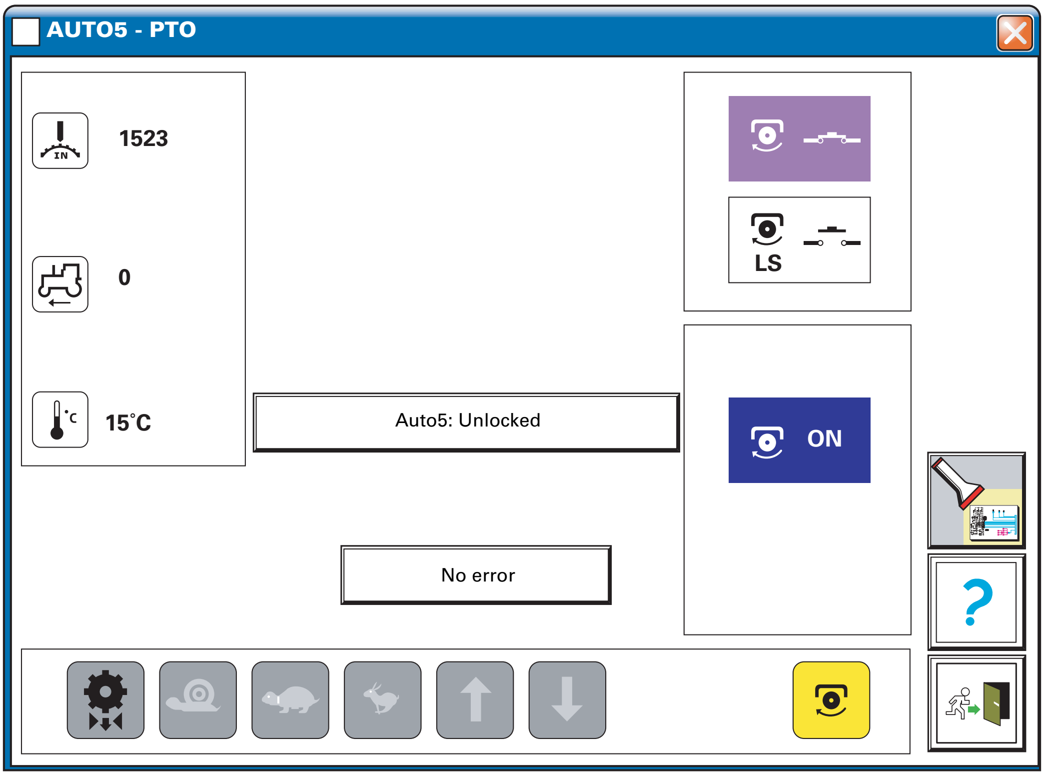
CONTENTS

A . Autotronic 5 statuses

The Autotronic 5 operates via 2 main statuses.
The status of the Autotronic 5 is displayed in each test screen.

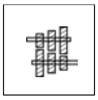
List of statuses

- Locked
- Unlocked



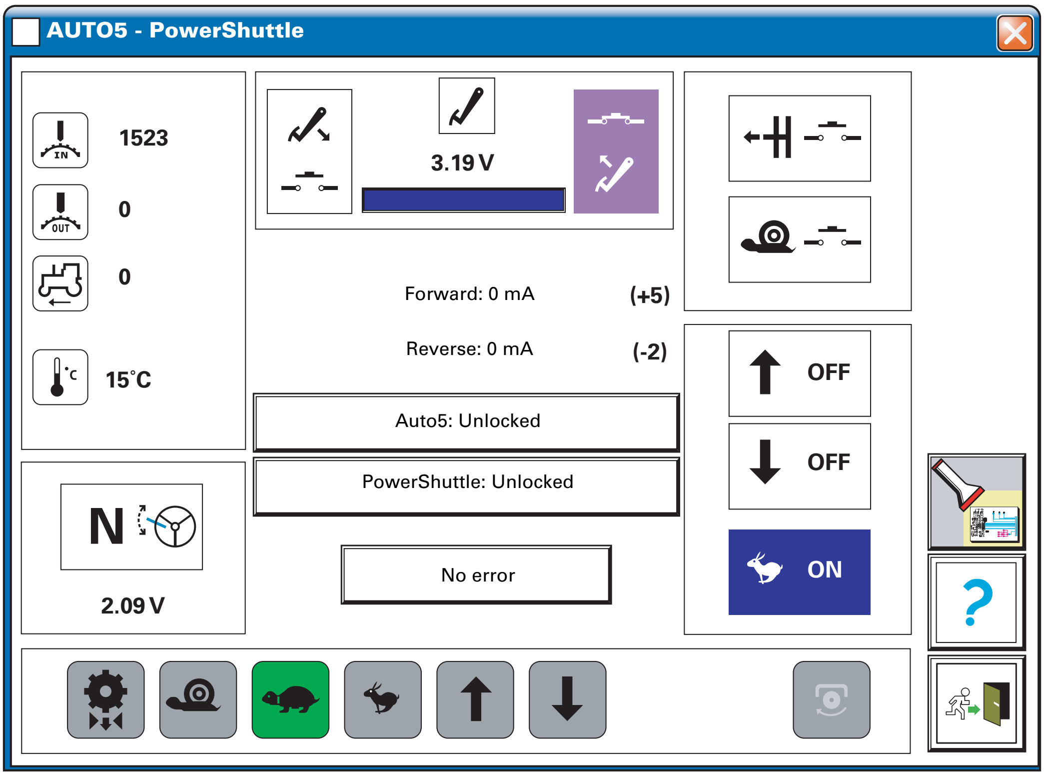
MA-11-01280A

B . Gearbox function

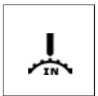
- Start the engine.
- Click on the "Gearbox" icon 

MA-11-01281A

The following screen is displayed:



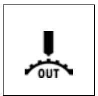
MA-11-01279A



1523

Engine speed sensor value in rpm (TR5)

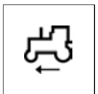
- red = speed under 400 rpm or over 3000 rpm



0

Gearbox input intermediate speed sensor value in rpm (TR25)

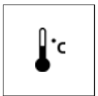
- Gearbox 30 kph = from 0 to 1 times the engine speed in range D
- Gearbox 40 kph = from 0 to 1.26 times the engine speed in range D
- red = over 3500 rpm



0

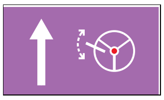
Design ground speed indicated by ground speed sensor in tenths of kph (TR2)

- red = over 45 kph

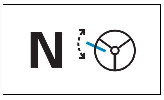


15

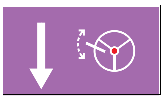
Transmission oil temperature sensor value in °C (TR24)



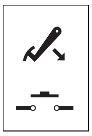
Power Shuttle lever signal and status
-Forward:...............from 5.52V to 6.24V



Power Shuttle lever signal and status
-Neutral: ....from 1.09V to 2.37V

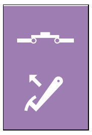


Power Shuttle lever signal and status
-Reverse:...............from 6.59V to 7.36V



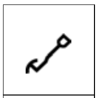
Bottom-of-Clutch pedal switch (BOC) (CAB18)

- on = violet
- off = white



Top-of-Clutch (TOC) sensor (56)

- on = violet
- off = white



3.19V

Clutch pedal travel potentiometer value in volts (+/-0.01V)

The high and low values are determined by automatic calibration GUF514

Progress bar displaying clutch pedal travel. Bar empty = clutch disengaged and blue bar = clutch engaged

Forward: 0 mA

Forward proportional solenoid valve current value

- lever in neutral position .... 0 mA
- lever in forward position.................200 to 1000 mA
- lever in reverse position .... 0 to 120 mA ("offset" correction current due to Autotronic 5 internal components)

Reverse 0 mA

Reverse proportional solenoid valve current value

- lever in neutral position .... 0 mA
- lever in reverse position ....200 to 1000 mA
- lever in forward position........ 0 to 120 mA ("offset" correction current due to Autotronic 5 internal components)

(+5)

Number of adjustments to forward clutch progressivity

- **(0)** = no adjustment since Power Shuttle calibration
- **(+#)** = clutch responsiveness increased
- **(-#)** = clutch responsiveness decreased

(-2)

Number of adjustments to reverse clutch progressivity

- **(0)** = no adjustment since Power Shuttle calibration
- **(+#)** = clutch responsiveness increased
- **(-#)** = clutch responsiveness decreased

Auto5: Unlocked

Autotronic 5 status

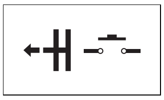
PowerShuttle: Unlocked

PowerShuttle status

- Locked
- Standby 1 (Standby before unlocking by moving Power Shuttle lever to neutral position)
- Standby 2 (Standby before unlocking by switching on TOC and BOC)
- Unlocked
- Calibration
- Adjustment

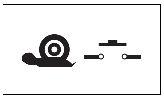
No error

Error code indication



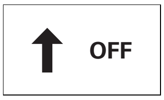
Hare / Tortoise control switch (CAB67)

- on = violet
- off = white



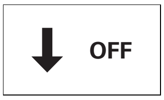
Available: Creeper gear switch (not wired)

- on = violet
- off = white



Forward proportional solenoid valve status (TR23)

- OFF = Solenoid valve at rest = white
- ON = Solenoid valve open or fully open = blue



Reverse proportional solenoid valve status (TR22)

- OFF = Solenoid valve at rest = white
- ON = Solenoid valve open or fully open = blue

Hare / Tortoise range solenoid valve status (TR13)

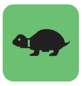
- Tortoise = OFF = Solenoid valve at rest = white
- Hare = ON = Solenoid valve supplied = blue


Indicator light of 17 bar low pressure hydraulic circuit pressure switch

- If pressure is correct, the background is grey

The display is red if the pressure is below 9 bar ± 1 or when the instrument panel indicator light is lit


Available: Creeper gear indicator light (not wired)

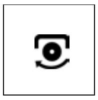

Tortoise range indicator light


Hare range indicator light


Forward indicator light

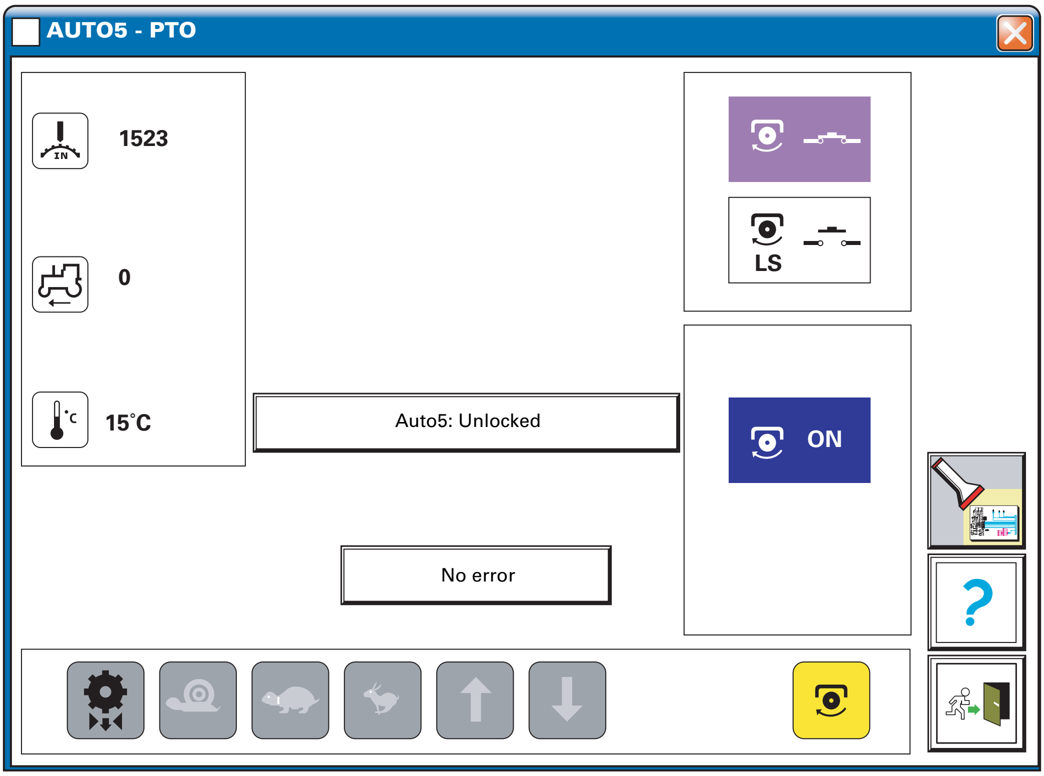

Reverse indicator light

C . Power Take-Off function

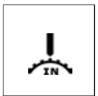
- Start the engine.
- Click on the “Power Take-Off” icon 

MA-11-01281A

The following screen is displayed:



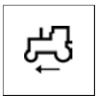
MA-11-01280A



1523

Engine speed sensor value in rpm (TR5)

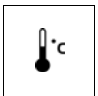
- red = speed under 400 rpm or over 3000 rpm



0

Design ground speed indicated by ground speed sensor in tenths of kph (TR2)

- red = over 45 kph

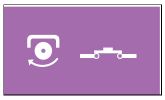


15

Transmission oil temperature sensor value in °C (TR24)

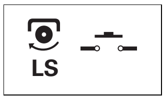
Auto5: Unlocked	Autotronic 5 status

No error	Error code indication



PTO ON/OFF switch (50)

- on = violet
- off = white



PTO economy mode control switch (51)

- on = violet
- off = white

Status of PTO solenoid valve (TR11)

- OFF = deactivated = white
- ON = activated = blue

Indicator light of 17 bar low pressure hydraulic circuit pressure switch

- If pressure is correct, the background is grey

The display is red if the pressure is below 9 bar ± 1 or when the instrument panel indicator light is lit

PTO indicator light

GUF513 - AUTOTRONIC 5 - PowerShuttle - Error codes

CONTENTS

NOTE: *Error codes are managed from soft version 01.03.*

A . Reading error codes

Reading codes on the instrument panel

Autotronic 5 continuously monitors the power shuttle function and PTO.

The user is informed of a fault by:
- The flashing reverse indicator light (9) for the PowerShuttle function (Fig. 1),
- The flashing PTO indicator light (22) for the PTO function and PowerShuttle calibration (Fig. 1).

Only one error code can be displayed at a time.

Reading principle:

1. The indicator light flashes in a rapid burst to signal the code is about to be displayed
2. 1st series of flashes displays the error code decimal.
3. Approximately one second without flash precedes display of the error code unit.
4. 2nd series of flashes displays the error code unit.
5. The procedure restarts from the beginning.

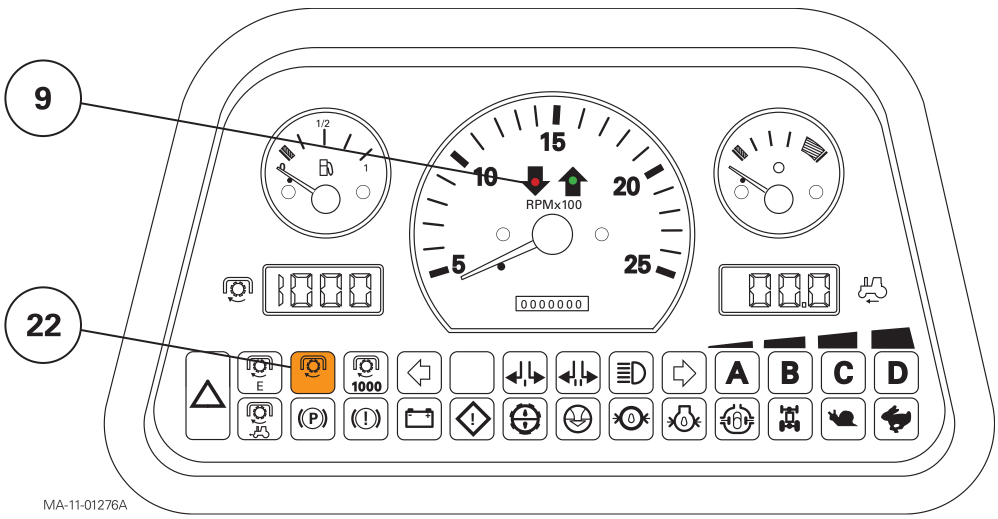
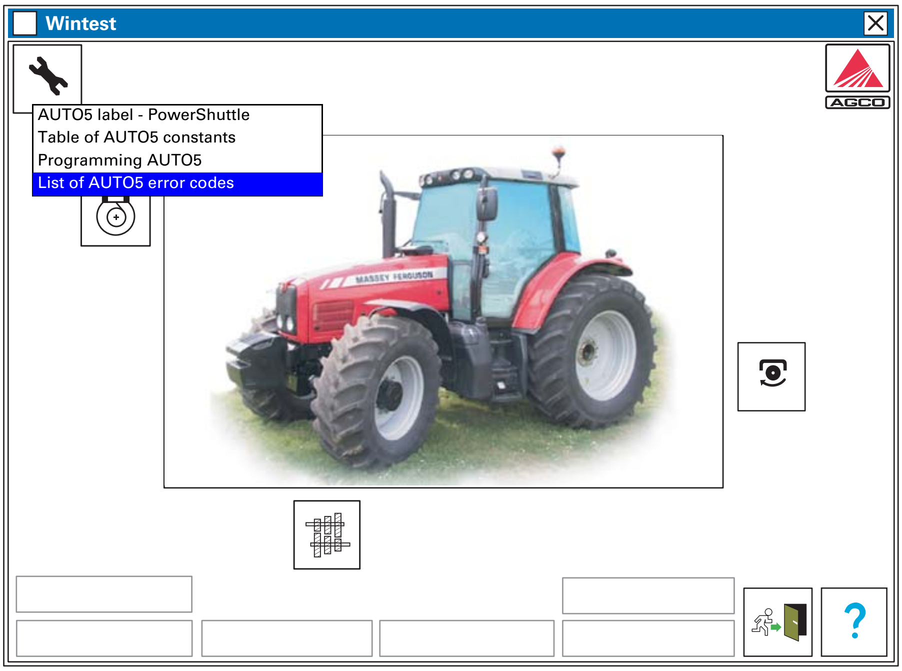


Fig. 1

AUTOTRONIC 5 - PowerShuttle - Error codes

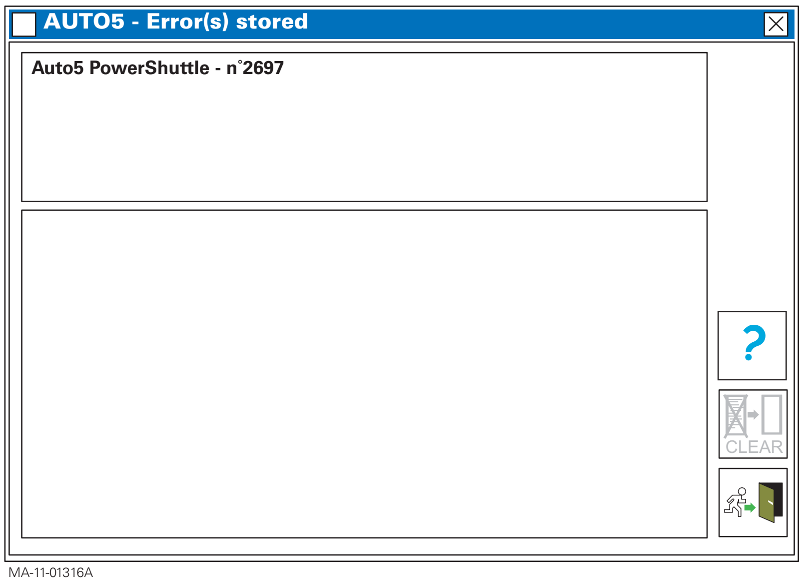
Reading error codes with Wintest

Wintest allows all error codes stored by Autotronic 5 to be displayed and cleared.
Click on the "Tools" icon and on "List of AUTO5 error codes".



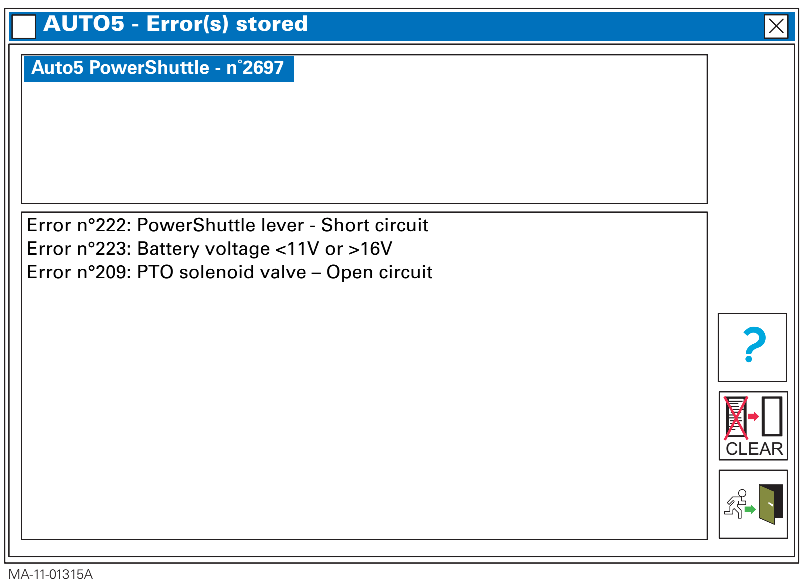
MA-11-01281A

The following screen is displayed:



- Click on the line of the calculator whose errors you wish to display.

The following screen is displayed:



Only errors stored when the ignition key is switched on appear.

The most recent errors are displayed at the top of the list.

Autotronic 5 PowerShuttle stores a maximum of 10 errors.

- If you click on "CLEAR", all error codes will be erased from the selected Autotronic 5 memory.

B . List of error codes

The error codes are divided into 3 classes according to their importance:

Class I: Major error

Class II: Error reducing operating capacity

Class III: Information

Errors		Flashing code on instrument panel	Components concerned		Description
I	**101**	11	TR23	Forward solenoid valve	Short circuit at +12V
	102	12	TR22	Reverse solenoid valve	Short circuit at +12V
	105	41	TR23	Forward solenoid valve	Open circuit
	106	42	TR22	Reverse solenoid valve	Open circuit
	113	43	CAB9	Autotronic 5 - PowerShuttle	Cheksum error
II	**203**	33	TR23	Forward solenoid valve	Short circuit at 0V
	204	34	TR22	Reverse solenoid valve	Short circuit at 0V
	207	51	TR11	PTO solenoid valve	Short circuit at +12V
	208	52	TR11	PTO solenoid valve	Short circuit at 0V
	209	53	TR11	PTO solenoid valve	Open circuit
	210	54			Excessive drop in engine speed
	211	55	50 TR11	PTO ON/OFF/brake switch PTO solenoid valve	Switch ON and PTO inactive
	213	57	51	LSPTO control	Engine speed too high (>1782 rpm) in LSPTO
	212	56	TR24	Oil transmission temperature sensor	Transmission temperature over 100°C
	215	21	CAB17	Clutch pedal progressivity sensor	Open circuit or short circuit at 0V
	216	22	CAB17	Clutch pedal progressivity sensor	Short circuit at +12V
	217	23	CAB18	Bottom-of-Clutch (BOC) pedal switch	Open circuit or short circuit at 0V
	218	24	CAB18	Bottom-of-Clutch (BOC) pedal switch	Short circuit at +12V
	219	25	56	Top-of-Clutch (TOC) pedal switch	Open circuit or short circuit at 0V
	220	26	56	Top-of-Clutch (TOC) pedal switch	Short circuit at +12V
	221	27	TR25	Intermediate speed sensor	Intermediate speed sensor error
	222	28	CAB12	PowerShuttle lever	Short circuit at +12V or 0V
	223	14			Battery voltage <11V or >16V

Errors		Flashing code on instrument panel	Components concerned		Description
III	**301**	35		PowerShuttle calibration	Temperature too low
	302	36		PowerShuttle calibration	Temperature too high
	303	37		PowerShuttle calibration	Wrong engine speed
	304	38		PowerShuttle calibration	Ground speed not zero

C . Analysing components and their error codes

CAB9: Autotronic 5

Description

Location: in the right-hand console

Allocation of Autotronic 5 connectors, see table below. Some connectors can be configured at their input and output, as determined by the calculator soft.

Possible error codes

113 : Cheksum error that occured during programming or when setting parameters.

Solution: Reprogram and set parameters correctly.

To reset the system: the Cheksum must be correct and the engine must be stopped.

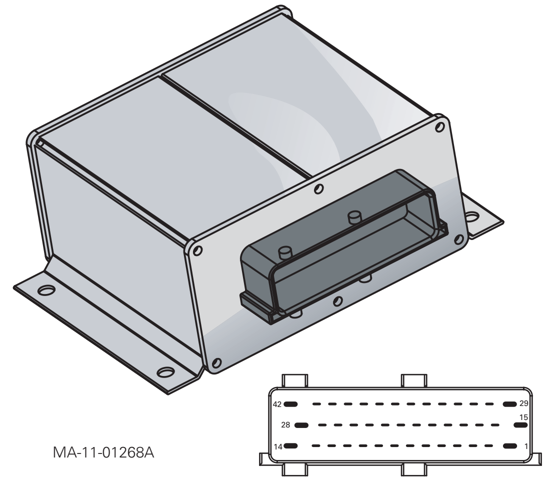


Fig. 2

Connector	Description		Type of signal
1	CAB18	BOC Switch	Initialisation
2	CAB12	PowerShuttle lever	10V regulated output
3	TR22	Reverse solenoid valve	Output 2 return (4A)
4	TR23	Forward solenoid valve	Output 1 return (4A)
5	TR23	Forward solenoid valve	Input / Output 1 (4A)
6	TR22	Reverse solenoid valve	Input / Output 2 (4A)
7	Not used		Digital Input / Output 1 (2A)
8	51	LSPTO control	Digital Input / Output 2 (2A)
9	50	PTO ON/OFF/brake switch	
10	Not used		Current output 1 (2A)
11	TR13	Hare / Tortoise solenoid valve	Current output 3 (2A)
12	49	Instrument panel (PTO indicator light)	Current output 5 (2A)
13	49	Instrument panel (reverse travel indicator light)	Current output 7 (2A)
14	Calculator power supply +12 V AC (Ignition key On)		
15	Calculator ground		
16	CAB12	PowerShuttle lever	Analog / Digital input 2
17	Not used		Analog / Digital input 4
18	TR16	Hare / Tortoise switch	Analog / Digital input 6
19	56	Top-of-Clutch (TOC) pedal switch	Analog / Digital input 8
20	TR9	Low pressure switch	Analog / Digital input 10
21	TR24	Oil transmission temperature sensor	Analog / Digital input (PullUp)
22	Not used		Digital Input / Output 3 (2A)
23	TR11	PTO solenoid valve	Current output (2A)
24	Not used		Current output 2 (2A)

Connector	Description		Type of signal
25	Not used		Current output 4 (2A)
26	49	Instrument panel (forward position indicator light)	Current output 6 (2A)
27	49	Instrument panel (transmission oil pressure indicator light)	Current output 8 (2A)
28	Calculator ground		
29	+12V permanent calculator supply		
30	Not used		Analog / Digital input 1
31	Not used		Analog / Digital input 3
32	50	PTO ON/OFF/brake switch	Analog / Digital input 5
33	Not used		Analog / Digital input 7
34	CAB18	Bottom-of-Clutch (BOC) pedal switch	Analog / Digital input 9
35	CAB17	Clutch pedal progressivity sensor	Analog / Digital input 11
36	TR2	Design ground speed sensor	Frequency input 3
37	TR25	Intermediate speed sensor	Frequency input 2
38	TR5	Engine speed sensor	Frequency input 1
39	Low Can		
40	Can High		
41	Analog reference (Ground)		
42	Calculator power supply +12 V AC (Ignition key On)		

CAB12: PowerShuttle lever

Description

Location: to the left of the steering wheel

All resistance switches to form different voltage dividers.

- Connectors 1: +10V supply
- Connectors 2: Not used
- Connectors 3: Signal
- Connectors 4: Ground

Signals:

Forward: 6.12V
Neutral: 2.15V
Reverse: 7.16V

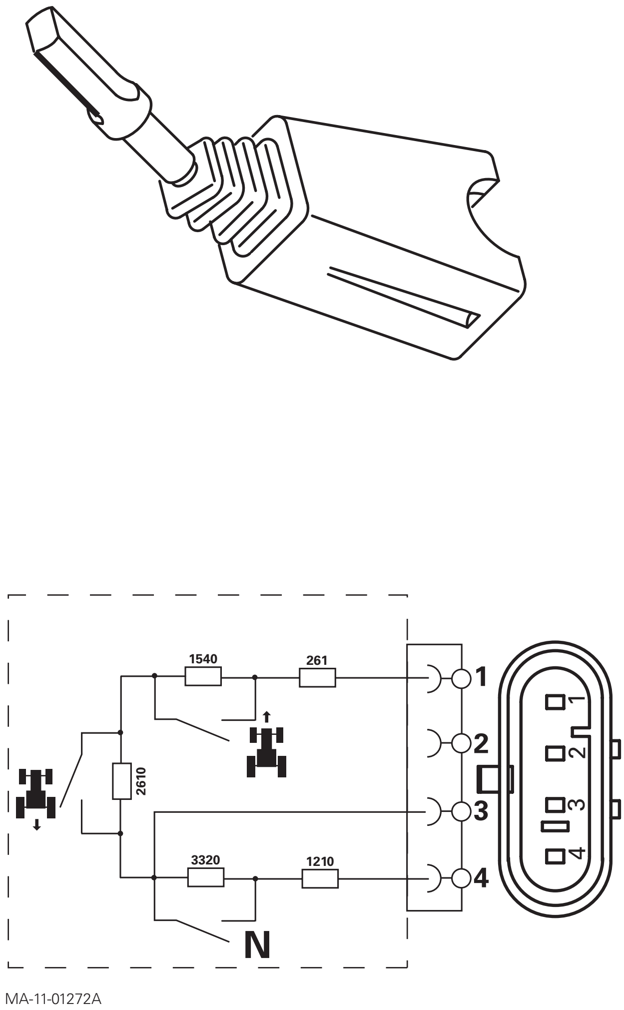


Fig. 3

Possible error codes

Errors	Description	Reaction of the System	Solutions	Resetting the system after clearing error
222	Short circuit at +12V or 0V	PowerShuttle locked	Check: - Contacts - Harness connections - Wiring - F12 and F23 fuses	Press the clutch pedal to contact the BOC

CAB17: Clutch pedal progressivity sensor

Description

Location: on the clutch pedal support (Fig. 4)
Angular sensor.

- Connectors 1: Power supply
- Connectors 2: Signal
- Connectors 3: Ground

Signals:
Varying voltage between 0.5 and 4.5V

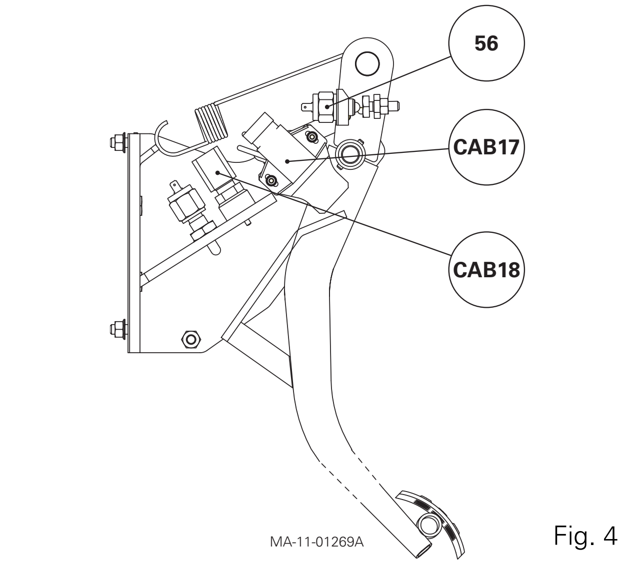


Fig. 4

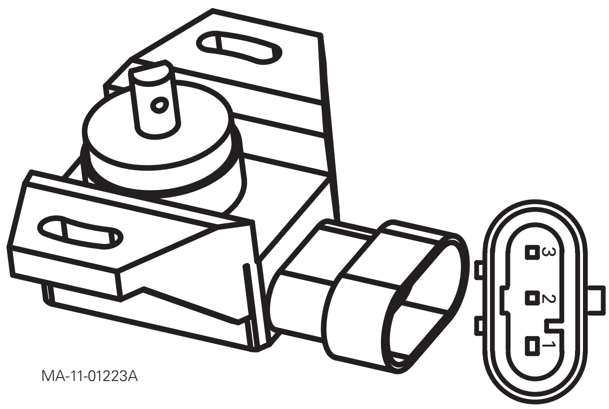


Fig. 5

Possible error codes

Errors	Description	Reaction of the System	Solutions	Resetting the system after clearing error
215	Open circuit or short circuit at 0V	Clutch fills with ramp by default	Check: - Contacts - Harness connections - Wiring - F12 and F23 fuses	Press the clutch pedal to contact the BOC
216	Short circuit at +12V			

CAB18: Bottom-of-Clutch (BOC) pedal switch

Description

Location: on the clutch pedal support (Fig. 6)
2 switches: NO et NC.

- Connectors 1: Signal
- Connectors 2: Power supply
- Connectors 3: Signal

Assembly:
- Tighten the locknut to approximately 8 Nm

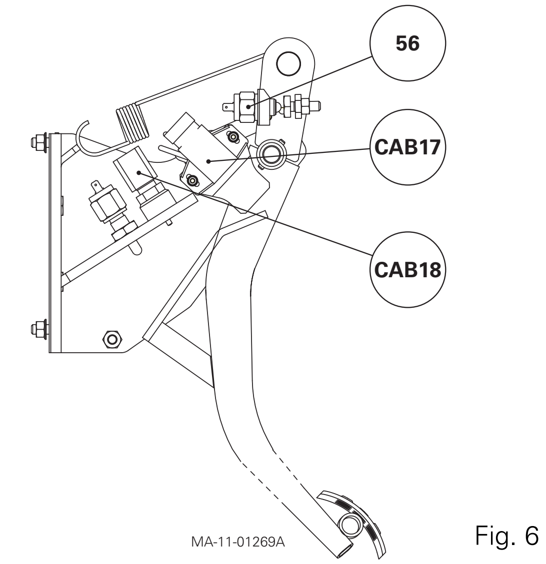


Fig. 6

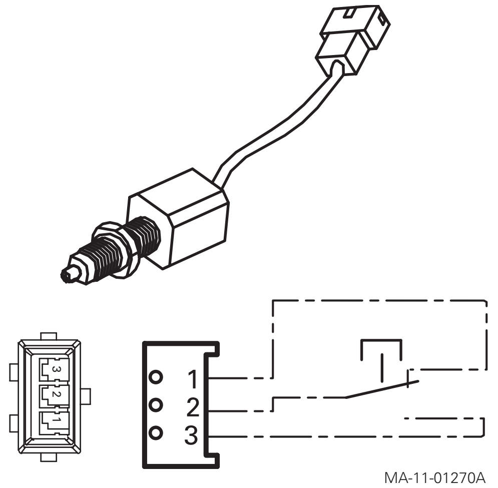


Fig. 7

Possible error codes

Errors	Description	Reaction of the System	Solutions	Resetting the system after clearing error
217	Open circuit or short circuit at 0V	PowerShuttle locked	Check: - Contacts - Harness connections - Wiring - F12 and F23 fuses	Press the clutch pedal to contact the BOC
218	Short circuit at +12V	Clutch fills with ramp by default		

TR11: PTO solenoid valve

Description

Location: on the right-hand hydraulic cover (Fig. 8)
ON/OFF solenoid valve controlled by frequency carrier signal.

- Connectors 1: Signal
- Connectors 2: Ground

Signals:
OFF solenoid valve: 0A
ON solenoid valve: 12V

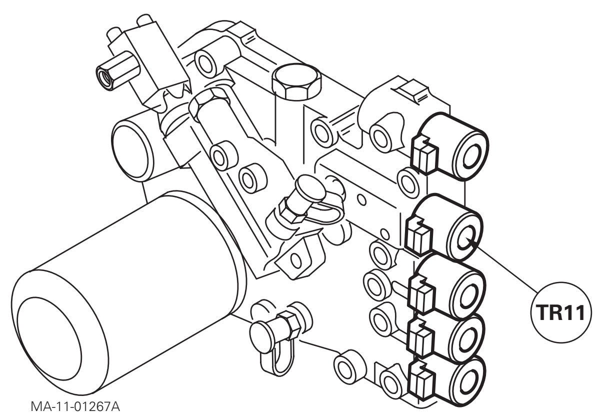


Fig. 8

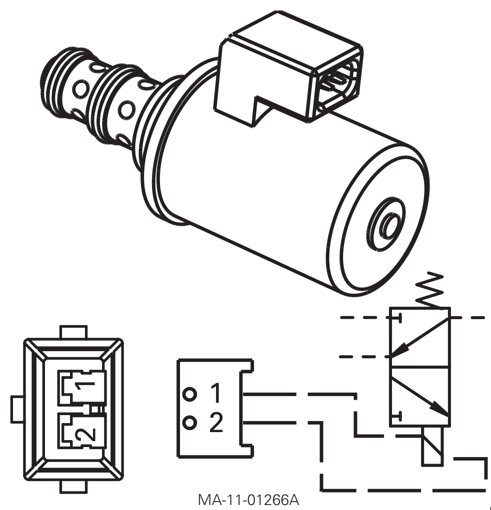


Fig. 9

Possible error codes

Errors	Description	Reaction of the System	Solutions	Resetting the system after clearing error
207	Short circuit at +12V	PTO locked	Check: - Contacts - Harness connections - Wiring - F6 fuse	Press the clutch pedal to contact the BOCor: move the PTO switch from ON to OFF
208	Short circuit at 0V			
209	Open circuit			
211	Switch ON and PTO inactive		Move the PTO switch from ON to OFF	

TR22: Reverse solenoid valve

Description

Location: on the hydraulic unit of the power shuttle control (Fig. 10)
Proportional solenoid valve supplied with current

- Connectors 1: Signal
- Connectors 2: Signal return

Signals:
OFF solenoid valve: 0A
ON solenoid valve: approximately 1.2A

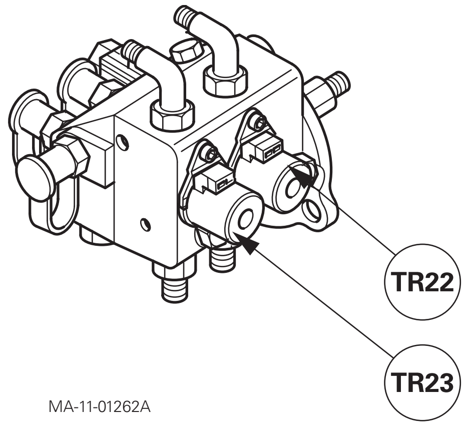


Fig. 10

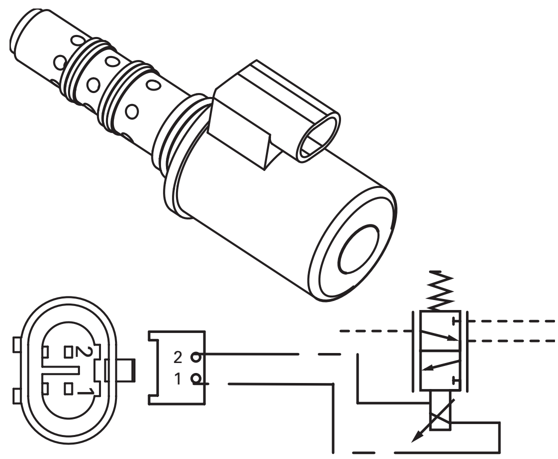


Fig. 11

Possible error codes

Errors	Description	Reaction of the System	Solutions	Resetting the system after clearing error
102	Short circuit at +12V	Reverse position locked	Check: - Contacts - Harness connections - Wiring - F12 and F23 fuses	Press the clutch pedal to contact the BOC
106	Open circuit			
204	Short circuit at 0V			

TR23: Forward solenoid valve

Description

Location: on the hydraulic unit of the power shuttle control (Fig. 12)

Proportional solenoid valve supplied with current

- Connectors 1: Signal
- Connectors 2: Signal return

Signals:
OFF solenoid valve: 0A
ON solenoid valve: approximately 1.2A

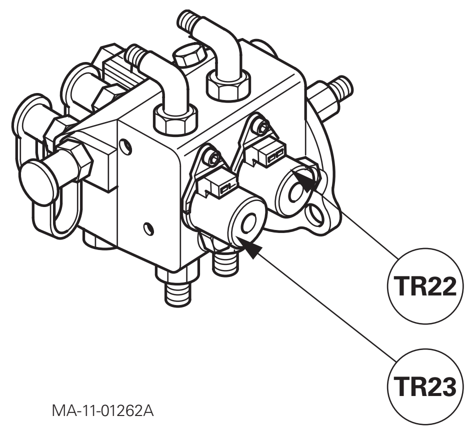


Fig. 12

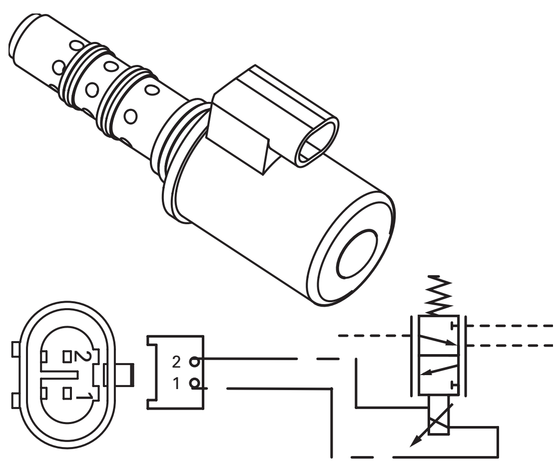


Fig. 13

Possible error codes

Errors	Description	Reaction of the System	Solutions	Resetting the system after clearing error
101	Short circuit at +12V	Forward position locked	Check: - Contacts - Harness connections - Wiring - F12 and F23 fuses	Press the clutch pedal to contact the BOC
105	Open circuit			
203	Short circuit at 0V			

TR24: Oil transmission temperature sensor

Description

Location: on the gearbox cover (Fig. 14)
Resistant sensor.

- Connectors 1: Ground
- Connectors 2: Signal

Signals:

Temperature in °C	Resistance in ohms
0	10.7 K (+/- 1.3)
20	4000
50	500

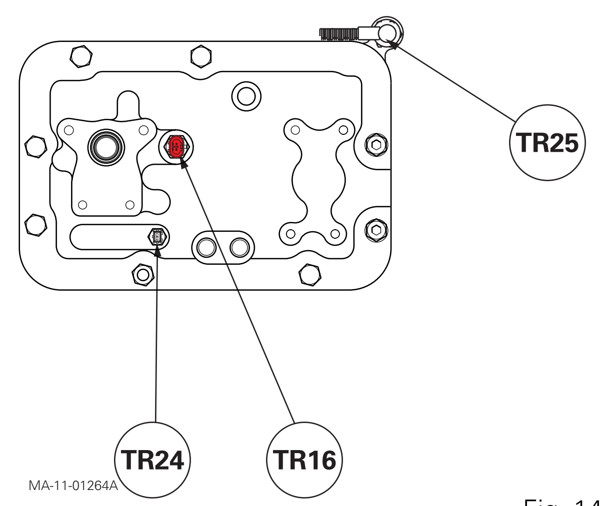


Fig. 14

Assembly:

- Apply a small amount of Loctite 542 to the thread
- Tighten to a torque of approximately 30 Nm

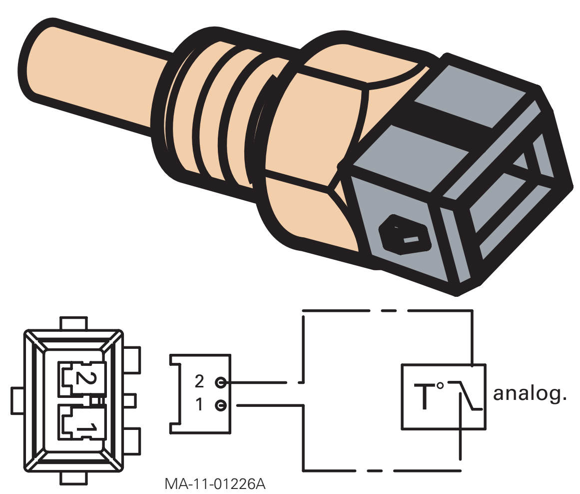


Fig. 15

Possible error codes

Errors	Description	Solutions	Resetting the system after clearing error
212	Transmission temperature over 100°C	There are 2 possibilities: - Temperature is too high • Stop tractor movement, auxiliary spool valve and PTO operation to allow the transmission to cool • Ensure that the oil level is correct - the sensor is faulty and displays incorrect data. It must therefore be checked.	Press the clutch pedal to contact the BOC

TR25: Intermediate speed sensor

Description

Location: close to the gearbox cover (Fig. 16)
Induction sensor.

- Connectors 1: Signal
- Connectors 2: Ground

Signals:
Resistance when stopped: 450 Ohm +/- 20
Alternating voltage when pinion is rotating

To adjust the air-gap:
- Apply a small amount of Loctite 5922 to the thread
- Screw the sensor home in abutment on the pinion
- Unscrew the sensor by 3/4 turn
- Tighten the locknut to approximately 6 Nm

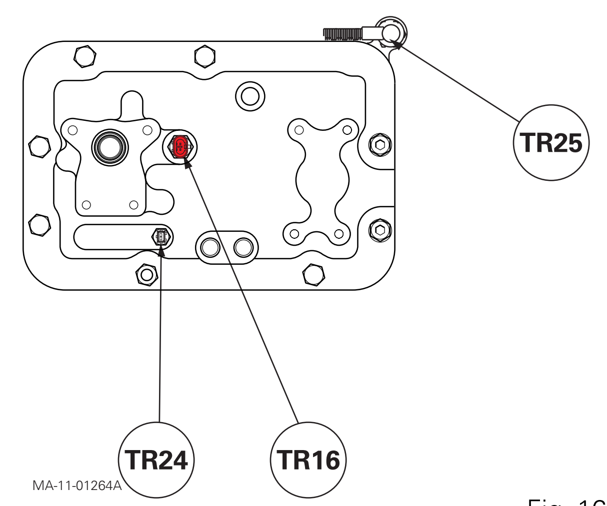


Fig. 16

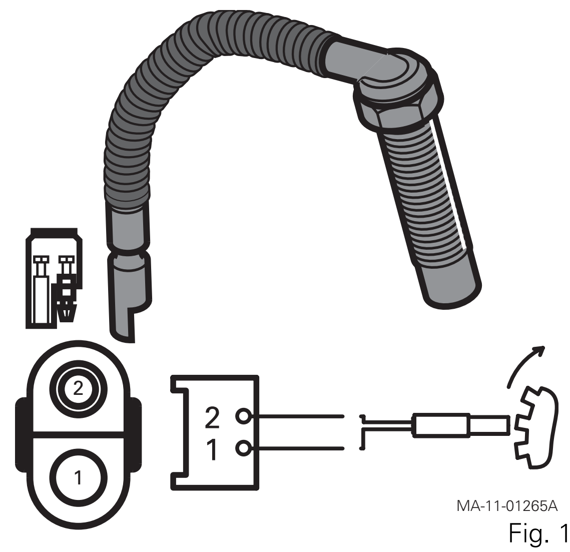


Fig. 17

Possible error codes

Errors	Description	Solutions	Resetting the system after clearing error
221	Intermediate speed sensor error	Check: - Sensor status - Sensor resistance of 450 Ohm, as well as alternating voltage when pinion is rotating - Contacts - Harness connections - Wiring	Press the clutch pedal to contact the BOC

50 : PTO ON/OFF/brake switch

Description

Location: on cab right-hand console

- Connectors +: Power supply
- Connectors F: Brake signal
- Connectors P: PTO control signal

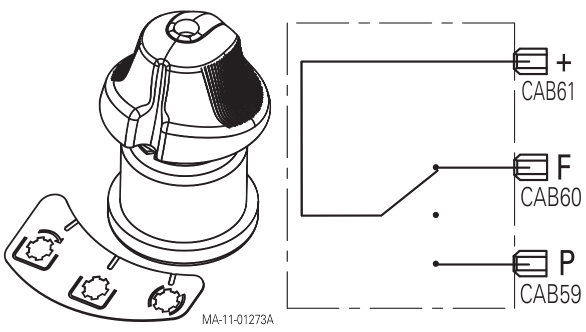


Fig. 18

Possible error codes

Errors	Description	Reaction of the System	Solutions	Resetting the system after clearing error
211	Switch ON and PTO inactive	PTO locked	Move the PTO switch from ON to OFF	Press the clutch pedal to contact the BOCor: move the PTO switch from ON to OFF

51 : LSPTO control

Description

Location: on cab right-hand console

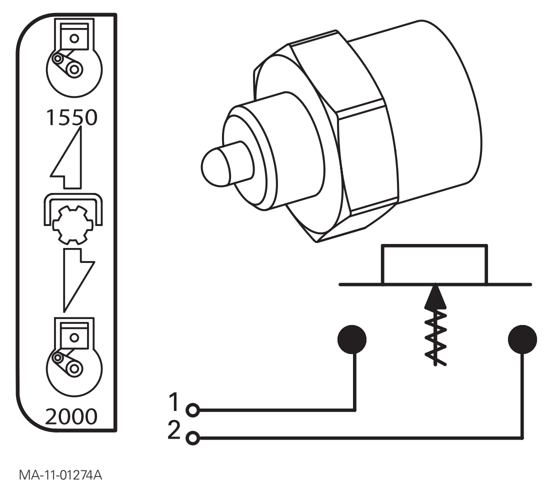


Fig. 19

Possible error codes

Errors	Description	Reaction of the System	Solutions	Resetting the system after clearing error
213	Engine speed too high (>1782 rpm) in LSPTO	PTO locked	There are 2 possibilities: - Operating safety: use PTO in Load Sensing mode at a speed lower than 1782 rpm - Ensure that during normal PTO use, the switch does not remain on, thus giving LSPTO data	Press the clutch pedal to contact the BOCor: move the PTO switch from ON to OFF

56 : Top-of-Clutch (TOC) pedal switch

Description

Location: on the clutch pedal support (Fig. 20)

Assembly:
- Tighten the locknut to approximately 20 Nm

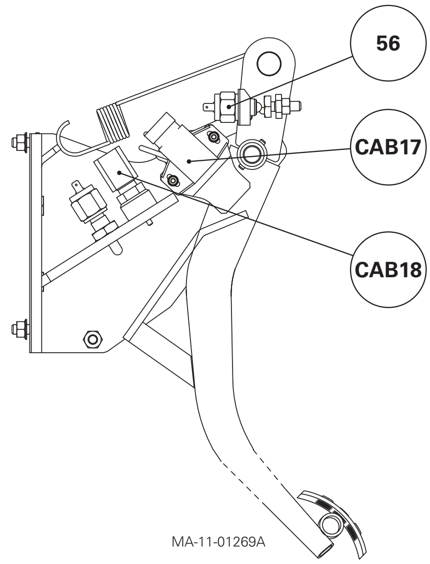


Fig. 20

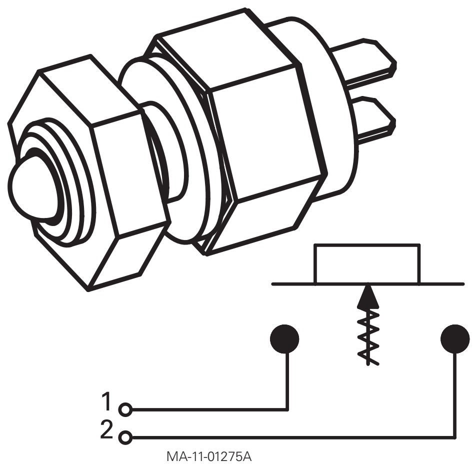


Fig. 21

Possible error codes

Errors	Description	Reaction of the System	Solutions	Resetting the system after clearing error
219	Open circuit or short circuit at 0V	Clutch fills with ramp by default	Check: - Contacts - Harness connections - Wiring - F12 and F23 fuses	Press the clutch pedal to contact the BOC
220	Short circuit at +12V			

D . Analysing other error codes

Error	Description	Reaction of the System	Solutions	Resetting the system after clearing error
210	Engine speed drops by more than 50% or to under 500 rpm	PTO locked	Ensure that the tool is suitable for use with the tractor and that the engine is not working at underspeed, because the PTO is protected to prevent it from stalling the engine	Press the clutch pedal to contact the BOCor: move the PTO switch from ON to OFF
301	PowerShuttle calibration: temperature too low	Calibration in standby	Place vehicle in conditions required to carry out calibration	Wait
302	PowerShuttle calibration: temperature too high			
303	PowerShuttle calibration: wrong engine speed	Calibration stopped:		Press the clutch pedal to contact the BOC
304	PowerShuttle calibration: ground speed not zero			

GUF514 - AUTOTRONIC 5 - PowerShuttle - Calibration and adjustments

CONTENTS

A . Calibrating the Power Shuttle

The calibration of the Power Shuttle is mandatory where the following components are changed:

- a Power Shuttle solenoid valve
- the Power Shuttle hydraulic control unit
- the Power Shuttle unit or one of its components
- the Autotronic 5

Calibration is automatic, which allows a deft and smooth quality of shuttling.

Preliminary operations

NOTE : *To authorise entry into calibration mode, the transmission oil temperature must be:*

35 / 45° C : the temperature is measured by the gearbox cover sensor and can be read using Wintest or by a direct reading of a specific instrument panel display (Fig. 1).

To enter direct read mode:

NOTE : *The user has a maximum 0.5 second delay between each operation to enter this mode.*

- move Power Shuttle lever to neutral position
- move gear lever to neutral position
- move Power Shuttle lever to forward or reverse position
- press the Hare / Tortoise control switch 4 times
- move Power Shuttle lever to neutral position
- the display appears on the instrument panel (Fig. 1).

To exit direct read mode, repeat the procedure used to enter direct read mode, or stop the engine.

NOTE : *The tractor can always be used when in temperature direct read mode, but the position indicator light displayed corresponds with the temperature.*

Calibration autorisation:

- from 36 to 39°C: calibration authorised
- from 39 to 44°C: **optimum calibration**
- from 44 to 46°C: calibration authorised

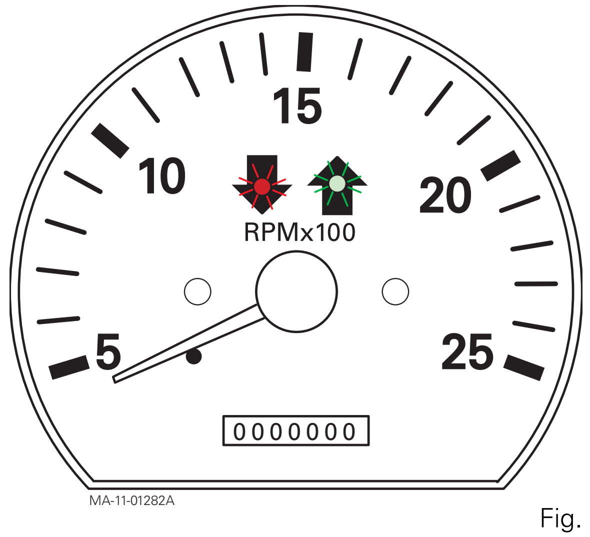


Fig. 1

Gearbox cover temperature	Flashing indicator light	
	Reverse indicator light	Forward indicator light
< 15°C	ON at 95%	OFF
= 25°C	ON at 50%	OFF
= 34°C	ON at 5%	OFF
from 35°C to 45°C	ON	ON
= 46°C	OFF	ON at 5%
= 55°C	OFF	ON at 50%
= 65°C	OFF	ON at 95%

1. Bring the tractor up to temperature, for example:

Tractor stationary

- Run the engine, gear shift lever and Power Shuttle levers in neutral, PTO clutch engaged.
- Then, move the Power Shuttle lever 10 times in each direction, leaving the lever 5 to 10 seconds in each position in order to bring the control unit and solenoid valves up to transmission temperature.
- Measure and note the temperature.

Tractor moving

- Carry out reversing manoeuvres every 5 to 10 seconds, in Hare range 1st or 2nd gear.
- Measure and note the temperature.

2. Place the tractor on a hard even surface, free of any obstacles 3 metres away at least.

3. The tractor must be free of any implements.

4. Stop the PTO, disengage the front axle.

5. Stop the engine.

6. Extinguish any headlights / road lights.

7. Put the gear shift lever and Power Shuttle lever into neutral.

Automatic calibration

8. Apply the handbrake.

9. Start the engine.

10. Release the clutch pedal.

11. Increase engine speed to 1500 rpm ± 100 with the hand throttle lever.

12. Shift into the Tortoise range without declutching.

13. Place the Power Shuttle lever in forward or reverse position to reset the system and then leave it in this position.

14. Choose the correct Speedshift ratio for equal engine and intermediate speeds:

- Gearbox 30 kph: ratio D
- Gearbox 40 kph: ratio C

NOTE: *Access to Automatic calibration mode takes place immediately following the above described manoeuvres.*

15. Simultaneously, and at least for 4 seconds, press:

- the button on the gear shift lever to activate the Hare / Tortoise range switch (tractor shifts to Hare range),
- the differential lock switch.

16. Entry into automatic calibration mode is then indicated by the simultaneous flashing of the forward and reverse indicator lights. Release the range and differential lock switches.

17. Calibration takes approximately 5 minutes and is complete when the 2 indicator lights stop flashing. Only the indicator light of the selected position flashes.

18. Disengage the clutch using the pedal and return the lever to neutral position to complete and validate the calibration of the Power Shuttle.

Validation

Immediate validation after calibration

1. Without stopping the engine, set the engine speed to 1500 rpm, and engage 4th gear in the Tortoise range.
2. Carry out 10 forward / reverse Power Shuttle manoeuvres.
3. Carry out 10 neutral to forward and neutral to reverse Power Shuttle manoeuvres.
4. Judge the quality of the shuttling which should be deft and smooth.

Validation of an already calibrated tractor

NOTE: *The transmission temperature must be above 20° C.*

1. Put the gear shift lever in neutral, the power take-off must be declutched, the front axle disengaged.
2. Start the engine.
3. Put the Power Shuttle lever in forward position for at least 1 minute, then at least 1 minute in reverse position.
4. Put the Power Shuttle lever back into neutral position.
5. Engage 4th Tortoise, with an engine speed of 1500 rpm.
6. Carry out 10 forward / reverse Power Shuttle manoeuvres.
7. Carry out 10 neutral to forward and neutral to reverse Power Shuttle manoeuvres.
8. Judge the quality of the shuttling which should be deft and smooth.

   NOTE: *An abrupt reaction on the 1st manoeuvre is normal.*

Calibration faults

NOTE: *A fault due to non-compliance of the conditions required to access or maintain the calibration mode is signalled by the flashing PTO indicator light.*

Entry in calibration mode is not provided if:

- the transmission temperature is not correct
- the correct Speedshift ratio in relation to the gearbox (30 or 40 kph) is not engaged
- the engine speed is other than 1500 rpm ± 100
- The Tortoise range has not been engaged before accessing calibration mode
- the Power Shuttle lever has not been engaged.

1. Check that the access to calibration conditions in operations 1 to 7 have been met.
2. Check the solenoid valve coils connections.
3. Check that the TOC (top-of- clutch pedal switch) is connected and correctly adjusted.

Calibration enters standby mode if:

- The engine speed changes from 1500 rpm ± 100

Calibration mode is deactivated if:

- The Power Shuttle lever is placed in neutral position.

NOTE: *If the calibration fails, the system uses the previously memorised parameters, or the default parameters in the case of a new Autotronic 5 unit.*

B . Adjusting the Power Shuttle progressive shifting

Once the calibration has been correctly carried out, it is possible to adjust the calibration parameters to obtain faster or slower Power Shuttle reactions if the acceptable criteria have not been met.

This procedure can be carried out from soft version 01.03.

After a new calibration, the adjustment procedures of each direction of travel are reinitialised.

Note : *During the procedure, if the pedal is pressed down or the ignition key switched off, the modifications are not stored.*

Preocedure to follow

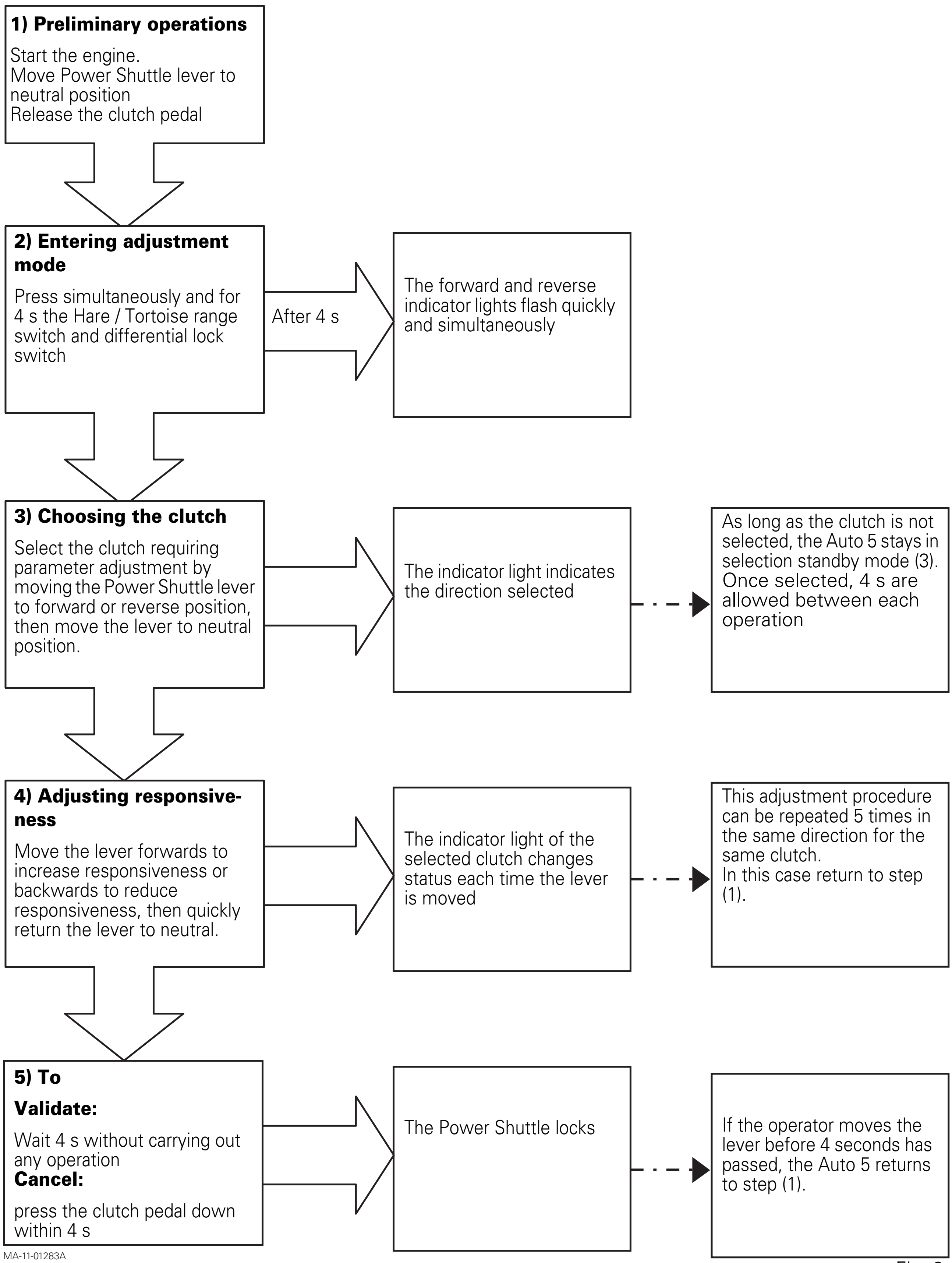


Fig. 2

C . Adjusting the manoeuvring pedal

Manoeuvring pedal assembly (Fig. 5)

(2) Bottom of clutch switch (BOC)
(3) Starter safety switch
(4) Pedal pressed adjustment screw
(5) Pedal released stop adjustment screw
(6) Top of clutch switch (TOC)
(7) Clutch pedal progressivity potentiometer

- The manoeuvring pedal can be used when manoeuvring in very tight spaces or when hitching an implement.
- It is not necessary to use this pedal either when engaging a gear from neutral, when changing gears or when reversing the direction of travel.
- The position of the manoeuvring pedal is transmitted to the Autotronic 5 by the sensors.

Adjusting BOC

- Tighten to provide a clearance of 0.3 to 1mm between the switch body and the holder (Section C-C)
- Tighten the lock nut to a torque of 6 - 9 Nm.

Adjusting the potentiometer and switch

- Fit the potentiometer into its housing.
- Tighten the screws in order to reach the centre of the lights (Fig. 3).
- Fit the plastic fork and tighten the screws with Loctite 241 or equivalent (Fig. 4).
- Adjust the released pedal stop adjustment screw (5) to provide a clearance of 6mm (view B).

- Fit and tighten the top of clutch (TOC) switch (6) to a torque of 18 to 30 Nm.
- With the pedal released (top), allow 0.5 to 0.7 mm clearance between the switch body and screw head (view A).

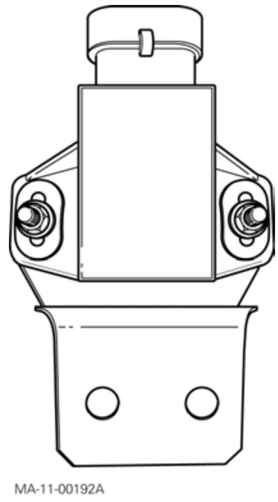


Fig. 3

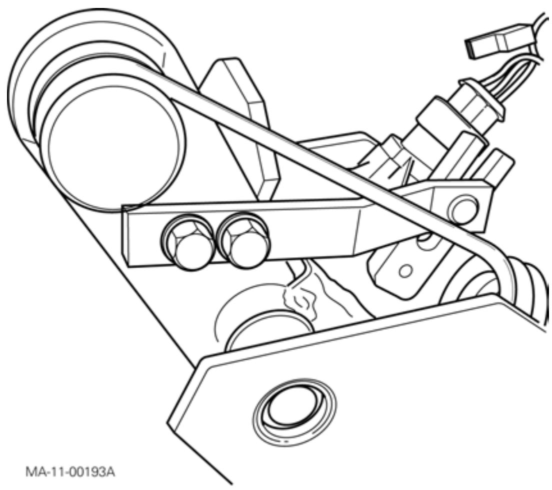


Fig. 4

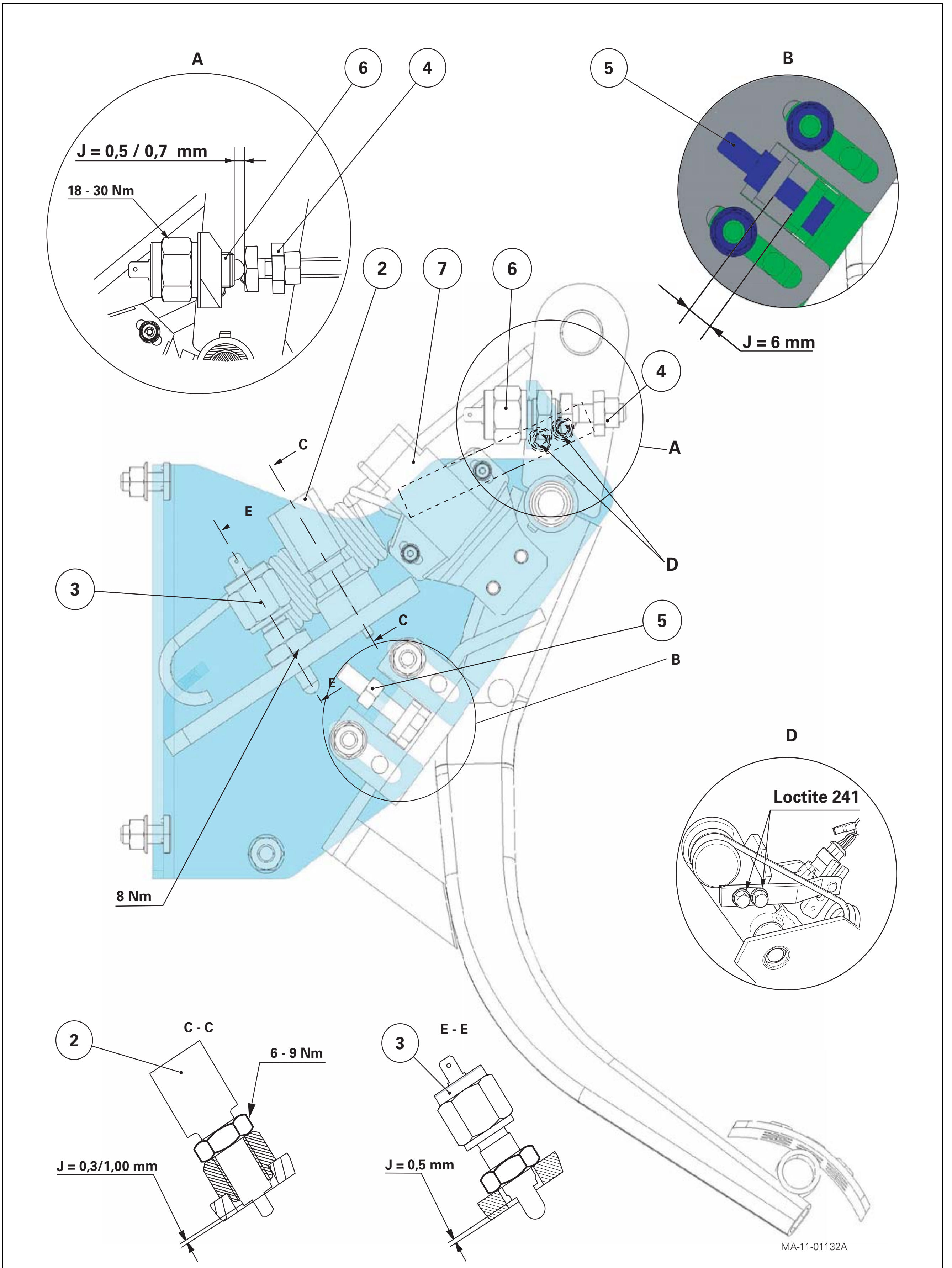

A
6
4
5
B
J = 0,5 / 0,7 mm
18 - 30 Nm
J = 6 mm
2
7
6
4
A
C
E
D
3
C
5
E
B
8 Nm
D
Loctite 241
2
C - C
6 - 9 Nm
J = 0,3/1,00 mm
3
E - E
J = 0,5 mm
MA-11-01132A

Fig. 5

D . Calibrating the (manoeuvring) clutch pedal

Each time the clutch is disengaged then reengaged (BOC then TOC), the Autotronic 5 gradually readjusts its calibration parameters to centre the potentiometer range correctly according to the pedal travel.

The calibration of the clutch pedal must be carried out each time that one of the following elements is replaced or modified:

- Clutch pedal progressivity potentiometer
- Autotronic 5

Method:

NOTE: *The user has a maximum 0.5 second delay between each operation to enter this mode.*

- move Power Shuttle lever to neutral position
- move gear lever to neutral position
- move Power Shuttle lever to forward or reverse position
- press the Hare / Tortoise control switch 10 times
- move Power Shuttle lever to neutral position
- press the clutch pedal fully in once, then release.

The pedal is calibrated.

GUF515 - AUTOTRONIC 5 - PowerShuttle - Electrical diagrams

CONTENTS

A . General

Description

The harnesses fitted on the tractor allow data to be exchanged and power to be supplied to the electrical and electronic systems.

The tractor is fitted with 3 different types of power supply:

- +12V Battery (Permanent)
- +12V APC (Ignition key ON)
- +12V ACC (Accessories)

Most harnesses have a maximum of six different wire colours:

- Black: Ground
- Brown: +12V Permanent
- Red: +12V APC and Accessories
- White: Information
- Yellow: CAN High
- Green: CAN Low

  The CAN network wires (yellow and green) are twisted together.

- Components with only one connector are identified by the connector name:

  CAB16: Clutch pedal progressivity sensor (Fig. 1).
- Harnesses performing the same functions have the same colour on the diagram (Fig. 1):
  - FAI90: Cab Power Shuttle option harness (pink)
  - FAI102: Platform Power Shuttle option harness (pink)
- All wires can be identified by the pins of the outgoing and incoming connectors of the harness:

  CAB11.2/CAB18.1: The wire connects pin 2 of the CAB11 connector to pin 1 of the CAB18 connector
- The pin reference for each connector is indicated on the harness side
- The wire colour is indicated: CAB11.2/CAB18.1 B, the wire is white

  List of colours:
  - N: Black
  - M: Brown
  - R: Red
  - B: White
  - J: Yellow
  - V: Green
- The splices inside the harnesses are indicated by a dot and the letter S (S1).

In general, the components or connectors are named in order to indicate the corresponding elements of the tractor:

CA## Automatic air conditioning
CAB## Cab
ENG## Engine
LIG## Lighting
R## Roof
TR## Transmission and linkage
CDX# External controls

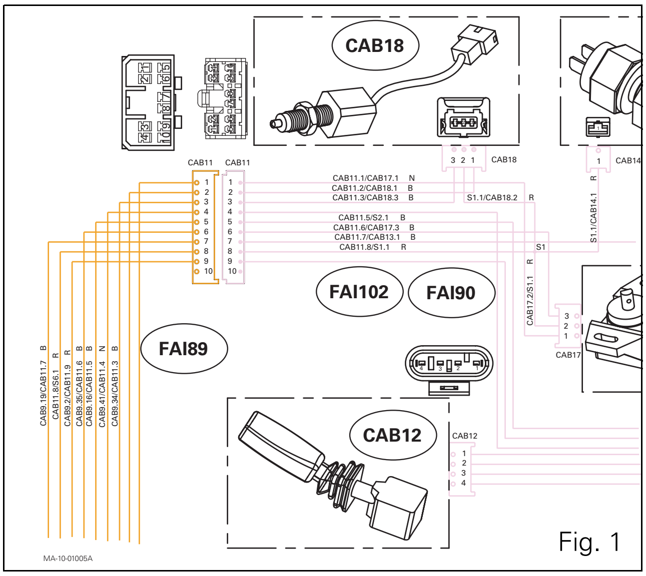
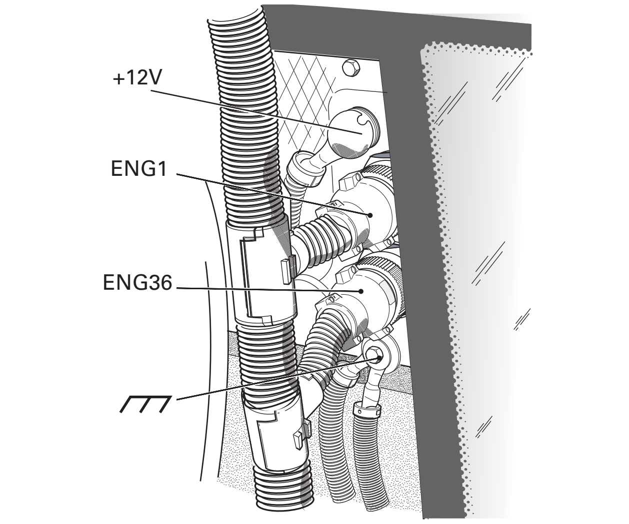


Fig. 1

Layout

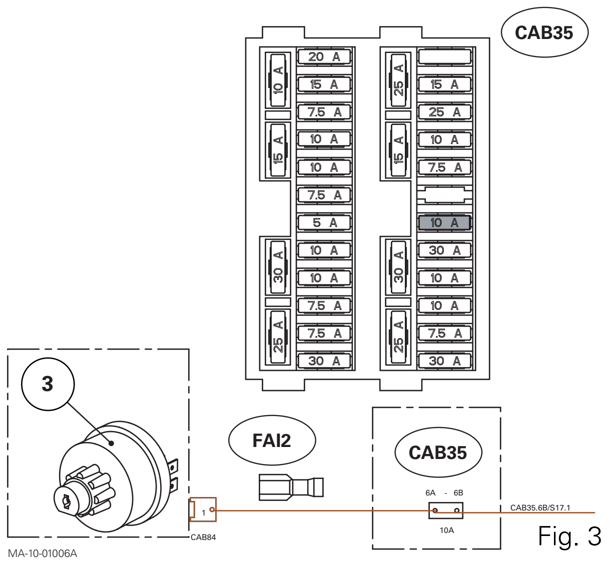
1 or 2 Deutsch connectors (31-way) are connected on the front wall of the cab (according to model) Fig. 2.

All these connectors belong to the engine harness. ENG2 is dedicated to information relating to the electronic injection (only present on the relevant models).



MA-10-01004A Fig. 2

The fuses of the electrical or electronic board (Fig. 3) are indicated by a grey mark on their locations on the fuse box (CAB35).



MA-10-01006A Fig. 3

B . Electrical diagrams

Harness parts list

FAI 02 Instrument panel harness
FAI 07 GSPTO harness
FAI 73 Linkage harness
FAI 74 Cab console harness
FAI 81 Perkins EEM engine harness
FAI 88 Power Shuttle GBA20 transmission - 57 l/min hydraulics harness
FAI 89 Autotronic 5 Power Shuttle harness
FAI 90 Cab Power Shuttle option harness
FAI 93 EEM option adaptation harness
FAI 111 Proportional PTO switch harness

Component parts list

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CAB9 Autotronic 5 - Power Shuttle
CAB12 Power Shuttle lever
CAB17 Clutch pedal progressivity sensor
CAB18 Bottom-of-Clutch (BOC) pedal switch
CAB21 16-pin connector
CAB35 Fuse box
CAB55 Right-hand brake switch
CAB56 Left-hand brake switch
CAB62 Differential lock relay
CAB64 Differential lock switch
CAB67 Hare / Tortoise control switch
ENG35 Electronic injection harness junction
TR2 Design ground speed sensor
TR3 PTO speed sensor
TR5 Engine speed sensor
TR6 Differential lock solenoid valve
TR7 Clogging indicator
TR8 Booster and lubricating pressure switch
TR9 Low pressure switch
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TR23 Forward solenoid valve
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TR25 Intermediate speed sensor

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51 PTO speed selector switch
53 Electronic PTO control
56 Top-of-Clutch (TOC) sensor

Colour reminder

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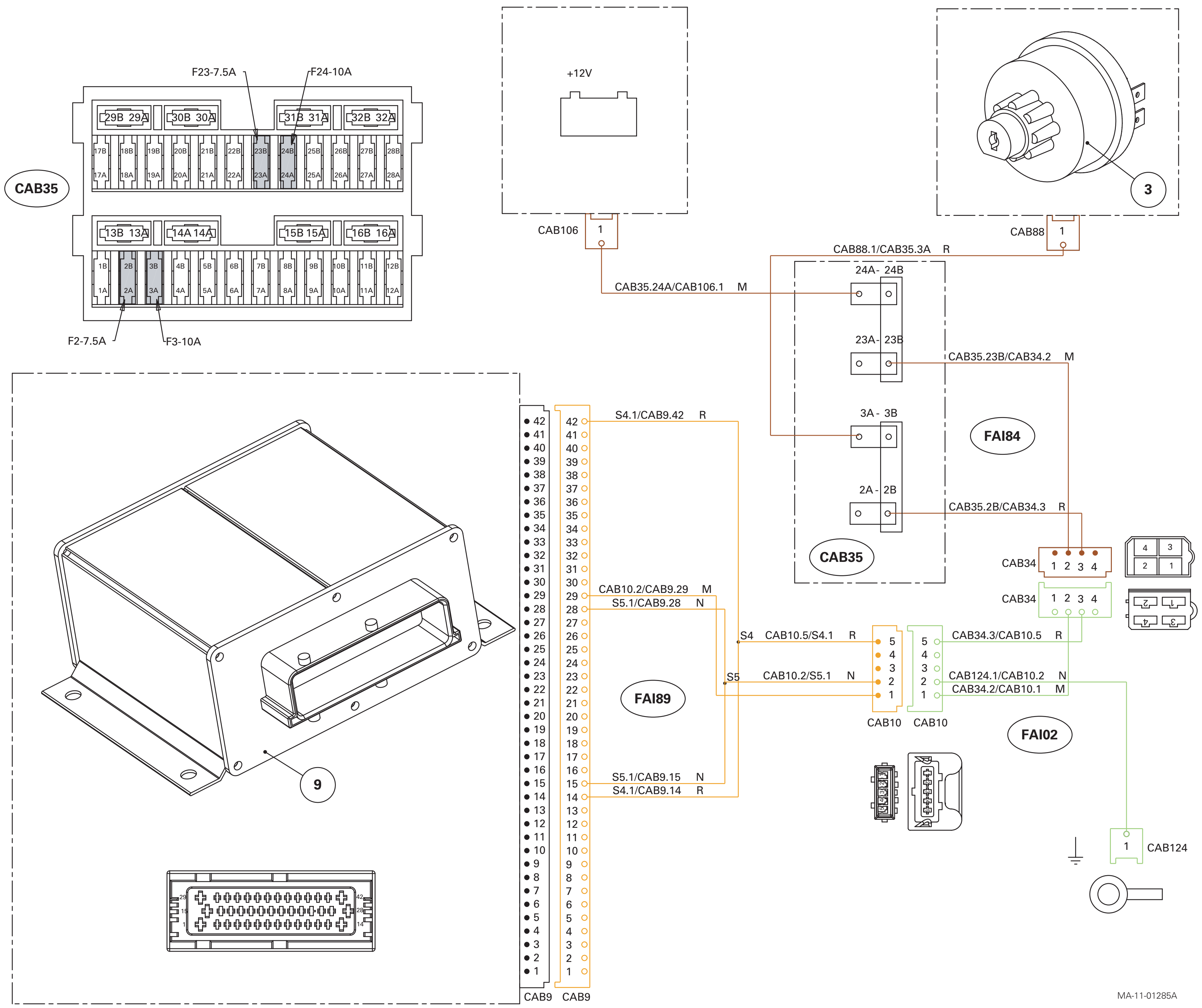
V: Green

Electrical supply



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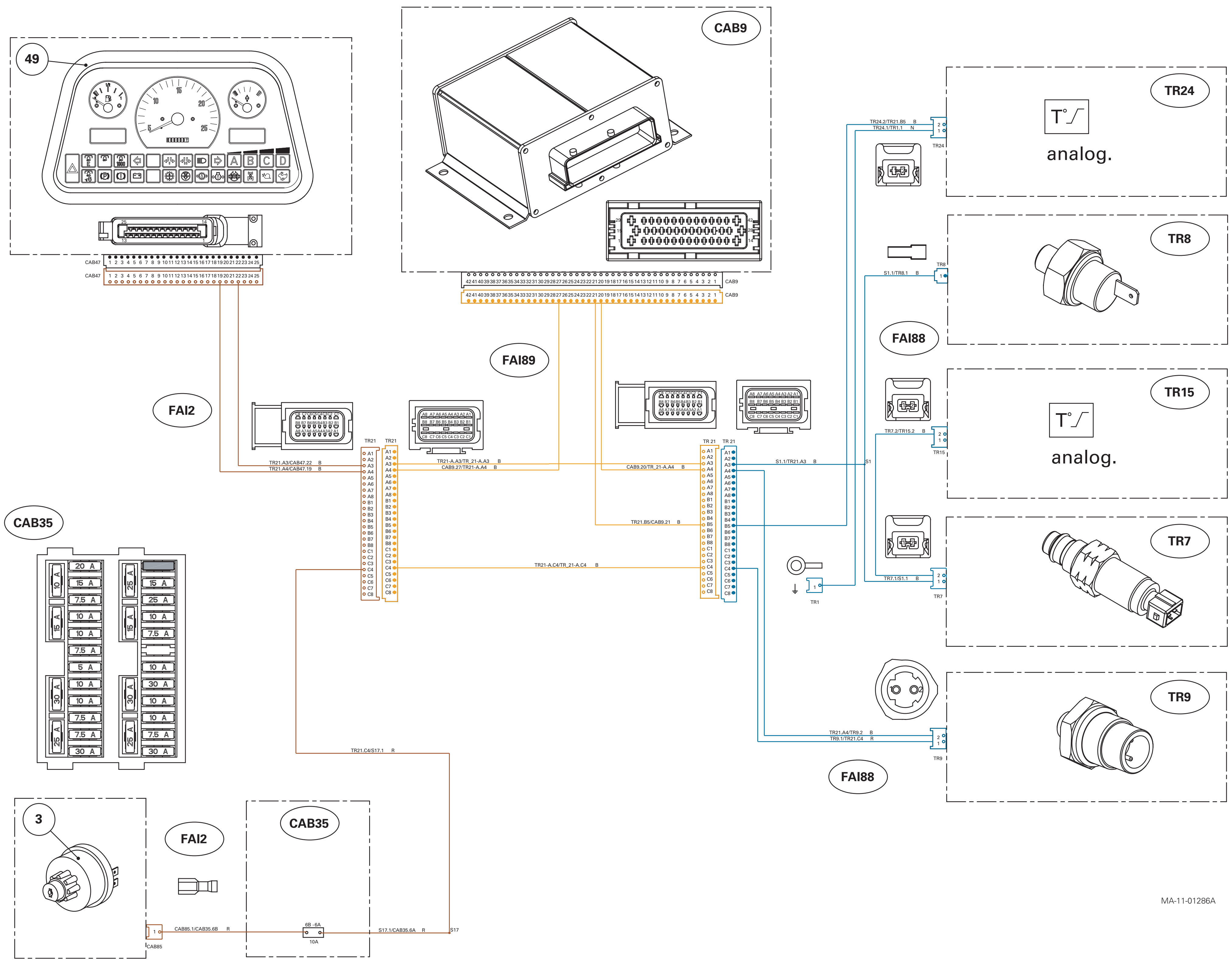
Safety


49
CAB9
TR24
analog.
TR8
FAI88
TR15
analog.
TR7
TR9
FAI88
FAI89
FAI2
CAB35
3
FAI2
CAB35
MA-11-01286A

Harness parts list

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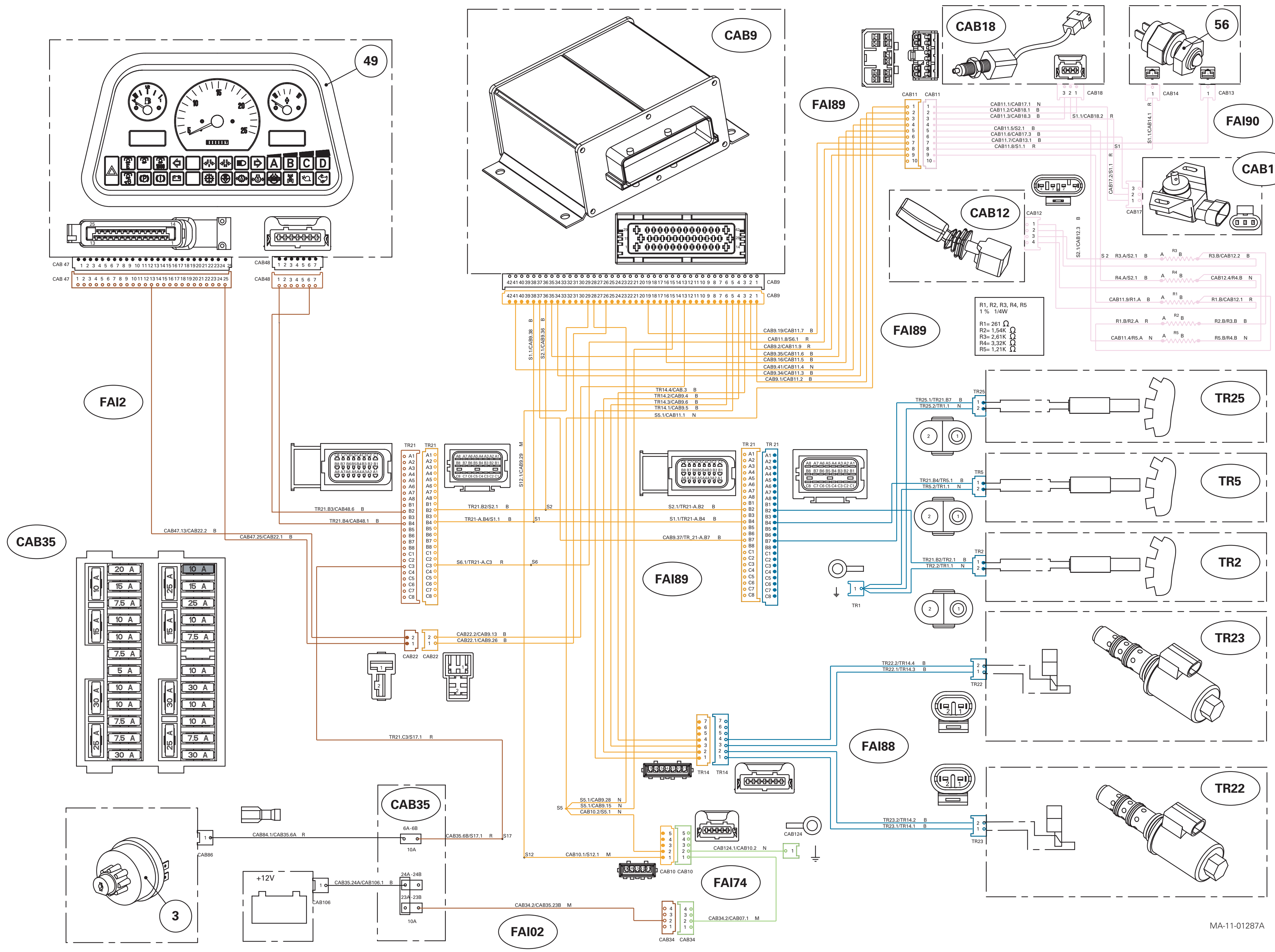
Power shuttle



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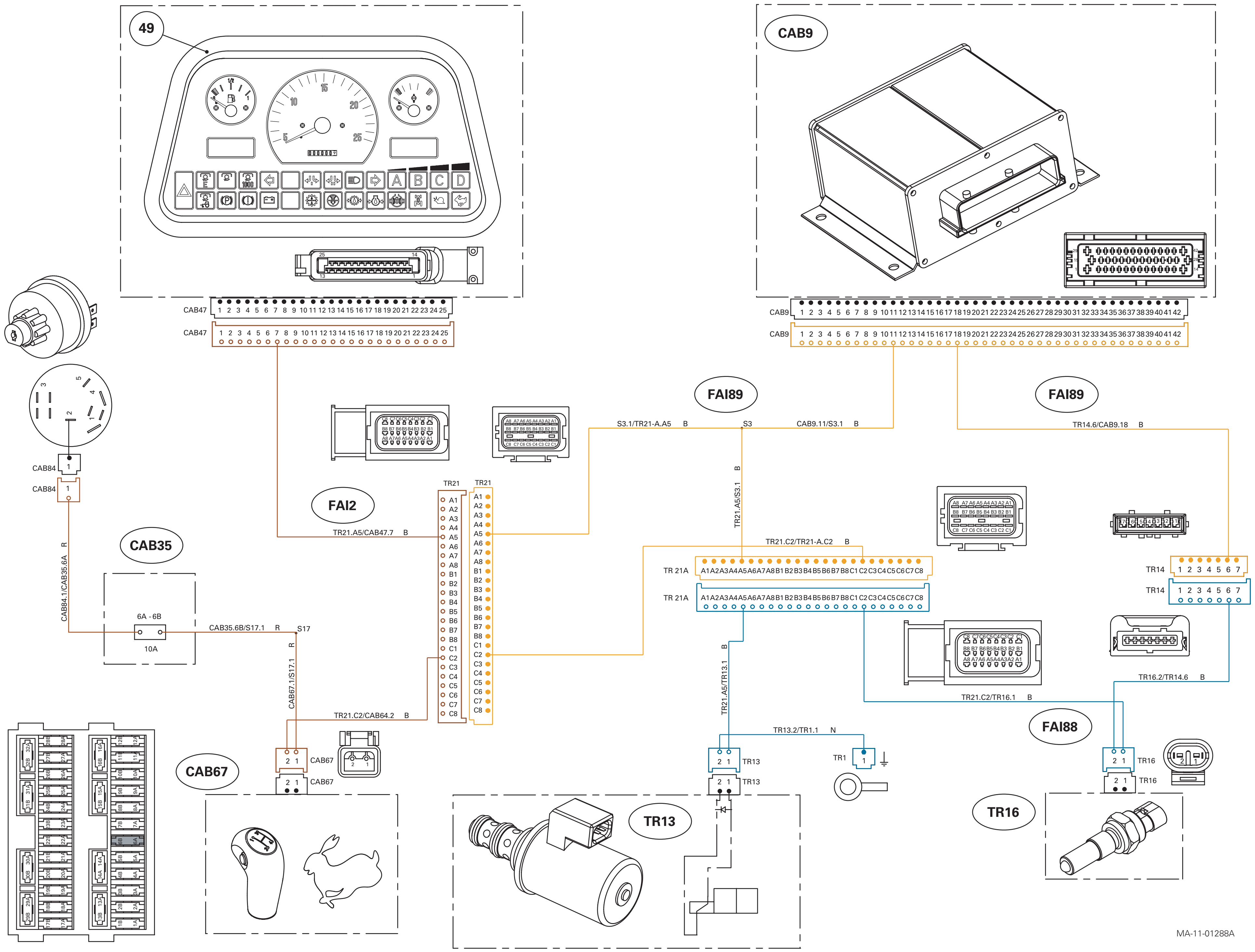
Hare / Tortoise



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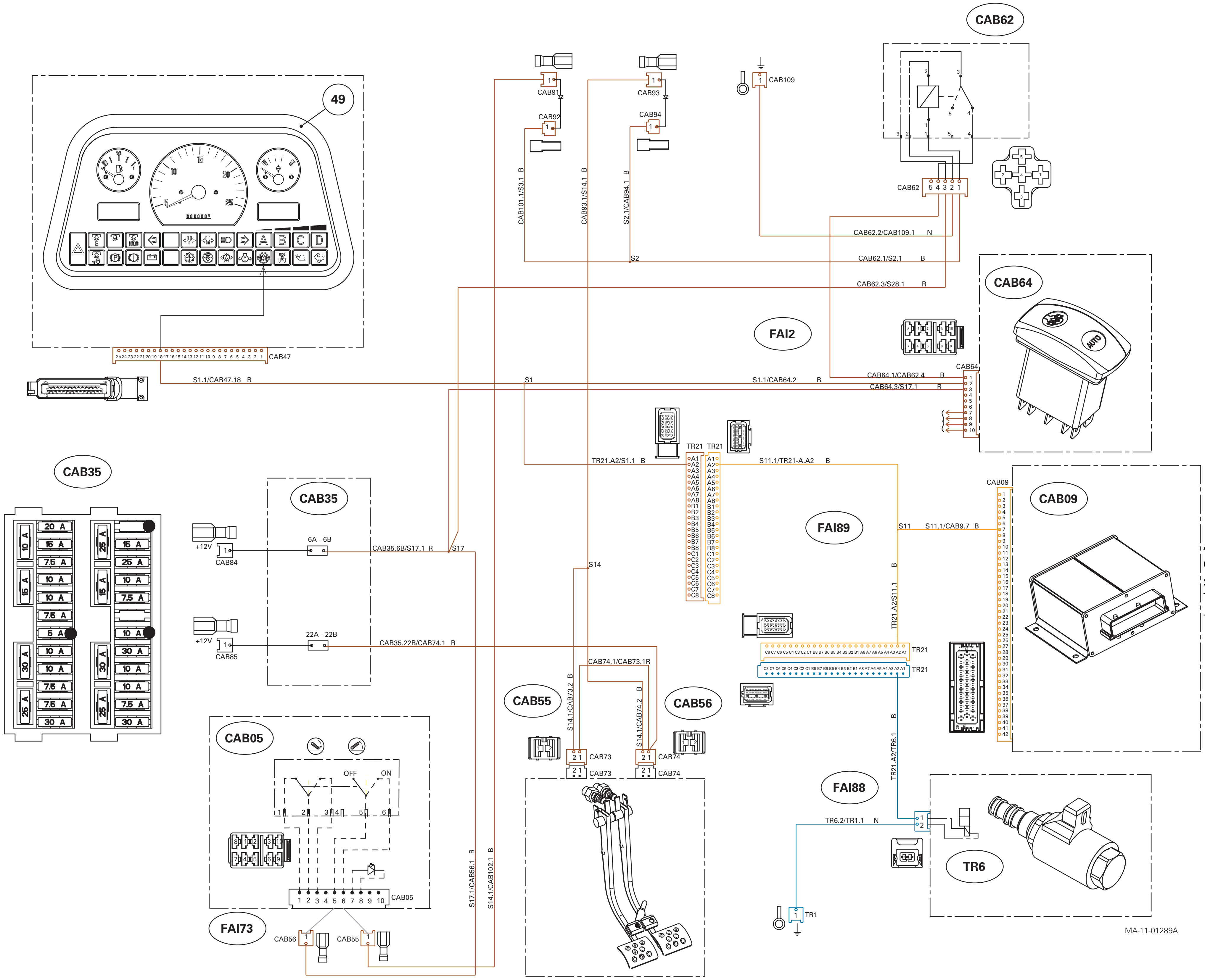
Differential lock



Autotronic 5 cabling, only to detect Power Shuttle calibration start.
The calculator does not manage the differential lock.

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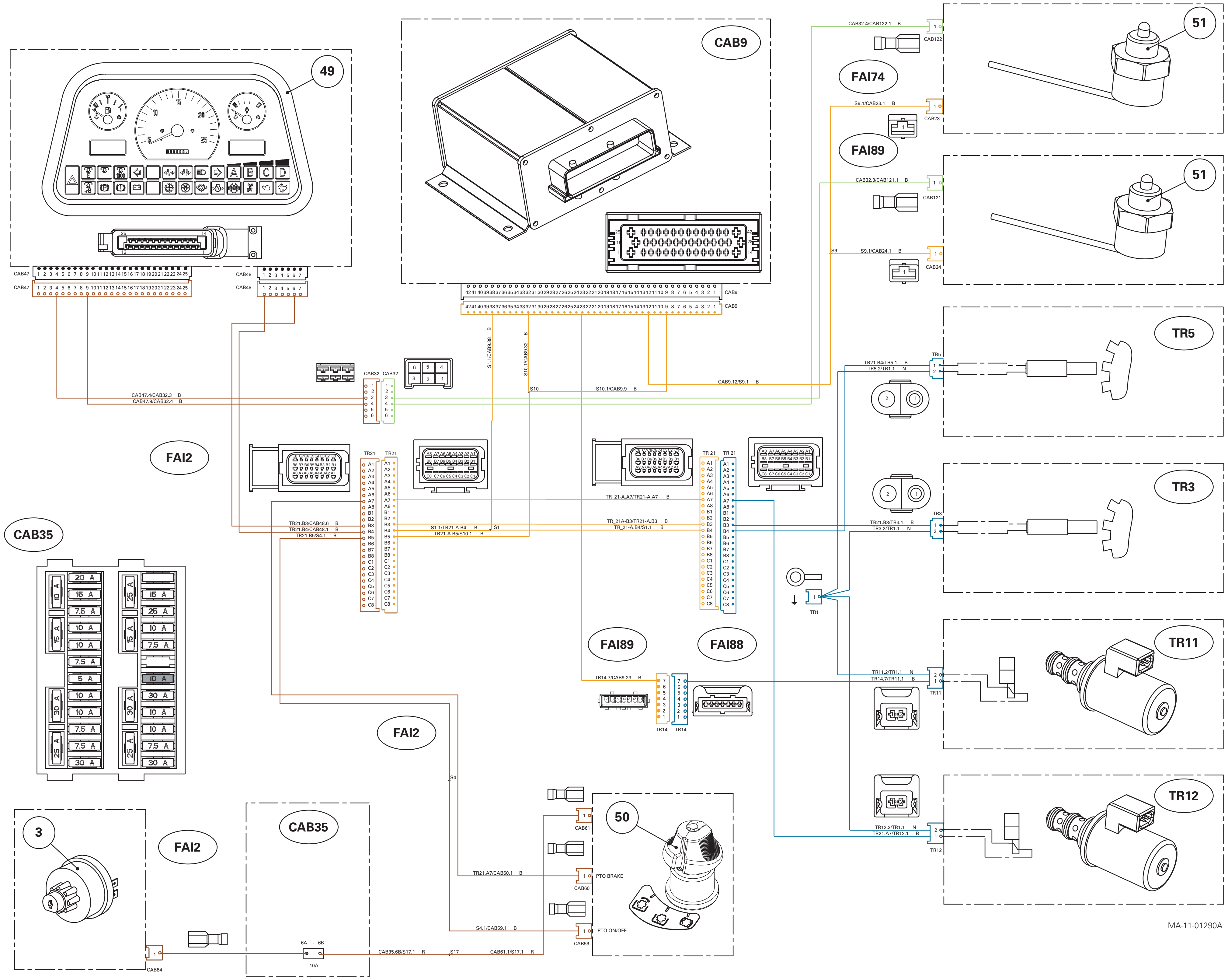
PTO.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CAB9
FAI74
51
FAI89
51
TR5
TR3
FAI2
CAB35
FAI89
FAI88
TR11
FAI2
TR12
3
FAI2
CAB35
50
PTO BRAKE
PTO ON/OFF
MA-11-01290A

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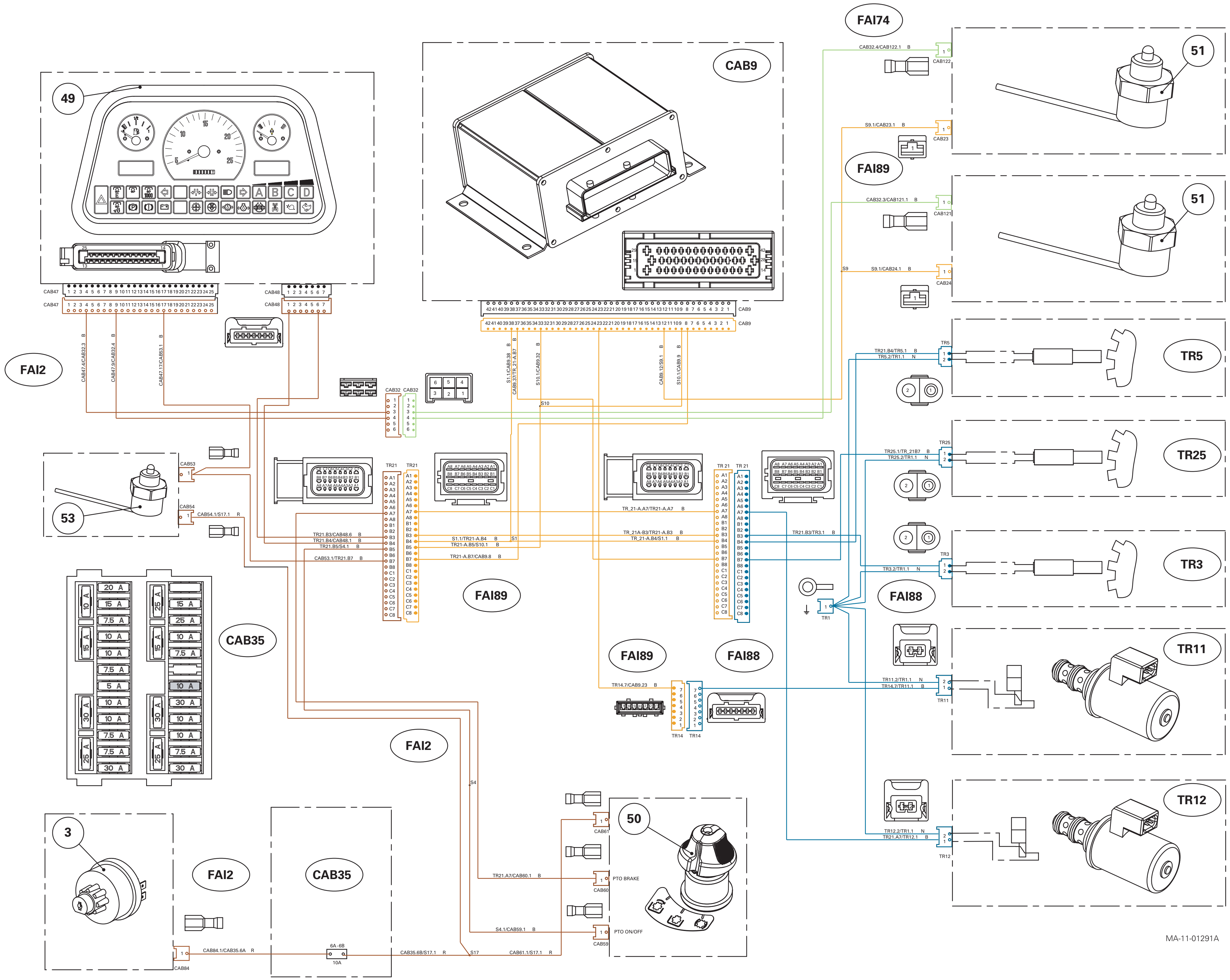
LSPTO



FAI74
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CAB9
49
FAI89
51
TR5
FAI2
TR25
53
TR3
FAI89
FAI88
CAB35
TR11
FAI89
FAI88
FAI2
TR12
50
3
FAI2
CAB35
PTO BRAKE
PTO ON/OFF
MA-11-01291A

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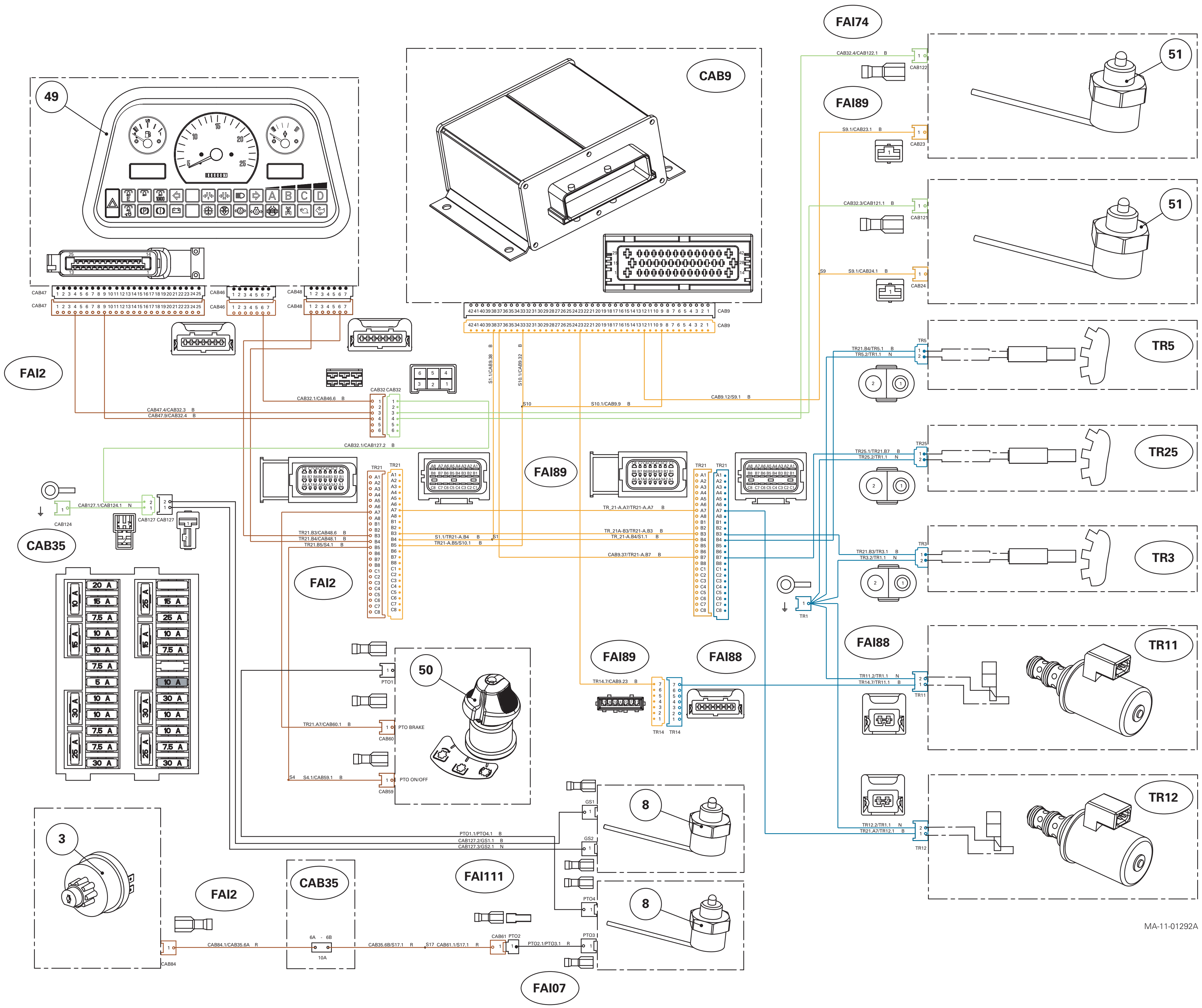
GSPTO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CAB9
FAI89
49
51
TR5
FAI2
TR25
FAI89
CAB35
TR3
FAI2
FAI88
TR11
FAI89
FAI88
50
TR12
8
3
8
FAI2
CAB35
FAI111
FAI07
MA-11-01292A

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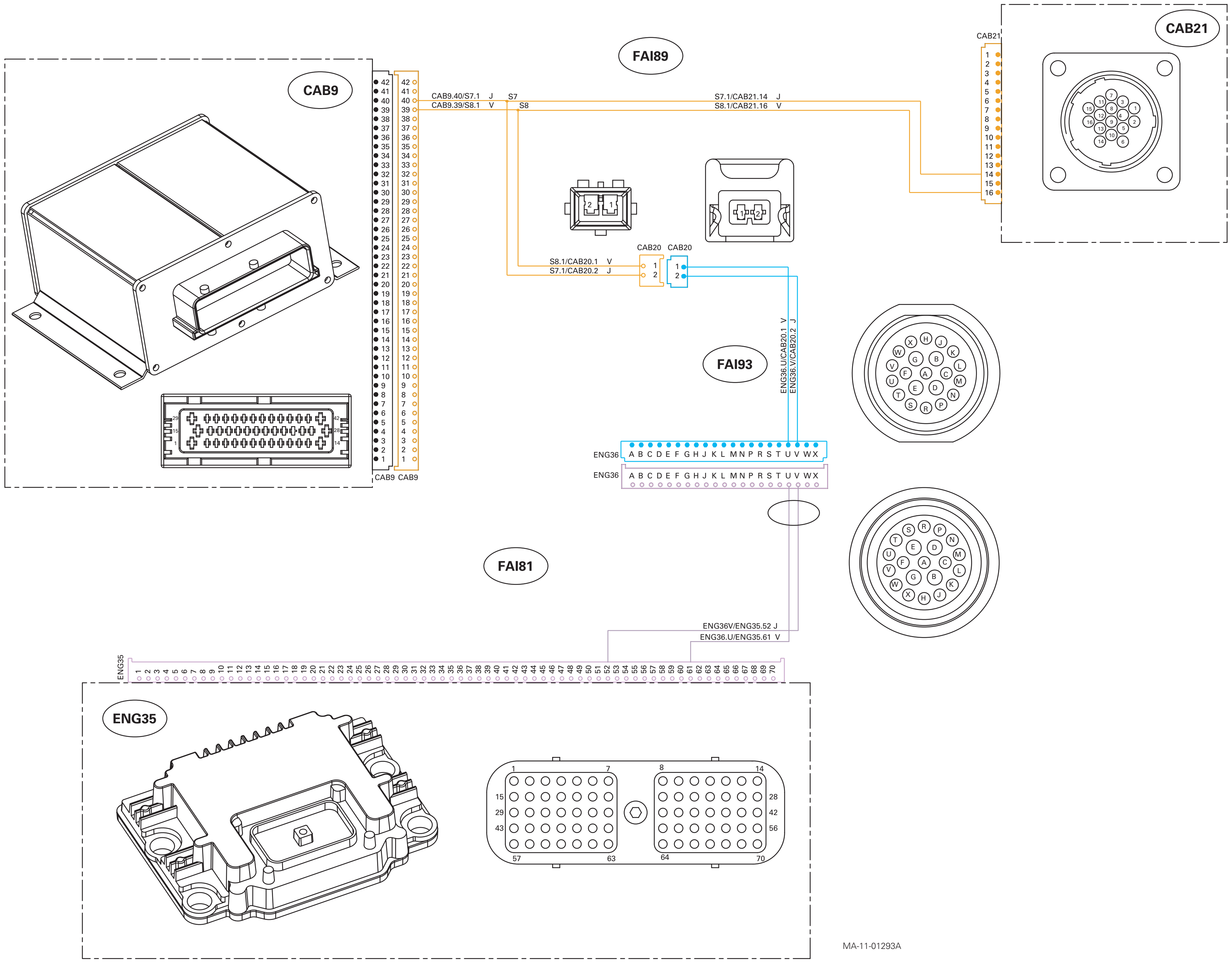
TR8 Booster and lubricating pressure switch
TR9 Low pressure switch
TR11 PTO solenoid valve
TR12 PTO brake solenoid valve
TR13 Hare / Tortoise solenoid valve
TR15 Transmission oil temperature sensor
TR16 Hare / Tortoise switch
TR22 Reverse solenoid valve
TR23 Forward solenoid valve
TR24 Transmission oil temperature sensor
TR25 Intermediate speed sensor

3 Start switch
8 GSPTO safety switch
49 Instrument panel
50 PTO ON/OFF/brake switch
51 PTO speed selector switch
53 Electronic PTO control
56 Top-of-Clutch (TOC) sensor

Colour reminder

N: Black
M: Brown
R: Red
B: White
J: Yellow
V: Green

CAN network



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C . Layout of components

Harness parts list

FAI 02 Instrument panel harness
FAI 07 GSPTO harness
FAI 73 Linkage harness
FAI 74 Cab console harness
FAI 81 Perkins EEM engine harness
FAI 88 Power Shuttle GBA20 transmission - 57 l/min hydraulics harness
FAI 89 Autotronic 5 Power Shuttle harness
FAI 90 Cab Power Shuttle option harness
FAI 93 EEM option adaptation harness
FAI 111 Proportional PTO switch harness

Component parts list

CAB5 Lifting / lowering / neutral linkage selector switch
CAB9 Autotronic 5 - Power Shuttle
CAB12 Power Shuttle lever
CAB17 Clutch pedal progressivity sensor
CAB18 Bottom-of-Clutch (BOC) pedal switch
CAB21 16-pin connector
CAB35 Fuse box
CAB55 Right-hand brake switch
CAB56 Left-hand brake switch
CAB62 Differential lock relay
CAB64 Differential lock switch
CAB67 Hare / Tortoise control switch
ENG35 Electronic injection harness junction
TR2 Design ground speed sensor
TR3 PTO speed sensor
TR5 Engine speed sensor
TR6 Differential lock solenoid valve
TR7 Clogging indicator
TR8 Booster and lubricating pressure switch
TR9 Low pressure switch
TR11 PTO solenoid valve
TR12 PTO brake solenoid valve
TR13 Hare / Tortoise solenoid valve
TR15 Transmission oil temperature sensor
TR16 Hare / Tortoise switch
TR22 Reverse solenoid valve
TR23 Forward solenoid valve
TR24 Transmission oil temperature sensor
TR25 Intermediate speed sensor

3 Start switch
8 GSPTO safety switch
49 Instrument panel
50 PTO ON/OFF/brake switch
51 PTO speed selector switch
53 Electronic PTO control
56 Top-of-Clutch (TOC) sensor

Colour reminder

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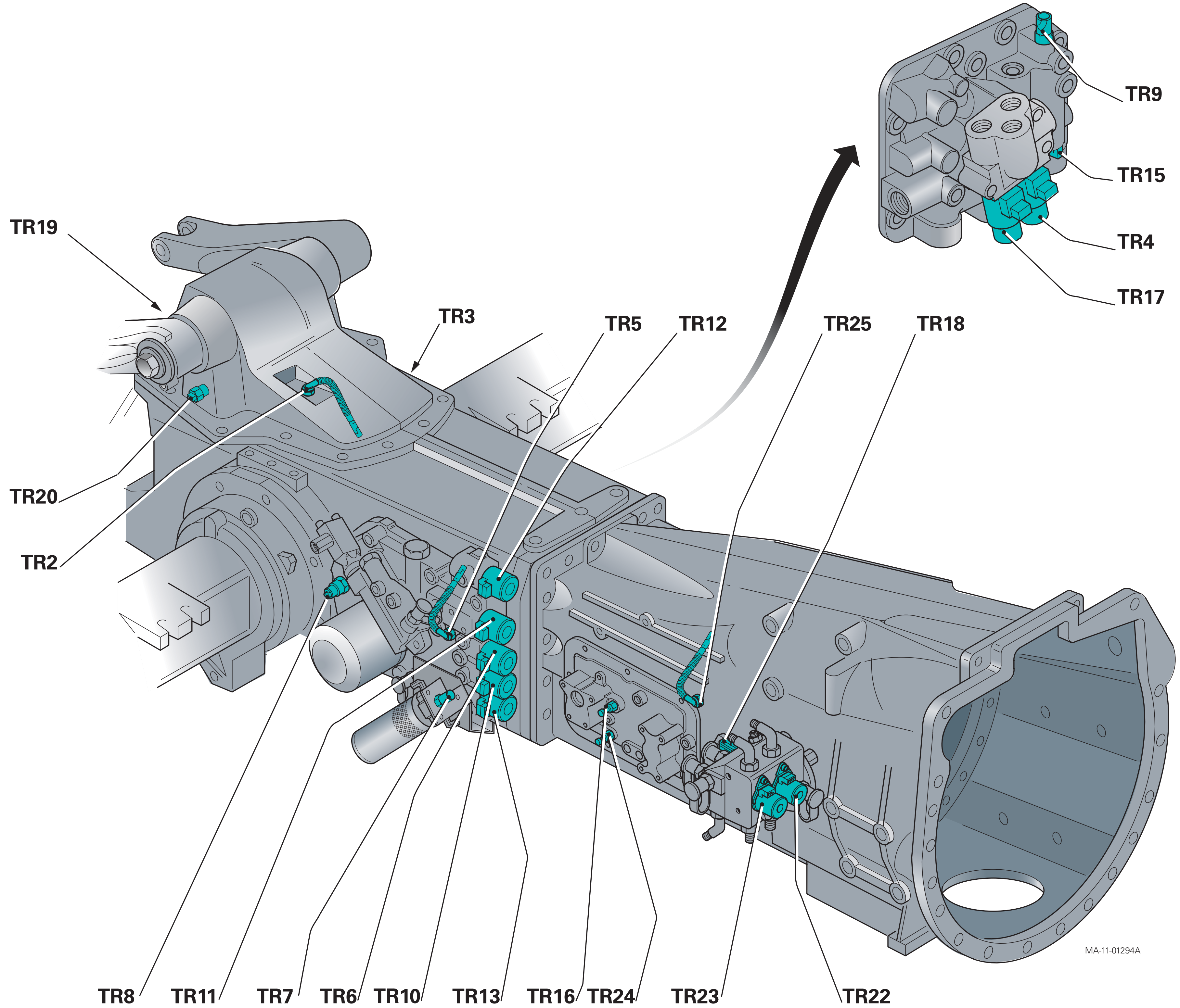
TR9
TR15
TR4
TR17
TR19
TR3
TR5
TR12
TR25
TR18
TR20
TR2
TR8
TR11
TR7
TR6
TR10
TR13
TR16
TR24
TR23
TR22
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11C10- ELECTRONIC LINKAGE - Description

CONTENTS

A . Description

The 5400 series tractors are equipped with an Electronic Linkage Control system that is composed of the following components (Fig. 1):

Control console (1)

It is located on the right-hand side panel inside the cab, it comprises:
- three potentiometers
- a push button
- four indicator lights

Electronic calculator (EHRB) (2)

It is fitted inside the right-hand side panel in the cab beneath the hydraulic spoolvalves control levers.

The calculator records the signals sent from the different console (1) and mouse (7) controls and compares them with the signals transmitted by the sensors. If the two signals have different values, the calculator sends its own signals to the solenoids of the lift control valve. This permits the raising or lowering of the lifting arms until the values displayed on the console and mouse equal those of the sensors.

When the tractor is working, corrections are constantly carried out, permitting an optimal work quality.

NOTE: *The EHRB calculator is not connected to CAN bus and consequently it is not possible to reprogram, enter parameters and test with Wintest this calculator.*

Safety

In order to avoid the electronic system remaining active when the engine is stopped, a safety system is installed.

When the ignition switch (10) is turned on, the calculator receives 12 volts from the switch. This lights the two indicator lights "I" and "J" .

"J" lights up for 0.5 seconds.

"I" remains lit until an "engine running" signal is received from the D+ terminal of the alternator (11) and the Lift/Neutral/Lowering switch (5) is moved to lift position and then to Neutral position.

IMPORTANT: *turn knob "B" to 1 to position control.*

Position sensor (3)

The position sensor is fitted to the rear of the tractor on the lifting arm support. It contacts with a cam fixed on the lifting arm shaft.

The sensor records the angular position of the linkage arm and sends the information to the electronic linkage calculator.

Height / depth adjustment potentiometer (4)

It is located in the ELC mouse (7) on the cab right hand side panel.

Lift/Neutral/Lowering switch (5)

It is located at the front of the ELC mouse (7). It permits the selection of the Lift, Neutral and Lowering/Working functions.

Draft sensor (6)

This sensor is fitted in the bracket of the top link. It measures the force acting on the top link and converts it into electric signals. These signals are then transmitted to the ELC calculator.

Electronic Linkage Control valve with proportional electric control (8)

The valve is mounted on the left-hand side hydraulic cover.

Its function is to regulate the oil flow to lift or lower the lifting arms according to the signals sent by the calculator to the two solenoid valves. The ELC valve is fitted to the high pressure (high flow) hydraulic circuit.

External control switches (9)

There are four switches fixed on the rear of the fenders.

Their aim is to simplify the hitching of certain equipment allowing the operator to control the height of the implement.

These switches can be used if the control console is activated and the Lift/Neutral/Lowering switch (5) is in the `neutral' or `lowering' position.

For safety reasons, the linkage controls in the cab are automatically locked when the external switches are used.

To control again the linkage from the in cab controls, it is necessary to move the switch (5) to the Lift position.

All these various components are linked together by a cluster of electrical harnesses (see chapter 11).

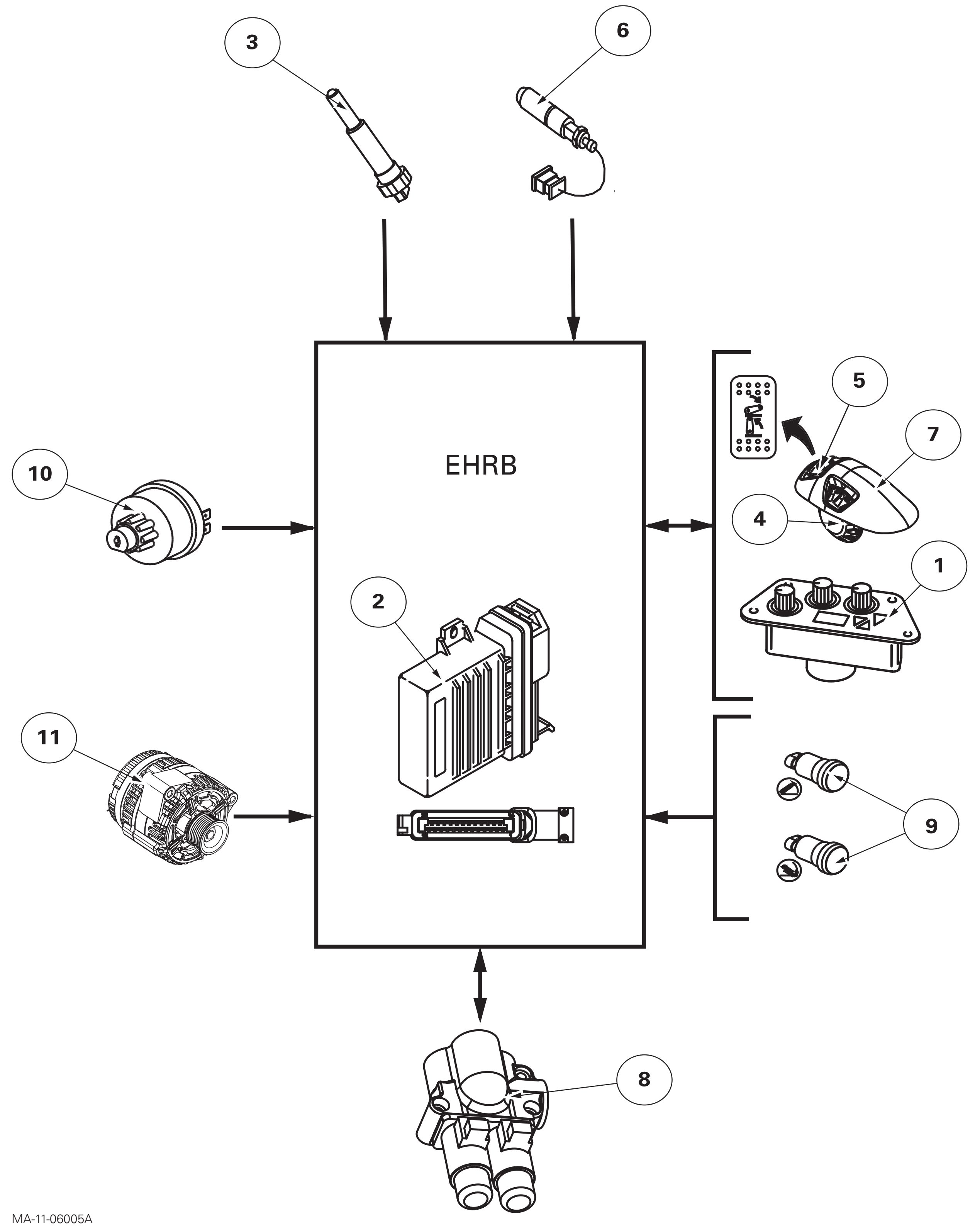

Fig. 1

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B . Console

List of controls

(A) Height / depth adjustment potentiometer
(B) Function selector potentiometer (Draft, Intermix, Position)
(C) Maximum high position adjustment potentiometer
(D) Lowering speed adjustment potentiometer : manual and locked position
(E) Lift/Neutral/Lowering switch
(F) Active Transport Control switch (ATC = shock absorber)
(G) Lift indicator light
(H) Lowering indicator light
(I) Console status and error code indicator light:
- remaining lit = console locked
- flashing = self-diagnostic of error on the system

(J) Active Transport Control indicator light

Fig. 2

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Description of controls

A. Height / depth adjustment potentiometer

The potentiometer "A" must be used to adjust the depth (or height) of the implement after a selection has been made on function selector "B".

In position control, the potentiometer travel is maximum.

The maximum high position is slightly higher when using the external controls instead of potentiometer "A".

A floating position can be obtained by positioning potentiometer "A" on position 9. In this case, the Lowering indicator lamp remains lit.

B. Function selector potentiometer (Draft / Intermix / Position)

This potentiometer must be adjusted in relation to the work being carried out:

- Position control: used with transported implements
- Draft control: used with soil penetrating implements (rarely 100% control).
- Intermix: used with soil penetrating implements, in order to control the maximum force while keeping a regular depth (most commonly used position for ploughing, subsoiling, etc.).

C. Maximum high position adjustment potentiometer

This potentiometer is used to adjust the maximum height of the lifting arm.

When the switch "E" is toggled to the Lift position, the lifting arm raises until it reaches the adjustment value selected on the high position potentiometer "C".

D. Lowering speed adjustment potentiometer

This potentiometer is used to adjust the Lowering speed of the implement according to its weight and when switch "E" is in the Working position.

The potentiometer functions in the following two modes:

- Locked position: when the potentiometer is in the maximum anti-clockwise position, the lowering of the linkage is impossible (transport safety function).
- Manual speed position (red and yellow sectors): when the potentiometer is in these sectors, the operator adjusts the lowering speed in relation to the weight of the implement.

E. Lift/Neutral/Lowering switch

This switch allows work to be carried out in the following modes:

- Lift position: the implement raises until it attains the maximum position as selected by potentiometer "C".
- Neutral position: the implement is locked in its position. This position must not be used for the work.
- Lower/Working position: the implement lowers until it reaches the position selected by the depth potentiometer "A" and the function selector potentiometer "B".

NOTE: *On starting or after having used the external controls, the switch "E" must be toggled to the Lifting position in order to activate the system.*

F. Active Transport Control switch (ATC)

To activate the ATC shock absorber system, the switch must be pressed once when switch "E" is in the Lift position. In this case, each time that switch "E" is placed in the Lifting position, the ELC sends current to the coils of the lift control valve in order to keep the implement stable, whatever the speed of the tractor.

The system is automatically disengaged when switch "E" is in the Neutral or Working position.

The indicator lamp "J" is lit whenever the system is in the active Transport position.

To deactivate this function, place the lifting arms in the Lift position and press the button "F" once.

G -H. Lift and lowering indicator lights

The indicator lights are lit at the same time as the solenoid valves receive the current and indicate the correct functioning of the system.

Their status changes continually when the linkage is used in Draft control.

I . Console status and error code indicator light

J . Active Transport Control indicator light

C . Electronic calculator EHRB connector pin allocation

The calculator includes a 25 pin connector of which the input/output signals are described below.

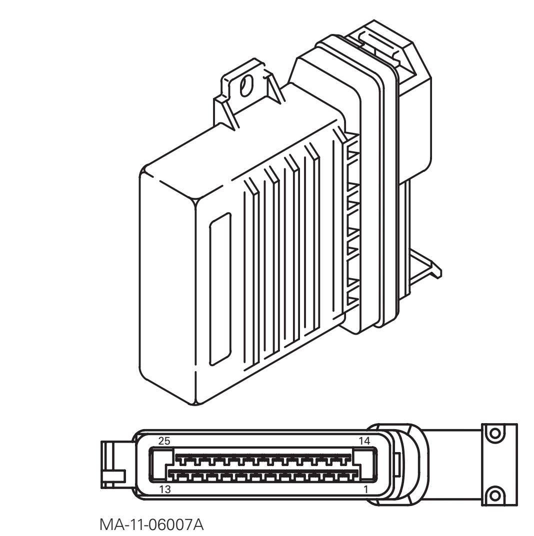


Fig. 3

Pin	Description		Signal
1	Ground (-)		
2	TR4 CAB2	Lift solenoid valve and indicator	PWM current output
3	CAB2 CAB4 CAB5	Console potentiometers Height / depth adjustment potentiometer Lift/Neutral/Lowering switch	1.6 V minimum reference voltage output
4	CAB2	Function selector potentiometer (Draft / Intermix / Position)	Analog input (between 1.6 V & 9.5 V)
5	46	Alternator D+ 12 V terminal	Digital input
6	TR4 TR17	Lift and lowering solenoid valves	Return current (3.6 A max.)
7	Not used		
8	CAB5	Lift/Neutral/Lowering switch	Analog input
9	CAB2	Console status and error code indicator light	Digital output (12 V)
10	CDX3 CDX6	Lift external control switches	Digital input (9.5 V)
11	CAB2	Active Transport Control indicator light	Digital output (12 V)
12	CAB2 CAB4 CAB5 CDX2 CDX3 CDX5 CDX6	Console potentiometers Height / depth adjustment potentiometer Lift/Neutral/Lowering switch Lift and lowering external control switches	9.5 V reference voltage output
13	TR19 TR20	Draft sensor Position sensor	9.5 V reference voltage output
14	TR17 CAB2	Lowering solenoid valve and indicator	PWM current output

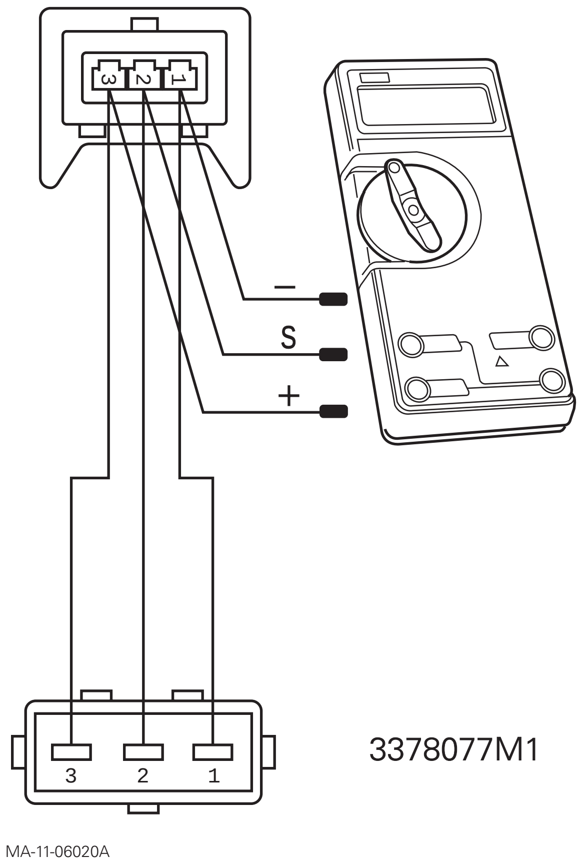
Pin	Description		Signal
15	TR19 TR20	Draft sensor Position sensor	Reference ground (-) output
16	CAB4	Height / depth adjustment potentiometer	Analog input (between 1.6 V & 9.5 V)
17	TR19	Draft sensor	Analog input (between 2.5 V & 7.5 V)
18	Not used		
19	TR20	Position sensor	Analog input (between 2.5 V & 7.5 V)
20	CDX2 CDX5	Lowering external control switches	Digital input (9.5 V)
21	CAB2	Active Transport Control switch	Digital input (9.5 V)
22	CAB2	Maximum high position adjustment potentiometer	Analog input (between 1.6 V & 9.5 V)
23	Not used		
24	CAB2	Lowering speed adjustment potentiometer	Analog input (between 1.6 V & 9.5 V)
25	+12 V ignition on supply		

11C12 - ELECTRONIC LINKAGE - Tests and diagnostics

CONTENTS

A . Electronic Linkage component testing and diagnostics

For testing the components it is necessary to use the MF 3005 digital multimeter and for some of them the service tool test harness 3378077M1 (Fig. 1).



1 Ground
2 Signal
3 Power supply 9.5 V

Fig. 1

CAB1: Electronic calculator EHRB

Power supply

1. Remove the right-hand side panel in the cab to get access to the calculator.
2. Disconnect the harness 25 pin connector from the calculator.
3. Switch ignition ON with engine OFF.
4. Set the MF 3005 multimeter to volts DC.
5. Multimeter positive probe to harness connector pin 25 and negative probe to connector pin1, a reading of battery voltage should be obtained, **12 VDC**.

   If there is no voltage, check:
   - ground connection,
   - battery voltage 12 VDC,
   - fuses F2 = 7.5 A and F3 = 10 A in the fuse box (CAB35),
   - all electrical connections in the circuit.

Alternator D+ 12V terminal safety signal

6. With the harness 25 pin connector still disconnected, start the engine.
7. Multimeter positive probe to harness connector pin 5 and negative probe to connector pin1, a reading of battery voltage should be obtained, **12 VDC**.

   If there is no voltage check:
   - ground connection,
   - alternator D+ terminal,
   - fuse F18 = 7.5 A in the fuse box (CAB35),
   - all electrical connections in the circuit.

CAB2: Control console and CAB4: Height/depth adjustment potentiometer

There is no test equipment available to test the control console and the heig/depth potentiometer. It is recommended that the initial diagnostic is carried out by replacing the console and the potentiometer with others units of correct condition.

If the problem still exists, check for open circuit on the harness lines between the console connector and the calculator connector, and, between the potentiometer connector and the calculator connector (see section 11C13 for the pin out of these components).

CAB5 : Lift/Neutral/Lowering switch

1. Disconnect the switch.
2. With the MF 3005 multimeter set to «bleep», check the circuit between:
   - pin 2 and pin 3 of the switch: with Lowering position selected, a «bleep» should be obtained,
   - pin 1 and pin 2 of the switch: with Lift position selected, a «bleep» should be obtained.

   If the problem still exists with a correct switch, check for open circuit on the harness lines between the switch connector and the calculator connector (see section 11C13 for the pin out of these components).

CDX2, CDX3, CDX5 and CDX6: Lift and Lowering external control switches

1. The harness 25 pin connector must be disconnected, the engine OFF and the ignition OFF.
2. With the MF 3005 multimeter set to «bleep», check the circuit between pin 12 on the 25 pin connector and pin 10.

   Press the Lift external control switches in turn: a «bleep» should be obtained with each switch.
3. With the MF 3005 multimeter set to «bleep», check the circuit between pin 12 on the 25 pin connector and pin 20.

   Press the Lowering external control switches in turn: a «bleep» should be obtained with each switch.

TR4 and TR17: Lift and Lower solenoid valve coils

The testing of the solenoid coils is a simple ohm test across the winding of as follows:

1. Disconnect the harness connector from the coil.
2. Set the MF 3005 multimeter to ohms.
3. Connect the multimeter to the coil pins.

   A reading of approximatly **1.6 ohms** should be obtained

   If the coil proves faulty, replace the coil.

TR19: Draft sensor

Supply voltage

1. Connect:
   - the female connector of the test harness 3378077M1 to the sensor,
   - the male connector to the tractor harness.
2. Connect pin 1 (-) and pin 3 (+) wires to the MF 3005 multimeter set to volts DC.

   Ignition ON, engine OFF, the voltage reading should be **9.5 VDC**.

Checking voltage

3. Connect pin 2 (S) wire instead of pin 3 (+) wire on the multimeter.

   The checking voltage of the sensor is 50% of the supply voltage with no load on the top link (there is no adjustment possible). So the voltage reading should be **4.75 VDC**.

   Pushing the link the voltage decreases (min. value = **2.5 VDC**). Pulling the link, the voltage increases (max. value = **7.5 VDC**).

TR20: Position sensor

Supply voltage

1. Connect:
- the female connector of the test harness 3378077M1 to the sensor,
- the male connector to the tractor harness.

2. Connect pin 1 (-) and pin 3 (+) wires to the MF 3005 multimeter set to volts DC.

Ignition ON, engine OFF, the voltage reading should be **9.5 VDC**.

Setting voltage

3. Connect pin 2 (S) wire instead of pin 3 (+) wire on the multimeter.

4. Start the engine, reset the system and place the lift arms in the maximum raised position using the Lift/Neutral/Lowering switch.

In this position the setting voltage of the sensor is 75% of the supply voltage. So the voltage reading should be **7.13 VDC** (see section 11C14 for the adjustment of the position sensor).

11C13 - ELECTRONIC LINKAGE - Error codes

CONTENTS

A . Reading error codes

The ELC calculator EHRB is able to detect certain faults in the wiring harness or linkage components.

When a fault is identified:

- the self-diagnostic lamp on the linkage console flashes according to the error 

The first figure of the error code indicates the severity of the failure:

- 1 = serious
- 2 = medium
- 3 = minor

The second figure of the error code indicates the fault.

B . List of error codes

N°	Components concerned		Description
1 - 1	TR4	Lift solenoid valve	Open circuit or Solenoid valve disconnected
1 - 2	TR17	Lowering solenoid valve	Open circuit or Solenoid valve disconnected
1 - 3	TR4 TR17	Lift or Lowering solenoid valve	Short circuit
1 - 4	CDX3 CDX6	Lift external control switches	Short circuit or open circuit or switch disconnected
1 - 5	CDX2 CDX5	Lowering external control switches	Short circuit or open circuit or switch disconnected
1 - 6	CAB1	Electronic calculator EHRB power supply	Power supply <10 V or >15 V 9.5 V reference voltage not correct or ground (-) not correct
2 - 2	TR20	Position sensor	Short circuit or open circuit or sensor disconnected or out of adjustment range
2 - 3	CAB4 FAI73	Height/depth adjustment potentiometer ELC harness	Open circuit or potentiometer disconnected or ELC harness resistor R30 failed
2 - 4	CAB2	High position potentiometer	Open circuit
2 - 8	CAB5 FAI73	Lift/Neutral/Lowering switch ELC harness	Open circuit or switch disconnected or ELC harness resistors R10 or R20 or R40 or R50 failed
3 - 2	TR19	Draft sensor	Short circuit or open circuit or sensor disconnected or failed or overload on the sensor
3 - 4	CAB2	Lowering speed potentiometer	Open circuit
3 - 6	CAB2	Function selector potentiometer (Draft / Intermix / Position)	Open circuit

C . Analysing components and their error codes

CAB1 : Electronic calculator EHRB

Description

Location: inside the right-hand side panel in the cab.

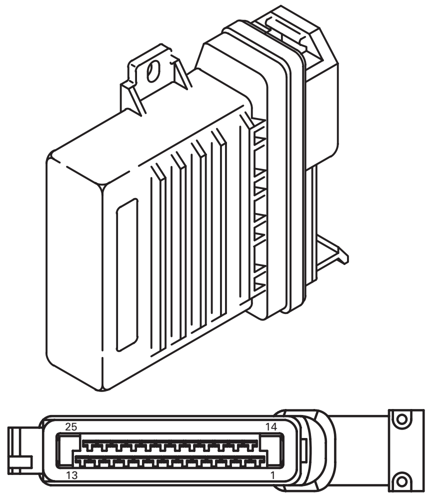


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Fig. 1

The calculator includes a 25 pin connector of which the input/output signals are described below.

Pin	Description		Signal
1	Ground (-)		
2	TR4 CAB2	Lift solenoid valve and indicator	PWM current output
3	CAB2 CAB4 CAB5	Console potentiometers Height / depth adjustment potentiometer Lift/Neutral/Lowering switch	1.6 V minimum reference voltage output
4	CAB2	Function selector potentiometer (Draft / Intermix / Position)	Analog input (between 1.6 V & 9.5 V)
5	46	Alternator D+ 12 V terminal	Digital input
6	TR4 TR17	Lift and lowering solenoid valves	Return current (3.6 A max.)
7	Not used		
8	CAB5	Lift/Neutral/Lowering switch	Analog input
9	CAB2	Console status and error code indicator light	Digital output (12 V)
10	CDX3 CDX6	Lift external control switches	Digital input (9.5 V)
11	CAB2	Active Transport Control indicator light	Digital output (12 V)
12	CAB2 CAB4 CAB5 CDX2 CDX3 CDX5 CDX6	Console potentiometers Height / depth adjustment potentiometer Lift/Neutral/Lowering switch Lift and lowering external control switches	9.5 V reference voltage output
13	TR19 TR20	Draft sensor Position sensor	9.5 V reference voltage output
14	TR17 CAB2	Lowering solenoid valve and indicator	PWM current output

Pin	Description		Signal
15	TR19 TR20	Draft sensor Position sensor	Reference ground (-) output
16	CAB4	Height / depth adjustment potentiometer	Analog input (between 1.6 V & 9.5 V)
17	TR19	Draft sensor	Analog input (between 2.5 V & 7.5 V)
18	Not used		
19	TR20	Position sensor	Analog input (between 2.5 V & 7.5 V)
20	CDX2 CDX5	Lowering external control switches	Digital input (9.5 V)
21	CAB2	Active Transport Control switch	Digital input (9.5 V)
22	CAB2	Maximum high position adjustment potentiometer	Analog input (between 1.6 V & 9.5 V)
23	Not used		
24	CAB2	Lowering speed adjustment potentiometer	Analog input (between 1.6 V & 9.5 V)
25	+12 V ignition on supply		

Possible error codes

Error	Components concerned	Description	System reaction	Action
1 - 6	Electronic calculator EHRB power supply	Power supply <10 V or >15 V 9.5 V reference voltage not correct or ground (-) not correct	Cuts power to lift control valve solenoids No lift arm movements authorised	Stop the engine. Correct the fault. Restart the engine. Reset the system

CAB2 : Console potentiometers:

- High position potentiometer
- Lowering speed potentiometer
- Function selector potentiometer (Draft / Intermix / Position)

Description

Location: on the right-hand side panel inside the cab

Pin	Description
1	Function selector potentiometer (Draft / Intermix / Position) signal output (between 1.6 V & 9.5 V)
2	9.5 V reference voltage input
3	1.6 v minimum reference voltage input
4	Lowering speed potentiometer signal output (between 1.6 V & 9.5 V)
5	High position potentiometer signal output (between 1.6 V & 9.5 V)
6	Console status and error code indicator light 12 V input
7	Not used
8	Active Transport Control indicator light 12 V input
9	Active Transport Control switch signal output (9.5 V)
10	Lift solenoid valve indicator light 12 V input
11	Lower solenoid valve indicator light 12 V input
12	Ground (-)
13	Not used
14	Not used
15	Not used
16	Not used

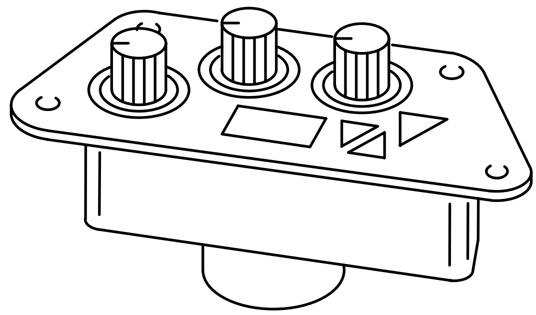

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Fig. 2

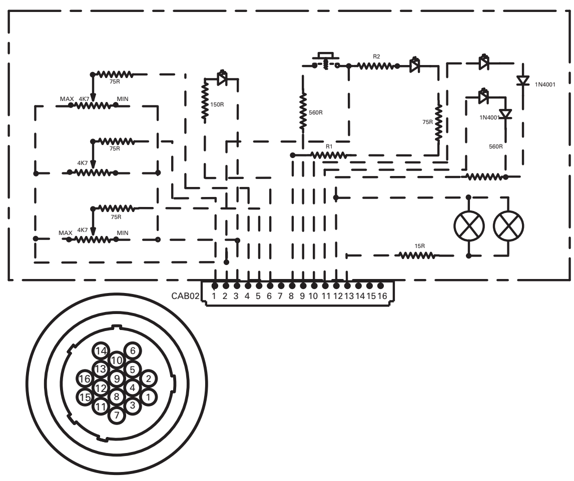

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Fig. 3

Possible error codes

Error	Components concerned	Description	System reaction	Action
2 - 4	High position potentiometer	Open circuit	ELC console locked	Correct the fault Reset the system
3 - 4	Lowering speed potentiometer	Open circuit	ELC operates but diagnostics lamp flashes	Correct the fault Reset the system
3 - 6	Function selector potentiometer (Draft / Intermix / Position)	Open circuit	ELC operates but diagnostics lamp flashes	Correct the fault Reset the system

CAB4 : Height/depth adjustment potentiometer

Description

Location: in the ELC mouse on the right-hand side panel in the cab.

- Pin 1 : 9.5 V reference voltage input
- Pin 2 : Signal output (between 1.6 V & 9.5 V)
- Pin 3 : 1.6 V reference voltage input

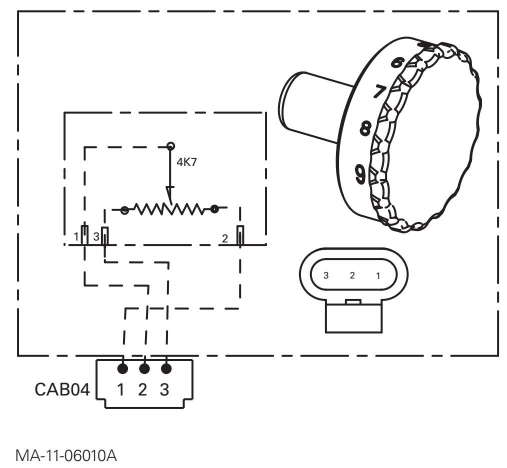


Fig. 4

FAI73: ELC harness

Description

Location: inside the right-hand side panel in the cab.

- Resistor R30 on signal line between pin 2 of height/depth adjustment potentiometer and pin 16 of calculator EHRB

Possible error code

Error	Components concerned	Description	System reaction	Action
2 - 3	Height/depth adjustment potentiometer ELC harness	Open circuit or potentiometer disconnected or ELC harness resistor R30 failed	ELC console locked	Correct the fault Reset the system

CAB5 : Lift/Neutral/Lowering switch

Description

Location: at the front of the ELC mouse on the right-hand side panel in the cab.

- Pin 1 : 1.6 V reference voltage input
- Pin 2 : Signal output (between 1.6 V & 9.5 V)
- Pin 3 : 9.5 V reference voltage input

FAI73: ELC harness

Description

Location: inside the right-hand side panel in the cab.

- Resistor R40 on 1.6 V reference voltage line between pin 1 of Lift/Neutral/Lowering switch and pin 3 of calculator EHRB
- Resistor R10 on 9.5 V reference voltage line between pin 3 of Lift/Neutral/Lowering switch and pin 12 of calculator EHRB
- Resistors R20 and R50 on signal line between pin 2 of Lift/Neutral/Lowering switch and pin 8 of calculator EHRB

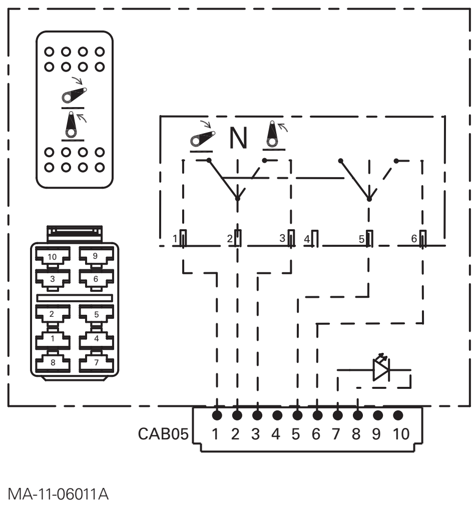


Fig. 5

Possible error code

Error	Components concerned	Description	System reaction	Action
2 - 8	Lift/Neutral/Lowering switch ELC harness	Open circuit or switch disconnected or ELC harness resistors R10 or R20 or R40 or R50 failed	ELC console locked	Correct the fault Reset the system

CDX2 and CDX5 : Lowering external control switches

Description

Location: at the rear of the fenders.

- Pin 1 : Signal output (9.5 V)
- Pin 2 : 9.5 V reference voltage input
- Pin 3 : Not used

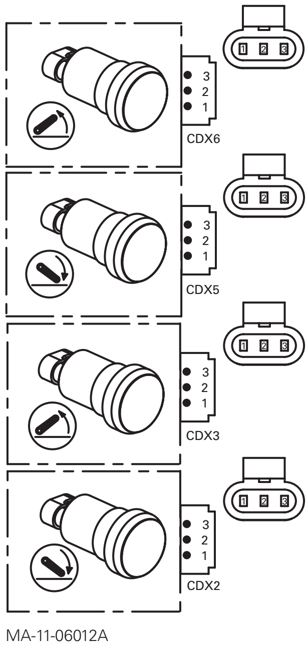


Fig. 6

Possible error code

Error	Components concerned	Description	System reaction	Action
1 - 5	Lowering external control switches	Short circuit or open circuit or switch disconnected	Cuts power to lift control valve solenoids No lift arm movements authorised	Stop the engine. Correct the fault. Restart the engine. Reset the system

CDX3 and CDX6 : Lift external control switches

Description

Location: at the rear of the fenders.

- Pin 1 : Signal output (9.5 V)
- Pin 2 : 9.5 V reference voltage input
- Pin 3 : Not used

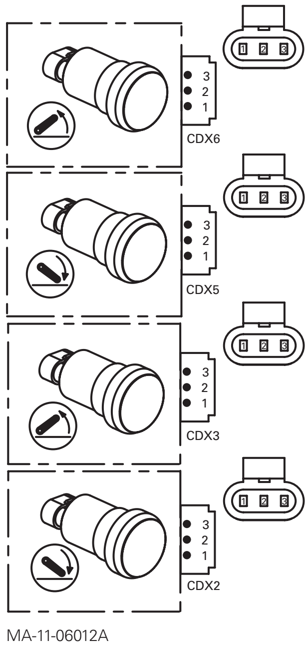


Fig. 7

Possible error code

Error	Components concerned	Description	System reaction	Action
1 - 4	Lift external control switches	Short circuit or open circuit or switch disconnected	Cuts power to lift control valve solenoids No lift arm movements authorised	Stop the engine. Correct the fault. Restart the engine. Reset the system

TR4 : Lift solenoid valve

Description

Location: in the ELC valve mounted on the left-hand side hydraulic cover.

- Pin 1 : PWM current input
- Pin 2 : Return current output (3.6 A max.)

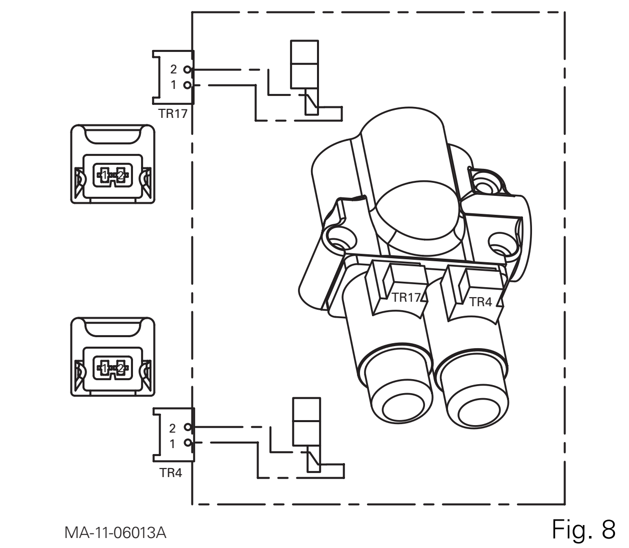


Fig. 8

Possible error codes

Error	Components concerned	Description	System reaction	Action
1 - 1	Lift solenoid valve	Open circuit or solenoid valve disconnected	Cuts power to lift control valve solenoids No lift arm movements authorised	Stop the engine. Correct the fault. Restart the engine. Reset the system
1 - 3		Short circuit		

TR17 : Lower solenoid valve

Description

Location: in the ELC valve mounted on the left-hand side hydraulic cover.

- Pin 1 : PWM current input
- Pin 2 : Return current output (3.6 A max.)

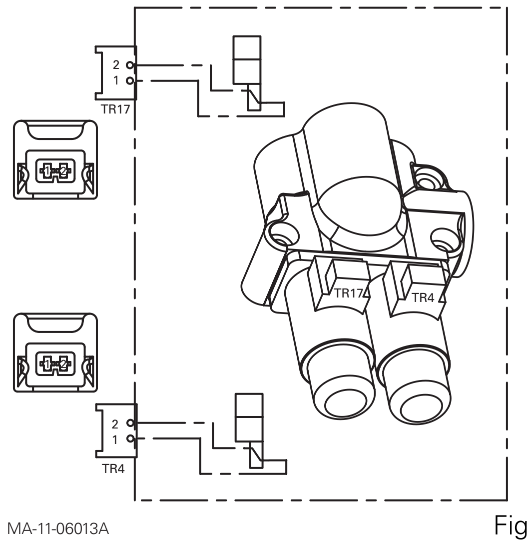


Fig. 9

Possible error codes

Error	Components concerned	Description	System reaction	Action
1 - 2	Lower solenoid valve	Open circuit or solenoid valve disconnected	Cuts power to lift control valve solenoids No lift arm movements authorised	Stop the engine. Correct the fault. Restart the engine. Reset the system
1 - 3		Short circuit		

TR19 : Draft sensor

Description

Location: in the bracket of the top link

- Pin 1 : Reference ground (-) input
- Pin 2 : Signal output (between 2.5 V & 7.5 V)
- Pin 3 : 9.5 V reference voltage input

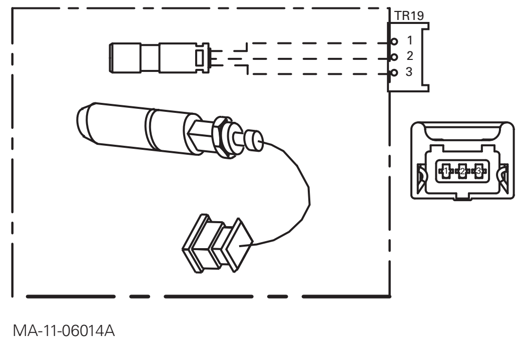


Fig. 10

Possible error code

Error	Components concerned	Description	System reaction	Action
3 - 2	Draft sensor	Short circuit or open circuit or sensor disconnected or failed	Cuts power to lift control valve solenoids No lift arm movements authorised	Stop the engine. Correct the fault. Restart the engine. Reset the system
		Overload on the sensor	ELC operates but diagnostics lamp flashes	Correct the fault Reset the system

NOTE: *The error code dedicated to the draft sensor is included in the minor failure category but depending on the reason of the error the system can reacts as for a serious failure.*

TR20 : Position sensor

Description

Location: to the rear of the tractor on the lifting arm support.

- Pin 1 : Reference ground (-) input
- Pin 2 : Signal output (between 2.5 V & 7.5 V)
- Pin 3 : 9.5 V reference voltage input

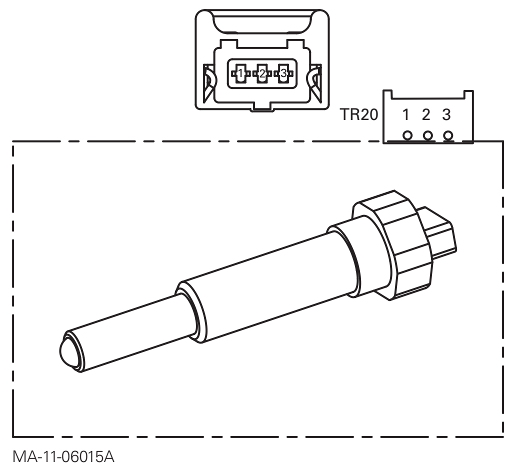


Fig. 11

Possible error code

Error	Components concerned	Description	System reaction	Action
2 - 2	Position sensor	Short circuit or open circuit or sensor disconnected or out of adjustment range	ELC console locked	Repair fault Reset ELC

11C14 - ELECTRONIC LINKAGE - Adjustment

CONTENTS

A . Adjusting the position sensor

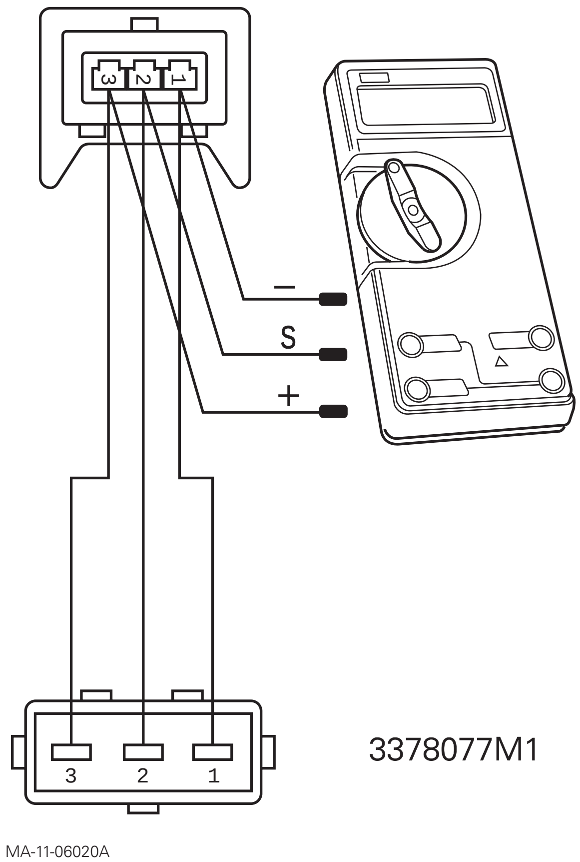
For the adjustment of the position sensor it is necessary to use the MF 3005 digital multimeter and the service tool test harness 3378077M1 (Fig. 1).

1. Start the engine
2. Using the external controls, place the lift arms in the maximum raised position.
3. ***CAUTION : For safety reasons, stop the engine while keeping the ignition on.***
4. Screw the sensor in completely on the cam.
5. Connect:
- the female connector of the test harness 3378077M1 to the sensor,
- the male connector to the tractor harness.

6. Connect pin 1 (-) and pin 2 (S) wires to the MF 3005 multimeter set to volts DC
The voltage reading should be **7.20 VDC**. If not screw or unscrew the sensor to obtain the correct voltage and tighten the sensor lock nut to 25 Nm using a suitable spanner.
7. Start the engine. Reset the system.
Check the operation of the sensor using the Lift/Neutral/Lowering switch:
- Lift arms fully lowered
  The voltage reading should be **2.3 to 2.5 VDC** corresponding to 25% of the sensor power supply voltage.
- Lift arms fully raised
  The voltage reading should be **7.10 to 7.15 VDC** corresponding to 75% of the sensor power supply voltage.

8. Stop the engine.
Reconnect the tractor harness to the sensor.

NOTE: *A wrong adjustment of the position sensor, voltage over 7.24 VDC, will create the error code 22 flashing.*



1 Ground
2 Signal
3 Sensor power supply 9.5 V

Fig. 1

11C15 - ELECTRONIC LINKAGE - Electrical diagrams

CONTENTS

A . General

Description

The harnesses fitted on the tractor allow data to be exchanged and power to be supplied to the electrical and electronic systems.

The tractor is fitted with 3 different types of power supply:

- +12V Battery (Permanent)
- +12V APC (Ignition key ON)
- +12V ACC (Accessories)

Most harnesses have a maximum of six different wire colours:

- Black: Ground
- Brown: +12V Permanent
- Red: +12V APC and Accessories
- White: Information
- Yellow: CAN High
- Green: CAN Low

  The CAN network wires (yellow and green) are twisted together.

- Components with only one connector are identified by the connector name:

  CAB16: Clutch pedal progressivity sensor (Fig. 1).
- Harnesses performing the same functions have the same colour on the diagram (Fig. 1):
  - FAI90: Cab Power Shuttle option harness (pink)
  - FAI102: Platform Power Shuttle option harness (pink)
- All wires can be identified by the pins of the outgoing and incoming connectors of the harness:

  CAB11.2/CAB18.1: The wire connects pin 2 of the CAB11 connector to pin 1 of the CAB18 connector
- The pin reference for each connector is indicated on the harness side
- The wire colour is indicated: CAB11.2/CAB18.1 B, the wire is white

  List of colours:
  - N: Black
  - M: Brown
  - R: Red
  - B: White
  - J: Yellow
  - V: Green
- The splices inside the harnesses are indicated by a dot and the letter S (S1).

In general, the components or connectors are named in order to indicate the corresponding elements of the tractor:

CA## Automatic air conditioning

CAB## Cab

ENG## Engine

LIG## Lighting

R## Roof

TR## Transmission and linkage

CDX# External controls

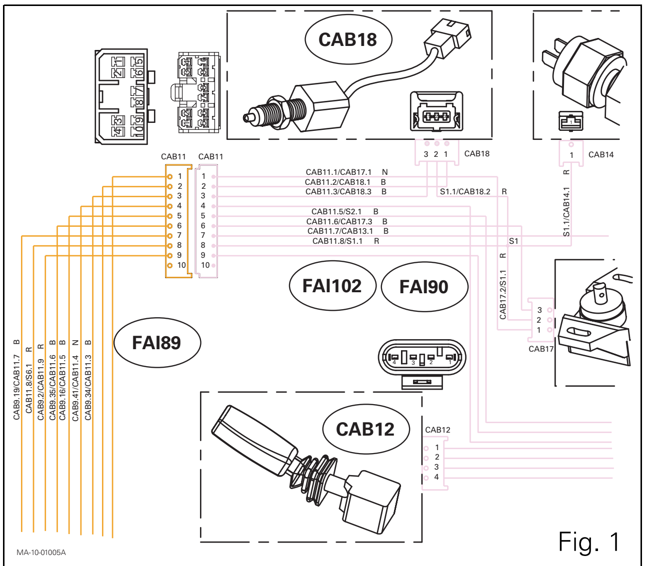


Fig. 1

Layout

1 or 2 Deutsch connectors (31-way) are connected on the front wall of the cab (according to model) Fig. 2.

All these connectors belong to the engine harness. ENG2 is dedicated to information relating to the electronic injection (only present on the relevant models).

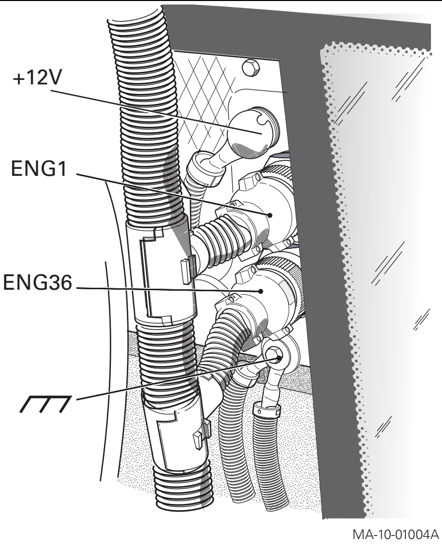


Fig. 2

The fuses of the electrical or electronic board (Fig. 3) are indicated by a grey mark on their locations on the fuse box (CAB35).

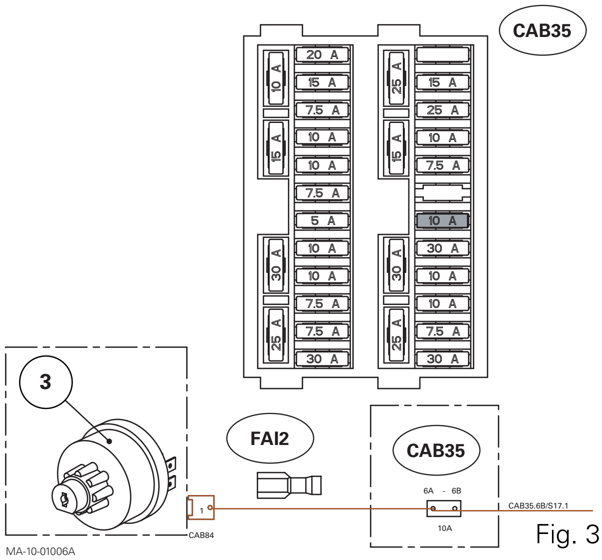


Fig. 3

B . Electrical diagrams

Harness parts list

FAI 73 Linkage harness
FAI 74 Cab console harness.
FAI 81 Perkins EEM engine harness
FAI 84 Cab dashboard harness
FAI 86 Platform dashboard harness
FAI 87 GBA20 transmission - 57 l/min hydraulics harness
FAI 89 Autotronic 5 adaptation harness
FAI 96 External control switch harness
FAI 108 External control switch adaptation harness
FAI 113 External control switch extension harness

Component parts list

CAB1 Electronic calculator EHRB
CAB2 Control console
CAB4 Height/depth adjustment potentiometer
CAB5 Lift / Neutral / Lowering linkage selector switch
CAB9 Autotronic 5
CAB35 Fuse box
CDX2 Lowering external control switch
CDX3 Lift external control switch
CDX5 Lowering external control switch
CDX6 Lift external control switch
TR4 Lift solenoid valve
TR17 Lowering solenoid valve
TR19 Draft sensor
TR20 Position sensor

3 Ignition switch
46 Alternator

Colour reminder

N: Black
M: Brown
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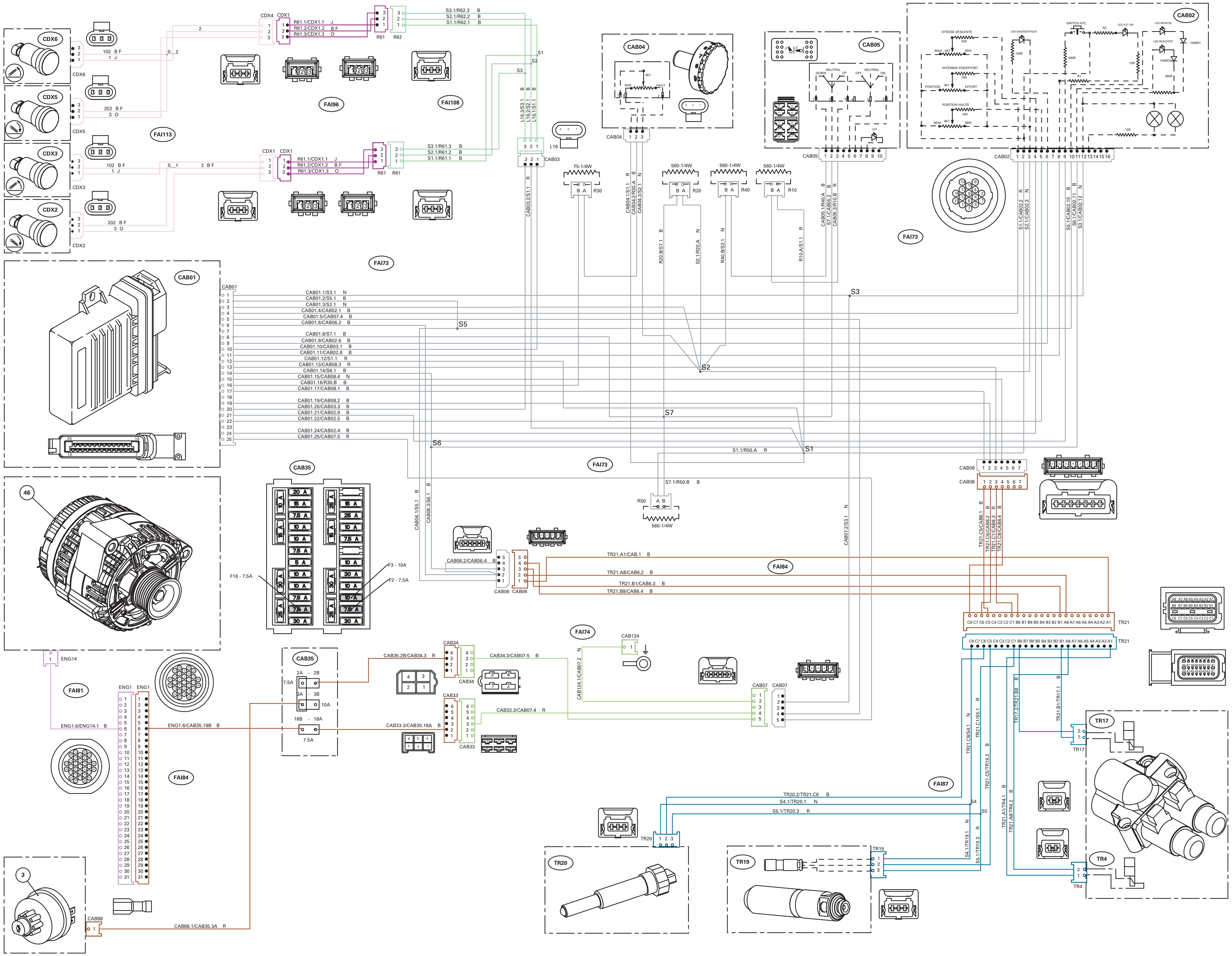
Electronic linkage on cab tractors with mechanical reverse shuttle



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Harness parts list

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FAI 74 Cab console harness.
FAI 81 Perkins EEM engine harness
FAI 84 Cab dashboard harness
FAI 86 Platform dashboard harness
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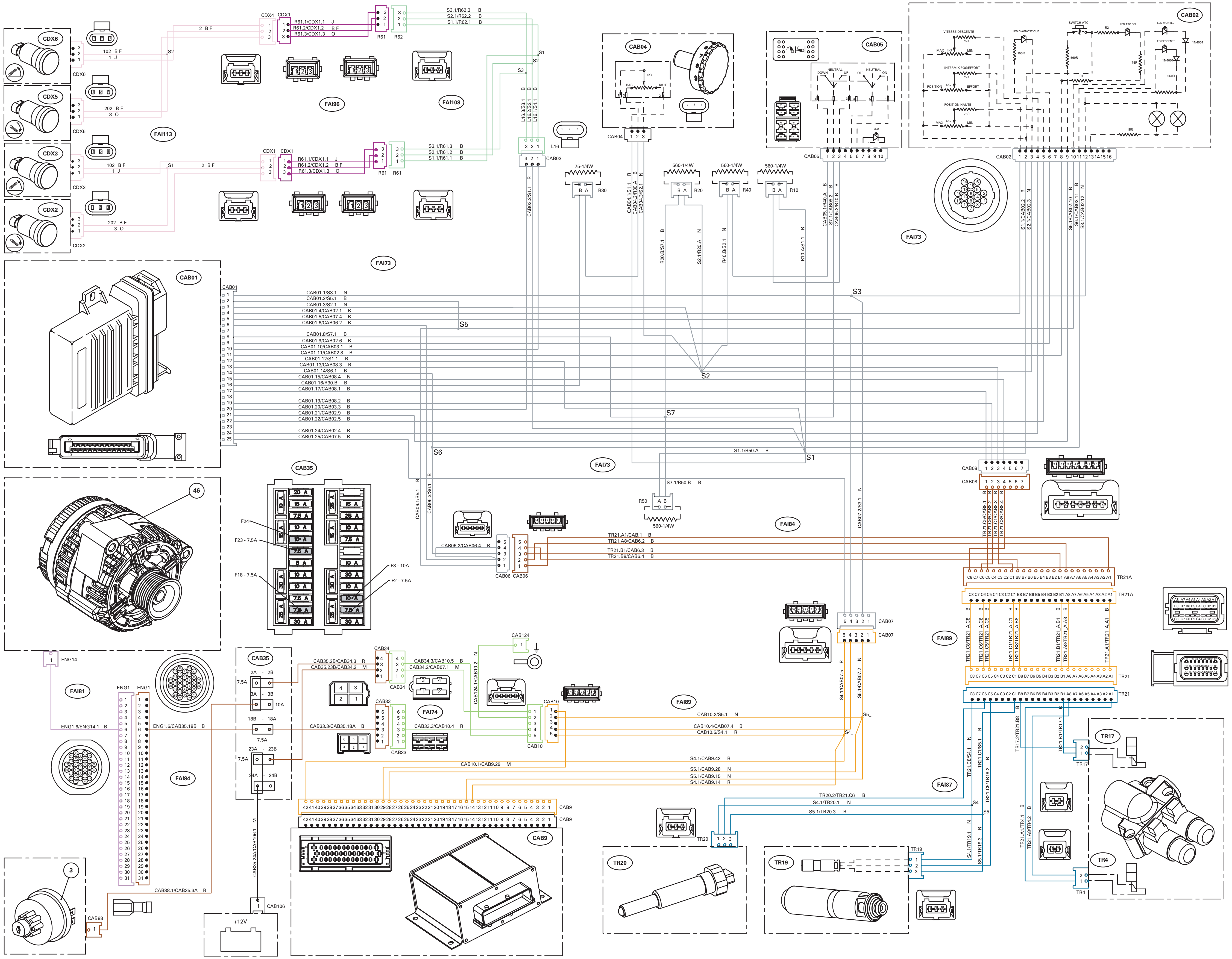
Electronic linkage on cab tractors with PowerShuttle



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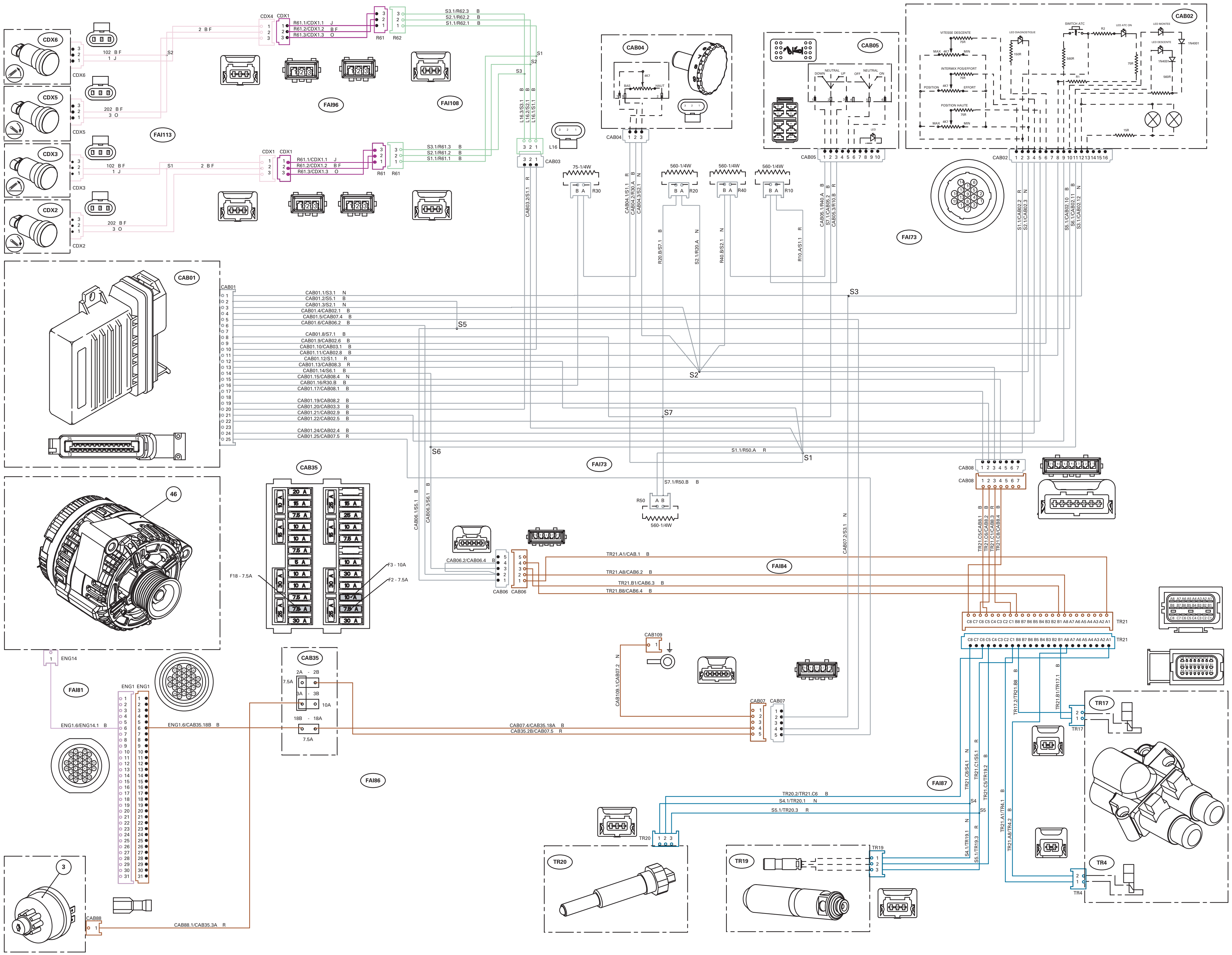
Electronic linkage on platform tractors with mechanical reverse shuttle



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Harness parts list

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FAI 74 Cab console harness.
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FAI 84 Cab dashboard harness
FAI 86 Platform dashboard harness
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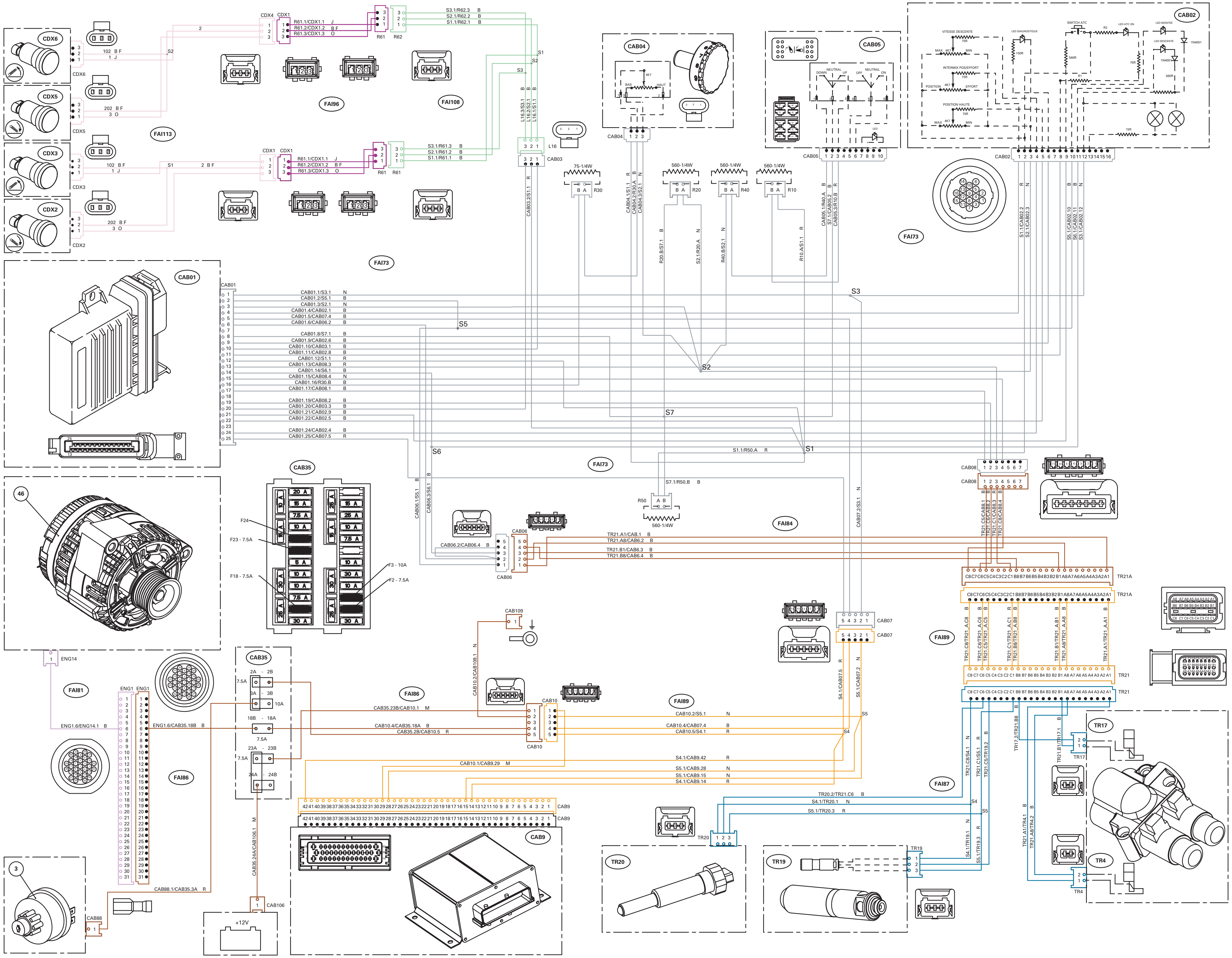
Electronic linkage on platform tractors with PowerShuttle



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