WEBMTNV000

SHOP MANUAL

TNV

3D82AE SERIES
3D84E SERIES
3D88E SERIES
4D88E SERIES
4D98E SERIES
4D106 SERIES
S4D84E SERIES
S4D98E SERIES
S4D106 SERIES

DIESEL ENGINE

KOMATSU

Utility

WEBMTNV000

SHOP MANUAL

APPLICABLE MACHINE MODEL	ENGINE MODEL	
	YANMAR DESCRIPTION	KOMATSU DESCRIPTION
PC27R-8	3TNV82A-M5FA	3D82AE-5MFA
PC35R-8	3TNV88-N5FA	3D88E-5NFA
PC45R-8	4TNV88-N5FA	4D88E-5NFA
PC75R-2	4TNV98-X2FB	4D98E-2XFB
PW75R-2	4TNV98-X2FB	4D98E-2XFB
PC95R-2	4TNV106-S2FB	4D106-2SFB
PW95R-2	4TNV106-S2FB	4D1062SFB
PC110R-1	4TNV106T-W2FB	S4D106-2WFB
PW110R-1	4TNV106T-W2FB	S4D106-2WFB
SK510-5	3TNV84-K5FD	3D84E-5KFD
SK714-5	4TNV88-K5FD	4D88E-5KFD
SK815-5	4TNV88-K5FD	4D88E-5KFD
SK815-5 turbo	4TNV84T-K5FD	S4D84E-5KFD
SK818-5	4TNV88-K5FD	4D88E-5KFD
SK820-5 turbo	4TNV84T-K5FD	S4D84E-5KFD
SK1020-5	4TNV98-N2FE	4D98E-2NFE
SK1020-5 turbo	4TNV98T-N2FE	S4D98E-2NFE
SK1026-5 turbo	4TNV98T-N2FE	S4D98E-2NFE
WB70A-1	4TNV98-N2FA	4D98E-2NFA
WB98A-2	4TNV106T-S2FC	S4D106-2SFC
WB91R-2	4TNV106-S2FA	4D106-2SFA
WB93R-2	4TNV106T-S2FA	S4D106-2SFA
WB97R-2	4TNV106T-S2FA	S4D106-2SFA
WB97S-2	4TNV106T-S2FA	S4D106-2SFA
WB150AWS-2	4TNV106T-S2FA	S4D106-2SFA

PREFACE

This manual describes the service procedures for the TNV series engines of indirect injection system that have been certified by the US EPA, California ARB and/or the 97/68/EC Directive for industrial use.

Please use this manual for accurate, quick and safe servicing of the said engine. Since the explanation in this manual assumes the standard type engine, the specifications and components may partially be different from the engine installed on individual work equipment (power generator, pump, compressor, etc.). Please also refer to the service manual for each work equipment for details.

The specifications and components may be subject to change for improvement of the engine quality without notice. If any modification of the contents described herein becomes necessary, it will be notified in the form of correction information each time.

SAFETY LABELS

- Most accidents are caused by negligence of basic safety rules and precautions. For accident prevention, it is important to avoid such causes before development to accidents.
  Please read this manual carefully before starting repair or maintenance to fully understand safety precautions and appropriate inspection and maintenance procedures.
  Attempting at a repair or maintenance job without sufficient knowledge may cause an unexpected accident.

- It is impossible to cover every possible danger in repair or maintenance in the manual. Sufficient consideration for safety is required in addition to the matters marked ⚠ CAUTION. Especially for safety precautions in a repair or maintenance job not described in this manual, receive instructions from a knowledgeable leader.

- Safety marks used in this manual and their meanings are as follows:

⚠ DANGER **DANGER**-indicates an imminently hazardous situation, which, if not avoided, WILL result in death or serious injury.

⚠ WARNING **WARNING**-indicates a potentially hazardous situation, which, if not avoided, COULD result in death or serious injury.

⚠ CAUTION **CAUTION**-indicates a potentially hazardous situation, which, if not avoided, MAY result in minor or moderate injury.

- **NOTICE**-indicates that if not observed, the product performance or quality may not be guaranteed.

Safety Precautions

(1) SERVICE AREA

⚠ WARNING

● Sufficient Ventilation

Inhalation of exhaust fumes and dust particles may be hazardous to ones health. Running engines welding, sanding, painting, and polishing tasks should be only done in well ventilated areas.

⚠ CAUTION

● Safe / Adequate Work Area

The service area should be clean, spacious, level and free from holes in the floor, to prevent “slip” or “trip and fall” type accidents.

⚠ CAUTION

● Bright, Safely Illuminated Area

The work area should be well lit or illuminated in a safe manner. For work in enclosed or dark areas, a “drop cord” should be utilized. The drop cord must have a wire cage to prevent bulb breakage and possible ignition of flammable substances.

⚠ CAUTION

● Safety Equipment

Fire extinguisher(s), first aid kit and eye wash / shower station should be close at hand (or easily accessible) in case of an emergency.

(2) WORK – WEAR (GARMENTS

⚠ CAUTION

●Safe Work Clothing

Appropriate safety wear (gloves, special shoes/boots, eye/ear protection, head gear, harness', clothing, etc.) should be used/worn to match the task at hand. Avoid wearing jewelry, unbuttoned cuffs, ties or loose fitting clothes around moving machinery. A serious accident may occur if caught in moving/rotating machinery.

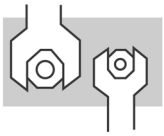
(3) TOOLS

⚠ WARNING

●Appropriate Lifting / Holding

When lifting an engine, use only a lifting device (crane, jack, etc.) with sufficient lifting capacity. Do not overload the device. Use only a chain, cable, or lifting strap as an attaching device. Do not use rope, serious injury may result.
To hold or support an engine, secure the engine to a support stand, test bed or test cart designed to carry the weight of the engine. Do not overload this device, serious injury may result.
Never run an engine without being properly secured to an engine support stand, test bed or test cart, serious injury may result.

⚠ CAUTION



●Appropriate Tools

Always use tools that are designed for the task at hand. Incorrect usage of tools may result in damage to the engine and or serious personal injury.

(4) GENUINE PARTS and MATERIALS

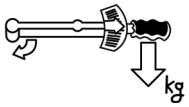
⚠ CAUTION

●Genuine Parts

Always use genuine parts or recommended parts and goods. Damage to the engine, shortened engine life and or personal injury may result.

(5) FASTENER TORQUE

⚠ WARNING



● Torqueing Fasteners

Always follow the torque values and procedures as designated in the service manual. Incorrect values, procedures and or tools may cause damage to the engine and or personal injury.

(6) Electrical

⚠ WARNING

● Short Circuits

Always disconnect the (-) Negative battery cable before working on the electrical system. An accidental “short circuit” may cause damage, fire and or personal injury. Remember to connect the (-) Negative battery cable (back onto the battery) last.
Fasten the terminals tightly.

⚠ WARNING

● Charging Batteries

Charging wet celled batteries produces hydrogen gas. Hydrogen gas is extremely explosive. Keep sparks, open flame and any other form of ignition away. Explosion may occur causing severe personal injury.

⚠ WARNING

● Battery Electrolyte

Batteries contain sulfuric acid. Do NOT allow it to come in contact with clothing, skin and or eyes, severe burns will result.

(7) WASTE MANAGEMENT

⚠ CAUTION

Observe the following instructions with regard to hazardous waste disposal. Negligence of these will have a serious impact on environmental pollution concerns.

1) Waste fluids such as lube oil, fuel and coolant shall be carefully put into separate sealed containers and disposed of properly.
2) Do NOT dispose of waste materials irresponsibly by dumping them into the sewer, overland or into natural waterways.
3) Waste materials such as oil, fuel, coolant, solvents, filter elements and batteries, must be disposed of properly according to local ordinances. Consult the local authorities or reclamation facility.

(8) FURTHER PRECAUTIONS

⚠ WARNING

● Fueling / Refueling

Keep sparks, open flames or any other form of ignition (match, cigarette, etc.) away when fueling/refueling the unit. *Fire and or an explosion may result.*

⚠ WARNING

● Hot Surfaces.

Do NOT touch the engine (or any of its components) during running or shortly after shutting it down. *Scalding / serious burns may result.* Allow the engine to cool down before attempting to approach the unit.

⚠ WARNING

● Rotating Parts

Be careful around moving/rotating parts. Loose clothing, jewelry, ties or tools may become entangled causing damage to the engine and or severe personal injury.

⚠ WARNING

● Preventing burns from scalding

1) Never open the radiator filler cap shortly after shutting the engine down.
   Steam and hot water will spurt out and seriously burn you. Allow the engine to cool down before attempt to open the filler cap.
2) Securely tighten the filler cap after checking the radiator.
   Steam can spurt out during engine running, if tightening loose.

Precautions for Service Work

(1) Precautions for Safety

Read the safety precautions given at the beginning of this manual carefully and always mind safety in work.

(2) Preparation for Service Work

Preparation is necessary for accurate, efficient service work. Check the customer ledger file for the history of the engine.

- Preceding service date
- Period/operation hours after preceding service
- Problems and actions in preceding service
- Replacement parts expected to be required for service
- Recording form/check sheet required for service

(3) Preparation before Disassembly

- Prepare general tools, special service tools, measuring instruments, oil, grease, non-reusable parts, and parts expected to be required for replacement.
- When disassembling complicated portions, put match-marks and other marks at places not adversely affecting the function for easy reassembly.

(4) Precautions in Disassembly

- Each time a parts is removed, check the part installed state, deformation, damage, roughening, surface defect, etc.
- Arrange the removed parts orderly with clear distinction between those to be replaced and those to be used again.
- Parts to be used again shall be washed and cleaned sufficiently.
- Select especially clean locations and use clean tools for disassembly of hydraulic units such as the fuel injection pump.

(5) Precautions for Inspection and Measurement

Inspect and measure parts to be used again as required to determine whether they are reusable or not.

(6) Precautions for Reassembly

- Reassemble correct parts in correct order according to the specified standards (tightening torques, and adjustment standards). Apply oil important bolts and nuts before tightening when specified.
- Always use genuine parts for replacement.
- Always use new oil seals, O-rings, packing and cotter pins.
- Apply sealant to packing depending on the place where they are used. Apply of grease to sliding contact portions, and apply grease to oil seal lips.

(7) Precautions for Adjustment and Check

Use measuring instruments for adjustment to the specified service standards.

How to Read this Manual

(1) Range of Operation Explanation

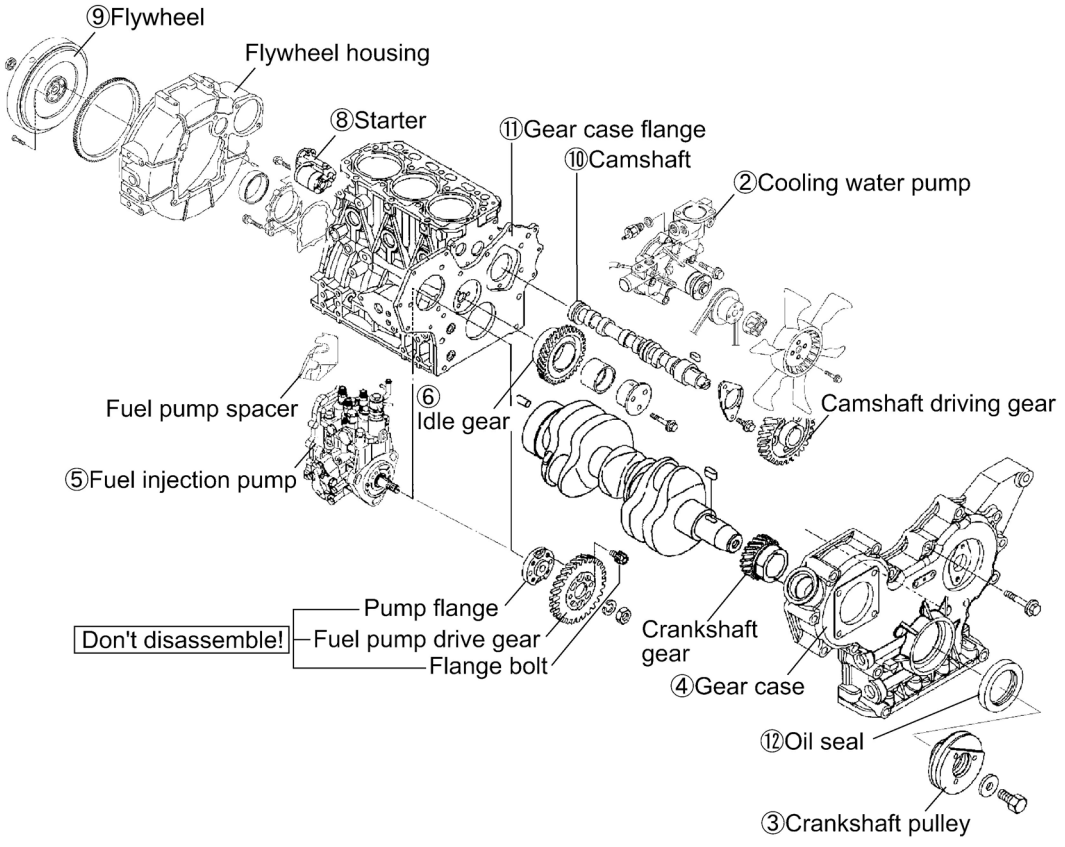
This manual explains the troubleshooting, installation/removal, replacement, disassemble/reassembly, inspection, adjustment and adjusting operation procedures for the TNV series engines with direct injection system.

Refer to the manufacturer’s manual for each of the fuel injection pump, governor, starting motor and alternator except for their installation.

(2) How to Read the Explanations

- An exploded view, sectional views, a system diagram, etc. are shown at the beginning of each section as required for easy understanding of the mounted states of the components.
- For the removal/installation of each part, the procedure is shown with the procedural step No. in the illustration.
- Precautions and key points for disassembly and reassembly of parts are described as **points**. In the explanation for each point, detailed operation method, information, standard and precautions are described.

Description Example



Note) This figure shows the 3TNV84.

The job contents are described in the disassembly procedure for Nos. not shown in the illustration.

- Disassembly procedure

1) Follow steps (1) to (15) of the cylinder head disassembly procedure.
2) Remove the cooling water pump.
3) Remove the crankshaft pulley. (**Point 1**) ← Operation point to be explained on a later page.

- Operation points

Disassemble: Service point for removal
Reassemble: Service point for installation
Disassemble-Reassemble: Service point required in both removal and installation.

- Contents omitted in this manual
  Though the following jobs are omitted in the explanation in this manual, they should be conducted in actual work:
  3) Jacking up and lifting
  4) Cleaning and washing of removed parts as required
  5) Visual inspection

(3) Definition of Terms

[NOTICE]: Instruction whose negligence is very likely to cause an accident. Always observe it.

Standard: Allowable range for inspection and adjustment.

Limit: The maximum or minimum value that must be satisfied during inspection or adjustment.

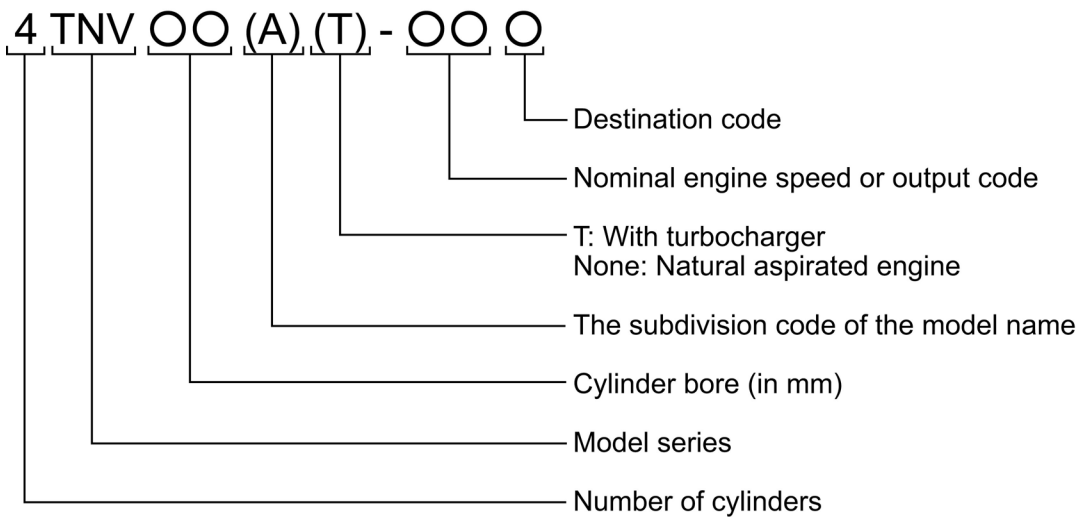
(4) Abbreviations

Abbreviation	Meaning	Abbreviation	Meaning
Assy	assembly	T.D.C.	top dead center
Sub-Assy	sub-assembly	B.D.C.	bottom dead center
a.T.D.C	after top dead center	OS	oversize
b.T.D.C	before top dead center	US	undersize
STD	Standard	Min^{-1}	revolutions per minute
IN	Intake	PS	Output (metric horsepower)
EX	Exhaust	T	Bolt/nut tightening torque

CONTENTS

1. General

1.1 Engine Nomenclature



The engine specification class

Classification	Load	Engine speed	Available engine speed (min^{-1})
CL	Constant load	Constant speed	1500/1800
VM	Variable load	Variable speed	2000-3000

※ The engine specification class (CL or VM) is described in the specifications table.

1.2 Specifications

NOTE:

1) The information described in the engine specifications tables (the next page and after) is for "standard" engine. To obtain the information for the engine installed in each machine unit, refer to the manual provided by the equipment manufacturer.
2) Engine rating conditions are as follows (SAE J1349, ISO 3046/1)
   - Atmospheric condition: Room temp. 25℃, Atmospheric press. 100 kPa (750mm Hg), Relative humidity 30%
   - Fuel temp: 25℃ (Fuel injection pump inlet)
   - With cooling fan, air cleaner, exhaust silencer.
   - After running-in hours. Output allowable deviation: ±3%

(1) 3TNV82A

Engine name		Unit	3TNV82A								
Engine specification class		-	CL	VM							
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine								
Combustion chamber		-	Direct injection								
Number of cylinders		-	3								
Cylinder bore×stroke		mm×mm	82×84								
Displacement		L	1.331								
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-						
	Output	kW (hp)	9.9 (13.5)	12.0 (16.3)	-						
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500	2600	2800	3000
	Output	kW (hp)	11.0 (14.9)	13.2 (17.9)	14.6 (19.9)	16.0 (21.8)	17.5 (23.8)	18.2 (24.8)	19.0 (25.8)	20.4 (27.8)	21.9 (29.8)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2375	2570	2675	2780	2995	3180
Ignition order		-	1-3-2-1(No.1 cylinder on flywheel side)								
Power take off		-	Flywheel								
Direction of rotation		-	Counterclockwise (viewed from flywheel)								
Cooling system		-	Radiator								
Lubrication system		-	Forced lubrication with trochoid pump								
Starting system		-	Electric								
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)								
Applicable lubricant		-	API grade class CD or CF								
Lubricant capacity (oil pan) *	Total	L	3.6							5.5	
	Effective	L	1.2							2.2	
Coolant water capacity (engine only)		L	1.8								
Engine Dimensions ** (with flyw Crankshaft V pulley diameter & heel housing)	Overall length	mm	553	528							
	Overall width	mm	489								
	Overall height	mm	565								
Engine mass (dry) ** (with flywheel housing)		kg	138	128							
Cooling fan (std.)		mm	335 mm O/D, 6 blades pusher type								
Fun V pulley diameter (std.)		mm	120×90	110×110							

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(2) 3TNV84

Engine name		Unit	3TNV84								
Engine specification class		-	CL		VM						
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine								
Combustion chamber		-	Direct injection								
Number of cylinders		-	3								
Cylinder bore×stroke		mm×mm	84×90								
Displacement		L	1.496								
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-						
	Output	kW (hp)	11.3 (15.3)	13.5 (18.3)	-						
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500	2600	2800	3000
	Output	kW (hp)	12.4 (16.8)	14.8 (20.1)	16.4 (22.3)	18.1 (24.6)	19.7 (26.8)	20.5 (27.9)	21.3 (29.0)	23.0 (31.3)	24.6 (33.5)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400	2590	2690	2810	2995	3210
Ignition order		-	1-3-2-1(No.1 cylinder on flywheel side)								
Power take off		-	Flywheel								
Direction of rotation		-	Counterclockwise (viewed from flywheel)								
Cooling system		-	Radiator								
Lubrication system		-	Forced lubrication with trochoid pump								
Starting system		-	Electric								
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)								
Applicable lubricant		-	API grade class CD								
Lubricant capacity (oil pan) *	Total	L	6.7								
	Effective	L	1.9								
Coolant water capacity (engine only)		L	1.8								
Engine dimensions ** (with flywheel housing)	Overall length	mm	589	564							
	Overall width	mm	486								
	Overall height	mm	622								
Engine mass (dry) ** (with flywheel housing)		kg	161	155							
Cooling fan (std.)		mm	335 mm O/D, 6 blades pusher type								
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	120×90	110×110							

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(3) 3TNV84T

Engine name		Unit	3TNV84T								
Engine specification class		-	CL	VM							
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine								
Combustion chamber		-	Direct injection								
Number of cylinders		-	3								
Cylinder bore×stroke		mm×mm	84×90								
Displacement		L	1.496								
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-						
	Output	kW (hp)	14.0 (19.0)	16.5 (22.5)	-						
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500	2600	2800	3000
	Output	kW (hp)	15.8 (21.5)	18.8 (25.5)			25.0 (34.0)	25.9 (35.2)	26.8 (36.5)	29.1 (39.5)	30.9 (42.0)
Max. no-load speed (±25)		min^{-1}	1600	1895				2590	2700	2810	2995	3210
Ignition order		-	1-3-2-1(No.1 cylinder on flywheel side)								
Power take off		-	Flywheel								
Direction of rotation		-	Counterclockwise (viewed from flywheel)								
Cooling system		-	Radiator								
Lubrication system		-	Forced lubrication with trochoid pump								
Starting system		-	Electric								
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (cetane No.45 min.)								
Applicable lubricant		-	API grade class CD or CF								
Lubricant capacity (oil pan) *	Total	L	6.7								
	Effective	L	1.9								
Coolant water capacity (engine only)		L	2.0								
Engine dimensions ** (with flywheel housing)	Overall length	mm	589	564							
	Overall width	mm	486								
	Overall height	mm	622								
Engine mass (dry) ** (with flywheel housing)		kg	161	155							
Cooling fan (std.)		mm	350 mm O/D, 6 blades pusher type								
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	120×90	110×110							

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(4) 3TNV88

Engine name		Unit	3TNV88								
Engine specification class		-	CL		VM						
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine								
Combustion chamber		-	Direct injection								
Number of cylinders		-	3								
Cylinder bore×stroke		mm× mm	88×90								
Displacement		L	1.642								
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-						
	Output	kW (hp)	12.3 (16.7)	14.8 (20.1)	-						
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500	2600	2800	3000
	Output	kW (hp)	13.5 (18.4)	16.3 (22.1)	18.0 24.5)	19.9 (27.0)	21.6 (29.4)	22.6 (30.7)	23.5 (31.9)	25.2 (34.2)	27.1 (36.8)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400	2590	2700	2810	2995	3210
Ignition order		-	1-3-2-1(No.1 cylinder on flywheel side)								
Power take off		-	Flywheel								
Direction of rotation		-	Counterclockwise (viewed from flywheel)								
Cooling system		-	Radiator								
Lubrication system		-	Forced lubrication with trochoid pump								
Starting system		-	Electric								
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)								
Applicable lubricant		-	API grade class CD or CF								
Lubricant capacity (oil pan) *	Total	L	4.7								7.2
	Effectiv e	L	1.8								3.5
Coolant water capacity (engine only)		L	2.0								
Engine dimensions ** (with flywheel housing)	Overall length	mm	589			564					
	Overall width	mm	486								
	Overall height	mm	622								
Engine mass (dry) ** (with flywheel housing)		kg	155								
Cooling fan (std.)		Mm	350 mm O/D, 6 blades pusher type								
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		Mm	120×90			120×90					

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(5) 4TNV84

Engine name		Unit	4TNV84								
Engine specification class		-	CL		VM						
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine								
Combustion chamber		-	Direct injection								
Number of cylinders		-	4								
Cylinder bore×stroke		mm× mm	84×90								
Displacement		L	1.995								
Continuous Rating	Revolving speed	Min^{-1}	1500	1800	-						
	Output	kW (hp)	14.9 (20.3)	17.7 (24.1)	-						
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500	2600	2800	3000
	Output	kW (hp)	16.4 (22.3)	19.5 (26.5)	21.9 (29.8)	24.1 (32.8)	26.3 (35.8)	27.4 (37.3)	28.5 (38.7)	30.7 41.7)	32.9 (44.7)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400	2590	2700	2810	2995	3210
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)								
Power take off		-	Flywheel								
Direction of rotation		-	Counterclockwise (viewed from flywheel)								
Cooling system		-	Radiator								
Lubrication system		-	Forced lubrication with trochoid pump								
Starting system		-	Electric								
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (cetane No.45 min.)								
Applicable lubricant		-	API grade class CD or CF								
Lubricant capacity (oil pan) *	Total	L	7.4								
	Effective	L	2.3								
Coolant water capacity (engine only)		L	2.7								
Engine dimensions ** (with flywheel housing)	Overall length	mm	683	658							
	Overall width	mm	498.5								
	Overall height	mm	617								
Engine mass (dry) ** (with flywheel housing)		kg	183	170							
Cooling fan (std.)		mm	370 mm O/D, 6 blades pusher type								
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	120×90	110×110							

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(6) 4TNV84T

Engine name		Unit	4TNV84T							
Engine specification class		-	CL		VM					
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine							
Combustion chamber		-	Direct injection							
Number of cylinders		-	4							
Cylinder bore×stroke		mm×mm	84×90							
Displacement		L	1.995							
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-					
	Output	KW (hp)	19.1 (26.0)	24.3 (33.0)	-					
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2600	2800	3000
	Output	KW (hp)	21.3 (29.0)	26.9 (36.5)	27.9 (38.0)	30.5 (41.5)	33.5 (45.5)	35.7 (48.5)	38.6 (52.5)	41.2 (56.0)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400	2590	2810	2995	3210
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)							
Power take off		-	Flywheel							
Direction of rotation		-	Counterclockwise (viewed from flywheel)							
Cooling system		-	Radiator							
Lubrication system		-	Forced lubrication with trochoid pump							
Starting system		-	Electric							
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)							
Applicable lubricant		-	API grade class CD or CF							
Lubricant capacity (oil pan) *	Total	L	7.4							
	Effective	L	3.4							
Coolant water capacity (engine only)		L	2.7							
Engine dimensions **	Overall length	mm	683	649						
	Overall width	mm	498.5							
	Overall height	mm	713							
Engine mass (dry) ** (with flywheel housing)		kg	183	170						
Cooling fan (std.)		mm	370 mm O/D, 6 blades pusher type							
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	120×90	110×110						

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(7) 4TNV88

Engine name		Unit	4TNV88								
Engine specification class		-	CL		VM						
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine								
Combustion chamber		-	Direct injection								
Number of cylinders		-	4								
Cylinder bore×stroke		mm×mm	88×90								
Displacement		L	2.190								
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-						
	Output	kW (hp)	16.4 (22.3)	19.6 (26.7)	-						
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500	2600	2800	3000
	Output	kW (hp)	18.0 (24.5)	21.6 (29.4)	24.1 (32.7)	26.5 (36.0)	28.8 (39.2)	30.1 (40.9)	31.3 (42.5)	33.7 (45.8)	35.4 (48.1)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400	2590	2700	2810	2995	3210
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)								
Power take off		-	Flywheel								
Direction of rotation		-	Counterclockwise (viewed from flywheel)								
Cooling system		-	Radiator								
Lubrication system		-	Forced lubrication with trochoid pump								
Starting system		-	Electric								
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (cetane No.45 min.)								
Applicable lubricant		-	API grade class CD or CF								
Lubricant capacity (oil pan) *	Total	L	5.8								8.6
	Effective	L	2.3								4.2
Coolant water capacity (engine only)		L	2.7								
Engine dimensions ** (with wheel housing)	Overall engthh	mm	683		658						
	Overall width	mm	498.5								
	Overall height	mm	618								
Engine mass (dry) ** (with flywheel housing)		kg	183		170						
Cooling fan (std.)		mm	370 mm O/D, 6 blades pusher type								
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	120×90		110×110						

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(8) 4TNV94L

Engine name		Unit	4TNV94L					
Engine specification class		-	CL		VM			
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine					
Combustion chamber		-	Direct injection					
Number of cylinders		-	4					
Cylinder bore×stroke		mm×mm	94×110					
Displacement		L	3.053					
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-			
	Output	kW (hp)	26.1 (35.5)	31.3 (42.5)	-			
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500
	Output	kW (hp)	29.1 (39.5)	34.6 (47.0)	35.3 (48.0)	38.2 (52.0)	41.6 (56.5)	43.0 (58.5)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400	2590	2700
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)					
Power take off		-	Flywheel					
Direction of rotation		-	Counterclockwise (viewed from flywheel)					
Cooling system		-	Radiator					
Lubrication system		-	Forced lubrication with trochoid pump					
Starting system		-	Electric					
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
Applicable lubricant		-	API grade class CD or CF					
Lubricant capacity (oil pan) *	Total	L	10.2					
	Effective	L	4.5					
Coolant water capacity (engine only)		L	4.2					
Engine dimensions ** (with flywheel housing)	Overall length	mm	719					
	Overall width	mm	498					
	Overall height	mm	717					
Engine mass (dry) ** (with flywheel housing)		kg	245 (equivalent to SAE#3)		235 (equivalent to SAE#4)			
Cooling fan (std.)		mm	410 mm O/D, 6 blades pusher type					
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	130×130					

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(9) 4TNV98

Engine name		Unit	4TNV98					
Engine specification class		-	CL		VM			
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine					
Combustion chamber		-	Direct injection					
Number of cylinders		-	4					
Cylinder bore×stroke		mm×mm	98×110					
Displacement		L	3.318					
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-			
	Output	kW (hp)	30.9 (42.0)	36.8 (50.0)	-			
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500
	Output	kW (hp)	34.6 (47.0	41.2 (56.0)	41.9 (57.0)	45.6 (62.0)	49.3 (67.0)	51.1 (69.5)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400	2590	2700
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)					
Power take off		-	Flywheel					
Direction of rotation		-	Counterclockwise (viewed from flywheel)					
Cooling system		-	Radiator					
Lubrication system		-	Forced lubrication with trochoid pump					
Starting system		-	Electric					
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
Applicable lubricant		-	API grade class CD or CF					
Lubricant capacity (oil pan) *	Total	L	10.2					
	Effective	L	4.5					
Coolant water capacity (engine only)		L	4.2					
Engine dimensions ** (with flywheel housing)	Overall length	mm	719					
	Overall width	mm	498					
	Overall height	mm	717					
Engine mass (dry) ** (with flywheel housing)		kg	248 (equivalent to SAE#3)		235 (equivalent to SAE#4)			
Cooling fan (std.)		mm	410 mm O/D, 6 blades pusher type					
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	130×130					

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(10) 4TNV98T

Engine name		Unit	4TNV98T						
Engine specification class		-	CL		VM				
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine						
Combustion chamber		-	Direct injection						
Number of cylinders		-	4						
Cylinder bore×stroke		mm×mm	88×110						
Displacement		L	3.318						
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-				
	Output	kW (hp)	37.9 (51.5)	45.6 (62.0)	-				
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500	2600
	Output	kW (hp)	41.9 (57.0)	50.4 (68.5)	50.7 (69.0)	55.5 (75.5)	60.3 (82.0)	62.5 (85.0)	64.0 (87.0)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400	2590	2700	2810
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)						
Power take off		-	Flywheel						
Direction of rotation		-	Counterclockwise (viewed from flywheel)						
Cooling system		-	Radiator						
Lubrication system		-	Forced lubrication with trochoid pump						
Starting system		-	Electric						
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (cetane No.45 min.)						
Applicable lubricant		-	API grade class CD or CF						
Lubricant capacity (oil pan) *	Total	L	10.2						
	Effective	L	4.5						
Coolant water capacity (engine only)		L	4.2						
Engine dimensions ** (with flywheel housing)	Overall length	mm	715						
	Overall width	mm	575						
	Overall height	mm	779						
Engine mass (dry) ** (with flywheel housing)		kg	258 (equivalent to SAE#3)		245 (equivalent to SAE#4)				
Cooling fan (std.)		mm	430 mm O/D, 8 blades suction type						
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	130×130						

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(11) 4TNV106

Engine name		Unit	4TNV106					
Engine specification class		-	CL		VM			
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine					
Combustion chamber		-	Direct injection					
Number of cylinders		-	4					
Cylinder bore×stroke		mm×mm	106×125					
Displacement		L	4.412					
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-			
	Output	kW (hp)	41.2 (56.0)	49.3 (67.0)	-			
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200	2400	2500
	Output	kW (hp)	45.6 (62.0	54.4 (74.0)	56.6 (77.0)	61.4 (83.5)	65.5 (89.0)	67.7 (92.0)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400	2590	2700
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)					
Power take off		-	Flywheel					
Direction of rotation		-	Counterclockwise (viewed from flywheel)					
Cooling system		-	Radiator					
Lubrication system		-	Forced lubrication with trochoid pump					
Starting system		-	Electric					
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)					
Applicable lubricant		-	API grade class CD or CF					
Lubricant capacity (oil pan) *	Total	L	14.0					
	Effective	L	9.0		7.5			
Coolant water capacity (engine only)		L	6.0					
Engine dimensions ** (with flywheel housing)	Overall length	mm	808		776			
	Overall width	mm	629		629			
	Overall height	mm	803		803			
Engine mass (dry) ** (with flywheel housing)		kg	345 (equivalent to SAE#3)		330 (equivalent to SAE#3)			
Cooling fan (std.)		mm	500 mm O/D, 7 blades pusher type		500 mm O/D, 7 blades suction type			
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	150×150					

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

(12) 4TNV106T

Engine name		Unit	4TNV106T			
Engine specification class		-	CL		VM	
Type		-	Vertical, in-line, 4-cycle, water-cooled diesel engine			
Combustion chamber		-	Direct injection			
Number of cylinders		-	4			
Cylinder bore×stroke		mm×mm	106×125			
Displacement		L	4.412			
Continuous rating	Revolving speed	Min^{-1}	1500	1800	-	
	Output	kW (hp)	51.5 (70.0)	61.8 (84.0)	-	
Rated output	Revolving speed	Min^{-1}	1500	1800	2000	2200
	Output	kW (hp)	56.8 (77.2	68.0 (92.5)	69.9 (95.0)	72.0 (97.9)
Max. no-load speed (±25)		min^{-1}	1600	1895	2180	2400
Ignition order		-	1-3-4-2-1(No.1 cylinder on flywheel side)			
Power take off		-	Flywheel			
Direction of rotation		-	Counterclockwise (viewed from flywheel)			
Cooling system		-	Radiator			
Lubrication system		-	Forced lubrication with trochoid pump			
Starting system		-	Electric			
Applicable fuel		-	Diesel oil-ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.45 min.)			
Applicable lubricant		-	API grade class CD or CF			
Lubricant capacity (oil pan) *	Total	L	14.0			
	Effective	L	9.0		7.5	
Coolant water capacity (engine only)		L	6.0			
Engine dimensions ** (with flywheel housing)	Overall length	mm	808		776	
	Overall width	mm	629		628.6	
	Overall height	mm	866		866	
Engine mass (dry) ** (with flywheel housing)		kg	355 (equivalent to SAE#3)		340 (equivalent to SAE#3)	
Cooling fan (std.)		mm	500 mm O/D, 7 blades pusher type		500 mm O/D, 7 blades suction type	
Crankshaft V pulley diameter & Fun V pulley diameter (std.)		mm	150×150			

* Engine oil capacity may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

1.3 Fuel Oil, Lubricating Oil and Coolant Water

1.3.1 Fuel oil

IMPORTANT:
Only use the recommended fuel to obtain the best engine performance and prevent damage of parts, also prevent air pollution.

(1) Selection of fuel oil

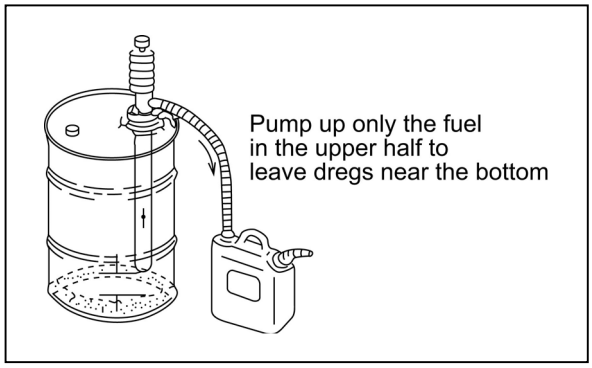
Use the following diesel fuels for best engine performance:
BS 2869 A1 or A2

Fuels equivalent to Japanese Industrial Standard, JIS. No. K2204-2

Fuel cetane number should be 45 or greater

(2) Fuel handling

- Water and dust in the fuel oil can cause operation failure. Use containers which are clean inside to store fuel oil. Store the containers away from rain water and dust.
- Before supplying fuel, let the fuel container rest for several hours so that water and dust in the fuel are deposited on the bottom. Pump up only the clean fuel.



(3) Fuel tank

Be sure to attach a drain cock, precipitation trap and primary strainer to the fuel tank as shown illustration right.