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

Service - Manual Sva 6035448106

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Chapter

2002

ENGINE WORKSHOP MANUAL

2002

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ENGINE DATA

Engine type	620.95	620.96	620.97	620.98	620.99
Number of cylinders	6				
Capacity (dm^3)	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[1] (bar)	24				
Charge-air pressure[2] (bar)	0,94	1,03	1,12	1,24	1,45
Weight[3] (kg)	510				
Direction of rotation of the crankshaft	Clockwise				

1) Minimum value at operating temperature and starter speed.
Highest permissible difference between the cylinders is 3 bar (max.)
2) 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
3) Without flywheel and electrical equipment.

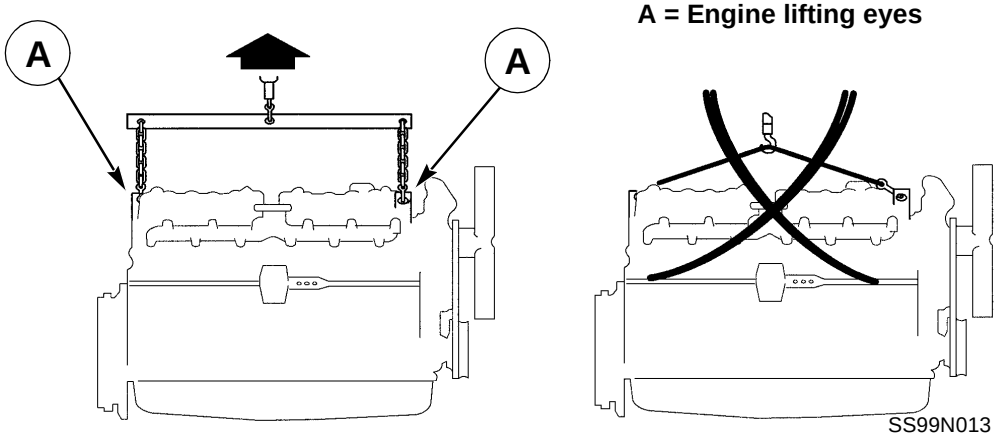
IMPORTANT: *After certain repairs to the engine, the fuel system must be bled before starting for the first time (for details, refer to Chapter 3001, Injection system).*

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



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 ..... 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)
Valve seat angle:
– Inlet valve ..... $35^{\circ +20'}$
– Outlet valve ..... $45^{\circ +20'}$
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 ..... $35^{\circ -20'}$
– Outlet valve ..... $45^{\circ -20'}$
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 ..... 1.835 - 1.842 mm
– 1st. repair level 0.25 mm..... 1.960 - 1.967 mm
– 2nd. repair level 0.50 mm ..... 2.085 - 2.092 mm
– 3rd. repair level 1.00 mm ..... 2.335 - 2.342 mm
– 4th. repair level 1.50 mm ..... 2.585 - 2.592 mm
Con-rod bearing play ..... 0.046 - 0.098 mm
Con-rod bearing axial play..... 0.200 - 0.410 mm
Alignment of the con-rod bearing bore to the piston-pin bearing bore..... within 0.15:100
Parallelism of the con-rod bearing bore to the piston-pin bearing bore ..... within 0.05:100
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..... 20 g

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$^{\pm 2}$
Fully open at ..... 94 °C
Max. stroke ..... 7.5 mm

Type, version ..... ∅67/dual-circuit
Starts opening at ..... 83 °C$^{\pm 2}$
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$^{\pm 3}$ °C
Fault code EEM112 (test values for sensor: see Service Tool)
Acoustic alarm (additionally) when temperature ..... > 113$^{\pm 3}$ °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

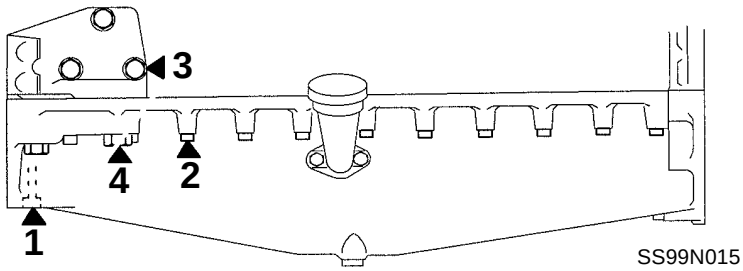
NOTE: *Use washers for aluminium parts.*

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

	M8	M10
Cast iron	$35^{\pm 5}$ Nm	$70^{\pm 5}$ Nm
Aluminium	$25^{\pm 5}$ Nm	$50^{\pm 5}$ Nm

Bolts for the self-supporting oil sump

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

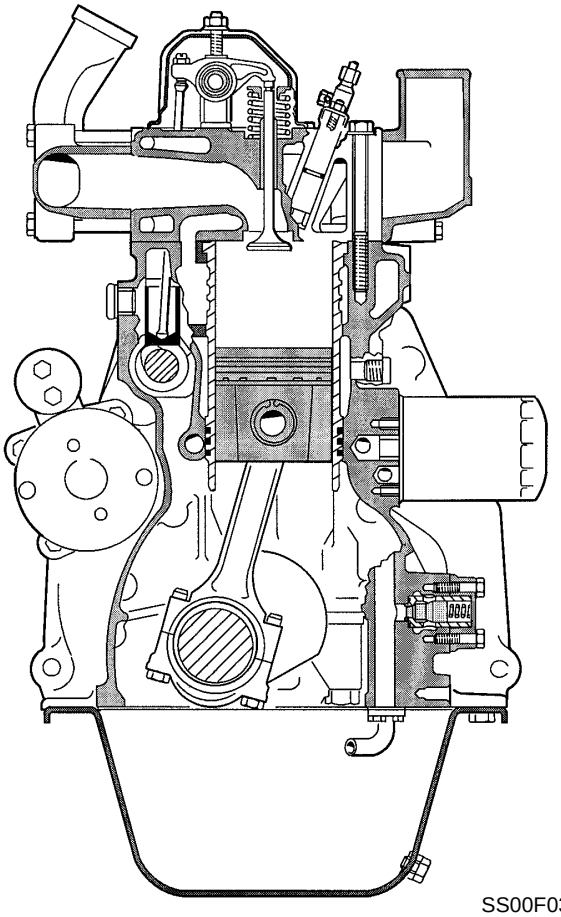


SS99N015

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.



SS00F035

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.

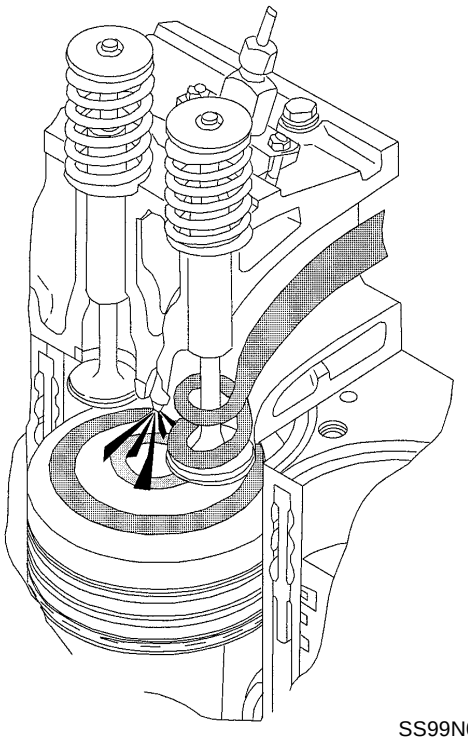
The camshaft is located in the cylinder block. All camshaft bearings are equipped with replaceable cylinder liners.

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.



SS99N017

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 check 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.

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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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.