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Agrison TX920L – TX930LX Wheel Loader Range

Operation Manual

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Introduction of Non road Series Diesel Engine

“Agrison” 90, 92, 95, 100, 102GB Series of diesel engine are designed. The advanced technology developed for diesel engines for non-road diesel machinery products .This series diesel engine has excellent power and economic indexes, high reliability and durability and mainly applicable for engineering and agricultural machinery, marine main and auxiliary engines, and small generating unit.. As required by users, by modification of part of components (such as adjusting injection pump, replacing clutch housing, oil pan, air outlet and inlet pipe, engine support, electric appliance system), it can meet the different requirements of performance and installation of vehicles (units).

To ensure the normal use of the diesel engine, this specification describes the knowledge of non-road diesel machinery technical parameters, structure, performance and other aspects, while providing the use, maintenance and fault analysis of technical information and other aspects.

The data and description offered in the Instruction shall be based on current products solely. Please pay attention, due to continuous improvement of our products and for the purpose of satisfaction of different users, the in-kind product shall prevail if any discrepancy existed in the Instruction.

With diesel engine factory service manual, random tools and spare parts, the user can randomly enumeration tools and spare parts list.

Before you use, please read this manual seriously , using strictly according to the provisions of this specification, maintenance and repair of diesel engine.

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Preface

Thanks for your choosing “Agrison” diesel engine. The Instruction is prepared for your understanding its operation and maintenance. For the sake of safety of person and property, please read it carefully before using.

The mark “⚠” in the Instruction shows that personal injury or other damages may be caused, please obey the instruction strictly.

The instruction marked with “Notice” in the Instruction shows that personal injury or slight damages on gadget may be caused, please follow the operation procedure carefully.

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Notice for Users

1. In order to guarantee the safety of person and property, please read the Instruction carefully before using and operate and maintain diesel engine according to the regulations in the Instruction strictly.
2. Diesel engine’s startup, running-in, operation, shutdown shall be carried out properly according to the Instruction, wherein the new engine or that after overhaul must run in before using, through which the surfaces of moving parts of the engine can reach good matching so as to avoid abnormal abrasion and damage. Its service life, reliability and economics shall depend on the quality of initial running-in to the great extent, please run it in strictly according to the specification (Strictly prohibit running in at idle speed at original place).
3. Operators shall pay attention to the safety warning marks. Do not close to the area with safety warning during the operation of diesel engine.
4. In order to prolong the life of starter and battery, the continuous starting time of starter shall not exceed 15 seconds. If restart is required, turn the ignition key to “OFF” and restart after 2 minutes.
5. Do not remove air filter during operation. The air filter shall be cleaned as required. The upper and lower gasket rings for filter element shall be fit up for sealing in re-installation. When the filter is connected with hose, clamp shall be used to prevent the hose from loosing due to shake of diesel engine. Strictly prohibit not-filtered dusty air from entering into cylinder.
6. Oil supply system is the important system of diesel engine. The parts and components thereof

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shall not be removed or adjusted without permission, which shall be carried out in the technical service station authorized by Agrison Power.

7. When the running-in period comes to an end, please carry out maintenance in the near franchised service station as required by enclosed “Engine Service Manual”.
8. For the details of 3-Rs (Return, Replacement and Repair at no charge) for Agrison engines, please refer to the “Engine Service Manual”.
9. Please keep “Conformity Certificate” of engine and “Engine Service Manual” well.

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Chapter1 Main Technical Specifications and Parameters of 90、92、95、100、102 Series Diesel Engine

Parameters listed in the book based standard environment (atmospheric pressure: 100Kpa, inlet temperature 298, dry air pressure 99Kpa, water vapor partial pressure 1Kpa, relative humidity 30%) in the value under the condition; another particular value changes due to continuous product and product kind prevail.

(I) Main Technical Specifications

Natural Aspirated Diesel Engine **Table 1**

Model No.	490G	490GB	490T		495T			495GB	
Model	in-line four-cylinder, direct injection, water cooling, four-stroke, natural aspirated								
Total Piston Displacement L	2.7				3.0				
Bore×Stroke（mm）	90×105				95×105				
Rated Power/Speed kW/r/min	39/2650	39/2650	33/2600	39/2650	36.8/2400	38/2400	42/2650	45/2650	42/2800
Max.NetPower/Speed kW/r/min	37/2650	37/2650	30/2600	36/2650	34/2400	35/2400	40/2650	42/2650	40/2800
Max. Torque/Speed N·m/r/min	156-170/1700-1900				181-195/1700-1900				
Cylinders Working Sequence	1—3—4—2								
Min. Idling Stabilized Speed	800-850r/min								

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Min. Fuel Consumption Rate	≤ 238 g/kW·h
Crankshaft Rotating Direction	Clockwise (from the front view of diesel engine)
Lubricating Way	Pressure & splash combined
Cooling Way	Forced circulating water cooled
Oil Capacity（L）	6±0.2/7±0.2
Net Mass kg	230±20

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Model No.	4100GB						4100GB-2	
Model	in-line four-cylinder, direct injection, water cooling, four-stroke, natural aspirated							
Total Piston Displacement L	3.3						3.6	
Bore×Stroke（mm）	100×105						100×115	
Rated Power/Speed kW/r/min	46/2400	50/2400	45/2600	45/2650	52/2600	52/2800	53/2600	50/2400
Max.NetPower/Speed kW/r/min	44/2400	47/2400	42/2600	43/2650	45/2600	50/2800	50/2600	48/2400
Max. Torque/Speed N·m/r/min	185-224/1600-2000						234-250/1700-2000	
Cylinders Working Sequence	1—3—4—2							
Min. Idling Stabilized Speed	800-850r/min							
Min. Fuel Consumption Rate	≤ 238 g/kW·h							
Crankshaft Rotating Direction	Clockwise (from the front view of diesel engine)							
Lubricating Way	Pressure & splash combined							
Cooling Way	Forced circulating water cooled							
Oil Capacity（L）	6.8±0.2/9.5±0.2							
Net Mass kg	340±20							

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Model No.	4102GB	4102TB	4102GB				4102GB-1	4102GB						
Model	in-line four-cylinder, direct injection, water cooling, four-stroke, natural aspirated													
Bore×Stroke（mm）	102×115													
Total Piston Displacement L	3.8													
Rated Power/Speed kW/r/min	52/2200	48/2300	48/2400	50/2400	51/2400	52/2400	55/2400	58/2400	46/2600	48/2600	55/2600	56/2600	55/2650	60/2800
Max.NetPower/Speed kW/r/min	50/2200	45/2300	45/2400	48/2400	48/2400	50/2400	52/2400	55/2400	44/2600	45/2600	52/2600	55/2600	52/2650	57/2800
Max. Torque/Speed N • m/r/min	212-235/1700-2000	250-265/1600-1800	212-235/1700-2000											
Cylinders Working Sequence	1-3-4-2													
Min.Idling Stabilized Speed	800-850													
Min. Fuel Consumption Rate	≤ 238													
Crankshaft Rotating Direction	Clockwise (from the front view of diesel engine)													
Lubricating Way	Pressure & splash combined													
Cooling Way	Forced circulating water cooled													
Oil Capacity（L）	6.8±0.2/9.5±0.2													
Net Mass kg (kg)	340±20													

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Model No.	YN27GB1	YN30GB1	YN33GB1	YN33GB			
Model	in-line four-cylinder, direct injection, water cooling, four-stroke, natural aspirated						
Bore×Stroke（mm）	90×105	95×105	100×105				
Total Piston Displacement L	2.7	3.0	3.3				
Rated Power/Speed kW/r/min	40/2600	45/2600	50/2600	48/2400	50/2400	52/2600	58.8/3200
Max.NetPower/Speed kW/r/min	37/2600	42/2600	47/2600	45/2400	48/2400	50/2600	55/3200
Max. Torque/Speed N • m/r/min	160-170/1600-1800	181-190/1600-1800	203-215/1600-1800	210-225/1600-2000			
Cylinders Working Sequence	1-3-4-2						
Min.Idling Stabilized Speed	780-820		800-850				
Min. Fuel Consumption Rate	⩽ 225						
Crankshaft Rotating Direction	Clockwise (from the front view of diesel engine)						

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Lubricating Way	Pressure & splash combined	
Cooling Way	Forced circulating water cooled	
Oil Capacity（L）	6±0.2/7±0.2	6.8±0.2/9.5±0.2
Net Mass kg (kg)	230±20	340±20

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Model No.	YN36GB1	YN36GB2	YN36	YN38GB1	YN38GB2		
Model	in-line four-cylinder, direct injection, water cooling, four-stroke, natural aspirated						
Bore×Stroke（mm）	100×115			102×115			
Total Piston Displacement L	3.6			3.8			
Rated Power/Speed kW/r/min	55/2600	50/2200	60KW/2600	65/2800	60/2600	62/2600	57/2600
Max.NetPower/Speed kW/r/min	52/2600	48/2200	58/2600	61.5/2800	57/2600	60/2600	55/2600
Max. Torque/Speed N • m/r/min	215-240/1600-1800			240-255/1600-1800	230-255/1600-1800		
Cylinders Working Sequence	1-3-4-2						
Min.Idling Stabilized Speed	800-850						
Min. Fuel Consumption Rate（g/Kw.h）	≤ 225						
Crankshaft Rotating Direction	Clockwise (from the front view of diesel engine)						
Lubricating Way	Pressure & splash combined						

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Cooling Way	Forced circulating water cooled
Oil Capacity（L）	6.8±0.2/9.5±0.2
Net Mass kg (kg)	340±20

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Turbocharged Diesel Engine

Model No.	YN27GBZ				YN27GBZ1	YN27GBZ2	YN30GBZ			YN30GBZ1
Model	in-line four-cylinder, direct injection, water cooling, four-stroke, turbocharged									
Bore×Stroke（mm）	90×105						95×105			
Total Piston Displacement L	2.7						3.0			
Rated Power/Speed kW/r/min	60/2400	50/2600	52/2600	60/2600	60/2400	50/2600	62/2400	62/2600	65/2600	68/2600
Max.NetPower/Speed kW/r/min	57/2400	47/2600	49/2600	57/2600	57/2400	47/2600	60/2400	60/2600	62/2600	65/2600
Max. Torque/Speed N • m/r/min	213-237/1800-2200						230-255/1600-1800			
Cylinders Working Sequence	1-3-4-2									
Min.Idling Stabilized Speed	800 ±20									
Min. Fuel Consumption Rate（g/Kw.h）	⩽ 225									
Crankshaft Rotating Direction	Clockwise (from the front view of diesel engine)									
Lubricating Way	Pressure & splash combined									
Cooling Way	Forced circulating water cooled									

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Oil Capacity（L）	6±0.2/7±0.2
Net Mass kg (kg)	240±20

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Model No.	YN38GBZ	YN38GBZ1		YN38GBZ2
Model	in-line four-cylinder, direct injection, water cooling, four-stroke, turbocharged			
Bore×Stroke（mm）	102×115			
Total Piston Displacement L	3.8			
Rated Power/Speed kW/r/min	63/2600	58/2400	65/2400	75/2400
Max.NetPower/Speed kW/r/min	60/2600	55/2400	61/2400	71/2400
Max. Torque/Speed N • m/r/min	260-360/1800-2200			
Cylinders Working Sequence	1-3-4-2			
Min.Idling Stabilized Speed (r/min)	800 ±20			
Min. Fuel Consumption Rate（g/Kw.h）	⩽ 225			
Crankshaft Rotating Direction	Clockwise (from the front view of diesel engine)			
Lubricating Way	Pressure & splash combined			
Cooling Way	Forced circulating water cooled			

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Oil Capacity（L）	6.8±0.2/9.5±0.2
Net Mass kg (kg)	350±20

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Model No.	YN4A088-30	YN4A085-30	YN4A075-30	YN4A062-30	YN4A062-31	YN4A075-31	YN4B092-30	YN4B085-30
Model	in-line four-cylinder, direct injection, water cooling, four-stroke, turbocharged、Electric-EGR							
Bore×Stroke（mm）	90×105						92×105	
Total Piston Displacement L	2.7						2.8	
Rated Power/Speed kW/r/min	65/2600	63/2400	55/2400	45/2400	45/2600	55/2600	68/2600	63/2400
Max.NetPower/Speed kW/r/min	62/2600	60/2400	52/2400	42/2400	42/2600	52/2600	65/2600	60/2400
Max. Torque/Speed N • m/r/min	270/1600~1950	280/1600~1800	245/1600~1800	205/1600~1800	195/1600~1950	230/1600~1800	285/1600~1950	280/1600~1800
Cylinders Working Sequence	1-3-4-2							
Min.Idling Stabilized Speed (r/min)	800 ±20							
Min. Fuel Consumption Rate（g/Kw.h）	⩽ 225							
Crankshaft Rotating Direction	Clockwise (from the front view of diesel engine)							
Lubricating Way	Pressure & splash combined							

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Cooling Way	Forced circulating water cooled
Oil Capacity（L）	6±0.2/7±0.2
Net Mass kg (kg)	240±20

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Model No.	YN4C082-30	YN4C075-30	YN4C075-31	YN4D088-30	YN4E106-30	YN4E102-30	YN4E095-30	YN4E088-30
Model	in-line four-cylinder, direct injection, water cooling, four-stroke, turbocharged、Electric-EGR							
Bore×Stroke（mm）	100×105			100×115	102×115			
Total Piston Displacement L	3.3			3.6	3.8			
Rated Power/Speed kW/r/min	60/2600	55/2400	55/2600	65/2600	78/2600	75/2400	70/2600	65/2400
Max.NetPower/Speed kW/r/min	57/2600	52/2400	52/2600	62/2600	74/2600	72/2400	67/2600	62/2400
Max. Torque/Speed N • m/r/min	255/1600~1950	255/1600~1800	230/1600~1950	285/1600~1950	350/1600~1950	350/1600~1800	320/1600~1950	320/1600~1800
Cylinders Working Sequence	1-3-4-2							
Min.Idling Stabilized Speed (r/min)	800 ±20							
Min. Fuel Consumption Rate（g/Kw.h）	⩽ 225							
Crankshaft Rotating Direction	Clockwise (from the front view of diesel engine)							
Lubricating Way	Pressure & splash combined							

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Cooling Way	Forced circulating water cooled
Oil Capacity（L）	6.8±0.2/9.5±0.2
Net Mass kg (kg)	350±20

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(II) Main Technical Data

1. Valve Clearance

Table 2

Intake Valve	Cold state	0.30～0.35mm
	Hot state	0.25～0.30mm
Exhaust Valve	Cold state	0.35～0.40mm
	Hot state	0.30～0.35mm

2. Temperature and Pressure Ranges of Diesel Engine under Normal Situation

Table 3

Leaving Water Temperature	≤ 95℃
Oil Pressure	196～588 kPa
Oil Pressure at Min. No-load Speed	≥49 kPa

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3.Tightening Torque of Main Bolts

Table 4

Model No.	490、495（YN27、YN30） Series Diesel Engine	4100、4102（YN33、YN36、YN38） Series Diesel Engine
Bolts for Cylinder Head	130~160N·m（13~16kgf·m）	160~200N·m（16~20kgf·m）
Bolts for Main Bearing	140~170N·m（14~17kgf·m）	200~240N·m（20~24kgf·m）
Bolts for Connecting Rod	100~130N·m（10~13kgf·m）	100~140N·m（10~14kgf·m）
Bolts for Flywheel	100~130N·m（10~13kgf·m）	100~140N·m（10~14kgf·m）
Bolts for Clutch Housing	70~100N·m（7~10kgf·m）	70~110N·m（7~11kgf·m）
Bolts for Crankshaft Pulley	140~170N·m（14~17kgf·m）	200~230N·m（20~23kgf·m）

4. Tightening Torque of General Bolts and Nuts (For Reference)

Table 5

Strength Class of Bolt	Nominal Diameter of Bolt mm							
	6	8	10	12	14	16	18	20
	Tightening Torque N.m							
5.6	5~7	12~15	25~31	44~54	69~88	108~137	147~186	206~265
6.6	6~8	14~18	29~39	49~64	83~98	127~157	176~216	245~314
8.8	9~12	22~29	44~58	76~102	121~162	189~252	260~347	369~492
10.9	13~14	29~35	64~76	108~127	176~206	274~323	372~441	529~637
12.9	15~20	37~50	74~88	128~171	204~273	319~425	489~565	622~830

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5.Recommended Value of Tightening Torque of Screw Plug

Table 6

Thread Size	NPT1/8	NPT1/4	NPT3/8	NPT1/2	NPT3/4	NPT1
Tightening Torque N.m	8～14	24～34	47～68	68～95	88～102	

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Chapter2 Operation of Diesel Engine

(I) Fuel

In order to guarantee the reliability of supply system, the clean diesel produced by regular oil company in the country and in conformity with the state’s standard must be used; in case of automatic filing, the fuel vessel must be clean and used exclusively; the fuel filling shall be tried to be carried out in sealing; the diesel to be filled must be precipitated for more than 48 hours and that in the upper part of the vessel shall be used.

The selected diesel brand is related to ambient temperature. When the temperature is low, the wax in the diesel is separated resulting in increased viscosity and blocking the pipeline, which will cause difficult startup and black smoke. On the contrary, if the diesel for winter is used in summer, high temperature will result in decreased viscosity causing bad lubrication in supply system, which may damage injection pump and injector; moreover, lead to delayed ignition causing short of power and white smoke. Therefore, different brands of diesel shall be used in different seasons and at different regions.

Please use diesel as the requirement in the following table based on local climate conditions.

Table 7

Ambient Temp.	T＞5℃	−10℃≤T＜5℃	−20≤T＜−10	T＞−20℃
Diesel Brand to be used	No. 0	No. -10 light diesel	No. -20 light diesel	No. -35 light diesel

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Notice:

1. Too much collecting water in the water-filtering cup at the lower part of oil-water separator will cause the engine not to be started, which will be eliminated in time.

2. Be sure not to operate till the fuel tank is completely empty; otherwise it may lead to air entering in the fuel pipeline causing abnormal supply and power cutoff.

Please fill diesel in the regular service station. The failure of engine caused by inferior diesel will make you lose the interest of quality assurance.

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(II) Lubricating Oil

Diesel engine shall use the diesel at CD level or above.

The viscosity number of selected oil is related to ambient temperature. When the temperature is low, high viscosity will increase startup resistance and the engine can not reach starting speed easily so that the startup is difficult. Therefore, proper brand of lubricating oil shall be used based on different ambient temperature in different seasons and at different regions.

Table 8

Ambient Temp.	Lubricating Oil Brand	Corresponding SAE Number
＞-10℃	15W/40 CD level	15W/40 CD level
-20℃～-5℃	10W/30 CD level	10W/30 CD level
＞-20℃	5W/30 CD level	5W/30 CD level

Notice:

1. It is not allowed to use different brands of oil from different manufacturers together;
2. The oil to be filled is not allowed to contain impurities or water.

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(III) Coolant Fluid

Diesel engine shall use antifreeze coolant fluid (which may use alcohol and glycerin mixture or glycol). It has the necessary performance of antifreeze, anticorrosion, antiscale and increasing boiling point.

If there is no antifreeze fluid, clean soft water, such as river water, rain water, shall be used, which has poor mineral composition and little scale deposit after heated so that the cooling system will not be clogged easily and affect heat dissipation.

Notice:

1. Constantly use coolant fluid and pay attention to the continuity of the usage. Please notice that coolant fluid has not only the function of antifreeze but also the roles of anticorrosion, antiboiling and antiscale.

2. Select coolant fluid with different freezing point based on the air temperature of the region the diesel engine to be used. The freezing point shall be10℃ lower than the min. temperature of this region at least so as to avoid malfunctioning.

3. Purchase qualified product and do not buy inferior one on the cheap so as to avoid damages on engine and cause unnecessary loss.

4. Different brands of coolant fluid are not allowed to be used together so as to prevent chemical reaction and destroy the comprehensive performance of anticorrosion.

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5. Do not add hard water, such as well water, tap water; once the coolant fluid is found to have any suspended or deposited matter, or has been stunk, it is demonstrated that it has been reacted chemically and deteriorated and malfunctioned; at this time, the cooling system should be cleaned in time and the coolant fluid should be replaced completely.

6. Glycol coolant fluid is poisonous, which shall be prevented from being contacted or inhaled; in case of skin contact, wash with water immediately and completely; furthermore, anticorrosive additive of nitrite in this coolant fluid has carcinogenicity so that the waste is not allowed to poured randomly to avoid environment pollution.

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(IV) Startup of Diesel Engine

Preparation and Inspection before First Startup:

1. Fill lubricating oil into oil pan till reaching upper mark on dipstick.

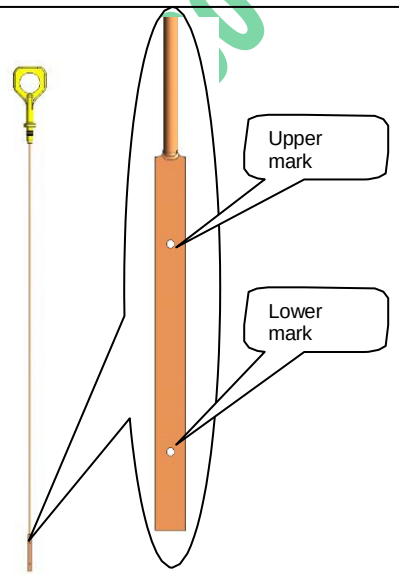
2. Add coolant fluid till reaching water tank filler, and stand 4 to 5 minutes to remove the air inside ,then cover the filler cap.

3. Fill clean diesel into the tank, check the pipeline thereof for free flowing and exhaust the air inside.

4. Check the connections between battery and electrical system for the correctness and firmness.

5. Check the pipelines and joint faces for oil and water leakage.

6. Check the belt for its tensioning force and any abnormal.



Attention: When oil level is measured, The vehicle or the engine must be placed horizontally, the engine is cold.

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Preparation and Inspection before Daily Startup:

1. Stop vehicle at flat ground with parking brake.
2. Pull out dipstick
3. Wipe it with clean cloth, then insert it again down to the bottom.
4. Pull out the dipstick again and check the oil level.
5. Check the oil level and confirm whether it is between upper and lower mark on the dipstick; if it is below the lower mark, add the oil required.

Notice

1. The oil level check shall be carried out after shutdown for 15～20min.
2. Check the water tank coolant is enough, and add properly if required.
3. Check oil tank for shortage and add properly if required.
4. Check the pipelines and joint faces for oil and water leakage.
5. Confirm the parking brake is in working.
6. The engine should be in the empty load condition.

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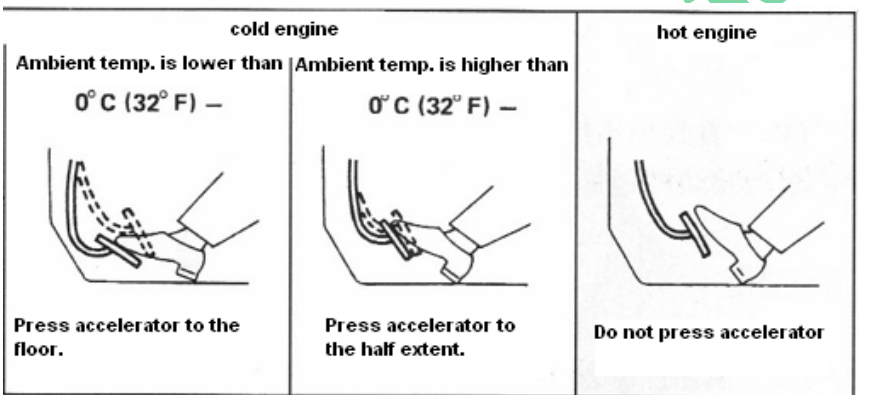

Starting procedure of cold engine (ambient temp. is higher than 0℃):

1. Switch on with the key and check each electrical instrument for normal indication.
2. Turn the ignition key to “ON”.
3. Press the accelerator to the half extent and start the diesel engine.
4. Take the foot off the accelerator pedal slowly after startup.
5. It should loosen the ignition key after starting the diesel engine.

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Starting procedure of hot engine

1. Switch on with the key and check each electrical instrument for normal indication.
2. Turn the ignition key to “ON”.
3. It should loosen the ignition key after starting the diesel engine .

Notice: When lubricating oil or oil filter is replaced or diesel engine is not used for long time (more than 1 week), oil pump shall be in oil-break before startup and vehicle is empty load condition; drive crankshaft with starter for about 10～15s and prelubricate turbocharger, then start the engine.

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Warming up and inspection after startup:

1. Diesel engine shall be idling for 3～5min after startup for warming up, but cold engine shall be prevented from idling for long time.

2. The followings shall be checked during warming up:

Oil pressure (the alarm light thereof is off after warming up).

Charging state of dynamo (the indicator light thereof is off during warming up).

Pay attention to abnormal sound of engine; if any abnormal sound is heard, check the engine immediately and eliminate the fault in time.

The color of the engine exhaust:

The color of exhaust	Burning state of the engine	Remark
Colorless or Slight blue smoke	Normal	The ideal combustion state
Black smoke	Abnormal	The unsatisfactory combustion state
White smoke	Abnormal	The unsatisfactory combustion state

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(V) Running-in of Diesel Engine

Diesel before use must be running, running - can make the surface by moving parts of the diesel engine to achieve a good fit for each, in order to avoid abnormal wear and damage. Diesel engine service life, reliability and economy work, to a large extent depends on the initial run-good or bad.

Run-diesel can be carried out together with the supporting machinery, running time is 40 to 60 hours. During the run, the load should not exceed 70% of the specified load, the speed shall not exceed 80% of rated speed. Do not let the engine idle for a long time, after the end of the run, after running to be "forced to go together maintenance" (see Chapter III, seventh). Recommended to the Agrison Power technical service stations of were " compulsory running-in maintenance."

(1). Diesel is not allowed in the case of cooling fluid "boil" work, and do not work in the long-term water temperature is too high or too low.

(2).Diesel engine is not allowed to run at idle for more than 10min.

The user of harvester engine should run it strictly according to the following specification.

1.Run at idle for 5 minutes.

2.Diesel engine from the accelerator semi open transition to open the throttle fully in place 1 hours of operation,careful observation of the diesel engine is working properly.

3.Diesel engine with the harvest units on-site 3 hours of operation from the accelerator semi opentrans to open the throttle fully.

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4. Diesel engine with the harvest units to throttle the half open walking 5 hours of operation

5.Before the harvester works continuously，the lubricating oil pressure should reach 2kgf/cm2，water temperature raise to 60℃.After that the harvester begin to keep a slow speed with small feed quantity，and increase the load gradually to the rated feed quantity.

(VI) Precautions during Operation of Diesel Engine

During operation of diesel engine, there will be some omens which shall draw our attention before malfunction:

1. Oil Pressure

During operation of diesel engine, the alarm light of oil pressure is twinkled repeatedly, which shows the oil pressure is relatively low and the engine should be shut down for inspection.

2. Coolant Temperature

The indication of water thermometer exceeds100℃ or the indicator light thereof is on, which shows the engine is overheated and it should be run at the speed lower than 1000rpm for 5min and shut down after cooled for inspection.

In case of normal operation, water temperature can not reach the normal temperature, which shows that the engine is overcooled; early abrasion may be caused and insulation measures shall be adopted, such as add protection cover for radiator.

3. Engine Noise

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The engine and related parts has any abnormal sound, which shows that it runs abnormally or the moving part has abnormal friction; thus the engine should be shut down for inspection.

4. Exhaust Smoke Color

Volume of white or black smoke rose from the engine, which shows the combustion inside is abnormal and the engine should be shut down for inspection.

Notice:

1. Do not stop overheated engine in a second.

2. Diesel engine is not allowed to work under overload for long time.

3. Strictly prohibit adding cold water into engine immediately in case of high temperature and water shortage.

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(VII) Shutdown and Inspection of Diesel Engine

1. Before the engine has been shut down,it should make sure the gear has been positioned in neutral and the vehicle has been in the empty load condition.

2. Diesel engine shall be operated at low speed for 3-5 minutes before shutdown so as to be cooled down completely, during which the engine shall be checked for leakage of water, oil and gas and abnormal sound.

3. Turn the key switch to “OFF” and disconnect the general supply for vehicle.

4. When the ambient temperature is below 0℃, the drainage valves of engine block and water tank shall be opened after shutdown to drain the cooling water fully and prevent the block, water pump and radiator from frost damage. If antifreeze fluid at proper temperature is used, the drainage is not required.

(VIII) Security Warning

1. When diesel engine is running, do not contact fan, belt pulley, belt and other exposed area of rotating parts so as to avoid being hurted by them.

2. Operator is not allowed to open the water filler cap on radiator immediately if diesel engine is hot so as to avoid being scalded by high-temperature water vapor.

3. When diesel engine is hot, do not contact exhaust pipe and other high-temperature parts so as to

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prevent from being scalded.

4. It is necessary to ensure the effective ventilation when diesel engine is used, because it will exhaust harmful gas and soot.

5. The influence of waste gas, exhaust smoke and noise on surrounding environment, personnel and articles has to be taken into account when diesel engine is working.

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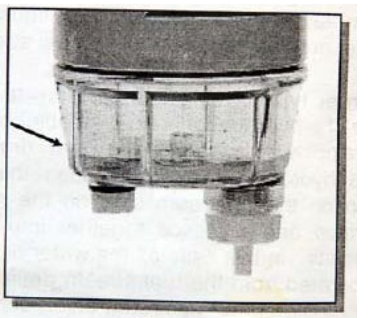
Chapter 3 Regular Inspection and Technical Maintenance

AS the condition of most of Non road engine is very scurviness . The service life of engine is depended on time and mode of use. If no attention is paid to decreased performance of engine, the vehicle's performance will be reduced. In order to guarantee diesel engine to be in good technical situation and serve you reliably for long time, please carry out regular inspection and technical maintenance in accordance with the technological specification in this chapter.

(I) Fuel Supply System

The pump and nozzle for injection is precise parts so that the water content or impurities in the fuel will cause the pump piston or injector to be damaged and make the filter dirty or clogged. Thus unclean fuel will reduce the service life of the pump and the injector. Please carry out regular inspection according to the following.



1. Drainage of Oil-water Separator or Fuel Tank

Drain the water in oil-water separator or fuel tank regularly (every time fuel is filled). If the indicator light (if provided) on oil-water separator is on during working, shut down and drain the water.

Stop vehicle or engine at safe place.

Place a vessel under drain plug of oil-water separator or fuel tank.

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Screw of the drain plug 4 or 5 turns to drain the water inside. In order to avoid the plug from dropping, do not screw it off extremely.

After drainage, screw up the plug and check it for leakage.

Carry out exhaust for fuel system (refer to Exhaust in Fuel System).

The vehicle with oil-water separator shall start engine to check whether the drain plug is leaked and whether the indicator light of the separator is off.

Notice: If frequent drainage is required, please drain the water in fuel tank at the service station of Agrison Power to get rid of water.

2. Replacement of Diesel Filter

Replacement Cycle

The replacement cycle for the diesel filter: Under the condition of guarantee fuel to clean every 12 months or the cumulative work 320 hours. If the impurities such as fuel and water cut is large,it should shorten the cycle.

Replacement Procedure

Screw off the diesel filter with proper tool.

Wipe the joint face of the filter cartridge seat clean, then apply little diesel to the rubber sealing ring for filter cartridge, and fill with diesel into the new filter cartridge from outer race.

Screw on filter cartridge till there is slight resistance, and then screw up more than 2/3 circle till

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tightened.

Exhaust the gas in fuel pipes.

Start up engine and check for the leakage.

3. Exhaust in Fuel System

Air entering into the fuel system will lead to difficult startup of engine and other failures. If the fuel tank is emptied during maintenance, please exhaust the gas in the fuel system after refilling of fuel.

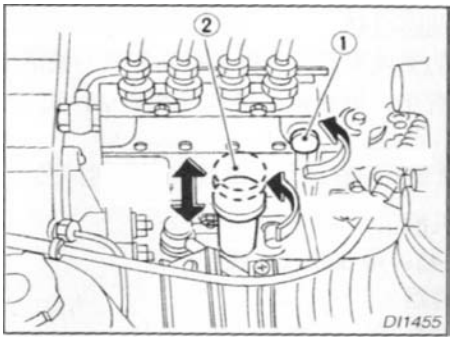
Procedure of Exhaust in Fuel System

Loosen the bleed screw ①.

Press the fuel transfer pump ② up and down with force till no bubbles could be seen in the fuel exhausted from the bleed screw ①.

Tighten the bleed screw ① and press the transfer pump ② up and down with force till the resistance is felt to increase suddenly.

If the engine is not operated stably after startup, the accelerator handle could be pulled two or three times.



Notice:

1. The piston type fuel transfer pump, mounted on the side of injection pump, is driven by the eccentric wheel on the camshaft of the injection pump. When diesel engine stops running and fuel pumping or air

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exhausting in the system is required, pump fuel with manual pump and then tighten the nut on manual lever. The joint of fuel suction pipe is set at the bottom of the transfer pump; and inside the joint bolt, there is a small sieve which is arranged at the front portion of the fuel passage impeding most of impurities. Hence do not throw this small sieve away in usual inspection; furthermore, this sieve shall be cleaned frequently, otherwise the fuel passage will be clogged resulting in abnormal operation of diesel engine.

2. Diesel filter provided to diesel engine is single- or double-grade spin-on filter with bleed screw on the top. The filter element shall be replaced regularly. The interior shall be prevented from dirty when in maintenance; especially, the seal at every portion shall be noticed when in assembling. In order to guarantee diesel engine to get clean fuel, automobile accessory manufacturers or users are required to add one-stage oil-water separator before this filter.

3. Injection pump is the heart of diesel engine so that the performance of the engine depends on that of the pump. The pump has been adjusted properly before delivery and sealed with lead already. Do not unseal. Maintenance and adjustment is required to be carried out on special test stand by professional.

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(II) Lubricating System

Bad engine lubrication system for maintenance,it will greatly influence the service life of the engine.

Please replace lubricating oil and the filter thereof in accordance with the specified maintenance cycle.

Replace lubricating oil and the filter thereof

It should be replaced according to the following steps to synchronous change oil and oil filter.

The warning light for oil pressure is on during operation of the engine indicating filter clogged. Replace it immediately regardless of the specified maintenance cycle.

1.<u>Replacement Cycle</u>

Lubricating oil: 6 months or the accumulative work 100 hours

Oil filter: 6 months or the accumulative work 100 hours

2.<u>Replacement Procedure for Lubricating Oil</u>

The vehicle or the temperature of the engine is in normal use.

Stop vehicle on horizontal plane with parking brake.

Stop the engine. Cut off the power and wait at least 10 to 15 minutes.

Loosen the filter with special wrench. (Depending on the specification of the engine, a special cap wrench is required. If there is any question, please consult to Agrison service station.) Then screw off the filter by hand.

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Wipe the mounting surface of the filter clean.

Include new filter with rubber gasket which is dipped with oil fully.

Screw on the filter by hand till the hand can not play the role, and then tighten it with wrench.

Loosen drain screw on oil pan with wrench to drain off the oil; then screw on and tighten it.

Wipe clean the oil filler on the cylinder head cover when oiling from this hole so as to prevent from mixing foreign matters. After filling, cover carefully and then check the oil level after 5-10 minutes.

When start up the engine, check the filter and the screw on oil pan for leakage and then adjust as required.

When shut down the engine, check the oil level after several minutes and fill if required.

Notice: Be careful that hand is to be scalded by hot oil.

1. Check the oil level frequently. Lack of oil will cause the engine damage which is not guaranteed.

2. Be sure that the used oil is not to be poured to ground, gutter or river, which shall be disposed at dump area with proper equipment.

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Oiling capacity (Approx): Unit：Liter **Table 10**

	Integrated oil pan	Welded oil pan
Oil filter replaced	7.5	10
Oil filter not replaced	7	9.5

Note: The recommended lubricating oil is used (Refer to the section of "*Lubricating Oil"* in Chapter 2 for details) with the filling capacity is different based on the oil temperature and oil draining time. The above vales are for reference only and the oil level must be checked with dipstick after replacement of oil.

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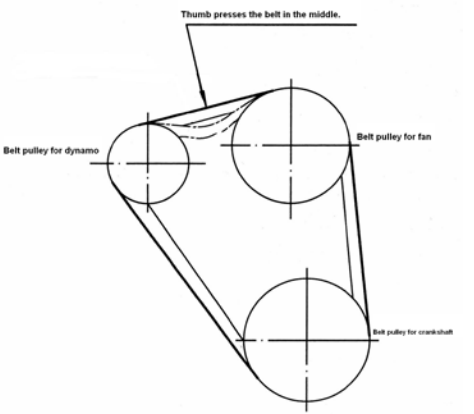
(III) Cooling System

1. Inspection and Adjustment Requirement of Belt

Check the belt for cracks, cilia, wearing or attachment of oil. Replace it if necessary. The belt is not allowed to contact the bottom of the groove.

Check and adjust the tightness of the belt. Loose belt will lead to excessive temperature of the water in the engine or tight belt to wearing or breaking of belt. Press down the belt pulley of water pump and the belt at the middle of the engine to check the deviation. When the deviation of fan belt is more than the specified value or after replacement of fan belt, the tightness of the fan belt shall be adjusted. Refer to Table 12 for the details.



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Belt Deviation： Unit：mm **Table 11**

Driving belt	Deviation of used belt		Deviation of new belt
	Limit	Deviation after adjustment	
Fan belt	12～13	8～9	7～8
Pressure applied	98N（10kg）		

2.Engine cooling fluid

When the engine is in operation, sufficient coolant fluid inside the cooling system is required to guarantee normal work; hence careful inspection before every dispatch is necessary and the clean coolant fluid shall be added in time. It is forbidden to use hard water containing large amount of alkali or mineral matters in the cooling system.

Notice:

If the cooling system requires frequent supplement of coolant fluid, please make a check in maintenance service center.

The antifreeze coolant fluid is poisonous so that it shall be stored in the marked container carefully and prevented from being contacted by children.

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Replacement Procedure of Coolant Fluid in Engine

Open both drain plug and radiator cap.

Open the drain valve on the engine block.

Tighten the water switch on the block after drainage of coolant fluid.

Fill water into the radiator

Keep the engine at the speed of 1600-2000rpm for about 1 minutes to vent air.

Shut down and repeat the step 2 to 4 two to three times.

Add coolant fluid into the radiator to specified level.

Carry out the proportion of antifreeze fluid and water in accordance with the description attached to the container for antifreeze fluid.

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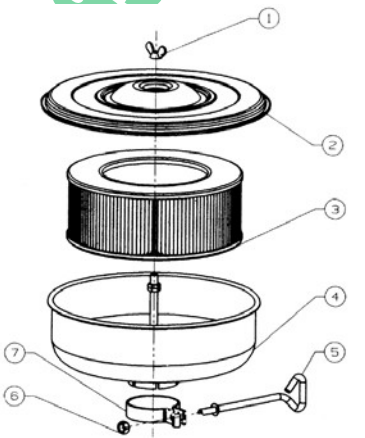
(IV) Air Intake System

The status of air intake system will affect the life and performance of the engine and the air compressor to a great extent. It is recommended to use one air filter for both air compressor and the engine and clean and maintain it frequently.

Dirty filter element will cause insufficient air intake of engine and air compressor leading to decreased power of the engine and then to engine failure finally. In addition, damaged filter element will cause abraded cylinder and air valve mechanism of engine and air compressor leading to increased oil consumption and decreased output of the engine and then to shortened service life of both machines finally.

For the air filter for diesel engine, please maintain it as specified for that on vehicle in "*Regular Technical Maintenance*".



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(V) Battery

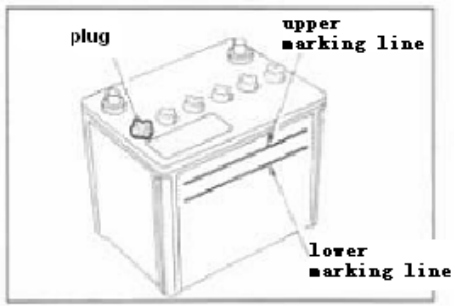
1. The surface of battery shall be kept clean and dry. Any corrosive liquid shall be washed away with alkaline water.

2. The joint of battery shall be ensured clean and firm.

3. The negative terminal of battery shall be cut off (or the master supply switch be cut off) if the vehicle is not used in 30 days or longer so as to prevent from electric leakage.

Notice:

Do not let the battery near to fireworks or electric spark since the hydrogen released during the reaction of battery would explode. Do not let battery fluid contact skin, eyes, textile, or paintwork. After touch the battery by hand, do not rub eyes with this hand and clean it completely. Once the acid fluid contacts eyes, skin or clothes, wash with clean water for at least 15 minutes immediately and go to see a doctor in time.



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(VI) Air Compressor

Air compressor is the pressure gas source for braking. Its performance will affect the safety of driving. In order to guarantee the compressor to work reliably, the followings shall be obeyed.

1. Do not increase the pressure setting of the pressure adjusting valve on air cylinder at discretion.

2. Regularly check the drying unit, retaining valve, pressure adjusting valve, unloading valve and safety valve on the exhausting pipeline of the air compressor for their situations.

3. The impurities and dust in the intake air will affect the sealing performance of valve sheet of the compressor, which are the main causes for no air inflating and low inflating efficiency. Please clean and maintain the valve sheet regularly and remove the cylinder head for cleaning every 8000km.

Steps: Remove the four bolts on the top of the cylinder head and take down the head and the valve seat plate to clean away impurities and dirts on the sealing face of the valve seat by gasoline or diluting agent. Take down the inlet valve sheet from two locating pins and clean away impurities and dirts on the sheet by gasoline or diluting agent. Take down the valve sheet from the head, remove the two screws on the pressing plate for exhausting valve sheet and take down the sheet to clean away impurities and dirts on the valve sheet, plate and seat by gasoline or diluting agent. After cleaning, the assembly could be recovered by getting rid of the pad on the head and using special gland bush which is not allowed to be substituted by common gasket, during which the valve sheet is not allowed to be installed backward. After assembling, all bolts shall be checked for the tightness. Start the engine and check the pumping performance of the compressor to confirm whether there is leakage, if yes, clear the fault in time.

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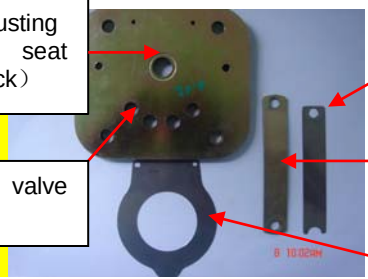
Remove the four bolts on the top of the cylinder head.

Clean away dirts on the sheet and seat of the inlet valve by gasoline or diluting agent.

Clean away dirts on the sheet and seat of the exhausting valve by gasoline or diluting agent.

Exhausting valve seat（Back）

Inlet valve seat



Exhausting valve sheet

Pressing plate for exhausting valve sheet

Inlet valve sheet

Notice: When air compressor is working, there is a little of oil vapour in the compressed air objectively. After a period of using, oil vapour and water content will deposit in the air reservoir. Oil water mixture will be exhausted as draining the water in this reservoir; however, providing that the oil consumption of the engine is normal, it is normal.

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(VII) Usage and Technical Maintenance in Winter

When the temperature is below 5 ℃ in winter, the diesel may be frozen due to low temperature of diesel engine body and large viscosity of lubricating oil, which results in difficult startup of the engine. Hence it had better be carried out comprehensive technical maintenance once before entering into winter and the followings shall be noticed in usage:

1. Choice of the fuel

Select proper fuel as appropriate (Refer to the section of "*Fuel*" in Chapter 2 for details).

Please go to service station to make sure you use the right fuel.

2. The supply of fuel and eliminate water

Pay attention to the supply of fuel.

Pay attention to loose the drain plug of the fuel tank to exhaust the deposited water content before startup.

- Notice:

1.If the liquid surface of Fuel tank is low,it will increase the cubage of air.So that it will increase the amount of air in the fuel tank.

2. Damp amassment may cause the fuel tank rust，and it may lead engine start difficulity or engine malfunction.

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2. Coolant Fluid

When the temperature decreases below 5℃, the water in the cooling system shall be drained after shutdown. In order to avoid draining and filling water repeatedly, we recommend to use antifreeze coolant fluid (refer to the section of "*Coolant Fluid*" in Chapter 2 for details).

Notice：

Carbinol base antifreeze is not recommended because it will affect the non-metal material in the cooling system and decrease the boiling point of the coolant fluid.

High silicate antifreeze is not recommended because it will lead to serious deposits.

Please use antifreeze as the proper proportion recommended by related manufacturer.

3. Lubricating Oil

When the temperature decreases, the viscosity of the oil increases resulting in difficult startup of the engine, and the viscosity affects the stability of the engine to a large extent; hence it is very important to select lubricating oil with appropriate viscosity based on the temperature. (Refer to the section of "*Lubricating Oil*" in Chapter 2 for details)

4. Battery

The battery capacity decreases with the temperature and its discharge rate reduces rapidly. Therefore it is proposed to check the battery in chartered service station before winter and replace it if necessary.

Pay attention to charge the battery fully in cold winter.

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Cold startup requires current consumption to a larger extent, thus comparing to normal temperature, more time is needed for recharge after startup.

The electrolyte of undercharged battery has low specific density so that it is easy to be iced up and damaged.

Pay attention to cold-proof for battery in winter.

Refill distilled water to battery shortly after starting the engine. If it is done after the engine begins to work, the supplemented water can not mix with the original electrolyte and the unmixed water may stay in the upper layer and cause ice.

5. Engine Startup in Winter

Below the temperature of 0℃,the engine should fix preheating equipment to start the engine easily.The followings shall be paid attention to in starting the engine:

(1). Before starting the engine ,the engine should preheat.

(2). Press the accelerator to the full extent and start the diesel engine.

(3). If start the engine fail unsuccessfully for the first time,wait for 30 seconds to let the batteries resume the power of electricity. And then preheat to start afresh.

(4). To protect the engine ,every starting time should not preponderate over 2 minutes.

(5). When start the engine,if it appears starter gear and flywheel impact iterative,which indicates batteries is in shortage.

(6) Under the condition of low temperature especially, set the accelerator to the location of breaking

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off fuel and let the engine rotate in the empty load condition.And it make every active part rotate easily to minish the viscosity of lubricating.Finally preheat engine and start engine.

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(VIII) Regular Technical Maintenance

Regular maintenance is important and rational use of the diesel engine project, in order to make the diesel engine to maintain a good technical condition, long-term reliable work for you, it must be carefully technical maintenance according to specifications.

When maintenance, pay special attention to cleaning the parts, when dismantling parts reinstall, should be cleaned and ensure the correct installation, and then start checking whether functioning properly.

Technical maintenance are classified as follows:

(一) Routine maintenance (work 8 to 10 hours)

(二) The first compulsory running-in maintenance（3 months or the cumulative work 50 hours）

(三) The first level Technical Maintenance（6 months or the cumulative work 100 hours）;

(四)The second level Technical Maintenance（12 months or the cumulative work 300 hours）;

(五) The third level Technical Maintenance（18 months or the cumulative work 500 hours）;

■ Daily Maintenance：

I、Check the oil level and confirm whether it is between upper and lower mark on the Vernier;If it is below the lower mark,add the oil required. When the surface of the oil suddenly increased or decreased, should check the reason immediately.

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2、Check the coolant fluid of water tank;add properly in case of shortage.

3、Check the battery electrolyte fluid level, it should be maintained above the plate 10~15 mm, should add distilled water shortage.

4、Check oil tank for shortage and add properly if required.

5、Check all parts of the diesel engine to be connected reliably and firmly, such as a loose fastening.

6、When the engine is working,it should debar the malfunction ,such as “leakage of water,oil and gas and adnormal sound

7、Clean away the dirts on the radiating surface of of water tank.

■ The first compulsory running-in maintenance：

1.Check the level and leakage of the coolant fluid.; all joints of the water pipes for coolant fluid shall have no leakage.

2.Check the battery. Verify positive and negative posts to be connected firmly and reliably and installed properly and observe the surrounding of battery to confirm whether the electrolyte leaks.

3. Check the power steering fluid. Observe the level of the power steering fluid to be located between the upper and lower marked scales and close to the upper limit.

4. Check the tightness and abnormal abrasion of the belt by sight.

5.Check all parts of the diesel engine to be connected reliably and firmly.

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6.Clean away the dirts on the radiating surface of charge air cooler and the surface of water tank.

7. Use compressed air to clean air filter.

8.Clean the air compressor (a pump) with independent air filter element.

9. put engine oil.

10. Replace the engine oil filter cartridge.

11. Fill in engine oil, it should be between the upper limitand lower scale and position on the scale of the.

12.Check diesel filter .If there is water in the water-filtering cup at the lower part of diesel filter,which will be eliminated in time.

13.Check the condition of engine idle, relaxedly press the accelerator,pay attention to abnormal sound of engine.

14.Slightly refueling door, when the water temperature rise, whether the fannormal start work listening with ears.

■ The first level Technical Maintenance：

Besides don't replace the element of oil filter cartridge and engine oil.，others are same as "running-in maintenance".

■ The second level Technical Maintenance：

In addition to the "running-in maintenance" the followings must be done:

1.Replace the element of diesel filter.

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2.Replace the element of air filter.

■ The third level Technical Maintenance：

Accomplish “The first level Technical Maintenance”， the followings must be done:：

1.Replace the element of diesel filter.

2.Replace the element of air filter.

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Chapter 4 Common Fault Analysis and Elimination Approaches for Diesel Engine

Notice: All fault eliminations are proposed to be disposed in the service station authorized by A g r i s o n ; otherwise you may not be entitled to enjoy the "Three Commitments".

(I) Difficult Startup of Diesel Engine

Fault Characteristics & Causes	Elimination Approaches
1.Fuel system a） Fuel brand is selected improperly. b） Fuel tank is free of oil or it is switched off. c） Air is entrained in fuel pipe and injection pump. d） Water is mixed in fuel, or fuel passage or filter is clogged. e） Pump for fuel transfer or injection does not supply oil or advance angle of fuel supply is improper.	a） Select proper fuel brand. b） Add fuel to the tank or switch it on; c） exhaust the air in fuel system, then tighten the pipe joints. Replace the fuel. d） Remove the fuel pipe and filter for cleaning or replace the filter element. e） Check and repair the transfer or injection pump, adjust the advance angle. f） Clean and polish the matching parts of the

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f） injector disgorges no or minor amount of fuel, has low injection pressure, or has bad atomization; the pressure adjusting spring thereof is damaged; injection hole is clogged or locked. g） Delivery valve of injection pump is leaked; the spring thereof is damaged; the matching part for the piston thereof is damaged.	injector, adjust the injection pressure; or replace the injector assembly. g） Replace the injection pump, spring or matching part for the piston.
2. Cylinder pressure is insufficient. a） Valve clearance is too small. b） Air leaks from valve. c） Air leaks from junction of cylinder head and gasket. d） Piston ring is worn, coked or the openings are overlapped. e） Abrasions of cylinder liner and piston	a） Adjust the valve clearance. b） In case of reduced elasticity of the valve spring, replace the spring; in case of bad sealing performance of the taper surface, polish the valve. c） Replace the head gasket. d） Remove the coking; replace the piston ring; adjust the opening position of the piston ring.

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exceed the specified limits.	e） Replace the cylinder liner and the piston.
3. Diesel has large viscosity and is difficult to be atomized due to too low temperature, even clogs fuel pipe.	Heat the cooling water and use proper diesel.
4. Check electric appliance system a） Battery level is low or the configuration is too small. b） Connections of electric appliance system have poor contact. c） Electromagnetic switch of starter malfunctioned. d） Gear of starter can not be engaged to ring gear of flywheel. e） Electric brush of starter and commutator has poor contact. f） Preheating device malfunctioned or preheating time is short.	a） Charge or provide with battery conforming to the requirement； b） Tighten the connections of the electric appliance system； c） Repair the electromagnetic switch of the starter or replace the starter； d） Find out the reasons and solve； e） Repair or replace the brush, clear up the commutator surface with fine emery paper, and blow off dust. f） Replace the preheating device or extend the preheating time.

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(II) Unstable Minimum No-load Steady Speed (Idle Speed)

Fault Characteristics & Causes	Elimination Approaches
1. The minimum no-load steady speed (idle speed) is low.	1. Go to Agrison technical service station to check fuel system.
2. High-speed and idle-speed accelerator handle have wrong positions.	2. Adjust the positions of the accelerator handles.
3. The handle is bent or has loose connection.	3. Tighten or replace the handle.
4. Air is entrained in oil passage.	4. Exhaust the air.
5. Nut connecting injection pump and diesel engine is loose.	5. Tighten the connecting nut.
6. High-speed and idle-speed accelerator handle have wrong positions.	6. Adjust the positions of the accelerator handles.
7. Valve clearance is too large.	7. Adjust the valve clearance.
8. Cylinder pressure is insufficient. a) Valve clearance is too small. b) Air leaks from valve. c) Air leaks from junction of cylinder head and gasket. d) Piston ring is worn, coked or the openings are overlapped. e) Abrasions of cylinder liner and piston exceed	a) Adjust the valve clearance to specified value; b) In case of reduced elasticity of the valve spring, replace the valve spring; in case of bad sealing performance of the taper surface, polish the valve; c) Replace the head gasket; d) Replace the piston ring and adjust the opening

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the specified limits.	position; e) Replace the cylinder liner and the piston.
9. Gear mark is wrong.	9. Adjust gear timing marks.
10. Internal sieve of bolt is clogged.	10. Clean the sieve.
11. Oil pump does not work properly.	11. Replace the pump.

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(III) Unstable Speed of Diesel Dngine

Fault Characteristics & Causes	Elimination Approaches
1. Fuel pipe a) Air exists in supply system. b) Excessive water content is included in fuel. c) Fuel pipe leaks.	a) Exhaust the air in the fuel system and tighten the connections of the fuel pipe; b) Replace the fuel; c) Tighten the connections of the fuel pipe or replace the pipe.
2. Speed governor works improperly.	Adjust and calibrate the speed governor.
3. Cylinder head gasket performs bad sealing.	Check the bolts and the gasket of the cylinder head. Tighten the bolts or replace the gasket.
4. Cylinders supply oil differently. a) Injection pump has different oil supplies from the cylinders; b) Injector performs badly or the matching parts are seized. c) Piston spring for injection pump is broken.	a) Adjust the oil supply from the cylinders to injection pump; b) Check the situation of injection, clean or replace the matching parts; c) Replace the spring.

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(IV) Underpower of Diesel Engine

Fault Characteristics & Causes	Elimination Approaches
1. Element of air filter is clogged.	1. Clean the element or replace it if necessary.
2. Intercooler is too dirty.	2. Clean away the oil stain inside the cooler as well as impurities and dust outside.
3. Air leaks from the pipes of intercooler.	3. Tighten the connections of the pipe or replace.
4. Exhaust manifold or main pipe is clogged.	4. Remove the foreign matters in the pipe.
5. Air leaks from exhaust manifold or main pipe.	5. Tighten the connecting screws or replace.
6. Air exists in fuel pipeline.	6. Exhaust the air and tighten the connections of the pipe.
7. Oil reserve in the tank is insufficient and the oil used is of poor quality.	7. Fill up fuel to the tank; select the fuel in accordance with the requirement.
8. Injection pump piston or delivery valve seat thereof malfunctioned; or the connecting nut of high-pressure oil pipe is loose.	8. Tighten or adjust.
9. Advance angle of fuel supply is improper.	9. Adjust the angle.
10. Injector has bad atomization.	10. Adjust the injection pressure.
11. Valve clearance is improper.	11. Adjust the clearance.

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12. Compression pressure in cylinder is insufficient.	12. Refer to Item 8 in (II) “unstable idle speed”.
13. Injection timing is improper.	13. Adjust the gear to align the mark.
14. Injection pump works improperly.	14. Adjust or replace the pump.
15. Turbocharging pressure is insufficient.	15. Adjust or replace the turbocharger.

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(V) Sudden Decreased Speed or Shutdown of Diesel Engine

Fault Characteristics & Causes	Elimination Approaches
1. Fuel system a) Air is entrained in low-pressure fuel pipeline. b) Water is mixed in fuel. c) Filter is clogged by impurities.	a）Loosen vented screw to exhaust the air. b) Screw off the drain plug of oil-water separator under coarse filter to drain the water inside. c) Regularly replace the filter element.
2. Fuel injection nozzle is seized.	2. Replace the injector.
3. Injector pump works improperly.	3. Adjust or replace the pump.

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(VI) Abnormal Smoke Exhaust

Fault Characteristics & Causes	Elimination Approaches
1. White smoke rises. a) Water penetration exists in cylinder. b) Water is included in fuel. c) Fuel has too bad atomization.	a) Check and eliminate the fault. b) Replace the fuel. c) Clean or replace the injector.
2. Blue smoke rises. a) Oil flees; piston ring is on backward, seized or worn too much. b) Clearance between valve stem and valve guide is too large. c) Oil seal for valve stem is damaged.	a) Adjust or replace piston ring. b) Replace the valve. c) Replace the oil seal.
3. Black smoke rises. a) Diesel engine is under overload. b) Fuel supply is delayed too much. c) Fuel supply is excessive. d) Air filter and exhaust pipe is clogged. e) Valve clearance is improper; valve is sealed incompletely. f) Timing for fuel injection is improper.	a) Reduce the load. b) Adjust the advance angle of fuel supply. c) Adjust injection pump and speed governor. d) Get rid of the dust in the air filter and exhaust pipe; or replace element of the filter. e) Adjust the valve clearance; in case of bad sealing performance of the taper surface, polish the valve f) Adjust the gear of the injection pump to align the

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g) Intercooler is too dirty.	mark. g) Clean away impurities and dust on the outside surface of the intercooler.

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(VII) Overheated Diesel Engine

Fault Characteristics & Causes	Elimination Approaches
1. Cooling water in the tank is insufficient or contaminated.	1. Fill up or replace the cooling water in the tank.
2. Cooling system is impeded.	2. Get rid of the scale, foreign matters in the pipes for free flowing.
3. Water pump belt is loose.	3. Adjust the tensity of the belt.
4. Water pump works improperly.	4. Repair or replace the water pump.
5. Temperature saver malfunctioned.	5. Repair or replace the temperature saver.
6. Lubricating oil is of poor quality.	6. Replace the lubricating oil.
7. Water thermometer malfunctioned.	7. Replace the water thermometer.
8. Diesel engine works under overload.	8. Reduce the load.

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(VIII) Abnormal Sound during Operation of Diesel Engine

Fault Characteristics & Causes	Elimination Approaches
1. Fuel injection is too early; there is rhythmed and clear metallic rapping in cylinder.	1. Adjust the advance angle of fuel supply.
2. Fuel injection is delayed too much; there is dull and indistinct sound in cylinder.	2. Adjust the advance angle of fuel supply.
3. Clearance between piston and cylinder is too large so that there is clash in the cylinder after startup of diesel engine. The sound will be diminished with warming up of the engine.	3. Replace the piston or the cylinder liner.
4. Clearance between piston pin and pin hole thereof is too large. The sound is soft and sharp, which will be clearer at idle especially.	4. Replace the parts to guarantee the specified clearance.
5. Clearance between main bearing and connecting rod bearing is too large so that clash of machine members can be heard when the speed of diesel engine is decreased suddenly. The sound is heavy and strong when the speed is low.	5. Replace the parts to guarantee the specified clearance.
6. Axial clearance of crankshaft is too large so that clash of the crankshaft’s moving forward and backward can be heard in case of idle speed.	6. Replace the crankshaft thrust plate to guarantee the specified clearance.
7. Valve spring is broken; push rod is bent; valve clearance is too large; splutter or soft and rhythmed	7. Replace the parts, adjust the valve clearance.

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knock can be heard at cylinder head cover.	
8. Top of piston bumps cylinder head or valve so that metallic rapping can be heard near the cylinder head in case of low speed.	8. Adjust the valve clearance, valve timing or replace the head gasket.
9. Gear clearance is too large due to wearing so that clash can be heard at gear box when speed is decreased suddenly.	9. Replace the gear as appropriate.

(IX) Excessive Lubricating Oil Consumption

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Fault Characteristics & Causes	Elimination Approaches
1. Lubricating oil is too much or splashed excessively.	1. Drain some oil.
2. Oil leaks at drain bolt, oil filter, cylinder head, oil pan gasket, cylinder head cover gasket, front and back oil seals, oil filter gasket, end caps, and plugs.	2. Tighten the bolt, replace the gasket, replace the end cap or plug.
3. Spill port of oil control piston ring is clogged by coke.	3. Get rid of the coke at the spill port.
4. The oil is of poor quality.	4. Replace the oil.
5. Piston ring is worn or clamped.	5. Replace the piston ring.
6. Clearance between cylinder liner and piston is too large.	6. Replace the cylinder liner or the piston.
7. Oil seal for valve stem is worn.	7. Replace the oil seal.

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(X) Excessive Fuel Consumption

Fault Characteristics & Causes	Elimination Approaches
1. Air filter is clogged.	1. Clean or replace the filter element.
2. Intercooler is too dirty.	2. Get rid of impurities and dust on outside surface of the intercooler.
3. High-speed stop screw is not sealed up.	3. Seal up the high-speed stop screw.
4. Fuel pipeline leaks.	4. Tighten fuel pipe joints, replace the pipe.
5. Exhaust pipe is clogged.	5. Get rid of the dirt in the exhaust pipe.
6. Min. no-load steady speed is too high.	6. Adjust the min. no-load steady speed to specified value
7. Fuel is of poor quality.	7. Use specified fuel.
8. Advance angle of fuel supply is improper.	8. Adjust the advance angle.
9. Injector spray is of poor quality.	9. Adjust the opening pressure of fuel injector, check and clean the nozzle or replace it.
10. Valve clearance is improper.	10. Adjust the valve clearance.
11. Injection pump works improperly.	11. Adjust or replace the injection pump.
12. Compression pressure in cylinder is insufficient.	12. Refer to the item 2 in (I) "*Difficult startup of diesel engine*" .

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(XI) Malfunctioned Lubricating System

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Fault Characteristics & Causes	Elimination Approaches
1. Oil pressure is too low. a) Oil pan is short of oil. b) Oil passage is clogged. c) Oil filter is clogged. d) Diesel engine is overheated so that the oil temperature is too high and the oil is thinned.	a) Oil to the marking line on the dipstick. b) Clean the oil passage and blow off by compressed air. c) Clean the oil filter or replace the filter element. d) Reduce the load, replace the oil and lower the oil temperature.
2. The oil is of poor quality.	2. Replace with the oil in conformity with the requirement.
3. Spill valve of oil filter is sticking or has excessive oil return.	3. Repair or replace the oil filter.
4. Oil pump screen is clogged.	4. Clean the screen.
5. Oil pump gear is worn or the end clearance is too large.	5. Adjust or replace the gear.
6. Oil pipe is broken or the joint gets loose.	6. Tighten the joint.
7. Oil pump malfunctioned.	7. Repair or replace the oil pump.

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8. Connecting rod bearing and main bearing are worn.	8. Replace the connecting rod bearing and the main bearing.
9. Oil pressure gauge is damaged.	9. Replace the pressure gauge.

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(XII) Malfunctioned Cooling System

Fault Characteristics & Causes	Elimination Approaches
1. Water temperature is too high.	
a) Cooling water is insufficient.	a) Fill up cooling water into the tank.
b) Spring of radiator cap is soft.	b) Replace the spring.
c) Belt of water pump is loose or damaged.	c) Tighten or replace the belt.
d) Temperature saver malfunctioned.	d) Replace the temperature saver.
e) Water pump works improperly.	e) Repair or replace the water pump.
f) Scale deposit in cooling water passage is too much.	f) Clean the cooling water passage to get rid of the scale.
g) Radiator is clogged.	g) Clean the pipeline of radiator for clearing.
h) Water leaks from radiator.	h) Repair or replace the radiator.
i) Water leaks from water pump.	i) Replace the gasket or packing plate.
j) Connecting tube of radiator is loose or broken.	j) Tighten or replace the connecting tube.
2. Water temperature is too low.	
a) Temperature saver malfunctioned.	a) Replace the temperature saver.
b) Temperature saver is improper.	b) Use as specified.
c) Ambient temperature is too low.	c) Set shelter from wind for protection.

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(XIII) Malfunctioned Starter

Fault Characteristics & Causes	Elimination Approaches
1. Starter does not work. a) Connection has poor contact. b) Battery is undercharged. c) Electric brush has poor contact. d) Starter has open circuit.	a) Clean and tighten the contact. b) Charge up the battery. c) Clean the commutator surface. d) Repair or replace the starter.
2. Starter has weak no-load run for startup. a) Bearing bushing is worn. b) Electric brush has poor contact. c) Commutator is dirty or singed. d) End terminal is desoldered. e) Poor contact. f) Switch has poor contact. g) Battery is undercharged or has small capacity.	a) Replace the bearing bushing. b) Clean the commutator surface. c) Clean the oil stain and polish with fine sand cloth. d) Weld the terminal firmly. e) Clean and tighten the contact. f) Repair the switch. g) Charge up the battery or replace with the battery having enough capacity.
3. Gear withdrawal is difficult; electromagnetic switch contact is burned out.	Replace the electromagnetic switch.

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(XIV) Malfunctioned Charging Dynamo

Fault Characteristics & Causes	Elimination Approaches
Not charged completely; undercharged; unstable charging current a) Measure diode or IC regulator one by one with multimeter after opening the back cover of dynamo. b) Check body and base of vacuum pump for any crack and matching face between pump core and main shaft spline of dynamo and internal working face for serious abrasion and scratch. c) Vacuum pump blade is worn seriously on the width. d) Oil leaks.	a) Replace in time if damaged. b) Replace in time if damaged. c) Replace in time once any damage is found; the width of the blade must not be less than 13mm. d) Replace the part leaking oil.

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(XV) Malfunctioned Air Compressor

Fault Characteristics & Causes	Elimination Approaches
1. No inflating a) Relief valve of air compressor is seized. b) Valve sheet is deformed or broken. c) There is excessive coke at air inlet/outlet or inside the chamber. d) Small washer for exhaust valve sheet of air compressor is missed.	a) Check the relief valve components, clean or replace failure ones. b) Take down and check the cylinder head, check the valve sheet. Replace the deformed or broken one. c) Take down and check the cylinder head, clean up the valve base plate and valve sheet. d) Check whether any part is missed and confirm the parts are all in place.
2. Air pressure is insufficient. a) Driving belt of air compressor is too loose causing skid. b) Oil-water separator or air filter is clogged. c) Air compressor's cylinder block, piston and piston ring are worn causing air leakage. d) Valve sheet of air compressor performs incomplete sealing, the spring thereof is soft	a) Adjust the belt tensity or replace the belt. b) Check and clean the dirt in the oil-water separator, air filter and the pipes thereof. c) Replace or repair the cylinder block, piston or piston ring. d) Replace the valve sheet or spring. e) Tighten the bolt on cylinder head or replace the

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excessively or broken. e) Bolt on cylinder head is loose and head gasket is washed out causing air leakage. f) Pipe between air compressor and air tank is broken or air leaks from the joint thereof.	head gasket. f) Replace the pipe or joint.
3. Oil flees in air compressor. a) Suction is impeded or inlet air is filtered improperly. b) Oil return is impeded. c) Cylinder block, piston and piston ring is worn excessively; or oil control ring is on backward or seized so that lubricating oil flees upward. d) Air compressor is cooled incompletely. e) Dirt is not drained from air tank frequently. f) Air compressor is operated too long. g) Pressure in crankcase of engine is too high. h) Oil pressure in engine is too high. i) Lubricating oil is deteriorated.	a) Check and replace the filter; check and eliminate the twist and deformation of suction pipe. b) Check and eliminate the bent, twist and deformation of oil return pipe. c) Check and replace the piston and piston ring. d) Clear away oil stain, soot or dirt accumulated on radiating fin. Replace damaged parts. Check cooling pipes. e) Check air valve of the air tank and clear away the dirt. f) Check and repair unloading system. g) Replace or repair ventilating device for the crankcase. h) Inspect lubricating oil pressure of the engine (at

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	oil inlet of air compressor). i) Replace with qualified lubricating oil.
4. There is abnormal sound in air compressor. a) Connecting rod bearing and bushing, or main bearing is worn seriously or damaged, and bolt on connecting rod is loose, which causes clash. b) Too loose belt, drive and driven pulley having inconsistent groove type causes skidding with scream. c) Oil supply does not follow operation of air compressor, which causes dry friction on metal surface with scream. d) Fixing bolt gets loose. e) Fixing nut on gear gets loose causing too large clearance with knock. f) There is foreign matter on top of piston.	a) Check and replace the connecting rod bearing and bushing, main shaft bearing; tighten the bolt on connecting rod. b) Check and replace the drive or driven pulley and adjust the belt tensity. c) Check and replace the broken, clogged inlet pipe for lubricating oil. d) Check and tighten the fixing bolt. e) Tighten the loose nut on gear, replace the malfunctioned gear. f) Clear away the foreign matter.
5. Oil leaks from air compressor. a) Oil seal falls off or has defect causing leakage. b) Main shaft is loose causing leakage at oil	a) Check and replace the oil seal with cracks, split or flanging at inner lip, scratch or defect on junction face; check and guarantee free oil turn. b) Replace the bearing shell and the oil seal.

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seal. c) Leakage occurs at junction face; joint on oil inlet or return pipe is loose. d) Belt is fixed tightly causing abrasion on main bearing shell.	c) Check or replace packing plate; tighten joint bolts for oil inlet and return. d) Check and readjust the belt tensity.
6. Air compressor is overheated. a) Relief valve or unloading valve is not in service causing air compressor to work constantly. b) Air brake system leaks seriously causing air compressor to work constantly. c) Moving parts have insufficient oil supply, and cylinder scoring occurs.	a) Check relief valve components when inlet unloading and clear away or replace the failure parts with seizure; check unloading valve when outlet unloading and clean, repair or replace the failure parts with blockage or seizure. b) Check and replace the brake system components and the failure parts in pipeline. c) Check, repair or replace the failure parts.

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(XVI) Fault Diagnosis of Turbocharger on Diesel Engine

Besides diesel engine faults is disposed in accordance with fault analysis and elimination approaches recommended in the Instruction, the working situation of turbocharger shall be checked and evaluated to judge the errors thereof.

Turbocharged diesel engine has the common faults as follows: 1. underpower of diesel engine; 2. large lubricating oil consumption; 3. black smoke rising from diesel engine; 4. loud noise in working.

Any of these faults may be resulted from the error inside diesel engine and that in air charging system formed by turbocharger and diesel engine. When the fault may be caused by turbocharger, please do not remove it from diesel engine, and definitely do not disassemble it. If replace the turbocharger only, the trouble may not be solved, even new troubles may occur. Therefore carry out fault diagnosis at first, and then eliminate it once find out the reason.

A turbocharger having been in normal operation is unlikely to have defect on its own in the future service. If the impeller of the turbocharger can rotate freely not scratching the inner shell, it need not be anxious to determine that its operation is in trouble. The experience shows that most of the faults thereof are related to improper use. Therefore, the recommended on-engine fault diagnosis table below is connected with the complete air charging system. After the diagnosis is finished and the details are recorded, the turbocharger may be removed if necessary for further analysis and inspection which shall be carried out in professional repair shop or the manufacturer of the diesel engine.

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On-Engine Fault Diagnosis Table		Issues						
Possible Causes	Elimination Approaches	Black smoke rises from diesel engine.	Diesel engine is	Diesel engine has excessive	Blue smoke rises from diesel engine.	Turbocharger has too loud noise in working.	There is periodic noise in turbocharger.	Oil seal at gas compressor side leaks.	Oil seal at turbine side leaks.
Air filter is too dirty.	Clean or replace the filter element.	√	√	√	√			√	
Air leaks from pipeline between air filter and gas compressor.	Tighten the fasteners or replace the sealing parts.					√			
Air leaks pipe between gas compressor and inlet duct of diesel engine.	Replace the sealing parts or tighten the fasteners.	√	√	√	√	√			
Intercooler is too dirty.	Clean the intercooler.	√	√	√		√			
Air leaks from joint face between diesel engine’s inlet manifold and cylinder head.	Replace the gasket or tighten the fasteners	√	√	√	√	√			

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	√	√	√	√	√	√	√	Inlet duct of gas compressor is impeded.	Clear away foreign matters or replace the damaged parts.
			√			√	√	Outlet duct of gas compressor is impeded.	Clear away foreign matters or replace the damaged parts.
			√			√	√	Intake pipe of diesel engine is impeded.	Clear away foreign matters.
	√		√			√	√	Air leaks from joint face at fuel gas inlet of turbine.	Replace the sealing parts or tighten the fasteners.
	√		√			√	√	Air leaks from joint face between diesel engine's exhaust manifold and cylinder head.	Replace the sealing parts or tighten the fasteners.
	√		√	√	√	√	√	Exhaust pipe of diesel engine is impeded.	Clear away foreign matters.
			√					Air leaks from joint face at fuel gas outlet of turbine.	Replace the sealing parts or tighten the fasteners.
	√					√	√	Muffler or tail pipe is impeded.	Clear away foreign matters or replace.
√	√			√	√			Oil return pipe of turbocharger is impeded.	Clear away foreign matters or replace oil return pipe.

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√	√			√	√			Crankcase breather of diesel engine is impeded.	Clear away foreign matters or replace.
				√	√	√	√	Center housing of turbocharger has dirt retention or coking.	As the case may be, replace lubricating oil and the oil filter element, or replace the turbocharger.
√	√	√	√	√	√	√	√	Turbine blade or impeller of gas compressor has dirt retention.	Clean the gas compressor or replace lubricating oil and the oil filter element.
	√							Impeller of gas compressor is worn or damaged.	Clean air intake system or replace the turbocharger.
√					√			Turbocharger's bearing, bearing hole or shaft diameter is worn.	Replace the turbocharger.
					√			Oil number is improper.	Use lubricating oil as specified.

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(XVII) Malfunctioned Power Steering Pump

Power steering pump has the common faults as follows: 1. abnormal sound; 2. hard steering.

Any of these faults may be resulted from the error of vehicle and steering system. When the fault may be caused by power steering pump, please do not remove it from diesel engine, and definitely do not

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disassemble it. If replace the power steering pump only, the trouble may not be solved, even new troubles may occur. Therefore carry out fault diagnosis at first, and then eliminate it once find out the reason.

A power steering pump having been in normal operation is unlikely to have defect on its own in the future service. If this pump can rotate freely without any abnormal sound, it need not be anxious to determine that its operation is in trouble. The experience shows that most of the faults thereof are related to improper use of vehicle. Therefore, it is recommended to check tyre pressure, hydraulic pipeline, driving system, fluid level inside and screen of the reservoir, pipe joints, and power steering fluid on vehicle at first. After the diagnosis is finished, the pump may be removed if necessary for further analysis and inspection which shall be carried out in professional repair shop or the manufacturer of the diesel engine.

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Fault Characteristics & Causes	Elimination Approaches
1. The pump neither sucks oil nor has pressure (the actuating mechanism does not work). a） The filter or the suction pipe is clogged. b） The joint leaks causing air to go into the pump. c） The parts are worn causing excessive clearance and serious leakage. d） The fluid has large viscosity so that the blade meets with large sliding resistance. e） The fluid level is too low.	a) Dismantle and clean the filter and the pipe; or replace the fluid. b) Check and tighten related threaded connecting part or replace the sealing part to prevent air invasion strictly. c) Check the related worn parts and grind. d) Replace with the fluid having low viscosity. e) Fill the fluid to the specified level.
2. Oil leaks from the junction of oil port. a） The joint is loose or the sealing part is damaged.	a） Tighten the threaded connecting part or replace the sealing part.
3. The noise is loud. a） Air goes into the pump. b） There has too large compression shock;	a） Check the related parts for leakage; add butter at the joints; reduced noise shows there is leakage, tighten the joints or replace the sealing ring.

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the compensating groove on oil distribution disc is clogged. c） The suction pipe has too large resistance, even clogged. d） The pump is worn increasingly.	b） Check and get rid of the blockage in the compensating groove. c） Check and get rid of the blockage. d） Check and replace the worn parts inside the pump.

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Chapter 5 Preservation of Diesel Engine

Never used diesel engine or diesel powered vehicle, if long-term storage is required, shall be disposed in advance in accordance with the following requirements:

1. Drain the lubricating oil off.
2. Open water drain valve to drain the coolant fluid off inside the diesel engine.
3. Drain the diesel off inside the fuel tank and the pipeline thereof.
4. Wipe out the oil and water stains, dust outside the diesel engine; apply antirust oil (add butter into drier oil and mix thoroughly after melting) on the unpainted parts and components. Rubber products as well as plastic products and parts shall not be applied with the oil.
5. The air filter (or air inlet) and the orifice of exhaust pipe shall be packed well with oiled paper to prevent dust and dirt from invasion.
6. The diesel engine or the vehicle shall be placed in the room with good ventilation, dry and clean conditions and free of intense magnetic field (temperature: -30～60℃; humidity: 0～80%). It is strictly prohibited to be piled at the place with corrosive chemicals. Pay attention to moisture proof for the machine (especially for the electrical system).

The used diesel engine or diesel powered vehicle, if long-term storage is required, shall be disposed in advance in accordance with the following requirements:

1. Drain the lubricating oil off when the engine is hot after shutdown; dismantle the oil pan for

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cleaning.

2. Open water drain valve to drain the coolant fluid off inside the diesel engine.
3. Drain the diesel off inside the fuel tank and the pipeline thereof.
4. Get rid of the dust on the element of air filter (paper type).
5. Dismantle the air intake pipe and fill 300g filtered HC-8 direr oil into each cylinder through gas passage (heat the oil to 110～120℃ till there is no bubble at all). Turn the crankshaft so that the oil attaches to the surfaces of the valve, cylinder liner, piston and other parts uniformly. Fix the intake pipe in place.
6. Wipe out the oil and water stains, dust outside the diesel engine; apply antirust oil (add butter into drier oil and mix thoroughly after melting) on the unpainted parts and components. Rubber products as well as plastic products and parts shall not be applied with the oil.
7. The air filter (or air inlet) and the orifice of exhaust pipe shall be packed well with oiled paper to prevent dust and dirt from invasion.
8. The diesel engine or the vehicle shall be placed in the room with good ventilation, dry and clean conditions and free of intense magnetic field. It is strictly prohibited to be piled at the place with corrosive chemicals. Pay attention to moisture proof for the machine (especially for the electrical system).

Notice: The aforesaid method of preservation can be in effect for 30 months; do the same again if expired.

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Chapter 6 Lifting, Installation and Depreservation of Diesel Engine

When lift diesel engine in packing case, hitch the lower four corners of the packing case with wire cable. Diesel engine unpacked has two lugs at both sides of the cylinder head for lifting. When diesel engine unpacked is placed, the oil pan is prohibited from landing.

The installation base for diesel engine must be laid properly when it is used for stationary work. It shall be fixed in the workshop with the characteristics of rain-proof, moisture-proof, good ventilation, little dust and spaciousness.

Diesel engine with oil seal had to be removed antirust oil before using. Continuously inject hot water into the cooling system to preheat the engine. Open the oil drain plug to drain the lubricating oil inside. Turn the crankshaft or drive it with starting dynamo (each starting time shall not be more than 15s), which shall be intermittently done several times. Finally start diesel engine according to the starting procedure; check and replace the rubber parts which require to be replaced.

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Addenda Ⅰ The list of vulnerable parts

Number	Name
1	Main liner
2	Crankshaft thrust sheet
3	Cylinder head gasket
4	Cylinder liner
5	Water seal ring
6	Piston
7	Piston ring
8	Piston pin
9	Rod
10	Bearing of connecting rod shaft
11	Front Oil seal
12	Back Oil seal

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Addenda II Packing list

Sort	Serial number	Apellation	Amount	Unit	Remark
Inside of packaging	1	Diesel engine	1		
	2	Qualification	1		
	Document with diesel engine				
	3	Operation instruction	1		
	4	Serving enchiridion	1		
	5	Packing list	1		

Remarks：
1.This list is only applicable to the common type. Spare parts for special customer requirements models or random accessories,
Add in the box under the contract.
2.Please check the box at the time, If discrepancies are to supply contracts signed with manufacturers of related supporting state prevail.

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