SHACMAN 汽车电器知识培训

哪壶不开提哪壶

F2000-F3000

陕汽进出口公司服务部培训科

第四课 线束 Lesson 4: Wiring Harness

一．概述 overview

陕汽卡车采用的是低压导线，这种导线是传输低电压的小电流的导线，绝缘层较薄。高压导线是传送高电压的导线，仅在天然气点火系统的高压点火线和新能源电动车上有应用，低压电缆是传输大电流的导线，用于起动机、蓄电池连接和搭铁线。高压导线和低压电缆的绝缘层都较厚。

SHACMAN uses low voltage wires. These wires are used to transmit low voltage and small current, and their insulation layer is relatively thin. High voltage wires are used to transmit high voltage and are only applied in high-voltage ignition systems of natural gas ignition systems and new energy electric vehicles. Low voltage cables are used to transmit large current and are used for starters, battery connections and grounding wires. The insulation layers of high voltage wires and low voltage cables are thicker.

汽车电路用的低压导线由多股铜线拧成线芯，线芯外面包裹聚氯乙烯（PVC）绝缘层构成。铜芯电阻低，且易于与电线接头压接或焊接。在汽车上还用到少量银、金、铝和黄铜薄板等导电材料。

The low-voltage wires used in automotive circuits consist of a core made of multiple strands of twisted copper wire, encased in a polyvinyl chloride (PVC) insulation layer. Copper core wires have low resistance and are easy to crimp or solder with wire connectors. A small amount of silver, gold, aluminum, and brass sheets are also used as conductive materials in automobiles.

注意：单股铜导线可以用在不需要柔软性的低压小电流电路。在高压、大电流或需要柔软性的电路，不要用单股铜导线。用多股线芯，是由于电流具有芯线表面流动（集肤效应）的特性。同样标称截面的导线，多股导线芯线露出的表面积（每根铜线的自身表面）比单股导线大，电阻也比单股导线小。采用PVC 塑料作绝缘材料，是由于PVC 具有耐温度老化和抗腐蚀的性能。PVC 还能耐蓄电池酸液、防冻液和汽油的腐蚀。绝缘包覆层起到了防止导线对铁短路和防腐蚀的作用。

Note: Single-strand copper wires can be used in low voltage, small current circuits where flexibility is not required. In high voltage, large current, or circuits that require flexibility, single-strand copper wires should not be used. The use of multi-strand wire cores is due to the characteristic of current flowing on the surface of the wire core (skin effect). For wires with the same nominal cross-section, the surface area exposed by the multi-strand wire core (the surface of each individual copper wire) is larger, and the resistance is also smaller than that of single-strand wires. PVC plastic is used as an insulating material because it is resistant to temperature aging and corrosion. PVC can also resist the corrosion of battery acid, antifreeze, and gasoline. The insulation coating prevents the wire from short-circuiting to the iron and provides corrosion resistance.

陕重汽生产的重型汽车线束电线的标识主要有两种方法，一种是色标表示法，电线上不同的颜色表示不同的功能。一种为编码表示法，所有的电线均为白色，主要靠其上不同的喷码表示不同的功能，以下我们分别对这两种表示方法进行介绍。

There are two main methods for identifying the wiring harness wires in heavy-duty vehicles produced by SHACMAN. The first method is color coding, where different colors on the wires indicate different functions. The second method is encoding, where all the wires are white and different functions are indicated by unique printed codes on the wires. The following introduces these two methods in detail.

二、用编码区别功能的电线

德龙系列车型的电线主要靠编码区别，编码一般由5 位数字组成:

前2 位代表该电线的电器性质,叫区域码；后3 位代表电线序号,叫顺序码。有些情况在顺序码后加1 位区别码，用来表示相同线号的不同连线。

Here’s the explanation of how wiring in the Delong series of vehicles is distinguished using codes:

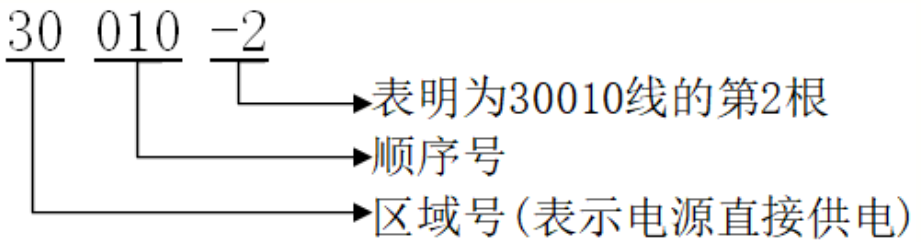
Each wire is typically identified by a 5-digit code. The first 2 digits represent the electrical property of the wire, known as the “area code”. The following 3 digits represent the wire’s sequence number, known as the “sequence code”. In some cases, an additional digit, known as the "differentiation code," is added after the sequence code to distinguish between different connections of the same wire number.

图（1-1）编码说明

Figure (1-1) Encoding Explanation

例如:
For example:

图（1-2）编码说明
Figure (1-2) Encoding Explanation



Indicates the 2nd wire of wire 30010
Sequence Code
Area Code (Direct Power Supply)

图（1-3）编码说明
Figure (1-3) Encoding Explanation

区域码	含　　义
15	经钥匙开关的电源输出
16	仪表线路
17	火焰预热
20	雨刮及喷淋线路
23	空调线路
24	后视镜加热及摇窗机(电源)线路
25	暖风电路及高顶天窗电路
30	直接与蓄电池”+”极相连或经电源总开关与蓄电池”+”极相连
31	搭铁线
40	轮/轴差控制电路
43	制动及熄火电路
49	闪光系电路
50	起动信号
56	前照灯及辅助前照灯电路
58	驾驶室内辅助照明灯电路
59	发电机运转信号
75	收放机电路
91	电动摇窗机电路

表（1-1）德龙车型常见的电线区域码

Power output through the ignition switch
Instrument circuit
Flame preheat
Wiper and washer circuit
Air conditioning circuit
Heated mirrors and power window (power) circuit
Heater circuit and high roof skylight circuit
Directly connected to the battery "+" terminal or connected to the battery "+" terminal via the main power switch
Ground wire
Wheel/axle differential control circuit
Brake and shutdown circuit
Flasher circuit
Starting signal
Headlight and auxiliary headlight circuit
Cabin auxiliary lighting circuit
Generator operation signal
Radio circuit
Electrical window circuit

表（1-1）所示为德龙车型常见的电线区域码，其中加粗显示字体内容表示较重要或较常见的区域码。

Table (1-1) shows the common wire area codes for Delong models, in which bold text indicating the more important or common used area codes.

表（1-2）为一些德龙驾驶室线束中常见电线对应的功能分配表。

电线编码	功 能 描 述
16000	仪表电源(钥匙开关打开后经电器板 24 号保险有电)
30006	未经电源总开关的电源(蓄电池接上即有电)
30010	与蓄电池”+”极相连(受电源总开关控制)
31000(棕色)	搭铁线
50300	起动信号
58000	翘板开关照明电源(灯光开关打开时通电)
58300	亮度可调的仪表照明电源((灯光开关打开时通电)
59000	发电机工作信号输出端

Table (1-2) is the function allocation table corresponding to some common wires in DeLongh cab wiring harness.
Function description
Instrument power supply (after the key switch is turned on, there is power through the electrical panel No. 24 insurance)
Power supply without main power switch (battery has power when connected)
Connected to the "+" pole of the battery (controlled by the main power switch)
Ground wire
start signal
Rocker switch lighting power supply (power is supplied when the light switch is turned on)
Instrument lighting power supply with adjustable brightness (energized when the light switch is turned on)
Generator working signal output terminal

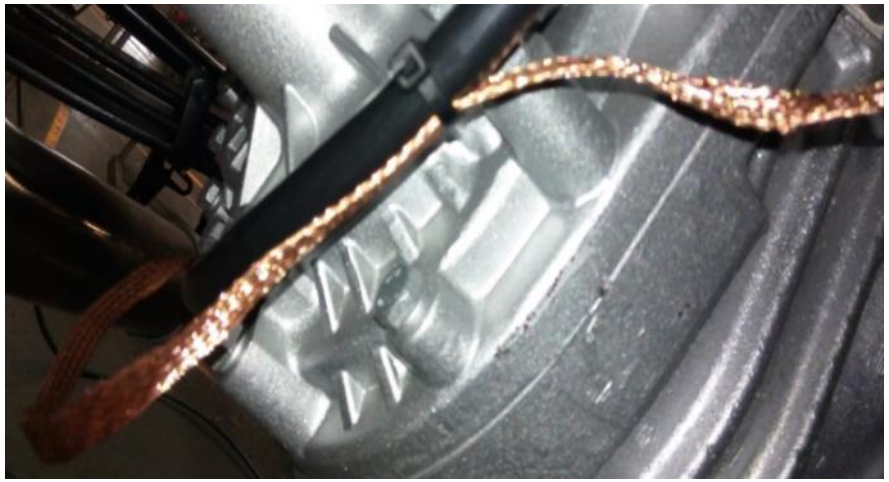
三、 F2000-F3000车型用颜色区别功能的电线

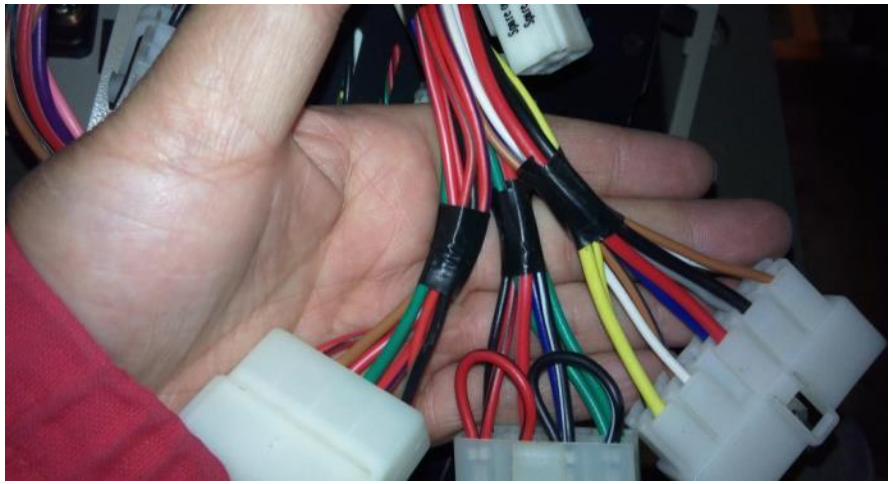
1、F2000-F3000车型的电线主要用颜色来表示电线功能，共有13 种颜色，如表（1-3）所示。

1. The wires of F2000-F3000 models mainly use colors to indicate wire functions. There are 13 colors in total, as shown in Table (1-3).

color
red
black
white
yellow
ash
green
purple
orange
dark blue
blue
brown
ground wire without insulation
Pink

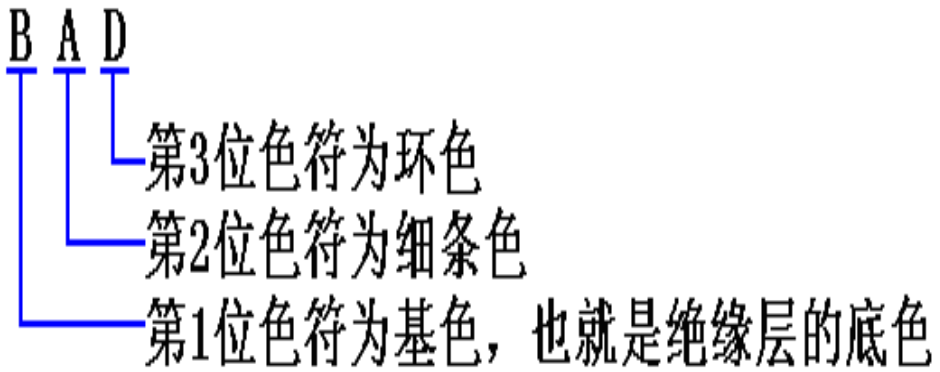
颜色	字母代号
红	A
黑	B
白	C
黄	D
灰	E
绿	F
紫	G
橙	H
深蓝	I
蓝	K
棕	L
（无绝缘层的搭铁线）	M
粉红	N





导线上颜色附加在导线绝缘层上的条状、点状的颜色，构成了导线的三位色符标识，在此基础上形成单色线、双色线、三色线。

The colors on the wire, in the form of stripes or dots added to the wire insulation, create a three-position color code identification. Based on this, single-color wires, two-color wires, and three-color wires are formed.



- The 3rd color code represents the ring color
- The 2nd color code represents the stripe color
- The 1st color code represents the base color, which is the color of the insulation layer

图（1-5）颜色定义说明

Figure (1-5) Color Definition Explanation

2、单色线

常用的单色线所代表的功能及特征如下所示：

①红色：整车电路的电源线，线径较粗，只受电源总开关控制且未经保险，用红色表示应特别注意；

②黑色：从钥匙开关出来的电源线为黑色线(注意：黑色线仍是电源线)；

③白色：前照灯远光灯的总电源线；

④黄色：前照灯近光灯的总电源线；

⑤灰色：位置灯（示高灯、示宽灯、开关仪表照明）的总电源线；

⑥棕色：搭铁线（注意：是棕色而不是黑色）；

上述的红色、黑色、白色、黄色、灰色线是保险的进线，本身不受保护，所以具体操作时要注意，防止其搭铁短路。

注意：短路可导致线束烧毁及人员灼伤。

2. Single-Color Wires

The functions and characteristics of commonly used single-color wires are as follows:

1.Red: Represents the power supply wire for the entire vehicle circuit. This wire is relatively thick, controlled only by the main power switch, and not fused. The use of red indicates special caution is needed.

2.Black: The power supply wire coming from the ignition switch is black. Note that black wires are still power wires.

3.White: Main power supply wire for the high beam headlights.

4.Yellow: Main power supply wire for the low beam headlights.

5.Gray: Main power supply wire for position lights, including clearance lamps, width lamps, and instrument panel lighting switches.

6.Brown: Ground wire. Note that brown, not black, is used for ground wires.

The red, black, white, yellow, and gray wires are unfused incoming wires and are not protected. Therefore, specific operations must be handled with care to prevent grounding and short circuits.

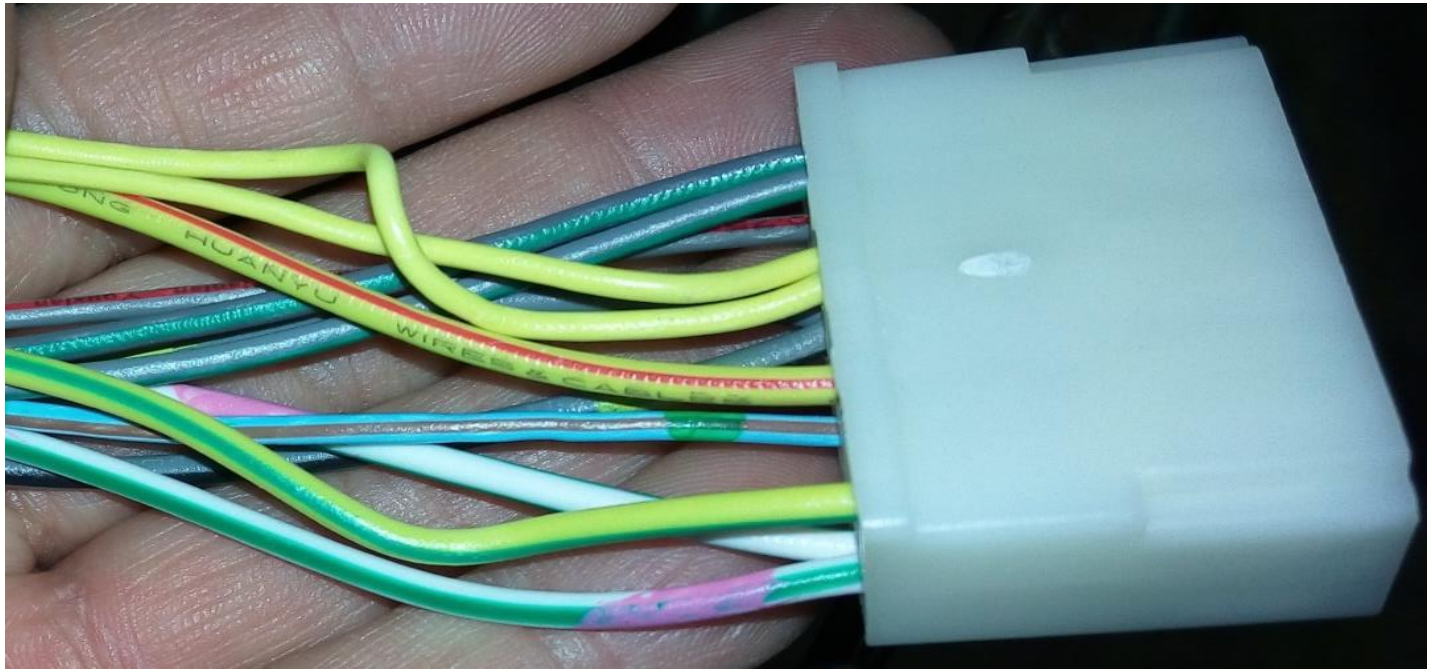
Note: Short circuits can cause wire harness damage and personal injury.

3、双色线

双色线由基色加细条色组成，从导线截面积看，基色线占截面周长的2/3，细色色线占截面周长的1/3，有时细色条的宽度较宽，不易区分基色与细条色，应转动电线进行识别。

3. Two-Color Wires

Two-color wires consist of a base color and a stripe color. In terms of the cross-sectional area of the wire, the base color occupies 2/3 of the circumference, while the stripe color occupies 1/3 of the circumference. Sometimes, the stripe color may have a wider width, making it difficult to distinguish between the base color and the stripe color. In such cases, rotating the wire can help with identification.



①按斯太尔电线标准一般单色线经过保险或电器元件后，变成双色线。
例如：红黑、红白线均源自红色线；
黑红、黑绿线均源自黑线；
白红、白黄线均源自白线；
黄绿、黄红线均源自黄线；
灰红、灰绿、灰黑线均源自灰线。
②前照灯、转向灯等左右对称的电器，其中的双色线的细条色中，绿色代表左边线束，红色代表右边线束。例如：灰绿为左示高灯线，灰红为右示高灯线
③表（1-4）中列出比较重要的几种双色线的电路功能：

1.According to the Steer wire standard, single-color wires generally transform into two-color wires after passing through a fuse or electrical component. For example:

1. Red-black and red-white wires both originate from red wires.
2. Black-red and black-green wires both originate from black wires.
3. White-red and white-yellow wires both originate from white wires.
4. Yellow-green and yellow-red wires both originate from yellow wires.
5. Gray-red, gray-green, and gray-black wires all originate from gray wires.

2.For symmetric electrical components like headlights and turn signals, the stripe color in two-color wires signifies left and right bundles:

1. Green represents the left side bundle.
2. Red represents the right side bundle. For instance, gray-green is the left high beam wire, while gray-red is the right high beam wire.

3.Table (1-4) lists several important two-color wire circuit functions.

颜色	功　　能
AB（红黑）	点烟器电源线
AC（红白）	驾驶室内照明灯及收放机电源线
BF（黑绿）	仪表、翘板开关及电磁阀电源线
BA（黑红）	制动灯、充电指示及火焰预热电源线
BL（黑棕）	暖风机电源线
BC（黑白）	倒车灯电源
BK（黑蓝）	雨刮控制器电源线
GC（紫白）	闪光继电器输出的转向信号
GF/GA（紫绿/紫红）	左/右转向灯线
CF/CA（白绿/白红）	左/右远光灯线
DF/DA（黄绿/黄红）	左/右近光灯线

Function

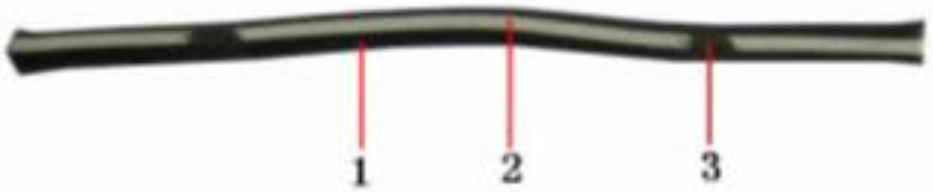
1. Cigarette lighter power supply wire
2. Interior lighting and radio power supply wire
3. Instrument panel, switch, and solenoid valve power supply wire
4. Brake lights, charging indicator, and flame preheat power supply wire
5. Heater fan power supply wire
6. Reverse light power supply wire
7. Windshield wiper controller power supply wire
8. Flasher relay output trigger signal
9. Left/right high beam turning light
10. Left/right high beam light wire
11. Left/right low beam light wire

4、三色线

双色线过功能开关或一些电器装置后的出线为三色线，三色线其颜色的基色、细条色表示方法与双色线相同，第3 色为环色线，如图（1-6）所示：

4. Three-Color Wires

After passing through a function switch or some electrical devices, two-color wires become three-color wires. The representation method of the base color and stripe color in three-color wires is the same as that of two-color wires. The third color is the ring color.



1-基色（黑色） 2-细条色（白色） 3-环色（棕色）

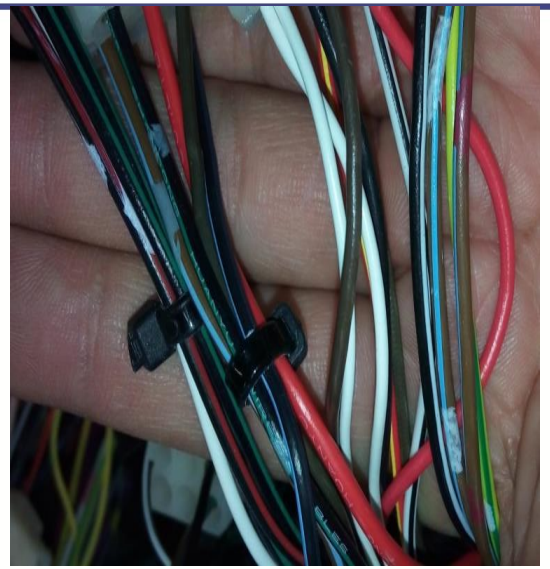
图（1-6）三色线

表（1-5）中汇总了比较重要的三色线和相应功能：
Table (1-5) summarizes the important three-color wires and their respective functions:

颜色	功　　能
BFA（黑绿红）	接轮差电磁阀
BFC（黑绿白）	接轴差电磁阀
BFD（黑绿黄）	接举升电磁阀
BFE（黑绿灰）	接全轮驱动电磁阀
BFG（黑绿紫）	接取力器电磁阀
LKA（棕蓝红）	接轮差信号开关
LKC（棕蓝白）	接轴差信号开关
LKD（棕蓝黄）	接举升信号开关
LKE（棕蓝灰）	接全轮驱动信号开关
LKG（棕蓝紫）	接取力器信号开关

FUNCTION

1. Connect to the wheel differential solenoid valve.
2. Connect to the axle differential solenoid valve.
3. Connect to the lift solenoid valve.
4. Connect to the all-wheel drive solenoid valve.
5. Connect to the power take-off solenoid valve.
6. Connect to the wheel differential signal switch.
7. Connect to the axle differential signal switch.
8. Connect to the lift signal switch.
9. Connect to the all-wheel drive signal switch.
10. Connect to the power take-off signal switch.



注意：在线束设计过程中色符变化是有一定规律的。

在实际电路中凡经过配电盒、插接器、分线器连接的导线，其电气功能没有改变，色符则相同；电线经过控制开关或保险后，其标识色符就会出现变化，一般是增加1 位色符。导线的标识色符增加后，仍具有原来基型线的性质。

Note: There is a certain pattern to color code changes in the wiring harness design process. In practical circuits, wires that pass through distribution boxes, connectors, or splitters without changing their electrical functions will maintain the same color code. However, when wires pass through control switches or fuses, their color codes may change, typically by adding an additional color code digit. Even after the color code is modified, the wire still retains the properties of its original base type.

例如：红白、红紫白与红色线一样都不受钥匙开关控制，以下为2 个特例：①制动灯的黑红线、倒车灯的黑白线，按规律本应增加色符标识的，但因其线路简单，不易与其他导线混淆，所以仍用双色线。

②灯泡是易损件，所以与灯泡连接的线一般都不增加色符标识，以达到醒目，容易辨识的目的。

For example: Red-white, red-purple-white, and red wires all remain uncontrolled by the ignition switch. There are two exceptions: 1.The black-red wire for the brake light and the black-white wire for the reverse light should follow the pattern of adding additional color code digits. However, due to the simplicity of their circuits and the low likelihood of confusion with other wires, they are still represented as two-color wires. 2. Bulbs are susceptible to damage, so wires connected to bulbs typically do not have additional color code digits added to ensure visibility and easy identification.

5、关于电线标识的补充说明

国家标准定义红线接正极，黑线接负极，但斯太尔S2000定义不同，斯太尔S2000车型黑线仍为火线（红线通过钥匙开关后变为黑线—钥匙电源），有些厂家的外协件的线路仍是按国家标准制作的，对接时可先找到对接装置的电源线，一般为红线或电线颜色含有红色部分，然后再找到本体上的搭铁线（棕色），这样另外两根电线也就可以确定了。

另外一般主电源线线径较大，小功率设备的电源线或继电器控制端线径较小，这也可以作为判断依据。

康明斯欧Ⅲ（ISM 系列）发动机的线束中还有数字地，仍为搭铁线，只不过没有和其他搭铁线连接，而是集中接到蓄电池的负极上，目前电线颜色为白色，编号31001，容易产生误解，需要注意。

5.Additional Notes on Wire Identification

The national standard defines red wires as positive (+) and black wires as negative (-). However, the Staiel S2000 model defines them differently. In the Staiel S2000 model, black wires are still considered live wires (red wires become black wires after passing through the ignition switch - key power). Some manufacturers' outsourced components may still adhere to the national standard for wire color coding. When connecting these components, you can first identify the power supply wire of the connecting device, which is generally red or has some red coloration. Then, you can locate the ground wire on the main body (brown color). This way, the other two wires can be determined.

Additionally, main power supply wires typically have larger diameters, while power supply wires for low-power devices or relay control terminals have smaller diameters. This can also be used as a reference for identification.

In Cummins Euro III (ISM series) engine harnesses, there are still ground wires labeled with numbers, but they are not connected to other ground wires. Instead, they are directly connected to the negative terminal of the battery. Currently, these wires are white in color with the number 31001, which can lead to confusion and requires attention.