



WD615 / WD10 系列船用柴油机

使用保养说明书及用户服务指南

Operation & Maintenance Manual
and Service Manual for
WD615/WD10 Series Marine Diesel Engine

潍柴动力股份有限公司

WEICHAI POWER CO., LTD.

地址: 山东省潍坊市民生东街26号	Address: No.26. Minsheng East Street, Weifang, Shandong, China
电话: 0536-8197777	Tel: +86-536-8197777
传真: 0536-8221210 邮编: 261001	Fax: +86-536-8221210 P.C.: 261001
服务热线: 800 860 3066/400 618 3066	Service Hotline: 800 860 3066/400 618 3066
电子邮箱: weichai@weichai.com	E-mail: weichai@weichai.com
网址: http://www.weichai.com	Website: http://www.weichai.com

零件件号: 612600820178	Part No.: 612600820178
设计版本号: <u>ppbs sjzl 0901</u>	Design Version No.: <u>ppbs sjzl 0901</u>
2009年3月修订	Revised in March 2009
本材料供用户参考使用,	This manual is for reference only,
产品参数如有变更, 恕不另行通知,	product parameters are subject to alteration
请以产品实物为准。	without notice,
	whichever is the physical product.

612600820178



Foreword

Dear customers, thank you for using WD615C series marine diesel engine produced by Weifang Diesel Engine Works(WDEW).WD615C marine engine is a new version designed on the basis of WD615/WD10 series engine introducing from Italy Steyr Company and possessing the advanced world level of the 1990s. The engine conforms to the requirements stated in Steel Vessel Classification and Building Specifications.

The rated power of WD615C series marine engine is 110~205kW, speed(at rated conditions) is 1500~2100r/min.

WD615C marine engine possesses the features of small volume,large power, low fuel consumption, easy operation and maintenance and so on. Before operate the engine,users are advised to read this manual carefully and use right grade of fuel, oil and coolant and operate the engine correctly so as to prolong its service life and obtain the best efficiency and ideal result.

If users have any questions, please contact with After Service Department of WDEW and we will provide our best service.

Mar, 2009

Special Attention

- In order to protect legitimate right and interests of user ,it is forbidden to dismantle lead sealing of injection pump privately.
- Once injection pump is adjusted or lead sealing is dismantle ,the guarantee ceases to be in effect .
- Injectiojn pump is of precision parts ,it is forbidden to dismantle by user ,or the guarantee cease to be in effect.
- Rotor shaft of turbocharger is precision high-speed rotating parts,dismantling and impacting are forbidden,or the guarantee ceases to be in effect.
- There are strict demands on torque and turned angle for main bearing bolts and connecting rod,loosening and dismantling is forbidden,or the guarantee cease to be in effect.
- Before starting the diesel engine,check whether the coolant is full and whether the lub-oil is enough.
- Connecting rod bolts can be used only once.

Read this manual carefully before operation!

Points for Attention

1. The engine has been tested strictly in accordance with the test stipulations before delivery. The throttle has been sealed, it is forbidden to dismantle the seal optionally and to enlarge the throttle. Otherwise we would not provide free service for returning product, replacement and repair, users would better pay attention to this.
2. The engine operator must read this Operation and Maintenance Manual carefully to know the engine's structure, and comply with the operation and routine rules in this manual.
3. Before using a new engine, 50 hours test running should be done. After the engine is cold started, the speed should be increased slowly. It is forbidden to run the engine in high speed suddenly and in idling for a long time. After running in high load, running the engine at low speed and in no load about 5-10 min, then stop the engine. After the engine is stopped, if the ambient temp. is lower than 0°C and no antifreeze is used, the water in water tank and in diesel engine should be drained off.
4. It is forbidden that the engine works without air filter to prevent unfiltered air from entering into the cylinder. Applied fuel and lubricating oil must be in accordance with specified grades and filtered by strainer, and a special clean container should be used. The fuel should be settled for more than 72 hours.
5. Inspection and maintenance for electric system must be done by workers mastering electric appliance knowledge. The oil seal period of the engine is one year. Inspect the engine and adopt necessary measures if beyond a year.
6. Feedback of engine quality information
The manufacturer has established quality files for WD615 series diesel engine. Please fill in the card and post it to us, we will contact with user according to the card.



11. Notice to repairing and replacing parts

WD615/WD10 series diesel engine is of high performance product. Maintenance should be done in accordance with WD615/WD10 series diesel engine parts catalogue and specifications of maintenance manual. Purchased parts must have approved by us in order to ensure performance, reliability and service life.

12. Reasonable, affective and protective measures must be taken for mobile parts such as pulley to avoid injury, before customer operates engine.

Contents

Chapter I

1 Introduction	1
2 Main specifications of WD615C series marine diesel engine	2
3 Tightening force and method of high strength bolts.....	5
3.1 Main bearing bolts.....	5
3.2 Cylinder head bolts.....	5
3.3 Tightning procedure.....	6
3.4 Connecting foe bolts.....	6
3.5 Flywheel bolts.....	6
3.6 Connecting bolts for flywheel housing and cylinder bolck.....	6
3.7 Tightening bolts for tuning gear shaft.....	7
3.8 Screws for oil pOump idler gear	7
3.9 Screws for rocker bracket	8
3.10 Screws for tension pully	8
3.11 Screws for fuel injection pump shaft and angle adjusting plqte.....	8
3.12 Bolt for dtive gear of injection pump.....	8
3.13 Screws fo crankshaft gear.....	9
3.14 Screws fo crankshaft gear.....	9
4 Fuel, lubricating oil, coolant and auxiliary materials.....	10
4.1 Fuel.....	10
4.2 Lubricating oil.....	10
4.3 Coolant	11
4.4 Weichai special oil	11
4.5 Auxiliary materials.....	13
5 The WD615/WD10 series ship installs with the diesel engine	15
5.1 Unpacking and lifting.....	15
5.2 Installation.....	15
6 Operation.....	17



Chapter II Service Manual

1 Weichai Power warranty Card(for user)	21
2 Warranty Explanation	22
3 Weichai Power Regulations on Quality Assurance for Diesel Engine used in Marine Electric Machinery	24
4 Overseas Service Center of weichai power Company Limited	25
5 Maintenance Record Table (Filled by service member)	26
6 Weichai Power Product Warranty Card(for company)	28
7 User Satisfaction Degree Examination Table	29

1 Introduction

WD615C series diesel engine derived from WD615/WD10 engine possesses the world level of the 1990s. WD615C series diesel engine has the advantages of WD615/WD10 engine, and is suited to the matching requirements of different ships.

In this "Operation and maintenance manual for WD615C series diesel engine", the main performance data and structure features of WD61561C (1800r/min~2100r/min) series diesel engines are introduced.

1.1 Rating of power

The rated power of the engine refers to the power delivered at rated speed and standard ambient conditions (atmospheric pressure: 100kPa; ambient temp: 25°C; relative humidity: 30%; exhaust back pressure: ≤ 3.3kPa; without seawater pump; generator running idly). 110% of rated power can be delivered at 103% of rated speed (running 1 hour for every 12 hours is permitted). Unlimited navigation power is 90% of rated power.

1.2 The max. fuel supply of the engine is sealed at the position of 110% rated power before delivery. The power of trailing axle of the ship depends on the mechanical efficiency of the gear case.

1.3 Φ511.17H8(SAE I) and Φ532H8(6135Ca) flywheel casings and corresponding flywheels are available.

1.4 There are 2~4 belt grooves in the crankshaft pulley with joint flange for drive seawater pump and small generator through belts. Seawater pump and small generator (total power less than 10kW) should be arranged symmetrically to the sides of crankshaft. The flange connected with the diesel engine through flexible coupling is used for drive net-lifting machinery on special support. Its axis should be concentric with crankshaft, the uncoaxiality is less than 0.1mm.

2 Main specifications of WD618C sermarine diesel engine

Table 2.1 Main specifications

Item	Model					
	WD61561C		WD61567C		WD61568C	
Bore/stroke(mm)	126/130					
Intake mode	Turbocharged		Turbocharged and inter-cooled		Turbocharged And inter-cooled	
Rated speed(r/min)	1500	1800	2100	1800	2100	2100
Speed at 110% rated power r/min	110/136	140	147	176	180	205
110% rated power kW	1545	1845	2163	1854	2163	2163
Speed at 110% rated power r/min	121/149.6	154	161.7	193.6	198	225.5
Min.fuel consumption at full load g/kWh	215		208		204	
Exhaust temp.after turbocharger °C	≤550		≤550		≤550	
Oil pres. kPa	343-550		343-550		343-550	
Water outlet temp. °C	≤90		≤90		≤90	
Fuel advance angle °C A	16°~18°		16°~18°		14°~16°	
Permitted gradient	Longitudinal	30°				
	Cross	30°				

2.2 Technical Specifaion of WD615/WD10 Series Diesel Engine for Power Generation

No.	Item	Model Item			
		61CD	67CD	68CD	46CD
1	Type	Water cooling, in line, for-stroke, dry-liner and direct injection			
2	Number of cylinder	6			
3	Bore/Stroke(mm)	126/130			
4	Displacement(L)	9.726			
5	Rated power/rated speed(Kw/r/min)	117/1500	138/1500	170/1500	204/1500
6	Fuel consumption at rated condition (g/kW·h)	≤228	≤215	≤210	≤220

7	Oil fuel consumption ratio(%)	≤0.4	
8	Idling speed(r/min)	600±50	
9	Noise average dB(A)	≤105	
10	Steady state speed regulation	≤3% (electronic governing)	
11	Intake method	Turbocharged	Turbocharged and intercooled
12	Starting method	Electric motor start	
13	Cooling method	Water cooled forced circulation	
14	Oil pressure kPa	350-550	300-550
15	Oil pressure at idling speed kPa	≥100	
16	Exhaust temperature after turbine °C	≤550	
17	Crankshaft rotating direction (face to output end)	Counter clockwise	
18	Valve clearance(cold state)mm	Intake valve 0.3mm Exhaust valve 0.4mm	
19	Firing order	1-5-3-6-2-4	
20	Allowable slope	Longitudinal 30° Cross 30°	
21	Dimension	See outline drawing	

2.3 Matching clearances and wear limits of engine main parts

unit:mm

No.	Item	Theoretical	Wear limit
1	Main bearing clearance	0.095~0.163	0.17
2	Connecting rod bearing clearance	0.059~0.127	0.16
3	Crankshaft axial clearance	0.059~0.255	0.35
4	Clearance between connecting rod big end and crankshaft	0.15~0.35	
5	Min. clearance of piston skirt at cold state	0.143~0.182	0.35~0.4
6	Clearance of piston pin in connecting rod small end bushing	0.045~0.066	0.1
7	Clearance of piston pin in piston pin seat	0.003~0.013	
8	1 st piston ring ends clearance at cold state(in special ring gauge)	0.4~0.6	1~1.2
9	2 nd piston ring ends clearance at cold state(in special ring gauge)	0.25~0.4	0.1~1.2
10	Oil ring ends clearance at cold state (in special ring gauge)	0.35~0.55	0.1~1.2
11	Clearance of inlet valve stem in valve guide	0.05~0.086	0.15
12	Clearance of exhaust valve stem in valve guide	0.03~0.066	0.10

13	Height between valve bottom face and cylinder head bottom surface(exhaust/inlet)	WD61561/71	1.25~1.45	1.8
		WD6158	1.25~0.95	
14	Height of cylinder liner above cylinder block upper face		0.02~0.07	
15	Camshaft axial clearance		0.1~0.4	
16	Camshaft bearing clearance		0.04~0.12	
17	Clearance of tappetin tappet bore		0.025~0.089	
18	Clearance of cylinder liner in cylinder bore		-0.01~0.033	
19	Clearance of rocker shaft in its bushing		0.04~0.119	
20	Clearance between the piston crown and the bottom of the cylinder head		1.0	
21	Valve clearance at cold state (inlet / exhaust)		0.3~0.4	
22	Gear side clearance		0.12~0.4	
			0.12~0.33	

3 Tightening force and method of high strength bots

3.1 Main bearing bolts

Fourteen (14) M18 bolts are tightened in the following order(fig1).

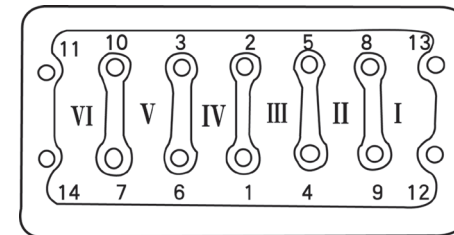


Fig1

The 1 stage, coat some clean oil on bolt rod and mounting surface and then screw up with hand.

The 2 nd stage, it should be twisted to 30 N·m

The 3 rd stage, it should be twisted to 80 N·m

The 4 th stage, it should be twisted to 250⁺²⁵ N·m

3.2 Cylinder head bolts

No.1-21 are M12 auxiliary bolts (stud, can be used twice).

No.22-45 are M16 main bolts (hexagon, can be used three time).

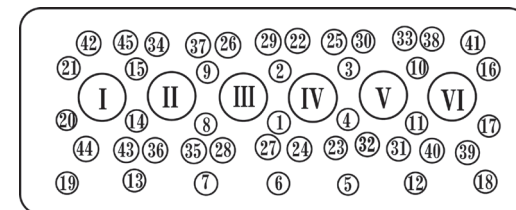


Fig 2

3.3 Tightning procedure

3.3.3.1 Locate (ongitudinal and cross) the cylinder heads, gasketsand cylinder block withΦ locating pins, level the exhaust sides ofthe cylinder heads and fix them.

3.3.3.2 Coat some clea oil on the screwed surfaces of main bolts and the shoulder nuts for auxiliary bolts before saaembly, and screw up with hand.

3.3.3.3 Tighten (30N·m) all main bolts and auxiliary bolts caaording to the order shown in fig.2.

3.3.3.4 Turn the main bolts and the nuts fo auxiliary bolts through an angle of 90° separately in order.

3.3.3.5 Turn the nuts for auxiliary bolts through an angle of 90° in order again, the torques reach 120~160 N·m, if the torque of a nut can not conform with the specified torque, replace it a new one.

3.3.3.6 Turn the main bolts through anges of 90° in oder again, at the same time,the torques rech 240~340N·m, if the torque of a blot can not conform to the specified value, replace it.

3.4 Connecting foe bolts(fig 3)

Coating some caean oil in two connecting rod bolts and screw up with hand, tighen them symmetrically to a torque of 120 N·m, otherwise replace it. Dismantledbolts can be reused. The connecting rod bolts can not be replaced with common M14×1.5 Hexagon bolts to prevent serous conse-quences.

3.5 Flywheel bolts:M14×1.5 (9)

Tightening the nine (9) bolts symmetrically to 60N·m, the turn and angle of 180°±25° separately according to the asme order, and the torque reach 230~280N·m, otherwise replace them. The bolts can be used twice(i.e. the flywheel bolts can be dismantled/ereassembled only once after delivery).

3.6 Connecting bolts for flywheel housing and clyinder bolck

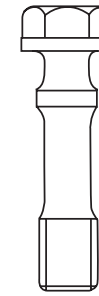


Fig3

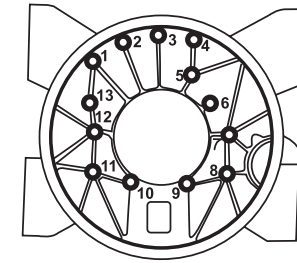


Fig4

(fig4, viewing from the output only once after delivery).

Flywheel housing, cylinder block and crankcase are connected and fastened with thir-teen (13) bolts. The lengths of No. 2,3,8,9,10,11 bolts are all 60mm, the others 70mm, do not nounting mistakenly. Tightening is as follows:

3.6.1 After screwing down, tighten the bolts separatel with a torque of 40N.m. in other of 7,12,9,2,3,10,5,11,8,13,6,1,4.

3.6.2 Turn and andgle of 120°±5° separately (according to the other in 3.6.1), the torques reach 110~140Nmm. Replace the bolts that could not conform the specified torque. these bolts can be used twice.

3.7 Tightening bolts for tining gear shaft (4,M10×80), in the following order:

3.7.1 Coating some Loctite 242 sealant, tightening the four (4) bolts to 60Nm according to the order shown in fig5.

3.7.2 Turn an andgle of 120° separately according to the order, replace the bolt which of the torque is less than 100~120N·m.

3.7.3 These bolts can be used three times.

3.8 Screws for oil p0ump idler gear (M10×9.5-10.9Zn)

Tightened up to 60+50N·m by once (coating some Loctite 242 sealant on screwed parts).

3.9 Screws for rocker bracket (12, M12×60-10.Zn)

Tightened up to 10N·m by once (fig6).

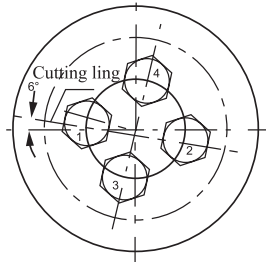


Fig5

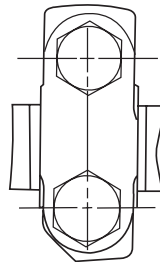


Fig6

3.10 Screws for tension pulley (M16×50)

Coating some Loctile 242 sealant on screwed part, and then githten up to 200N·m (fig.7)

3.11 Screws for fuel injection pump shaft and angle adjusting plqte(M12×65-12.9Zn): Twisted to 130N·m by once (fig.8).

3.12 Bolt for dtive gear of injection pump (fig.9): (M18×1.5)

Tightened up to 196N·n by once (for WD 1561C, WD 61567C engines).
Tightened up to 300N·n by once (for WD 1648C engines).

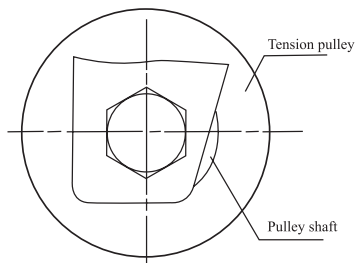


Fig7

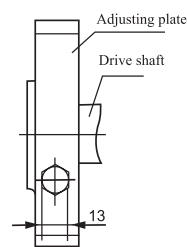


Fig8

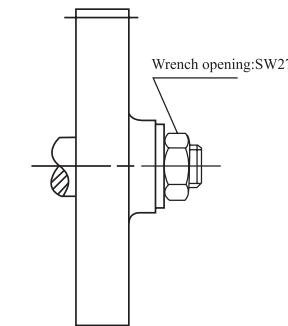


Fig9

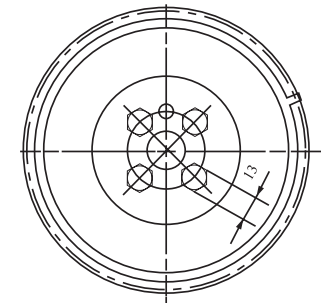


Fig10

3.13 Screws fo crankshaft gear (4, M8×20-10.9Zn)

Coating some Loctile 242 sealant on screwed part, twisted symmetrically to 32N·m (fig.10)

3.14 Screws fo crankshaft gear (8, M10×70-10.9Zn)

Coating some Loctile 242 sealant on screwed part twisted symmetrically to 60%⁸ (fig.11)

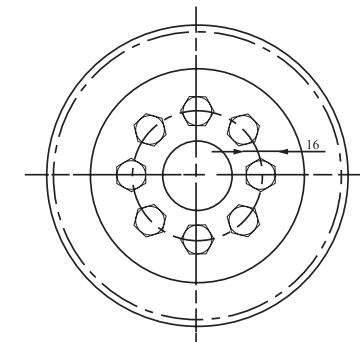


Fig11

4 Fuel, lubricating oil, coolant and auxiliary materials

4.1 Fuel

Fuel is the energy source of the engine. The power, fuel consumption and reliability of the engine are influenced directly by the quality of fuel. So, specified and clean fuel must be used.

4.1.1 No. 0 or No. -10 light diesel fuel should be used separately when ambient temperature is above 5°C or between 0°C ~ 5°C. If the ambient temperature is lower than 0°C, corresponding fuel should be used. All diesel fuels used must meet the requirements of RC-0, RC-10 or RC-20 in standard GB252-94.

4.1.2 Fuel tank should be cleaned with kerosene or light diesel fuel before the first rilling. The cleaning light diesel fuel can't be reused for engine. The fuel should be laid up statically for 24 hours preferably and must be filtered before filling.

4.2 Lubricating oil

4.2.1 Points for attention

There is no oil in the oil pan of the engine when delivery. Before starting the engine, supply lubricating oil sump from the filling pipe at the upright position of the timing gear case (view from the output end) through a filter screen with 40 meshes. The oil level should be within the high and low graduation marks. Check the oil level periodically. The oil volume is about 19 L.

4.2.2 CD grade 15W-40 oil (classified according to API)

The main technical specifications of CD15W-40 oil

		Specifications	Test method
1	Kinematic viscosity: CST°C 100	12.5~16.3	GB265
2	Cold start simulated test: CSC-15°C mps	≤3500	GB6358
3	Flash point (open)	≥180	GB267
4	Condensation point	≤-23	GB3535
5	Bearing weight loss because of corrosive gas mg	≤25	GB2629

4.2.3 Lubricating grease

The oil cup of water pump of the engine is filled with general lithium-based Grease (GB5671-85).

4.3 Coolant

4.3.1 The cooling water for diesel engine (i.e. the inner circulating water) must be of neutral, soft fresh water without impurities. Seawater, semi-alakome water, salt water and untreated river water or ground water can't be used.

4.3.2 Long- acting coolant should be added into the cooling water. JEF-336 long- acting anti - icing fluid (Greases Trail- produce Factory of Oil Research Institute, General Rear- Service Department of the PLA, Beijing) and FK-30*long - acting anti - icing fluid (Qingao Chemical Plant Everyday Use Articles of Shandong) are recommended. Refer to the relative "Operation Instructions of Anti - icing Fluid".

4.4 Weichai special oil

4.4.1 The characteristics of Weichai special oil

1) Good ingredients are the guarantee of high-quality oil

Imported hydrocracking base oil and compound additives are favorable to guarantee the good quality of lubricating oil.

2) Under normal use, oil drain interval can be extended by 3500-7000 kilometers (CH-4 can be extended by 10000 kilometers)

Outstanding high-temperature oxidation resistance and good Total

Base Number (TBN) retention can extend oil drain interval.3) Professional protection can extend the engine life

Professional lubricating oil for high-power and high-load engines, which can extend the engine life (special oil can be extended the engine life by 30~40%), has been developed based on a great deal of engine performance and endurance tests.

4) Better performance requirements

The engine performance can be improved in terms of abrasion resistance, TBN retention, oxidation resistance, soot dispersion capacity, fuel control as well as shear stability and the precipitate in turbocharger can be reduced.

5) Saving energy

The energy-saving formula “low viscosity+ multi-polarity+ friction modifier” is the guarantee of high-viscosity index and good film strength and flexibility of Weichai special oil, which can ensure smooth operation, low operation resistance and low fuel consumption of engines (fuel consumption reduced by 3~8%).

6) Protecting environment: low ash, low sulphur and low phosphorous

The ash content is controlled within 1.0% in order to extend the life of Diesel Particulate Filter <DPF>; the sulphur content is within 0.4% to prevent the deactivation of oxidation catalyst <DOC> and reduce particulates; the phosphorus content is within 0.12% to prevent the deactivation of oxidation catalyst <DOC> and NOX control system; and volatility can be controlled within 13%.

4.4.2 The difference between Weichai special oil and regular engine oil

Term	Special oil	Regular engine oil
base oil	imported class III hydrocracking base oil	domestic class I base oil and a little class II base oil
additive	imported high-quality compound additives	domestic additives
performance	professional formula with strong points, good lubrication, clean, low fuel consumption (fuel consumption can be reduced by 3~8%), and professional protection for engines under poor working conditions	general lubricating performance
oil drain interval	Under normal use, oil drain interval can be extended by 3500-7000 kilometers (CH-4 can be extended by 10000 kilometers)	normal value

4.4.3 Some commonly used special oil products of Weichai Power

Type	Class	Specification	Packaging capacity
diesel engine oil	WP-E1(CD)	15W/40 20W/50 10W/30	4L,18L, 200L
	WP-E2(CF-4)	15W/40 20W/50 10W/30	4L,18L, 200L
	WP-E3(CH-4)	5W/30 15W/40 20W/50 10W/30	4L, 18L, 200L
	WP-E4(CI-4)	15W/40	4L,18L
heavy duty gear oil for automobiles	GL-5	85W/90 80W/90	4L,18L
engine coolant (antifreeze)	-25 -35		4KG,18KG

4.4.4 Weichai special oil for different engine models

Type	Standard No. of special oil	Major applied engine models
high-speed engines, high-power and medium-speed engines	WP-E1 (CD)	medium-speed engine sets
	WP-E2 (CF-4)	Euro I and Euro II engines; construction machinery such as 50, 30 loaders; WD618/WD12 series engines; WD615/WD10 series engines; 226B and medium-speed engines; Heavy-duty trucks with a load capacity of above 15 tonnes
	WP-E3 (CH-4)	Euro III engines; Landking engines; heavy-duty trucks with super large tonnage; coaches; WP4、WP6 (180~240HP)、WP10 (240~360HP)、WP12 (400~480HP)、WD10、WD12.
	WP-E4 (CI-4)	National IV engines(including heavy-duty trucks with super large tonnage)
gas engines	CNG	compressed natural gas engines; coaches and gensets equipped with compressed natural gas engines

4.4.5 How to choose appropriate viscosity

	SAE viscosity level	Applicable temperature (°C)
	5W/30	-30 ~ 35
lubricating oil	10W/30	-25 ~ 35
	15W/40	-20~40
	20W/50	-15~50
gear oil	85W/90	-15~49
	80W/90	-25~49
	85W/140(above 85W/90)	-15~49

4.5 Auxiliary materials

4.5.1 When saeambling and repairing the engine, Loctite sealant / binder or molykote powder should be used.

4.5.2 Auxiliary materials and their applications are as follows:

No	Name	Color	Applications
1	Molykote Powder	Black	Coated on the outer surface of cylinder line, inlet/exhaust gaskets and turbocharger gasket to prevent from biting each other.
2	Molybodium disulphide grease	Dark gray	Coated evenly on the valve rod (pre - lubricating)
3	Loctite 242	Blue	Coated on the screwed parts of fastening bolts for pressure - limiting valve of oil pump, pressure - limiting valve in main oil passage and strainer to prevent looseness.
4	DDL 601	Black	Suitable for oil cavity sealing, such as coated on the screwed part of screw plug.
5	Loctite 510	Red	Coated on the bright surface of metal for sealing. E.g. the mating surfaces of: timing gear case and cylinder block and crankcase; cylinder block and crankcase; oil filter seat and crankcase.

5 The WD615/WD10 series ship installs with the diesel engine

5.1 Unpacking and lifting

When unpacking the diesel engine, do not damage the diesel engine parts. After unpacking, check all ports of oil, fuel, water and air, seal all ports with plastic film or plastic covers and sleeves to avoid foreign matter entering into them. Finally check up the accessories, documents and spare parts attached to the engine in accordance with the packing list (intermediary must not open the documents bag and spare parts box and must send them with the ship to final user).

Eye screws are used for lifting up diesel engine. During lifting up, diesel engine crankshaft must be horizontal. The following lifting tool is recommended (fig 12).

5.2 Installation

5.2.1 The flywheel and the flywheel housing SAE1 or 6135 Ca must be matched with the selected gear case.

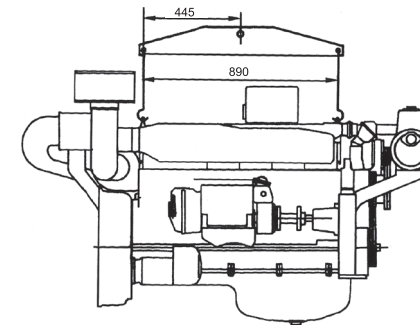


Fig12

5.2.2 The center of diesel engine crankshaft is concentric with



the gear case input shaft, the non-concentricity should be less than 0.1.

5.2.3 The Spring coupling must be used between diesel engine and gear case. After the coupling is mounted, the engine crankshaft should not be subjected to axial force, otherwise the thrust plate will be damaged.

5.2.4 Installation of seawater cooling system

The pipeline for seawater pump inlet port must meet the following demands.

a. the bore diameter of undersea coarse strainer is not more than 15mm, the bore diameter of water filter screen is not more than 4mm, flow area of coarse filter and water filter are all not less than 1500mm².

b. Minimize pipeline length and elbows as far as possible. The length of the pipeline: $\leq 10\text{M}$; the suction head: $\leq 3\text{M}$; total resistance: $\leq 3\text{ kPa}$; internal diameter of pipeline: $> 50\text{mm}$.

6. Operation

6.1 Preparations before starting

Check the fresh water level from the observation window in fresh water cooler, fill up suitable coolant according to the requirements in this manual if necessary. While running the engine at a low speed, check if the coolant level drops. Stop the engine after running for several minutes, then check if the coolant level returns to normal. Otherwise fill up the coolant to the specified level.

6.2 Inspection of fuel

Check the fuel level in the fuel tank, and check if the valves of fuel pipeline should be opened, and there's no fuel leakage. Loosen fuel return screw of high-pressure pump, then supply fuel and drain away the air by manual delivery pump, and then tighten the screw. Supply fuel continuously until the low-pressure cavity of the fuel pump is full of fuel and the pressure in cavity is about 50 kPa.

6.3 Inspection of oil capacity

Check the oil level in oil sump, the oil level must lie between calibration tails of oil scale plate, full oil to required height if the level is too low. Drain out oil till the required height if the level goes beyond the upper limit, and analyze if there is fuel or water in oil, and find out the reason.

6.4 Check fuel advance angle

Check fuel advance angle and valve timing of the first cylinder according to the method and data supplied by this manual, adjust them if necessary. Inspection must be precise to avoid wrong adjustment and engine damage.

6.5 Check fastening parts

Turn the engine crankshaft and check whether the engine is abnormal, and check all fastening parts and transmission belt.

6.6 Inspection of electric equipments and monitoring instruments

Check the connection for circuit wires and grounding, check the storage battery to avoid starting failure of the engine, and check the motion of the



monitoring instruments by valve, check whether the solenoid valve can top the engine in time.

6.7 Starting

Before starting engine, set the gear case clutch to neutral, then turn the engine crankshaft, and check whether the engine and coupling are abnormal and whether all bolts are tightened. Under normal conditions, each starting time mustn't be more than 15 seconds, sition should be set to 1/3 opening in summer, and set to 2/3 opening in winter or when oil temperature is lower than 15°C .

6.8 Running of engine

After the engine is started, increase the speed to 60~70°C , the engine runs at this working conditions stably for sometime.

After checking the oil pressure and control instruments, runs the engine on load.

6.9 Initial running

For new diesel engine, the load should be below 90% of full load in the initial running of 50 hours. Pay attention to the oil pressure, oil temperature, leakages and instruments in wear - in period, and check whether net hauler, generator and seawater pump are normal. Stop and adjust the diesel engine to normal running condition if the engine vibrate seriously, otherwise the reliable running of the engine will be damaged.

6.10 Engine stop

During running ,all parameters must be within stipulated ranges. Continuous runing time at 103% of speed (110% of full load) is permissible for 1 hour per 12 hours. It is for bidden to dismantle the lead sealing optionally and to enlarge throttle, otherwise user is responsible for the disastrous effect.

Before stopping the engine, decrease the throttle opening and set gear case clutch to neutral, the diesel engine runs idly at 2/3 of rated speed several minutes, the fresh water outlet temperature decreases to about 60, then engine runs at idling speed for about 4 ~5 minutes, turn the stop handle to stop engine, After the engine is stopped, check the fuel and

water line to avoid leakages, and cut off the electricity supply.

6.11 Emergery stop

For the diesel engine with solenoid valve for stopping, operate the emergency stop knob on instrument case to stop the engine if abnormal occurs. For manual emergency stopping mechanism, use the emergency stop throttle to stop the engine. After stop, turn the engine crankshaft at once and check whether the engine is normal, and prevent seizure and scuffing due to high temperature of the engine.

If the diesel engine doesn't work for a long time and there's no antifreeze in coolant, open the drain out valves of sea/fresh water heat exchanger, intercooler and the valve on the side of cylinder block, and drain the water off to prevent from cracking.

Chapter II Service Manual

Dear customers:

Welcome to use the products of Weichai Power, and thank you for your great support to our products.

In order to guide you to operate the engine correctly, please read the Operation and Maintenance Manual carefully and abide by the operations rules in the manual. If the engine was failed, please contact Weichai Maintenance and Service Center or Weichai User Service Center as soon as possible. We will offer effective service to you timely.

"Maintenance Record Table" should be filled by Maintenance and Service Centre in repair and preserved by user.

Weichai Power Warranty Card (for user)

Item	Content	Item	Content
User Name		User Postcode	
User Phone		User Mobile Phone	
User Address			
Distributor		Distributor Tel.	
Distributor Address			
Engine Model		Engine Order No.	
Engine ID No.		Purchased Date	
Construction machinery manufacturer		Construction machinery Model	



Warranty Explanation

1. Service promises

In the service region of Weichai Maintenance and Service Centre, after received information from users and verifying that service is needed, our maintenance team shall get to the place within 24 hours in which the service centre is located, within 48 hours for city areas, and within 72 hours for remote areas.

(remote areas or force majeure factors excluded)

2. Special attention

- The engine operator must read the Operation and Maintenance Manual carefully and abide by the operation rules in the Manual, and pay attention to the warning directions and marks.
- The engine has been tested strictly in accordance with the test stipulations before delivery. The throttle has been sealed. It is forbidden to disassemble the seal optionally and to enlarge the throttle. Otherwise, Weichai will not be responsible for free repair.
- Some bolts of the engine are strictly specified for torque requirement and times of use. It is forbidden to loosen main bearing bolts and connecting rod bolts. See Operation and Maintenance Manual for detail.
- Before using a new engine, a 50-hour commissioning should be performed.
- After the engine is started from a cold state, do not increase the engine speed suddenly, and do not run at idle speed for a long time.
- After the engine is stopped, if the ambient temperature was lower than 0°C and no antifreeze is used, the water in water tank and in diesel engine should be drained off.
- It is forbidden to operate the engine without a air cleaner and try to prevent unfiltered air from entering into the cylinder. In severe working conditions, clean or replace the air filter element more frequently, so as to prevent early abrasion of engine.
- Applied fuel and lubricating oil must be in accordance with specified grades and filtered by strainer, and a special clean container should be used. The fuel should be settled for more than 72 hours.



3. The principle and stipulation of warranty service

- The principle of warranty Service

The engine purchased by users or fitted on other machinery, in case of using and maintaining normally within the guarantee period, the damage or trouble caused by manufacture and assembly etc. should be paid by our company.

- Time limit of warranty service (shown in appendix table)

(1) For the end product of our company, the starting date of warranty period is in accordance with the date on our sales invoice, warranty card or the formal invoice of the distributor (It should be within the 12-month oil seal period of the engine).

(2) For the matching products, the starting date of guarantee period is in accordance with the date on sales invoice or warranty card of the matched product (It should be within the 12-month oil seal period of the engine).

4. Following conditions are excluded by warranty

- Early wear and trouble arising from improper operation and maintenance, e.g.: damages from careless load and unload during transportation the engine by users, operation conditions beyond the specified range in the operation manual, over-speed or over-load operation; run-in, inspection, adjustment and tightening not abiding by the operation manual, improper match, usage of incorrect fuel, oil or antifreeze etc.
- Troubles arising from refitting, adjusting and disassembling the positions and parts that are not allowed to adjust and disassemble casually according to the product specification.
- Oil, antifreeze, filter element, hose and belt etc. for normal operation and maintenance are not in the range of warranty service
- No warranty card or valid invoice, or no evidence that proves the product is in warranty period.
- The specification and model of product in the guarantee card or invoice differs from that of the requested product for three guarantees, or the card and invoice was altered.
- Instead of maintaining the original damaged situation after trouble occurs, user treats the trouble presumptuously and the reason or trouble can not be verified.

Weichai Power Regulations on Quality Assurance for Diesel Engine used in Marine Electric Machinery

Serial number	Product models	Quality assurance period	Notes	
I. Whole diesel engine				
1	Diesel engine used in vessels, diesel generator and other power facilities.	12 months or 1500 hours	Subject to the date when they are actually purchased, which shall be evidenced by the sales invoice, warranty card, or reading on the meter.	
II. Diesel engine components				
1	Base components Engine body, crankshaft, engine seat, connecting rod.	2 years or 3000 hours (only limited to defects in production process, such as sand oil).		
2	Important components Cylinder head, flywheel, flywheel housing, timing gear chamber, connecting rod bolt, piston, piston ring, piston pin, main spindle bush, camshaft bush, camshaft, cylinder liner, valve, valve spring, valve seat, valve guide, valve shroud, tappet, lifter, rocker arm and rocker arm shaft, WEVB system, various gears, gear shaft, tension wheel, gear ring, oil pump, intake/exhaust pipe, front/rear support bracket, belt pulley, flange, water tank, high-pressure fuel pump, fuel injection valve, oil pump bracket, coupler, air-compressor, various covering and backing plates, water pump, oil cooler, fan bracket, silicon oil clutch, pressure limiting valve, vibration damper, crankshaft balancing mechanism, rear oil seal, various oil and water pipes and joints, power steering pump, thermostat, oil-gas separator, cylinder cushion, ECU, common-rail pipe, high-pressure fuel pipe, air filter body, oil filter body, muffler, thrust plate, suction filter, idle speed boost, oil dip rod tube, cooling oil nozzle, front and various other oil seals, turbocharger, intake pipe gasket, exhaust pipe gasket, turbocharger gasket, valve gasket, rubber hose, oil injector's return pipe, fuel supply pump, oil level gauge, fan, waterproof and oil proof rubber rings, bowl-shaped plug, starter, power generator, meters and instruments, various sensors, accelerator pedal, wire harness, electro-magnetic valve, flame preheating device	According to the above quality assurance period for the whole diesel engine.	Subject to quality assurance period or the specified number of kilometers (or hours), whichever expires early.	
3	Vulnerable components Belt, fan shroud, oil nozzle, plunger coupled parts, other gaskets, various weaved hose, hoop.	1 month		
Notes: 1. If the timing meter for marine diesel engine is damaged, the quality assurance period shall be calculated at 15 hours/day. 2. The warranty period may be calculated from the date when the diesel engine is readjusted and tested, but under no circumstances shall such date go beyond half a year after purchasing such engine.				

Overseas Service Center of weichai power Company Limited

No.	Country	Staffer	Tel.
1	Iran	Liu Xiting Zhong Lei	0098-21-22344130 0098-9122146779
2	sudan	wang zmao	00249922668539 00249183233846
3	russia	xue yuhui	0079267520188
4	singapore	dai liancheng	0065-96234801
5	vietnam	zhang yan	0084904315108
6	angola	song xiangming	00244924771275
7	kazstan	xia jianing	0077071130129
8	bengal	liu ningyu	008801711542654
9	india	li kongjiang wang yuhe	0091-9790789138
10	algeria	zhou jingwei	00213552950194
11	south africa	ma tianliang	0027-787114346
12	mongolia	liu weijun	00976-99911097
13	kenya	cao lei	00254722467613
14	syria	sun jijun	00963999602551
15	UAE	hanjie	00971502827836
16	thailand	zhang yunjian	0066830860868
17	cuba	huangjingui	005372604631
18	Saudi Arabia	wang xianwei	00966530663181
19	Nigeria	chen weichao	13515405118



Maintenance Record Table (Filled by service member)

Item	Content	Item	Content
User Name		User Postcode	
User Phone		User Mobile Phone	
User Address			
Distributor		Distributor Telephone	
Distributor Address			
Engine Model		Engine Order No.	
Engine ID No.		Purchased Date	
Construction machinery manufacturer		Construction machinery Model	

Service Centre	Date	warranty Item	Parts Changed	Quantity	Signed by Service Member	Signed by User

Service Centre	Date	warranty Item	Parts Changed	Quantity	Signed by Service Member	Signed by User

Please fill in this card carefully, and mail to User Service Centre of Weichai Power Company Limited. Our company will regards users as the first, and respect and adopt users' valuable suggestions.

Weichai Power Product warranty Card (for company)

Item	Content	Item	Content
User		User Postcode	
User Phone		User Mobile Phone	
User Address			
Distributor		Distributor Telephone	
Distributor Address			
Engine Model		Engine Order No.	
Engine ID No.		Purchased Date	
Construction machinery manufacturer		Construction machinery Model	

User Satisfaction Degree Examination Table

Project	Item	Very satisfying	satisfying	Acceptable	Dissatisfying	Disappointing
Quality of object	Appearance					
	Performance					
	Reliability					
Quality of delivery	Completeness of entire engine					
	Attached spare parts and tools					
	Attached documents					
	Time of delivery					
Quality of service	Timeliness of service					
	Service quality					
	Service attitude					
Others	Customer interruption					
	Returns goods					
	Extra transportation					
	Other suggestions from users					
Signed by customer						
Date:						
Maintenance and Service Centre of Weichai Power Company Limited Address: No.26 Minsheng East Street, Weifang, Shandong, China Tel: 0086-5368197520 Fax:0086-5362297520						

Note: Column for comments by customer to be clicked by the mark “√”