4F Series Engine Electric System

Installation Guide

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Appendix 1：

12V ECU Electrical System Schematic Diagram

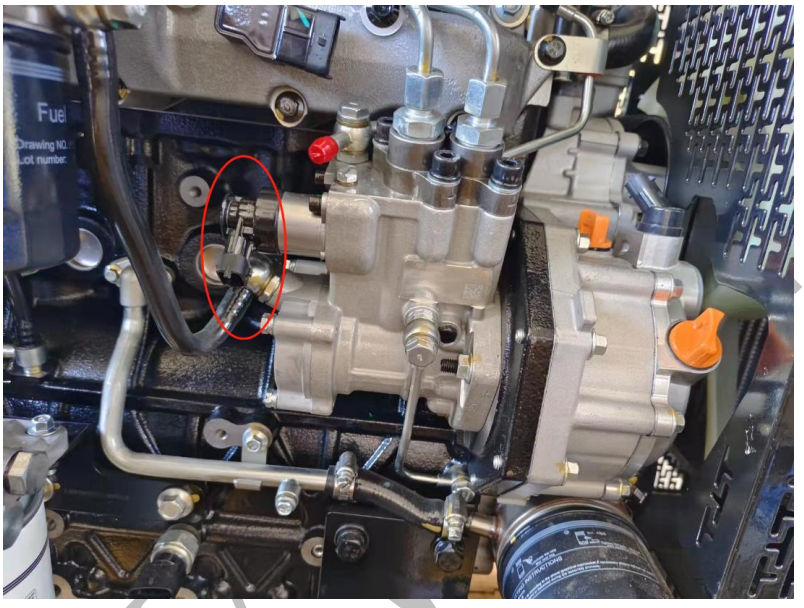
Wiring harness installation guide

Update History

Version	Date	Author	Updates	
1.0	2019/07/17	HWL	Created	N/A
1.1	2019/12/25	HWL	Increase differences in ship machinery	N/A
1.2	2020/08/01	YUE GANG	Add 32-bit system and wiring guidance	N/A
1.3	2021/01/19	YUE GANG	Add fault information	N/A
1.4	2021/01/21	-	Installation and wiring precautions	N/A
1.5	2023/07/24	CYX	Modify the wiring instructions and successful startup conditions of the ship's engine	N/A

1.System introduction

1.1.Fuel system：



Note: For the 4F series, the ECU only controls the oil pump oil quantity, which is the transmission control signal at the position indicated in the figure.

1.2.ECU:

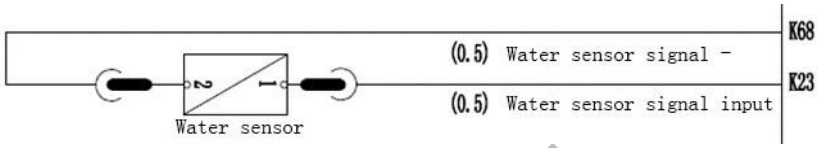
MD1CC878

ECU Shape

Note: The 12V ECU has 154pin.

2.Sensors

2.1.Water sensor



The temperature sensor is composed of NTC thermistors, and the resistance value of the thermistor changes with the temperature of the coolant, causing the voltage output of the sensor to also change. The ECU calculates the current coolant temperature value based on the collected signal, mainly used for cold start control.

2.2.Oil pressure sensor

Oil pressure sensor: VDO 10Bar

Engine oil temperature alarm value: -40~125 ℃, the alarm value is set on the instrument according to requirements

Installation thread: NPT 1/4

Output the oil pressure signal to the ECU, and finally feedback it to the instrument through CAN communication, which is displayed in digital form

4.AD输电压输出(电源电压5V时)：

表压力(MPa)	0	0.4
AD电压(V)	0.710±0.07	2.59±0.06

5.T输电阻输出(测试电流小于1mA，温度平衡时间大于10min)：

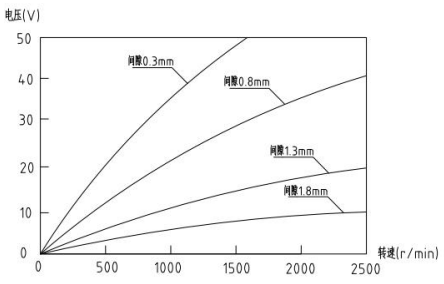
温度(℃)	-10	20	80
电阻(Ω)	9.365k±0.565k	2.51k±0.1k	322±10

2.3.Speed sensor

Speed sensor (optional):

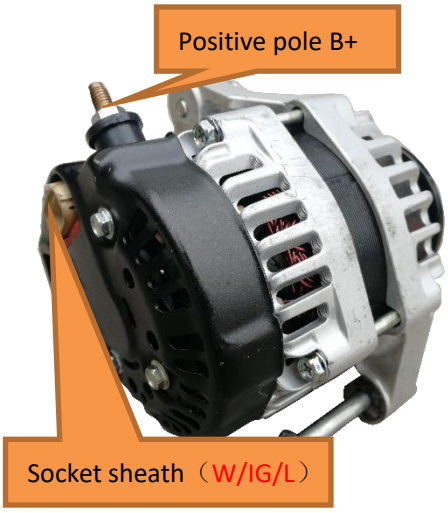
Installation thread: M18X1.5

Installation distance: generally 0.7-1mm from the flying gear teeth



3.Alternator, starter introduction

3.1.Alternator

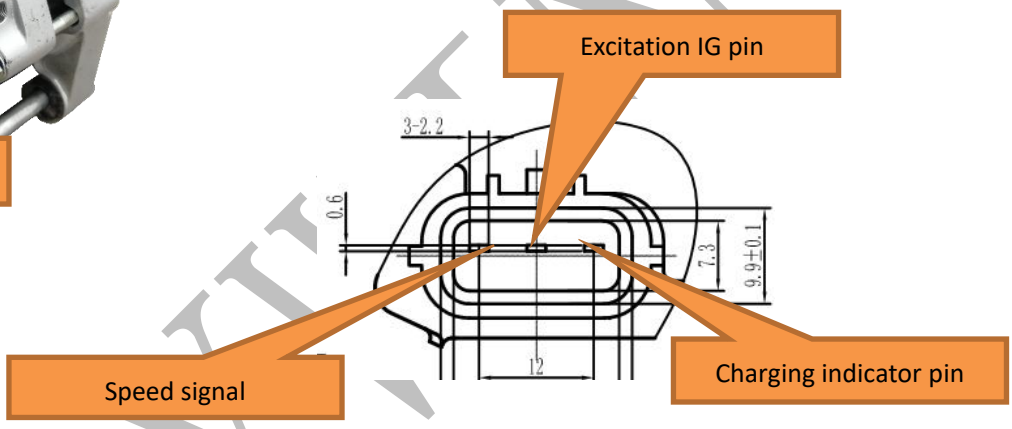


Alternator adopts conventional Japanese structure

Electrical part:

1、 Positive pole B+（ ϕ6）

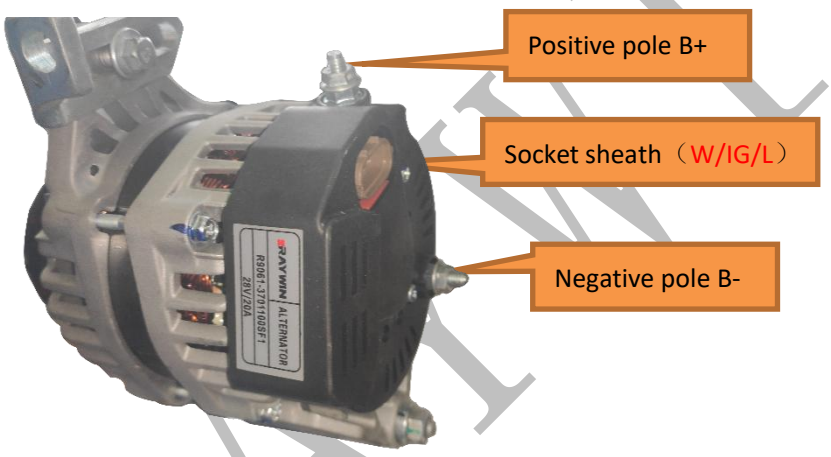
2、 **3-pin connector**（We provide connectors and pins）



Note: The land generator set has provided excitation wires on the engine harness; The generator is not self-excited, and the IG signal is normally energized in the ON position.

3.1.1 Marine Alternator

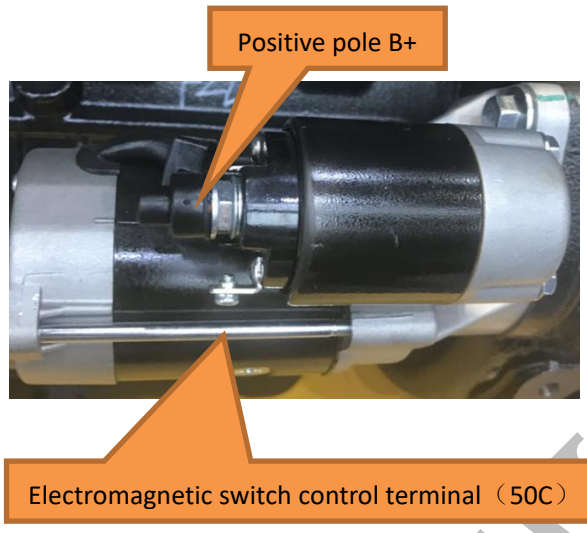
Special note: Due to market demand, the marine alternator is a dual wire system, and the negative electrode needs to be grounded. The negative electrode B- of the marine alternator is led out with a bolt and not connected to the engine casing. The details are as follows



Requirement: In addition to the grounding of the land alternator, the negative pole of the marine alternator also needs to be directly connected to the main switch of the battery negative pole, otherwise the generator cannot generate electricity normally. The recommended wire diameter from generator B+to battery charging line is 10mm ^{2} (Adjustable according to generator current and

distance)

3.2 Starter



The starter is a DC geared motor

Electrical part:

1、 Positive terminal B+（φ8）

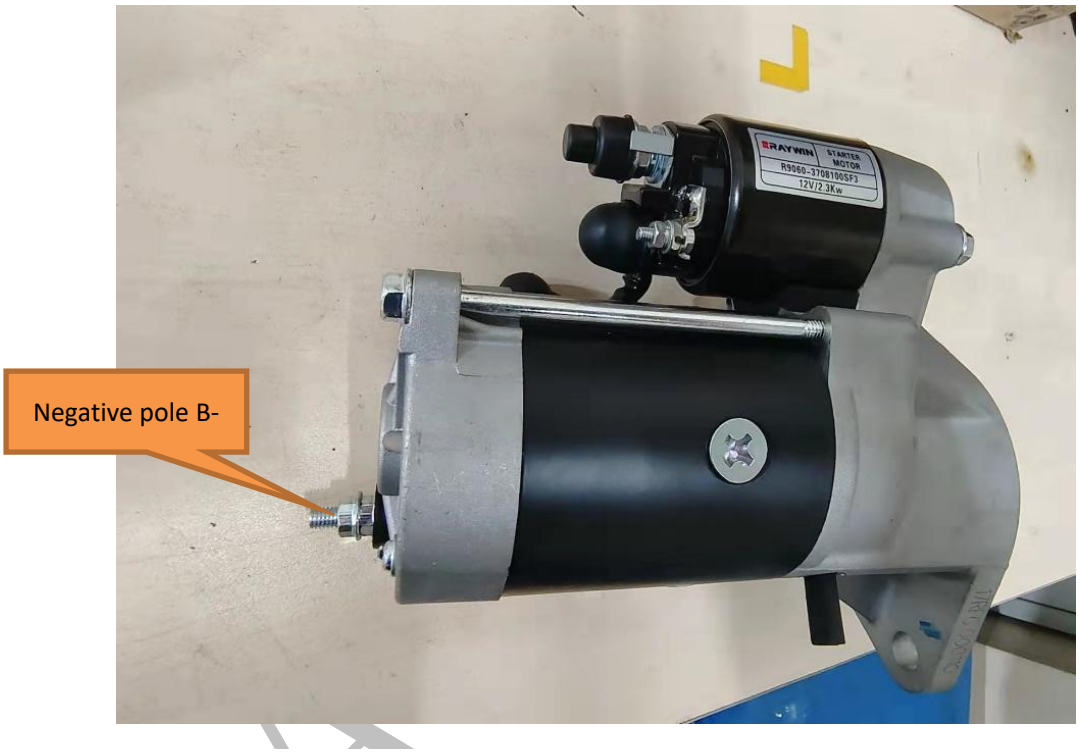
2、Electromagnetic switch control terminal (also called 50C terminal or S terminal)（φ4））

12V Starter electromagnetic switch current: 45-60A

24V Starter electromagnetic switch current: 25-30A

3.2.1 Marine starter

Special note: Due to market demand, the marine starter is a dual wire system, and the negative pole needs to be grounded. The negative pole B- of the marine starter is led out with a bolt and not connected to the engine casing. The details are as follows

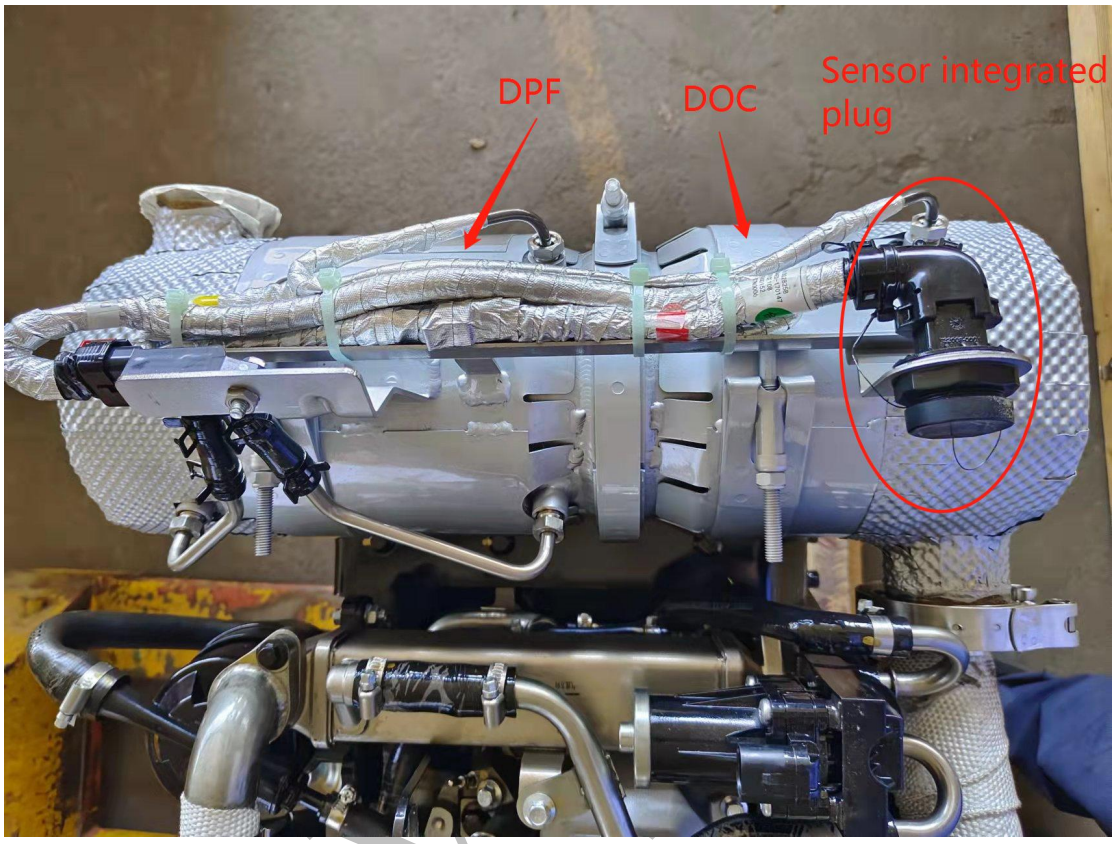


Requirements:

1. On the basis of land based starters, the negative pole B- of marine starters needs to be directly connected to the battery negative pole main switch.

2. The general configuration of the marine engine is as shown in the figure with a starting relay, which can also be directly controlled by the customer by installing a new relay (refer to the following three requirements for details)

3.3.1 Introduction to post-processing system



The post-treatment system is an exhaust gas treatment system that achieves emission requirements by adsorbing impurities in the exhaust gas. The post-processing device includes three sensors: DOC exhaust temperature sensor, DPF exhaust temperature sensor, and differential pressure sensor.

The above three sensors have been integrated together at the marked plug position to avoid incorrect connection.

Pressure difference sensor: The pressure difference sensor is used to measure the pressure values before and after DPF, and the pressure

difference result is an important basis for judging the quality of DPF and whether regeneration is successful.

3.3.2 Post processing usage

K87B	DPF power output	(再生开关电源输出)
K16	DPF regeneration switch	(再生开关)
K68	Prohibit regeneration power output	(禁止再生开关电源输出)
K15	DPF prohibit regeneration switch	(禁止再生开关)
K73	Indicator power output	(再生提示灯电源输出)
K25	DPF regeneration indicator	(再生提示灯)

If you want to use the regeneration function, you need to connect the functional wire of the vehicle harness shown in the above figure, and connect a switch between the switch wire and the power output.

Preconditions for DPF regeneration activation:

a) Engine running time>10 seconds, water temperature>65 degrees;

b) 100 ℃ ≥ ambient temperature ≥ -40 ℃, 100 ℃ ≥ temperature after intercooling ≥ -40 ℃;

c) 24V engines require a battery voltage greater than 16V, while 12V engines require a battery voltage greater than 11.5V;

d) Do not step on the clutch, brake or accelerator;

e) The gear position is in neutral, and the vehicle speed is 0;

f) The engine speed is greater than 700rpm and less than 3750rpm;

g) T4 and T5 temperatures>80 ℃;

h) If a DPF severe overload fault is reported, carbon cleaning is required before regeneration;

The above are the prerequisites for automatic regeneration and the activation of regeneration function.

In situ parking regeneration:

1) When parking for regeneration, you can first step on the accelerator to increase the water temperature to above 70 ℃;

2) After heating up, keep the vehicle ignition at idle speed and in neutral position. During this period, do not touch the clutch, accelerator, or brake, and ensure that the no regeneration switch button is turned off;

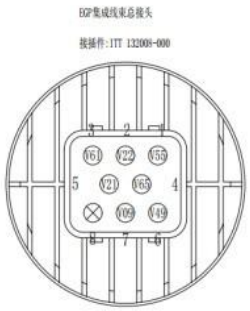
3) Press the manual regeneration switch for 5 seconds to activate DPF regeneration. As shown in the figure (special attention should be paid to low speed and short distance vehicles, and the indicator light flashing should be immediately regenerated), during the regeneration period, the vehicle will perform automatic refueling door and other operations;

4) At the same time, the vehicle must be parked in an open area without flammable and explosive materials around it, as the exhaust temperature will be above 600 ℃ at this moment; Do not park in a confined space, as it may pose a safety hazard. Park regeneration takes approximately 30 minutes.

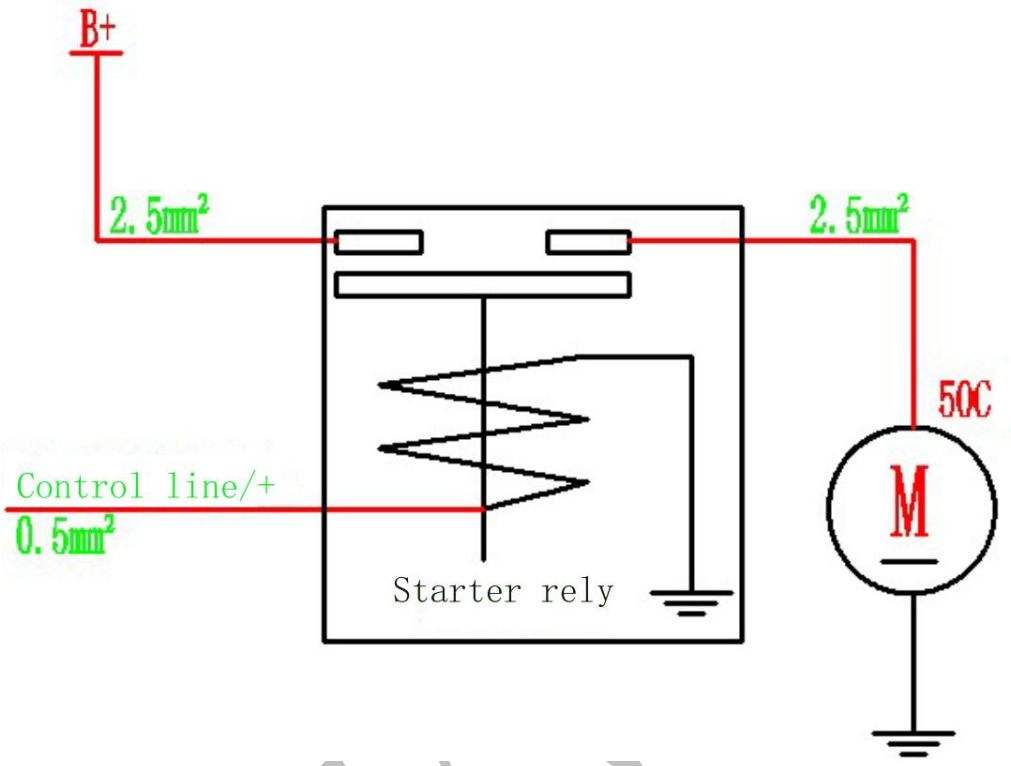
Only when the above conditions are met can the regeneration switch be pressed. Press and hold for a few seconds (2-5 seconds), and release according to the regeneration indicator light, at which point the parking regeneration begins.

The disable regeneration switch button is used to disable automatic regeneration and manual regeneration functions. (This button can only be opened when the regeneration conditions are not met, and it is absolutely prohibited to be opened under normal driving conditions)

Definition of post processor plug:

Pin assignment	Number	Assignment
	1	Differential pressure sensor positive pole
	2	Differential pressure sensor negative pole
	3	Differential pressure sensor signal
	4	DOC temperature signal
	5	DOC temperature sensor negative pole
	6	DPF temperature signal
	7	DPF temperature sensor negative pole

4.Usage requirements（must read）



4.1 Starter rely:

The starting method is relay controlled starting, and the principle is shown in the right figure.

Starter rely ≥12V/60A;24V/40A

4.2 Panel requirements：（important）

To prevent damage to the starter due to reverse drag, a panel is used for startup control。

1.1 Condition for determining successful engine start: Speed=350rpm, Oil pressure=125kPa

1.2 If the engine fails to start for three consecutive times, it should be shut down for a short time to wait for the starter to cool down, and the oil, electricity, and gas circuits should be checked for faults before starting the operation

4.2.1 Basic Introduction

1. The engine ECU adopts CAN communication and follows the J1939 protocol. It can display water temperature, oil pressure, power voltage, and speed, and has a fault code, without connecting to a fault light or charging indicator

2. The ECU power cord in the reserved interface must be connected to the battery terminal as much as possible, and no other electrical appliances except switches are allowed to be connected in the middle

3. If the engine is used as the main engine, please use the Yuchai system standard throttle interface for the throttle

4. Used as a generator set, with the control strategy starting at idle speed and automatically rising to the working speed within 10 seconds without connecting the speed switch

4.2.2 Battery and Mainline Requirements (Recommended)

Battery requirements：

12V System ⩾85Ah 630CCA

24V System ⩾85Ah 630CCA*2

It is recommended to increase the battery capacity in high-altitude and cold regions.

Main line requirements for power supply: wire diameter 50-75mm ^{2} Above length<2m

Suggestion: Connect the positive wire of the battery to the positive wire B+ of the starter, and connect the negative wire controlled by the main switch directly to the bolt of the flywheel housing. The connection should be firm and reliable. For the selection of the main line diameter, please refer to the following table. The line diameter in the table is only for calculation purposes. Please choose the appropriate line diameter according to the actual situation.

Nominal voltage	Drop Vd/100A	Conditions of Use
12V	0.2	Good/General
24V	0.4	
12V	0.1	Bad
24V	0.17	

The usage conditions in the table are "good", "general", and "bad", which need to be determined by experience based on the degree of impact of the actual usage environment on the engine, including temperature, humidity, vibration, corrosion, and other factors. They are also related to the engine's usage time, area, and purpose

Average starting current	Drop Vd/100A	Conditions of Use	Line length L	1m	2m
300A	0.2	General	Wire diameter S（mm^2）	40	50
	0.1	Bad		50	75
S=I*2L/(54.4*Vd)					

4.2.3 Requirements for marine engine batteries

The environmental requirements for the use of marine engines require high electrical performance. It is recommended that customers use large capacity batteries to meet the engine's battery requirements to the greatest extent possible:

12V System ⩾150Ah 1000CCA

24V System ⩾150Ah 1000CCA*2

Main line requirements for power supply: wire diameter 50-75mm ^{2} The above length is less than 2m.

5.Common electrical system faults

5.1 Battery loss

Generally, starting an engine requires a battery level of 60% -70% or more. Under normal conditions, the static discharge current is very low, and the battery can be stored for more than one month. If the battery loses power in a short period of time, there may be a situation where the electrical appliance continues to discharge. All electrical appliances need to go through the negative main switch. When not in use, the negative main switch can be disconnected to minimize electrical consumption; Check if the engine belt is loose, which may lead to poor engine charging or power loss. Tensioning or replacing the belt is sufficient.

5.2 Engine cannot stop

The engine shutdown is achieved by powering off the A2 signal line; A2 is normally energized during normal operation; If there is a power outage, the machine will shut down. If the machine cannot be stopped, check if the A2 wiring is in the ON position.

5.3 The generator panel cannot control the shutdown

The panel can start and stop the engine normally. But after disconnecting the negative main switch, the instrument cannot be powered off and extinguished. In this situation, the positive and negative poles of the panel are usually directly connected to the positive and negative poles of the battery, without passing through the negative main switch; It is recommended to connect the negative main switch. The reason for this is often due to other electrical appliances applying reverse voltage through the circuit of the monitor when the circuit is complete, which may cause the instrument to fail to turn off. It can be checked by disconnecting the wiring to the instrument one by one.

5.4 Alternator doesn't generate electricity

The normal generator output voltage is around 14 ± 0.25V and 27V, which is slightly higher than the battery voltage.

The conditions for normal operation of the generator: the speed of the generator gear train is greater than 1000rpm; There is an excitation signal, and the excitation requires ON power, and there is always power during operation; The generator B+should form a complete circuit with the battery; If you believe that the generator is

faulty, please check if the above three conditions are met.

5.5 Post processor failure

1. Remove the differential pressure sensor, check the differential pressure pipe, and confirm if there is any blockage, bending, or air leakage in the differential pressure pipe;

2. Use a multimeter to measure whether there is a 5V voltage between pins 1 and 2 of the differential pressure sensor wiring harness, and whether pin 2 can conduct normally with the ground wire;

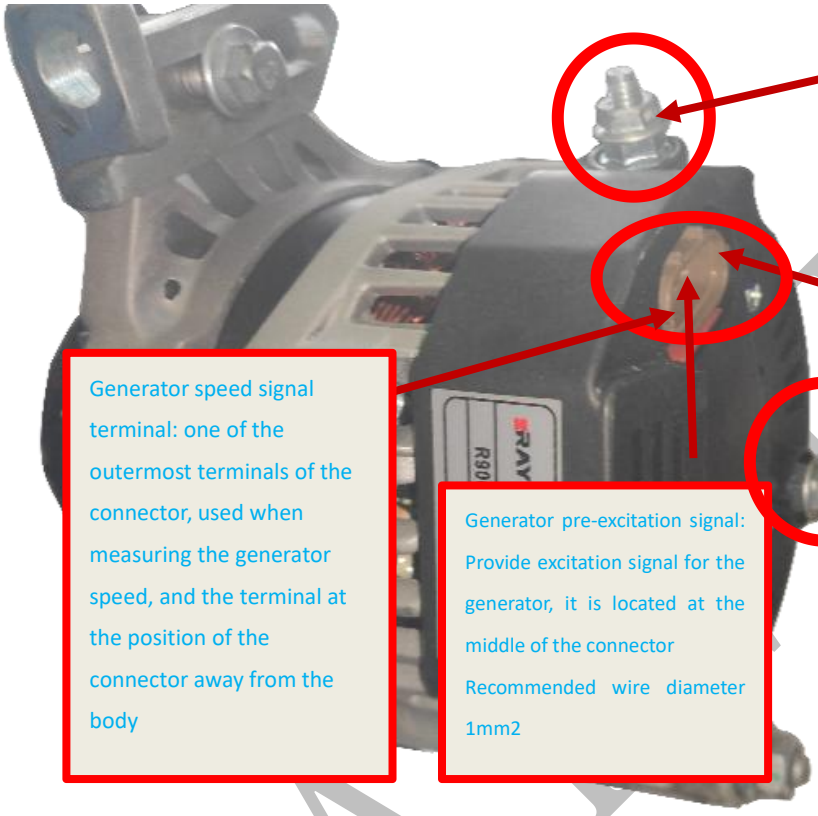
3. Disconnect the two differential pressure tubes of the differential pressure sensor, and measure the output voltage of pins 2 and 3 with a multimeter. At this time, the actual pressure difference between the two ends of the differential pressure sensor is "0Kpa", and the voltage measured by the multimeter should be between

4. About 0.50V; Blow air from the front air inlet of the differential pressure sensor with a nozzle, and the voltage measured by the multimeter should be around 1-2V. If the output voltage does not match, it is judged that the differential pressure sensor is damaged;

5. If there are no issues with the above, disassemble the DPF, observe whether the DPF gasket and DPF carrier are damaged, and whether there is obvious ablation of the DPF. If so, replace the DPF.

5.6 Important parts installation instructions

5.6.1 Alternator wiring



Battery charging terminal (B+): Connected to the battery positive or starter B+ to charge the battery, you need to remove the plastic sheath (connecting wire diameter using 10mm²)

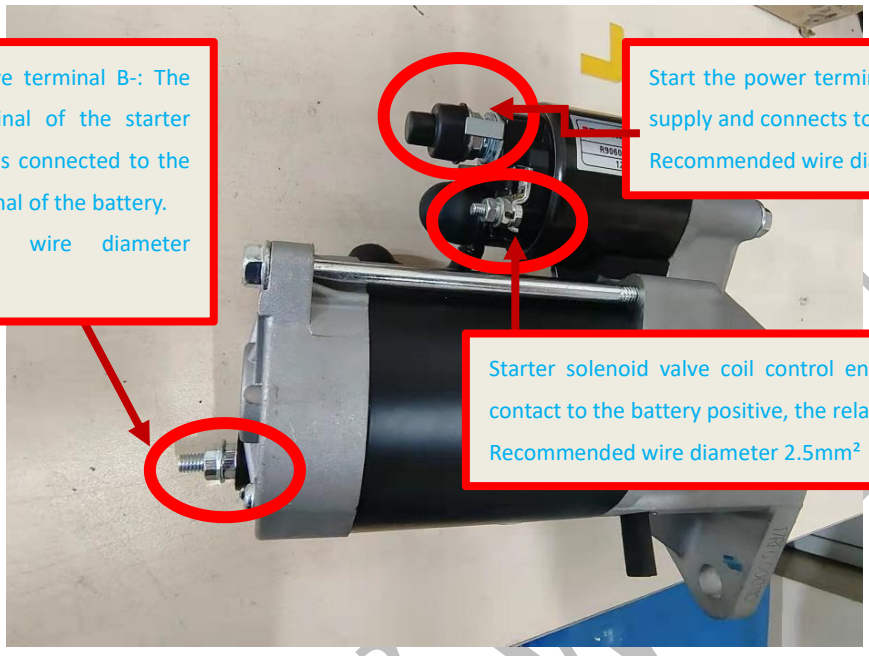
The generator charging fault indicator is at the terminal closest to the body position of the connector.
Recommended wire diameter 1mm2

Generator speed signal terminal: one of the outermost terminals of the connector, used when measuring the generator speed, and the terminal at the position of the connector away from the body

Generator pre-excitation signal: Provide excitation signal for the generator, it is located at the middle of the connector
Recommended wire diameter 1mm2

The negative terminal B- is only used on ships, located at the rear cover of the generator and connected to the negative terminal of the battery. The recommended wire diameter is 10mm ²

5.6.2 Starter Wiring



6.Installation and wiring precautions

6.1 The wiring locations of battery+ and battery - on the engine harness

（Wrong） （Right）

Attention: The purpose of the above wiring is to avoid excessive voltage drop at the remote end during startup, which may ultimately lead to startup failure. When shutdown for a long time without use, the negative main switch must be turned off to avoid battery feeding (all negative circuits must be controlled by the negative main switch).

6.2 Alternator wiring

6.3 Engine harness and instrument wiring

预留接口

线号	粘贴标识内容	
K54B	comm CAN_H	(CAN通讯_H)
K76B	comm CAN_L	(CAN通讯_L)
K88D	Ignition signal	(点火信号)
K35B	Start signal	(启动信号)
K87B	DPF power output	(再生开关电源输出)
K16	DPF regeneration switch	(再生开关)
K68	Prohibit regeneration power output	(禁止再生开关电源输出)
K15	DPF prohibit regeneration switch	(禁止再生开关)

预留线

线号	粘贴标识内容
A2b	Alternator excitation
L	Charge indicator

(励磁线)

(充电指示灯)

As shown in the above figure:

Connect the CAN communication line to the instrument and read the entire machine information;

The K88D ignition signal is an electrical signal that must be connected to the positive pole;

When the K35B start signal is received from the positive pole, start the machine, ignite it, and disconnect it, which cannot be connected normally.

The regeneration switch and the prohibit regeneration switch are mandatory connections when using post-processing. The connection method is shown in the attached figure.

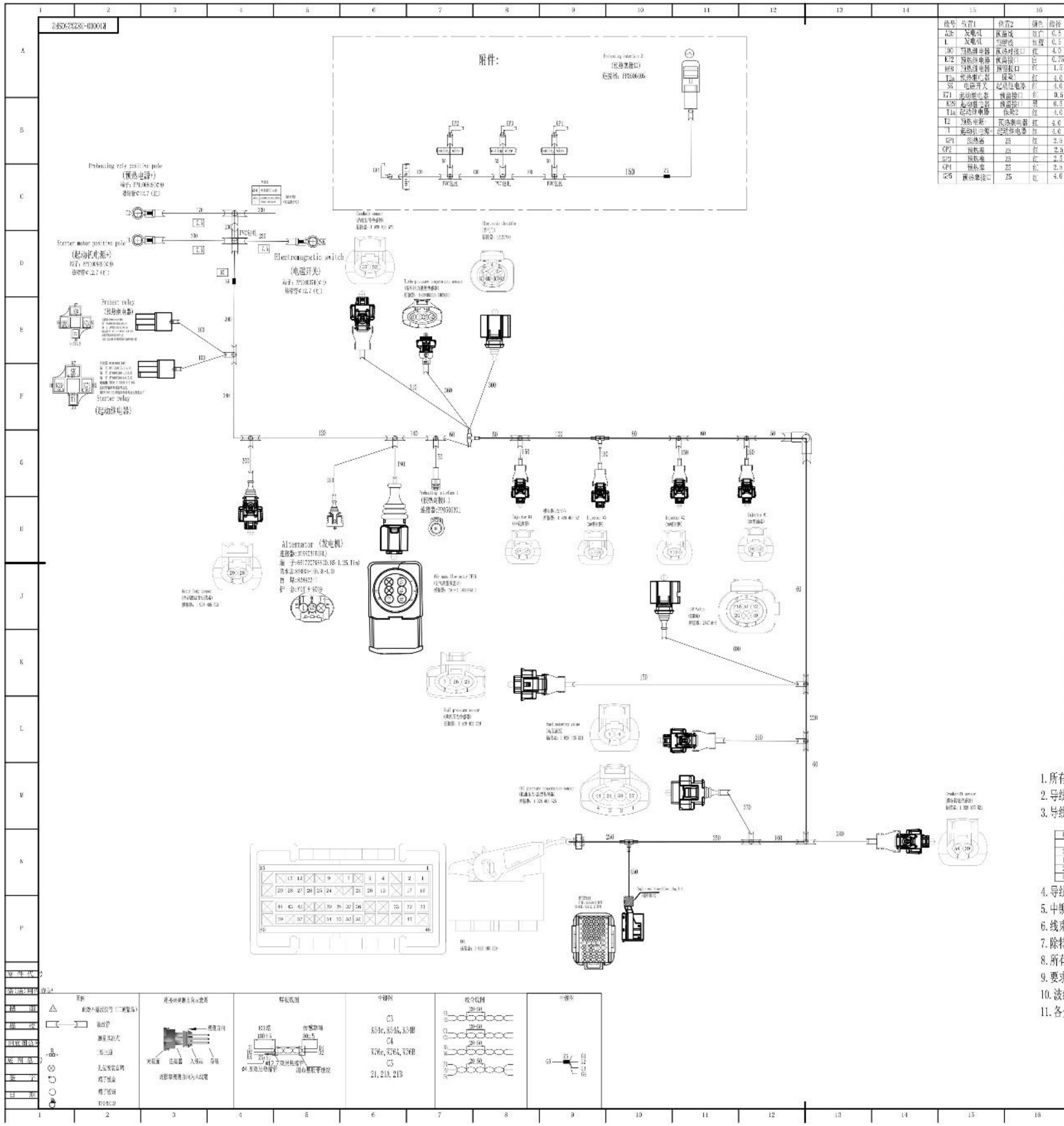
The A2b excitation line is a necessary connection for the generator. After connecting to the positive pole and the generator B+

to the battery+, charging begins.

The L charging indicator light is used as needed and can be connected to the positive electrode.

6.4 Check the preheating plug

Note: The working time of the preheating plug is controlled by the engine ECU. Firstly, confirm whether the preheating plug is correctly connected during the wiring process; Secondly, whether the preheating relay is working properly.



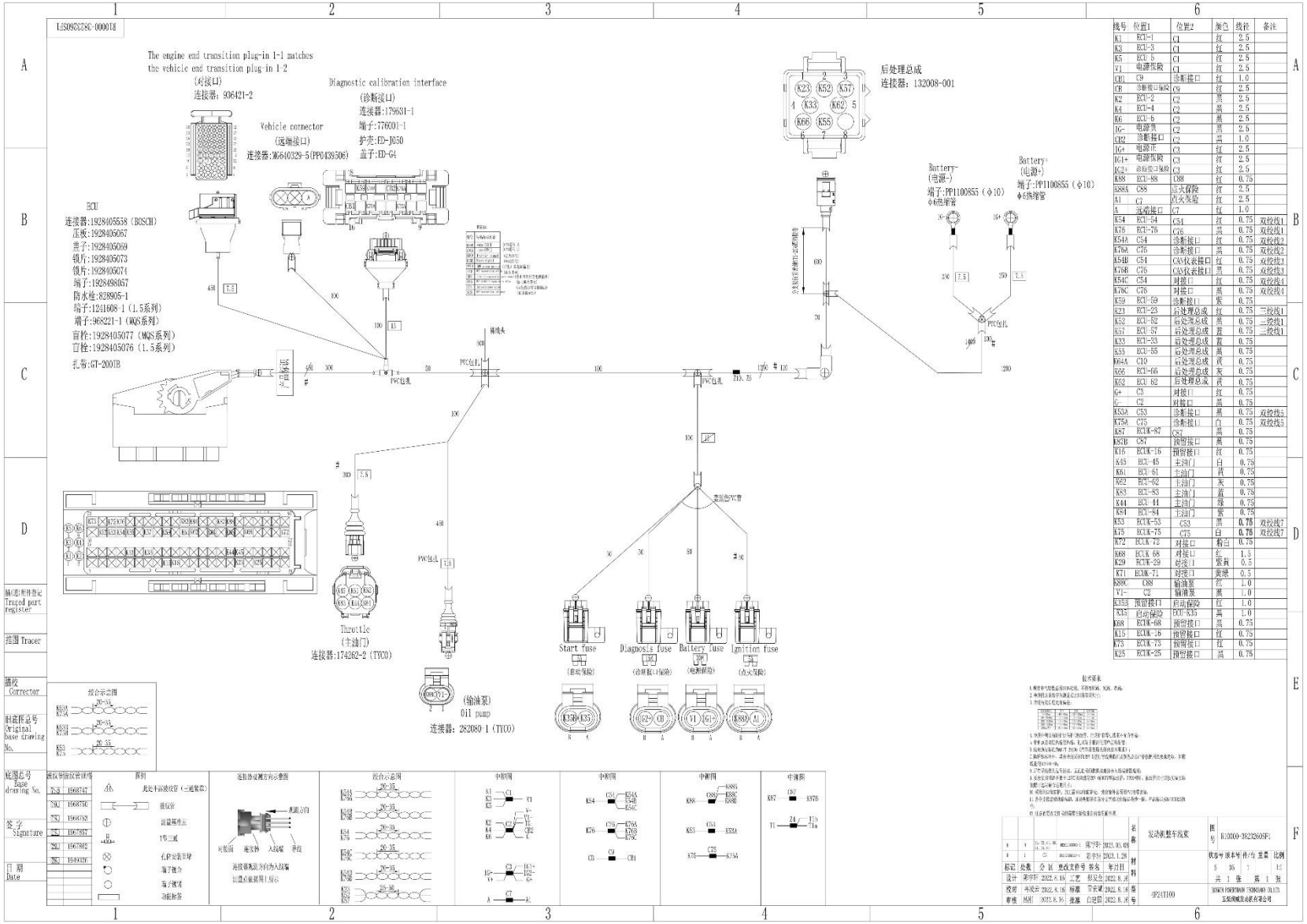
线号	位 置 1	位 置 2	颜色	截面mm²	备注
29	ECU-29	冷却液温度-2	白	0.75	
28	ECU-28	冷却液温度-1	黄	0.75	
7	ECU-7	共轨压力-3	白	0.75	三绞线
25	ECU-25	共轨压力-1	棕	0.75	
26	ECU-26	共轨压力-2	棕、绿	0.75	
54	ECU-54	曲轴转速传感器-2	白	0.75	双绞屏蔽线
39	ECU-39	曲轴转速传感器-1	黑	0.75	
S1	C1	传感器端剪断		屏蔽层	
38	ECU-38	C1	棕	0.75	
4	ECU-4	高压油泵-1	红	0.75	双绞线
5	ECU-5	高压油泵-2	灰	0.75	
42	ECU-42	增压压力温度-4	红	0.75	
9	ECU-9	增压压力温度-2	黄	0.75	
43	ECU-43	增压压力温度-1	黑	0.75	
27	ECU-27	增压压力温度-3	蓝	0.75	
17	ECU-17	4#喷油器-2	棕	1.5	双绞线
47	ECU-47	4#喷油器-1	红	1.5	
33	ECU-33	1#喷油器-1	红	1.5	双绞线
16	ECU-16	1#喷油器-2	白	1.5	
2	ECU-2	2#喷油器-2	绿	1.5	双绞线
32	ECU-32	2#喷油器-1	红	1.5	
1	ECU-1	3#喷油器-2	白、蓝	1.5	双绞线
31	ECU-31	3#喷油器-1	红	1.5	
52	ECU-52	凸轮信号传感器-1	白	0.75	双绞屏蔽线
37	ECU-37	凸轮信号传感器-2	黑	0.75	
S2	C2	传感器端剪断		屏蔽层	
53	ECU-53	C2	蓝	0.75	
36	ECU-36	空气质量流量计-3	蓝	0.75	
21B	C5	空气质量流量计-6	绿	0.75	
K54A	C3	空气质量流量计-1	白	0.75	双绞线
K76A	C4	空气质量流量计-2	黑	0.75	
12	ECU-12	EGR阀-2	蓝	0.75	
21A	C5	EGR阀-6	绿	0.75	
51	ECU-51	EGR阀-4	黄	0.75	
19	ECU-19	EGR阀-1	黑	0.75	
20	ECU-20	EGR阀-5	白	0.75	
K54c	预留接口	C3	白	0.75	双绞线
K76c	预留接口	C4	黑	0.75	
G-	预留接口	节气门-2	白	0.75	
G+	预留接口	节气门-6	红、白	0.75	
K54B	C3	节气门-5	白	0.75	双绞线
K76B	C4	节气门-1	黑	0.75	
21	ECU-21	C5	绿	0.75	
57	ECU-57	机油压力温度-1	红	0.75	
59	ECU-59	机油压力温度-2	黄	0.75	
24	ECU-24	机油压力温度-3	黑	0.75	
44	ECU-44	机油压力温度-4	蓝	0.75	

技术要求

1. 所有电气特性必须100%检测，不得有断路、短路、串路；
2. 导线附近的数字为测量点之间的有效尺寸；
3. 导线有效长度允许偏差：

线束基本尺寸	主干	分支	定位件间
0~200mm	[illegible]	[illegible]	[illegible]
200~1000mm	[illegible]	[illegible]	[illegible]
1000~2000mm	[illegible]	[illegible]	[illegible]
2000~5000mm	[illegible]	[illegible]	[illegible]
5000mm以上	[illegible]	[illegible]	[illegible]

4. 导线外侧须有防护层保护(波纹管、尼龙护套等),线束不允许外露；
5. 中铆点用双层热缩管热缩，孔式端子根部使用单层热缩管；
6. 线束执行标准为QC/T 29106《汽车用低压电线束技术要求》；
7. 除特殊标注外，其余导线采用FLR9Y-B型且导线横截面及颜色必须严格按照图纸要求选取，屏蔽线采用AESSXF-SB；
8. 所有导线按孔位号插接，无孔位号的按照按连接器入线端视图观测；
9. 要求使用耐温不低于125℃的阻燃等级V-0的UFW型波纹管，PPBS材料，波纹管尺寸应按实际实际装配时选取最合适的尺寸；
10. 波纹管内导线PVC裸缠，所有节点采用合适管夹进行连接；
11. 各分支按要求贴功能标识，括号内为英文的中文对照，请按括号外名称执行，产品标识按Q/RWTS.04.07执行；



线号	位置1	位置2	颜色	线径	备注
K1	ECU-1	C1	红	2.5	
K3	ECU-3	C1	红	2.5	
K5	ECU-5	C1	红	2.5	
V1	电源保险	C1	红	2.5	
CB1	C9	诊断接口	红	1.0	
CB	诊断接口保险	C9	红	2.5	
K2	ECU-2	C2	黑	2.5	
K4	ECU-4	C2	黑	2.5	
K6	ECU-6	C2	黑	2.5	
IG-	电源负	C2	黑	2.5	
CB2	诊断接口	C2	黑	1.0	
IG+	电源正	C3	红	2.5	
IG1+	电源保险	C3	红	2.5	
IG2+	诊断接口保险	C3	红	2.5	
K88	ECU-88	C88	红	0.75	
K88A	C88	点火保险	红	2.5	
A1	G2	点火负载	红	2.5	
A	远端接口	G7	红	1.0	
K54	ECU-54	C54	红	0.75	双绞线1
K76	ECU-76	C76	黑	0.75	双绞线1
K54A	C54	诊断接口	红	0.75	双绞线2
K76A	C76	诊断接口	黑	0.75	双绞线2
K54B	C54	CAN转接接口	红	0.75	双绞线3
K76B	C76	CAN转接接口	黑	0.75	双绞线3
K54C	C54	对接口	红	0.75	双绞线4
K76C	C76	对接口	黑	0.75	双绞线4
K59	ECU-59	诊断接口	黑	0.75	
K23	ECU-23	后处理总成	红	0.75	二绞线1
K52	ECU-52	后处理总成	黑	0.75	二绞线1
K57	ECU-57	后处理总成	蓝	0.75	二绞线1
K33	ECU-33	后处理总成	蓝	0.75	
K55	ECU-55	后处理总成	黑	0.75	
K66A	C10	后处理总成	黄	0.75	
K66	ECU-66	后处理总成	灰	0.75	
K62	ECU-62	后处理总成	黄	0.75	
G+	C3	对接口	红	0.75	
G-	C2	对接口	黑	0.75	
K53A	C53	诊断接口	黑	0.75	双绞线5
K75A	C75	诊断接口	白	0.75	双绞线5
K87	ECUK-87	C87	黑	0.75	
K87B	C87	预留接口	黑	0.75	
K16	ECUK-16	预留接口	红	0.75	
K45	ECU-45	主油门	白	0.75	
K61	ECU-61	主油门	黄	0.75	
K42	ECU-42	主油门	灰	0.75	
K43	ECU-43	主油门	蓝	0.75	
K44	ECU-44	主油门	绿	0.75	
K84	ECU-84	主油门	紫	0.75	
K53	ECUK-53	C53	黑	0.75	双绞线7
K75	ECUK-75	C75	白	0.75	双绞线7
K72	ECUK-72	对接口	粉白	0.75	
K68	ECUK-68	对接口	红	1.5	
K29	ECUK-29	对接口	蓝黄	0.5	
K71	ECUK-71	对接口	黄绿	0.5	
K88C	C88	输油泵	红	1.0	
V1-	C2	输油泵	黑	1.0	
K35	预留接口	启动保险	红	1.0	
K35	启动保险	ECU-K35	黑	1.0	
K68	ECUK-68	预留接口	黑	0.75	
K15	ECUK-15	预留接口	红	0.75	
K73	ECUK-73	预留接口	红	0.75	
K25	ECUK-25	预留接口	黑	0.75	

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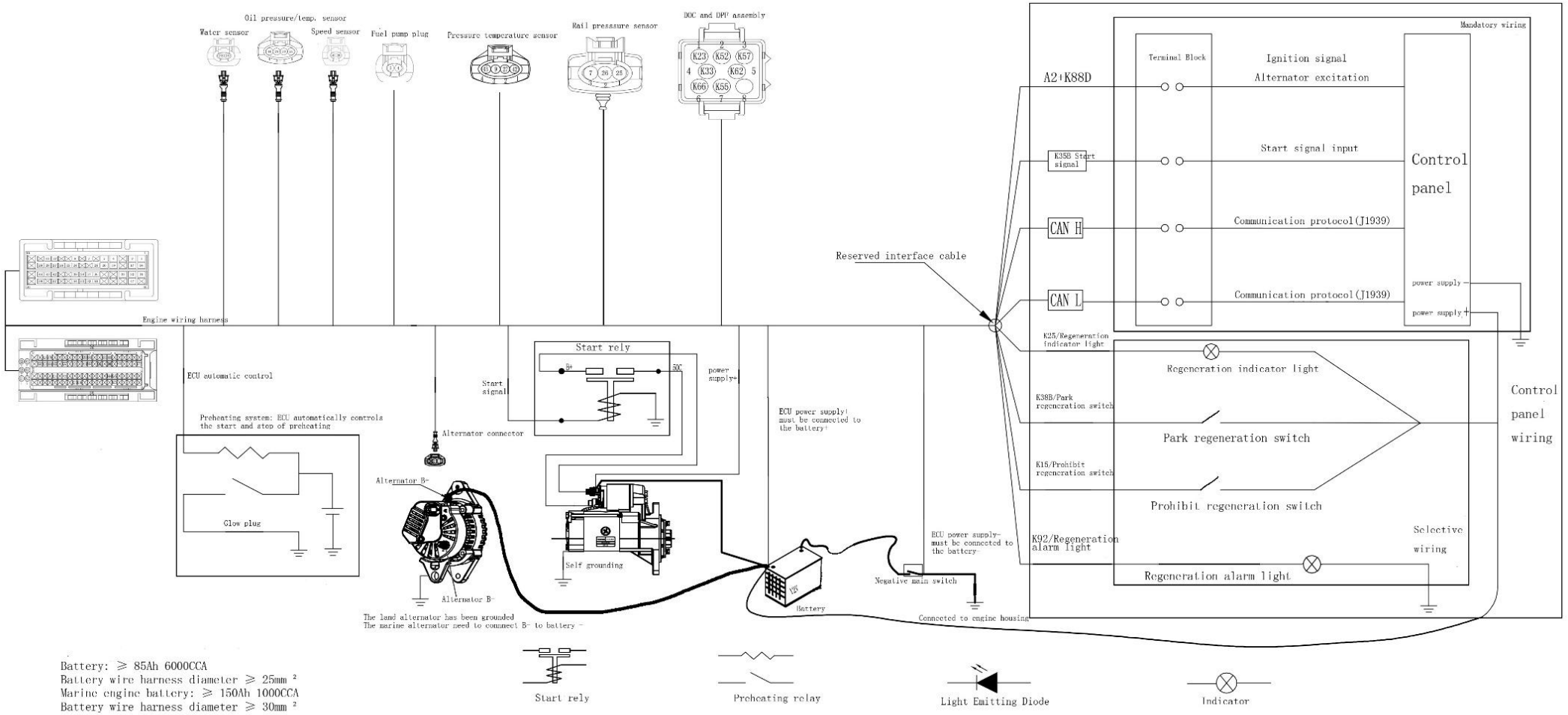

Battery: ⩾ 85Ah 6000CCA
Battery wire harness diameter ⩾ 25mm ²
Marine engine battery: ⩾ 150Ah 1000CCA
Battery wire harness diameter ⩾ 30mm ²

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