Section G

Brakes

Service Manual - Backhoe Loader

Publication No.

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Contents **Page No.**

Contents **Page No.**

Technical Data

Service Brakes

Hydraulic servo assisted service brakes in rear axle only, operated from separate pedals.

Table 1. Service Brakes

Type	JCB Oil-immersed multi-plate disc.
Actuation	Hydraulic - vacuum servo assisted.
Location	Housed inside the rear axle centre casing (2 brake packs).
Friction Plates (5 per brake pack)	
Outside Diameter	220 mm (7.992 in)
Inside Diameter	160 mm (6.299 in)
Facing Area per Plate	18603 mm^2 (28.8 in^2)
Piston Diameter	216 mm (8.5 in)

Note: *Because the service brakes are located in the rear axle, the procedures for dismantling and assembly are described in a separate publication, see* ***Transmissions Service Manual*** *(Publication No. 9803-8610) which includes procedures for the axle sub-assemblies.*

Table 2. Master Cylinder (Servo Assisted)

Type	Compensated master cylinder.
Number of Cylinders	2
Piston Diameter	22.22 mm (0.875 in)

Service Brakes - 3C Machines

Hydraulically operated service brakes in rear axle only, operated from separate pedals. Vacuum servo assistance via remotely mounted servo units may be fitted as an option.

Table 3. Service Brakes

Type	JCB Oil-immersed multi-plate disc.
Actuation	Hydraulic
Location	Housed inside the rear axle centre casing (2 brake packs).
Friction Plates (5 per brake pack)	
Outside Diameter	220 mm (7.992 in)
Inside Diameter	160 mm (6.299 in)
Facing Area per Plate	18603 mm^2 (28.8 in^2)
Piston Diameter	216 mm (8.5 in)

Note: *Because the service brakes are located in the rear axle, the procedures for dismantling and assembly are described in a separate publication, see* ***Transmissions Service Manual*** *(Publication No. 9803-8610) which includes procedures for the axle sub-assemblies.*

Table 4. Master Cylinder

Type	Compensated master cylinder.
Number of Cylinders	2
Piston Diameter	22.22 mm (0.875 in)

Table 5. Remote Servo Unit (Option)

Type	Vacuum operated.
Number of Units	2
Location	Mounted on rear chassis cross-member.
Brake Cut-in Pressure	4 bar (58 lb in^2)
Vacuum Cylinder	135.5 mm (5.33 in) diameter
Hydraulic Cylinder	19 mm (0.75 in) diameter

Park Brake

Independent cable operated parking brake in the drive to the rear wheels.

Table 6. Synchro Shuttle Machines

Type	Disc brake, manually adjusted calliper.
Actuation	Cable operated.
Location	Mounted on the rear axle drive head.
Disc Diameter	279.4 mm (11 in)

Table 7. Powershift Machines

Type	JCB Oil-immersed multi-plate disc.
Actuation	Cable operated.
Location	Housed inside the gearbox.
Friction Plates (5 per brake pack)	
Outside Diameter	TBA
Inside Diameter	TBA
Brake Pack Overall Thickness (1)	
New (Max.)	38.9 mm (1.531 in)
Service Limit (Min.)	37.1 mm (1.460 in)

(1) See Park Brake, Powershift Machines - Inspection.

Basic System Operation

Compensating Master Cylinder

Compensating master cylinders overcome the problem of unequal wear between the right and left brake. The units incorporate both master cylinder and compensating valve.

⇨ *Fig 1. (G-5)*. Each brake has its own master cylinder **A**, **A1**, brake pedals **B**, **B1**, servo units **N**, **N1** and associated pipework. Both master cylinders have one common reservoir **C**.

Note: *Dual pedal braking is applicable only to 2WS machines. 4WS machines have a single brake pedal.*

Pedals Locked - Normal Operation

When the brake pedals are pushed down (the brake pedals are mechanically locked together), rod **D** pushes the plunger **E** down the bore of the master cylinder. Pressurised oil acting on centre valve seal **F** via valve stem **G** causes the seal to close off the reservoir supply port. As the plunger continues to move down the bore, pressurised oil flows to the brake pack **H** via service port **J** and the associated pipework.

Master cylinder **A1** operates in the same way to feed brake pack **H1**.

With valve stem **G** at maximum travel, further movement of plunger **E** causes valve **K** to lift off its seat. Both master cylinders are interconnected via bridge pipe **M**, therefore hydraulic pressure in both cylinders will be equal.

If the brake packs **H** and **H1** have worn equally, then the amount of oil displacement between cylinders will be minimal and the brakes will be applied evenly.

Pedals Locked - Compensating Operation

When the brake pedals are pushed down (the brake pedals are mechanically locked together), actuation of the brake packs **H** and **H1** is as described in Pedals Locked - Normal Operation. If however, the brakes have not worn equally, then the amount of fluid displaced from each master cylinder will vary and some form of compensation is required.

Pedal application moves plungers **E** down the bores of master cylinders **A** and **A1**. Linings of brake **H** are brought into contact before the linings of brake **H1** because they have not worn as severely.

If further displacement took place at the linings, brake **H** would be applied before brake **H1**. Therefore master cylinder **A** begins to compensate for master cylinder **A1**.

Fluid is displaced from **A** to **A1** via bridge pipe **M** until the pressures are equalised. In this condition both compensating valves are open and both brakes are applied evenly.

Pedals Unlocked - Normal Operation

When a single brake pedal is pushed down, rod **D** pushes the plunger **E** down the bore of the master cylinder. Pressurised oil acting on centre valve seal **F** via valve stem **G** causes the seal to close off the reservoir supply port. As the plunger continues to move down the bore, pressurised oil flows to the brake pack **H** via service port **J** and associated pipework, thus braking one wheel only.

With valve stem **G** at maximum travel, further movement of plunger **E** causes valve **K** to lift off its seat. Fluid is displaced through drillings **P** from the active cylinder **A** via bridge pipe **M** to passive cylinder **A1**. Valve **K1** in the passive cylinder is held on its seat by the displaced pressurised fluid.

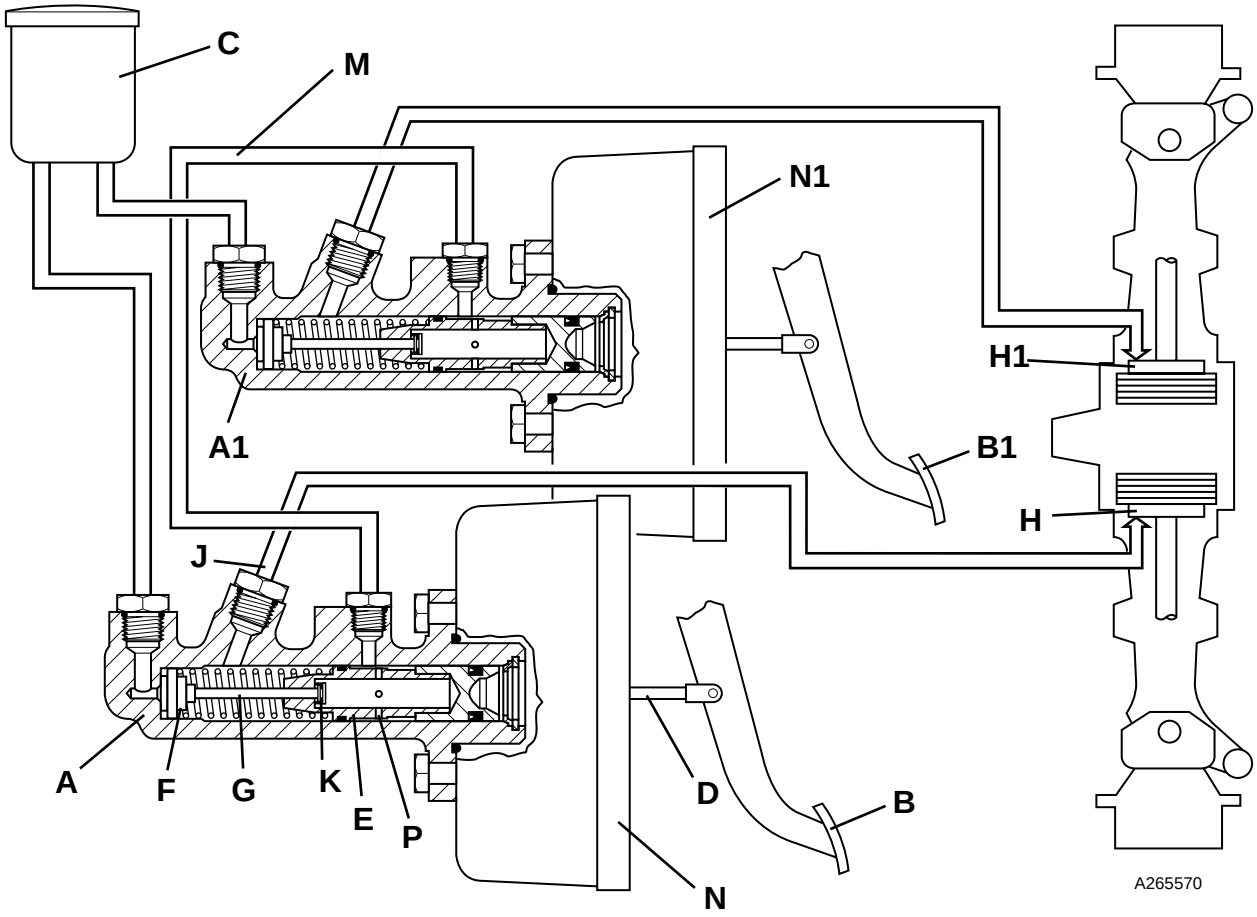


Fig 1. Schematic Diagram

2 and 4 Wheel Braking Modes

Although the machine only has brakes in the rear axle (2-wheel braking), 4-wheel braking is achieved by engaging 4-wheel drive. In this way all 4 wheels are effectively braked via the machine transmission.

4WD (and therefore brake mode) is controlled electrically by selector switches in the cab. There are 2 switch configurations dependant on machine variant as described below:

2 Wheel Steer Machines

The system is controlled by a rotary 3 position mode switch, ⇒ *Fig 2. (G-7)*.

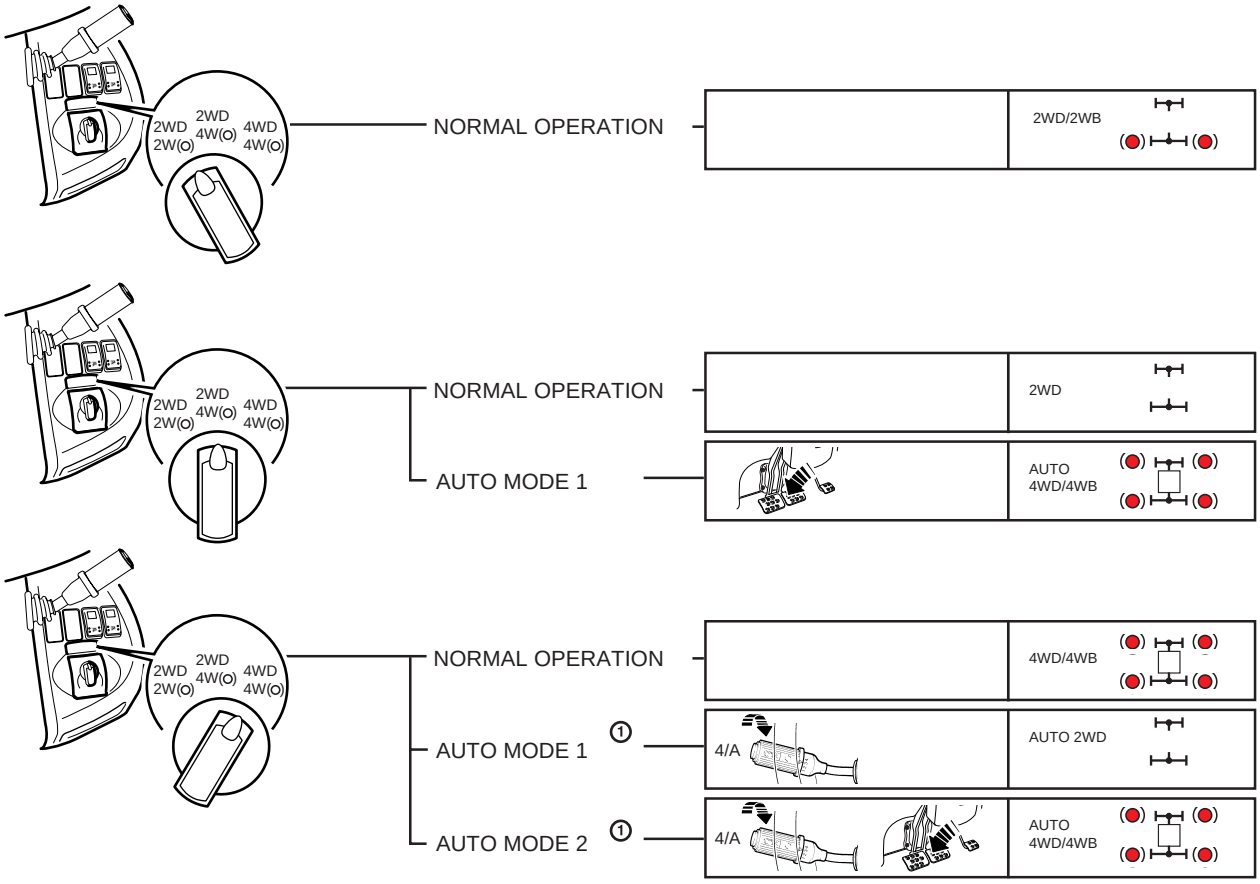
4 Wheel Steer Machines

The system is controlled by a 2 position switch, ⇒ *Fig 3. (G-8)*.

Auto 2 and 4 Wheel Braking

The 2 or 4WD setting is overridden automatically by application of the service brakes and, on Powershift Shiftmaster machines, selection of 4th or Auto gear.

For a full description of the 2 and 4 wheel braking electrical system, see ***Electrical Connections, 2 and 4 Wheel Braking Modes.***



① Powershift/Shiftmaster machines only

Fig 2. 2 Wheel Steer Machines (Not German Specification)

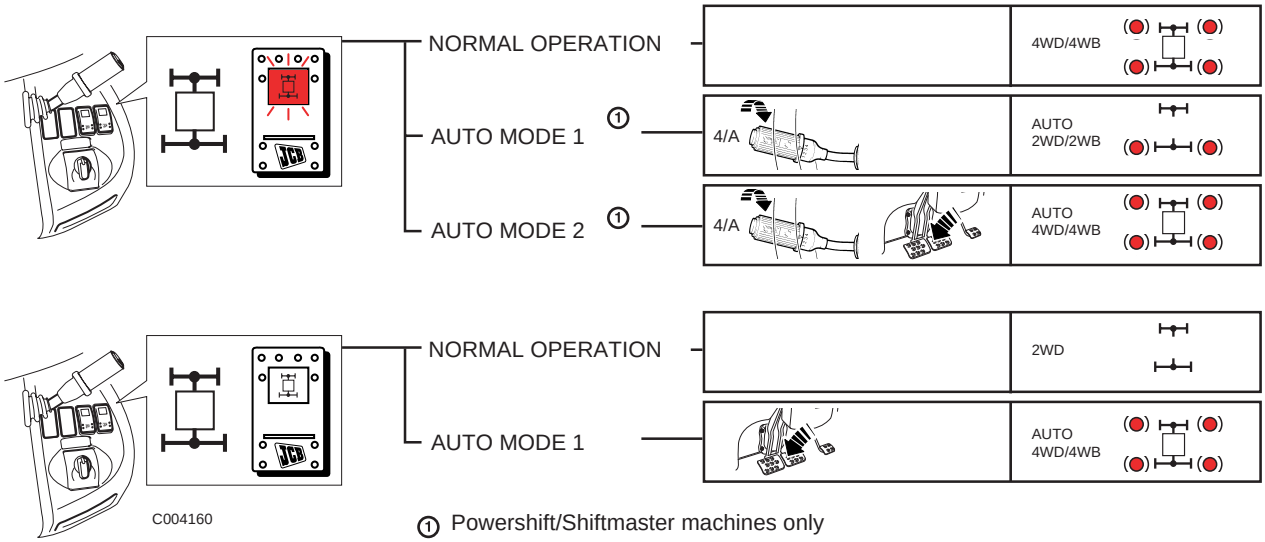


Fig 3. 4 Wheel Steer Machines (Not German Specification)

Electrical Connections

2 and 4 Wheel Braking Modes

Quick Reference

2 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

⇒ *Fig 4. (G-10)*. The illustration shows the electrical circuit schematic together with the actual location of the main electrical components on the machine. The information is intended as an aid when checking for faulty wires or connectors by means of continuity tests using a multimeter.

Circuit Schematics

The electrical circuit enables operation of the 4 wheel drive and 4 wheel brake in several different `modes'. Three of the modes are illustrated as follows:

1 **Switch FU set to 2WD and 4WB, service brakes applied:** In this condition 2WD is engaged. When the brake pedals are pressed 2WD is overridden and 4WD is engaged enabling 4 wheel braking.

2 **Switch FU set to 4WD and 4WB, 4th gear selected (Powershift only):** In this condition 4WD is engaged. Then when 4th gear is selected 4WD is overridden and 2WD is engaged.

3 **Switch FU set to 4WD and 4WB, 4th gear selected, service brakes applied (Powershift only):** In this condition 4WD is engaged. Then when 4th gear is selected 4WD is overridden and 2WD is engaged. When the brake pedals are pressed 2WD is overridden and 4WD is engaged, enabling 4 wheel braking.

Note that the wires coloured red show the electrical live feeds; wires coloured green show electrical earths.

For a description of all the various 2 and 4 wheel braking modes, see ***Basic System Operation, 2 and 4 Wheel Braking Modes.***

Component Key:

1	Brake light bulb
2	Brake light bulb
FH1	Auto 2WD relay
FH2	Auto 4WB relay
FJ	Territorial link (link wire and diodes)
FL	Column gear lever (Powershift, Shiftmaster only)
FM	Brake light switch
FU	Brake mode switch
GE	4WD solenoid

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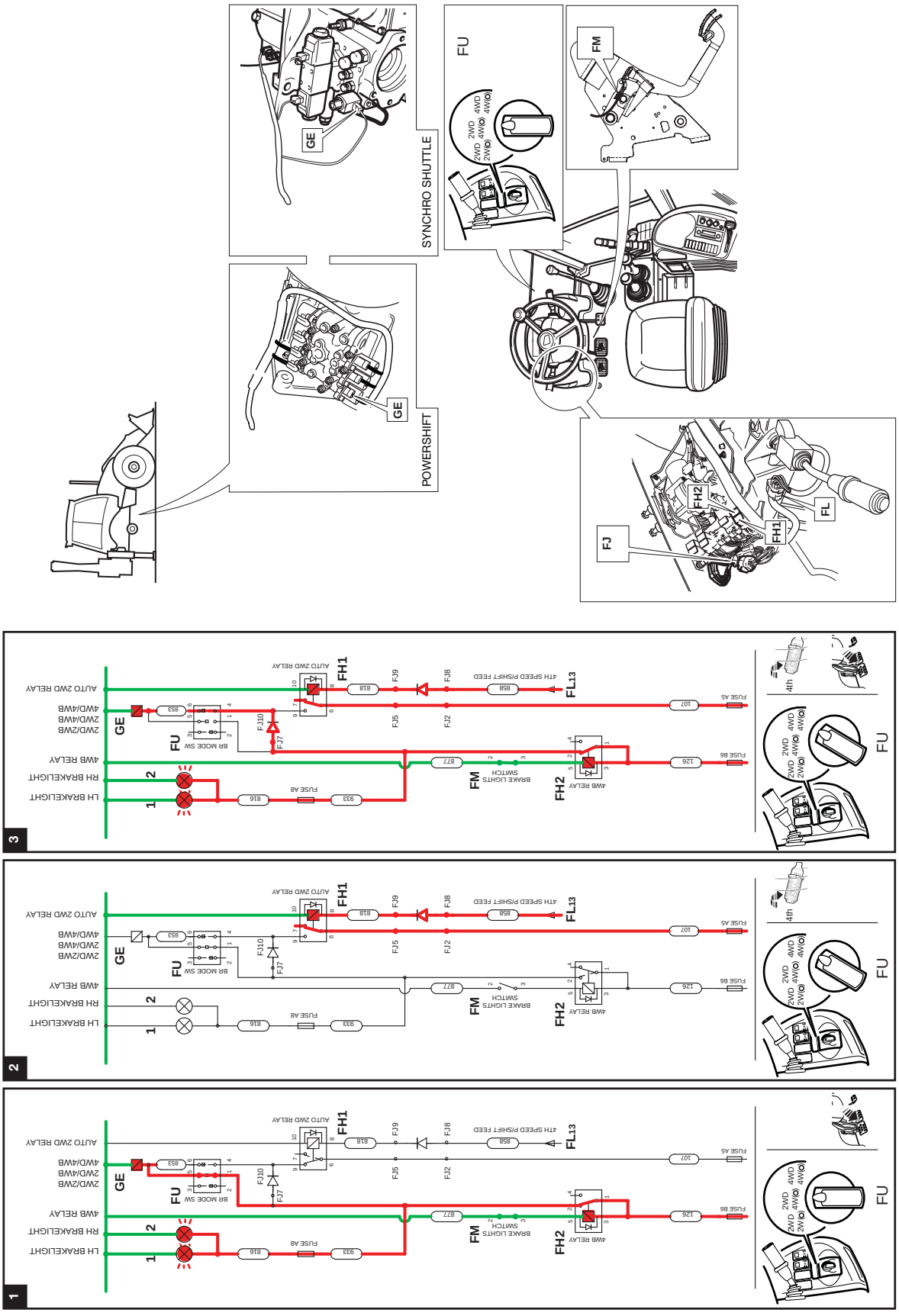

Fig 4. 2 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

4 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

⇒ *Fig 5. (G-12)*. The illustration shows the electrical circuit schematic together with the actual location of the main electrical components on the machine. The information is intended as an aid when checking for faulty wires or connectors by means of continuity tests using a multimeter.

Circuit Schematics

The electrical circuit enables operation of the 4 wheel drive and 4 wheel brake system in several different `modes'. Three of the modes are illustrated as follows:

1 **Switch FX set to 4WD:** In this condition 4WD is engaged, enabling 4 wheel braking. Switch **FX** is illuminated.

2 **Switch FX set to 2WD service brakes applied:** In this condition 2WD is engaged. When the brake pedals are pressed 2WD is overridden and 4WD is engaged, enabling 4 wheel braking. Note that the switch **FX** is illuminated when the brake pedals are pressed and 4WD is engaged.

3 **Switch FX set to 4WD, 4th gear selected (Powershift only):** In this condition 4WD is engaged. When 4th gear is selected 4WD is overridden and 2WD is engaged. Note that the switch **FX** is not illuminated when the when 4th gear is selected and 2WD is engaged.

Note that the wires coloured red show the electrical live feeds; wires coloured green show electrical earths.

For a description of all the various 2 and 4 wheel braking modes, see ***Basic System Operation, 2 and 4 Wheel Braking Modes***.

Component Key:

1 Brake light bulb

2 Brake light bulb

FH1 Auto 2WD relay

FH2 Auto 4WB relay

FJ Territorial link (link wire and diodes)

FL Column gear lever (Powershift, Shiftmaster only)

FM Brake light switch

FX 2 and 4WD selector switch

GE 4WD solenoid

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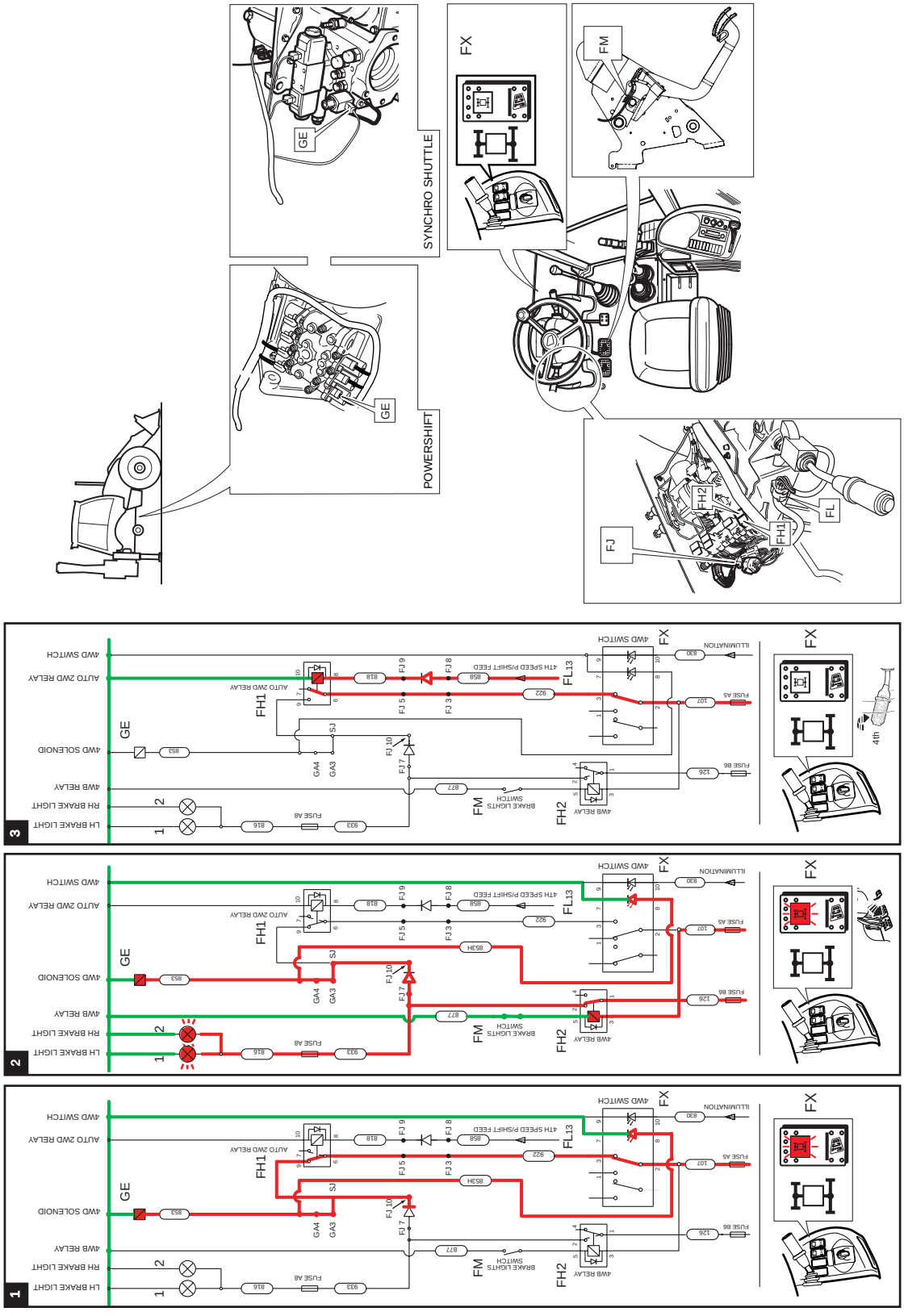

Fig 5. 4 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

2 and 4 Wheel Steer Machines, ShiftMaster

⇒ *Fig 6. (G-14)*. The illustration shows the electrical circuit schematic (one for 2 wheel steer and one for 4 wheel steer machines) together with the actual location of the main electrical components on the machine. The information is intended as an aid when checking for faulty wires or connectors by means of continuity tests using a multimeter.

It should be noted that the 4WD and 4WB system is controlled by the transmission electronic control unit (ECU). The ECU is sent electrical `inputs' from cab switches **FU** or **FX**, gear select switch **FL** and brake light switch **FM**. Depending on the combination of `inputs', the ECU determines if an `output' is sent to energise the 4WD solenoid.

Note: *When fault finding DO NOT use a multimeter on the ECU connector pins. Only test the associated wiring, uncouple connectors **GB** and **GC** and then use a multimeter at the pins inside these connectors as applicable. Use the ShiftMaster Diagnostics system to identify possible faults with the ECU. See **Section F, Transmission - Powershift Gearbox - 6 Speed, ShiftMaster Diagnostics - User Guide.***

Circuit Schematics - 2 Wheel Steer Machines

The electrical circuit enables operation of the 4 wheel drive and 4 wheel brake system in several different `modes'. The circuit schematic shows current flow for one of the modes as follows:

1 **Switch FU set to 2WD and 4WB, service brakes applied 2WD engaged:** When the brake pedals are pressed 2WD is overridden and 4WD is engaged, enabling 4 wheel braking.

Note that the wires coloured red show the electrical live feeds; wires coloured green show electrical earths.

Circuit Schematic - 4 Wheel Steer Machines

The electrical circuit enables operation of the 4 wheel drive and 4 wheel brake in several different `modes'. The circuit schematic shows current flow for one of the modes as follows:

1 **Switch FX set to 4WD, Auto gears selected 4WD engaged:** When `A' is selected 4WD is overridden and 2WD engaged, disabling 4 wheel braking.

Note that on 4 wheel steer machines, 2WB relay **FH1** is never energised. It is only used as an electrical `link' in some operating modes.

Note that the wires coloured red show the electrical live feeds; wires coloured green show electrical earths.

For a description of all the various 4 and 2 wheel braking modes, see ***Basic System Operation, 2 and 4 Wheel Braking Modes***.

Component Key:

1	Brake light bulb
2	Brake light bulb
C80	4WD solenoid (labelled K)
FH1	Auto 2WD relay
FH2	Auto 4WB relay
FL	Column gear lever
FM	Brake light switch
FU	Brake mode switch (2 wheel steer machines)
FX	2 and 4WD selector switch (4 wheel steer machines)
GA	Brake link pin
GB	ECU connector
GC	ECU connector

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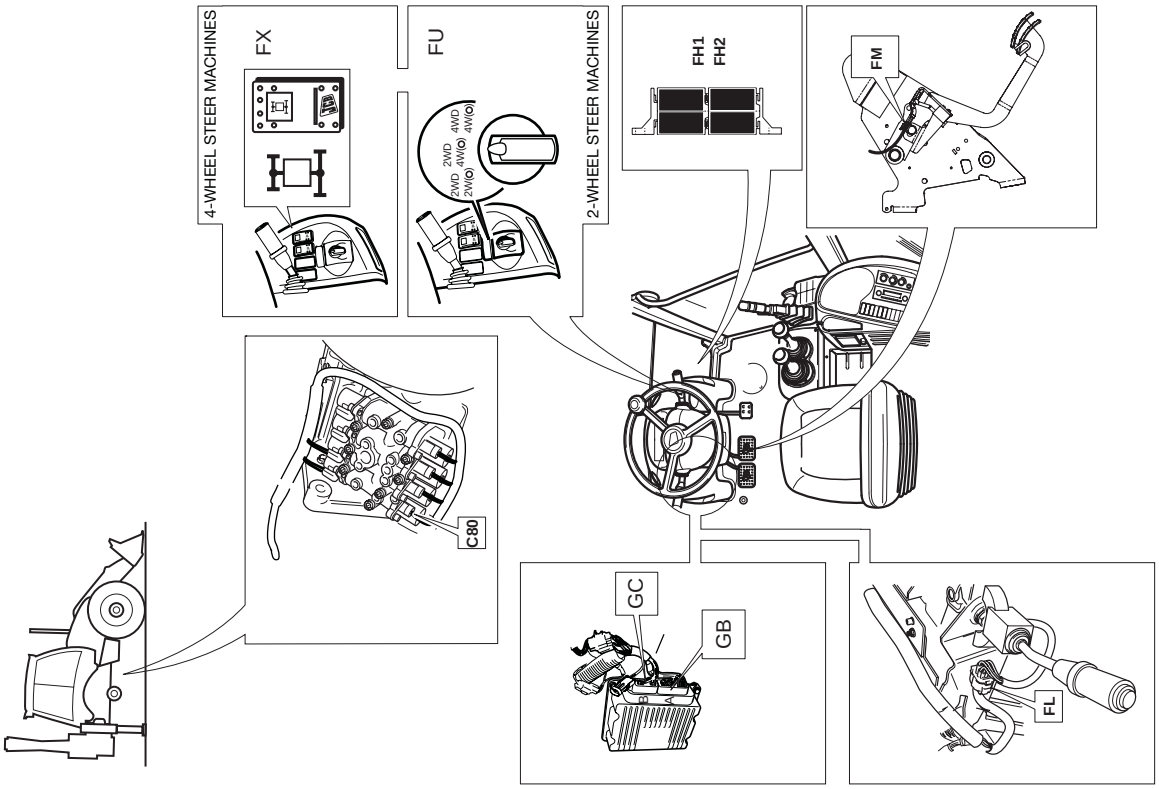

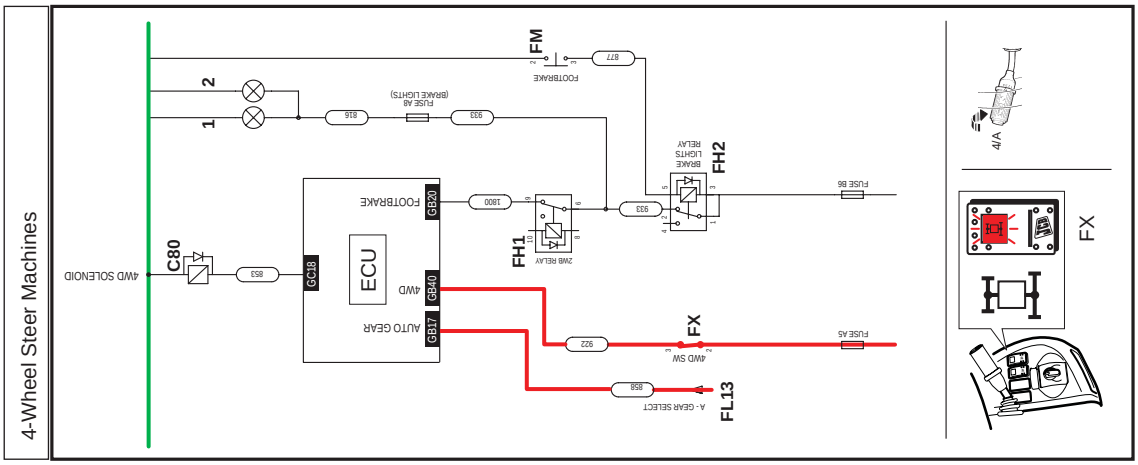

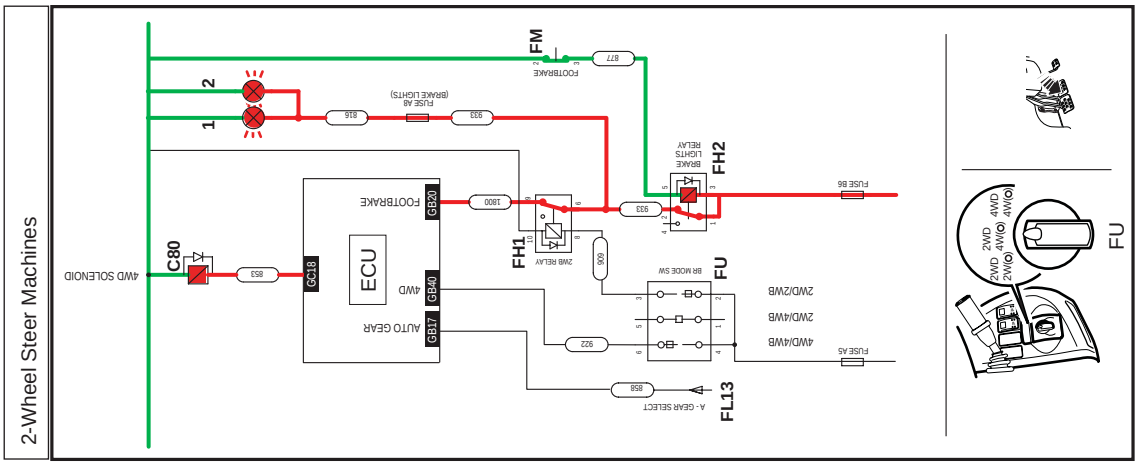

Fig 6. 2 and 4 Wheel Steer Machines, Shiftmaster

2 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

⇒ *Fig 7. (G-16)*. The illustration shows the electrical circuit schematic together with the actual location of the main electrical components on the machine. The information is intended as an aid when checking for faulty wires or connectors by means of continuity tests using a multimeter.

Circuit Schematics

Remember that on German specification machines the 2 and 4WD clutch selects 2WD when the solenoid **GE** is energised.

The electrical circuit enables operation of the 4 wheel drive and 4 wheel brake in several different `modes'. Three of the modes are illustrated as follows:

1 **Switch FU set to 2WD and 4WB:** In this condition 2WD is engaged. (When the brake pedals are pressed 2WD is overriddenand 4WD is engaged, enabling 4 wheel braking. (This mode is not shown in the schematic **1**)

2 **Switch FU set to 4WD and 4WB, 4th gear selected (Powershift only):** In this condition 4WD is selected. When 4th gear is selected 4WD is overridden and 2WD is engaged.

3 **Switch FU set to 4WD and 4WB, 4th gear selected, service brakes applied (Powershift only):** In this condition 4WD is selected. When 4th gear is selected 4WD is overridden and 2WD is engaged. When the brake pedals are pressed 2WD is overridden and 4WD is engaged, enabling 4 wheel braking.

Note that the wires coloured red show the electrical live feeds; wires coloured green show electrical earths.

Component Key:

1 Brake light bulb
2 Brake light bulb
FH1 Auto 2WD relay
FH2 Auto 4WB relay
FJ Territorial link (link wire and diodes)
FL Column gear lever
FM Brake light switch
FU Brake mode switch (2 wheel steer machines)
GE 4WD solenoid

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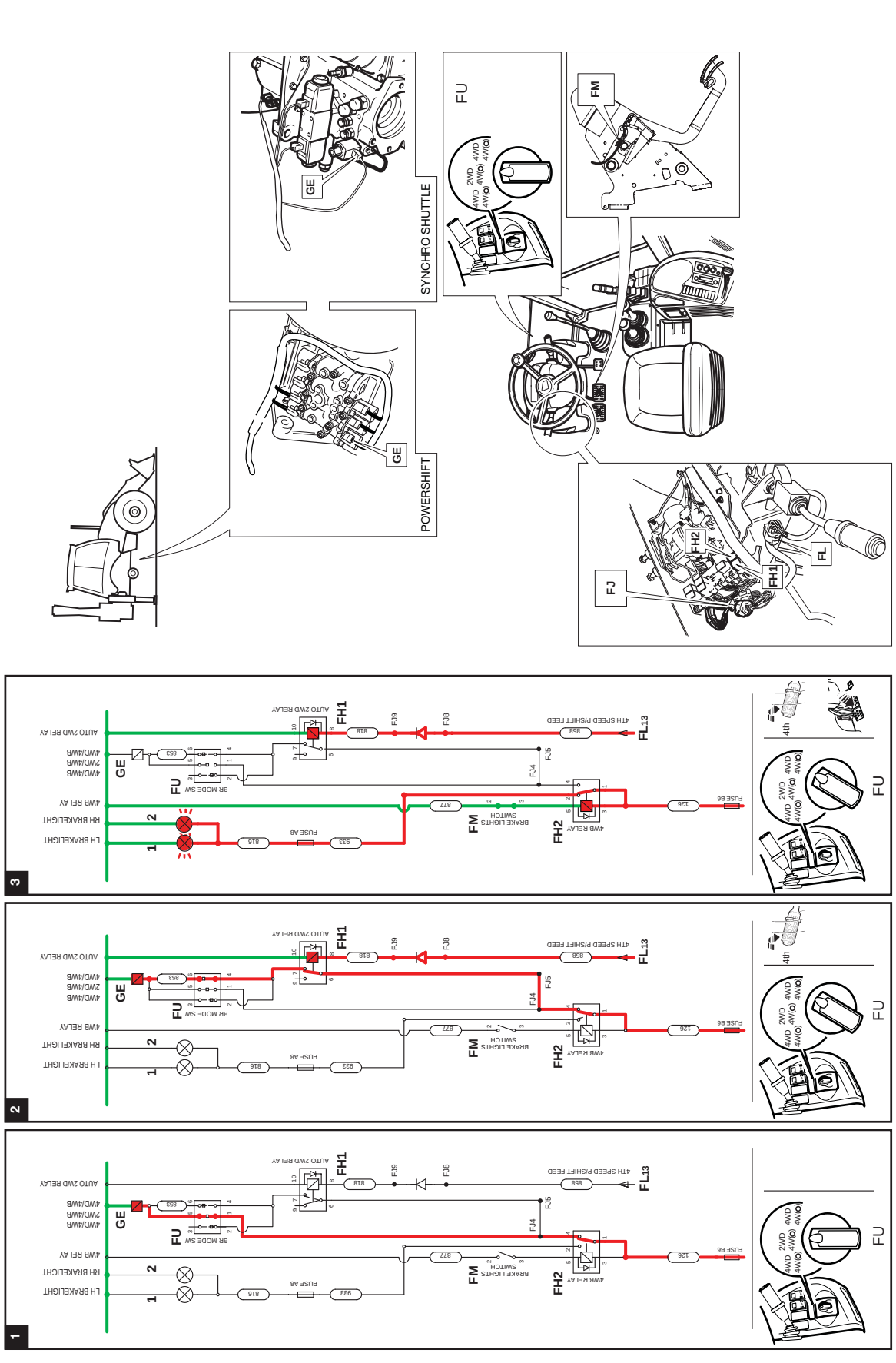

Fig 7. 2 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

4 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

⇨ *Fig 8. (G-18)*. The illustration shows the electrical circuit schematic together with the actual location of the main electrical components on the machine. The information is intended as an aid when checking for faulty wires or connectors by means of continuity tests using a multimeter.

Circuit Schematics

Remember that on German specification machines the 2 and 4WD clutch selects 2WD when the solenoid **GE** is energised.

The electrical circuit enables operation of the 4 wheel drive and 4 wheel brake system in several different `modes'. Three of the modes are illustrated as follows:

1 **Switch FX set to 4WD:** In this condition 4WD is engaged, enabling 4 wheel braking. Note that the switch **FX** is not illuminated when 4WD is selected.

2 **Switch FX set to 2WD service brakes applied:** In this condition 2WD is selected. When the brake pedals are pressed 2WD is overridden and 4WD is engaged, enabling 4 wheel braking. Note that the switch **FX** is not illuminated when the brake pedals are pressed and 4WD is engaged.

3 **Switch FX set to 4WD, 4th gear selected (Powershift only):** In this condition 4WD is engaged. When 4th gear is selected 4WD is overridden and 2WD is engaged and switch **FX** illuminates.

Note that the wires coloured red show the electrical live feeds; wires coloured green show electrical earths.

Component Key:

1 Brake light bulb
2 Brake light bulb
FH1 Auto 2WD relay
FH2 Auto 4WB relay
FJ Territorial link (link wire and diodes)
FL Column gear lever
FM Brake light switch
FX 2 and 4WD selector switch
GA Brake link
GE 4WD solenoid

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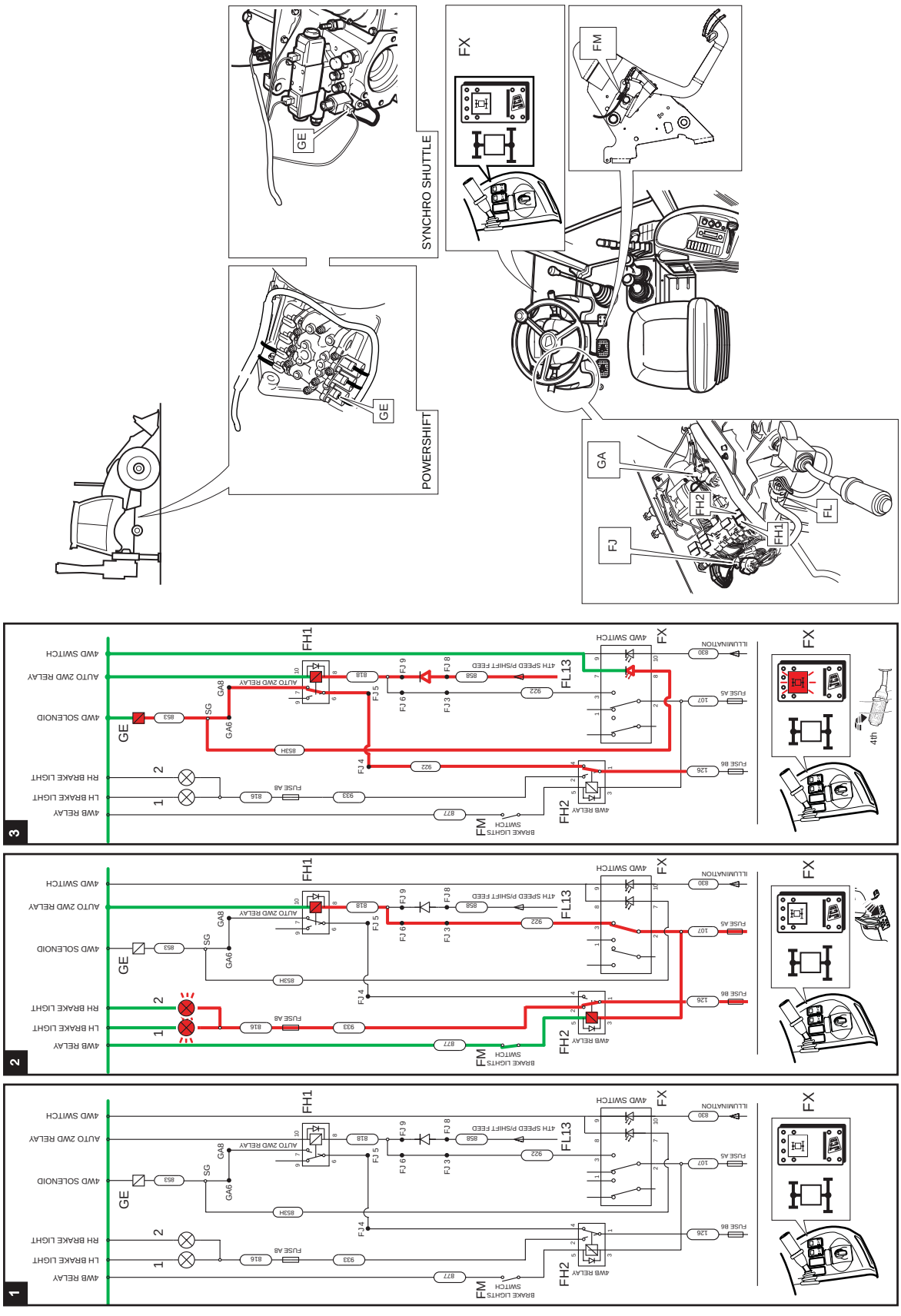


Fig 8. 4 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

Wires and Connectors

On the electrical diagrams the electrical connectors (example, FA to CB) are shown looking on the mating face of each connector when they are disconnected ⇨ *Fig 14. (G-28)*. The wire numbers and colours, where appropriate, are shown as an aid to identification whilst fault finding.

Before fault finding make sure that you understand how the the electrical circuits work. Most potential faults can be traced using a multimeter to carry out continuity checks on wires, switches and solenoid coils. Gearbox solenoid coils can be checked for the correct resistance value as given in ***Technical Data***. See ***Section C, Service Procedures***, for more details.

2 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

Components and connector locations ⇨ *Fig 9. (G-21)*.

Wires and connectors ⇨ *Fig 10. (G-22)*.

The circuit is shown with the selector switch **FU** set at position 2: the 2-wheel drive/all wheel braking position and with the service brake applied. When the brakes are applied, the brake light switch **FM** is actuated, energising relay **FH2**. This causes current to flow through the switch **FU**, and on to energise the transmission solenoid which engages 4-wheel drive.

Note: *The coloured wires apply only for the state described. When switch states are changed the live and earth paths will also change.*

Note: *The diagram does not show connections to the machine brake lamps.*

With the selector switch at position 1, current cannot flow to the solenoid, 2-wheel drive is selected with rear wheel braking only.

With the selector switch at position 3, 4-wheel drive and therefore 4-wheel braking is applied.

Earth Points

Faults may be caused by poor earth connections. Although earth connections are shown, it must be remembered that the cab assembly is earthed via further earth strap and cable connections. For details of these connections see ***Section C, Machine Earth Connections***.

Component Key

The following key identifies the component connectors.

h1	Harness - Front console
h2	Harness - Cab & Side console
h3	Harness - Powershift Gearbox
	Harness - Synchro Shuttle gearbox

Note: For harness drawings see Section C, Electrics.

Connectors (h1)

FA	h1 - h2
FB1	Earth point
FH1	Auto 2WD relay
FH2	Auto 4WB relay
FL	Column gear lever
FJ	Diode gate / link
FM	Brake lamps switch
FU	Brake mode switch
GA	Link

Connectors (h2)

CB	h2 - h1
CCA	Fuses
CCB	Fuses
DR3	Earth point
EW	h2 - h3

Connectors (h3)

GA	h3 - h2
GE	4WD solenoid

Splices (h1)

SA	**SS**
SF	**SV**
SG	**SZ**
SL	

Splices (h2)

TH

Splices (h3)

SA

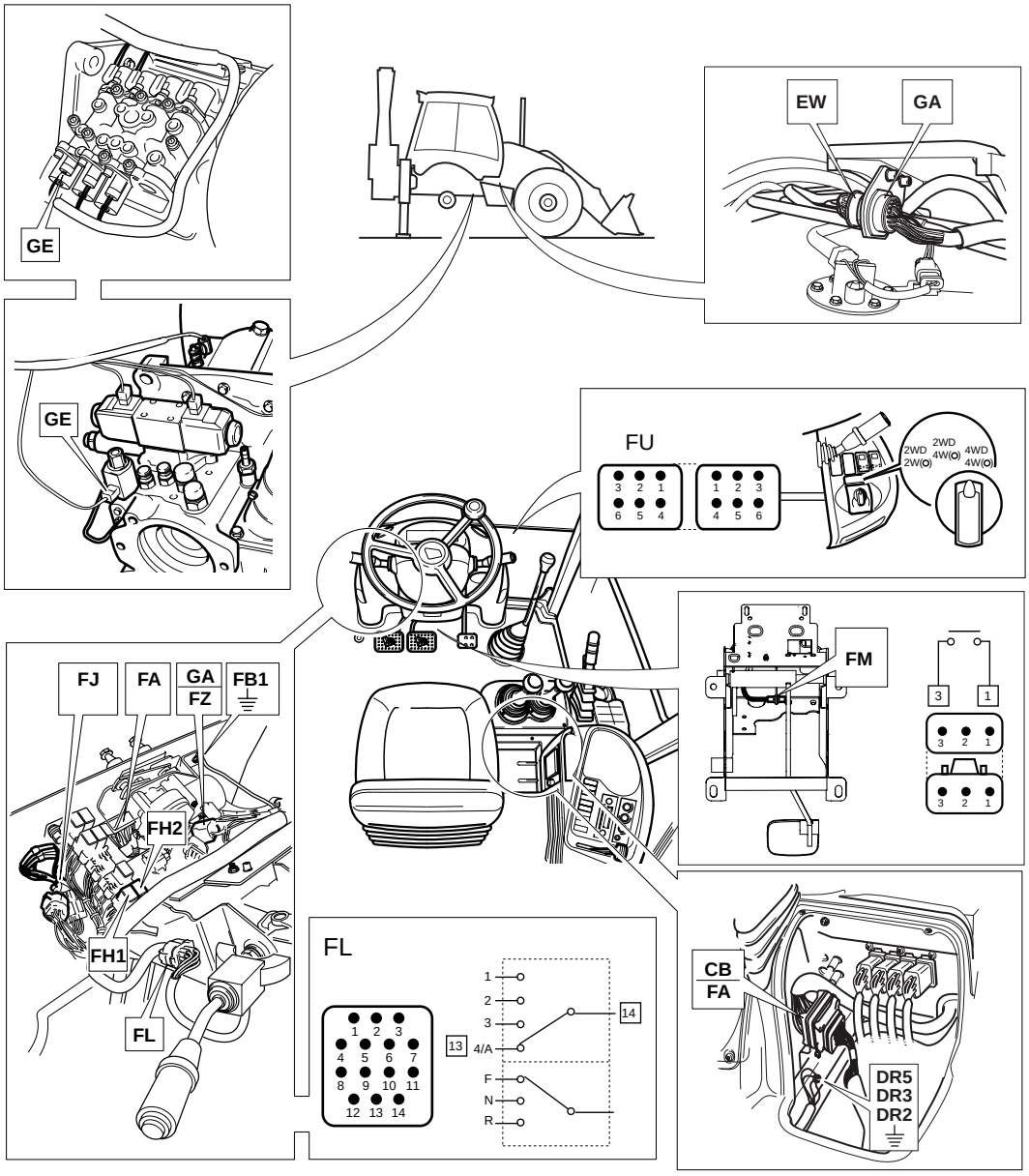


Fig 9. Electrical Connectors 2 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

⇒ *Component Key (G-20)*

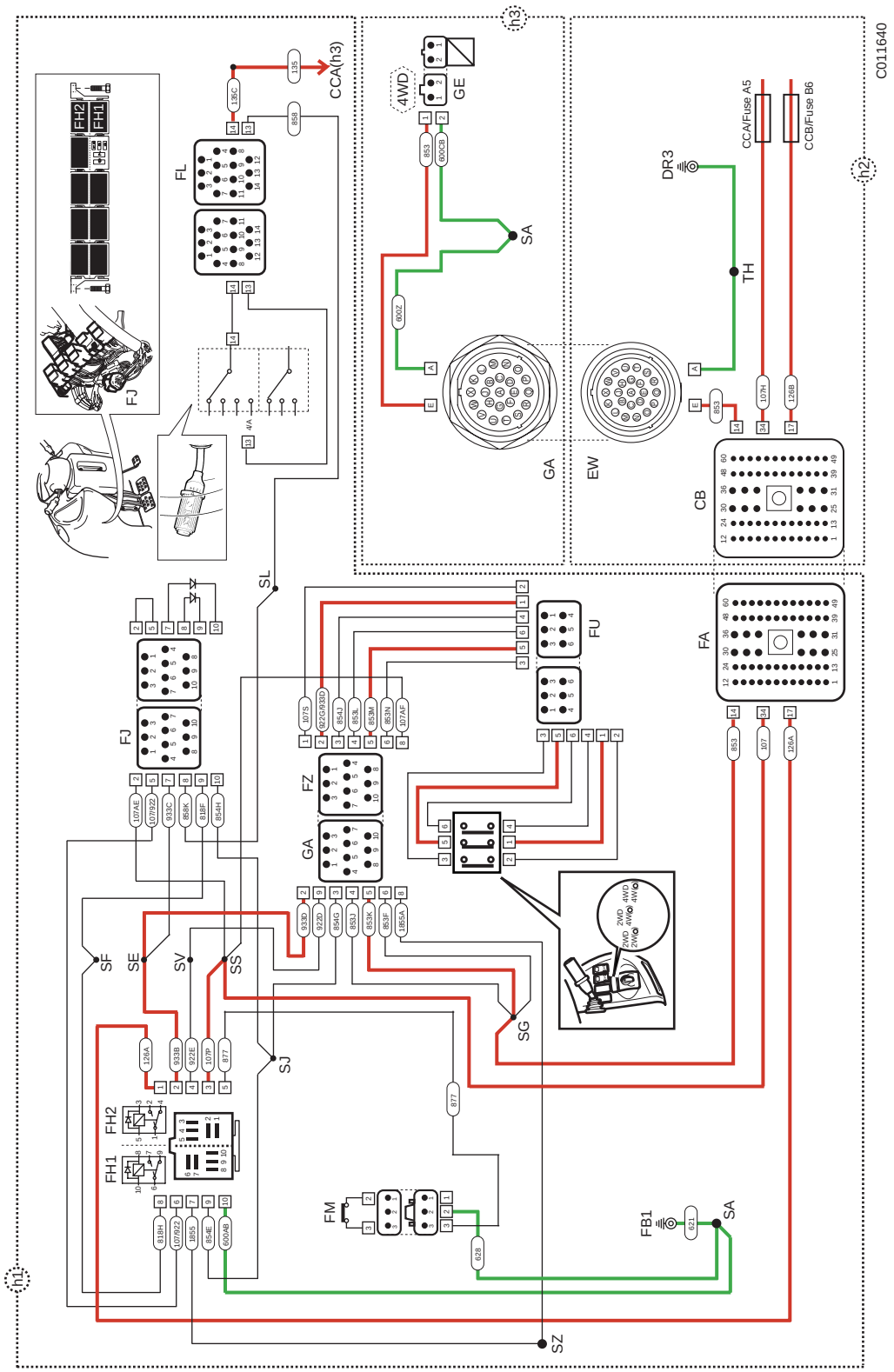


Fig 10. 2 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

⇒ *Component Key (G-20)*

2 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

Components and connector locations ⇨ *Fig 11. (G-24)*.

Wires and connectors ⇨ *Fig 12. (G-25)*.

The circuit is shown with the selector switch **FU** set at position 2: the 2-wheel drive/all wheel braking position and with the service brakes NOT applied. This causes current to flow through the switch **FU**, and on to energise the transmission solenoid **GE** which engages 2-wheel drive.

Note: *The coloured wires apply only for the state described. When switch states are changed the live and earth paths will also change.*

Note: *The diagram does not show connections to the machine brake lamps.*

Earth Points

Faults may be caused by poor earth connections. Although earth connections are shown, it must be remembered that the cab assembly is earthed via further earth strap and cable connections. For details of these connections see ***Section C, Machine Earth Connections***.

Component Key

The following key identifies the component connectors.

h1	Harness - Front console
h1a	Harness - German link
h2	Harness - Cab & Side console
h3	Harness - Powershift gearbox
	Harness - Synchro Shuttle gearbox

Note: For harness drawings see Section C, Electrics.

Connectors (h1)

FA	h1 - h2
FB1	Earth point
FH1	Auto 2WD relay
FH2	Auto 4WB relay
FL	Column gear lever
FJ	Diode gate / link
FM	Brake lamps switch
FX	2/4WD select switch
GA	Link

Connectors (h2)

CB	h2 - h1
CCA	Fuses
CCB	Fuses
DR3	Earth point
EW	h2 - h3

Connectors (h3)

GA	h3 - h2
GE	4WD solenoid

Splices (h1)

SA	**SL**
SE	**SS**
SF	**SV**
SG	**SV**
SJ	**SZ**

Splices (h2)

TH

Splices (h3)

SA

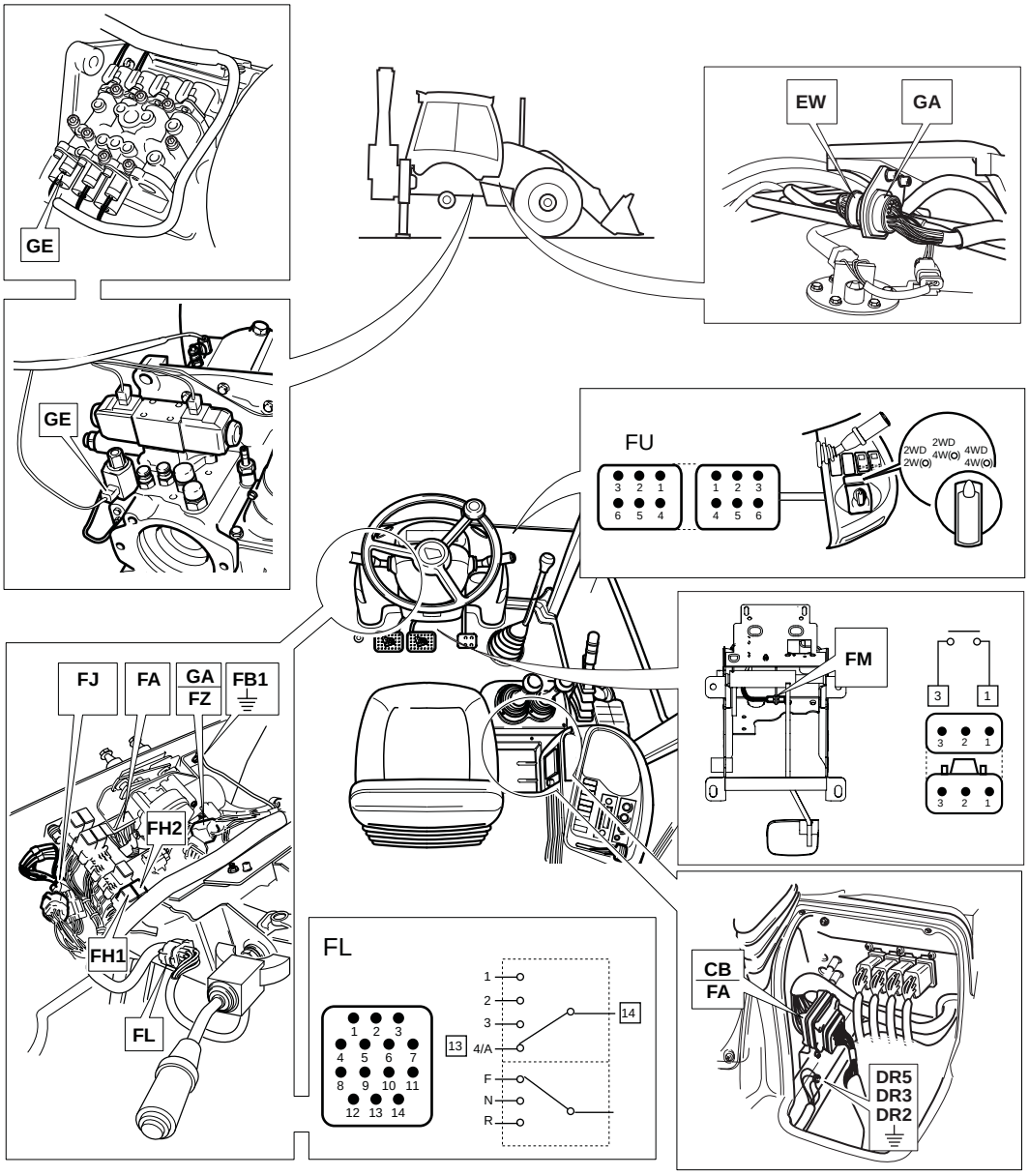


Fig 11. Electrical Connectors 2 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

⇒ *Component Key (G-23)*

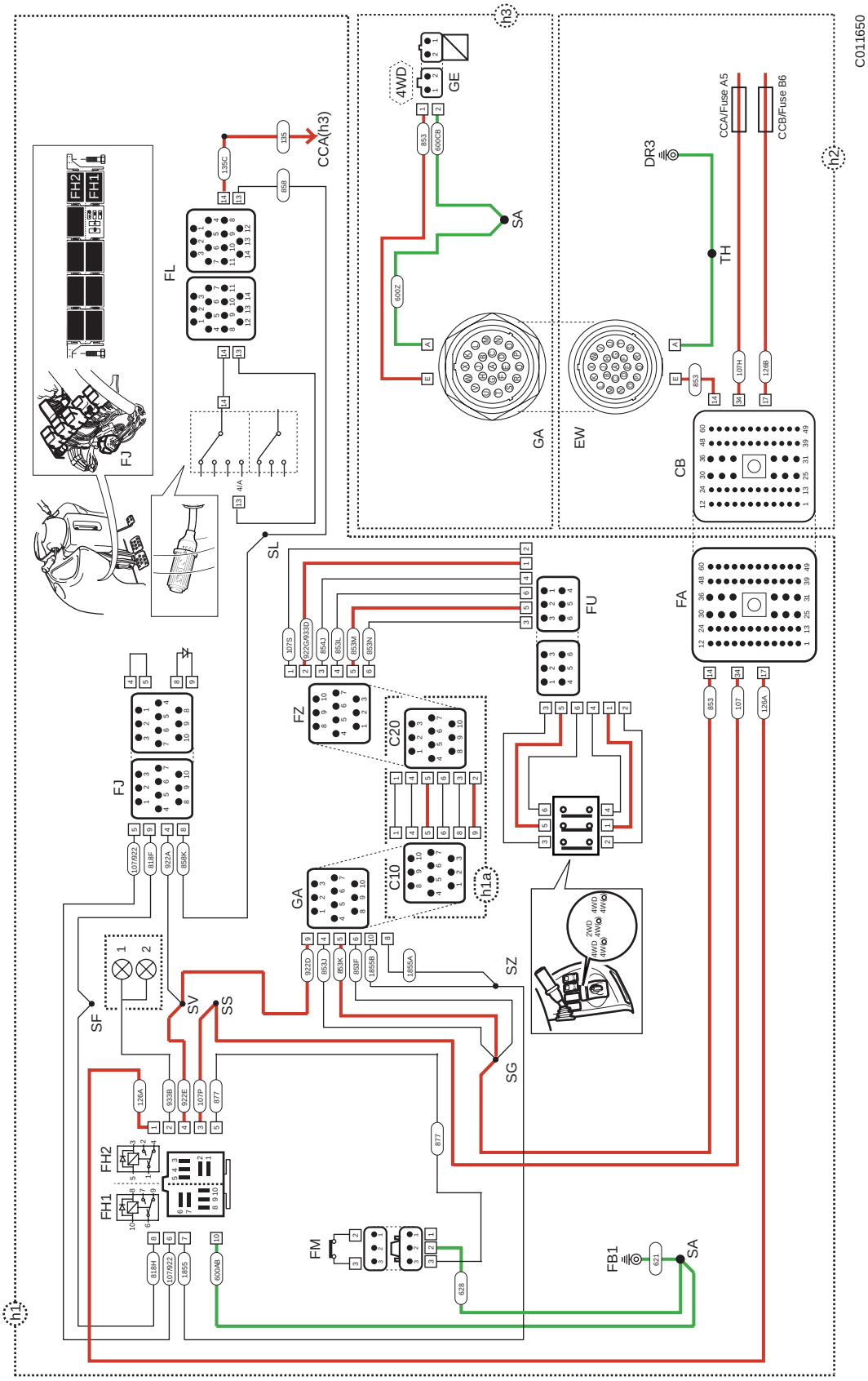


Fig 12. 2 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

⇒ *Component Key (G-23)*

4 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

Components and connector locations ⇨ *Fig 13. (G-27)*.

Wires and connectors ⇨ *Fig 14. (G-28)*.

The circuit is shown with the switch **FX** set at the 4-wheel drive position. 4th gear is NOT selected and the service brakes are NOT applied. The gearbox 4WD solenoid (connector **GE**) is energised, engaging 4-wheel drive. The wires coloured red show the electrical live feed, wires coloured green show the path to earth.

Note: *The coloured wires apply only for the state described. When switch states are changed the live and earth paths will also change.*

Note: *The diagram does not show connections to the machine brake lamps.*

Earth Points

Faults may be caused by poor earth connections. Although earth connections are shown, it must be remembered that the cab assembly is earthed via further earth strap and cable connections. For details of these connections see ***Section C, Machine Earth Connections***.

Component Key

The following key identifies the component connectors.

h1	Harness - Front console
h2	Harness - Cab & Side console
h3	Harness - Powershift Gearbox
	Harness - Synchro Shuttle gearbox

Note: For harness drawings see Section C, Electrics.

Connectors (h1)

FA	h1 - h2
FB1	Earth point
FH1	Auto 2WD relay
FH2	Auto 4WB relay
FL	Column gear lever
FJ	Diode gate / link
FM	Brake lamps switch
FX	2/4WD select switch
GA	Link

Connectors (h2)

CB	h2 - h1
CCA	Fuses
CCB	Fuses
DR3	Earth point
EW	h2 - h3

Connectors (h3)

GA	h3 - h2
GE	4WD solenoid

Splices (h1)

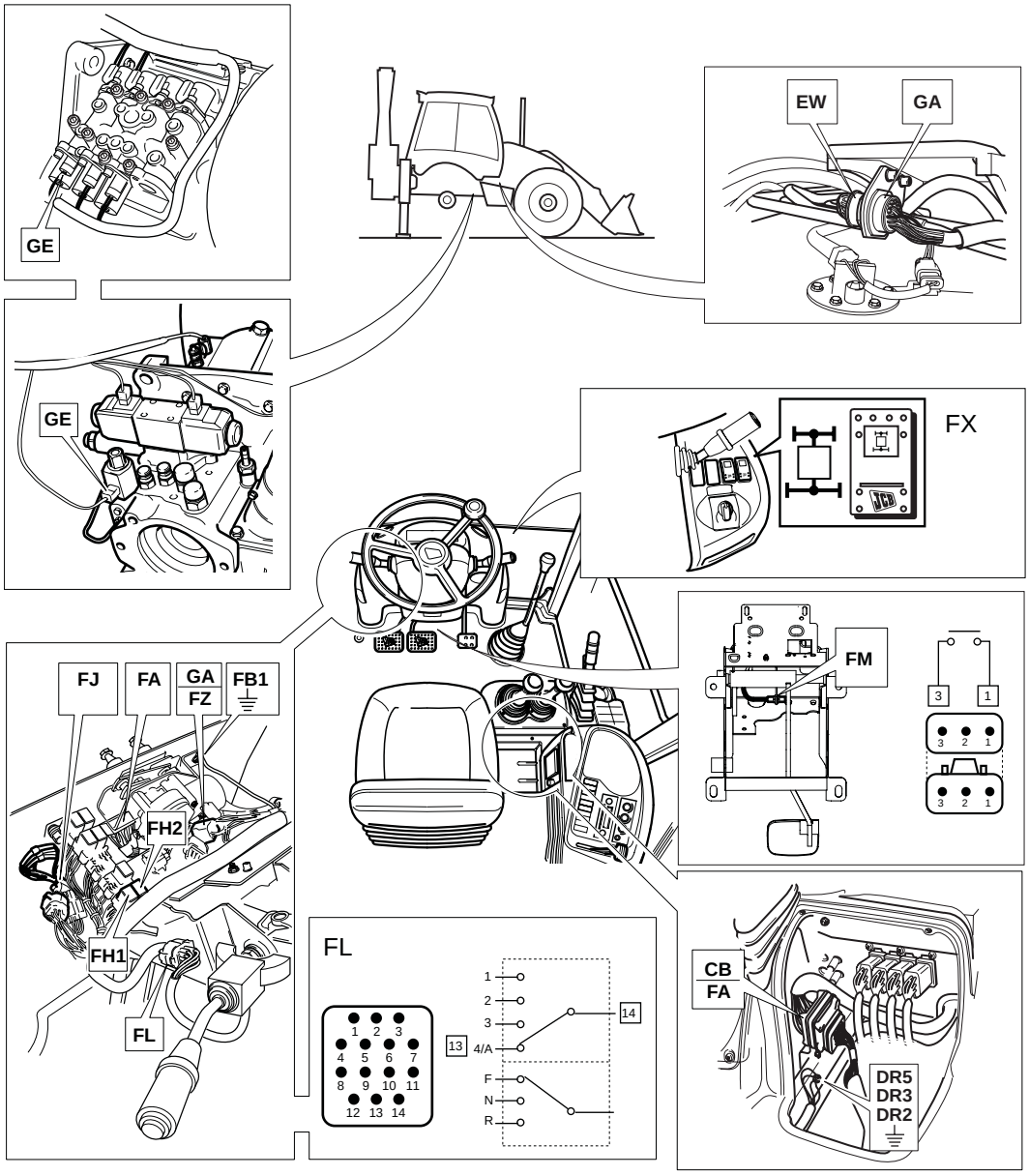
SA	**SJ**
SE	**SL**
SF	**SS**
SG	

Splices (h2)

TH

Splices (h3)

SA



C011620-C1

Fig 13. Electrical Connectors 4 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

⇨ *Component Key (G-26)*

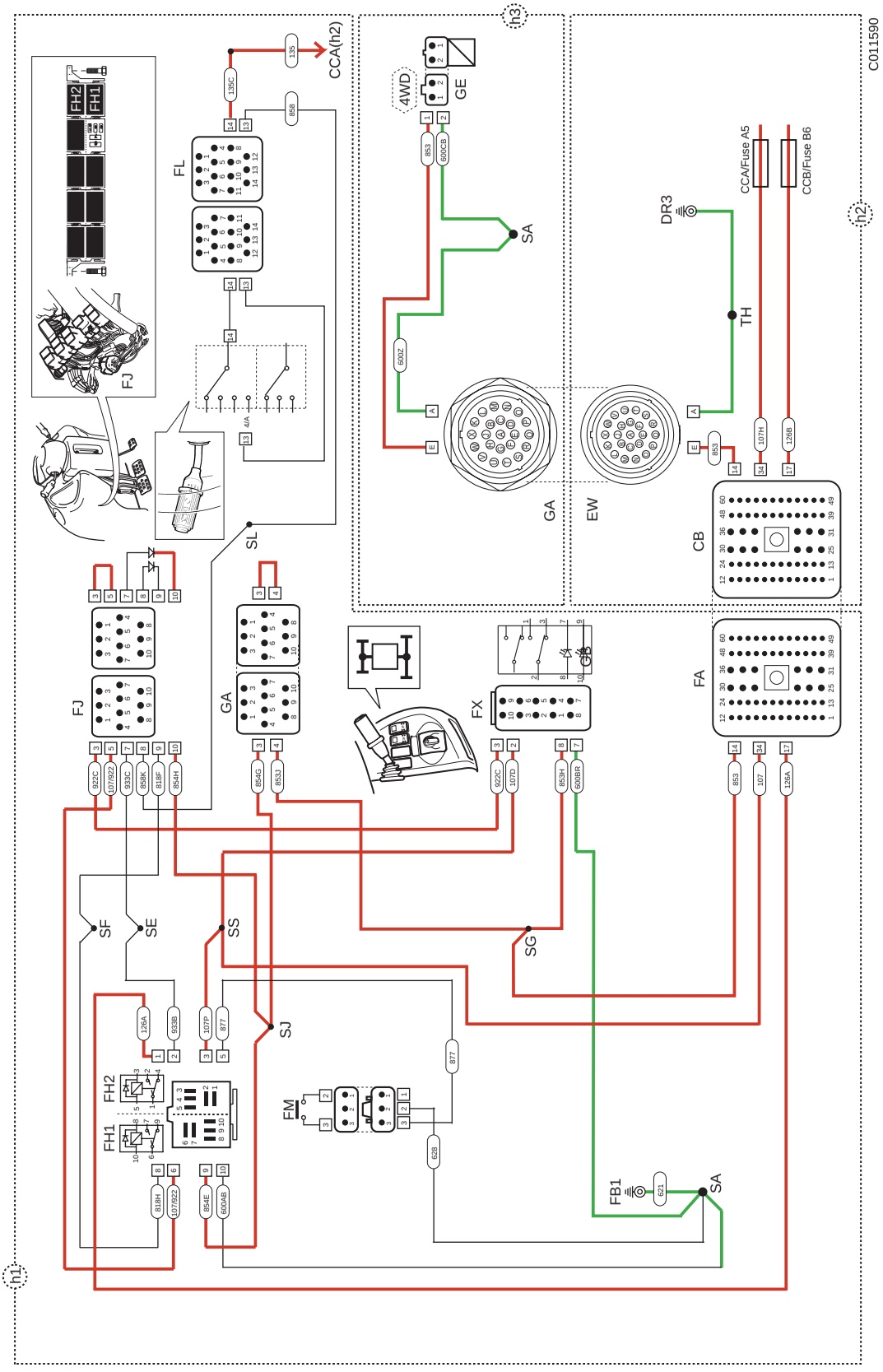


Fig 14. 4 Wheel Steer Machines, Synchro Shuttle and Powershift (NOT German)

⇒ Component Key (G-26)

4 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

Components and connector locations ⇨ *Fig 15. (G-30)*.

Wires and connectors ⇨ *Fig 16. (G-31)*.

The circuit is shown with the switch **FX** set at the 2-wheel drive position. 4th gear is NOT selected and the service brakes are NOT applied. The gearbox 4WD solenoid (connector **GE**) is energised, engaging 2-wheel drive. The wires coloured red show the electrical live feed, wires coloured green show the path to earth.

Note: *The coloured wires apply only for the state described. When switch states are changed the live and earth paths will also change.*

Note: *The diagram does not show connections to the machine brake lamps.*

Earth Points

Faults may be caused by poor earth connections. Although earth connections are shown, it must be remembered that the cab assembly is earthed via further earth strap and cable connections. For details of these connections see ***Section C, Machine Earth Connections***.

Component Key

The following key identifies the component connectors.

h1	Harness - Front console
h2	Harness - Cab & Side console
h3	Harness - Powershift gearbox
	Harness - Synchro Shuttle gearbox

Note: For harness drawings see Section C, Electrics.

Connectors (h1)

FA	h1 - h2
FB1	Earth point
FH1	Auto 2WD relay
FH2	Auto 4WB relay
FL	Column gear lever
FJ	Diode gate / link
FM	Brake lamps switch
FX	2/4WD select switch
GA	Link

Connectors (h2)

CB	h2 - h1
CCA	Fuses
CCB	Fuses
DR3	Earth point
EW	h2 - h3

Connectors (h3)

GA	h3 - h2
GE	4WD solenoid

Splices (h1)

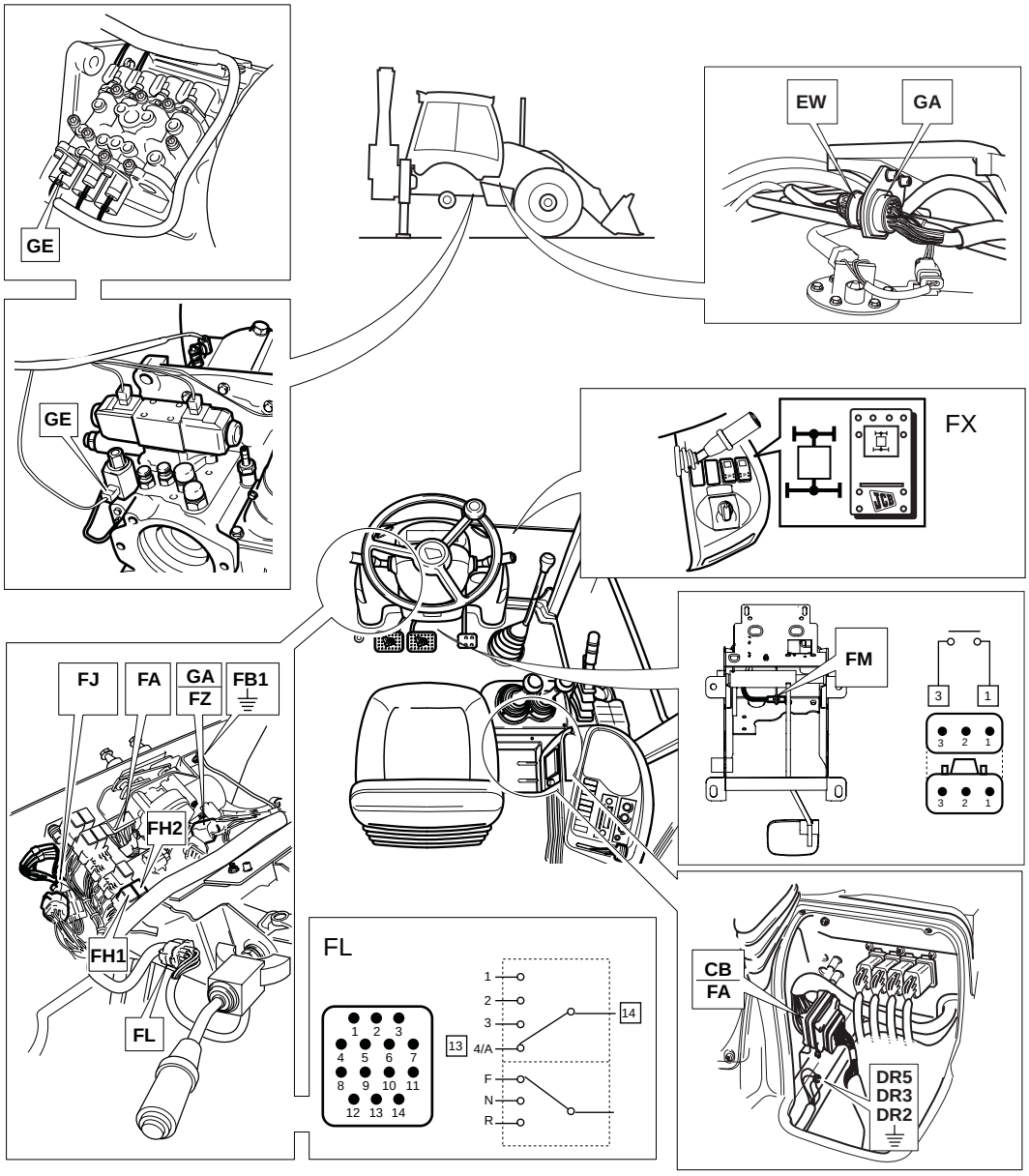
SA	**SL**
SE	**SS**
SF	**SV**
SG	**SV**
SJ	**SZ**

Splices (h2)

TH

Splices (h3)

SA



C011620-C2

Fig 15. Electrical Connectors 4 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

⇨ *Component Key (G-29)*

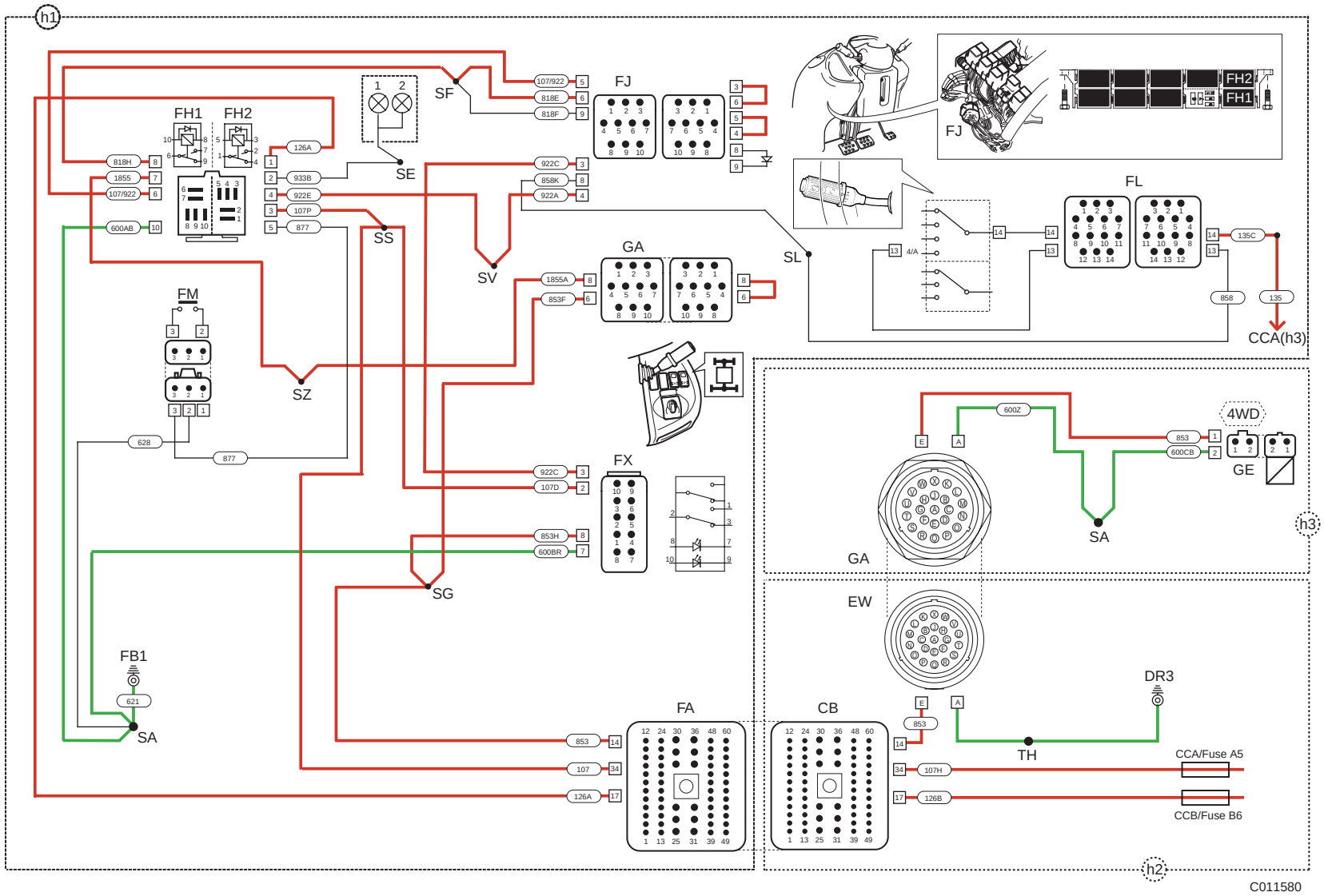


Fig 16. 4 Wheel Steer Machines, Synchro Shuttle and Powershift (German)

⇒ *Component Key (G-29)*

Fault Finding

Brake System

Note: *The brakes generate a high temperature when operating, this means that the casing will be hot to touch, this condition is normal. Note also that 4WS machines do not have dual pedal breaking.*

Fault(s)

⇨ *Table 8. One or more brakes do not apply. (Brake travel not excessive, brakes not pulling to one side) (G-32)*.
⇨ *Table 9. Pedal travel excessive. (but not touching floor) (G-32)*.
⇨ *Table 10. Applying one brake (pedals unlocked) also partially engages the other brake. (G-32)*.
⇨ *Table 11. Pedal hard to operate. (G-33)*.
⇨ *Table 12. Pedal touches floor under constant pressure - no fluid loss. (G-33)*.
⇨ *Table 13. Pedal touches floor under constant pressure - and fluid loss. (G-33)*.
⇨ *Table 15. Poor braking (not pulling to one side). (G-34)*.
⇨ *Table 16. Brakes not releasing. (G-34)*.
⇨ *Table 17. Poor braking when hot. (G-34)*.
⇨ *Table 18. Excessive brake noise in operation. (G-34)*.
⇨ *Table 19. Fluid loss when machine standing for instance - overnight. (G-35)*.

Table 8. One or more brakes do not apply. (Brake travel not excessive, brakes not pulling to one side)

Possible Cause		Action
1	Master cylinder fault.	Check master cylinder in single and coupled pedal modes to identify fault area, service as required.
2	Friction and counter plate distortion.	Check friction and counter plates.

Table 9. Pedal travel excessive. (but not touching floor)

Possible Cause		Action
3	Air in hydraulic system.	Check fluid reservoir level. Check for fluid and air leaks, rectify as required.
4	Leak in hydraulic system.	Check for fluid loss at master cylinder and brake piston, all pipes and fittings for loose connections. Rectify as required.
5	Friction and counter plate distortion.	Renew friction and counter plates - BOTH sides.

Table 10. Applying one brake (pedals unlocked) also partially engages the other brake.

6	Valve stem seal inside (non active) master cylinder piston not sealing.	Renew master cylinder piston.

Table 11. Pedal hard to operate.

Possible Cause		Action
7	Tightness at pedal pivot.	Inspect pedal pivot. Free-off and lubricate.
8	Fluid contamination and seal damage.	Flush system and renew all hydraulic seals.
9	Misaligned push rod or pedal.	Check and rectify as required.
10	Kinked or crushed brake pipes.	Check and renew brake pipework.
11	Vacuum failure due to low vacuum at source.(1)	Inspect and service engine mounted exhauster unit as required.
12	Blocked or leaking vacuum pipe.(1)	Check and renew vacuum pipe.
13	Servo defect.(1)	Renew servo unit.

(1) Machines fitted with servo assisted brakes only.

Table 12. Pedal touches floor under constant pressure - no fluid loss.

Possible Cause		Action
14	Master cylinder fault.	See Item **1**.
15	Friction and counter plate distortion.	See Item **5**.
16	Air in hydraulic system.	See Item **3**.

Table 13. Pedal touches floor under constant pressure - and fluid loss.

Possible Cause		Action
17	External fluid leaks.	Visually check brake circuit for fluid loss, service as required.
18	Internal fluid leaks.	Refer to ***Service Procedures - Brake Piston Seal Leakage Test***.

Table 14. Pulling to one side when pedals locked together.

19	Compensating feature not working.	Inspect master cylinder compensating operation. Check if blockage in bridging pipe. Service as required.
20	Braking system inoperative on one side.	Unlatch pedals to test circuits individually.
21	Friction plates worn beyond limits or distorted on one side.	Renew friction and counter plates - BOTH sides.
22	Badly adjusted push rods.	Adjust push rod (1mm minimum).
23	Servo operating rod out of adjustment.	Adjust servo operating rod.
24	Annular piston fault	See item **35**.

Table 15. Poor braking (not pulling to one side).

Possible Cause	Action
25 Friction plates worn beyond limits or distorted.	Renew friction and counter plates - BOTH sides of relevant axle.
26 Master cylinder fault.	See Item **1**.
27 Annular piston fault.	See Item **35**.
28 Incorrect or low axle oil.	Fill axle with correct type of oil.
29 Vacuum failure.(1)	Inspect vacuum source and pipes, service as required.

(1) Machines fitted with servo assisted brakes.

Table 16. Brakes not releasing.

Possible Cause	Action
30 Brake pedal spring fault.	Fit a new spring.
31 Master cylinder fault (plunger stuck in bore).	See Item **1**.
32 Blocked hole in master cylinder reservoir cap.	Fit a new reservoir cap.
33 Brake pedal free travel incorrect.	Adjust pedal free travel.
34 Fluid contamination and seal damage.	Flush system and renew hydraulic seals.
35 Annular brake piston(s) binding in axle.	– Check that correct brake fluid has been used (incorrect fluid could swell the annular brake piston seals). – Check if annular brake piston seals in good condition. – Check that annular brake piston rotates freely in its housing with no seals fitted. – Check that the annular brake piston seal retracts the piston approximately 0.5 mm (0.020 in).
36 Kinked or crushed brake pipes.	Check and renew pipes as required.
37 Friction and counter plates not free on splines or dowels.	Check friction and counter plates for free movement, renew if required - BOTH sides of relevant axle.

Table 17. Poor braking when hot.

Possible Cause	Action
38 Moisture in system vaporising when axle is hot.	Strip axle and clean annular piston to remove moisture. Remove master cylinder and check for corrosion, service as required. Flush hydraulic brake system.

Table 18. Excessive brake noise in operation.

Possible Cause(1)	Action
39 Deterioration of axle oil or wrong type of axle oil.	Change axle oil.
40 Axle oil loss.	Refill axle with correct oil and check for leaks.
41 Friction plates worn beyond limits.	Renew friction and counter plates.
42 Friction and counter plates in poor condition.	Check for distortion or surface pitting and roughness of friction and counter plates (annular grooving of counter plates is acceptable).

(1) Due to the metal to metal contact of oil immersed brakes, limited noise can be heard which is consistent with this type of design - this is normal.

Table 19. Fluid loss when machine standing for instance - overnight.

Possible Cause[1]	Action
43 Severe damage or slight cut or nick in the brake piston seal, refer to ***Service Procedures - Brake Piston Seal Leakage Test.***	Strip axle, replace seal.

(1) Confirm fault is as indicated by checking that the brake pedal DOES NOT touch the floor under constant pressure.

Service Procedures

Service Brakes

Brake Light Switch - Adjustment

1 Uncouple the sensor switch electrical connector **A**.

2 Connect a suitable multimeter across the pins in the end of the connector, to measure the point at which the sensor switch contacts operate.

3 Depress the brake pedal and check that the sensor switch operates when the brake pedal has travelled between 10 and 15 mm **B** as shown, and check that the sensor switch remains operated throughout the remaining brake travel.

If necessary, slacken bolt **C** and adjust the position of the trigger plate **D**:

a If the sensor switch contacts operate before the required distance, move the trigger plate further towards the sensor switch.

b If the sensor switch contacts operate after the required distance, move the trigger plate further away from the sensor switch.

c When the trigger plate **D** is correctly set, torque tighten the bolt **C**, ⇨ *Table 20. Torque Settings (G-36)*.

4 Couple the sensor switch electrical connector. Select the starter key switch to the ON position, but do not start the engine.

5 Check that the brake lights come on when the brake pedal is depressed.

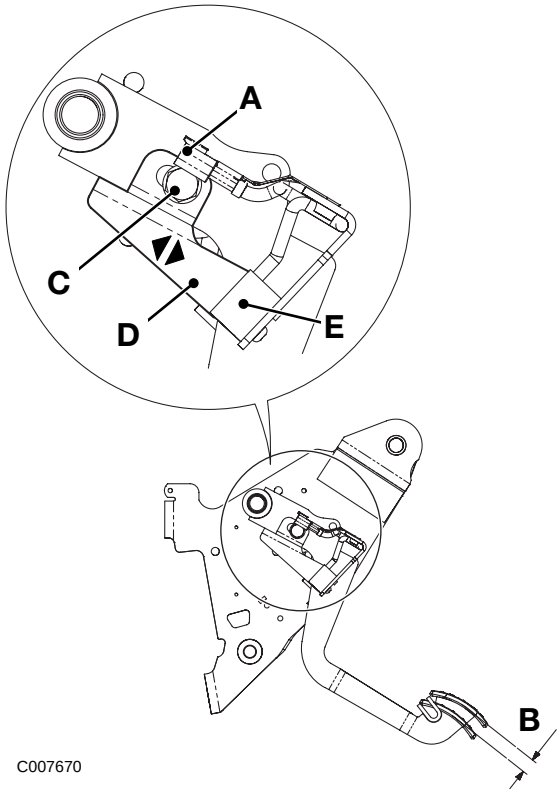


Fig 17.

Table 20. Torque Settings

Item	Nm	kgf m	lbf ft
C	45	4.6	33

Bleeding

⚠ WARNING

Before proceeding with the bleeding procedure it is important to ensure that the park brake is engaged and that one pair of wheels is blocked on both sides.

BRAK-1-2

⚠ WARNING

Use of incorrect fluid will cause serious damage to the seals which could in turn cause brake failure.

BRAK-1-1

1 Fill the master cylinder reservoir with the correct fluid as specified in ***Section 3, Routine Maintenance***, and ensure that throughout the bleeding process the level is not allowed to fall below the MINIMUM mark.

2 Unlatch the pedals, and bleed the bridge pipe and each brake separately.

3 Bridge pipe:

a Attached a tube to the left hand brake bleed screw **A**, ensuring that the free end of the tube is immersed in the correct fluid contained in a suitable container.

b Open the left hand bleed screw, slightly depress the left hand pedal to activate the compensating valve (e.g approximately 10% of pedal travel), and apply full pedal stroke of the right hand pedal.

c Close the bleed screw with the right hand pedal fully depressed and allow the pedal to return to its stop.

d Continue bleeding the bridge pipe until all air is expelled.

4 Left hand master cylinder:

a Leave the tube still attached to the left hand brake bleed screw **A**, ensuring that the free end of the tube is immersed in the correct fluid contained in a suitable container.

b Open the brake bleed screw and depress the left pedal full stroke, close the brake bleed screw and allow the pedal to return to its stop.

c Continue bleeding of the left hand master cylinder until all air is expelled.

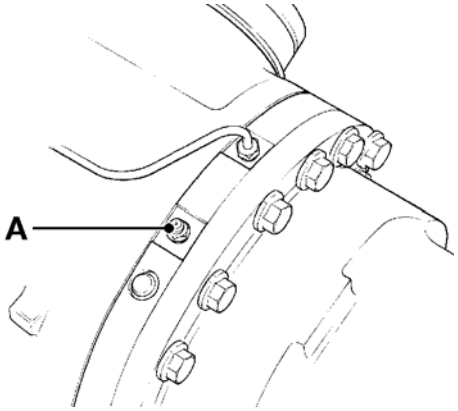


Fig 18.

5 Right hand master cylinder:

a Attach a tube to the right hand brake bleed screw **A**, ensuring that the free end of the tube is immersed in the correct fluid contained in a suitable container.

b Open the brake bleed screw and depress the right pedal full stroke, close the brake bleed screw and allow the pedal to return to its stop.

c Continue bleeding of the right hand master cylinder until all air is expelled.

6 Top up the reservoir to the full mark.

7 On completion, check the brake circuit for leaks and correct operation.

Brake Vacuum Tests

If the vacuum assist system is defective the brake pedal effort required to operate the service brakes will be greatly increased. There may be one or more causes for poor vacuum performance.

Before proceeding with all the vacuum tests perform the following quick test to confirm if the brake vacuum system has failed totally:

Note: *This test can only determine if the vacuum system has failed totally. Reduced vacuum performance can not be identified using this test.*

1 Stop the engine and apply the park brake.

2 Apply the footbrake fully for 5 brake applications, this will exhaust any remaining vacuum in the system.

3 Apply constant heavy pressure on the pedal and at the same time start the engine. As the vacuum builds the pedal should be felt to move down further. Stop the engine.

Carry out the following procedures in sequence, starting with Test 1. The results from the first test determine which test comes next and so on. If a fault is identified before completion of the test sequence, renew the faulty component and then start the test sequence again.

The following test equipment is required, which can be obtained locally:

⇨ *Fig 19. (G-38)*

A Vacuum gauge (range up to 1 bar)
B `T' adaptor
C Vacuum hose - 2 lengths X 75 mm (3 inch) long
D Clips - worm drive

⚠ WARNING

Before working on the brake system make sure the machine is on level ground and chock all four wheels.

BRAK-1-4

1 Park the machine on firm level ground, apply the parking brake. Raise the loader arms and fit the safety strut. Lower the excavator to the ground, switch OFF the engine and remove the starter key.

2 Raise the engine cover, refer to ***Section 3, Maintenance.***

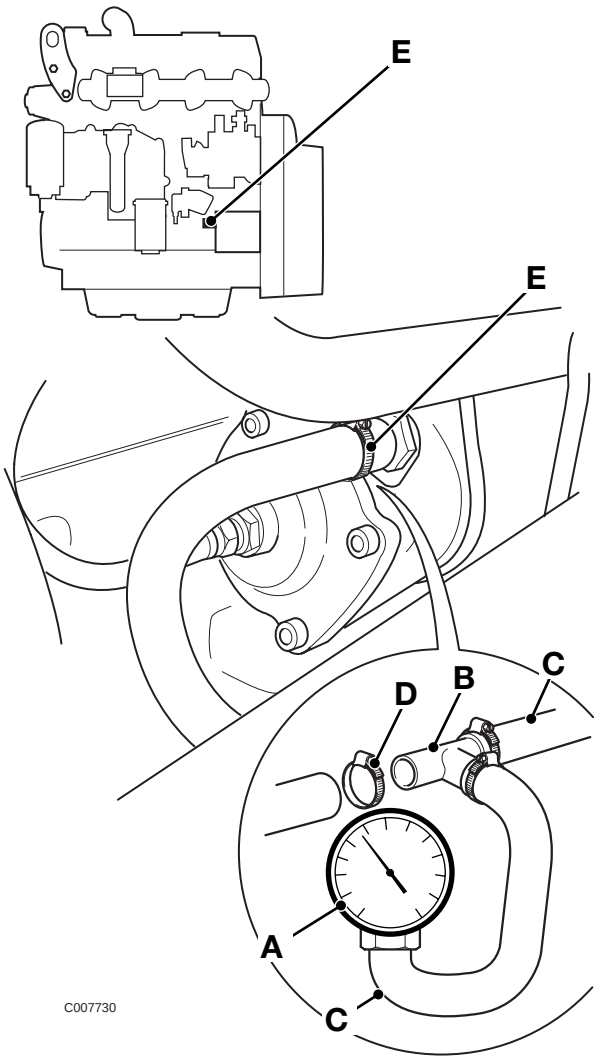


Fig 19.

Test 1

1 Apply the footbrake fully for 5 brake applications, this will exhaust any remaining vacuum in the system.

2 Working at the engine compartment, disconnect the brake vacuum line **19E** at the brake vacuum pump. Using a tee adaptor **19**B connect a vacuum gauge **19**A directly into the vacuum line from the pump.

3 Start the engine and let it idle (900 r.p.m.). Note the time taken for the vacuum level to stabilise and the vacuum value.

Result	Procedure
Vacuum level reaches 900 mBar in less than 15 seconds	Carry out Test 2. ⇒ *Test 2 (G-39)*
Vacuum takes longer than 15 seconds to reach 900 mBar or is less than 900 mBar	Carry out Test 5. ⇒ *Test 5 (G-40)*

Test 2

1 Watch the vacuum gauge. Stop the engine and note the time until the vacuum starts to decay.

Result	Procedure
Vacuum level stays constant for more than 1 minute	Carry out Test 3. ⇒ *Test 3 (G-39)*
Vacuum level starts to decay in less than 1 minute	Carry out Test 5. ⇒ *Test 5 (G-40)*

Test 3

1 Start the engine and let it idle (900 r.p.m.). Watch the vacuum gauge and at the same time depress the brake pedal.

Note: *On machines with dual pedal braking disconnect the brake pedals by removing the pedal link bar and carry out the test using each pedal in turn. This can help identify failure of one or other servo unit.*

Result	Procedure
Vacuum level drops and then restores to the original value	Carry out Test 4. ⇒ *Test 4 (G-39)*
Vacuum level drops and does not restore to the original value	Servo unit diaphragm failed. Renew the servo unit as applicable then test the system again, starting with Test 1

Test 4

1 Start the engine and let it idle (900 r.p.m.). Depress the brake pedal. Watch the vacuum gauge and at the same time release the brake pedal.

Note: *On machines with dual pedal braking disconnect the brake pedals by removing the pedal link bar and carry out the test using each pedal in turn. This can help identify failure of one or other servo unit.*

Result	Procedure
Vacuum level drops and then restores to the original value	**Testing Complete.** System operating normally
Vacuum level drops and does not restore to the original value	Servo unit valve sticking. Renew the servo unit as applicable then test the system again, starting with Test 1

Test 5

1 Stop the engine. Remove the tee and fit the vacuum gauge directly to the pump outlet.

2 Watch the vacuum gauge. Start the engine and let it idle (900 r.p.m.). Note the time taken for the vacuum level to stabilise and the vacuum value.

Result	Procedure
Vacuum level reaches 900 mBar in less than 15 seconds	Carry out Test 6. ⇨ *Test 6 (G-40)*
Vacuum takes longer than 15 seconds to reach 900 mBar or is less than 900 mBar	Renew the vacuum pump then test the system again, starting with Test 1

Test 6

1 Watch the vacuum gauge. Stop the engine and note the time until the vacuum starts to decay.

Result	Procedure
Vacuum level stays constant for more than 1 minute	Carry out Test 7. ⇨ *Test 7 (G-40)*
Vacuum level starts to decay in less than 1 minute	Renew the vacuum pump then test the system again, starting with Test 1

Test 7

1 Stop the engine. Using a tee adaptor connect a vacuum gauge directly into the vacuum line from the pump.

2 Pull out the servo check valves **20C** from the servo units. Cap the open port on the check valves using a suitable mastic such as plasticine.

3 Watch the vacuum gauge. Start the engine and let it idle (900 r.p.m.). Note the time taken for the vacuum level to stabilise and the vacuum value.

Result	Procedure
Vacuum level reaches 900 mBar in less than 15 seconds	Carry out Test 8. ⇨ *Test 8 (G-41)*
Vacuum takes longer than 15 seconds to reach 900 mBar or is less than 900 mBar	Renew the vacuum hoses then test the system again, starting with Test 1

Test 8

1 Stop the engine and reconnect one servo check valve.

2 Watch the vacuum gauge. Start the engine and let it idle (900 r.p.m.). Note the time taken for the vacuum level to stabilise and the vacuum value.

3 Stop the engine. Change over the connections at the servo units and repeat the test for the other servo unit.

4 Stop the engine and reconnect the servo check valve as applicable.

Result	Procedure
Vacuum level reaches 900 mBar in less than 15 seconds	**Testing Complete** System operating normally
Vacuum takes longer than 15 seconds to reach 900 mBar or is less than 900 mBar - one servo unit only	One servo unit defective. Carry out Test 9. ⇨ *Test 9 (G-41)*
Vacuum takes longer than 15 seconds to reach 900 mBar or is less than 900 mBar - both servo units	Both servo units defective or vacuum pump defective. Carry out Test 10. ⇨ *Test 10 (G-42)*

Test 9

1 Start the engine and let it idle (900 r.p.m.) for 1minute.

2 Stop the engine and listen for hissing in the engine compartment at the defective servo unit.

Result	Procedure
No hissing audible	Servo leaking through inlet (cab side). Renew the servo unit as applicable then test the system again, starting with Test 1
Hissing audible	Check condition of master cylinder face seal **20A** and check valve seal **20B** on the servo units as applicable then test the system again, starting with Test 1

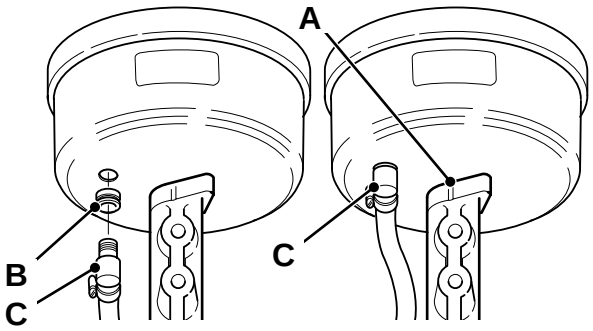


Fig 20.

Test 10

1 Start the engine and let it idle (900 r.p.m.) for 1 minute.

2 Stop the engine and listen for hissing in the engine compartment at the servo units.

Result	Procedure
No hissing audible	Both servo units leaking through inlet (cab side), or pump performance is insufficient. Renew the vacuum pump and repeat Test 9. If the vacuum system does not function normally, refit the original pump and renew both servo units. Repeat Test 9 to confirm normal system operation. Finally test the system again, starting at Test 1 to confirm there are no other faults.
Hissing audible	Check condition of master cylinder face seal **21A** and check valve seal **21B** on the servo units as applicable then test the system again, starting with Test 1

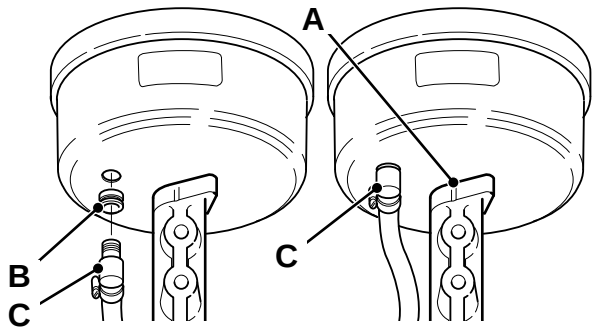


Fig 21.

Brake Piston Seal Leakage Test

The following procedure explains how to check if a brake piston seal is severely damaged, perished or if the seal has a small cut or nick. The test must only be done when the axle is COLD.

⚠ WARNING

Before working on the brake system make sure the machine is on level ground and chock all four wheels.

BRAK-1-4

⚠ WARNING

Do not drive the machine with any part of its brake system disconnected. When the following test has been completed reconnect all brake pipes and bleed the brake system using the recommended procedure.

BRAK-2-1

1 Remove and cap brake piston feed pipe **A**.

2 Fill the brake piston housing with JCB Light Hydraulic Fluid.

3 Check for severe piston seal damage:

a Install a hand pump fitted with a 0 - 40 bar (0 - 600 lbf/in²) pressure gauge to port **B**, as shown at **X**, ⇨ *Fig 22. (G-43)*.

Note: *The hand pump MUST be filled with JCB Light Hydraulic Fluid. DO NOT exceed 69bar (1000 lbf/in²).*

b Use the hand pump to generate a pressure in the brake piston housing.

c If the pressure falls off rapidly, or if no pressure reading can be obtained, the seal is severely damaged and needs replacing with a new one.

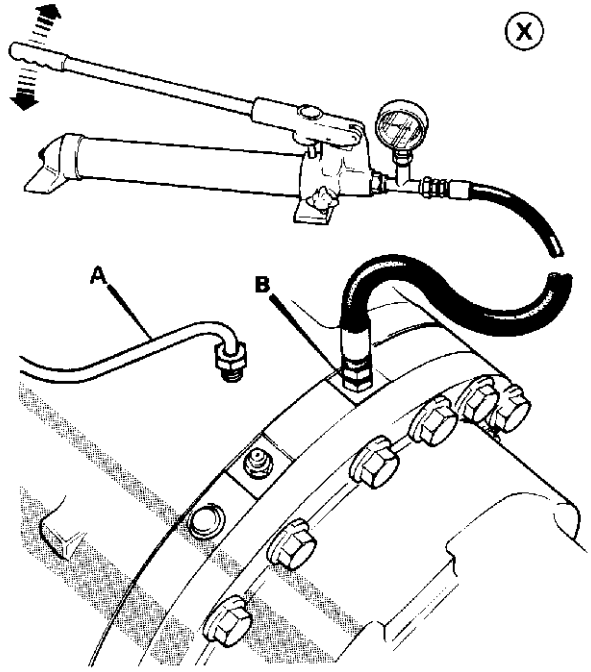


Fig 22.

4 Check for small cuts or nicks in the piston seal:

a Install an adapter fitted with a piece of clear tube to the brake piston port **B**, as shown at **Y**, ⇨ *Fig 23. (G-44)*.

Note: *The tube must be kept vertical during the test, use tape to attach the tube to the side of the machine.*

b Fill the tube until approximately three quarters full with JCB Light Hydraulic Fluid

c Using a suitable pen, mark the level line of the brake fluid on the tube, as shown at **C**.

d After approximately 1/2 hour, check if the level has dropped below the original marked line, if it has then check the brake piston seal for slight nicks, cuts or generally for wear.

5 Repeat steps 1 to 4 for the opposite brake piston seal.

6 Reconnect all brake pipes and bleed the brake system. ⇨ *Bleeding (G-37)*.

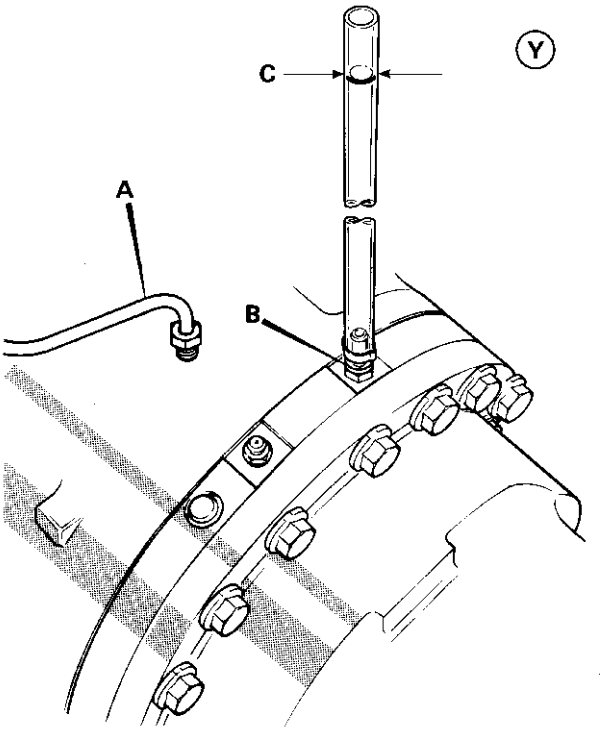


Fig 23. Brake Piston Seal Leakage Test

Axle Breather (Braked Axles) - Inspection

Breathers are fitted to axles to relieve pressure build up, due to braking and prolonged roading.

If breathers are not kept clear, seal leakage and brake problems can result due to pressure build up. Most axles are fitted with long stem breather type **A**.

Ensure there is adequate clearance around the breather and if it should be dislodged or removed, ensure it is refitted with hole **C** pointing outwards towards the wheel.

The breather is always fitted on the opposite side to the crownwheel (in less turbulent oil) avoiding oil seepage.

Plug **B** is fitted in the crownwheel side.

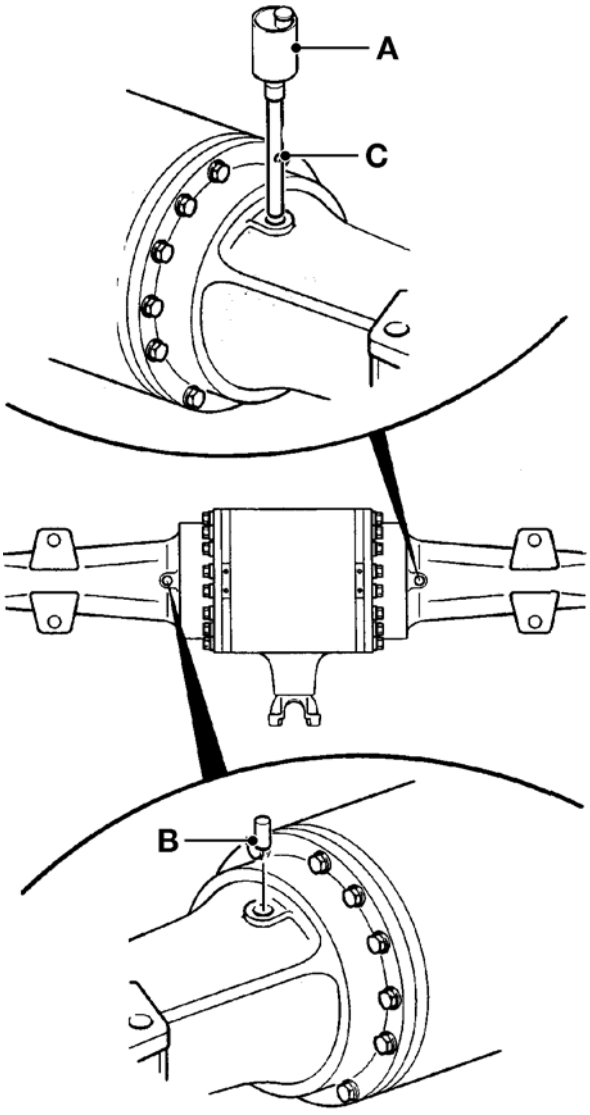


Fig 24.

Park Brake

Testing

SAFETY NOTICE: Ensure all routine health and safety precautions are observed before operating machines.

⚠ WARNING

Before testing the park brake make sure the area around the machine is clear of people.

2-2-4-5

1 Enter the machine. Fasten your seat belt and park the machine on a level dry surface.

2 Fully apply the parking brake **A**.

3 On machines with two brake pedals **B** ensure they are locked together.

4 Start the engine and raise the attachments to the appropriate travelling position.

5 Select fourth gear, **C** for synchro shuttle machines or **D** for powershift machines.

6 Push down hard on foot brake pedal **B**.

7 Select forward drive **E**.

⚠ WARNING

If the machine starts to move during the following test, immediately apply the foot brake and reduce the engine speed.

2-2-5-1

Test the parking brake as follows:

8 Move the parking brake lever fractionally forward until the warning light **F** is just extinguished.

9 Slowly release the foot brake pedal **B**.

10 If the machine has not moved, use the accelerator pedal to gradually increase the engine speed to 1500 RPM. The machine should not move.

11 Do not do this test for longer than 20 seconds.

12 Reduce the engine speed to idle and select neutral **C** or **D**.

13 Return the park brake lever **A**to the fully on position from its partially applied position.

14 Lower attachments and stop the engine.

15 If the machine moved during this test, adjust the parking brake and repeat the test. See ***Adjustment (Synchro Shuttle Machines)*** or ***Adjustment (Powershift Machines)*** as applicable.

If you have any queries concerning this test procedure or parking brake adjustment, consult your local JCB distributor.

⚠ WARNING

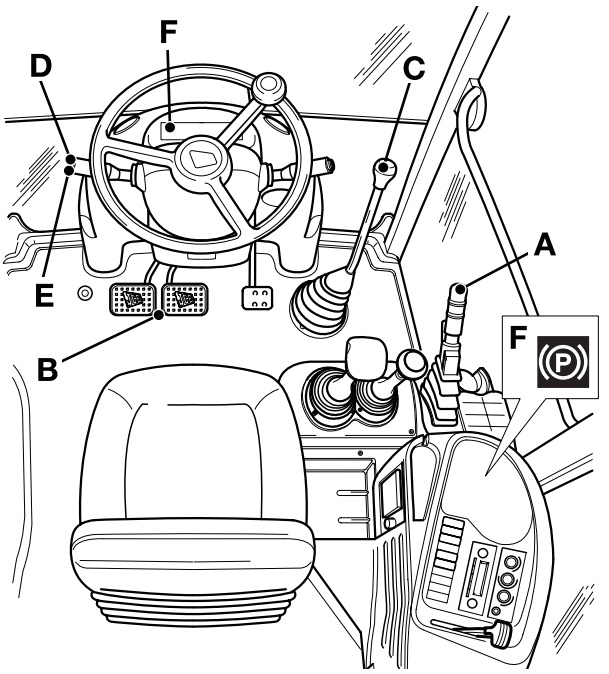
Do not use a machine with a faulty park brake.

3-2-3-10_2

⚠ WARNING

Non approved modifications to drive ratios, machine weight or wheel and tyre sizes may adversely affect the performance of the park brake.

3-2-3-11



C004690-C2

Fig 25.

Adjustment (Synchro Shuttle Machines)

⚠ CAUTION

The park brake must not be used to slow the machine from travelling speed, except in an emergency, otherwise the efficiency of the brake will be reduced. Whenever the park brake has been used in an emergency, always renew both brake pads.

4-2-1-1_2

⚠ WARNING

Before adjusting the park brake, make sure that the machine is on level ground. Put blocks each side of all four wheels. Disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

2-3-2-4

⚠ WARNING

Over adjustment of the park brake could result in the park brake not fully releasing.

0011

Note: *Before attempting to adjust the park brake after an emergency stop remove and inspect the brake friction components. Renew components if necessary, see Renewing the Brake Pads, Synchro Shuttle Machines.*

Lever Adjustment

The park brake should be fully engaged when the lever is vertical. The park brake indicator light should light when the brake is engaged with the forward and reverse lever away from neutral (starter switch at IGN).

1 Disengage the park brake (lever horizontal).

2 Turn handle grip **E** clockwise, half a turn.

3 Test the park brake, ⇨ ***Testing (G-46)***.

If the brake fails the test, repeat steps 1, 2 and 3. If there is no more adjustment and pin **F** is at the end of its travel adjust the cable at the calliper. ⇨ ***Cable Adjustment (G-48)***

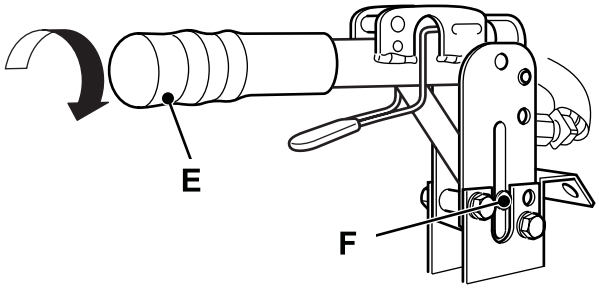


Fig 26.

Cable Adjustment

Adjust the cable at the calliper if there is insufficient adjustment at the parking brake lever.

If there is no adjustment at the lever or the calliper, change the brake pads, ⇨ *Renewing the Brake Pads (Synchro Shuttle Machines) (G-52)*.

Always renew a worn or damaged cable.

1 Disengage the park brake (lever horizontal).

2 Turn hand grip **E** anti-clockwise to centre the pin **F** in its slot.

3 Release the two locknuts at **B** and adjust the cable length to give 10 to 15mm (0.40 to 0.60 in) of caliper lever movement at the outer cable fixing hole **H**. The total clearance between the brake pad to brake disc should be 0.5 to 0.75 mm (0.02 to 0.3 in).

4 Make sure there is adequate freedom of movement of operating lever **C** to ensure a positive brake application, and that the lever returns to the rest position when the park brake is released.

5 Test the park brake, ⇨ *Testing (G-46)*. Make final adjustments at the park brake lever if the brake fails the test, ⇨ *Lever Adjustment (G-47)*.

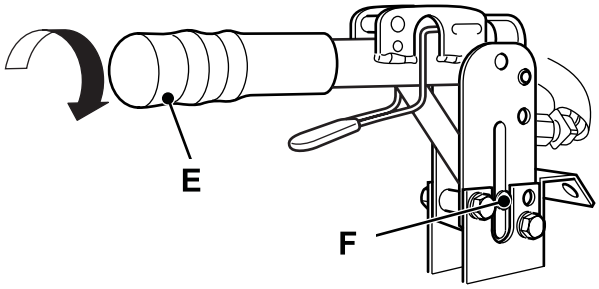


Fig 27.

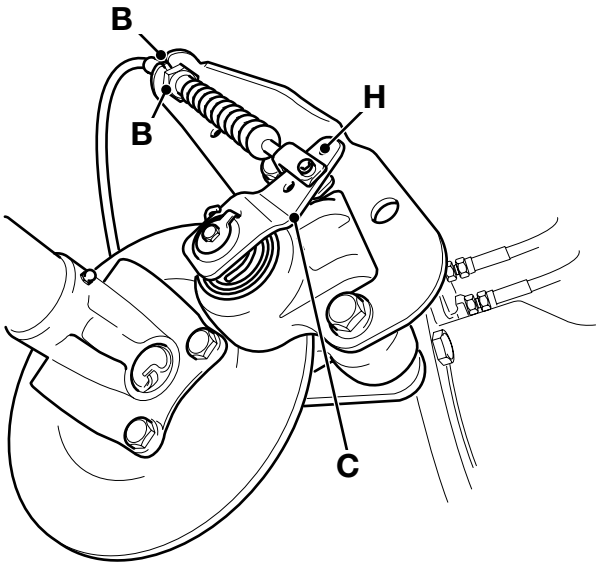


Fig 28.

Adjustment (Powershift Machines)

Powershift machines feature a wet multiplate brake assembly integral with the gearbox. During normal operation little or no adjustment of the brake cable at the lever is required. In the event of poor brake performance it is likely that components have failed or, after extended service, friction material is worn away. Dismantle, inspect and renew components as required, see ***Park Brake, Powershift Machines.***

⚠ CAUTION

The park brake must not be used to slow the machine from travelling speed, except in an emergency, otherwise the efficiency of the brake will be reduced. Whenever the park brake has been used in an emergency, always renew both brake pads.

4-2-1-1_2

⚠ WARNING

Before adjusting the park brake, make sure that the machine is on level ground. Put blocks each side of all four wheels. Disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

2-3-2-4

⚠ WARNING

Over adjustment of the park brake could result in the park brake not fully releasing.

0011

Adjustment at the park brake lever should only be required after renewal of the cable, brake components or extended service. Proceed as follows:

Note: *Before attempting to adjust the park brake after an emergency stop remove and inspect the brake friction components. Renew components if necessary, see* ***Park Brake, Powershift Machines***

Lever Adjustment

The park brake should be fully engaged when the lever is vertical. The park brake indicator light should light when the brake is engaged with the forward and reverse lever away from neutral (starter switch at IGN).

1 Disengage the park bake (lever horizontal)

2 Turn the hand grip **29E** clockwise, half a turn.

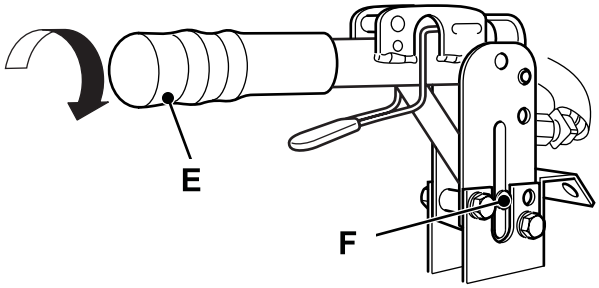


Fig 29.

3 Test the park brake ⇒ ***Testing (G-46)***. If the brake fails the test repeat steps 1 and 2. If there is no more adjustment and pin **29F** is at the end of its travel, dismantle, inspect and renew park brake components as required, see ***Park Brake, Powershift Machines.***

Important: *After adjusting the park brake lever the following steps MUST be carried out to confirm correct brake operation. Incorrect adjustment can result damage to the brake components and excessive overheating of the brake assembly.*

4 Remove five screws **30A** and two bolts **30B**. Using a flat blade screwdriver located in the housing cut out **30C**, lever off the cover plate **30D**.

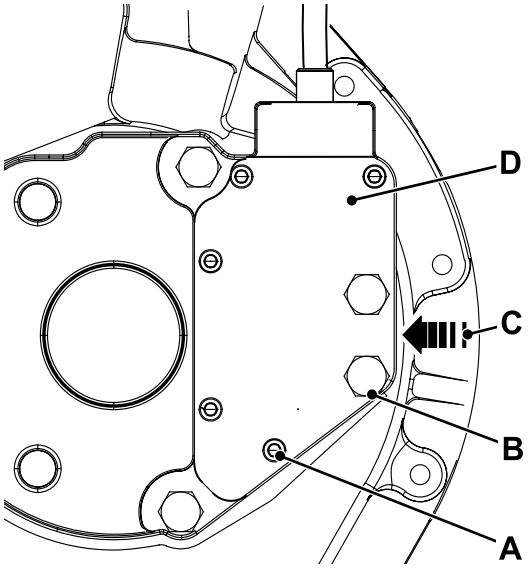


Fig 30.

5 Use the cover plate **31A** as a wear indicator. Use a bolt **31B** to fit the plate at right angles to the housing as shown ⇨ *Fig 31. (G-50)*. Pull the plate down when tightening the bolt to take up the clearance in the bolt hole.

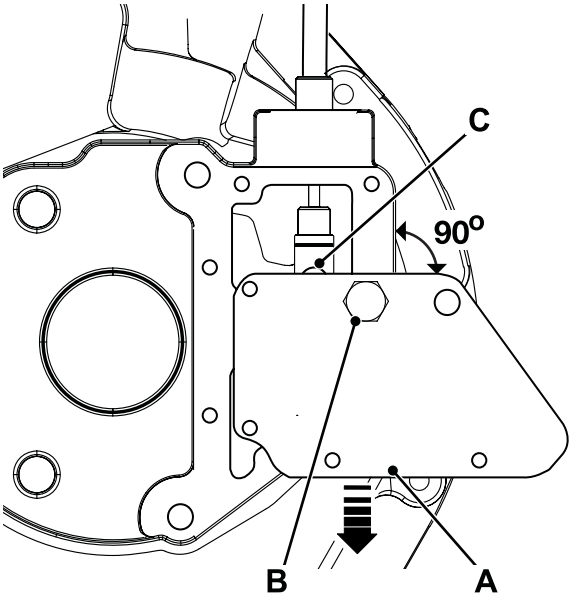


Fig 31.

6 Fully apply the park brake (lever vertical). If the brake is within service limits the clevis pin **31C** hexagon MUST NOT BE VISIBLE above the cover plate. Renew the friction pack if any of the clevis pin hexagon is visible, see ***Park Brake. Powershift Machines.***

Note: *If friction pack components are distorted (typically after performing an emergency stop) the clevis pin may not be visible in the check described. If the park brake performance is poor it may be due to distorted components. Dismantle and inspect the park brake assembly. See* ***Park Brake, Powershift Machines.***

7 Disengage the park brake (lever horizontal). Make sure that the brake is fully released. Remove the cover plate **31A** and feel the edge of the brake pack plates. When the brake is released free play between the plates should be easily detectable ⇨ *Fig 32. (G-50)*. If the plates are not free DO NOT OPERATE THE MACHINE. Dismantle, inspect and renew park brake components as required, see ***Park Brake, Powershift Machines.***

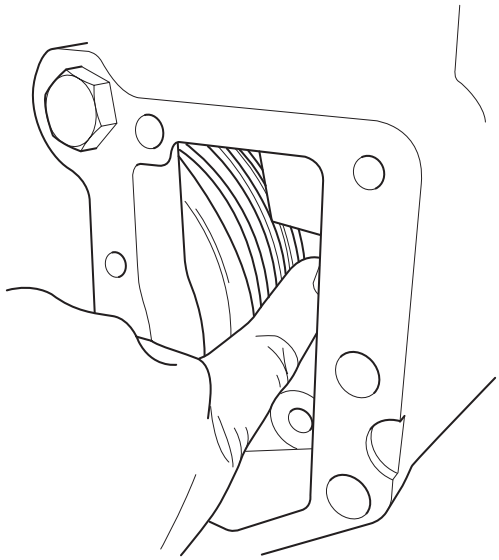


Fig 32.

8 If the brake pack is serviceable clean off all traces of old sealant from the cover plate and brake housing. Make sure that no sealant enters the gearbox. Apply a bead of JCB Multigasket to the brake housing, see ***Park Brake, Powershift Machines.*** Fit the cover plate. Torque tighten the bolts.

Table 21. Torque Settings

Item	Nm	kgf m	lbf ft
30A	16	1.6	12
30B	56	5.7	41

Park Brake Switch - Adjustment

The park brake sensor switch **A** is a reed type. It operates when the metal vane **B** moves between the switch faces **C**. The switch is not adjustable.

If the switch is suspected as being faulty, check the associated wires and electrical connectors for damage. Ensure that the vane **B** moves between the switch faces **C** when the park brake is operated. If the switch has failed it must be renewed.

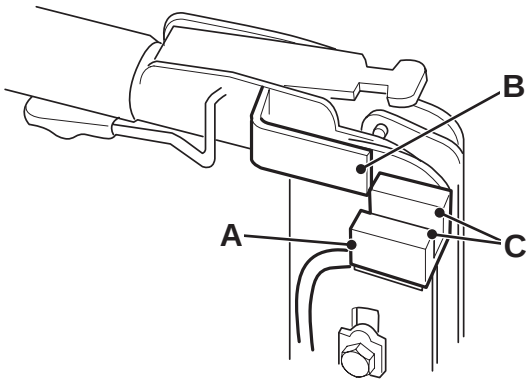


Fig 33.

Renewing the Brake Pads (Synchro Shuttle Machines)

⇒ Fig 34. (G-53).

WARNING

This is a safety critical installation. Do not attempt to do this procedure unless you are skilled and competent to do so.

Installation and mounting of the park brake caliper requires tightening of the mounting bolts to a specific torque figure. Do not attempt to do this job unless you have the correct tools available.

0010

WARNING

Before working on the park brake, park on level ground and put blocks on each side of all four wheels. Stop the engine and disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

BRAK-8-8

WARNING

Brake pads generate dust which if inhaled, may endanger health. Wash off the caliper assemblies before commencing work. Clean hands thoroughly after work.

13-3-1-3

Pad Removal

1 Remove the parking brake calliper from the axle mounting bracket, refer to ***Park Brake - Calliper Removal and Replacement.***

2 Press carrier side pad **1** into housing **15** and remove. Ensure any residual silicone used for pad retention during assembly is removed.

3 Carefully lever pad **2** from the rotor inside the housing using a flat blade screwdriver. Take care to prevent damage to the plastic clip in the centre of the rotor **9** (there is no need to remove the rotor from the calliper).

Pad Inspection

WARNING

Oil on the brake disc will reduce brake effectiveness. Keep oil away from the brake disc. Remove any oil from the disc with a suitable solvent. Read and understand the solvent manufacturer's safety instructions. If the pads are oily, new ones must be fitted.

2-3-2-3_3

1 The minimum thickness of the friction material on either pad is 1mm (0.04 in), but it is recommended new pads are fitted as pads worn to this limit may not be able to be adjusted.

2 Check the condition of the disc surface. Renew the disc if badly warped, pitted or worn. For brake disc removal, refer to ***Park Brake, Brake Disc - Removal and Replacement***.

3 Renew the cable if worn or damaged.

Pad Replacement

1 Fit the pad **2** to the lever side of the calliper. Position the pad inside housing **15**. Locate the plastic clip in the centre of the rotor **9** into the hole **X**, and press the pad into place.

2 Make sure the plastic anti-rattle pad **Y** is correctly located. Fit the pad **1** to the carrier side of the calliper. Add a small amount of silicone sealant to the back outer edge of the backing plate to hold the pad in place within the housing.

3 Replace the calliper, refer to ***Park Brake - Calliper Removal and Replacement.***

Note: *If there is insufficient adjustment after fitting new pads change the brake cable.*

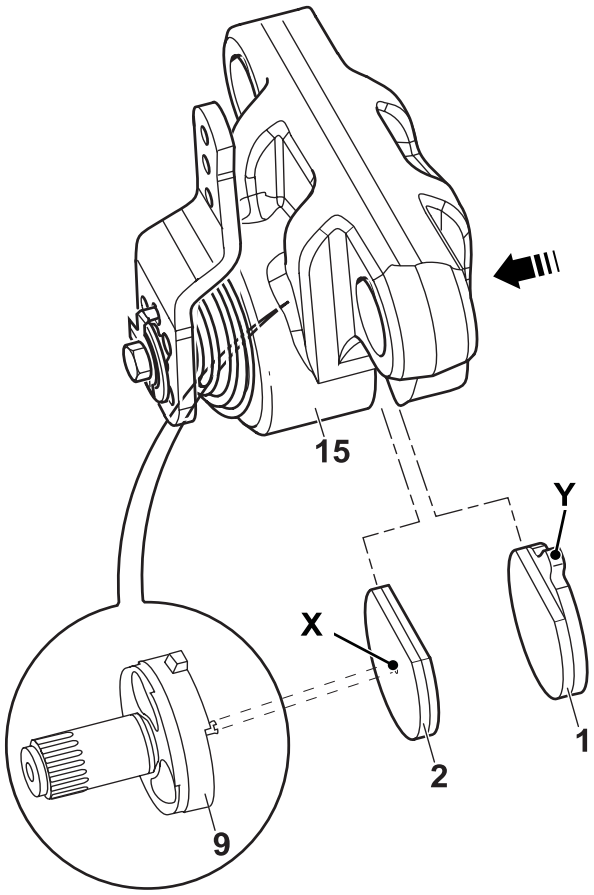


Fig 34. Brake Pads (Synchro Shuttle Machines)

Master Cylinder and Servo Unit

Removal and Replacement

⚠ WARNING

Before working on the brake system make sure the machine is on level ground and chock all four wheels.

BRAK-1-4

Removal

1 Gain access the brake pedal box assembly. Remove the steering wheel, column switches and console assembly. See ***Section D Controls, Steering Column - Removal*** for procedures.

2 ⇨ ***Fig 35. (G-55)***. Working outside the cab, loosen and remove brake pipe unions **B**, plug and cap to prevent loss of fluid and ingress of dirt.

3 Remove the brake pipes from the master cylinders: master cylinders bridging pipe **D**; axle feed pipes **E** and reservoir supply pipes **H**.

4 Working inside the cab, remove the brake pedals clevis **F** and disengage the brake pedal from the servo unit (both pedals).

5 Loosen and remove the servo unit retaining nuts **G** (both units).

6 Tag the cylinders (left and right hand). Remove the master cylinder and servo units.

Replacement

Replacement is the reverse of the removal sequence, but note the following:

Fit a new gasket **L** to each servo unit.

Refit the cylinders in their original positions.

If the brake master cylinders or brake servo units are removed it is recommended that the servo brake assembly operating rod measurement is checked. If the rod length is not checked it may result in differing brake pedal travel which could result in uneven braking.

1 With the brake master cylinder removed, measure from the face of the servo unit to the end of the servo brake rod as shown at **J** which should be 8.5 to 8.3 mm (0.334 to 0.326 in).

2 Adjust measurement **J** by screwing domed bolt **K** in or out as required, secure in position with JCB Threadlocker and Sealer.

Note: *If no adjustment is required make sure the domed bolt **K** can not be rotated by finger pressure.*

⚠ WARNING

Use of incorrect fluid will cause serious damage to the seals which could in turn cause brake failure.

BRAK-1-1

3 Fill the brake system with JCB Light Hydraulic Fluid and bleed the system. Refer to ***Service Procedures, Service Brakes - Bleeding.***

Note: *4WS machines do not have dual pedal braking. Procedures described still apply to a single pedal application.*

4 Unlatch pedals and ensure that pedal pads are level with each other and fully back against their stops.

5 Adjust pedal linkages for free movement to give 1 mm (0.040 in) on each pushrod.

6 With pedals still unlatched, apply an equal force to each pedal and check if pedals remain level. If necessary adjust by increasing the clearance on one of the pushrods. Do not decrease either clearance below 1 mm (0.040 in).

On completion, bleed the brake system and check the brakes operate correctly and that machine stops in a straight line. Refer to ***Service Procedures, Service Brakes - Bleeding***.

Latch pedals and check for straight line braking; if satisfactory straight line braking cannot be achieved refer to ***Fault Finding***.

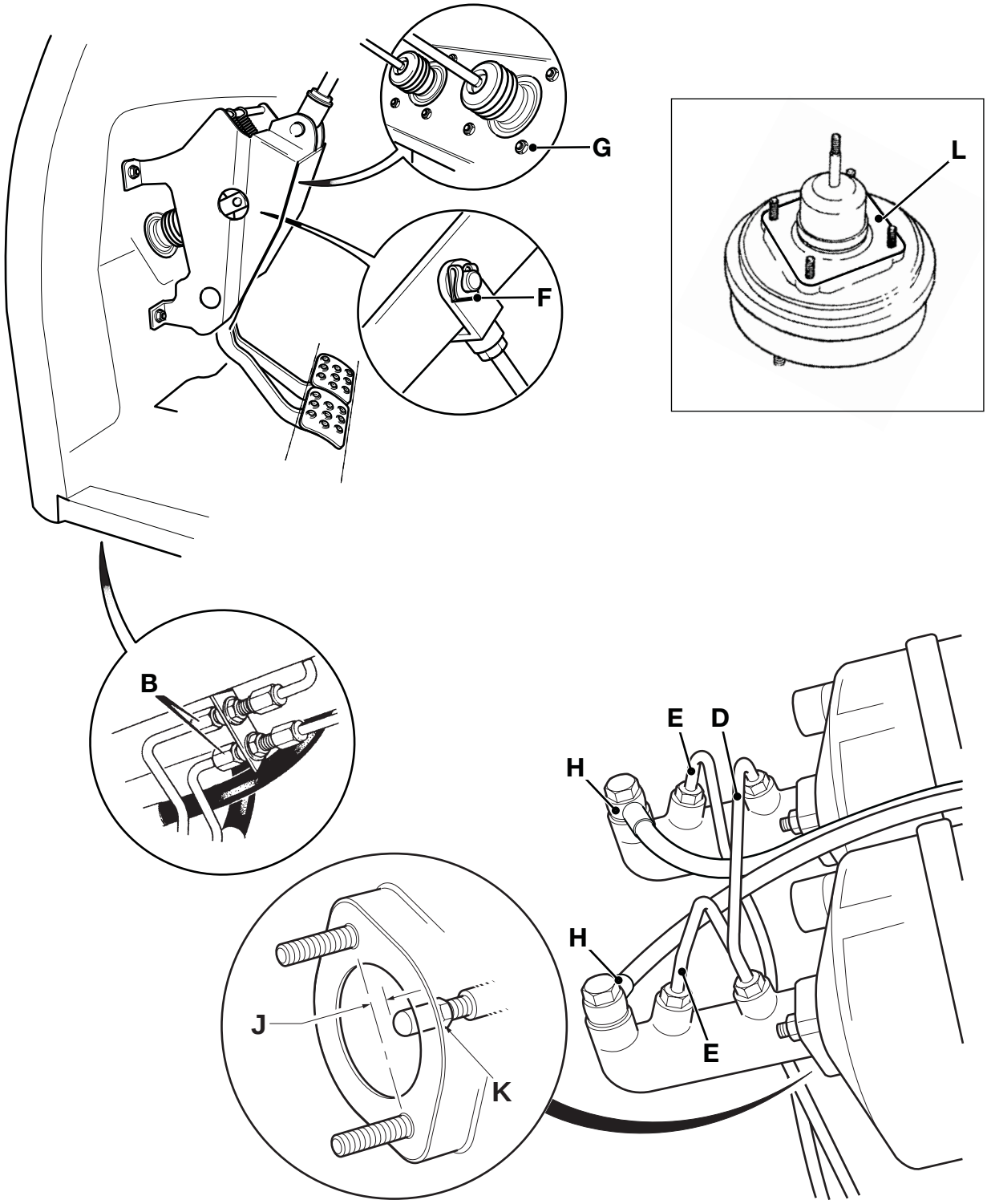


Fig 35.

Table 22. Torque Settings

Item	Nm	kgf m	lbf ft
H	18 - 22	1.8 - 2.2	13 - 16

Dismantle and Assemble

Note: *The servo unit (not shown) is a non serviceable part. A faulty servo unit must be replaced with a new one.*

Note: *Seal kits are no longer available for the master cylinders, the only servicing permitted is a major repair kit which comprises of a full piston assembly. A faulty master cylinder and piston assembly must be replaced with new ones.*

Dismantle

1 Remove circlip **1** and washer **2**.

2 Shake the cylinder body, or use compressed air, to eject piston assembly **3**. Take care not to damage the piston assembly or the bore of the cylinder body.

3 Examine the working surfaces of piston and cylinder. If these are not in perfect condition the master cylinder assembly must be renewed. The piston assembly **3** cannot be dismantled. If it is damaged (including seal **5**), the complete piston and seal assembly must be renewed, see ***Note***.

Assemble

⚠ WARNING

Use of incorrect fluid will cause serious damage to the seals which could in turn cause brake failure.

BRAK-1-1

1 Clean and lubricate all components, including new seals, with JCB Special Hydraulic Fluid. DO NOT USE CONVENTIONAL BRAKE FLUID OR SERIOUS DAMAGE WILL BE CAUSED.

2 Take care not to damage the machined faces of piston assembly **3** when assembling.

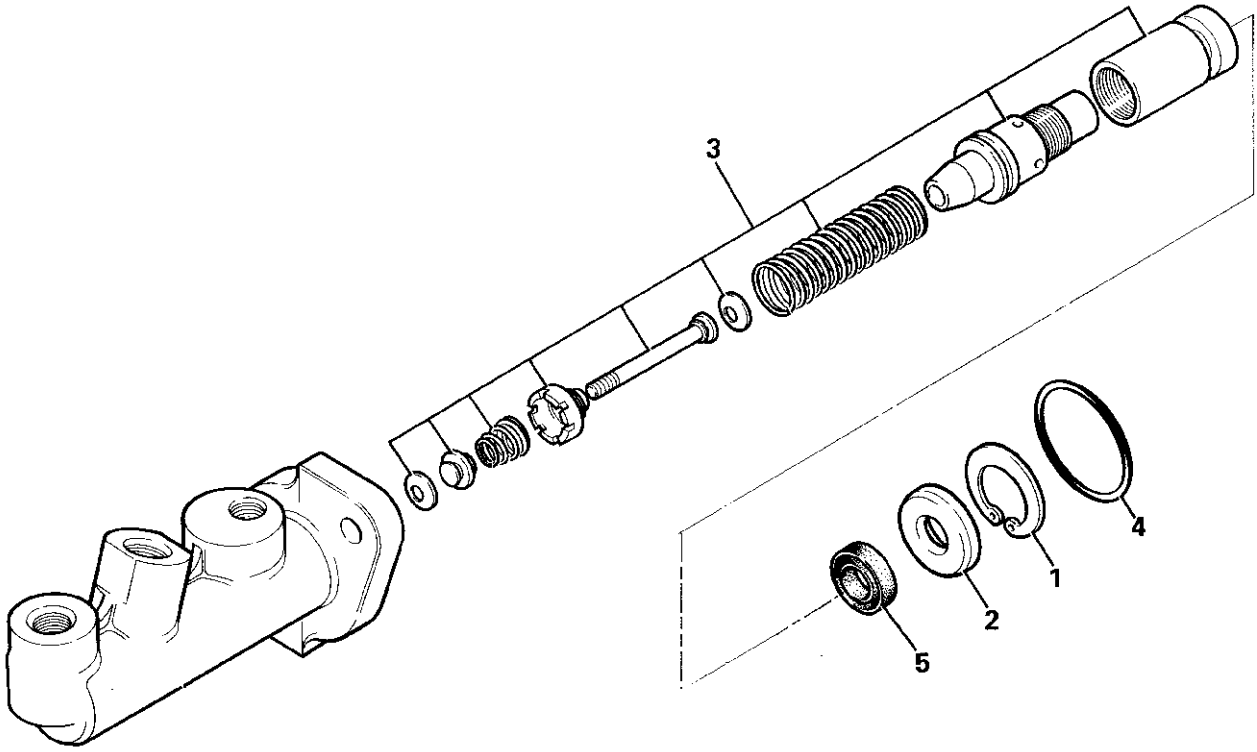


Fig 36.

Remote Servo Unit - 3C Machines (Option)

Removal and Replacement

The following procedure describes the removal of the near-side servo unit. The procedure for the off-side unit is identical.

⚠ WARNING

Before working on the brake system make sure the machine is on level ground and chock all four wheels.

BRAK-1-4

Removal

1 ⇨ *Fig 37. (G-58)*. Working beneath the machine, undo the clip **A** and pull off the vacuum hose.

2 Disconnect hose **B** (outlet - to rear axle), and hose **C** (inlet - from cab brake pipe) at the hydraulic cylinder.

Label the hoses before disconnecting to ensure correct replacement. Plug the open ports and cap the hose ends to prevent loss of fluid and ingress of dirt.

3 Remove the two securing bolts **D**, then lift the servo unit together with the mounting bracket clear of the machine.

Replacement

Replacement is the reverse of the removal sequence, but note the following:

⚠ WARNING

Use of incorrect fluid will cause serious damage to the seals which could in turn cause brake failure.

BRAK-1-1

On completion, bleed the brake system and check the brakes operate correctly and that machine stops in a straight line. Refer to ***Service Procedures, Service Brakes - Bleeding***.

Latch pedals and check for straight line braking; if satisfactory straight line braking cannot be achieved refer to ***Fault Finding***.

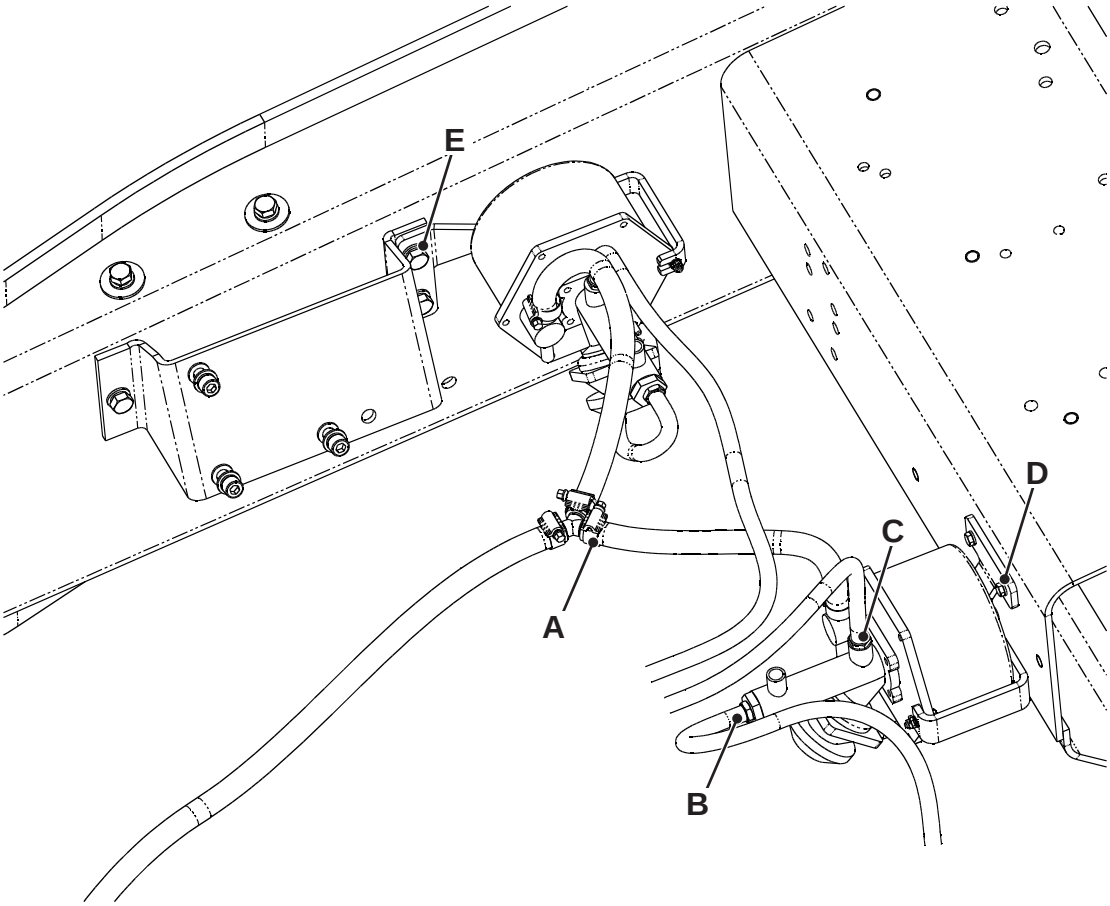


Fig 37. Remotely Mounted Servo Units

Table 23. Torque Settings

Item	Nm	kgf m	lbf ft
D	9.9	1.0	7.3
E	47.0	4.8	34.7

Servo Exhauster Unit

Removal and Replacement

If the brake performance is poor and the brake servo vacuum is suspected, carry out the brake vacuum tests before renewing the servo exhauster unit, see ***Service Procedures - Brake Vacuum Tests***.

⚠ WARNING

Before working on the brake system make sure the machine is on level ground and chock all four wheels.

BRAK-1-4

Removal

1 Park the machine on firm level ground, engage the parking brake and set the transmission to neutral. Raise the loader arms and fit the loader arm safety strut. Stop the engine and remove the starter key.

⚠ WARNING

Raised Equipment

Never walk or work under raised equipment unless it is supported by a mechanical device. Equipment which is supported only by a hydraulic device can drop and injure you if the hydraulic system fails or if the control is operated (even with the engine stopped).

13-2-3-7_2

2 Remove the front grille and raise the engine cover.

3 Disconnect the battery.

4 ⇨ ***Fig 38. (📄 G-60)***. Working at the LH side of the engine compartment, undo the clip and release the brake vacuum hose **A** from the pipe stub **B**. Disconnect the oil feed hose **C**. Blank off the open ends of the hoses to prevent ingress of dirt. Tie the hoses out of the way.

5 Undo the two screws **D** and carefully withdraw the servo exhauster unit from the engine. Discard the gasket **E**.

Replacement

Replacement is a reversal of the removal sequence, but note the following:

Important: *The special adaptor **F** is fitted with an oil feed restrictor orifice (3 mm diameter). Check to make sure that the orifice is not blocked before fitting the servo exhauster unit.*

Ensure the servo exhauster unit flange and engine mating face are clean. Fit a new gasket **E**.

Carefully align the gear **G** so that the gear teeth engage with the drive gear in the engine.

Torque tighten screws **D**. ⇨ ***Table 24. Torque Settings (📄 G-60)***.

On completion test the brakes.

Note: *The servo exhauster unit is a non-serviceable part. If it is suspected as being faulty it must be renewed as a complete assembly.*

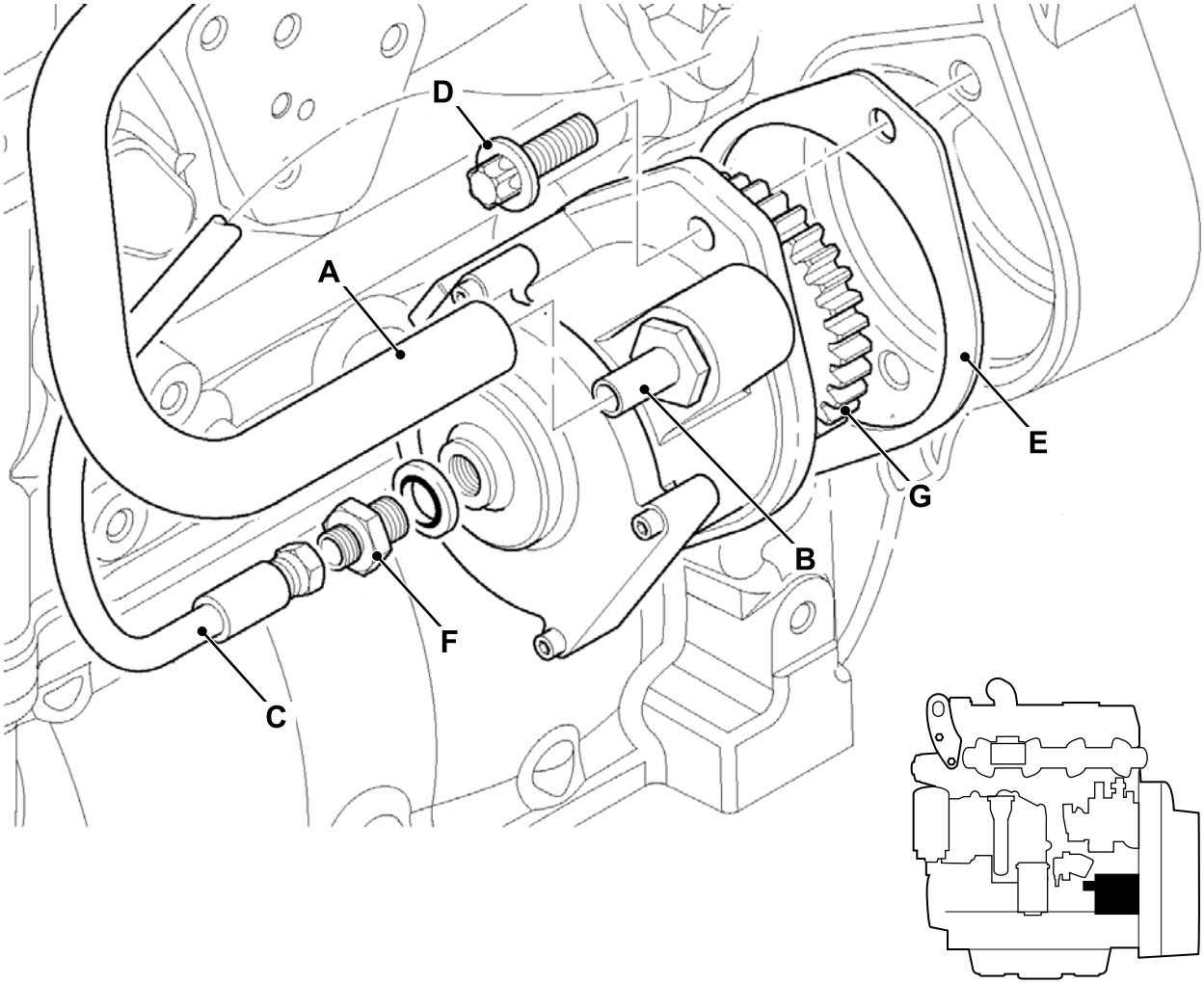


Fig 38.

Table 24. Torque Settings

Item	Nm	kgf m	lbf ft
D	43 - 51	4.4 - 5.2	32 - 38

Service Brakes

Dismantle and Assemble

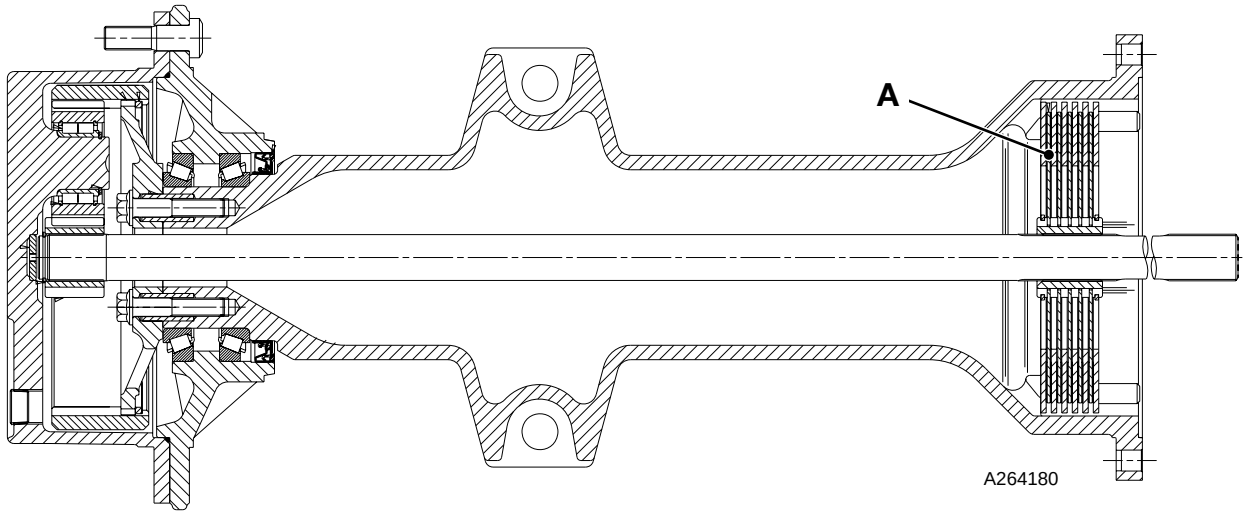


Fig 39.

The service brakes are located in the rear axle, as shown at **A**. The procedures for dismantling and assembly are described in a separate publication, see ***Transmissions Service Manual*** (Publication No. 9803-8610) which includes procedures for the axle sub-assemblies.

Park Brake

Synchro Shuttle Machines

Torque Figures

The illustration shows a typical installation.

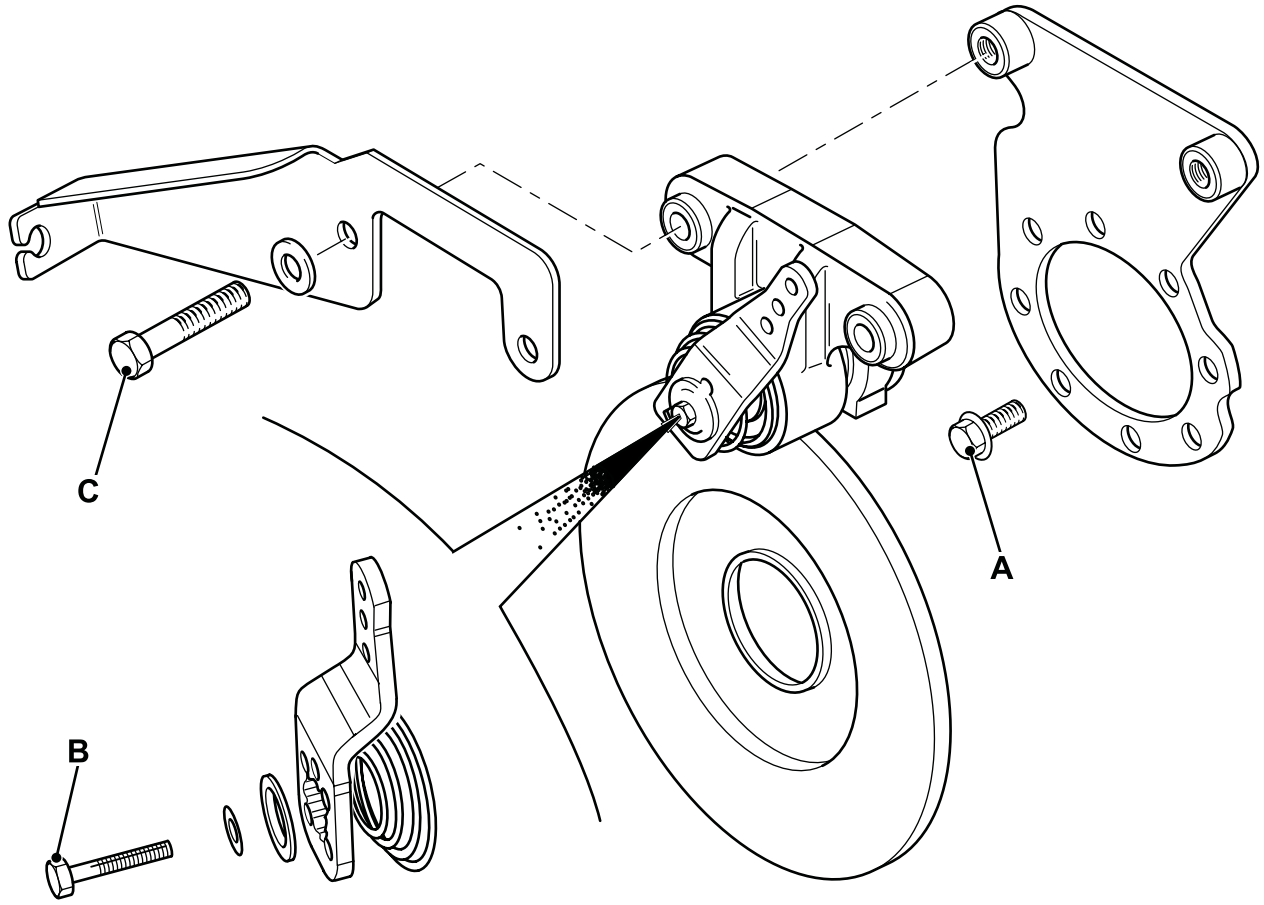


Fig 40.

Where appropriate, the grade of bolt is indicated in parenthesis e.g. (10.9). Refer also to relevant dismantling and assembly procedures.

Table 25. Torque Settings

Item	Nm	Kgf m	lbf ft
A	166	17	122 (12.9)
B	13 - 16	1.3 - 1.6	9 - 12
C	255	26	188 (10.9 Tuflok)

Calliper - Removal and Replacement

⚠ WARNING

This is a safety critical installation. Do not attempt to do this procedure unless you are skilled and competent to do so.

Installation and mounting of the park brake caliper requires tightening of the mounting bolts to a specific torque figure. Do not attempt to do this job unless you have the correct tools available.

0010

⚠ WARNING

Before working on the park brake, park on level ground and put blocks on each side of all four wheels. Stop the engine and disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

BRAK-8-8

⚠ WARNING

Brake pads generate dust which if inhaled, may endanger health. Wash off the caliper assemblies before commencing work. Clean hands thoroughly after work.

13-3-1-3

Removal

1 Release the park brake lever (lever horizontal).

2 Disconnect clevis **A**, note which of the three holes on the lever is used.

3 Undo locknuts **B** and disconnect the cable from the bracket **D**.

4 Support the calliper and remove the two mounting bolts and hardened washers **C**. Lift the calliper and bracket **D** clear of the brake disc.

Note: *Do not remove axle mounting bracket **F** unless it needs to be renewed.*

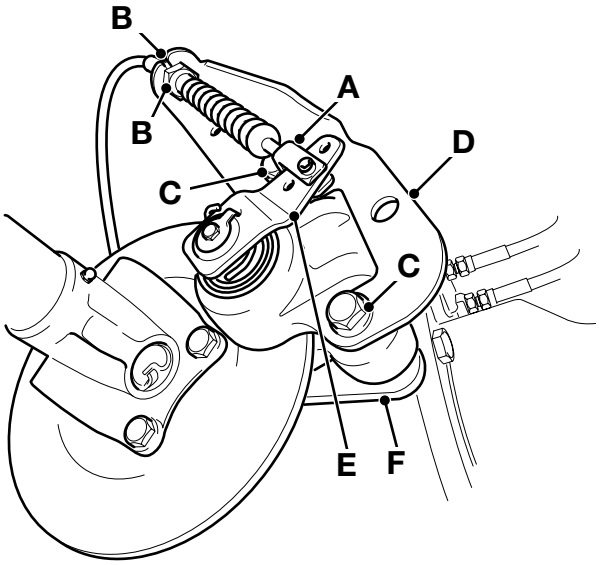


Fig 41.

Replacement

Replacement is the reverse of the removal sequence.

1 Locate the calliper on the brake disc. Fit new mounting bolts **C** with hardened washers and torque tighten, ⇨ *Table 25. Torque Settings (G-62)*.

2 Insert cable into bracket **D**, do not tighten locknuts **B** at this stage as the brake will need adjusting.

3 Refit the clevis **A** into the hole in the operating lever **E** as shown.

4 Make sure there is adequate freedom of movement of operating lever **E** to ensure a positive brake application, and that the lever returns to the rest position when the parking brake is released.

5 Adjust the park brake, see ***Service Procedures, Park Brake - Adjustment.***

Never unscrew the clevis A to adjust the cable.

Table 26. Torque Settings

Item	Nm	kgf m	lbf ft
C	255	26	188

Calliper - Dismantle, Inspection and Assemble

WARNING

This is a safety critical installation. Do not attempt to do this procedure unless you are skilled and competent to do so.

Installation and mounting of the park brake caliper requires tightening of the mounting bolts to a specific torque figure. Do not attempt to do this job unless you have the correct tools available.

0010

WARNING

Before working on the park brake, park on level ground and put blocks on each side of all four wheels. Stop the engine and disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

BRAK-8-8

WARNING

Brake pads generate dust which if inhaled, may endanger health. Wash off the caliper assemblies before commencing work. Clean hands thoroughly after work.

13-3-1-3

Dismantle

⇒ Fig 42. (G-65). The numerical sequence shown on the illustration is intended as a guide to dismantling.

1 Remove the calliper and brake pads, *⇒ Calliper - Removal and Replacement (G-63)*.

2 Remove the screw **3**, and washers **4** and **5**. Hold lever **6** against the tension of the spring as the screw is removed.

3 Note the position of lever **6** relative to the splines of the rotor shaft **8**. Mark the end of the shaft and lever **6** to aid assembly. Remove lever **6** and spring **7**.

4 Push out rotor **8** and remove ball spacer **9** and ball bearings **10**. Take care not to lose the ball bearings.

5 Push out mounting bushes **11** and remove dust seals **12**.

6 Remove the rotor seal **13** followed by bearing ring **14**. Note that the rotor seal may be located on the rotor shaft or may have been left in the calliper housing **15**.

Note: *Shaft seal **16** will not need to be renewed unless excessively worn or damaged. If removal is necessary, press the seal out from inside the housing using a suitable spacer block and bench press. Clean out any remains of the seal after removal.*

Component Key: *⇒ Fig 42. (G-65)*

1	Carrier side pad
2	Lever side pad
3	Screw
4	Washer
5	Washer
6	Lever
7	Spring
8	Rotor
9	Ball spacer
10	Ball bearings
11	Mounting bushes
12	Dust seals
13	Rotor Seal
14	Bearing ring
15	Housing
16	Shaft seal

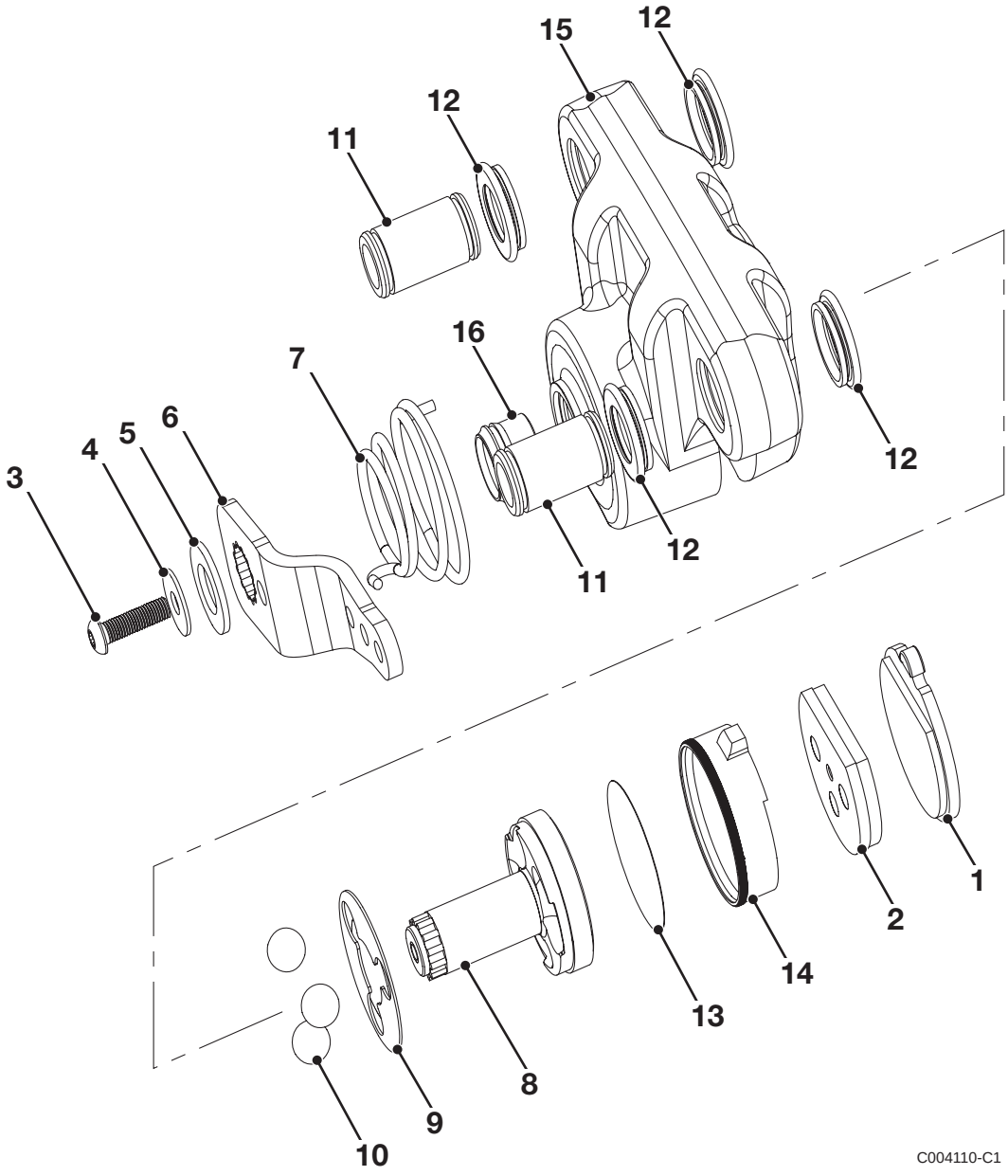


Fig 42. Park Brake Calliper

Inspection

1 Clean and dry all parts. Check all parts are free from excessive wear, damage or corrosion. Light scores or stains should be removed. Renew corroded or deeply scored parts.

2 Check rotor **8** for damage or distortion. Renew if necessary.Always renew both brake pads if the parking brake has been used in an emergency.Check the ball pockets in housing **15** for signs of scoring, pitting, damage or corrosion. Renew the housing if damaged.Check spring **7** is not broken or distorted. Check the condition of the disc surface. Renew the disc if badly warped, pitted or worn.

Assemble

⇨ *Fig 42. (G-65)*. The numerical sequence shown on the illustration is intended as a guide to assembling.

Before assembly make sure all parts are clean and serviceable.

1 Fit a new shaft seal **16** if removed. Install the seal as shown. Press the seal into the housing using a suitable spacer block and bench press.

2 Coat the shaft, outer diameter and ball pockets of rotor **8** and the ball pockets of housing **15** with silicone grease.

3 Insert the three ball bearings **10** into the pockets in the housing **15**. Insert ball spacer **9**.

4 Coat the bearing ring **14** with silicone grease and fit the ring to the inner diameter on rotor seal **13**. Assemble the rotor seal to the rotor **8**.

5 Slide rotor **8** through the casting and seat the ball pockets against the bearings.

6 Position spring **7** over the shaft of rotor **8**. Insert the large diameter end of the spring into hole **43X** in the face of the housing.

7 Locate the small diameter end of spring **7** around the outside edge of lever **6** as shown at **43Y**.

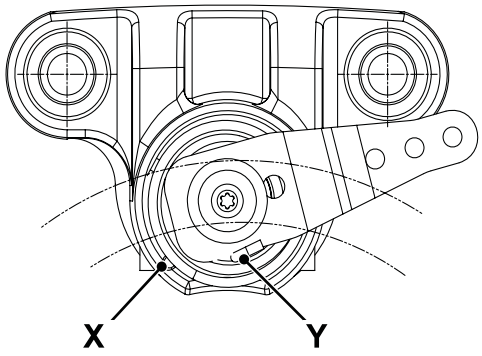


Fig 43.

8 Fit lever **6**. Align the lever to the mark made during dismantling.

9 Hold the lever against the tension of the spring and fit washers **4** and **5** Fit screw **3** and torque tighten, ⇨ *Table 26. Torque Settings (G-63)*.

10 Fit the new brake pads, refer to ***Service Procedures, Park Brake - Renewing the Brake Pads***.

11 Lubricate the dust seals **12** and bushes **11** with silicone grease. Fit the dust seals to the housing and insert mounting bushes. Make sure that the dust seals locate in their location grooves on the bushes **11** and housing **15**. Wipe off any excess grease.

12 Before fitting the calliper, ensure the lever rotates smoothly and that the lever side pad **2** returns to the off position when the lever is released.

13 Refit the brake calliper. ⇨ *Calliper - Removal and Replacement (G-63)*. Adjust the parking brake, refer to ***Service Procedures, Park Brake - Adjustment***.

Table 27. Torque Settings

Item	Nm	kgf m	lbf ft
3	13 - 16	1.3 - 1.6	9 - 12

Disc - Removal and Replacement

WARNING

This is a safety critical installation. Do not attempt to do this procedure unless you are skilled and competent to do so.

0203

WARNING

Before working on the park brake, park on level ground and put blocks on each side of all four wheels. Stop the engine and disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

BRAK-8-8

Removal

1 Disconnect the propshaft to the rear axle, refer to ***Section F Transmission, Propshafts - Removal and Replacement***.

2 Remove the calliper from the axle mounting bracket **F**. ⇨ ***Calliper - Removal and Replacement (G-63)***.

3 Undo the stake nut and withdraw the brake disc from the drive pinion shaft.

Note: *If the axle is not mounted to a machine, fit flange spanner* ***44A*** *(service tool 992/04800) to prevent brake disc and drive pinion shaft turning when loosening or tightening the stake nut. Refer to* ***Section F Transmission - Service Tools****.*

Replacement

Replacement is the reverse of the removal sequence, but note the following:

Fit a new stake nut and torque tighten, ⇨ ***Table 28. Torque Settings (G-67)***.

Re-stake the nut using a square ended staking tool.

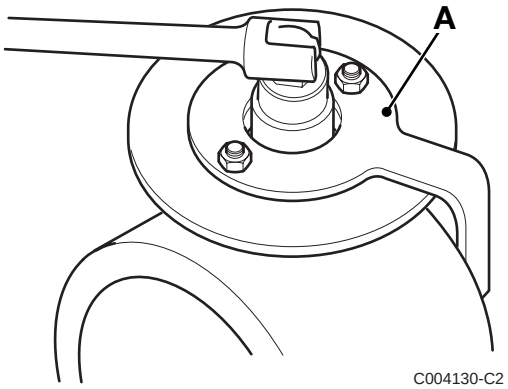


Fig 44.

Table 28. Torque Settings

Item	Nm	kgf m	lbf ft
1	370	38	273

Powershift Machines

Dismantle, Inspection and Assemble

The integral park brake consists of a wet multi-plate friction pack and a mechanical actuator assembly. A separate dismantling procedure is given for each sub assembly.

⚠ WARNING

Before working on the park brake, park on level ground and put blocks on each side of all four wheels. Stop the engine and disconnect the battery so that the engine cannot be started. If you do not take these precautions the machine could run over you.

BRAK-8-8

Dismantle the Multi-Plate Brake Pack

⇨ *Fig 47. (G-69)*.

1 Working inside the cab, disengage the park brake (lever horizontal). Rotate the park brake lever to fully slacken the cable.

2 Remove the rear propshaft, see ***Section F, Propshafts.*** Position the output yoke **46A** as shown.

3 Working beneath the machine at the gearbox, undo two bolts **47A** at positions **47X** and screws **47B**. Using a flat bladed screwdriver located in the cover cutout, lever off cover plate **47C**.

4 Undo the remaining four bolts **47A** and carefully pull off cover **47D**, keeping it square to the mating face on the gearbox (Note that the park brake cable is still attached at this stage).

Note: *If the cover does not come free one or more reaction pins **47F** will have remained in the cover. Use a pair of long nosed pliers to push the pins back into the gearbox casing. Be sure not to damage the surface of the pins.*

5 Remove the needle roller thrust bearing **47E**, thrust plate **47G**, friction plates **47H** (5-off) and counter plates **47J** (5-off).

Note: *If the brake actuator is to be dismantled, or the cable renewed, then remove the park brake cable **45A**. Undo screw **45C**, remove circlip **45B** and withdraw the cable from the housing.*

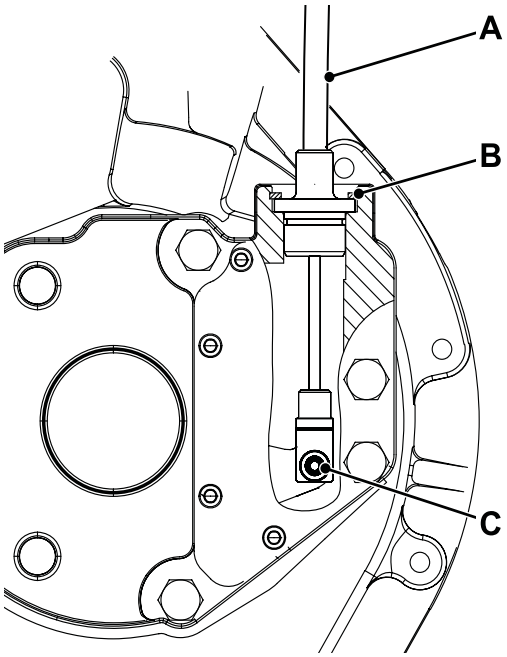


Fig 45.

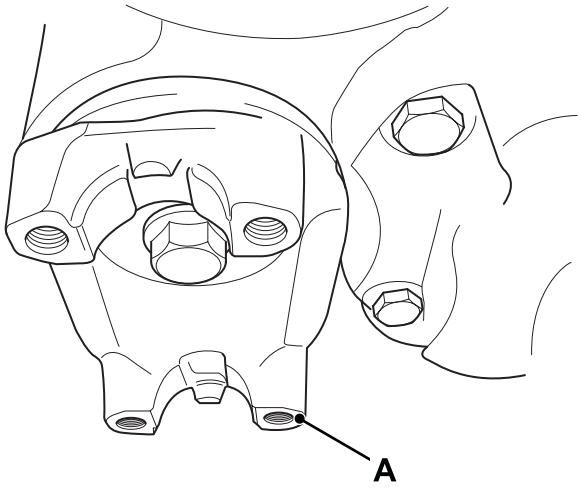


Fig 46.

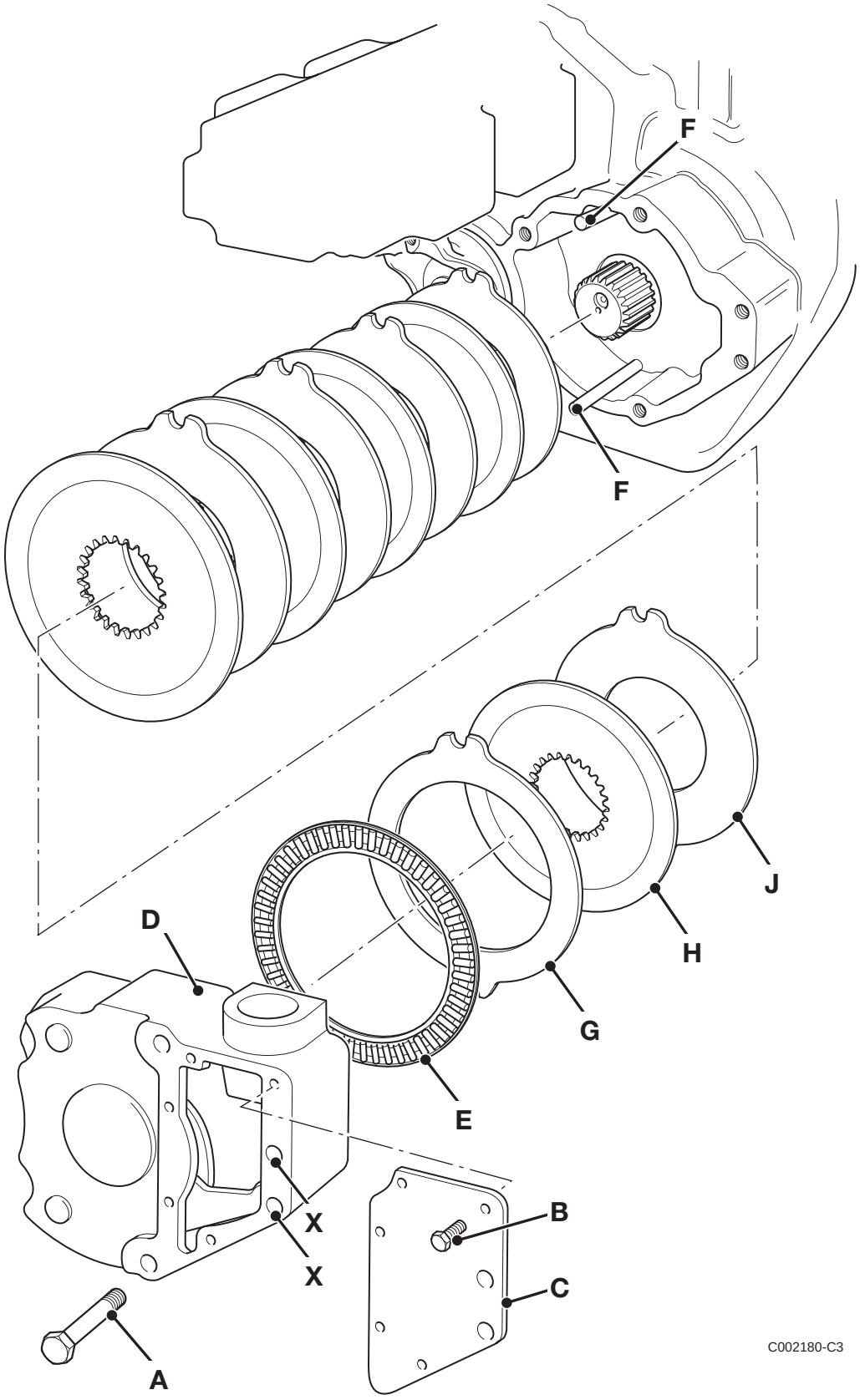


Fig 47. Multi-Plate Brake Pack

Dismantle the Brake Actuator

1 Carefully undo screw **A**, note that the screw is under tension from springs **B** and **C**.

2 Remove washers **D** and **E**, followed by springs **B** and **C**.

3 Lift out the brake actuator plate **F** followed by balls **G** (5-off).

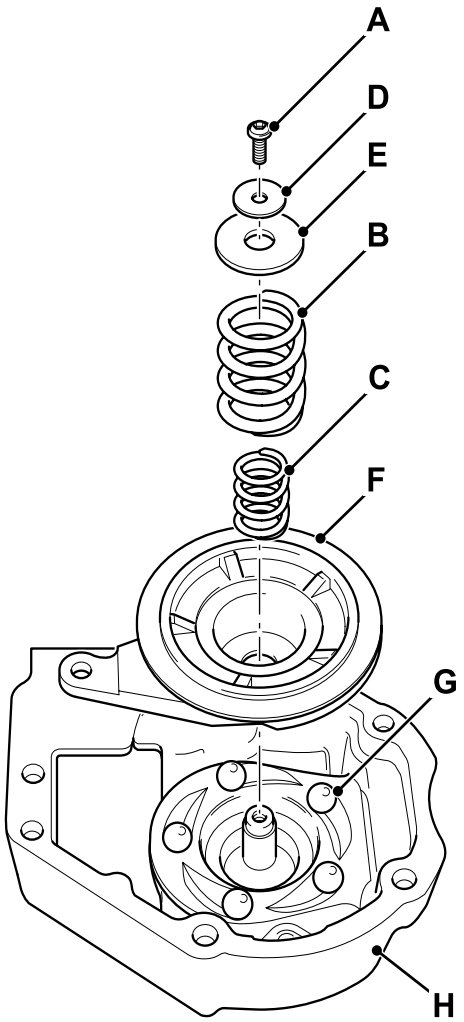


Fig 48.

Inspection

Before inspecting the brake components carefully remove all traces of sealing compound from component mating faces. Using a suitable degreaser clean the brake components including the brake housing in the gearbox rear casing.

1 Carefully inspect the friction plates **A** and counter plates **B**. If any of the plates show signs of damage or distortion, renew the complete friction pack.

2 Assemble the friction and counter plates (including the thrust plate **C**) on a suitable datum table. Measure the overall thickness of the assembled friction pack. The thickness **X** must be between 39.6 mm and 37.1mm. If the pack is out side these limits the complete friction pack assembly must be renewed.

Note: *The friction pack may be outside the maximum thickness value if the plates are distorted, typically after the brake has performed an emergency stop.*

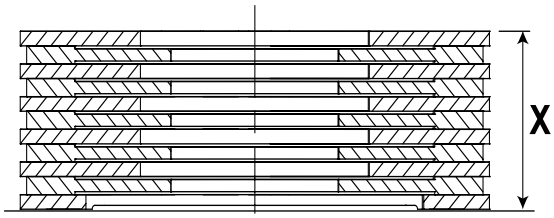


Fig 49.

3 Inspect the following components for signs of excessive wear or damage: Balls **D** and their tapered locating slots (cover **E** and actuator plate **F**), needle roller thrust bearing **G** and the corresponding bearing surfaces (actuator plate **F** and thrust plate **C**).

Note: *Some discolouration of the needle rollers is acceptable providing the surface of the rollers is otherwise undamaged.*

4 Make sure that the park brake cable is smooth and free in operation. Inspect the cable outer for signs of damage. Renew the cable if it is damaged or stiff to operate.

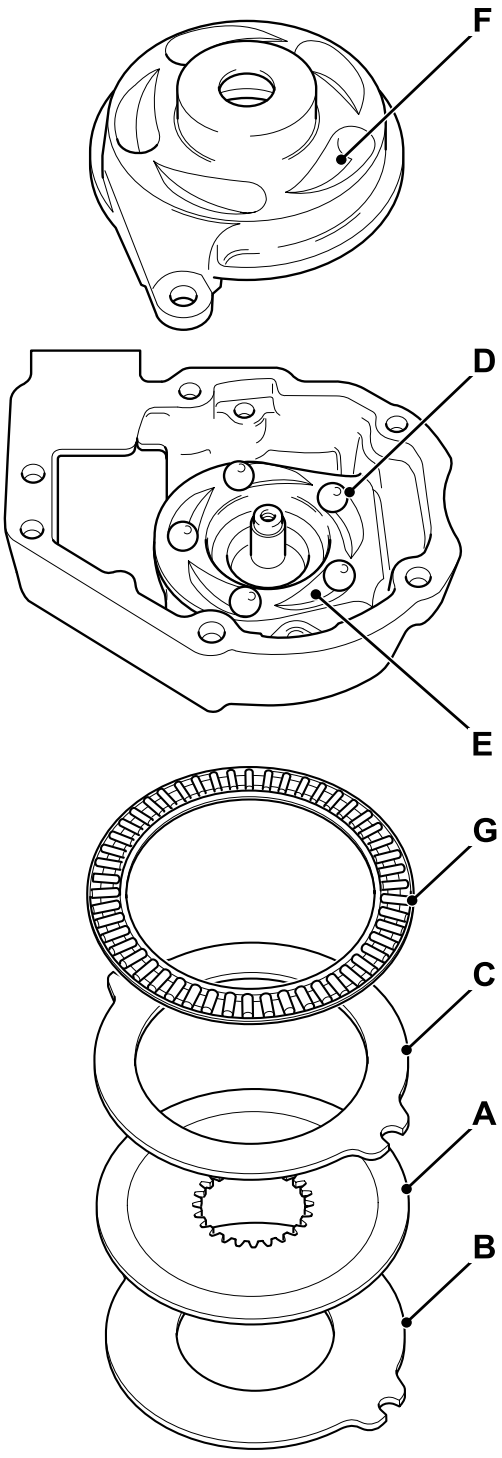


Fig 50.

Assemble the Brake Actuator

1 Apply a little grease to the ball locating slots in cover **H** and actuator plate **F**. Locate balls **G** in their slots in cover **H**.

2 Fit actuator plate **F** followed by springs **B** and **C**.

3 Locate washers **D** and **E**. Compress the springs **B** and **C**, then fit screw **A** and tighten.

Table 29. Torque Settings

Item	Nm	kgf m	lbf ft
A	16	1.6	12

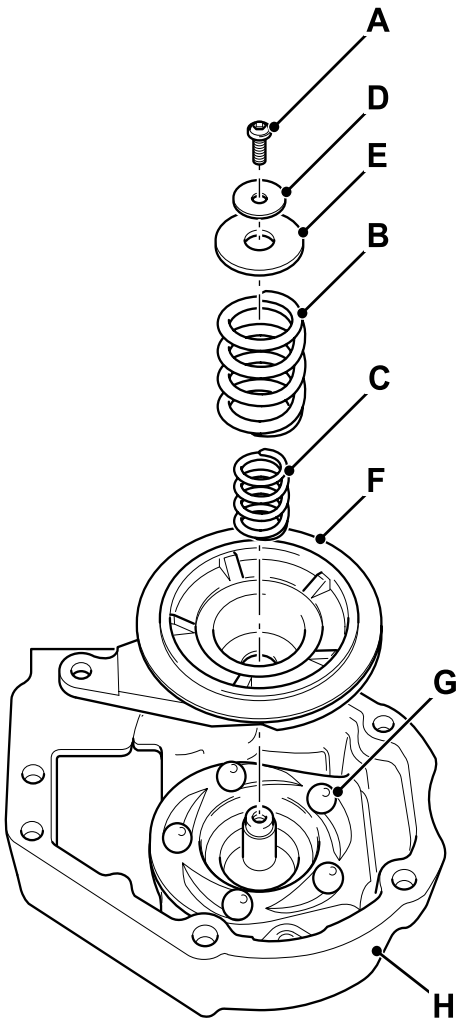


Fig 51.

Assemble the Multi-Plate Brake Pack

⇒ Fig 53. (G-74).

1 Working beneath the machine, assemble the reaction pins **53F** followed by the friction pack into the gearbox casing. Note that a counter plate **53J** is fitted first followed by a friction plate **53H** and so on. Fit the thrust plate **53** last.

Note: *If removed during the dismantling, fit the park brake cable **52A**. Feed the cable into the housing and connect the fork end to the brake actuator **52F** with screw **52E**. Make sure that `O' ring **52D** is undamaged and correctly fitted on collar **52B**. Locate the collar inside the brake housing and retain with circlip **52C**.*

Note: *Screw **52E** is a special clevis pin. DO NOT fit a normal bolt or screw.*

2 Make sure that the needle roller thrust bearing **53E** is correctly located on the brake actuator assembly, if necessary use some grease to help retain the bearing.

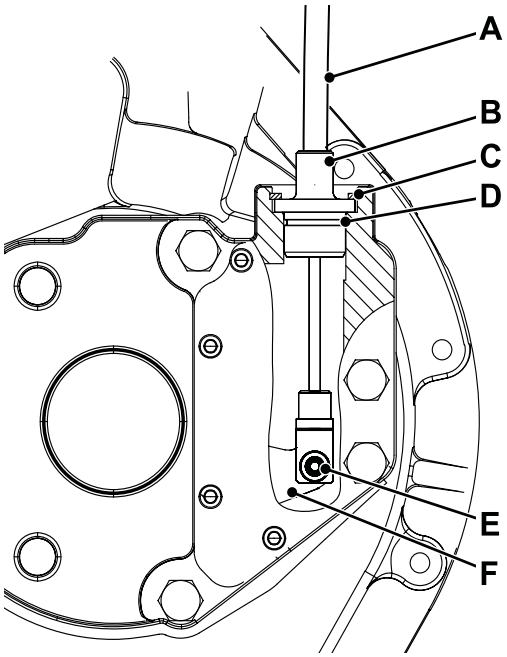


Fig 52.

3 Before fitting the cover **53D**, apply a bead of JCB Multigasket sealant to the mating face on the gearbox casing as shown at **53Y**. Fit the cover and 4-off bolts **53A**. Torque tighten bolts **53A**, *⇒ Table 28. Torque Settings (G-67)*. Note that 2-off bolts at position **53X** are not fitted at this stage. Carefully feed the park brake cable up into the cab, through the aperture in the cab floor.

4 Working inside the cab, reconnect the park brake cable to the park brake lever and adjust the lever, see ***Service Procedures, Park Brake, Adjustment, Powershift Machines.*** Working under the machine view the brake friction pack through the housing aperture and check its operation. Play in the plates will be easily felt when the brake is off.

5 Before fitting cover plate **53C**, apply a bead of JCB Multigasket sealant to the mating face on the cover **53D** as shown at **53Z**. Fit screws **53B** (5 off) and remaining bolts **53A** (2-off), *⇒ Table 28. Torque Settings (G-67)*.

6 If any brake components have been renewed it must be assumed that the gearbox oil will be contaminated. Change the gearbox oil and filter, see ***Section 3, Maintenance.***

Note: *A small quantity of gearbox oil will be transferred from the sump to fill the brake cavity when the engine is started. Check the gearbox oil level and top up if necessary, see **Section 3, Maintenance.***

Table 30. Torque Settings

Item	Nm	kgf m	lbf ft
52E	9	0.9	6.6
53A	56	5.7	41
53B	16	1.6	12

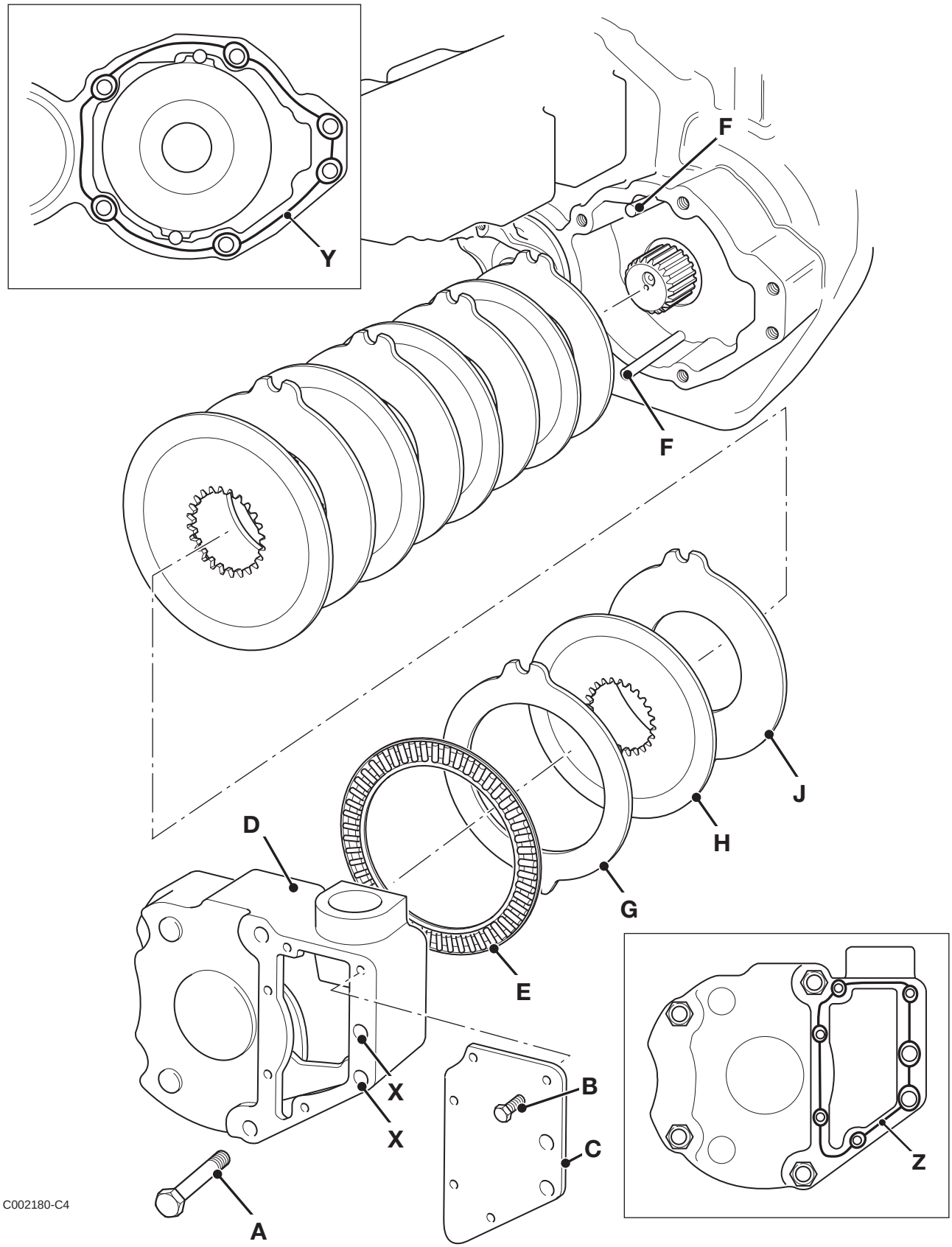


Fig 53. Multi-Plate Brake Pack