95/100 Series Engine Operation Manual

Manual de Operación Motores Serie 95 & 100

REMINGTON® DIESEL

Motores Diesel Remington

Remington Diesel Engines

www.remingtonengines.com

IMPORTANTE: Adicional a estos términos y condiciones de garantía, aplican tambien todas las condiciones y se deben seguir todas las instrucciones, detalladas en el Manual Original de Fábrica entregado con su equipo. Todos los términos de garantía estan sujetos a las condiciones y limitaciones detalladas a continuación en este Manual.

Content

Chapter 1

Description

Remington 495-2100-4100 series high speed diesel engine are based on the Ricardo engine patent, for direct injection method, according to the operation method of the main and auxiliaries of the marine diesel engine, optimizing so its operation with radiator cooling system for land systems operation. The Rated Power is similar to the marine main engine rating for continuous operation.

Chapter 2

Diesel Engine Operation and Hints

- ✓ Every Diesel engine is tested at our factory during several hours according to ISO standards, and submitted to extreme temperatures and overload.
- ✓ Do not use bad quality or unclear fuel and oil.
- ✓ Use the only diesel engine coolant in the radiator. Avoid tap water and never use seawater.
- ✓ Don not to operate without an air filter in good conditions and clear of dust.
- ✓ Do not operate or start the engine unless the oil and coolant levels are at its full level.
- ✓ Do not work at long time overload and such against work regulation.
- ✓ Do no test the alternator or any electric parts by short circuit method.
- ✓ Control the electric starting time and spacing between starting attempts.
- ✓ Apply technical maintenance at fixed periods.
- ✓ Drain out the cooling water to prevent the cylinder frost cracking at the ambient temperature lower 0 ℃.
- ✓ Inject hot water and oil at the ambient temperature lower than -5℃.
- ✓ Do some test run as describe in the next chapters before using the new engine.
- ✓ Do not speed up the engine suddenly and run with load, after the engine has been started without load. Acceleration must be done slowly.
- ✓ Identify the safety mark at engine operation.
- ✓ Follow all the recommendations and security steps as instructed by your local technical support.

Pay attention to all the above advices.

Chapter 3

Diesel Engine Safety Operation Specification

1. The operator should read the Maintenance Manual and know well about the structure, operation and maintenance.
2. One who is not familiar with the operation instructions is not allowed to operate the engine.
3. The engine is not permitted to be started unless the preparation protocol for the engine starting has been completed.
4. Attention to the fire protection at the engine running, the fuel tank should be providing a fire prevention device.
5. While the engine is operating, it is not permitted to be dismantled, checked and adjusted.
6. Apply the emergency stop of the engine, when the oil pressure is lower or even falls to zero, or with abnormal sound inside while engine running.
7. Once the engine over-speeds suddenly due to out of control, push the stop lever immediately to stop the engine, then check the cause and remedy the fault. If the stop lever is out of order, push down the decompression lever or block up the air inlet port to stop the engine.
8. The circuit system should be altered only by the technical support.
9. The engine should be used in a well ventilated area to prevent the exhaust gas pollute the working environment.

Chapter 4

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4.1 Engine Main Techincal Specification

Model	495/4100
Type	In line, water cooling, 4 stroke, wet cylinder, direct injecting combustion chamber, electrical starting
Intake	Naturally or turbocharged or after-cooled.
Turbocharged System	Stable pressure type
Lubricating System	pressure, splash combined type
Cooling System	Liquid cooling (Water or Coolant)
Crankshaft rotation	Inverse (face to the flywheel)
Cylinder no.	2 (2100) or 4 (495 & 4100)
Bore X stroke mm	95 x 115 (95 Series) / 100 X115 (100 Series)
Displacement L	1.77L (2100) / 3.26L (495) / 3.54L (4100)
Pressure ratio	naturally type：17:1 / turbocharged type：16:1
Firing order	1-3-4-2
Rated output kW	18kW (2100) / 31kW (495) / 36kW (4100)
Rated speed r/min	1800
Highest speed r/min	1900
Average effective pressure kPa	650
Fuel consumption g/kW.h	Naturally ≤239 Turbocharged ≤232 Turbocharged and after-cooled：≤218
Oil consumption g/kW.h	≤1.63（after run in）
Lowest load stable speed	1200 r/min
Lowest ldling stable speed	550 r/min

4.2 Engine technical Data

(At 12 hours power rating）

- Lubricating Oil Temperature:
  - Naturally ≤ 95°C, turbocharged ≤ 105°C
- Outlet water temperature ≤ 95°C
- Main oil passage oil pressure: 0.30~0.50MP

  (idle≥0.10MPa)
- Exhaust gas temperature : ≤600 (at manifold branch)
- Injection pressure: 21±1.0Mpa
- Tightening Torques of main bolts and nuts:
  - Cylinder head bolts: 130±10N.m
  - Main bearing bolts: 150±10N.m
  - Connecting rod bolts: 110±10N.m
  - Flywheel bolts: 110±10N.m
  - Crank Pulley bolts: 130±10N.m
- Valve clearance(cooled):
  - Intake valve: 0.30~0.40mm
  - Exhaust valve: 0.40~0.50mm
- Main adjustment values:
  - Compression clearance: 1.0 ~ 1.20mm
  - Commencement of fuel injection (in rank angel) \

1500~2200r/min type: 17±2°

- Valve timing(in crank angel)
  - Intake valve opens: before TDC 12°
  - Intake valve closes: after BDC 38°
  - Exhaust valve opens: Before BDC 55°
  - Exhaust valve closes: After TDC 12°

4.2 Fit Clearances and Wear Limit of Main Parts

No.	Description			Clearances (mm)	Wear limits (mm)
1	Main journal and bearing		diametric clearance	0.04~0.108	0.30
2	crank and thrust shoe		axial clearance	0.13~0.28	0.40
3	connecting rod journal and bearing		diametric clearance	0.04~0.097	0.30
4	connecting rod large end and crank fillet surfaces		axial clearance	0.10~0.30	0.60
5	piston skirt and cylinder liner hole		diametric clearance	0.14~0.235	0.35
6	piston pin and connecting rod small end bushing hole		diametric clearance	0.024~0.05	0.10
7	first compression ring and ring grooves end surfaces		Clearance	0.065~0.105	0.30
8	second compression ring and ring grooves end surfaces		clearance	0.04~0.08	0.30
9	oil ring and ring groove end surfaces		clearance	0.045~0.080	0.30
10	gap of first compression ring in the cylinder	measure under the standard bore gauge	clearance	0.40~0.60	1.50
11	gap of second compression ring in the cylinder		clearance	0.30~0.50	1.50
12	gap of oil ring in the cylinder			0.30~0.50	1.50
13	camshaft supporting journal and bushing hole		diametric clearance	0.062~0.125	0.25
14	camshaft and thrust plate		axial clearance	0.05~0.15	0.40
15	valve tappet and cylinder block tappet hole		diametric clearance	0.04~0.082	0.20
16	Idling gear shaft and bushing hole		diametric clearance	0.025~0.075	0.20
17	idling gear shaft and idler shaft		axial clearance	0.038~0.095	0.25

18	intake valve rod and valve guide hole	diametric clearance	0.031~0.069	0.20
19	exhaust valve rod and valve guide hole	diametric clearance	0.044~0.082	0.25
20		height difference	0.05~0.12	
21	backlash of all timing gears	clearance	0.10~0.15	0.50
22	Rocker arm shaft and rocker arm hole	diametric clearance		

Chapter 5

Operation of the Diesel Engine

5.1 Engine transportation

When the diesel engine is transported, should lift the engine by engine hooks. When moving the engine, pay more attention to avoid damage the engine appearance, accessories, oil pipes, panel, etc.

When long distance transportation is necessary, the air filter and silencer should be dismantled, use plugs and plastics to seal the air intake and exhaust hole, water pump inlet and outlet hole, fuel inlet and outlet hole. If necessary, pack the engine properly and transport.

5.2 Installation

- ✓ The diesel engine should install on horizontal, firm surface. When connected with marine gear box, marine generator or other transmission equipment, its axes angle must be adjusted and controlled in 0.13mm. The flywheel and connected axes must keep 1.0-3.0mm clearance, to avoid damage the engine when affected by the reaction of the axes.
- ✓ When install the marine engine, allow 8°vertical gradient , the same gradient of power output exes and impel axes with the parallel should no more than 0.08mm . Users should check , measure and adjust it , to avoid big vibration cause by out of center , then output descend and exes、flexible pin and gear tooth irregular wear , cause engine body and ship body.

- ✓ Engine exhaust pipe cannot be too long, also should reduce the turning, the corner should have bigger bendy semi-diameter, to avoid big pressure of exhaust and reduce engine output.

5.3 Storage and Preservation

If the engine will not be used in a long period, should store and preserve it according following method:

First, drain out the fuel, oil and cooling water from the engine.

Demount the injector, put 200G dehydrated clean oil to each cylinder , turn crankshaft to make oil on every part surface symmetrically, then install the injector and fixed it well .

Wrap up the air filter with plastic film, dismantle the silencer and plug up the exhaust hole with wooden plug.

Wipe off the dirty oil 、dust and rust from the surface of the engine, smear the unpainted parts surface with thin layer of anti-rusting grease, then cover it with clean paper. Finally pack the engine with plastic bag.

The preserved engine should be stored in well ventilated, dry and clean place, it is strictly forbidden to be putted together with corrosive substances.

The effective period of this method is 3 months, when the time exceeds the period, please repeat this procedure.

5.4 Fuel, oil and jacket water

Diesel Fuel oil:

The diesel engine should use following specification oil according form 1:

Form 1 fuel oil specification

Fuel oil specification	GB252 light diesel oil		
Atmospheric Temp.	Above 0 ℃	0℃～－10℃	－10℃～－20℃
Diesel oil brand	0	-10	-20

Please clear the fuel oil for at least 72 hours before filling it into the fuel tank , then Pick up the top clean fuel oil. The fuel oil must be strictly filtered when filled to the fuel tank.

Lubricant oil:

The diesel engine should use following specification lubricant oil according form 2:

Form 2 lubricant oil specifications

Lubricant oil specification	Level	SAE	Temperature
GB11122 oil	CC or CD	30 or 40	5℃
		20W/40～50	<5℃～－15℃
		15W/40～50	－15℃～－20℃

Level: The suitable oil level should be between top and bottom level of the oil sump gauge.

Do not use inferior quality oil !

Do not use mixed or recycled oil ! 

Cooling Water:

Avoid Water. Prefer to use always coolant. In case coolant is not available, Use clear soft water, such as rain water, or tap water, etc.

Do not use hard water, such as well water and spring water which contains many minerals, seawater or salt water. 

When the temperature drops below 0℃, antifreeze mixture must be used for cooling. The antifreeze mixture can be mixed with water and alcohol.

5.5 Prepare for starting

1. Check if the diesel engine is secured to the ground.
2. Check the oil sump and injector pump, if the oil meets the standard level. Check if the fuel tank for full fuel, fuel system expedite.

3. Open the fuel tank valve, and let out the air from the fuel system. At the same time, check if there are any leaks from each fuel pipe, and call the technical support or try tightening the nuts at the pipes ends.
4. Check if every accessory is connected properly, battery has sufficient load, and the electric system is work well and not overheating.
5. Check if the clutch system is disengaged.
6. Check for grease on the greasing points.
7. Check for loosen bolts and tighten.
8. Check for the transmission belts, to have the correct tightening.

5.6 Starting

1. Keep the control handle of the fuel valve to the position where the fuel will be delivered rather more for moderate speed.

2. Turn the circuit switch clockwise and close the circuit.

3. Turn the starting switch to the “starting position “, after the crankshaft is speeded up by the starting motor, the engine is started then.

4. Please note: Each starting no more than 10 seconds to protect the motor and battery. If the start attempts are continuously, the interval time should be more than 2 min. If three times start failed, please do not start until the problem is found out and be eliminated.

5. As soon as the engine starts, turn the starting switch back to the previous position. Turn on the circuit; let the alternator product electricity to the battery. At the same time, adapt the fuel valve to moderate speed to see if the diesel engine runs properly.

6. Check if the oil pressure is ok, and then adapt the speed handle gradually to make the speed meet 75%~80% of the standard speed. Then run without load.

5.7 Running the Engine

1. Only when the temperature of the cooling water reach 50~60℃ and oil temperature reach 40~50℃, can operate the engine with load. When the water temperature reaches 80℃, operate the engine at full load. You can reduce the speed of the engine, engage the load and accelerate again, slowly to the rated speed.
2. The engine speed and load should be increased and decreased gradually. In general, shouldn't increase and decrease rapidly.
3. When the engine is working, should pay attention to each data of the meter and observe the color of the exhaust smoke, listen to the voice inside. If any problem appears, should stop the engine immediately and calla the technical support.
4. It is not recommended to let the engine run at idle speed for long time. Warming up and cooling down period should not exceed max. 5 min.
5. Do no run the engine with load, at idling speed, for more than 1 min.
5. The injection pump has been adjusted rightly before leaving factory, it is forbidden for user to change it at will. If necessary, call the technical support.

Note: New diesel engine or just overhauled engine, it is permitted to run at full load only after it has worked over 60 hours!

5.8 Stopping the engine

1. Before stopping the engine, unload first, decrease the engine to the idle speed gradually, also cut off the clutch system. When the water temperature falls down below 70°C, operate the stop handle to stop to stop the engine.
2. After stopping, should take the circuit switch, close the fuel tank valve.
3. When the temperature under 0℃, if do not use the antifreeze, should drain out the cooling water from the engine to avoid damage the engine body and water pump. If with antifreeze, it is unnecessary to drain out the water.

Note: Do not stop the engine by shutting off the valve of the fuel tank!

Do not stop the engine suddenly at high water temperature.

Do not stop the engine at high speed over 1000RPM!

5.9 Run in Operation rule for the new diesel engine

The new engine´s operating life period, working stability and economics, mainly depends on previous adjusting period. Thus user should operate the engine under the:

“New engine adjusting principle”.

Number	Load	Running time	Note
1	Idle load	10 min.	1) During adjusting period, fuel valve should at full open position , load can be estimated by left load form , but must know the principle of increasing load gradually . 2) During running period , pay attention to water temperature, oil pressure, oil increasing temperature . Listen carefully for strange sound. If any problem, stop engine and remedy immediately .
2	25% load	2 hours	
3	50% load	15 hours	
4	75% load	30 hours	
5	100% load	45 hours	
6	total	60 hours	

Chapter 6

Technical Maintenance of diesel engine

In order to work well and reliability for diesel engine, keep better technique capability, reduce abrasion of spare parts, extend the engine life, the users must carry out following maintenance rule carefully and regularly.

Diesel engine maintenance criterion:

1. 1st Class Daily maintenance (Carry through each class)

2. 2nd Class maintenance (Carry through after working 100hours in Total)

3. 3rd Class maintenance (Carry through after working 500hours in Total)

4. 4th Class maintenance (Carry through after working 1000hours in Total)

6.1 1st Class “Daily” maintenance items

(max. every 12 hours).

1. Check the oil sump face of diesel engine should be kept between fuel gauges up and down scale. When not enough, it must be filled.
2. Checked the oil in speed governor of injection pump should be kept on stated situation, when not enough, must be filled.
3. When the temperature is below 0°C, cooling water should be filled antifreeze and dropt it when engine stop.
4. Check and screw down the tight and fitted parts outside of diesel engine, remove the leaking oil, water and air matter in timely.
5. Clean out dust and smeary on surface of engine, keep engine cleanness
6. Guarantee cleanness and dryness of electric equipment and wires, clean out all of fault and abnormality phenomena when diesel engine running.

6.2 2nd Class maintenance items

(Every 100hours)

1. Carry out all of daily maintenance items
2. Replace oil in oil sump and cleanout oil sump and collection oil pump and scree assembly.
3. Clean out or replace oil filter after max. 200 working hours in total.
4. Clean out fuel filter or replace new filters after max. 200 working hours in total.
5. Checked the screw moment of screw in cylinder head and see if the valve distance gets to stated request.
6. Clean out the dust in plate for dust and surface of air filter, clean out dust and ash in exhaust pipe and muffler.
7. After working 200hours in total, check the injection pressure and injection atomization instance, cleanout valve parts and readjust injection pressure when necessary.
8. Check the voltage of the battery and ACID rate should be kept between 1.27 and 1.28 (atmosphere temperature 20℃). If rate is below 1.14, should charge the battery.

6.3 3rd Class maintenance items

(Every 500hours)

1. Carry out all of the 1st class “daily” and 2nd class, maintenance items
2. Checked work of injection pump, adjust oil supplying advanced angle. When necessary, and should readjust oil capacity of injection pump on testing bed.
3. Checked seal ring of in-take and out-take valve and clean out cumulated carbon. When necessary, should whet and correct and readjust valve distance get to stated request.
4. Checked the tightness and fitted instance of connecting rod screw, main bearing screw, cylinder head screw and flywheel screw should be suitable with screw moment.
5. Cleanout or replace air filter. (Depending on environment pollution).
6. *If Water is used instead of coolant:* Cleanout the sewage in cooling system, lotion should be used caustic soda (NaOH) plus 1 liter water to be mixed. Before cleaning, let out water fully, then filled with lotion. After 8-12 hours, restart diesel engine and stop when water temperature get to working temperature about 80°C, then let out lotion at once. Finally, cleanout whole cooling system by cleaning water.
7. Checked working instance for thermostat, check any leaking instance and the hole for releasing water. If leaking is serious, seal should be replaced.

8. Check and see if electric equipment and wires connection is fitted and if lead touching is well. In case burnt, must be clean up and replaced.
9. Check and see if moving capacity of rotor for turbo charger is in stated range. When necessary, should repair or replace.

6.5 4th Class maintenance items

(Every 1000hours)

1. Carry out all of the 1st, 2nd and 3rd Class maintenance items.
2. Check each spare parts of diesel engine and adjust and necessary maintenance.
3. Remove and check alternator and starter. Clean up bearing and fill with new lubricant, meanwhile check and see if start gear abrasion.
4. Remove and check cylinder head, cylinder liner, piston and piston rings. Clean out the water, oil smudgy and cumulated carbon and clean up again.
5. Check and measure piston and piston ring's abrasion instance.
6. Check and measure the abrasion instance of holes inside of cylinder line.
7. Check and measure abrasion instance of each shaft neck for crankshaft, and clean up each oil way of crankshaft.
8. Check and measure abrasion instance of main bearing and connection rod bearing.
9. Clean up each oil way for engine body and replace oil.
10. After reinstall the engine, make the engine work and work must be according to new canonical running rules after try to be running.

Chapter 7

Troubleshooting

Start failure

Cause	Remedy and method
Jammed in filter and fuel system	Dismantle and clean
Air trapped in fuel system	Went the air from the system and fixed all pipe
Fuel supply time wrong	Adjust the supply time
Injector sprays abnormally	Check and adjust injector fuel pressure , clean or replace valve
Insufficient compress pressure	Check or replace piston ring, cylinder liner and valve. If the cylinder head gasket leak steam, please screw well the cylinder head bolt, If any damage of cylinder head gasket, please replace it.
Valve gap wrong	Adjust the valve gap and aim at gear tooth as sign
Battery is insufficient	Recharging the battery
Connecting of electric device is not good	Check and tight the connection
Temperature is low , oil is too viscous	Make the water and oil to be higher temperature

Inefficiency power

Cause	Remedy and method
Less pressure in cylinder	Please refer to item 5 “ hard to start “ , if any parts exceed wear out limit , replace it.
Fuel supply time wrong	Adjust the supply time
Valve gap wrong	Adjust it
Each cylinder fuel supply is unbalanced	Adjust injector pump fuel supply
Air filter is blocked	Clean or replace the filter
Injector pump 、injector wear out or injector pressure is incorrect	Replace it with new parts, adjust injector pressure and check spray condition.
Incorrect speed	Adjust handle to make speed meet standard level

Abnormal exhaust smoke

Cause	Remedy and method
Overload	Reduce the load. If the power is not suitable, should adjust it.
Injector is not good	Check the injector pressure and spray condition , if the injector with problem , replace it
Fuel inferior quality	Change good quality fuel
Inefficiency fuel inflammation	Mainly caused by the spray is not good, supply fuel time is incorrect, cylinder head gasket leak steam, compression ratio inefficiency . Solve out one by one

Unusual pounding noise

Cause	Remedy
Fuel delivery advance angle is not correct	Adjust the fuel delivery advance angle
Air in the fuel system	Drains the air in the fuel system.
Fuel delivery not balanced	Adjust fuel delivery of every cylinder injection pump
Fuel quality bad	Replace the qualified fuel
Parts fray over the limits	Exchange the parts

Oil pressure drop to zero or lacking pressure

Cause	Remedy
Oil level is too low in the crankcase oil tray	Add oil to the oil staff standard
Oil passage leak oil	Rule out oil leaking
Oil filter, secondary filter and passage jam	Wash, replace the filter if necessary
Oil pressure meter breaks or meter and passage jam	Overhaul or replace
Oil be too thinness	Replace the qualified oil
Oil pump gear is worn out and clearance too large	Adjust the clearance or replace the gear
Pressure regulating valve of oil filter breaks	Overhaul or adjust the regulate valve
Crank shaft, camshaft bearing clearances too large.	Overhaul or replace

Engine Overheated

Cause	Remedy
Cooling water temperature over high	
Cooling water insufficient	Fill the water tank full, improve the water lever to make the cooling water high than the water pump center
Water pump	Check the water pump and belt to eliminate leaking
Too much furring in the cooling system	Eliminate the furring
Oil temperature too high:	
over or less quantity of oil	Check the oil level if in the standard
Low oil pressure and less flow	Refer to Oil pressure drop to zero or lacking pressure
engine overload	low the load of engine

Engine Overspeed

Cause	Remedy
Govenor are stuck	stop the engine immediately and overhaul
Control Rod of injection pump is stuck.	Stop the engine immediately and overhaul
Injection pump supply fuel too much	Stop the engine immediately and re-adjust the fuel feeding quantity.
Engine consume too much oil	Stop the engine immediately and overhaul

Needed Tools

No.	Tool and meter name	Purpose
1	valve clearance gauge	To adjust the intake and exhaust valve rocker clearance
2	valve key dismantling tool	To dismantle the intake and exhaust valve and valve spring
3	valve lapper	To lap the sealing face between intake and exhaust valve and seat ring
4	piston ring dismantling tool	To check and replace the piston ring
5	retainer ring dismantling tool	To dismantling the relative rainer ring
6	jigger tool (gear)	To rotate crankshaft manual at the daily check and adjust
7	Oil pressure meter	Monitor and measure main pipe oil pressure under different working condition
8	Oil temperature meter	Monitor and measure oil temperature under different working condition
9	Water temperature meter	Monitor and measure water temperature under different cooling condition
10	Charge current meter	Monitor and measure electrical source (storage battery) charged capacity