

## Service - Manual Sva 6035448106

### Table of Contents Volume 1 - 3

Section Pub. No.

#### TABLE OF CONTENTS - VOLUME 1

<b>2 ENGINE</b>		
Workshop Manual.....	2002	6-51250
Workshop Manual (TVT 195) .....	2002A	6-93080
<b>3 FUEL SYSTEM</b>		
Functional description Injection System .....	3001	6-51300
Functional description Injection System - Common Rail System (TVT 195) .....	3001A	6-93150
<b>4 ELECTRICAL</b>		
Functional description CAN Bus (Basics) .....	4002	6-51350
Functional description and Troubleshooting – ADIC .....	4003	6-91700
Function diagrams - Electrics .....	4008	6-92771
Function diagrams - Electrics (TVT 195) .....	4008A	6-93221
Connectors, Wiring Harnesses, Electrical and Electronic Components .....	4009	6-92970
Connectors, Wiring Harnesses, Electrical and Electronic Components (TVT 195) ..	4009A	6-93290
Circuit diagram .....	4010	6-51402
Circuit diagram (TVT 195) .....	4010A	6-93360

#### TABLE OF CONTENTS - VOLUME 2

<b>4 ELECTRICAL</b>		
Fault codes .....	4011	6-52632

#### TABLE OF CONTENTS - VOLUME 3

<b>5 STEERING SYSTEM</b>		
Functional description, Troubleshooting and Settings		
Front Axle with Independent Suspension 20.25S.....	5001	6-51450
Functional description, Troubleshooting and Settings		
Front Axle with Independent Suspension 20.29S.....	5002	6-51500
Workshop Manual - Front Axle - Carraro 20.25, 20.25 FR .....	5005	6-51550
Workshop Manual - Independently Suspended Front Axle 20.25S and 20.25SI FR.....	5006	6-51600
Workshop Manual - Independently Suspended Front Axle 20.29SI / FR .....	5007	6-51651
<b>6 TRANSMISSION</b>		
Functional description Transmission .....	6001	6-51700
Troubleshooting - System hydraulics .....	6002	6-51750
Cartridge - Removing and Fitting.....	6005	6-51800
Cartridge - Disassembling and Assembling.....	6006	6-51850
Rear Axle - Removing and Fitting.....	6007	6-51900
Rear Axle - Disassembling and Assembling.....	6008	6-51950
Parking Interlock, 4-wheel Drive Clutch and Bevel Pinion (Rear Module).....	6009	6-52000

**8 HYDRAULIC SYSTEM**

Functional description CC-LS Hydraulic System (Closed Center-Load Sensing)....	8001	6-52051
Functional description and troubleshooting		
High Pressure Hydraulic Circuit.....	8002	6-92610
Functional description and troubleshooting		
(Electronic 3-point hitch control system EDC) .....	8005	6-52100
Fault codes and fault description, EHS Auxiliary Control Units .....	8006	6-52150

**9 CABIN**

Functional description and troubleshooting Air Conditioning.....	9002	6-92840
--	------	---------

**TVT 135, TVT 145, TVT 155, TVT 170, TVT 190, TVT 195 Tractors**

**Service - Manual Sva 6035448106**

**TABLE OF CONTENTS - VOLUME 2**

**4 ELECTRICAL**

Fault codes ..... 4011

6-52632



# TVT 135, TVT 145, TVT 155, TVT 170, TVT 190, TVT 195 Tractors

## Service - Manual Sva 6035448106

### TABLE OF CONTENTS - VOLUME 3

#### 5 STEERING SYSTEM

Functional description, Troubleshooting and Settings		
Front Axle with Independent Suspension 20.25S.....	5001	6-51450
Functional description, Troubleshooting and Settings		
Front Axle with Independent Suspension 20.29S.....	5002	6-51500
Workshop Manual - Front Axle - Carraro 20.25, 20.25 FR.....	5005	6-51550
Workshop Manual - Independently Suspended Front Axle 20.25S and 20.25SI FR.....	5006	6-51600
Workshop Manual - Independently Suspended Front Axle 20.29SI / FR.....	5007	6-51651

#### 6 TRANSMISSION

Functional description Transmission.....	6001	6-51700
Troubleshooting - System hydraulics.....	6002	6-51750
Cartridge - Removing and Fitting.....	6005	6-51800
Cartridge - Disassembling and Assembling.....	6006	6-51850
Rear Axle - Removing and Fitting.....	6007	6-51900
Rear Axle - Disassembling and Assembling.....	6008	6-51950
Parking Interlock, 4-wheel Drive Clutch and Bevel Pinion (Rear Module).....	6009	6-52000

#### 8 HYDRAULIC SYSTEM

Functional description CC-LS Hydraulic System (Closed Center-Load Sensing) ...	8001	6-52051
Functional description and troubleshooting		
High Pressure Hydraulic Circuit.....	8002	6-92610
Functional description and troubleshooting		
(Electronic 3-point hitch control system EDC) .....	8005	6-52100
Fault codes and fault description, EHS Auxiliary Control Units .....	8006	6-52150

#### 9 CABIN

Functional description and troubleshooting Air Conditioning.....	9002	6-92840
TVT 195		



# Chapter

# 2002

## ENGINE WORKSHOP MANUAL

2002

## TABLE OF CONTENTS

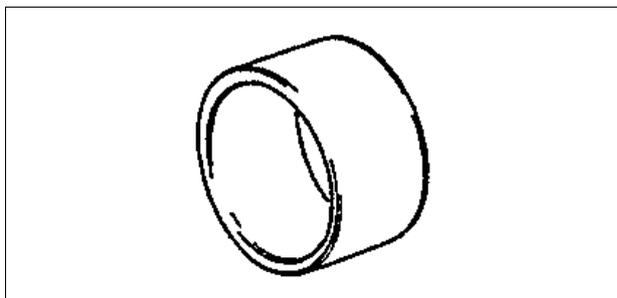
SPECIAL TOOLS .....	5
FOR THE USER .....	7
Engine code and serial number .....	7
SAFETY REGULATIONS .....	8
ENGINE DATA .....	9
Lifting the engine .....	9
TECHNICAL DATA .....	10
Conformance with exhaust standards .....	10
Cylinder block .....	10
Cylinder liners .....	10
Cylinder head .....	10
Valves, rocker arms and push rods .....	11
Camshaft .....	12
Crankshaft .....	12
Flywheel .....	13
Gear drive, camshaft and injection pump .....	13
Con-rods .....	13
Pistons, piston rings and piston pins .....	14
Lubrication system .....	14
Lubrication oil pump .....	15
Thermostat .....	15
Coolant temperature indication and monitoring (signal from sensor B22) .....	15
Coolant pump .....	15
Schwitzer turbocharger S200 .....	15
Tightening torques .....	16
CONSTRUCTION .....	17
General .....	17
Cylinder block .....	17
Flywheel casing .....	17
Cylinder head .....	18
Valve mechanism .....	18
Crankshaft drive .....	20
Timing gears .....	21
Lubrication system .....	22
Cooling system .....	23
Fan .....	24
Intake/exhaust system .....	25

ELECTRONIC ENGINE CONTROL SYSTEM – EEM2 .....	26
Layout .....	27
Signals .....	28
Function .....	28
JOB INSTRUCTIONS .....	29
1. Cylinder block .....	29
A. Measuring the cylinder liner wear .....	29
B. Removing the cylinder liner .....	29
C. Checking the cylinder block .....	29
D. Replacing the camshaft bearing bush .....	29
E. Oversize bearing bushes for the camshaft .....	30
F. Fitting the plug at the rear camshaft end .....	31
G. Fitting the plug at the rear camshaft end after inserting an oversize bearing bush ..	31
H. Installing the oil dipstick tube .....	31
I. Fitting the cylinder liner .....	31
2. Flywheel casing .....	33
A. Fitting the flywheel casing .....	33
B. Replacing the rear crankshaft sealing ring .....	33
3. Cylinder head .....	34
A. Removing the cylinder head .....	34
B. Removing the valves .....	34
C. Checking the cylinder head .....	34
D. Replacing the valve guides .....	35
E. Machining the valve seat .....	36
F. Replacing the valve seat rings .....	36
G. Grinding the valves .....	36
H. Fitting the valves .....	37
I. Fitting the cylinder head .....	37
4. Valve mechanism .....	38
A. Maintenance of the rocker arm system .....	38
B. Replacing the camshaft/camshaft gear wheel .....	38
C. Checking and adjusting the valve clearance .....	39
5. Crankshaft .....	40
A. Removing the crankshaft .....	40
B. Checking the crankshaft .....	40
C. Replacing the crankshaft gear wheels .....	40
D. Fitting the crankshaft .....	41
E. Crankshaft hub .....	41
F. Replacing the crankshaft belt pulley and the vibration damper .....	42
G. Checking the rubber element in the vibration damper .....	42
6. Pistons and con-rods .....	43
A. Removing the pistons together with the con-rods .....	43
B. Checking and replacing the con-rod bearings .....	43
C. Checking the con-rod .....	43
D. Checking and replacing the piston rings .....	44
E. Checking the pistons .....	45
F. Fitting the piston pin .....	45
G. Fitting the pistons and con-rods .....	45

7. Flywheel .....	46
A. Replacing the starter ring gear on the flywheel .....	46
B. Fitting the flywheel .....	46
8. Timing mechanism .....	47
A. Removing the timing gear case .....	47
B. Replacing the intermediate gear wheel bearing bush .....	47
C. Fitting the timing gear case .....	48
9. Lubrication system .....	50
A. Checking the oil pressure valve .....	50
B. Removing and checking the oil pump .....	50
C. Assembling and fitting the oil pump .....	50
D. Fitting the sump .....	51
E. Oil cooler .....	51
F. Piston cooling nozzles .....	52
G. Recommended lubrication oils .....	52
10. Cooling system .....	53
A. Thermostat .....	53
B. Repairing the coolant pump .....	53
C. Coolant quality requirements .....	54
11. Intake/exhaust system .....	55
A. Checking the air filter .....	55
B. Checking the intake/exhaust system .....	55
C. Checking the boost pressure .....	55
D. Checking the turbocharger .....	56
E. Fitting the turbocharger .....	57

## SPECIAL TOOLS

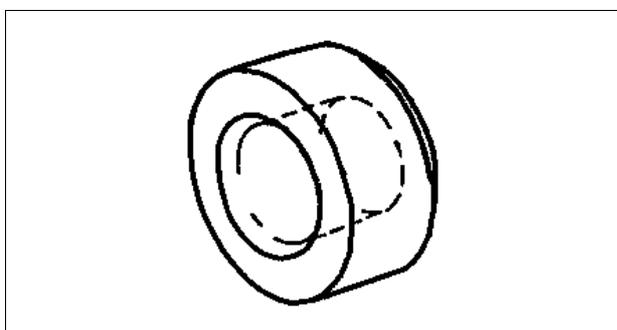
**Pressing tool for the front crankshaft  
dust seal**



SS00B064

1 x 380000010 (1TSW 519)

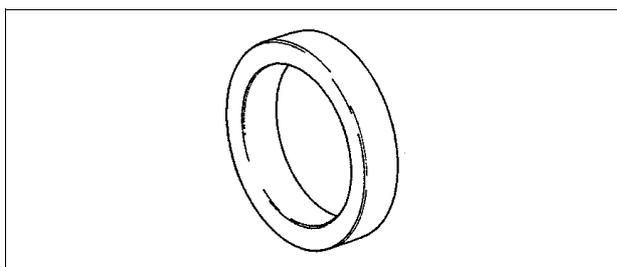
**Pressing tool for the front crankshaft  
shaft sealing ring**



SS00B065

1 x 380000002 (1TSW 520)

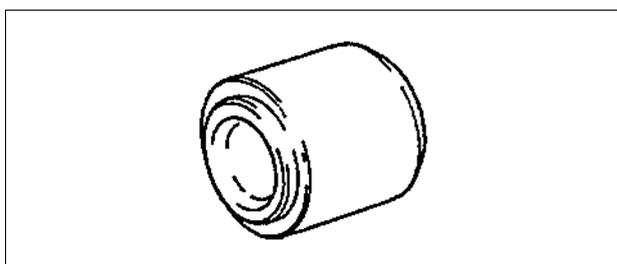
**Pressing tool for the rear crankshaft  
shaft seal**



SS00B066

1 x 380000003 (1TSW 521)

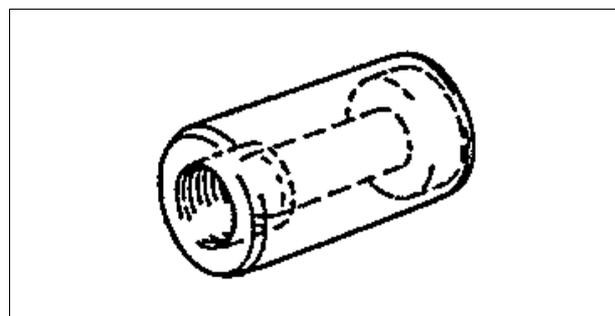
**Pressing tool for  
cam shaft cover**



SS00B067

1 x 380000004 (1TSW 522)

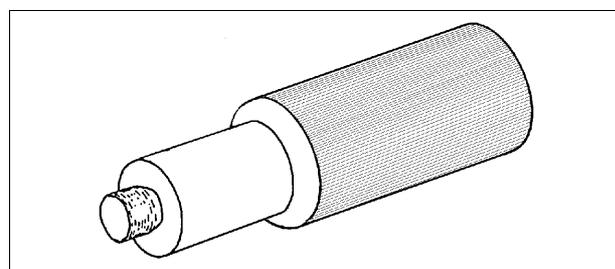
**Assembly pin for the water pump seal**



SS00B068

1 x 380000005 (1TSW 523)

**Universal pin**

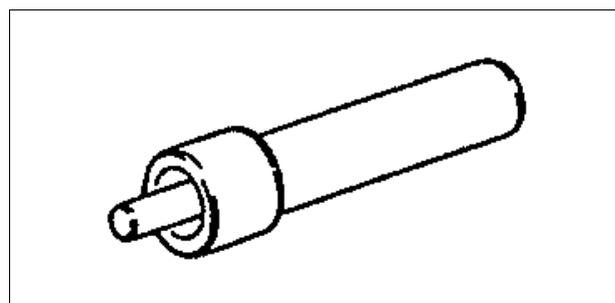


SS00B077

1 x 1TSW 18390

M24

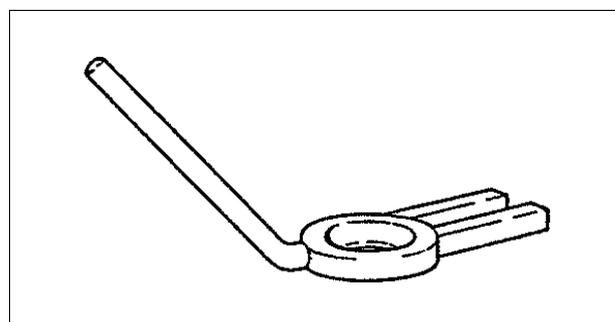
**Pressing tool for valve guides**



SS00B069

1 x 380000007 (1TSW 524)

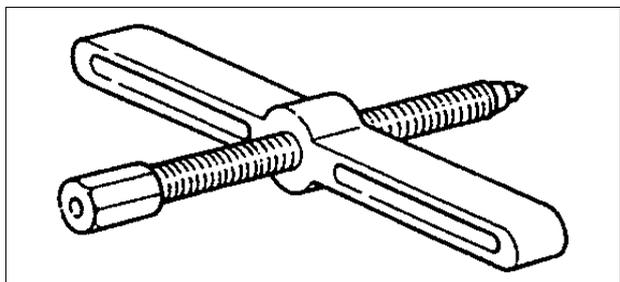
**Valve spring tensioning lever**



SS00B071

1 x 380000008 (1TSW 014)

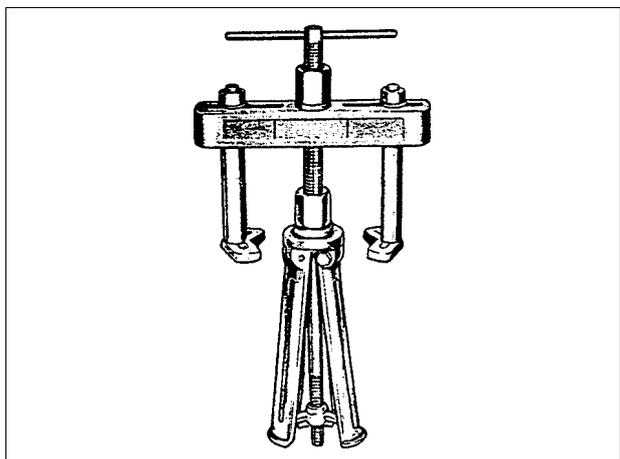
### Extractor



SS00B070

1 x 1TSW 662 (available from your dealer)

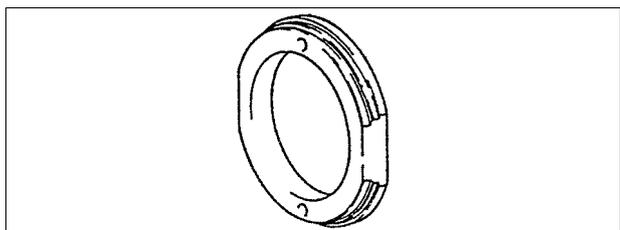
### Cylinder liner extractor



SS00B072

1 x 1TSW 510 (available from your dealer)

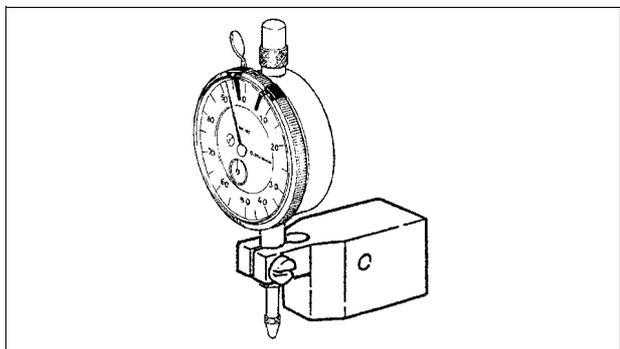
### Extraction plate



SS00B073

1 x 380000011 (1TSW 508)

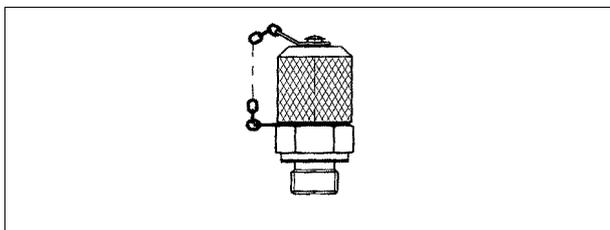
### Dial test indicator and holder



SS00B075

1 x 380000364 (1TSW 5610) Holder  
1 x 380000228 (1TSW 17049-6) Dial test indicator

### Mini-measuring connection

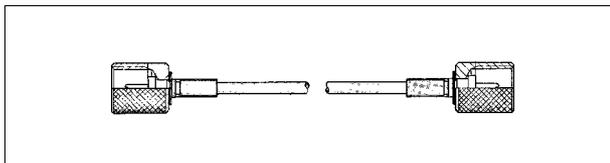


SS98J031

1 x 380001915

M12x1,5

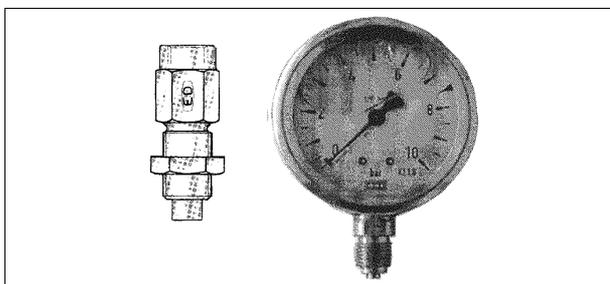
### Mini-measuring line



SS98J030

1 x 380001127 (1TSW 635)

### Pressure gauge and connection

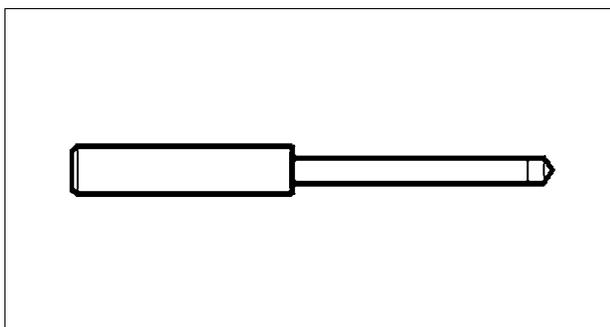


SS00B076

1 x 380001129 (1TSW 645)  
1 x 380001121 (1TSW 5002)

Connection  
Pressure gauge

### Injection pump installation pin



SS03D046

380001487

## FOR THE USER

The purpose of this manual is to provide basic information required to service and repair CNH diesel engines.

The engines are of the same design. Differences which have an influence on repair work are therefore listed in the technical data and repair instructions. All dimensions are specified in millimetres and apply at a temperature of +20 °C, if not specified otherwise.

Before starting repair work, make sure all necessary special tools, spare parts and accessories are available. It is not absolutely necessary to have all the special tools mentioned in this manual. However, having them does make it quicker and easier to carry out any repairs necessary. After a repair, the engine must be run in just like a new engine.

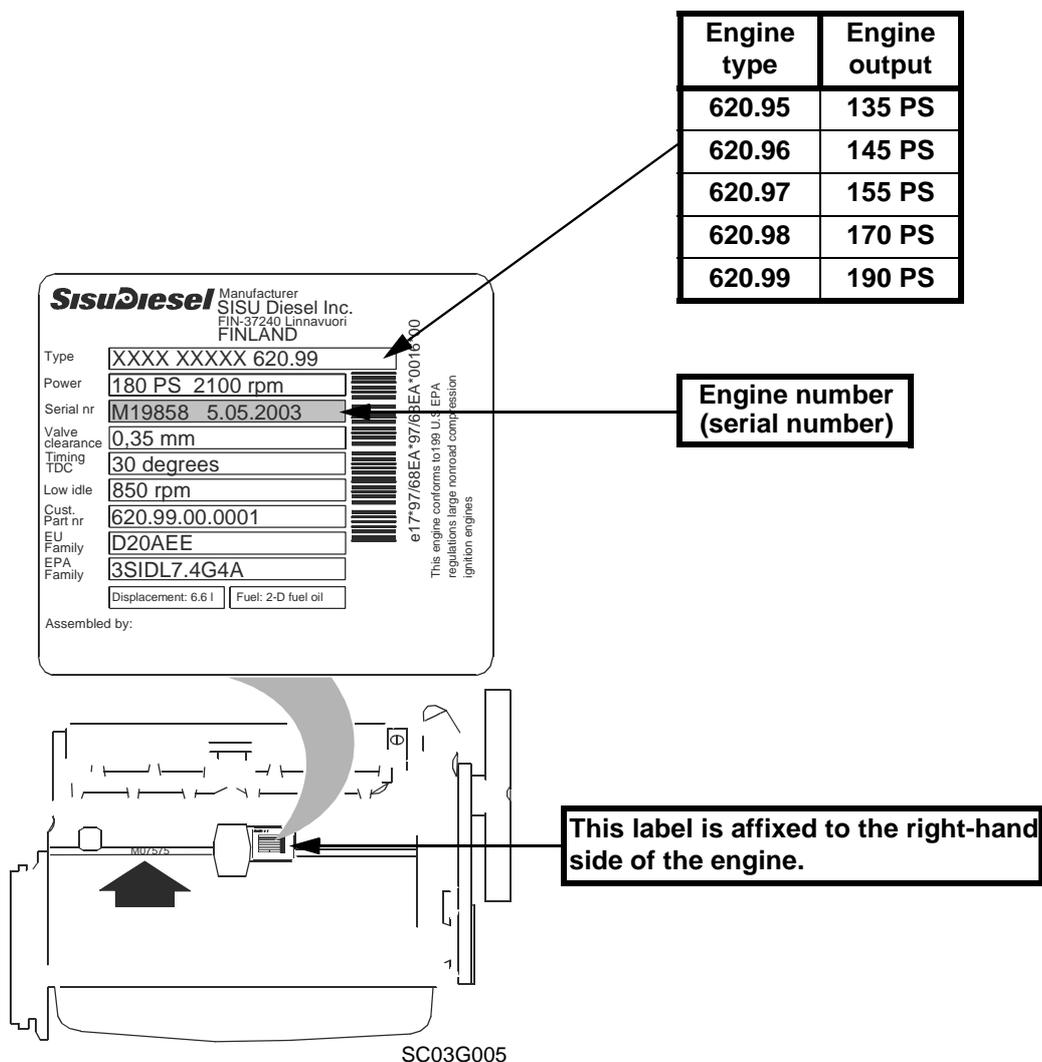
If any questions arise, which cannot be clarified with the aid of this manual, please contact Customer Service at CNH Österreich GmbH in St. Valentin or the respective importer.

**IMPORTANT:** When making any queries, please specify the following engine data and the current operating hours count.

**EEM2** = Electronic Engine Management

**PCU** = Pump Control Unit

### Engine code and serial number



## SAFETY REGULATIONS

**There is always a risk of getting injured when performing service and repair work. Before commencing work, the following safety regulations and instructions must be read.**



- Never start repair work which you do not fully understand.
- Make sure that it is possible to work safely at the location and in the vicinity.
- Make sure the location is clean and in a good state.
- Never use wrong or unsuitable tools.
- Remove all rings, chains and watches before commencing work.
- Use state of the art safety equipment. For example, wear goggles when using compressed air for cleaning, grinding, hammering or similar work.
- Use a lifting device for lifting or transporting heavy (over 20 kg) parts. Make sure the hooks and chains are in a good condition and sit firmly.
- Never work below an engine hanging from a lifting device or raised by a jack. Always secure the engine with strong supports before commencing work.
- Only use **original CNH spare parts**.
- Only start the engine from the cab, using the ignition key.
- Never start the engine with the protective covers removed.

**WARNING:** *It is difficult to see the radiator fan when the engine is running! Loose fitting clothes and long hair can get caught in rotating engine parts!*

- If the engine is started in a confined space, sufficient ventilation must be provided.
- Never use auxiliary starting fuels on an aerosol basis whilst the pre-glow starting facility is in operation (explosion hazard).
- Ear muffs must be worn when testing the engine or working close to the engine.
- Always switch the engine OFF before carrying out repair work.
- Avoid touching the exhaust manifold, turbocharger and other hot engine parts.
- When the engine is hot and the coolant is pressurised, be careful on opening the radiator sealing cover. Coolant and lubrication oil out of the hot engine can cause severe injuries if contact is made with the skin.

- Naked flames and smoking are not permitted in the vicinity of fuel tanks or batteries. Electrical sparks should be avoided. (Particularly when charging the batteries. Explosion hazard!)
- Disconnect the cable at the negative battery pole before carrying out service or repair work on the electrical system.
- If the engine gets excessively hot (over 300 °C), for example, if it catches fire, the viton seals (e.g. bottom O-ring on the cylinder liner or the O-ring on the oil pressure valve) release highly caustic HF acid. Never touch viton seals, which have been subjected to unusually high temperatures, with bare hands. Always wear neoprene gloves or thick work gloves and safety goggles when removing these harmful substances. Wash the seals and contaminated surfaces with a 10 % hydroxide solution or another alkaline solution. Collect the material in air-tight sealed plastic bags and bring them to an authorised collecting depot.

**IMPORTANT:** *Viton seals may never be burned!*

- Fuel, lubrication oil and coolant can cause skin irritations, if contact is made over a longer period.
- Avoid running the engine in idle unnecessarily.
- When carrying out service work, take measures to prevent fuel or other fluids from entering the ground or drains.
- All seals are asbestos-free.
- Be careful when washing the engine using a washing facility with a high water pressure. Do not wash, for example, the electrical and fuel systems under high pressure as they can easily be damaged.

## ENGINE DATA

Engine type	620.95	620.96	620.97	620.98	620.99
Number of cylinders	6				
Capacity (dm <sup>3</sup> )	6,6				
Bore (mm)	108				
Stroke (mm)	120				
Rated power in PS at 2100 rpm acc. to ISO 14396	135	145	155	170	190
Delivery start mark on the V-belt pulley (° before UDC)	30				
Compression ratio	18,5 : 1		18,5 : 1		
Method of combustion	direct injection				
Injection sequence	1 - 5 - 3 - 6 - 2 - 4				
Compression pressure <sup>1</sup> (bar)	24				
Charge-air pressure <sup>2</sup> (bar)	0,94	1,03	1,12	1,24	1,45
Weight <sup>3</sup> (kg)	510				
Direction of rotation of the crankshaft	Clockwise				

<sup>1</sup>) Minimum value at operating temperature and starter speed.

Highest permissible difference between the cylinders is 3 bar (max.)

<sup>2</sup>) Measured behind the charge-air cooler (measuring point: see section entitled "Checking the boost pressure" page 55), at full load, nominal engine speed and top fan speed

<sup>3</sup>) Without flywheel and electrical equipment.

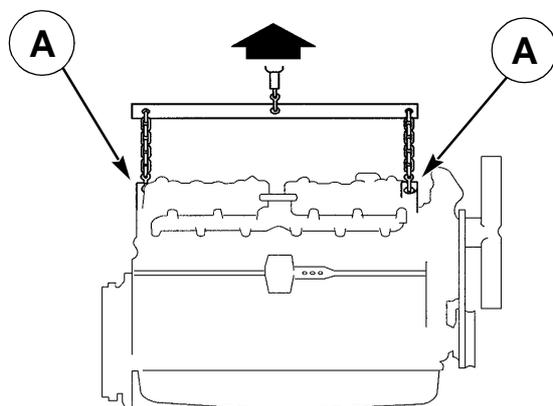
**IMPORTANT:** After certain repairs to the engine, the fuel system must be bled before starting for the first time (for details, refer to Chapter 3001, Injection system).

**NOTE:** The plug-in connection on the PCU must be released and disconnected before performing any arc welding work. **Do not touch the plug-in contacts!**

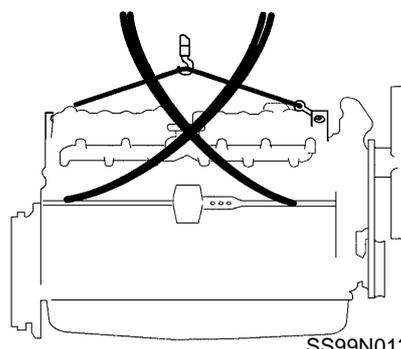
### Lifting the engine



The engine is lifted safely by means of a lifting device, on which the lifting force acts vertically on the lifting eyes.



A = Engine lifting eyes



SS99N013

# TECHNICAL DATA

## Conformance with exhaust standards

Europe: 97/68 EC Level 2

America: Tier 2

## Cylinder block

Guide pin bore holes .....	13.250 - 13.320 mm
Diameter of the crankshaft bearing base bore hole .....	91.000 - 91.025 mm
Diameter of the crankshaft bearing base bore hole (oversize) .....	92.000 - 92.025 mm
Bore hole diameter of the cylinder liner:	
– top .....	124.514 - 124.554 mm
– bottom .....	123.000 - 123.040 mm
Diameter of the camshaft bearing bush (fitted) .....	50.010 - 50.070 mm
Construction height of the cylinder block .....	428.170 - 428.430 mm

## Cylinder liners

Liner height above the cylinder block .....	0.030 - 0.080 mm
Highest permissible height difference between cylinder liners .....	0.02 mm
Diameter of the cylinder liner bore holes in the engine block:	
– top end of liner .....	124.475 - 124.500 mm
– bottom end of liner .....	122.961 - 122.986 mm
Cylinder liner bore hole .....	108.010 - 108.032 mm
Height, cylinder liner flange .....	9.03 - 9.05 mm
Height, cylinder liner flange, 1st oversize .....	9.08 - 9.10 mm
Height, cylinder liner flange, 2nd oversize .....	9.13 - 9.15 mm
Height, cylinder liner flange, 3rd oversize .....	9.23 - 9.25 mm
Outer diameter of the cylinder liner flange .....	131.700 - 131.800 mm

## Cylinder head

Construction height of the cylinder head .....	104.800 - 105.000 mm
Minimum height of the cylinder head after surface grinding .....	104.000 mm
Inner diameter of the valve guide (when not fitted) .....	9.000 - 9.015 mm
Outer diameter of the valve guide .....	16.028 - 16.039 mm
Diameter of the bore hole for the valve guide in the cylinder head .....	16.000 - 16.018 mm
Projection of the valve guide over the cylinder head face .....	
– Inlet valve .....	0.7 ± 0.05 mm (max. 2,20 mm)
– Outlet valve .....	0.6 ± 0.05 mm (max. 2,20 mm)
Valve seat angle:	
– Inlet valve .....	35°+20'
– Outlet valve .....	45°+20'
Valve seat width:	
– Inlet valve .....	2.9 - 3.7 mm
– Outlet valve .....	1.3 - 2.3 mm
Diameter, outlet valve seat insert (standard) .....	44.070 - 44.132 mm
Bore hole in cylinder head for outlet valve seat insert (standard) .....	44.000 - 44.025 mm
Diameter, outlet valve seat insert (oversize) .....	44.270 - 44.332 mm
Bore hole in cylinder head for outlet valve seat insert (oversize) .....	44.200 - 44.225 mm
Diameter, inlet valve seat insert (standard) .....	48.570 - 48.632 mm
Bore hole in cylinder head for inlet valve seat insert (standard) .....	48.500 - 48.525 mm
Diameter, inlet valve seat insert (oversize) .....	48.770 - 48.832 mm
Bore hole in cylinder head for inlet valve seat insert (oversize) .....	48.700 - 48.725 mm

## Valves, rocker arms and push rods

Valve control times at a valve play of 1.0 mm:

– Inlet valve opens .....	0° ±2° before TDC
– Inlet valve closes .....	16° ±2° after BDC
– Outlet valve opens .....	39° ±2° before BDC
– Outlet valve closes .....	1° ±2° after TDC

Valve play when engine is cold/hot:

– Inlet valve .....	0.35 mm
– Outlet valve .....	0.35 mm

Valve head angle:

– Inlet valve .....	35°-20'
– Outlet valve .....	45°-20'

Valve head diameter:

– Inlet valve .....	48 mm
– Outlet valve .....	41 mm

Maximum opening lift of the valves:

– Inlet valve .....	10,9 mm
– Outlet valve .....	12.1 mm

Diameter, inlet valve stem .....

8.960 - 8.975 mm

Diameter, outlet valve stem .....

8.925 - 8.940 mm

Clearance, inlet valve stem (guide fitted in cylinder head) .....

0.025 - 0.055 mm

Wear limit (inlet valve stem) .....

0.30 mm

Clearance, outlet valve stem (guide fitted in cylinder head) .....

0.060 - 0.090 mm

Wear limit (outlet valve stem) .....

0.35 mm

Inner diameter of the valve guide (when not fitted) .....

9.000 - 9.015 mm

Outer diameter of the valve guide .....

16.028 - 16.039 mm

Diameter of the bore hole for the valve guide in the cylinder head .....

16.000 - 16.018 mm

Projection of the valve guide over the cylinder head face .....

21 mm

Depth, valve head below cylinder head surface:

– Inlet valve .....

0.7 ± 0.05 mm (max. 2.20 mm)

– Outlet valve .....

0.6 ± 0.05 mm (max. 2.20 mm)

Length of the valve spring, relaxed .....

69.8 mm

Force of the valve spring compressed to a length of:

– 48,6 mm .....

327 ± 17 N

– 37.4 mm .....

500 ± 23 N

Diameter, rocker arm shaft .....

22.970 - 22.990 mm

Diameter of rocker arm bore hole .....

23.000 - 23.021 mm

Permissible radial deflection of the push rod (free) .....

0.4 mm

Length of the rocker arm spring, relaxed .....

80 mm

Force of the valve spring compressed to a length of 58 mm .....

80 - 100 N

Outer diameter of the tappet .....

29.939 - 29.960 mm

Diameter of the tappet bore holes in the cylinder block .....

30.000 - 30.043 mm

## Camshaft

Diameter, camshaft bearing journal No. 1 (front) .....	49.925 - 49.950 mm
Diameter, camshaft bearing journals No. 2, 3 and 4 .....	49.865 - 49.890 mm
Diameter, camshaft bearing journal No. 5 .....	49.885 - 49.910 mm
Diameter, camshaft bearing No. 1 (bearing bush fitted).....	50.010 - 50.070 mm
Diameter of the other camshaft bearings (bearing bushes fitted) .....	50.000 - 50.025 mm
Play, camshaft bearing No. 1 .....	0.060 - 0.145 mm
Play of camshaft bearings No. 2, 3 and 4 .....	0.110 - 0.160 mm
Play, camshaft bearing No. 5 .....	0.090 - 0.140 mm
Overlap of the bearing seats (press fit) in the cylinder block .....	0.025 - 0.080 mm
Diameter of the bearing seat bore holes in the cylinder block .....	55.620 - 55.650 mm
Axial play of the camshaft (with a 0.5 mm seal between the cylinder block and timing case and between the timing case and timing case cover .....	0.5 - 1.0 mm
Cam height (dimension between cam base circle and cam lobe):	
– Inlet valve .....	41.180 - 41.430 mm
– Outlet valve .....	40.080 - 40.330 mm
Cam stroke:	
– Inlet valve .....	7.38 mm
– Outlet valve .....	8.28 mm
Max. permissible radial deflection of the camshaft .....	0.03 mm

## Crankshaft

Diameter of the con-rod bearing journals:

– Standard dimension .....	67.981 - 68.000 mm
– 1st. repair level 0.25 mm .....	67.731 - 67.750 mm
– 2nd. repair level 0.50 mm .....	67.481 - 67.500 mm
– 3rd. repair level 1.00 mm .....	66.981 - 67.000 mm
– 4th. repair level 1.50 mm .....	66.481 - 66.500 mm
Width of the con-rod bearing journal .....	40.000 - 40.160 mm

Diameter of the crankshaft journals:

– Standard dimension .....	84.985 - 85.020 mm
– 1st. repair level 0.25 mm .....	84.735 - 84.770 mm
– 2nd. repair level 0.50 mm .....	84.485 - 84.520 mm
– 3rd. repair level 1.00 mm .....	83.985 - 84.020 mm
– 4th. repair level 1.50 mm .....	83.485 - 83.520 mm
Diameter, crankshaft bearing casing .....	91.000 - 91.025 mm

Thickness of the main bearing shells

– Standard dimension .....	2.955 - 2.965 mm
– 1st. repair level 0.25 mm .....	3.080 - 3.090 mm
– 2nd. repair level 0.50 mm .....	3.205 - 3.215 mm
– 3rd. repair level 1.00 mm .....	3.455 - 3.465 mm
– 4th. repair level 1.50 mm .....	3.705 - 3.715 mm

Crankshaft bearing play .....

0.050 - 0.127 mm

Width of the journal at the thrust bearing (crankshaft bearing at flywheel):

– Standard dimension (2 standard thrust washers) .....	45.000 - 45.080 mm
– 1st. repair level (one standard thrust washer and one with an oversize of 0.1 mm) ..	45.100 - 45.180 mm
– 2nd. repair level (one standard thrust washer and one with an oversize of 0.2 mm) ..	45.200 - 45.280 mm
– 3rd. repair level (one 0.1 mm thrust washer and one with an oversize of 0.2 mm) .....	45.300 - 45.380 mm
– 4th. repair level (two thrust washers with an oversize of 0.2 mm) .....	45.400 - 45.480 mm

Other crankshaft bearing journals must not be ground wider.

Axial play of the crankshaft .....

0.100 - 0.380 mm

Max. permissible out-of-true of the crankshaft or con-rod bearing journals .....

0.03 mm

Max. permissible imbalance of the crankshaft .....

1.0 Ncm.

## Flywheel

Overlap of the starter ring gear on the flywheel .....	0.425 - 0.600 mm
Before pressing the starter ring gear onto the flywheel, the ring gear must be heated up to a temperature of .....	150 - 200 °C
Max. permissible imbalance at the flywheel .....	1.0 Ncm
Max. permissible warpage of the clutch surface measured at the inner edge of the clutch surface (diameter 200mm) .....	0.06 mm

## Gear drive, camshaft and injection pump

Tooth flank play:

Intermediate gear wheel – crankshaft .....	0.05 - 0.25 mm
Intermediate gear wheel – camshaft .....	0.05 - 0.25 mm
Intermediate gear wheel – injection pump .....	0.05 - 0.25 mm
Max. permissible lateral runout of the wheels .....	0.05 mm
Intermediate gear wheel (with friction bearing):	
– Inner diameter, intermediate gear wheel bearing bush (fitted) .....	55.000 - 55.030 mm
– Diameter, bearing journal for intermediate gear wheel .....	54.951 - 54.970 mm
Inner diameter, camshaft gear wheel .....	32.000 - 32.025 mm
Diameter, front end of the camshaft .....	32.043 - 32.059 mm

Timing marks:

The alignment of the timing marks on the gear wheels correspond to the top dead centre of the piston in the 1st cylinder, between the compression stroke and firing stroke.

On the crankshaft gear wheel ..... 2 dots on the teeth

On the intermediate gear wheel:

- opposite the crankshaft gear wheel ..... "0" mark on the tooth
- opposite the camshaft gear wheel ..... 1 dot on the tooth
- opposite the injection pump gear wheel ..... 1 dot at the tooth gap

On the camshaft gear wheel ..... 1 dot at the tooth gap

On the injection pump gear wheel ..... 1 dot on the tooth

## Con-rods

Inner diameter, piston-pin bush

(bearing bush pressed into the con-rod) .....	40.025 - 40.040 mm
Outer diameter of the piston-pin bush .....	44.082 - 44.120 mm
Overlap of the bearing seat (press fit) in the con-rod .....	0.057 - 0.120 mm
Bore, seat for piston-pin bush .....	44.000 - 44.025 mm
Bore, con-rod bearing end .....	71.730 - 71.749 mm

Thickness of the con-rod bearing shells:

- Standard .....
- 1st. repair level 0.25 mm .....
- 2nd. repair level 0.50 mm .....
- 3rd. repair level 1.00 mm .....
- 4th. repair level 1.50 mm .....

Con-rod bearing play .....

Con-rod bearing axial play .....

Alignment of the con-rod bearing bore to the piston-pin bearing bore .....

Parallelism of the con-rod bearing bore to the piston-pin bearing bore .....

The weight markings are punched in the bottom end of the con-rods

(on the camshaft side)

Max. permissible weight difference between con-rods in the same engine .....

## Pistons, piston rings and piston pins

Smallest gap between the piston and cylinder head (measured through the bore for the nozzle holder seat using lead wire) .....	0.900 - 1.150 mm
Piston diameter (measured 17 mm above the lower edge of the piston) .....	107.873 - 107.887 mm
Diameter, piston pin bore hole in the piston .....	40.003 - 40.009 mm
Diameter, piston pin .....	39.991 - 40.000 mm
Width of the piston ring grooves:	
– 1st. groove (rectangular compression ring) .....	2.560 - 2.580 mm
– 2nd. groove .....	2.520 - 2.540 mm
– 3rd. groove .....	4.040 - 4.060 mm
Vertical play of the piston rings in their grooves:	
– 1st. groove (rectangular compression ring) .....	0.07 - 0.102 mm
– 2nd. groove .....	0.03 - 0.062 mm
– 3rd. groove .....	0.05 - 0.082 mm
– Wear limit .....	0.15 mm
Piston ring height (in direction of cylinder):	
– 1st. groove (rectangular compression ring) .....	2.478 - 2.490 mm
– 2nd. groove .....	2.478 - 2.490 mm
– 3rd. groove .....	3.975 - 3.990 mm
End play of piston rings (with piston fitted):	
– 1st. groove (wedge-type compression ring) .....	0.40 - 0.55 mm
– 1st. groove (rectangular compression ring) .....	0.30 - 0.45 mm
– 2nd. groove .....	0.60 - 0.80 mm
– 3rd. groove .....	0.30 - 0.60 mm
– Wear limit, rings 1 and 3 .....	1.0 mm
– Wear limit, ring 2 .....	1.5 mm
Max. permissible weight difference between pistons in the same engine .....	25 g

**NOTE:** When fitting the pistons, make sure the piston recess is on the same side as the nozzle holders.

## Lubrication system

Oil pressure at normal operating temperature:	
– idling .....	at least 1.0 bar
– at operational speed .....	2.5 - 5 bar
Lubrication oil filter overflow valve opens at a differential pressure of .....	$2 \pm 0,5$ bar
Oil pressure switch opens at .....	$p > 0.5$ bar
Engine types 620.95 and 620.96:	
Spring in oil pressure valve: length, relaxed .....	49.5 mm
Spring length and force (with oil pressure valve fitted) .....	28.5 mm/76 N
Engine types 620.97, 620.98 and 620.99:	
Spring in oil pressure valve: length, relaxed .....	49.8 mm
Spring length and force (with oil pressure valve fitted) .....	28.5 mm/127 N
Oil pressure alarm at .....	$p < 0.5$ bar
Fault code EEM99 .....	Indicated on ADIC
Optical and acoustic warning, automatic engine shutoff after .....	30 seconds
Overflow valves for the piston cooling nozzles: Opening pressure .....	$3 \pm 0,25$ bar

## Lubrication oil pump

Tooth flank play when the crankshaft lies firmly against the under side of the bearing	
– between the crankshaft gear wheel and oil pump gear wheel .....	0.05 - 0.025 mm
– between the oil pump gear wheels .....	0.16 - 0.26 mm
Diameter of the drive shaft in the housing and cover.....	17.966 - 17.984 mm
Diameter of the drive shaft bearing bores.....	18.000 - 18.018 mm
Diameter of the fixed shaft near the pump gear wheel .....	17.966 - 17.984 mm
Diameter of the bearing bore in the pump gear wheel.....	18.000 - 18.018 mm
Diameter of the fixed shaft in the pump housing.....	20.035 - 20.048 mm
Depth of the drive shaft end below the housing surface .....	0.5 - 1.0 mm
Thickness of the housing seal.....	0.06 - 0.08 mm
Outer diameter of the gear wheels.....	55.824 - 55.870 mm
Housing diameter.....	56.000 - 56.120 mm
Width of the gear wheels .....	32.000 - 32.027 mm
Axial play of the gear wheels .....	0.03 - 0.11 mm
Housing depth.....	32.000 - 32.043 mm
Number of teeth on the drive gear wheel.....	46

## Thermostat

Type, version .....	∅ 54 mm/single circuit
Starts opening at.....	79 °C <sup>±2</sup>
Fully open at .....	94 °C
Max. stroke .....	7.5 mm
Type, version .....	∅67/dual-circuit
Starts opening at.....	83 °C <sup>±2</sup>
Fully open at .....	95 °C
Max. stroke .....	8 mm

## Coolant temperature indication and monitoring (signal from sensor B22)

Display on ADIC.....	analog
Warning at ADIC when temperature .....	> 106 <sup>±3</sup> °C
Fault code EEM112 (test values for sensor: see Service Tool)	
Acoustic alarm (additionally) when temperature .....	> 113 <sup>±3</sup> °C
Fault code EEM113 (test values for sensor: see Service Tool)	

## Coolant pump

Bearing outer diameter .....	52 mm
Bearing housing diameter .....	51.979 - 52.009 mm
Shaft diameter at bearing.....	19.980 - 19.993 mm
Shaft diameter at impeller .....	15.907 - 15.920 mm
Diameter of impeller bore hole.....	15.876 - 15.894 mm
Clearance between impeller and rear side of housing.....	0.8 - 1.2 mm
(must be observed when pressed on)	
Permissible imbalance of the fan .....	max. 0.3 Ncm max (30 pcm)
V-belt tension, when pressed in between the two pulleys, amount of give .....	10 - 15 mm

## Schwitzer turbocharger S200

Axial play of the shaft.....	max. 0.10 mm
Radial play of the shaft (compressor end) .....	max. 0.88 mm
Tightening torque for the compressor housing bolts .....	13.60 Nm
Tightening torque for the turbine housing bolts.....	21.00 Nm
Tightening torque for the shaft nut (compressor end).....	13.60 Nm

## Tightening torques

Cylinder head nuts and bolts (up to engine number N 8956) .....	80 Nm+90°+90° (+60° at coolant temperature of 75 °C)
Cylinder head nuts and bolts (from engine number N 8957) .....	80 Nm+90°+90°
Cylinder head bolts in the cylinder block .....	30 Nm
Crankshaft bearing bolts .....	200 Nm
Con-rod bolts (Torx E18) .....	40 Nm + 90°
Nut on crankshaft (face) .....	1000 Nm
Belt pulley bolts .....	30 Nm
Securing bolts for flywheel .....	150 Nm
Securing bolts for flywheel casing:	
– internal M10 bolts .....	80 Nm
– external M12 bolts .....	150 Nm
Retaining screws for intermediate gear wheel (with friction bearing):	
– M10 .....	60 Nm
– M14 .....	200 Nm
Overflow valve, piston cooling nozzle (620.97, 620.98, 620.99) .....	30 Nm
Nut for lubrication oil pump gear wheel .....	60 Nm
Retaining screws for lubrication oil pump .....	60 Nm
Connecting part for (engine) oil cooler .....	60 Nm
Nut for belt pulley on coolant pump .....	120 Nm
Fastening, Visco fan on Visco hub .....	30 Nm
Nuts/bolts for exhaust manifold .....	50 Nm
Bolts for air intake channel .....	30 Nm
Nut for injection pump gear wheel .....	90 Nm
Retaining nuts, nozzle holder (for bolts) .....	15 Nm
Injection nozzle union nut .....	60 Nm
Injection line union nut .....	25 Nm

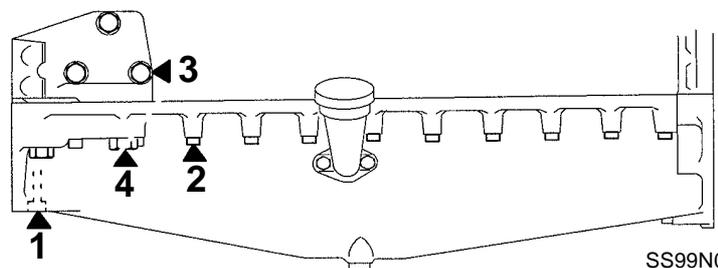
**NOTE:** Use washers for aluminium parts.

If no particular tightening torques are specified,  
always use the values specified in the table below.

	M8	M10
Cast iron	35 <sup>±5</sup> Nm	70 <sup>±5</sup> Nm
Aluminium	25 <sup>±5</sup> Nm	50 <sup>±5</sup> Nm

### Bolts for the self-supporting oil sump

1	M8	25 Nm
2	M10	90 Nm
3	M14	160 Nm
4	M20	600 Nm



# CONSTRUCTION

## General

The 620 series CNH diesel engines are water-cooled, four stroke, in-line engines with direct injection. All models are equipped with wet, replaceable cylinder liners, an exhaust turbocharger and charge-air cooling (air/air). As the engines are equipped with an electronic diesel control system in conjunction with an electronic engine control system (CAN network including solenoid valve-controlled distributor injection pump VP30), all models comply with the exhaust-gas regulations in accordance with Tier 2.

## Cylinder block

The rib-reinforced cylinder block forms the main engine unit, onto which other engine components are mounted.

The wet, replaceable cylinder liners are supported in the middle, thus reducing vibration and the coolant flow is mainly directed to the upper section of the cylinder liners.

The bottom part of the cylinder liner and the cylinder block are sealed by three O-rings, which are inserted in the grooves in the cylinder liner. The upper part is sealed by the cylinder head gasket.

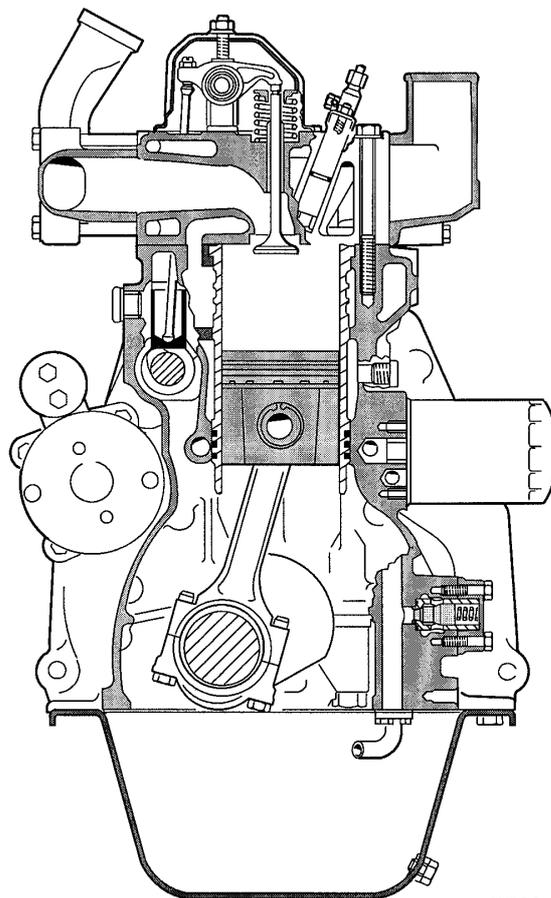
The camshaft is located in the cylinder block. All camshaft bearings are equipped with replaceable cylinder liners.

Guide bearings are fitted on both sides of the rear crankshaft bearings (crankshaft – axial bearings).

## Flywheel casing

The flywheel casing is fitted at the rear end of the cylinder block. The seal for the rear end of the crankshaft is fitted in a bore hole in the casing. The flange for the starter is located in the flywheel casing.

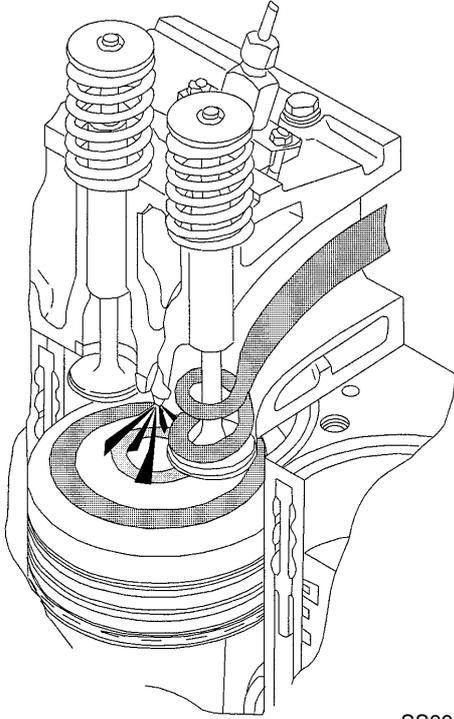
The underside of the flywheel casing is used as a sealing surface for the oil sump seal. This means that the underside of the cylinder block must be flush with the flywheel casing. When the flywheel casing is fitted, its position is determined by sprung dowel pins.



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## Valve mechanism

The valve mechanism is operated by the camshaft in the cylinder block. The drive power is transferred via valve tappets and push rods. The camshaft gear wheel is force fitted on the camshaft and fixed (radially) by a feather key. The bearings are lubricated with pressure oil through bore holes in the engine block.



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## Cylinder head

The engines are equipped with two interchangeable cylinder heads. Each cylinder has its own intake and outlet channels in the cylinder head. To compensate for thermal stress, an inlet valve is fitted between the outlet valves

The cylinder head bolts are high-tensile pre-tensioned bolts, which are tightened to their elongation limit in accordance with the angular tightening principle. Due to the high degree of elongation, the retaining power is kept constant throughout the entire service life, and the bolts do not therefore have to be checked and tightened.

The injection nozzle seats are integrated into the cylinder head. The inlet and outlet valve guides are identical and can be interchanged. Furthermore, the in/outlet valves are fitted with replaceable valve seat inserts.

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## Crankshaft drive

The crankshaft is made from forged chrome alloy special steel and the bearing and sealing surfaces are inductively tempered. The bearing points can be re-ground four times without having to be re-tempered. The gear wheels are force fitted at the front end of the crankshaft. They are used to drive the camshaft, injection pump and oil pump. In addition, the front end of the crankshaft has key-ways for seating the drive hub. The V-belt pulley and the torsional vibration damper (with rubber element) are fitted on the hub. The front PTO shaft (if fitted) is also driven via this hub. An oil deflector ring is fitted between the hub and gear wheel and a dust seal is fitted on the hub to protect the crankshaft sealing ring. The transmitter wheel for the engine speed sensor is fitted on a crankshaft web.

A crankshaft bearing is located on both sides of each cylinder. There are thus seven crankshaft bearings. The crankshaft axial bearings are located on both sides of the rearmost crankshaft bearing. The flywheel is mounted at the rear end of the crankshaft and carries a force fitted crown gear.

The forged con-rods have an I-shaped cross-section. The con-rod bearing is split horizontally. The bearing cover is secured by means of two special bolts. The upper part has a wedge-shaped bearing seat in which the small end bearing bush is force fitted.

The piston is made of an eutectic aluminium alloy. There is a combustion space in the piston head. The shape of the optimised combustion space ensures an optimal carburetion of air and fuel. The pistons have different types of piston rings depending on the engine type (see next paragraph).

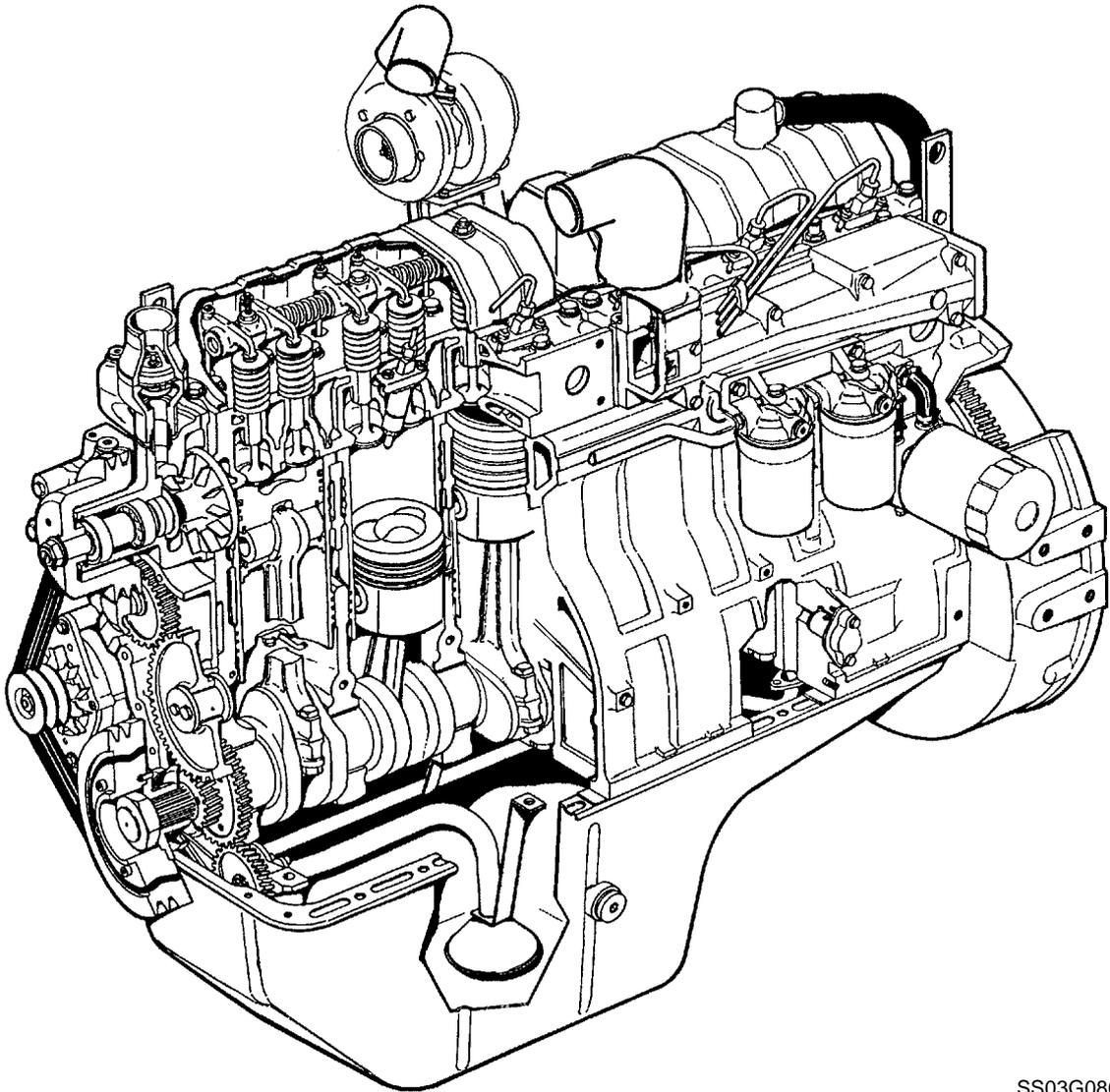
The pistons are equipped with two compression rings and an oil scraper ring. In the case of engine types 620.95 and 620.96, the top molybdenum-coated piston ring has a rectangular cross-section. Engine types 620.97, 620.98 and 620.99 have a top piston ring with a trapezoidal cross-section.

The middle piston ring is a taper face ring (the outer diameter has a conical surface).

The oil scraper ring is sprung and has two chrome-plated scraping edges.

The pistons are ring carrier pistons (the piston has a special cast iron ring carrier cast into it to seat the top piston ring). The friction surface of the piston skirt also has a graphite coating to ensure optimal running-in.

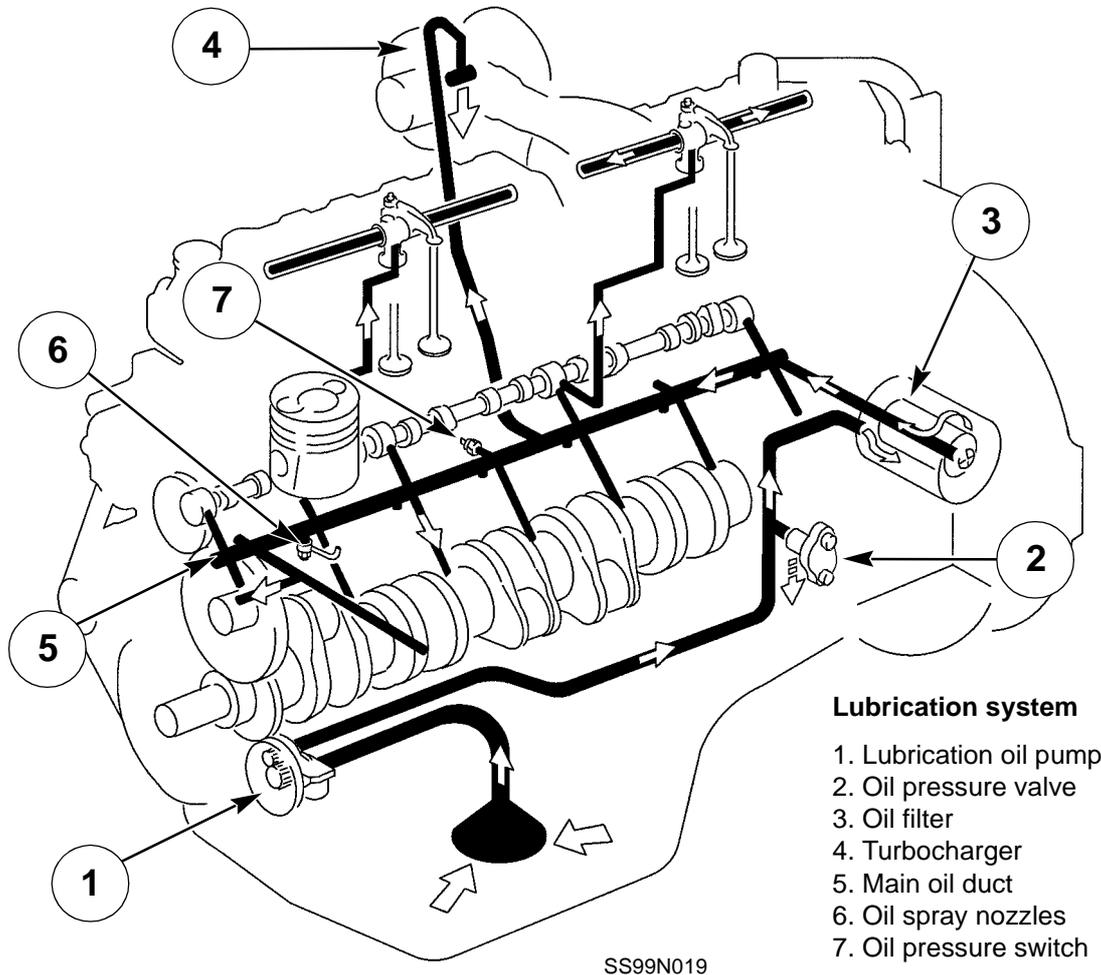
In the case of engine types 620.97, 620.98 and 620.99, the piston head is cooled from below by additional oil spray as soon as the oil pressure exceeds 3 bar.



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## Timing gears

The engine control gear wheels are hardened in the area of contact and have a helical gearing. The gear wheels are located in the timing gear case, which is fitted at the front of the engine. The timing gears drive the camshaft, the fuel injection pump and the oil pump. The intermediate wheel runs in pressure-lubricated friction bearings (like the camshaft). The bearing journal is fixed to the front surface of the cylinder block.



### Lubrication system

The engine is equipped with a pressure lubrication system, in which the oil pump (gear pump) is fixed to the lower part of the cylinder block. The pump sucks the oil in via an intake sieve. From the pump, the oil is fed through an oil line to the oil cooler (heat exchanger) and to the oil filter. The oil pressure valve is located parallel. The oil is then fed into the main oil duct, from which other oil bores branch off. The oil flows through the oil bores to the crankshaft bearings and through the crankshaft to the con-rod bearings.

The pressure oil flows from the main oil duct to the turbocharger and to the air compressor (if fitted). In addition, the intermediate gear wheel bearings, camshaft bearings and valve mechanism are lubricated with pressure oil via the main oil duct.

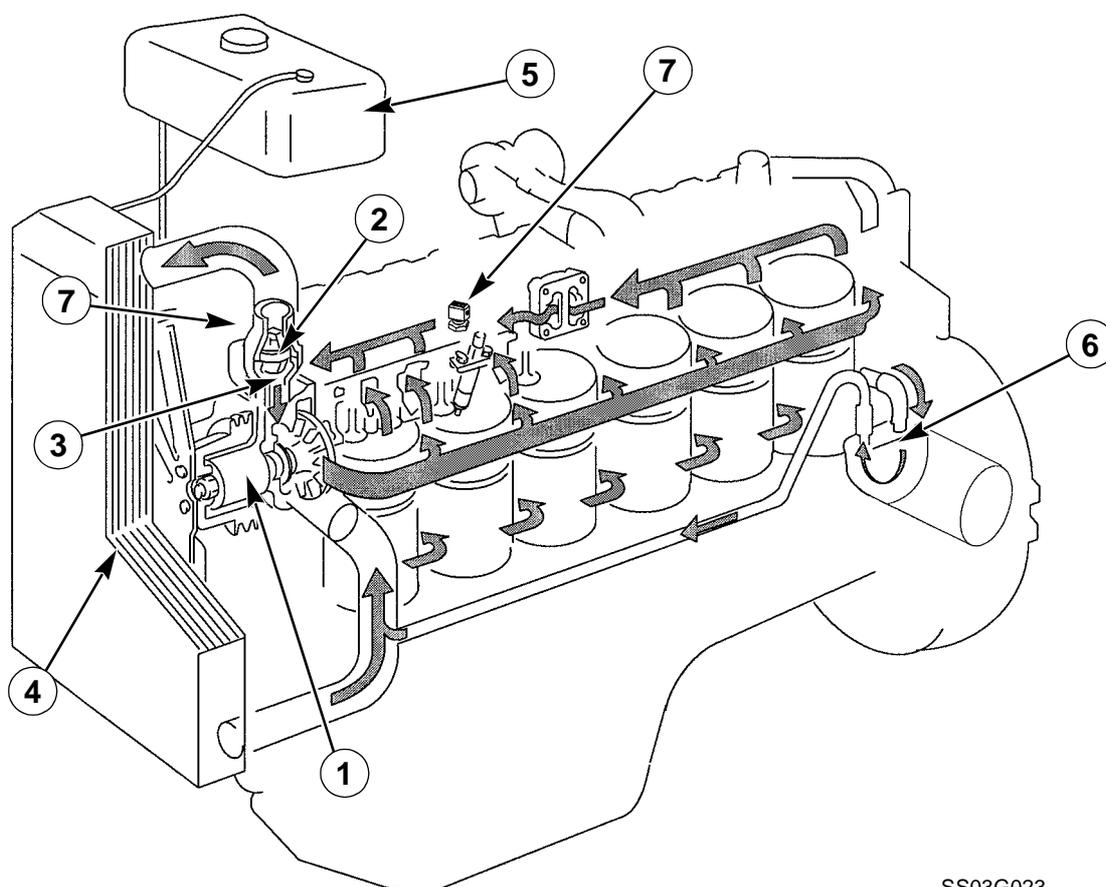
In the case of engines 620.97, 620.98 and 620.99, the piston heads are sprayed with oil from below and cooled as long as the lubrication oil pressure is higher than 3 bar.

The oil pressure valve regulates the lubrication oil pressure so that a constant value is maintained independent of the engine speed. Depending upon the grade of oil, the engine speed and temperature, the oil pressure lies between **2.5 - 5 bar**.

The oil pressure must be **at least 1.0 bar** at idling speed.

The oil filter is a one-way main stream filter. An overflow valve, on the underside of the filter, ensures reliable engine lubrication after cold starting at extremely low outside temperatures and sufficient lubrication in the event of a filter blockage. A non-return valve prevents the filter being completely drained of oil after switching off the engine.

The oil pressure switch opens at a pressure of **> 0.5 bar**.



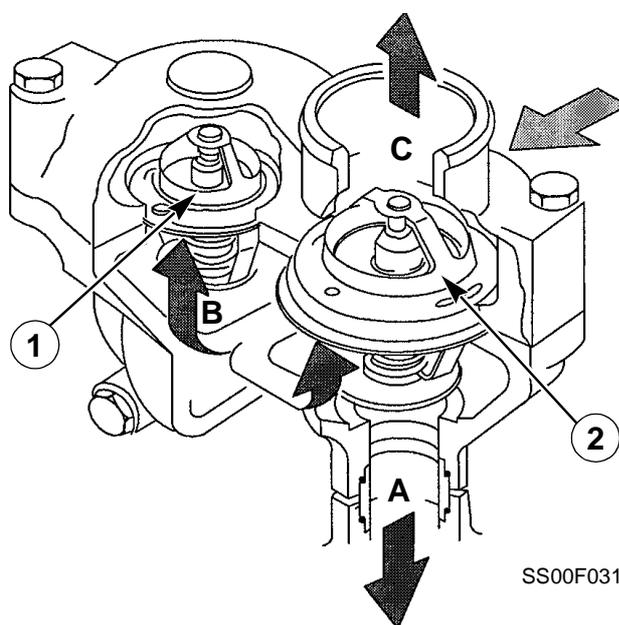
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### Cooling system

- |                   |                              |
|-------------------|------------------------------|
| 1. Coolant pump   | 5. Expansion chamber         |
| 2. Thermostat     | 6. Oil cooler                |
| 3. Bypass channel | 7. Engine temperature sensor |
| 4. Radiator       |                              |

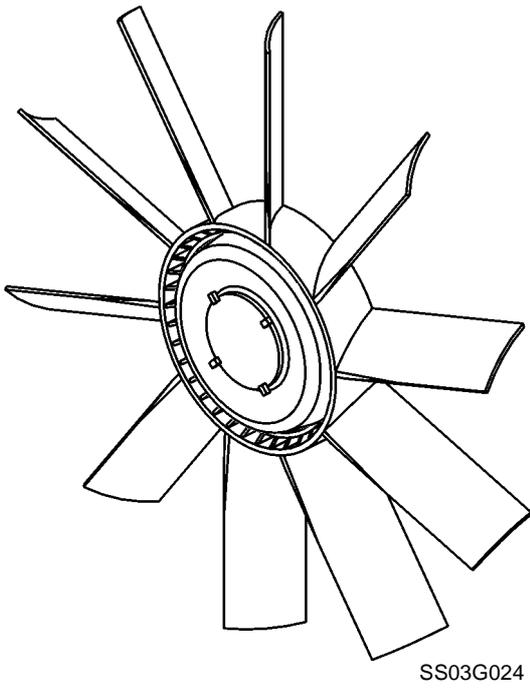
### Cooling system

The belt-driven coolant pump is located at the front end of the cylinder block. The thermostat housing is situated above the pump. The cooling system is equipped with two thermostats, which control the coolant flow. The thermostats have different opening temperatures. If the coolant temperature lies below the opening temperature, the coolant (A) circulates back to the coolant pump via the bypass channel. The smaller, single-action thermostat (1) starts to open at 79 °C and lets some of the coolant (B) flow into the radiator. When the engine temperature increases, the dual-circuit thermostat (2) also starts to open at 83 °C. It closes the bypass when it opens and allows all the coolant (C) to flow into the radiator.

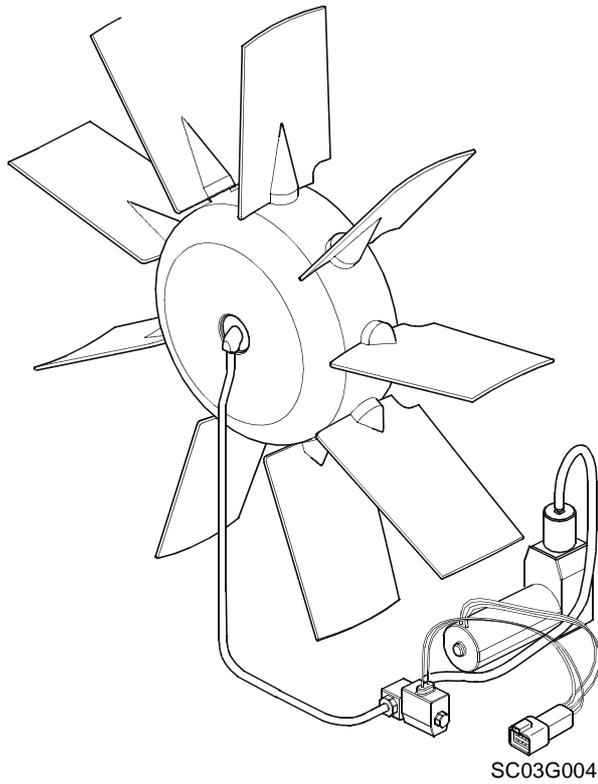


SS00F031

### VISCO FAN



### REVERSIBLE FAN



#### Visco fan with modulating hub (standard equipment)

In the case of the modulating hub, every flow air temperature corresponds to a certain slip. As long as there is little or no requirement for cooling, the fan rotates at low speed (= high slip), but dependent on the engine speed. The air flow through the cooler/radiator assembly (air conditioning condenser, charge-air cooler, transmission oil cooler, radiator for engine coolant) acts on the front of the Visco hub. A bimetal spring located here continuously measures the discharge temperature behind the radiator (coolant). As the discharge temperature increases (loading on the tractor increases), the control valve reduces the slip and the fan rotates faster according to the temperature until the minimum slip of approx. 5 % is reached. When the discharge temperature decreases (loading on the tractor decreases), the control valve increases the slip and the fan rotates slower according to the temperature.

The Visco fan with a modulating hub has the following advantages: More exact adaptation of the cooling performance to the tractor load, reduction of the fan's power consumption and noise level. The Visco fan is maintenance-free.

#### Reversible fan (optional equipment)

The blades on the reversible fan can be rotated on the hub. Integrated thermoelements vary the angle of the blades during operation and the cooling performance of the fan is adapted to the cooling requirements. Return springs hold the blades securely in position.

The following automatic process is activated on pressing the "Fan reversal" button:

The electronic central control unit (ECCU2) controls a small electric motor-operated air compressor and a solenoid valve. This control unit is fitted on the left-hand side of the engine. Compressed air is supplied via a pressure line and a special seal to the control cylinders (that rotate with the hub and blades) and turn the blades. A powerful stream of air then blows in the opposite direction through the radiator/coolers and any grass, blossoms, insects, etc., which have been sucked in are removed from the radiator/coolers. The blades automatically return to their original position after 30 seconds. The fan reversal function can also be activated automatically when programmed accordingly by the driver, i.e. in conjunction with automatic processes concerning the front or rear hitch or EHS auxiliary valves.