SERVICE MANUAL

TT4.55 / TT4.65 / TT4.75

Tractor

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SERVICE MANUAL

TT4.55 TIER 3 Engine, 2WD Tractor, TT4.55 TIER 3 Engine, 4WD Tractor, TT4.65 NH 2WD TIER 3 ROPS, TT4.65 NH 4WD TIER 3 ROPS, TT4.75 NH 2WD TIER 3 ROPS, TT4.75 NH 4WD TIER 3 ROPS

Contents

SERVICE MANUAL

Engine

TT4.55 TIER 3 Engine, 2WD Tractor, TT4.55 TIER 3 Engine, 4WD Tractor, TT4.65 NH 2WD TIER 3 ROPS, TT4.65 NH 4WD TIER 3 ROPS, TT4.75 NH 2WD TIER 3 ROPS, TT4.75 NH 4WD TIER 3 ROPS

Contents

Engine - 10

Engine - 10

Engine and crankcase - 001

TT4.55 TIER 3 Engine, 2WD Tractor, TT4.55 TIER 3 Engine, 4WD Tractor, TT4.65 NH 2WD TIER 3 ROPS, TT4.65 NH 4WD TIER 3 ROPS, TT4.75 NH 2WD TIER 3 ROPS, TT4.75 NH 4WD TIER 3 ROPS

Contents

Engine - 10

Engine and crankcase - 001

(*) See content for specific models

Engine - General specification

Table 1

GENERAL SPECIFICATIONS	
Make	IVECO
Type	4 stroke, diesel, naturally aspirated, direct injection, water cooled
Power	**55/60/65/75 Hp**
No of Cylinders	3
Bore	**104 mm**
Stroke	**115 mm**
Cubic Capacity	**2931 cm³**
Compression Ratio	18:1
Firing Order	1–2–3
Idle Speed	**650 ± 50 RPM**
Maximum no Load Speed	**2550 ± 50 RPM**
Rated Speed	**2300 RPM**
Engine block	
Cylinder liner seat diameter in engine block	**106.850 - 106.900 mm**
Cylinder sleeve O.D	**106.94 - 106.97 mm**
Interference between liners and seats in block	**0.04 - 0.12 mm**
Liner O.D oversize	**0.2 mm**
Cylinder liner inner diameter	**104.00 - 104.024 mm**
Maximum ovality and taper due to wear	**0.12 mm**
Liner inner diameter oversize	**0.4 - 0.8 mm**
Camshaft bush seat diameters	
Front	**54.780 - 54.805 mm**
Intermediate	**54.280- - 54.305 mm**
Rear	**53.780 - 53.805 mm**
Tappet seat bore diameter	**15.000 - 15.018 mm**
Tappet oversize	**0.1–0.2 - 0.3 mm**
Main bearing seat bore diameter	**84.200 - 84.230 mm**
Cylinder head	
Valve guide seat bore diameter in head	**13.950 - 13.983 mm**
Valve guide oversize	**0.2 mm**
Valve stand-in	**0.7 - 1.0 mm**
Maximum stand-in permitted	**1.3 mm**
Injector standout	**0.05 - 0.7 mm**
Max. standout permitted	**1.0 mm**
Original cylinder head height	**92 mm**
Maximum head dressing allowed	**0.5 mm**
Compression pressure	**28 bar**
Engine cracking speed	**250 RPM**
Exhaust valves	
Valve head diameter	**40.75 - 41.25 mm**
Valve stem diameter	**7.975 - 7.990 mm**
Face angle	**45 30’ ± 7’ °**
Tappet clearance	**0.30 ± 0.05 mm**
Cam lift	**6.127 mm**
Valve lift	**10.445 mm**
Intake valves	
Valve head diameter	**45.300 - 45.500 mm**
Valve stem diameter	**7.985 - 8.000 mm**
Face angle	**60 30´ ± 7´ °**
Tappet clearance (cold)	**0.30 ± 0.05 mm**
Cam lift	**5.889 mm**

Valve lift	**10.445 mm**
Tiner - Internal Exhaust Gas Recirculation(EGR)	
Intake opening (After BDC, during exhaust stroke)	**3 °**
Intake valve closing (Before TDC, during Exhaust stroke)	**61 °**
'Tiner' cam lobe lift	**1.076 mm**
Intake valve lift (tiner)	**1.908 mm**
Valve springs	
Number per valve	**1 mm**
Free length	**44.6 mm**
Length loaded at **26.1 - 28.9 kg**	**34 mm**
Length loaded at **51.2 - 56.5 kg**	**23.8 mm**
Valve timing	
Intake opening (before top dead centre)	**15 °**
Intake closing (after bottom dead centre)	**45 °**
Exhaust opening (before bottom dead centre)	**56 °**
Exhaust closing (after top dead centre)	**26 °**
Valve inserts	
Valve guide OD	**13.933 - 14.016 mm**
Valve guide oversize	**0.2 mm**
Valve guide interference fit in housing cylinder head	**0.005 - 0.050 mm**
Valve guide fitted ID after reaming	**8.023 - 8.043 mm**
Valve stem clearance in guide	**0.023 - 0.058 mm** (for intake valve) **0.033 - 0.068 mm** (for exhaust valve)
Maximum wear clearance .	**0.13 mm**
Maximum valve stem eccentricity over one revolution with stylus on sealing face	**0.03 mm**

Crank gear

Crankshaft- Bearings	
Main journal diameter	**79.791 - 79.810 mm**
Main journal undersize	**0.254-0.508-0.762-1.016 mm**
Main bearing wall thickness	**2.168 - 2.178 mm**
Main bearing undersize	**0.254-0.508-0.762-1.016 mm**
Main journal clearance in bearings	**0.034 - 0.103 mm**
maximum wear clearance	**0.180 mm**
Crank pin diameter	**63.725 - 63.744 mm**
Crank pin undersize	**0.254-0.508-0.762-1.016 mm**
Big end bearing wall thickness	**1.805 - 1.815 mm**
Big end bearing undersize	**0.254-0.508-0.762-1.016 mm**
Crank pin clearance in big end bearing	**0.033 - 0.087 mm**
maximum wear clearance	**0.180 mm**
Crankshaft thrust washer thickness	**3.378 - 3.429 mm**
Thrust washer oversize	**0.127-0.254-0.508 mm**
Width of main bearing housing over thrust washers	**31.766 - 31.918 mm**
Length of corresponding main journal	**32.000 - 32.100 mm**
Crankshaft end float	**0.082 - 0.334 mm**
maximum wear end float	**0.40 mm**
Maximum main journal and crank pin ovality or taper after grinding	**0.01 mm**
Maximum main journal and crankpin ovality or taper due to wear or taper due to wear	**0.05 mm**
Maximum main journal misalignment	
Crankshaft resting on end journals	**0.10 mm**
Maximum misalignment of crank pins relative to main journals(in either direction)	**0.25 mm**
Tolerance from outer crankpin edge to crank-shaft center line	**±0.10 mm**

Maximum crankshaft flange run-out with gauge, over 108 mm (4.25”) diameter (total gauge reading)	**0.025 mm**
Maximum flywheel seat eccentricity relative to main journals (total gauge reading)	**0.04 mm**
Connecting rods	
Small end bore diameter	**41.846 - 41.884 mm**
Small end bushing outer diameter	**41.979 - 42.017 mm**
Bushing interference fit in small end	**0.095 - 0.171 mm**
Small end bushing fitted I.D .	**38.004 - 38.014 mm**
Big end bore diameter	**67.407 - 67.422 mm**
Maximum connecting rod axis misalignment at **125 mm**	**± 0.07 mm**
Maximum connecting rod weight difference over a complete set from the same engine	**25 g**
Pistons	
Piston diameter: measured at **12 mm** from base of skirt and right angles to pin	**103.852 - 103.870 mm**
Piston clearance in liner	**0.130 - 0.172 mm**
max. wear clearance	**0.30 mm**
Piston oversize range	**0.6 mm**
Piston stand-out with respect to head at T.D.C	**0.430 - 0.840 mm**
Piston pin diameter	**37.983 - 37.99 mm**
Piston pin seat bore in piston	**38.000 - 38.006 mm**
Piston pin clearance in piston	**0.010 - 0.023 mm**
Piston pin clearance in small end bushing	**0.014 - 0.031 mm**
maximum wear clearance	**0.06 mm**
Maximum weight difference between pistons on same engine	**20 g**
Piston ring clearance in groove	
• Top	**0.090 - 0.122 mm**
• 2nd	**0.060 - 0.092 mm**
• 3rd	**0.040 - 0.080 mm**
Maximum wear clearance	
• Top	**0.50 mm**
• 2nd and 3rd .	**0.20 mm**
Piston ring gap	
• Top	**0.30 - 0.45 mm**
• 2nd	**0.60 - 0.85 mm**
• 3rd	**0.30 - 0.55 mm**
Maximum wear gap	**1.20 mm**

Valve gear

Valve timing gears	
Timing gear backlash	**0.160 mm**
Idler gear jack shaft diameter	**36.975 - 37.000 mm**
Idler gear bushing fitted I.D. after reaming	**37.050 - 37.075 mm**
Jack shaft journal clearance in bushing	**0.050 - 0.100 mm**
Max. wear clearance	**0.15 mm**
Bushing interference fit in idler gear	**0.063 - 0.140 mm**
Lift and power steering pump drive gear shaft	
Diameter	**36.975 - 37.000 mm**
Bushing fitted I.D. after reaming	**37.050 - 37.075 mm**
Shaft clearance in bushing	**0.050 - 0.100 mm**
Bushing interference fit in housing	**0.063 - 0.140 mm**
Pump drive gear thrust washer thickness	**1.45 - 1.50 mm**

Camshaft	
Camshaft bushing O.D.	
• Front	**54.875 - 54.930 mm**
• Intermediate	**54.375 - 54.430 mm**
• Rear	**53.875 - 53.930 mm**
Bushing interference fit in housing	**0.070 - 0.150 mm**
Camshaft bushing fitted I.D after reaming:	
- Front	**51.080 - 51.130 mm**
- Intermediate	**50.580 - 50.630 mm**
- Rear	**50.080 - 50.130 mm**
Camshaft journal diameter:	
- Front	**50.970 - 51.000 mm**
-Intermediate	**50.470 - 50.500 mm**
- Rear	**49.970 - 50.000 mm**
Camshaft journal clearance in bushing	**0.080 - 0.160 mm**
Maximum wear clearance	**0.20 mm**
Camshaft end float (thrust plate to associated seat in camshaft)	**0.070 - 0.220 mm**
Tappets	
Tappet O.D	**14.950 - 14.970 mm**
Tappet clearance in housing on engine block	**0.030 - 0.068 mm**
Maximum wear clearance	**0.15 mm**
Tappet oversize	**0.1-0.2-0.3 mm**
Rocker bore diameter	**18.016 - 18.034 mm**
Rocker shaft diameter	**17.982 - 18.000 mm**
Rocker shaft clearance in bracket	**0.016 - 0.052 mm**
maximum wear clearance	**0.15 mm**
Rocker spacer spring length:	
- Free	**59.5 mm**
under load **4.7 - 5.3 kg**	**44 mm**
Valves, guides and springs	
Valve head diameter inlet	**45.300 - 45.500 mm**
Exhaust	**40.75 - 41.25 mm**
Valve stem diameter	Inlet- **7.985 - 8.000 mm** Exhaust **7.975 - 7.990 mm**
Valve face angle: inlet	**60 o 30'±7 ' °**
Exhaust	**45 o 30±77' °**
Tappet clearance	**0.45 °**
Engine inlet	**0.30±0.05 mm**
Exhaust (cold)	**0.30±0.05 mm**
Cam lift: inlet	**5.889 mm**
exhaust	**6.127 mm**
Valve lift: inlet	**10.445 mm**
Exhaust	**10.868 mm**

Lubrication system

Oil pump	Gear, crankshaft driven
Oil pump drive ratio	1.27:1
Oil pressure	Rated – **3 - 4.5 bar** Peak torque – **2.5 - 3.5 bar**
Relief valve crack-off setting .	**3.6 bar**
Assembly. clearance between shaft and bushing oil pump drive	**0.016 - 0.070 mm**
Shaft clearance in driven gear	**0.016 - 0.054 mm**
Gear backlash	**0.100 mm**
Gear radial clearance in pump housing	**0.015 - 0.067 mm**
Drive and driven gear width	**15.973 - 16.000 mm**

Gear housing depth in pump body	**16.016 - 16.080 mm**
Drive and driven gear end float	**0.016 - 0.107 mm**
Relief valve spring length:	
- Free	**35.9 mm**
- AT load 134.55±6.73 N	**29 mm**
- AT load 245.70±12.3 N	**23.2 mm**
Oil filter	Mesh on suction and cartridge on delivery

Cooling system

Water pump		Centrifugal, vane	
	60 / 55 Hp	**65 Hp**	**75 Hp**
Water pump drive ratio	1.04	1.18	1.38
Shaft interference fit in impeller		**0.017 - 0.059 mm**	
Shaft interference fit in fan hub		**0.024 - 0.058 mm**	
Face sealing bushing interference fit in impeller		**0.012 - 0.058 mm**	
Thermostat type		Wax	
Opening temperature		**79±2 °C**	
Close off temperature		**94 °C**	
Valve travel when fully open		**7.5 mm**	
Radiator		Vertical tube and Aluminium fins	
Fan		Suction, steel, 6 blades	
Water temperature gauge		Three colored sectors	
Temperature range for each sector:			
- white sector		**0 - 40 °C**	
- green sector		**40 - 112 °C**	
- red sector		**112 - 120 °C**	

Fuel system

Fuel feed pump		Double diaphragm	
Operation		Engine driven	
Minimum fuel flow at **1600 RPM** shaft speed		**100 L/hour**	
Drive shaft eccentricity		**3 mm**	
Fuel pump drive Shaft journal dia		**31.975 - 32.000 mm**	
Bushing fitted I.D. after reaming		**32.050 - 32.075 mm**	
Shaft clearance in bushing		**0.050 - 0.100 mm**	
Bushing interference fit in housing		**0.063 - 0.140 mm**	
Inner washer thickness		**1.45 - 1.50 mm**	
Outer washer thickness		**2.93 - 3.00 mm**	
Injection pump		Distributor, integral governor and advance device	
- BOSCH			
	55 Hp	**60 Hp**	**65 Hp**
	0460423063 (with LDA) 0460423079 (without LDA)	(0460423072) With KSB (0460423076) Without KSB	0460423073 With KSB (0460423077) Without KSB
		75 Hp	
		(0460423075) With KSB (0460423078) Without KSB	
Firing order :		1-2-3	
Injectors:	**55 / 60 / 65 Hp**		**75 Hp**
Make	BOSCH		BOSCH
Nozzle holder	F002 C70 567 (KBAL 86 P 163)		F002 C70 567 (KBAL 86 P 163)
Nozzle.	F002 C40 750 (DSLA 142 P 5565)		F002 C40 738 (DSLA 145 P 5544)

Number of spray orifices	6	6
Spray orifice diameter	**0.176 mm**	**0.193 mm**
Pressure setting	**260 - 268 Kg/cm²**	**260 - 268 Kg/cm²**
Delivery pipes		
Type	5801439057	
pipe dimensions	6X1.6X530	
Pump timing, cylinder no. 1 in compression stroke (delivery connection of cylinder no. 1: marked with letter “A”	55 hp-0.45±0.05 mm plunger lift @ TDC (without LDA) 55 hp- 0.6±0.05 mm plunger lift @ TDC (with LDA) 60 hp- 1±0.05 mm plunger lift @ TDC 65 hp- 1±0.05 mm plunger lift @ TDC 75 hp- 1.2±0.05 mm plunger lift @ TDC	

Engine - Torque

TIGHTENING TORQUES

Description	Thread size	Torque (Nm)	Angle
Cap screw, cylinder head (C1)	**M12 x 1.25**	40	**130±5 + 140±5 °**
Cap screw, main bearing caps (C2)	**M14 x 1.25**	80	**90 °**
Cap screw, timing cover and case (C3)	**M12 x 1.25**	40	
Cap screw, connecting rod caps (C4)	**M11 x 1.25**	40	**60 °**
Cap screw, flywheel (C5)	**M12 x 1.25**	40	**60 °**
Cap screw, rocker shaft bracket (C6)	**M8x1.25**	25	
Nut, crankshaft pulley hub (C7)	**M30 x 1.5**	300	
Cap screw, fan and alternator drive pulley(C8)	**M12 x 1.25**	49	
Nut, injection pump shaft gear (C9)	**M12 x 1.25**	64	
Nuts, injection pump to support (C10)	**M12 x 1.25**	23	
Retaining screws, additional weights (C11)	**M12 x 1.25**	110	

Engine - Sealing

SEALANTS

Operation Description	Sealant Specification
Adopter for Oil Filter (S1)	**LOCTITE® 270**
Adopter for Tachometer Cable (S2)	**LOCTITE® 243™**
Flywheel Housing to Engine Block (S3)	**LOCTITE® 510™**
Timing Gear case Studs (S4)	**LOCTITE® 270**
Timing Gear cover Dowel pin(S5)	**LOCTITE® 270**
Starter Motor to Flywheel Housing (S6)	**LOCTITE® 510™**
Allen Plug in Cylinder Head Thermostat Housing (S7)	**LOCTITE® 243™**
Cylinder Head Exhaust Manifold Studs (S8)	**LOCTITE® 270**
Oil Sump to Engine Block (S9)	**LOCTITE® 5900®**
Silencer mounting Studs on Exhaust Manifold(S10)	**LOCTITE® NICKEL ANTI-SEIZE 77164**
Flywheel Bolt (S11)	**LOCTITE® 243™**

Engine - Special tools

TT4.55	ANZ --- APAC --- LA --- MEA
TT4.65	ANZ --- APAC --- LA --- MEA
TT4.75	ANZ --- APAC --- LA --- MEA

Serial number	Special tool description	Special tool number
1	Engine stand with support	380000301
2	Nozzle tester	380000215
3	Sling hook engine	380000216

Serial number	Special tool description	Special tool number
4	Adopter for slide hammer	380000541
5	Tappet adjusting screw driver	380000232
6	Angular torquing gauge	380000304
7	Remover, filters	380200593
8	Engine oil pressure gauge with adapter	380200591
9	Remover, fuel injection pump nut	380200594
10	Wrench to remove solenoid switch	380200595
11	Compression gauge	380200596
12	Dummy injector (turbo engine)	380200334

Engine - Overview DESCRIPTION AND OPERATION

The engine is a 3 cylinder engine with Turbo Charger and a inter-cooler. This engine features cross flow cylinder heads, with the inlet and exhaust manifolds on opposite sides of the cylinder head. The fuel and air combustion process, takes place in the specially designed bowel in the crown of the pistons

CYLINDER HEAD ASSEMBLY

The cylinder head consists of valves and springs, with the valve rocker arm shaft assembly bolted to the cylinder block through the cylinder head. Cylinder head retaining bolts are evenly spaced with a six- point pattern around each cylinder; this ensures an even clamping load across the cylinder head. The intake and exhaust manifolds are bolted to the head; the intake manifold is mounted on the right side of the engine, with the diesel injectors mounted outside the rocker cover. The exhaust manifold is mounted on the left side of the engine. Water outlet connections and thermostat being attached to the front of the cylinder block directly behind the radiator Valve guides are inserted into the cylinder head, and replaceable. Special replaceable cast alloy valve seats are pressed into each valve port during manufacturing. No oversize valve seats on guides are available. All valves are fitted with positive value rotators; valve clearance is maintained by adjustment of the self locking adjusting screw, mounted in each of the rocker arms.

CAMSHAFT ASSEMBLY

The camshaft runs in 3 replaceable bushes. The camshaft drive gear is in mesh with and driven by the camshaft idler gear which is driven by the crankshaft timing gear. Camshaft end thrust is controlled by a thrust plate bolted to the block, and located between the camshaft gear and the front camshaft journal. A helical gear is integral on rear of cam shaft, and drives the engine oil lubrication pump mounted forward of the flywheel.

Cylinder block assembly

The cylinder block is an alloy cast iron with deep cylinder skirts & water jackets for cooling the cylinders. The cylinder bores are machined integral with the cylinder block, during the manufacturing process. Cylinders are inline and vertical and numbered from 1 to 3 from front of the engine to the rear. The oil sump, which is attached to the bottom of the cylinder block, is the reservoir for the engine oil lubrication system. A cast iron engine front cover and front plate is attached to the front of the engine and covers all of the timing gear assembly.

CRANKSHAFT ASSEMBLY

The crankshaft is supported in the cylinder block by 4 main bearings. The crankshaft is manufactured from steel with machined finished crank webs, End thrust is controlled by a thrust bearing. A dynamic balancer is fitted and driven by crankshaft to ensure smooth running operation. Front and rear crankshaft oil sealing is affected by one piece seals that are designed for long and durable service life.

CONNECTING RODS

The “Wedge” shaped at the small end of the connecting rod has been designed to reduce the reciprocating weight at the piston end. The connecting rods have a heavy beam construction and are assembled as a matched set to each engine. They are attached to the crankshaft, by means of insert type bearings. They are retained in position by the connecting rod big end cap and secured by two bolts per rod. The small end of the connecting rod is fitted with a replaceable bronze bushing, through which the free floating piston pin is fitted. The steel pin being held in place within the piston by two snap rings.

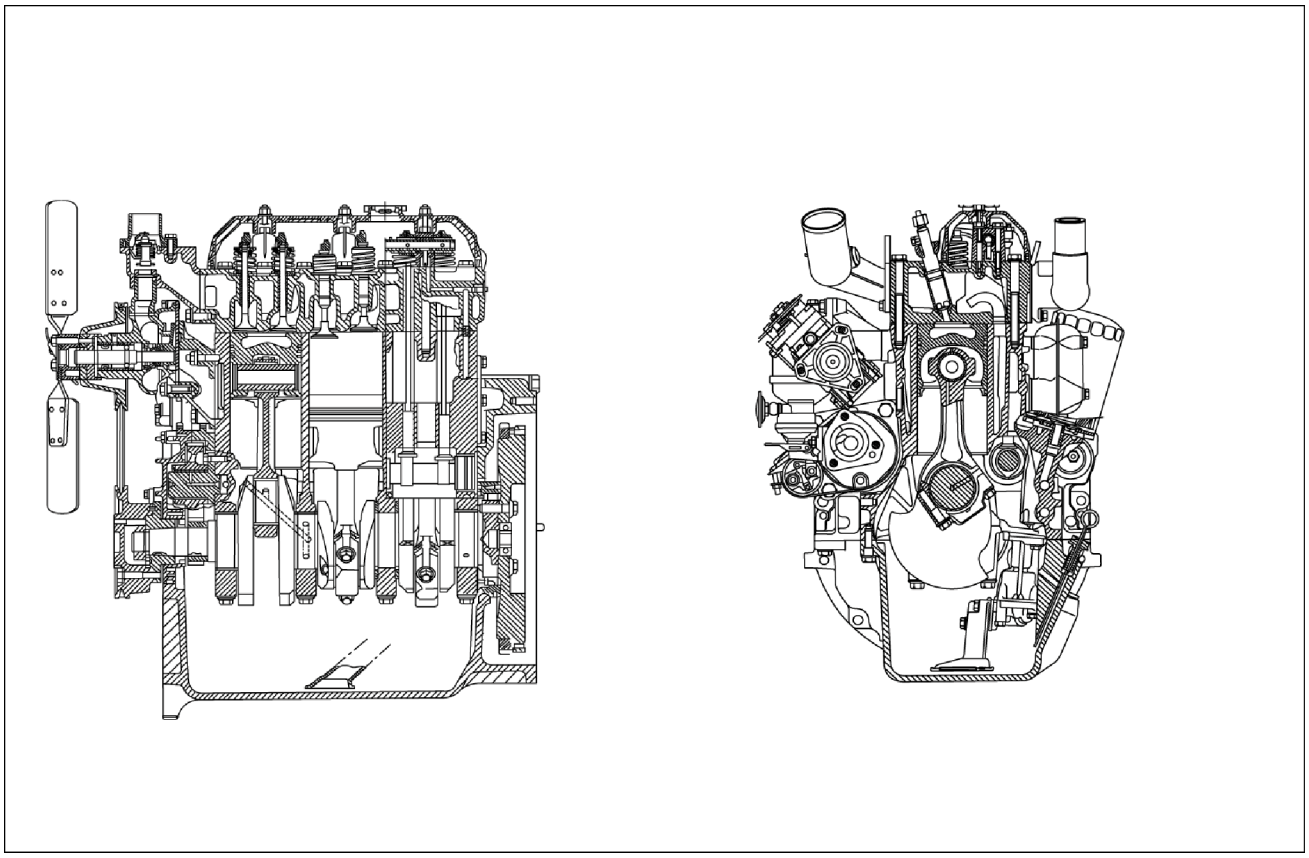
PISTONS

Pistons are constructed of an aluminium silicon alloy with notch type combustion chamber being recessed in to the piston crowns.
Each piston has two compression rings and one oil control ring, to reduce the friction and increase positive seating. All rings are located above the piston pin.

Manifolds

The cross flow design aluminium intake, and cast iron exhaust manifolds are on opposite sides of the cylinder head. This is designed to maintain balanced heat distribution within the cylinder head. The configuration of the manifolds

also ensures minimum heat transfer to the intake manifold. The intake manifold is connected through hose to air cleaner.



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Timing gears

The crankshaft timing gear is heated and press fitted on to the front of the crankshaft, to a high degree of accuracy during manufacturing. This enables precise timing being maintained during the life of the engine. The crankshaft gear drives the idler gear, which is attached to the front of cylinder block. The idler gear then drives the camshaft and the injection pump via meshing helical gears

The camshaft gear is bolted to the front of the shaft and is keyed to maintain position of the gear on the camshaft.

LUBRICATION SYSTEM

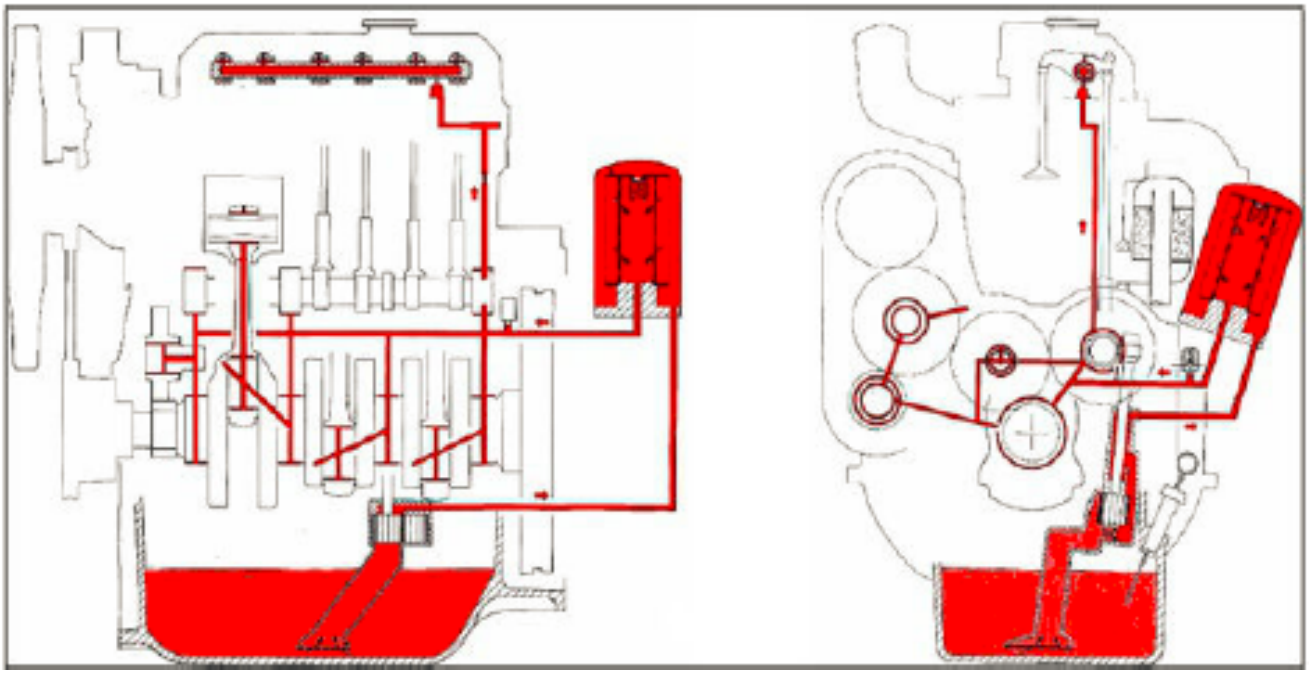
Lubrication of the engine, Figure 7 & 8 is maintained by a gear type oil pump mounted in the rear of the engine block., forward of the flywheel on the left hand side viewing from rear side of the engine. The oil pump is driven from the rear of the camshaft and drains oil from the engine oil sump through a tube and screen assembly

A spring loaded relief valve is integral with the oil filter and prevents over pressurization of the system. A spin on type oil filter is mounted externally to its support housing on the left hand side of the engine. Oil flows from the filter to the main oil gallery, which runs the length of the cylinder block, which also intersects the camshaft follower chamber.

The main gallery also supplies oil to the crankshaft main bearings, connecting rods both big and small ends and timing gear bushes. The underside of the pistons and pins are lubricated by oil pressure jets.

Timing gears are lubricated by splashed oil from the cam follower chamber and the pressure lubricated camshaft drive gear bushing.

An intermittent flow of oil is directed to the value rocker arm shaft assembly via a drilled passage in the cylinder block. This is located vertically above No. 3 camshaft bearing and aligns to a hole in the cylinder head. The rotation of the camshaft allows a controlled intermediate flow of lubrication.



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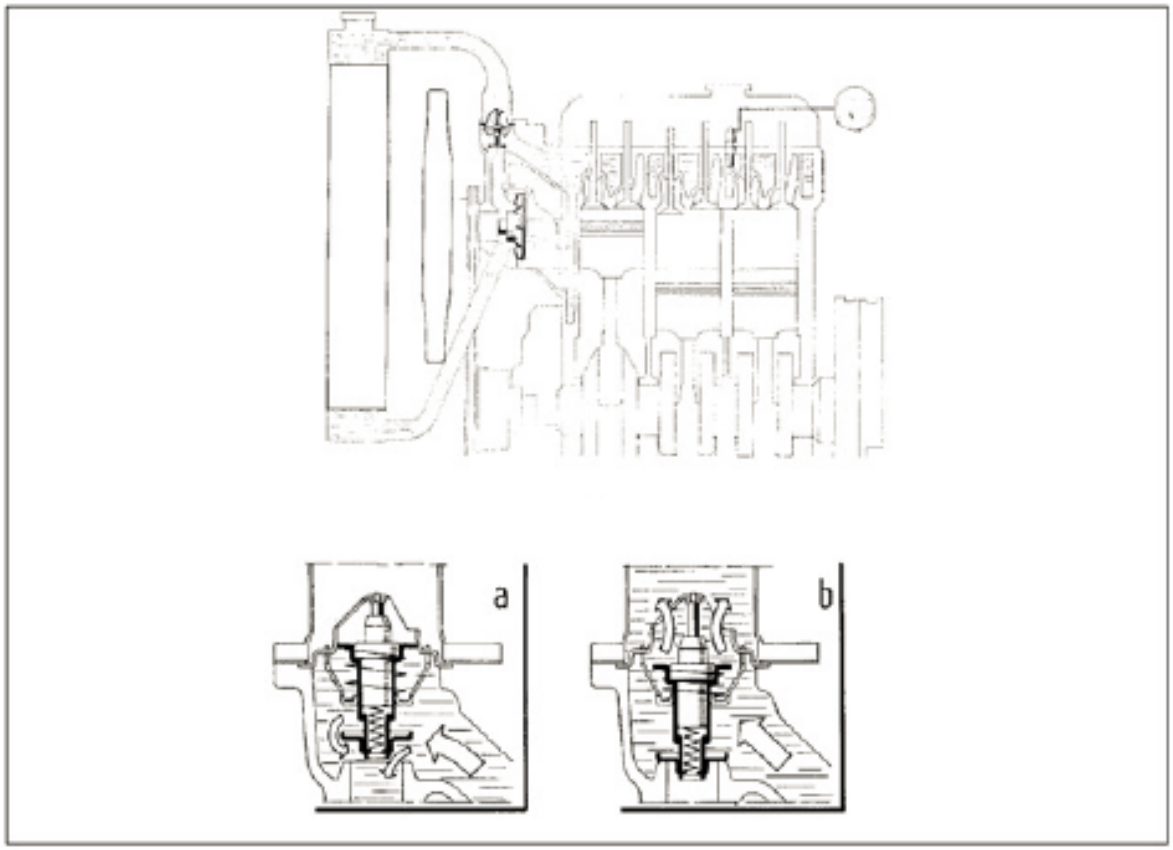
COOLING SYSTEM

The function of the water pump mounted at the front of the engine, is to maintain a continuous flow of water around the cooling system. This is essential to ensure engine temperature and performance within the recommended range, during vehicle operation.
The Water pump is driven by a ‘V’ belt by the crankshaft pulley, when the engine is running.

The cooling system for the new generation of engines is of recirculating by-pass type with full length water jackets for the bottom tank of the radiator by the water pump, which passes the coolant to the cylinder block. This coolant then flows through cored passages to cool the cylinder walls.

Passages in the cylinder head gasket allow coolant to flow from the cylinder block, into the cylinder head cored passages also conduct the coolant to the fuel injector nozzle locations before re-entering the water pump below the thermostat

The thermostat is located in the top of the water pump body, and controls the flow of the water as required by temperature changes.



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NOTE: *A faulty thermostat may cause the engine to operate at too high (hot) or low (cold) operating temperature. If not replaced this could result in a damaged engine or impaired engine performance. When the thermostat is closed a recirculating by-pass is provided to allow the coolant to recirculate from the head to the block in order to aid a faster warm-up. Once the engine has reached its normal operating temperature, the thermostat will open and allow water to be drawn through the radiator by the pump action. Cooled water then returns to the engine system. Cooling occurs as the coolant passes down through the radiator cores, which are exposed to the air as it is drawn through the radiator by the fan.*

NOTE: *Do not operate an engine without a thermostat. The cooling system incorporates a drain plug, on the left hand side of the cylinder block. The cap on the radiator is a system pressure cap and should not be removed unless refilling the system from empty.*
The engine cooling fan is mounted on a pump pulley which is belt driven from the crankshaft.

Engine - Remove

Preliminary instructions

In the following procedures and illustrations the engine is shown removed from the tractor. However there are certain operations that can performed with the engine still in the tractor, or separated at the connection to the front axle support, or separated from the transmission housing.

The engine overhaul procedure initially describes the assembly process for rebuilding an engine using all new components. Following this section are defined headings, which describe detailed repair specifications and procedures, where components are suitable for re-use. See **Engine - General specification (10.001)**, to ensure components are serviceable.

Where overhaul of components is required without engine being removed from the tractor refer to the following headings, and the relevant paragraphs, in the main overhaul procedure

Operations or repairs that can be performed with the engine still in the tractor.

1. Cylinder head and associated inlet and exhaust components.
2. Fuel injection pump and related parts.
3. Water pump, thermostat, and associated components.
4. Front timing cover/timing gear removal
5. Front pulley

Operations or repairs that are performed with the engine separated from the front axle

1. Oil pan removal for access to oil pan gasket, crankshaft, bearing shells, piston removal and oil pump.

Operations or repairs that are performed with the engine separated from the transmission housing, and with oil pan removed

1. Crankshaft rear oil seal and carrier removal. Dismantle the engine by referring to the removal procedure. Refer to the specification section wherever necessary.

NOTE: *All gaskets, seals and 'O' rings must be replaced while reassembling. Where new sealant is to be applied refer to "Engine Specifications".*

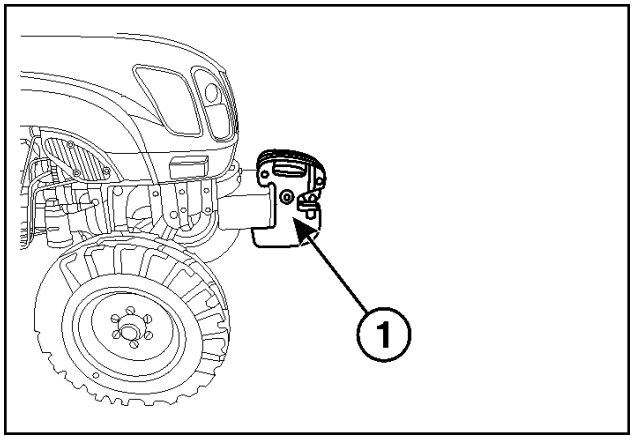
Engine removal

⚠ WARNING

Avoid injury!
Handle all parts carefully. Do not place your hands or fingers between parts. Use Personal Protective Equipment (PPE) as indicated in this manual, including protective goggles, gloves, and safety footwear.
Failure to comply could result in death or serious injury.

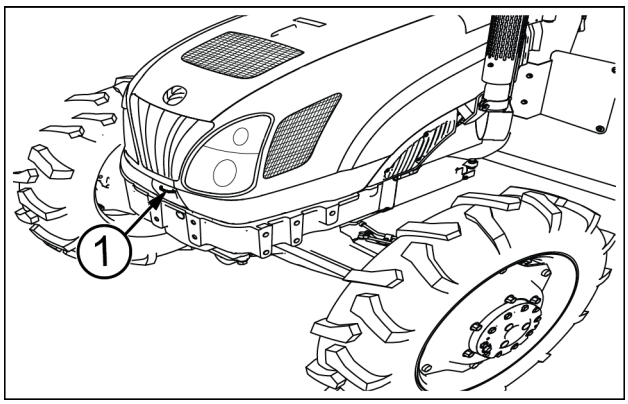
W0208A

1. Remove front ballast weights **(1)**, if fitted.



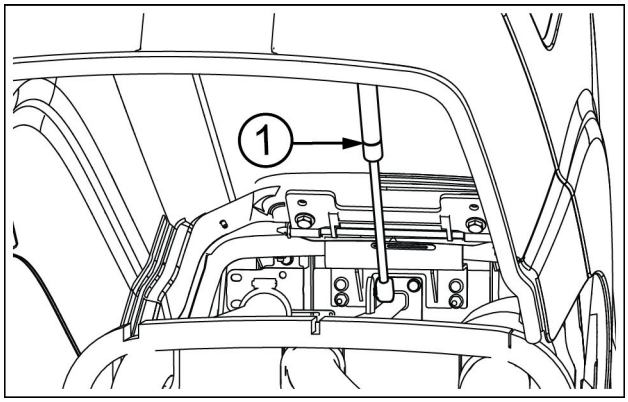
GNIL14TR02001AA 1

2. Pull the lock **(1)** out, and open the front hood.



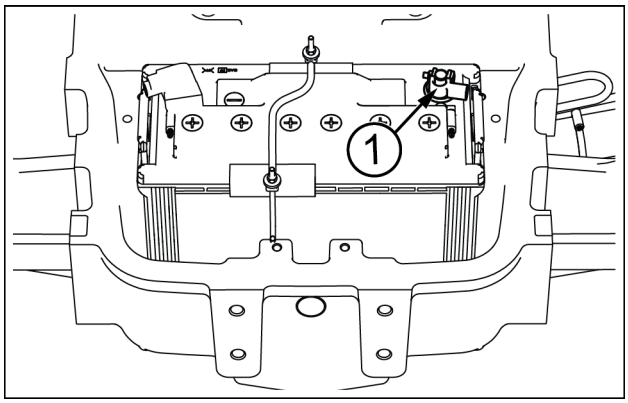
GNIL14TR02002AA 2

3. To maintain the hood in the raised position, a gas strut **(1)** is provided underside the hood.



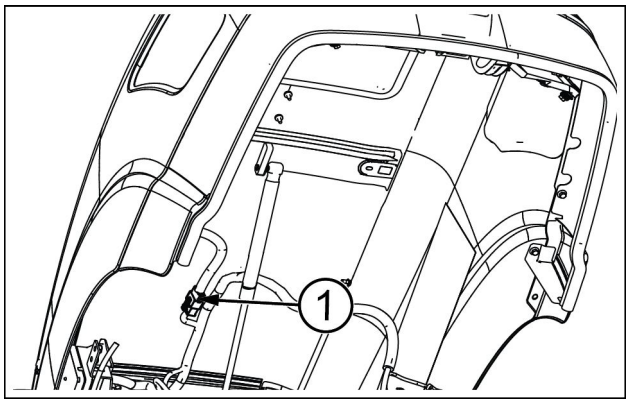
GNIL14TR02003AA 3

4. Disconnect the negative terminal **(1)** of the battery followed by the positive terminal.



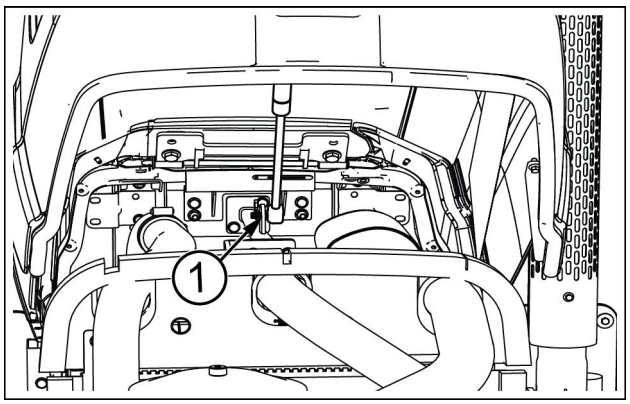
GNIL14TR02004AA 4

5. Disconnect the electric coupler **(1)** of head lamp harness located near hood gas strut.



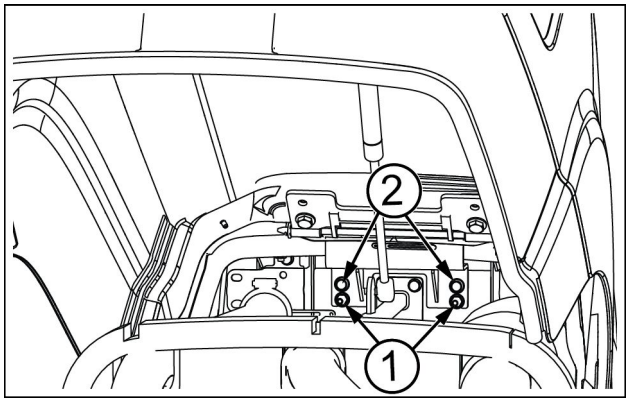
GNIL14TR02706AA 5

6. Loosen the lower nut of gas strut **(1)**.



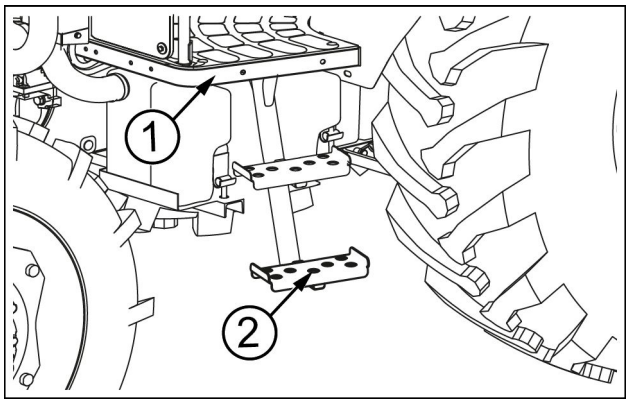
GNIL14TR02006AA 6

7. Loosen and remove the two lower nuts **(1)** and the two upper bolts **(2)** of front hood mounting bracket and remove the front hood.



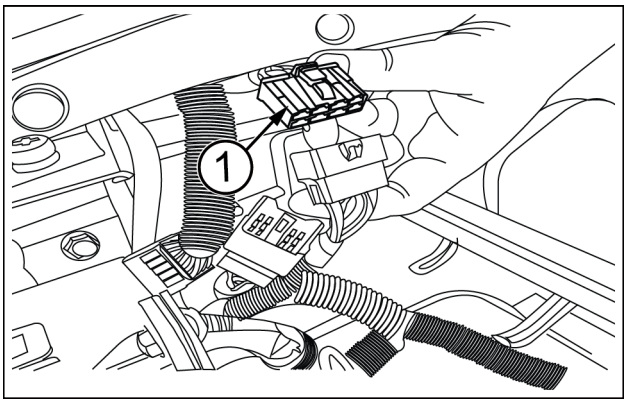
GNIL14TR02007AA 7

8. Drain the coolant and disconnect the radiator hoses. Disconnect the intercooler and oil cooler hoses.
9. Loosen and remove the four bolts below the LH side footboard **(1)** for the removal of foot ladder **(2)**.



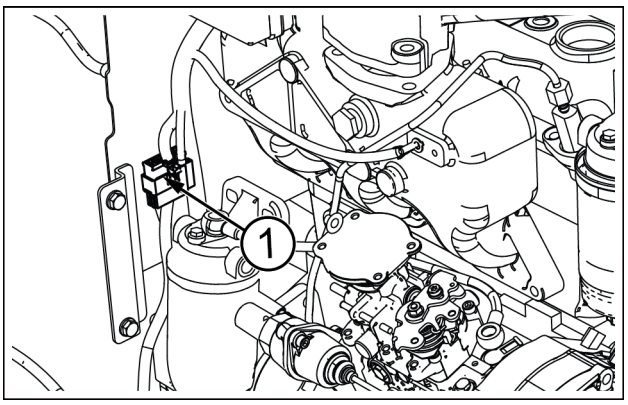
GNIL14TR02009AA 8

10. Disconnect the wiring harness coupler. **(1)** (Main to Instrument Cluster)



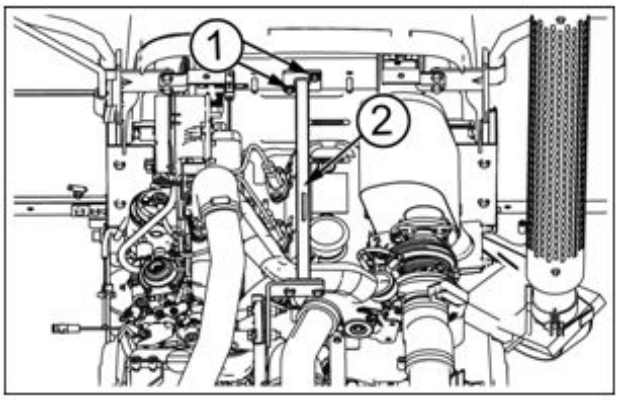
GNIL14TR02010AA 9

11. Disconnect Wiring harness coupler (Main to rear) **(1)**.



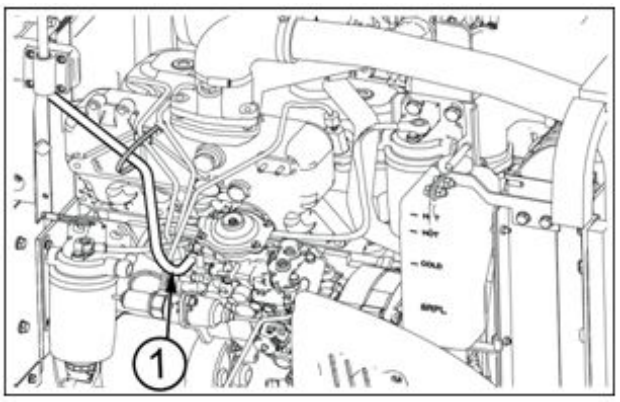
GNIL14TR02011AA 10

12. Loosen and remove the four bolts (two from each side) and remove the support bar **(2)**.



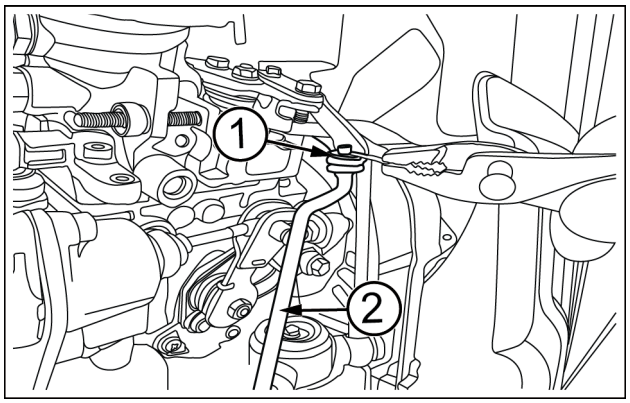
GNIL14TR02012AA 11

13. Loosen the hose clamp and disconnect the hose connecting Fuel Injection Pump (FIP) to fuel tank **(1)**.



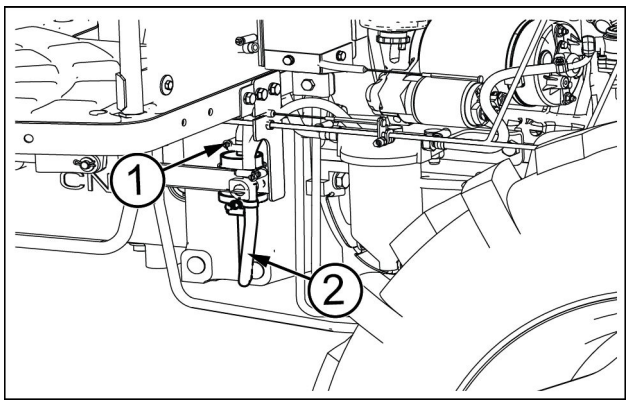
GNIL14TR02013AA 12

14. Remove split pin **(1)** and disconnect accelerator rod from FIP lever **(2)**.



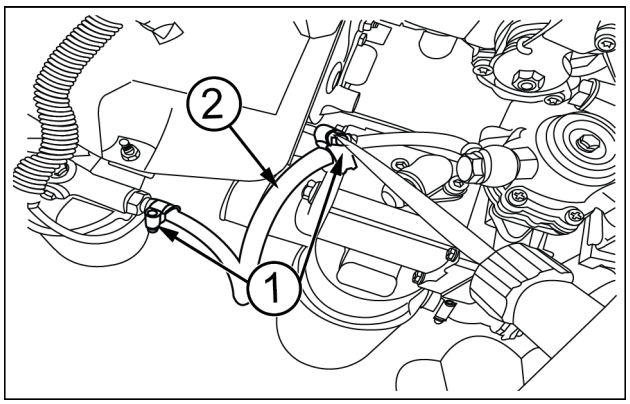
GNIL14TR02014AA 13

15. Loosen worm drive clamp of fuel suction flexible pipe **(1)** and disconnect the flexible pipe, connecting pre-filter to water separator **(2)**.



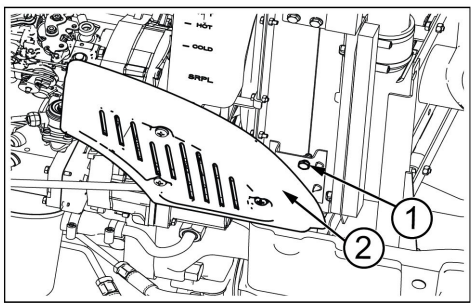
GNIL14TR02015AA 14

16. Loosen worm drive clamp of fuel suction flexible pipe **(1)** and disconnect the hose **(2)** connecting water separator to feed pump.



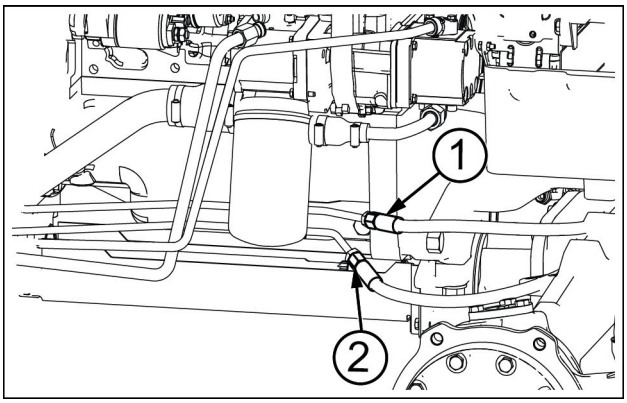
GNIL14TR02016AA 15

17. Loosen and remove the two bolts **(1)** from the bracket. Remove the side panel with bracket, mounted on radiator **(2)**.



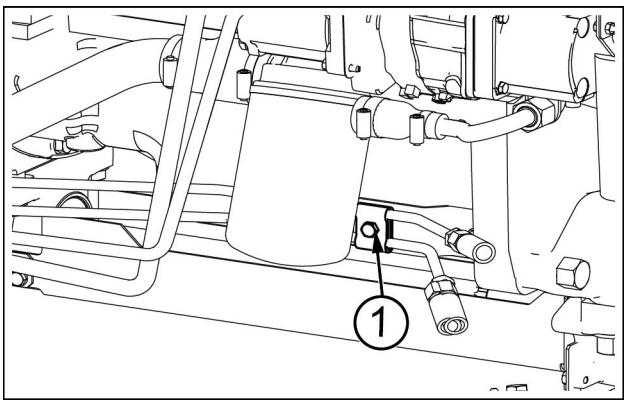
GNIL14TR02017AA 16

18. Disconnect the power steering pipe connecting steering pipes with steering cylinder (both ends) **(1)** & **(2)**.



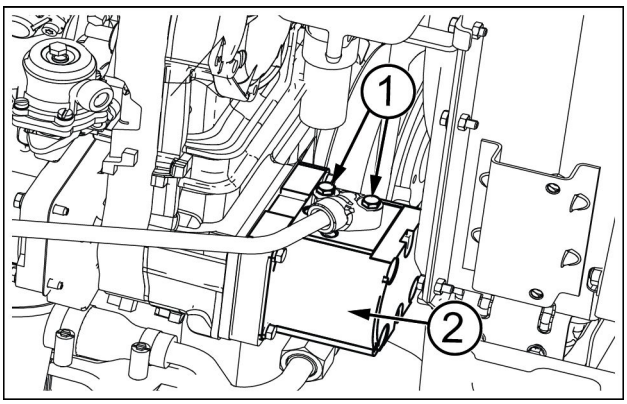
GNIL14TR02018AA 17

19. Loosen pipe clamp **(1)** holding the power steering pipes.



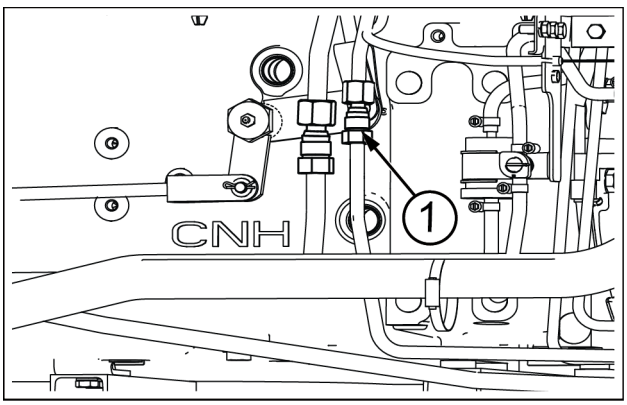
GNIL14TR02019AA 18

20. Loosen and remove the two bolts **(1)** and detach power steering delivery pipe from power steering pump **(2)**.



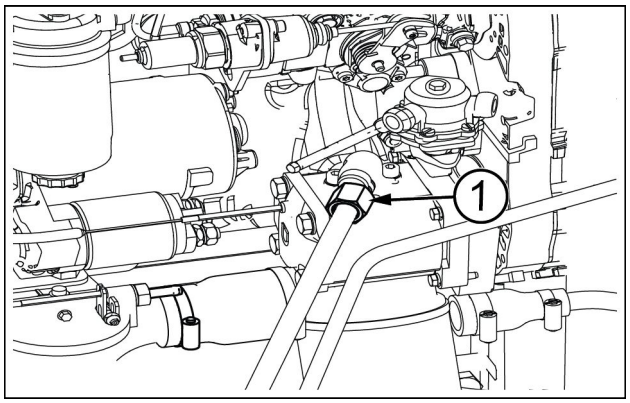
GNIL14TR02020AA 19

21. Detach power steering pipe **(1)**, connecting power steering motor and power steering pump.



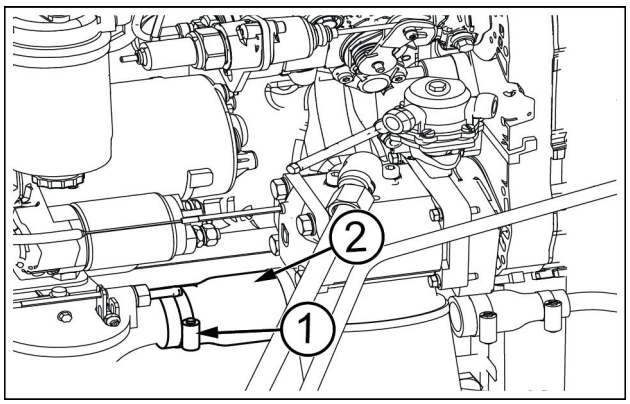
GNIL14TR02021AA 20

22. Loosen and remove the hollow nuts **(1)** ,from both ends, and disconnect the hydraulic delivery pipe from hydraulic pump.



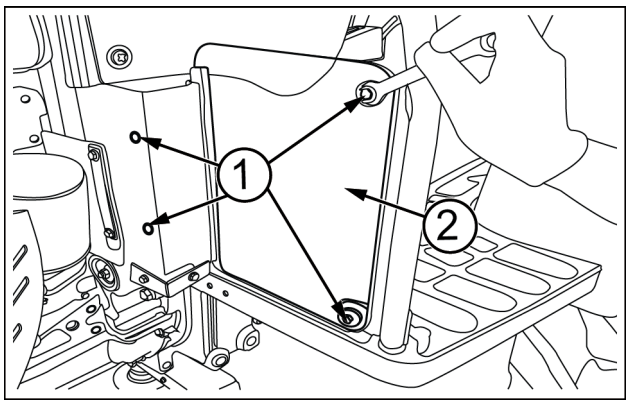
GNIL14TR02022AA 21

23. Loosen hose clamp **(1)**. Remove the hydraulic suction hose **(2)** connecting hydraulic pipe to hydraulic filter.



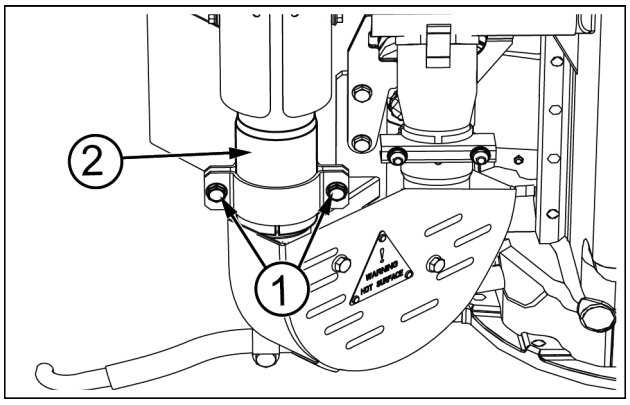
GNIL14TR02023AA 22

24. Loosen the 4 bolts **(1)** and remove shield **(2)** on LH side. Similarly remove the shield on RH side.
25. In case of Four-Wheel Drive (4WD), remove the propeller shaft and the shields. Refer drive lines section for removal details.
26. Remove the exhaust pipes referring to the “exhaus pipe removal” process
27. Cut the plastic clamp and take out complete center wiring to front side
28. remove wiring connections of alternator, sensor, WT relay, OPS, FIP and starter solenoid.



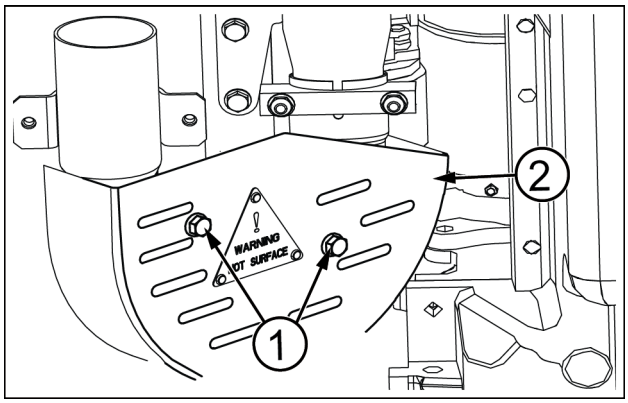
GNIL14TR02024AA 23

29. Loosen and remove the two clamp bolts **(1)** and remove muffler pipe **(2)**.



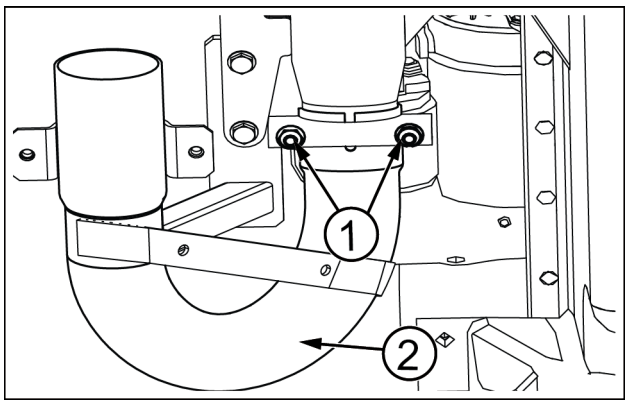
GNIL14TR02025AA 24

30. Loosen and remove the bolts **(1)**. Remove the heat shield **(2)**.



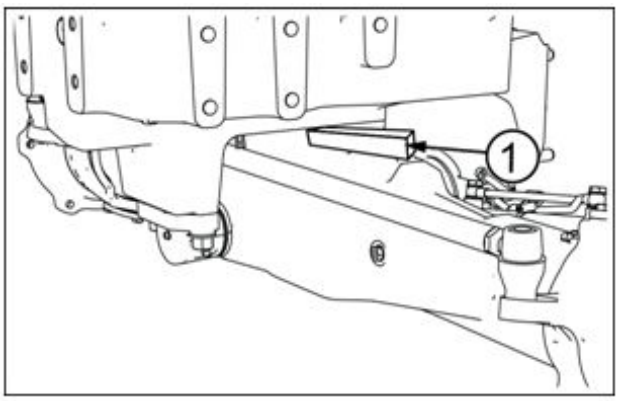
GNIL14TR02026AA 25

31. Loosen and remove the “U” clamp bolts **(1)**. Remove the muffler U -pipe **(2)**.



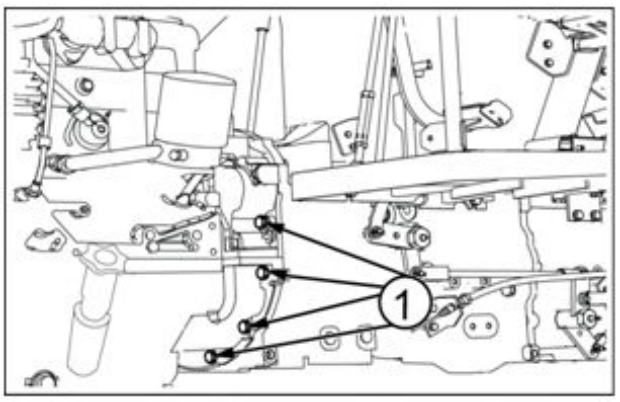
GNIL14TR02027AA 26

32. Separate the Four-Wheel Drive (4WD) shaft from the front axle (if fitted). See **Dropbox drive shaft - Remove (21.200)**.
33. Use wedge **(1)** between the axle and front axle support to prevent articulation.
34. Support front axle with a movable jack and rail and immovable screw jack below engine frame.



GNIL14TR02028AA 27

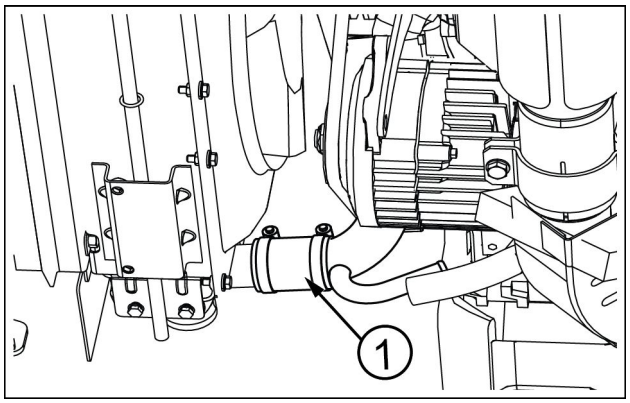
35. Remove the twelve buckle up bolts **(1)** between engine & master clutch housing. Pull the engine away using moving rail jack.



GNIL14TR02029AA 28

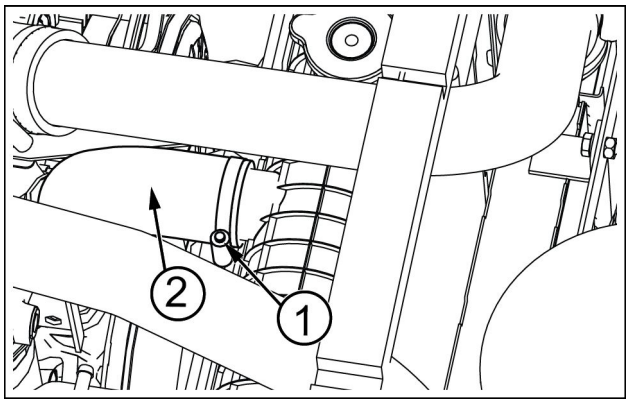
Separating the front axle from the engine

1. Loosen and remove the hose clamps and remove the bottom hose **(1)** from radiator to drain the coolant.



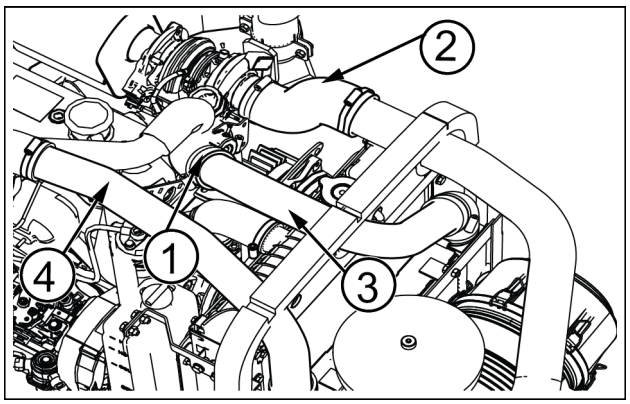
GNIL14TR02030AA 29

2. Detach radiator upper hose **(2)** by removing the hose clamp **(1)**



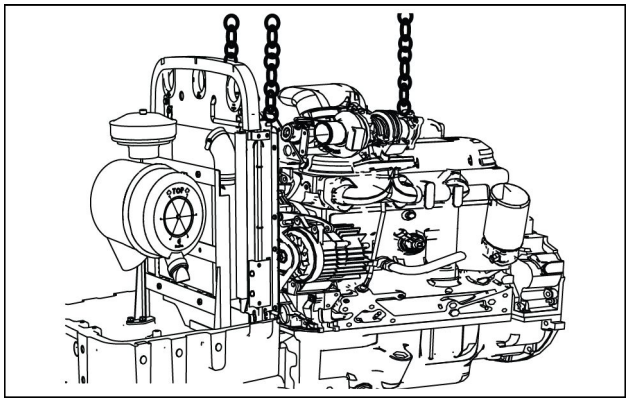
GNIL14TR02031AA 30

3. Loosen and remove the hose clamps **(1)**. Disconnect hose **(2)** from air cleaner to turbocharger. Turbocharger to after cooler **(3)**. Inter cooler to air intake **(4)**.



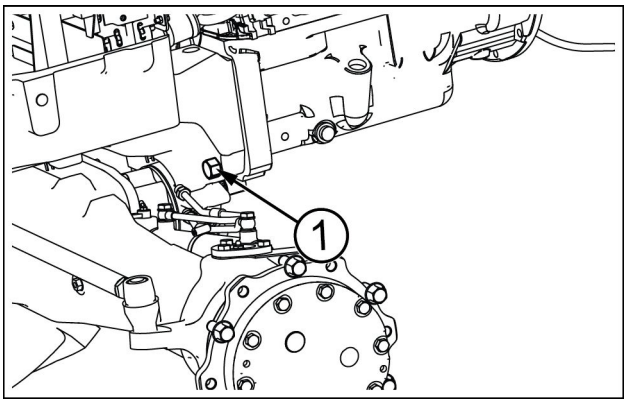
GNIL14TR02032AA 31

4. Connect the engine to a suitable hoist.



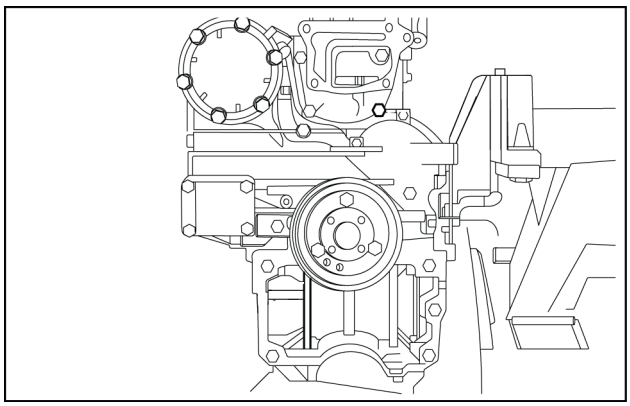
GNIL14TR02033AA 32

4. Remove the four buckle up bolts **(1)** coupling engine and front axle support. Separate it from the front axle.



GNIL14TR02034AA 33

5. Remove the engine from front axle carefully. Mount it on engine stand **380000301**.



NDIL14TR00042AA 34