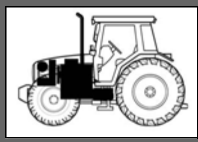
Chapter 3



Engine

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3A10

Sisu Tier 3 engine - General

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A. General

Notice to the technician

Citius series engines (types 44, 49, 66, 74 and 84) are generally constructed to the same model: the repair instructions will therefore usually apply to different engine types. The differences between engine types that do affect repair work are explained in the technical specifications and repair instructions. All measurements are made in millimetres and are valid when the room temperature is +20 °C, unless otherwise indicated.

Safety instructions

When using and servicing an engine, there is always a risk of injury. Before carrying out any servicing work, make sure you have read and correctly understood the following safety instructions and information!

- Do not begin any repair work until you have completely understood the procedure.
- Ensure that the location chosen to carry out the repair work, as well as the immediate surroundings, provide a safe working environment.
- Always check that the space is clean and tidy.
- Do not use faulty or unsuitable tools.
- Remove any jewellery (rings, chains and watches) before starting.
- Use new protective equipment during the operation. For example, wear safety goggles for protection when using compressed air for cleaning, grinding, striking etc.
- Use a lifting device to raise and transport heavy items (over 20 kg). Make sure all lifting hooks and chains are in good condition. The engine lifting rings should not be subjected to lateral forces during lifting.
- Never work beneath an engine raised by a lifting device or jack. Always check that supports are sound before starting.
- Only use genuine Massey Ferguson spare parts.
- Only start the engine using the start switch in the cab.
- Do not start the engine unless all protective covers are fitted.

  ***Note:** It is difficult to see the fan clearly while the engine is running! Make sure baggy clothes and long hair cannot be caught up in the rotating parts of the engine.*
- If the engine is running in a closed space, make sure the ventilation system is operating correctly.
- Never use aerosol as a cold-starting aid! (risk of explosion)
- When the engine is running or when working close to machinery, use ear protection to prevent hearing loss.
- Always stop the engine before starting any maintenance or repair work.
- Take care not to touch the exhaust manifold, turbocharger or any other hot part of the engine.
- Take care when opening the radiator cap if the engine is still hot, because the cooling system is pressurised. The coolant and lubricating oil of a hot engine can cause injury on contact with skin.
- Keep naked flames, smoke and sparks away from the fuel system and batteries at all times, especially when charging the batteries, because there is a risk of explosion.
- Always disconnect the negative (-) battery terminal when maintaining or repairing the electrical circuit.
- At temperatures above 300 °C, for example if the engine is on fire, the fluorinated rubber engine seals (i.e. the "O" ring on the lower cylinder liner) emit hydrofluoric acid, which is highly corrosive. Do not touch the fluorinated rubber seals with your bare hands when they are exposed to excessively high temperatures. Always wear neoprene or reinforced gloves and protective goggles for decontamination work. Wash the seals and the contaminated area with a 10% calcium hydroxide solution or other alkali solution. Place any materials that you remove in sealed plastic bags and take them to the appropriate disposal site specified by the authorities concerned.

  ***Note:** Never burn fluorinated rubber seals to destroy them!*
- When checking the fuel injectors, do not allow the jet of high-pressure fuel to come into contact with skin. If fuel penetrates the skin, it can cause serious injury. Seek medical advice immediately!
- Fuel, lubricating oil and coolant can cause prolonged irritation if they come into contact with skin.
- When welding or carrying out similar operations requiring a high voltage current, it is strongly recommended that you disconnect the main connector of the EEM3 control unit before starting.
- Avoid running the engine at idle speed unnecessarily.
- Do not allow oil or any other liquid to spill on the floor during engine maintenance.
- All engine seals are asbestos-free.
- Take care when cleaning the engine with high-pressure cleaning equipment. Do not use high-pressure equipment to wash electrical equipment, the fuel system, the radiator etc. because they are very fragile.

Description of engine types

(1) 4 valves/cylinder
(2) Intercooler fitted
- A: air to air heat exchanger
- I: air to water heat exchanger

(3) Turbocharger engine
- W: bypass turbo
- T: standard turbo

(4) Engine type
- 74: cubic capacity, in decilitres
- C: common rail

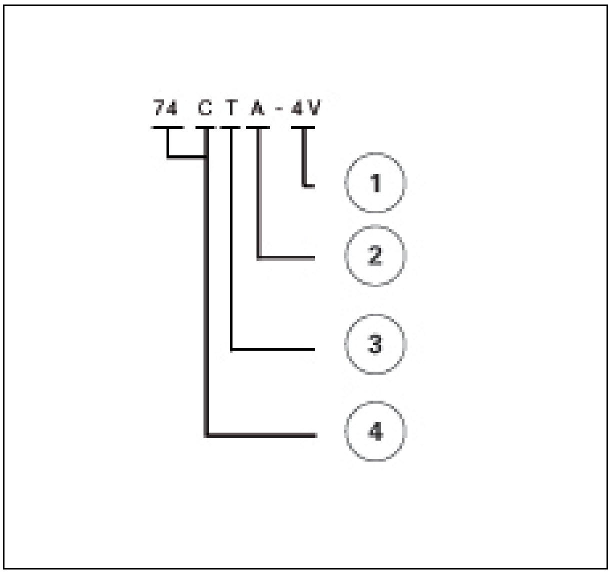

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Fig. 1

Location of the engine serial number

The engine serial number is always embossed on the cylinder block as shown in the illustration.
This serial number is also specified on the type plate:

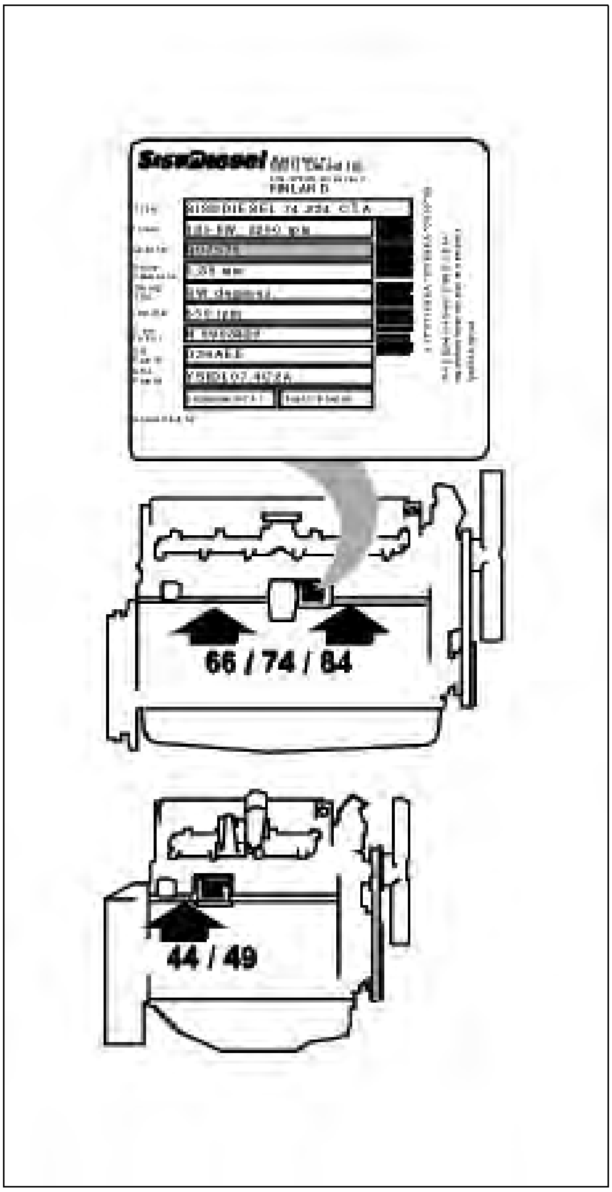

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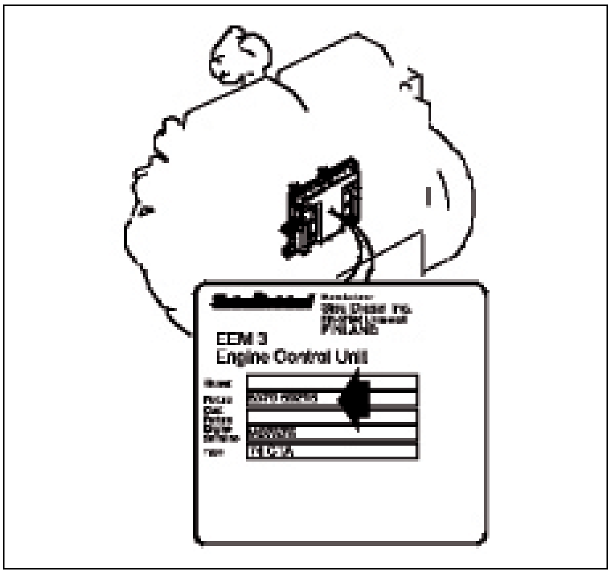
Fig. 2

Markings on the EEM3 control unit

The model specification is indicated on the EEM3 control unit type plate. This specification must always be provided when buying a control unit or when requesting adjustments to the settings.

NOTE: *The engine complies with emissions standards EU97/68/EC Stage IIIA and EPA 40 CFR 89 Phase 3.*

Do not fit components on the engine that were not originally designed for this purpose. Sisu Diesel Inc. disclaims all liability relating to emissions standards if parts other than genuine SisuDiesel spare parts are used.



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Lifting the engine

A Engine lifting rings

The engine can be lifted safely using a mechanism that applies vertical lifting force to the lifting rings.

Engine weight

Engine type	Weight(1)
44	345 kg
49	345 kg
66	515 kg
74	525 kg
84	650 kg

(1) Dry weight without flywheel or electrical circuits

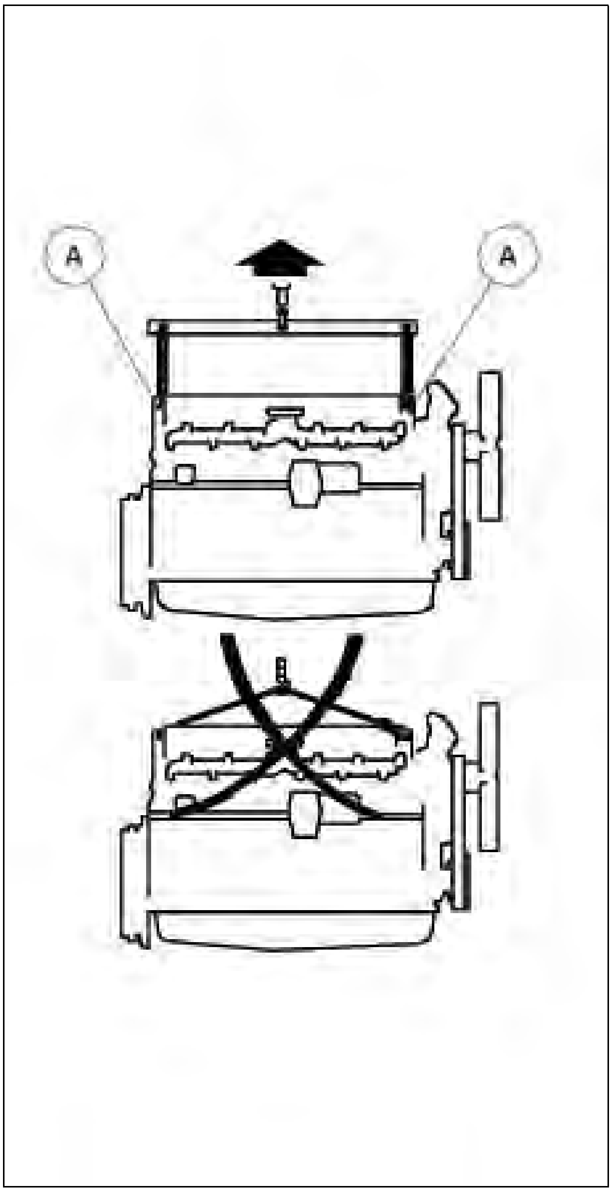

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Fig. 4

A.1 Technical specifications

Cylinder block

44, 49, 66 and 74 type engines

Ports for dowel pins .... 13,250 mm to 13,320 mm
Bearing housing diameter (44, 49 and 66 type engines) .... 91,000 mm to 91,025 mm
Bearing housing diameter (74 type engines) .... 96,000 mm to 96,025 mm
Bearing housing diameter (with bearing 8361 40950), (44, 49 and 66 type engines) .... 92,000 mm to 92,025 mm
Location of cylinder liners, upper end diameter .... 124,514 mm to 124,554 mm
Location of cylinder liners, lower end diameter............ 123,000 mm to 123,040 mm
Internal diameter of camshaft ring no.1 (fitted)............ 50,040 mm to 50,060 mm
Internal diameter of camshaft ring no. 2-4 (44 and 49 type engines)............ 50,000 mm to 50,025 mm
Internal diameter of camshaft bearing rings no. 2-5 (fitted, 66 and 74 type engines) .... 50,010 mm to 50,070 mm
Diameter of ring bore inside block (44 and 49 type engines) 55,620 mm to 55,650 mm
Cylinder block height .... 428,170 mm to 428,430 mm

84 type engines

Ports for dowel pins	13,250 mm to 13,320 mm
Bearing housing diameter	96,000 mm to 96,025 mm
Location of cylinder liners, upper end diameter	125,014 mm to 125,054 mm
Location of cylinder liners, lower end diameter	121,000 mm to 121,040 mm
Internal diameter of camshaft ring no.1 (fitted)	50,040 mm to 50,060 mm
Internal diameter of camshaft bearing rings no. 2-5 (fitted)	50,010 mm to 50,070 mm
Cylinder block height	468,850 mm to 469,150 mm

Cylinder liners

Cylinder liner projection above the upper section of the cylinder block	0.030 mm to 0,080 mm
Maximum height permitted between liners (on the same cylinder head)	0,02 mm
Cylinder liner collar height, standard	9,03 mm to 9,05 mm
Cylinder liner collar height, 1st over-size dimension	9,08 mm to 9,10 mm
Cylinder liner collar height, 2nd over-size dimension	9,13 mm to 9,15 mm
Cylinder liner collar height, 3rd over-size dimension	9,23 mm to 9,25 mm
External diameter of cylinder liner collar	131,700 mm to 131,800 mm

44, 49, 66 and 74 type engines

External diameter of cylinder liner guide at upper end of liner	124,475 mm to 124,500 mm
External diameter of cylinder liner guide at lower end of liner	122,961 mm to 122,986 mm
Liner bore	108,010 mm to 108,032 mm

84 type engines

External diameter of cylinder liner guide at upper end of liner	124,975 mm to 125,000 mm
External diameter of cylinder liner guide at lower end of liner	120,966 mm to 120,991 mm
Liner bore	111,000 mm to 111,002 mm

Cylinder head, 4 V engines

Cylinder head height	109,900 mm to 110,000 mm
Cylinder head height after regrinding (minimum)	109,500 mm
Cylinder head screw length	145 mm ± 0,08 mm (147 mm max.)
Cylinder head stud length (overall length)	186 mm + 1 mm (188,5 mm max.)
Internal diameter of valve guide	8,000 mm to 8,015 mm
External diameter of valve guide	16,028 mm to 16,039 mm
Diameter of valve guide bore inside cylinder head	16,000 mm to 16,018 mm
Position of top of valve guide above surface of cylinder head	13 mm
Depth of valve head below surface of cylinder head - inlet valve	0,65 mm to 0,85 mm (2,20 mm max.)
Depth of valve head below surface of cylinder head - exhaust valve	0,45 mm to 0,65 mm (2,20 mm max.)
Valve seat angle - inlet valve	35° + 20'
Valve seat angle - exhaust valve	45° + 20'
Valve seat width - inlet valve	2,2 mm
Valve seat width - exhaust valve	2,0 mm
Diameter of exhaust valve seat ring	36,060 mm to 36,122 mm
Diameter of exhaust valve seat ring housing	36,000 mm to 36,025 mm
Diameter of exhaust valve seat ring (spare part 8370 70187)	36,260 mm to 36,322 mm
Diameter of exhaust valve seat ring housing (spare part 8370 70187)	36,200 mm to 36,225 mm
Diameter of inlet valve seat ring	41,070 mm to 41,132 mm

Diameter of inlet valve seat ring housing	41,000 mm to 41,025 mm
Diameter of inlet valve seat ring (spare part 8370 70188)	41,270 mm to 41,332 mm
Diameter of inlet valve seat ring housing (spare part 8370 70188)	41,200 mm to 41,225 mm

Valves and rocker arms, 4 V engines

Inlet valve opening (with valve clearance of 1,0 mm)	2° ± 2° before TDC
Inlet valve closure (with valve clearance of 1,0 mm)	18° ± 2° after BDC
Exhaust valve opening (with valve clearance of 1,0 mm)	36° ± 2° before BDC
Exhaust valve closure (with valve clearance of 1,0 mm)	21° ± 2° after TDC
Valve clearance warm and cold - inlet valve	0,35 mm
Valve clearance warm and cold - exhaust valve	0,35 mm
Valve flange angle - inlet valve	35° - 20'
Valve flange angle - exhaust valve	45° - 20'
External diameter of valve head - inlet valve	39 mm
External diameter of valve head - exhaust valve	35 mm
Maximum valve movement with a valve clearance of 0,35 mm - inlet valve	9,5 mm
Maximum valve movement with a valve clearance of 0,35 mm - exhaust valve	9,0 mm
Diameter of inlet valve stem	7,960 mm to 7,975 mm
Diameter of exhaust valve stem	7,925 mm to 7,940 mm
Inlet valve stem clearance	0,025 mm to 0,055 mm
Offset threshold	0,30 mm
Exhaust valve stem clearance	0,060 mm to 0,090 mm
Offset threshold	0,35 mm
Depth of valve head below surface of cylinder head - inlet valve	0,65 mm to 0,85 mm (2,20 mm max.)
Depth of valve head below surface of cylinder head - exhaust valve	0,45 mm to 0,65 mm (2,20 mm max.)
Valve spring free length	75,1 mm
Pressure when spring is compressed to a length of 41,0 mm	300 ± 10 N
Pressure when spring is compressed to a length of 31,0 mm	420 ± 15 N
Diameter of rocker arm shaft	24,970 mm to 24,990 mm
Diameter of rocker arm bore	25,000 mm to 25,021 mm
Rocker arm spring free length	88 mm
Pressure when spring is compressed to a length of 66 mm	75 to 95 N

Valve lifters and rocker arm rods

External diameter of valve lifter	29,939 mm to 29,960 mm
Diameter of valve lifter bore inside cylinder block	30,000 mm to 30,043 mm
Maximum deflection permitted by rocker arm rod (if free).	0,4 mm
Overall length of rocker arm rod (4 V 44, 49, 66 and 74 type engines)	245 mm to 246,3 mm
Overall length of rocker arm rod (4 V 84 type engines)	286 mm to 287,3 mm

Camshaft

Diameter of camshaft bearing journal no. 1	49,875 mm to 49,900 mm
Diameter of camshaft bearing journals nos. 2-4 (44 and 49 type engines)	49,885 mm to 49,910 mm
Diameter of camshaft bearing journals nos. 2-4 (66, 74 and 84 type engines)	49,865 mm to 49,890 mm
Diameter of camshaft bearing journal no. 5 (66, 74 and 84 type engines)	49,885 mm to 49,910 mm
Camshaft clearance inside ring no. 1	0,140 mm to 0,185 mm
Camshaft clearance inside rings no. 2-4 (44 and 49 type engines)	0,120 mm to 0,205 mm
Camshaft clearance inside rings no. 2-4 (66, 74 and 84 type engines)	0,110 mm to 0,160 mm

Camshaft clearance inside ring no. 5 (66, 74 and 84 type engines)	0,100 mm to 0,185 mm
Camshaft axial clearance	0,5 mm to 1,0 mm
Cam height (distance between the back and the head of the cam) - inlet valve	43,180 mm to 43,680 mm
Cam height (distance between the back and the head of the cam) - exhaust valve	41,700 mm to 42,200 mm
Cam lift - inlet valve	6,18 mm
Cam lift - exhaust valve	7,70 mm
Cam width (4 V type engines)	19,70 mm to 20,30 mm
Maximum permitted camshaft deflection (total indications)	0,03 mm

Crankshaft

44, 49, 66 and 74 type engines

Crankpin diameter - standard	67,981 mm to 68,000 mm
Crankpin diameter - 1^{st} under-size dimension 0,25 mm	67,731 mm to 67,750 mm
Crankpin diameter - 2^{th} under-size dimension 0,50 mm	67,481 mm to 67,500 mm
Crankpin diameter - 3^{th} under-size dimension 1,00 mm	66,981 mm to 67,000 mm
Crankpin diameter - 4^{th} under-size dimension 1,50 mm	66,481 mm to 66,500 mm
Crankpin length	40,000 mm to 40,160 mm
Bearing journal diameter (44, 49 and 66 type engines) - standard	84,985 mm to 85,020 mm
Bearing journal diameter (44, 49 and 66 type engines) - 1^{st} under-size dimension 0,25 mm	84,735 mm to 84,770 mm
Bearing journal diameter (44, 49 and 66 type engines) - 2^{th} under-size dimension 0,50 mm	84,485 mm to 84,520 mm
Bearing journal diameter (44, 49 and 66 type engines) - 3^{th} under-size dimension 1,00 mm	83,985 mm to 84,020 mm
Bearing journal diameter (44, 49 and 66 type engines) - 4^{th} under-size dimension 1,50 mm	83,485 mm to 83,520 mm
Bearing housing diameter (inside cylinder block)	91,000 mm to 91,025 mm
Bearing journal diameter (74 type engines) - standard	89,985 mm to 90,020 mm
Bearing journal diameter (74 type engines) - 1^{st} under-size dimension 0,25 mm	89,735 mm to 89,770 mm
Bearing journal diameter (74 type engines) - 2^{th} under-size dimension 0,50 mm	89,485 mm to 89,520 mm
Bearing journal diameter (74 type engines) - 3^{th} under-size dimension 1,00 mm	88,985 mm to 89,020 mm
Bearing journal diameter (74 type engines) - 4^{th} under-size dimension 1,50 mm	88,485 mm to 88,520 mm
Bearing housing diameter (inside cylinder block)	96,000 mm to 96,025 mm
Crankshaft bearing bush thickness - standard	2,955 mm to 2,965 mm
Crankshaft bearing bush thickness - 1^{st} under-size dimension 0,25 mm	3,080 mm to 3,090 mm
Crankshaft bearing bush thickness - 2^{th} under-size dimension 0,50 mm	3,205 mm to 3,215 mm
Crankshaft bearing bush thickness - 3^{th} under-size dimension 1,00 mm	3,455 mm to 3,465 mm
Crankshaft bearing bush thickness - 4^{th} under-size dimension 1,50 mm	3,705 mm to 3,715 mm
Crankshaft bearing bush thickness - bearing 8361 40950	3.705 to 3,715 mm
Bearing clearance	0,050 mm to 0,127 mm
Thrust bearing journal length (nearest the flywheel) - standard (2 standard thrust plates)	45,000 mm to 45,080 mm
Thrust bearing journal length (nearest the flywheel) - 1^{st} over-size dimension (one standard thrust plate and one thicker plate of 0,1 mm)	45,100 mm to 45,180 mm

44, 49, 66 and 74 type engines

Thrust bearing journal length (nearest the flywheel) - 2th over-size dimension (one standard thrust plate and one thicker plate of 0,2 mm) .... 45,200 mm to 45,280 mm

Thrust bearing journal length (nearest the flywheel) - 3th over-size dimension (one thicker thrust plate of 0,1 mm and another of 0,2 mm).. 45,300 mm to 45,380 mm

Thrust bearing journal length (nearest the flywheel) - 4th over-size dimension (two thicker thrust plates of 0,2 mm) . 45,400 mm to 45,480 mm

The other crankshaft bearing journals cannot be reground further.

Crankshaft axial clearance .... 0,100 mm to 0,380 mm
Out-of-round wearing and other maximum permitted deformation of crankpins or bearing journals............................. 0,03 mm
Crankshaft imbalance .... 1.0 Ncm max.

Balancing unit ring gear location, diameter (44 and 49 type engines) .... 150,220 mm to 150,260 mm
Internal diameter of balancing unit ring gear (44 and 49 type engines) .... 150,000 mm to 150,040 mm
Number of teeth on trigger wheel...................................... 60-2

84 type engines

Crankpin diameter - standard... 72,981 mm to 73,000 mm
Crankpin diameter - 1st under-size dimension 0,25 mm ..... 72,731 mm to 72,750 mm
Crankpin diameter - 2th under-size dimension 0,50 mm..... 72,481 mm to 72,500 mm
Crankpin diameter - 3th under-size dimension 1,00 mm..... 71,981 mm to 72,000 mm
Crankpin diameter - 4th under-size dimension 1,50 mm..... 71,481 mm to 71,500 mm
Crankpin length.. 40,000 mm to 40,160 mm
Bearing journal diameter - standard................................... 89,985 mm to 90,020 mm
Bearing journal diameter - 1st under-size dimension 0,25 mm .... 89,735 mm to 89,770 mm
Bearing journal diameter - 2th under-size dimension 0,50 mm .... 89,485 mm to 89,520 mm
Bearing journal diameter - 3th under-size dimension 1,00 mm .... 88,985 mm to 89,020 mm
Bearing journal diameter - 4th under-size dimension 1,50 mm .... 88,485 mm to 88,520 mm
Bearing housing diameter (inside cylinder block) .... 96,000 mm to 96,025 mm
Crankshaft bearing bush thickness - standard................... 2,955 mm to 2,965 mm
Crankshaft bearing bush thickness - 1st under-size dimension 0,25 mm... 3,080 mm to 3,090 mm
Crankshaft bearing bush thickness - 2th under-size dimension 0,50 mm... 3,205 mm to 3,215 mm
Crankshaft bearing bush thickness - 3th under-size dimension 1,00 mm .... 3,455 mm to 3,465 mm
Crankshaft bearing bush thickness - 4th under-size dimension 1,50 mm... 3,705 mm to 3,715 mm
Bearing clearance .... 0,050 mm to 0,127 mm
Thrust bearing journal length (nearest the flywheel) - standard (2 standard thrust plates)... 45,000 mm to 45,080 mm
Thrust bearing journal length (nearest the flywheel) - 1st over-size dimension (one standard thrust plate and one thicker plate of 0,1 mm) .... 45,100 mm to 45,180 mm

84 type engines

Thrust bearing journal length (nearest the flywheel) - 2th over-size dimension (one standard thrust plate and one thicker plate of 0,2 mm) ..... 45,200 mm to 45,280 mm

Thrust bearing journal length (nearest the flywheel) - 3th over-size dimension (one thicker thrust plate of 0,1 mm and another of 0,2 mm) ..... 45,300 mm to 45,380 mm

Thrust bearing journal length (nearest the flywheel) - 4th over-size dimension (two thicker thrust plates of 0,2 mm) . 45,400 mm to 45,480 mm

The other crankshaft bearing journals cannot be reground further.

Rounded edge of crankpins and bearing journals ..... R4 + 0,5 mm
Crankshaft axial clearance ..... 0,100 mm to 0,380 mm
Out-of-round wearing and other maximum permitted deformation of crankpins or bearing journals ..... 0,03 mm
Crankshaft imbalance ..... 1.0 Ncm max.
Number of teeth on trigger wheel 60-2

Steering wheel

Adjustment with flywheel-ring gear tightening..... 0,425 mm to 0,600 mm
Before fitting the ring gear, heat it to a temperature of between..... 150 °C and 200 °C
Flywheel imbalance ..... 1.0 Ncm max.
Maximum permitted axial flutter of the flywheel clutch surface, measured from the internal edge of the clutch surface over the 200 mm diameter 0.06:ø200

Balancing unit, 44 and 49 type engines

Clearance at teeth - crankshaft-ring gear balancing unit weights ..... 0,1 mm to 0,3 mm
Clearance at teeth - between balancing unit weight gears. 0,05 mm to 0,250 mm
Balancing unit weight axial clearance ..... 0,1 mm to 0,3 mm
Shaft diameter at bearing surfaces ..... 36,000 mm to 36,016 mm
Internal diameter of bearing ring (fitted) ..... 36,050 mm to 36,075 mm
Diameter of ports inside shaft body, rear end..... 36,058 mm to 36,083 mm
Diameter of ports inside shaft body, front end ..... 35,958 mm to 35,983 mm
Thickness of shims, cylinder block-balancing unit assembly 0,2 mm

Distribution

Clearance at teeth..... 0,05 mm to 0,25 mm
Maximum permitted gear run-out..... 0,05 mm
Layshaft gear (smooth bearing, shaft length 50,7 mm) - Layshaft gear shaft, diameter ..... 55,151 mm to 55,170 mm
Layshaft gear (smooth bearing, shaft length 50,7 mm) - Internal diameter of layshaft gear ring (fitted)..... 55,200 mm to 55,230 mm
Internal diameter of layshaft gear port..... 60,000 mm to 60,030 mm

Timing marks: The timing marks on the gears are aligned when the 1st cylinder piston is at top dead centre between compression and combustion travel.

On the crankshaft gear ..... 2 points on the tooth
On the layshaft gear - opposite the crankshaft gear witness mark..... 1 point on the tooth
On the layshaft gear - opposite the camshaft gear witness mark..... 1 point on the tooth
On the camshaft gear ..... 1 point on the slot

Connecting rod

Thickness of the connecting rod big end cap - standard	1,835 mm to 1,842 mm
Thickness of the connecting rod big end cap - 1st under-size dimension 0,25 mm	1,960 mm to 1,967 mm
Thickness of the connecting rod big end cap - 2th under-size dimension 0,50 mm	2,085 mm to 2,092 mm
Thickness of the connecting rod big end cap - 3th under-size dimension 1,00 mm	2,335 mm to 2,342 mm
Thickness of the connecting rod big end cap - 4th under-size dimension 1,50 mm	2,585 mm to 2,592 mm
Connecting rod big end bush clearance	0,046 mm to 0,098 mm
Crankshaft connecting rod big end axial clearance (side sway)	0,200 mm to 0,410 mm
Location of gudgeon pin ring perpendicular to the longitudinal axis of the connecting rod between	0.15:100
Location of gudgeon pin ring and connecting rod big end bush in parallel between	0.05:100
Maximum permitted weight difference between connecting rods on the same engine	20 g Weight marking (letter) on lower end

44, 49, 66 and 74 type engines

Internal diameter of gudgeon pin bush (with bush adjusted by tightening in the connecting rod)	40,025 mm to 40,040 mm
External diameter of gudgeon pin bush (standard)	44,080 mm to 44,120 mm
External diameter of gudgeon pin bush (over-size dimension 8353 28326)	44,580 mm to 44,620 mm
Adjustment with tightening: connecting rod-connecting rod small end bush	0,057 mm to 0,120 mm
Connecting rod small end bore	44,000 mm to 44,025 mm
Connecting rod small end bore (over-size dimension of ring)	44,500 mm to 44,525 mm
Connecting rod big end bore	71,730 mm to 71,749 mm

84 type engines

Internal diameter of gudgeon pin bush (with bush adjusted by tightening in the connecting rod)	44,025 mm to 44,040 mm
External diameter of gudgeon pin bush (standard)	48,080 mm to 48,120 mm
External diameter of gudgeon pin bush (over-size dimension 8363 38606)	48,580 mm to 48,620 mm
Adjustment with tightening: connecting rod-connecting rod small end bush	0,057 mm to 0,120 mm
Connecting rod small end bore	48,000 mm to 48,025 mm
Connecting rod small end bore (over-size dimension of ring)	48,500 mm to 48,525 mm
Connecting rod big end bore	76,730 mm to 76,749 mm

Piston, rings and pin

44, 49, 66 and 74 type engines

Piston diameter - 17 mm from the lower edge (4 V 44 and 66 type engines)	107,883 mm to 107,897 mm
Piston diameter - 19 mm from the lower edge (4 V 49 and 74 type engines)	107,893 mm to 107,907 mm
Gudgeon pin bore	40,003 mm to 40,009 mm
Gudgeon pin diameter	39,991 mm to 40,000 mm
Width of ring grooves - 1st groove	wedge-shaped
Width of ring grooves - 2th groove	2,520 mm to 2,540 mm
Width of ring grooves - 3th groove	4,040 mm to 4,060 mm
Piston ring side sway in their grooves - 1st ring	wedge-shaped
Piston ring side sway in their grooves - 2th ring	0,03 mm to 0,062 mm
Piston ring side sway in their grooves - 3th ring	0,05 mm to 0,082 mm
Piston ring side sway in their grooves - Offset threshold	0,15 mm
Piston ring height (in cylinder direction) - 1st ring	wedge-shaped

44, 49, 66 and 74 type engines

Piston ring height (in cylinder direction) - 2th ring .... 2,478 mm to 2,490 mm
Piston ring height (in cylinder direction) - 3th ring .... 3,975 mm to 3,990 mm
Piston ring play (with piston fitted in cylinder) - 1st ring...... 0,40 mm to 0,55 mm
Piston ring play (with piston fitted in cylinder) - 2th ring...... 0,60 mm to 0,80 mm
Piston ring play (with piston fitted in cylinder) - 3th ring...... 0,30 mm to 0,60 mm
Piston ring play (with piston fitted in cylinder) - Offset threshold of the 1st and 3th rings....................................... 1,0 mm
Piston ring play (with piston fitted in cylinder) - Offset threshold of the 2th ring... 1,5 mm
Maximum permitted weight difference between pistons on the same engine .... 25 g

Piston to be heated to 100 °C before installing the gudgeon pin.

84 type engines

Piston diameter - 15 mm from the lower edge.................. 110,863 mm to 110,877 mm
Gudgeon pin bore .... 44,003 mm to 44,009 mm
Gudgeon pin diameter .... 43,994 mm to 44,000 mm
Width of ring grooves - 1st groove .... wedge-shaped
Width of ring grooves - 2th groove .... 2,520 mm to 2,540 mm
Width of ring grooves - 3th groove .... 4,040 mm to 4,060 mm
Piston ring side sway in their grooves - 1st ring................. wedge-shaped
Piston ring side sway in their grooves - 2th ring................. 0,03 mm to 0,062 mm
Piston ring side sway in their grooves - 3th ring................. 0,05 mm to 0,082 mm
Piston ring side sway in their grooves - Offset threshold ... 0,15 mm
Piston ring height (in cylinder direction) - 1st ring .... wedge-shaped
Piston ring height (in cylinder direction) - 2th ring .... 2,478 mm to 2,490 mm
Piston ring height (in cylinder direction) - 3th ring .... 3,975 mm to 3,990 mm
Piston ring play (with piston fitted in cylinder) - 1st ring (wedge-shaped) .... 0,35 mm to 0,50 mm
Piston ring play (with piston fitted in cylinder) - 2th ring...... 0,60 mm to 0,80 mm
Piston ring play (with piston fitted in cylinder) - 3th ring...... 0,30 mm to 0,60 mm
Piston ring play (with piston fitted in cylinder) - Offset threshold of the 1st and 3th rings....................................... 1,0 mm
Piston ring play (with piston fitted in cylinder) - Offset threshold of the 2th ring... 1,3 mm
Maximum permitted weight difference between pistons on the same engine .... 25 g

Piston to be heated to 100 °C before installing the gudgeon pin.

Lubrication system

Oil pressure at normal operating temperature - at idle speed (min.) .... 1,0 bar
Oil pressure at normal operating temperature - at operating speed .... 2,5 bar to 5,0 bar
Oil pressure regulator (44 and 49 type engines) - Oil pressure regulator spring free length .... 48,2 mm to 51,8 mm
Oil pressure regulator (44 and 49 type engines) - Oil pressure regulator spring length/load .... 28,5 mm / 89 N
Oil pressure regulator (66, 74 and 84 type engines) - Oil pressure regulator spring free length (identification = yellow dot) .... 49,3 mm to 50,8 mm
Oil pressure regulator (66, 74 and 84 type engines) - Oil pressure regulator spring length/load .... 28,5 mm / 127 N
Oil filter bypass valve opening at a pressure difference ..... 2 bar ± 0,5 bar

Oil pump

44 and 49 type engines

Clearance between the gears when the crankshaft is resting firmly on the lower side of the bearings - crankshaft gear-lubricating oil pump gear	0,05 mm to 0,25 mm
Clearance between the gears when the crankshaft is resting firmly on the lower side of the bearings - between the pump gears	0,16 mm to 0,26 mm
Diameter of the drive shaft at body and bonnet bearing level	17,966 mm to 17,984 mm
Diameter of shaft holes on body and bonnet	18,000 mm to 18,018 mm
Diameter of gear port	18,060 mm to 18,078 mm
Fixed shaft, diameter	18,028 mm to 18,039 mm
Fixed shaft end projection under pump unit	0,5 mm to 1,0 mm
Thickness of cover plate seal	0,06 mm to 0,08 mm
External diameter of gear	43,486 mm to 43,525 mm
Unit diameter	43,650 mm to 43,750 mm
Thickness of gears	24,000 mm to 24,027 mm
Axial clearance of gears	0,03 mm to 0,11 mm
Unit depth	24,000 mm to 24,043 mm

66, 74 and 84 type engines

Clearance between the gears when the crankshaft is resting firmly on the lower side of the bearings - crankshaft gear-lubricating oil pump gear	0,05 mm to 0,25 mm
Clearance between the gears when the crankshaft is resting firmly on the lower side of the bearings - between the pump gears	0,16 mm to 0,26 mm
Diameter of the drive shaft at body and bonnet bearing level	17,966 mm to 17,984 mm
Diameter of drive shaft bearing holes on body and bonnet	18,000 mm to 18,018 mm
Internal diameter of bearing for the gear that turns on a fixed shaft	18,000 mm to 18,018 mm
Diameter of fixed shaft on the gear	17,966 mm to 17,984 mm
Fixed shaft inside pump body, diameter	20,035 mm to 20,048 mm
Fixed shaft end projection under pump unit	0,5 mm
Thickness of cover plate seal	0,06 mm to 0,08 mm
External diameter of gears	55,824 mm to 55,870 mm
Unit diameter	56,000 mm to 56,120 mm
Thickness of gears	32,000 mm to 32,027 mm
Axial clearance of gears	0,03 mm to 0,11 mm
Unit depth	32,000 mm to 32,043 mm

Water pump

44 and 49 type engines

External diameter of bearing	52 mm
Bearing housing diameter	51,979 mm to 52,009 mm
Bearing shaft diameter	20,002 mm to 20,015 mm
Turbine shaft diameter	15,907 mm to 15,920 mm
Turbine port diameter	15,876 mm to 15,894 mm
Distance between turbine blade and unit	0,2 mm to 1,0 mm
Fan balancing accuracy	0.3 Ncm max.
Maximum permitted eccentricity of fan	±0,3 mm

66 and 74 type engines

External diameter of bearing	72 mm
Bearing housing diameter	71,961 mm to 71,991 mm
Diameter of water seal housing in pump body	39,981 mm to 40,019 mm
Bearing shaft diameter	30,002 mm to 30,015 mm
Turbine shaft diameter	15,907 mm to 15,920 mm
Turbine port diameter	15,876 mm to 15,894 mm
Distance between turbine blade and unit	0,7 mm
Fan balancing accuracy	0.3 Ncm max.

Pump fitted with reinforced bearing

External diameter of front bearing 95 mm - Diameter of bearing in water pump gear .... 94,965 mm to 95,000 mm
External diameter of front bearing 95 mm - External diameter of position of bearings in pump chassis .... 60,002 mm to 60,021 mm
External diameter of front bearing 120 mm - Diameter of bearing in water pump gear .... 119,965 mm to 120,000 mm
External diameter of front bearing 120 mm - External diameter of position of bearings in pump chassis .... 65,002 mm to 65,021 mm
External diameter of rear bearing .... 52 mm
Bearing housing diameter .... 51,979 mm to 52,009 mm
Diameter of water seal housing in pump body .... 36,450 mm to 36,489 mm
Rear bearing shaft diameter.. 20,002 mm to 20,015 mm
Turbine shaft diameter .... 15,907 mm to 15,920 mm

84 type engines

External diameter of bearing... 47 mm
Bearing housing diameter .... 46,967 mm to 46,992 mm
Bearing shaft diameter .... 19,996 mm to 20,009 mm
Turbine shaft diameter .... 15,917 mm to 15,930 mm
Turbine port diameter... 15,879 mm to 15,890 mm
Diameter of water seal housing in pump body .... 39,981 mm to 40,019 mm

Thermostat

Reference	Type	Start of opening at	Full opening at	Maximum travel
8366 66334	ø 67 mm / 83 °C	83 °C ± 2 °C	95 °C	8,0 mm
8366 59685	ø 67 mm / 86 °C	86 °C ± 2 °C	99 °C	8,0 mm
8360 15156	ø 54 mm / 79 °C	79 °C ± 2 °C	94 °C	7,5 mm
8363 31590	ø 67 mm / 83 °C	83 °C ± 2 °C	95 °C	8,0 mm

Turbocharger

Schwitzer

	S100	S200	S300
Maximum axial clearance	0,10 mm	0,10 mm	0,12 mm
Maximum radial clearance (compressor end)	0,82 mm	0,88 mm	0,88 mm
Tightening torque of compressor wheel locknut	6,8 Nm	13,6 Nm	20,3 Nm
Tightening torque of compressor unit screws	13,6 Nm	13,6 Nm	13,6 Nm
Tightening torque of turbine unit	21,0 Nm	21,0 Nm	21,0 Nm

Tightening torques

Cylinder head bolts and nuts... 80 Nm + 90° + 90°
Studs securing the cylinder head to the cylinder block ...... 30 Nm
Bearing screw .... 200 Nm
Connecting rod screw... 40 Nm + 90°
Crankshaft nut, 44/49 .... 600 Nm
Crankshaft nut, 66/74/84... 1000 Nm
Crankshaft pulley screw.. 30 Nm
Crankshaft pulley screw, 74/84 .... 80 Nm
Flywheel housing screw - M12 .... 150 Nm
Flywheel housing screw - M10 .... 80 Nm
Flywheel screw... 150 Nm
Flywheel screw, 84 .... 200 Nm
Layshaft gear screw, 44/49/66 - M10 .... 60 Nm
Layshaft gear screw, 44/49/66 - M14 .... 200 Nm
Layshaft gear screw (with ball bearing), 66/74/84 - M14 .... 180 Nm
Layshaft gear screw (with ball bearing), 66/74/84 - M8 ...... 32 Nm
Double layshaft gear - M12 screw .... 120 Nm

Double layshaft gear - M14 nut .... 140 Nm
Camshaft gear nut .... 200 Nm
Rocker arm support screws and nuts .... 45 Nm
Valve cover plate and chassis screws .... 25 Nm
Piston cooling valve .... 30 Nm
Oil pump attachment screws .... 60 Nm
Oil sump drain plug M18 .... 80 Nm
Oil cooler connection piece, 44/49/66/74 .... 60 Nm
Water pump pulley screw, 44/49 .... 80 Nm
Water pump pulley nut, 44/49/66/74 .... 120 Nm
Water pump gear nut, 84.. 180 Nm
Belt tensioner screw, 44/49/66/74 .... 48 Nm
Exhaust manifold screws.. 50 Nm

Always use the tightening torque values listed in the following tables if specific torque values are not available.

Thread	Tensile grade	
	8.8	10.9
M8	25 Nm	35 Nm
M10	50 Nm	75 Nm

Use a washer with aluminium parts.

B. Principles of operation

B.1 Mechanical part

In the Citius series, the engines used are diesel engines with in-line cylinders, water cooling and four or six cylinders. The engines with turbochargers are fitted with wet, replaceable cylinder liners. All engine types have a rigid, splined cylinder block. The mobile engine parts are able to withstand boost pressure. The cylinder liners are wet and are supported by the middle. The cylinder head bolts are highly resistant to traction.

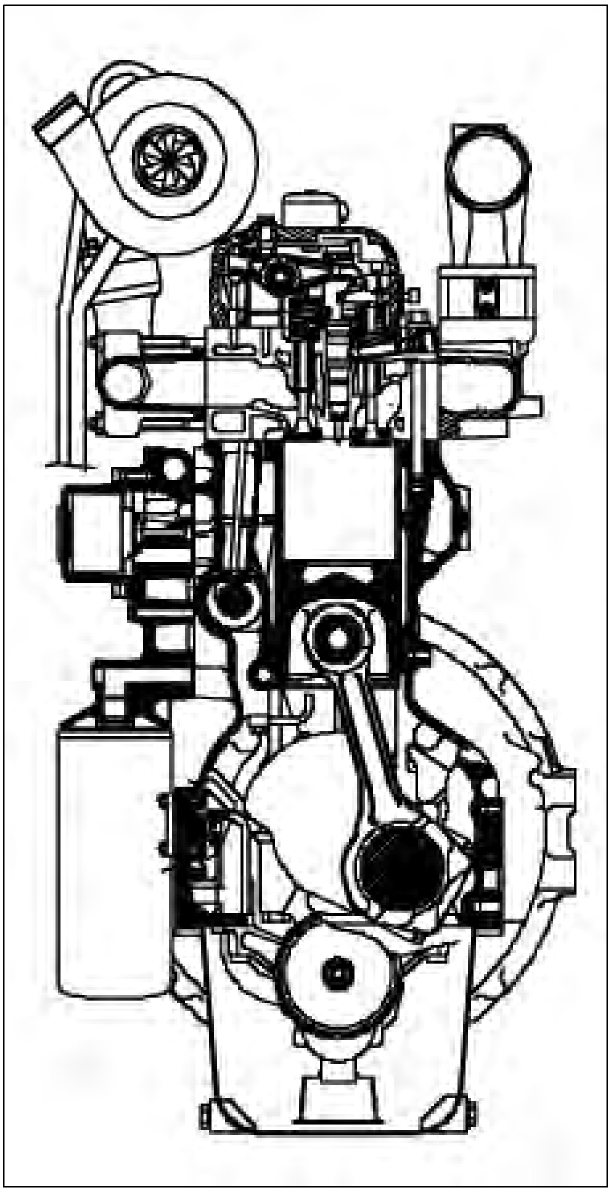
Cylinder block

The cylinder block is the main component of the engine, and the other engine parts are attached to it. The wet, replaceable cylinder liners are supported by the middle in order to reduce vibration and essentially direct the coolant flow towards the top of the liners.

On 44, 49, 66 and 74 type engines, the lower part of the cylinder liners is sealed against the cylinder block by three "O" rings fitted in the grooves of the liner. On 84 type engines, the "O" rings are fitted in the grooves of the cylinder block. The top part is sealed by the cylinder head seal.

The camshaft is located in the cylinder block. On 44 and 49 type engines, the housing of the front camshaft bearing is fitted with a separate bearing sleeve. The other bearing housings are machined directly into the cylinder block. On 66, 74 and 84 type engines, separate bearing sleeves are fitted on all bearing housings on the camshaft. The drilled port at the rear end of the camshaft is blocked with a plug.

Spaces on both sides of the rear bearing allow guide-bearing shims to be fitted (crankshaft thrust bearings).



I008072 Fig. 5

Flywheel housing

The flywheel housing is fitted at the back of the cylinder block. The seal at the rear end of the crankshaft is fitted into a bore in the housing. The starter attachment point is fitted in the flywheel housing.

The lower part of the flywheel housing functions as a friction surface for the oil sump seal. For this reason, the lower part of the cylinder block must be fitted at the same level as the flywheel housing. When installing the flywheel housing, its position is determined by tensioning pins.

The flywheel housing is delivered in accordance with the stated requirements, depending on the engine model. The different flywheel housings can be fitted on all engine types.

Valve mechanism

The valve mechanism is activated by the camshaft located in the cylinder block. Movement is transmitted via the valve lifters and rocker arm rods. The camshaft gear is fitted with a nut and fixed with a key. Each bearing is lubricated by the pressurised lubricating system via oil channels drilled in the cylinder block.

Cylinder head, 4 V engines

The engines used for the 44 and 49 series have one cylinder head, while engines used for the 66, 74 and 84 series are fitted with two cylinder heads. Each cylinder has four valves. The injector may be located in the middle of the four valves. The injector is fitted vertically at the centre of the cylinder, in the middle of the combustion chamber. This allows a precise, homogenous mix of fuel and air, and ensures that the clean and low emission combustion takes place efficiently.

Each cylinder has its own inlet and exhaust ports located to either side of the cylinder head. Each cylinder has its own inlet port, but there is only one exhaust port for the two exhaust valves of the cylinder. The cylinder head inlet does not have a port to channel water. Water can therefore not mix with the inlet air.

The cylinder head bolts are highly resistant to traction and are tightened to maximum capacity via the angle tightening method. Because they have been lengthened significantly, the tightening force is maintained at a constant level for the complete lifetime of the parts, and the bolts will not need to be retightened.

The locations of the injector and lateral supply pipe are machined directly into the cylinder head. The port intended for the lateral supply pipe is located between the inlet ports. The inlet and exhaust valve guides are identical and can be interchanged. Exhaust valves are fitted with separate seat rings. Very powerful engines are also fitted with separate inlet valve seats.

Mobile engine components

The crankshaft is forged from a special chrome alloy steel. However, the bearing and seal friction surfaces of this part are hardened by induction. It is therefore possible to regrind the bearings up to four times before applying a new heat treatment. The gears are located at the front end of the crankshaft. They are force fitted and drive the idler wheel and oil pump. In addition, the front end of the crankshaft is splined to fit the hub of the V belt pulley. The hub of 74 and 84 type engines is fixed to the crankshaft via a tapered joint. The oil deflector is located between the hub and the gear.

The crankshaft is supported on the cylinder block by bearings fitted to either side of each cylinder. The bearings therefore number one more than the cylinders. The crankshaft thrust washers are positioned to either side of the rearmost bearing.

The rear end of the crankshaft is fitted with a flywheel which includes a force fitted starter ring gear. The transverse cross section of the forged connecting rod is an "I" shape. The bearing housing at the lower end of the rod is divided in two, and the bearing cup is fixed using two special lengthened screws. The top part has a wedge-shaped bearing housing into which the gudgeon pin bush is force fitted.

The piston is made from an aluminium eutectic alloy. The top part of the piston comprises a combustion chamber. The shape of this chamber is designed to optimise the air-fuel mix. The housing for the top ring is formed in a cast iron ring, which has itself been cast in the piston. In addition, the piston is covered in graphite to ensure smooth running in.

The piston has three rings. The top ring has a molybdenum covering and a wedge-shaped transversal cross section. On some slightly turbocharged engines, the top ring is fitted at a right angle. The middle ring is tapered and fits into the groove. The angle compensates for the clearance. The oil control ring comprises a spring and is fitted with a two-level chrome-plated scraper edge. Some four-cylinder engines are fitted with a balancing unit. The eccentric weights, which rotate at twice the engine speed, balance out the vibrations caused by the movement of the pistons and mobile engine components.

Distribution

44, 49, 66 and 74 type engines

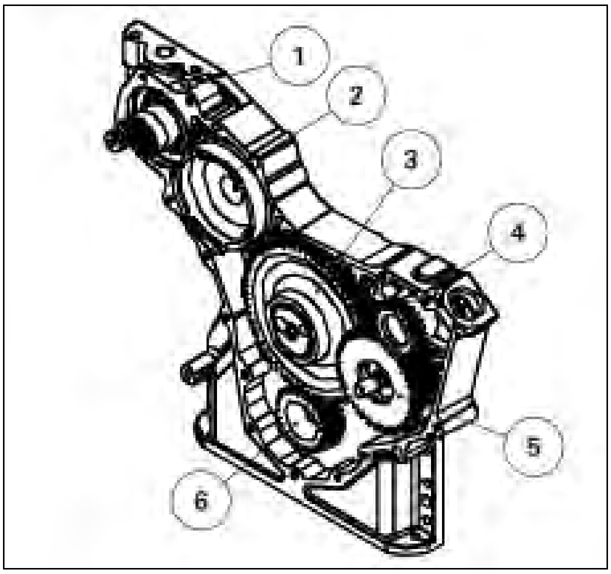
Timing gear parts

(1) PTO gear
(2) Camshaft gear
(3) Layshaft gear
(4) High-pressure pump gear
(5) Double layshaft gear
(6) Crankshaft gear

The timing gear drives the camshaft, the high-pressure pump and the oil pump. The timing gear system comprises helical cut hardened gears. The high-pressure pump is fitted with cylindrical gearing and is driven by a double layshaft gear. The gears are housed in the timing housing fitted at the front of the engine.

If the engine is fitted with a hydraulic pump, this pump is driven by a separate gear or drive mechanism.

The layshaft gear is supported on the shaft by a bearing sleeve/ball bearing (66 and 74 type engines), at the front of the cylinder head block. The gear and shaft are available in two different sizes.



I008073

Fig. 6

84 type engines

Timing gear parts

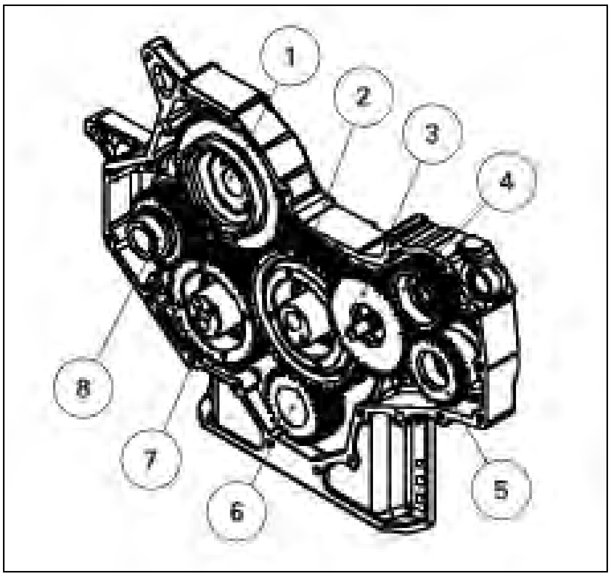
(1) Camshaft gear
(2) Layshaft gear
(3) Double layshaft gear
(4) Water pump gear
(5) High-pressure pump gear
(6) Crankshaft gear
(7) Small layshaft gear
(8) PTO gear

There are two main types of timing gear: narrow and wide timing housings.

The timing gear drives the camshaft, the high-pressure pump, the oil pump and the water pump. The timing gear system comprises helical cut hardened gears. The gears of the high-pressure pump and water pump are straight gears and are driven by a double layshaft gear. The gears are housed in the timing housing fitted at the front of the engine.

If the engine has a wide timing housing, it includes a separate drive mechanism for a hydraulic pump or a compressor. The separate drive mechanism is driven by a small layshaft gear.

The layshaft gear is supported by a chamfered ball bearing on the shaft, located at the front of the cylinder block.



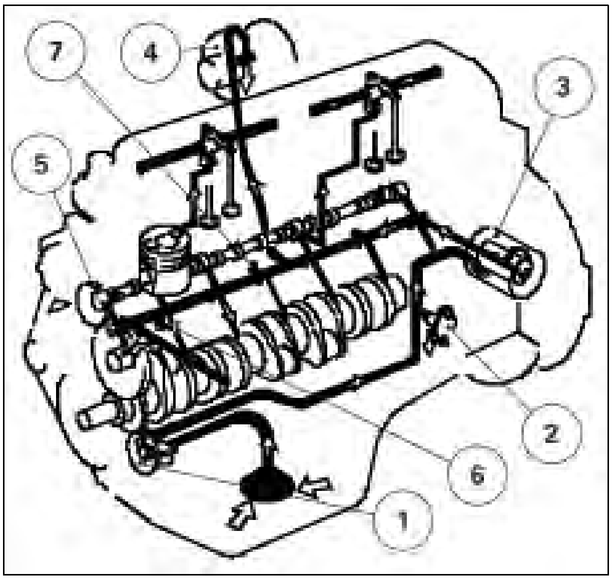
I008074

Fig. 7

B.2 Lubrication system

Lubrication system (66 and 74 type engines)

(1) Oil pump
(2) Oil pressure regulating valve
(3) Oil filter
(4) Turbocharger
(5) Main lubrication line
(6) Piston cooling nozzle
(7) Oil pressure sensor



I008075 Fig. 8

The engine has a pressurised lubrication system in which the oil pump (gear pump) is connected to the lower section of the cylinder block. The oil is sucked through the pump via a suction strainer. The oil then circulates inside a special channel to the oil pressure regulator and then into the oil cooler to the oil filter. The oil then flows through the main lubrication line, from which the oil pipes extend. The oil flows through these pipes into the bearings, through the crankshaft and to the connecting rod big end bushes.

It is then directed from the main line to the accessories, the turbocharger, the balancing unit (44 and 49 type engines) and to a compressor (if fitted). In addition, the camshaft end points and the valve mechanism are supplied with oil via the main lubrication line.

The lower face of the very powerful engine pistons is still cooled by a spray of oil when the oil pressure exceeds 3 bar.

The oil pressure regulator is located underneath the oil filter on the left-hand side of the engine (right-hand side on 84 type engines). The regulator maintains a constant oil pressure, irrespective of engine speed. At working speed, the oil pressure fluctuates between 2,5 bar and 5 bar, according to the temperature and grade of the lubricating oil. At idle speed, this pressure is a minimum of 1,0 bar.

The oil filter is of main flow type. A replaceable cartridge is fitted on the left-hand side of the engine (right-hand side on 84 type engines). At the bottom of the oil filter cartridge, a bypass valve is used to operate the engine even when cold starting or if there is a filter obstruction.

Some engine models are equipped with an oil cooler located between the cylinder block and the oil filter. Any oil which flows through the filter also flows through the cooler and is cooled by the fluid circulating inside the oil cooler.

84 type engines are equipped with an oil plate cooler, located above the filter on the right-hand side of the engine. The cooler is of main flow type.

B.3 Cooling system

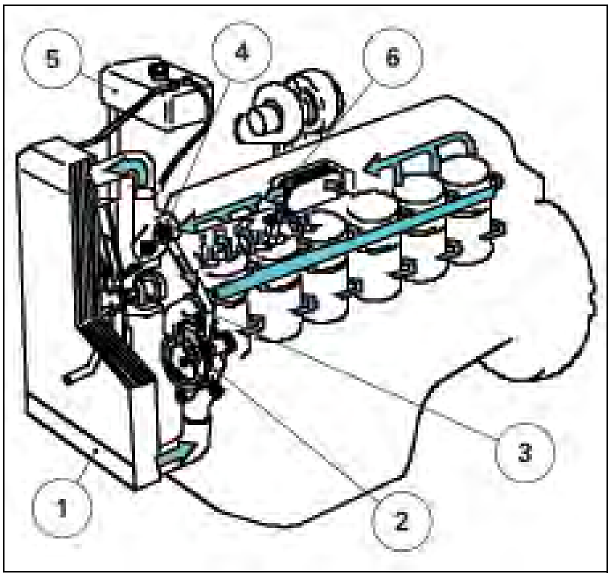
Cooling system (84 type engines)

(1) Radiator
(2) Water pump
(3) Bypass pipe
(4) Thermostats
(5) Expansion tank
(6) Oil cooler

The water pump is fitted to the front of the cylinder block and the thermostat housing is fitted just above.

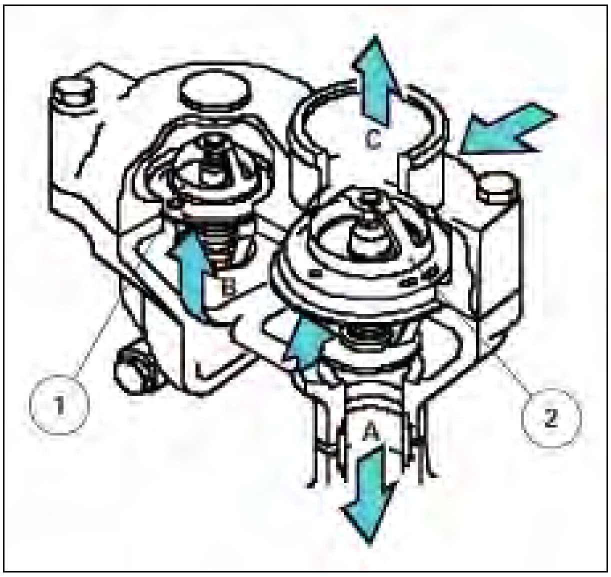
On the 84 type engines, the water pump is driven by a gear system and is fitted to the front of the timing housing. The thermostat housing is fitted to the front of the cylinder head.

The system has an internal fluid system which passes through the bypass pipe. Circulation is controlled by a two-way thermostat. This provides constant engine heating, in all conditions.



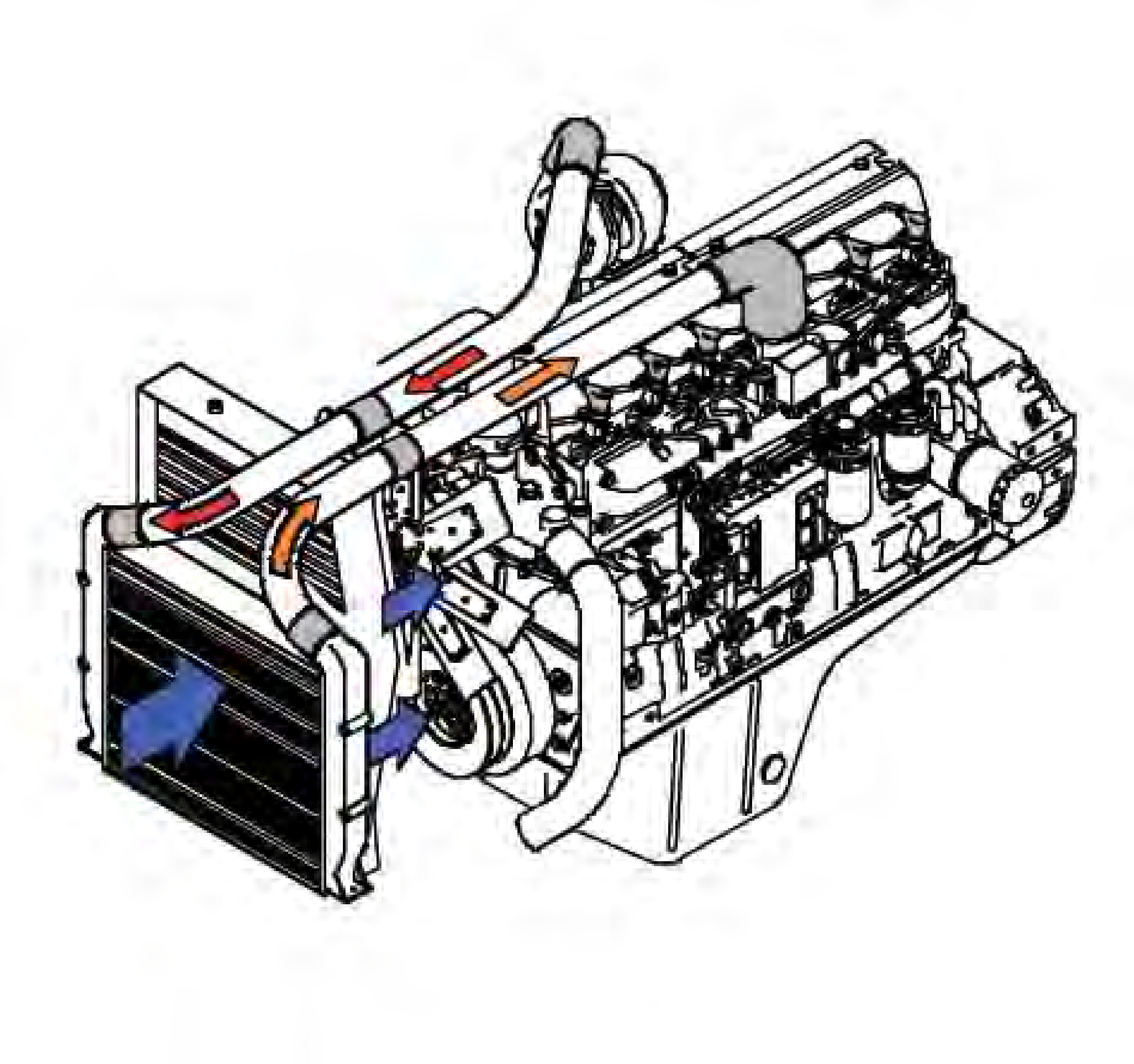
I008076 Fig. 9

Some 66, 74 and 84 type engines are equipped with two separate thermostats, one of which guides the coolant by-pass. The thermostats differ in terms of type and opening temperature. When the coolant temperature is below the thermostat opening temperature, the coolant (A) flows via the bypass port to the water pump A smaller, single-acting thermostat (1) opens first (at 79 °C), and allows a small amount of coolant (B) to flow into the radiator. Depending on the increase in load, the other thermostat (2) also opens (at 83 °C). This is a double-acting thermostat which closes the bypass port and directs the coolant (C) to the radiator. These engine models do not have separate winter type thermostats.



I008077 Fig. 10

B.4 Inlet and exhaust system



I008078

Fig. 11

The engine air intake filtration system comprises a cyclone type primary dust separator and a paper filter which acts as the main filter. The incoming air must pass through the primary dust separator. Most of the impurities are then discharged and collected in the dust cup on the primary dust separator. The paper filter comprises one or two disposable filter cartridges. The paper is corrugated and surrounded by a metal support.

Impurities in the air are collected in the main filter cartridge, which can be cleaned if required. The internal safety filter prevents impurities from entering inside the engine if the main filter cartridge should fail or is incorrectly fitted.

An electrical or mechanical maintenance indicator may be fitted to the filter body or the inlet pipe to warn of any filter cartridge obstruction. The inlet system also includes hoses fitted between the air filter and the turbocharger and between the turbocharger and the inlet manifold.

The exhaust manifold is connected to the cylinder head by high traction resistance bolts, with no separate gasket. It is not necessary to retighten the manifold bolts.

This turbocharger is driven by the exhaust fumes. The compact turbocharger reacts quickly, even at low speed. It is lubricated and cooled by the engine lubricating system. The CWA engine has a bypass turbocharger, in which the overflow of compressed air is regulated by a "bypass channel". The boost pressure has been set correctly by the manufacturer; the pressure must therefore not be modified.

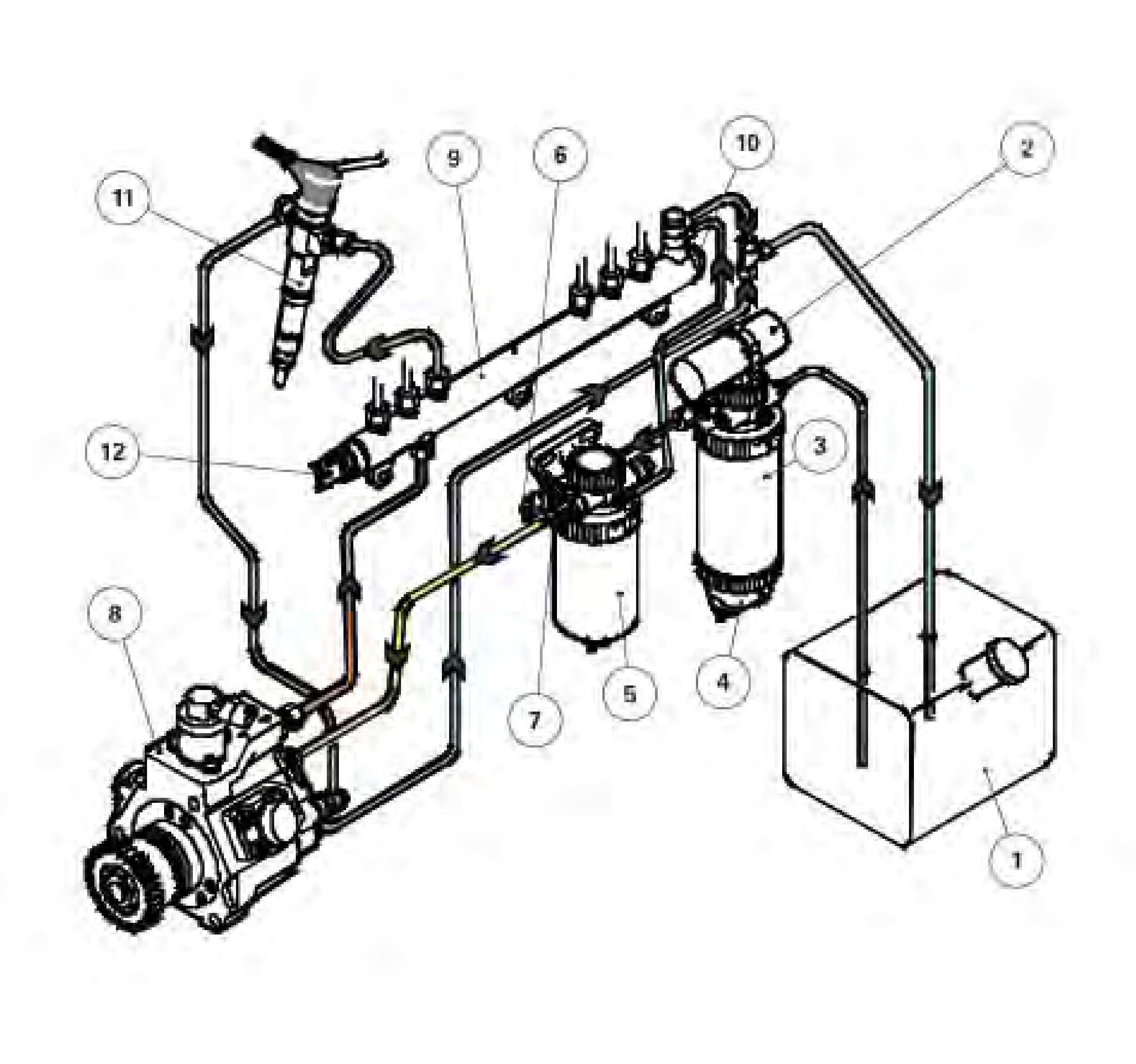
The compressed air is cooled by an air-air intercooler system. The temperature of the air coming from the turbocharger is approximately 150°C and is cooled by the engine air cooling system. Ideally, the intercooler sensor is fitted in front of the radiator or next to the radiator. Cooling the compressed air stabilises combustion, irrespective of the temperature, and minimises the mechanical and thermal load on the engine, thus reducing the level of nitrous oxides (NOx) and particulates (PT).

B.5 Fuel system

Citius series engines meet the required conditions in terms of emissions as defined by the authorities (97/68/EC Level III A and EPA 40 CFR 89 Tier 3). The manufacturer guarantees that all engines of this type are equivalent to the officially approved engine. It should be noted that the maintenance programme must be strictly followed, in particular during the periodic maintenance intervals. Any adjustments or repairs to the injection system or the engine control unit must be made by a representative approved by Sisu Diesel Inc. Use only genuine SisuDiesel spare parts for all maintenance or repair operations. Incorrect or late maintenance together with the use of parts other than SisuDiesel spare parts will invalidate any liability of Sisu Diesel Inc. in terms of meeting the conditions required for emissions levels.

Note: *This manual only provides general instructions concerning maintenance and repairs related to the fuel system. As a result, there are no instructions relating to replacement of the high-pressure pump, the injectors and the rail, which must be carried out by a person specially trained in the use of special tools and the necessary pressure gauges. All maintenance and repair work related to the fuel system requires special attention and cleanliness!*

Citius series engines are equipped with a common rail system controlled by the EEM3 electronic control unit.



I008079

Fig. 12

Fuel system parts

(1)	Fuel tank
(2)	Fuel pump
(3)	Prefilter
(4)	Water separator
(5)	Fuel filter
(6)	Temperature sensor
(7)	Fuel supply pressure sensor
(8)	High-pressure pump
(9)	Rail
(10)	Overflow valve
(11)	Injector
(12)	Pressure sensor

The electric fuel pump sucks the fuel from the fuel tank via the prefilter and then via the main fuel filter to the high-pressure pump. From the high-pressure pump, the fuel is sucked into the rail. This fuel, which is under high pressure, is stored in a high-pressure pipe where it is controlled and then injected via electronic injectors controlled by the EEM 3. Fuel injection is optimised in terms of emissions, efficiency and operating noise and takes place in four stages (maximum). Excess fuel is distributed from the injectors and the high-pressure pump pressure regulation valves and the rail and is fed back into the fuel tank. The overflow pipe from the filter assists in automatically bleeding the system.

Technical specifications

High-pressure pump

Type CP1H (engines 44, 49 and 66)	3 cylindrical/radial plungers
maximum injection pressure	1100 bar
gear ratio	4: 3
Type CP 3.3 (engines 74 and 84)	3 cylindrical/radial plungers
maximum injection pressure	1400 bar
gear ratio	4: 3
Injection order:	
engines 44 and 49	1-2-4-3
engines 66, 74 and 84	1-5-3-6-2-4

Injectors

Type	CRIN2-2V/CRIN2-4V
2V engines with nozzle	5 ports
4V engines with nozzle	8 ports

Fuel system

Fuel	the fuel must comply with the standard EN 590
Maximum temperature of continuous fuel delivery	70 °C
Fuel filters:	
prefilter	Stanadyne 30 µ
main filter	Stanadyne 5 µ
Fuel pump	electrical type, with prefilter
Supply voltage	12 V
Current consumption	6 A maximum
Fuel supply pressure at idle speed	
if high-pressure pump type CP1H	0,75 bar
if high-pressure pump type CP 3.3	1,0 bar to 1,2 bar

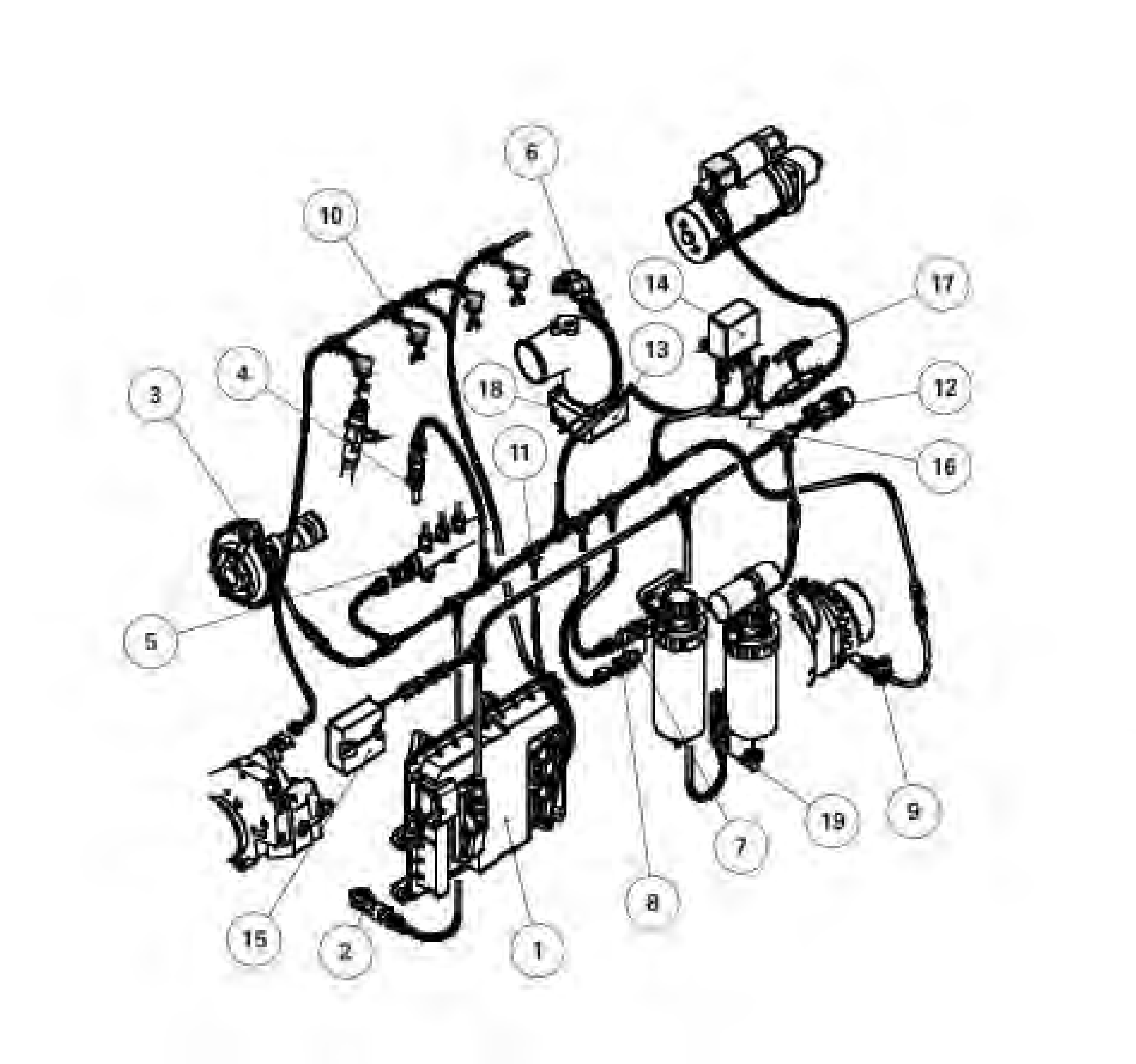
Tightening torques

Injector thread nuts (M4)	1,5 Nm
High-pressure pump CP1H gear nut (M14)	70 Nm
High-pressure pump CP3.3 gear nut (M18)	105 Nm
High-pressure pump attachment screws	30 Nm
High-pressure fuel supply pipes to the high-pressure pump and rail	30 Nm
Low-pressure fuel pipes to the high-pressure pump	25 Nm

B.6 Electric control circuit

Citius series engines meet the required conditions in terms of emissions as defined by the authorities (97/68/EC Level III A and EPA 40 CFR 89 Tier 3). The manufacturer guarantees that all engines of this type are equivalent to the officially approved engine. It should be noted that the maintenance programme must be strictly followed, in particular during the periodic maintenance intervals. Any adjustments or repairs to the injection system or the engine control unit must be made by a representative approved by Sisu Diesel Inc. Use only genuine SisuDiesel spare parts for all maintenance or repair operations. Incorrect or late maintenance together with the use of parts other than SisuDiesel spare parts will invalidate any liability of Sisu Diesel Inc. in terms of meeting the conditions required for emissions levels.

EEM 3 component layout



I009391

Fig. 13

(1) Electronic control unit (ECU)
(2) Oil pressure sensor
(3) Speed sensor (camshaft)
(4) Coolant temperature sensor
(5) Rail pressure sensor
(6) Boost pressure sensor
(7) Fuel temperature sensor

(8) Fuel pressure sensor
(9) Speed sensor (crankshaft)
(10) Injector wiring
(11) Sensor wiring
(12) Vehicle connector wiring
(13) Inlet air heater
(14) Air heater solenoid valve
(15) ID module
(16) Heater wiring
(17) Fuse
(18) Earth connection
(19) Water sensor (fuel)

EEM 3 engine control system - Description

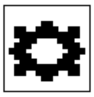
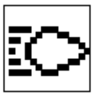
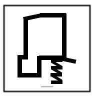
The basic function of an engine electronic control unit is to continuously adjust and measure engine load, fuel quantity and engine speed. Additional functions include automatic cold starting and engine protection systems. The electronic control system central unit continuously receives signals from the sensors which measure the various engine functions such as engine speed, oil pressure, boost pressure, fuel temperature and coolant temperature. The control unit receives important information relating to the conditions required for engine load from the transmission or the cab via the CAN bus. Information relating to the identifier code and engine operation comes from the ID module. The EEM 3 unit also provides many diagnostic functions via codes or a diagnostic indicator light.

3A11

Sisu Tier 3 engine - Error codes

TABLE OF CONTENTS

A. Reading error codes

	ERROR CODES DISPLAYED ON THE INSTRUMENT PANEL			
	DISPLAY with Dash Control Center			DISPLAY without Dash Control Center
Instrument panel		+	Letter D (Dashboard)	Letter D (Dashboard)
Engine		+	Letter E (Engine)	Letter E (Engine)
SCR system	no icon		Letter U (Urea)	Letter U (Urea)
Transmission/4WD/PTO		+	Letter T (Transmission)	Letter T (Transmission)
Lights module		+	Letter L (Light)	Letter L (Light)
ParkLock		+	Letter P (ParkLock)	Letter P (ParkLock)
Front axle		+	Letters FA (Front Axle)	Letters FA (Front Axle)
Linkage		+	Letters R (Linkage)	Letter R (Linkage)
Electrohydraulic		+	Letters H (Hydraulics)	Letter H (Hydraulics)
Cab		+	Letters C (Cab)	Letter C (Cab)
Auto-Guide		+	Letters A (Auto-Guide)	Letter A (Auto-Guide)
Control Arm		+	Letters AR (ARmrest)	Letter AR (ARmrest)

	OTHER DISPLAYS
Automatic air conditioning	Displayed on the air conditioning module.

B. Engine error codes

No.		FMI	Components concerned	Causes
E	91	4	Throttle sensor	Throttle sensor 1 LOW fault (IDLE)
E	91	3	Throttle sensor	Throttle sensor 1 HIGH fault (IDLE)
E	94	31	Fuel filter pressure sensor	Oil filter pressure LOW (with old sensor)
E	94	4	Fuel filter pressure sensor	LOW fuel filter pressure sensor fault
E	94	3	Fuel filter pressure sensor	HIGH fuel filter pressure sensor fault
E	94	2	Fuel filter pressure sensor	Fuel filter pressure NO SIGNAL
E	94	16	Fuel filter pressure sensor	Fuel filter pressure ABOVE NORMAL
E	94	18	Fuel filter pressure sensor	Fuel filter pressure BELOW NORMAL
E	97	31		Water in fuel
E	100	16	Oil pressure sensor	Oil pressure ABOVE NORMAL (9.5 bar/ 30°C)
E	100	2	Oil pressure sensor	Oil pressure NO SIGNAL
E	100	31	Oil pressure sensor	Oil pressure sensor fault
E	100	4	Oil pressure sensor	LOW oil pressure sensor fault
E	100	3	Oil pressure sensor	HIGH oil pressure sensor fault
E	100	18	Oil pressure sensor	Oil pressure LOW
E	100	1-	Oil pressure sensor	Oil pressure LOW, ALARM
E	102	4	Boost pressure sensor	LOW boost pressure sensor fault
E	102	3	Boost pressure sensor	HIGH boost pressure sensor fault
E	102	18	Boost pressure sensor	Boost pressure LOW
E	102	16	Boost pressure sensor	Boost pressure ABOVE NORMAL
E	102	2	Boost pressure sensor	Boost pressure NO SIGNAL
E	102	31	Boost pressure sensor	Inlet manifold pressure drop too HIGH at start-up
E	105	4	Inlet manifold temperature sensor	LOW inlet manifold temperature sensor fault
E	105	3	Inlet manifold temperature sensor	HIGH inlet manifold temperature sensor fault
E	105	16	Inlet manifold temperature sensor	Inlet manifold temperature ABOVE NOR-MAL (>90°C)
E	105	2	Inlet manifold temperature sensor	Inlet manifold temperature sensor NO SIGNAL
E	107	18	Air filter pressure sensor	Air filter pressure BELOW NORMAL
E	107	31	Air filter pressure sensor	Air filter pressure sensor fault
E	110	2	Coolant temperature sensor	Coolant temperature NO SIGNAL
E	110	4	Coolant temperature sensor	LOW coolant temperature sensor fault
E	110	3	Coolant temperature sensor	HIGH coolant temperature sensor fault
E	110	16	Coolant temperature sensor	Coolant temperature HIGH
E	110	0	Coolant temperature sensor	Coolant temperature HIGH, ALARM
E	157	4	Rail pressure sensor	LOW rail pressure sensor fault
E	157	3	Rail pressure sensor	HIGH rail pressure sensor fault
E	157	16	Rail pressure sensor	Rail pressure ABOVE NORMAL
E	157	2	Rail pressure sensor	Rail pressure NO SIGNAL
E	157	1-	Rail pressure sensor	Rail pressure LOW
E	157	0	Rail pressure sensor	Rail pressure HIGH
E	168	1-	Battery voltage	Battery voltage VERY LOW (<6.5 V)
E	168	0	Battery voltage	Battery voltage VERY HIGH (>36.0 V)
E	168	2	Battery voltage	Battery voltage NO SIGNAL

No.		FMI	Components concerned	Causes
E	168	18	Battery voltage	Battery voltage BELOW NORMAL (<7.8 V)
E	168	16	Battery voltage	Battery voltage ABOVE NORMAL
E	174	4	Fuel temperature sensor	LOW fuel temperature sensor fault
E	174	3	Fuel temperature sensor	HIGH fuel temperature sensor fault
E	174	16	Fuel temperature sensor	Fuel temperature ABOVE NORMAL
E	174	2	Fuel temperature sensor	Fuel temperature NO SIGNAL
E	175	4	Engine oil temperature sensor	LOW engine oil temperature sensor fault
E	175	3	Engine oil temperature sensor	HIGH engine oil temperature sensor fault
E	175	16	Engine oil temperature sensor	Engine oil temperature HIGH
E	175	2	Engine oil temperature sensor	Engine oil temperature sensor NO SIGNAL
E	190	16	Engine speed signal	Engine speed signal ABOVE NORMAL
E	626	4		Inlet air heater control, voltage below normal
E	626	3		Inlet air heater control, voltage above normal
E	629	10	EEPROM	EEPROM error
E	898	4	Requested speed	Requested speed out of LOW range (<500 rpm)
E	898	3	Requested speed	Requested speed out of HIGH range (>3000 rpm)
E	1136	16	ECU temperature sensor	ECU temperature ABOVE NORMAL >115°C
E	1136	4	ECU temperature sensor	ECU LOW temperature sensor fault
E	1136	3	ECU temperature sensor	ECU HIGH temperature sensor fault
E	1136	2	ECU temperature sensor	ECU temperature NO SIGNAL
E	1378	16		Engine oil drain: delayed for too long
E	9006	31	Vehicle CAN	Vehicle CAN off
E	9008	31	CAN ID module	CAN ID module off (ECU to ID)
E	9010	4	Ambient pressure sensor	LOW ambient pressure sensor fault
E	9010	3	Ambient pressure sensor	HIGH ambient pressure sensor fault
E	9010	16	Ambient pressure sensor	Ambient pressure ABOVE NORMAL
E	9010	2	Ambient pressure sensor	Ambient pressure NO SIGNAL
E	9021	4	5 V DC supply	5 V DC supply 1 LOW fault
E	9021	3	5 V DC supply	5 V DC supply 1 HIGH fault
E	9022	4	5 V DC supply	5 V DC supply 2 LOW fault
E	9022	3	5 V DC supply	5 V DC supply 2 HIGH fault
E	9023	4	5 V DC supply	5 V DC supply 3 LOW fault
E	9023	3	5 V DC supply	5 V DC supply 3 HIGH fault
E	9024	18	Supply of sensor detecting water in the fuel	Supply voltage of sensor detecting water in fuel BELOW NORMAL
E	9024	16	Supply of sensor detecting water in the fuel	Supply voltage of sensor detecting water in fuel ABOVE NORMAL
E	9025	31	Self-test cut-off paths	Self-test cut-off paths, monitoring
E	9026	3	Self-test cut-off paths	Self-test cut-off paths, HIGH processor voltage check
E	9027	4	Self-test cut-off paths	Self-test cut-off paths, LOW processor voltage check
E	9030	6	Main relay, short circuit to EARTH	Short circuit to EARTH, ECU main relay1
E	9030	3	Main relay, short circuit to BAT+	Short circuit to BAT+, ECU main relay1
E	9031	6	Main relay, short circuit to EARTH	Short circuit to EARTH, ECU main relay2

No.		FMI	Components concerned	Causes
E	9031	3	Main relay, short circuit to BAT+	Short circuit to BAT+, ECU main relay2
E	9032	6	Main relay, short circuit to EARTH	Short circuit to EARTH, ECU main relay3
E	9032	3	Main relay, short circuit to BAT+	Short circuit to BAT+, ECU main relay3
E	9033	31	Main relay	ECU cut-off does not work
E	9034	31	Main relay	ECU cut-off did not work last time
E	9035	31		Normal recovery
E	9036	31		Total restart after 3 recoveries in 2 seconds
E	9070	31	Crankshaft speed sensor	Crankshaft speed signal from the TPU
E	9071	31	Crankshaft speed sensor	Crankshaft speed signal, too many pulses
E	9072	31	Crankshaft speed sensor	Crankshaft speed sensor, reverse connected
E	9080	31	Cam speed sensor	APS cam speed signal
E	9081	31	Cam speed sensor	TPS cam speed signal
E	9082	31	Cam speed sensor	Cam speed sensor, reverse connected
E	9083	31	Cam speed sensor	No cam speed signal detected
E	9090	31	Engine speed signal	Engine speed signal evaluation error
E	9100	31		Protection upgrade fault
E	9107	31		Invalid ECU source address selection
E	9131	6	Solenoid valve 1	Solenoid valve 1, short circuit to EARTH (bank off)
E	9131	3	Solenoid valve 1	Solenoid valve 1, short circuit between cables (bank off)
E	9131	5	Solenoid valve 1	Solenoid valve 1, OPEN CIRCUIT
E	9131	31	Solenoid valve 1	Solenoid valve 1, fast decay error (bank off)
E	9131	11	Solenoid valve 1	Solenoid valve 1, current level error (bank off)
E	9132	6	Solenoid valve 2	Solenoid valve 2, short circuit to EARTH (bank off)
E	9132	3	Solenoid valve 2	Solenoid valve 2, short circuit between cables (bank off)
E	9132	5	Solenoid valve 2	Solenoid valve 2, OPEN CIRCUIT
E	9132	31	Solenoid valve 2	Solenoid valve 2, fast decay error (bank off)
E	9132	11	Solenoid valve 2	Solenoid valve 2, current level error (bank off)
E	9133	6	Solenoid valve 3	Solenoid valve 3, short circuit to EARTH (bank off)
E	9133	3	Solenoid valve 3	Solenoid valve 3, short circuit between cables (bank off)
E	9133	5	Solenoid valve 3	Solenoid valve 3, OPEN CIRCUIT
E	9133	31	Solenoid valve 3	Solenoid valve 3, fast decay error (bank off)
E	9133	11	Solenoid valve 3	Solenoid valve 3, current level error (bank off)
E	9134	6	Solenoid valve 4	Solenoid valve 4, short circuit to EARTH (bank off)
E	9134	3	Solenoid valve 4	Solenoid valve 4, short circuit between cables (bank off)
E	9134	5	Solenoid valve 4	Solenoid valve 4, OPEN CIRCUIT
E	9134	31	Solenoid valve 4	Solenoid valve 4, fast decay error (bank off)

No.		FMI	Components concerned	Causes
E	9134	11	Solenoid valve 4	Solenoid valve 4, current level error (bank off)
E	9135	6	Solenoid valve 5	Solenoid valve 5, short circuit to EARTH (bank off)
E	9135	3	Solenoid valve 5	Solenoid valve 5, short circuit between cables (bank off)
E	9135	5	Solenoid valve 5	Solenoid valve 5, OPEN CIRCUIT
E	9135	31	Solenoid valve 5	Solenoid valve 5, fast decay error (bank off)
E	9135	11	Solenoid valve 5	Solenoid valve 5, current level error (bank off)
E	9136	6	Solenoid valve 6	Solenoid valve 6, short circuit to EARTH (bank off)
E	9136	3	Solenoid valve 6	Solenoid valve 6, short circuit between cables (bank off)
E	9136	5	Solenoid valve 6	Solenoid valve 6, OPEN CIRCUIT
E	9136	31	Solenoid valve 6	Solenoid valve 6, fast decay error (bank off)
E	9136	11	Solenoid valve 6	Solenoid valve 6, current level error (bank off)
E	9150	16	Rail pressure sensor	Rail pressure, negative deviation
E	9150	18	Rail pressure sensor	Rail pressure, positive deviation
E	9150	5	Rail pressure sensor	Rail pressure, leakage detected during idle
E	9150	8	Rail pressure sensor	Rail pressure, leakage detected through quantity balance
E	9150	31	Rail pressure sensor	Rail pressure, leakage detected during overrun
E	9151	31	Pressure regulating valve	PRV recognised as OPEN
E	9151	7	Pressure regulating valve	PRV is sticking
E	9152	31	Fuel filter pressure sensor	Fuel filter pressure, fluctuating
E	9153	31	Fuel filter pressure sensor	Fuel filter pressure sensor, loose contact
E	9170	6	Lift pump control	Lift pump control (ECU), short circuit to earth
E	9170	5	Lift pump control	Lift pump control (ECU), open circuit
E	9171	6	Preheater control	Preheater control, short circuit to earth
E	9171	5	Preheater control	Preheater control, open circuit
E	9172	6	Starter relay control	Start relay control, short circuit to earth (lower side)
E	9172	3	Starter relay control	Start relay control, short circuit to BAT+ (lower side)
E	9172	5	Starter relay control	Start relay control, open circuit (lower side)
E	9172	31	Starter relay control	Start relay control, excessive temperature (lower side)
E	9173	6	Starter relay control	Start relay control, short circuit to earth (upper side)
E	9173	3	Starter relay control	Start relay control, short circuit to BAT+ (upper side)
E	9174	6	MPROP control	MPROP control, short circuit to earth
E	9174	3	MPROP control	MPROP control, short circuit to BAT+
E	9174	5	MPROP control	MPROP control, open circuit
E	9174	31	MPROP control	MPROP control, excessive temperature
E	9230	31	Diagnostic ID module	Engine specification mismatch
E	9231	31	Diagnostic ID module	Engine serial number mismatch

No.		FMI	Components concerned	Causes
E	9233	31	Diagnostic ID module	ID module not present
E	9234	31	Diagnostic ID module	ID not compatible with current ECU
E	9235	31	Diagnostic ID module	ID module memory fault
E	9235	3	Diagnostic ID module	ID module, supply voltage HIGH (>32.0 V)
E	9235	4	Diagnostic ID module	ID module memory fault
E	9235	16	Diagnostic ID module	ID temperature, temperature HIGH (>95°C)
E	9236	31	Diagnostic ID module	ID module additional memory defect
E	9237	31	Diagnostic ID module	ID module, monitoring reset
E	9238	31	Diagnostic ID module	ID module, brownout reset
E	9239	31	Diagnostic ID module	Engine specification missing
E	9240	31	Diagnostic ID module	Engine serial number missing
E	9241	31	Diagnostic ID module	ID module not present, bypass active
E	9242	31	Diagnostic ID module	Generated bypass time expired
E	9243	31	Diagnostic ID module	Maximum ECU bypass time expired
E	9244	31	Diagnostic ID module	ID module recovery
E	9303	31		Speed regulator UI fault
E	9304	31		Vehicle speed missing
E	9305	31		Incorrect digital input configuration
E	9306	31		PTO input error
E	9310	31		Fault with external digital input 1
E	9311	31		Fault with external digital input 2
E	9312	31		Torque control input
E	9317	31		DCU not present

C. Armrest error codes

No.		Components concerned	Causes
AR	01	**X104** - Armrest Autotronic 5	10 V output fault
AR	02	**X104** - Armrest Autotronic 5	VIN Error - Vehicle electronic identification incorrect
AR	11	**X307** - FingerTIP 1	Short circuit 0 V
AR	12		Short circuit to 12 V
AR	21	**X308** - FingerTIP 2	Short circuit 0 V
AR	22		Short circuit to 12 V
AR	31	**X108** - FingerTIP 3	Short circuit 0 V
AR	32		Short circuit to 12 V
AR	41	**X109** - FingerTIP 4	Short circuit 0 V
AR	42		Short circuit to 12 V
AR	51	**X110** - FingerTIP 5	Short circuit 0 V
AR	52		Short circuit to 12 V
AR	61	**X130** - FingerTIP 6 front linkage function	Short circuit 0 V
AR	62		Short circuit to 12 V
AR	71	**X122** - Hand throttle	Short circuit 0 V
AR	72		Short circuit to 12 V
AR	81	**X121** - Rear linkage height/depth adjustment thumb wheel	Short circuit 0 V
AR	82		Short circuit to 12 V
AR	91	**X106** - Transmission lever in armrest	Short circuit 0 V
AR	92		Short circuit to 12 V

D. Instrument panel error codes

No.		Component(s) concerned	Cause(s)
D	121		Alternator regulator voltage too high (filtered battery signal)
D	122		Alternator regulator voltage too low (filtered battery signal)
D	127	**X197** - Diesel fuel gauge	Electrical signal too high
D	128		Electrical signal too low
D	129		Battery voltage too high (non-filtered battery signal)
D	130		Battery voltage too low (non-filtered battery signal)
D	133	**X71** - Throttle pedal sensor	Electrical signal too high
D	134		Electrical signal too low
D	135	**X56** - Power Control lever**X71** - Throttle pedal sensor	Electrical signal too high - C.N.
D	136		Electrical signal too low - C.N.
D	137	**X106** - Transmission lever in armrest	Electrical signal too high
D	138		Electrical signal too low
D	139	**X68** - Clutch pedal sensor	Electrical signal too high
D	140		Electrical signal too low
D	141	**X25** - Engine speed sensor	Engine speed signal not at maximum level
D	142	**X68** - Clutch pedal sensor	Short circuit to + 12 V AC
D	143		Short circuit to + 12 V AC - C.N.
D	144	**X56** - Power Control lever	Electrical signal too high
D	145		Electrical signal too low
D	146		Electrical signal too high
D	147		Electrical signal too low
D	148	**X55** - Instrument panel	Attempt to program with engine running
D	149		CAN network deactivated (CAN bus off)
D	150		CAN messages lost
D	151		Tractor speed too high
D	152	**X55** - Instrument panel	Hourmeter error for engine maintenance
D	153		Parameter table error
D	154		CAN communications from Autotronic 4 to DCC3 - C.N. Special failed
D	155	**X55** - Instrument panel	Incorrect tractor code selected
D	156	**X68** - Clutch pedal sensor	TOC stuck open
D	157	**X25** - Engine speed sensor	No electrical signal
D	158	**X106** - Transmission lever in armrest	Incorrect calibration of armrest lever
D	159	**X56** - Power Control lever	Neutral switch error in neutral - C.N. position
D	160		Neutral switch error outside neutral - C.N. position
D	164		CAN communications from EEM to DCC3 failed
D	170	**X122** - Hand throttle	
D	183	**X235** - Front axle steering sensor (WAS sensor)	Electrical signal too high
D	184		Electrical signal too low
D	185	**X57** - DOT Matrix keyboard	Electrical signal too high
D	186		Electrical signal too low
D	189	**X55** - Instrument panel	9.5 V output - electrical signal too high
D	190		9.5 V output - electrical signal too low
D	191	**X168** - Pneumatic brake system pressure sensor	Electrical signal too high
D	192		Electrical signal too low

No.		Component(s) concerned	Cause(s)
D	193	**X144** - Variable steering setting potentiometer (fast steering)	Electrical signal too high
D	194		Electrical signal too low
D	195	**X55** - Instrument panel	Electrical signal too high
D	196		Electrical signal too low
D	197	**X1** - Auxiliary hydraulic oil temperature sensor	Electrical signal too high
D	198		Electrical signal too low

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Sisu Tier 3 engine - Diagrams and plans

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A. Electrical diagrams

A.1 Identification of electrical connectors and harnesses

Identification of electrical connectors

X1 - Auxiliary hydraulic oil temperature sensor
X2 - Auxiliary hydraulic oil filter blockage switch
X3 - 540 rpm PTO speed solenoid valve
X4 - 1000 rpm PTO speed solenoid valve
X5 - 4WD solenoid valve
X6 - Differential lock solenoid valve
X7 - Rear PTO solenoid valve
X8 - Bevel gear theoretical speed sensor
X9 - Transmission oil high pressure sensor 1
X10 - Collecting shaft speed sensor
X11 - Solenoid valve limiting speed to 30 kph
X12 - Coupler function solenoid valve
X13 - Hare range solenoid valve
X14 - Tortoise range solenoid valve
X15 - PTO clutch speed sensor
X16 - PTO shaft speed sensor
X17 - Hare/Tortoise range position sensor
X18 - Transmission control module
X19 - Transmission hydraulic oil temperature sensor
X20 - Transmission filter blockage switch
X21 - ParkLock brake pressure sensor
X22 - Radar
X23 - Steering pressure sensor
X24 - Auxiliary hydraulic oil gauge
X25 - Engine speed sensor
X26 - Pneumatic brake solenoid valve
X27 - Rear linkage lifting solenoid valve
X28 - Rear linkage lowering solenoid valve
X29 - Dual Control socket connector
X30 - Rear linkage position sensor
X31 - Rear linkage right-hand draft sensor
X32 - Rear linkage left-hand draft sensor
X33 - Transmission harness CAN junction
X34 - Transmission oil high pressure sensor 2
X35 - ParkLock hydraulic system pressure sensor
X36 - LS signal breaker solenoid valve
X37 - ParkLock pressure reversing solenoid valve
X38 - Trailer braking proportional solenoid valve
X39 - Trailer braking safety solenoid valve
X40 - Front linkage single/double acting function solenoid valve
X41 - Divider solenoid valve 1
X42 - Divider solenoid valve 2
X43 - Auto-hitch lifting solenoid valve
X44 - Auto-hitch lowering solenoid valve
X45 - Bleed for pneumatic suspended cab front and rear systems
X46 - Rear left-hand ram position sensor for cab suspension
X47 - Rear right-hand unit for suspended cab
X48 - Rear left-hand unit for suspended cab
X49 - Suspended cab rear lowering solenoid valve
X50 - Suspended cab front lowering solenoid valve
X51 - Transmission harness earth (chassis)
X52 - Engine harness/transmission harness junction
X53 - Cab transmission harness/transmission harness junction
X54 - Suspended cab lifting solenoid valve
X55 - Instrument panel
X56 - Power Control lever
X57 - DOT Matrix keyboard
X58 - Windscreen wiper and indicator control unit
X59 - DOT Matrix keyboard connection on instrument panel
X60 - Engine harness/instrument panel harness junction
X61 - Cab transmission harness/engine harness junction
X62 - Instrument panel harness/cab transmission harness junction
X63 - Instrument panel harness connection on fuse box
X64 - Instrument panel harness connection on fuse box
X65 - Front windscreen wiper motor
X66 - Left-hand brake pedal sensor
X67 - Right-hand brake pedal sensor
X68 - Clutch pedal sensor
X69 - Cab interior temperature sensor
X70 - Solar radiation sensor
X71 - Throttle pedal sensor
X72 - ParkLock switch on Power Control lever
X73 - Buzzer Control
X74 - Buzzer Supply (+12 V APC)
X75 - Pillar harness/right-hand fender harness junction
X76 - Rear right-hand indicator
X77 - Rear right-hand side light and stop light
X78 - Work light on rear right-hand fender
X79 - -
X80 - -
X81 - -
X82 - -
X83 - -
X84 - -
X85 - -
X86 - -
X87 - Linkage lifting/lowering switch on right-hand fender
X88 - Rear right-hand NA indicator extension
X89 - Earth (chassis)
X90 - Pillar harness/left-hand fender harness junction
X91 - Rear left-hand indicator
X92 - Rear left-hand side light and stop light
X93 - Work light on rear left-hand fender
X94 - PTO ON/OFF switch on left-hand fender
X95 - PTO Stop switch on left-hand fender
X96 - Hydraulic spool valve switch on left-hand fender
X97 - Linkage lifting/lowering switch on left-hand fender
X98 - Rear left-hand NA indicator extension
X99 - PTO and linkage console harness/cab transmission harness junction
X100 - Instrument panel harness earth (chassis)
X101 - Instrument panel harness/electric rear-view mirror harness junction
X102 - Right-hand fender lighting harness/trailer connector harness junction
X103 - Armrest harness/cab transmission harness junction
X104 - Armrest Autotronic 5

X105 - Datatronic CCD
X106 - Transmission lever in armrest
X107 - Headland mode switch (headland function)
X108 - FingerTIP 3
X109 - FingerTIP 4
X110 - FingerTIP 5
X111 - DTM dynamic transmission mode switch
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X113 - Armrest 6-button keyboard
X114 - Supply on fuse box for 3rd spool valve
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X116 - +12 V battery supply (for lighting module)
X117 - Isobus +12 V battery power socket
X118 - Automatic PTO switch
X119 - Rear linkage lifting/lowering switch
X120 - Datatronic CCD navigation keyboard
X121 - Rear linkage height/depth adjustment thumb wheel
X122 - Hand throttle
X123 - Hare/Tortoise range shift switch
X124 - Pedal/lever mode switch
X125 - SV1 speed setting potentiometer
X126 - SV2 speed setting potentiometer
X127 - Front PTO ON/OFF switch
X128 - Rear PTO ON/OFF switch
X129 - Fuse box +12 V battery connection
X130 - FingerTIP 6 front linkage function
X131 - Front linkage suspension solenoid valve
X132 - Instrument panel harness/armrest harness junction
X133 - Console harness/cab transmission harness junction
X134 - Console harness/pillar harness junction
X135 - Braking pressure sensor
X136 - Differential lock switch
X137 - 4WD switch
X138 - Hazard warning lights indicator light and switch
X139 - Suspended front axle switch
X140 - Suspended front axle setting potentiometer
X141 - Suspended cab switch
X142 - Suspended cab setting potentiometer
X143 - Variable steering switch (fast steering)
X144 - Variable steering setting potentiometer (fast steering)
X145 - PTO/linkage console
X146 - Rear linkage suspension switch
X147 - Roof harness/pillar harness junction
X148 - Roof harness/pillar harness junction
X149 - Headlights module (black connector)
X150 - Pillar harness/cab power socket harness junction
X151 - Pillar harness/cab power socket harness junction
X152 - Start switch
X153 - Non-Isobus implement connector
X154 - Suspended front axle lifting solenoid valve
X155 - Cigarette lighter socket (power)
X156 - Cigarette lighter socket (backlighting)
X157 - Left-hand side +12 V socket (power)
X158 - Left-hand side +12 V socket (backlighting)
X159 - Suspended front axle lowering solenoid valve
X160 - Console harness earth (chassis)
X161 - Solenoid valve 1 for suspended front axle suspension
X162 - Pillar harness connection on fuse box
X163 - Solenoid valve 2 for suspended front axle suspension
X164 - Pillar harness/cab transmission harness junction
X165 - Automatic air conditioning harness/pillar harness junction
X166 - Suspended front axle position sensor
X167 - +12 V APC fuse box connection
X168 - Pneumatic brake system pressure sensor
X169 - Power socket control switch (in cab)
X170 - Pillar harness connection on fuse box
X171 - Cab transmission harness connection on fuse box
X172 - Cab transmission harness connection on fuse box
X173 - Cab transmission harness earth
X174 - Autotronic 4 transmission controller
X175 - Emergency control switch
X176 - Earth (Autotronic 4 transmission controller)
X177 - Autotronic 5 Linkage
X178 - ParkLock/suspended front axle/passive suspended cab Autotronic 5
X179 - Main lighting, sidelight/dipped light activation switch
X180 - Front windscreen washer pump
X181 - Front linkage single acting / double acting function switch
X182 - Linkage external lifting switch
X183 - Diagnostics connector (tractor-Isobus CAN)
X184 - Diagnostics connector (engine-valve CAN)
X185 - Sisu EEM unit
X186 - Starter
X187 - Engine start relay
X188 - Engine identification module (ID module)
X189 - Fuel lift pump
X190 - Vistronic fan
X191 - Diesel fuel preheater
X192 - B + alternator 1
X193 - B + alternator 2
X194 - D + alternator 1
X195 - D + alternator 2
X196 - In line fuse (225 A)
X197 - Diesel fuel gauge
X198 - Pneumatic trailer brake sensor
X199 - Work light on left-hand step
X200 - Work light on right-hand step
X201 - Engine harness earth
X202 - Front accessory connection socket harness/front function harness junction
X203 - Engine harness/front headlights harness junction
X204 - Cooling unit harness/engine harness junction
X205 - Front axle harness/engine harness junction
X206 - Sensor detecting water in the diesel fuel
X207 - Pneumatic seat adjustment control
X208 - Front linkage suspension switch LED
X209 - Rear linkage external lowering switch
X210 - Orbitrol steering sensor (SASA sensor)
X211 - Rear Dual Control connector

X212 - Instrument panel harness/armrest harness junction
X213 - Power socket for additional heating
X214 - Armrest harness/cab transmission harness junction
X215 - Trailer connector (right-hand side light and number plate lights)
X216 - Reversing light
X217 - Isobus CAN connector
X218 - External Isobus tool connector
X219 - Cab Isobus harness/external Isobus harness junction
X220 - Trailer connector (left-hand side light)
X221 - Trailer connector (right-hand indicator)
X222 - Trailer connector (left-hand indicator)
X223 - Trailer connector (brake lights)
X224 - Trailer connector (earth)
X225 - Trailer connector (reversing light)
X226 - Trailer connector harness earth
X227 - Console harness/cab transmission harness junction
X228 - Front linkage single/double-acting function LED
X229 - 120 Ohm CAN 1 resistor (cab transmission harness)
X230 - 120 Ohm CAN 2 resistor (cab transmission harness)
X231 - 120 Ohm CAN 3 resistor (cab transmission harness)
X232 - 120 Ohm CAN 4 resistor (cab transmission harness)
X233 - Cab transmission harness/Isobus harness junction
X234 - 120 Ohm CAN ATC resistor
X235 - Front axle steering sensor (WAS sensor)
X236 - Electrohydraulic Orbitrol (grey connector)
X237 - Electrohydraulic Orbitrol (black connector)
X238 - Connector 1 for valve harness
X239 - Connector 2 for valve harness
X240 - 120 Ohm resistor for electrohydraulic spool valves
X241 - Sisu engine preheating supply (Grid Heater)
X242 - Exhaust temperature sensor
X243 - AdBlue/DEF reservoir (urea) level gauge and temperature sensor
X244 - CAN SCR harness
X245 - +12 V APC supply for SCR
X246 - Auto-Guide external harness/engine harness junction
X247 - Roof harness/electric rear-view mirror harness junction
X248 - Right and left-hand electric rear-view mirror adjustment switch
X249 - External rear-view mirror defroster switch
X250 - Power socket in cab
X251 - In line fuse (225 A)
X252 - Automatic air conditioning condenser
X253 - Air filter vacuum sensor
X254 - Horn (earth)
X255 - Horn
X256 - Roof harness/hand rail harness junction
X257 - Side light and indicator on hand rail (right and left)
X258 - Main beam on hand rail (right and left)
X259 - Hand rail upper work light
X260 - Hand rail upper work light
X261 - Front right-hand unit for suspended cab
X262 - Front left-hand unit for suspended cab
X263 - Floating stop relay control (US front-end loader)
X264 - Front linkage suspension switch
X265 - Rear linkage suspension switch indicator light
X266 - Rear linkage diagnostic and lifting/lowering LEDs
X267 - Switch for left-hand side heater
X268 - Pillar harness connection on fuse box
X269 - Cab suspension harness/cab transmission harness junction
X270 - Front accessories connection socket (rotary beacon)
X271 - Front accessories connection socket (+12 V battery)
X272 - Front accessories connection socket (+12 V APC)
X273 - Front accessories connection socket (main beam light)
X274 - Front accessories connection socket (main beam light)
X275 - Front accessories connection socket (work light)
X276 - Earth for front accessory connection socket harness
X277 - Front linkage lifting/lowering external control
X278 - Front linkage lifting switch (external)
X279 - Dual Control or TIC position sensor
X280 - Front linkage rams pressure sensor
X281 - Solenoid valve for front PTO
X282 - Roof harness/cab Auto-Guide harness junction
X283 - TopDock
X284 - Headlights module keyboard
X285 - Ad Blue (urea) metering valve
X286 - Ad Blue (urea) injection valve
X287 - Ad Blue (urea) reservoir preheating valve
X288 - 12/24 V converter for SCR system
X289 - SCR management module
X290 - Front accessory connection socket harness/front function harness junction
X291 - Front accessory connection socket harness/front function harness junction
X292 - Front windscreen washer pump
X293 - 540 rpm PTO switch
X294 - 540 eco rpm PTO switch
X295 - 1000 rpm PTO switch
X296 - USB connector
X297 - PTO/linkage console backlighting
X298 - Headland mode switch (headland function)
X299 - Linkage lowering speed potentiometer
X300 - -
X301 - PTO stop switch on left-hand fender
X302 - Switch for pre-selected engine speed A
X303 - Switch for pre-selected engine speed B
X304 - Instrument panel harness/armrest harness junction
X305 - Headlights module (grey connector)
X306 - Switch for pre-selected engine speed A/B
X307 - FingerTIP 1
X308 - FingerTIP 2
X309 - SV1/SV2 speed regulator switch

X310 - Divider 1 indicator light and solenoid valve (earth)
X311 - Divider 2 indicator light and solenoid valve (+12 V)
X312 - SV1/SV2 speed setting potentiometer in armrest
X313 - Pedal/lever transmission control mode switch and DTM switch
X314 - Hydraulics switch 1, road/field mode
X315 - Hydraulics switch 2, road/field mode
X316 - Headland mode switch (headland function)
X317 - + battery supply for headlights module
X318 - Automatic air conditioning compressor
X319 - + battery supply for headlights module
X320 - + battery supply on headlights module
X321 - + battery supply on headlights module
X322 - + battery supply on headlights module
X323 - + battery supply on headlights module
X324 - +12 V APC fuse box connector (battery isolator switch)
X325 - Pillar harness / non-Isobus implement connector harness junction
X326 - Pillar harness / non-Isobus implement connector harness junction
X327 - Battery earth (chassis)
X328 - Battery isolator switch earth terminal
X329 - Battery isolator switch earth terminal
X330 - Battery negative terminal contact (battery isolator switch)
X331 - Pillar harness connection on fuse box
X332 - + battery (start switch)
X333 - Engine harness earth (chassis)
X334 - Battery isolator switch earth terminal
X335 - Battery isolator switch earth terminal
X336 - Battery isolator switch
X337 - Pneumatic brake ParkLock solenoid valve
X338 - Earth (battery isolator switch)
X339 - Pneumatic trailer braking solenoid valve
X340 - + terminal on battery for fuse box
X341 - Starter supply
X342 - Positive battery terminal
X343 - RS232 diagnostics connector for Auto-Guide
X344 - Isobus connector in cab
X345 - Supply for additional terminal (mitron unit)
X346 - Auto-Guide switch
X347 - Cab transmission harness connection on fuse box
X348 - Cab transmission harness connection on fuse box
X349 - -
X350 - Front right-hand grille work light
X351 - Front right-hand grille work light
X352 - Front right-hand grille work light
X353 - Front left-hand grille work light
X354 - Front left-hand grille work light
X355 - Front left-hand grille work light
X356 - Right-hand main beam and dipped light
X357 - Left-hand main beam and dipped light
X358 - Outside temperature sensor
X359 - Cab suspension harness/cab transmission harness junction
X360 - Pillar harness connection on fuse box
X361 - Pillar harness connection on fuse box
X362 - Fuse box (+12 V battery)
X363 - Auto-hitch (Dromone) switch
X364 - 120 Ohm resistor for Auto-Guide/Isobus CAN network
X365 - Hand rail lower work light
X366 - Pneumatic brake harness / transmission harness junction
X367 - Switch 1 on joystick
X368 - Switch 2 on joystick
X369 - Engine speed + switch
X370 - Engine speed - switch
X371 - Engine speed stop switch
X372 - Orbitrol safety solenoid valve
X373 - Left-hand 12 V socket (cab) (power)
X374 - Left-hand 12 V socket (cab) (backlighting)
X375 - Instrument panel harness/cab transmission harness junction
X376 - Fuse box (reserve for + APC)
X377 - Fuse box (supply for cab suspension compressor)
X378 - FNRP lever and button
X379 - Front left-hand work light on roof
X380 - Front right-hand work light on roof
X381 - Front left-hand work light on roof
X382 - Front right-hand work light on roof
X383 - Front left-hand roof indicator
X384 - Front right-hand roof indicator
X385 - Rear left-hand work light on roof
X386 - Rear right-hand work light on roof
X387 - Rear left-hand work light on roof
X388 - Rear right-hand work light on roof
X389 - Rear left-hand work lights
X390 - Rear right-hand work lights
X391 - Rear left-hand roof indicator
X392 - Rear right-hand roof indicator
X393 - Earth
X394 - Radio aerial connector
X395 - Radio supply
X396 - Radio speaker connector
X397 - Front left-hand speaker
X398 - Front right-hand speaker
X399 - Rear left-hand speaker (+ supply)
X400 - Rear right-hand speaker (+ supply)
X401 - Rear left-hand speaker (- supply)
X402 - Rear right-hand speaker (- supply)
X403 - Rear windscreen wiper motor
X404 - Door switch
X405 - Interior light (earth)
X406 - Interior light (control)
X407 - Interior light (+12 V battery supply)
X408 - Right-hand console light
X409 - Left-hand rotary beacon
X410 - Right-hand rotary beacon
X411 - Rear windscreen wiper switch
X412 - Radio aerial
X413 - Earth (aerial)
X414 - Left-hand number plate light
X415 - Right-hand number plate light
X416 - Radio supply
X417 - Radio speaker connector
X418 - Earth
X419 - Earth
X420 - Rotary beacon harness earth (chassis)

X421 - Earth
X422 - Roof harness earth (chassis)
X423 - Left-hand side fan ON/OFF switch
X424 - Fan speed control knob
X425 - Air conditioning switch
X426 - Air conditioning indicator light
X427 - Manual air conditioning module
X428 - Electronic thermostat for heating
X429 - Speed 1relay for fan
X430 - Speed 2relay for fan
X431 - Speed 3relay for fan
X432 - Speed 4relay for fan
X433 - Left-hand heating resistor
X434 - Right-hand fan
X435 - Left-hand fan
X436 - Left-hand side fan switch
X437 - Relay for left-hand side fan
X438 - Earth (automatic air conditioning)
X439 - Air conditioning control module (blue connector)
X440 - Air conditioning control module (yellow connector)
X441 - Heating temperature sensor
X442 - TT2 sensor
X443 - Evaporator temperature sensor
X444 - Right-hand fan adapter module (signal)
X445 - Left-hand fan adapter module
X446 - Right-hand fan adapter module (supply)
X447 - Left-hand fan adapter module (supply)
X448 - Separation harness for automatic air conditioning
X449 - Motor for left-hand heating shutter
X450 - Motor for right-hand heating shutter
X451 - Motor for heating mixer shutter
X452 - Relay for heater pump
X453 - Heater accelerator pump
X454 - Earth (roof)
X455 - Roof harness earth
X456 - Solar panel
X457 - Earth (Auto-Guide)
X458 - Cab transmission harness/pillar harness junction
X459 - Linkage lifting switch on fender
X460 - Linkage lowering switch on fender
X461 - Pillar harness/TECU harness junction
X462 - Supply indicator light for power socket on pillar
X463 - Earth (Isobus)
X464 - Pillar harness/armrest harness junction
X465 - Battery positive terminal contact
X466 - Active suspended cab Autotronic 5
X467 - Right-hand electric rear-view mirror
X468 - Left-hand electric rear-view mirror
X469 - Additional fan connection
X470 - Operator presence in seat switch
X471 - Suspended cab harness connection

Identification of harnesses

FAI200 - Engine harness
FAI201 - Front headlights harness
FAI202 - Suspended front axle harness
FAI203 - Transmission harness
FAI204 - Cab/platform linkage external harness
FAI205 - Electrohydraulic valves harness
FAI206 - Transmission harness — PTO
FAI207 - Front Dual Control harness
FAI208 - Linkage with Dual Control and TIC harness
FAI209 - Instrument panel harness
FAI210 - Cab transmission harness
FAI211 - Cab linkage harness
FAI212 - Lighting harness
FAI213 - Cab interior lighting harness
FAI214 - Armrest harness
FAI215 - Pillar harness
FAI216 - Diagnostics connector harness
FAI217 - Datatronic 3 harness
FAI218 - Fieldstar harness
FAI219 - Cab interior power socket harness
FAI220 - BOC harness — safety switch
FAI221 - Automatic air conditioning harness — instrument panel
FAI222 - Autotronic 5 ParkLock/suspended front axle harness
FAI223 - Roof harness
FAI224 - Hand rail lighting harness
FAI225 - Electric rear-view mirror harness
FAI226 - Roof/external harness
FAI227 - Automatic air conditioning harness - roof
FAI228 - Number plate lighting harness
FAI229 - Xenon light adapter harness
FAI230 - GSPTO harness
FAI231 - Transmission harness — ParkLock
FAI232 - Radio harness
FAI235 - Front accessory connection socket harness
FAI236 - Start-up harness
FAI237 - +12 APC fuse box harness
FAI238 - +12 APC instrument panel harness
FAI239 - Permanent +12 V supply harness
FAI240 - +12 V permanent fuse box harness
FAI241 - Automatic air conditioning adapter harness
FAI242 - Main beams on hand rail adapter harness
FAI243 - Circuit breaker harness
FAI244 - Linkage external controls extension harness
FAI245 - Left-hand linkage external controls harness
FAI246 - Right-hand linkage external controls harness
FAI247 - PTO shunt harness
FAI248 - Linkage external controls harness
FAI249 - Suspended front axle harness
FAI250 - Engine harness
FAI251 - Parking brake harness
FAI252 - +12 V battery harness
FAI253 - Hand rail harness
FAI254 - Windscreen wiper harness
FAI255 - Windscreen wiper harness
FAI256 - High-visibility roof heating harness
FAI257 - High-visibility roof heating harness
FAI258 - Roof earth harness
FAI260 - Cooling unit harness
FAI261 - Isobus harness
FAI262 - Auto-Guide engine harness
FAI263 - Auto-Guide cab adapter harness
FAI265 - Pneumatic brake harness
FAI267 - Console harness
FAI268 - Front function harness
FAI271 - Cab electric rear-view mirror harness
FAI272 - Active suspended cab harness

FAI273 - Front linkage harness
FAI274 - Rear right-hand lighting harness
FAI275 - Trailer connector harness
FAI276 - Rear left-hand lighting harness
FAI280 - Negative battery harness
FAI281 - Negative battery harness
FAI282 - Negative battery harness
FAI283 - TopDock harness
FAIxxx - Non-Isobus tool connector harness
FAIxxx - Non-Isobus implement connector controller harness
FAIxxx - Additional fan harness

A.2 Fuse box supply with circuit breaker

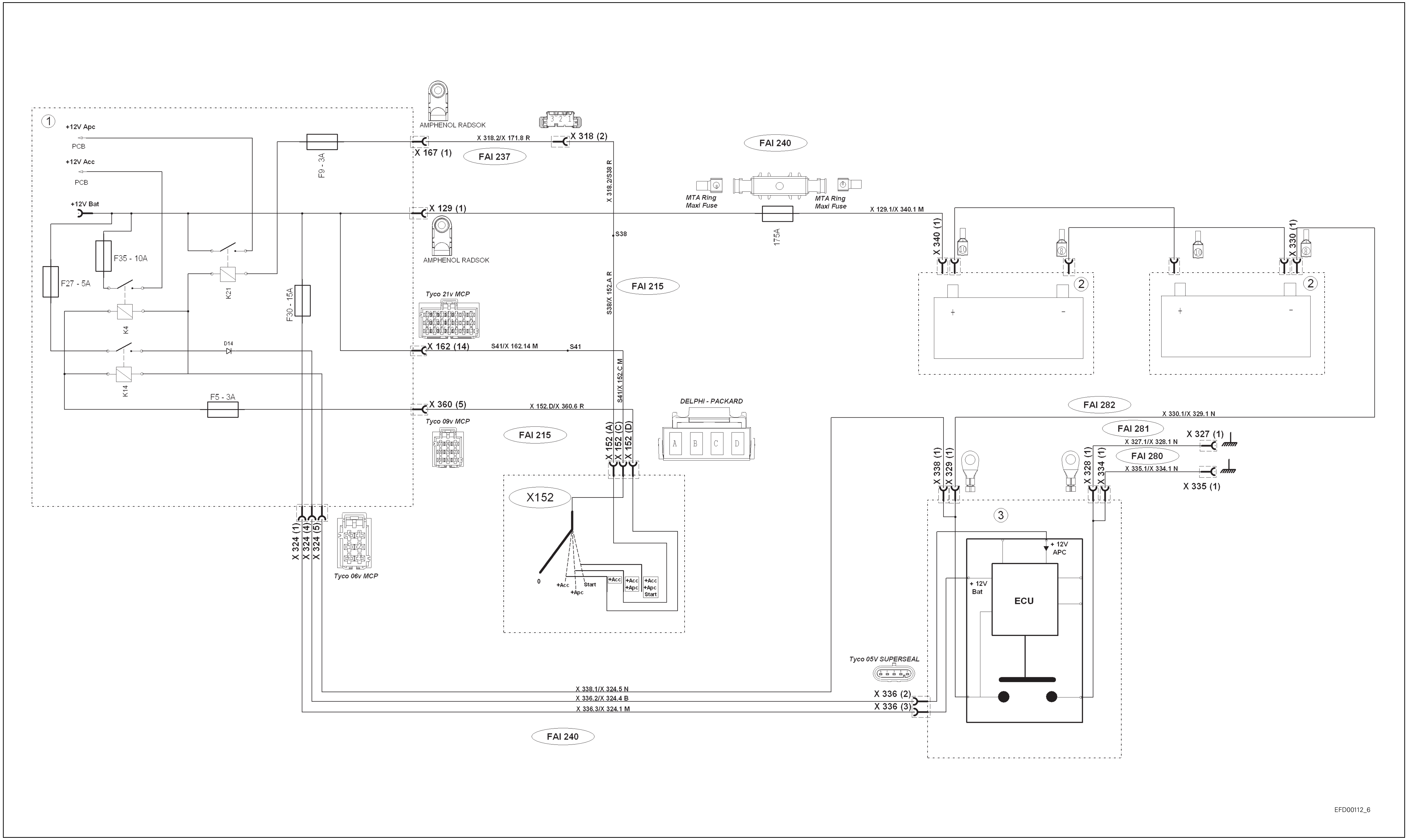

Fig. 1

A.3 Autotronic 4 electrical power supply

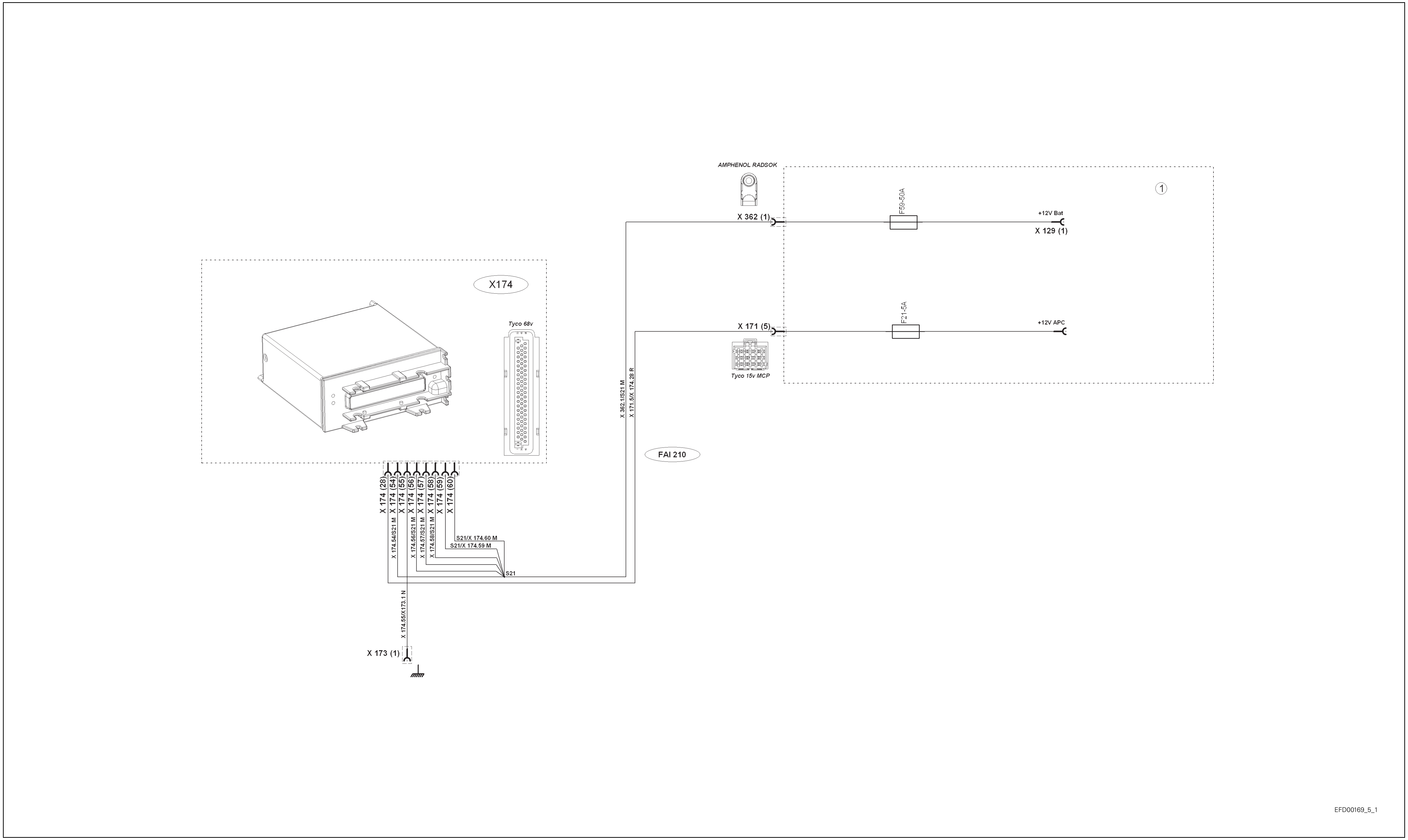

Fig. 2

A.4 Autotronic 5 linkage electrical power supply

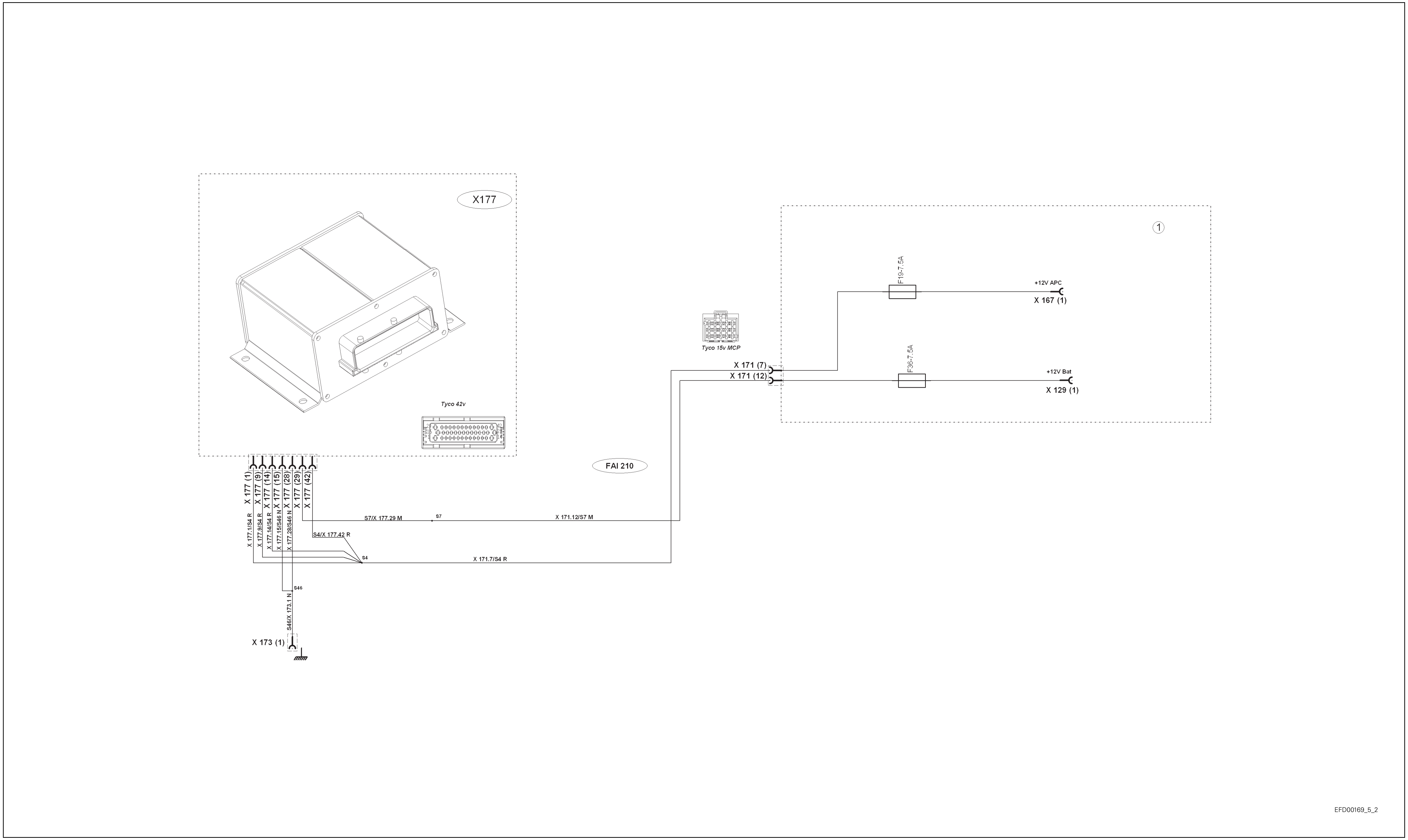

Fig. 3

A.5 Autotronic 5 ParkLock/suspended front axle electrical power supply

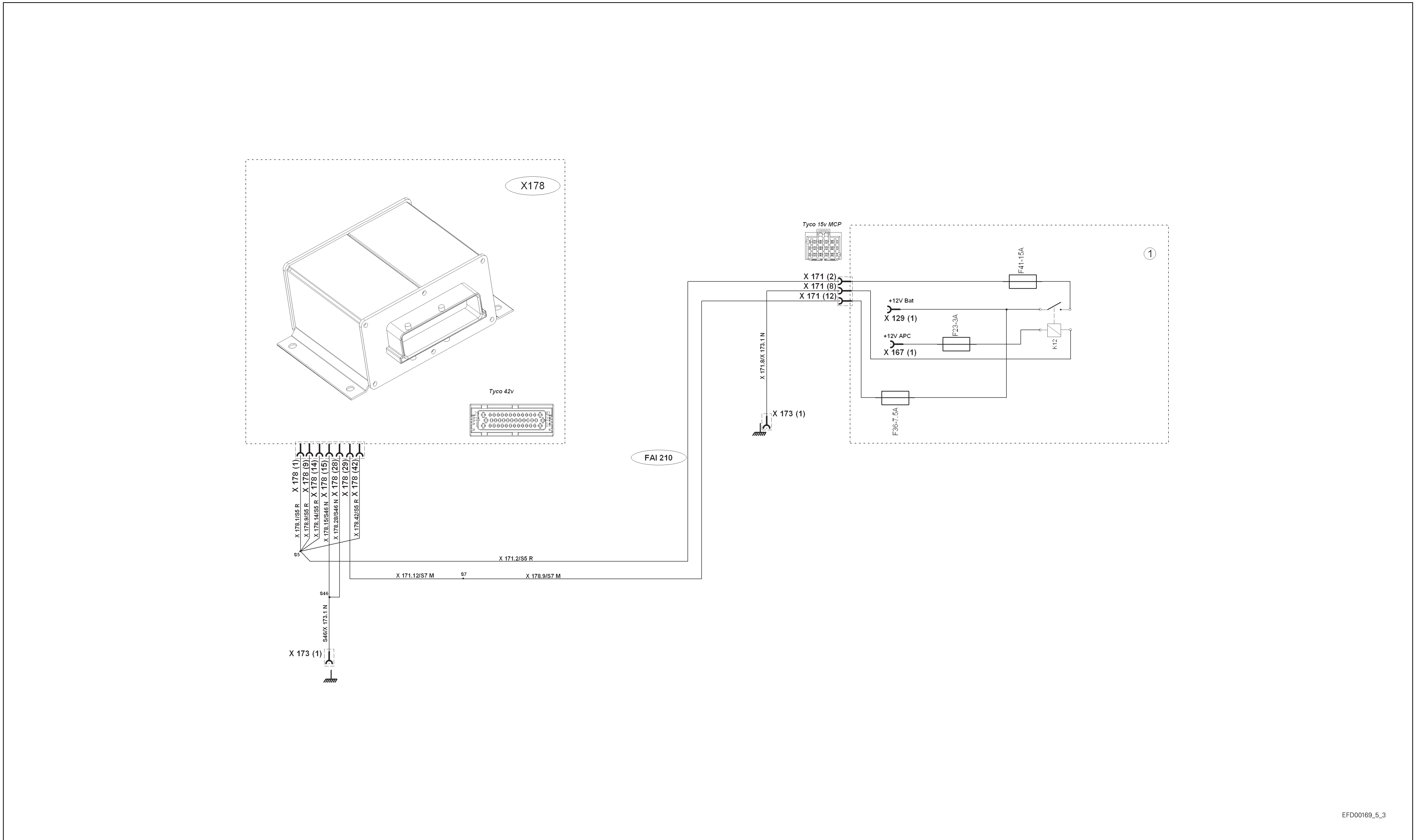

Fig. 4

A.6 DCC3 instrument panel electrical power supply

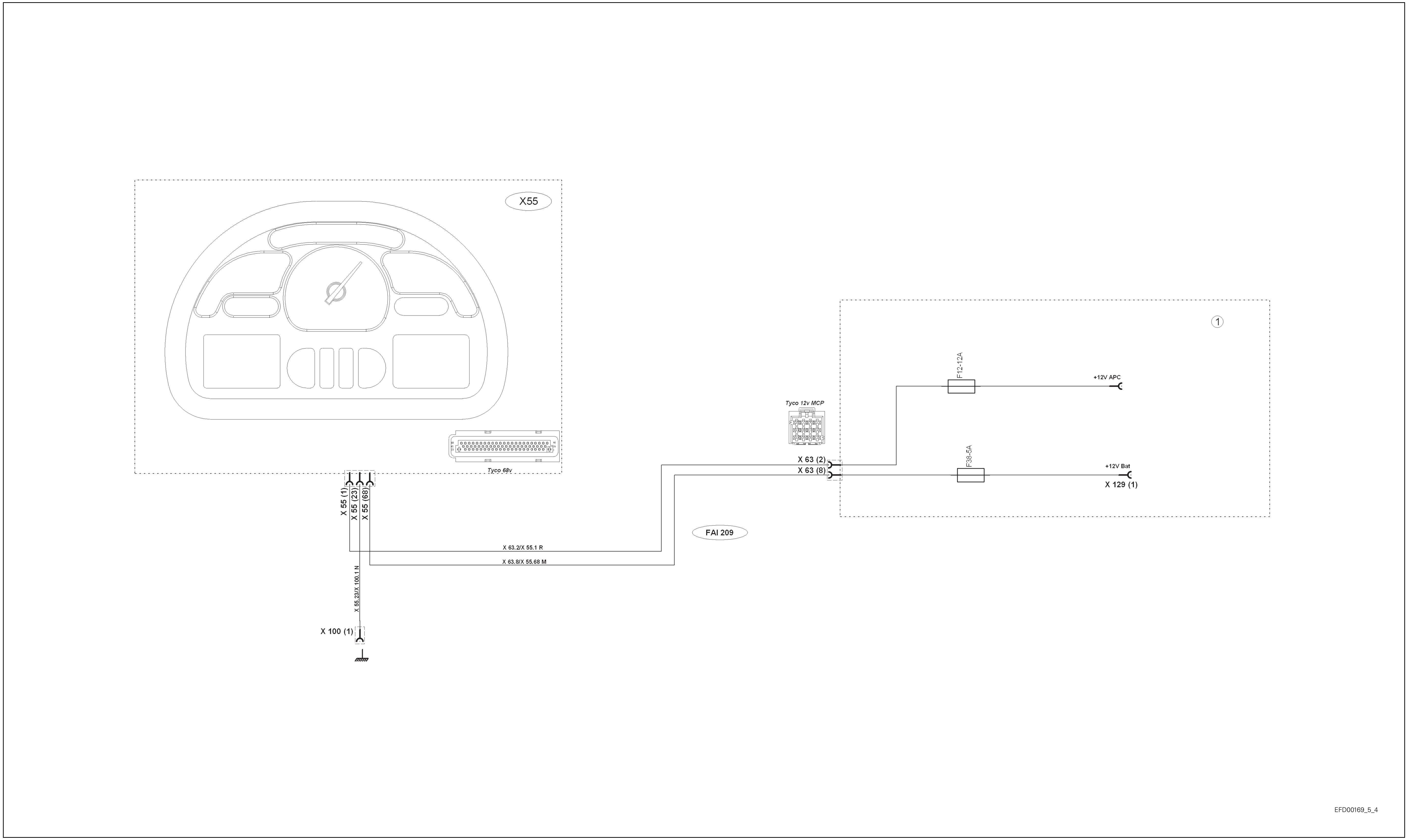

Fig. 5

A.7 Autotronic 5 armrest electrical power supply

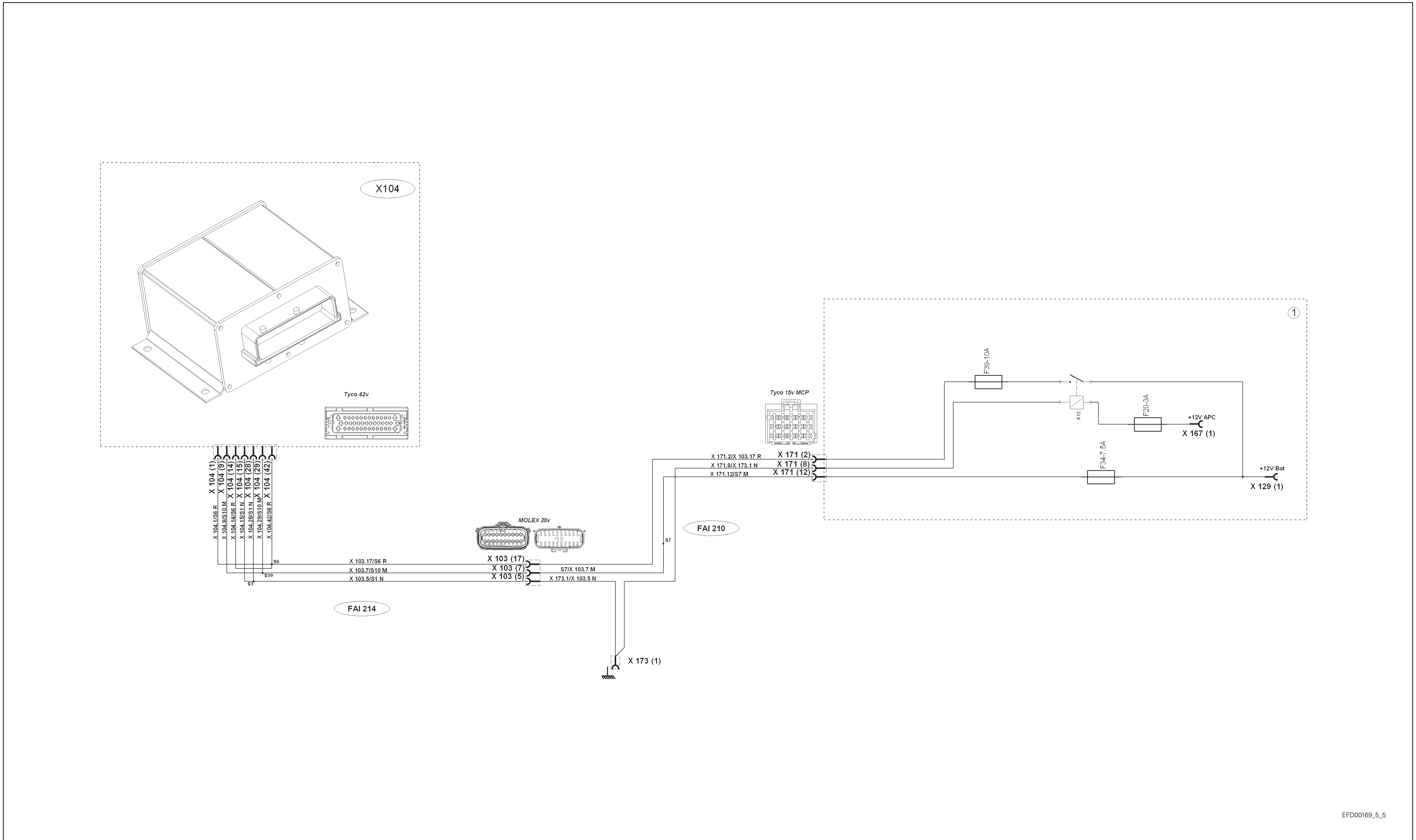

Fig. 6

A.8 Autotronic 5 active suspended cab electrical power supply

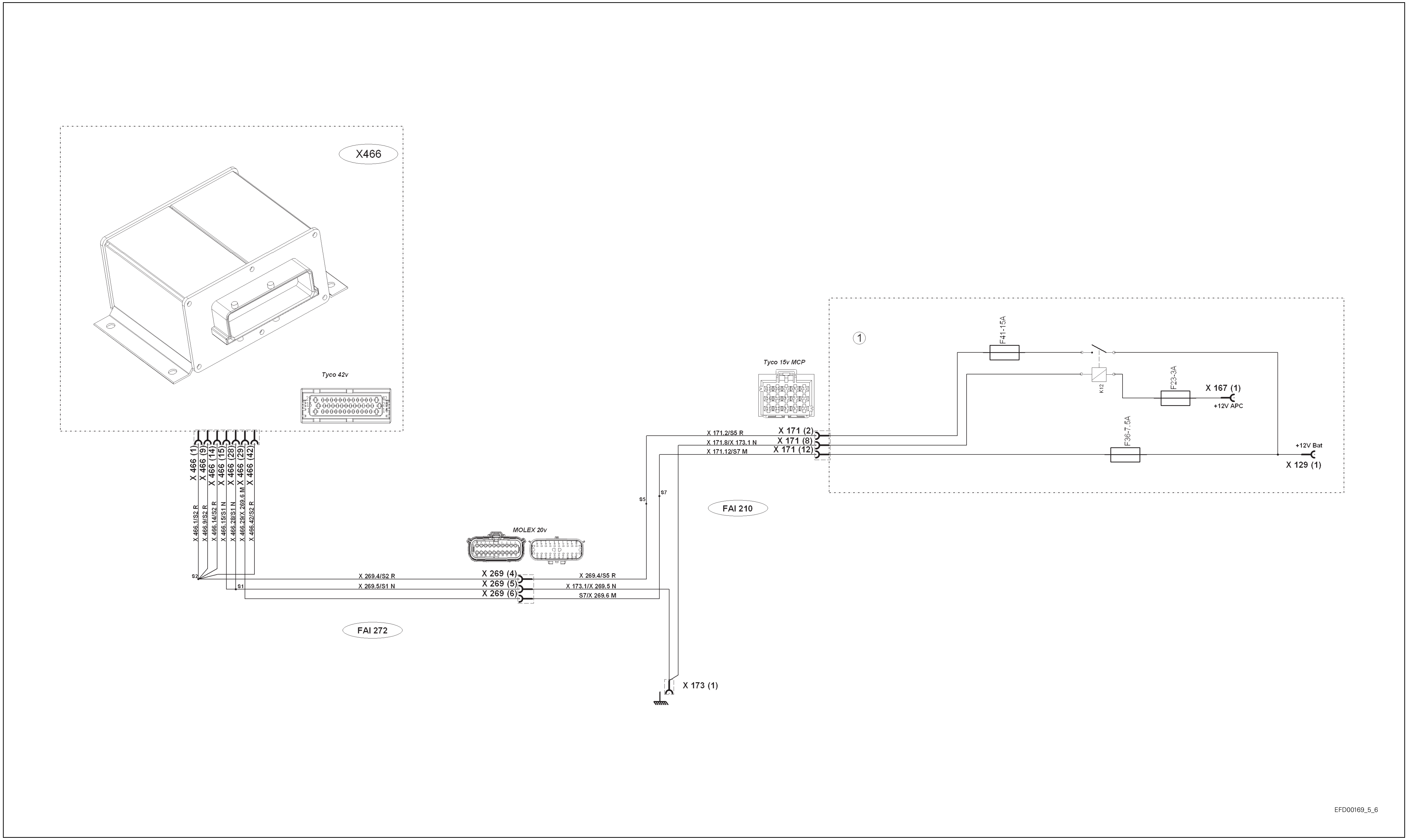

Fig. 7

A.9 Sisu EEM electronic unit electrical power supply

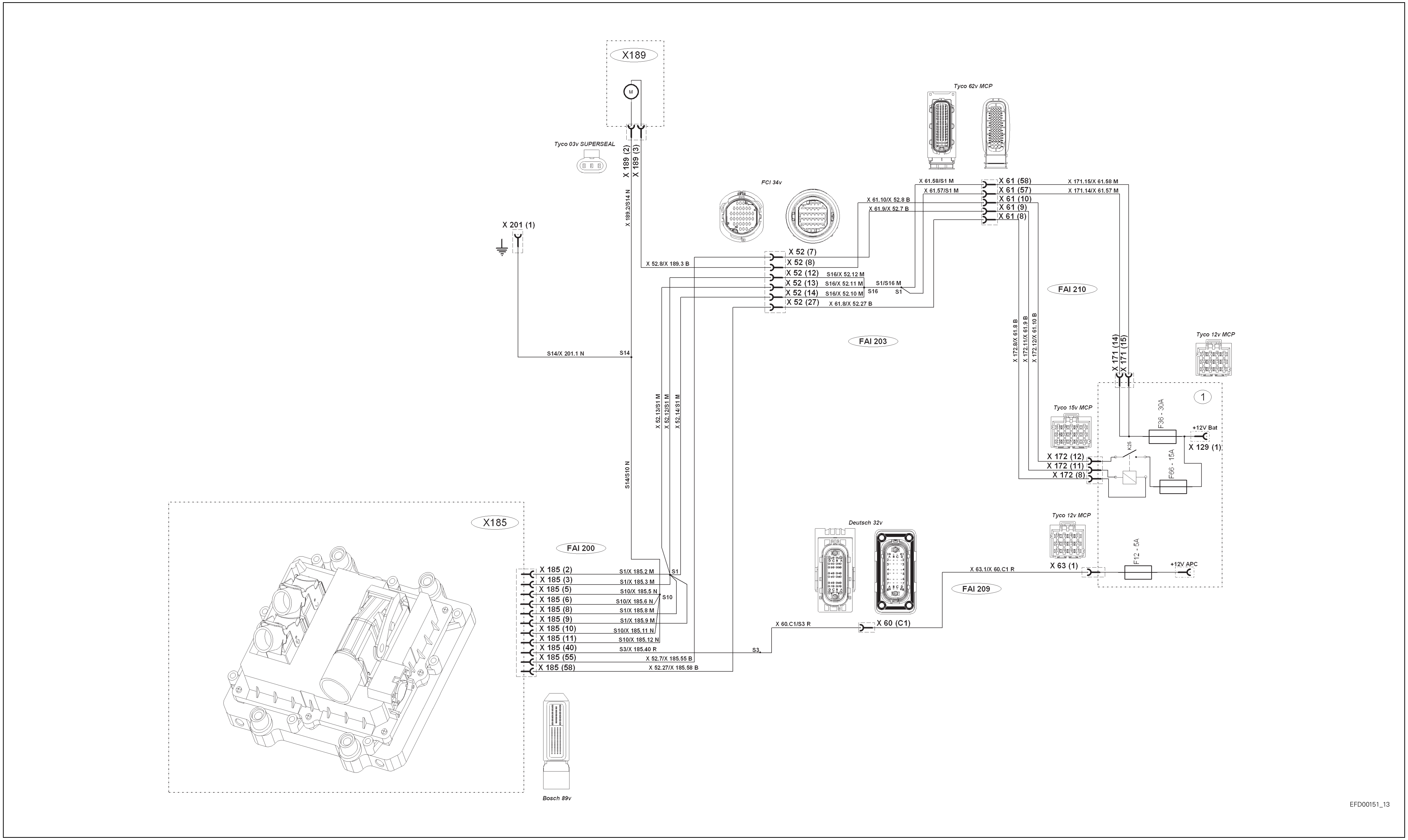

Fig. 8

A.10 Automatic air-conditioning unit electrical power supply

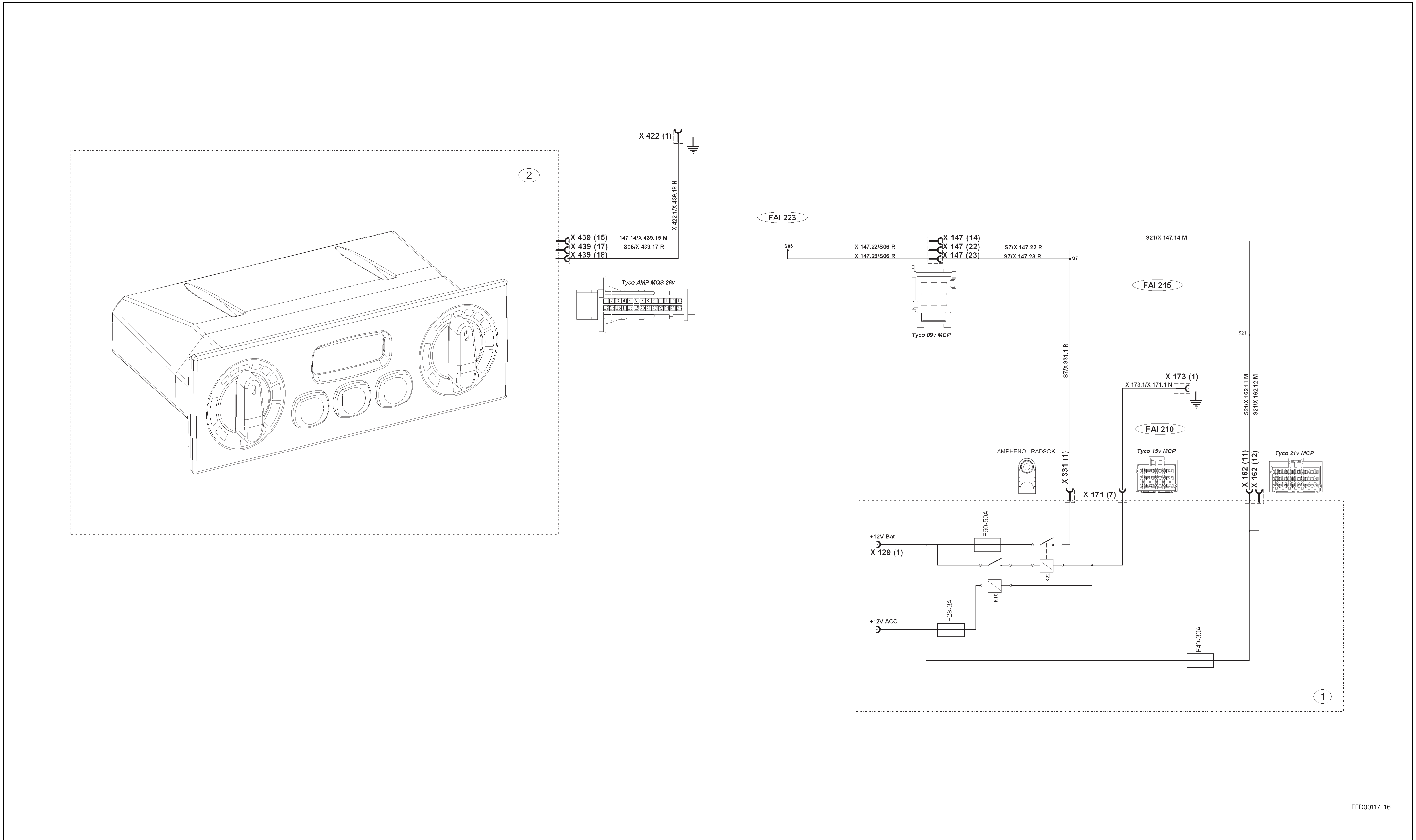

Fig. 9

A.11 Diagnostics connector electrical power supply

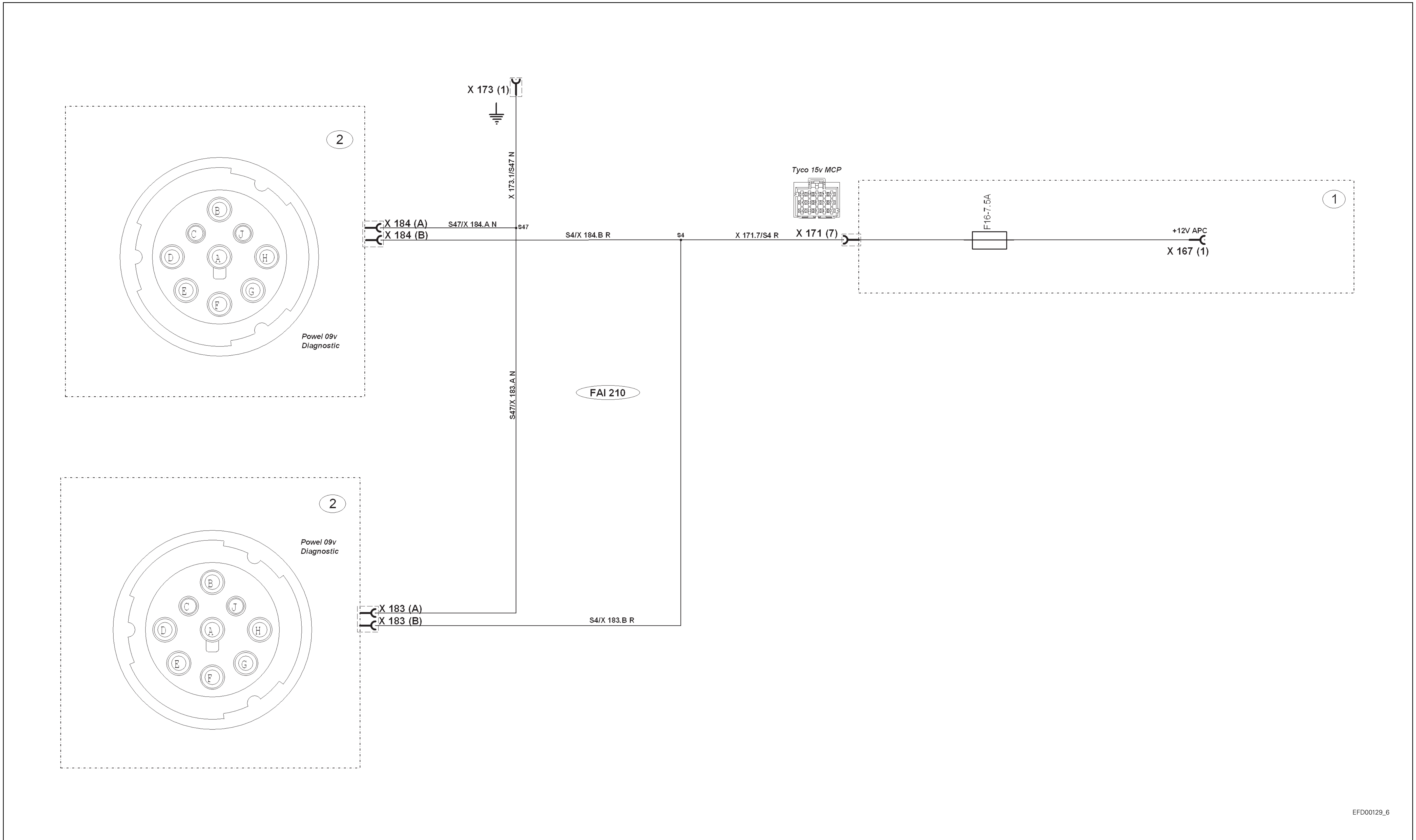

Fig. 10

A.12Tractor CAN network

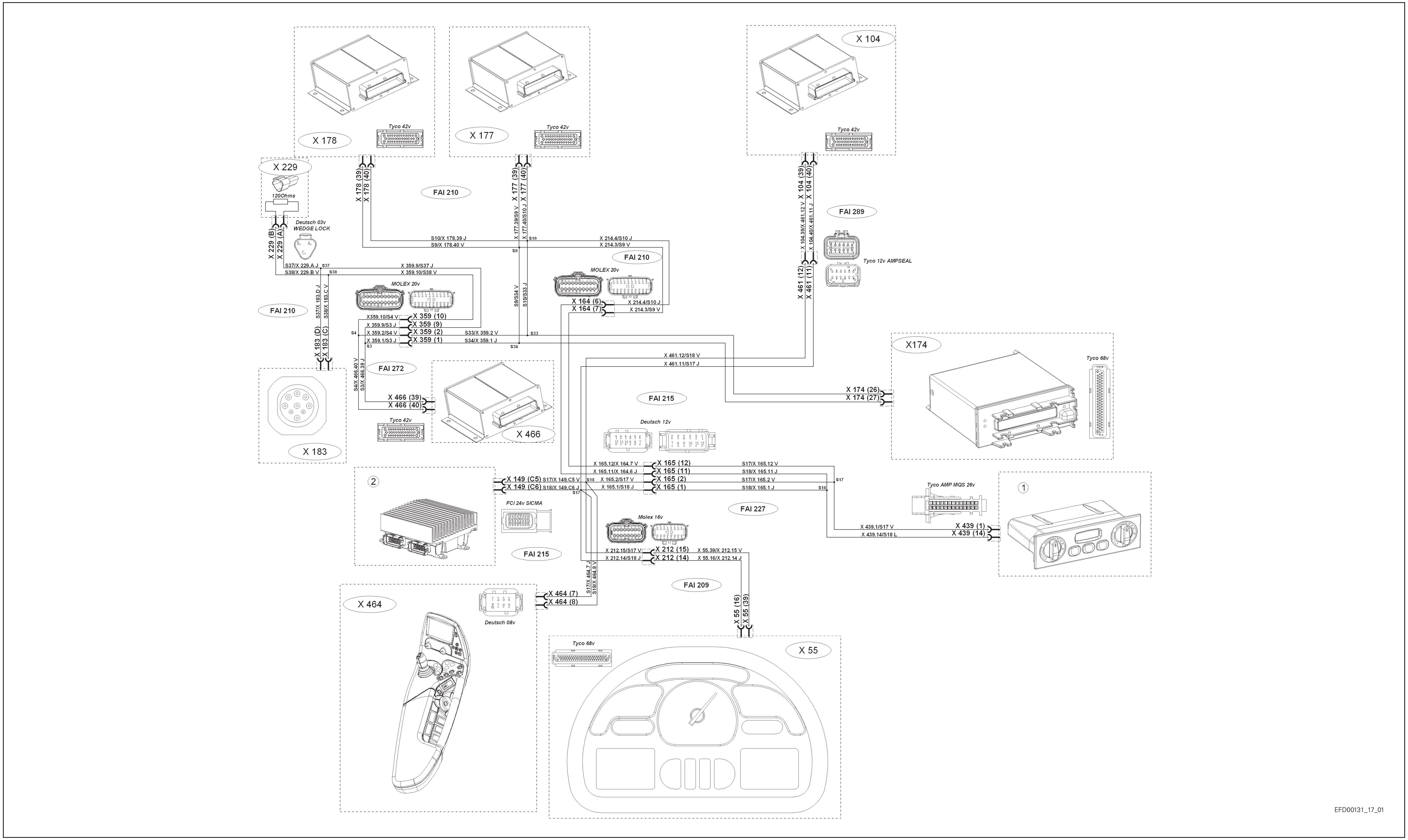

Fig. 11

A.13Engine CAN network

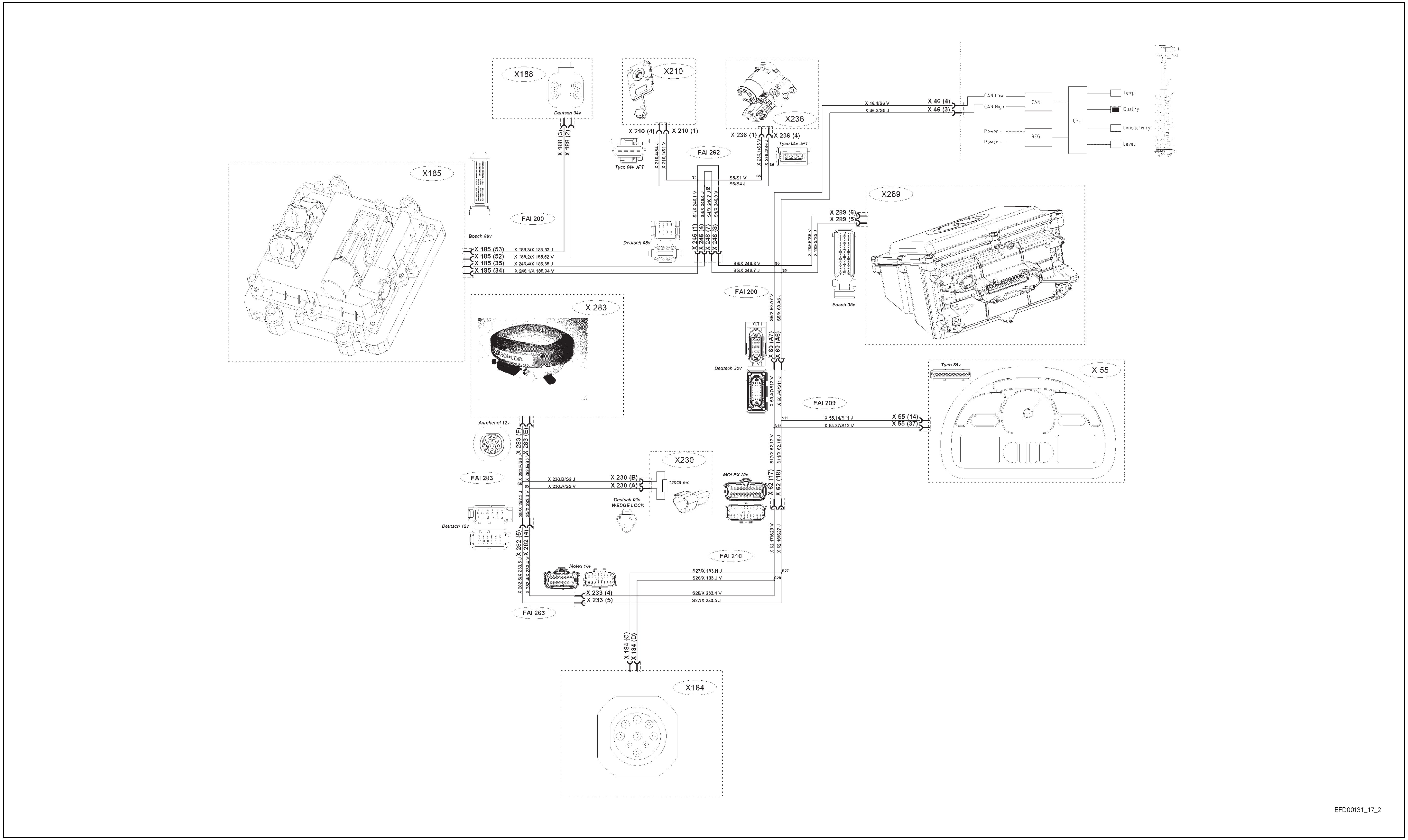

Fig. 12

A.14 Linkage CAN network

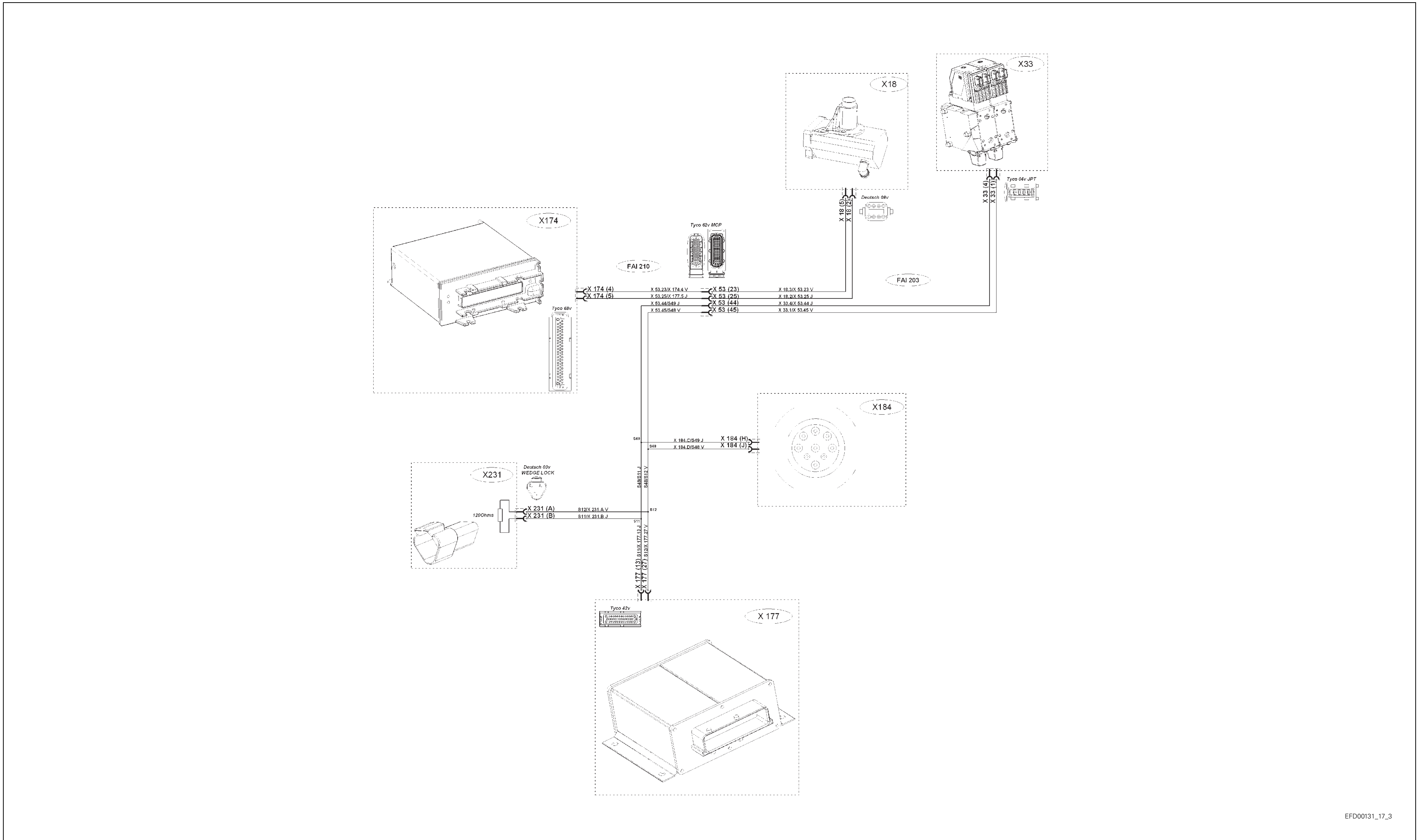

Fig. 13

A.15 Isobus CAN network

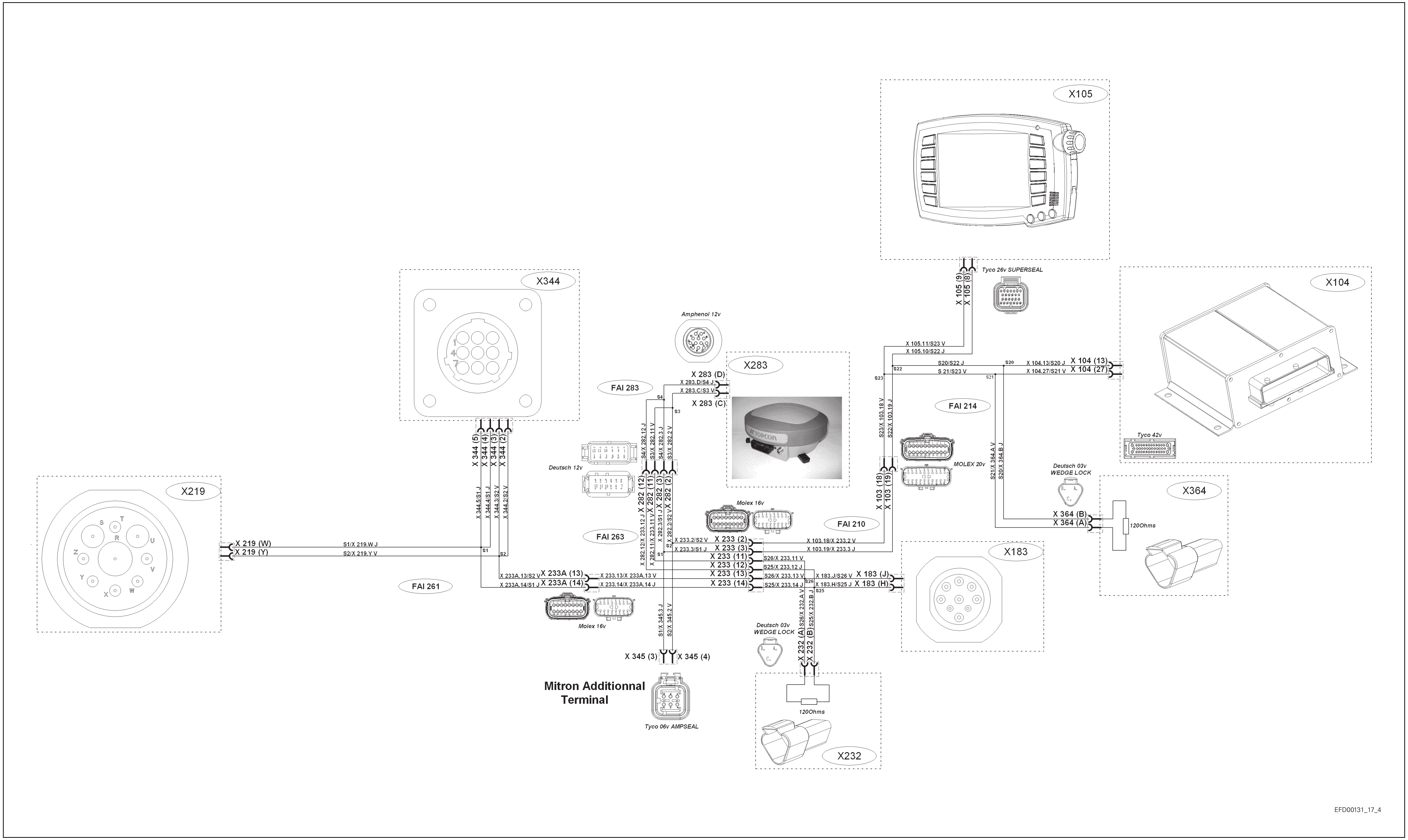

Fig. 14

A.16Batteries - load/start-up circuit

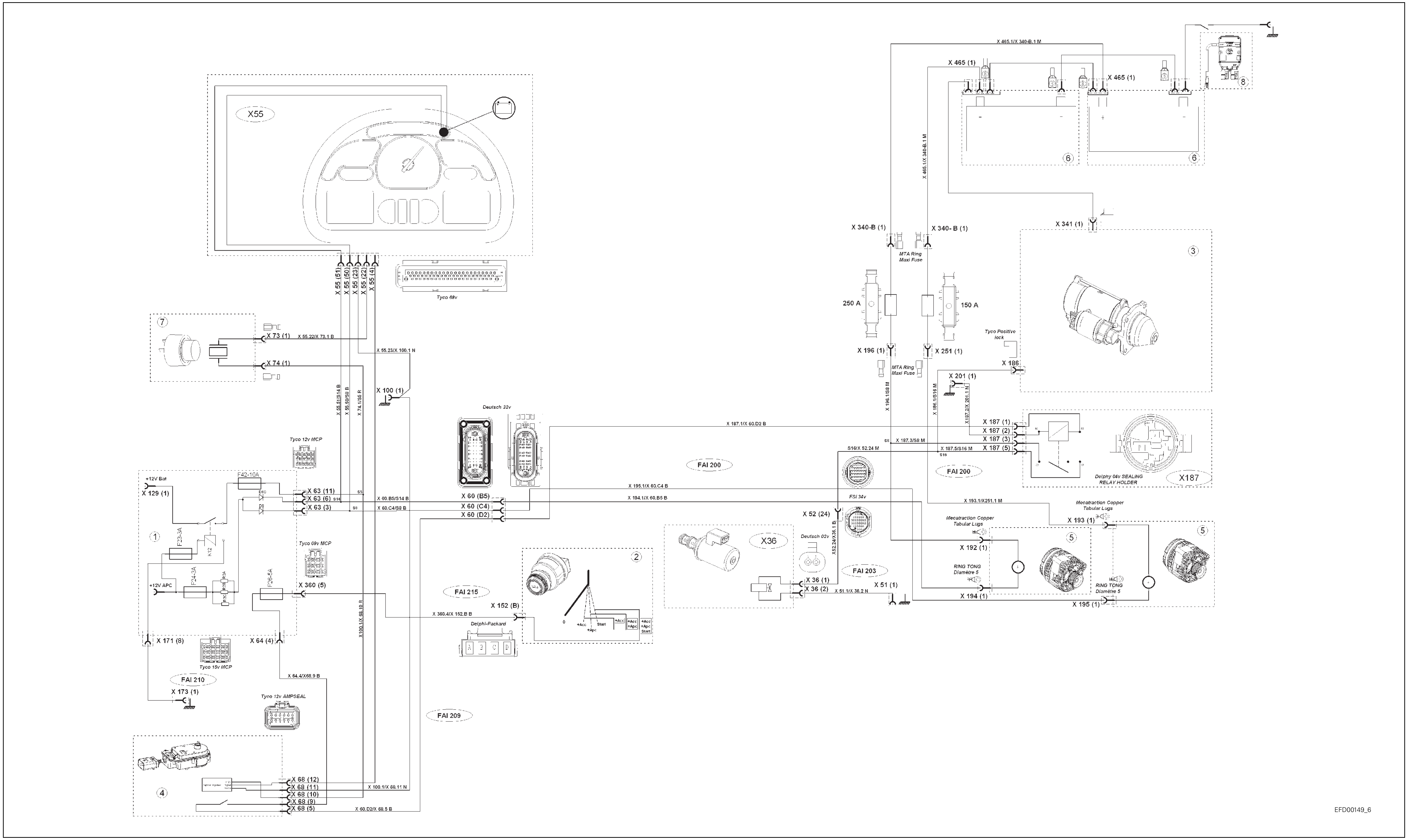

Fig. 15

A.17 Air filter vacuum sensor

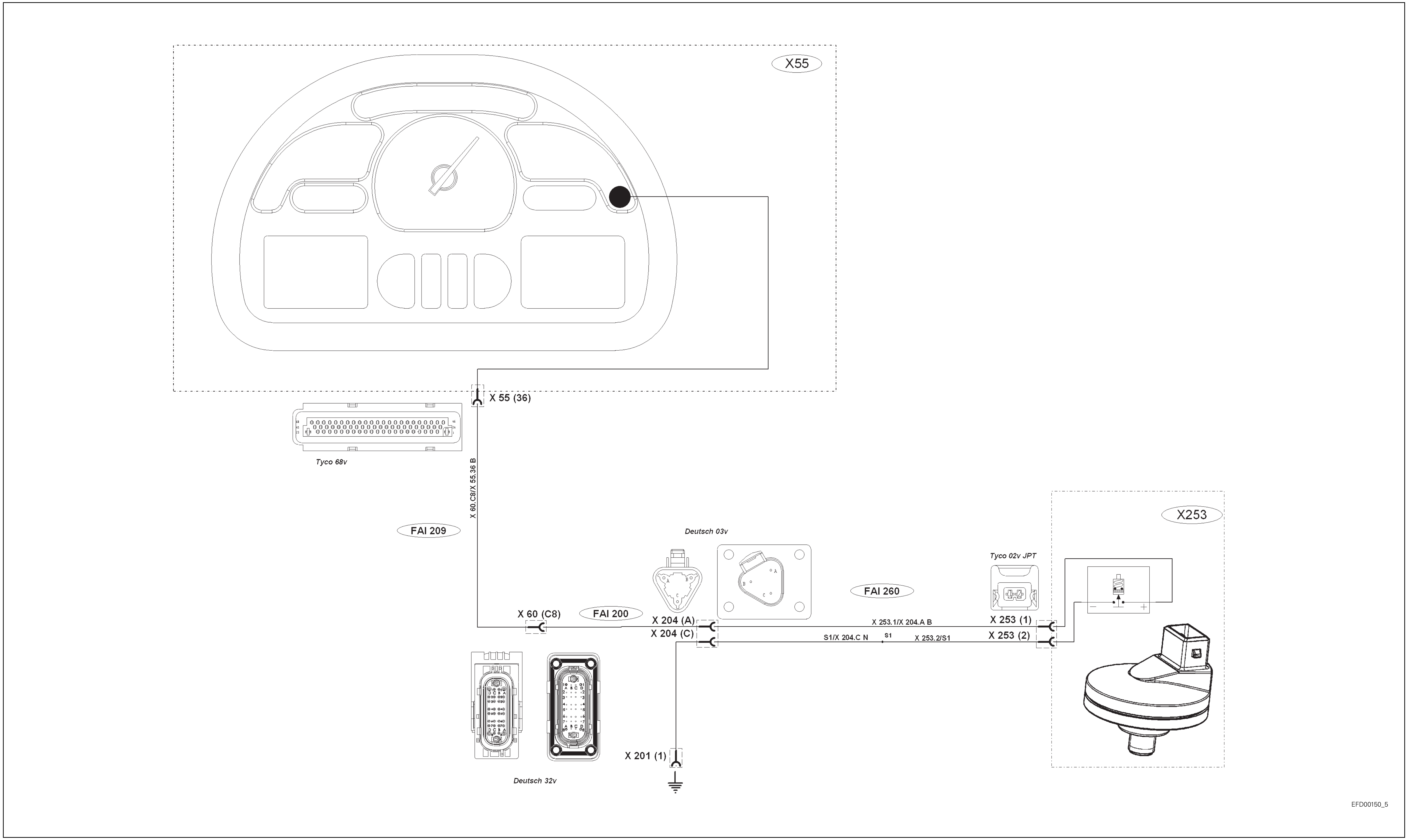

Fig. 16

A.18 Sisu engine electronic injection

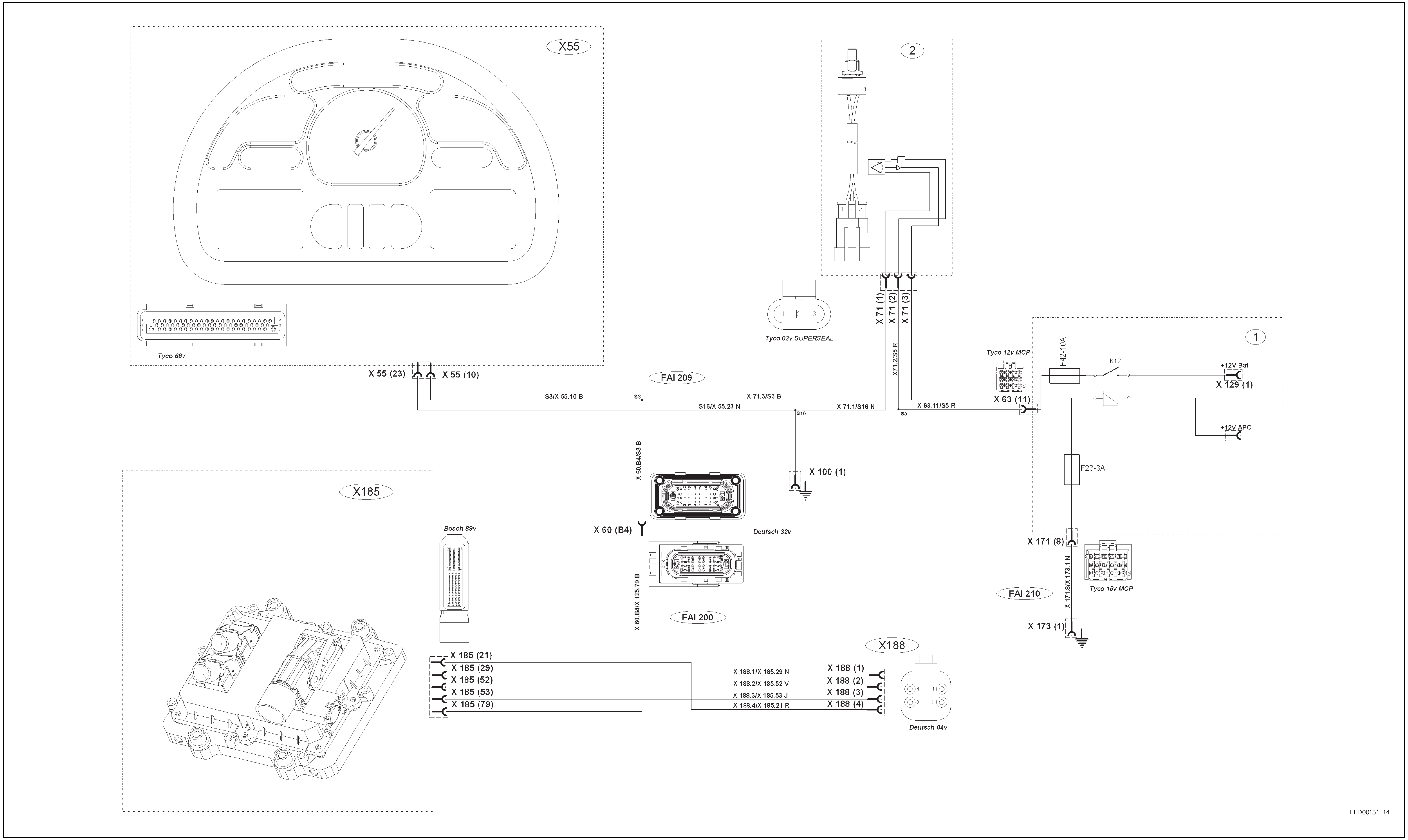

Fig. 17

A.19 Sisu engine preheating (Grid Heater)

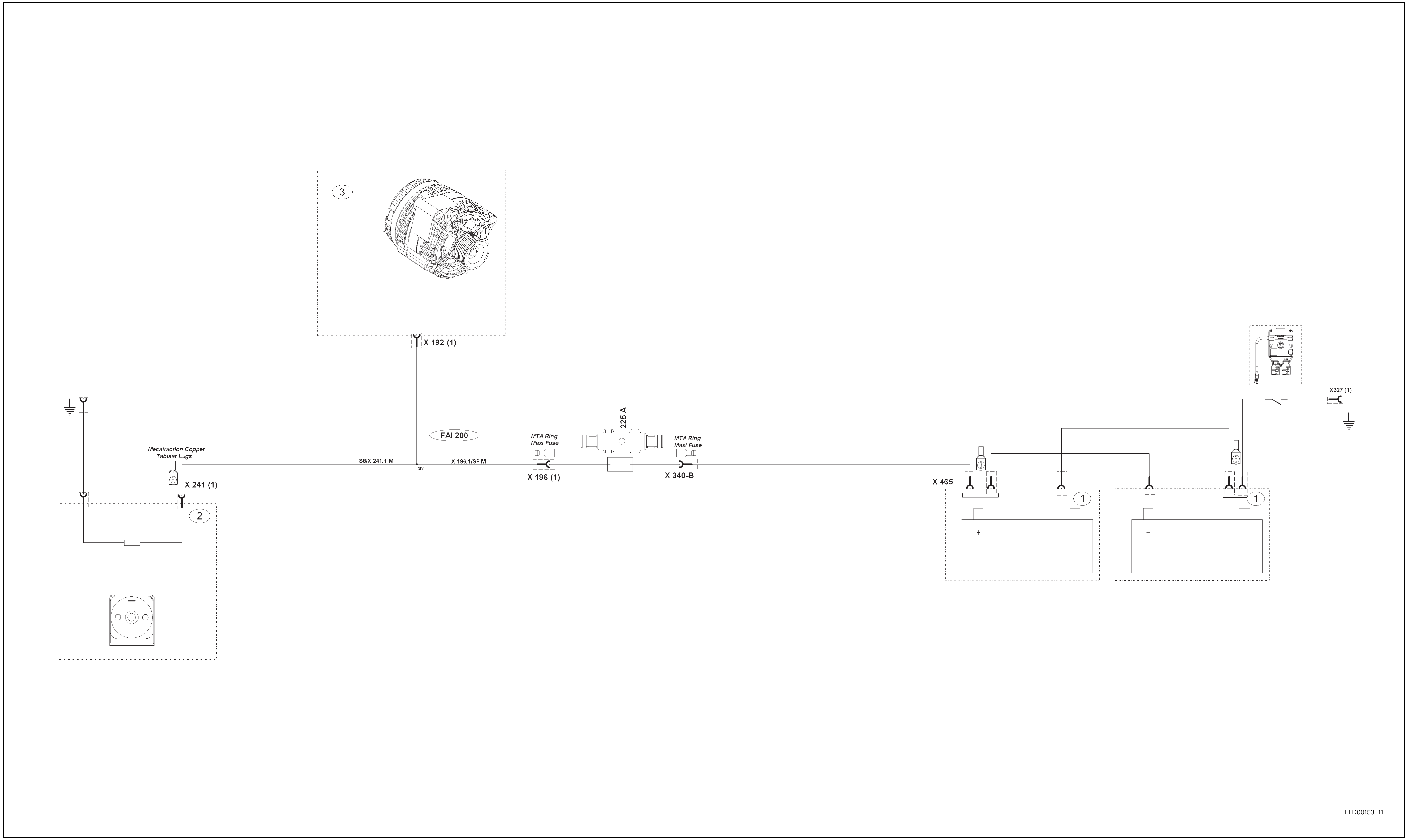

Fig. 18

A.20Fuel preheater

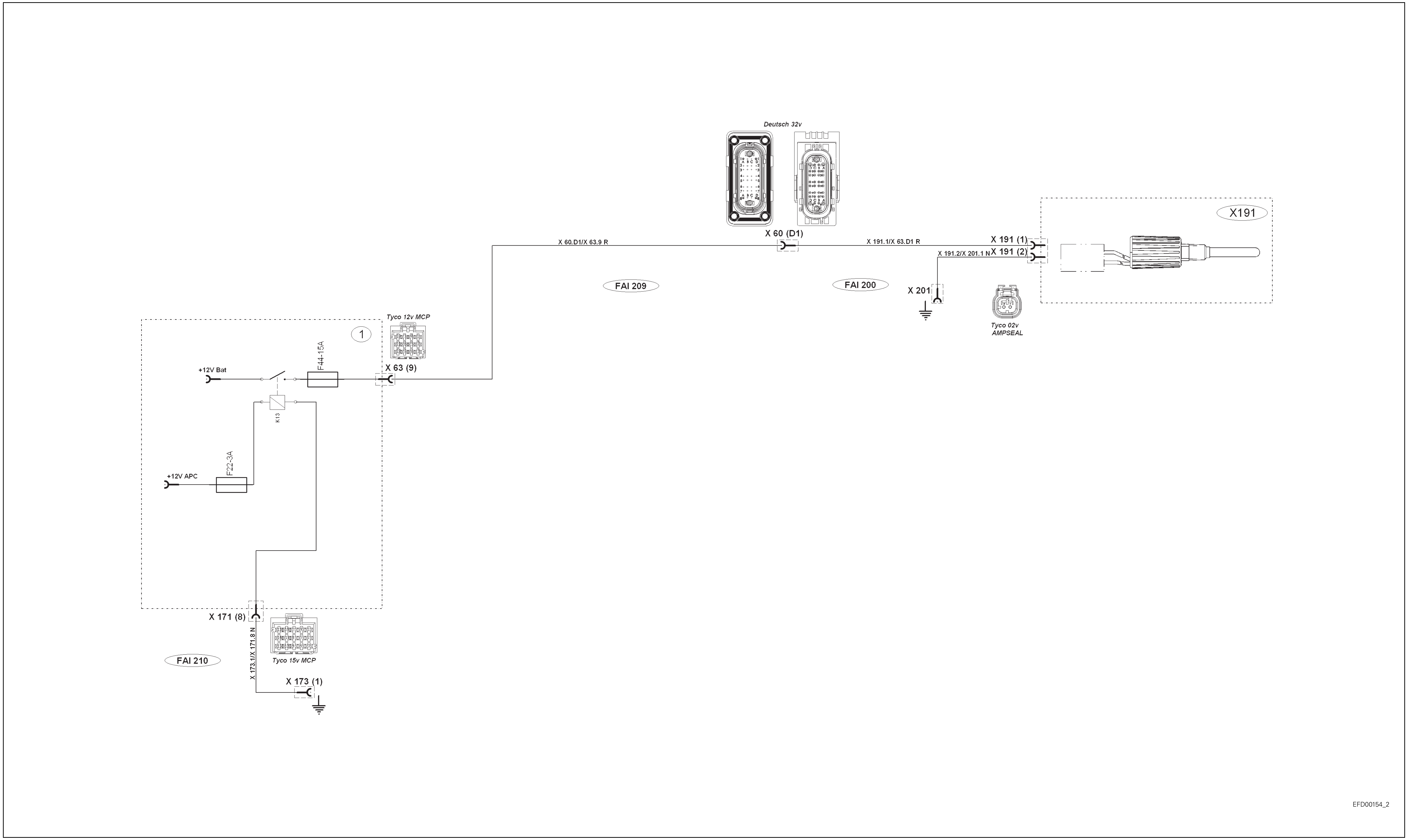

Fig. 19

A.21Vistronic fan

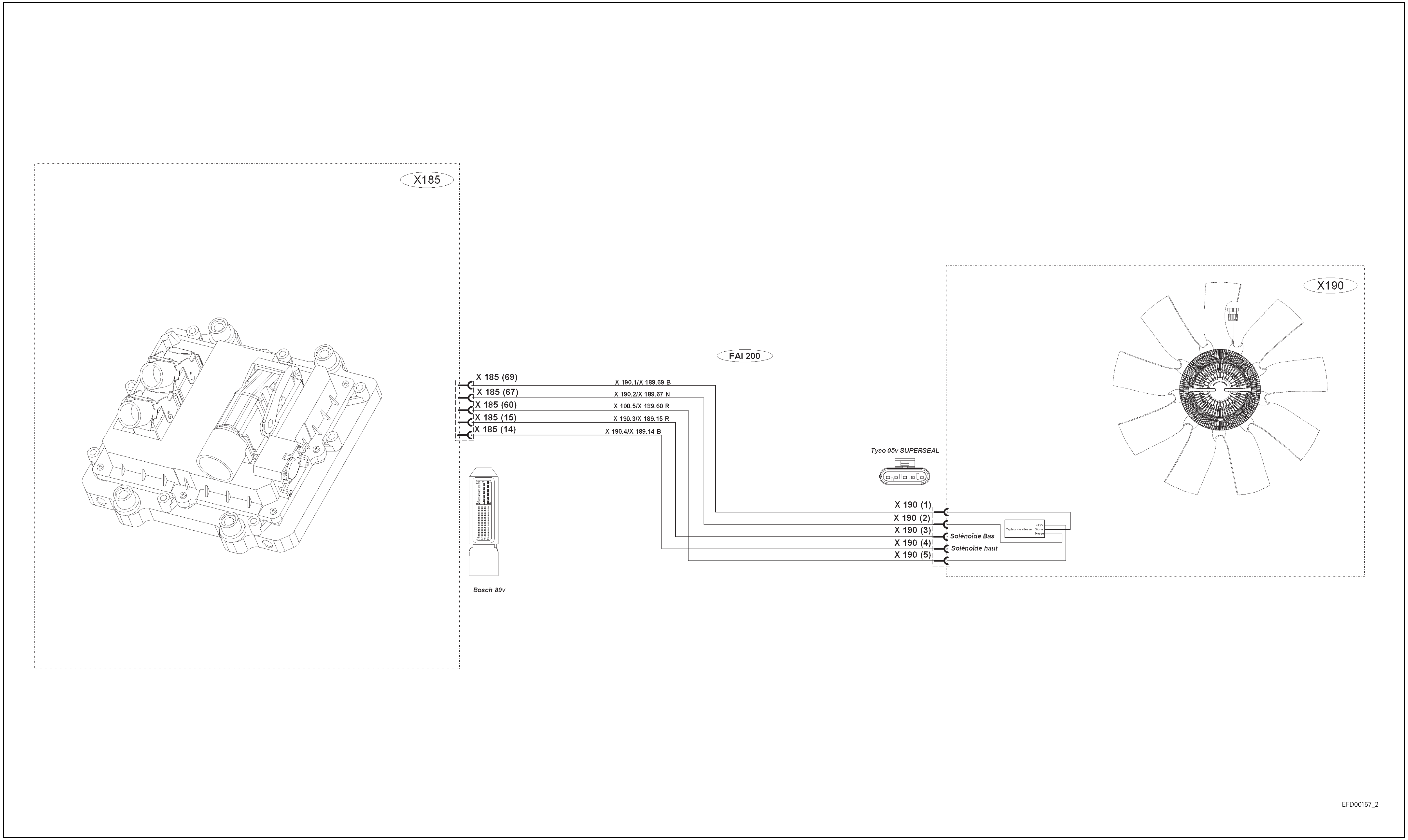

Fig. 20

A.22Sensor detecting water in the diesel fuel

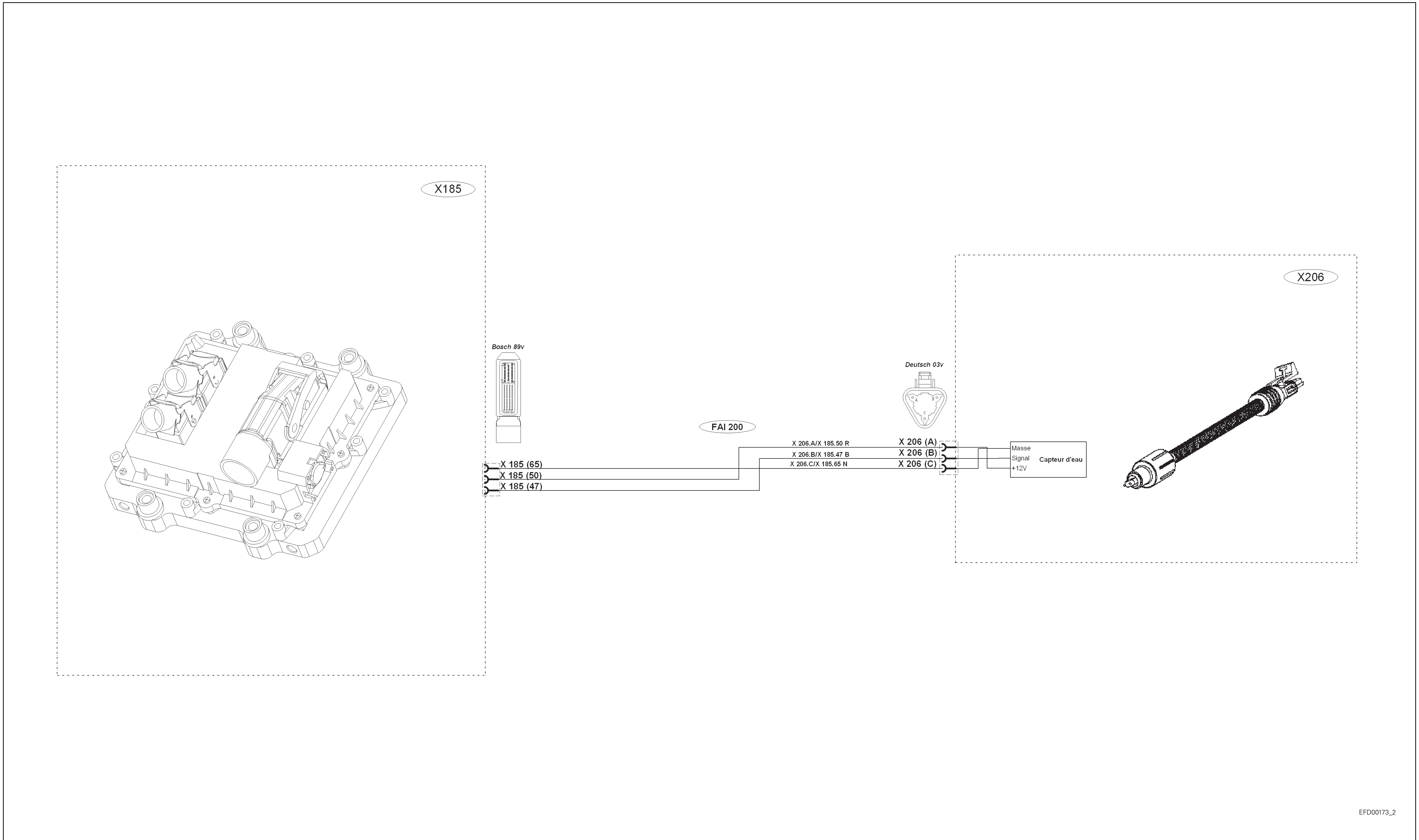

Fig. 21

A.23Diesel fuel gauge

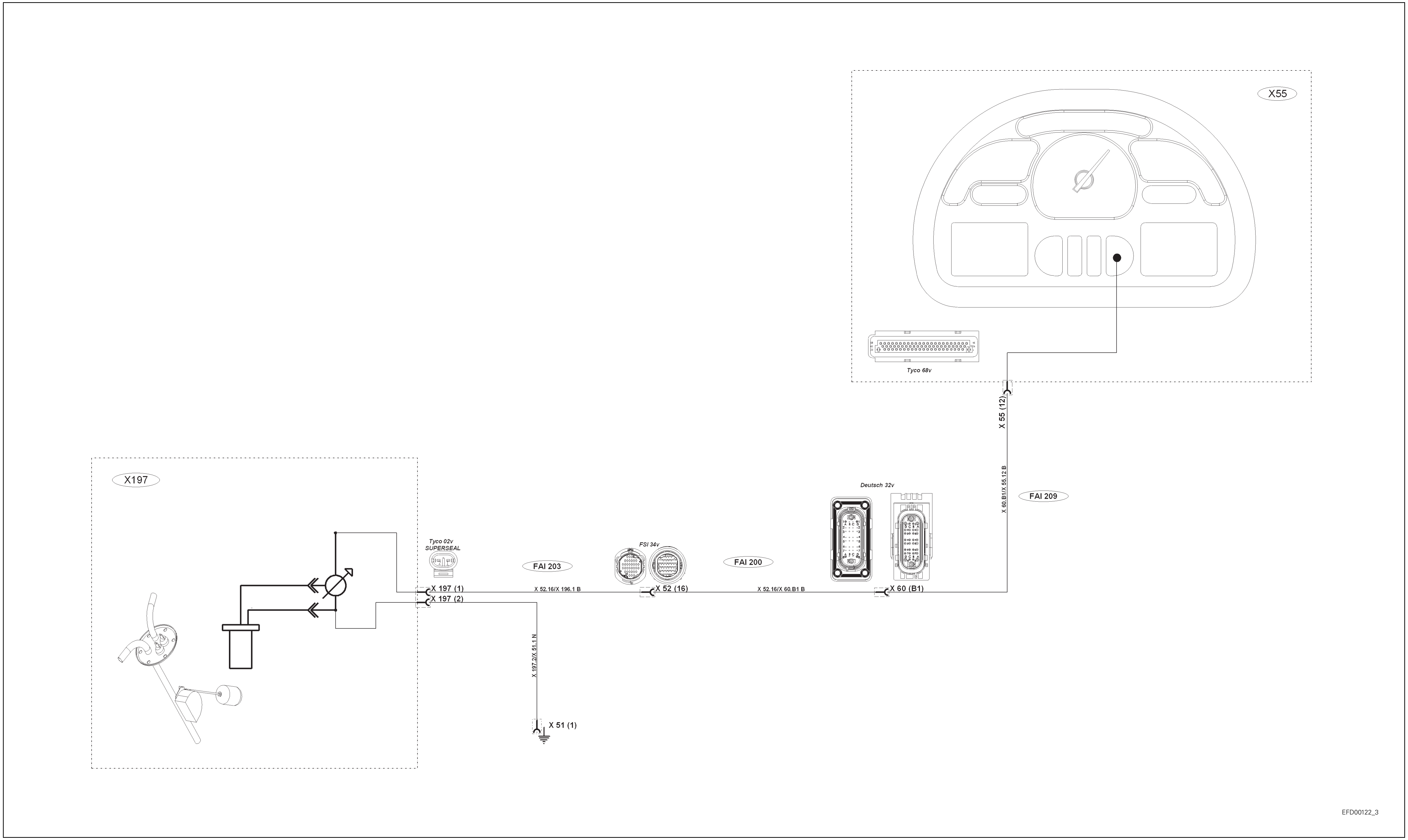

Fig. 22

3A13

Sisu Tier 3 engine - Layout of components

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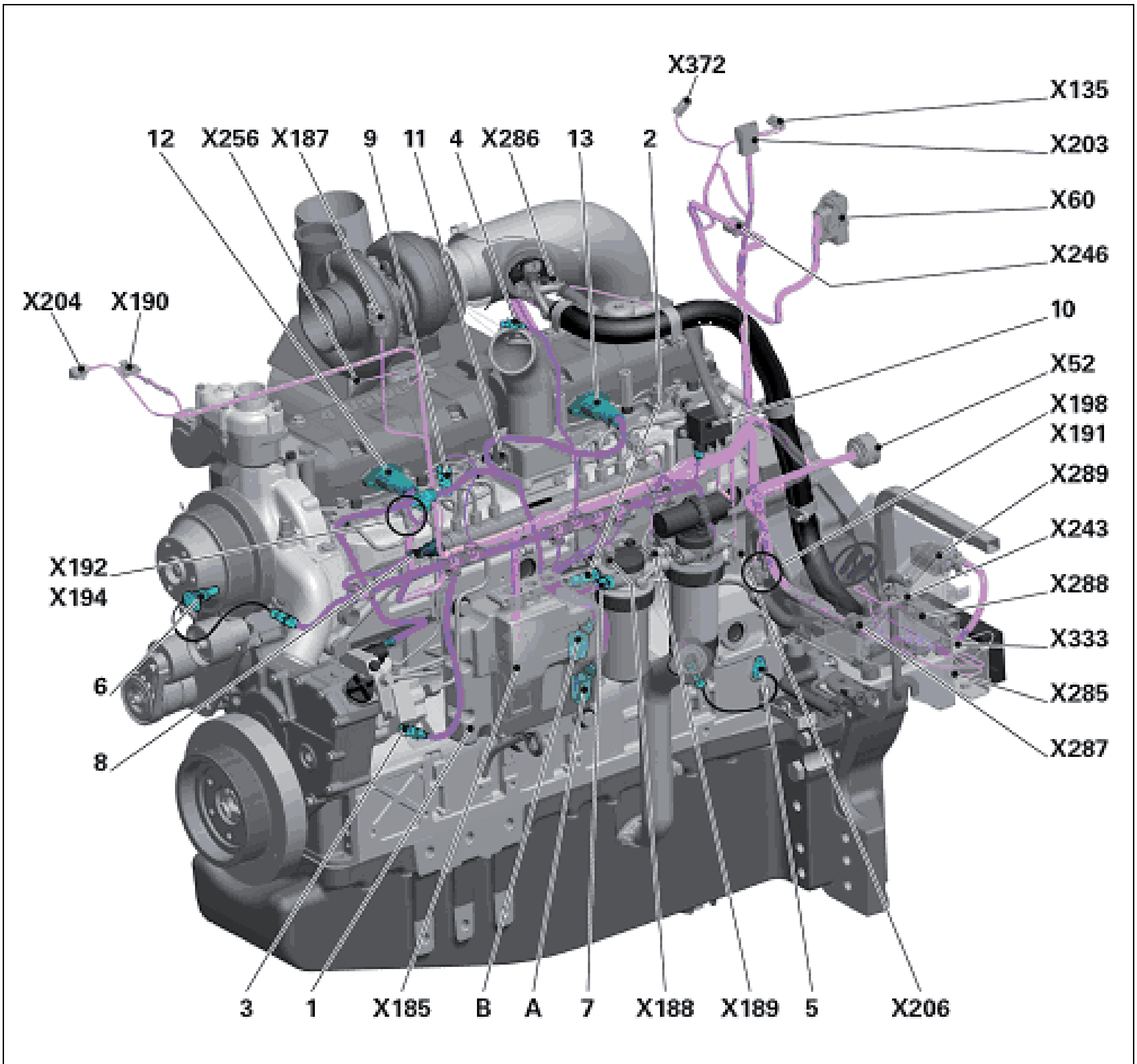
A. Engine



I010290

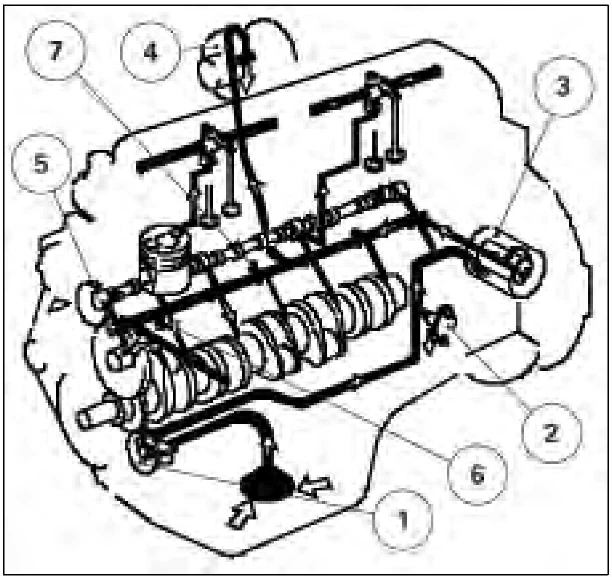
Fig. 1

(1)	EEM3 engine controller
(2)	Fuel temperature sensor
(3)	Engine oil pressure sensor
(4)	Inlet air pressure and temperature sensor
(5)	Primary speed sensor
(6)	Secondary speed sensor
(7)	Fuel pressure sensor
(8)	High-pressure sensor
(9)	Coolant temperature sensor
(10)	Preheater relay
(11)	Inlet air preheater
(12)	Connector for injectors 1/2/3
(13)	Connector for injectors 4/5/6
(A)	Engine harness junction for sensors/controller
(B)	Engine harness junction for injectors and pump/controller
(X52)	Engine harness/transmission harness junction
(X60)	Engine harness/instrument panel harness junction
(X135)	Braking pressure sensor

(X185) Sisu EEM unit
(X187) Engine start relay
(X188) Engine identification module (ID module)
(X189) Fuel lift pump
(X190) Vistronic fan
(X191) Diesel fuel preheater
(X192) B + alternator 1
(X194) D + alternator 1
(X198) Connector for pneumatic trailer brake
(X203) Engine harness/front headlights harness junction
(X204) Cooling unit harness/engine harness junction
(X206) Sensor detecting water in the diesel fuel
(X243) AdBlue/DEF reservoir (urea) level gauge and temperature sensor
(X246) Auto-Guide external harness/engine harness junction
(X256) Roof harness/hand rail harness junction
(X285) AdBlue/DEF (urea) metering valve
(X286) AdBlue/DEF (urea) injection valve
(X287) AdBlue/DEF (urea) reservoir preheating valve
(X288) 12/24 V converter for SCR system
(X289) SCR management module
(X333) Engine harness earth (chassis)
(X372) Variable steering switch (SpeedSteer)

B. Lubrication system

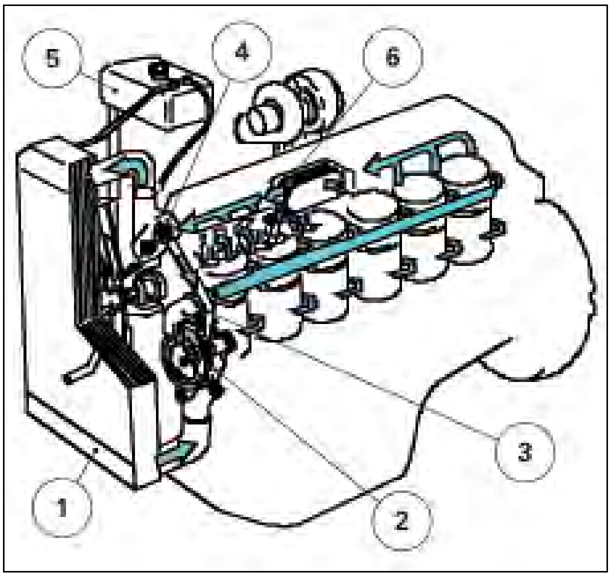
(1) Oil pump
(2) Oil pressure regulating valve
(3) Oil filter
(4) Turbocharger
(5) Main lubrication line
(6) Piston cooling nozzle
(7) Oil pressure sensor



I008075 Fig. 2

C. Cooling system

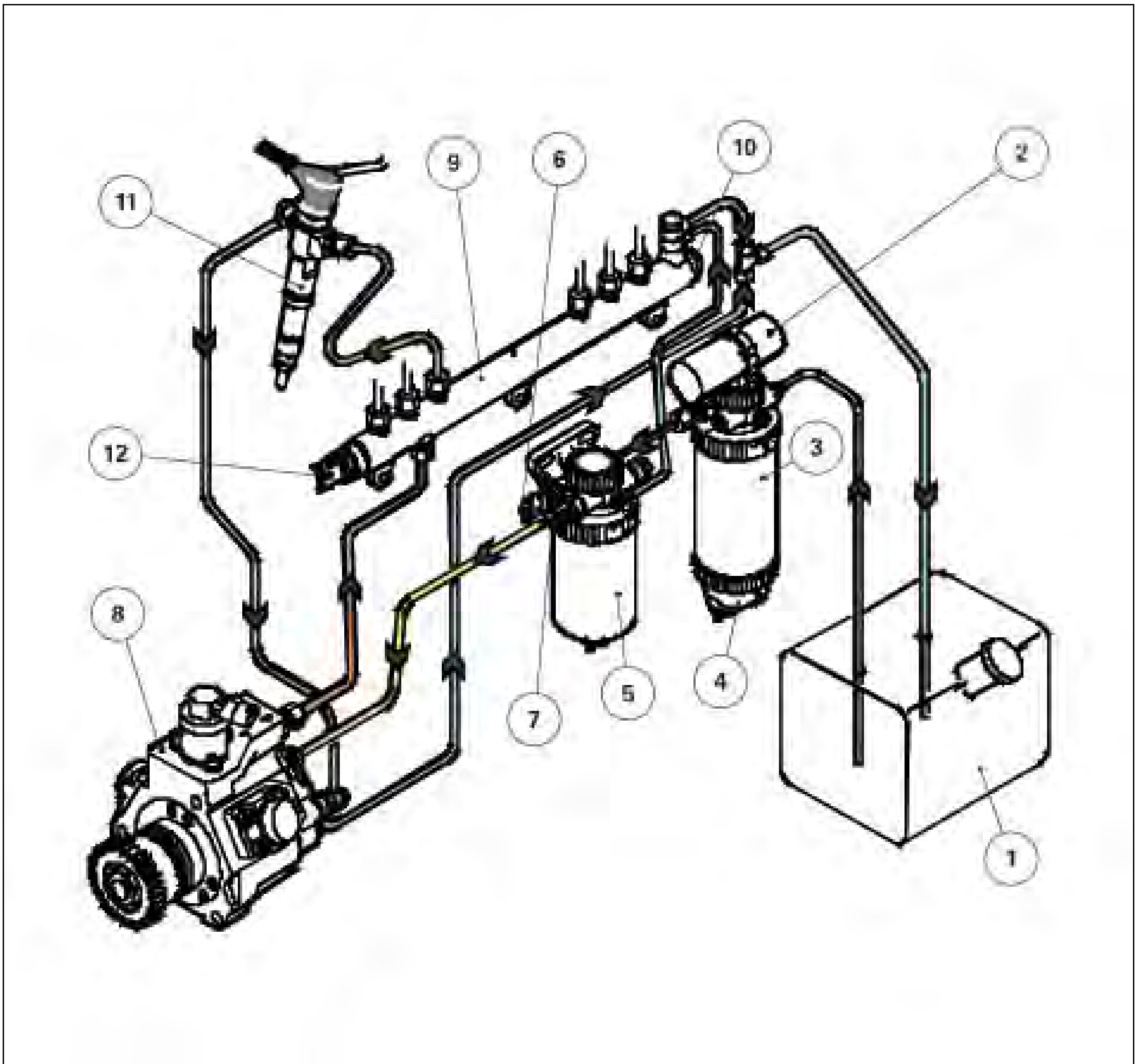
(1) Radiator
(2) Water pump
(3) Bypass pipe
(4) Thermostats
(5) Expansion tank
(6) Oil cooler



I008076

Fig. 3

D. Fuel system

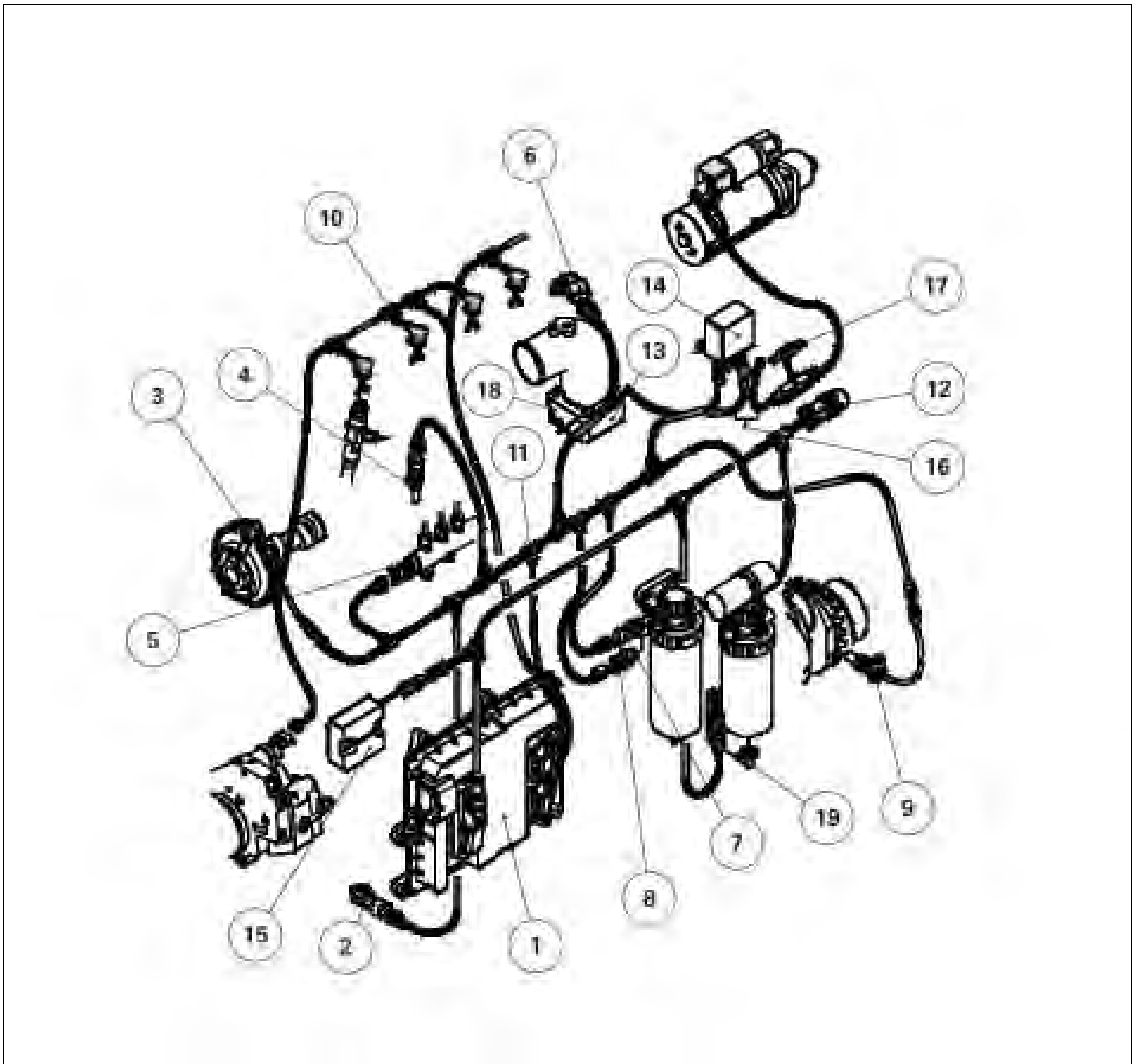


I008079

Fig. 4

(1)	Fuel tank
(2)	Fuel pump
(3)	Prefilter
(4)	Water separator
(5)	Fuel filter
(6)	Temperature sensor
(7)	Fuel supply pressure sensor
(8)	High-pressure pump
(9)	Rail
(10)	Overflow valve
(11)	Injector
(12)	Pressure sensor

E. Common Rail electronic system



I009391

Fig. 5

(1) Electronic control unit (ECU)
(2) Oil pressure sensor
(3) Speed sensor (camshaft)
(4) Coolant temperature sensor
(5) Rail pressure sensor
(6) Boost pressure sensor
(7) Fuel temperature sensor
(8) Fuel pressure sensor
(9) Speed sensor (crankshaft)
(10) Injector
(11) Sensor wiring
(12) Connection to tractor harness
(13) Grid Heater
(14) Grid Heater relay
(15) ID module
(16) Grid Heater harness

(17) In line fuse
(18) Chassis earth
(19) Water sensor (fuel)

3A14

Sisu Tier 3 engine - Tests and diagnostics

Table of contents

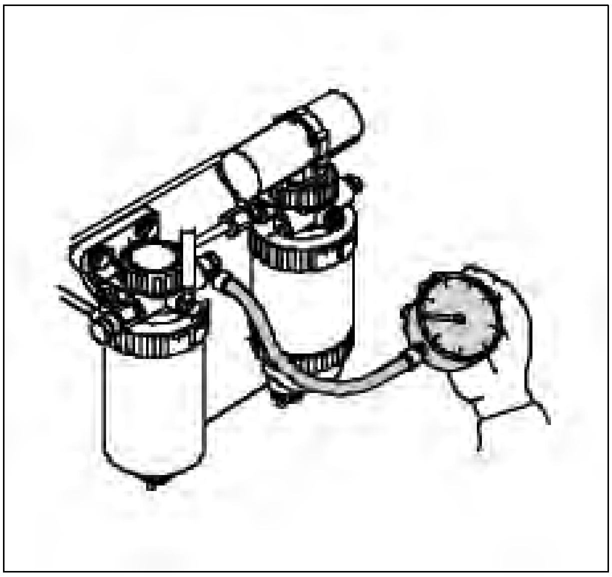
A. Tests

Measuring the fuel supply pressure

1. Clean the fuel prefilter and filter from the outside, in addition to the connected fuel pipes.
2. Disconnect the pressostat from the fuel filter and connect the pressure gauge instead (M14 x 1.5 thread).
3. Run the engine at idle speed for a short while and compare the values on the pressure gauge against the specified value (0,75 bar with a CP1H and CP 3.3 high-pressure pump).

If the pressure is lower than the specified value, this may be due to:
- blocked fuel filters
- a malfunctioning fuel pump
- blocked suction pipes or an air leak
- an empty fuel tank or unsuitable fuel (e.g. summer fuel in winter)

Note: *The flow rate of this pump is 273 l/h.*



I008082 Fig. 1

B. Measuring the engine oil pressure

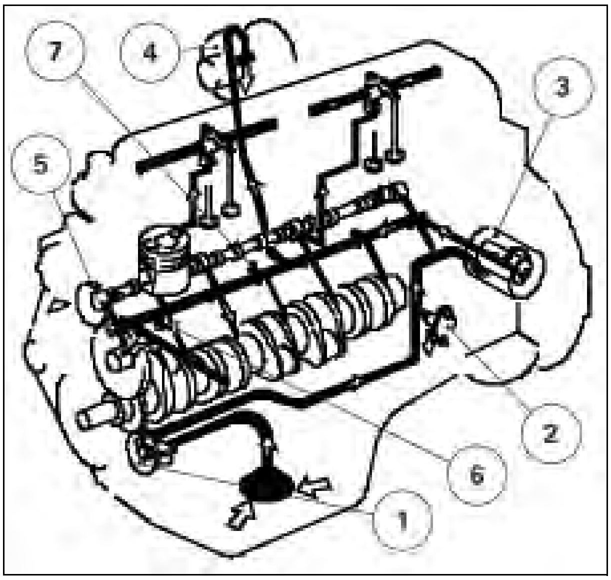
1. Remove the oil pressure sensor (7) and replace it with a pressure gauge of 0 bar to 10 bar.

2. Measure the lubrication pressure between minimum and maximum speed. This should be between 2,5 bar and 5 bar.

3. If the engine lubrication oil pressure is low or varies, check the oil level, check the regulating valve and then check the lubrication pump.

Pressure regulating valve

The oil pressure regulating valve is located underneath the oil filter on the right-hand side.



I008075 Fig. 2

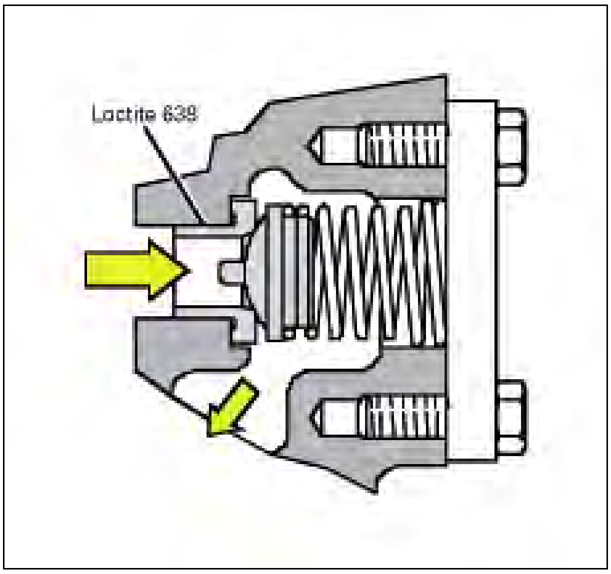
1. Remove the cover and spring with the valve disc.

2. Clean the parts and check that the mating faces are not damaged. Any damaged parts should be replaced. Scrape off any residue left on the seal.

3. Apply a locking product (type Loctite 638) to the outside of the valve seat.

4. Using a suitable pin punch, tap on the new valve seat to insert it into the cylinder block.

5. Insert the spring with the valve disc into the cylinder block and fit the cover with a new seal.



I008187 Fig. 3

Lubrication pump

1. Drain the engine oil and remove the oil sump (see chapter 2).

2. Remove the suction pipe and the pressurised pipe from the oil pump.

3. Take out the oil pump with the shims inserted between the pump and the cylinder block.

4. Remove the pump cover and seal. Remove the gearing from the lazy axle.

5. Clamp the pump gearing by its teeth in a vice with soft jaws and loosen the driving gear nut. Use a bronze drift to take out the gearing. Extract the gear from the drive shaft.

6. Clean the parts. Check for wear and check the general condition.
Replace any damaged parts and all the seals.

7. On 66, 74 and 84 type engines, the bearing points are fitted with separate bearing rings. If the rings need replacing, machine them to a dimension of 18,000 mm to 18,018 mm after assembly.

3A15

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3A16

Sisu Tier 3 engine - Adjustments, bleeding and calibrations

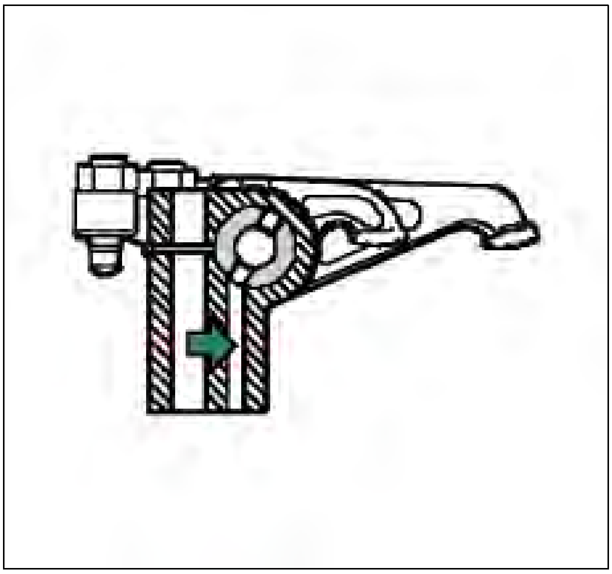
Table of contents

A. Adjustments

A.1 Adjusting valve clearances

Reconditioning the valve mechanism

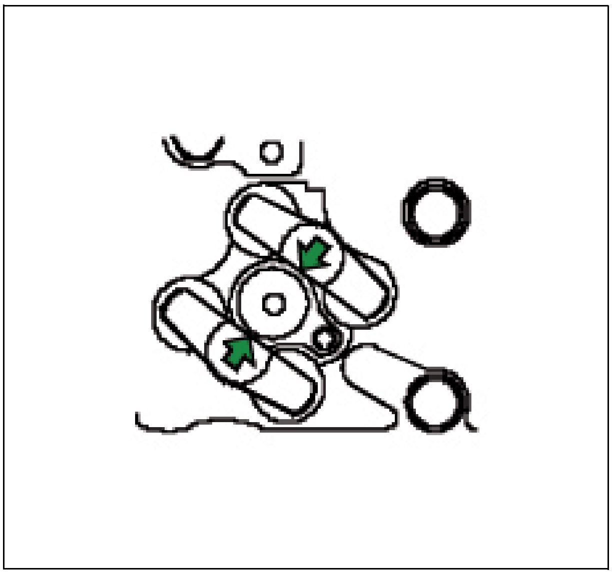
1. Fit the plug on the other end of the rocker arm pin. Grease the pin and fit the various parts in the correct order. Note the correct locations of the supports and the shaft. Install a plug on the other end and tighten the plugs to a torque of 25 Nm.



I008083

Fig. 1

2. Fit unions on the valves as indicated in the illustrations.



I008084

Fig. 2

3. Install the valve mechanism and ensure that the clearance at the right-hand end is between 0,05 mm and 0,20 mm for the levers at the end. Tighten the screws and nuts of the mechanism to a torque of 45 Nm.

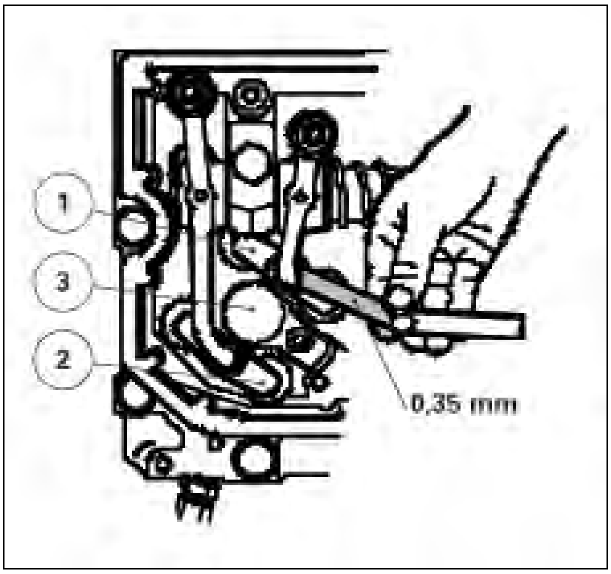
I008085 Fig. 3

Checking and adjusting valve clearances

Valve clearance, which can be adjusted when the engine is either hot or cold, is 0,35 mm for both inlet and exhaust valves. It is adjusted when the corresponding piston is at TDC in the compression stroke. The valves of different cylinders are adjusted in the same sequence as the order of injection.

Settings

(1) Inlet valves
(2) Exhaust valves
(3) Injector



I008086 Fig. 4

1. Loosen the locknut on the adjustment screw.

2. Check the clearance with a depth gauge and adjust by turning the adjustment screw.

3. Tighten the locknut and check the clearance again.

44 and 49 type engines

1. Turn the crankshaft in the direction of operation until the valves of the 4th cylinder are rocking (exhaust closed, inlet open). Check the valve clearance of the 1st cylinder.

2. Turn the crankshaft one half-turn in the direction of operation to rock the valves of the 3th cylinder. Check the valves of the 2th cylinder.

3. Continue in this manner following the order of injection:

Firing order	1 - 2 - 4 - 3
Rocks the valves in cylinder nos.	4 - 3 - 1 - 2

66, 74 and 84 type engines

1. Turn the crankshaft in the direction of operation until the valves of the 6th cylinder are rocking (exhaust closed, inlet open). Check the valve clearance of the 1st cylinder.

2. Turn the crankshaft one third-turn in the direction of operation to rock the valves of the 2th cylinder. Check the valves of the 5th cylinder.

3. Continue in this manner following the order of injection:

Firing order	1 - 5 - 3 - 6 - 2 - 4
Rocks the valves in cylinder nos.	6 - 2 - 4 - 1 - 5 - 3

A.2 Throttle pedal potentiometer

The calibration of the throttle pedal potentiometer must be carried out each time one of the following elements is replaced or modified:
- throttle potentiometer
- instrument panel.

Preliminary steps

4. Switch on the ignition, with ParkLock engaged.

5. The power take-off must be disengaged.

Calibration

The calibration is carried out in two successive steps so as to determine the minimum and maximum engine speeds in relation to the pedal position.

Minimum speed

6. Pedal fully released, minimum engine speed.

7. Press and hold down the differential lock switch for 5 seconds.

8. An alarm sounds. This indicates the end of the first calibration phase (pedal fully released).
Release the differential switch.

Maximum speed

9. Pedal fully depressed, maximum engine speed.

10. Press and hold down the differential lock switch for 5 seconds.

11. An alarm sounds. This indicates the end of the second calibration phase (pedal fully depressed).
Release the differential switch.

B. Fuel bleed system

Note: *Do not open up the high-pressure pipe connectors on the fuel system when the engine is running. Wait at least 30 seconds after the engine is switched off. If the jet of high-pressure fuel should come into contact with your skin, fuel can penetrate the skin and cause serious injuries. Seek medical advice immediately.*

Citius series engines have an automatic fuel bleed system. A separate bleed is not necessary when replacing the fuel filters or if there is insufficient fuel. It is sufficient to switch on the current and allow the electric fuel pump to operate for 30 seconds before starting the engine. Run the engine for approximately 10 seconds. If the engine will not start, pump and start it alternately until it does start.

3A17

Sisu Tier 3 engine - Disassembly and reassembly

TABLE OF CONTENTS

A. Cylinder block

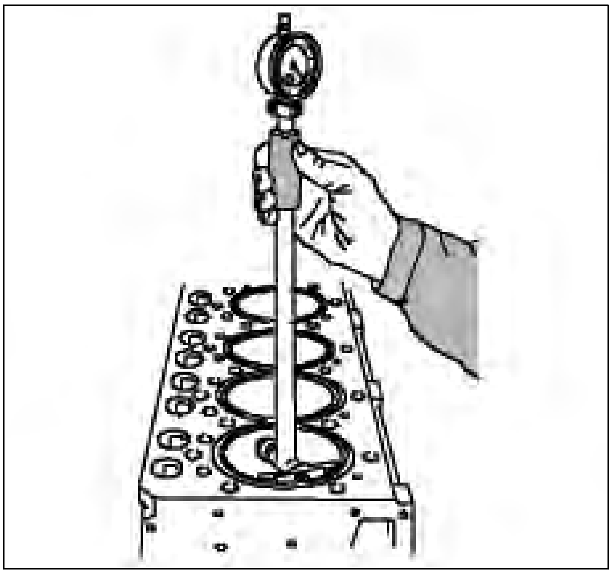
Measuring the wear on cylinder liners

1. Set the dial gauge to zero with a micrometer, using a new cylinder liner to provide the initial dimension of the bore.

2. Carefully clean the internal surface of the cylinder liner before carrying out the measurement.

3. Measure the cross section at the top end of the liner, then the bottom end, and lastly in the middle.

4. Compare the maximum wear and out-of-round readings against the nominal values.



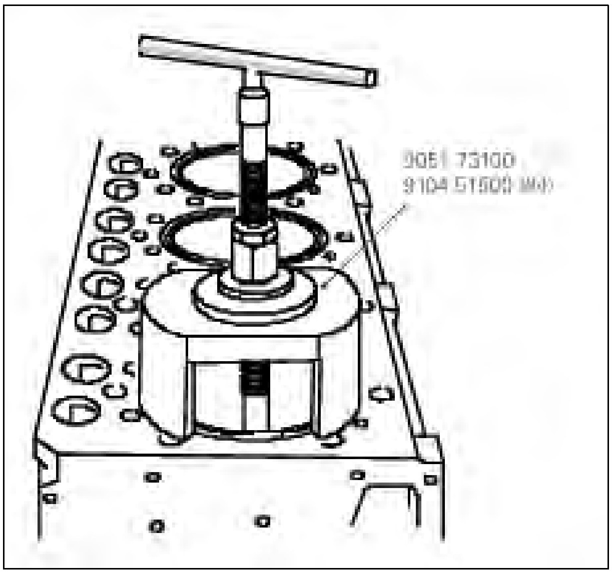
I008096

Fig. 1

Removing the cylinder liners

1. If the cylinder liners are to be reused, mark them in order to reassemble them on the same cylinders later.

2. Remove the cylinder liners using extractor 9051 73100 or 9104 51500 (84 type engines).



I008097

Fig. 2

Checking the cylinder block

1. Clean the cylinder block and all oil channels.

2. Check the cooling channels, and clean out any carbon and other deposits to ensure the engine is cooled efficiently.

3. Check the tightness of the cup plugs and threaded plugs of the cylinder block, and check its general condition and mating faces.

4. Measure the wear to the camshaft bearing points (compare against the nominal values).

Note: *If the top part of the cylinder block needs to be machined, the pistons must be shortened accordingly. Note the spacing of the valve discs on the top part of the pistons.*

Replacing the camshaft ring

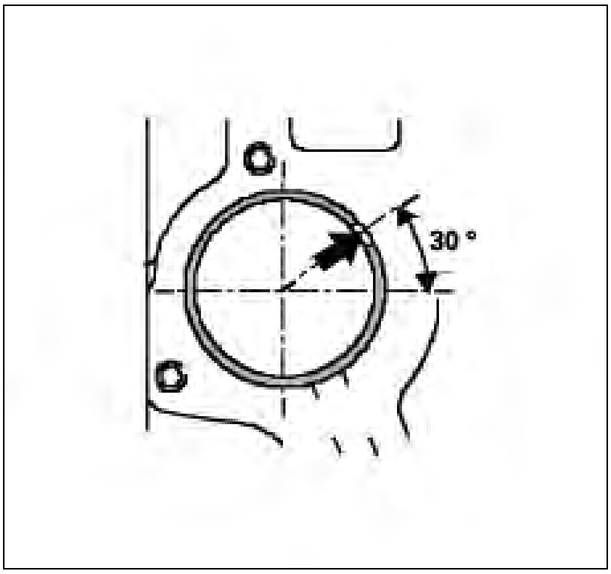
44 and 49 type engines

1. Extract the ring with an internal extractor, for example the Sykes 854. If the plug at the rear end of the camshaft is removed, the ring can be extracted using a long punch.
2. Carefully clean the location of the ring.
3. Fit the ring with its lubrication port raised 30° above horizontal, as in the illustration. There is no need to bore it, because its internal diameter is correct when it is fitted.

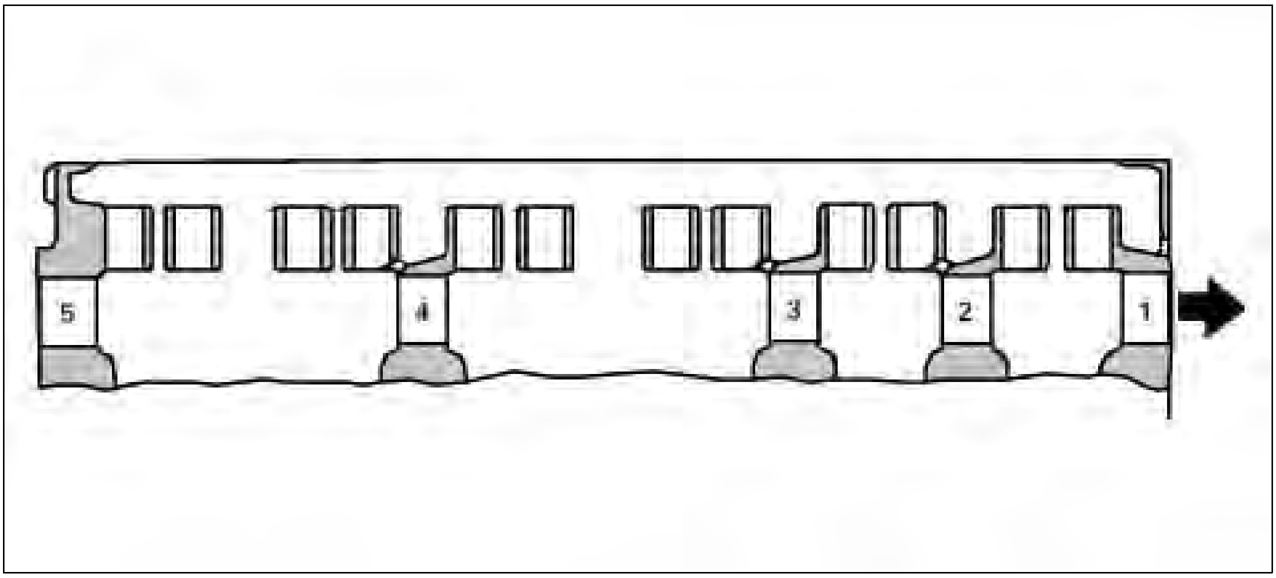
66, 74 and 84 type engines

On 66, 74 and 84 type engines, all the camshaft bearing points are fitted with a separate bearing ring.

1. Take off the rear end of the camshaft and remove the rings using a long punch. Observe the different external diameters during removal.



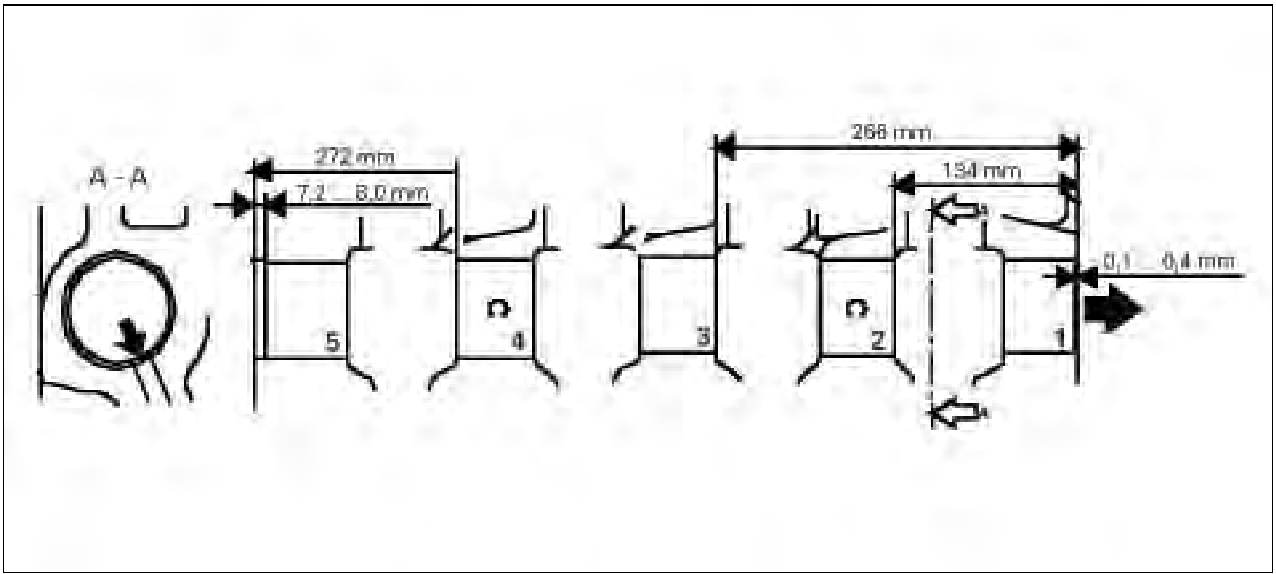
I008098 Fig. 3



I008099 Fig. 4

2. Carefully clean the ring locations.

Port diameter (numbering is in ascending order starting at the front end of the engine.)	
(1)	55,62 mm - 55,65 mm
(2)	55,42 mm - 55,45 mm
(3)	55,22 mm - 55,25 mm
(4)	55,42 mm - 55,45 mm
(5)	55,64 mm - 55,67 mm



I008100

Fig. 5

3. Insert new rings (2 - 5). Observe the different external diameters. Note the position of the lubrication port. There is no need to bore it, because its internal diameter is correct when it is fitted.

Note: *The ring at the front end of the camshaft (1) has a lubrication groove on its external surface. Fit the ring with its lubrication port raised 30° above horizontal. The ring has the correct dimensions after assembly (machining not required).*

Installing the plug at the rear end of the camshaft

1. Clean the seat of the plug.

2. Apply a sealing paste to the contact face of the plug.

3. Insert the plug using fitting punch 9025 87400.

Note: *Do not drive the plug in too deep, because this will change the axial clearance of the camshaft.*

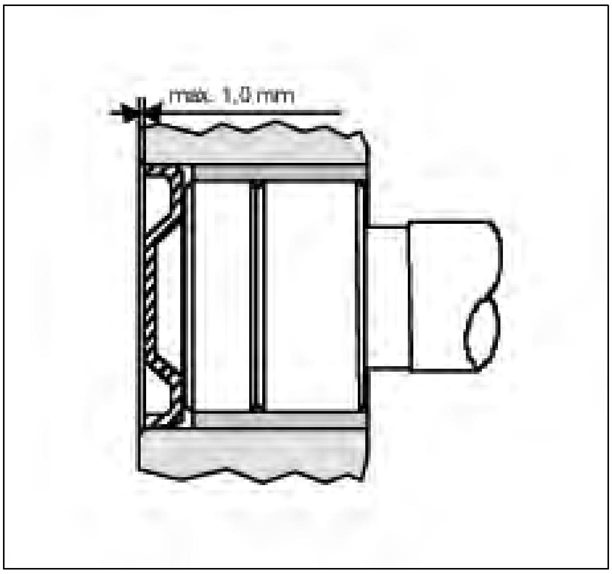
Over-size dimension of camshaft rings

44 and 49 type engines

If the location of the camshaft ring (front bearing) is damaged, a ring with an external diameter over-size value of 0,4 mm can be fitted. Rings are available even for other camshafts that do not usually use them. The figure indicates the references and machining dimensions of ring locations.

Observe the position of the ring lubrication ports. It is not necessary to bore the rings after assembly.

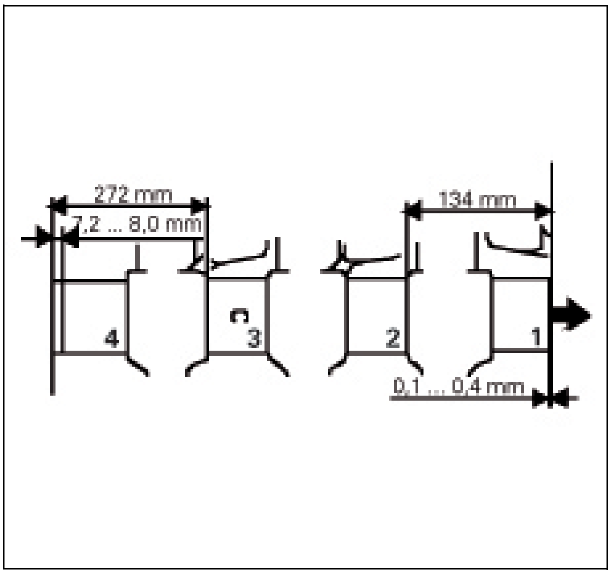
References of over-size camshaft rings and ring port diameters (44 type engines). Numbering is in ascending order starting at the front end of the engine.



I008101

Fig. 6

Reference		Diameter of port
(1)	8368 66036	56,02 mm - 56,05 mm
(2)	8368 52460	55,42 mm - 55,45 mm
(3)	8368 52460	55,42 mm - 55,45 mm
(4)	8368 52461	55,64 mm - 55,67 mm



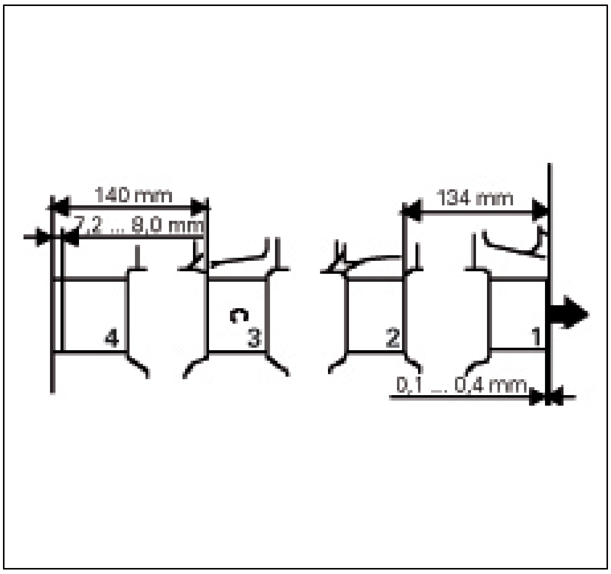
I008103

Fig. 7

66, 74 and 84 type engines

References of over-size camshaft rings and ring port diameters. Numbering is in ascending order starting at the front end of the engine. The assembly locations are identical to those of standard rings.

Reference		Diameter of port
(1)	8368 66036	56,02 mm - 56,05 mm
(2)	8368 52466	55,62 mm - 55,65 mm
(3)	8368 52460	55,42 mm - 55,45 mm
(4)	8368 52466	55,62 mm - 55,65 mm
(5)	8368 52467	55,84 mm - 55,87 mm

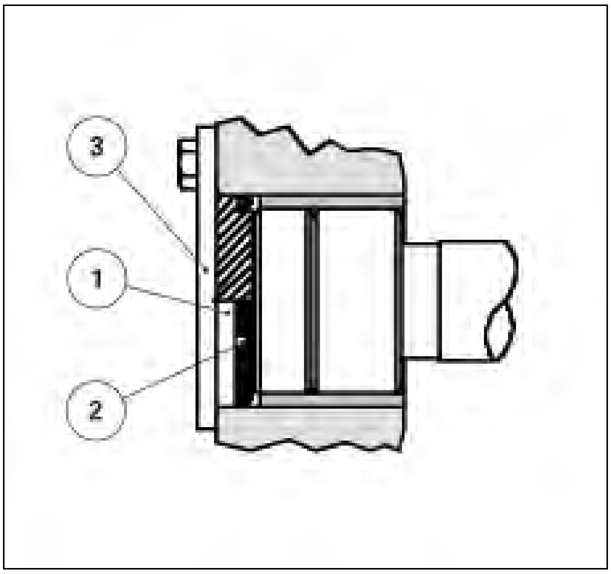


I008104

Fig. 8

Installing the plug at the rear end of the camshaft (over-size rings)

The plug located at the rear end of the camshaft is replaced with plug 8363 24391 (1) and "O" ring 6146 05125 (2) after machining. Use plate 8361 24210 (3) on engines in which the flywheel housing does not cover the blocking plug.

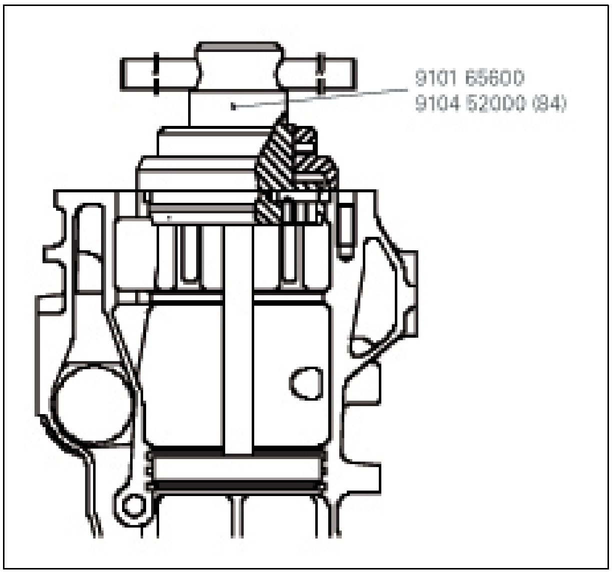


I008105

Fig. 9

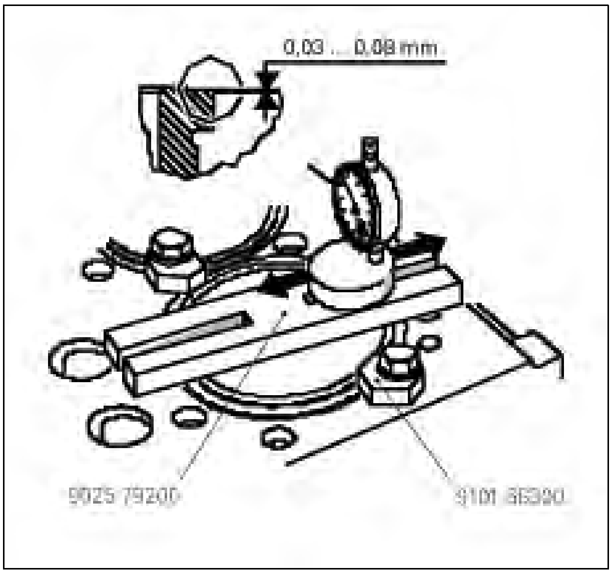
Installing a cylinder liner

1. Clean the cylinder liner and its housing in the cylinder block. With no "O" ring fitted, the liner should turn freely in its housing.
2. Apply a thin layer of marker paint underneath the cylinder liner collar. Fit the liner without an "O" ring and turn it forwards, then backwards. Lift the liner and check there is now a paint mark along the whole surface of the contact face.
3. If the housing is damaged or if the height of the cylinder liner needs to be adjusted, use cutter 9101 65600 or 9104 52000 (84 type engines). If required, after cutting, grind slightly using the cylinder liner. Smear abrasive paste on the underside of the cylinder liner collar and twist the liner using the appropriate tool. Grinding is not suitable to correct the height of the cylinder liner.
4. Clean the mating faces.



I008107 Fig. 10

5. Fit the cylinder liners and fix each one using two presses 9101 66300. Measure the height of the cylinder liner using a dial gauge and support 9025 79200. Reset the dial gauge against a flat surface; for example the side of the cylinder block. Measure each liner at four different places. The height of the cylinder liner above the cylinder block should be between 0,03 mm and 0,08 mm. The height difference between the various cylinder liners on the same cylinder head should not exceed 0,02 mm, and an intermediate liner should not be lower than an outer liner.

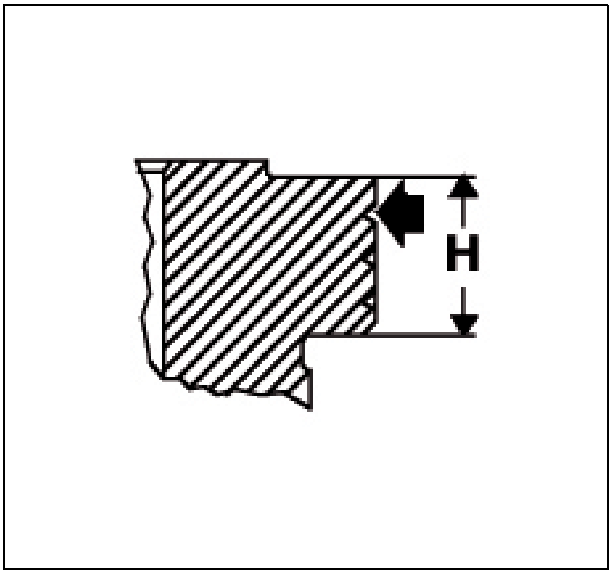


I008108 Fig. 11

6. If the height of the cylinder liner is too low, fit a liner with a larger collar.

44, 49, 66 and 74 type engines

Reference	H	Number of reference grooves
8366 47420	$9.03^{+0.02}$	- (std.)
8366 47933	$9.08^{+0.02}$	1-
8366 47934	$9.13^{+0.02}$	2
8366 47935	$9.23^{+0.02}$	3



I008109 Fig. 12

84 type engines

Reference	H	Number of reference grooves
8368 67048	$9.03^{+0.02}$	- (std.)
8368 67050	$9.08^{+0.02}$	1-
8368 67051	$9.13^{+0.02}$	2
8368 67052	$9.23^{+0.02}$	3

Cylinder liners with over-size collars (bigger collars) are marked with grooves around the rim as follows:

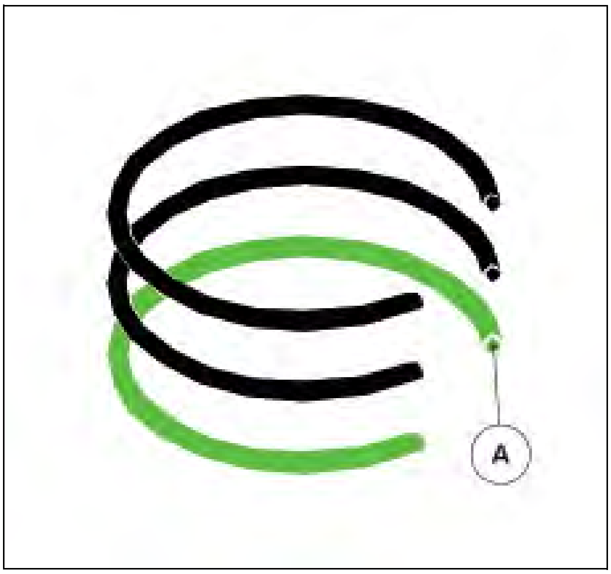
- 1-st over-size dimension, 0,05 mm = 1 reference groove
- 2th over-size dimension, 0,10 mm = 2 reference groove
- 3th over-size dimension, 0,20 mm = 3 reference groove

NOTE: *The depth of the housing is adjusted using cylinder liner housing cutter 9101 65600 or 9104 52000 (84 type engines).*

7. If the height of a cylinder liner is not uniform around the whole rim, the collar and the depth of the cylinder block housing must be checked. Discard any liner with a warped collar.

8. Fit "O" rings in the cylinder liner grooves. For 84 type engines, fit "O" rings in the cylinder block grooves. Fit the green "O" ring (A) in the lowest groove. Lubricate the "O" rings with liquid soap (not engine oil).

NOTE: *Stretch "O" rings as little as possible when installing. Maximum allowable stretch is 6%.*



I008110 Fig. 13

9. Drive in the cylinder liners in the cylinder block. Gentle pressure should be enough to fit them. Ensure that the liners do not rise up after fitting.

I008111

Fig. 14

B. Flywheel housing

Installing the flywheel housing

The flywheel housing is centred on the cylinder block by two tensioning pins. The pre-holes for these pins are present even on flywheel housings supplied as spare parts.

1. Clean the mating faces between the cylinder block and flywheel housing.

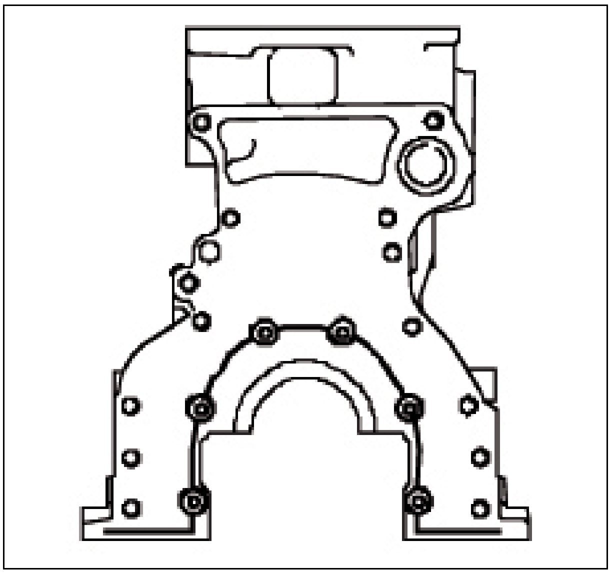
2. Apply a silicone-based sealing paste as illustrated.

3. Fit the flywheel housing in place and position all the bolts.

4. Centre the housing using centring tool 9052 46400 or 9104 52700 (84 type engines).

Note: *Important for engines with a turbine clutch: Install tensioning pins using punch 9025 98700.*

5. Tighten the attachment bolts as follows: the socket head bolts of the internal ring to 80 Nm and the hexagon head bolts of the exterior ring to 150 Nm.



I008112 Fig. 15

Replacing the crankshaft rear oil seal

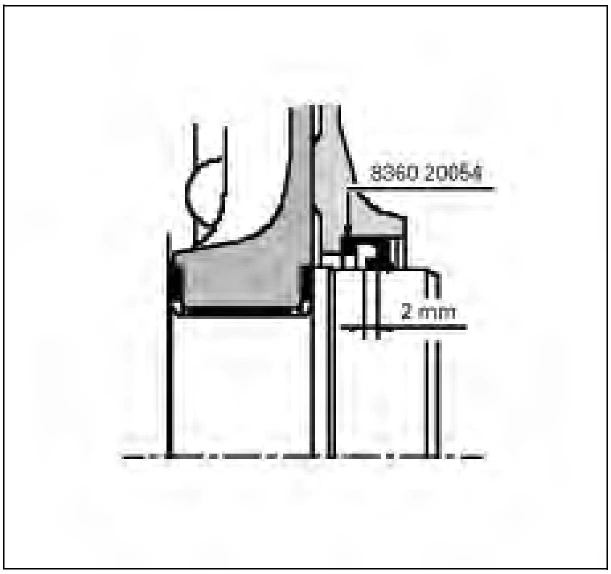
1. Lift the engine. Remove the clutch (and, if applicable, the turbine clutch).

2. Remove the flywheel.

3. Remove the oil seal. Do not damage the crankshaft.

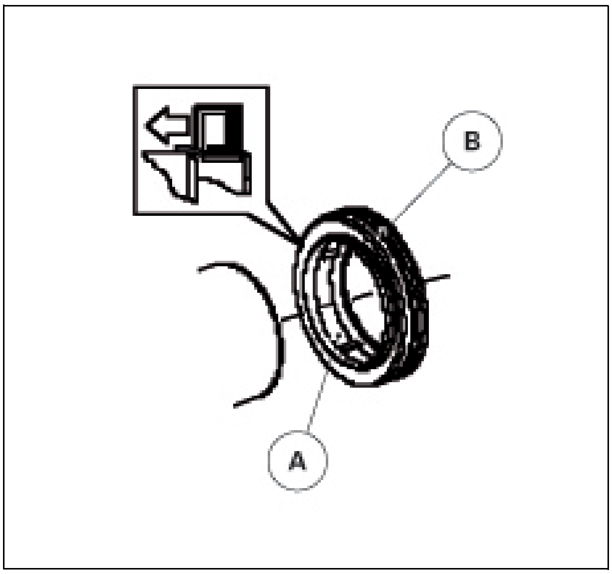
4. Clean the location of the seal and grind off the burrs.

Note: *If the crankshaft is worn at the seal location, a 2 mm spacer, reference 8360 20054, can be fitted in front of the crankshaft rear oil seal.*



I008113 Fig. 16

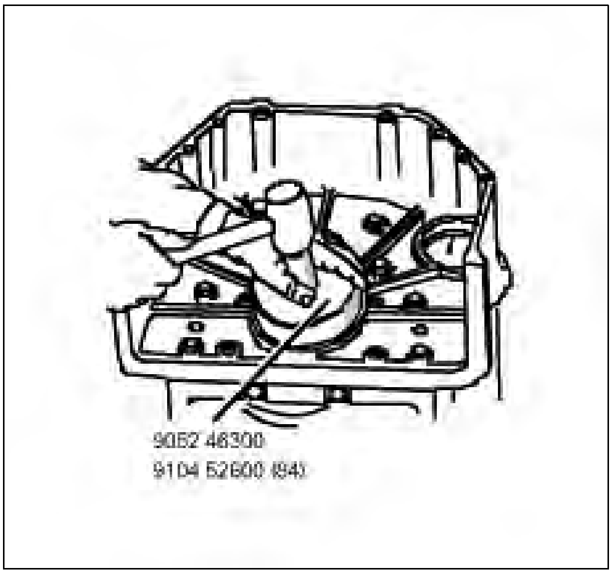
5. Position the seal as follows:
- Do not remove the plastic sleeve before installing.
- Fit the seal dry and unoiled.
- Position the sleeve (A) against the rear end of the crankshaft so that the sleeve is resting against the shaft chamfer.
- Push the seal (B) onto the shaft sleeve, then up against the flywheel housing.



I008114

Fig. 17

6. Take off the sleeve and strike the seal to fit it in place using assembly tool 9052 46300 or 9104 52600 (84 type engines).



I008115

Fig. 18

C. Cylinder head, 4V engines

Removing the cylinder head

1. Switch off the current at the main switch.

2. Clean the outside of the engine and drain the coolant. Disconnect the coolant hoses from the cylinder head and thermostat housing.

3. Take off the suction hoses located between the turbo-charger and air filter, then between the turbocharger and inlet manifold.

4. Disconnect the pressure pipes from the turbocharger and the oil return pipes.

5. Disconnect the inlet air heater wires and the injectors.

6. Remove the fuel leak pipe from the injector and the high-pressure pipes. Remove the injectors. Fit blank-ing-off plugs on all the open unions.

NOTE: *Do not open up the high-pressure pipe unions of the fuel system when the engine is running. Wait at least 30 seconds after the engine is switched off. If the jet of high-pressure fuel should come into contact with your skin, fuel can penetrate the skin and cause serious injuries.*

7. Remove the inlet and exhaust manifolds, as well as the thermostat housing.

NOTE: *The cylinder head can be removed even if these parts are attached to it.*

8. Remove the valve cover plate.

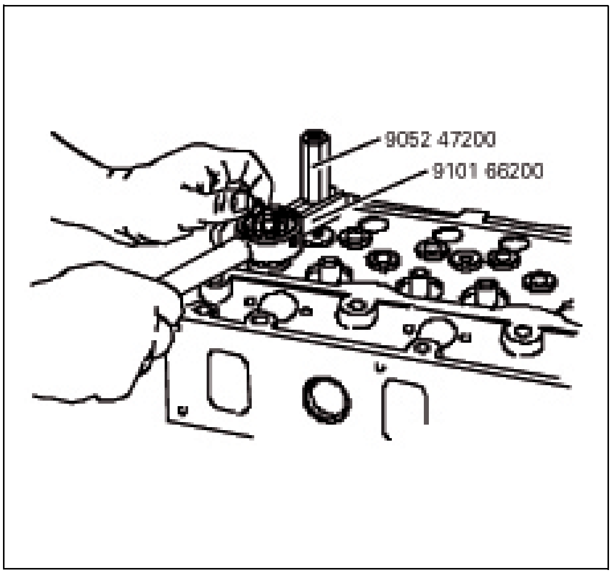
9. Take off the rocker arm mechanism and rods.

10. First loosen all the cylinder head screws by a quarter turn, then fully loosen and remove them. Remove the cylinder head.

Removing the valves

Ensure that all the valves to be reused are marked so they can be reassembled in their original locations.

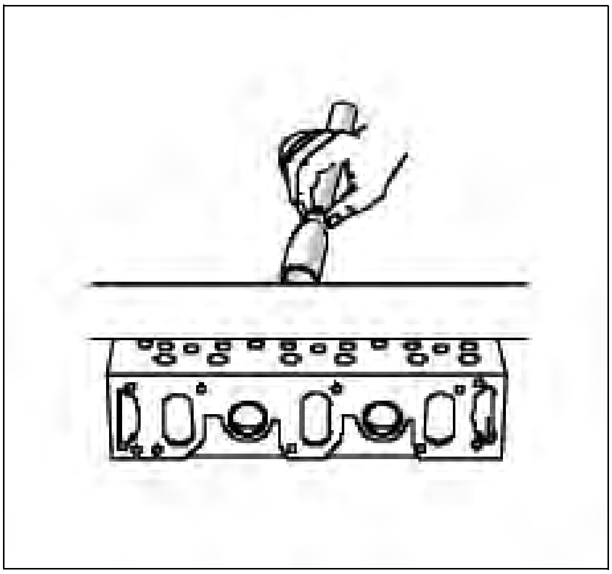
1. Fit check screw 9052 47200 from the valve spring installation tool in the rocker arm cover screw. Engine types 33, 66, 74 and 84 do not have a screw-in stud on the valves of the central cylinder. Use a screw of suitable length instead.
2. Compress the valve springs using lever 9101 66200. Take out the valve keys, the spring guide and the spring. Remove the valves.



I008116 Fig. 19

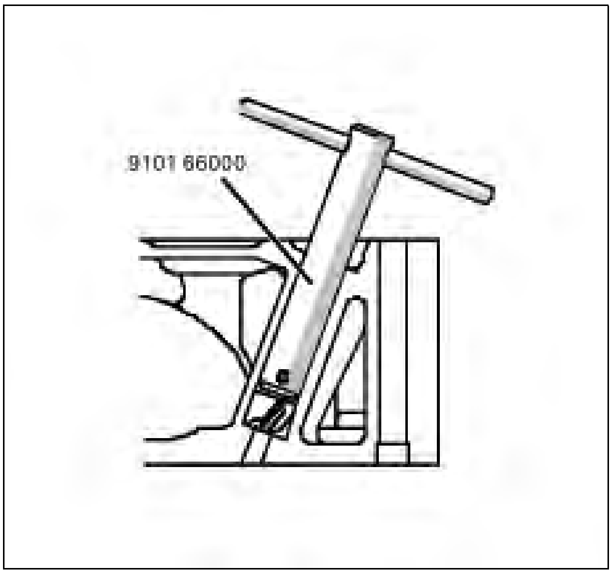
Checking the cylinder head

1. Remove any soot from the exhaust ports, clean the mating faces and wash the cylinder head.
2. Check that there are no cracks or any other damage.
3. Check that the cylinder head is flat, using a rule. If a surface is uneven or damaged, it needs to be reground. The height of the cylinder head, after regrinding, must not be lower than 104.00 mm. The depth of the valve discs from the surface of the cylinder head must be 0.60 mm for exhaust valves and 0.70 mm for inlet valves.



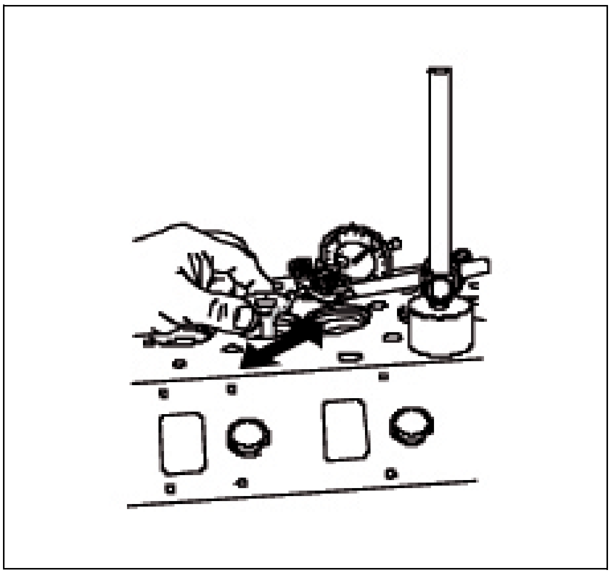
I008117 Fig. 20

4. Straighten and clean the seat of the injector housing in the cylinder head using cutter 9101 66000.



I008118 Fig. 21

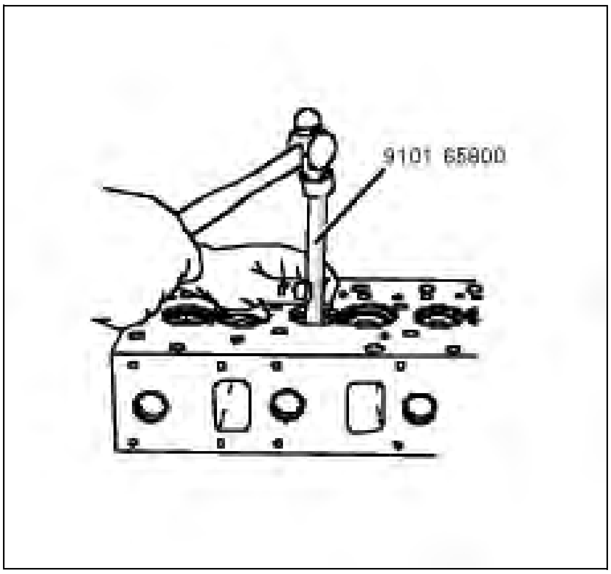
5. Measure the clearance between the valve rod and the valve guide using a dial gauge. Raise the valve until its head is 15 mm from the surface of the cylinder head, then measure the clearance. It must not exceed 0.30 mm for inlet valves and 0.35 mm for exhaust valves. In order to determine the level of wear on the valve guide, measure it against a new valve.



I008119 Fig. 22

Replacing valve guides

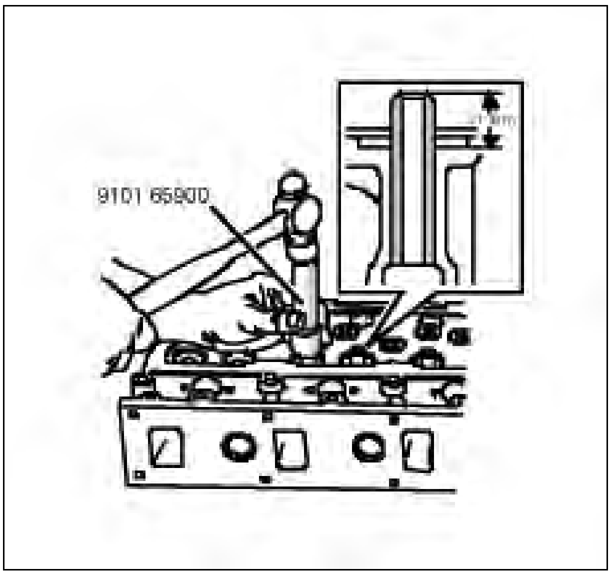
1. Press or tap out the old guides using punch 9101 65800. Clean the valve guide housings.



I008120 Fig. 23

2. Lubricate the external surfaces of the new guides and fit them using punch 9101 65900, which ensures that they are fitted at the correct height (21 mm) on the surface of the spring.

3. Identical guides are used for both the inlet and exhaust valves. Ensure that the sharper chamfer of the guide is turned towards the cylinder head. Check that the valves slide freely in the guides.



I008121 Fig. 24

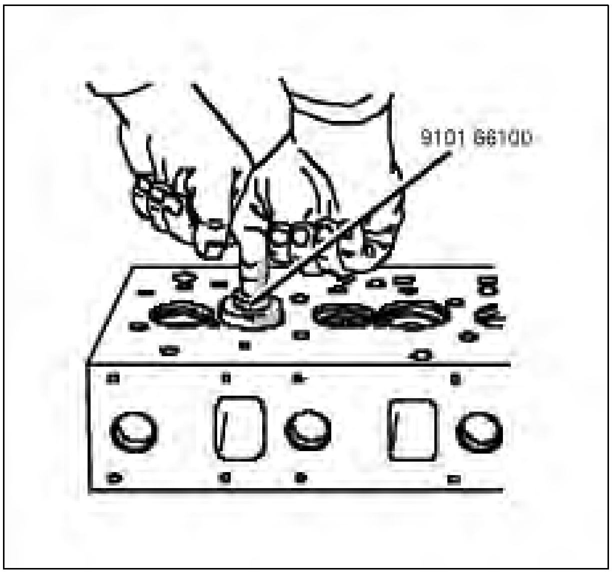
Machining the valve seats

Machine the seats of damaged valves with a cutter. If the width of the seat exceeds 2.3 mm at the exhaust and 3.7 mm
at the inlet, it must be reduced on the outside edge. The valve seat angle is $45^{\circ +20'}$ for the exhaust valve and $35^{\circ +20'}$ for the inlet valve.

Replacing valve seat rings

Exhaust valves are fitted with separate seat rings. Very powerful engines are also fitted with separate inlet valve seats. If the mating face is too badly damaged to be repaired by machining, replace the ring.

1. Regrind the head of a discarded valve head to make it fit the seat. Fit the valve and weld it in position in the seat. Cool it with water.

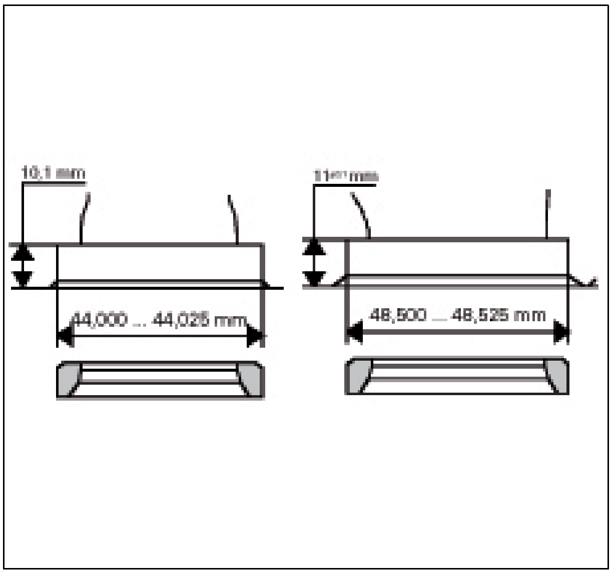


I008122 Fig. 25

2. Turn the cylinder head over and tap on the valve and the seat.
3. Clean the location of the valve seat. Cool the new seat ring in liquid nitrogen until there are no more bubbles or place it in carbon dioxide snow.
4. Fit the seat using a suitable punch. Machine the seat.

NOTE: *If necessary, replace standard sized seats with inserts that have a wider external diameter.*

The seat of the inlet valve, which is machined directly on the cylinder head, may be fitted with a separate valve seat ring with reference 8366 47936. Machine the location for the insert intended for the seat on the cylinder head. Fit the insert like an exhaust valve seat.



I008123 Fig. 26

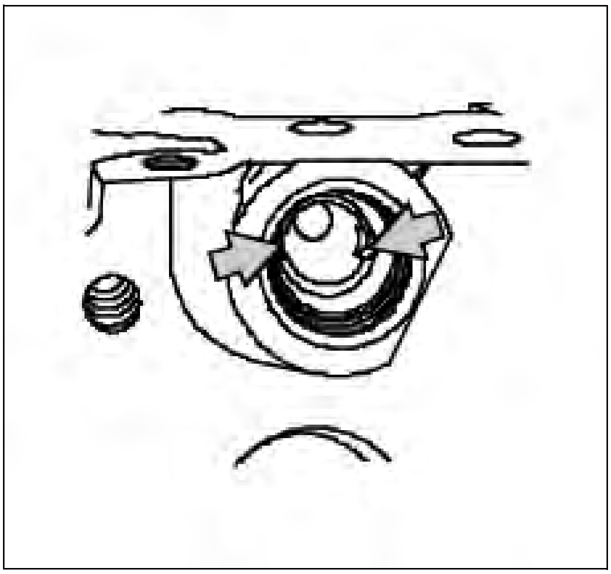
Installing the valves

1. Using a spring tester, check the straightness, length and tension of the valve springs.
2. Lubricate the valve stems and fit the valves in the cylinder head in the correct order.
3. Fit the springs, spring guides and valve keys using valve spring compression lever 9101 66200.
4. After installing the valve, gently tap the end of the stem to check that it is correctly attached.

Reconditioning

1. Using a standard valve spring press, take out the valve keys, spring guide and spring. Remove the valve. If the old valves have been reassembled, ensure they have been refitted in exactly the same positions.
2. The height of the cylinder head, after regrinding, must not be lower than 109.50 mm. The depth of the valve discs from the surface of the cylinder head must be 0.60 mm for exhaust valves and 0.80 mm for inlet valves.

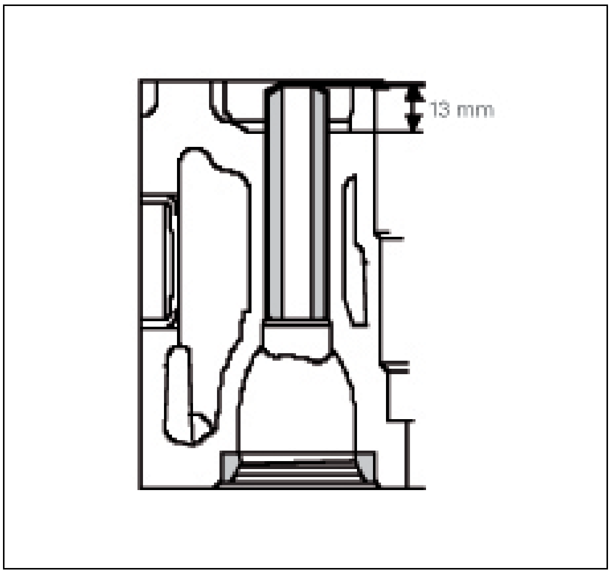
3. Straighten and clean the seat of the injector housing in the cylinder head using cutter 9120 85400. Also ensure that the location of the lateral supply pipe is clean, especially the guide ball grooves.



I008126 Fig. 27

4. If required, compress or release the old guides using punch 9120 85300. Clean the valve guide housings. Lubricate the external surfaces of the new guides and fit them using punch 9120 85000, which ensures that they are fitted at the correct height (13 mm) on the surface of the spring.

5. Machine the damaged valve seat with cutter kit 8370 62635. If the width of the seat exceeds 2.0 mm at the exhaust and 2.2 mm at the inlet, it must be reduced on the outside edge. The valve seat angle is $45°^{+20'}$ for the exhaust valve and $35°^{+20'}$ for the inlet valve.

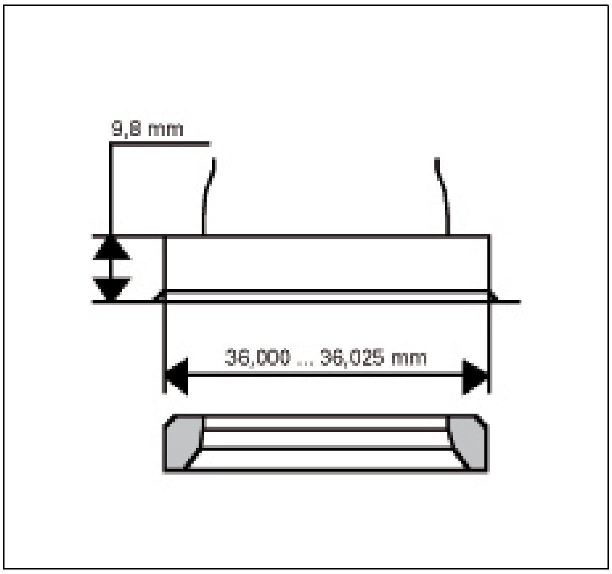


I008127 Fig. 28

6. Exhaust and inlet valves are fitted with separate seat rings. If the mating face is too badly damaged to be repaired by machining, replace the ring.

***NOTE:** If necessary, replace standard sized seats with inserts that have a wider external diameter.*

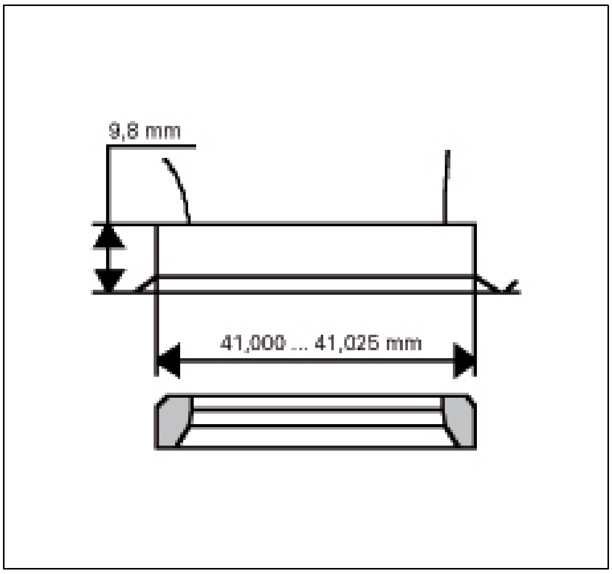
Exhaust



I008128

Fig. 29

Inlet

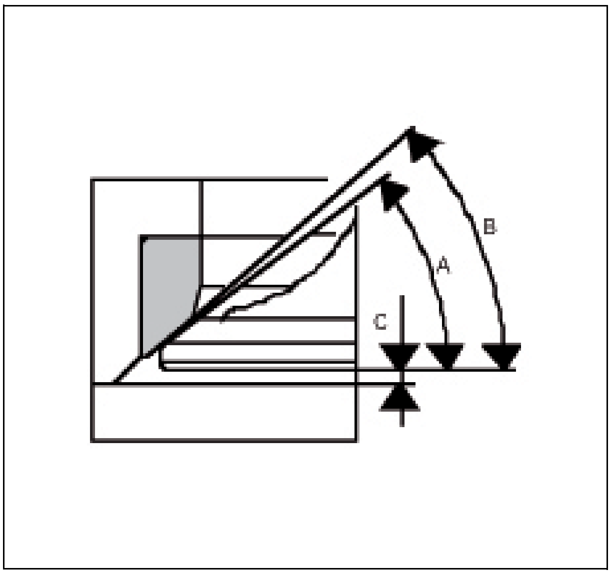


I008129

Fig. 30

7. To ensure an adequate seal around the valves, the mating faces are constructed with different angles. The very narrow mating face therefore ensures effective sealing, even after prolonged operation.

	A	B	C (mm)
Inlet	$35^{\circ -20'}$	$35^{\circ +20'}$	$0.8^{\pm 0.05}$ (max. 2.20)
Exhaust	$45^{\circ -20'}$	$45^{\circ +20'}$	$0.6^{\pm 0.05}$ (max. 2.20)



I008130

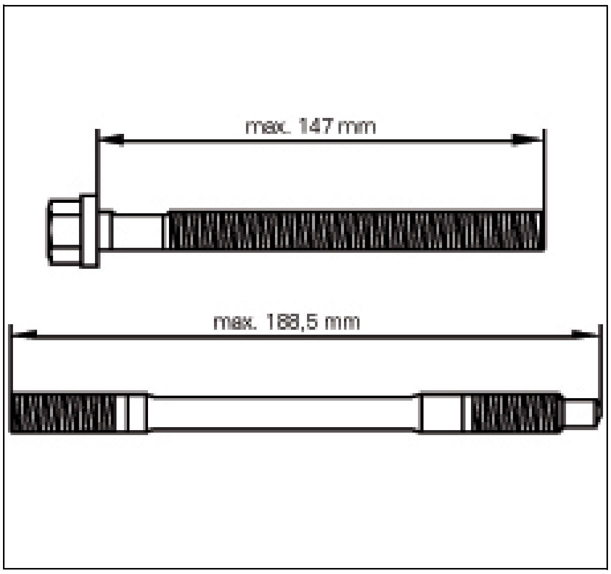
Fig. 31

Installing the cylinder head

1. Measure the length of the cylinder head screws. Compare them to the dimensions indicated (Fig. 32). Replace any screws that are too long.

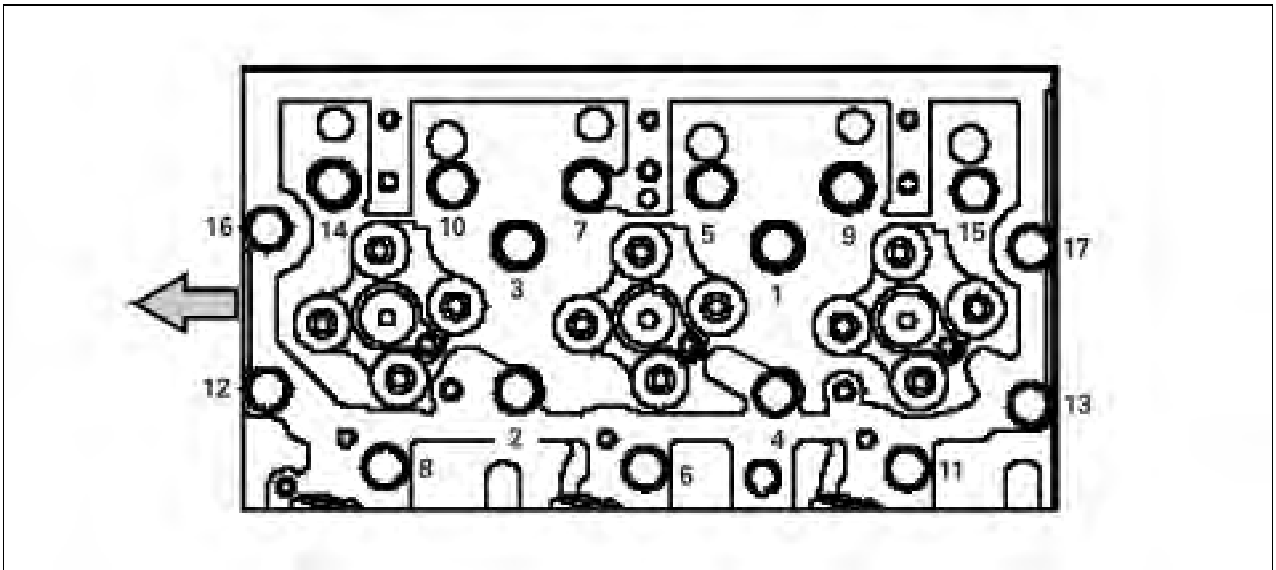
2. Screw the cylinder head studs in the cylinder block to a torque of 30 Nm. Refit the valve lifters if they have been removed.

3. Check that the mating faces are clean and fit the cylinder head gaskets, as well as the cylinder heads. Check that the two cylinder heads on six-cylinder engines are parallel while loosely attaching the exhaust manifold, before tightening the cylinder head screws (the exhaust manifold can be damaged if the cylinder heads are not parallel). Clean, grease and fit the screws.



I008124

Fig. 32



I008125

Fig. 33

4. The cylinder head screws should be inserted in the order shown in (Fig. 33). The order is not indicated on the cylinder heads.

5. Gradually tighten the cylinder head screws as follows:
- First tighten to 80 Nm.
- Angle tighten 90°.
- Angle tighten another 90°.

NOTE: *After this procedure, the cylinder heads do not need to be retightened again.*

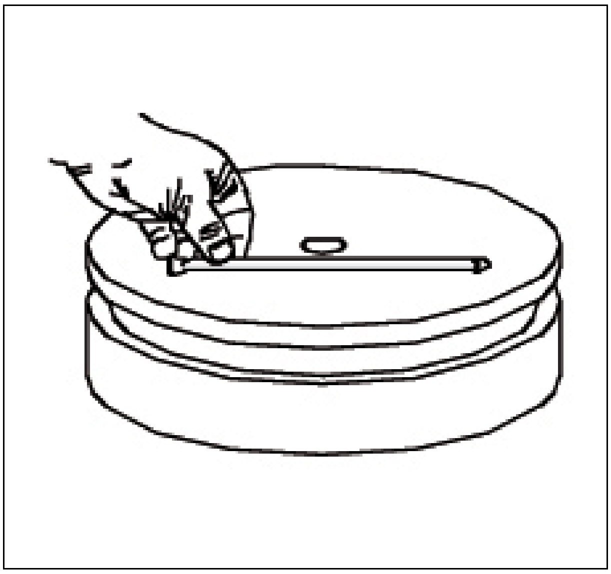
D. Valve mechanism, 4V engines

Reconditioning the valve mechanism

1. Check the valve lifters, and in particular the contact face with the camshaft. Discard any worn or damaged lifters.

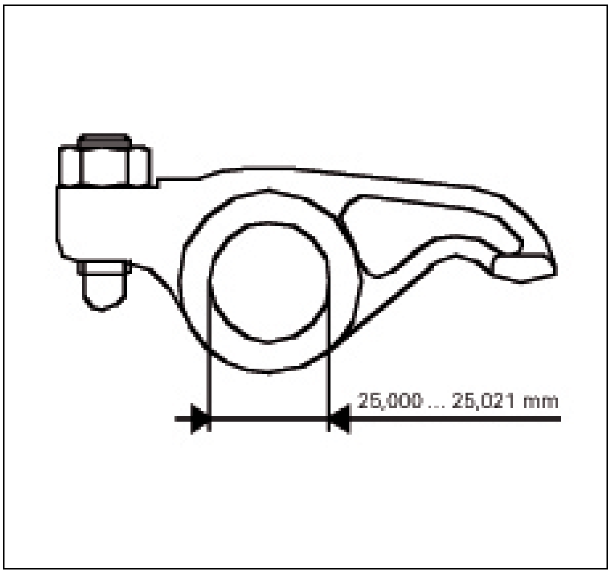
2. Check the straightness of the rocker arm rods by rolling them on a surface plate. Also check the spherical ends.

3. Disassemble and clean the rocker arm mechanism. Check the amount of wear on the shaft, as well as the cleanliness of the oil channels.



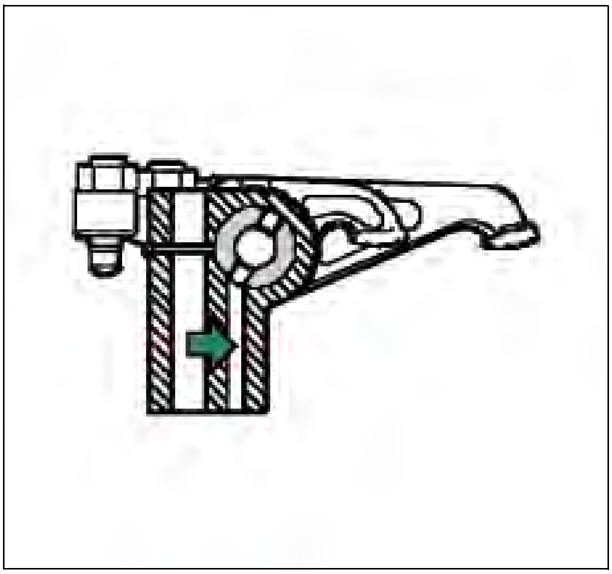
I008132 Fig. 34

4. Check the diameter of the rocker arm bore: 25,000 mm to 25,021 mm. Replace any worn or damaged rocker arms. If necessary, regrind the contact face of the rocker arm valve to give it the correct shape. Do not regrind more than necessary because the hardened layer is thin.



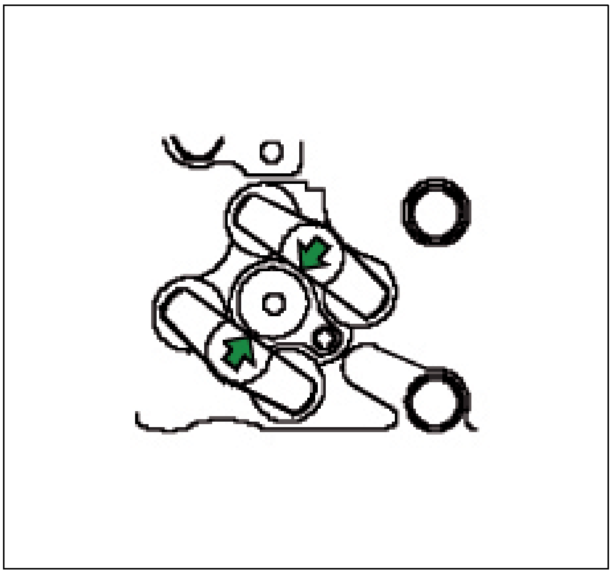
I008135 Fig. 35

1. Fit the plug on the other end of the rocker arm pin. Grease the pin and fit the various parts in the correct order. Note the correct locations of the supports and the shaft. Install a plug on the other end and tighten the plugs to a torque of 25 Nm.



I008083 Fig. 36

2. Fit unions on the valves as indicated in the illustrations.



I008084 Fig. 37

3. Install the valve mechanism and ensure that the clearance at the right-hand end is between 0,05 mm and 0,20 mm for the levers at the end. Tighten the screws and nuts of the mechanism to a torque of 45 Nm.

I008085 Fig. 38

Replacing the camshaft and its gear

1. Remove the valve cover plate. Remove the rocker arm mechanism.
2. Remove the radiator, cooler fan, alternator and belt.
3. Remove the belt pulley, crankshaft nut and the hub (with vibration damper).

   For 74 and 84 type engines, remove the belt pulley and vibration damper. Loosen the crankshaft nut. Do not remove it! Remove the hub using extractor 9104 53300. Take off the extractor, loosen the nut and remove the hub.
4. Remove the cover plate from the timing housing (front cover plate of the engine).

5. Using "O" rings or elastic bands, hold the rocker arm rods together in pairs to prevent them from falling out.

NOTE: *Do not hold the rods too tightly together, to prevent them from bending or breaking.*

6. Start the engine to align the alignment marks of the layshaft gear on the camshaft gear. Extract the camshaft.

7. Separate the camshaft from the gear.

8. Clean the parts for reassembly.

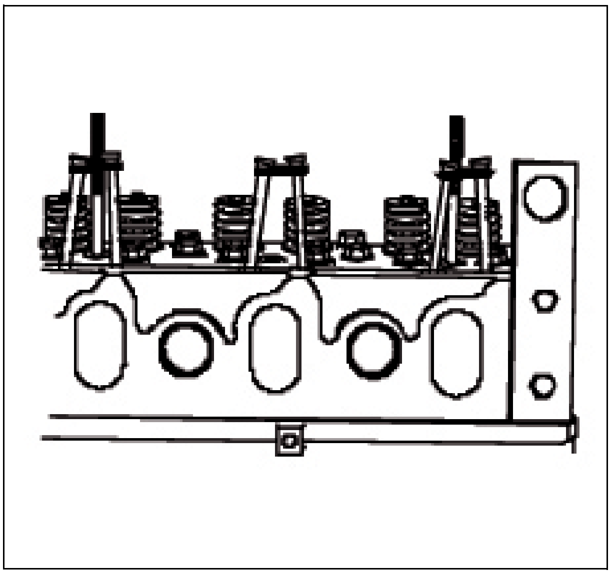
9. Install the key in the groove and fit the gear on the camshaft. Tighten the nut to a torque of 200 Nm.

10. Grease the bearing surfaces and lobes, then insert the shaft into the cylinder block. Check that the marks are still aligned.

11. Fit the cover plate of the timing housing, the hub, vibration damper, and crankshaft belt pulley.

12. Release the lifter rods and fit the rocker arm mechanism. Adjust the valves. Fit the valve cover.

13. Reassemble the other parts.



I008137

Fig. 39

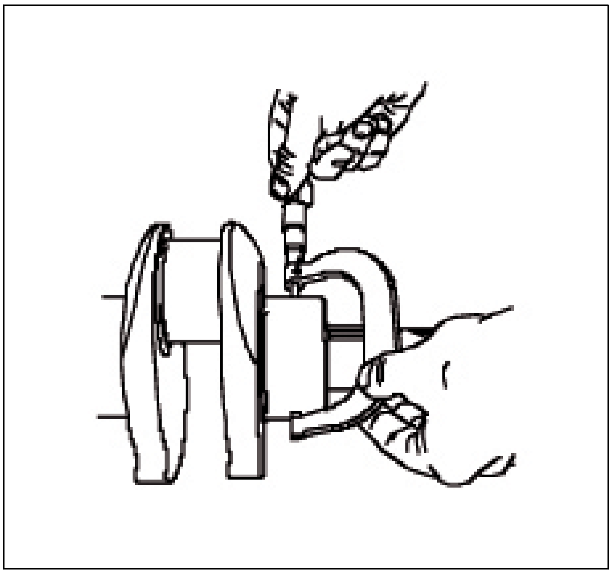
E. Crankshaft

Removing the crankshaft

1. Remove the oil sump.
2. Disconnect the oil pipe from the cylinder block balancing unit and unscrew the attachment bolts from the balancing unit. Remove the balancing unit and the lubricating oil pipe (44 and 49 type engines only).
3. Unscrew the pressurised pipe attachment screws from the oil pump at the cylinder block. Remove the oil pump and the suction and pressurised pipes.
4. Remove the flywheel and housing.
5. Remove the belt pulley and the hub at the front end of the crankshaft. Remove the timing housing.
6. Remove the caps from the connecting rod bushes and move the rods away from the area of travel of the crankshaft.
7. Take off the bearing caps and raise the crankshaft to remove it.

Checking the crankshaft

1. Clean the crankshaft. Do not forget the oil channels.
2. Measure the wear to the bearing journal at several points. On the rim, the angle or wear should not exceed 0,03 mm.



I008140

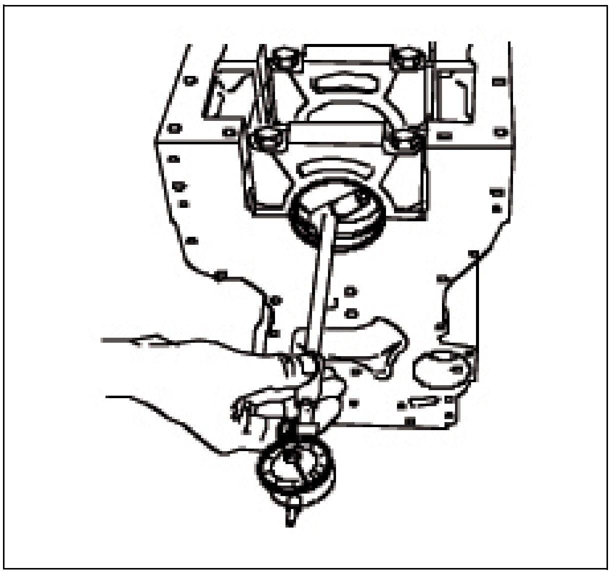
Fig. 40

3. Refit the bearing caps with new bearing shells and tighten to the correct torque. Measure the internal diameter with a reset dial gauge to obtain the dimensions corresponding with those obtained . Using this method, the indicator shows the actual clearance of the bearings. Carry out the measurement at several points if the worn bearing housing is not round.

4. If the bearing clearance exceeds 0,18 mm for the main bearings or 0,14 mm for the connecting rod big end bushes with new bearing shells, the crankshaft bearing journals need to be reground.

NOTE: *When regrinding, the edges of the bearing journals must remain round.*

NOTE: *If required, the main bearing can be fitted with an external diameter over-size value of 1,0 mm and an internal diameter under-size value of 0,5 mm (0,02 in). Reference 8361 40950. The main bearing housing is machined between 92,000 mm and 92,025 mm, and the crankshaft between 84,485 mm and 84,520 mm. (Special bearings not available for 74 and 84 type engines.)*



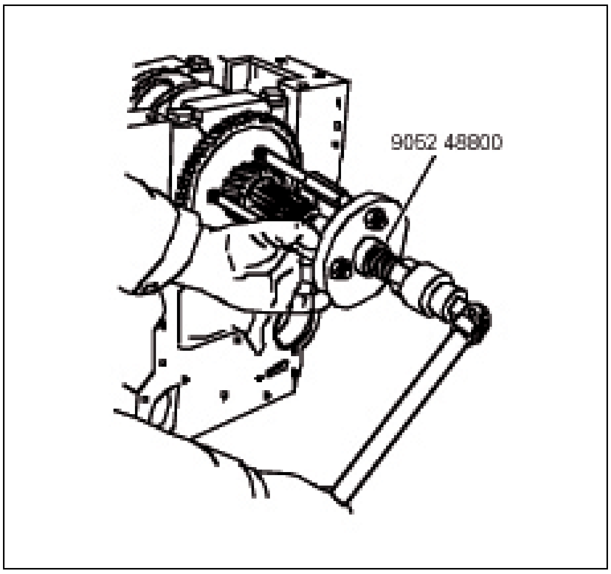
I008141 Fig. 41

Replacing crankshaft gears

1. Use extractor 9052 48800 to remove the two crankshaft gears.

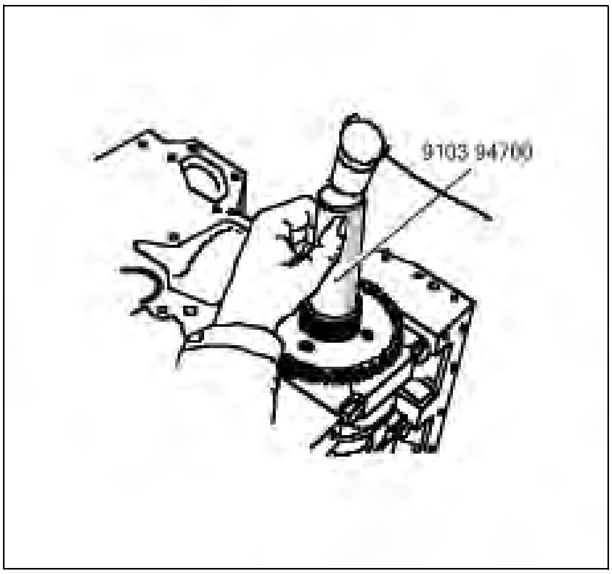
On 84 type engines, take out the crankshaft gears using a grinding machine, for example. Regrind the gears as required. Separate the gears using a chisel. Take care not to damage the crankshaft!

2. Clean the seat on the crankshaft with a wire brush, for example.



I008142 Fig. 42

3. Heat the new gears to a temperature between 220 °C and 250 °C. Tap them onto the shaft with punch 9103 94700. Note the position of the key and ensure that the alignment marks on the front gear are visible. Allow to cool.



I008143

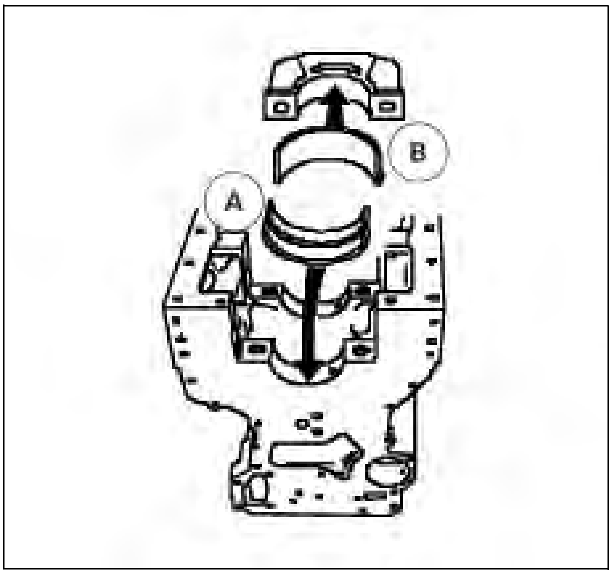
Fig. 43

Installing the crankshaft

1. Clean the oil channels, shells and bearing housings. Check that the crankshaft is clean.

2. Assemble the bearing with the lubrication ports/grooves (A) at the cylinder block and the bearing without ports (B) at the bearing cap. Ensure that the locking clamps holding the shells fit correctly in the slots and that the shells to be fitted in the cylinder block have a port that lines up with the oil port.

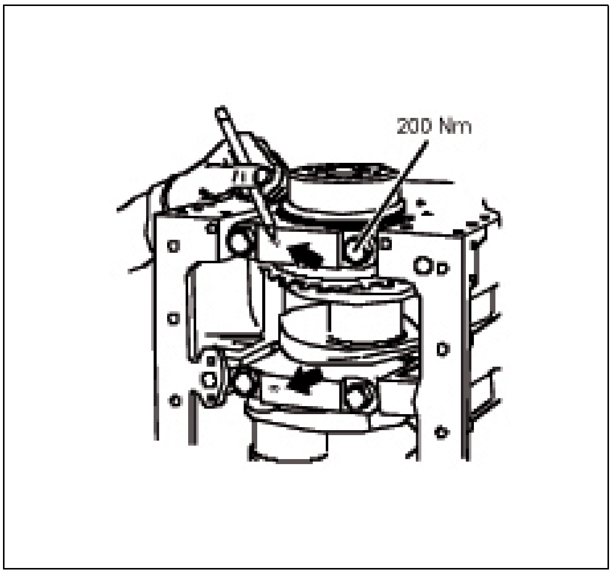
3. Lubricate the bearing surfaces and fit the crankshaft. Fit the thrust bearings with the lubrication grooves turned towards the crankshaft.



I008144

Fig. 44

4. Fit the main bearing caps according to their numbering (the bearing locks of the block and cap are located on the same side). The rear bearings with thrust points are fitted with guide lugs. Grease the bolts and tighten to a torque of 200 Nm.

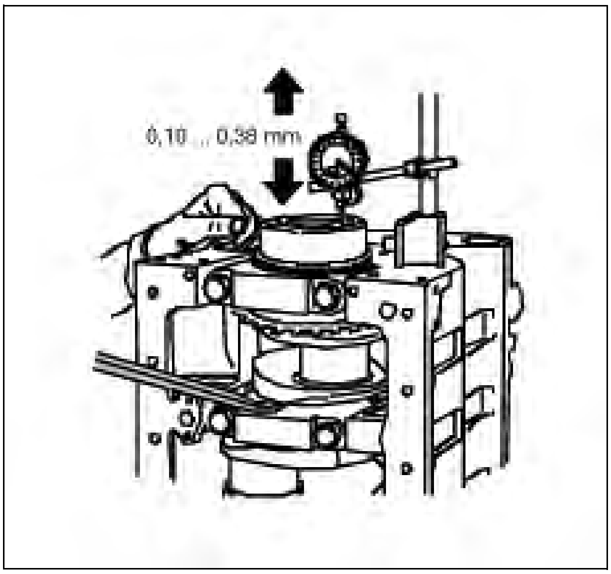


I008146

Fig. 45

5. Check that the crankshaft turns freely. Check the axial clearance with a dial gauge. The correct axial clearance is between 0,10 mm and 0,38 mm. If this clearance is too great, fit over-size thrust bearings.

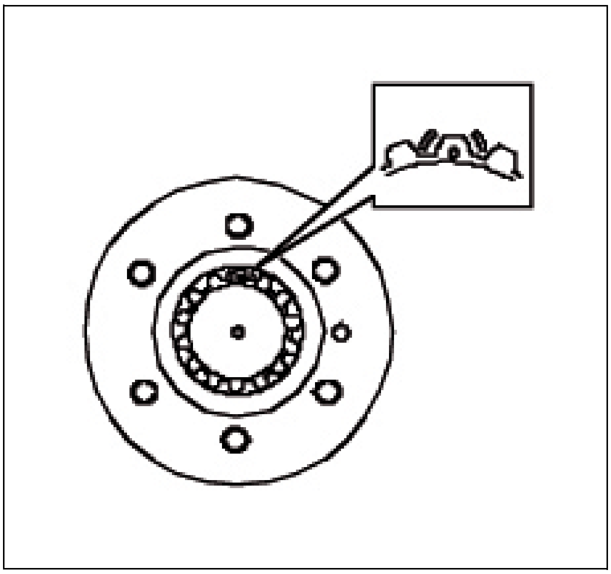
IMPORTANT: *Never machine or bore the bearing shells in any way whatsoever, and never file away the sides of the bearing caps.*



I008148 Fig. 46

Crankshaft hub

When installing the hub on the front section of the crankshaft, note the correct position of the hub (engines with the injection pump installation reference on the crankshaft pulley/vibration damper). An installation reference is displayed on two teeth on the hub, but only on one tooth of the crankshaft.

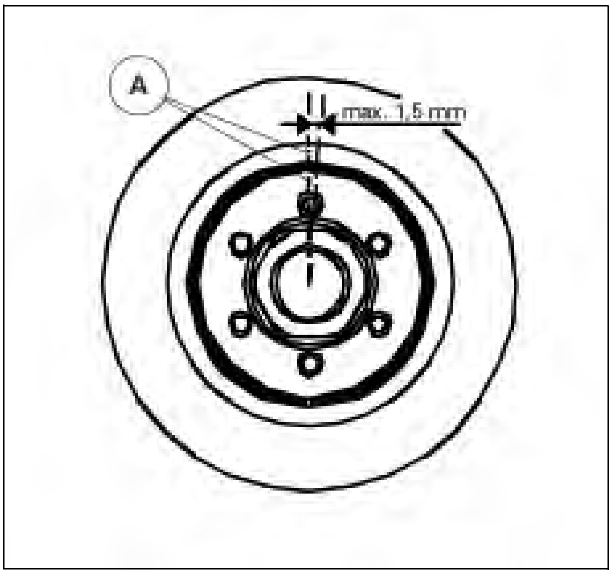


I008149 Fig. 47

Checking the rubber element of the vibration damper

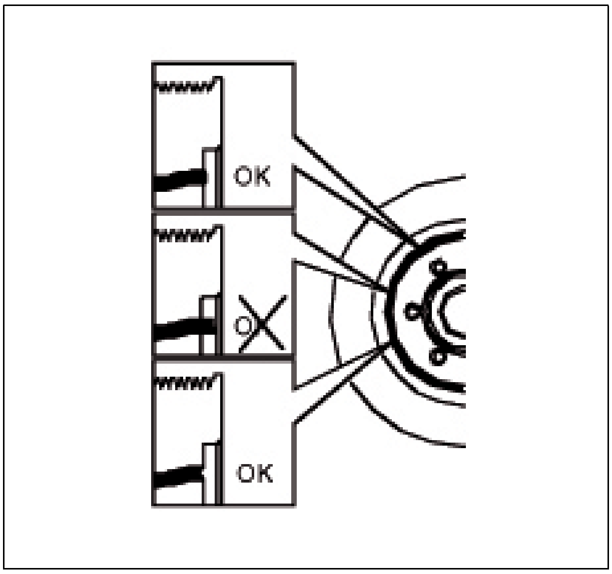
44, 49 and 66 type engines

1. Check the alignment marks (A) on each side of the rubber element. If the difference is greater than 1,5 mm, replace the damper with a new one.



I008150 Fig. 48

2. Also check the condition of the rubber element. If the rubber parts have come loose from the element, if the rubber has been compressed to a depth greater than 3,5 mm or if the rim is loose or moves in the same direction as the shaft, replace the damper.



I008151 Fig. 49

Viscose type vibration damper

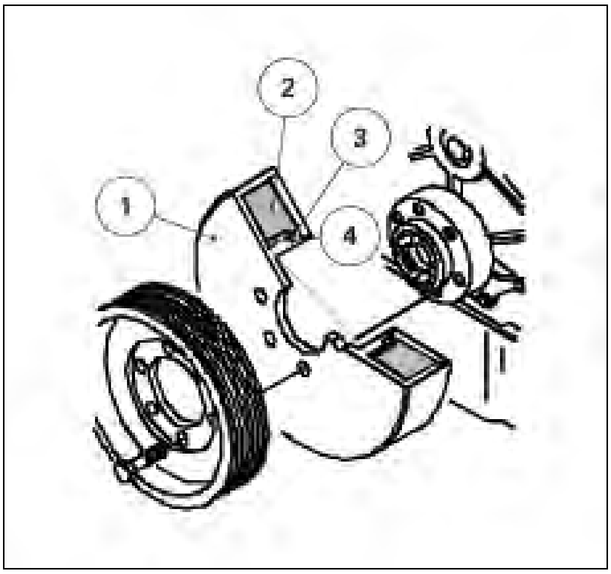
66, 74 and 84 type engines

(1) Housing
(2) Vibration damper weight
(3) Liquid cavity
(4) Ring

Engine types 74, 84 and some versions of 66 type engines are fitted with a "viscose" type vibration damper. Inside the damper, there is a housing filled with solid silicone oil in which the damping agent displays greatly reduced tolerances.

IMPORTANT: *Even a small dent can render the vibration damper ineffective. Do not force it during removal and take care not to damage it when it is loose. If a dent is detected on the external surface, do not refit the damper in the engine.*

NOTE: *Put an installation reference from the injection pump on the vibration damper using a red pen (do not strike it).*



I008152

Fig. 50

F. Rods and pistons

General removal of pistons with rods

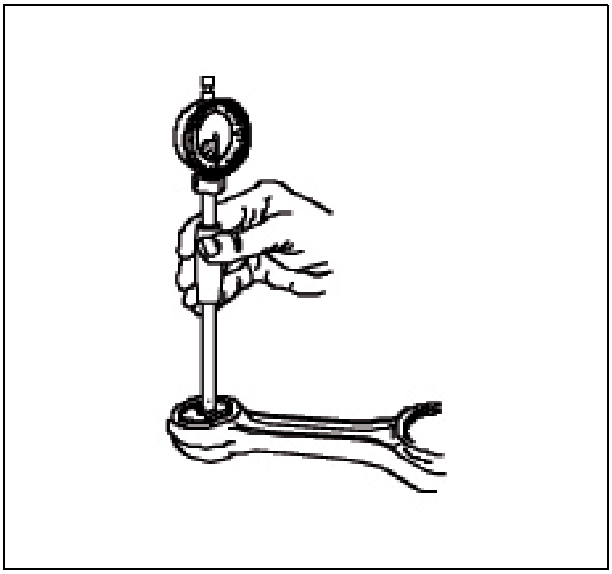
1. Remove the oil sump and the oil inlet and pressure pipes.
2. Remove the cylinder head.
3. Scrape off any soot that may have accumulated on the cylinder liner. If the rotating edge is heavily marked, carefully smoothen it with a scraper.
4. Remove the connecting rod big end caps and the bearing shells. Keep the shells in order of removal if they are to be reused.
5. Push the piston and rod with a hammer handle or similar wooden tool.
6. Remove the retaining rings from the gudgeon pin. Remove the pin.

   Note: *If the gudgeon pin cannot be pushed out by hand, the piston will need to be heated to 100 °C.*

Replacing the connecting rod bushes

Gudgeon pin ring

1. Clean the rod and bearing shells.
2. Measure the internal diameter of the gudgeon pin ring using a cylinder dial gauge.
3. If the ring is worn, extract it with a suitable punch.



I008153

Fig. 51

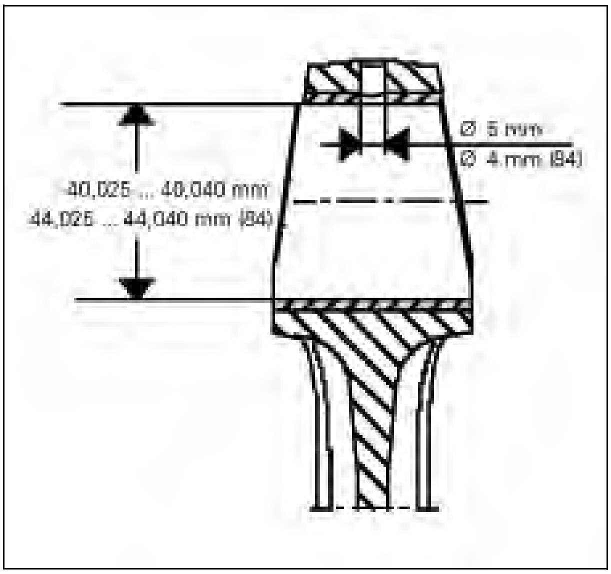
4. Drive the new ring into position. Ensure that the lubrication port on the ring connects with the corresponding port on the rod. Once the lubricating port is assembled (84 type engines), bore the ring to obtain the correct diameter.

   NOTE: *The rod can, if necessary, be fitted with a ring with an over-size value of 0,5 mm.*

Connecting rod big end bush

1. Fit the bearing shells at the same time and tighten the screws.
2. Measure the internal diameter using a reset cylinder dial gauge and compare it to the diameter of the corresponding bearing journal. If the clearance exceeds 0,14 mm with the new bearing shells, regrind the connecting rod big end bearing journals. Refer to the specifications to find out the under-size dimension and the corresponding bearing.

   NOTE: *When regrinding, be sure not to damage the radius at the end of the bearing journals.*



I008154

Fig. 52

Checking a connecting rod

Connecting rods are classified according to weight at intervals of 20 g. The class (a letter) is stamped on the side of the rod. All rods in a given engine must be in the same class, i.e. the maximum allowable variation in weight is 20 g.

The weight classes correspond to the following letters:

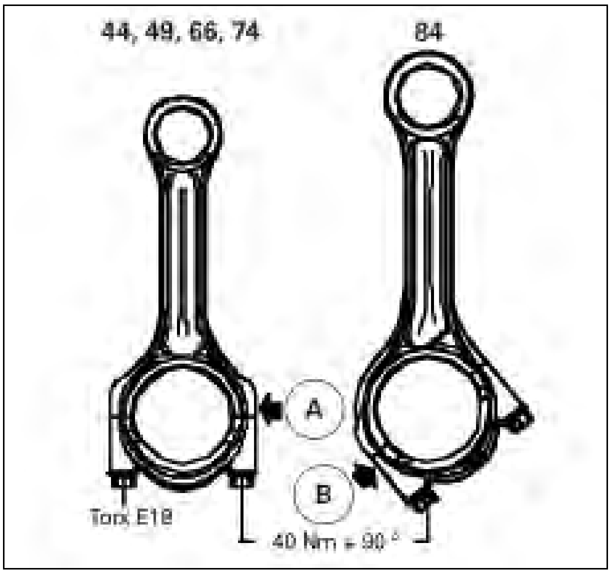
44, 49, 66 and 74 type engines

Letter (A)	Reference	Weight
F	8366 66430	1935 g - 1954 g
V	8366 66431	1955 g - 1974 g
X	8366 66432	1975 g - 1994 g
Y	8366 66433	1995 g - 2014 g
W	8366 66434	2015 g - 2034 g
Z	8366 66435	2035 g - 2054 g
G	8366 66436	2055 g - 2074 g

84 type engines

Letter (A)	Reference	Weight
E	8368 64101	2230 g - 2249 g
F	8368 64102	2250 g - 2269 g
G	8368 64103	2270 g - 2289 g
H	8368 64104	2290 g - 2309 g
I	8368 64105	2310 g - 2329 g
J	8368 64106	2330 g - 2349 g
K	8368 64107	2350 g - 2369 g

The reference numbers for connecting rod replacement kits are as follows:



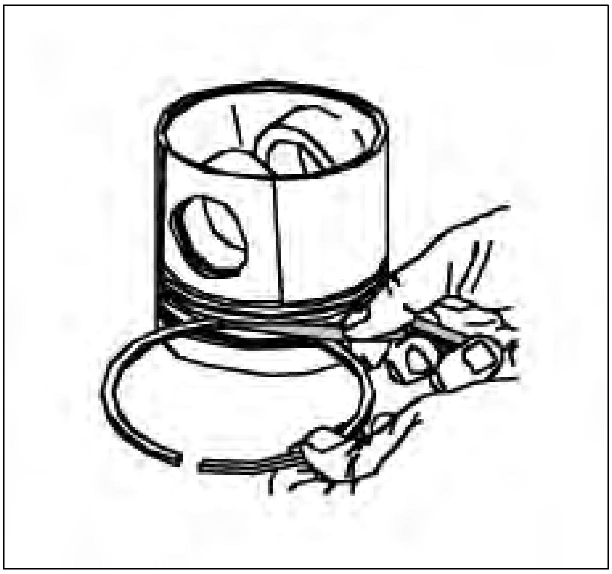
I008155

Fig. 53

Engine type	Number of cylinders	Reference
44, 49	4	8367 40859
66, 74	6	8368 40928
84	6	8363 40948

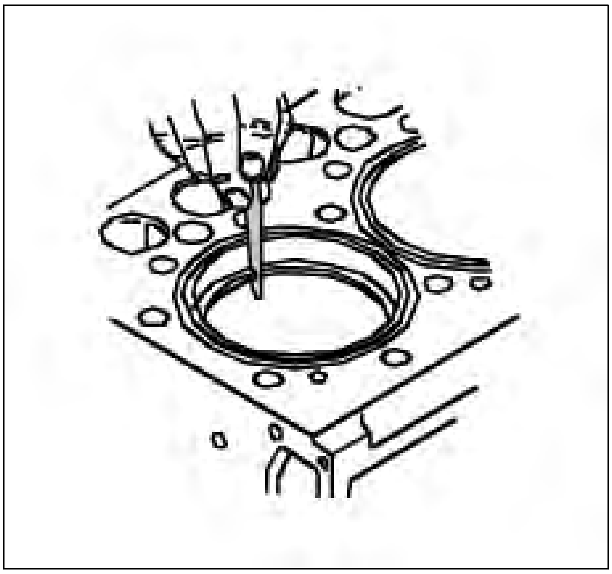
Replacing the piston rings

1. Remove the piston rings with suitable pliers 9052 46900. Do not open the rings more than necessary. If the rings need to be reused, ensure that they are refitted into the same groove.
2. Clean the piston ring grooves and measure the corresponding clearance. This should not exceed 0,15 mm. If clearance is too great, determine whether this is due to worn rings or a worn groove. Replace the worn parts.



I008156 Fig. 54

3. Measure the piston ring clearance by inserting rings one at a time into the cylinder bore. The clearance should not exceed 1 mm for piston rings 1 and 3 and 1,5 mm (84 type engines: 1,3 mm) for the second piston ring.

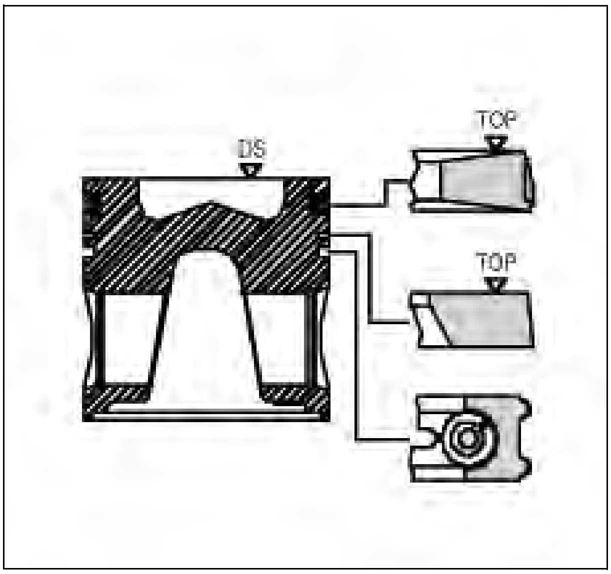


I008157 Fig. 55

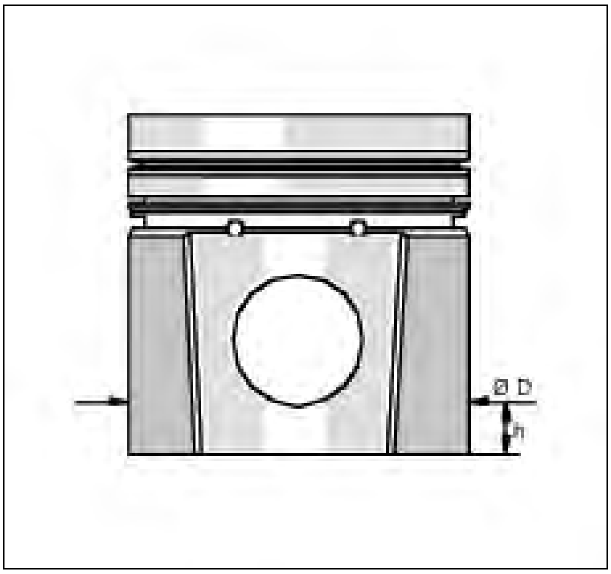
4. Fit the rings onto the piston using ring pliers. Ensure that the rings are fitted into the correct grooves and that the text "TOP" or any other manufacturer reference is facing upwards.

Checking the pistons

Check the condition of the pistons and their pins. Pay special attention to any cracks on the side of the combustion chamber and on the top side of the gudgeon pin port. Measure the piston diameter at the point indicated on the figure below. Replace the piston if required.



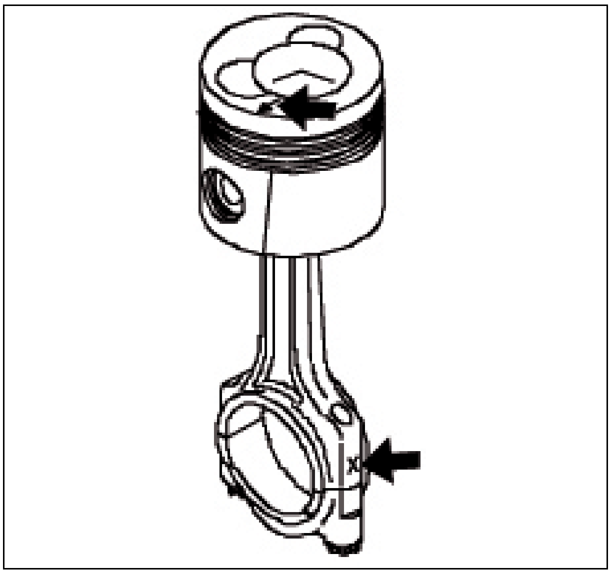
I008158 Fig. 56



I008159 Fig. 57

Engine	D	h
44, 66	107,883 mm to 107,897 mm	17,0 mm
49, 74	107,893 mm to 107,907 mm	19,0 mm
84	110,863 mm to 110,877 mm	15,0 mm

Installing the gudgeon pin



I008160 Fig. 58

1. Insert the rod into the piston and push the pin into position.
   The combustion chamber and the weight class letter should be located at the same side.

   ***Note:** On 84 type engines, the combustion chamber and the weight class letter should be located at opposing sides.*

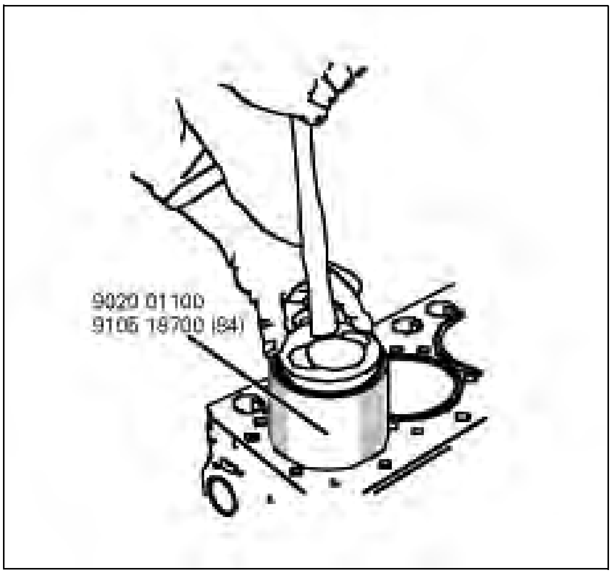
2. Fit the gudgeon pin circlips. Check that the circlips are correctly positioned in the grooves. The ends of the circlips should be pointing upwards.

Installing a piston linked to a connecting rod

1. Check that the bearing locations are clean and fit the shells into the rod and bearing cap. Note the position of the shells.

2. Grease the piston, rings and cylinder bore. Check that the piston ring sets are distributed all around the piston.

3. Use a piston ring flange or, better still, assembly tool 9020 01100 or 9105 18700 (84 type engines). Fit the piston and rod so that the combustion chamber and fuel injector are at the same side (an arrow on the piston should point to the front).
4. Lubricate the connecting rod big end bearing journal and the bearing shells, then push the piston downwards. Fit the bearing cap so that the guide lug slots are on the same side. Tighten the connecting rod screws to a torque of 40 Nm + 90°.
5. Ensure that the rod has enough axial clearance on the big end bearing journal.



I008161

Fig. 59

G. Counterweight (44 and 49 type engines)

Removing and disassembling the counterweight

1. Remove the oil sump.
2. Disconnect the oil pipe from the counterweight.
3. Remove the counterweight. Check for shims.
4. Loosen the lock screws and take out the shafts in the same direction as the lock screws. Remove the counterweights and thrust washers.
5. Clean all the parts.

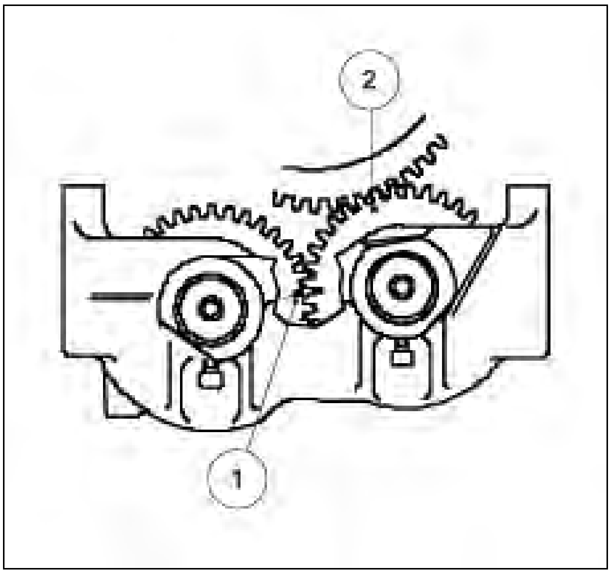
Reconditioning the counterweight

Check the shafts, gears and rings for wear and damage.

1. If one of the gears is damaged, replace both counterweights together. Gears are not available as individual spare parts.
2. If required, remove the old bushes with a suitable punch. Before removing them, mark the position of the lubrication groove of the rings on the counterweight. Drive the new bushes into position. After assembly, the bushes should be bored to the correct dimension.

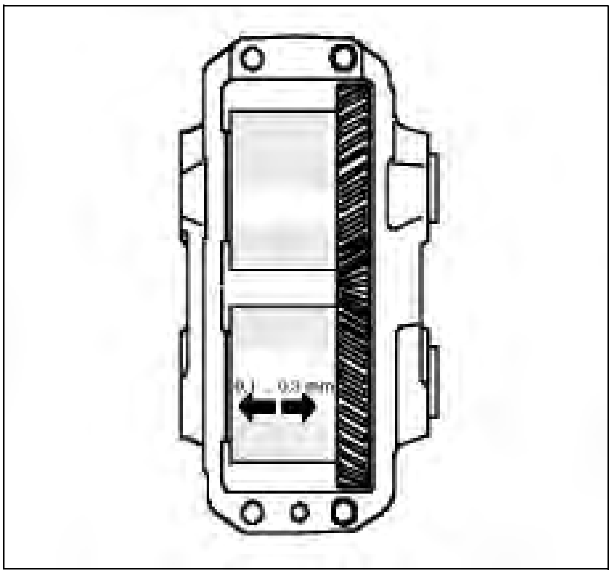
(1) Timing mark (slot)
(2) Mark in relation to crankshaft (punched hole)

3. Position the weight in the body according to the slots. The gear with the punched hole engages with the crankshaft and should therefore be positioned higher up. Insert the shafts, taking into consideration the thrust bearings. Apply a threadlock compound (Loctite 270, for example) to the lock screws, then lock the shafts in position.



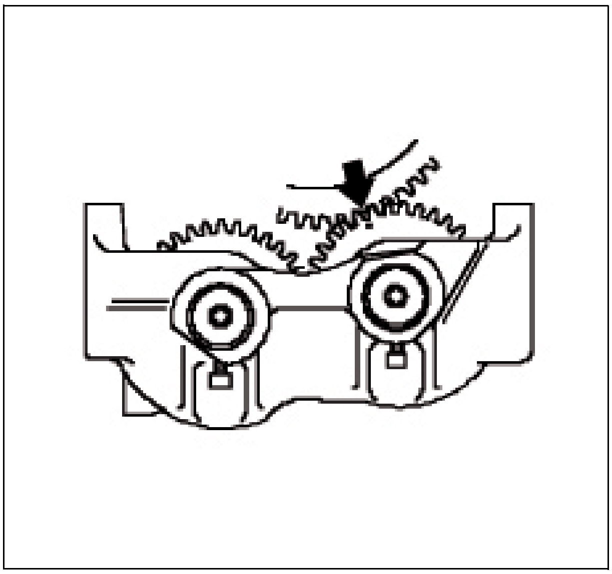
I008162 Fig. 60

4. Check that the clearance at the teeth is between 0,05 mm and 0,25 mm and that the axial clearance is between 0,1 mm and 0,3 mm.



I008163 Fig. 61

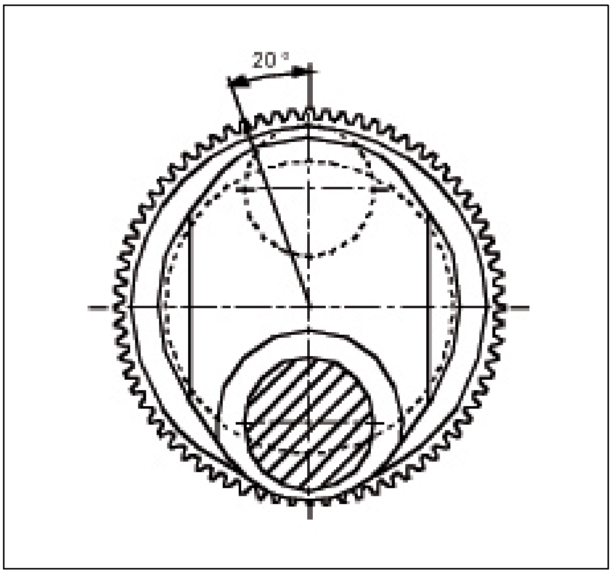
Installing the counterweight



I008164 Fig. 62

1. Fit the tensioning pins on the cylinder block.
2. Turn the crankshaft and weights until the marks are aligned, then raise the assembly to fit it in place.
3. Tighten the screws to a torque of 60 Nm. Check that the clearance at the teeth between the crankshaft and counterweight is between 0,1 mm and 0,3 mm. This clearance can be increased by inserting shims 0,2 mm in thickness (ref. 8361 19920) between the cylinder block and the body of the balancing unit. One shim (0,2 mm) modifies the clearance between the teeth by approximately 0,07 mm.
4. Fit the oil pipe, using new seals.
5. Fit the oil sump.

Replacing the crankshaft ring gear



I008165 Fig. 63

1. Mark the position of the ring gear on the shaft.
2. Heat the ring gear with a torch and extract it with a suitable punch.
3. Heat the new ring gear to 250 °C maximum. Fit the ring gear with the chamfer positioned opposite the crankshaft flange and the teeth corresponding with the marks or matching figure (Fig. 63). Drive in the ring gear and allow it to cool.

H. Steering wheel

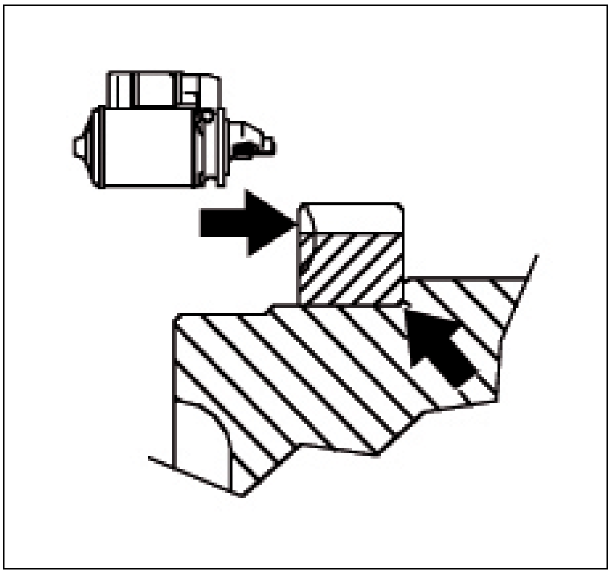
Replacing the flywheel starter ring gear

If the ring gear is worn, replace it with a new one. The ring gear cannot be turned because its teeth are chamfered and hardened on the starter side.

1. Remove the old ring gear by tapping it with a punch at different points. Clean the contact face of the flywheel with a wire brush.

2. Heat the ring gear to between 150 and 200°C. Fit the ring gear with its chamfered internal diameter turned towards the flywheel and the chamfered side of the teeth up against the starter.

3. Allow the ring gear to cool naturally without using coolant.



I008166 Fig. 64

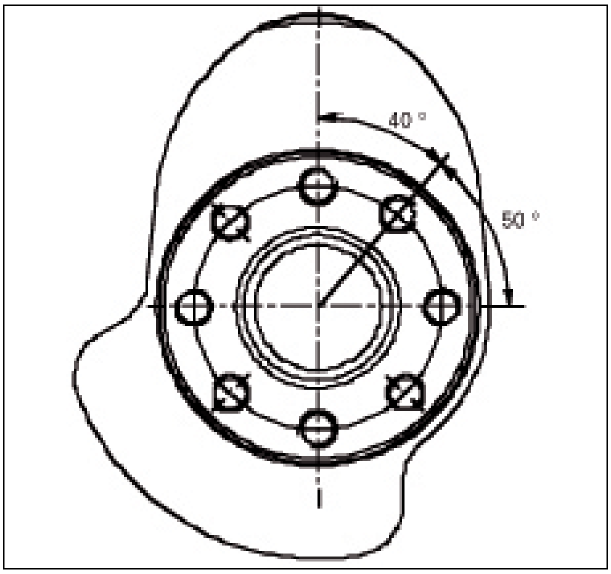
Installing the flywheel

1. Clean the contact faces on the rear crankshaft flange and flywheel.

2. Attach the flywheel at the rear end of the crankshaft. Suitable studs can be used (2 parts) as dowel pins; these are screwed into the ports of the flywheel attachment screws.

***Note:** In 84 type engines, the flywheel attachment screw ports are asymmetrical.*

3. Tighten the flywheel attachment screws evenly to a torque of 150 Nm (200 Nm on 84 type engines).



I008167 Fig. 65

I. Timing housing assembly for 44, 49 and 66 type engines

Removing the timing housing

The underside of the timing housing forms part of the combined surface of the oil sump, so it is impossible to remove the housing without first disassembling the oil sump.

1. Drain the engine oil and remove the oil sump.

2. Remove the radiator, fan, alternator, belt tensioner and belt (if they have not already been removed). If the engine is fitted with an air compressor or air conditioning unit, it must be removed.

3. Loosen the crankshaft nut (special tool 9101 65700 for 44 and 49 type engines or tool 9024 55800 for 66 type engines). Remove the hub (using the belt pulley and the viscose damper).

4. Remove the drive mechanism and the hydraulic pump (if installed).

5. Loosen the double layshaft gear nut and remove the cover plate of the timing housing and the oil deflector located at the front of the crankshaft.

6. Remove the high-pressure pump.

NOTE: *If the cover plate of the timing housing does not need to be replaced, the high-pressure pump can stay in position. In this case, disconnect all the wires and pipes from the pump.*

7. Remove the double layshaft gear.

NOTE: *If the timing housing does not need to be replaced, the double layshaft gear shaft can stay in place.*

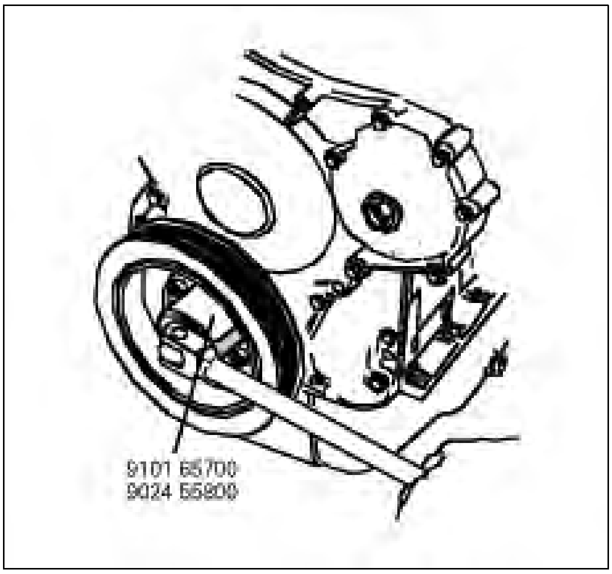
8. Loosen the bolts on the layshaft gear (17 mm and 22 mm). Remove the flange, gear and bearing journal.

9. Extract the camshaft.

NOTE: *If the cylinder head and valve mechanism have not been removed, ensure that the valve lifters are not able to fall out.*

10. Remove the timing housing. Check the condition of all the mating faces.

11. Remove the front crankshaft seal ring from the front housing and clean all the disassembled parts.

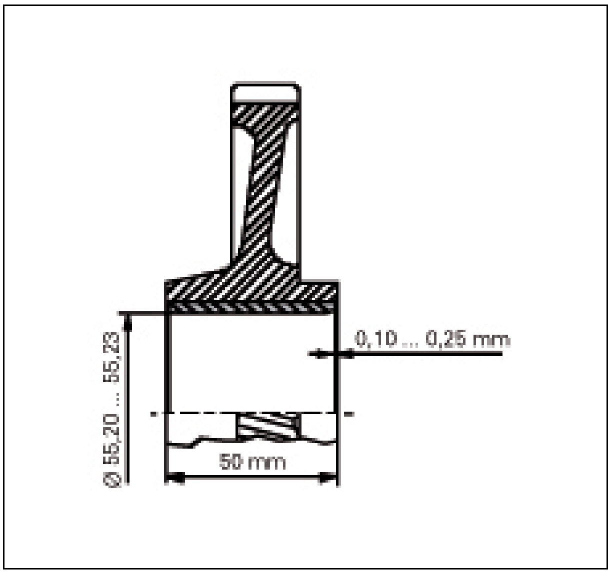


I008168

Fig. 66

Reconditioning the layshaft gear

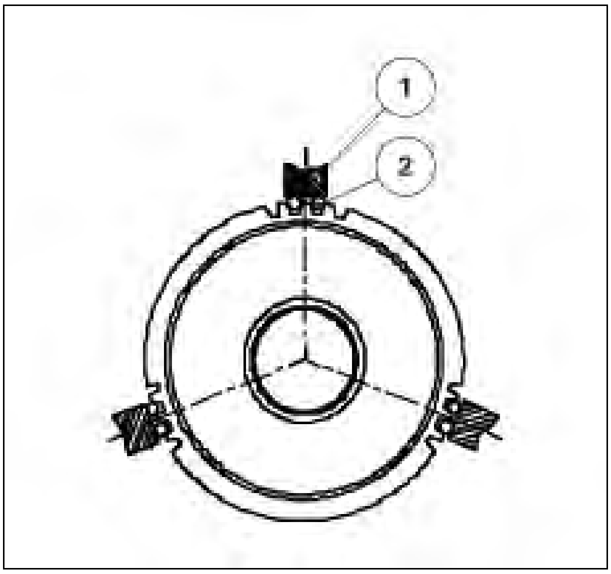
If the layshaft gear ring needs to be replaced, insert a new ring so that 0,1 mm to 0,25 mm of its rear rim is inserted into the rear rim of the gear.



I008169 Fig. 67

(1) Lathe mandrel
(2) 5 mm roll

Machine the internal diameter of the layshaft gear ring to a suitable dimension after assembly. Centre the layshaft gear as in the figure above, to ensure identical clearance between the teeth.

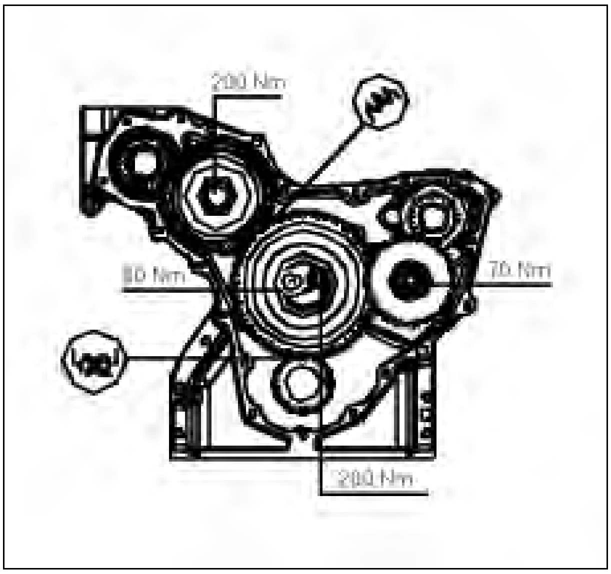


I008170 Fig. 68

Installing the timing housing

The position of the timing housing and the cover plate is determined by two tensioning pins. Therefore, do not centre the parts at the same time as installing them. However, do check the clearance between the teeth of the various gears. The ports intended for the tensioning pins are already machined into the housings and the covers are supplied as spare parts.

1. Apply a sealing paste to the friction surfaces and position the housing against the cylinder block. Drive in the tensioning pins using punch 9025 98700. Tighten the nuts and bolts.
2. Lubricate the camshaft bearings and insert the shaft into the cylinder block. Release the valve tappets and lifters if they have been suspended.
3. Assemble the layshaft gear with the shaft stud and ensure that the marks are correctly aligned. Fit the washer and tighten the bolts to the torque indicated.



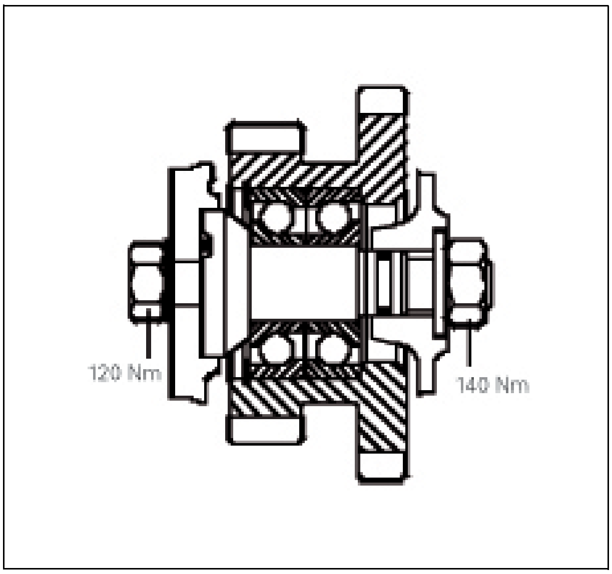
I008171 Fig. 69

4. Fit the bearings of the double layshaft gear . Fit the double layshaft gear using an "O" ring. Tighten the shaft attachment screw to a torque of 120 Nm.

   Important: *Fit the double layshaft gear shaft before fitting the high-pressure pump. Otherwise, it is impossible to tighten the screw in the shaft.*

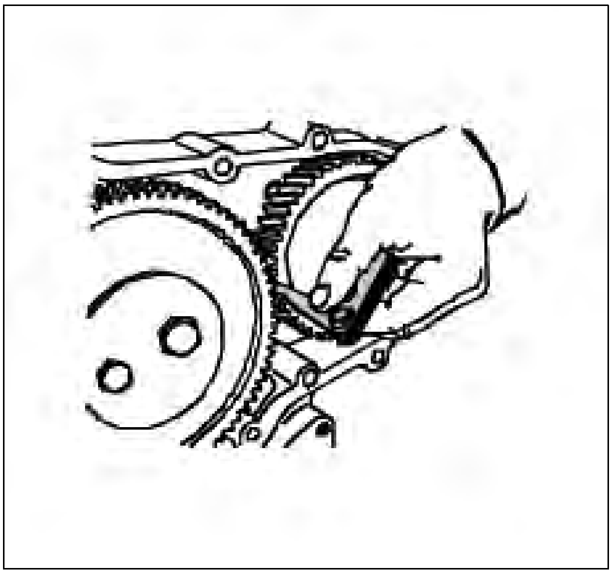
5. Fit the high-pressure pump and the gear.

6. Tighten the camshaft and the nuts of the high-pressure gear pump to the indicated torque.



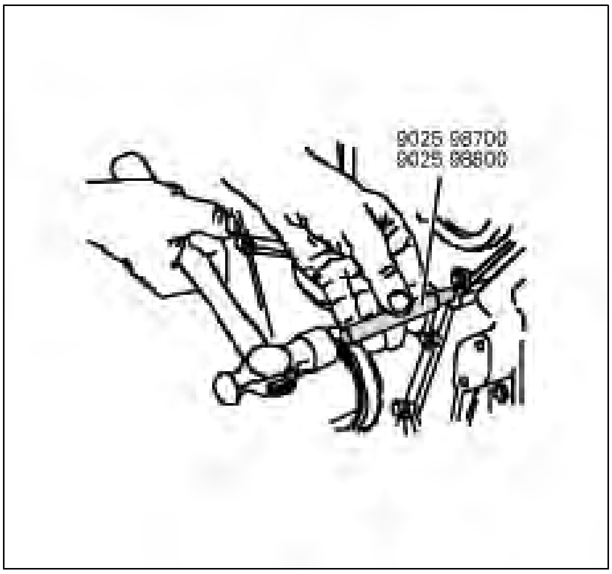
I008172 Fig. 70

7. Check the clearance at the teeth, which should be between 0,05 mm and 0,25 mm.



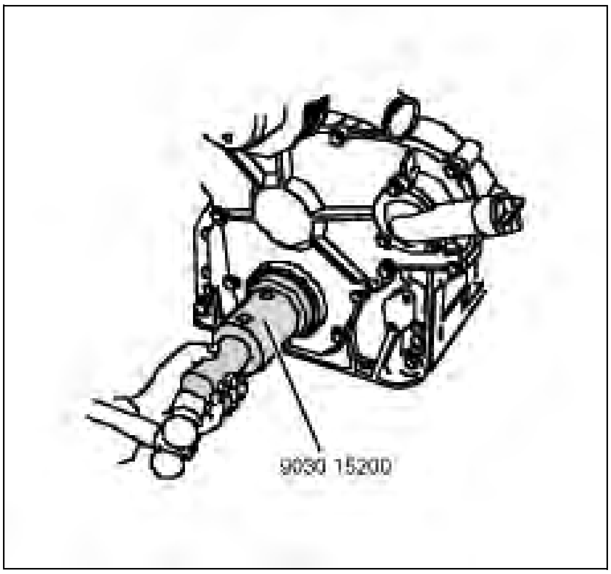
I008173 Fig. 71

8. Fit the oil deflector on the crankshaft and install the cover plate of the timing housing with a sealing paste. Insert the tensioning pins using punches 9025 98700 and 9025 98800 respectively (the spring pin inserted around the threaded stud). Tighten the nuts and bolts.



I008174 Fig. 72

9. Fit the safety shield in the seal location and fit the crankshaft front seal using special tool 9030 15200.

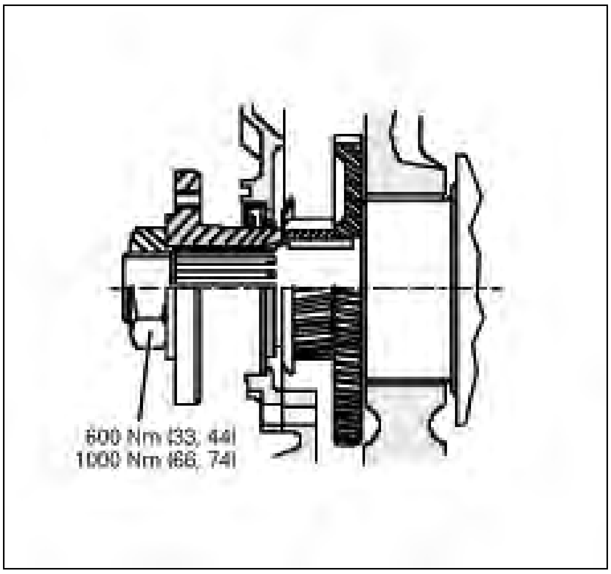


I008175 Fig. 73

10. Lubricate the seal and mating faces, then fit the crankshaft hub (with the belt pulley).

11. Apply grease to the threads of the crankshaft nuts. Tighten the nut to a torque of 600 Nm on 44 and 49 type engines and 1000 Nm on 66 type engines.

12. Reassemble the other parts.

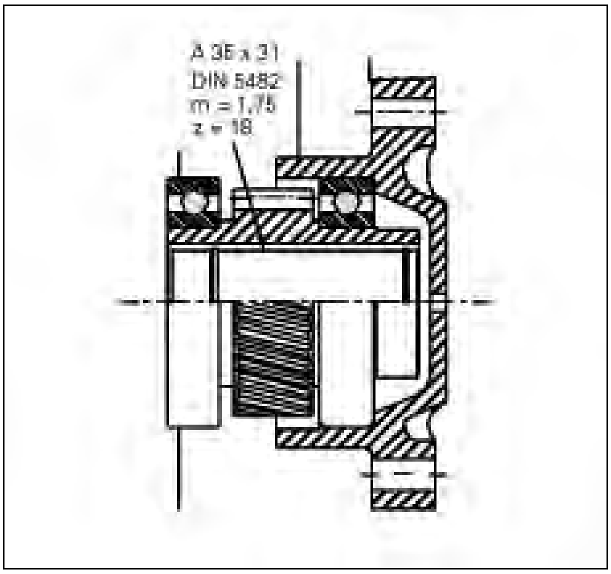


I008176 Fig. 74

Power take-off

The engines are equipped with a transmission that can be fitted with a power take-off activated by the camshaft gear. The power take-off can be used to operate a hydraulic pump, for example.

NOTE: *Use grease (NLGI 2) with molybdenum disulphide (MoS2) for ball bearings fitted in the grooves of the hydraulic pump shaft and drive sleeve.*



I008177 Fig. 75

J. Timing housing assembly for 74 and 84 type engines

This timing housing is equipped with a layshaft gear fitted with a ball bearing.

Removing the timing housing

The underside of the timing housing forms part of the combined surface of the oil sump, so it is impossible to remove the housing without first disassembling the oil sump.

1. Drain the engine oil and remove the oil sump.
2. Remove the radiator, fan, alternator, belt tensioner and belt (if they have not already been removed). If the engine is fitted with an air compressor or air conditioning unit, it must be removed.
3. Remove the crankshaft belt pulley and the vibration damper.
4. Loosen the crankshaft nut by about two turns (special tool 9024 55800). Install extractor 9104 53300 and extract the crankshaft hub. Take off the extractor, loosen the nut and remove the hub.

   Important: *Do not completely remove the nut at first. The hub can fly off dangerously when the nut is removed.*

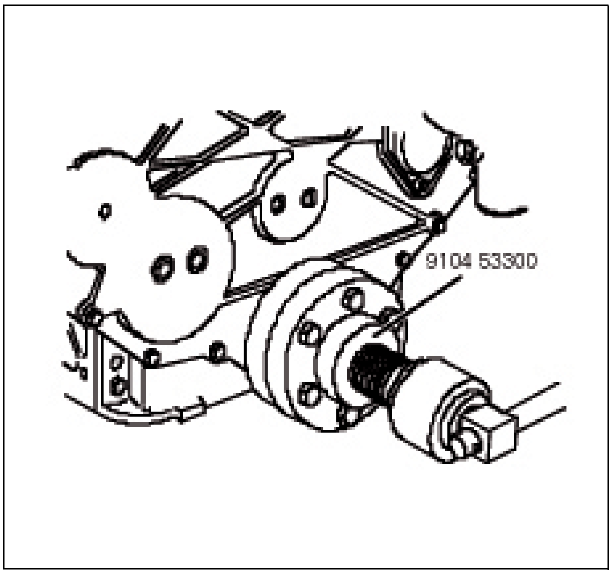
5. On 84 type engines, remove the cooling pump and check the attachment screws on the side of the high-pressure pump. Remove the cover plate from the timing housing.
6. Remove the high-pressure pump.

   Note: *If the cover plate of the timing housing does not need to be replaced, the high-pressure pump can stay in position. In this case, disconnect all the wires and pipes from the pump.*

7. Loosen the screw of the layshaft gear and remove the layshaft gear. Also remove the double layshaft gear and the small layshaft gear (large timing housing).
8. Extract the camshaft.

   Note: *If the cylinder head and valve mechanism have not been removed, ensure that the valve lifters are not able to fall out.*

9. Remove the timing housing. Check the condition of all the mating faces.
10. Remove the front crankshaft seal ring from the front housing and clean all the disassembled parts.



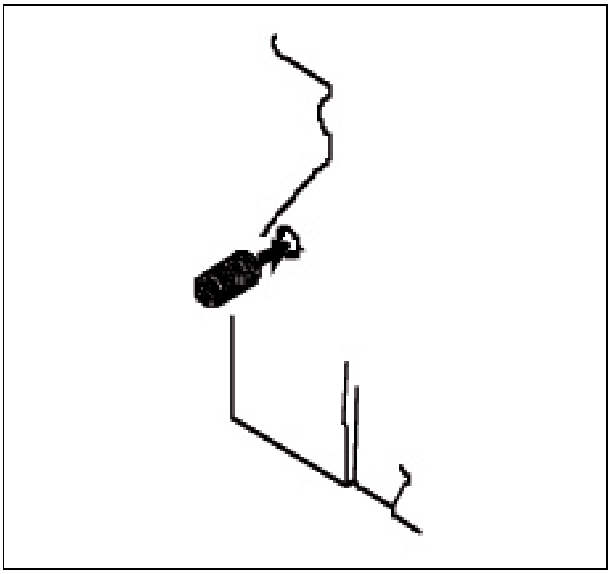
I008178

Fig. 76

Installing the timing housing

The position of the narrow timing housing and the cover plate is determined by two tensioning pins. Therefore, do not centre the parts at the same time as installing them. However, do check the clearance between the various gears. The ports intended for the tensioning pins are already machined into the housings and the covers are supplied as spare parts.

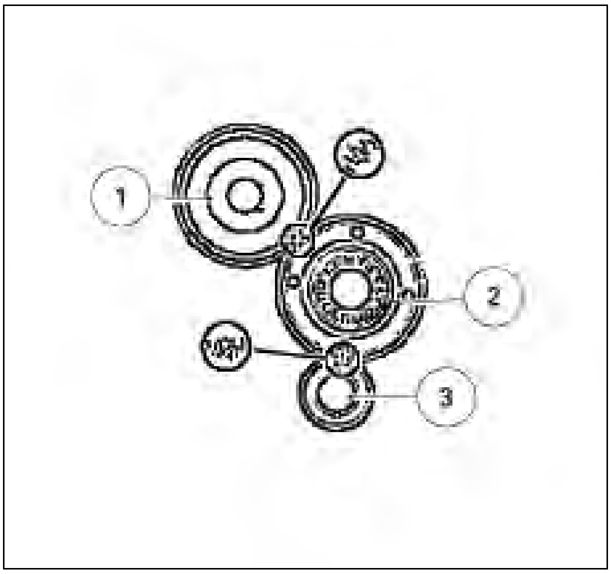
Note: *The front cover plate of the large timing housing is centred by the shafts of the layshaft gear. Separate dowel pins are not used.*



I008179 Fig. 77

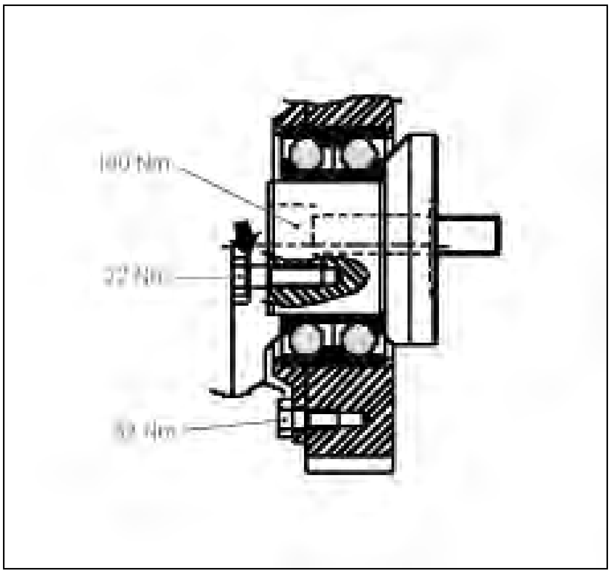
1. Screw threaded part M14/M8 into the cylinder block of the 84 type engine. Apply a sealing paste to the friction surfaces and position the housing against the cylinder block. Drive in the tensioning pins using punch 9025 98700. Tighten the screws and nuts.
2. Lubricate the camshaft bearings and insert the shaft into the cylinder block. Release the valve tappets and lifters if they have been suspended.

(1) Camshaft gear
(2) Layshaft gear
(3) Crankshaft gear



I008180 Fig. 78

3. Assemble the layshaft gears as illustrated. Lock the big layshaft gear in position. Note the position of the timing marks. Tighten the attachment screw in the highest position with a sealant product.



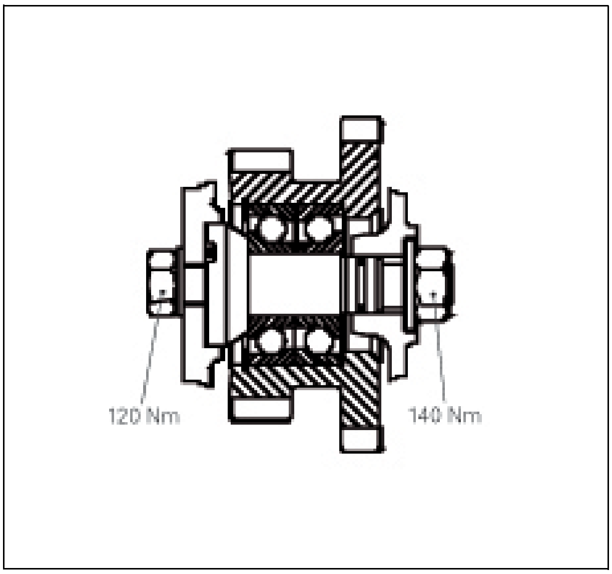
I008181 Fig. 79

4. Fit the bearings of the double layshaft gear as shown in the image. Fit them using new "O" rings. Tighten the shaft attachment screw to a torque of 120 Nm.

On 74 and 84 type engines, the double layshaft gear has a different number of teeth than the high-pressure pump gearing. The surfaces of the gears are marked with grooves for identification, as follows:

Engine	Reference grooves	Double layshaft gear	High-pressure pump gear
74	1-	8370 70086 / z = 45	8370 70087 / z = 30
84	2	8370 70072 / z = 51	8370 70073 / z = 34

NOTE: *Fit the double layshaft gear shaft before fitting the high-pressure pump. Otherwise, it is impossible to tighten the screw in the shaft.*



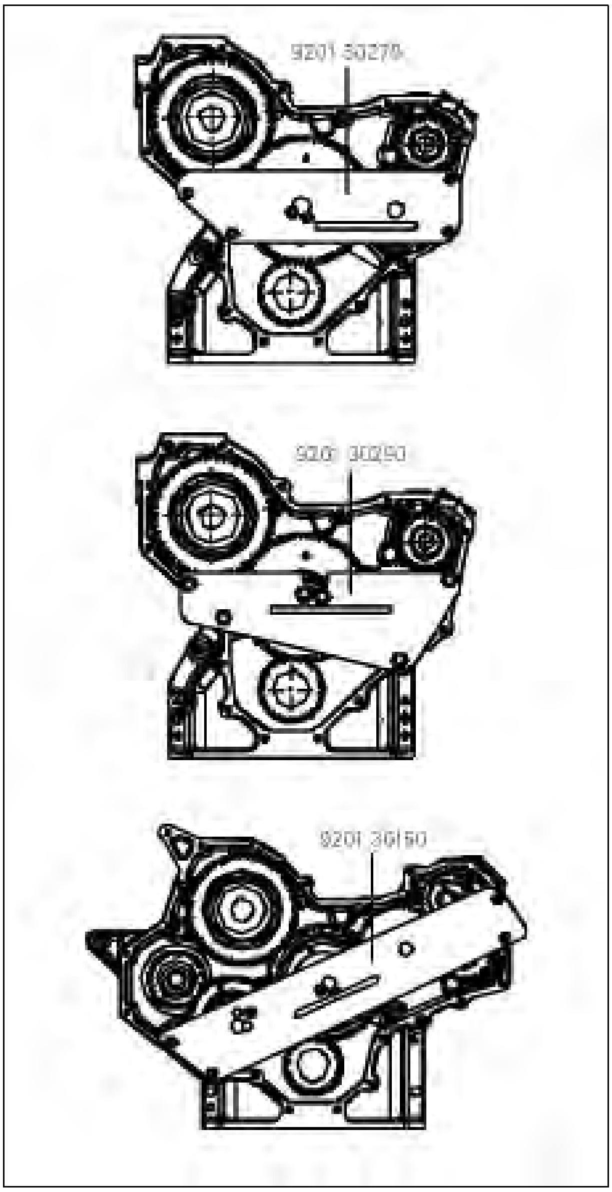
I008182

Fig. 80

5. Fit the high-pressure pump and the gear.

6. Tighten the guide screws on the frame of the centring tool and position the unit on the layshaft gears, as illustrated (the guide screws in the ports in the layshaft gear shaft and the ports in the housing). Tighten the layshaft gear screws in the ports of the centring tool. Tighten the layshaft gear screw (M14) to a torque of 180 Nm and the small layshaft gear screws (M8) to a torque of 45 Nm. Remove the centring tool.

Centring tool	Engine	Timing housing
9201 30270	74	8370 70062 - narrow 8370 70157 - narrow/drive mechanism
9201 30290	84	8370 70064 - narrow
9201 30150	84	8370 70107 - big/hydraulic pump PTO 8370 70109 - big/compressor PTO



I008183

Fig. 81

7. Tighten the camshaft and the nuts of the high-pressure gear pump to the appropriate torque.

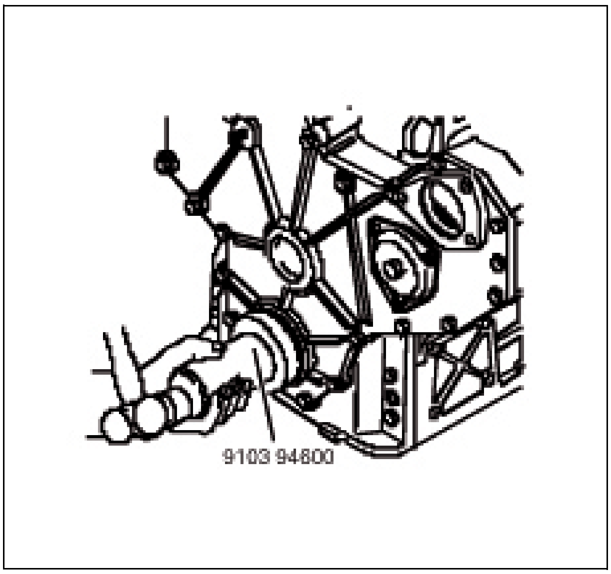
8. Check the clearance at the teeth, which should be between 0,05 mm and 0,25 mm.

9. Fit the shaft of the drive mechanism onto the front cover plate (engines with drive mechanism). Fit the cover plate and install the tensioning pins (narrow timing housing). Check the gaskets of the layshaft gear shaft screws. Fit the rear bearing and cover on the drive mechanism.

NOTE: *If the oil thrower ring is removed from the crankshaft, fit it using punch 9103 94900 before refitting the cover.*

10. Tighten the nut of the double layshaft gear to a torque of 140 Nm.

11. Fit the protective plate to the lower part of the seal and fit the front seal onto the crankshaft using special tool 9103 94600.

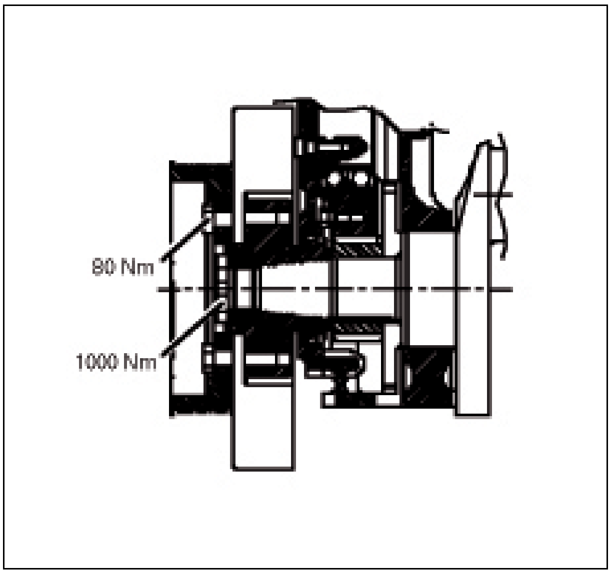


I008184 Fig. 82

12. Lubricate both the seal and the mating face and fit the crankshaft hub. Lightly lubricate the thread of the crankshaft nut and tighten the nut to a torque of 1000 Nm.

13. Reassemble the other parts.

Fan drive mechanism



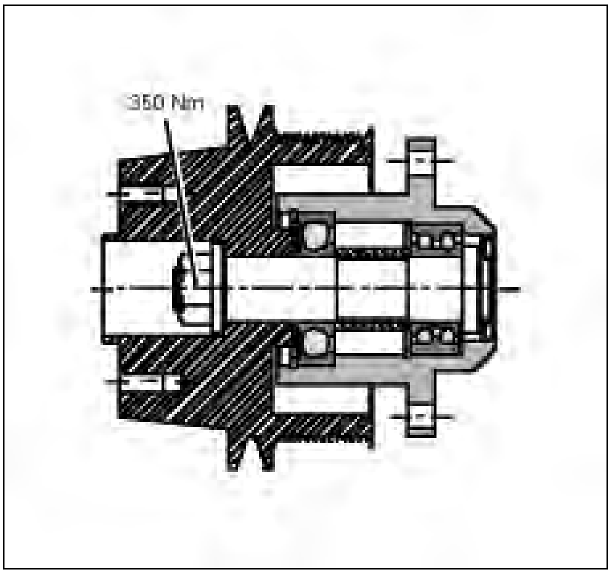
I008185 Fig. 83

1. Assemble the drive mechanism as illustrated. Fit the internal bearing and the locking ring. Partially fill the bearing housing with heat-resistant ball bearing grease (NLGI 2). Fit the spacer sleeve, external bearing and locking ring. Note the position of the external bearing during assembly.

2. Press on the shaft until its positioning prevents the ball bearings from transmitting pressure.

3. Tap the blocking plug (if removed) to position it correctly using fitting punch 9025 87400.

4. Fit the belt pulley, washer and nut. Tighten the nut to a torque of 350 Nm.



I008186 Fig. 84

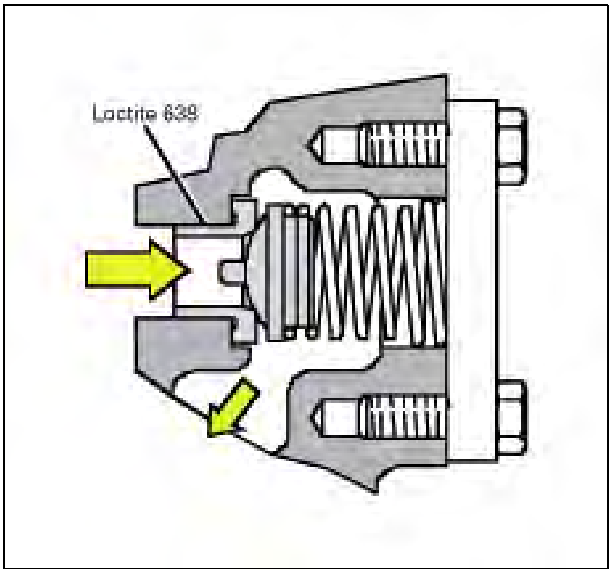
K. Lubrication system

Oil pressure regulating valve

If the engine lubricating oil pressure is too low or inconsistent, check the oil level and then the regulating valve.

1. Remove the cover and spring with the valve disc.
2. Clean the parts and check that the mating faces are not damaged. Any damaged parts should be replaced. Scrape off any residue left on the seal.

   Note: *There are two types of spring.*
3. Apply sealant fluid (Loctite 638, for example) on the outside of the valve seat. Using a suitable punch, tap on the new valve seat to insert it into the cylinder block. Insert the spring with the valve disc into the cylinder block and fit the cover with a new seal.



I008187 Fig. 85

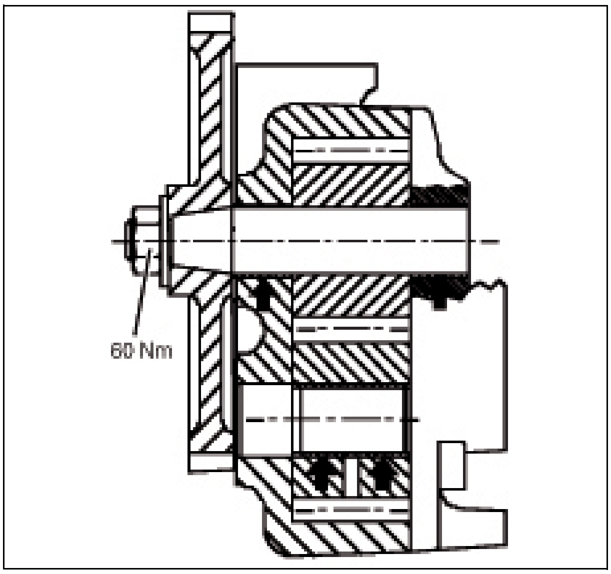
Removing and disassembling the lubricating oil pump

1. Drain the engine oil and remove the oil sump.
2. Remove the suction pipe and the pressurised pipe from the oil pump.
3. Take out the oil pump with the shims inserted between the pump and the cylinder block.
4. Remove the pump cover and seal. Remove the gearing and the lazy axle.
5. Clamp the pump gearing by its teeth in a vice with soft jaws and loosen the driving gear nut. Strike the end of the sleeve with a soft hammer to remove the gearing. Extract the gear from the driveshaft.
6. Clean the parts, check them for wear and assess their general condition. Replace any damaged parts and all the seals.
7. On 66, 74 and 84 type engines, the bearing points are fitted with separate bearing rings. If the rings need replacing, machine them to between 18,000 mm and 18,018 mm after assembly.

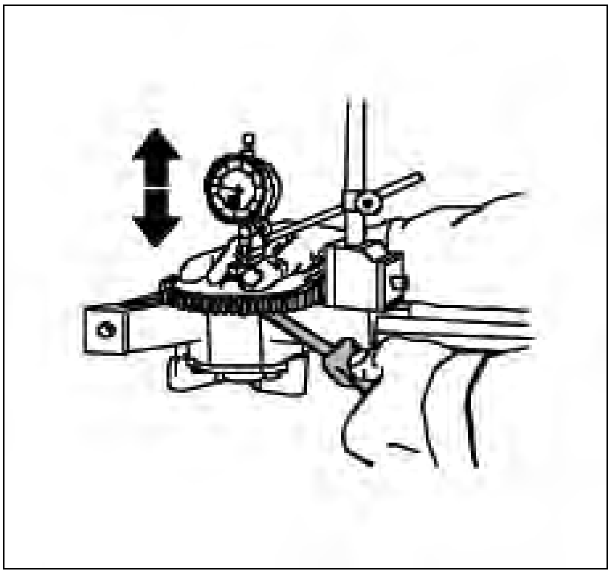
Assembling and installing the lubricating oil pump

1. Fit the gears on the body of the pump. Fit the cover and use a new seal. Partially tighten the screws. Turn the pump shaft and lightly tap the side of the cover until the shaft reaches the position in which it rotates most freely. Tighten the screws and check that the shaft still rotates freely.
2. Fit the driving gear onto the shaft. Apply sealant fluid (Loctite 242, for example) to the thread of the nut and tighten to 60 Nm. Remember to fit the washer under the nut.

3. Clamp the oil pump in a vice and check the axial clearance between the gearing and the pump housing. The clearance should be between 0,03 mm and 0,11 mm, and is set by the number of seals between the cover and the body.



I008188 Fig. 86



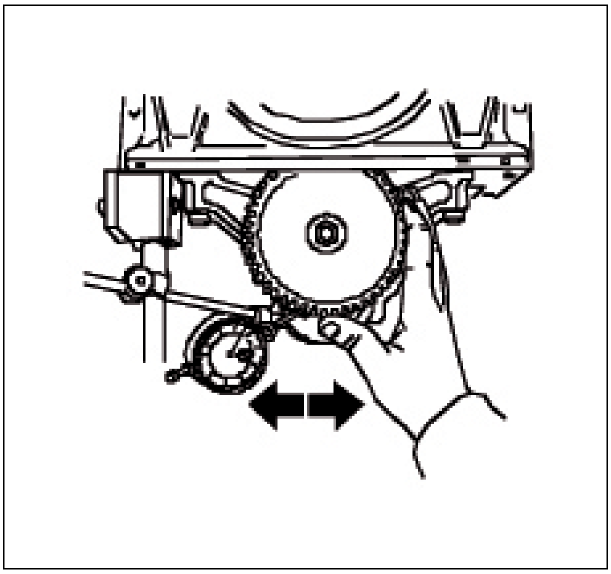
I008189 Fig. 87

4. Position the pump and check the clearance between the teeth and the crankshaft gear. The clearance should be between 0,05 mm and 0,25 mm, and is set using shims inserted between the pump body and the cylinder block (0,2 mm shim, reference 8360 07871). Each shim increases or decreases the clearance by approximately 0,07 mm.

Note: *When measuring the clearance between the teeth, the engine should be correctly turned upwards, because the crankshaft bearing clearance affects the clearance between the teeth.*

5. Connect the suction and pressurised pipes, using new seals.

6. Fit the oil sump and top up the lubricating oil.

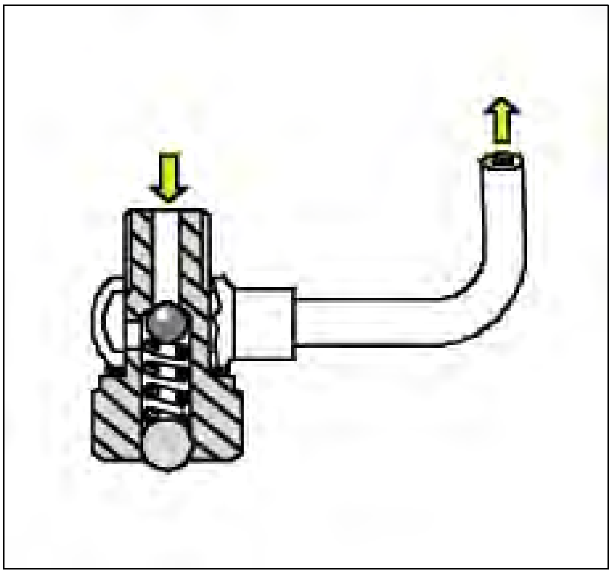


I008190 Fig. 88

Piston cooling nozzles

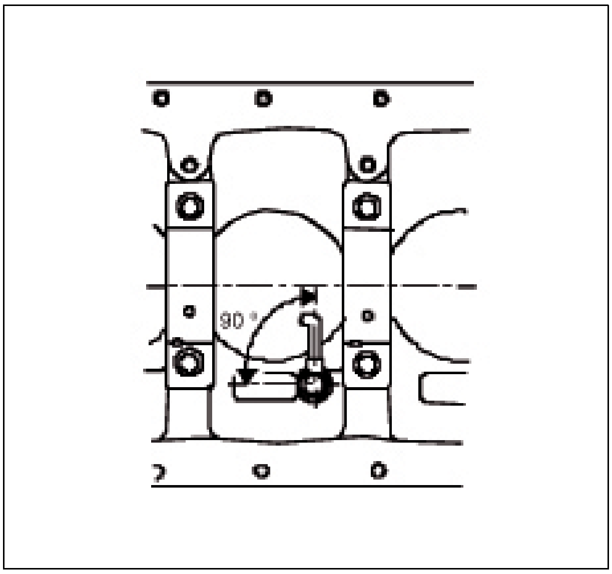
Very powerful engines are fitted with piston cooling nozzles. These nozzles can be disassembled once the oil sump has been removed. They are fitted with a ball valve with an opening pressure of $3^{\pm 0.25}$ bar.

1. Replace the valve if required. Detach the valve from the engine and remove the nozzle pipe. Fit a new valve.



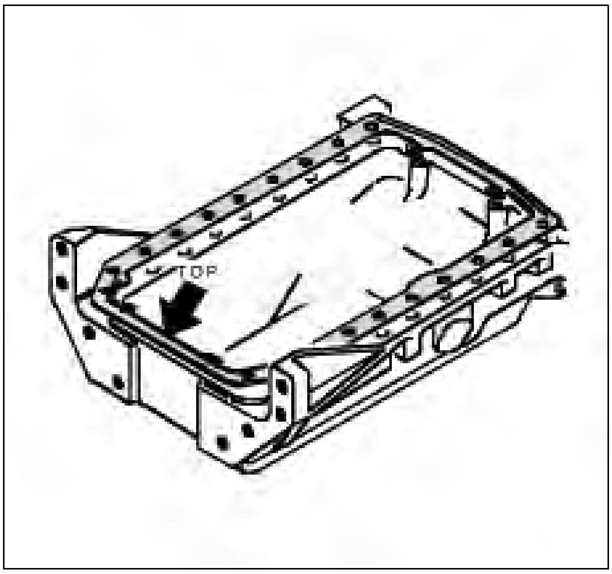
I008191 Fig. 89

2. Assemble the nozzle pipe at an angle of 90° from the median line of the crankshaft, as in the illustration above. Tighten the valve to a torque of 30 Nm. Ensure the pipe does not come into contact with the pistons or rods when the engine is running.



I008192 Fig. 90

Installing the oil sump seal



I008193 Fig. 91

Fit the oil sump seal with the silicone strips up against the cylinder block (film-forming, moulded oil sumps).

Lubricating oil cooler

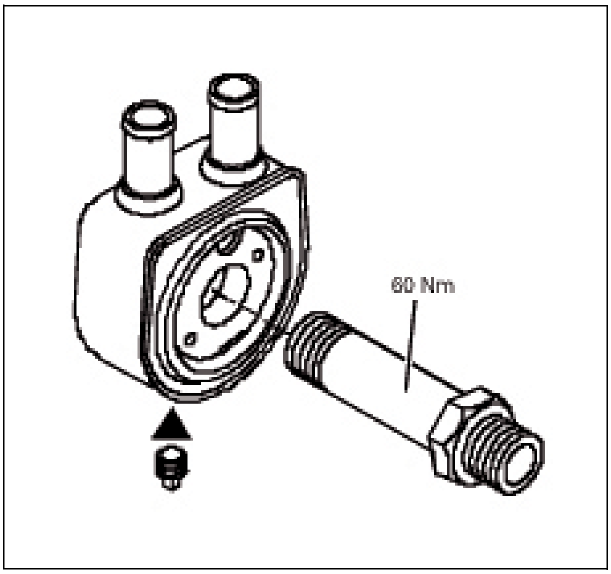
44, 49, 66 and 74 type engines

Some engines are fitted with a lubricating oil cooler, which is located between the oil filter and the cylinder block.

1. The engine coolant must be drained before the oil cooler is removed.

2. Fit new seal rings. Position the cooler with the drain plug turned downwards. Connect the coolant pipes, ensuring they point in the correct direction.

3. Apply sealant fluid (Loctite 242, for example) to the grease nipple (attachment thread on the cylinder block) and tighten to a torque of 60 Nm.

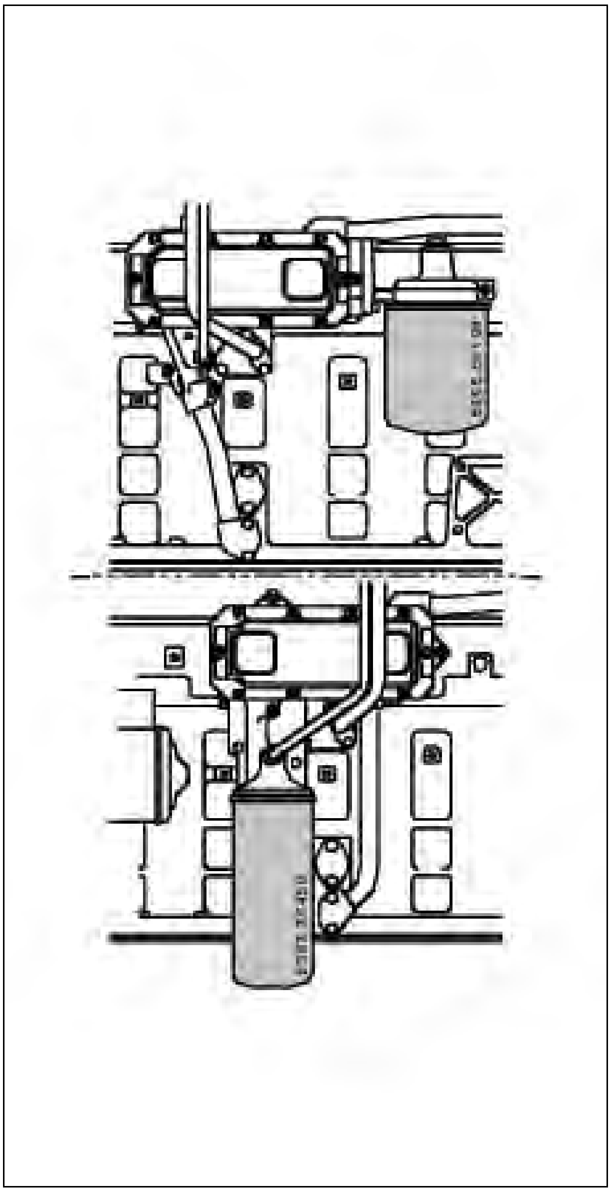


I008194 Fig. 92

84 type engines - Removal

Two oil coolers are available, each having the oil filter in a different position (Fig. 93).

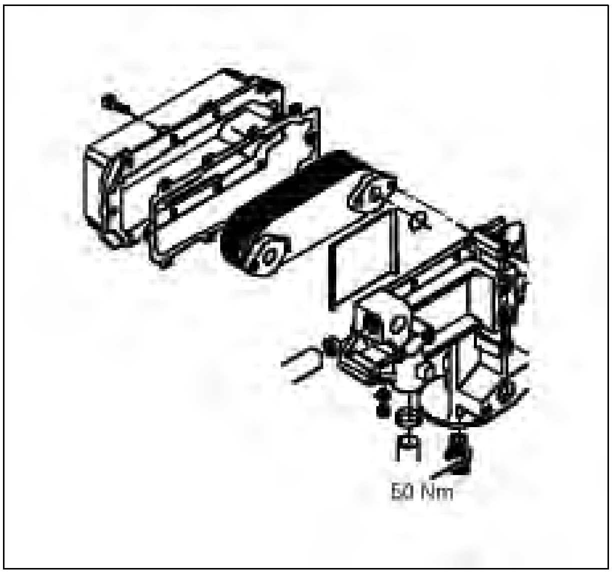
1. Open the coolant drain plug located under the oil cooler and drain the coolant into a suitable container. Remove the pipe connecting the thermostat housing.
2. Remove the oil pipes from the turbocharger and the pressurised oil pipe from the cylinder block. Remove the oil filter. Drain the oil into a receptacle.
3. Remove the engine oil cooler. Open the cooler housing and take out the guide plate. Loosen the sensor screws and take the sensor out of the body. Clean all components.



I008195 Fig. 93

Installing the oil cooler

1. Assemble the oil cooler with new seals. Fit the sensor on the body. The pressure on the oil side can be tested before the housing is fitted. The test pressure is 5 bar.
2. Push the guide plate between the sensor and the body, then fit the housing. If necessary, the pressure on the water side can now be tested. The test pressure is 5 bar.
3. Attach the oil cooler to the engine and fit the oil and coolant pipes. Replace the oil filter.
4. Fill the cooling system. Start the engine and check that there are no leaks.



I008196

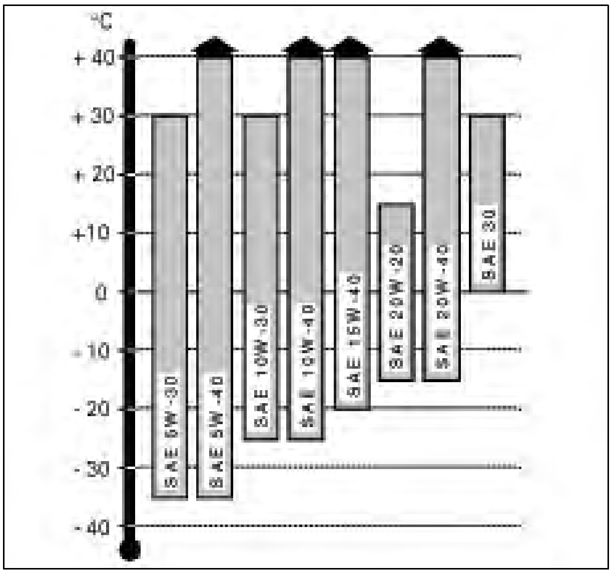
Fig. 94

Lubricating oil quality requirements

Use lubricating oils with the following quality grades.

API grade	ACEA grade
CI-4	E7

Select a viscosity grade depending on the outside temperature (Fig. 95).



I008197

Fig. 95

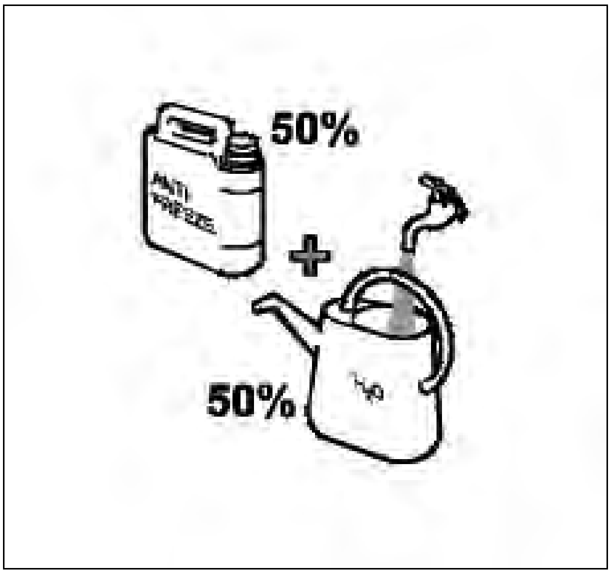
L. Cooling system

Required coolant quality

The coolant used must comply with the requirements of the standard ASTM D 3306 or BS 6580:1992.

- The coolant must be 40 to 60% ethylene glycol/propylene-glycol based antifreeze plus water. The ideal proportions are 50% antifreeze to 50% water.
- The water must be mechanically cleaned and must not be too acidic (swamp) or too hard (calcareous well water).
- The proportion of coolant (quality of resistance against freezing) must be checked regularly. Replace the coolant every two years.

IMPORTANT: *Never use pure water as a coolant!*



I008199 Fig. 96

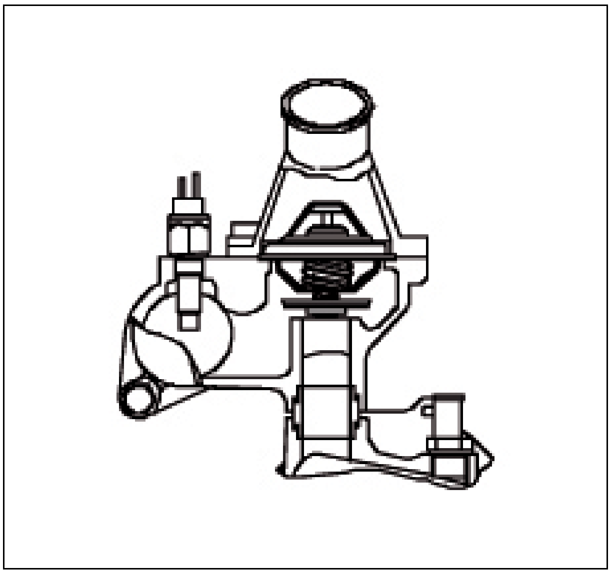
Thermostat

Check the operation of the thermostat as follows:

1. Immerse the thermostat in a container of boiling water such that it does not touch the sides or the bottom of the container.
2. The thermostat should start to open in less than 20 seconds.
3. The thermostat should open fully in under 50 seconds.

44, 49 and 66 type engines

These use a two-way thermostat. The opening temperature is 83 °C.

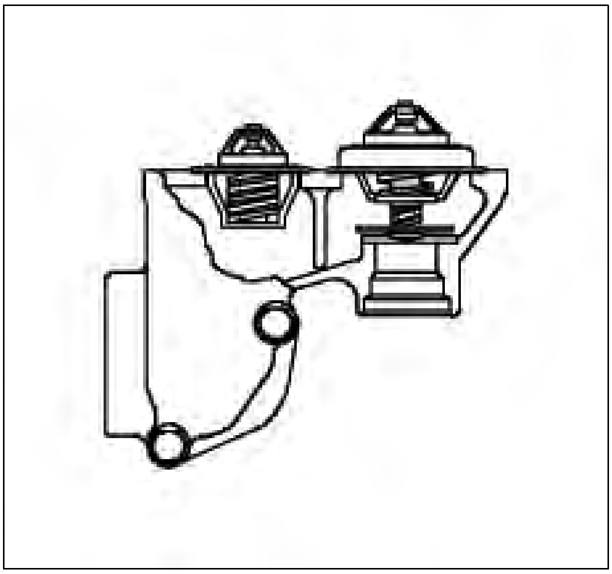


I008200 Fig. 97

66 and 74 type engines

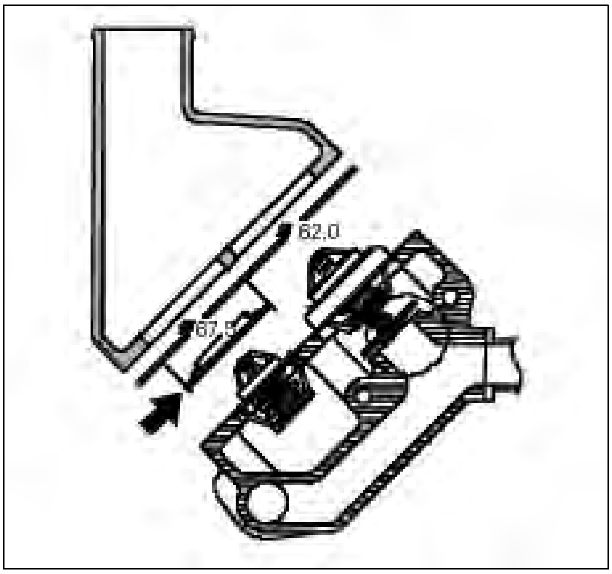
Some 66 and 74 type engines are equipped with two separate thermostats. They are different from the type used as a single thermostat and the two models are not interchangeable. For these engines, there is no independent winter thermostat.

84 type engines



I008201 Fig. 98

84 type engines are equipped with two independent thermostats. The smallest, which is a single-acting thermostat, opens at a temperature of 79 °C and the other, which is double acting, opens at 83 °C. In these engines, there is no separate winter thermostat.



I008202 Fig. 99

Removal

1. Drain the cooling system so that the coolant level is below the level of the thermostats and detach the upper hose from the water outlet cover plate.
2. Remove the outlet cover plate and the thermostats. Clean the mating faces.

Replacement

1. Fit the thermostats in place in their housing. Fit a new seal and fit the outlet cover plate. M8 studs (2 studs) can be used as guides. Check that the plate (if fitted) is positioned on the top of the smallest thermostat. Fit the seal so that the large diameter port is on the same side as the plate.
2. Connect the upper hose and fill the cooling system.

Reconditioning the water pump

44, 49, 66 and 74 type engines

1. Drain the coolant. Remove the thermostat housing, the fan and the V belt.
2. Take off the water pump. Detach the pump rear plate and clean the mating faces.
3. Unscrew the belt pulley nut/attachment screw and remove the pulley.

4. Remove the turbine from the shaft using extractor tool 9104 27700 (33 and 44 type engines) or 9101 93200 (66 and 74 type engines).

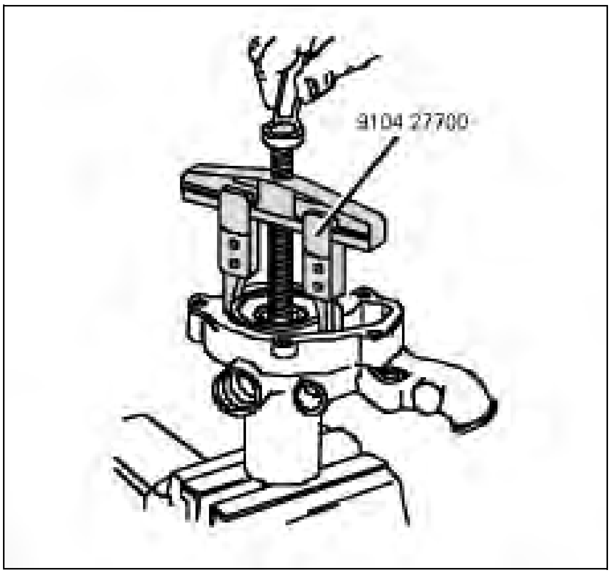
5. Remove the circlip from the pump body. Press the shaft with the bearings in the direction of the fan. Use a hydraulic press, for example. Support the pump body so that there is enough room to release the bearings.

6. Tap on the water seal and the shaft seal using a punch to remove them. Clean the parts and examine their condition. Replace any defective or worn parts with new parts.

Note: *If the pump bearings have to be replaced, use an overhaul kit. This kit also contains all the seals*

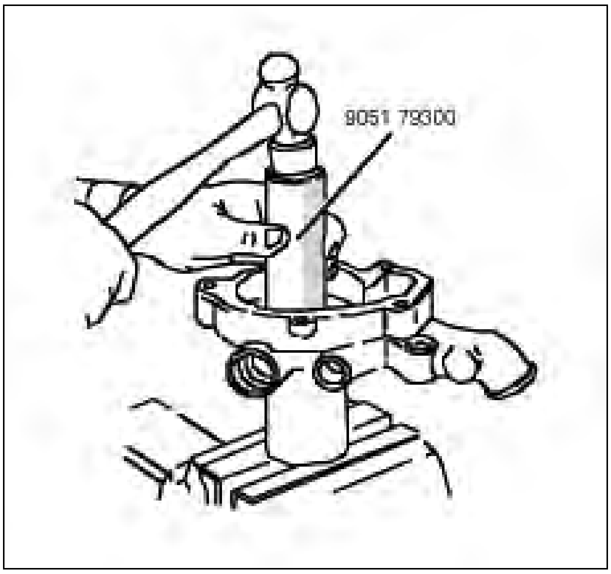
7. Insert the new shaft seal into the housing using a suitable punch. Fit the bearings and the sleeve cone onto the shaft. Lubricate the bearings with heat-resistant grease for ball bearings (NLGI 2). Fit the shaft and the bearings so that the ball bearings transmit no pressure. Fit the circlip onto the bearing.

8. Fit the water seal using punch 9051 79300. Use a "lubricating" coolant between the shaft and the seal.



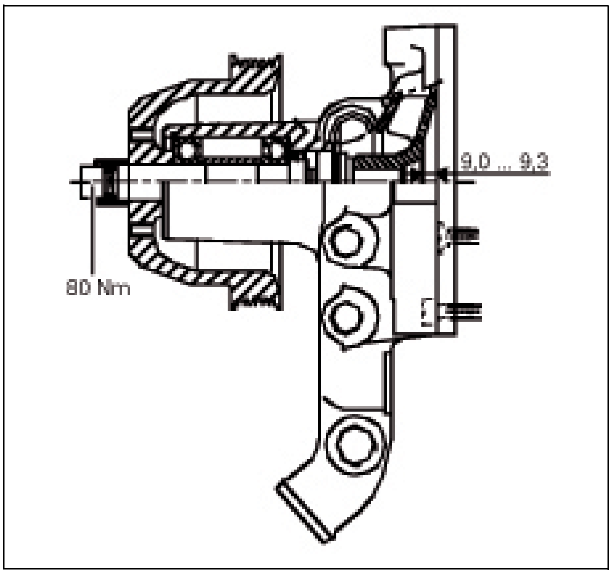
I008203

Fig. 100



I008204

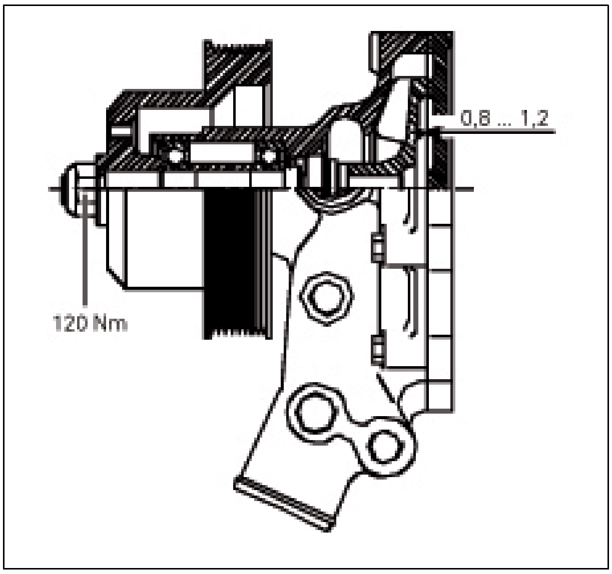
Fig. 101



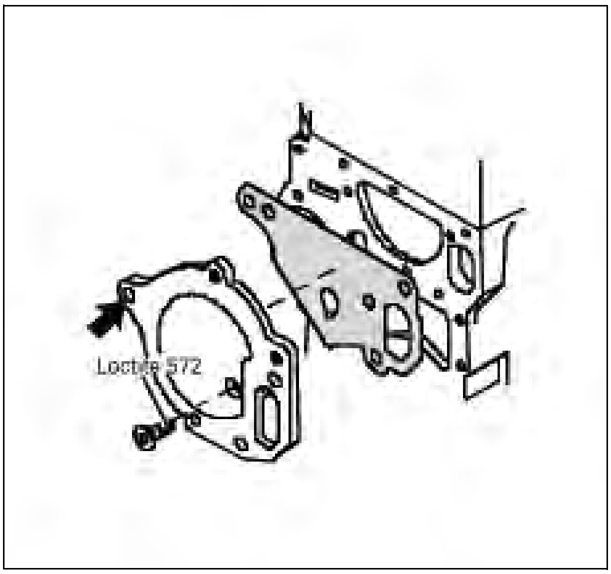
I008205 Fig. 102

9. Drive the turbine into position while supporting the shaft from the other end. The turbine fitting depth is between 9,0 mm and 9,3 mm on 33 and 44 type engines . Check that the shaft rotates freely. Fit the belt pulley and tighten the attachment screw to a torque of 80 Nm. In particular, mark the left-hand thread of the belt pulley attachment screw.

The turbine fitting depth is between 0,8 mm and 1,2 mm on 66 and 74 type engines . Check that the shaft rotates freely. Fit the belt pulley and tighten the retaining nut to a torque of 120 Nm.



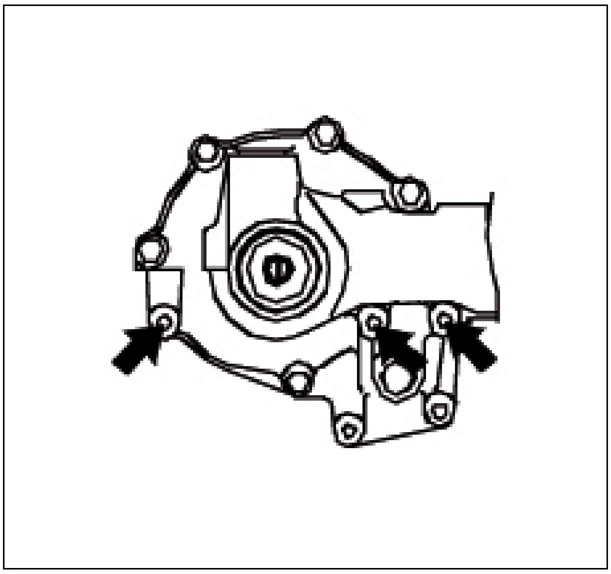
I008206 Fig. 103



I008207 Fig. 104

10. Fit the rear plate to the cylinder block with a new seal. Use a dowel pin (Ø 8 mm) in the port shown by . Apply sealing paste to the screw thread.

On 66 and 74 type engines, fit the rear plate to the pump with a new seal. Use dowel pins (Ø 8,5 mm) in the ports shown by .



I008208 Fig. 105

Water pumps with bearings for harsh service (66 and 74 type engines)

Some versions of 66 and 74 type engines are fitted with bearings for harsh service inside the water pump. In particular, mark the position of the bearing before and during assembly.

Reconditioning the water pump

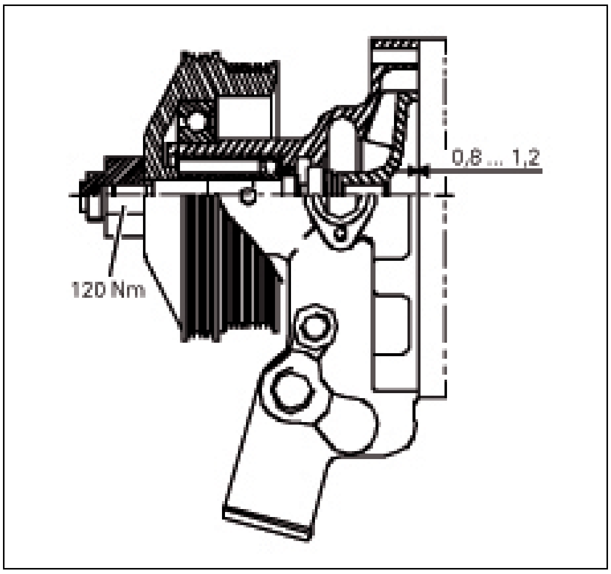
84 type engines

1. Drain the coolant. Detach the inlet union hose from the water pump. Loosen the water pump coolant pipes.

2. From the back, loosen the three screws connecting the water pump to the timing housing cover plate. Take off the water pump.

3. Unscrew the gear retaining nut and remove the gear. Remove the pump housing from the pump body.

4. Remove the circlip from the pump body. Press the shaft with the bearings in the direction of the gear.



I008209 Fig. 106

5. Tap on the water seal and the shaft seal using a punch to remove them. Remove the "O" rings, clean the parts and examine their condition. Replace any defective or worn parts with new parts.

***Note:** If the pump bearings have to be replaced, use a pump repair kit. This kit also contains all the seals (see parts catalogue).*

6. Insert the new shaft seal into the body using punch 9103 41000. Lubricate the bearings with heat-resistant grease for ball bearings (NLGI 2). Press on the bearings and fit the circlip.

7. Fit the shaft so that the ball bearings transmit no pressure.

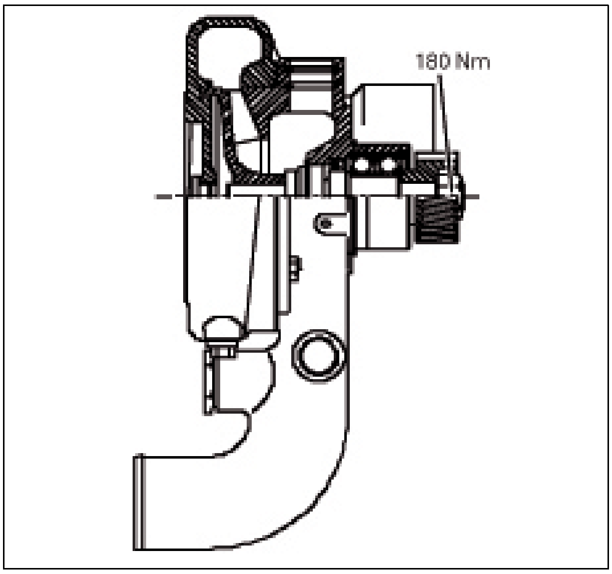
8. Tap on the water seal to fit it in place using tool 9103 41100. Press on the turbine to fit it into position (near the shaft shoulder), while supporting the shaft from the other end. Check that the shaft rotates freely.

9. Fit the gear to the shaft and tighten the nut to a torque of 180 Nm.

10. Fit the pump housing and use a new seal.

11. Fit the pump and use a new "O" ring.

***Note:** If the water pump and the injection pump are removed, first fit the water pump (there is an attachment screw that cannot be fitted when the injection pump is fitted in place).*



I008210

Fig. 107

M. Inlet and exhaust system

An engine equipped with a turbocharger is much more sensitive to variations and impurities in the inlet and exhaust systems than an engine with a normal intake system. It is therefore necessary to pay particular attention to checking the entire inlet and exhaust system.

Checking the air filter

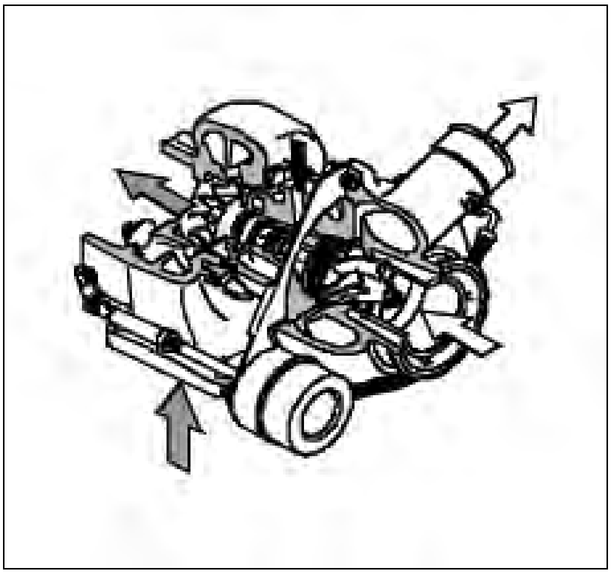
Engine performance and life span depends to a great extent on the condition of the air filter. A defective air filter allows impurities to pass through which cause damage to the turbocharger and the engine. A blocked air filter reduces engine power and also leads to leakages of oil from the turbocharger shaft gasket.

NOTE: *The safety filter inside the main filter must not be removed unnecessarily for checking or cleaning. It must not be cleaned, but can be replaced if required.*

Checking the inlet and exhaust pipes

IMPORTANT: *Leakages from the inlet or exhaust system result in a significant reduction in turbocharger performance. As a result of the pressure, even minor leakages from the manifold or the turbine inlet contact flange very quickly become major leakages. Any leakage must therefore be dealt with immediately.*

1- Intake air
2 Exhaust fumes
3 Lubricating oil



I008211

Fig. 108

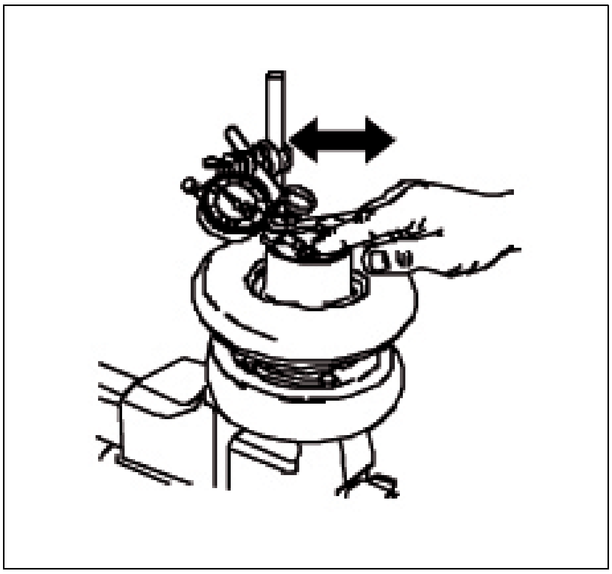
1. Examine the pipes and mating faces between the air filter and the turbocharger as well as between the turbocharger and the inlet manifold. If the inside of the inlet manifold is dusty, this indicates a leakage in the air filter or in the inlet pipes. Repair the leakage.
2. Clean the mating face of the inlet manifold. Check that the surface is even, using a rule. If the surface is uneven or scratched, machine or replace the inlet manifold. On engines 66, 74 and 84, check that the cylinder heads are parallel.
3. Fit a new seal and fit the inlet manifold. Tighten the manifold attachment screws to a torque of 30 Nm. Carefully fit the air pipes.
4. Check that the exhaust manifold is airtight. Tighten the nuts to a torque of 50 Nm and check that there is no damage (cracks, deformation, corrosion etc.). Also check the connection between the turbocharger and the exhaust manifold.
5. If necessary, remove the manifold. Clean the mating faces and remove all carbon deposits. Check that the mating faces are even. If the securing flanges are twisted or the mating faces are scratched, machine the flanges or replace the exhaust manifold.
6. Check that the exhaust pipe and silencer are free from foreign material and impurities. Any foreign material or impurity can increase the return pressure of the exhaust fumes from the turbine wheel.

Checking the turbocharger

If turbocharger failure is suspected, carry out the following operations to locate the fault:

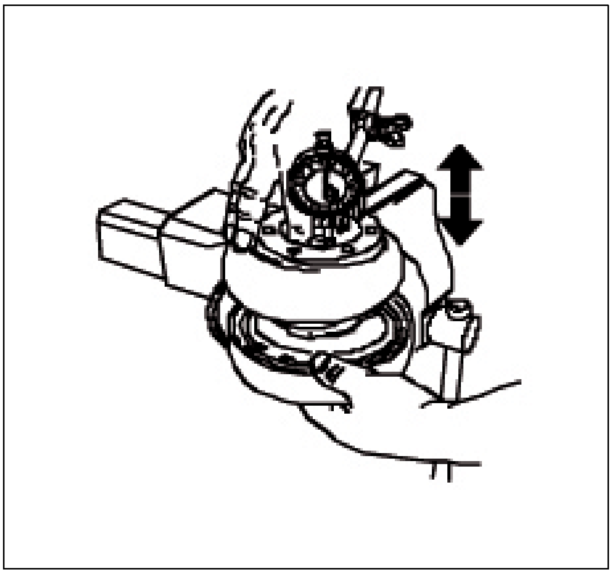
1. Visually inspect the turbine and the compressor wheels. The fins should not be damaged or deformed nor worn by foreign material.
2. Look for any leakage of oil from the turbine shaft seal rings and the compressor housing.

   Note: *At low idle speed, a certain amount of oil always seeps onto the side of the compressor. Do not be overly concerned unless the oil consumption is very high.*
3. Check the rotational play of the turbine shaft. Place the tip of a dial gauge against the shaft and move the shaft sideways. Refer to the amount of play shown in the specifications.



I008212 Fig. 109

4. Check the axial clearance of the shaft. Place the tip of the dial gauge against the end of the shaft and move it according to the pin. Refer to the amount of play shown in the specifications.



I008213 Fig. 110

If a defect or wear is detected, repair the turbocharger.

If the engine is not operating correctly and the turbocharger is neither defective nor worn, the failure may be caused by the following components:
- blocked air filter
- leakage from the inlet or exhaust systems
- leakage from the flange seal
- defective injection pump or EEM 3 control unit
- defective or incorrectly adjusted injectors
- low fuel pressure (for example: blocked fuel filter)
- low compression, incorrect valve clearance

Installing the turbocharger

Locate the cause of the turbocharger failure. Repair the fault before fitting the new turbocharger.

In order for the turbocharger to operate satisfactorily, it is important that the engine oil is of the correct grade and quality. It must also comply with the engine oil specification. The air and oil filters must be maintained

Adjustment of the injection system plays a crucial role in the operation of the turbocharger. The injection system must be adjusted in accordance with the manufacturers' instructions.

1. Check the sealing of the inlet and exhaust manifolds and their mounting. Ensure that there are no particles of carbon and rust or foreign material inside the manifolds.

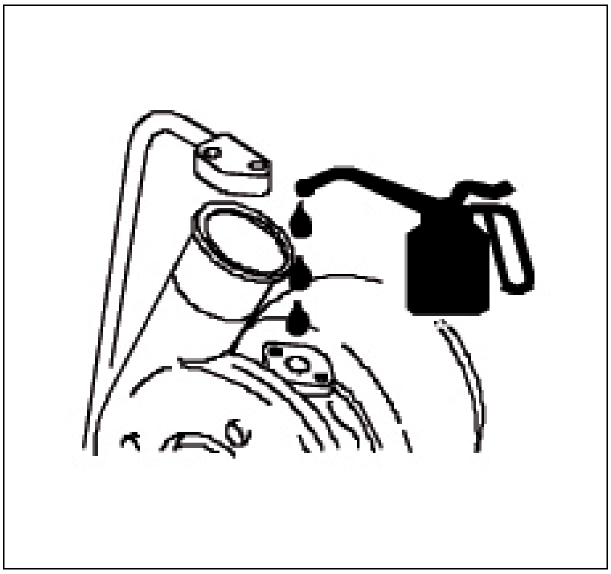
2. Connect the turbocharger to the exhaust manifold and ensure it is sealed with a new seal.

3. Connect the inlet and exhaust pipes to the turbocharger.

4. Pour approximately 0.1 litres of pure engine oil into the bearing housing before fitting the pressurised oil pipe. This step is very important to ensure that the turbocharger is lubricated during start-up.

5. Connect the pressurised oil and return pipes. Use a new seal. Check that there is no tension in the pipes when tightening.

6. Start the engine and check that there are no leaks.



I008214

Fig. 111

N. Injectors/pump

Removing the injectors, 4 V engine

1. Clean the high-pressure pipes and the surrounding surfaces.

2. Remove the valve cover plate.

3. Remove the high-pressure pipe and the injector wiring.

NOTE: *Prevent any fuel from circulating inside the engine via the overflow pipe located in the cylinder head (if the fuel tank is above the engine).*

4. Loosen the attachment screw holding the injector in place and the retaining nut securing the fuel supply pipe in position. Loosen them and remove them. Fit the plastic cover plates to all the connecting points.

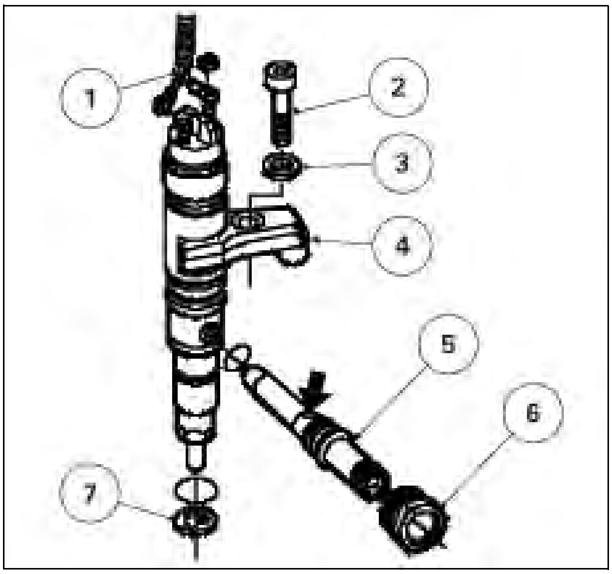
NOTE: *The injector pipe and the fuel supply pipe are calibrated to work in pairs. Do not mix them up.*

5. Also remove the injector seal ring located on the cylinder head if it has not already been removed with the injector.

Installing the injectors, 4 V engine

1. Check to ensure that the injector seat on the cylinder head is clean. Replace the seal ring and the "O" rings with new parts.

2. Fit the injector pipe and the fuel supply pipe onto the cylinder head. Note the position of the fuel supply pipe. Adjust the fuel supply pipe control bearings (shown by an arrow in the illustration) so that they are aligned with the cylinder head grooves.



I008215

Fig. 112

(1) Injector wiring
(2) Attachment screws
(3) Washer
(4) Retainer
(5) Fuel supply pipe
(6) Clip nut
(7) Seal ring

3. Gradually tighten the screw and the retaining nut as follows:
- Pre-tighten the attachment screw (2) to a torque of 15 Nm.
- Unscrew the attachment screw.
- Pre-tighten the retaining nut (6) to a torque of 15 Nm.
- Tighten the tightening screw to a torque of 40 Nm.
- Tighten the retaining nut to a torque of 50 Nm.

4. Fit the high-pressure pipe (tightening torque 30 Nm) and the injector wiring (M4 nuts, torque 1,5 Nm). Replace the valve cover plate seals and attach the cover plate (screw tightening torque 25 Nm).

High-pressure pump

The Citius engine series uses two different types of pump: Type CP1H on engines 44, 49 and 66 and type CP 3.3 on engines 74 and 84. Operation of the high-pressure pump can be tested using the Sisu EEM 3 service tool [also called "High-pressure test"].

Removing the high-pressure pump

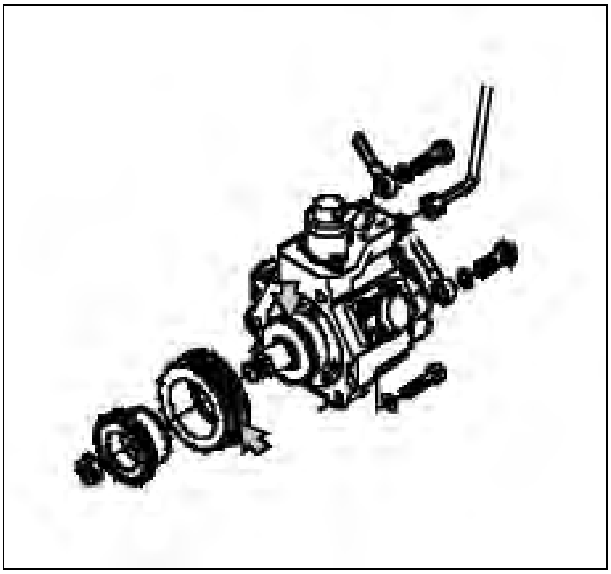
1. ***Note:*** *Do not open up the high-pressure pipe connectors on the fuel system when the engine is running. Wait at least 30 seconds after the engine is switched off. If the jet of high-pressure fuel should come into contact with your skin, fuel can penetrate the skin and cause serious injuries. Seek medical advice immediately.*

   Disconnect the main electrical switch. Clean the high-pressure pump and the surrounding surfaces. Detach the cable connector.

2. Detach the fuel supply pipes and fit protective plugs on the unions.
3. Unscrew the stop screws and remove the high-pressure pump. Note the guide ring used in the high-pressure pump fitted to engines 44, 49 and 66. Remove the gear using the appropriate tool..

Installing the high-pressure pump

1. Fit the new "O" ring onto the sealing neck of the high-pressure pump. If the front cover of the gear housing has not been removed, attach the gear to the pump shaft. Note that the guide ring on the high-pressure pump type CP1H must be fitted to the pump flange before attaching the gear.
2. Tighten the gear nut to a torque of 70 Nm in a type CP1H pump and to 105 Nm in a type CP 3.3 pump.
3. Lubricate the "O" ring, fit the high-pressure pump in place inside the housing and tighten the attachment screws to a torque of 30 Nm. There are no special instructions relating to alignment of the high-pressure pump gear with the double gear.



I008216 Fig. 113

4. Turn the bore hole in the guide ring of the CP1H pump so that it is aligned with a similar bore hole on the gear housing.
5. Fit the fuel supply pipes. Tighten the low-pressure pipe connectors to a torque of 25 Nm and tighten the high-pressure pipe connectors to a torque of 30 Nm. Then fit the cable connectors.

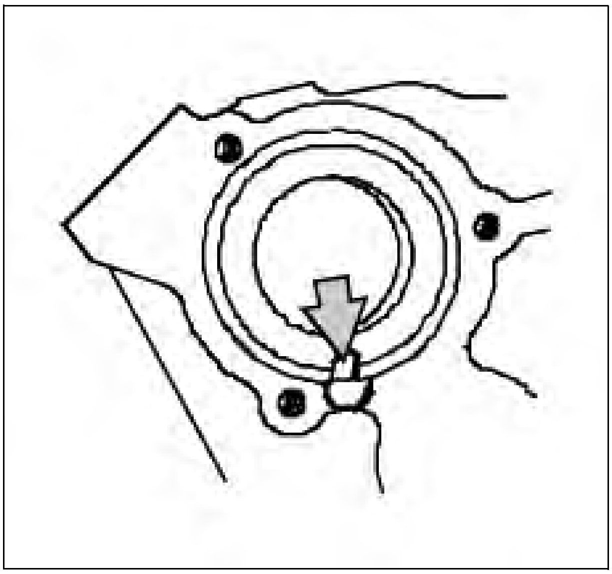

I008217

Fig. 114

Fuel quality requirements

	Requirement	Test method
Density, +15 °C	0.82 to 0.84 kg/dm^3	EN ISO 3675:1998, EN ISO 12185
Viscosity, + 40 °C	2.0 to 4.5 mm^2/s	EN ISO 3104
Sulphur content	350 mg/kg maximum	EN ISO 14596:1998
Cetane index	51 minimum	EN ISO 5165:1998
Water content	200 mg/kg maximum	prEN ISO 12937:1996
Lubrication properties/HFRR	460 µm maximum	ISO 12156-1

The fuel must comply with the standard EN 590.

Engine performance depends on the fuel quality.

Factors such as fuel temperature, density and viscosity affect the actual engine output. Our performance figures are based on fuel with a density of 0.84 kg/dm^3 and a specific heat consumption of 42.7 Mj/kg at a fuel temperature of +15 °C.

The percentage correction caused by a change in fuel quality is shown below.

FIG. A. Engine output dependency in relation to fuel temperature. The reference temperature is +35 °C (0% correction). Fuel temperature is not only affected by the ambient conditions, but it also varies according to the fuel system fitted to the tractor model (fuel tank capacity, location, return flow etc.).

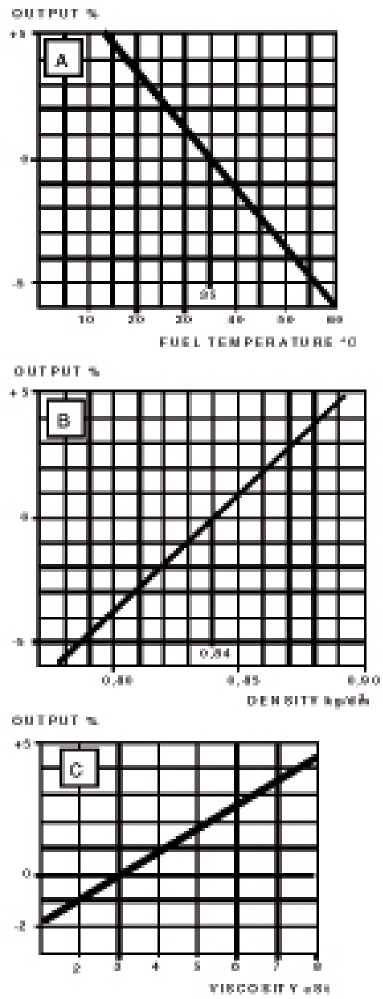
FIG. B. Engine output dependency in relation to fuel density. The normal value is 0.84 kg/dm^3 at +15 °C.

FIG. C. Engine output dependency in relation to fuel viscosity. The normal value is 3 cSt at +20 °C.

Note that figures B and C are only relevant if the fuel quality has been modified.

Figure A: All quality dependency is generated by a change in temperature. The fuel density and viscosity is indicated on the declaration produced by the manufacturer.

The output correction is calculated as follows: the correction percentages from figures A, B and C are totalled. The given nominal power output is then corrected based on the percentage obtained.



I008218

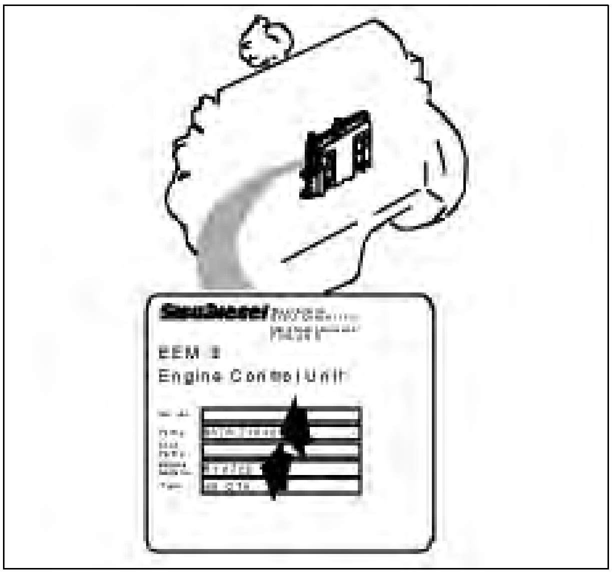
Fig. 115

O. Electrical controls

EEM3 control unit

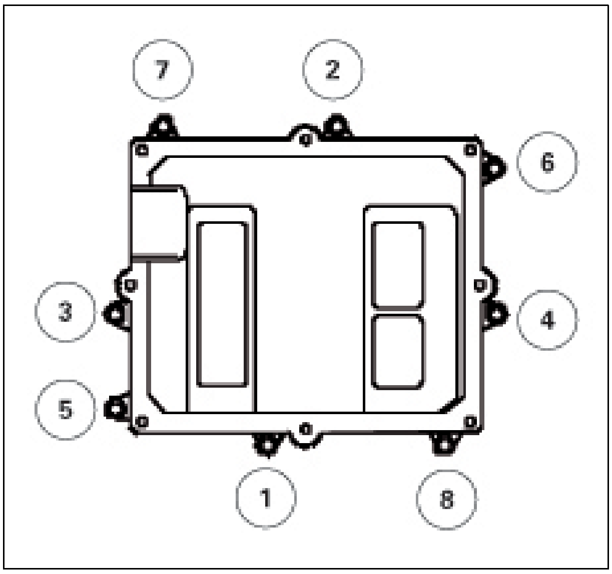
Note: *The engine model specification and serial number are provided on the EEM3 control unit identification plate. These numbers must always be quoted when ordering a control unit.*

1. The control unit (ECU) is attached to the support located on the left-hand side of the engine.
2. Remove the plastic external cover plate and disconnect the multi-pin connectors. Do not touch the connector pins. Remove the internal plastic cover.

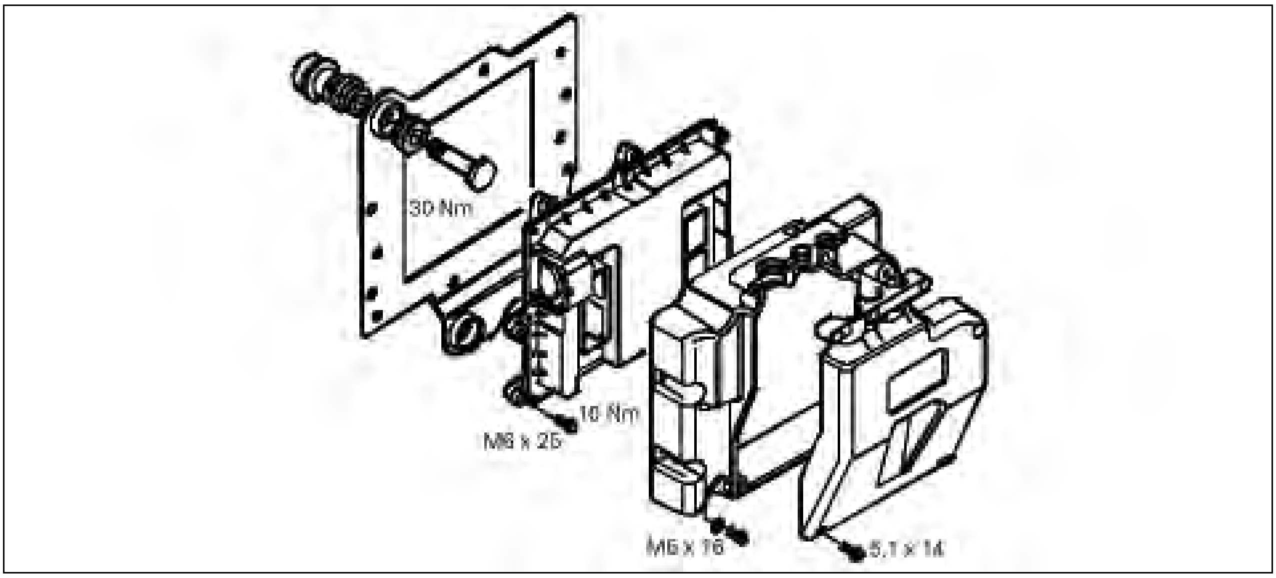


I008219 Fig. 116

3. Remove the control unit from the support. Check that the rubber damper on the support operates correctly. Replace it if necessary. Tighten the attachment screws to a torque of 30 Nm.



I008220 Fig. 117



I008221

Fig. 118

4. Attach the new control unit. Tighten the screws to a torque of 10 Nm in the order shown .

5. Attach the internal plastic cover, connect the multi-pin connectors and attach the external plastic cover.

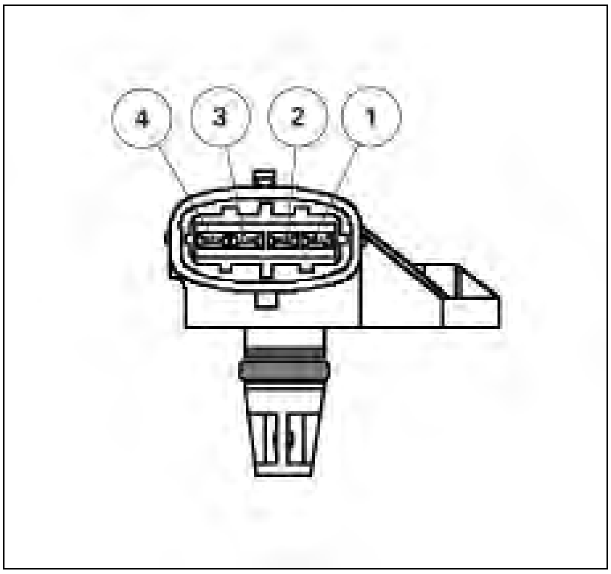
6. Load the control unit (ECU) programme using the Sisu EEM 3 service tool and open the data file stored in the ID module memory. Refer to the instructions relating to the Sisu EEM 3 service tool. Please note that the Sisu EEM 3 service tool can be connected using adapter 8368 62480 if the vehicle connector wiring harness is fitted inside the engine compartment.

Boost pressure/air temperature sensor

(1) Earth
(2) Temperature signal
(3) + 5 V
(4) Pressure signal

Location:

- Boost pipe
- M5 screw/3.3 Nm



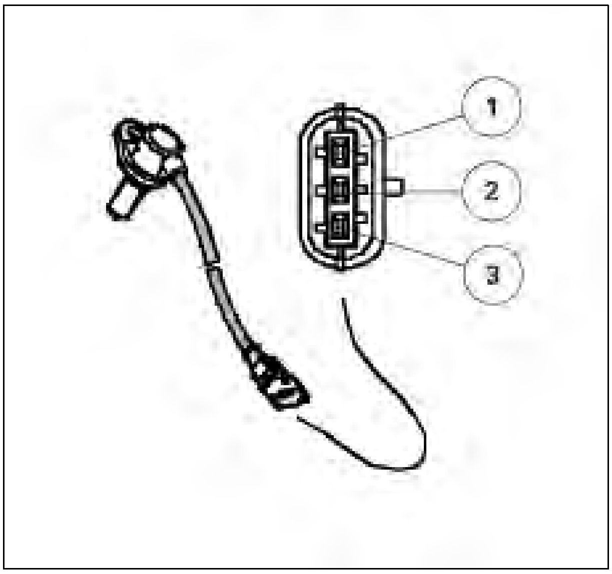
I008222

Fig. 119

Speed sensor (camshaft)

(1) Earth
(2) Speed signal
(3) Not used

Location:
- Timing housing
- M6 screw/8 Nm
- "O" ring, reference 6146 01524

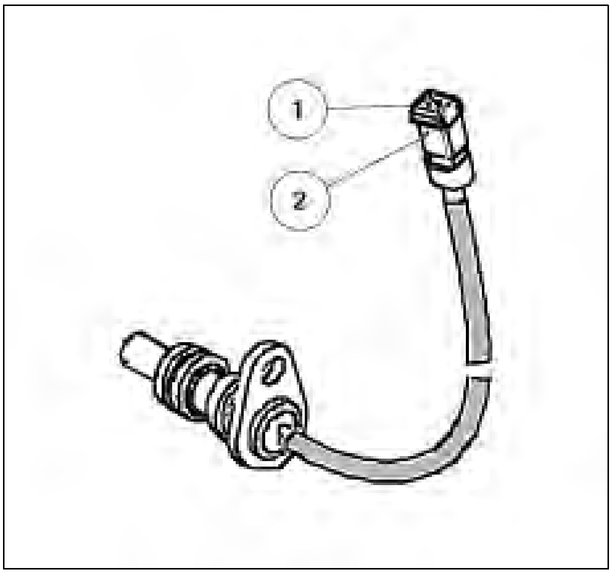


I008223 Fig. 120

Speed sensor (crankshaft)

(1) Earth
(2) Speed signal

Location:
- Cylinder block, left-hand
- M8 screw/25 Nm
- "O" ring, reference 6146 01524

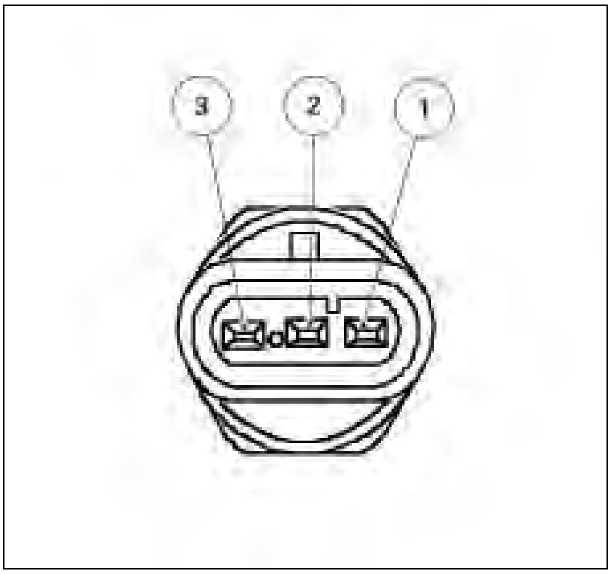


I008224 Fig. 121

Oil pressure sensor

(1) Earth
(2) Pressure signal
(3) + 5 V

Location:
- Cylinder block, right-hand
- M10 thread x 1/25 Nm
- Seal ring, reference 6155 71014

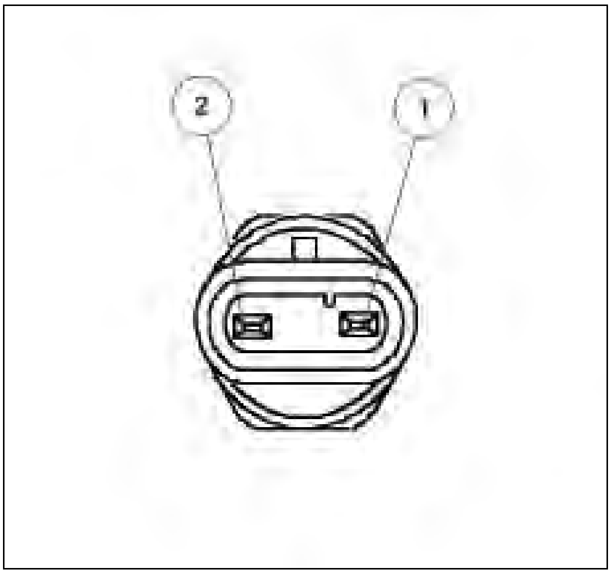


I008225 Fig. 122

Coolant and fuel temperature sensor

(1) Fuel/temperature signal
(2) + 5 V

Location:
- Cylinder head/coolant sensor and fuel filter/fuel sensor
- M12 thread x 1.5/25 Nm
- Seal ring, reference 6158 81418



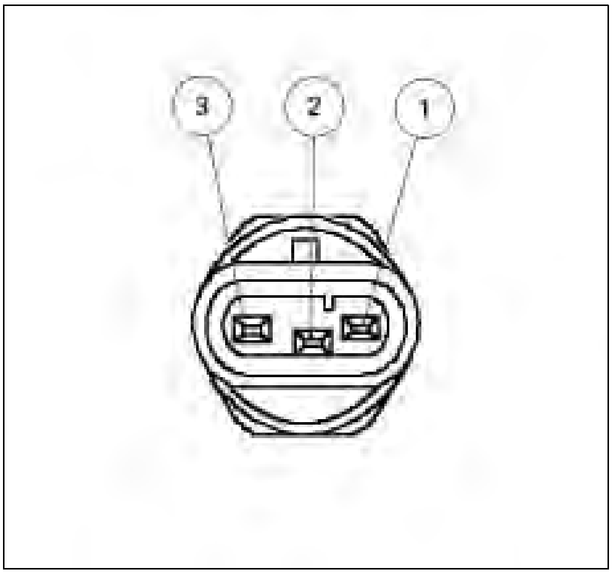
I008226 Fig. 123

Fuel transfer pressure sensor

(1) Earth
(2) Pressure signal
(3) + 5 V

Location:

- Main filter
- M14 thread x 1.5/25 Nm
- Seal ring, reference 6158 81420



I008227

Fig. 124

3A18

Sisu Tier 3 engine - Service tools

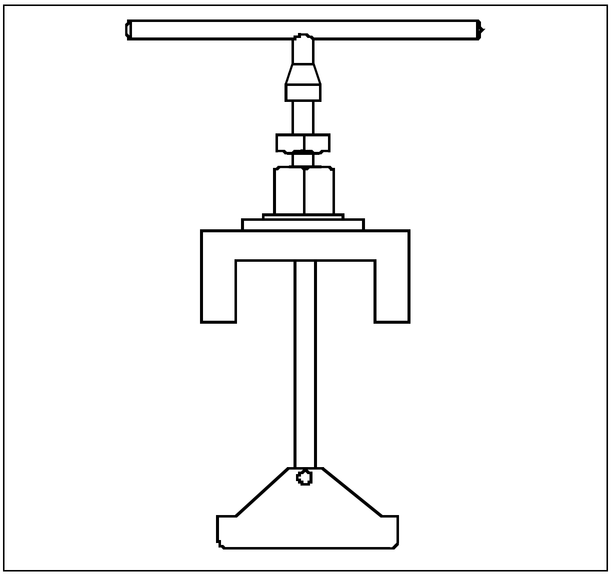
TABLE OF CONTENTS

A. General

The tools described in this section can be ordered from the AGCO spare parts department or by contacting the tooling division of Beauvais by referring to AGCOnet bulletin Trac 60/07.
The prices will then be sent out to you.

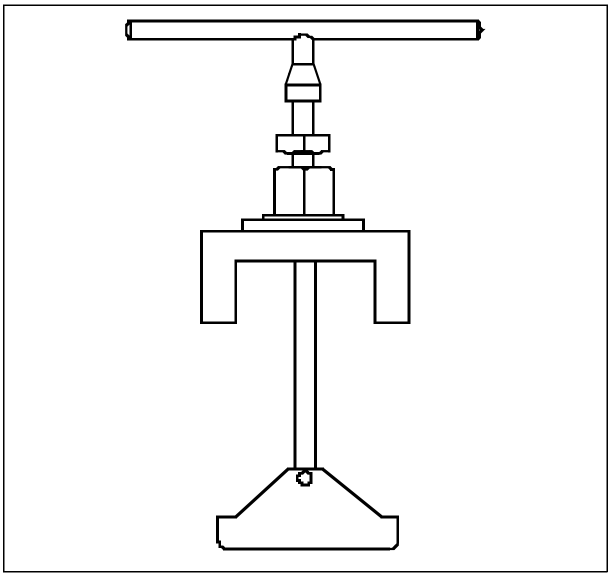
B. Cylinder block

Ref.	9051 73100
Description	Cylinder liner extraction tool
For engines	44, 49, 66, 74
Order	AGCO Beauvais



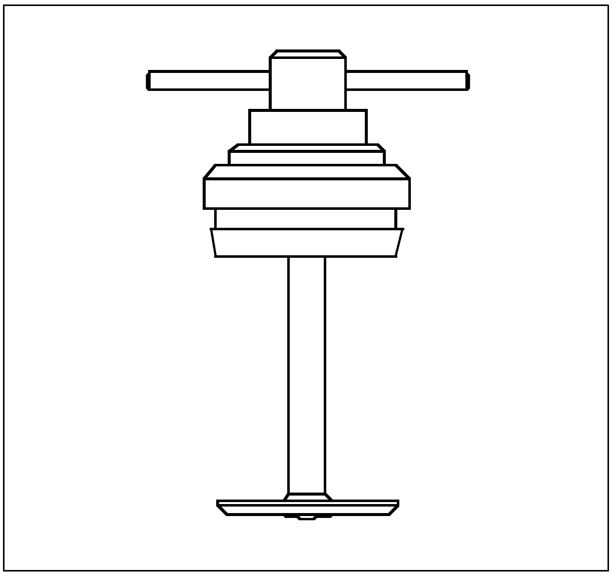
I008692 Fig. 1

Ref.	9104 51500
Description	Cylinder liner extraction tool
For engines	84
Order	AGCO Beauvais



I008692 Fig. 2

Ref.	9101 65600
Description	Cutter for cylinder liner seat
For engines	44, 49, 66, 74
Order	AGCO Beauvais

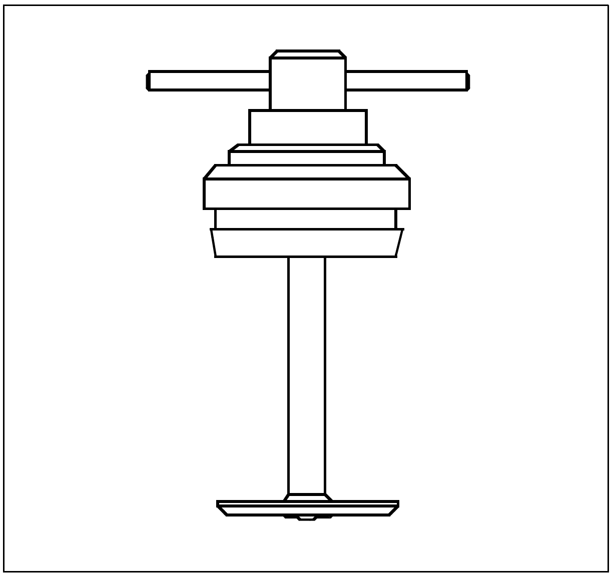


I008693

Fig. 3

Ref.	9104 52000
Description	Cutter for cylinder liner seat
For engines	84
Order	AGCO Beauvais

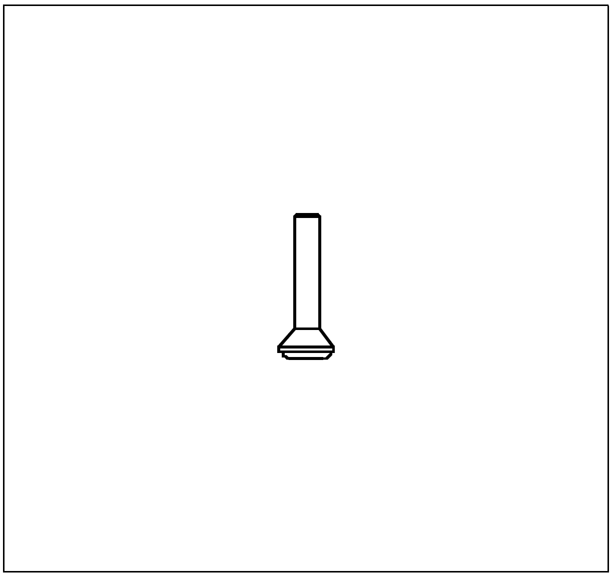
Ref.	-
Description	Spare cutting blade for cutter
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008693

Fig. 4

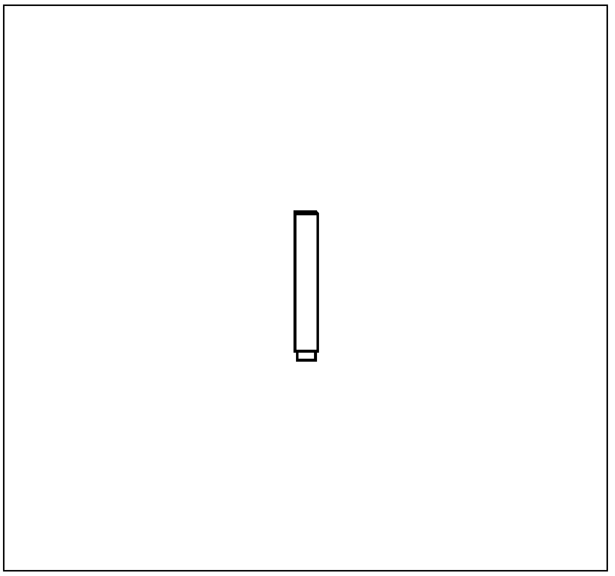
Ref.	9052 46620
Description	Punch for cup plug 40 mm
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008694

Fig. 5

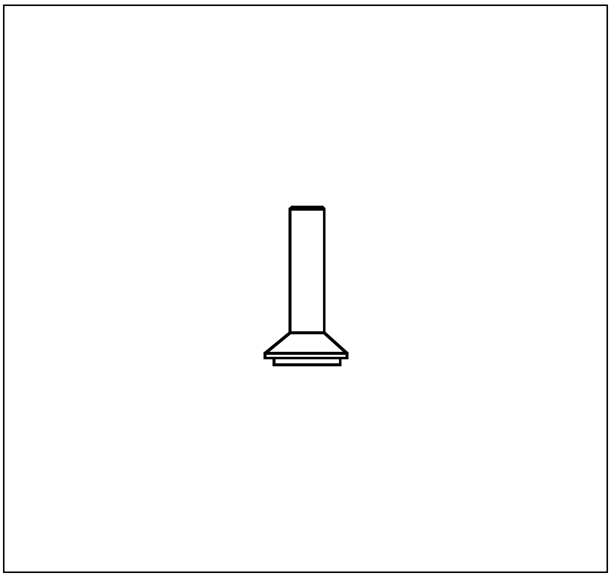
Ref.	9052 46650
Description	Punch for cup plug 16 mm
For engines	44, 49, 66, 74
Order	AGCO Beauvais



I008695

Fig. 6

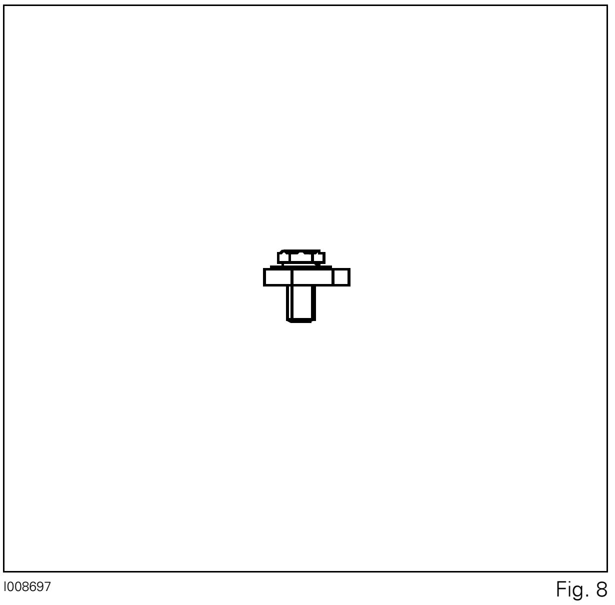
Ref.	9025 87400
Description	Punch for installing camshaft cup plug
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008696

Fig. 7

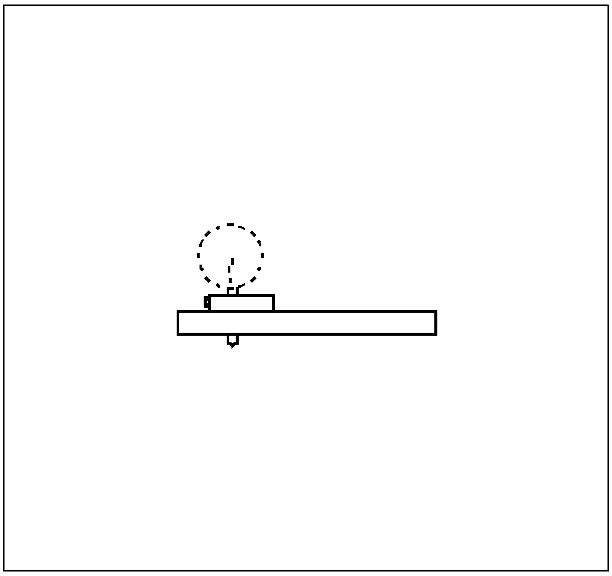
Ref.	9101 66300
Description	Press for cylinder liner
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008697

Fig. 8

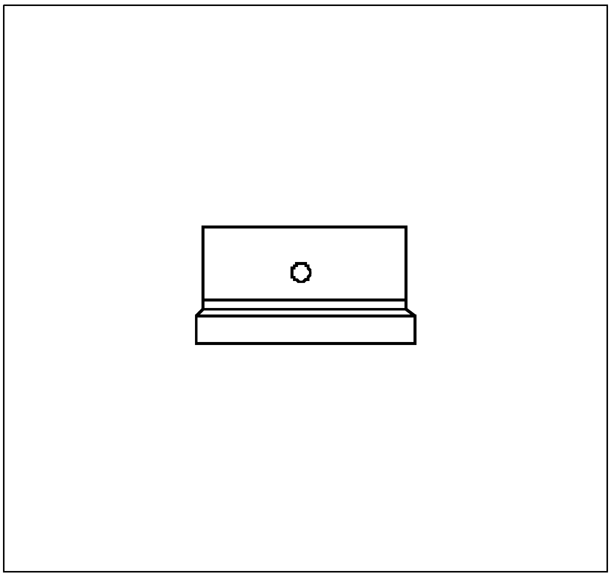
Ref.	9025 79200
Description	Dial gauge support
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008698 Fig. 9

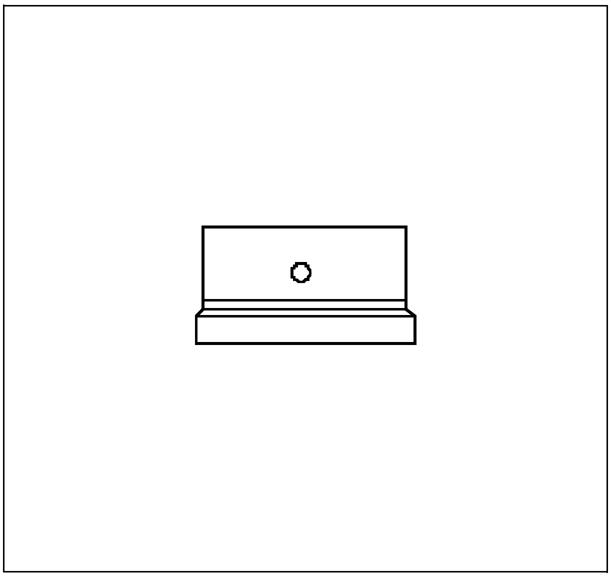
C. Timing housing and flywheel housing

Ref.	9052 46400
Description	Flywheel housing centring tool
For engines	44, 49, 66, 74
Order	AGCO Beauvais



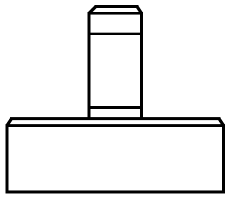
I008699 Fig. 10

Ref.	9104 52700
Description	Flywheel housing centring tool
For engines	84
Order	AGCO Beauvais



I008699 Fig. 11

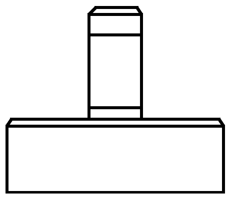
Ref.	9052 46300
Description	Punch for installing crankshaft rear seal
For engines	44, 49, 66, 74
Order	AGCO Beauvais



I008700

Fig. 12

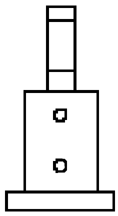
Ref.	9104 52600
Description	Punch for installing crankshaft rear seal
For engines	84
Order	AGCO Beauvais



I008700

Fig. 13

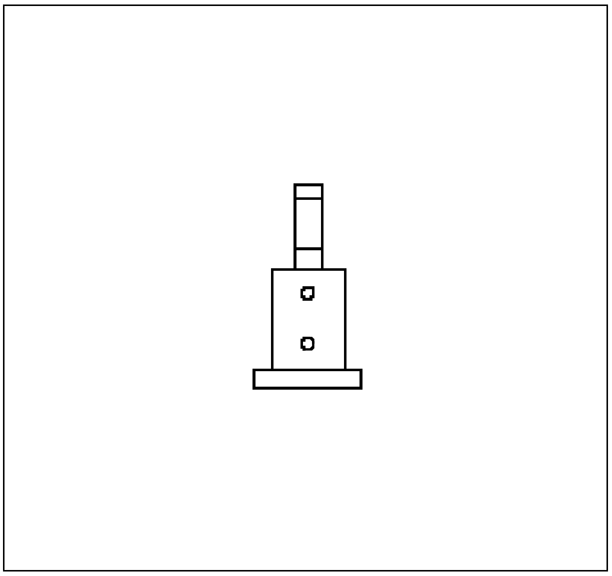
Ref.	9030 15200
Description	Punch for installing crankshaft front seal
For engines	44, 49, 66, 74
Order	AGCO Beauvais



I008701

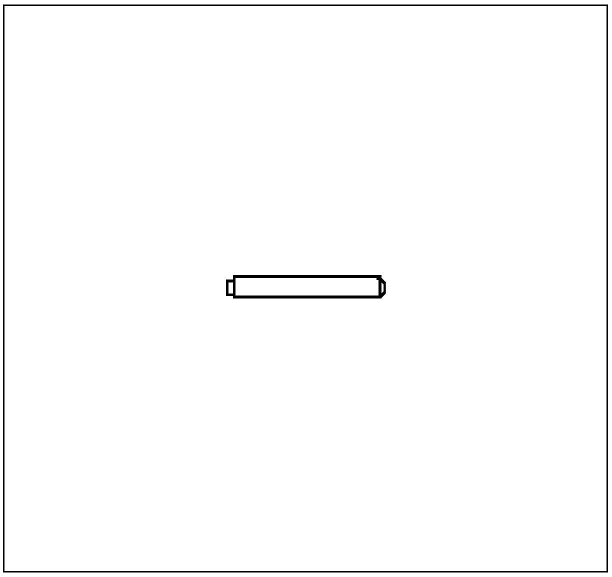
Fig. 14

Ref.	9103 94600
Description	Punch for installing crankshaft rear seal
For engines	84
Order	AGCO Beauvais



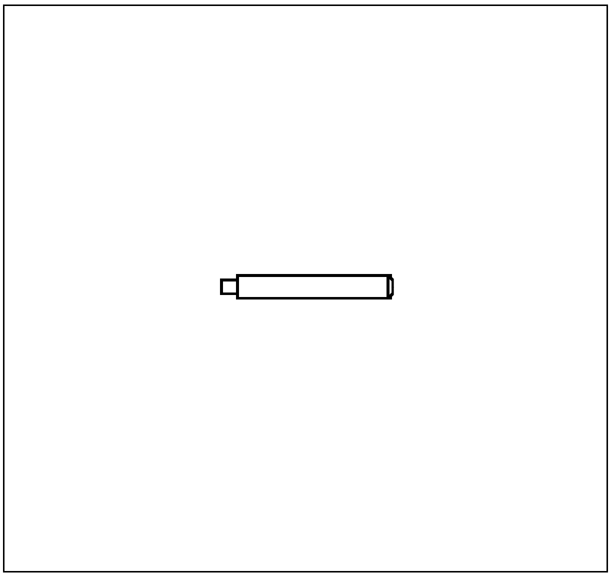
I008701 Fig. 15

Ref.	9025 98800
Description	Timing housing tension pin punch
For engines	44, 49, 66, 74
Order	AGCO Beauvais



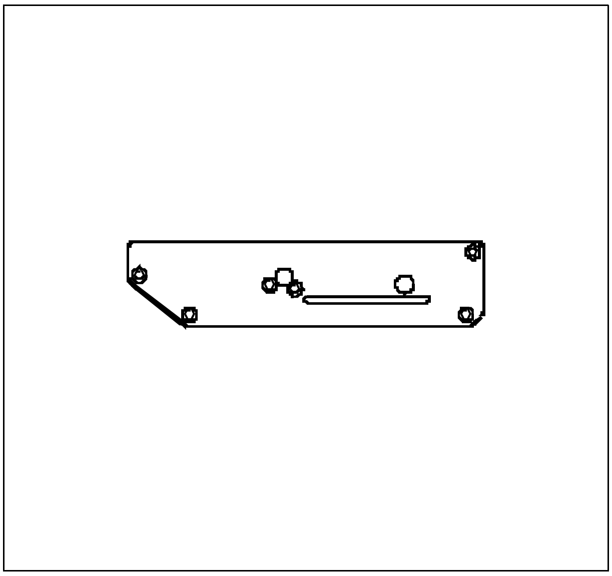
I008702 Fig. 16

Ref.	9025 98700
Description	Timing and flywheel housing tension pin punch
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008703 Fig. 17

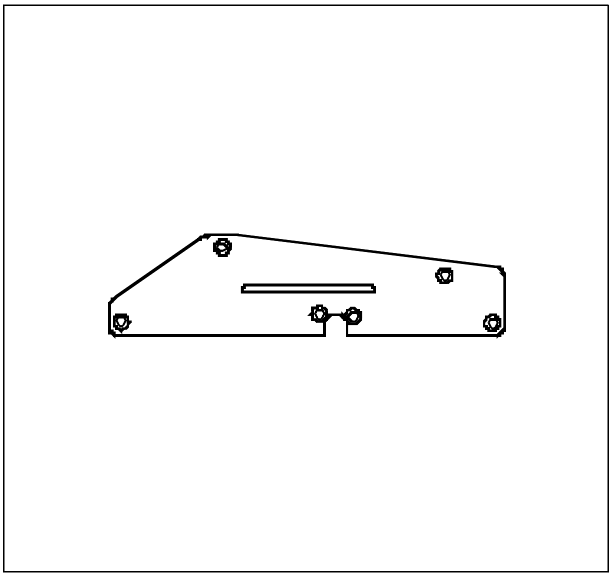
Ref.	9201 30270
Description	Centring tool for layshaft gear, narrow timing housing
For engines	74
Order	AGCO Beauvais



I008704

Fig. 18

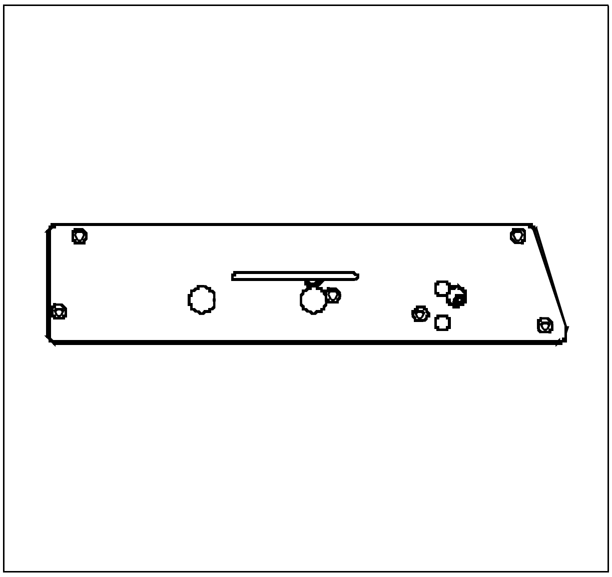
Ref.	9201 30290
Description	Centring tool for layshaft gear, narrow timing housing
For engines	84
Order	AGCO Beauvais



I008705

Fig. 19

Ref.	9201 30150
Description	Centring tool for layshaft gear, wide timing housing
For engines	84
Order	AGCO Beauvais

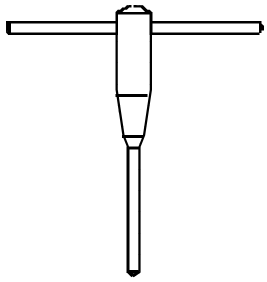


I008706

Fig. 20

D. Cylinder head and valve mechanisms

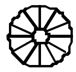
Ref.	9101 66100
Description	T-piece handle for valve seat cutter
For engines	44, 49, 66, 74
Order	AGCO Beauvais



I008707

Fig. 21

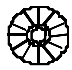
Ref.	9101 71100
Description	Cutter for surface grinding exhaust valve seat
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008708

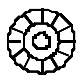
Fig. 22

Ref.	9101 65502
Description	Exhaust valve seat cutter
For engines	44, 49, 66, 74
Order	AGCO Beauvais



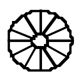
I008709 Fig. 23

Ref.	9101 65503
Description	Exhaust valve seat internal cutter
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



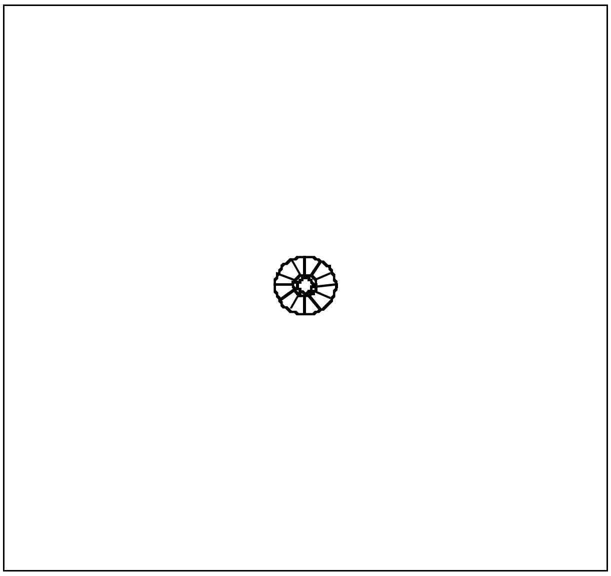
I008710 Fig. 24

Ref.	9101 75800
Description	Cutter for surface grinding inlet valve seat
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



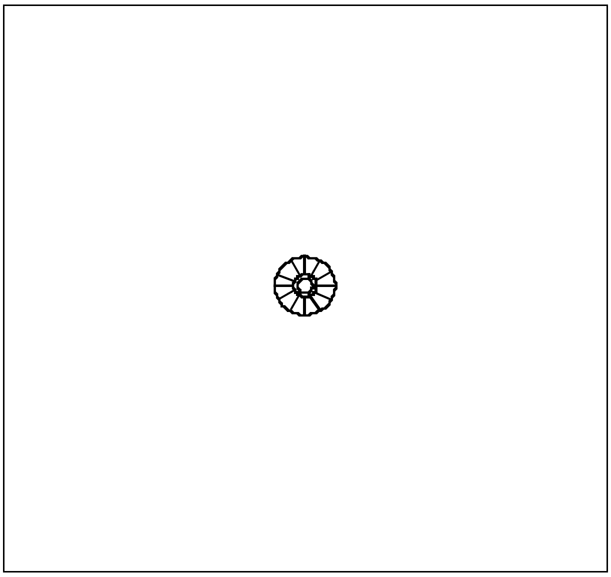
I008711 Fig. 25

Ref.	9101 65505
Description	Inlet valve seat cutter
For engines	44, 49, 66, 74
Order	AGCO Beauvais



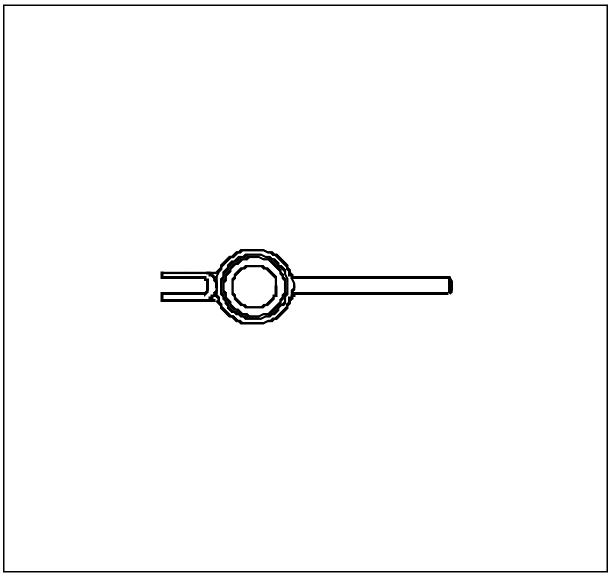
I008712 Fig. 26

Ref.	9101 65506
Description	Inlet valve seat internal cutter
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



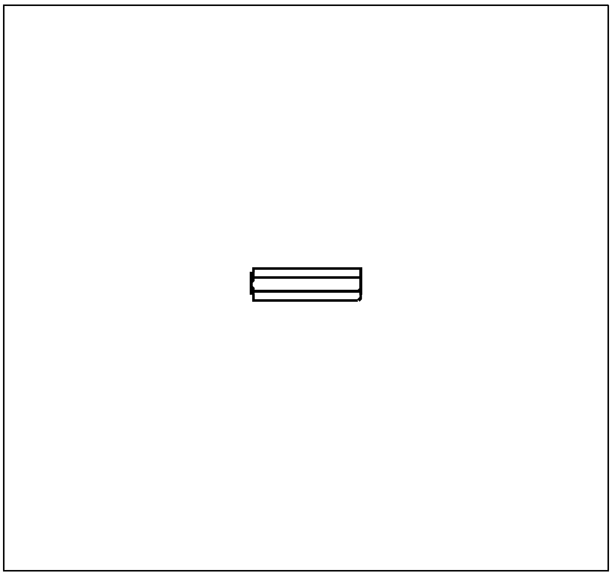
I008713 Fig. 27

Ref.	9101 66200
Description	Valve spring compression lever
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008714 Fig. 28

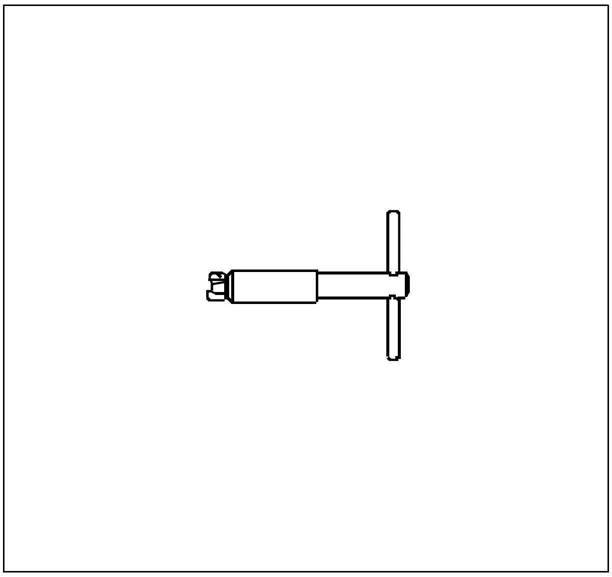
Ref.	9052 47200
Description	Lever locknut 9101 66200 (Fig. 28)
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008715

Fig. 29

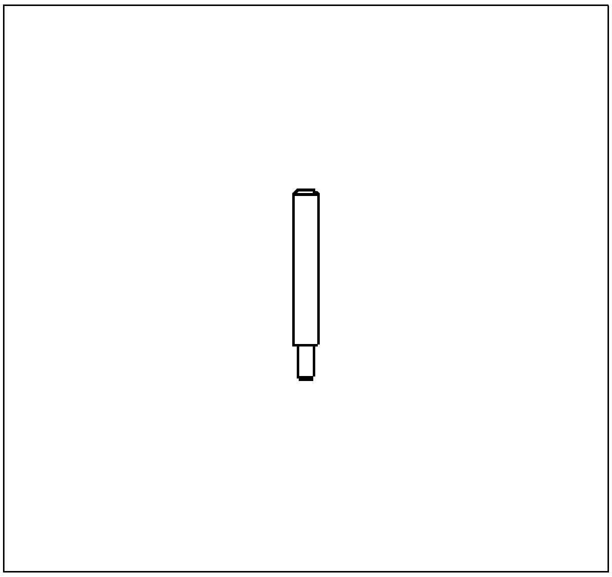
Ref.	9120 85400
Description	Injector seat cutter
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008716

Fig. 30

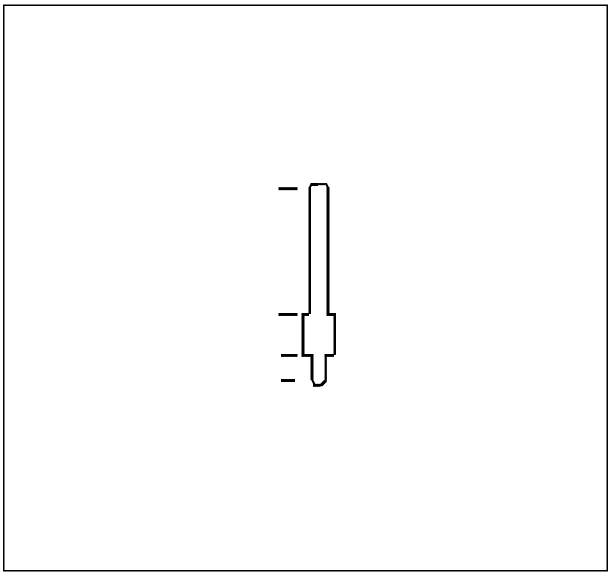
Ref.	9120 85300
Description	Valve guide drift
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008717

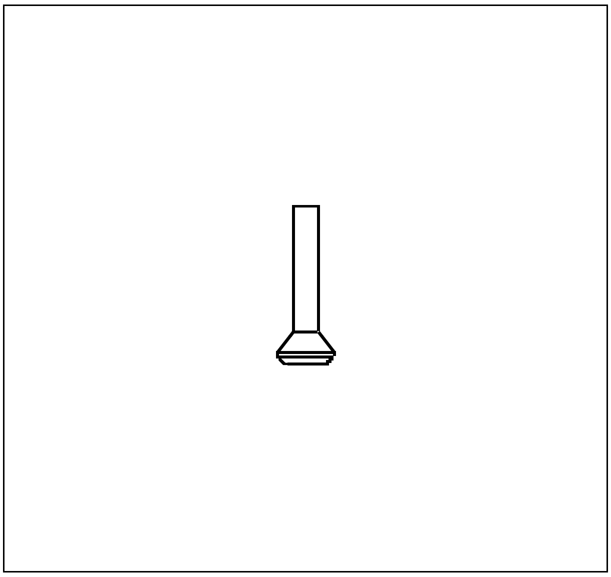
Fig. 31

Ref.	9120 85000
Description	Punch for installing valve guide
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



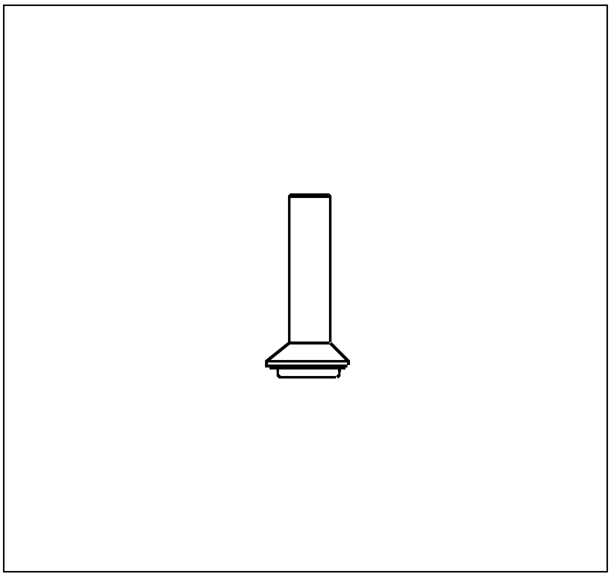
I008718 Fig. 32

Ref.	9052 46660
Description	Punch for cup plug 36 mm
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



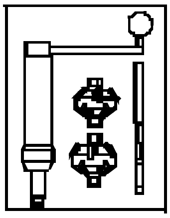
I008719 Fig. 33

Ref.	9103 94800
Description	Punch for cup plug 45 mm
For engines	66, 74, 84
Order	AGCO Beauvais



I008720 Fig. 34

Ref.	8370 62635
Description	Cutter kit for valve seat
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais

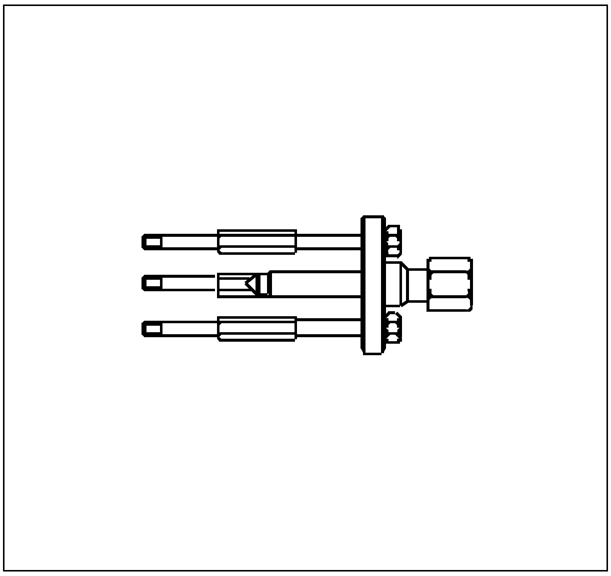


I008721

Fig. 35

E. Mobile engine components

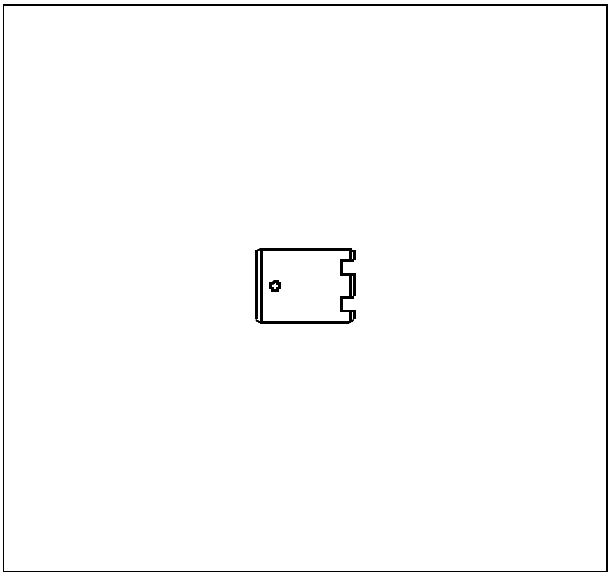
Ref.	9052 48800
Description	Crankshaft gear extraction tool
For engines	44, 49, 66, 74
Order	AGCO Beauvais



I008722

Fig. 36

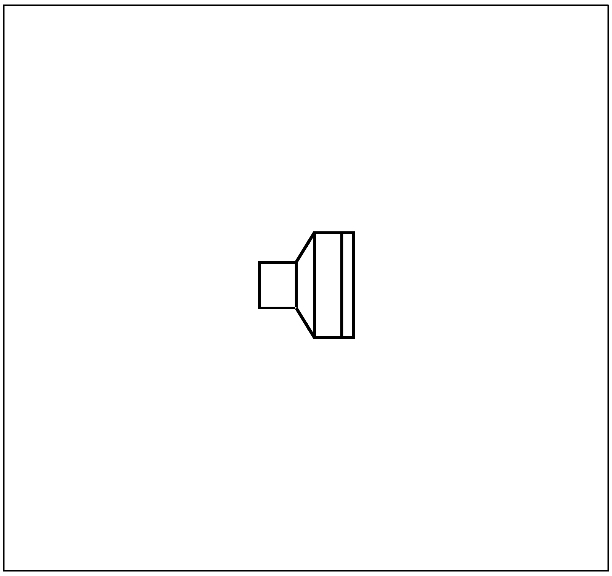
Ref.	9024 55800
Description	Crankshaft nut wrench
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008723

Fig. 37

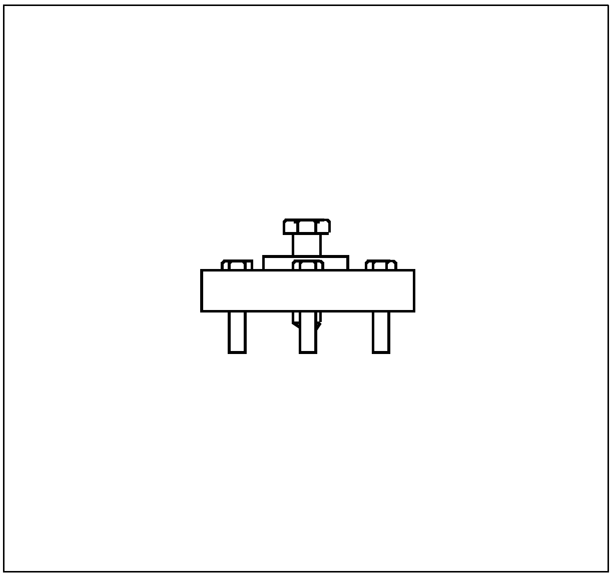
Ref.	9101 65700
Description	Crankshaft nut wrench
For engines	44, 49, 66
Order	AGCO Beauvais



I008724

Fig. 38

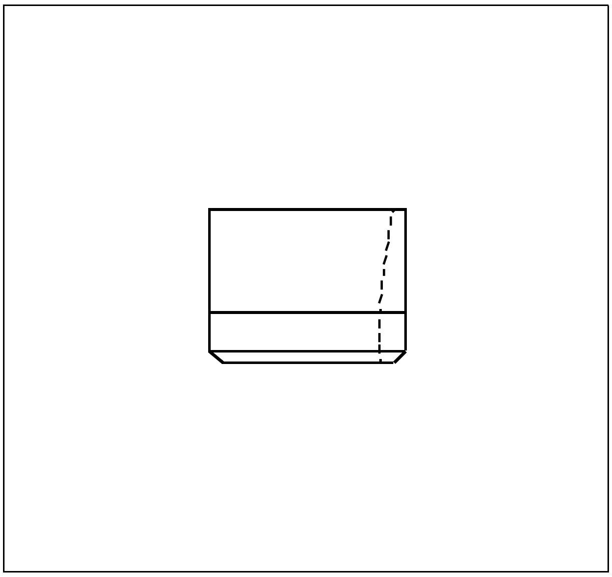
Ref.	9104 53300
Description	Crankshaft hub puller
For engines	74, 84
Order	AGCO Beauvais



I008729

Fig. 39

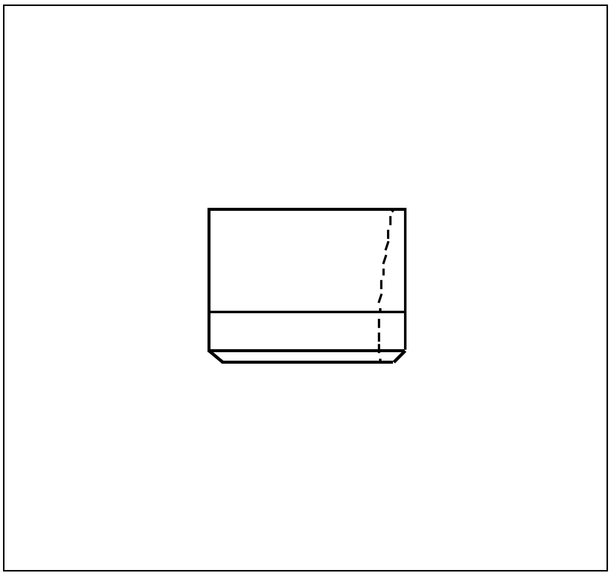
Ref.	9020 01100
Description	Tapered sleeve for installing pistons
For engines	44, 49, 66, 74
Order	AGCO Beauvais



I008725

Fig. 40

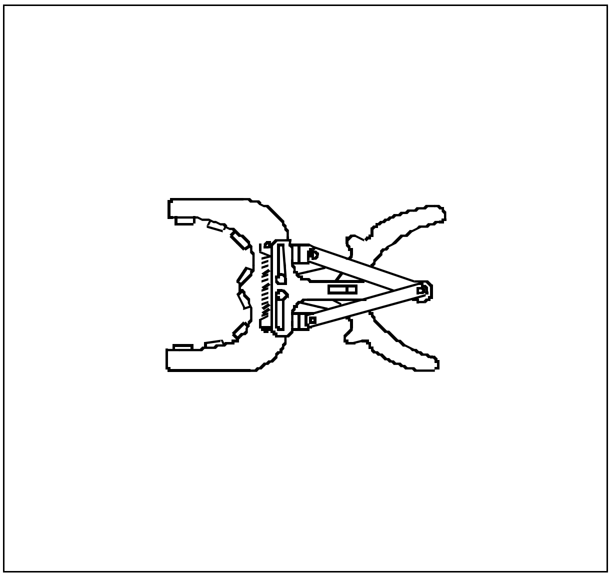
Ref.	9105 18700
Description	Tapered sleeve for installing pistons
For engines	84
Order	AGCO Beauvais



I008725

Fig. 41

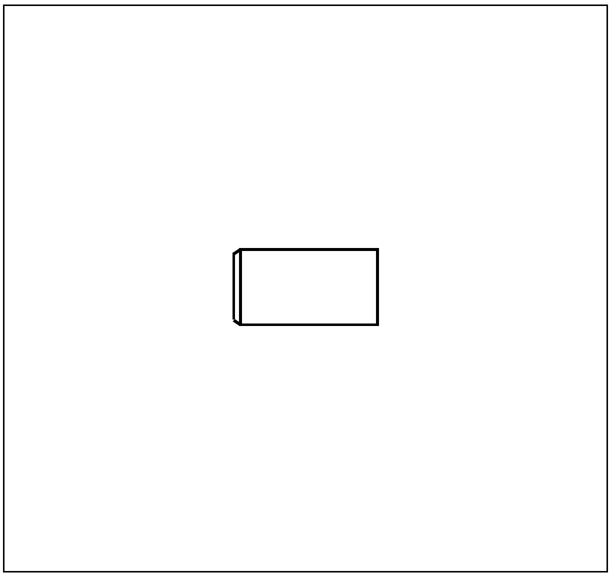
Ref.	9052 46900
Description	Piston ring pliers
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008726

Fig. 42

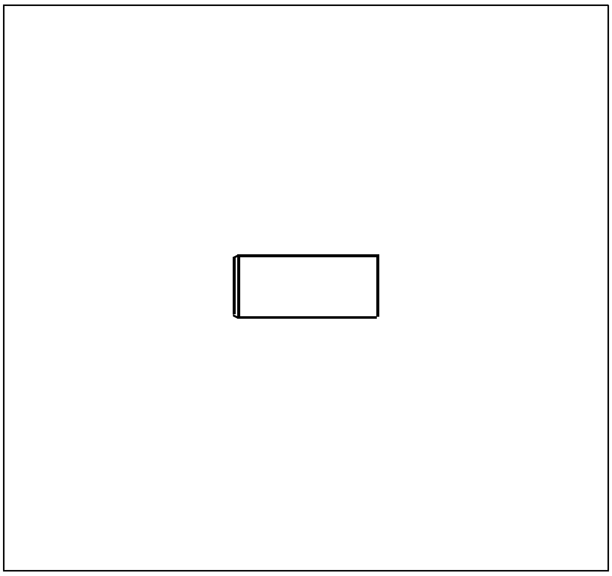
Ref.	9103 94700
Description	Punch for installing crankshaft gears
For engines	44, 49, 66, 74, 84
Order	AGCO Beauvais



I008727

Fig. 43

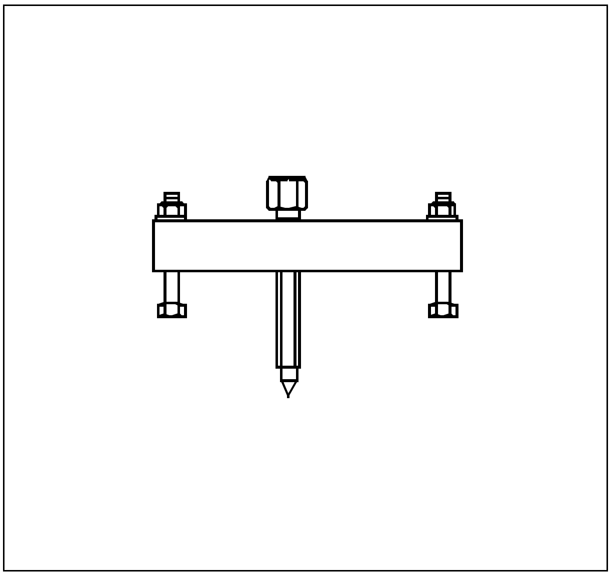
Ref.	9103 94900
Description	Punch for installing oil deflector at front end of crankshaft
For engines	84
Order	AGCO Beauvais



I008728 Fig. 44

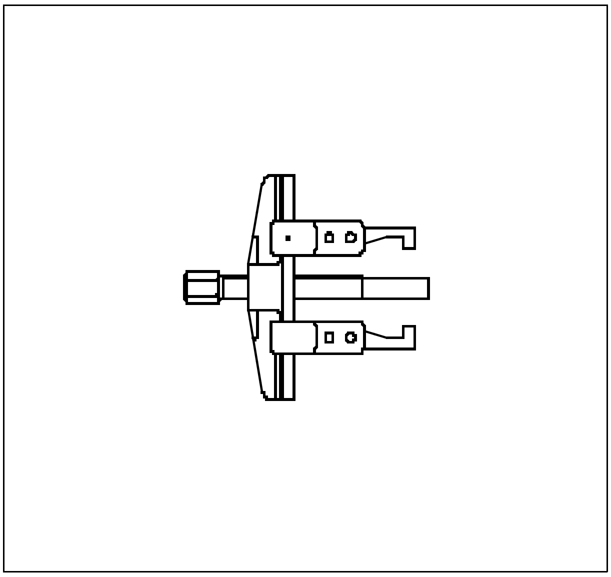
F. Water pump

Ref.	9101 93200
Description	Coolant pump turbine puller
For engines	66, 74
Order	AGCO Beauvais



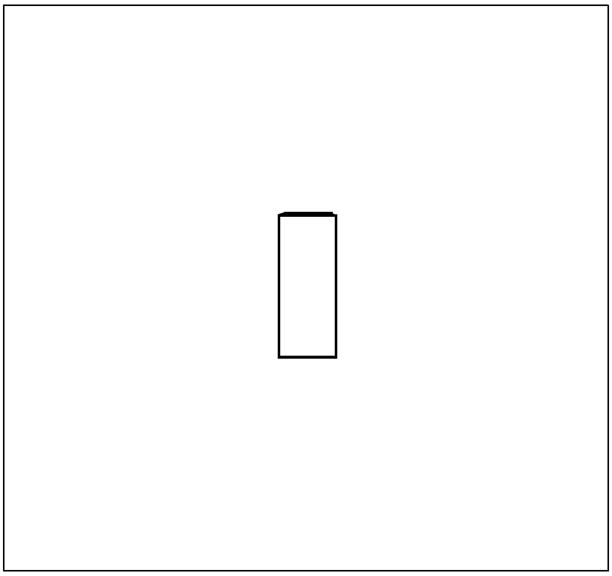
I008730 Fig. 45

Ref.	9104 27700
Description	Coolant pump turbine puller
For engines	44, 49
Order	AGCO Beauvais



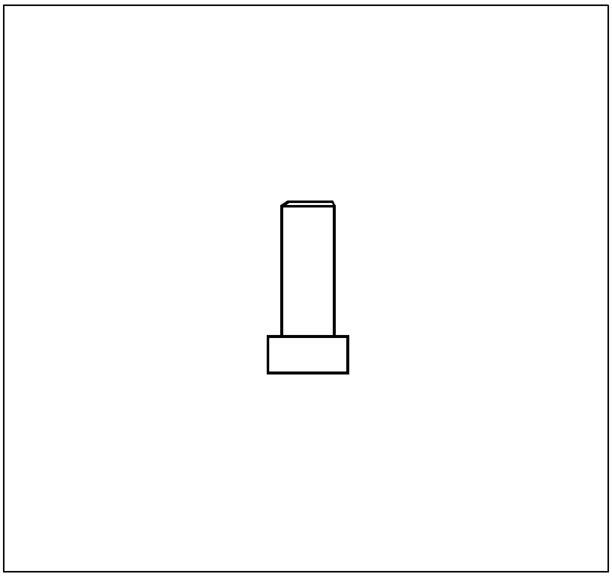
I008731 Fig. 46

Ref.	9051 79300
Description	Punch for installing the water pump seal
For engines	44, 49, 66, 74
Order	AGCO Beauvais



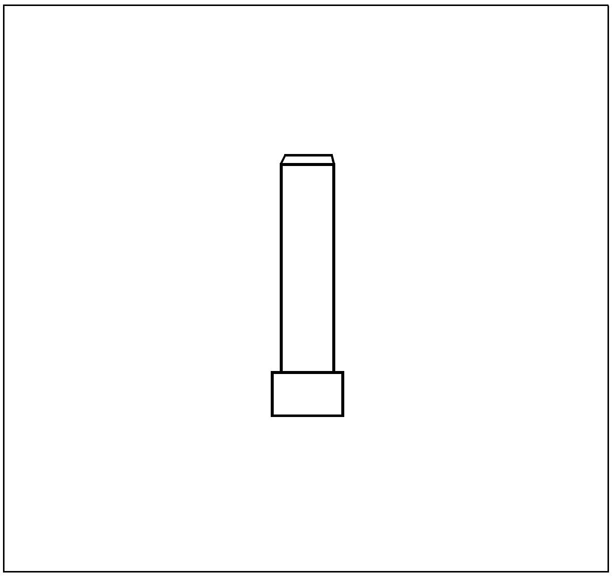
I008732 Fig. 47

Ref.	9103 41300
Description	Punch for installing the water pump bearings
For engines	84
Order	AGCO Beauvais



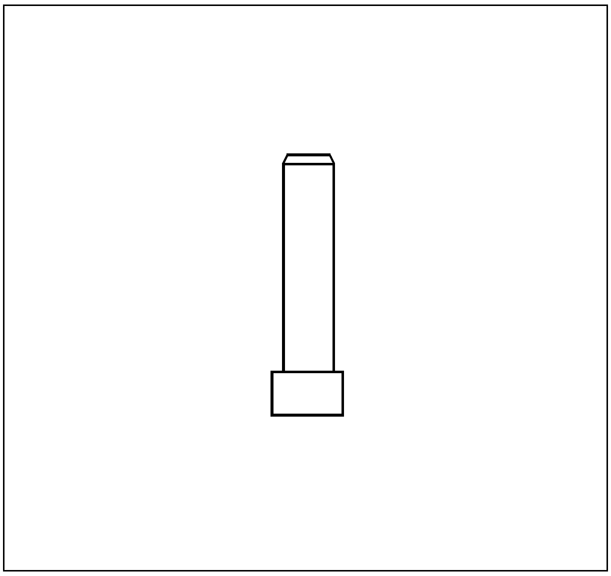
I008733 Fig. 48

Ref.	9103 41000
Description	Punch for installing the water pump shaft seal
For engines	84
Order	AGCO Beauvais



I008734 Fig. 49

Ref.	9103 41100
Description	Punch for installing the water pump seal
For engines	84
Order	AGCO Beauvais



I008735 Fig. 50

3B10

SCR system - General

TABLE OF CONTENTS

A. General

A.1 Notice to the technician

Selective Catalytic Reduction, also known as SCR, is a process applied to the emissions from diesel engines, designed to meet the emissions standards. In the SCR process, a diesel emissions reducing agent in the form of an aqueous urea solution is injected into the flow of exhaust fumes in order to convert nitrous oxide (NOx) into a harmless mixture of nitrogen and water vapour.

SCR is a simple nitrous oxide (NOx) post-treatment system which offers the following advantages:
- fuel savings
- a simple solution that requires no modification to current engine cooling systems In fact, because it is possible to reduce the recirculation rate of exhaust fumes, engine performance can be increased and the operating temperature lowered.
- very little maintenance is required
- a proven and reliable method

The SCR system comprises a urea tank, an injector, a metering module, some sensors and a catalyser.

The system is automated; the operator has only to monitor the gauge and to fill the urea tank as required. There are warnings of low urea level similar to the warnings for other fluids, such as the low fuel level warning.

The AdBlue/DEF product is a mixture of 67.5% water and 32.5% urea. Urea is a non-hazardous nitrogen product which is also used in fertilisers.

I008228

Fig. 1

A.2 Safety instructions related to urea (AdBlue/DEF)

Identification of dangers

According to Directive 1999/45/EC and its amendments, the product is not classified as hazardous.

Classification.. Not classified

Information about the components

Substance/preparation... Preparation

Component name	CAS Number	%	EC Number	Classification
water	7732-18-5	67.5	231-791-2	Not classified
urea	57-13-6	32.5	200-315-5	Not classified

First aid

Ingestion... If large quantities of this product are swallowed, seek medical advice immediately. Do not induce vomiting unless advised to do so by medical staff. Do not administer liquid to a person who is unconscious.

Contact with the skin... Avoid prolonged or repeated contact with the skin. After handling, always wash your hands thoroughly with soap and water. In the event of irritation, seek medical advice.

Contact with the eyes .... In case of contact with the eyes, rinse immediately under running water. In the event of irritation, seek medical advice.

Protection of rescuers .... No action must be taken which puts an individual at risk or in the absence of appropriate training.

Fire protection measures and prevention of explosions and fires

Extinguishing methods	In the event of fire, spray with water (spray mist), foam, dry chemical powder or carbon dioxide gas (CO_2)
Items that can be used	Use a suitable extinguishing agent to put out a neighbouring fire.
Risks related to thermal decomposition products	These products can be: oxides of carbon (CO, CO_2), oxides of nitrogen (NO, NO_2 etc.), ammonia (NH_3).
Special protective equipment for personnel pre-equipped to fight a fire	Fire brigade officers must wear suitable protective equipment as well as self-contained breathing apparatus with an integral mask operating in positive pressure mode.

Measures to be taken in the event of accidental spillage

Individual precautionary measures	Follow all of the procedures relating to fighting a fire.
Measures to protect the environment and clean-up methods	Prevent the spilled substance from coming into contact with the ground and surface water courses. Absorb using sand or an alternative dry non-combustible material. Collect up solid material and the absorbed product using a shovel and place it all inside a suitable and labelled waste container. Avoid forming a cloud of dust and prevent it from being spread by the wind. Keep a safe distance away from aquatic environments.

Handling and storage

Handling	Avoid all contact with the eyes, skin and clothing. Ensure that automatic eye rinsing systems and safety douches are located in close proximity to the location of the work stations.
Fuel storage	Keep the container firmly closed. Store the container in a cool and well-ventilated area. Keep away from heat and direct sunlight.
Recommended packaging materials	Use the original container.

Physical and chemical properties

General information

Physical state	Liquid (clear)
Colour	Colourless
Odour	Ammoniacal (weak)

Information relating to health, safety and the environment

pH	9.8 to 10 (Conc. (% weight/weight): 10%)
Boiling point	Decomposition temperature: 100 °C
Melting/freezing point	- 11,5 °C
Vapour pressure	6.4 kPa (48 mm Hg) (at 40 °C)
Volume mass	1.09 g/cm^3 (20 °C)
Can be mixed with water	Yes

Stability and reactivity

Stability	Stable under storage and recommended handling conditions.
Conditions to avoid	Urea reacts with sodium hypochlorite or calcium to form very explosive nitrogen trichloride.
Materials to avoid	Extremely reactive or incompatible with the following materials: oxidant materials, acids and alkalines.
Hazardous decomposition products	These products can be: oxides of carbon (CO, CO_2), oxides of nitrogen (NO, NO_2 etc.), ammonia (NH_3).

Toxicological information

Potential acute effects on health

Effects on health are considered as fairly unlikely if the product is used in accordance with the recommendations.

Potential chronic effects on health

Chronic effects	No major effects or critical dangers are known.
Carcinogenicity	No major effects or critical dangers are known.
Mutagenesis	No major effects or critical dangers are known.

Potential chronic effects on health

Congenital abnormalities	No major effects or critical dangers are known.
Effects on development	No major effects or critical dangers are known.
Effects on fertility	No major effects or critical dangers are known.

Signs/symptoms of over-exposure

Inhalation	No specific data.
Ingestion	No specific data.
Skin	No specific data.
Eyes	No specific data.

Information relating to waste disposal options

Waste processing methods	Empty containers or inner packaging may retain traces of product. Do not discard residue down the drain and do not dispose of this product and its container without taking all the necessary precautions relating to its use. Discard in accordance with all applicable local and national regulations.

A.3 Abbreviations or terms used

CAN	Controller Area Network
CAT	Catalyser
Denox Catalyst	Catalyser capable of reducing nitrous oxides as an oxidising mixture
Denox-tronic	Technical name of the metering module (BOSCH)
H_2O	Chemical symbol for water
N_2	Chemical symbol for nitrogen
NOx	Chemical symbol for nitrous oxide
SCR	Selective Catalytic Reduction

B. Principles of operation

B.1 Layout of the SCR system

I008229

Fig. 2

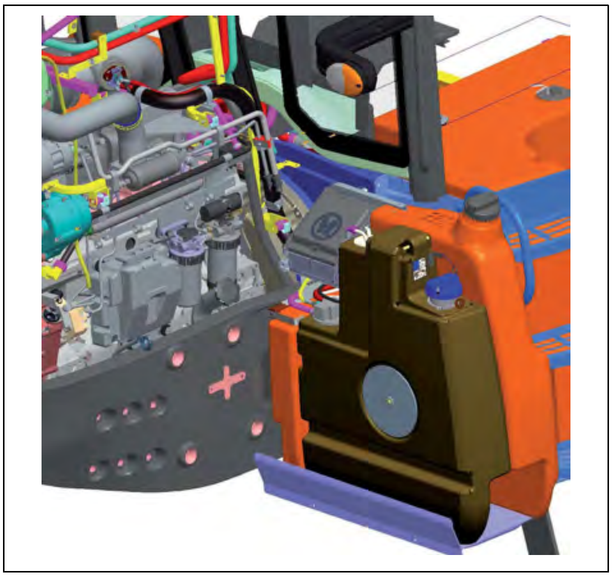
(1) AdBlue/DEF tank
(2) Metering module
(3) Engine
(4) AdBlue/DEF supply pipe
(5) Catalyser
(6) AdBlue/DEF injector
(7) Exhaust line
(8) Silencer

The SCR system comprises various components, all located close to the engine.

The SCR system is a self-managed system. It is electronically connected to the engine information in order to ensure the best measurement of urea into the exhaust line.

Urea tank

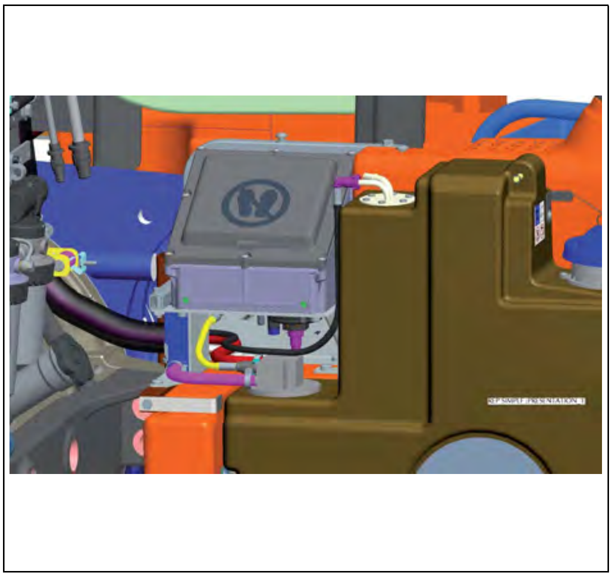
The AdBlue/DEF tank is located on the left-hand side of the tractor. It has a capacity of 30 l and is used to store the AdBlue/DEF.
The AdBlue/DEF filler plug is coloured blue to comply with the standard, so that the operator does not make a mistake when filling.



I008230 Fig. 3

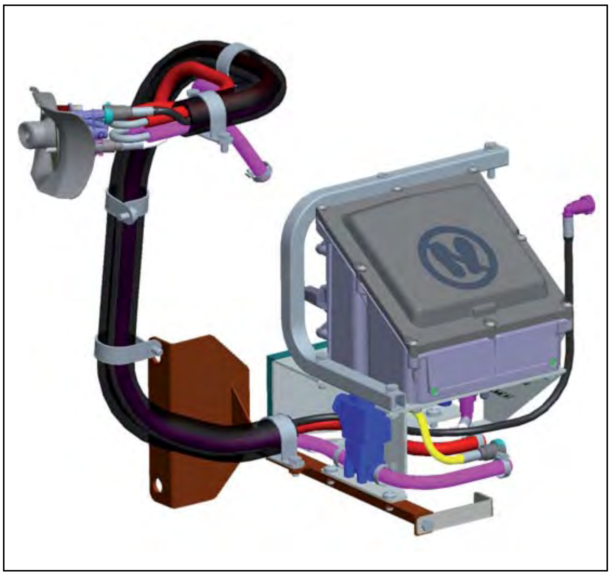
Metering module

The metering module, also called the Denoxtronic module, has been developed by BOSCH.
It is a vital component of the SCR system. It is equipped with the main systems used to self-manage the SCR technology.
It comprises a diaphragm pump system, filters, sensors and a controller.



I008232 Fig. 4

The module is connected via a harness which provides the electrical power supply and also enables the exchange of information with the other sensors and the engine in order to control the metering in relation to engine load.

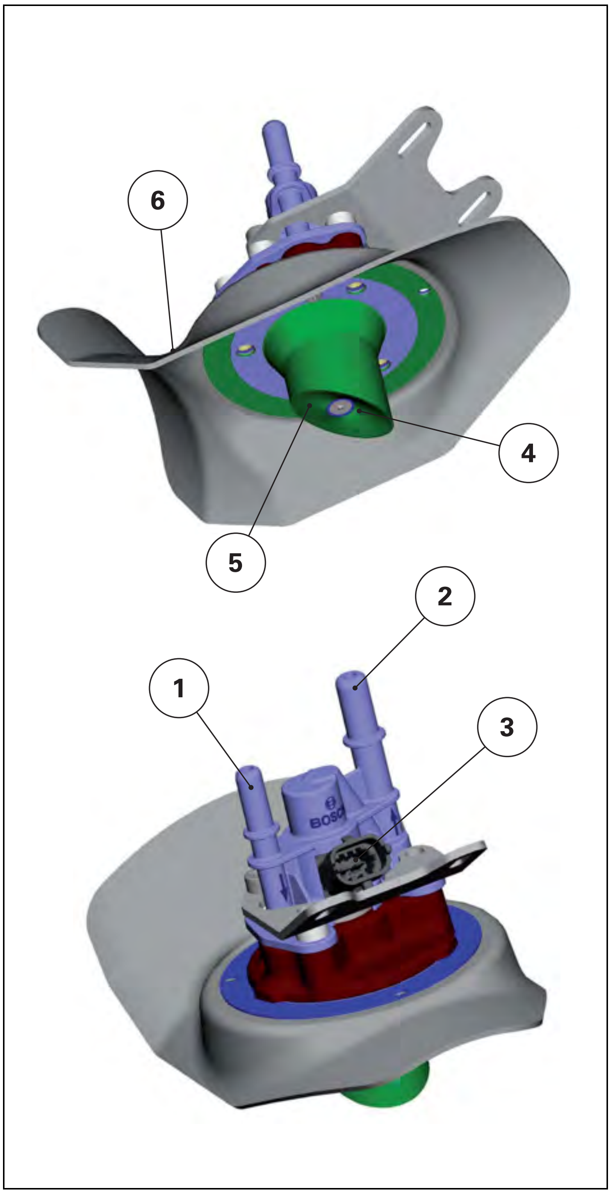


I008233

Fig. 5

Injector

(1) Supply line
(2) Return line: leakage to provide cooling
(3) Electrical connector
(4) Injector nozzle
(5) Protection against high temperatures
(6) Metal heat shield

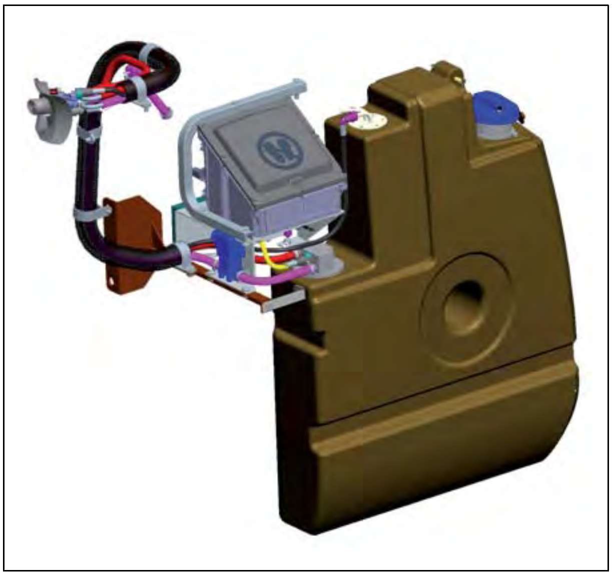


I008234

Fig. 6

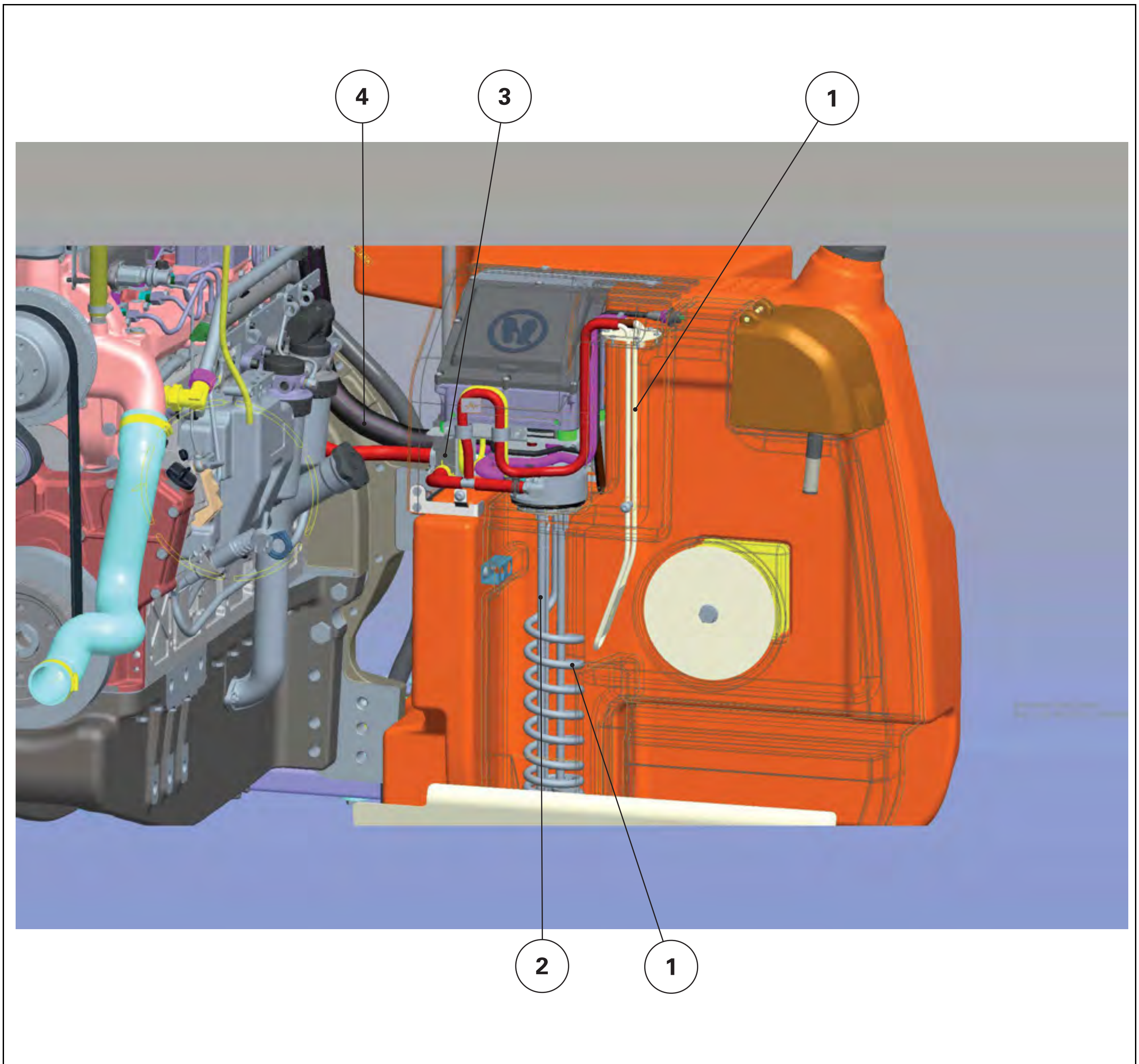
The injector is located on the exhaust line and controls the dose of urea.
The injector is electrically controlled by the module controller.
This injector has the special feature of being cooled by the AdBlue/DEF, as its operating temperature must not exceed 600 °C. Furthermore, this injector is activated when the temperature inside the exhaust line exceeds 200 °C and is deactivated after switching off the ignition, as soon as the exhaust temperature drops below 200 °C. This is the reason why, after switching off the engine, it is possible to hear the module pump, which continues to run in order to cool the injector.

Gauge



I008235

Fig. 7



I008236

Fig. 8

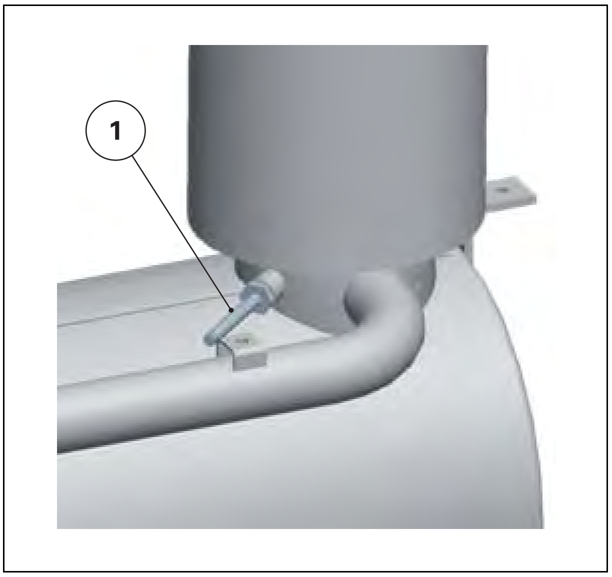
(1) Coolant line
(2) AdBlue/DEF pumping line
(3) Coolant solenoid valve
(4) AdBlue/DEF/coolant parallel lines

The gauge monitors the fluid level and fluid pumping.
This gauge is fitted with a coil through which the coolant from the engine passes. When temperatures are low, it is used to heat the AdBlue/DEF, which freezes at temperatures below -11,5 °C.
The circulation of coolant is controlled by a solenoid valve managed by the metering module according to the outside temperature information exchanged with the engine.
During operation, the coolant cools the line via a pipe fitted parallel to the AdBlue/DEF line.

Temperature sensor

(1) Temperature sensor

A temperature sensor is fitted to the engine exhaust to control the operation of the system.
This sensor also manages the starting and stopping of the injector control.

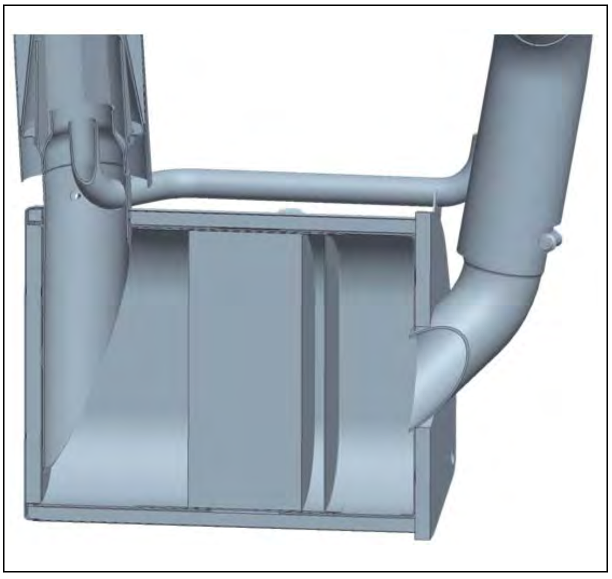


I008237 Fig. 9

Quality sensor

A quality sensor is fitted to the AdBlue/DEF tank to ensure that only a 32.5% solution of urea is used. This is to comply with emissions standards.
In addition to self-management, the system is also capable of detecting any operating faults via the electronic system.

Catalyser

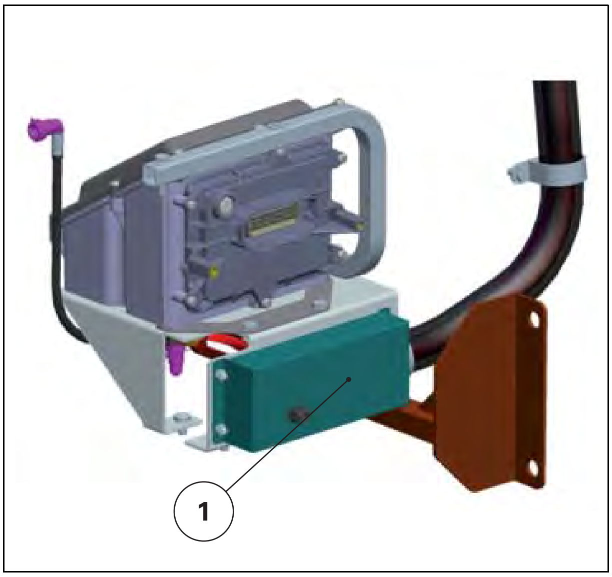

I008238 Fig. 10

The catalyser located on the right-hand side of the tractor between the exhaust line and the silencer has two main functions:
- To envelop the silencer, thus providing a reduction in noise.
- To mix the solution of urea with the exhaust fumes to ensure maximum reduction of toxic emissions of nitrous oxides (NOx), by converting them into nitrogen (N_2) and water (H_2O).

Voltage converter

(1) Voltage converter

The metering module, initially developed for application on heavy vehicles, is supplied with a voltage of 24 V. A voltage converter is therefore required for conversion from 12 V to 24 V.
This is located close to the module, at the rear and mounted against its support.



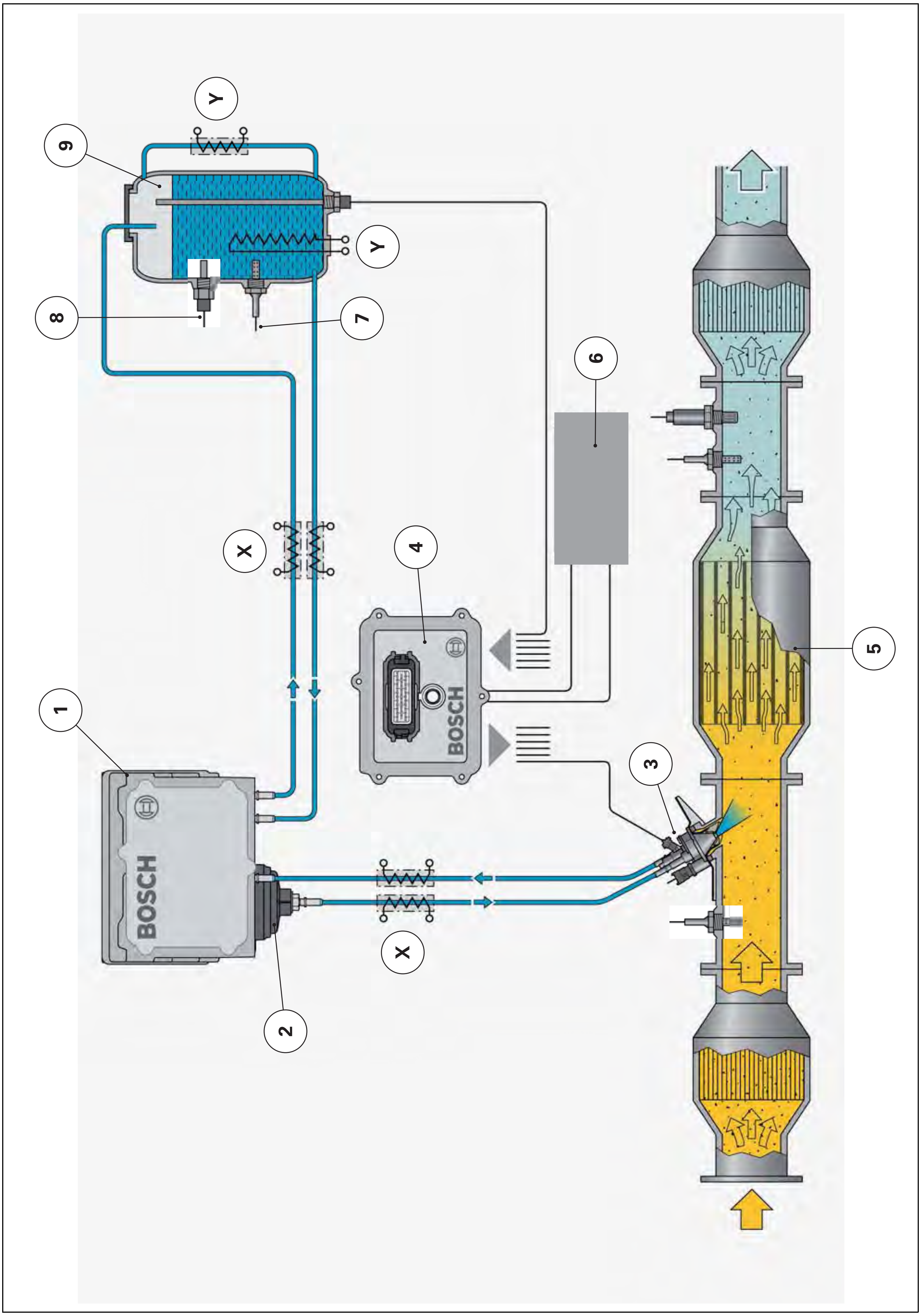
I008239 Fig. 11

B.2 Principles of operation

The principle of the SCR system relies on the following components: an AdBlue/DEF tank fitted the length of the fuel tank, an AdBlue/DEF spool valve, an injector and an SCR catalyser. The engine is not really involved in the process other than to deliver the optimum combustion ratios and exchange information from the various sensors that control it.

The three main lines of the system are:
- the AdBlue/DEF tank fitted next to the fuel tank
- the AdBlue/DEF additive injected into the exhaust fumes in the form of a fine spray
- inside the SCR catalyser, the nitrous oxides converted into nitrogen and water

In comparison to the fuel, AdBlue/DEF takes up a very small volume. With an approximate mixture of 2.5 to 3%, 25 l to 30 l of AdBlue/DEF is sufficient for 1000 l of fuel.
The quantity of AdBlue/DEF is always strictly proportional to the quantity of diesel fuel.



I009251

Fig. 12

(1) Denoxtronic module
(2) Filter
(3) Injector
(4) Denoxtronic module control unit
(5) Catalyser
(6) Engine CAN network
(7) Temperature sensor
(8) AdBlue/DEF quality sensor
(9) AdBlue/DEF tank
(X) Comparable to the coolant coil system
(Y) Comparable to the coolant parallel line

Normal operating phase

When the engine has reached an exhaust temperature above 200 °C, the AdBlue/DEF injection can start.
To do this, the urea stored in its specific tank is sucked through the sender unit by a diaphragm pump located inside the metering module.
The fluid which flows through a prefilter and a main filter is directed to the injector. Sensors fitted inside the metering module control the working conditions to optimise the system as required.
As the module is connected to the engine controller via the CAN network, it is able to adjust the injection (dose of AdBlue/DEF) based on instant fuel consumption.
The variable flow rate injector is electrically controlled in order to inject a mist of AdBlue/DEF into the exhaust line, which, due to the catalyser, reduces the pollution generated by the engine internal combustion process.
During this normal operating phase, several critical points are controlled by parallel systems and the electronic system.
For example, the parallel coolant line provides continuous cooling of the urea which, at a temperature above 80 °C, could cause the occurrence of ammonia (very dangerous).
The injector itself is continuously cooled by its permanent leakage system in order to control its temperature and therefore its life span.
The gauge continues to monitor the level and warns the user if it approaches the critical minimum level. The minimum level is 5 l. These 5 l ensure normal operation and therefore injector cooling.
The quality of the AdBlue/DEF is continuously controlled by the quality sensor to prevent any operating faults and/or intentional tampering by the user or a third person.

Operating phase in low external air temperatures

The external air temperature is an index that can be raised by the engine and the temperature of the AdBlue/DEF can be raised via the metering module.
This information that is known by the Denoxtronic module operates a parallel system to quickly heat the urea which may be frozen inside the tank.
A pipe coil containing coolant and a rigid pipe on the top of the tank heat the contents of the tank as soon as the engine coolant has warmed up.
The electronic system locks SCR operation if circulation of the AdBlue/DEF fluid is not possible over the whole loop.
A degraded mode is activated to inform the user and to reduce engine power.

To allow the coolant to circulate, a solenoid valve opens the heating loop, which is also electrically controlled by the module.
The parallel coolant/urea line, which under normal operating conditions cools the urea, also enters this phase to heat the urea system.

Operating phase after the engine is switched off

After the engine is switched off, the AdBlue/DEF injector is unable to reach the very high operating temperatures.
To prevent this, a permanent leakage system provides cooling during operation.
When the engine is switched off, the injection of AdBlue/DEF is stopped, but the pump continues to run until the exhaust temperature reaches a sufficient level to stop injector cooling (200 °C).
For this purpose, a 30-minute timer is pre-set in the electric battery isolator.
As a result, after switching off the engine it is normal for the pump inside the metering module to continue to supply a flow.

Degraded mode operating phase

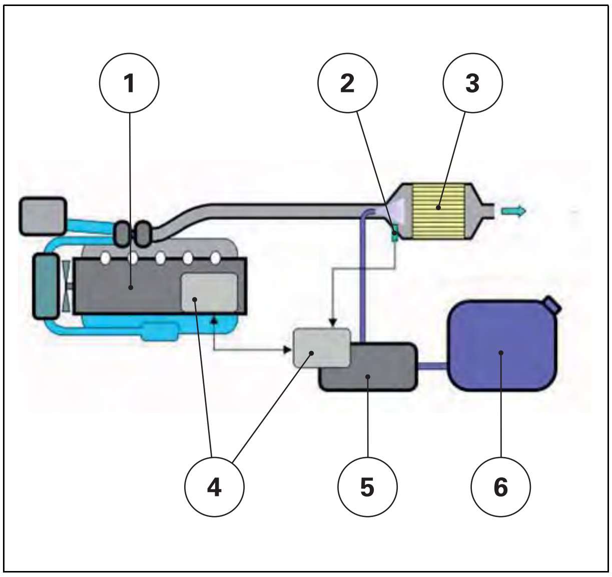
The electronic system is able to operate several degraded modes, which are represented by:
- an instrument panel display: flashing indicator lights and error codes
- a reduction in power level

The different degraded modes are more or less obstructive to the user depending on the type of problem that has occurred.
- Low urea level: the gauge indicates the level. If the level is below 10% of the total tank, a degraded mode will be activated to avoid damaging the system (reduction in power)
- Low external air temperature: when the SCR system is being heated up, a degraded mode warns the user and protects the system by reducing the power.
- System breakdown: error codes and degraded modes are used to warn of a potential problem.
- Poor quality urea: error codes are displayed and a degraded mode is activated, significantly reducing power output if anything other than AdBlue/DEF has been poured into the tank.

C. Schematic diagrams

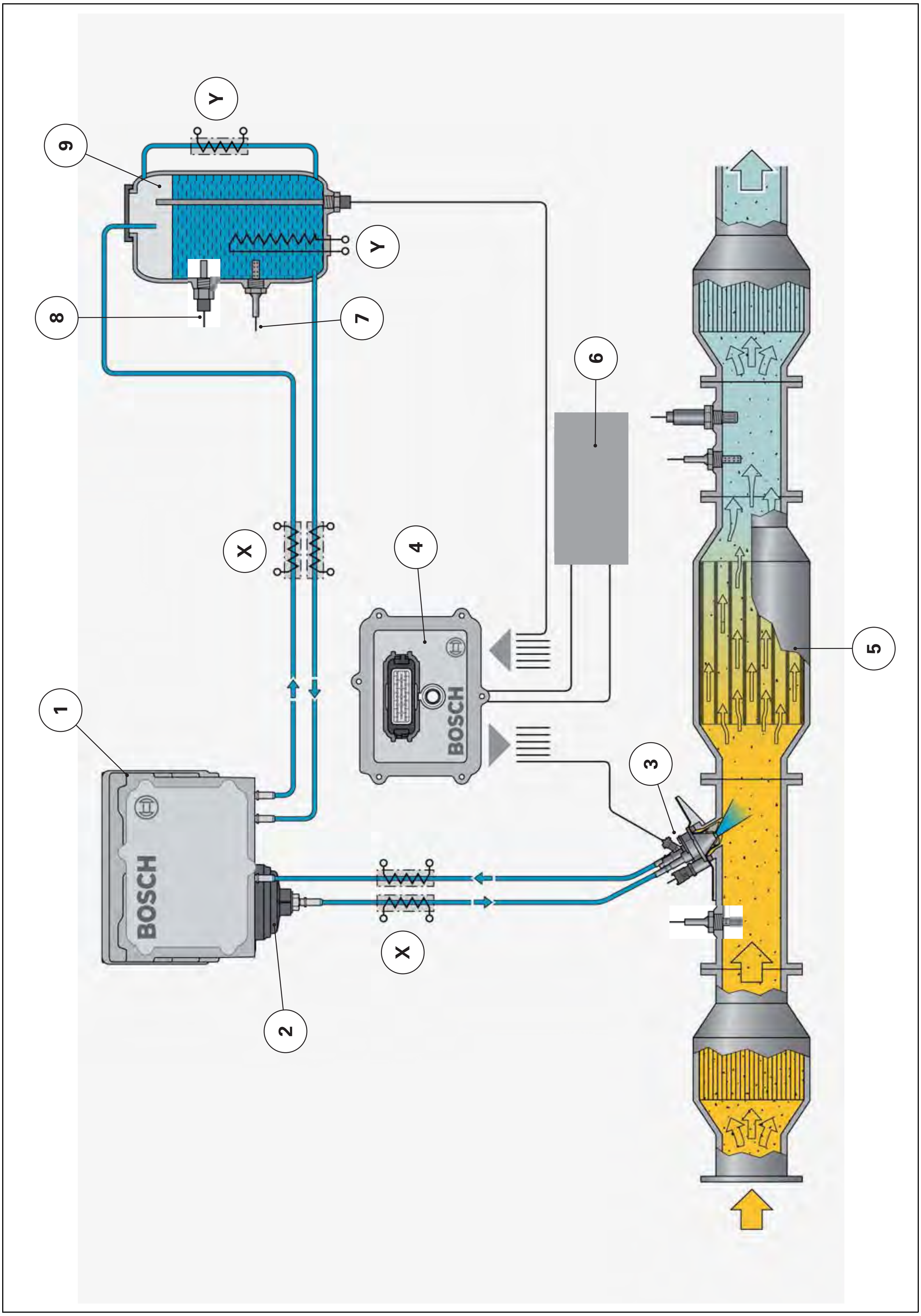
C.1 Simplified diagrams of the SCR system

(1) Engine
(2) Temperature sensor
(3) Catalyser
(4) Control unit
(5) Metering module
(6) Urea tank



I009250

Fig. 13



I009251

Fig. 14

(1) Denoxtronic module
(2) Filter
(3) Injector
(4) Denoxtronic module control unit
(5) Catalyser
(6) Engine CAN network
(7) Temperature sensor
(8) AdBlue/DEF quality sensor
(9) AdBlue/DEF tank
(X) Comparable to the coolant coil system
(Y) Comparable to the coolant parallel line

(1) Tank
(2) Top of tank preheater
(3) Preheater integrated in the gauge
(4) Coolant circulation solenoid valve
(5) Prefilter
(6) Diaphragm pump
(7) Level gauge
(8) Main filter
(9) Pressure sensor
(10) Temperature sensor
(11) Controllers
(12) Urea reverse circulation
(13) Relay
(14) 12 V tractor battery
(15) Injector
(16) Catalyser
(17) Temperature sensor
(18) Coolant delivery
(19) Coolant return
(20) To engine controller (CAN network)
(21) AdBlue/DEF quality sensor
(22) Sheath for cooling
(A) Pumping module
(B) Injection module
Coolant system

AdBlue/DEF system

C.2 Detailed diagram

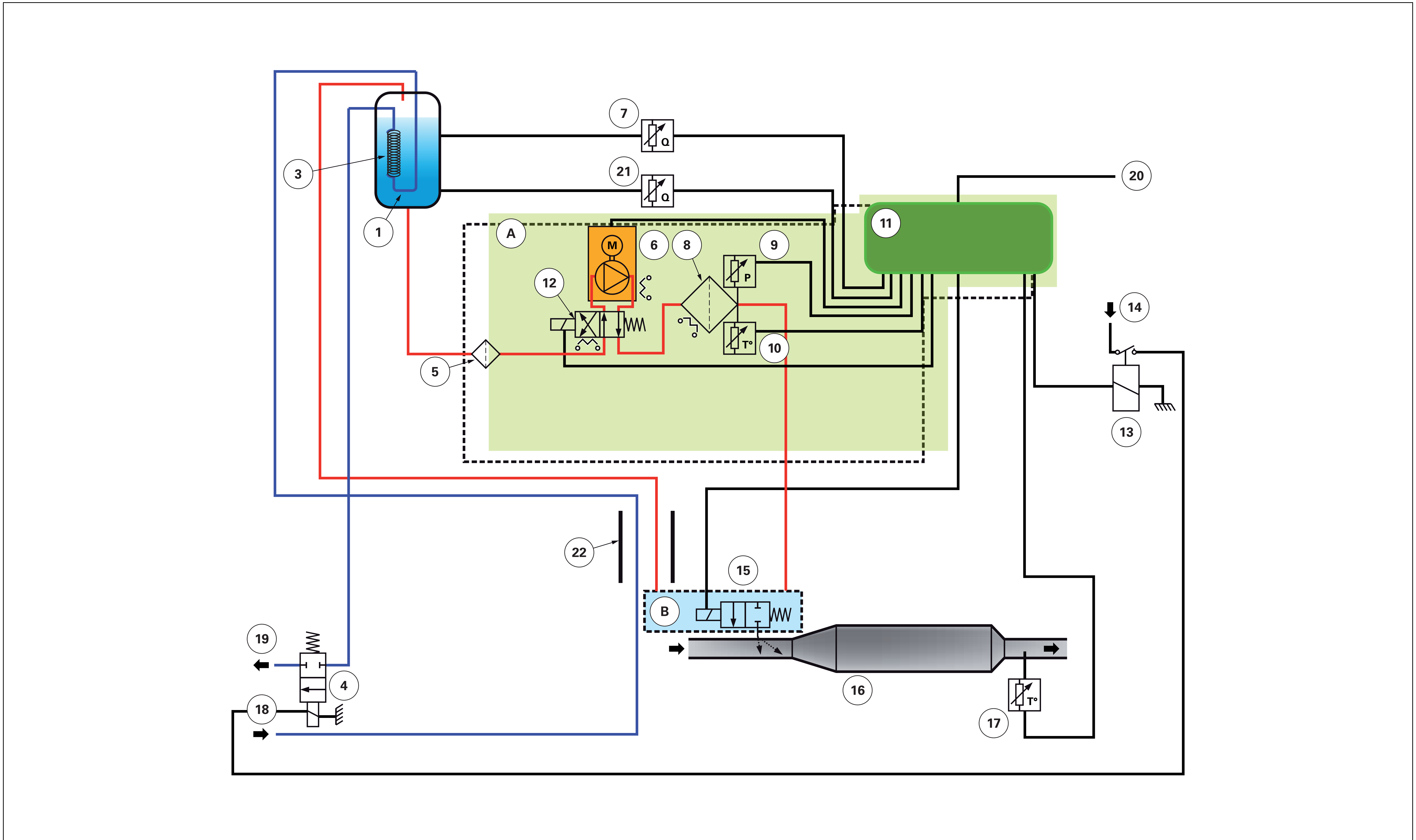


Fig. 15

3B11

SCR system - Error codes

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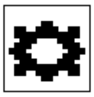
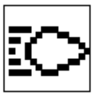
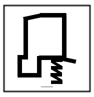
A. Reading error codes

	ERROR CODES DISPLAYED ON THE INSTRUMENT PANEL			
	DISPLAY with Dash Control Center			DISPLAY without Dash Control Center
Instrument panel		+	Letter D (Dashboard)	Letter D (Dashboard)
Engine		+	Letter E (Engine)	Letter E (Engine)
SCR system	no icon		Letter U (Urea)	Letter U (Urea)
Transmission/4WD/PTO		+	Letter T (Transmission)	Letter T (Transmission)
Lights module		+	Letter L (Light)	Letter L (Light)
ParkLock		+	Letter P (ParkLock)	Letter P (ParkLock)
Front axle		+	Letters FA (Front Axle)	Letters FA (Front Axle)
Linkage		+	Letters R (Linkage)	Letter R (Linkage)
Electrohydraulic		+	Letters H (Hydraulics)	Letter H (Hydraulics)
Cab		+	Letters C (Cab)	Letter C (Cab)
Auto-Guide		+	Letters A (Auto-Guide)	Letter A (Auto-Guide)
Control Arm		+	Letters AR (ARmrest)	Letter AR (ARmrest)

	OTHER DISPLAYS
Automatic air conditioning	Displayed on the air conditioning module.

B. Engine error codes

No.		FMI	Components concerned	Causes
E	91	4	Throttle sensor	Throttle sensor 1 LOW fault (IDLE)
E	91	3	Throttle sensor	Throttle sensor 1 HIGH fault (IDLE)
E	94	31	Fuel filter pressure sensor	Oil filter pressure LOW (with old sensor)
E	94	4	Fuel filter pressure sensor	LOW fuel filter pressure sensor fault
E	94	3	Fuel filter pressure sensor	HIGH fuel filter pressure sensor fault
E	94	2	Fuel filter pressure sensor	Fuel filter pressure NO SIGNAL
E	94	16	Fuel filter pressure sensor	Fuel filter pressure ABOVE NORMAL
E	94	18	Fuel filter pressure sensor	Fuel filter pressure BELOW NORMAL
E	97	31		Water in fuel
E	100	16	Oil pressure sensor	Oil pressure ABOVE NORMAL (9.5 bar/ 30°C)
E	100	2	Oil pressure sensor	Oil pressure NO SIGNAL
E	100	31	Oil pressure sensor	Oil pressure sensor fault
E	100	4	Oil pressure sensor	LOW oil pressure sensor fault
E	100	3	Oil pressure sensor	HIGH oil pressure sensor fault
E	100	18	Oil pressure sensor	Oil pressure LOW
E	100	1-	Oil pressure sensor	Oil pressure LOW, ALARM
E	102	4	Boost pressure sensor	LOW boost pressure sensor fault
E	102	3	Boost pressure sensor	HIGH boost pressure sensor fault
E	102	18	Boost pressure sensor	Boost pressure LOW
E	102	16	Boost pressure sensor	Boost pressure ABOVE NORMAL
E	102	2	Boost pressure sensor	Boost pressure NO SIGNAL
E	102	31	Boost pressure sensor	Inlet manifold pressure drop too HIGH at start-up
E	105	4	Inlet manifold temperature sensor	LOW inlet manifold temperature sensor fault
E	105	3	Inlet manifold temperature sensor	HIGH inlet manifold temperature sensor fault
E	105	16	Inlet manifold temperature sensor	Inlet manifold temperature ABOVE NOR-MAL (>90°C)
E	105	2	Inlet manifold temperature sensor	Inlet manifold temperature sensor NO SIGNAL
E	107	18	Air filter pressure sensor	Air filter pressure BELOW NORMAL
E	107	31	Air filter pressure sensor	Air filter pressure sensor fault
E	110	2	Coolant temperature sensor	Coolant temperature NO SIGNAL
E	110	4	Coolant temperature sensor	LOW coolant temperature sensor fault
E	110	3	Coolant temperature sensor	HIGH coolant temperature sensor fault
E	110	16	Coolant temperature sensor	Coolant temperature HIGH
E	110	0	Coolant temperature sensor	Coolant temperature HIGH, ALARM
E	157	4	Rail pressure sensor	LOW rail pressure sensor fault
E	157	3	Rail pressure sensor	HIGH rail pressure sensor fault
E	157	16	Rail pressure sensor	Rail pressure ABOVE NORMAL
E	157	2	Rail pressure sensor	Rail pressure NO SIGNAL
E	157	1-	Rail pressure sensor	Rail pressure LOW
E	157	0	Rail pressure sensor	Rail pressure HIGH
E	168	1-	Battery voltage	Battery voltage VERY LOW (<6.5 V)
E	168	0	Battery voltage	Battery voltage VERY HIGH (>36.0 V)
E	168	2	Battery voltage	Battery voltage NO SIGNAL

No.		FMI	Components concerned	Causes
E	168	18	Battery voltage	Battery voltage BELOW NORMAL (<7.8 V)
E	168	16	Battery voltage	Battery voltage ABOVE NORMAL
E	174	4	Fuel temperature sensor	LOW fuel temperature sensor fault
E	174	3	Fuel temperature sensor	HIGH fuel temperature sensor fault
E	174	16	Fuel temperature sensor	Fuel temperature ABOVE NORMAL
E	174	2	Fuel temperature sensor	Fuel temperature NO SIGNAL
E	175	4	Engine oil temperature sensor	LOW engine oil temperature sensor fault
E	175	3	Engine oil temperature sensor	HIGH engine oil temperature sensor fault
E	175	16	Engine oil temperature sensor	Engine oil temperature HIGH
E	175	2	Engine oil temperature sensor	Engine oil temperature sensor NO SIGNAL
E	190	16	Engine speed signal	Engine speed signal ABOVE NORMAL
E	626	4		Inlet air heater control, voltage below normal
E	626	3		Inlet air heater control, voltage above normal
E	629	10	EEPROM	EEPROM error
E	898	4	Requested speed	Requested speed out of LOW range (<500 rpm)
E	898	3	Requested speed	Requested speed out of HIGH range (>3000 rpm)
E	1136	16	ECU temperature sensor	ECU temperature ABOVE NORMAL >115°C
E	1136	4	ECU temperature sensor	ECU LOW temperature sensor fault
E	1136	3	ECU temperature sensor	ECU HIGH temperature sensor fault
E	1136	2	ECU temperature sensor	ECU temperature NO SIGNAL
E	1378	16		Engine oil drain: delayed for too long
E	9006	31	Vehicle CAN	Vehicle CAN off
E	9008	31	CAN ID module	CAN ID module off (ECU to ID)
E	9010	4	Ambient pressure sensor	LOW ambient pressure sensor fault
E	9010	3	Ambient pressure sensor	HIGH ambient pressure sensor fault
E	9010	16	Ambient pressure sensor	Ambient pressure ABOVE NORMAL
E	9010	2	Ambient pressure sensor	Ambient pressure NO SIGNAL
E	9021	4	5 V DC supply	5 V DC supply 1 LOW fault
E	9021	3	5 V DC supply	5 V DC supply 1 HIGH fault
E	9022	4	5 V DC supply	5 V DC supply 2 LOW fault
E	9022	3	5 V DC supply	5 V DC supply 2 HIGH fault
E	9023	4	5 V DC supply	5 V DC supply 3 LOW fault
E	9023	3	5 V DC supply	5 V DC supply 3 HIGH fault
E	9024	18	Supply of sensor detecting water in the fuel	Supply voltage of sensor detecting water in fuel BELOW NORMAL
E	9024	16	Supply of sensor detecting water in the fuel	Supply voltage of sensor detecting water in fuel ABOVE NORMAL
E	9025	31	Self-test cut-off paths	Self-test cut-off paths, monitoring
E	9026	3	Self-test cut-off paths	Self-test cut-off paths, HIGH processor voltage check
E	9027	4	Self-test cut-off paths	Self-test cut-off paths, LOW processor voltage check
E	9030	6	Main relay, short circuit to EARTH	Short circuit to EARTH, ECU main relay1
E	9030	3	Main relay, short circuit to BAT+	Short circuit to BAT+, ECU main relay1
E	9031	6	Main relay, short circuit to EARTH	Short circuit to EARTH, ECU main relay2

No.		FMI	Components concerned	Causes
E	9031	3	Main relay, short circuit to BAT+	Short circuit to BAT+, ECU main relay2
E	9032	6	Main relay, short circuit to EARTH	Short circuit to EARTH, ECU main relay3
E	9032	3	Main relay, short circuit to BAT+	Short circuit to BAT+, ECU main relay3
E	9033	31	Main relay	ECU cut-off does not work
E	9034	31	Main relay	ECU cut-off did not work last time
E	9035	31		Normal recovery
E	9036	31		Total restart after 3 recoveries in 2 seconds
E	9070	31	Crankshaft speed sensor	Crankshaft speed signal from the TPU
E	9071	31	Crankshaft speed sensor	Crankshaft speed signal, too many pulses
E	9072	31	Crankshaft speed sensor	Crankshaft speed sensor, reverse connected
E	9080	31	Cam speed sensor	APS cam speed signal
E	9081	31	Cam speed sensor	TPS cam speed signal
E	9082	31	Cam speed sensor	Cam speed sensor, reverse connected
E	9083	31	Cam speed sensor	No cam speed signal detected
E	9090	31	Engine speed signal	Engine speed signal evaluation error
E	9100	31		Protection upgrade fault
E	9107	31		Invalid ECU source address selection
E	9131	6	Solenoid valve 1	Solenoid valve 1, short circuit to EARTH (bank off)
E	9131	3	Solenoid valve 1	Solenoid valve 1, short circuit between cables (bank off)
E	9131	5	Solenoid valve 1	Solenoid valve 1, OPEN CIRCUIT
E	9131	31	Solenoid valve 1	Solenoid valve 1, fast decay error (bank off)
E	9131	11	Solenoid valve 1	Solenoid valve 1, current level error (bank off)
E	9132	6	Solenoid valve 2	Solenoid valve 2, short circuit to EARTH (bank off)
E	9132	3	Solenoid valve 2	Solenoid valve 2, short circuit between cables (bank off)
E	9132	5	Solenoid valve 2	Solenoid valve 2, OPEN CIRCUIT
E	9132	31	Solenoid valve 2	Solenoid valve 2, fast decay error (bank off)
E	9132	11	Solenoid valve 2	Solenoid valve 2, current level error (bank off)
E	9133	6	Solenoid valve 3	Solenoid valve 3, short circuit to EARTH (bank off)
E	9133	3	Solenoid valve 3	Solenoid valve 3, short circuit between cables (bank off)
E	9133	5	Solenoid valve 3	Solenoid valve 3, OPEN CIRCUIT
E	9133	31	Solenoid valve 3	Solenoid valve 3, fast decay error (bank off)
E	9133	11	Solenoid valve 3	Solenoid valve 3, current level error (bank off)
E	9134	6	Solenoid valve 4	Solenoid valve 4, short circuit to EARTH (bank off)
E	9134	3	Solenoid valve 4	Solenoid valve 4, short circuit between cables (bank off)
E	9134	5	Solenoid valve 4	Solenoid valve 4, OPEN CIRCUIT
E	9134	31	Solenoid valve 4	Solenoid valve 4, fast decay error (bank off)

No.		FMI	Components concerned	Causes
E	9134	11	Solenoid valve 4	Solenoid valve 4, current level error (bank off)
E	9135	6	Solenoid valve 5	Solenoid valve 5, short circuit to EARTH (bank off)
E	9135	3	Solenoid valve 5	Solenoid valve 5, short circuit between cables (bank off)
E	9135	5	Solenoid valve 5	Solenoid valve 5, OPEN CIRCUIT
E	9135	31	Solenoid valve 5	Solenoid valve 5, fast decay error (bank off)
E	9135	11	Solenoid valve 5	Solenoid valve 5, current level error (bank off)
E	9136	6	Solenoid valve 6	Solenoid valve 6, short circuit to EARTH (bank off)
E	9136	3	Solenoid valve 6	Solenoid valve 6, short circuit between cables (bank off)
E	9136	5	Solenoid valve 6	Solenoid valve 6, OPEN CIRCUIT
E	9136	31	Solenoid valve 6	Solenoid valve 6, fast decay error (bank off)
E	9136	11	Solenoid valve 6	Solenoid valve 6, current level error (bank off)
E	9150	16	Rail pressure sensor	Rail pressure, negative deviation
E	9150	18	Rail pressure sensor	Rail pressure, positive deviation
E	9150	5	Rail pressure sensor	Rail pressure, leakage detected during idle
E	9150	8	Rail pressure sensor	Rail pressure, leakage detected through quantity balance
E	9150	31	Rail pressure sensor	Rail pressure, leakage detected during overrun
E	9151	31	Pressure regulating valve	PRV recognised as OPEN
E	9151	7	Pressure regulating valve	PRV is sticking
E	9152	31	Fuel filter pressure sensor	Fuel filter pressure, fluctuating
E	9153	31	Fuel filter pressure sensor	Fuel filter pressure sensor, loose contact
E	9170	6	Lift pump control	Lift pump control (ECU), short circuit to earth
E	9170	5	Lift pump control	Lift pump control (ECU), open circuit
E	9171	6	Preheater control	Preheater control, short circuit to earth
E	9171	5	Preheater control	Preheater control, open circuit
E	9172	6	Starter relay control	Start relay control, short circuit to earth (lower side)
E	9172	3	Starter relay control	Start relay control, short circuit to BAT+ (lower side)
E	9172	5	Starter relay control	Start relay control, open circuit (lower side)
E	9172	31	Starter relay control	Start relay control, excessive temperature (lower side)
E	9173	6	Starter relay control	Start relay control, short circuit to earth (upper side)
E	9173	3	Starter relay control	Start relay control, short circuit to BAT+ (upper side)
E	9174	6	MPROP control	MPROP control, short circuit to earth
E	9174	3	MPROP control	MPROP control, short circuit to BAT+
E	9174	5	MPROP control	MPROP control, open circuit
E	9174	31	MPROP control	MPROP control, excessive temperature
E	9230	31	Diagnostic ID module	Engine specification mismatch
E	9231	31	Diagnostic ID module	Engine serial number mismatch

No.		FMI	Components concerned	Causes
E	9233	31	Diagnostic ID module	ID module not present
E	9234	31	Diagnostic ID module	ID not compatible with current ECU
E	9235	31	Diagnostic ID module	ID module memory fault
E	9235	3	Diagnostic ID module	ID module, supply voltage HIGH (>32.0 V)
E	9235	4	Diagnostic ID module	ID module memory fault
E	9235	16	Diagnostic ID module	ID temperature, temperature HIGH (>95°C)
E	9236	31	Diagnostic ID module	ID module additional memory defect
E	9237	31	Diagnostic ID module	ID module, monitoring reset
E	9238	31	Diagnostic ID module	ID module, brownout reset
E	9239	31	Diagnostic ID module	Engine specification missing
E	9240	31	Diagnostic ID module	Engine serial number missing
E	9241	31	Diagnostic ID module	ID module not present, bypass active
E	9242	31	Diagnostic ID module	Generated bypass time expired
E	9243	31	Diagnostic ID module	Maximum ECU bypass time expired
E	9244	31	Diagnostic ID module	ID module recovery
E	9303	31		Speed regulator UI fault
E	9304	31		Vehicle speed missing
E	9305	31		Incorrect digital input configuration
E	9306	31		PTO input error
E	9310	31		Fault with external digital input 1
E	9311	31		Fault with external digital input 2
E	9312	31		Torque control input
E	9317	31		DCU not present

C. SCR system error codes

No.		FMI	Cause(s)
U	168	0	Battery voltage monitoring: Voltage higher than normal
U	168	1-	Battery voltage monitoring: Voltage lower than normal
U	168	3	Battery voltage monitoring: Voltage too high
U	168	4	Battery voltage monitoring: Voltage too low
U	441	0	Catalyst downstream temperature sensor: Temperature too high
U	441	1-	Catalyst downstream temperature sensor: Temperature too low
U	441	2	Catalyst temp. downstream sensor plaus. Error: Static Plausibility
U	441	3	Catalyst downstream temperature sensor: Shortcut to Battery+
U	441	4	Catalyst downstream temperature sensor: Shortcut to Ground
U	441	11	Downstream catalyst temperature - physical error: Catalyst Temperature not OK
U	441	16	Catalyst temp. downstream sensor plaus. error: Dynamic plausibility, upper threshold
U	441	18	Catalyst temp. downstream sensor plaus. Error: Dynamic plausibility, lower threshold
U	442	0	Catalyst upstream temperature sensor: Temperature too high
U	442	1-	Catalyst upstream temperature sensor: Temperature too low
U	442	2	Catalyst temp. upstream sensor plaus. error: Static Plausibility
U	442	3	Catalyst upstream temperature sensor: Shortcut to Battery+
U	442	4	Catalyst upstream temperature sensor: Shortcut to Ground
U	442	16	Catalyst temp. upstream sensor plaus. error: Dynamic plausibility, upper threshold
U	442	18	Catalyst temp. upstream sensor plaus. error: Dynamic plausibility, lower threshold
U	697	3	Back flow line heater power stage error: Shortcut to Battery+
U	697	5	Back flow line heater power stage error: Open load
U	697	6	Back flow line heater power stage error: Shortcut to Ground
U	698	3	Cooling line heater power stage error: Shortcut to Battery+
U	698	5	Cooling line heater power stage error: Open load
U	698	6	Cooling line heater power stage error: Shortcut to Ground
U	699	3	Inlet line heater power stage error: Shortcut to Battery+
U	699	5	Inlet line heater power stage error: Open load
U	699	6	Inlet line heater power stage error: Shortcut to Ground
U	700	3	Pressure line heater power stage error: Shortcut to Battery+
U	700	5	Pressure line heater power stage error: Open load
U	700	6	Pressure line heater power stage error: Shortcut to Ground
U	1079	3	Sensor Supply Voltage 1 monitoring: Shortcut to Battery+
U	1079	4	Sensor Supply Voltage 1 monitoring: Shortcut to Ground
U	1080	3	Sensor Supply Voltage 2 monitoring: Shortcut to Battery+
U	1080	4	Sensor Supply Voltage 2 monitoring: Shortcut to Ground
U	1387	0	Urea pressure monitoring: Pressure too high
U	1387	1-	Urea pressure monitoring: Pressure too low
U	1387	2	Urea pressure sensor plausibility error: Dynamic plausibility
U	1388	3	Urea pressure sensor: Shortcut to Battery+
U	1388	4	Urea pressure sensor: Shortcut to Ground

No.		FMI	Cause(s)
U	1388	11	Urea pressure sensor: Supply voltage above upper or below lower limit
U	1485	3	Main relay error: No shut off of main relay
U	1485	6	Main relay error: Shut off too soon
U	1677	0	Modular Heater State Machine Error: Inlet line frozen error
U	1677	1-	Modular Heater State Machine Error: Pressure line frozen error
U	1677	2	Modular Heater State Machine Error: Pressure build - up error
U	1677	3	Modular Heater State Machine Error: Back flow line frozen error
U	1761	2	Urea Tank Level Sensor error: Range error of tank level
U	1761	3	Urea Tank Level Sensor error: Signal above upper limit
U	1761	4	Urea Tank Level Sensor error: Signal below lower limit
U	1761	5	Urea tank error: Open circuit in level sensor
U	1761	6	Urea tank error: Level sensor shortcut to GND
U	1761	9	Urea Tank Level Sensor error: Message overridden
U	1761	11	Urea tank error: Tank empty
U	1761	14	Urea Tank Level Sensor error: Supply Signal above upper or below lower limit
U	1761	17	Urea tank error: Tank level low
U	1761	18	Urea tank error: Tank level VERY low
U	1761	19	Urea Tank Level Sensor error: Time out
U	2854	2	CAN Rx Frame: Range error, barometric pressure or ambient air temp
U	2854	9	CAN Rx Frame: Message overridden
U	2854	19	CAN Rx Frame: Time out
U	2855	2	CAN Rx Frame: Range error of NOx/O2 concentration or status
U	2855	9	CAN Rx Frame: Message overridden
U	2855	19	CAN Rx Frame: Time out
U	2856	2	CAN Rx Frame: Range error of NOx/O2 concentration or status
U	2856	9	CAN Rx Frame: Message overridden
U	2856	19	CAN Rx Frame: Time out
U	2857	2	CAN Bus Off: CAN Bus 2
U	2857	19	CAN Bus Off: CAN Bus 1
U	2858	2	CAN Frame Error: Long Term Error Active or Error Suppression signal is out of range
U	2859	2	Message: Range error of UreaQ/Heating or Dosing Status/PTO/ Exh. gas mass or temp.
U	2859	9	CAN Frame Error: Message overridden
U	2859	19	CAN Frame Error: Time out
U	2860	2	CAN Frame Error: Range error of Exhaust Mass flow or Dew Point ErrorCode
U	2860	9	CAN Frame Error: Message overridden
U	2860	19	CAN Frame Error: Time out
U	2861	2	CAN Frame Error: Range error of EGR Valve Control signal
U	2861	9	CAN Frame Error: Message overridden
U	2861	19	CAN Frame Error: Time out
U	2862	2	CAN Frame Error: Message overridden
U	2862	19	CAN Frame Error: Time out
U	2863	2	CAN Frame Error: Range error of Engine speed
U	2863	9	CAN Frame Error: Message overridden

No.		FMI	Cause(s)
U	2863	11	CAN Frame Error: Range error of Driver demand % engine torque
U	2863	13	CAN Frame Error: Range error of Engine torque
U	2863	19	CAN Frame Error: Time out
U	2864	2	CAN Frame Error: Range error of Engine inlet air mass flow rate
U	2864	9	CAN Frame Error: Message overridden
U	2864	19	CAN Frame Error: Time out
U	2865	2	CAN Frame Error: Range error of Actual Retarder Percent Torque
U	2865	9	CAN Frame Error: Message overridden
U	2865	19	CAN Frame Error: Time out
U	2866	2	CAN Frame Error: Range error of Coolant or Engine oil temper-ature signal
U	2866	9	CAN Frame Error: Message overridden
U	2866	19	CAN Frame Error: Time out
U	2867	2	CAN Frame Error: Range error of Boost pressure or Intake Man-ifold 1 Temp.
U	2867	9	CAN Frame Error: Message overridden
U	2867	19	CAN Frame Error: Time out
U	2868	2	CAN Frame Error: Range error of external desired NOx emis-sions
U	2868	9	CAN Frame Error: Message overridden
U	2868	19	CAN Frame Error: Time out
U	2869	2	CAN Frame Error: Range error of Fuel injection quantity
U	2869	9	CAN Frame Error: Message overridden
U	2869	10	CAN Frame Error: Range error of Urea tank level
U	2869	11	CAN Frame Error: Range error of Urea tank temperature
U	2869	12	CAN Frame Error: Range error of NOx concentration from NOx sensor 2
U	2869	13	CAN Frame Error: Range error of NOx Status byte from NOx sensor 2
U	2869	19	CAN Frame Error: Time out
U	2870	2	CAN Frame Error: Range error of Vehicle speed
U	2870	9	CAN Frame Error: Message overridden
U	2870	19	CAN Frame Error: Time out
U	2871	2	CAN Frame Time Date Error: Range error
U	2871	9	CAN Frame Time Date Error: Message overridden
U	2871	19	CAN Frame Time Date Error: Time out
U	2872	8	DCU or Heater ON error: Time out - Timer 16 elapsed
U	2872	9	DCU or Heater ON error: Time out - Timer elapsed
U	2872	10	DCU or Heater ON error: Time out - Timer elapsed
U	3031	0	Urea Tank Temperature Sensor error: Signal Above Error
U	3031	1-	Urea Tank Temperature Sensor error: Signal Above Error
U	3031	2	Urea Tank Temperature Sensor error: J1939 error of Urea tank temp. signal
U	3031	3	Urea Tank Temperature Sensor error: Signal High Error
U	3031	4	Urea Tank Temperature Sensor error: Signal Low Error
U	3031	9	Urea Tank Temperature Sensor error: Message overridden error
U	3031	11	Plausibility check of urea tank temperature sensor: Signal not plausible
U	3031	19	Urea Tank Temperature Sensor error: Time out error

No.		FMI	Cause(s)
U	520201	0	Monitoring of Supply Module temperature: Temperature too high
U	520201	1-	Monitoring of Supply Module temperature: Temperature too low
U	520201	3	Monitoring of Supply Module temperature: Shortcut to Battery+
U	520201	4	Monitoring of Supply Module temperature: Shortcut to Ground
U	520220	9	EEPROM error: EEPROM communication error
U	520221	15	Frozen cycles counter error: Counter threshold exceeded
U	520221	16	Frozen cycles counter error: Counter2 threshold exceeded
U	520222	11	Emergency Shut Off: Over temperature detected (>85 °C)
U	520224	7	Tank Heater Valve Error: Detection of valve blocked open
U	520225	11	Urea Consumption Error: Urea consumption not plausible
U	520226	11	Urea Dosing Error: Dosing interrupted
U	520227	11	Urea Quality Error: Insufficient urea quality
U	520228	11	NOx emission control error: NOx threshold exceeded
U	520229	11	Urea Level Monitoring: Tank empty
U	520234	3	Diagnostic lamp power stage error: Shortcut to Battery+
U	520234	5	Diagnostic lamp power stage error: Open load
U	520234	6	Diagnostic lamp power stage error: Shortcut to Ground
U	520236	3	Filter outlet connector heater power stage error: Shortcut to Battery+
U	520236	5	Filter outlet connector heater power stage error: Open load
U	520236	6	Filter outlet connector heater power stage error: Shortcut to Ground
U	520237	3	Pressure compensation heater error: Shortcut to Battery+
U	520237	5	Pressure compensation heater error: Open load
U	520237	6	Pressure compensation heater error: Shortcut to Ground
U	520238	3	Filterbox module heater power stage error: Shortcut to Battery+
U	520238	5	Filterbox module heater power stage error: Open load
U	520238	6	Filterbox module heater power stage error: Shortcut to Ground
U	520239	3	Pump module heater power stage error: Shortcut to Battery+
U	520239	5	Pump module heater power stage error: Open load
U	520239	6	Pump module heater power stage error: Shortcut to Ground
U	520241	3	Urea dosing valve power stage error: Shortcut to Battery+
U	520241	5	Urea dosing valve power stage error: Open load
U	520241	6	Urea dosing valve power stage error: Shortcut to Ground
U	520241	7	Plausibility check of Urea Dosing Valve Stuck: UDV stuck closed
U	520241	14	Plausibility check of valve position stuck: Valve position unknown
U	520241	8	Plausibility check of Urea Dosing Valve Stuck: UDV stuck open
U	520242	3	Urea tank heater power stage error: Shortcut to Battery+
U	520242	5	Urea tank heater power stage error: Open load
U	520242	6	Urea tank heater power stage error: Shortcut to Ground
U	520243	2	Urea level plausibility error: Signal not plausible
U	520244	5	Pump speed evaluation error: Pump motor unplugged
U	520244	7	Pump speed evaluation error: Pump Motor Blocked
U	520244	8	Pump speed evaluation error: Over Speed condition
U	520244	12	Pump speed evaluation error: Pump Speed Sensor defective

No.		FMI	Cause(s)
U	520246	2	Plausibility check of urea tank temperature sensor: Signal not plausible
U	520248	3	Coolant control valve power stage error: Shortcut to Battery+
U	520248	5	Coolant control valve power stage error: Open load
U	520249	3	Reverting valve power stage error: Shortcut to Battery+
U	520249	5	Reverting valve power stage error: Open load
U	520249	6	Reverting valve power stage error: Shortcut to Ground
U	520250	6	Coolant control valve power stage error: Shortcut to Ground
U	520253	7	Detection of blocked pressure line: Blockage detected in state 1
U	520254	7	Detection of blocked backflow line: Block detected
U	520257	11	Static urea leakage test: Leakage detected
U	520260	7	Urea pressure buildup: Pressure buildup failed
U	520261	7	Urea pressure buildup: Error path bit 3 active
U	520262	2	Temperature plausibility during commissioning: Too cold during urea commissioning
U	520264	2	Urea pressure plausibility check: Urea pressure not plausible
U	520265	2	Urea box temperature - physical error: Box temperature too high or too low
U	520266	7	Vent Valve Error: CCV State machine, error path bit 3 active
U	520268	7	Reverting valve monitoring: Valve defect detected
U	520269	7	Vent Valve Error: Urea pressure not reduced
U	520273	3	Analog feedback signal for Main Relay 1: Shortcut to Battery+
U	520273	5	Analog feedback signal for Main Relay 1: Open circuit
U	520274	3	Analog feedback signal for Main Relay 2: Shortcut to Battery+
U	520274	4	Analog feedback signal for Main Relay 2: Shortcut to Ground
U	520274	5	Analog feedback signal for Main Relay 2: Open circuit
U	520275	3	Analog feedback signal for Main Relay 3: Shortcut to Battery+
U	520275	4	Analog feedback signal for Main Relay 3: Shortcut to Ground
U	520275	5	Analog feedback signal for Main Relay 3: Open circuit
U	520276	3	Monitoring of Supply Voltage: Shortcut to Battery+
U	520276	4	Monitoring of Supply Voltage: Shortcut to Ground
U	520277	3	Battery voltage monitoring: Voltage too high
U	520277	4	Battery voltage monitoring: Voltage too low
U	520296	11	Dosing Strategy Monitoring Module NOx conversion efficiency: Threshold 1 error
U	520297	11	Dosing Strategy Monitoring Module NOx conversion efficiency: Threshold 2 error
U	520298	2	Evaluation of Atmospheric Pressure: Range error of Barometric pressure
U	520299	2	Terminal 15 circuit defect: Ignition switch plausibility error
U	520301	2	NOx sensor concentration signal error: Plausibility check
U	520301	3	NOx sensor concentration signal error: Short circuit
U	520301	5	NOx sensor concentration signal error: Open wire
U	520301	11	NOx sensor concentration signal error: Other NOx errors
U	520301	17	NOx sensor concentration signal error: Sensor supply not in range
U	520302	2	NOx heater signal from NOx sensor: Plausibility check
U	520302	3	NOx heater signal from NOx sensor: Short circuit
U	520302	5	NOx heater signal from NOx sensor: Open wire
U	520302	11	NOx heater signal from NOx sensor: Other NOx errors

No.		FMI	Cause(s)
U	520308	2	NOx sensor plausibility error: Signal not plausible
U	520309	7	Start Up Cycle Counter for Pressure Drop during Dosing: Max. limit of counter exceeded
U	520310	2	Urea box temperature - physical error: Urea Temperature too high or too low

3B12

SCR system - Diagrams and plans

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A. Hydraulics diagram

(1)	Tank
(2)	Top of tank preheater
(3)	Preheater integrated in the gauge
(4)	Coolant circulation solenoid valve
(5)	Prefilter
(6)	Diaphragm pump
(7)	Level gauge
(8)	Main filter
(9)	Pressure sensor
(10)	Temperature sensor
(11)	Controllers
(12)	Urea reverse circulation
(13)	Relay
(14)	12 V tractor battery
(15)	Injector
(16)	Catalyser
(17)	Temperature sensor
(18)	Coolant delivery
(19)	Coolant return
(20)	To engine controller (CAN network)
(21)	AdBlue/DEF quality sensor
(22)	Sheath for cooling
(A)	Pumping module
(B)	Injection module
	Coolant system
	AdBlue/DEF system

A.1 Detailed diagram

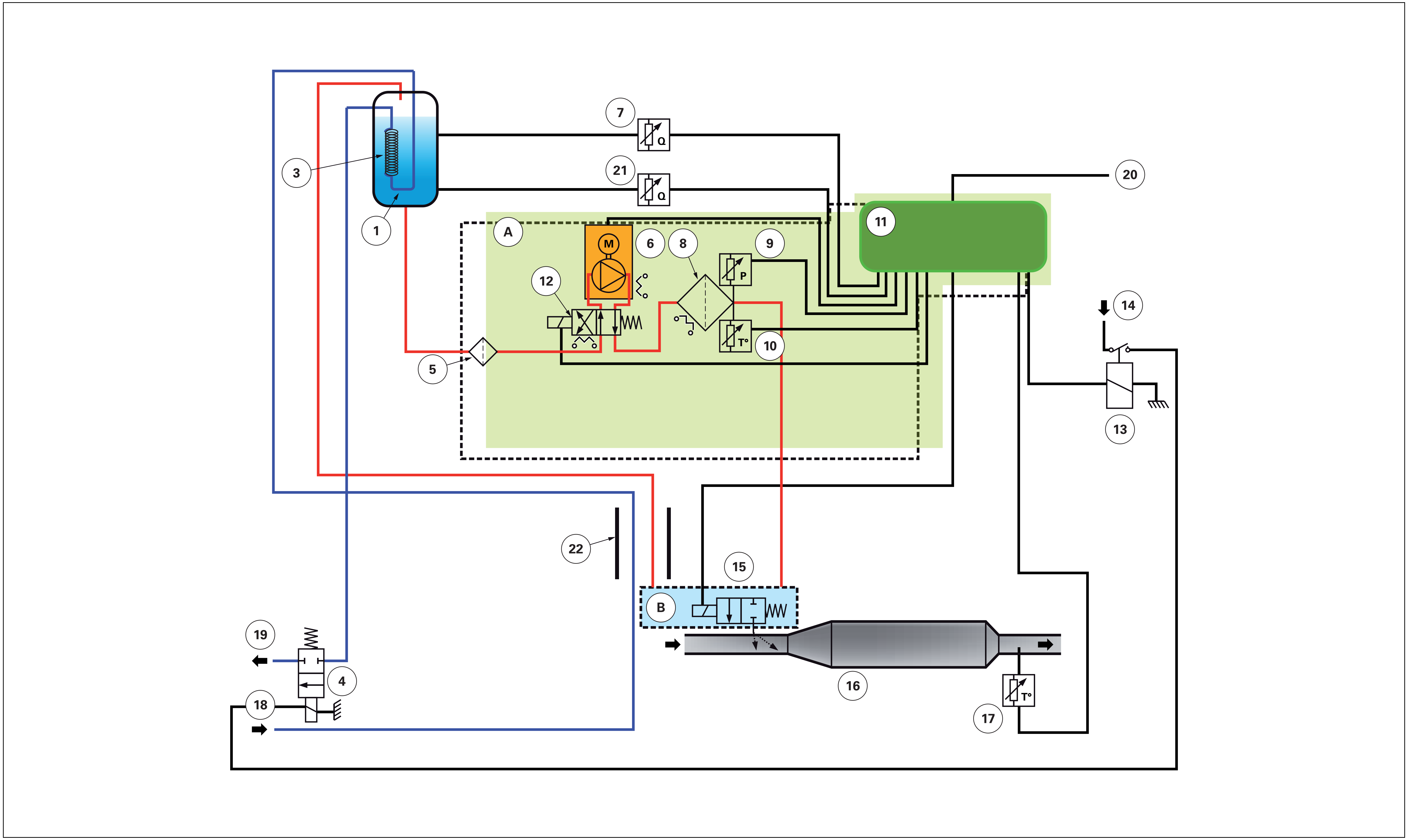

Fig. 1

B. Electrical diagrams

B.1 Identification of electrical connectors and harnesses

Identification of electrical connectors
X1 - Auxiliary hydraulic oil temperature sensor
X2 - Auxiliary hydraulic oil filter blockage switch
X3 - 540 rpm PTO speed solenoid valve
X4 - 1000 rpm PTO speed solenoid valve
X5 - 4WD solenoid valve
X6 - Differential lock solenoid valve
X7 - Rear PTO solenoid valve
X8 - Bevel gear theoretical speed sensor
X9 - Transmission oil high pressure sensor 1
X10 - Collecting shaft speed sensor
X11 - Solenoid valve limiting speed to 30 kph
X12 - Coupler function solenoid valve
X13 - Hare range solenoid valve
X14 - Tortoise range solenoid valve
X15 - PTO clutch speed sensor
X16 - PTO shaft speed sensor
X17 - Hare/Tortoise range position sensor
X18 - Transmission control module
X19 - Transmission hydraulic oil temperature sensor
X20 - Transmission filter blockage switch
X21 - ParkLock brake pressure sensor
X22 - Radar
X23 - Steering pressure sensor
X24 - Auxiliary hydraulic oil gauge
X25 - Engine speed sensor
X26 - Pneumatic brake solenoid valve
X27 - Rear linkage lifting solenoid valve
X28 - Rear linkage lowering solenoid valve
X29 - Dual Control socket connector
X30 - Rear linkage position sensor
X31 - Rear linkage right-hand draft sensor
X32 - Rear linkage left-hand draft sensor
X33 - Transmission harness CAN junction
X34 - Transmission oil high pressure sensor 2
X35 - ParkLock hydraulic system pressure sensor
X36 - LS signal breaker solenoid valve
X37 - ParkLock pressure reversing solenoid valve
X38 - Trailer braking proportional solenoid valve
X39 - Trailer braking safety solenoid valve
X40 - Front linkage single/double acting function solenoid valve
X41 - Divider solenoid valve 1
X42 - Divider solenoid valve 2
X43 - Auto-hitch lifting solenoid valve
X44 - Auto-hitch lowering solenoid valve
X45 - Bleed for pneumatic suspended cab front and rear systems
X46 - Rear left-hand ram position sensor for cab suspension
X47 - Rear right-hand unit for suspended cab
X48 - Rear left-hand unit for suspended cab
X49 - Suspended cab rear lowering solenoid valve
X50 - Suspended cab front lowering solenoid valve
X51 - Transmission harness earth (chassis)
X52 - Engine harness/transmission harness junction
X53 - Cab transmission harness/transmission harness junction
X54 - Suspended cab lifting solenoid valve
X55 - Instrument panel
X56 - Power Control lever
X57 - DOT Matrix keyboard
X58 - Windscreen wiper and indicator control unit
X59 - DOT Matrix keyboard connection on instrument panel
X60 - Engine harness/instrument panel harness junction
X61 - Cab transmission harness/engine harness junction
X62 - Instrument panel harness/cab transmission harness junction
X63 - Instrument panel harness connection on fuse box
X64 - Instrument panel harness connection on fuse box
X65 - Front windscreen wiper motor
X66 - Left-hand brake pedal sensor
X67 - Right-hand brake pedal sensor
X68 - Clutch pedal sensor
X69 - Cab interior temperature sensor
X70 - Solar radiation sensor
X71 - Throttle pedal sensor
X72 - ParkLock switch on Power Control lever
X73 - Buzzer Control
X74 - Buzzer Supply (+12 V APC)
X75 - Pillar harness/right-hand fender harness junction
X76 - Rear right-hand indicator
X77 - Rear right-hand side light and stop light
X78 - Work light on rear right-hand fender
X79 - -
X80 - -
X81 - -
X82 - -
X83 - -
X84 - -
X85 - -
X86 - -
X87 - Linkage lifting/lowering switch on right-hand fender
X88 - Rear right-hand NA indicator extension
X89 - Earth (chassis)
X90 - Pillar harness/left-hand fender harness junction
X91 - Rear left-hand indicator
X92 - Rear left-hand side light and stop light
X93 - Work light on rear left-hand fender
X94 - PTO ON/OFF switch on left-hand fender
X95 - PTO Stop switch on left-hand fender
X96 - Hydraulic spool valve switch on left-hand fender
X97 - Linkage lifting/lowering switch on left-hand fender
X98 - Rear left-hand NA indicator extension
X99 - PTO and linkage console harness/cab transmission harness junction
X100 - Instrument panel harness earth (chassis)
X101 - Instrument panel harness/electric rear-view mirror harness junction
X102 - Right-hand fender lighting harness/trailer connector harness junction
X103 - Armrest harness/cab transmission harness junction
X104 - Armrest Autotronic 5

X105 - Datatronic CCD
X106 - Transmission lever in armrest
X107 - Headland mode switch (headland function)
X108 - FingerTIP 3
X109 - FingerTIP 4
X110 - FingerTIP 5
X111 - DTM dynamic transmission mode switch
X112 - Joystick
X113 - Armrest 6-button keyboard
X114 - Supply on fuse box for 3rd spool valve
X115 - Supply on fuse box for 4th spool valve
X116 - +12 V battery supply (for lighting module)
X117 - Isobus +12 V battery power socket
X118 - Automatic PTO switch
X119 - Rear linkage lifting/lowering switch
X120 - Datatronic CCD navigation keyboard
X121 - Rear linkage height/depth adjustment thumb wheel
X122 - Hand throttle
X123 - Hare/Tortoise range shift switch
X124 - Pedal/lever mode switch
X125 - SV1 speed setting potentiometer
X126 - SV2 speed setting potentiometer
X127 - Front PTO ON/OFF switch
X128 - Rear PTO ON/OFF switch
X129 - Fuse box +12 V battery connection
X130 - FingerTIP 6 front linkage function
X131 - Front linkage suspension solenoid valve
X132 - Instrument panel harness/armrest harness junction
X133 - Console harness/cab transmission harness junction
X134 - Console harness/pillar harness junction
X135 - Braking pressure sensor
X136 - Differential lock switch
X137 - 4WD switch
X138 - Hazard warning lights indicator light and switch
X139 - Suspended front axle switch
X140 - Suspended front axle setting potentiometer
X141 - Suspended cab switch
X142 - Suspended cab setting potentiometer
X143 - Variable steering switch (fast steering)
X144 - Variable steering setting potentiometer (fast steering)
X145 - PTO/linkage console
X146 - Rear linkage suspension switch
X147 - Roof harness/pillar harness junction
X148 - Roof harness/pillar harness junction
X149 - Headlights module (black connector)
X150 - Pillar harness/cab power socket harness junction
X151 - Pillar harness/cab power socket harness junction
X152 - Start switch
X153 - Non-Isobus implement connector
X154 - Suspended front axle lifting solenoid valve
X155 - Cigarette lighter socket (power)
X156 - Cigarette lighter socket (backlighting)
X157 - Left-hand side +12 V socket (power)
X158 - Left-hand side +12 V socket (backlighting)
X159 - Suspended front axle lowering solenoid valve
X160 - Console harness earth (chassis)
X161 - Solenoid valve 1 for suspended front axle suspension
X162 - Pillar harness connection on fuse box
X163 - Solenoid valve 2 for suspended front axle suspension
X164 - Pillar harness/cab transmission harness junction
X165 - Automatic air conditioning harness/pillar harness junction
X166 - Suspended front axle position sensor
X167 - +12 V APC fuse box connection
X168 - Pneumatic brake system pressure sensor
X169 - Power socket control switch (in cab)
X170 - Pillar harness connection on fuse box
X171 - Cab transmission harness connection on fuse box
X172 - Cab transmission harness connection on fuse box
X173 - Cab transmission harness earth
X174 - Autotronic 4 transmission controller
X175 - Emergency control switch
X176 - Earth (Autotronic 4 transmission controller)
X177 - Autotronic 5 Linkage
X178 - ParkLock/suspended front axle/passive suspended cab Autotronic 5
X179 - Main lighting, sidelight/dipped light activation switch
X180 - Front windscreen washer pump
X181 - Front linkage single acting / double acting function switch
X182 - Linkage external lifting switch
X183 - Diagnostics connector (tractor-Isobus CAN)
X184 - Diagnostics connector (engine-valve CAN)
X185 - Sisu EEM unit
X186 - Starter
X187 - Engine start relay
X188 - Engine identification module (ID module)
X189 - Fuel lift pump
X190 - Vistronic fan
X191 - Diesel fuel preheater
X192 - B + alternator 1
X193 - B + alternator 2
X194 - D + alternator 1
X195 - D + alternator 2
X196 - In line fuse (225 A)
X197 - Diesel fuel gauge
X198 - Pneumatic trailer brake sensor
X199 - Work light on left-hand step
X200 - Work light on right-hand step
X201 - Engine harness earth
X202 - Front accessory connection socket harness/front function harness junction
X203 - Engine harness/front headlights harness junction
X204 - Cooling unit harness/engine harness junction
X205 - Front axle harness/engine harness junction
X206 - Sensor detecting water in the diesel fuel
X207 - Pneumatic seat adjustment control
X208 - Front linkage suspension switch LED
X209 - Rear linkage external lowering switch
X210 - Orbitrol steering sensor (SASA sensor)
X211 - Rear Dual Control connector

X212 - Instrument panel harness/armrest harness junction
X213 - Power socket for additional heating
X214 - Armrest harness/cab transmission harness junction
X215 - Trailer connector (right-hand side light and number plate lights)
X216 - Reversing light
X217 - Isobus CAN connector
X218 - External Isobus tool connector
X219 - Cab Isobus harness/external Isobus harness junction
X220 - Trailer connector (left-hand side light)
X221 - Trailer connector (right-hand indicator)
X222 - Trailer connector (left-hand indicator)
X223 - Trailer connector (brake lights)
X224 - Trailer connector (earth)
X225 - Trailer connector (reversing light)
X226 - Trailer connector harness earth
X227 - Console harness/cab transmission harness junction
X228 - Front linkage single/double-acting function LED
X229 - 120 Ohm CAN 1 resistor (cab transmission harness)
X230 - 120 Ohm CAN 2 resistor (cab transmission harness)
X231 - 120 Ohm CAN 3 resistor (cab transmission harness)
X232 - 120 Ohm CAN 4 resistor (cab transmission harness)
X233 - Cab transmission harness/Isobus harness junction
X234 - 120 Ohm CAN ATC resistor
X235 - Front axle steering sensor (WAS sensor)
X236 - Electrohydraulic Orbitrol (grey connector)
X237 - Electrohydraulic Orbitrol (black connector)
X238 - Connector 1 for valve harness
X239 - Connector 2 for valve harness
X240 - 120 Ohm resistor for electrohydraulic spool valves
X241 - Sisu engine preheating supply (Grid Heater)
X242 - Exhaust temperature sensor
X243 - AdBlue/DEF reservoir (urea) level gauge and temperature sensor
X244 - CAN SCR harness
X245 - +12 V APC supply for SCR
X246 - Auto-Guide external harness/engine harness junction
X247 - Roof harness/electric rear-view mirror harness junction
X248 - Right and left-hand electric rear-view mirror adjustment switch
X249 - External rear-view mirror defroster switch
X250 - Power socket in cab
X251 - In line fuse (225 A)
X252 - Automatic air conditioning condenser
X253 - Air filter vacuum sensor
X254 - Horn (earth)
X255 - Horn
X256 - Roof harness/hand rail harness junction
X257 - Side light and indicator on hand rail (right and left)
X258 - Main beam on hand rail (right and left)
X259 - Hand rail upper work light
X260 - Hand rail upper work light
X261 - Front right-hand unit for suspended cab
X262 - Front left-hand unit for suspended cab
X263 - Floating stop relay control (US front-end loader)
X264 - Front linkage suspension switch
X265 - Rear linkage suspension switch indicator light
X266 - Rear linkage diagnostic and lifting/lowering LEDs
X267 - Switch for left-hand side heater
X268 - Pillar harness connection on fuse box
X269 - Cab suspension harness/cab transmission harness junction
X270 - Front accessories connection socket (rotary beacon)
X271 - Front accessories connection socket (+12 V battery)
X272 - Front accessories connection socket (+12 V APC)
X273 - Front accessories connection socket (main beam light)
X274 - Front accessories connection socket (main beam light)
X275 - Front accessories connection socket (work light)
X276 - Earth for front accessory connection socket harness
X277 - Front linkage lifting/lowering external control
X278 - Front linkage lifting switch (external)
X279 - Dual Control or TIC position sensor
X280 - Front linkage rams pressure sensor
X281 - Solenoid valve for front PTO
X282 - Roof harness/cab Auto-Guide harness junction
X283 - TopDock
X284 - Headlights module keyboard
X285 - Ad Blue (urea) metering valve
X286 - Ad Blue (urea) injection valve
X287 - Ad Blue (urea) reservoir preheating valve
X288 - 12/24 V converter for SCR system
X289 - SCR management module
X290 - Front accessory connection socket harness/front function harness junction
X291 - Front accessory connection socket harness/front function harness junction
X292 - Front windscreen washer pump
X293 - 540 rpm PTO switch
X294 - 540 eco rpm PTO switch
X295 - 1000 rpm PTO switch
X296 - USB connector
X297 - PTO/linkage console backlighting
X298 - Headland mode switch (headland function)
X299 - Linkage lowering speed potentiometer
X300 - -
X301 - PTO stop switch on left-hand fender
X302 - Switch for pre-selected engine speed A
X303 - Switch for pre-selected engine speed B
X304 - Instrument panel harness/armrest harness junction
X305 - Headlights module (grey connector)
X306 - Switch for pre-selected engine speed A/B
X307 - FingerTIP 1
X308 - FingerTIP 2
X309 - SV1/SV2 speed regulator switch

X310 - Divider 1 indicator light and solenoid valve (earth)
X311 - Divider 2 indicator light and solenoid valve (+12 V)
X312 - SV1/SV2 speed setting potentiometer in armrest
X313 - Pedal/lever transmission control mode switch and DTM switch
X314 - Hydraulics switch 1, road/field mode
X315 - Hydraulics switch 2, road/field mode
X316 - Headland mode switch (headland function)
X317 - + battery supply for headlights module
X318 - Automatic air conditioning compressor
X319 - + battery supply for headlights module
X320 - + battery supply on headlights module
X321 - + battery supply on headlights module
X322 - + battery supply on headlights module
X323 - + battery supply on headlights module
X324 - +12 V APC fuse box connector (battery isolator switch)
X325 - Pillar harness / non-Isobus implement connector harness junction
X326 - Pillar harness / non-Isobus implement connector harness junction
X327 - Battery earth (chassis)
X328 - Battery isolator switch earth terminal
X329 - Battery isolator switch earth terminal
X330 - Battery negative terminal contact (battery isolator switch)
X331 - Pillar harness connection on fuse box
X332 - + battery (start switch)
X333 - Engine harness earth (chassis)
X334 - Battery isolator switch earth terminal
X335 - Battery isolator switch earth terminal
X336 - Battery isolator switch
X337 - Pneumatic brake ParkLock solenoid valve
X338 - Earth (battery isolator switch)
X339 - Pneumatic trailer braking solenoid valve
X340 - + terminal on battery for fuse box
X341 - Starter supply
X342 - Positive battery terminal
X343 - RS232 diagnostics connector for Auto-Guide
X344 - Isobus connector in cab
X345 - Supply for additional terminal (mitron unit)
X346 - Auto-Guide switch
X347 - Cab transmission harness connection on fuse box
X348 - Cab transmission harness connection on fuse box
X349 - -
X350 - Front right-hand grille work light
X351 - Front right-hand grille work light
X352 - Front right-hand grille work light
X353 - Front left-hand grille work light
X354 - Front left-hand grille work light
X355 - Front left-hand grille work light
X356 - Right-hand main beam and dipped light
X357 - Left-hand main beam and dipped light
X358 - Outside temperature sensor
X359 - Cab suspension harness/cab transmission harness junction
X360 - Pillar harness connection on fuse box
X361 - Pillar harness connection on fuse box
X362 - Fuse box (+12 V battery)
X363 - Auto-hitch (Dromone) switch
X364 - 120 Ohm resistor for Auto-Guide/Isobus CAN network
X365 - Hand rail lower work light
X366 - Pneumatic brake harness / transmission harness junction
X367 - Switch 1 on joystick
X368 - Switch 2 on joystick
X369 - Engine speed + switch
X370 - Engine speed - switch
X371 - Engine speed stop switch
X372 - Orbitrol safety solenoid valve
X373 - Left-hand 12 V socket (cab) (power)
X374 - Left-hand 12 V socket (cab) (backlighting)
X375 - Instrument panel harness/cab transmission harness junction
X376 - Fuse box (reserve for + APC)
X377 - Fuse box (supply for cab suspension compressor)
X378 - FNRP lever and button
X379 - Front left-hand work light on roof
X380 - Front right-hand work light on roof
X381 - Front left-hand work light on roof
X382 - Front right-hand work light on roof
X383 - Front left-hand roof indicator
X384 - Front right-hand roof indicator
X385 - Rear left-hand work light on roof
X386 - Rear right-hand work light on roof
X387 - Rear left-hand work light on roof
X388 - Rear right-hand work light on roof
X389 - Rear left-hand work lights
X390 - Rear right-hand work lights
X391 - Rear left-hand roof indicator
X392 - Rear right-hand roof indicator
X393 - Earth
X394 - Radio aerial connector
X395 - Radio supply
X396 - Radio speaker connector
X397 - Front left-hand speaker
X398 - Front right-hand speaker
X399 - Rear left-hand speaker (+ supply)
X400 - Rear right-hand speaker (+ supply)
X401 - Rear left-hand speaker (- supply)
X402 - Rear right-hand speaker (- supply)
X403 - Rear windscreen wiper motor
X404 - Door switch
X405 - Interior light (earth)
X406 - Interior light (control)
X407 - Interior light (+12 V battery supply)
X408 - Right-hand console light
X409 - Left-hand rotary beacon
X410 - Right-hand rotary beacon
X411 - Rear windscreen wiper switch
X412 - Radio aerial
X413 - Earth (aerial)
X414 - Left-hand number plate light
X415 - Right-hand number plate light
X416 - Radio supply
X417 - Radio speaker connector
X418 - Earth
X419 - Earth
X420 - Rotary beacon harness earth (chassis)

X421 - Earth
X422 - Roof harness earth (chassis)
X423 - Left-hand side fan ON/OFF switch
X424 - Fan speed control knob
X425 - Air conditioning switch
X426 - Air conditioning indicator light
X427 - Manual air conditioning module
X428 - Electronic thermostat for heating
X429 - Speed 1relay for fan
X430 - Speed 2relay for fan
X431 - Speed 3relay for fan
X432 - Speed 4relay for fan
X433 - Left-hand heating resistor
X434 - Right-hand fan
X435 - Left-hand fan
X436 - Left-hand side fan switch
X437 - Relay for left-hand side fan
X438 - Earth (automatic air conditioning)
X439 - Air conditioning control module (blue connector)
X440 - Air conditioning control module (yellow connector)
X441 - Heating temperature sensor
X442 - TT2 sensor
X443 - Evaporator temperature sensor
X444 - Right-hand fan adapter module (signal)
X445 - Left-hand fan adapter module
X446 - Right-hand fan adapter module (supply)
X447 - Left-hand fan adapter module (supply)
X448 - Separation harness for automatic air conditioning
X449 - Motor for left-hand heating shutter
X450 - Motor for right-hand heating shutter
X451 - Motor for heating mixer shutter
X452 - Relay for heater pump
X453 - Heater accelerator pump
X454 - Earth (roof)
X455 - Roof harness earth
X456 - Solar panel
X457 - Earth (Auto-Guide)
X458 - Cab transmission harness/pillar harness junction
X459 - Linkage lifting switch on fender
X460 - Linkage lowering switch on fender
X461 - Pillar harness/TECU harness junction
X462 - Supply indicator light for power socket on pillar
X463 - Earth (Isobus)
X464 - Pillar harness/armrest harness junction
X465 - Battery positive terminal contact
X466 - Active suspended cab Autotronic 5
X467 - Right-hand electric rear-view mirror
X468 - Left-hand electric rear-view mirror
X469 - Additional fan connection
X470 - Operator presence in seat switch
X471 - Suspended cab harness connection

Identification of harnesses
FAI200 - Engine harness
FAI201 - Front headlights harness
FAI202 - Suspended front axle harness
FAI203 - Transmission harness
FAI204 - Cab/platform linkage external harness
FAI205 - Electrohydraulic valves harness
FAI206 - Transmission harness — PTO
FAI207 - Front Dual Control harness
FAI208 - Linkage with Dual Control and TIC harness
FAI209 - Instrument panel harness
FAI210 - Cab transmission harness
FAI211 - Cab linkage harness
FAI212 - Lighting harness
FAI213 - Cab interior lighting harness
FAI214 - Armrest harness
FAI215 - Pillar harness
FAI216 - Diagnostics connector harness
FAI217 - Datatronic 3 harness
FAI218 - Fieldstar harness
FAI219 - Cab interior power socket harness
FAI220 - BOC harness — safety switch
FAI221 - Automatic air conditioning harness — instrument panel
FAI222 - Autotronic 5 ParkLock/suspended front axle harness
FAI223 - Roof harness
FAI224 - Hand rail lighting harness
FAI225 - Electric rear-view mirror harness
FAI226 - Roof/external harness
FAI227 - Automatic air conditioning harness - roof
FAI228 - Number plate lighting harness
FAI229 - Xenon light adapter harness
FAI230 - GSPTO harness
FAI231 - Transmission harness — ParkLock
FAI232 - Radio harness
FAI235 - Front accessory connection socket harness
FAI236 - Start-up harness
FAI237 - +12 APC fuse box harness
FAI238 - +12 APC instrument panel harness
FAI239 - Permanent +12 V supply harness
FAI240 - +12 V permanent fuse box harness
FAI241 - Automatic air conditioning adapter harness
FAI242 - Main beams on hand rail adapter harness
FAI243 - Circuit breaker harness
FAI244 - Linkage external controls extension harness
FAI245 - Left-hand linkage external controls harness
FAI246 - Right-hand linkage external controls harness
FAI247 - PTO shunt harness
FAI248 - Linkage external controls harness
FAI249 - Suspended front axle harness
FAI250 - Engine harness
FAI251 - Parking brake harness
FAI252 - +12 V battery harness
FAI253 - Hand rail harness
FAI254 - Windscreen wiper harness
FAI255 - Windscreen wiper harness
FAI256 - High-visibility roof heating harness
FAI257 - High-visibility roof heating harness
FAI258 - Roof earth harness
FAI260 - Cooling unit harness
FAI261 - Isobus harness
FAI262 - Auto-Guide engine harness
FAI263 - Auto-Guide cab adapter harness
FAI265 - Pneumatic brake harness
FAI267 - Console harness
FAI268 - Front function harness
FAI271 - Cab electric rear-view mirror harness
FAI272 - Active suspended cab harness

FAI273 - Front linkage harness
FAI274 - Rear right-hand lighting harness
FAI275 - Trailer connector harness
FAI276 - Rear left-hand lighting harness
FAI280 - Negative battery harness
FAI281 - Negative battery harness
FAI282 - Negative battery harness
FAI283 - TopDock harness
FAIxxx - Non-Isobus tool connector harness
FAIxxx - Non-Isobus implement connector controller harness
FAIxxx - Additional fan harness

B.2 Fuse box supply with circuit breaker

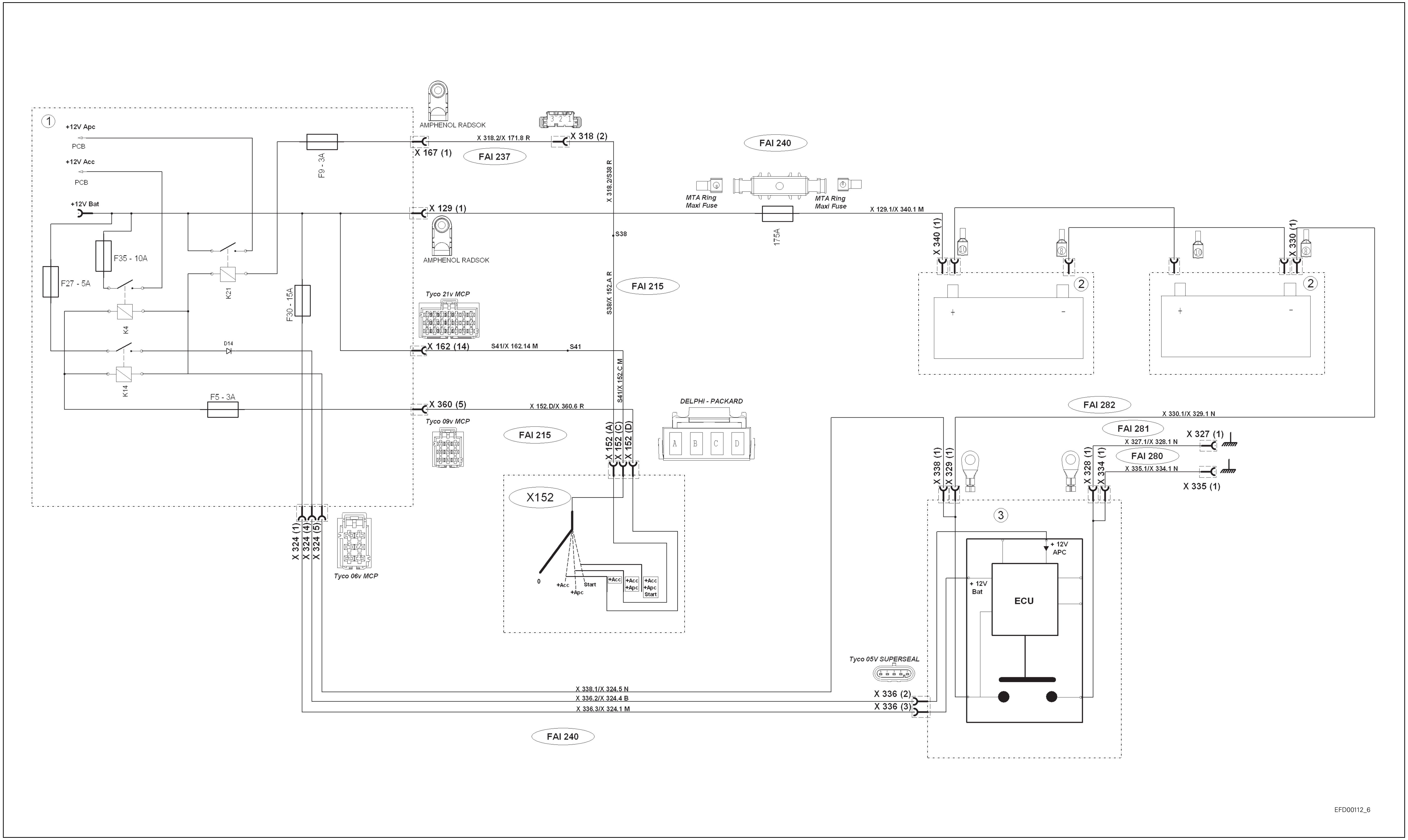

Fig. 2

B.3 Autotronic 4 electrical power supply

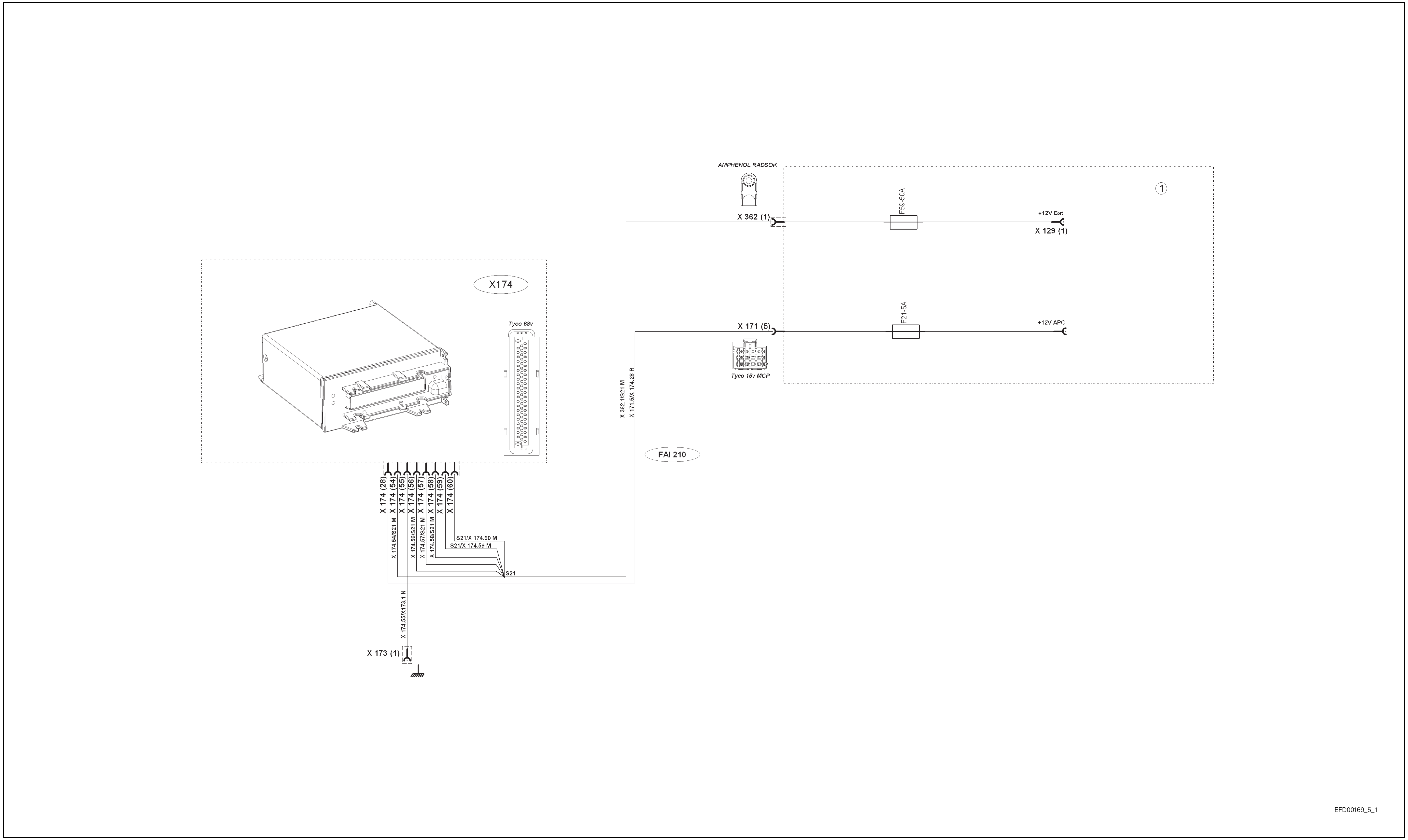

Fig. 3

B.4 Autotronic 5 linkage electrical power supply

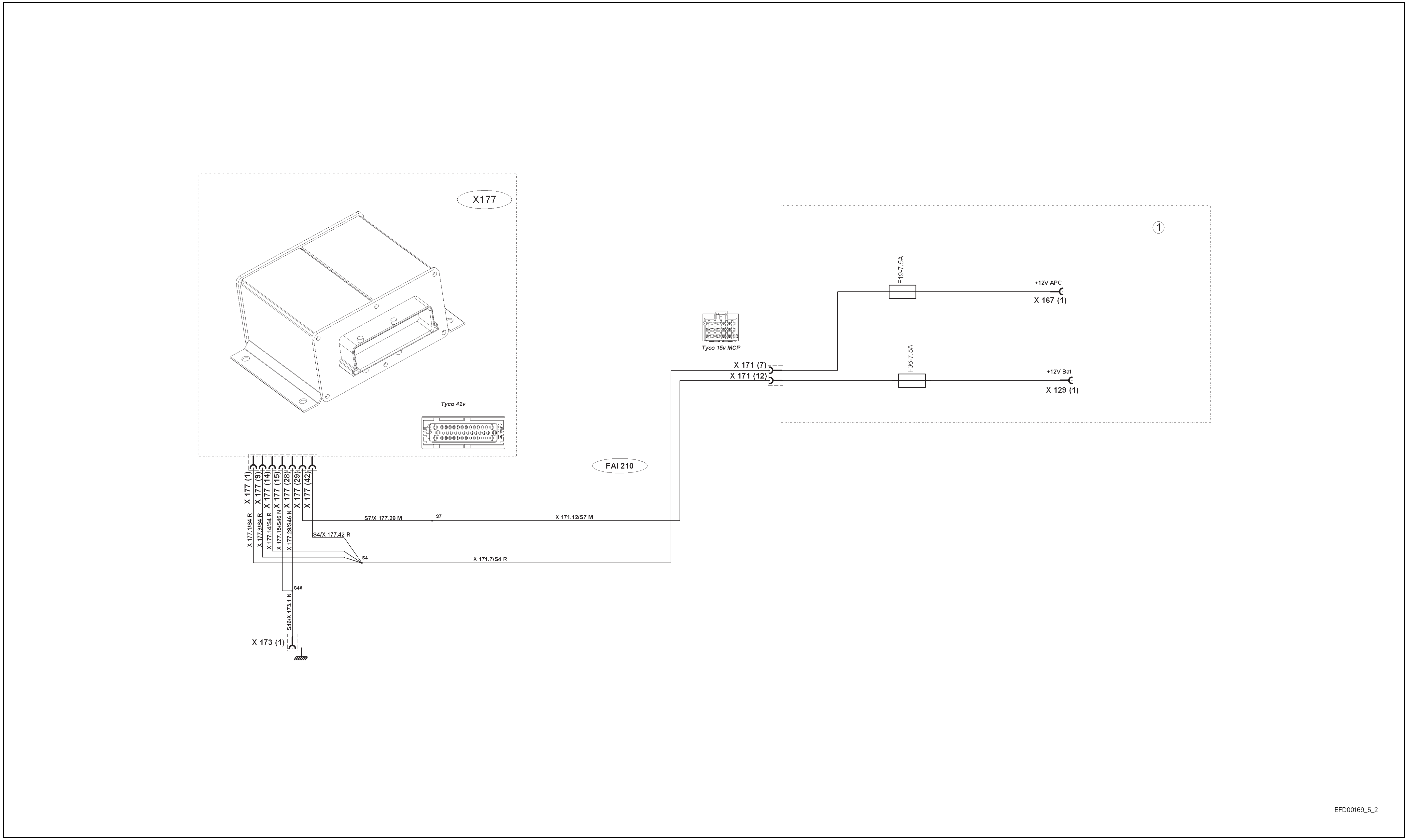

Fig. 4

B.5 Autotronic 5 ParkLock/suspended front axle electrical power supply

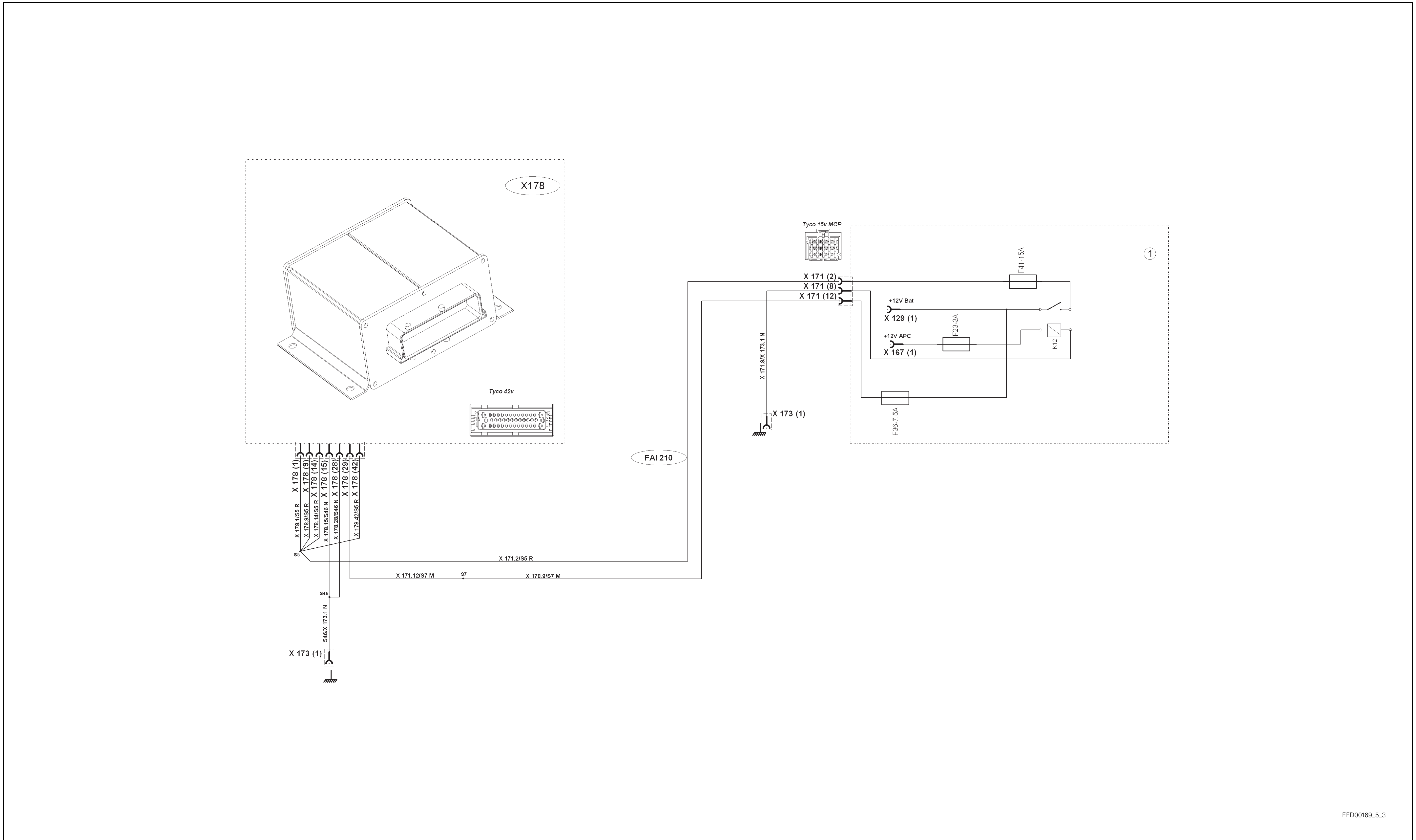

Fig. 5

B.6 DCC3 instrument panel electrical power supply

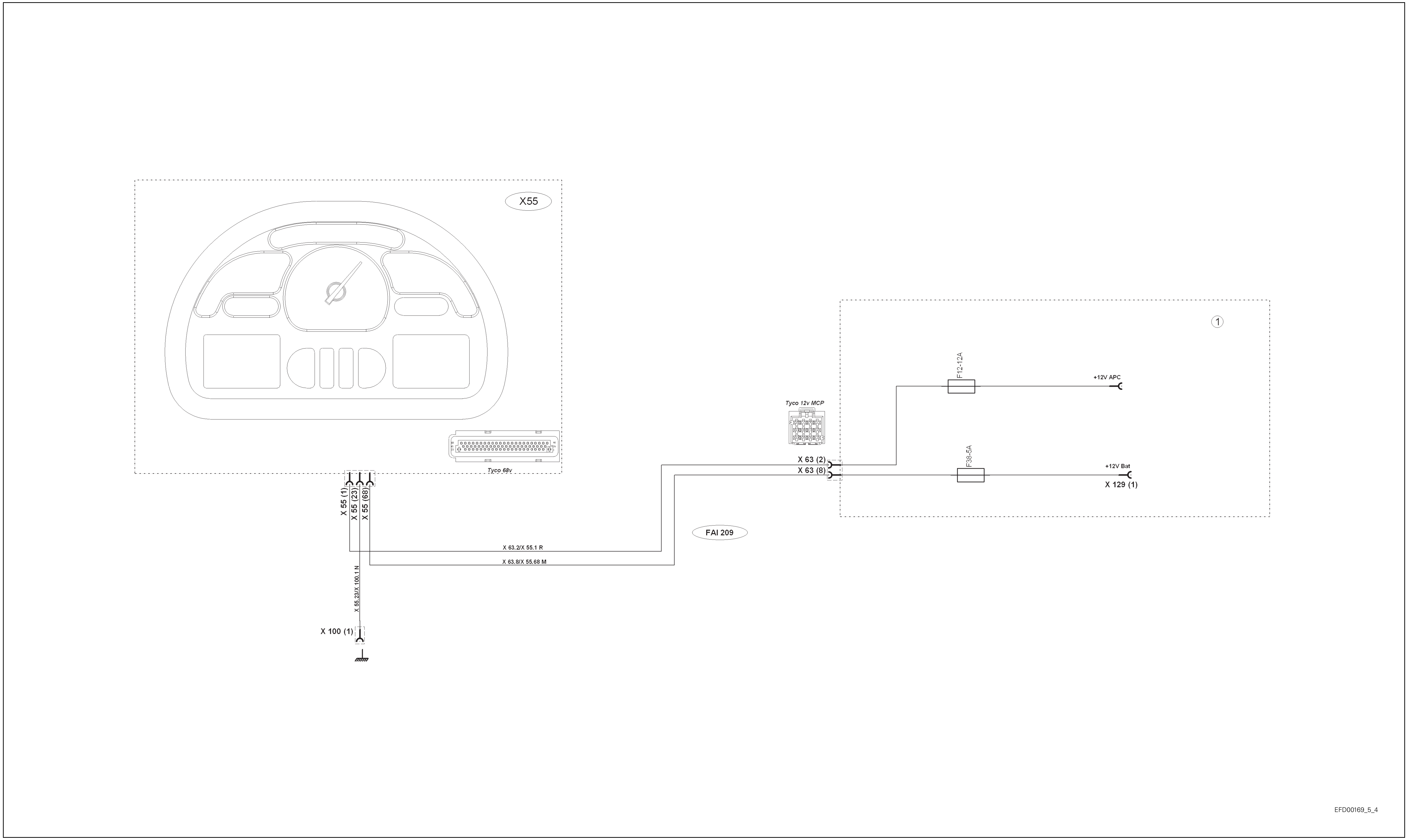

Fig. 6

B.7 Autotronic 5 armrest electrical power supply

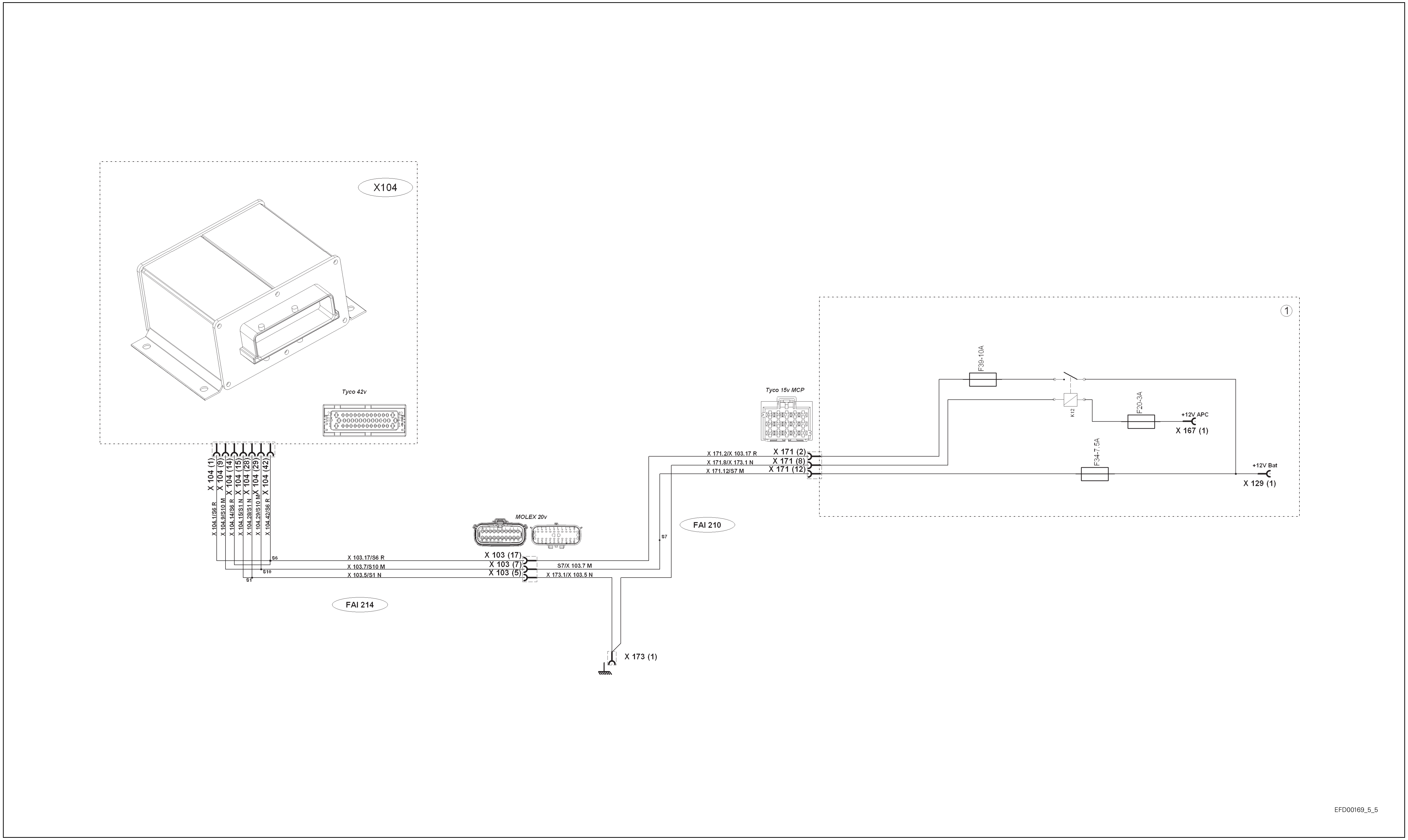

Fig. 7

B.8 Autotronic 5 active suspended cab electrical power supply

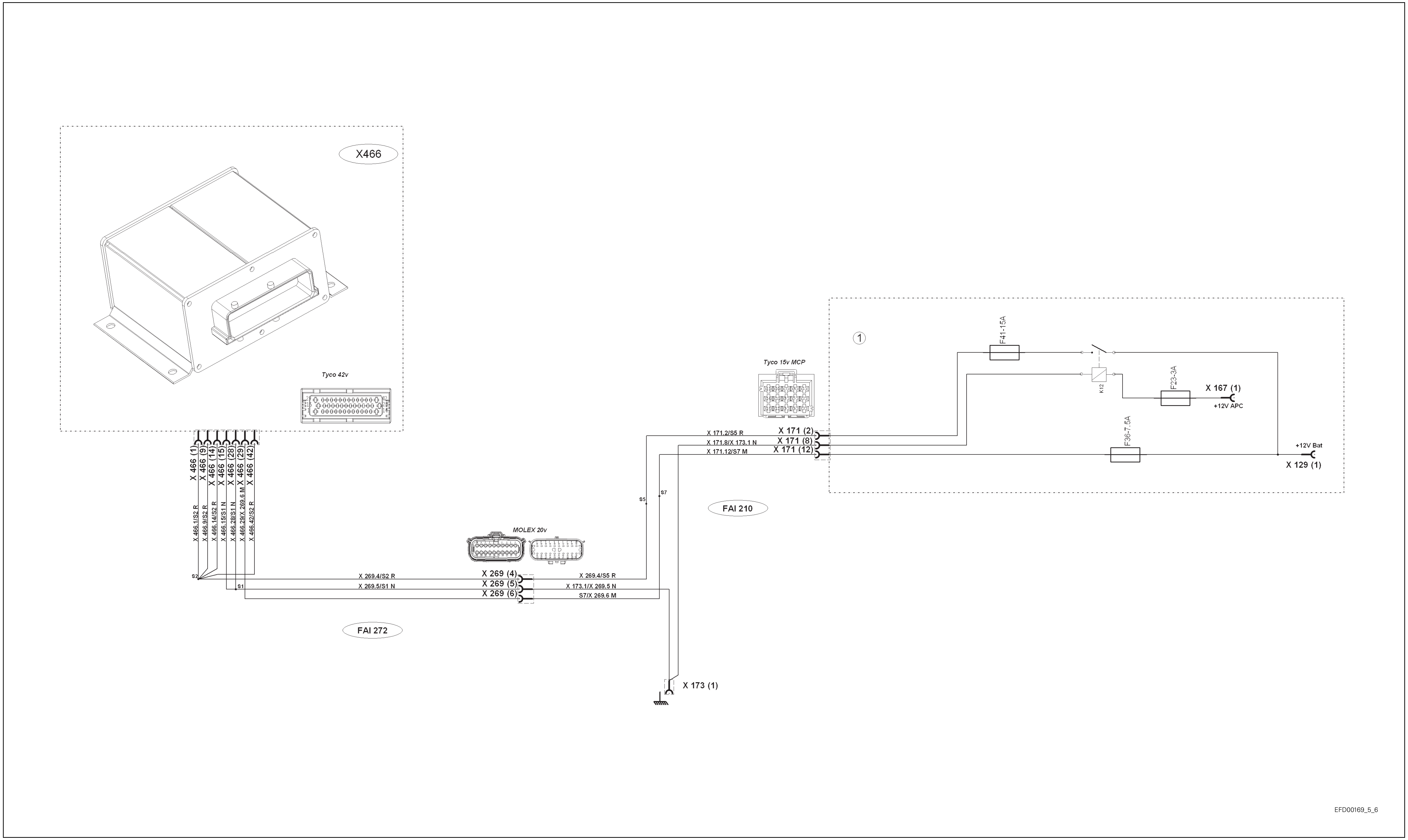

Fig. 8

B.9 Sisu EEM electronic unit electrical power supply

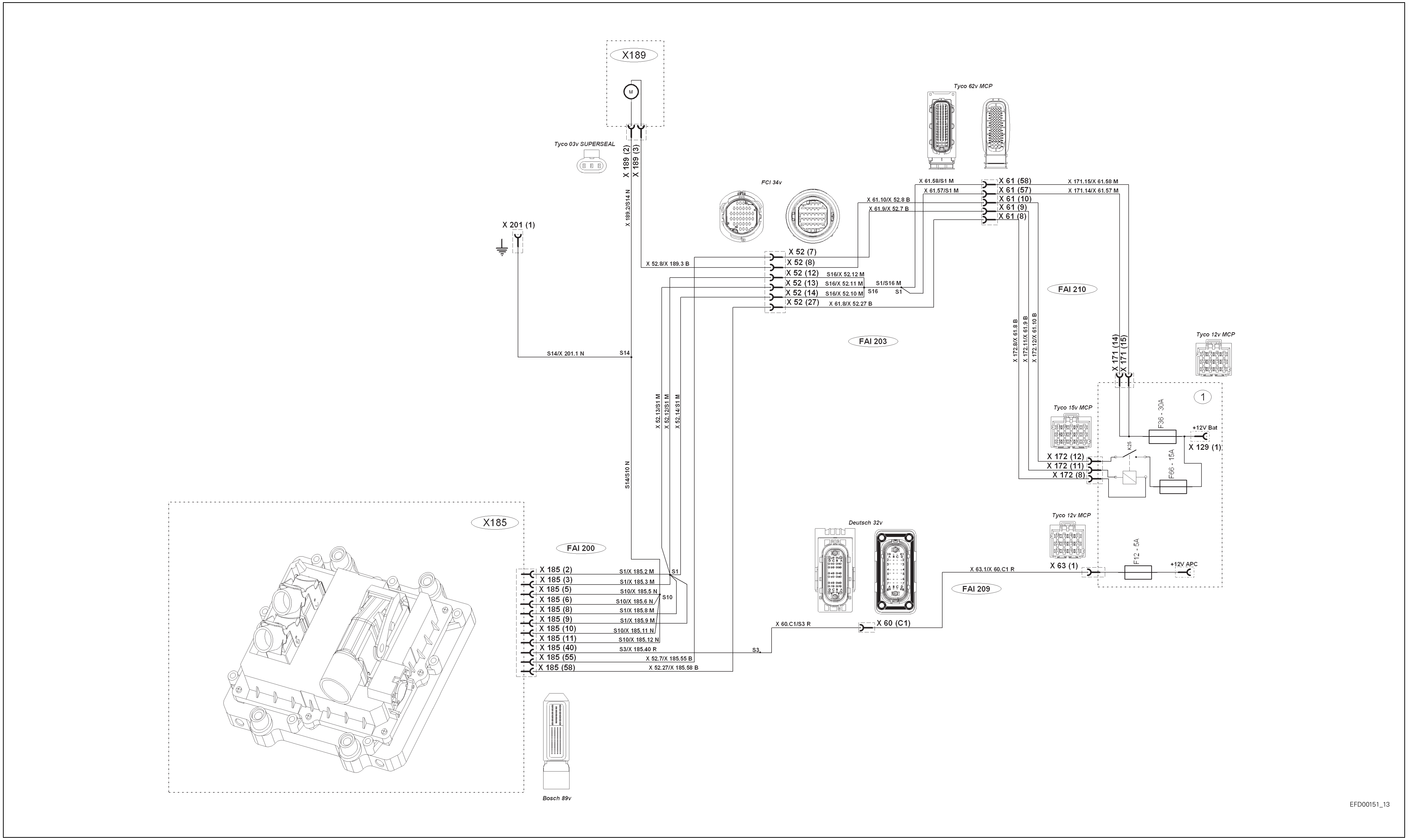

Fig. 9

B.10 Automatic air-conditioning unit electrical power supply

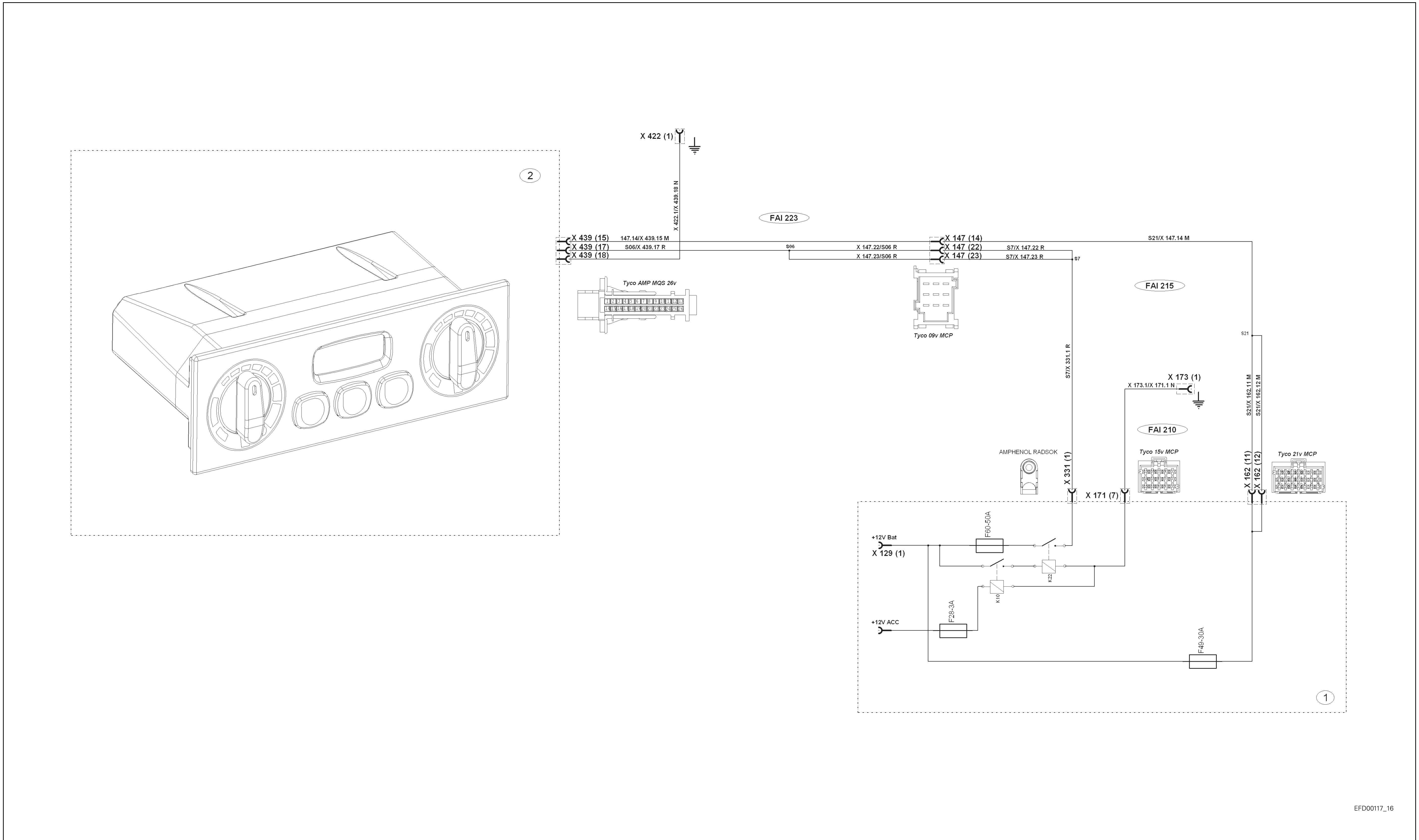

Fig. 10

B.11 Diagnostics connector electrical power supply

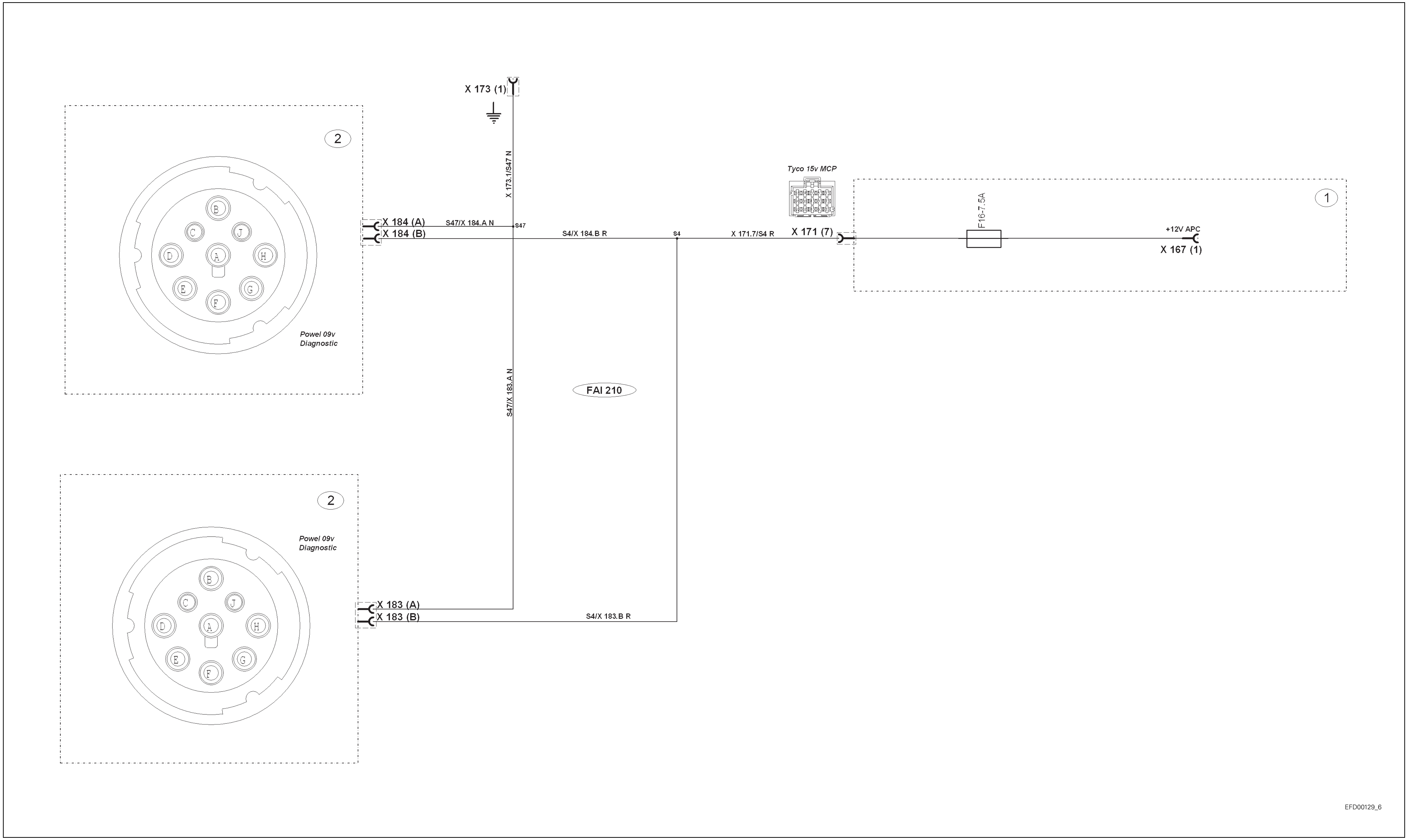

Fig. 11

B.12 Tractor CAN network

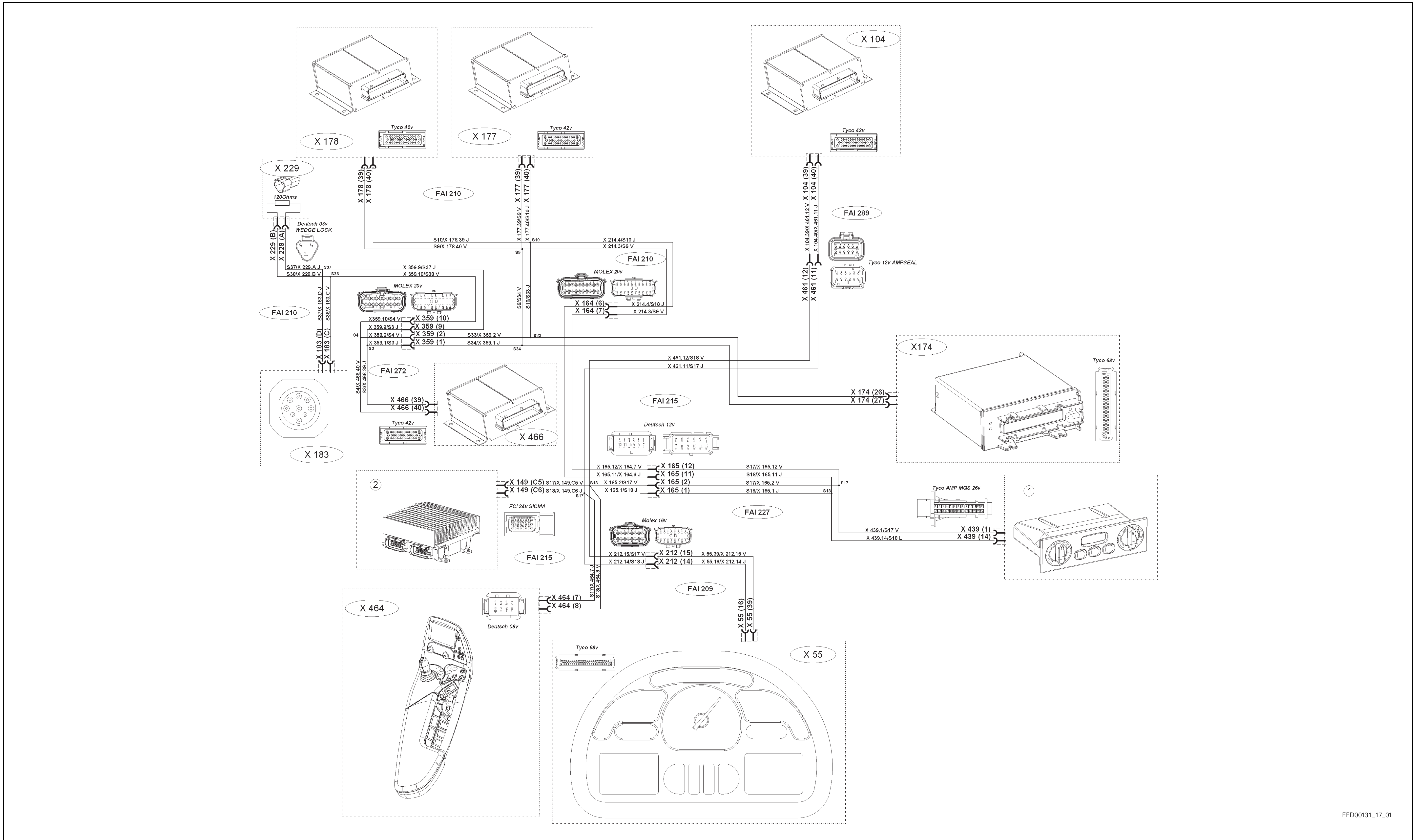

Fig. 12

B.13 Engine CAN network

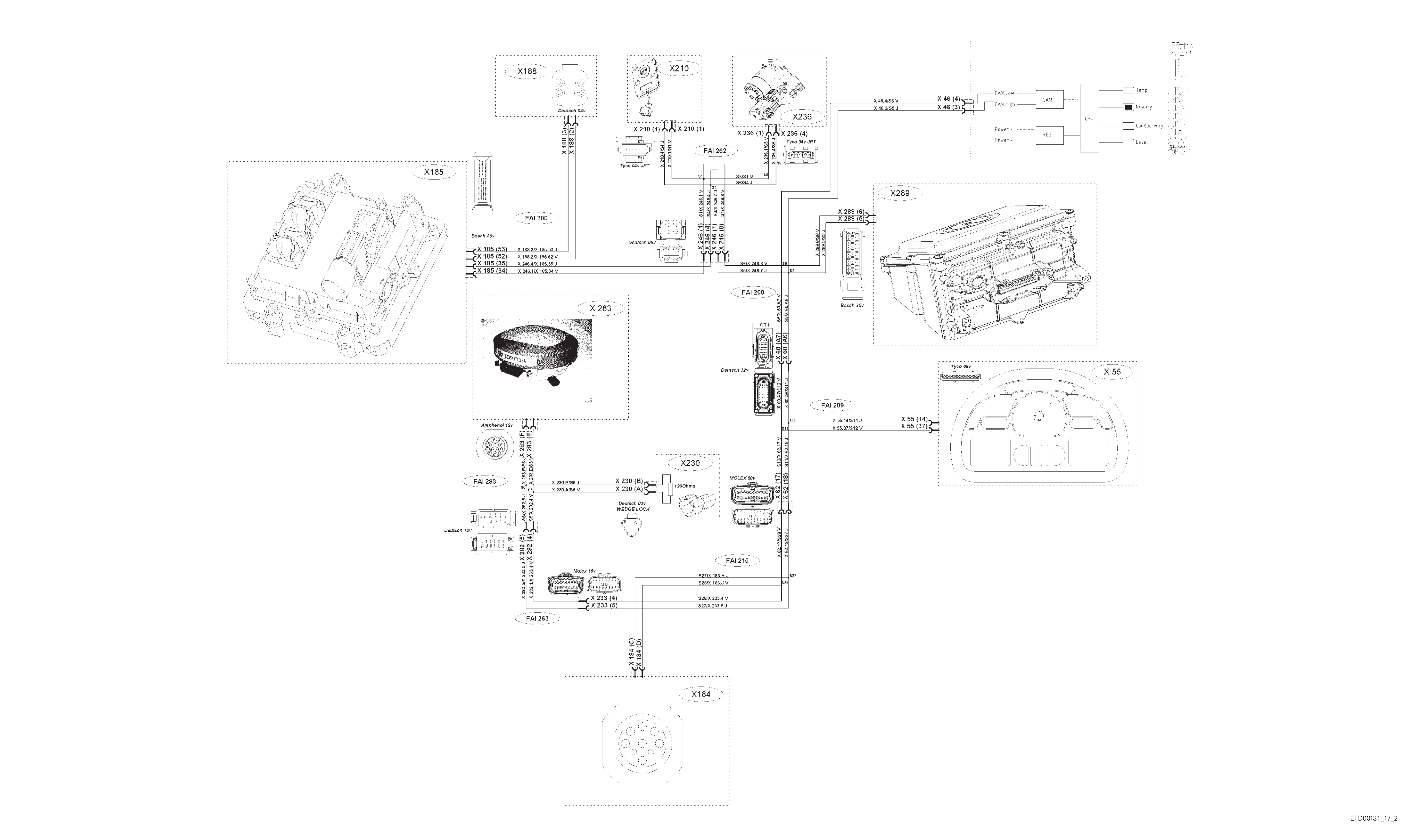

Fig. 13

B.14 Linkage CAN network

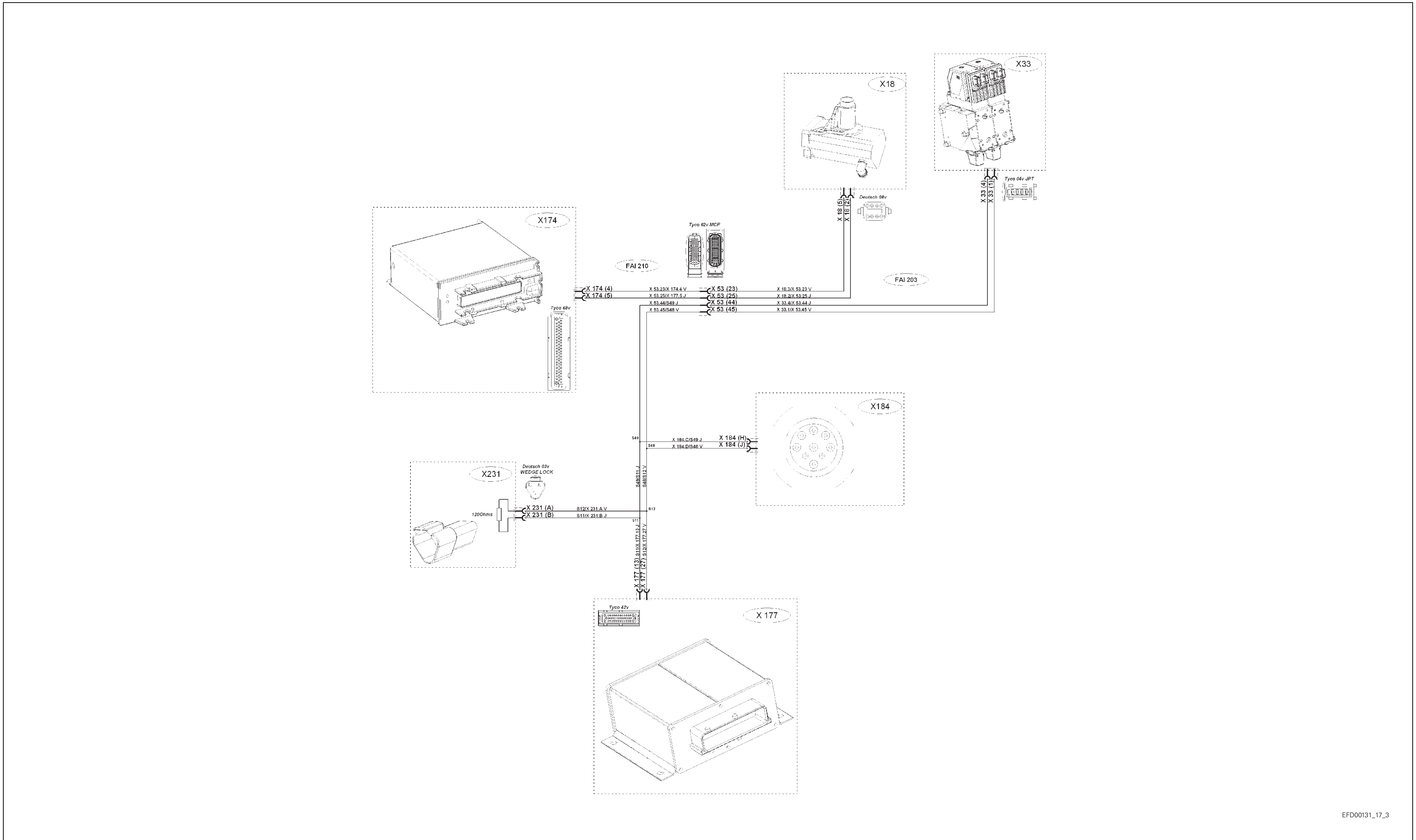

Fig. 14

B.15 Isobus CAN network

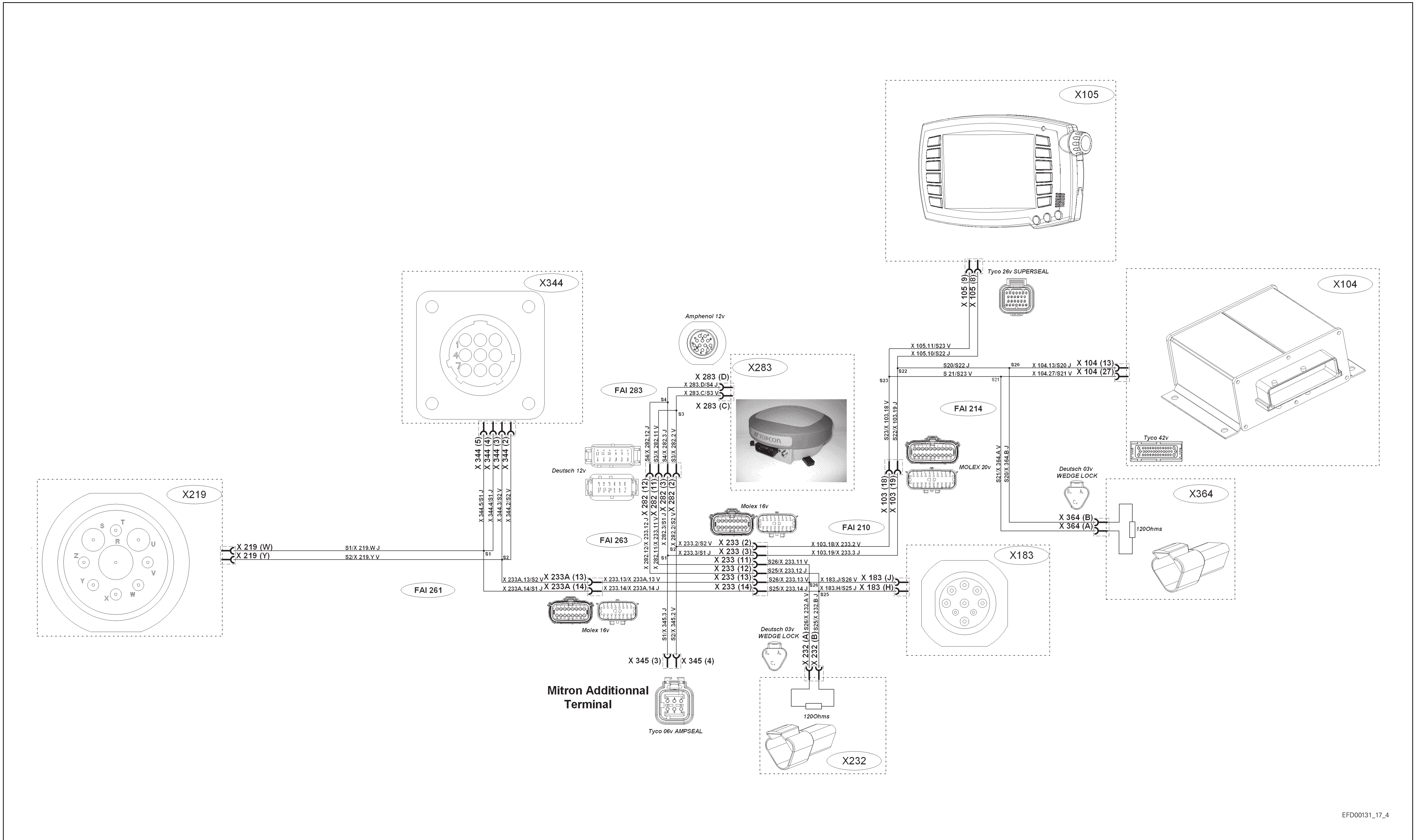

Fig. 15

B.16 Batteries - load/start-up circuit

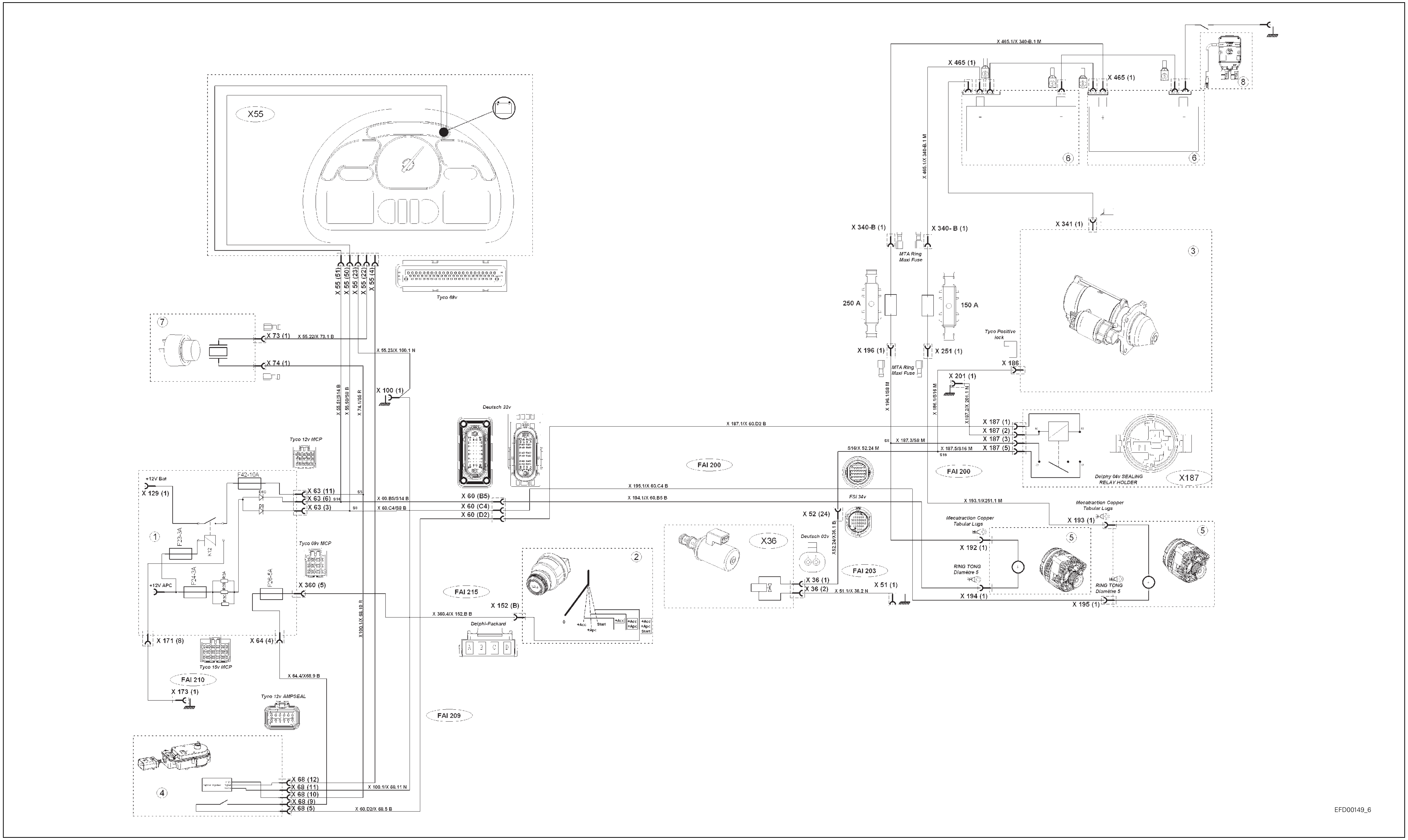

Fig. 16

B.17 Air filter vacuum sensor

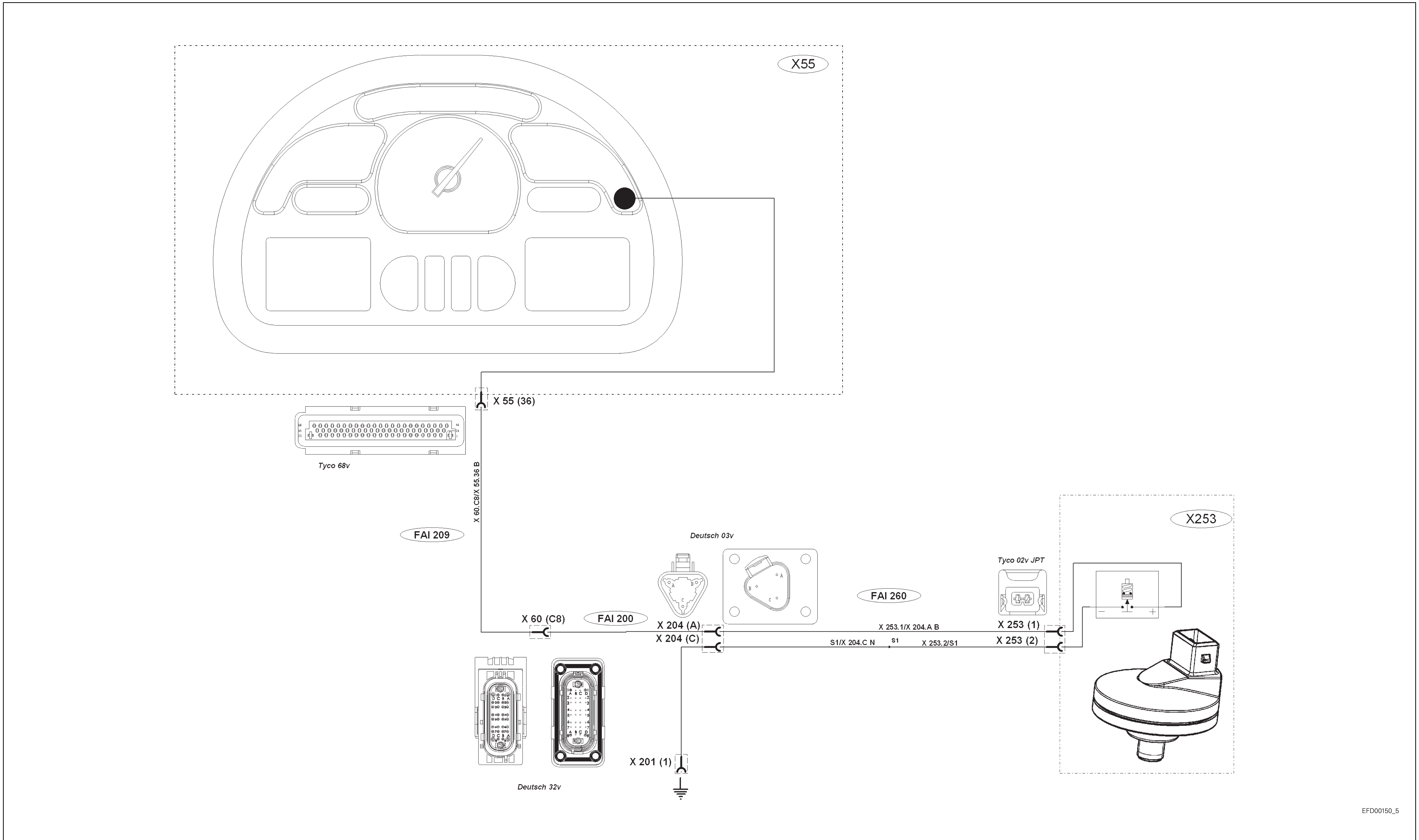

Fig. 17

B.18 Sisu engine electronic injection

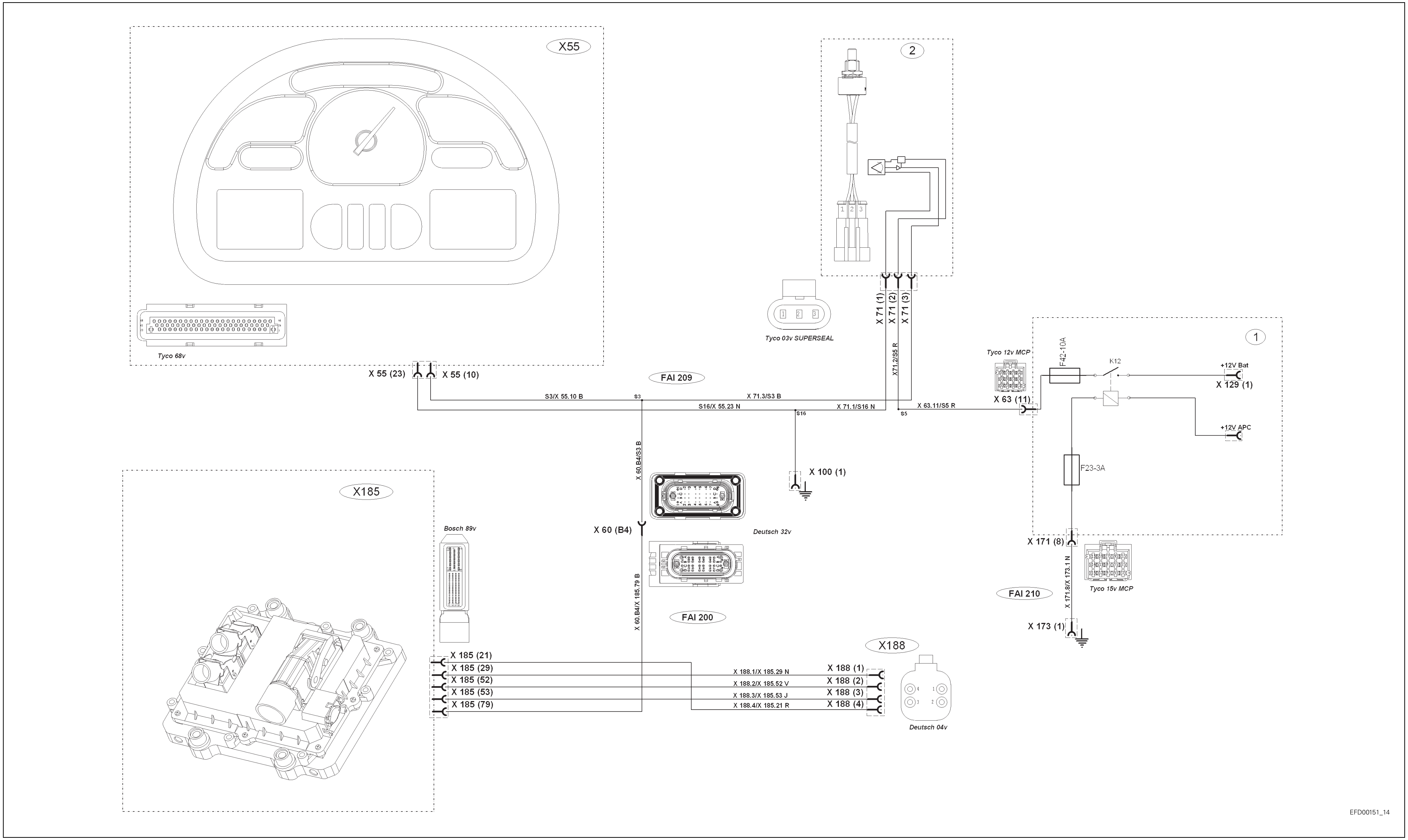

Fig. 18

B.19 Sisu engine preheating (Grid Heater)

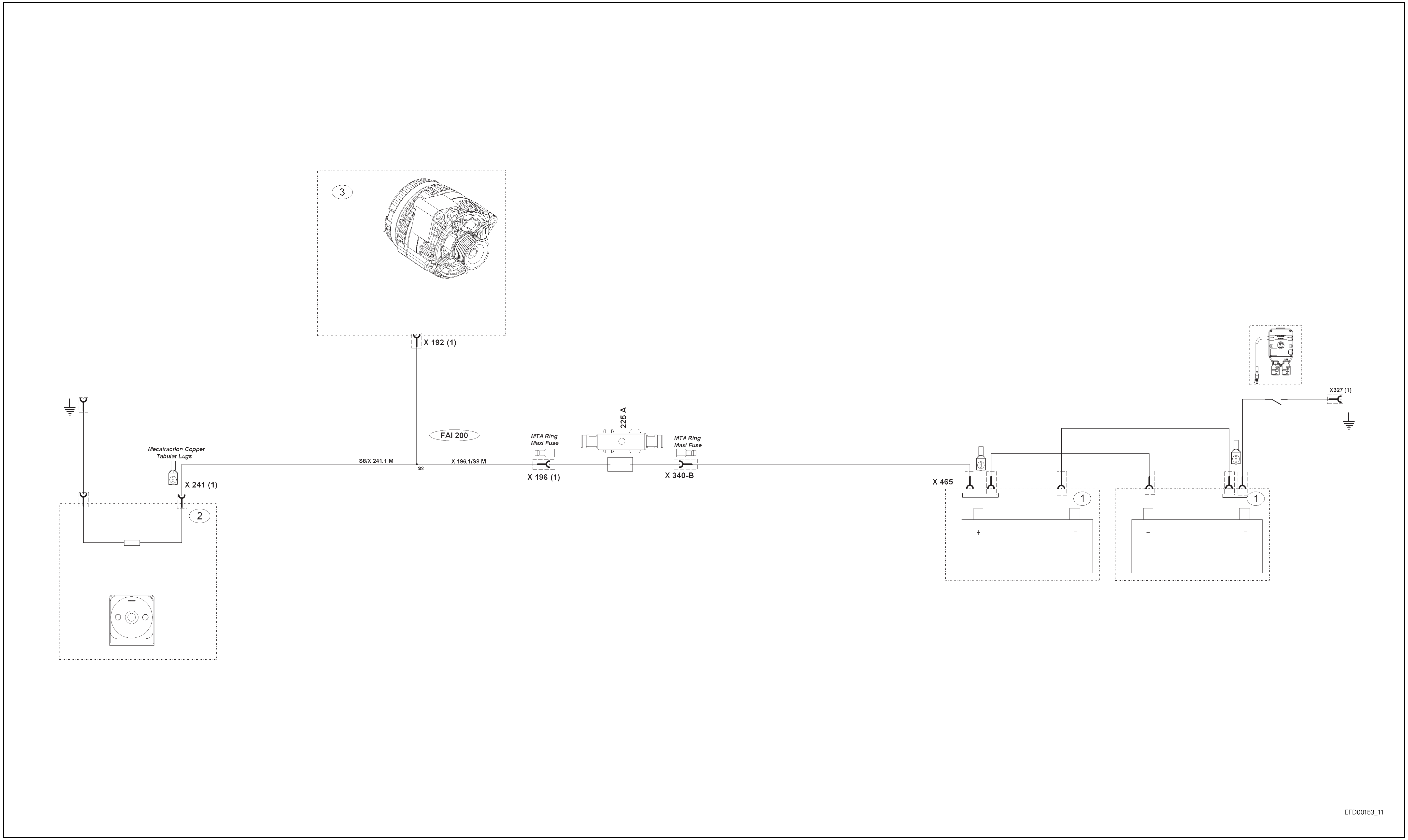

Fig. 19

B.20 Fuel preheater

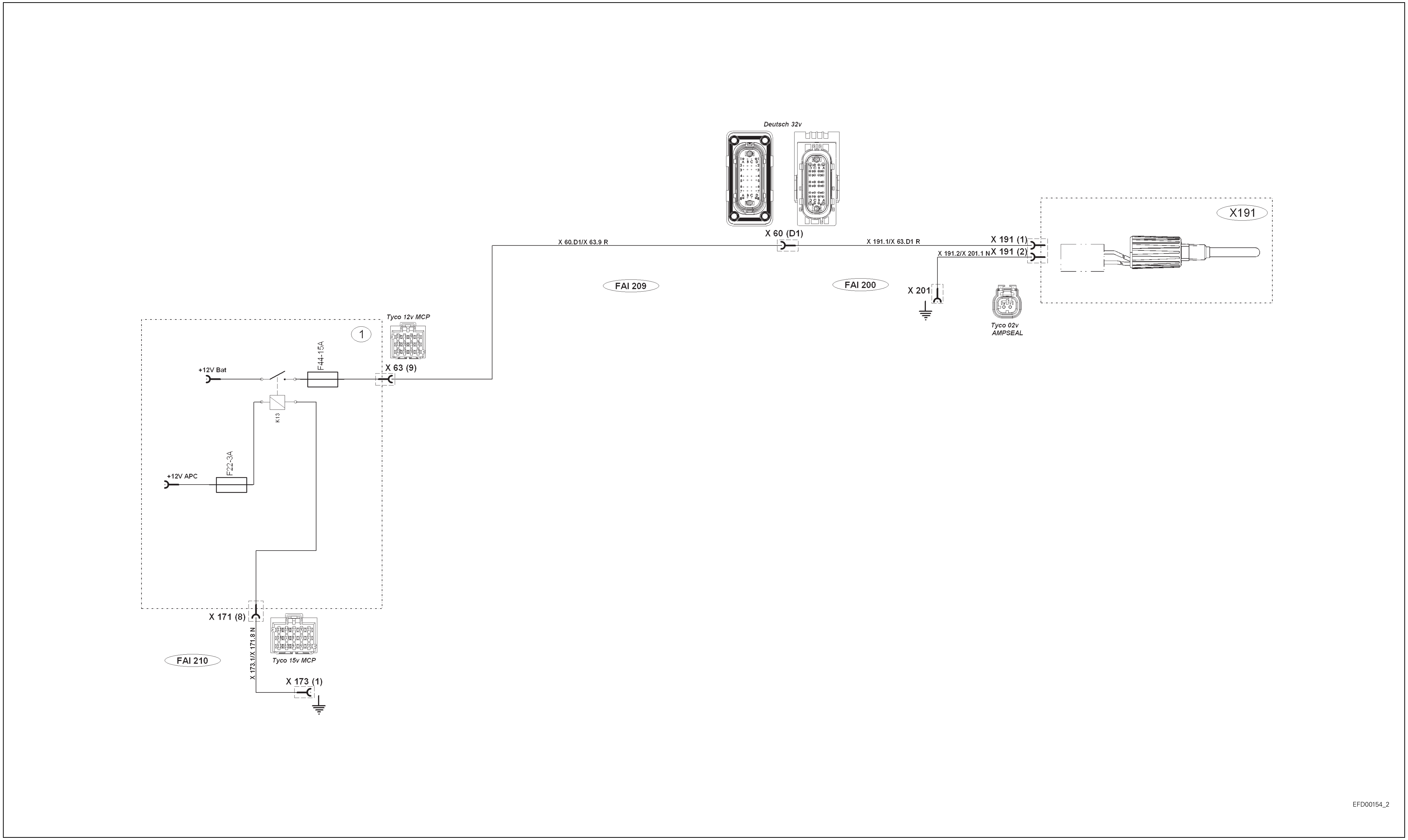

Fig. 20

B.21 Vistronic fan

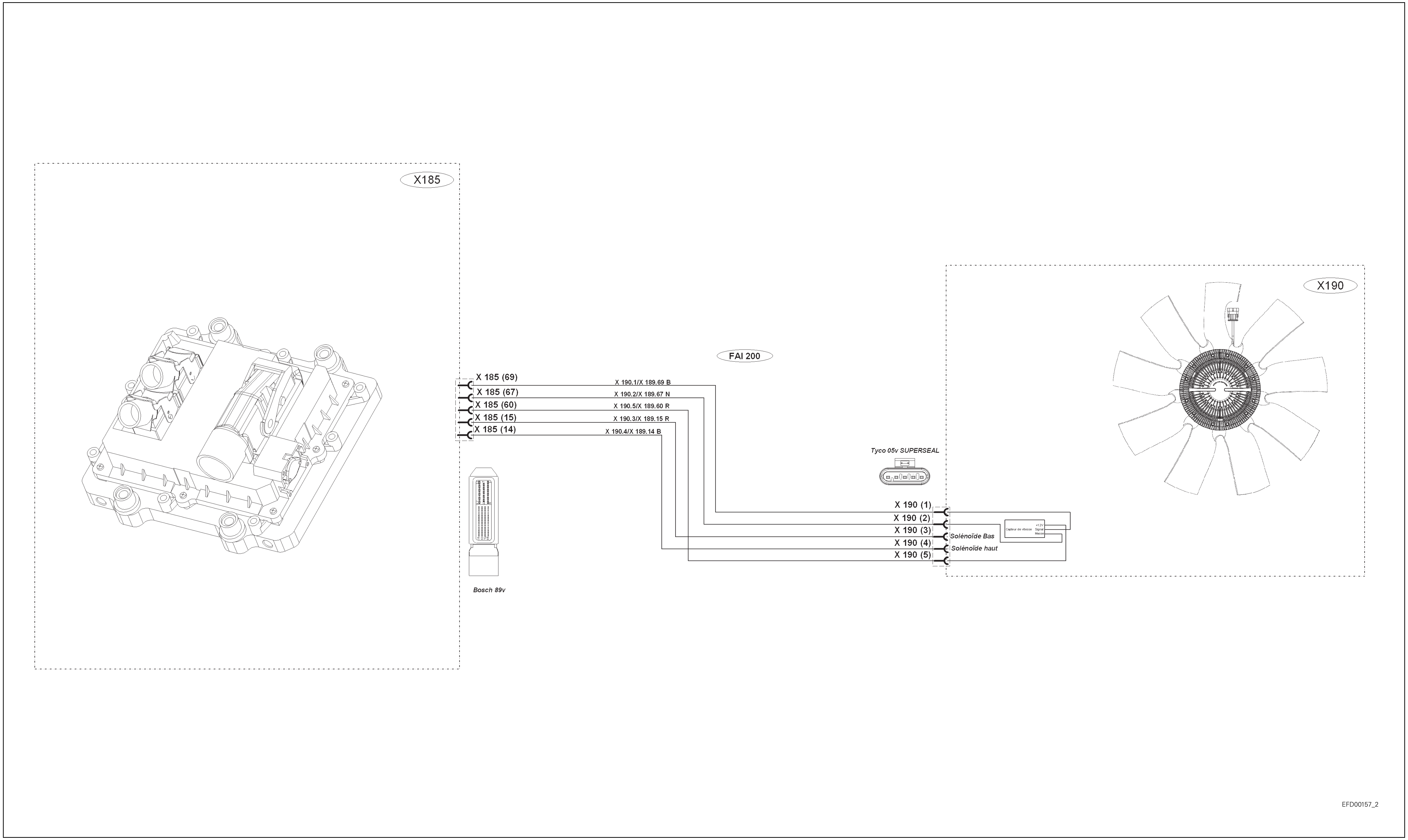

Fig. 21

B.22 Sensor detecting water in the diesel fuel

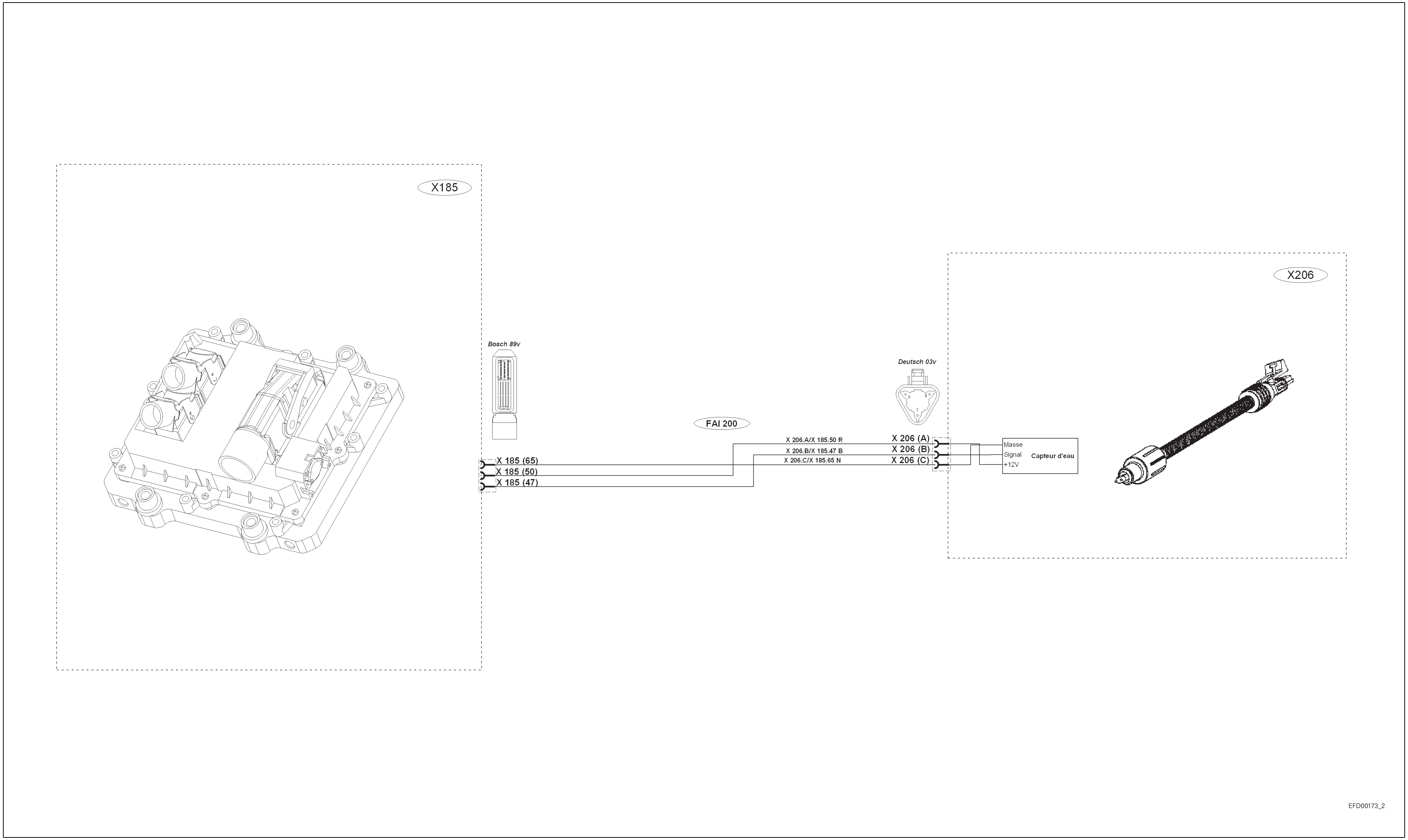

Fig. 22

B.23 Diesel fuel gauge

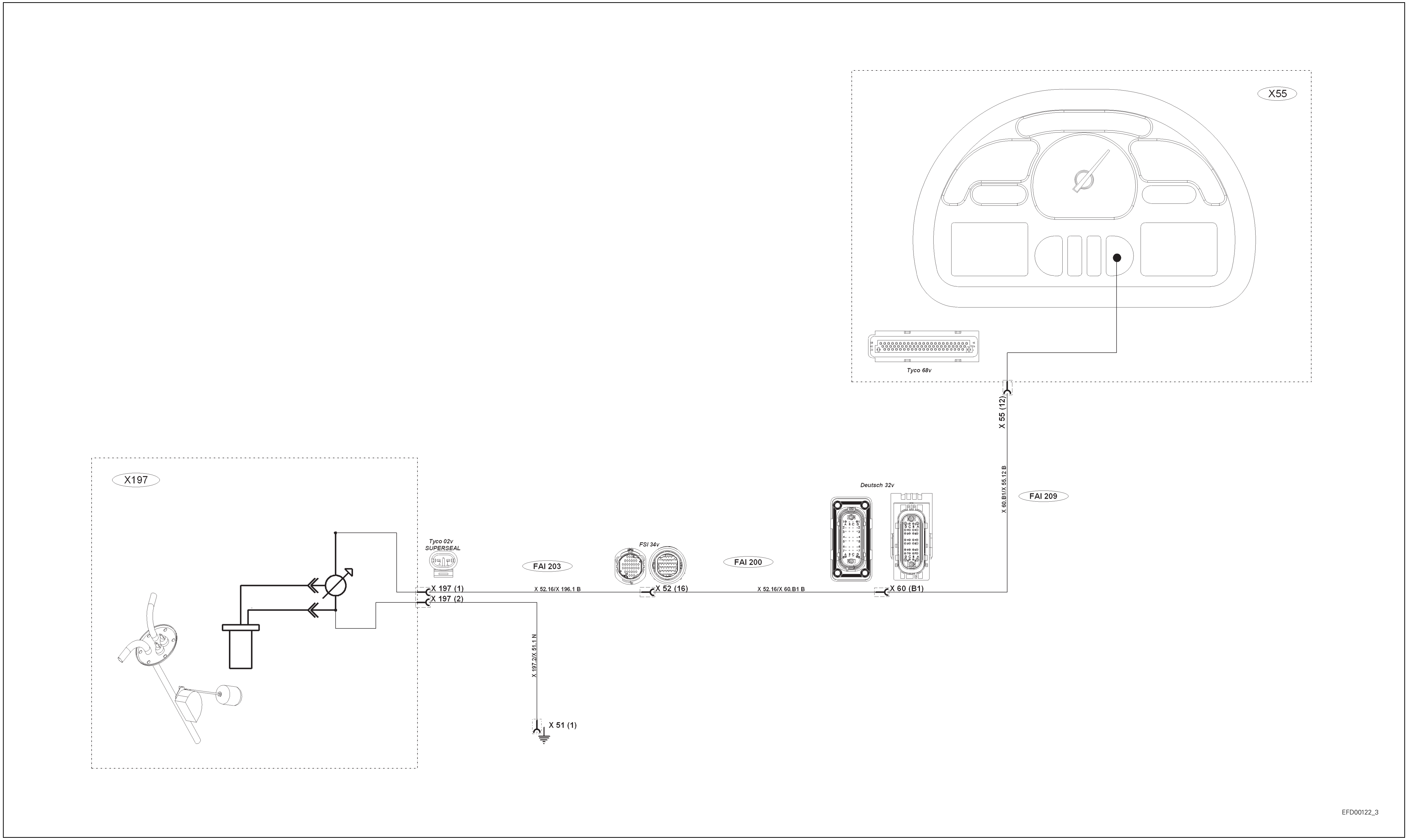

Fig. 23

B.24 SCR system

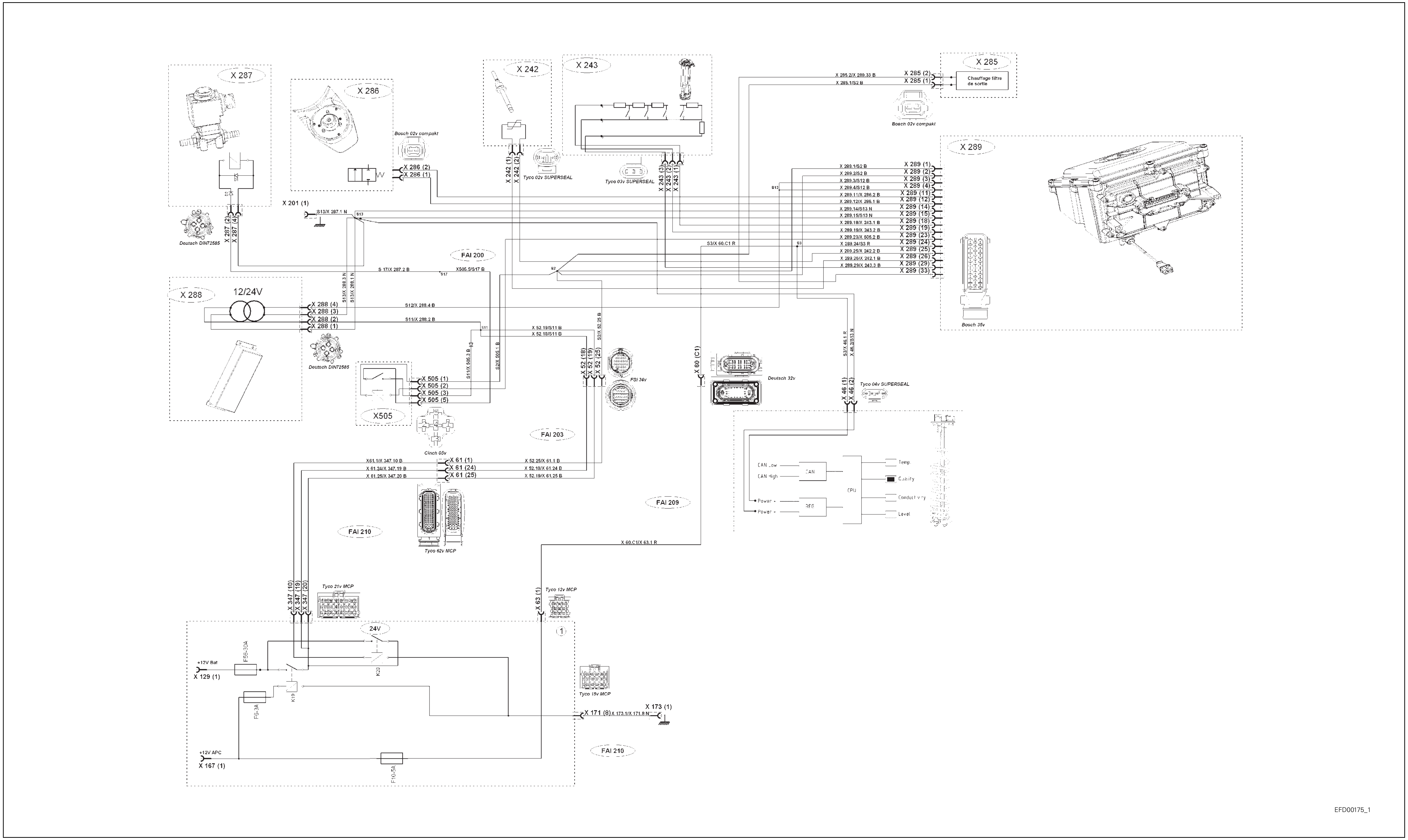

Fig. 24

3B13

SCR system - Layout of components

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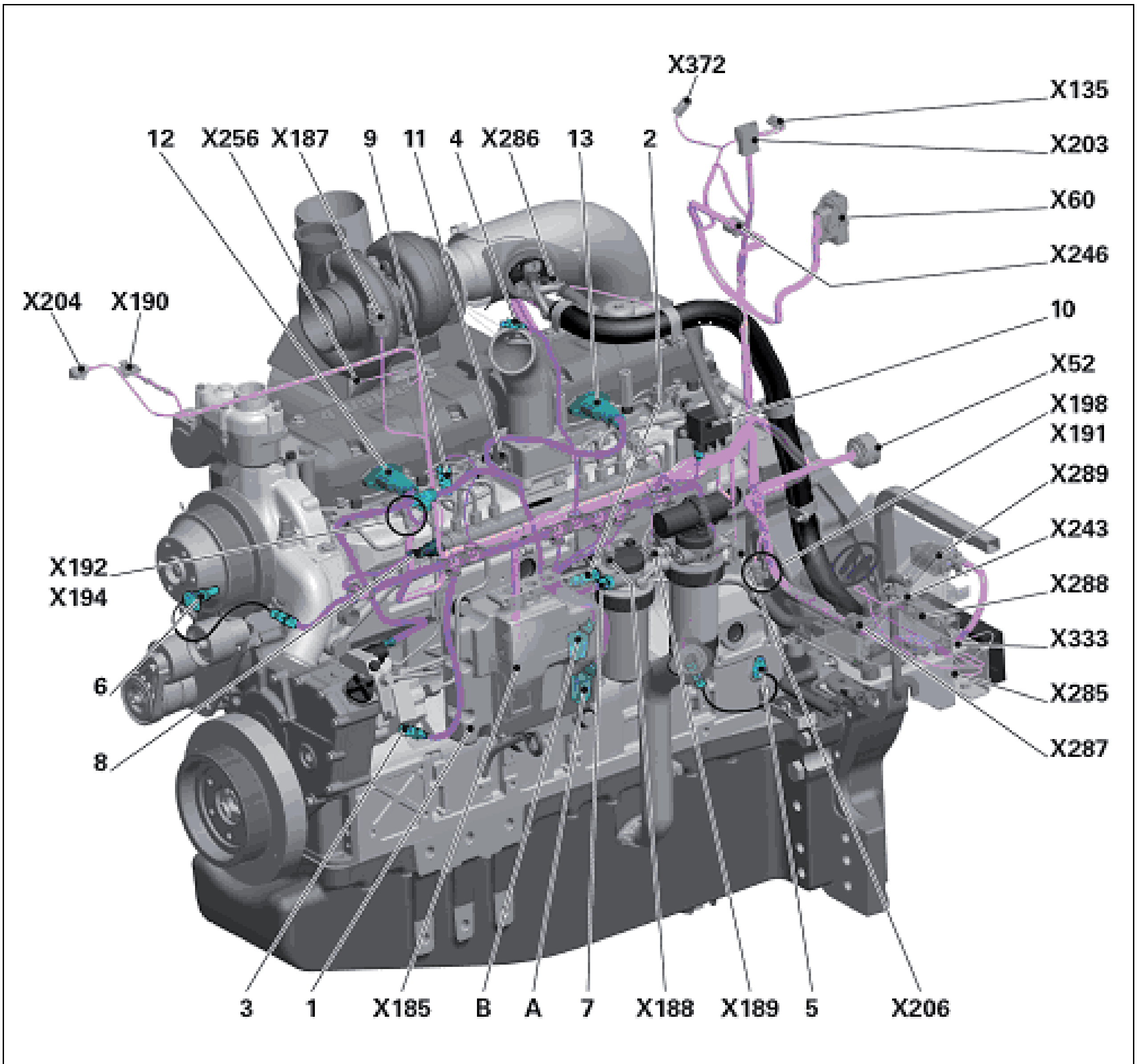
A. Engine



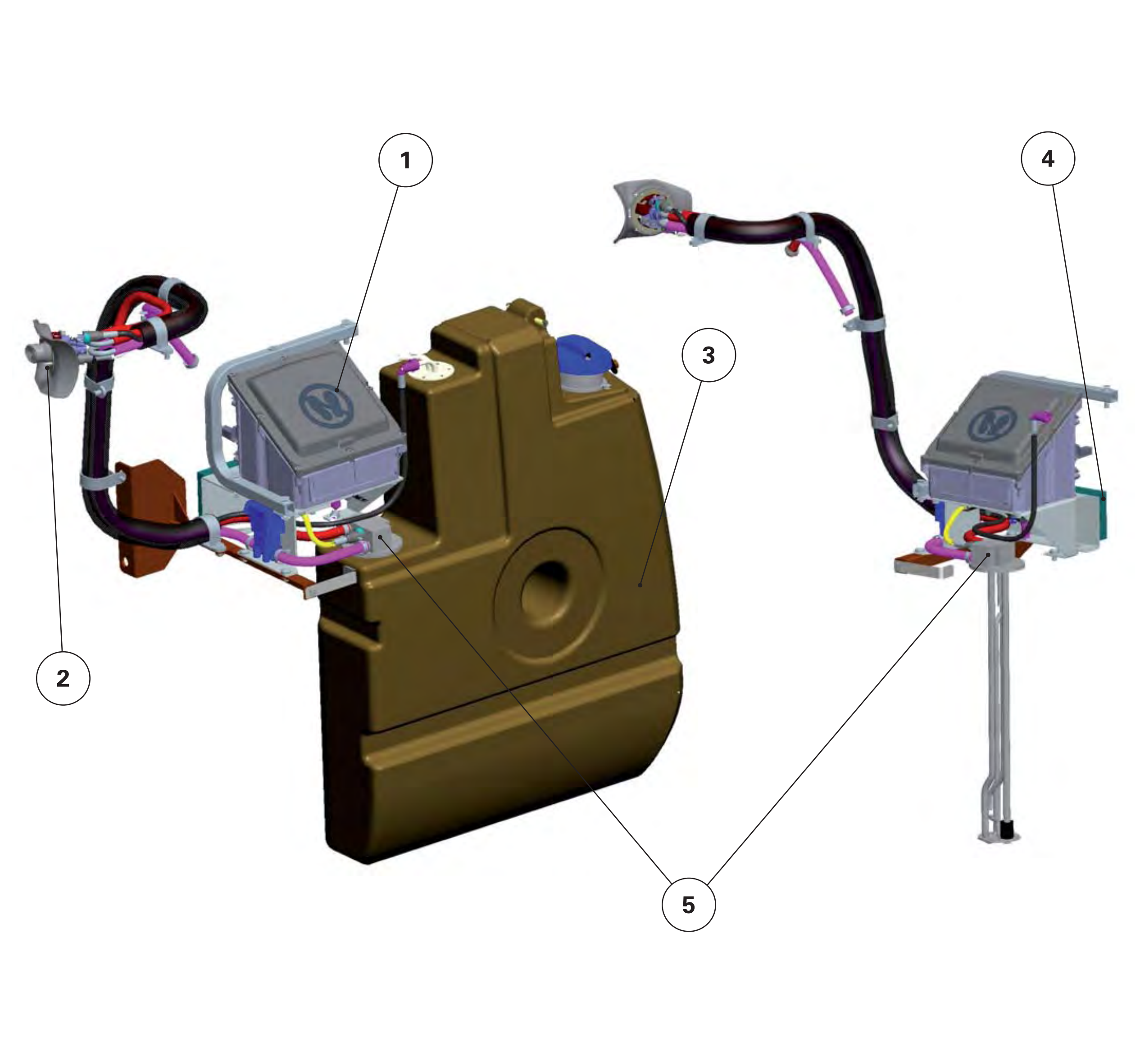
I010290

Fig. 1

(1) EEM3 engine controller
(2) Fuel temperature sensor
(3) Engine oil pressure sensor
(4) Inlet air pressure and temperature sensor
(5) Primary speed sensor
(6) Secondary speed sensor
(7) Fuel pressure sensor
(8) High-pressure sensor
(9) Coolant temperature sensor
(10) Preheater relay
(11) Inlet air preheater
(12) Connector for injectors 1/2/3
(13) Connector for injectors 4/5/6
(A) Engine harness junction for sensors/controller
(B) Engine harness junction for injectors and pump/controller
(X52) Engine harness/transmission harness junction
(X60) Engine harness/instrument panel harness junction
(X135) Braking pressure sensor

(X185) Sisu EEM unit
(X187) Engine start relay
(X188) Engine identification module (ID module)
(X189) Fuel lift pump
(X190) Vistronic fan
(X191) Diesel fuel preheater
(X192) B + alternator 1
(X194) D + alternator 1
(X198) Connector for pneumatic trailer brake
(X203) Engine harness/front headlights harness junction
(X204) Cooling unit harness/engine harness junction
(X206) Sensor detecting water in the diesel fuel
(X243) AdBlue/DEF reservoir (urea) level gauge and temperature sensor
(X246) Auto-Guide external harness/engine harness junction
(X256) Roof harness/hand rail harness junction
(X285) AdBlue/DEF (urea) metering valve
(X286) AdBlue/DEF (urea) injection valve
(X287) AdBlue/DEF (urea) reservoir preheating valve
(X288) 12/24 V converter for SCR system
(X289) SCR management module
(X333) Engine harness earth (chassis)
(X372) Variable steering switch (SpeedSteer)

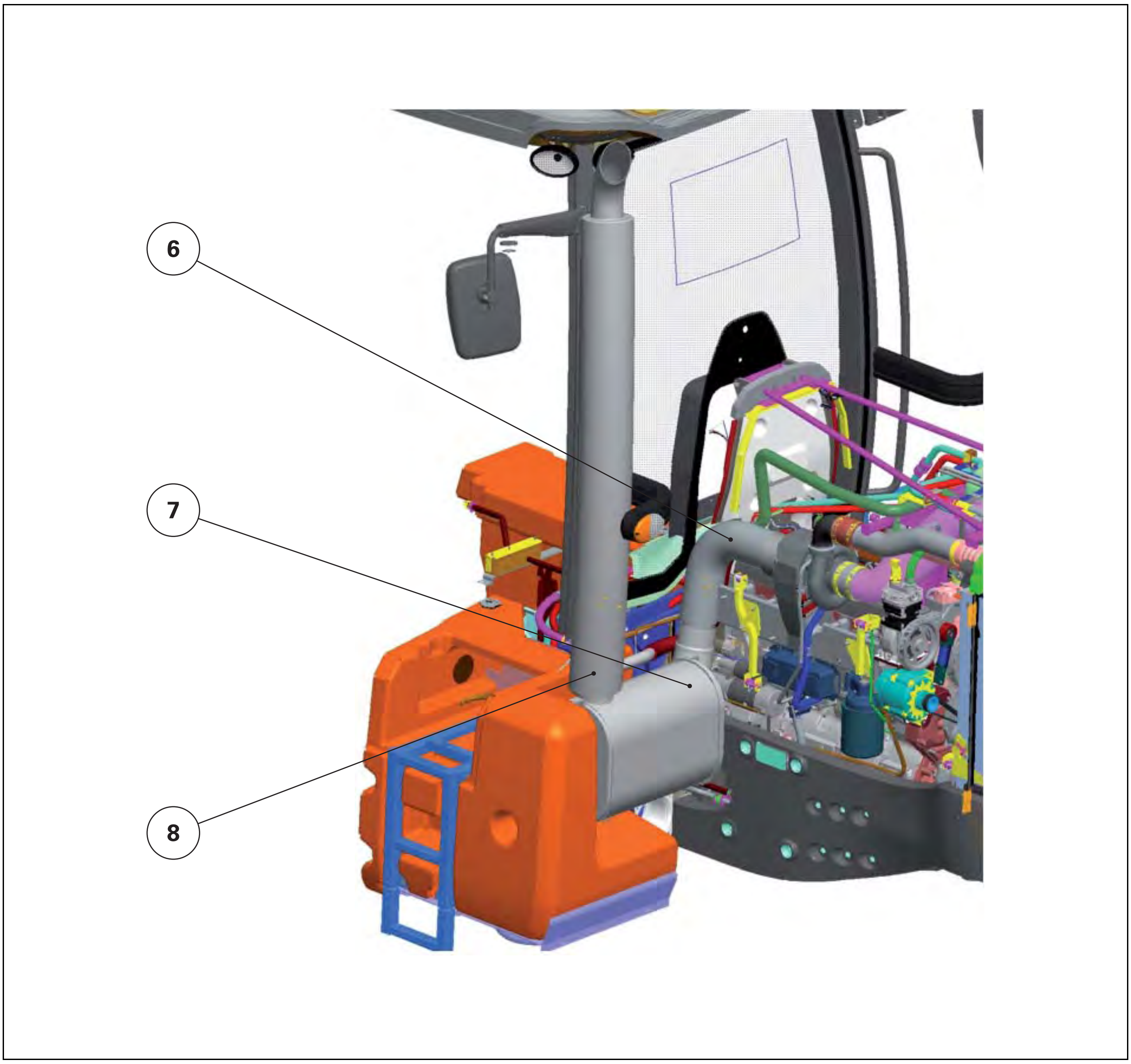
B. SCR system



I010292

Fig. 2

(1) Denoxtronic module with filters, sensors, controller and pump
(2) Injector
(3) AdBlue/DEF tank (30 l)
(4) 12/24 V converter
(5) AdBlue/DEF tank gauge with built-in quality sensor



I010293

Fig. 3

(6) Exhaust line where the injector is located
(7) Catalyser
(8) Temperature sensor

3B14

SCR system - Tests and diagnostics

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Section intentionally left blank

3B16

SCR system - Adjustments, bleeding and calibrations

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3B17

SCR system - Disassembly and reassembly

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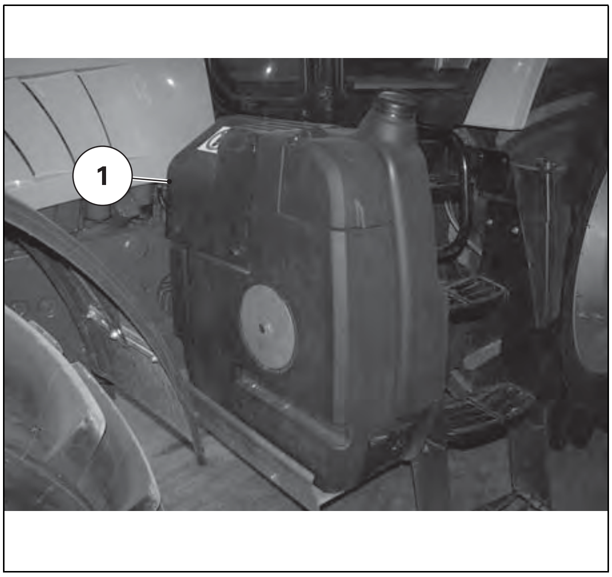
A. Metering module

Removal

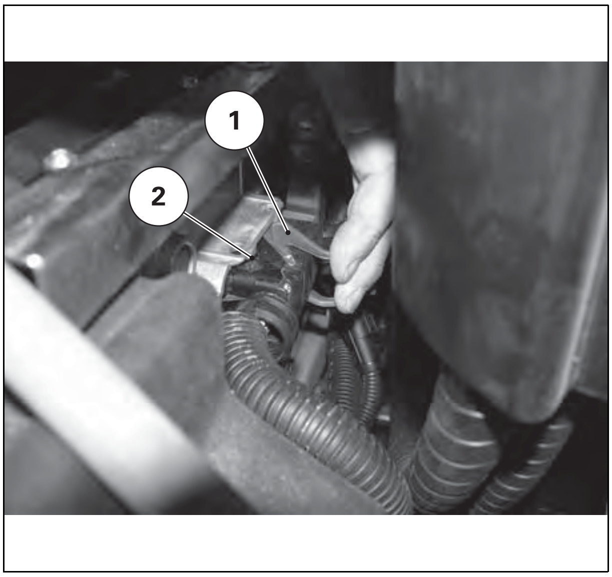
1. Remove the four mounting screws and remove the metering module cover (1).



I011494

Fig. 1

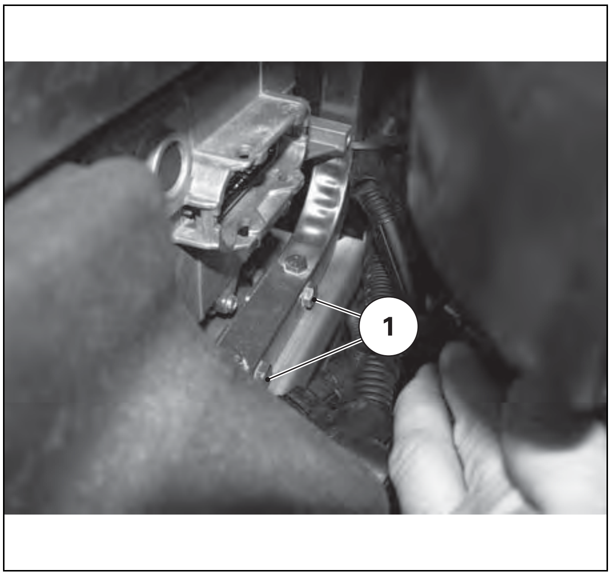
2. The metering module wire harness connector is located at the back of the metering module.
   Pull the connector locking tab (1) away from the connector (2) and remove the connector from the metering module.



I011495

Fig. 2

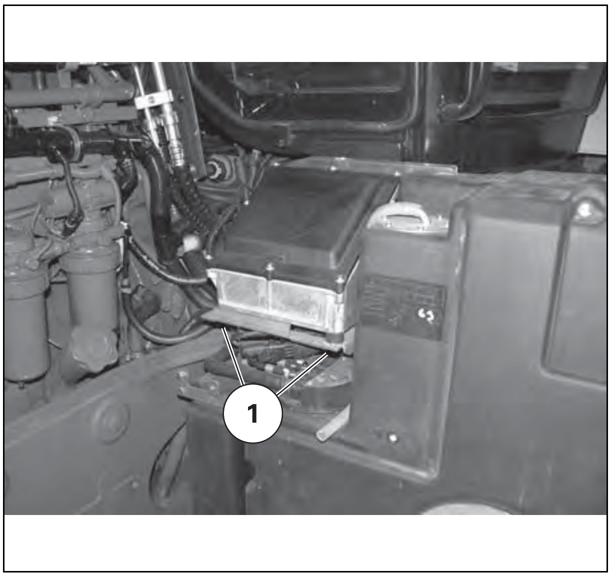
3. Remove the two screws (1) located at the rear of the metering module.



I011496

Fig. 3

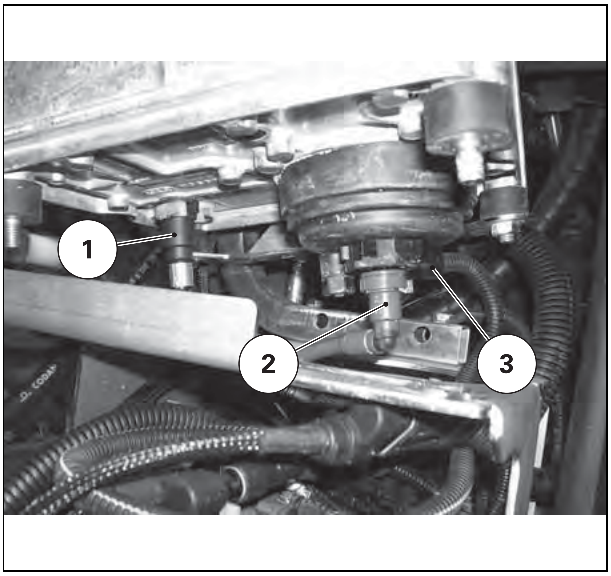
4. Remove the two nuts (1) located at the bottom on the front of the metering module.



I011497

Fig. 4

5. Carefully raise the metering module to gain access to the AdBlue/DEF suction pipe (1), AdBlue/DEF supply line (2) and heater filter (3).



I011498

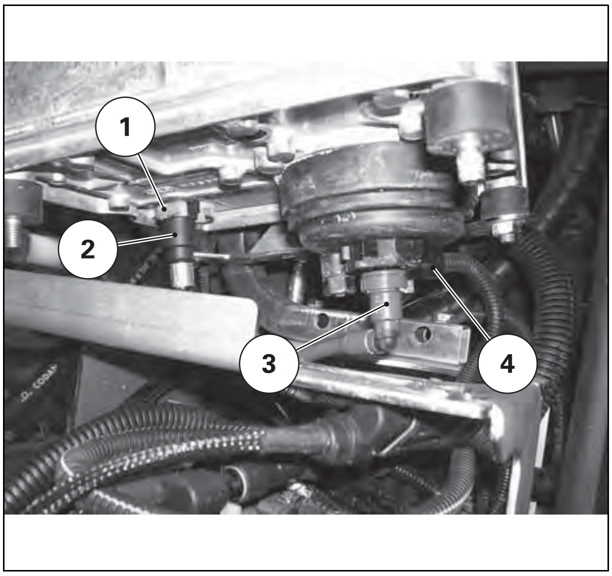
Fig. 5

6. Squeeze the locking tab ends (1) together and remove the AdBlue/DEF suction pipe (2). Remove the AdBlue/DEF pressure pipe (3) in the same manner.

   Note: *Ensure that the ends of the pipes are well blocked to prevent dirt or debris from entering.*

7. Pull the filter heater connector tabs apart and push the filter heater out towards the back of the metering module.

8. Remove the metering module.

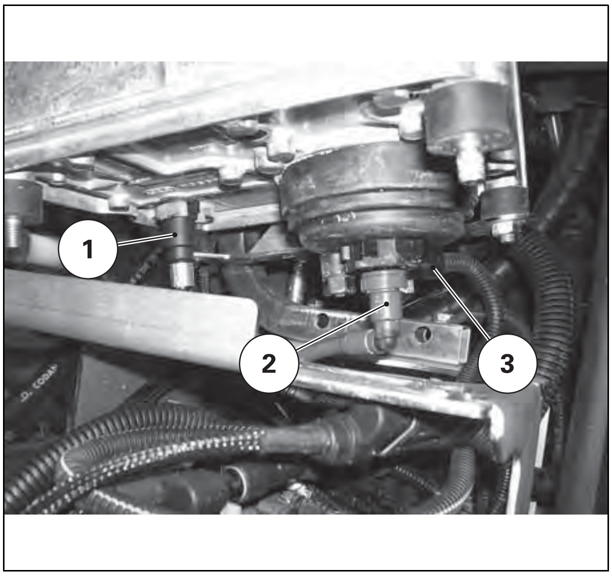


I011500 Fig. 6

Refitting

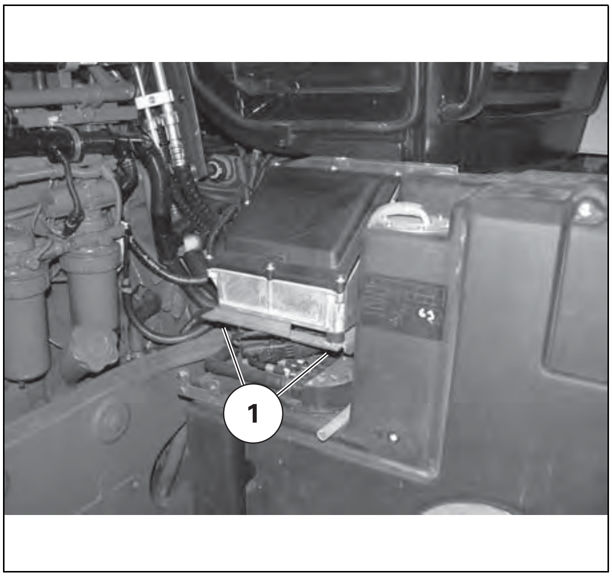
1. Put the metering module on the mounting bracket. Raise the front of the metering module and install the AdBlue/DEF suction pipe (1), the AdBlue/DEF supply line (2) and the heater filter (3).

   Important: *If any AdBlue/DEF has crystallised on the pipe fittings, ensure that the AdBlue/DEF pipes are cleaned prior to installation.*



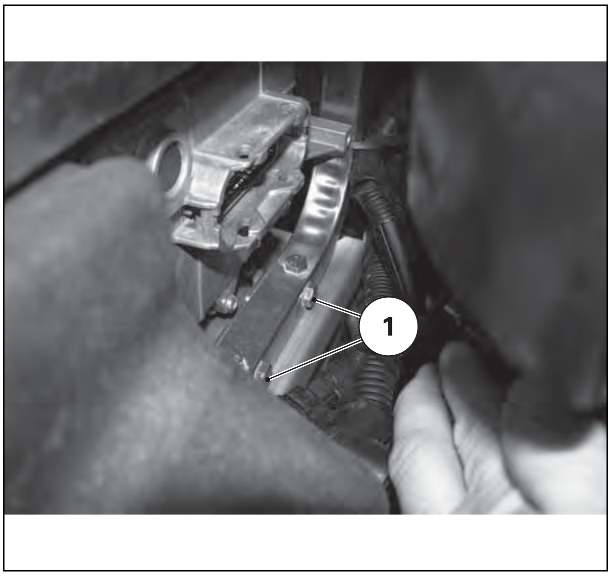
I011498 Fig. 7

2. Put the metering module on the mounting bracket and install the two front mounting nuts (1).



I011497 Fig. 8

3. Install the two screws (1) at the rear of the metering module.

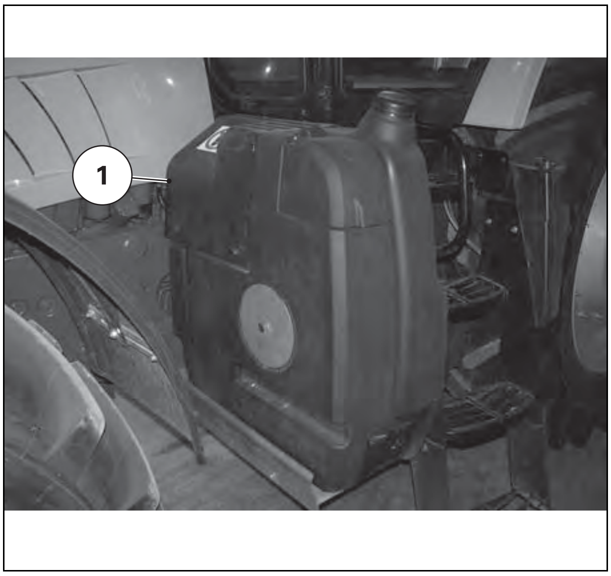


I011496 Fig. 9

4. Install the metering module wiring harness connector. Push the locking tab (1) towards the connector until the tab snaps into the locked position.

I011501 Fig. 10

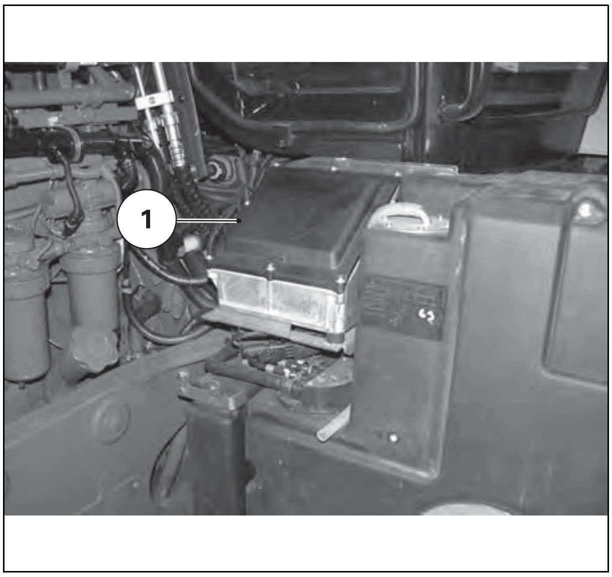
5. Install the metering module cover (1).



I011494 Fig. 11

Main filter - Removal

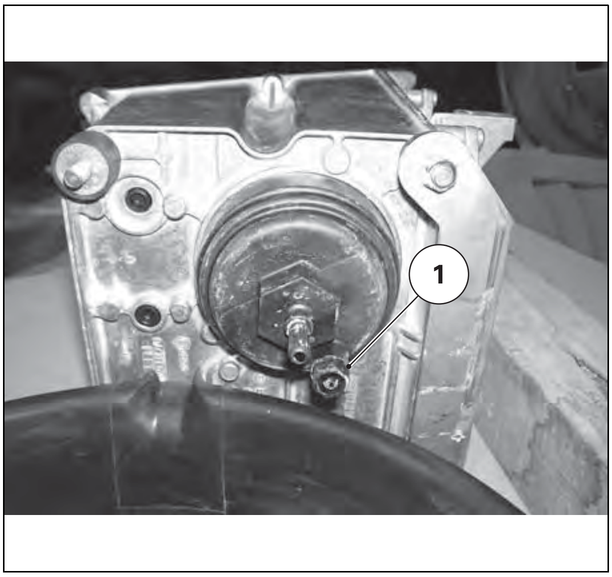
1. Remove the metering module (1).



I011502

Fig. 12

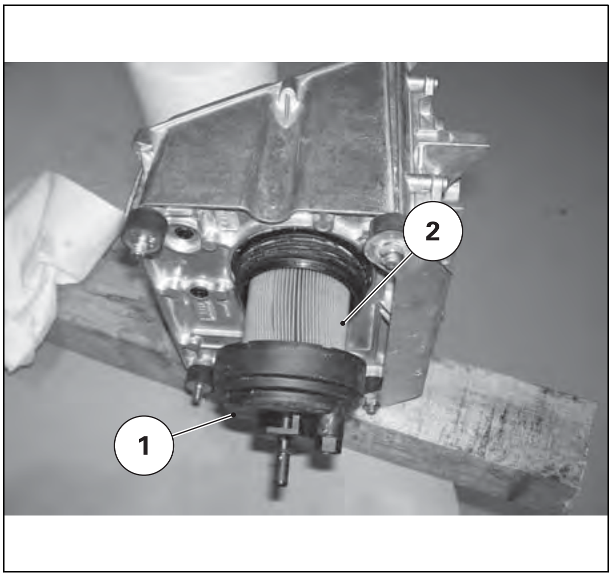
2. Turn the drain valve (1) anti-clockwise two full turns. Drain the AdBlue/DEF into a suitable container.



I011503

Fig. 13

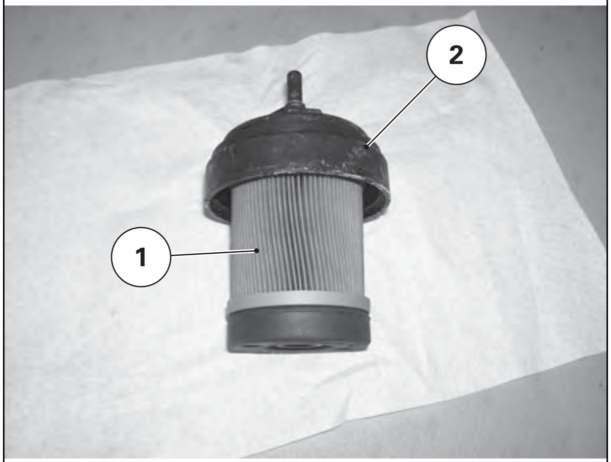
3. Prior to removing the main filter assembly, note the location of the drain valve.
Turn the main filter cap (1) anti-clockwise and remove the main filter cap and main filter (2) from the metering module.



I011504

Fig. 14

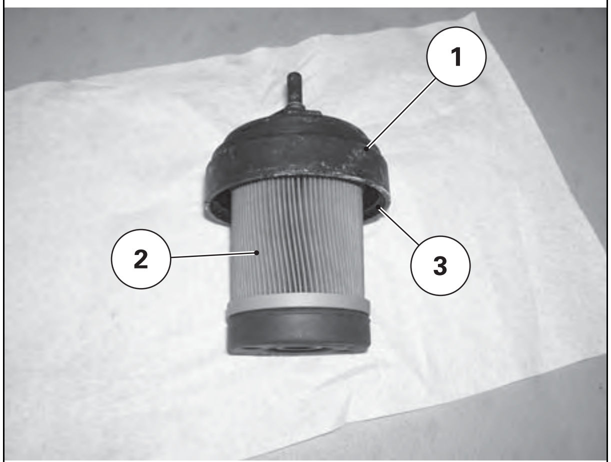
4. To remove the main filter (1) from the cap (2), turn the main filter anti-clockwise and remove the main filter from the cap.



I011505 Fig. 15

5. The main filter assembly consists of the following elements:
- The main filter cap (1)
- The main filter (2)
- An "O" ring (3) (located in main filter cap)

Note: *When replacing the main filter, ensure that a new "O" ring is fitted.*



I011506 Fig. 16

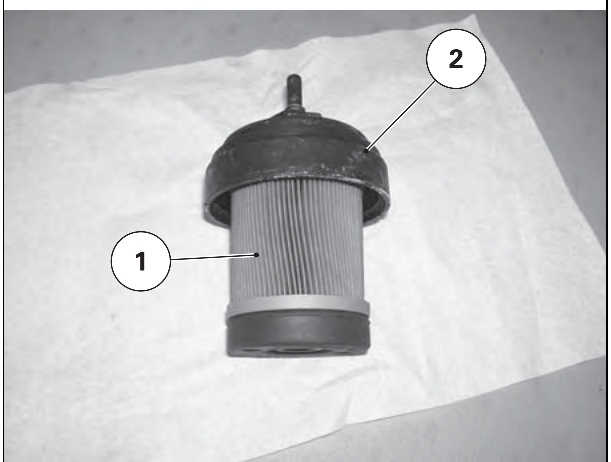
Main filter - Refitting

6. Ensure that a new "O" ring is installed in the cap.

7. Fit the new main filter (1) to the cap (2) by turning the main filter by hand until the main filter starts to come into contact with the cap. Tighten the main filter by an additional 1/4 turn.

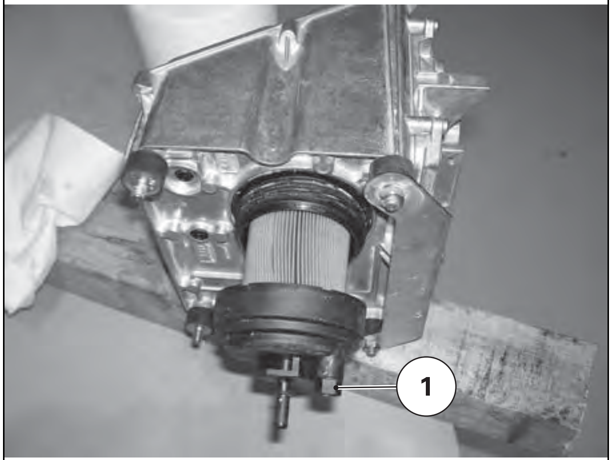
Important: *Do not install a worn and/or wet main filter. Doing so may cause damage or poor filtration to the system.*

Note: *When replacing the main filter, ensure that a new "O" ring is fitted.*



I011505 Fig. 17

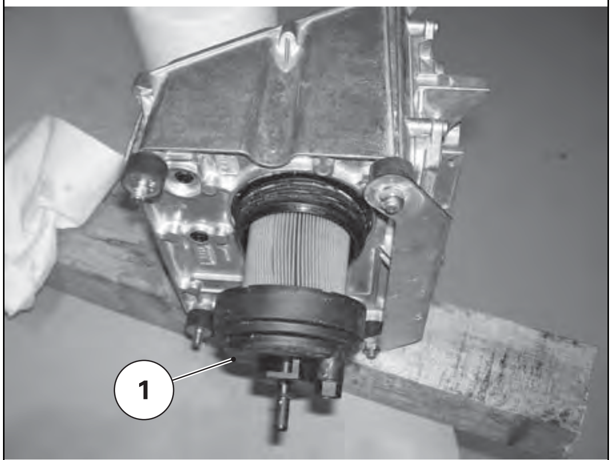
8. Turn the drain valve (1) clockwise two full turns and tighten by an additional 0,5 Nm.



I011507

Fig. 18

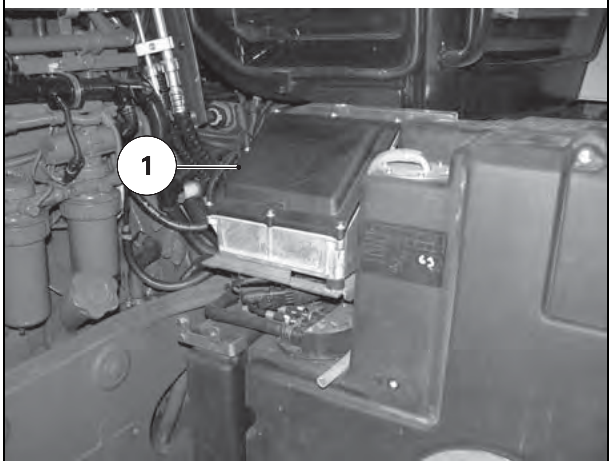
9. Install the main filter assembly (1). Tighten to 20 Nm.



I011510

Fig. 19

10. Install the metering module (1).

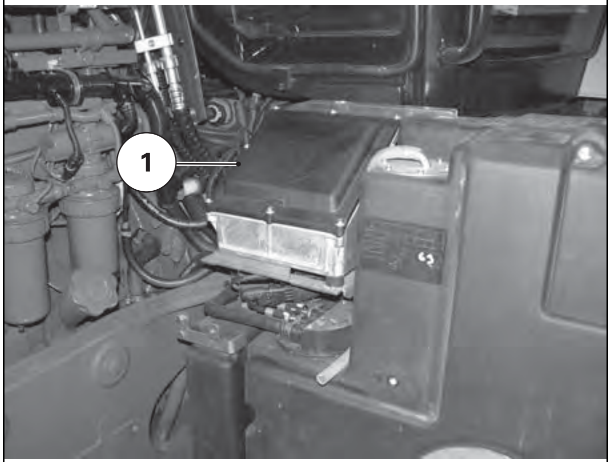


I011502

Fig. 20

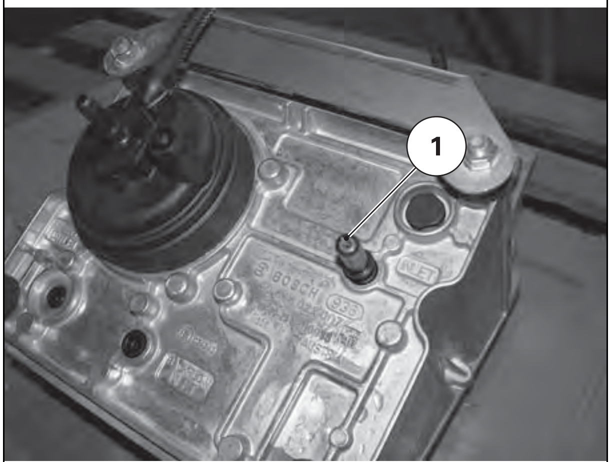
Prefilter - Removal

1. Remove the metering module (1).



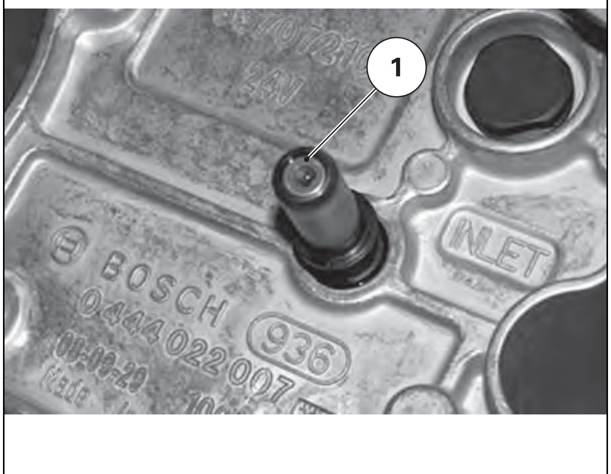
I011502 Fig. 21

2. Locate the inlet prefilter (1) on the bottom of the metering module.



I011511 Fig. 22

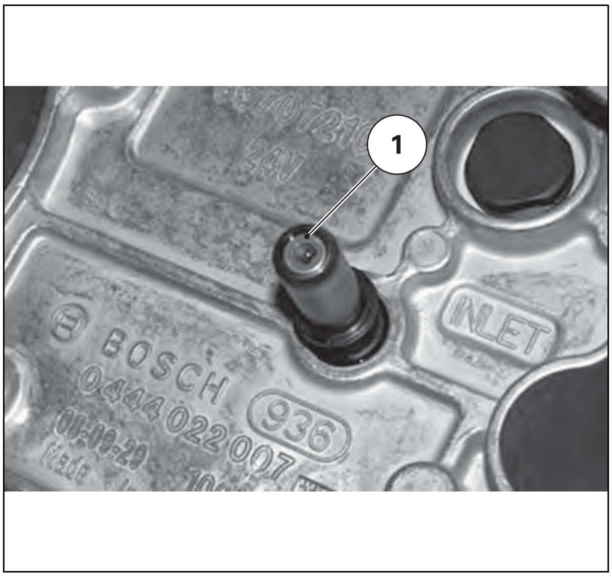
3. Screw a normal wood screw 2 mm to 3 mm into the prefilter (1) and pull out the prefilter.



I011512 Fig. 23

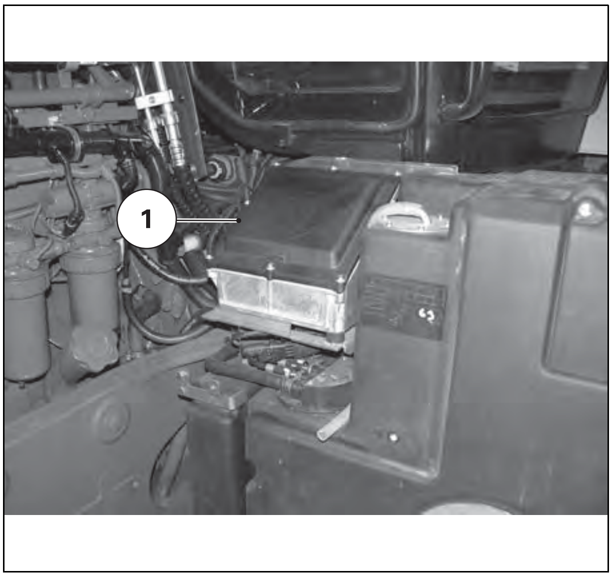
Prefilter - Refitting

1. Using a finger, press a new prefilter (1) into the metering module.
Then, using a screwdriver, carefully press the prefilter into the metering module until the prefilter is 0,2 mm to 0,4 mm below the edge of the housing.



I011512 Fig. 24

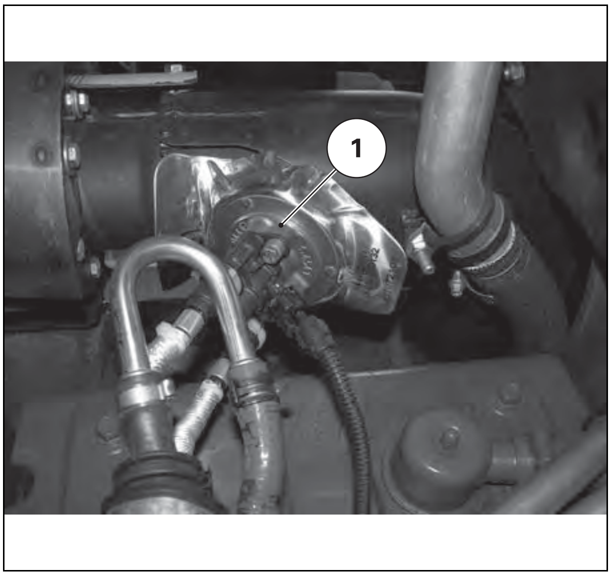
2. Install the metering module (1).



I011502 Fig. 25

B. Injector

1. The injector (1) is located in the silencer, on the turbo outlet side.

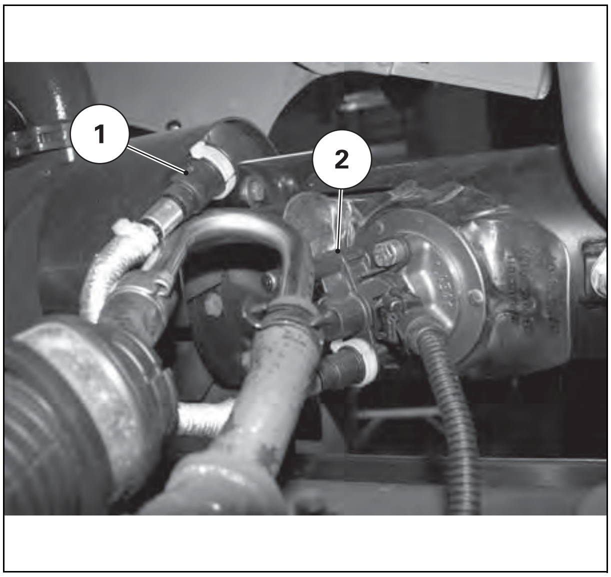


I011514 Fig. 26

Removal

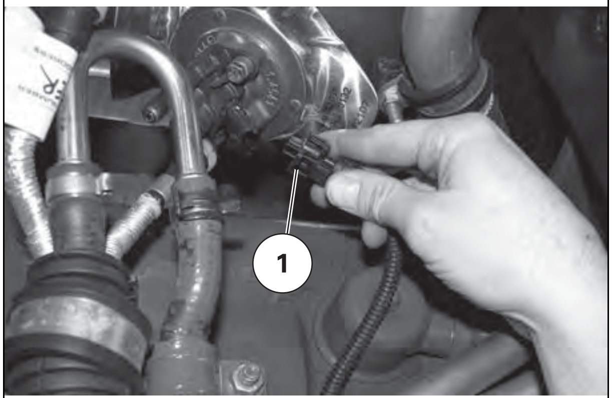
1. Remove the AdBlue/DEF return line (1) from the injector (2).

Note: *Ensure that the ends of the pipes are well blocked to prevent dirt or debris from entering.*



I011515 Fig. 27

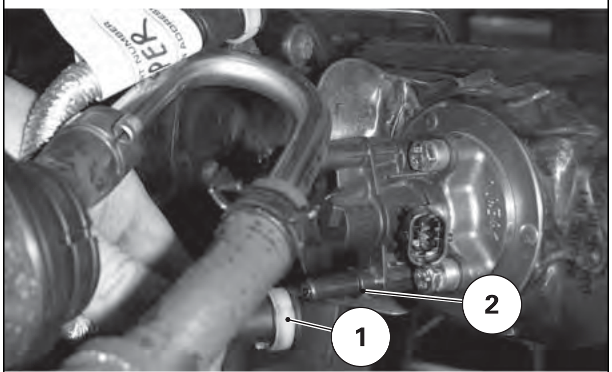
2. Remove the connector from the injector (1).



I011516 Fig. 28

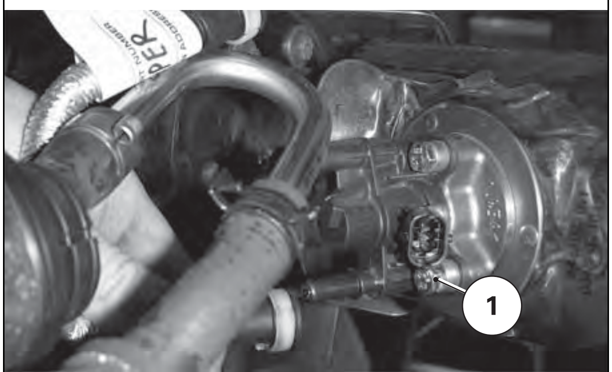
3. Remove the AdBlue/DEF supply line (1) from the injector (2).

Note: *Ensure that the ends of the pipes are well blocked to prevent dirt or debris from entering.*



I011517 Fig. 29

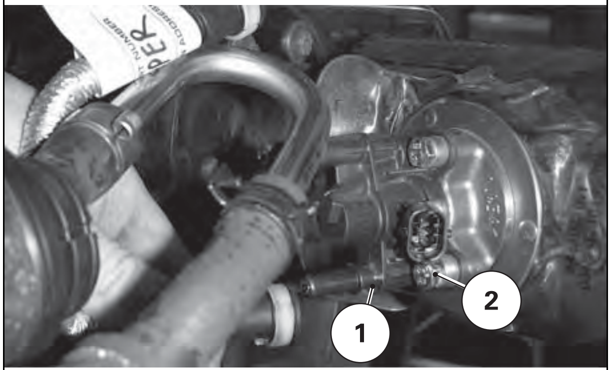
4. Remove the three screws (1) and take out the injector.



I011518 Fig. 30

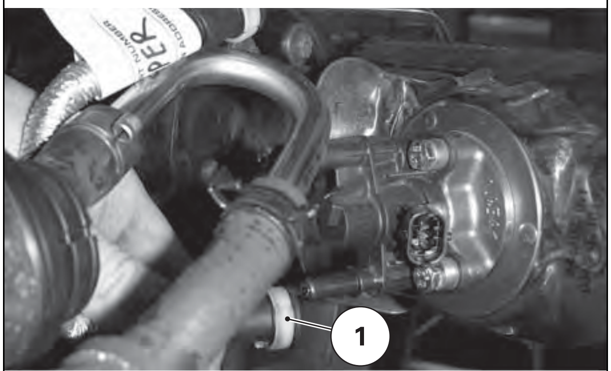
Refitting

1. Install the injector (1) using the three screws (2).



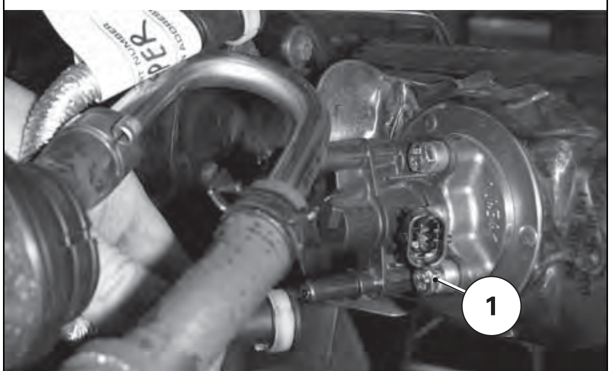
I011519 Fig. 31

2. Install the AdBlue/DEF supply line (1).



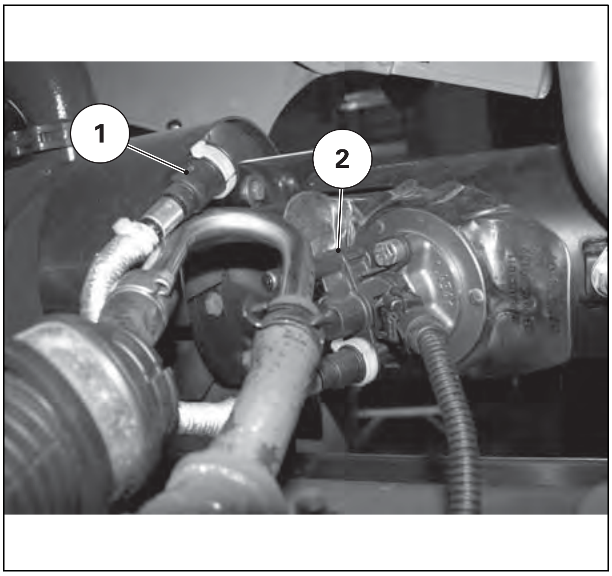
I011520 Fig. 32

3. Install the connector on the injector (1).



I011518 Fig. 33

4. Attach the AdBlue/DEF return line (1) to the injector (2).



I011515

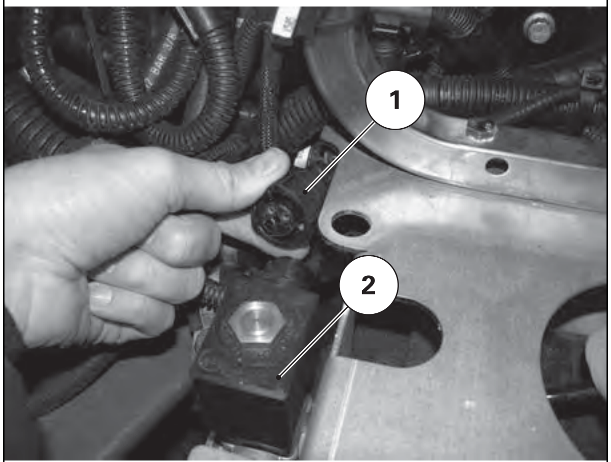
Fig. 34

C. Coolant solenoid valve

Removal

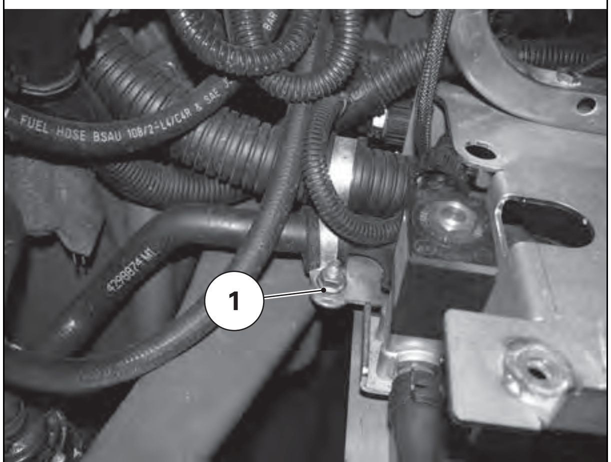
After the engine has fully cooled, remove the radiator cap to relieve any pressure on the cooling system.

1. Remove the connector (1) from the coolant solenoid valve (2).



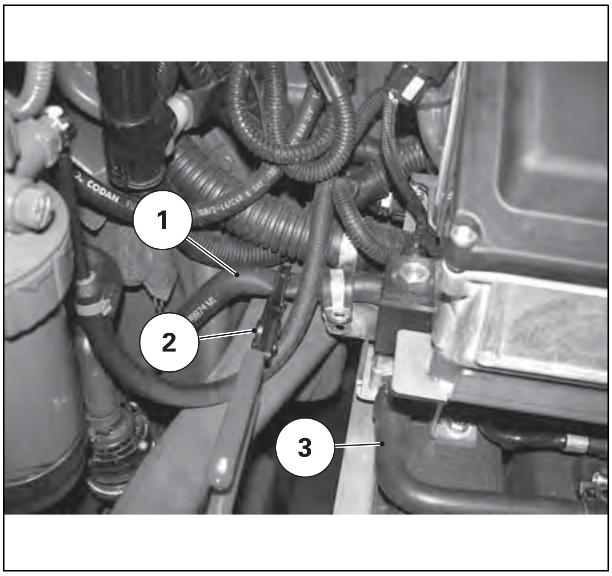
I011521 Fig. 35

2. Remove the nut (1) and screw retaining the coolant inlet tube.



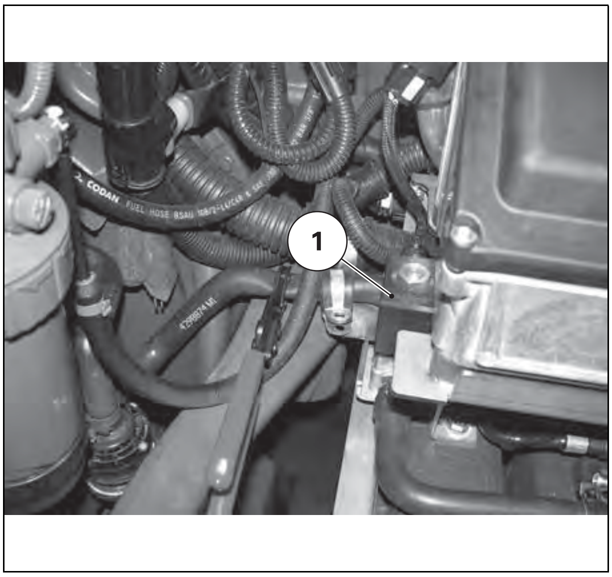
I011522 Fig. 36

3. Install pliers (1) on the coolant inlet tube (2) and the coolant tube (3) on the outlet side of the coolant solenoid valve.



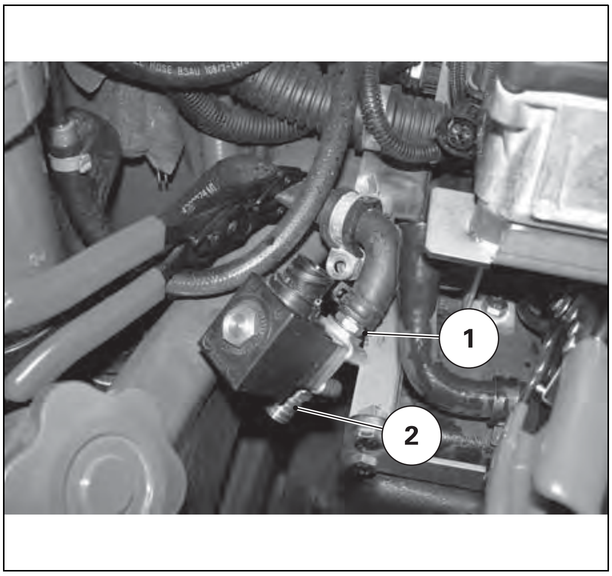
I011523 Fig. 37

4. Remove the two screws retaining the coolant solenoid valve (1).



I011524 Fig. 38

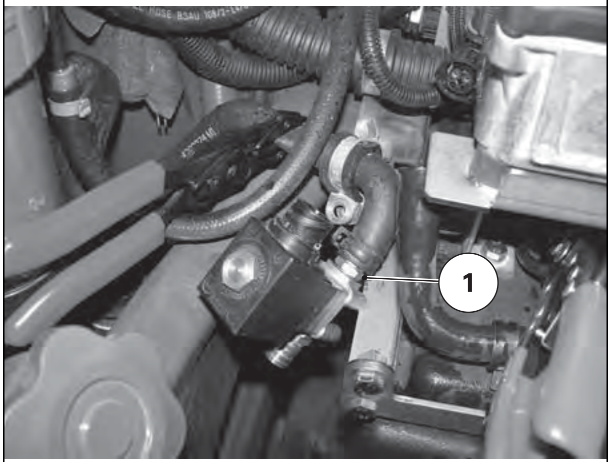
5. Remove the coolant hoses from the inlet (1) and outlet (2) of the coolant solenoid valve and remove the coolant solenoid valve.



I011525 Fig. 39

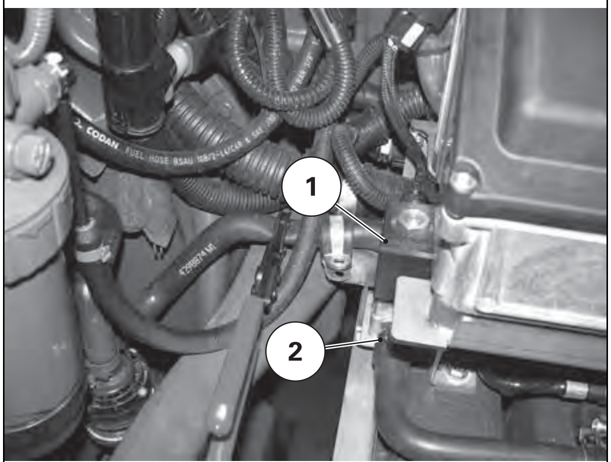
Refitting

1. Connect the coolant hose to the inlet (1) end of the coolant solenoid valve.



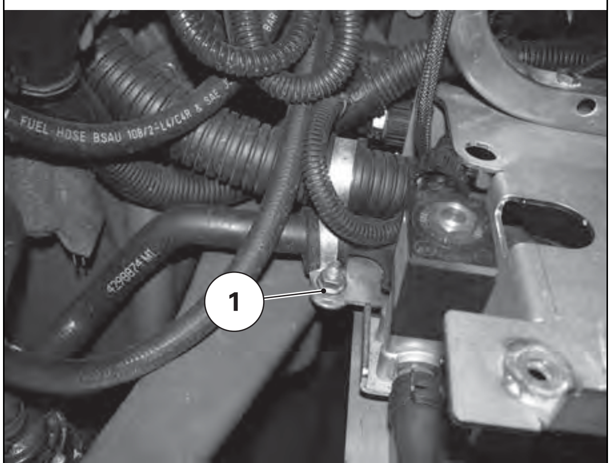
I011526 Fig. 40

2. Install the coolant solenoid valve (1).
3. Connect the coolant hose to the outlet (2) end of the coolant solenoid valve.



I011527 Fig. 41

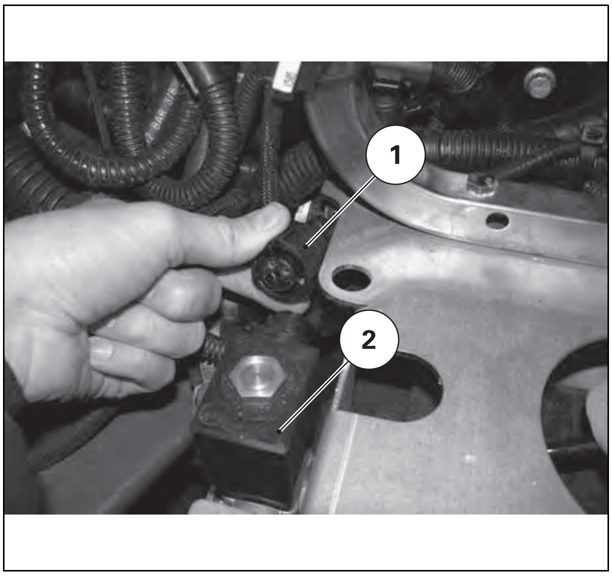
4. Remove the pliers and install the coolant inlet tube clip (1).



I011522 Fig. 42

5. Fit the connector (1) to the coolant solenoid valve (2).

6. Replace any coolant lost during removal and install the radiator cap. Start the engine and check for leaks.

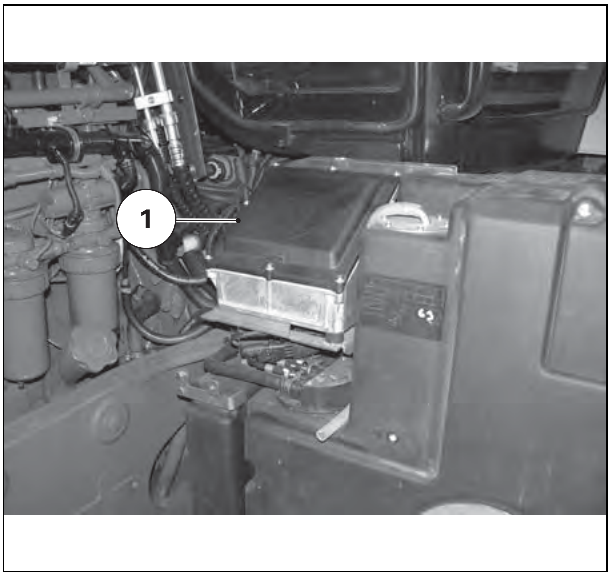


I011521 Fig. 43

D. Voltage converter

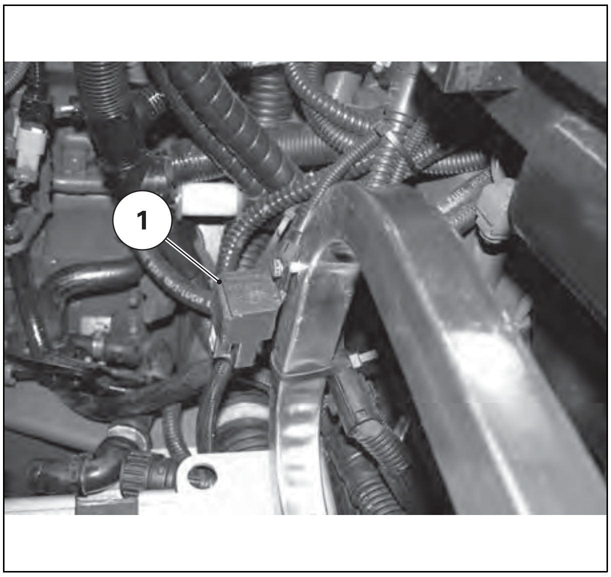
Removal

1. Remove the metering module (1).



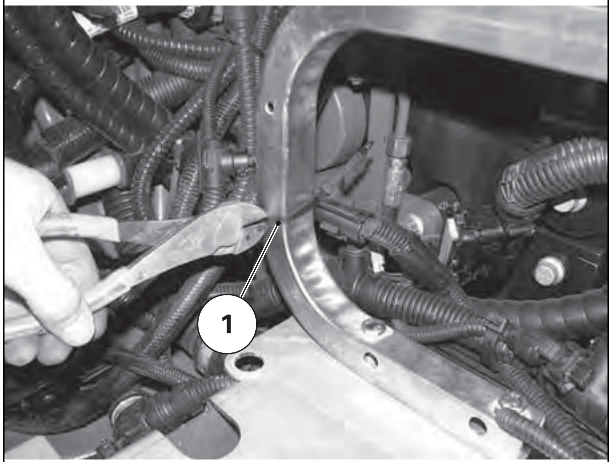
I011502 Fig. 44

2. Remove the relay (1) from the reinforcement tube.



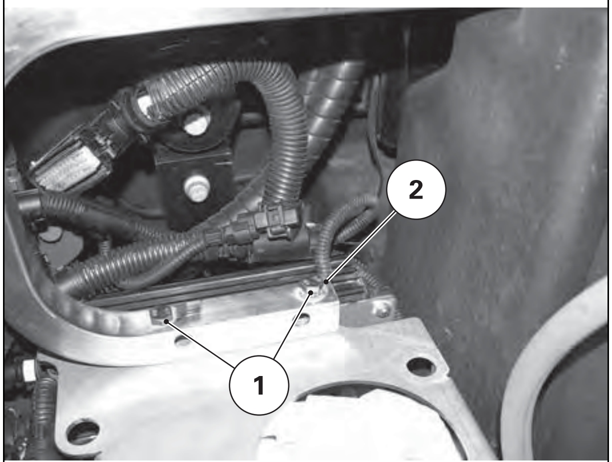
I011528 Fig. 45

3. Remove the plastic tie (1).



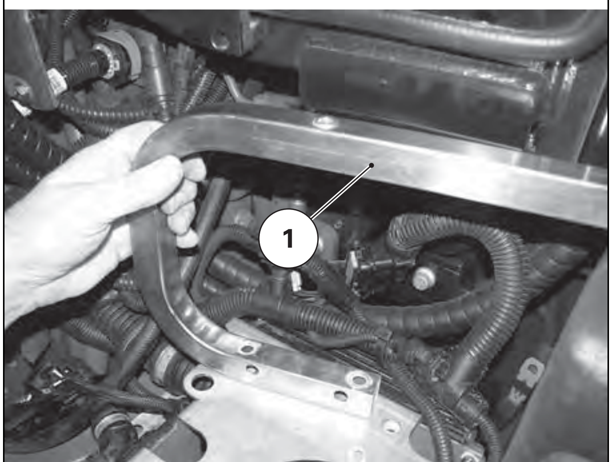
I011529 Fig. 46

4. Remove the two reinforcement tube mounting screws (1) and remove the earth wire (2).



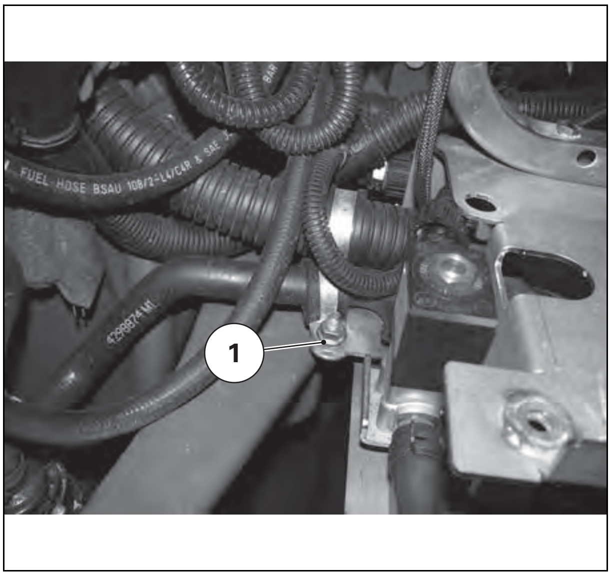
I011530 Fig. 47

5. Remove the reinforcement tube (1).



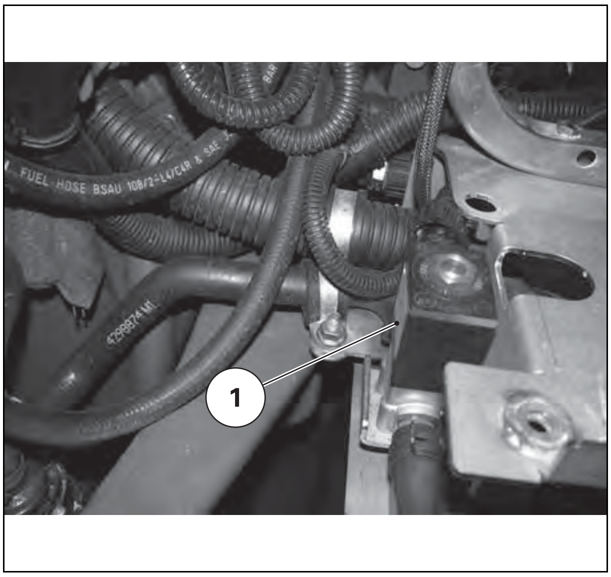
I011531 Fig. 48

6. Remove the nut (1) and screw retaining the coolant pipe.



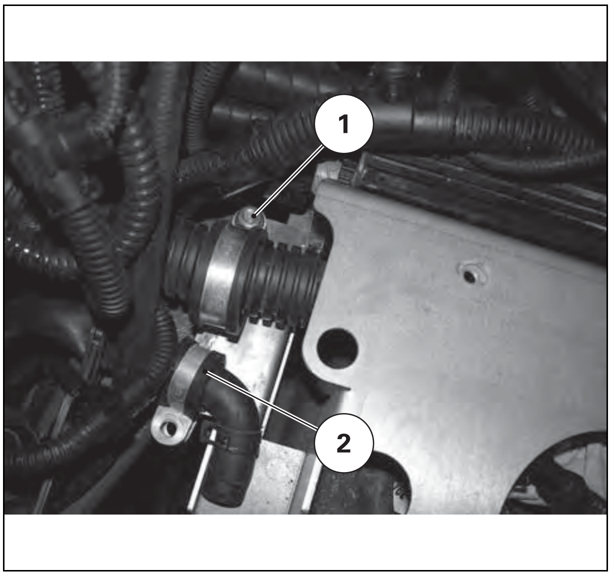
I011522 Fig. 49

7. Remove the two screws retaining the coolant solenoid valve (1) to the metering module mounting bracket.



I011532 Fig. 50

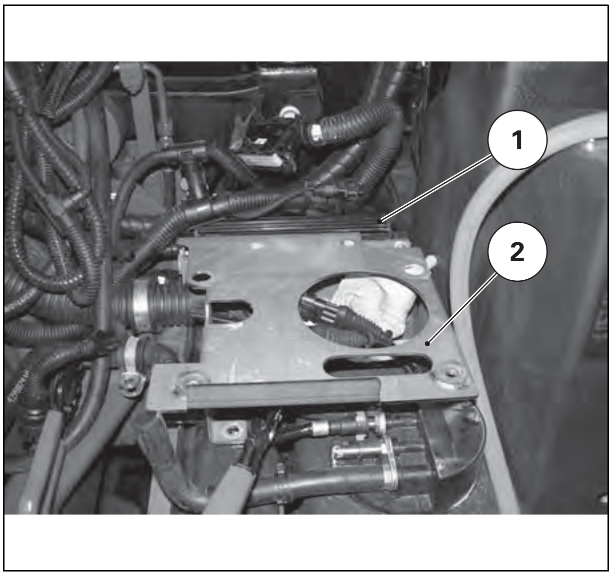
8. Remove the nut (1) holding the AdBlue/DEF pipe assembly and remove the clip (2) from its mounting studs.



I011533 Fig. 51

9. The voltage converter (1) is mounted to the rear of the metering module mounting bracket (2). To access the voltage converter, the metering module mounting bracket must be removed.
Remove the five screws securing the metering module mounting bracket and remove the bracket.

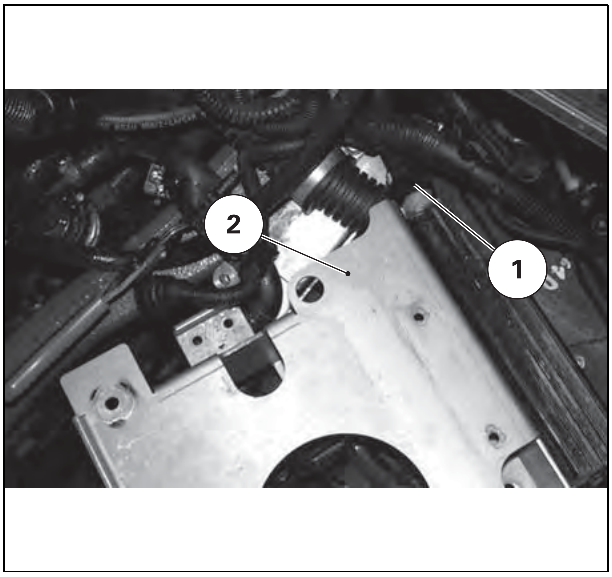
Note: *The right-hand rear mounting screw is accessed by carefully moving the AdBlue/DEF pipe assembly.*



I011534

Fig. 52

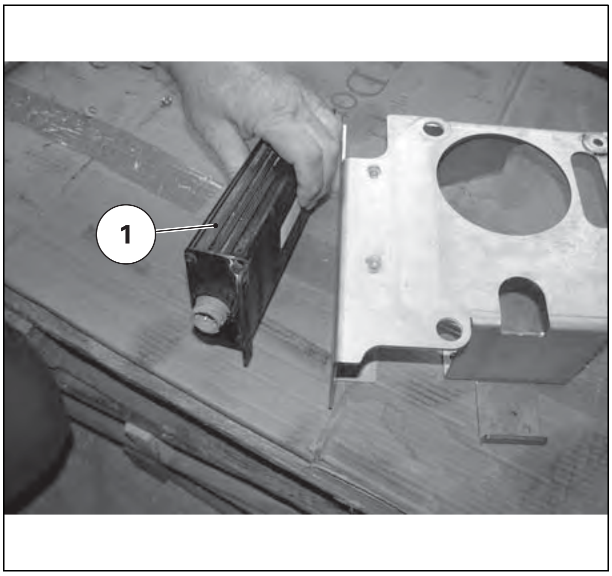
10. Remove the voltage converter connector (1) and remove the metering module mounting bracket (2).



I011535

Fig. 53

11. Remove the four screws and nuts retaining the voltage converter (1) and remove the voltage converter.

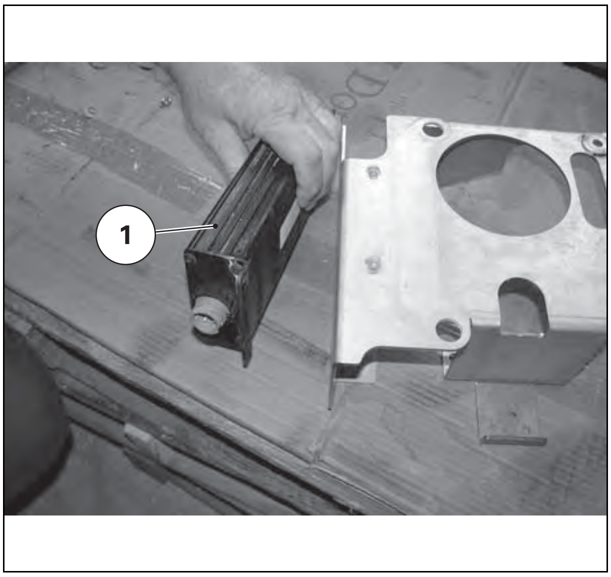


I011536

Fig. 54

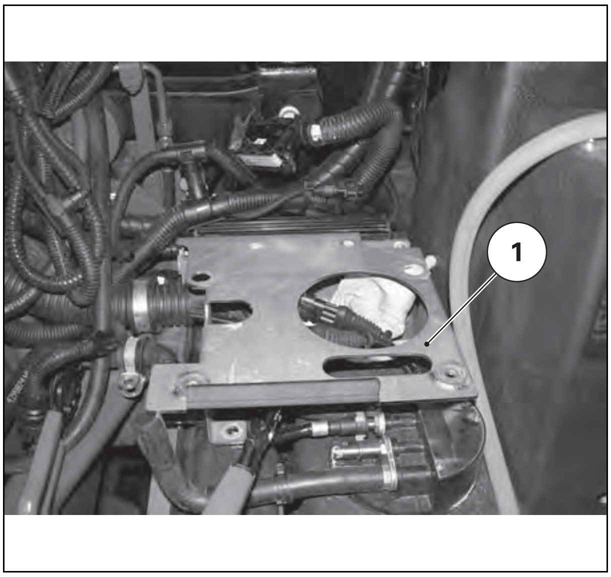
Refitting

1. Fit the voltage converter (1) to the metering module mounting bracket.



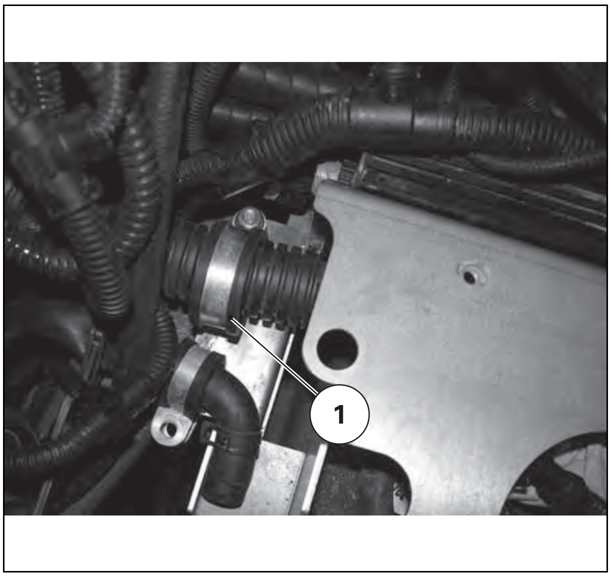
I011536 Fig. 55

2. Install the metering module mounting bracket (1). Fit the voltage converter connector to the voltage converter.



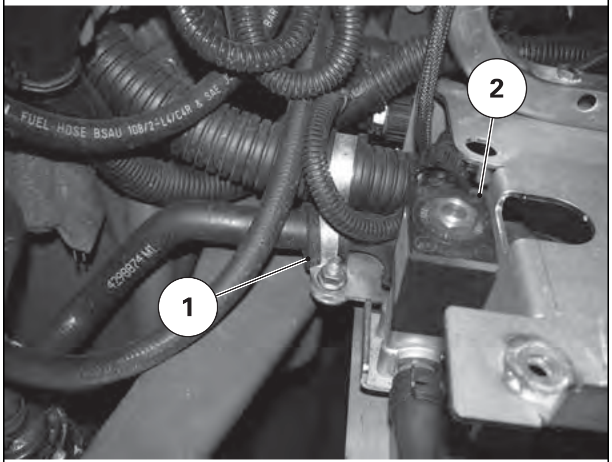
I011537 Fig. 56

3. Install the AdBlue/DEF pipe assembly clip (1).



I011538 Fig. 57

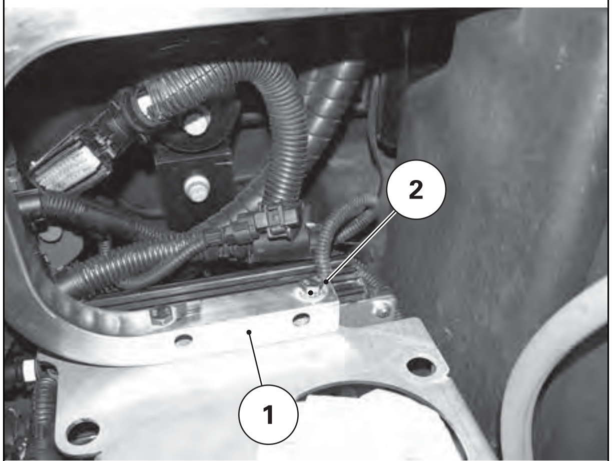
4. Install the coolant solenoid (1) and clip (2).



I011539

Fig. 58

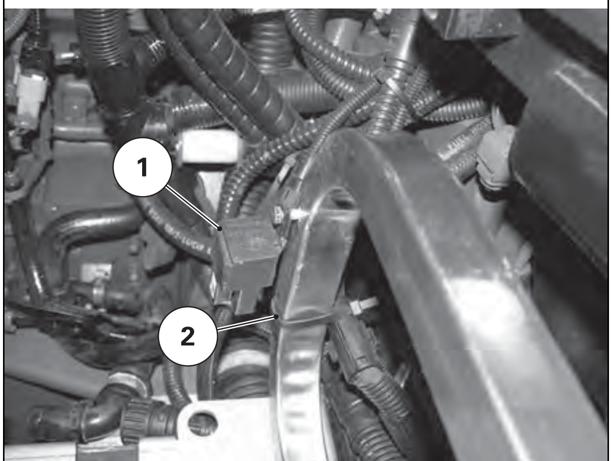
5. Install the reinforcement tube (1) and earth wire (2).



I011540

Fig. 59

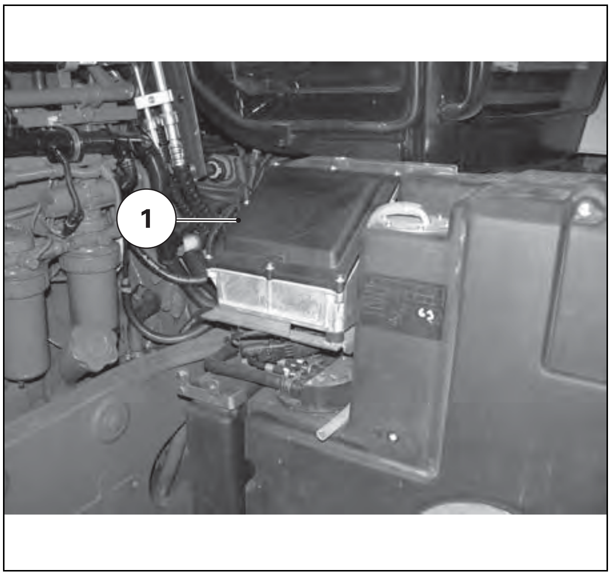
6. Install the relay (1) and a new plastic tie (2).



I011541

Fig. 60

7. Install the metering module (1).



I011502 Fig. 61

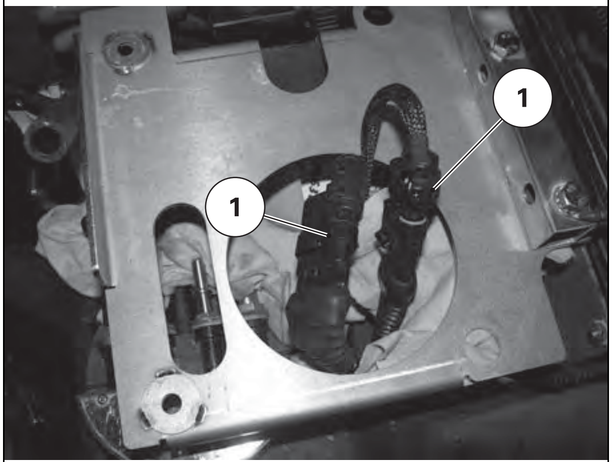
E. AdBlue/DEF tank

Removal

Note: *The AdBlue/DEF tank has a capacity of 30 l. Use a suitable lifting device to remove the AdBlue/DEF tank.*

1. Remove the metering module.

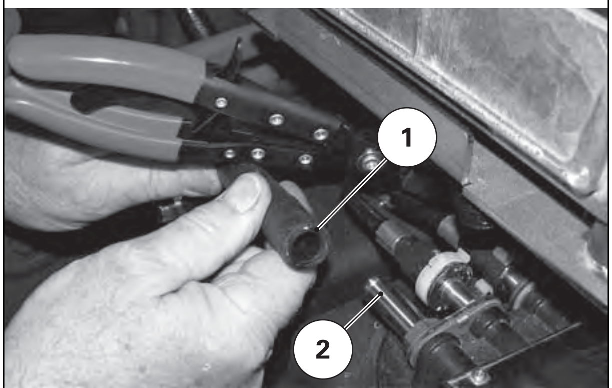
2. Disconnect the sender unit wiring harness connectors (1).



I011542

Fig. 62

3. Remove the coolant hose (1) from the front of the sender unit (2).

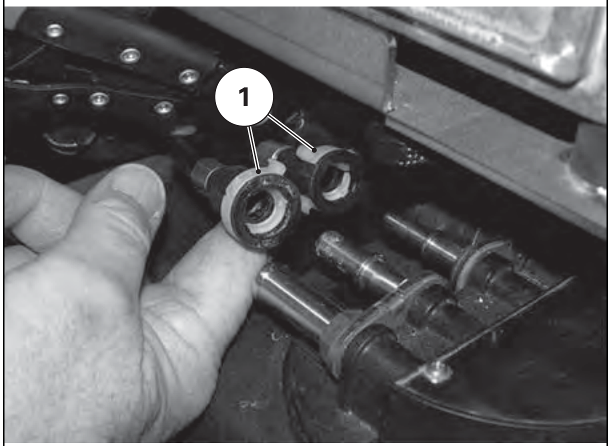


I011543

Fig. 63

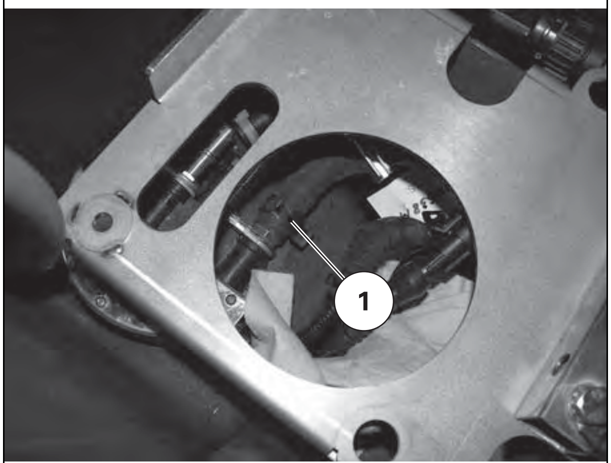
4. Remove the AdBlue/DEF pipes (1) from the sender unit.

Note: *Ensure that the ends of the pipes are well blocked to prevent dirt or debris from entering.*



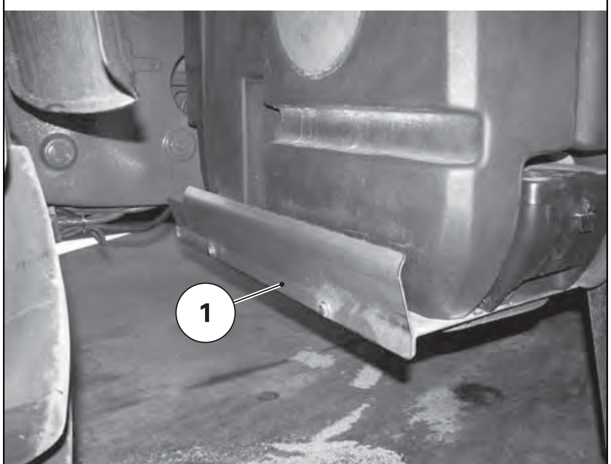
I011544 Fig. 64

5. Remove the coolant hose (1) from the back of the sender unit.



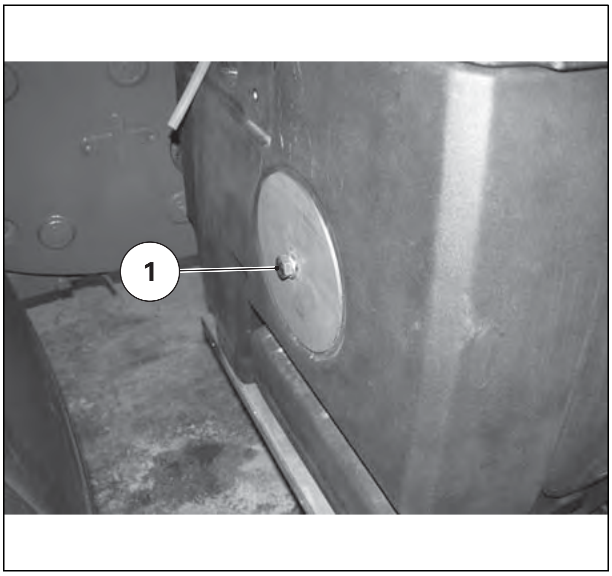
I011545 Fig. 65

6. Remove the shield (1) located in front of the AdBlue/DEF tank.



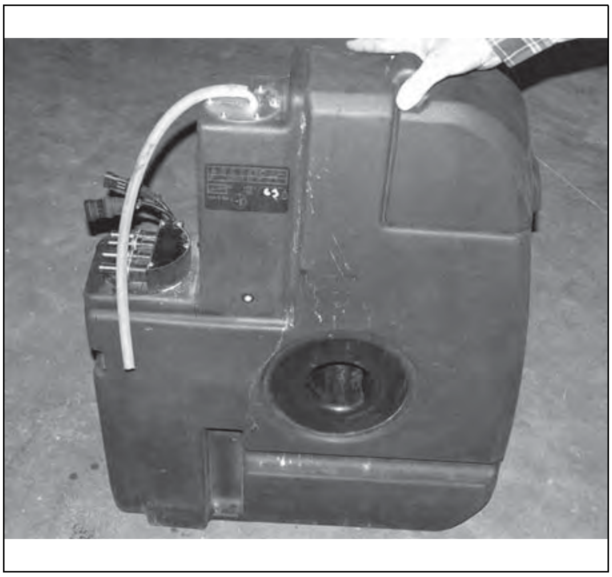
I011546 Fig. 66

7. Remove the screw (1), washer and disc.



I011547 Fig. 67

8. Carefully slide the AdBlue/DEF tank towards the front of the tractor until the tank is free from the mounting bar, and use a suitable lifting device to remove the AdBlue/DEF tank.

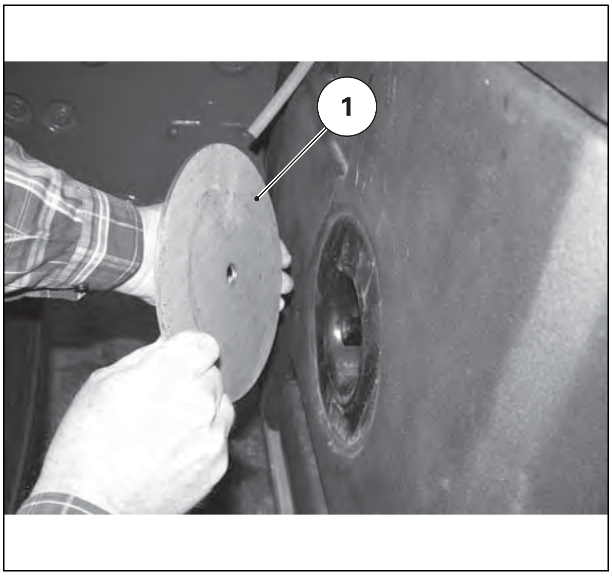


I011548 Fig. 68

Refitting

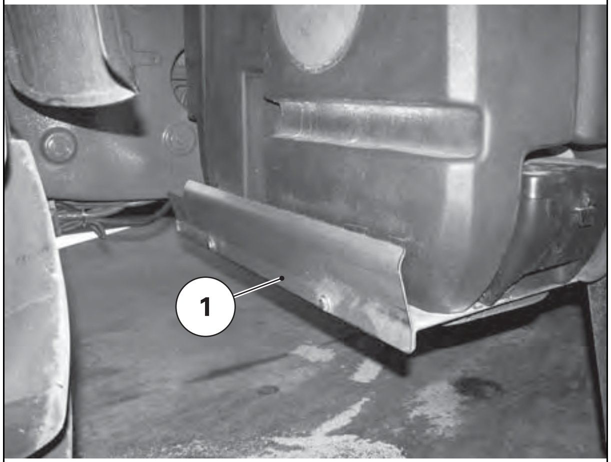
***NOTE:** The DEF tank has a capacity of 30 l. Use a suitable lifting device to install the DEF tank.*

1. Slide the AdBlue/DEF tank onto the mounting bar and install the disc (1), washer and screw.



I011549 Fig. 69

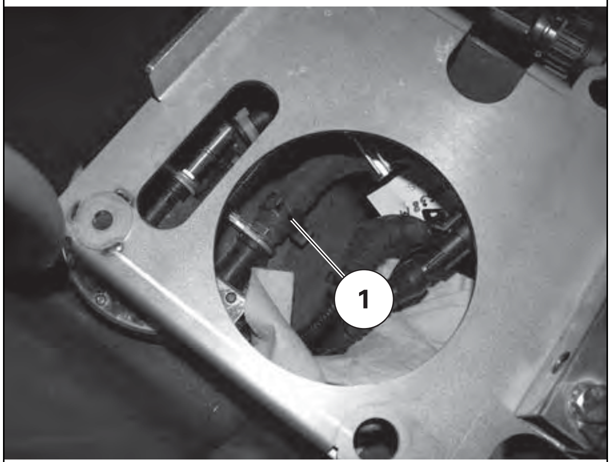
2. Install the shield (1).



I011546

Fig. 70

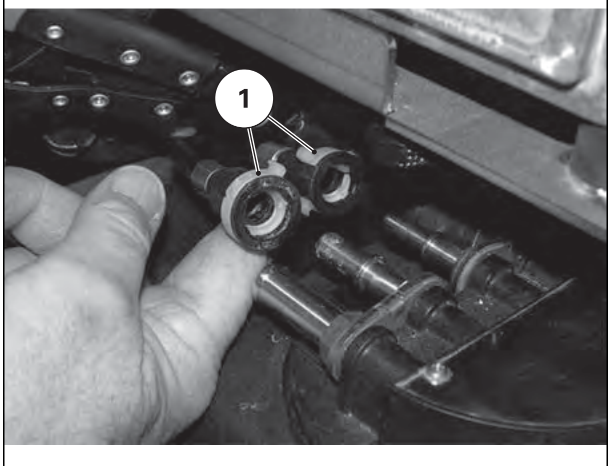
3. Fit the coolant hose (1) to the rear of the sender unit.



I011545

Fig. 71

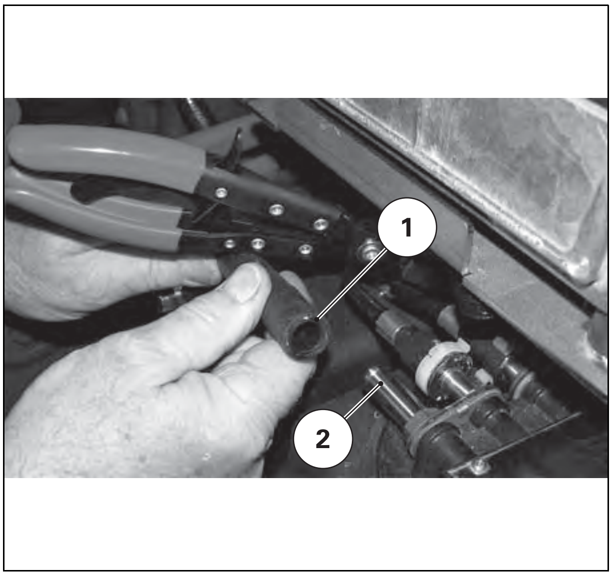
4. Fit the AdBlue/DEF pipes (1) to the sender unit.



I011544

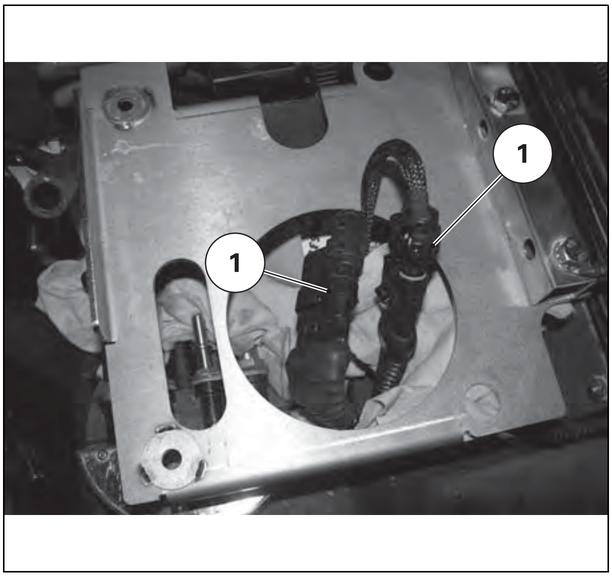
Fig. 72

5. Fit the coolant hose (1) to the front of the sender unit (2).



I011543 Fig. 73

6. Connect the sender unit wiring harness connectors (1).



I011542 Fig. 74

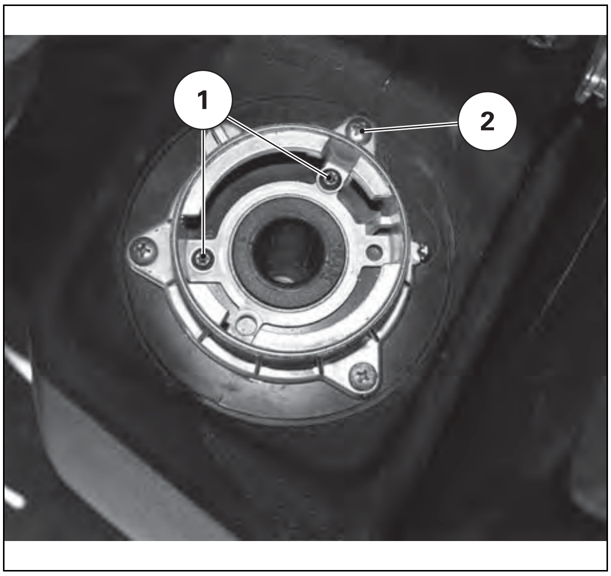
Inlet assembly

Removal

1. Remove the AdBlue/DEF tank cap (1).

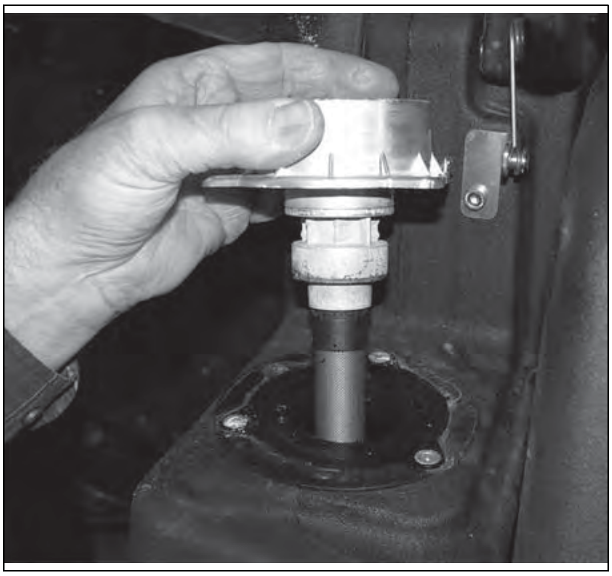
I011550 Fig. 75

2. Remove the two inner screws (1) and the three outer screws (2).



I011551 Fig. 76

3. Remove the inlet assembly from the AdBlue/DEF tank.



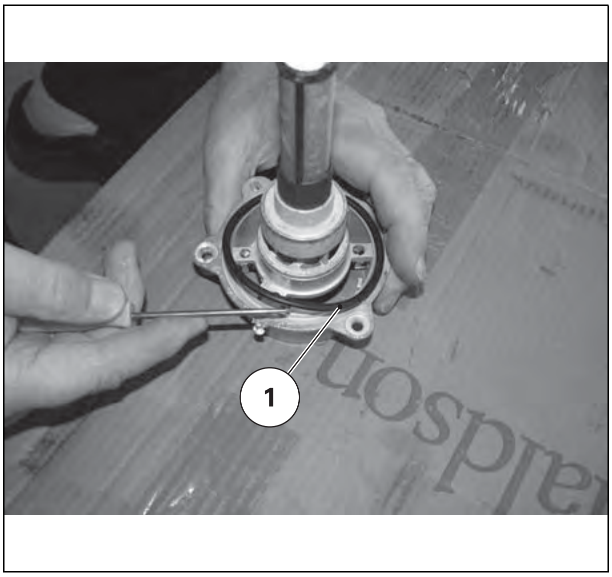
I011552 Fig. 77

"O" ring replacement

1. Remove the inlet assembly from the AdBlue/DEF tank.

2. Remove the "O" ring (1) from the inlet assembly. Install a new "O" ring in the inlet assembly.

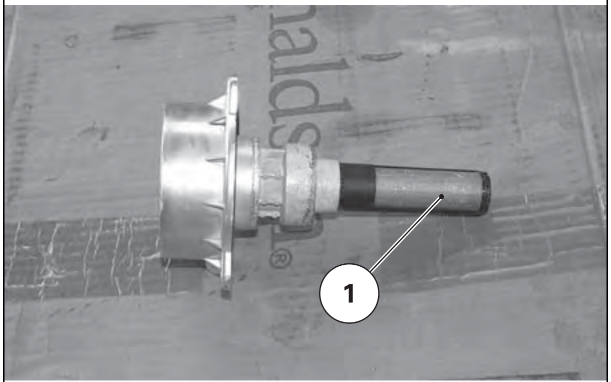
3. Install the inlet assembly in the AdBlue/DEF tank.



I011553 Fig. 78

Inlet screen replacement

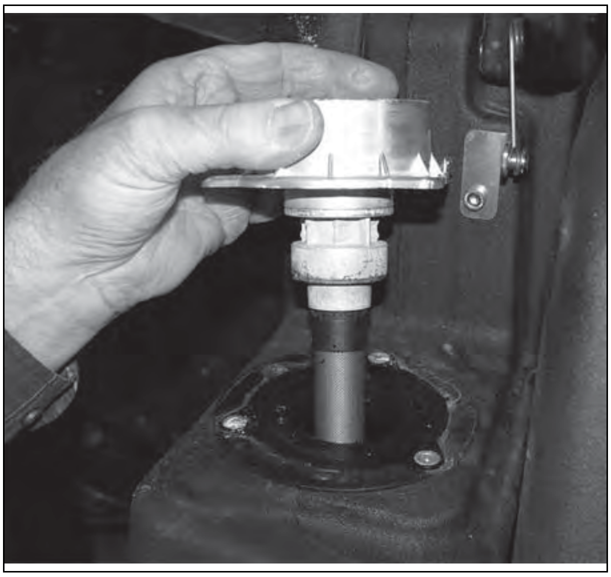
1. Remove the inlet assembly from the AdBlue/DEF tank.
2. Remove the inlet screen (1) from the inlet assembly by sliding the inlet screen out of the opening of the inlet assembly.
3. Replace the inlet screen and install the inlet assembly in the AdBlue/DEF tank.



I011554 Fig. 79

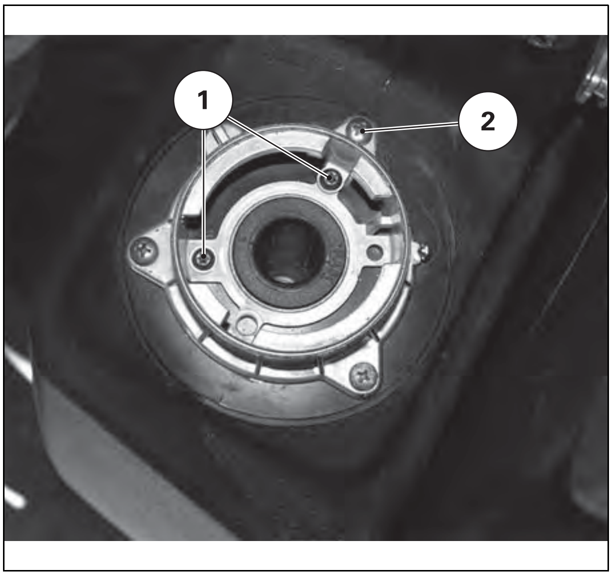
Refitting

1. Install the AdBlue/DEF tank inlet assembly in the AdBlue/DEF tank.



I011552 Fig. 80

2. Install the two inner screws (1) and the three outer screws (2).



I011551 Fig. 81

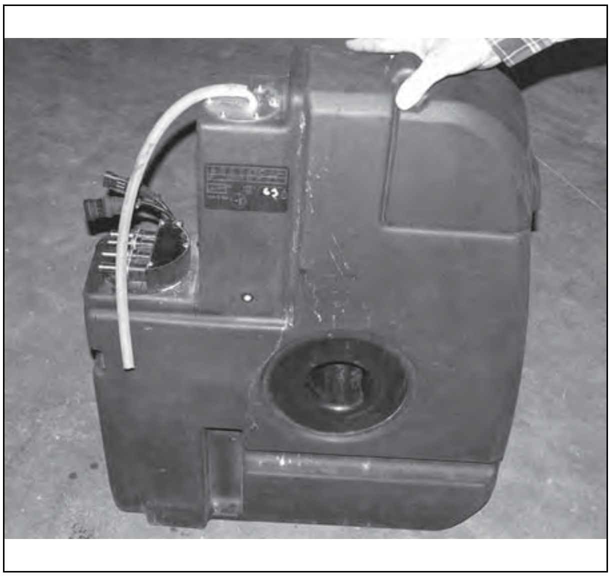
3. Fit the AdBlue/DEF tank cap (1).

I011550 Fig. 82

Gauge

Removal

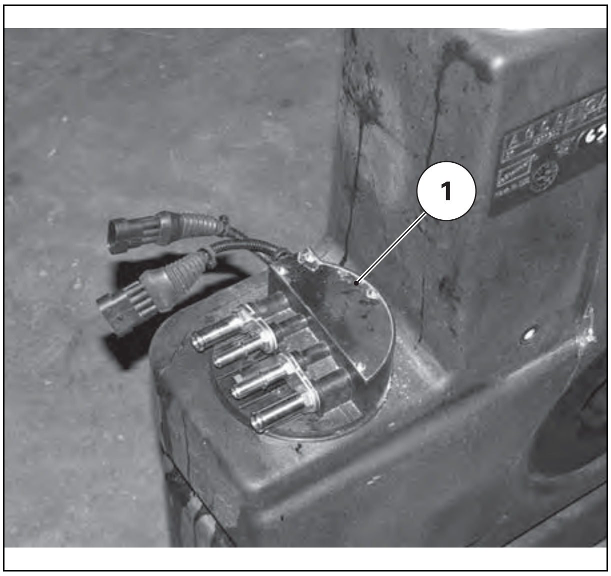
1. Remove the AdBlue/DEF tank.



I011548

Fig. 83

2. Use the special removing/refitting tool to remove the sender unit (1).



I011555

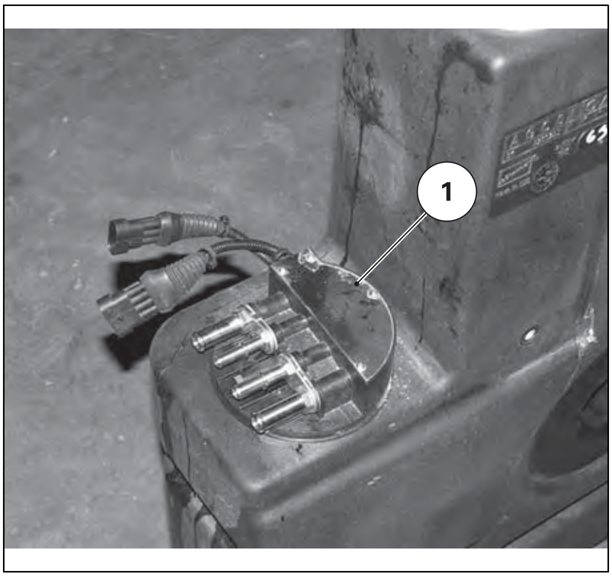
Fig. 84

Refitting

1. Install a new "O" ring on the sender unit (1).

2. Use the special removing/refitting tool to install the sender unit.

3. Install the AdBlue/DEF tank on the machine.



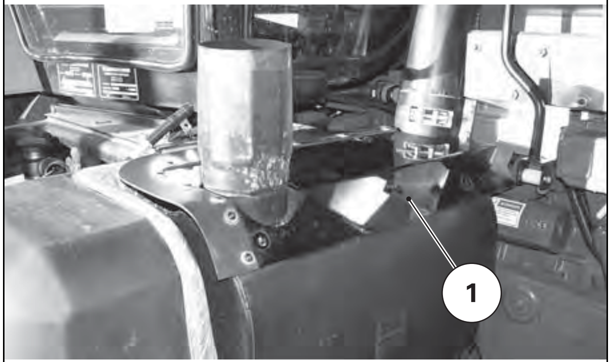
I011555

Fig. 85

F. Catalyser

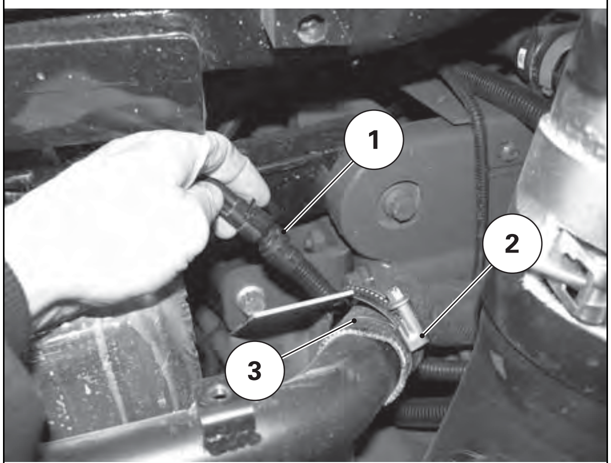
Removal

1. Remove the right-hand engine cover.
2. Remove the silencer from the top of the catalyser.
3. Remove the heat shield (1).



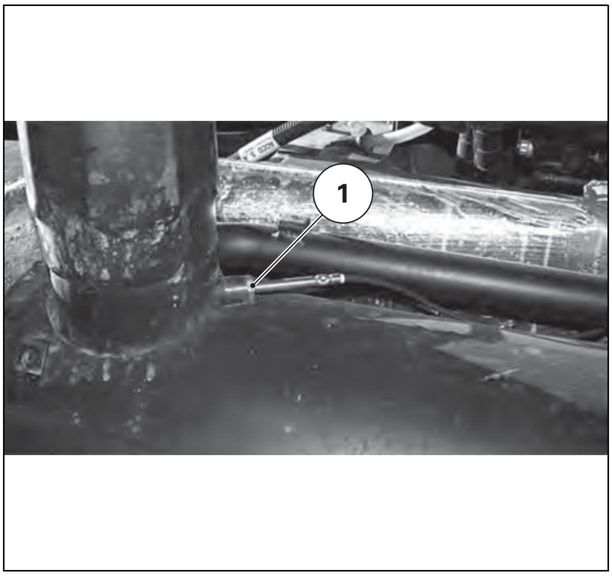
I011556 Fig. 86

4. Disconnect the temperature sensor wiring harness (1).
5. Loosen the clip (2) and remove the aspirator hose (3).



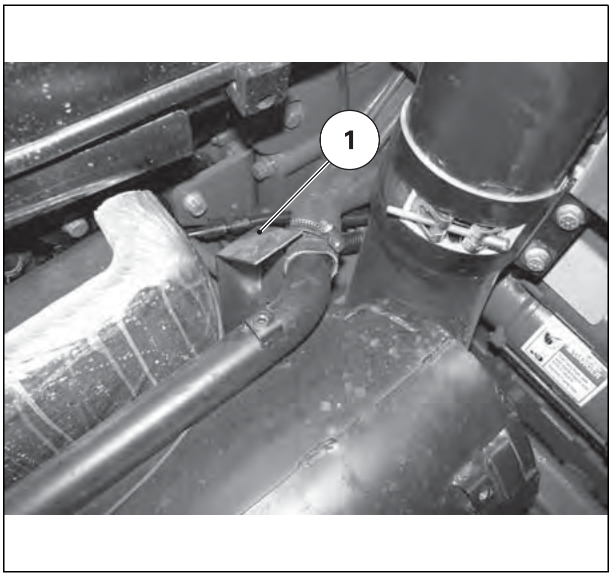
I011557 Fig. 87

6. Remove the temperature sensor (1) from the top of the catalyser.



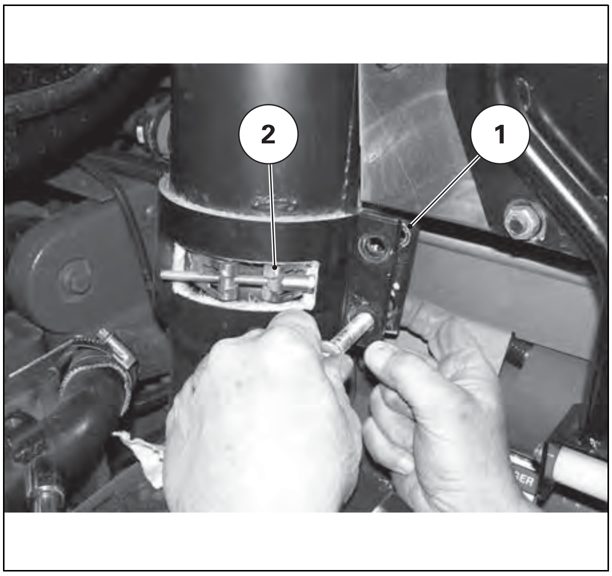
I011558 Fig. 88

7. Remove the shield (1).



I011559 Fig. 89

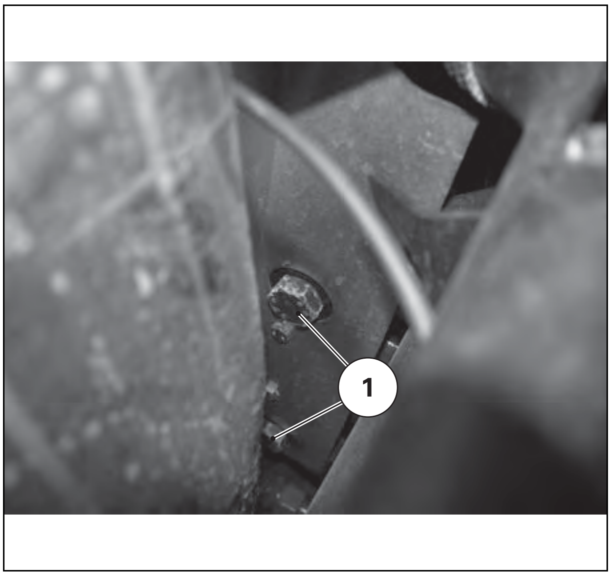
8. Remove the silencer clip (1) and the exhaust flange clip (2).



I011560 Fig. 90

9. Using a suitable lifting device, properly support the catalyser. Remove the two screws (1) retaining the catalyser.

Note: *The catalyser attachment screws are located at the rear left-hand side of the catalyser and the catalyser mounting bracket is indexed with two dowel pins.*



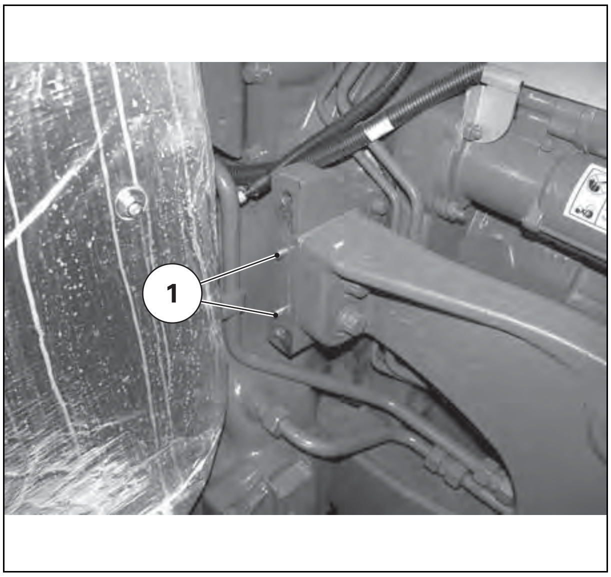
I011561 Fig. 91

10. Remove the catalyser.

I011562 Fig. 92

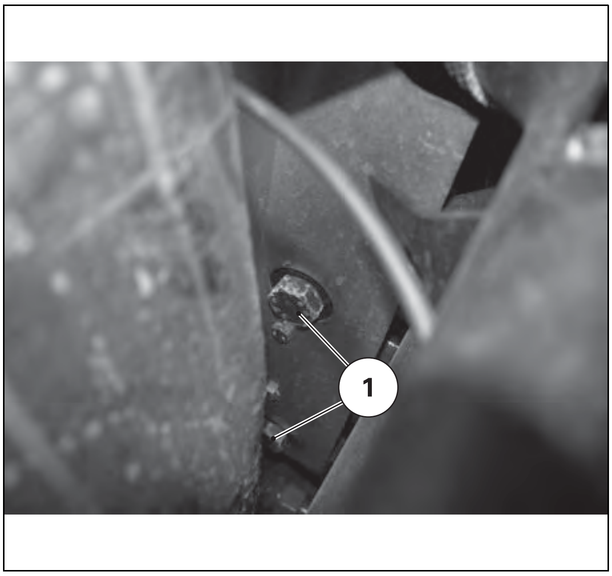
Refitting

1. Using a suitable lifting device, raise the catalyser into position. Ensure that the catalyser fully engages the dowel pins (1) on the machine.



I011563 Fig. 93

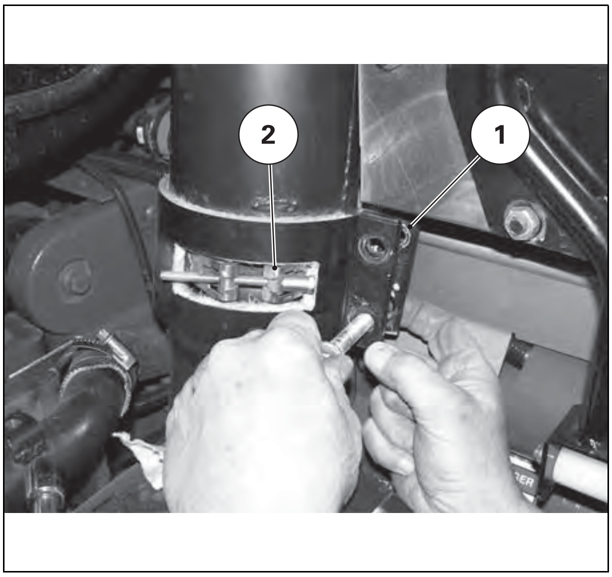
2. Install the two catalyser mounting screws (1).



I011561

Fig. 94

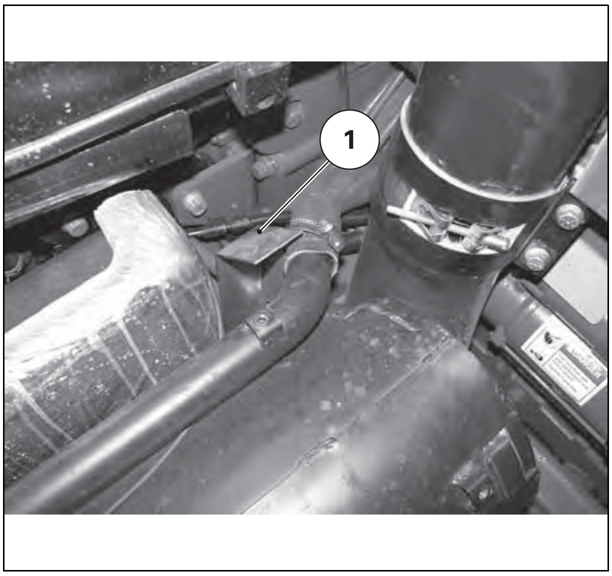
3. Install the exhaust flange clip (2) and the silencer clip (1).



I011560

Fig. 95

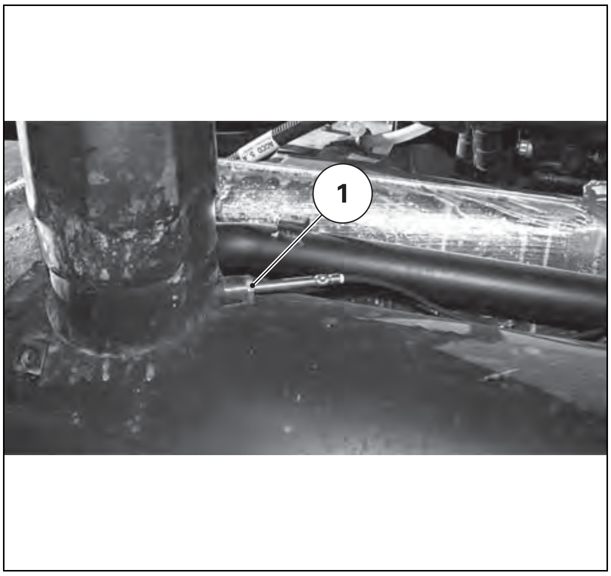
4. Install the shield (1).



I011559

Fig. 96

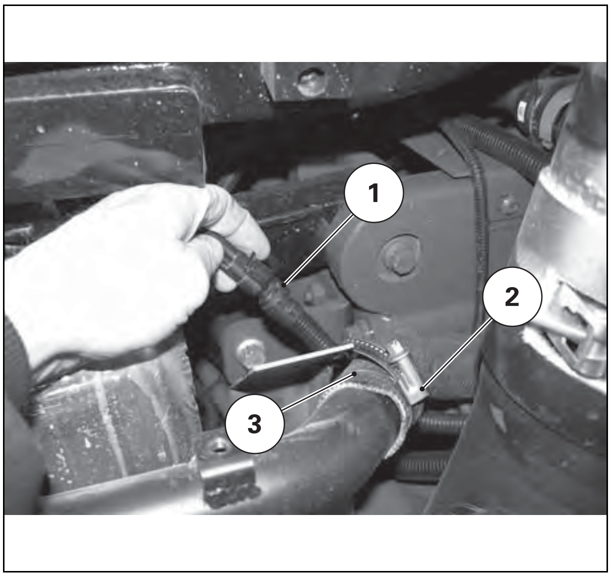
5. Install the temperature sensor (1).



I011558 Fig. 97

6. Connect the temperature sensor wiring harness (1).

7. Install the aspirator hose (3) with the existing clip (2).



I011557 Fig. 98

8. Install the heat shield (1).

9. Install the silencer and the right-hand engine cover.

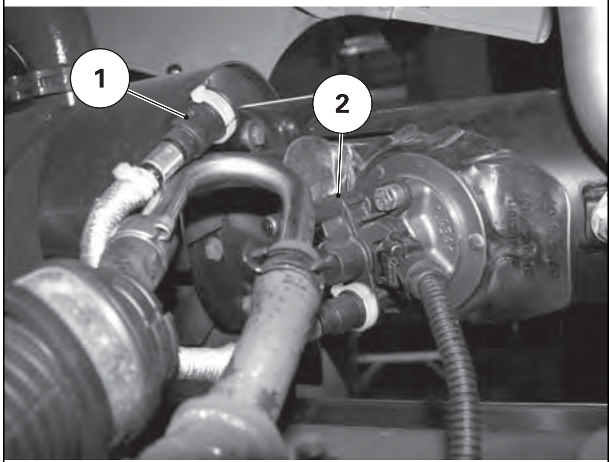
I011556 Fig. 99

G. AdBlue/DEF return line/pressure pipe assembly

Removal

1. Raise the engine bonnet and remove the left-hand engine cover.
2. Remove the AdBlue/DEF return line (1) from the metering module (2).

   ***Note:** Ensure that the ends of the pipes are well blocked to prevent dirt or debris from entering.*

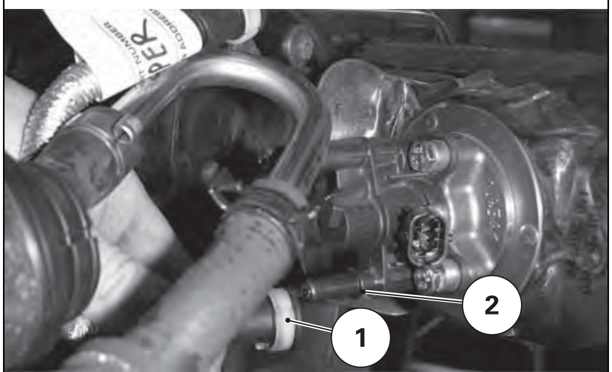


I011515

Fig. 100

3. Remove the AdBlue/DEF supply line (1) from the metering module (2).

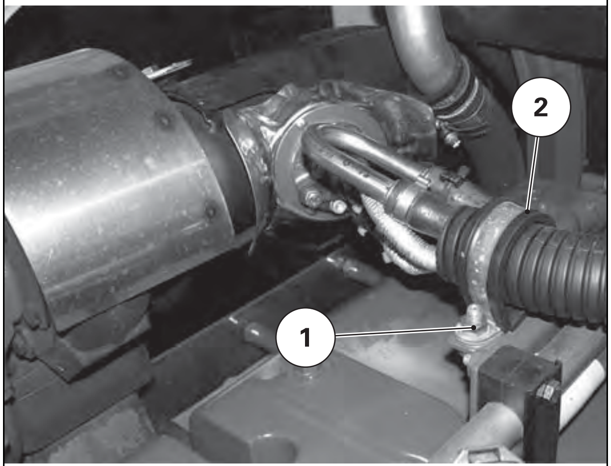
   ***Note:** Ensure that the ends of the pipes are well blocked to prevent dirt or debris from entering.*



I011517

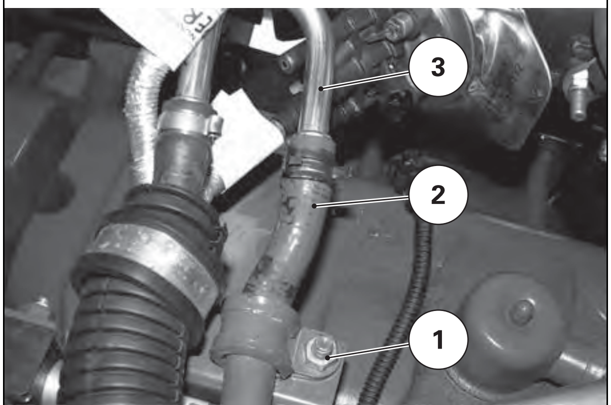
Fig. 101

4. Remove the nut (1) holding the AdBlue/DEF pipe assembly clip (2).



I011564 Fig. 102

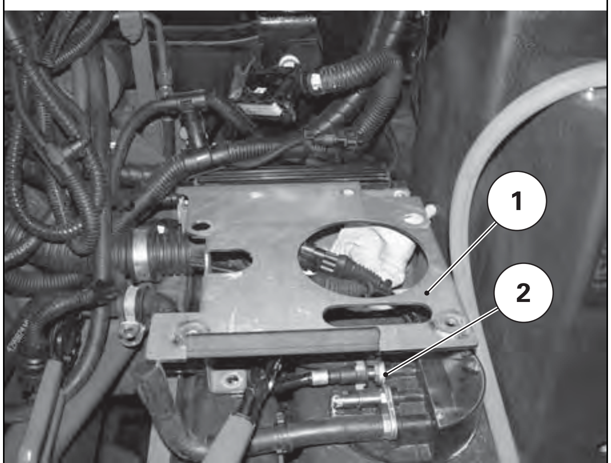
5. Remove the nut (1) retaining the coolant hose clip.
6. Lift the AdBlue/DEF pipe assembly up away from the clip mounting studs.
7. Use pliers to pinch off the coolant hose (2) and remove the coolant hose from the metal coolant tube (3).



I011565 Fig. 103

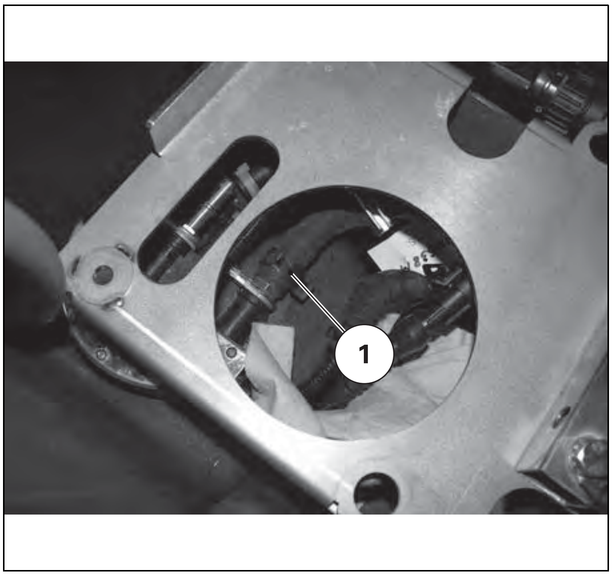
8. Remove the metering module and remove the module mounting bracket (1).
9. Remove the AdBlue/DEF return line (2) from the sender unit.

   Note: *Ensure that the ends of the pipes are well blocked to prevent dirt or debris from entering.*



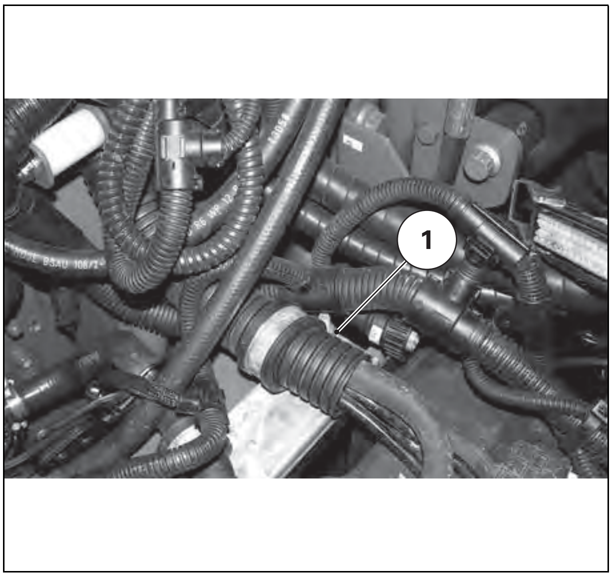
I011566 Fig. 104

10. Remove the coolant hose (1) from the back of the sender unit.



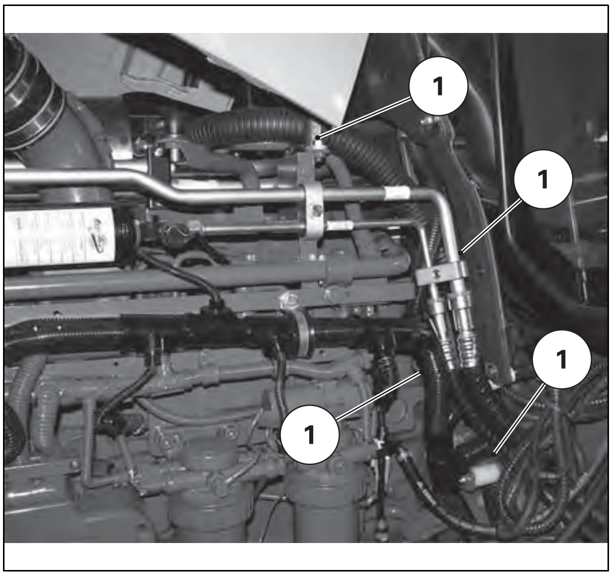
I011545 Fig. 105

11. Remove the nut (1) holding the AdBlue/DEF pipe assembly clip located beside the metering module mounting bracket.



I011567 Fig. 106

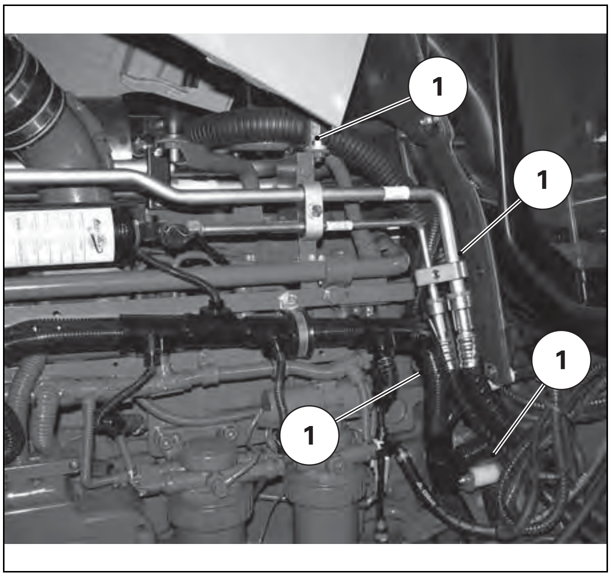
12. Remove the remaining clips (1) on the AdBlue/DEF pipe assembly clips and remove the pipe assembly.



I011568 Fig. 107

Refitting

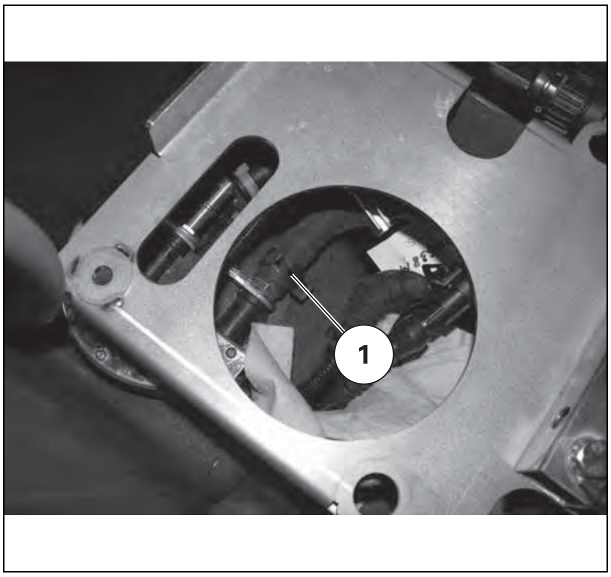
1. Install the AdBlue/DEF pipe assembly using the existing clips (1).



I011568

Fig. 108

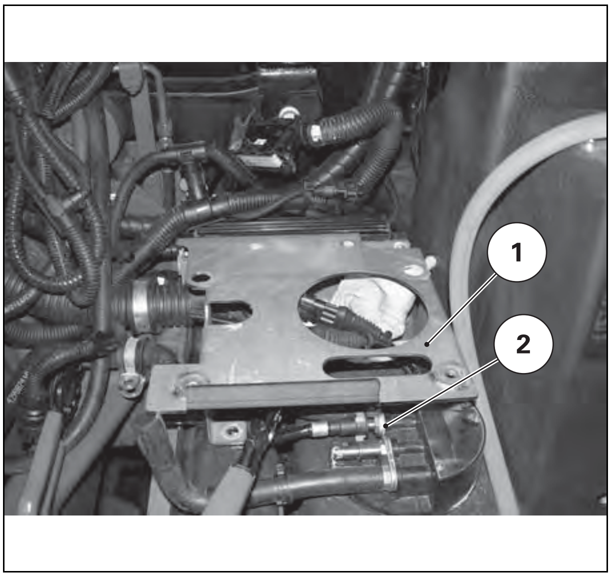
2. Install the coolant hose (1).



I011545

Fig. 109

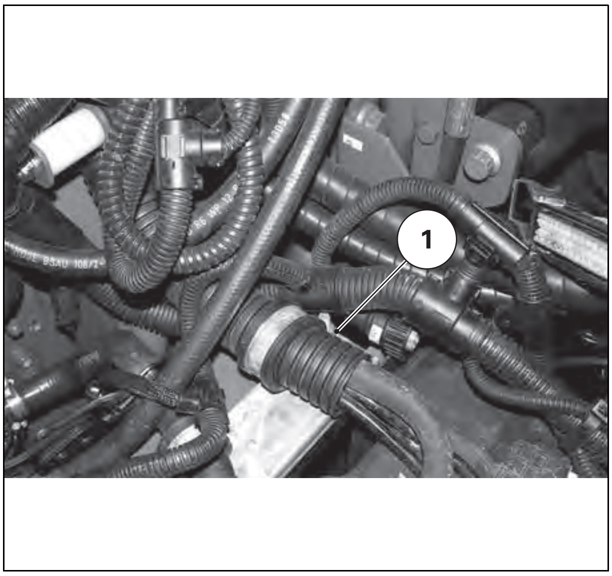
3. Install the AdBlue/DEF return line (2).
4. Install the metering module mounting bracket (1).



I011566

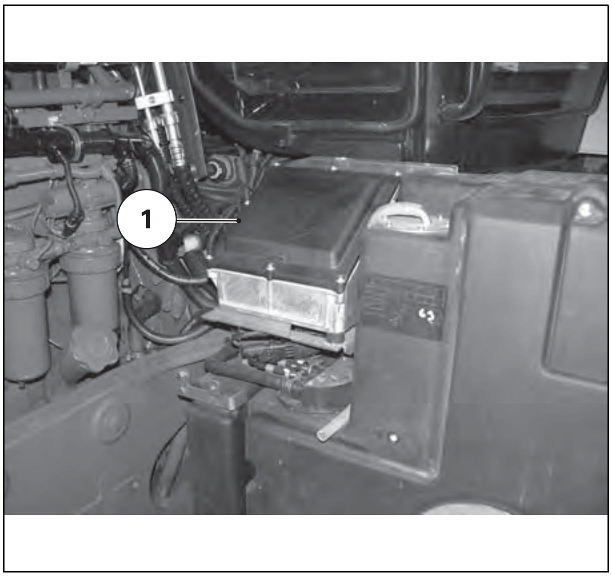
Fig. 110

5. Install the AdBlue/DEF pipe assembly clip (1).



I011567 Fig. 111

6. Install the metering module (1).

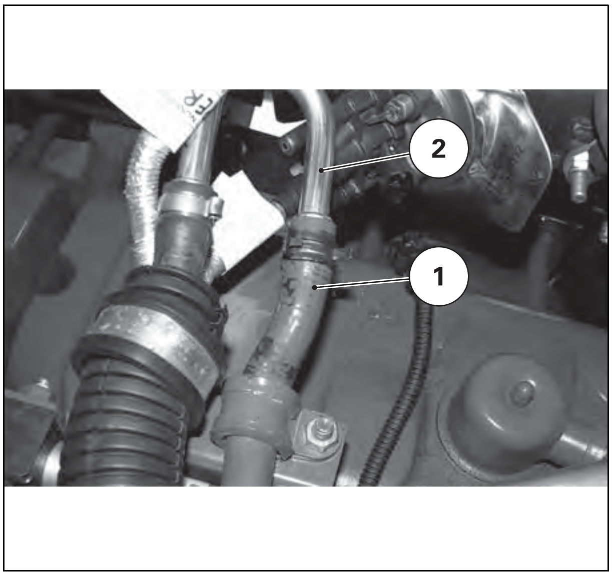


I011502 Fig. 112

7. Install the coolant hose (1) to the coolant tube (2).

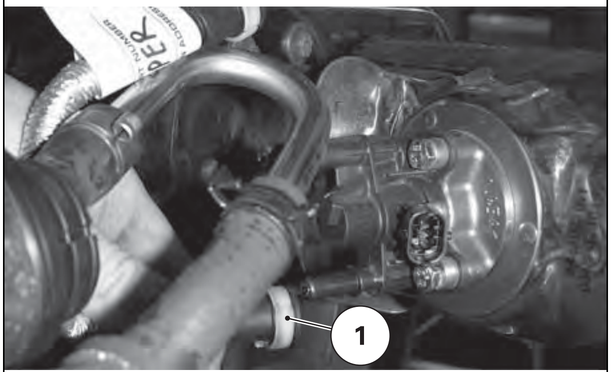
8. Install the AdBlue/DEF pipe assembly and coolant hose using the existing clips.

9. Remove the pliers.



I011569 Fig. 113

10. Install the AdBlue/DEF supply line (1).

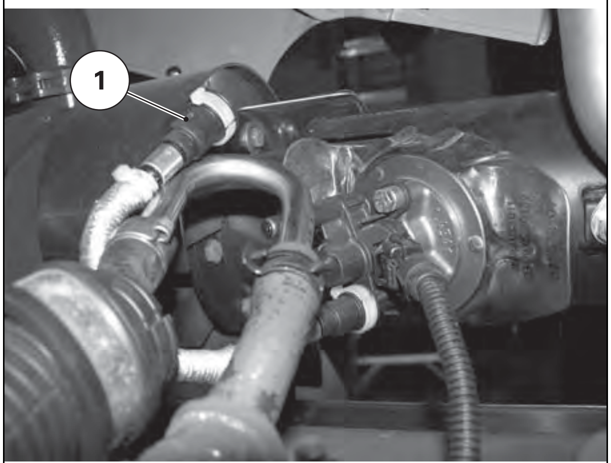


I011520 Fig. 114

11. Install the AdBlue/DEF return line (1).

12. Replace any coolant that was lost, start the engine and check for leaks.

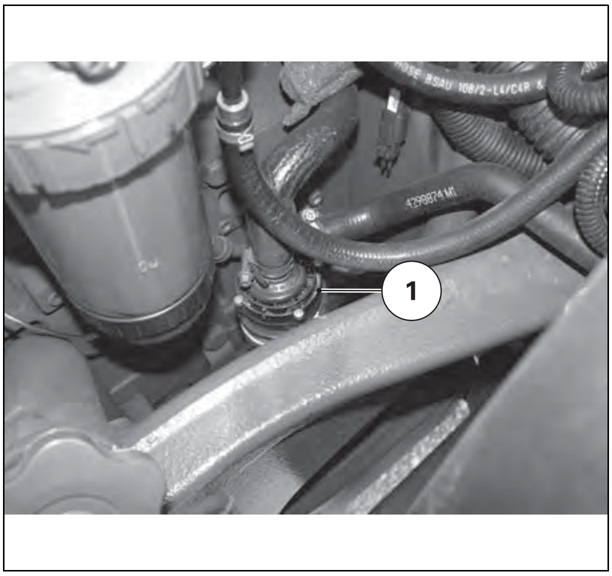
13. Install the left-hand engine cover and close the bonnet.



I011570 Fig. 115

H. Water pump (if installed)

1. If the engine is equipped with an engine block heater, an electric coolant water pump (1) is installed on the machine for the SCR system.



I011571

Fig. 116

3B18

SCR system - Service tools

TABLE OF CONTENTS

A. General

The tools described in this section can be ordered from the AGCO spare parts department or by contacting the tooling division of Beauvais by referring to AGCOnet bulletin Trac 60/07.
The prices will then be sent out to you.

B. SCR system - Service tools

Ref.	4346206M1
Description	Tool for the urea tank gauge
Order	AGCO Beauvais

I012083

Fig. 1