


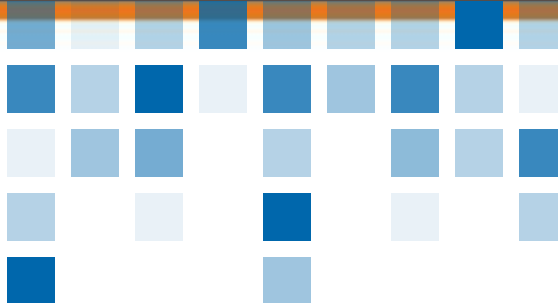




X3000系列车型 电器技术培训 X3000 Series Electrical Technology Training SHACMAN Office

陕西重型汽车进出口有限公司
服务部培训科
2022年4月6日


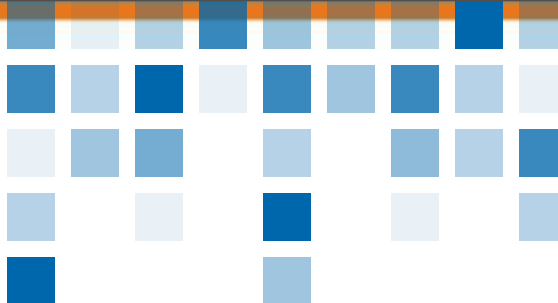
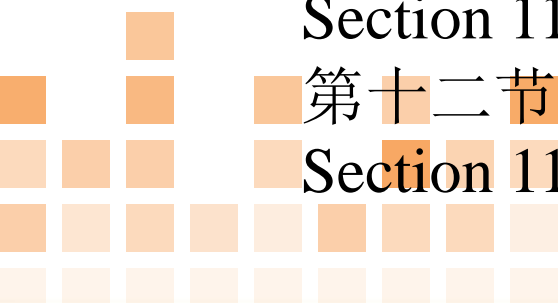

培训目录

Training Catalog

- 
- 
- 
- 
- | | |
|-----------|--|
| 第一节 | 电器维修工艺守则 |
| Section 1 | Electrical maintenance code |
| 第二节 | X3000车型组合仪表介绍 |
| Section 2 | Combination meter introduction |
| 第三节 | X3000车型电器装置板介绍 |
| Section 3 | Electrical device board introduction |
| 第四节 | X3000车型驾驶室电器介绍 |
| Section 4 | Cab electrical |
| 第五节 | 驾驶室线束结构 |
| Section 5 | Cab wiring harness structure |
| 第六节 | 发动机变速箱底盘线束结构 |
| Section 6 | Engine Transmission Chassis wiring harness structure |

培训目录

Training Catalog

- 
- 
- 
- 
- | | |
|------------|----------------------------------|
| 第七节 | 起动机线束结构 |
| Section 7 | Starter harness structure |
| 第八节 | X3000车型灯光介绍 |
| Section 8 | Lights introduction |
| 第九节 | X3000车型门控模块介绍 |
| Section 9 | Door control module introduction |
| 第十节 | X3000汽车空调介绍 |
| Section 10 | Air-conditioning |
| 第十一节 | X3000整车电源的连接路径 |
| Section 11 | Harness connection path |
| 第十二节 | X3000钥匙电源及起动电路 |
| Section 11 | Key power and start circuit |

电器维修工艺守则

Electrical maintenance code

电器维修工艺守则为每个电器维修人员要遵守的基本作业规范，涵盖范围为：安全操作，线束敷设、捆扎规范，线束连接，汽车电器装配、操作，汽车电路检修。

Electrical maintenance code is the basic operation specification that every electrical maintenance personnel should follow ,include : safe operation , harness laying and binding specification , harness connection , electrical assembly and operating , electrical repair .



电器维修工艺守则

Electrical maintenance code

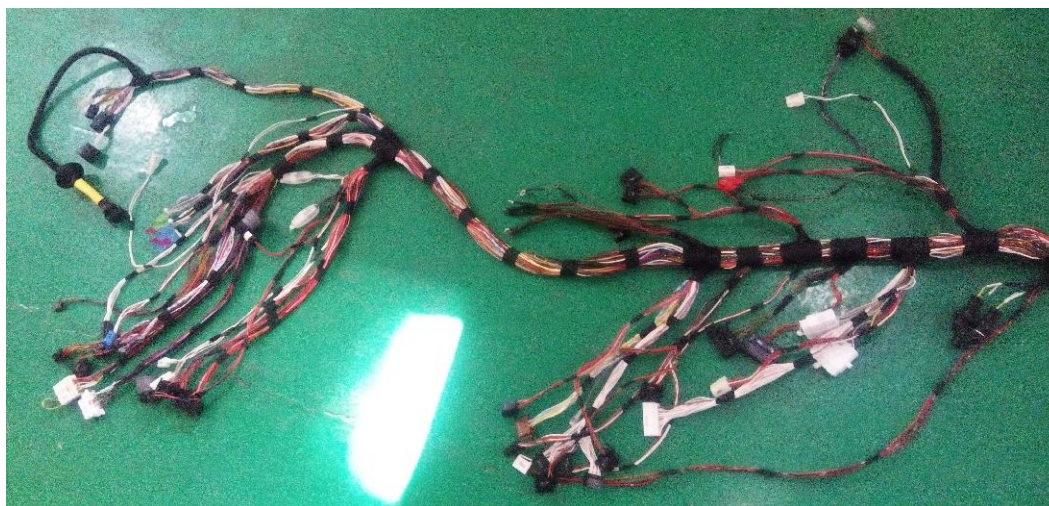
符号说明: Symbol description

 警告：不正确的操作可能会导致人身伤亡事故，用警告表示。

Warning : Incorrect operation may lead to personal injury and death, indicated by a warning.

 小心：不正确的操作可能毁坏设备，用小心表示。

Beware : Incorrect operation may damage the equipment, indicated by beware.



安全操作

Safe operation

◆在整车电路未连接完整时不得打开电源总开关。

◆ The main power switch must can not be turned on when the entire harness is not connected.

⚠ 小心：在车辆电路未连接完毕时打开电源总开关可能会导致短路事故，烧毁线路。

Be careful: Turning on the main power switch when the vehicle harness is not connected may cause a short circuit accident and burn the harness.



◆ 启动发动机之前，需要先确定变速器档位是否处于空档，只有确认空挡时，才可以起动发动机。

◆ If it is).

警告：应急起动功能会绕过空档保护电路起动发动机，若此时变速箱在档，将会导致车辆意外起步，产生危险。

Warning: The emergency start button will bypass the neutral protection circuit to start the engine

. If the transmission is in gear at this time, it will cause the vehicle to start accidentally, causing danger.



安全操作

- ◆ 起动车辆前, 检查驾驶室的锁紧状态 (驾驶室翻转指示灯应处于熄灭状态); 手刹阀处于制动位置 (此时信号灯板上驻车制动信号灯点亮), 档位处于空档位置; 确认周围人员处于安全位置 (车辆前后5m范围、左右1.5米范围不得有人, 车架上面或者下面不得有人) 并告知别人。
- ◆ Before starting the vehicle, check the locking
- ◆ state of the cab (cab flip indicator should
- ◆ be in the off state); Parking brake handle
- ◆ is in the pull-up position (at this time, the
- ◆ parking brake signal light on the signal
- ◆ light board is on),



the gear is in the neutral position . Confirm that the surrounding people are in a safe position (nobody in the range of 5m before and after the vehicle, 1.5m in the left and right, and there must be no people on the frame).

警告：驾驶室未锁紧会导致在车辆行驶过程中制动时驾驶室向前倾覆，导致安全事故。

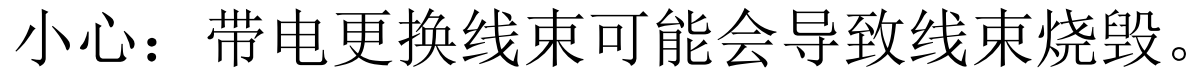
Warning: Unlocking the cab can cause the cab to tip over when the vehicle is in motion, resulting in a safety incident.





1. 2. 1.

陕西重型汽车进出口有限公司
SHAANXI HEAVY DUTY AUTOMOBILE IMPORT & EXPORT CO.,LTD



Caution: Replacement of the harness by charging may cause the harness to burn out.





1.2.2.



因车辆电器有部分是经过常火电源，关闭电源总开关并不能完全保证线路上不带电，所以首先从搭铁端开始接线，最后再接电源端。如果能够明确接线为常火电源则应在接线前摘除蓄电池正极接线端子。 Because part of the vehicle's electrical equipment is connected to the power supply at all times, turning off the main power switch does not completely guarantee that the line is not energized. Therefore, the wiring must be started from the ground terminal first, and then the power supply terminal . If it is clear that the wiring is a normal-fire power supply, remove the battery positive terminal before wiring.





SHACMAN

1. 2. 3.

陕西重型汽车进出口有限公司
SHAANXI HEAVY DUTY AUTOMOBILE IMPORT & EXPORT CO., LTD

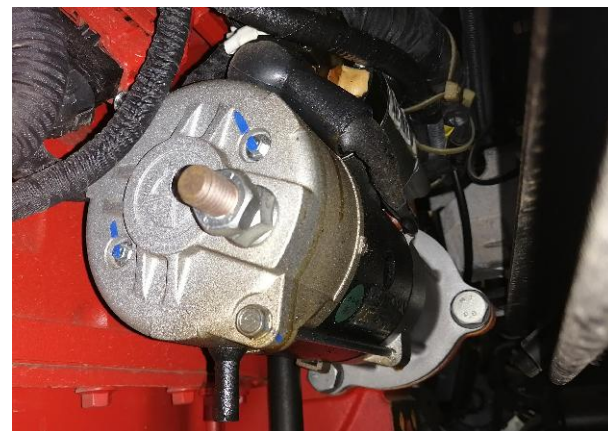


例如拆除起动机30接线柱接线端子时，应关闭电源总开关，在拆除前应在测试一下接线端是否有电（用试灯或万用表），防止电路短路灼伤人体。

For example, when removing the terminal block 30, the main switch of the power supply should be turned off. Before dismantling, it should be tested whether there is electricity at the terminal (using a test lamp or a multicomination meter) to prevent the short circuit to burn the human body.

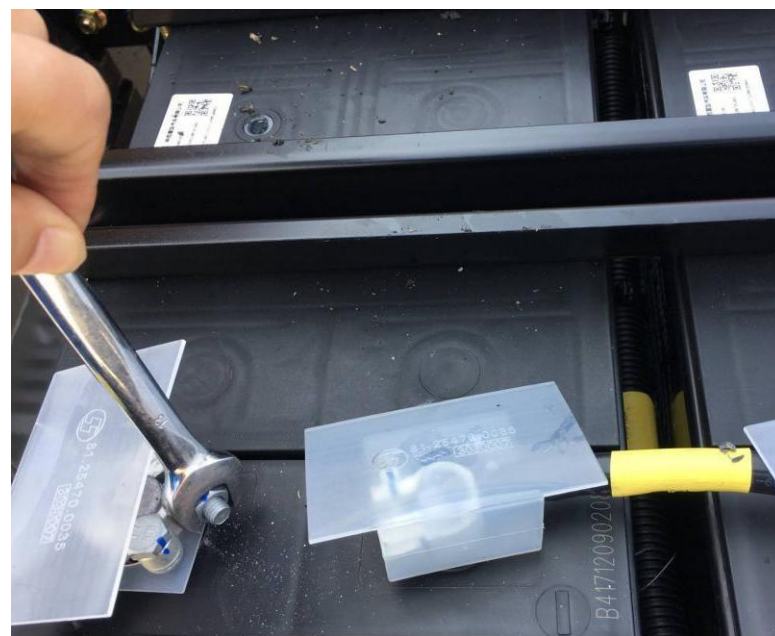
更换电源总开关时应首先摘除蓄电池正极接线柱端子。

When replacing the main power switch, remove the battery positive terminal.



◆ 摘除或安装蓄电池接线端子时应尽量选用带有绝缘手柄的扳手；如用普通扳手则拆卸时应小心不要碰触连接两接线柱。

⚠ When removing or installing battery terminals, try to use a wrench with an insulated handle. If using an ordinary wrench, be careful not to touch the negative terminal and the positive terminal at the same time.



警告：蓄电池短路会产生大量热量，灼伤人体。

蓄电池两接线柱之间间距较近，在安装时不注意扳手就可能搭接到两接线柱从而导致短路。

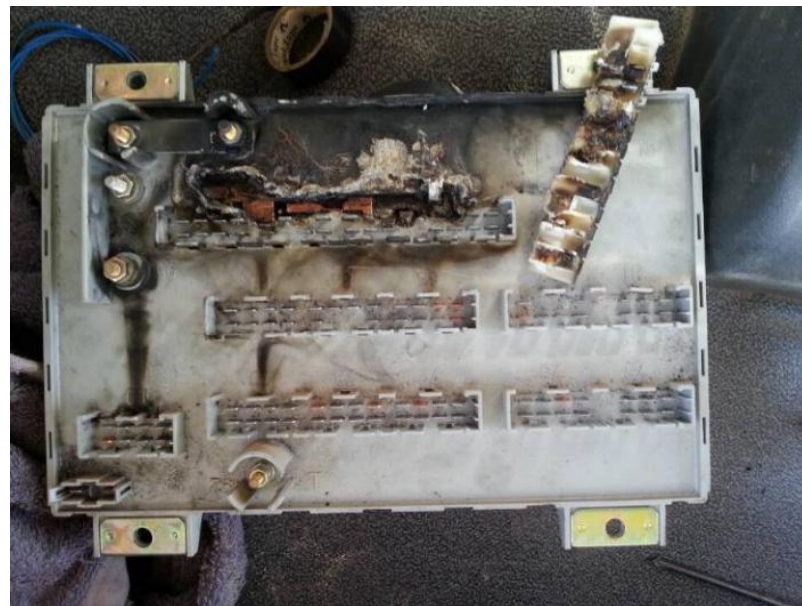
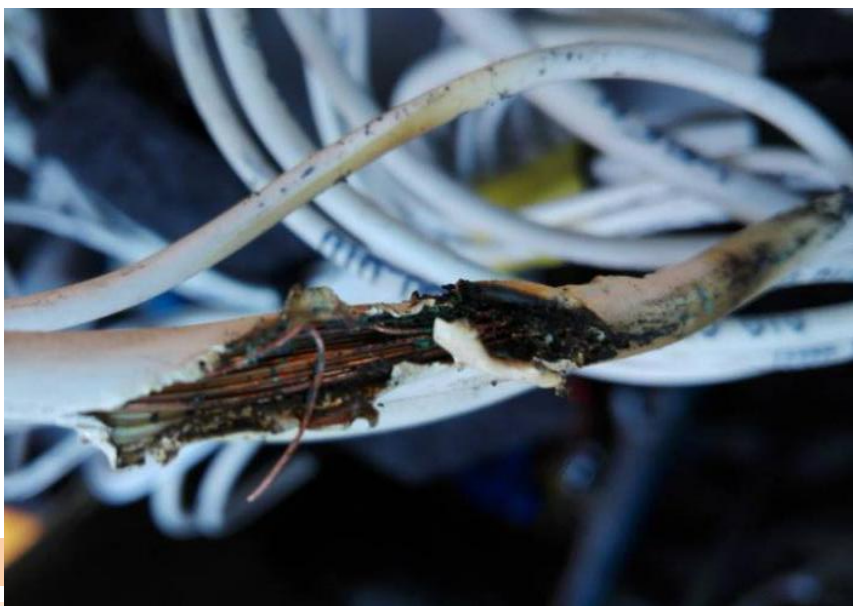
 Warning: Battery short circuits will generate a lot of heat and burn the human body.

The distance between the two terminals of a battery is short. The spanner may be connected to the two terminals, which may cause a short circuit.



- ◆如果在车辆行驶中发现有短路起火现象时，应首先将车辆停靠到安全位置，关闭钥匙电源及整车电源，然后再作进一步处理。

When a short-circuit fire occurs during driving, the vehicle should first be parked in a safe position, and the key power and vehicle power should be turned off before further processing.



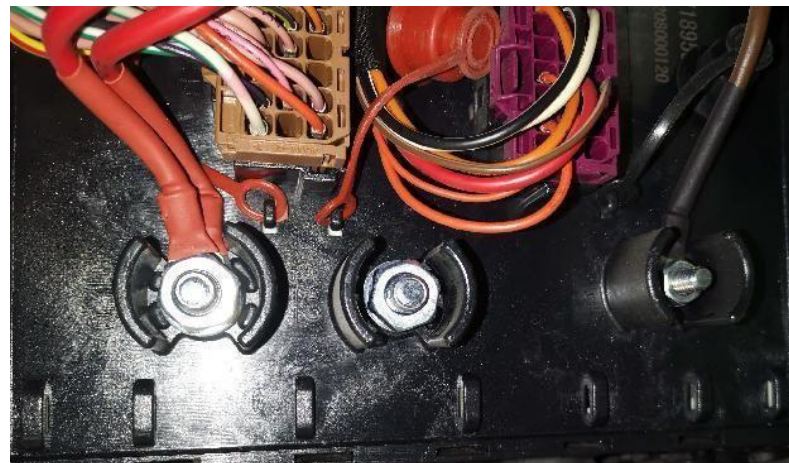


SHACMAN

1. 3. 2.

陕西重型汽车进出口有限公司
SHAANXI HEAVY DUTY AUTOMOBILE IMPORT & EXPORT CO.,LTD

- ◆ L3000, X3000车型电器板的保险丝及电器板背面暴露在外的接线端子没有绝缘保护，在检修时注意不要与驾驶室本体接触或将其他金属物品（如扳手、改锥、钥匙等）置于其上，以免发生短路事故。
- ◆ The fuses on the L3000 and X3000 models of electrical board and the exposed terminals on the back of the electrical board are not insulated. Take care not to touch the cab body or place other metal items (such as wrenches, screwdrivers, keys, etc.) during inspection. To avoid short circuit accidents.



线束敷设、捆扎规范

Harness laying and binding specifications

线束敷设应避开高温热源，严禁与其它高温零部件接触，应与其它高温零部件保持一定安全距离及保护措施，安装隔热保护装置以保护线束装置，防止线束早期老化失效。注意：线束被烫坏可能会导致线束短路。

Harnesses should avoid high temperature heat sources, and must not be in contact with other high-temperature components.

Maintain a certain safety distance and protective measures with other high-temperature components. Install thermal protection devices to protect harness and prevent early failure.

Note: Burned harness may cause a short circuit.



整车的高温热源:

1. 排气管、排气消声器。
2. 涡轮增压器。

High temperature heat source :

1. Exhaust pipe, exhaust muffler.
2. Turbocharger.



整车的高温热源:

3. 压缩空气冷却钢管。

4. 发动机本体。

High temperature heat source:

3. Compressed air cooling pipe.

4. Engine body.



◆线束敷设时应避开旋转、震动、跳动较大的部位（如发动机冷却风扇、车轮、传动轴、取力器输出轴、悬架、转向柱等）。小心：线束被卷入传动轴等旋转部件会导致电线断路、短路等故障。

◆Wiring harnesses should avoid rotating, vibration, and jumping parts (such as engine cooling fan, wheels, transmission shaft, power takeoff output shaft, suspension, steering column, etc.). **Caution:** Harnesses caught in rotating parts such as a drive shaft may cause open circuit, short circuits, or other troubles.



- ◆ 暴露在外部环境中的线束应尽量置于遮盖物下，或者使用防护包裹。
- ◆ Harnesses exposed to the outside environment should be placed under the cover as much as possible, or use protective wraps.





SHACMAN

1.4.3.

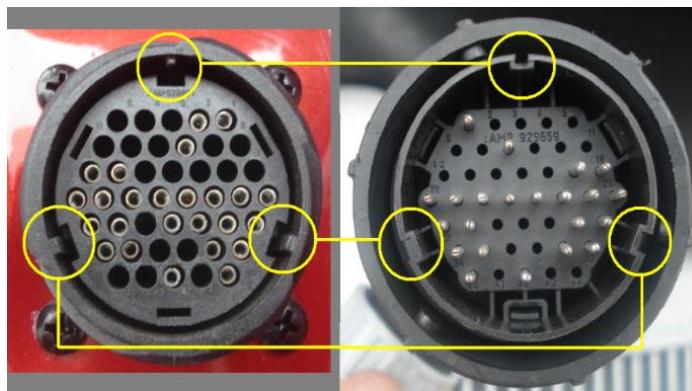
陕西重型汽车进出口有限公司
SHAANXI HEAVY DUTY AUTOMOBILE IMPORT & EXPORT CO.,LTD

- ◆ 线束的固定和捆扎。应在固定点用紧固带、隔环、固定夹捆扎固定，固定点最大间距500mm；捆扎带分布均匀，捆扎点最大间距200mm，；线束不得长距离悬空；紧固带拉紧后需剪掉多余部分。
- ◆ Harness fixing and strapping. Should be fixed at a fixed point with a fastening strap, spacer, and a fixed clip for binding. The maximum spacing of the fixing points is 500mm; the strapping is evenly distributed; the maximum spacing of the strapping points is 200mm; the wiring harness must not be hung long; The excess part must be cut after the fastening straps .



线束连接 Harness connection

- ◆ 插接器上有锁紧装置的应插接到锁紧装置锁紧（即锁片与锁扣相互挂住）。带锁紧螺帽的应旋紧螺帽，部分需旋至感到螺帽轻跳一下并听到“嗒”一声脆响才真正锁紧。在插接器对插完毕后，如发现插接件被顶出，应及时恢复。
- ◆ **There should be a plug-in position of the locking device on the plug connector (ie, the locking plate and the latch hook each other).** Screw nuts with locking nuts should be tightened. Some of them must be screwed to the nut to make a light jump and hear a "click" sound and then they are really locked. If the connector is found to be ejected, it should be restored in time.



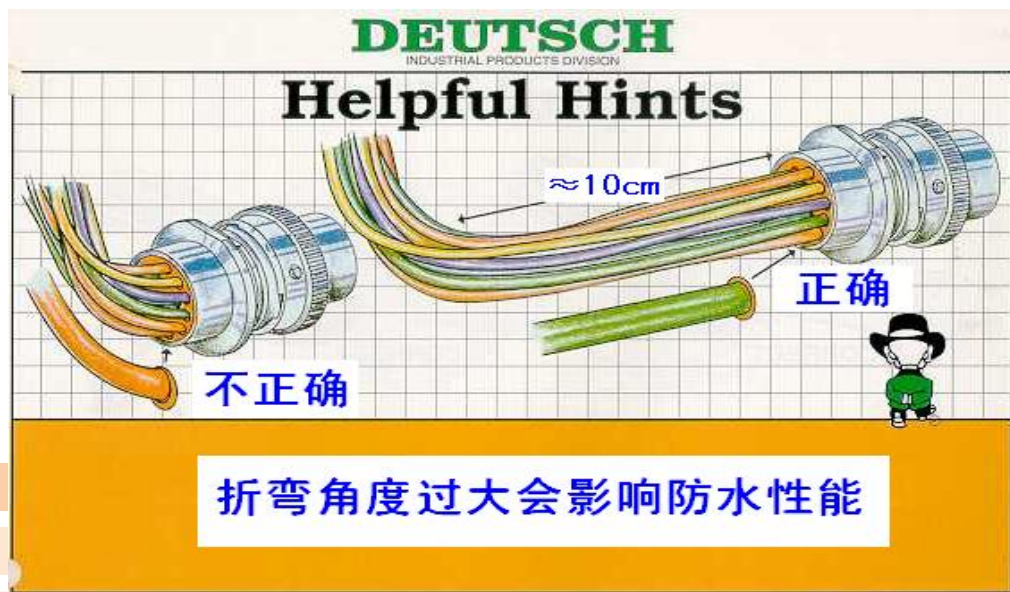


SHACMAN

1.5.2.

陕西重型汽车进出口有限公司
SHAANXI HEAVY DUTY AUTOMOBILE IMPORT & EXPORT CO.,LTD

- ◆ 暴露在外环境中的对接插接器应尽量置于遮盖物下，如无法遮盖则尽量保证接线端口与地面平行放置，避免因进水、积水造成线路故障。
- ◆ The docking connector exposed in the external environment should be placed under the covering as much as possible. If it cannot be covered, try to ensure that the connection port is placed parallel to the ground so as to avoid line failure caused by water .



◆ 线束连接时:

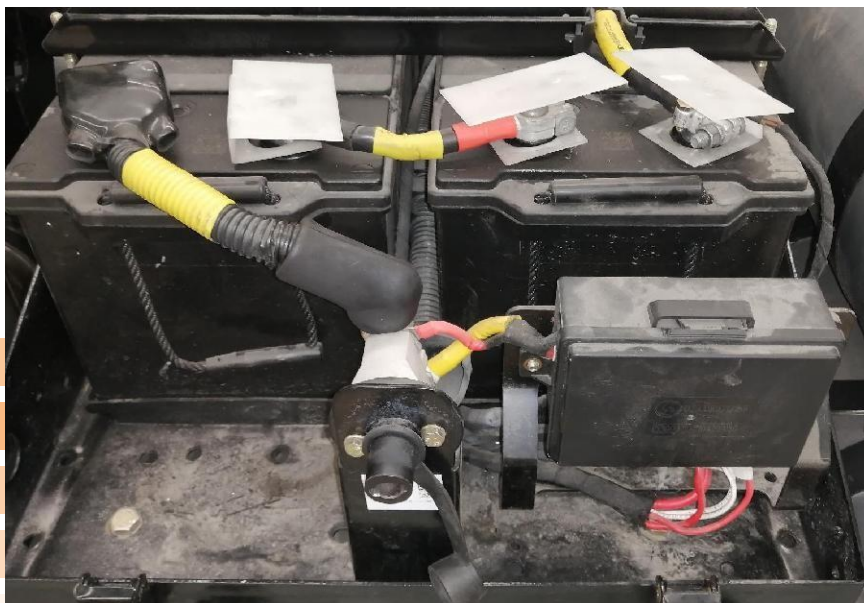
暴露在外环境中的直角插接器的出线口位置应向下, 防止雨水灌入 (如电磁阀插接器、变速箱信号开关插接器)。

◆ When connecting the harnesses:

The outlet of the right-angle connector exposed to the external environment shall be located downwards to prevent rainwater pouring (such as solenoid valve connector, gearbox signal switch connector).



- ◆ 在接线柱上接线（除搭铁线外）时，电线接头不得裸露在外，应戴绝缘护套（如蓄电池、起动机、发电机等）或加装隔离装置（如配电盒等装置）。
- ◆ When wiring on the terminal post (except for the ground wire), the wire connector shall not be exposed. Use an insulating sheath (such as battery, starter, generator, etc.) or an isolation device (such as power distribution box).



蓄电池接线柱有大小之分，较大的旁边有“+”字符，较小的接线柱旁边有“-”字符。更换新的蓄电池时注意正负极接线柱的位置是否相同。

有的蓄电池正极柱在左边，有的正极柱在右边，需要特别注意。

The battery terminals are divided into two sizes: On larger terminal there is a "+" character, and "-" character on the smaller terminal.

When replacing a new battery, note whether the positions of the positive and negative terminals are the same.

Some battery positive poles are on the left and some others are on the right. Special attention is required.

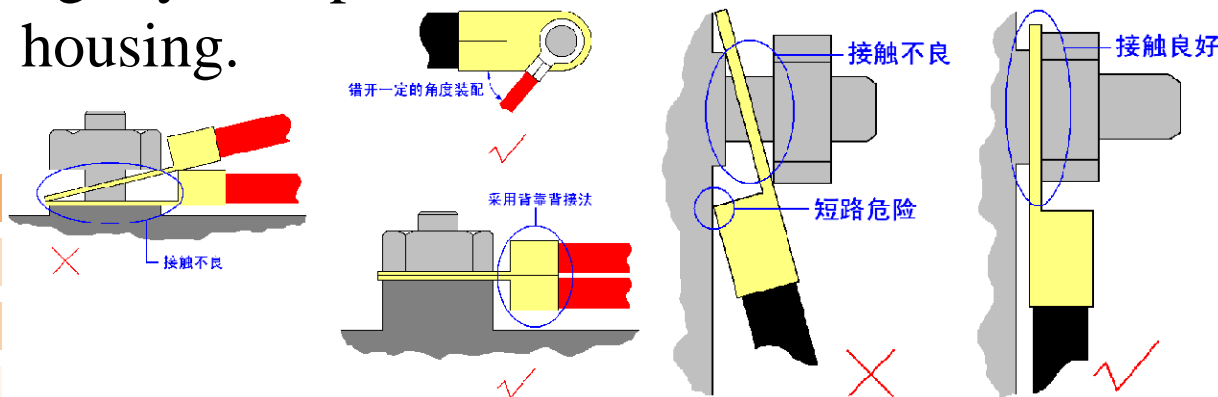


电线在接线柱接线时应保证接线端子接触良好，不发生短路。

When wires are connected to the terminals, ensure that the terminals are in good contact and no short circuit occurs.

两根电线接到一个接线柱时，则采用背对背接法，若有多根电线接到同一接线柱时，则采用相互错开接线，以便线束装配时，接头压紧牢靠。电源线不得与金属壳体接触。

When two wires are connected to one terminal, the back-to-back connection method is used. If multiple wires are connected to the same terminal, the wirings are staggered with each other so that when the wire harness is assembled, the connector is pressed tightly. The power cord must not come into contact with the metal housing.



◆ 电器接线柱相应的拧紧力矩要求如下：

起动机 30 接线柱螺母（M10）的拧紧力矩为：24.5 Nm～27.5Nm

起动机 50 接线柱螺母（M6）的拧紧力矩为：2.4～3.0Nm

发电机 B+ 接线柱螺母（M8）的拧紧力矩为：13～15Nm。

The tightening torque of the electrical terminal is as follows:

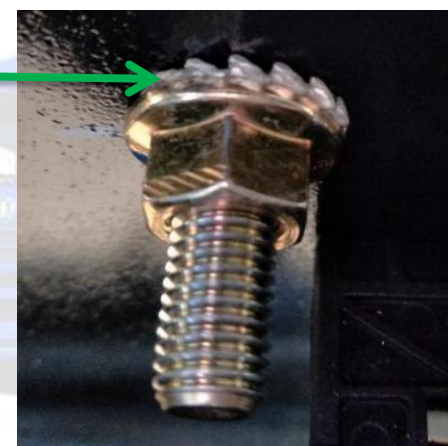
Starter 30 Tightening torque for terminal nut (M10): 24.5 Nm to 27.5 Nm

Starter 50 Tightening torque for terminal nut (M6): 2.4 to 3.0 Nm

The tightening torque for the generator B+ terminal nut (M8) is 13 to 15 Nm.



- ◆ 保险丝盒处接线依次装平垫、接线端子、弹垫、螺母。
- ◆ The wiring at the fuse box is loaded with flat pads, terminal blocks, spring washers and nuts.
- ◆ 后分线盒、电磁阀等，靠车架本体搭铁的接线柱，需要在搭铁线螺母与车架之间装齿形垫圈，可以刮开车架上漆层，增强导电效果。
- ◆ The terminal of the frame body iron must be equipped with a tooth-shaped washer between the ground wire nut and the frame, which can scratch the paint layer of the frame and enhance the conductive effect.





SHACMAN

1.5.9.

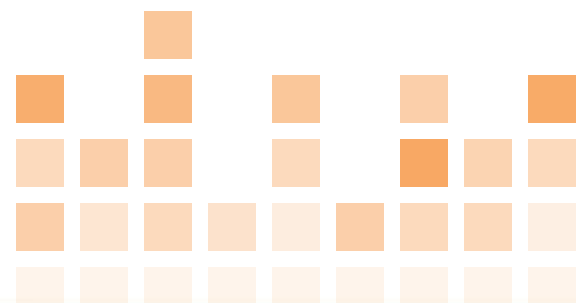
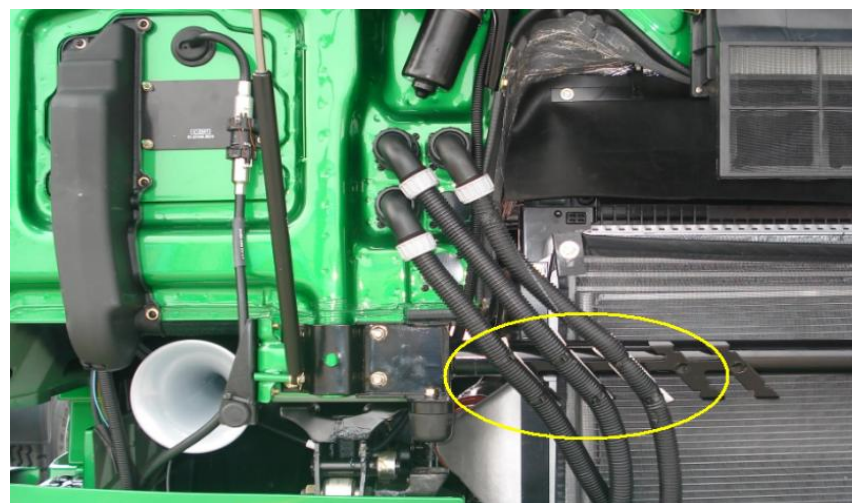
陕西重型汽车进出口有限公司
SHAANXI HEAVY DUTY AUTOMOBILE IMPORT & EXPORT CO.,LTD

线束插接器应尽量避免受外力作用

插接器应固定，或捆扎到附近。线束敷设在两相对运动部件之间时需要留余量，余量应大于两相对运动部件可能出现的最大距离。插接器不能直接承受重力、拉力，线束不能绷紧。

Harness connector should be avoided by external force

Plug connectors should be fixed or bundled nearby. When the wiring harness is laid between two relatively moving parts, it is necessary to make allowance, and the remaining amount should be greater than the maximum distance that the two relative moving parts may appear. Plug connector can not directly withstand tension, wire harness can not be tight.

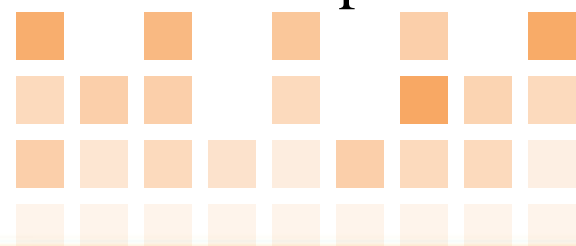


电焊作业时:

在对车辆进行电焊作业时需关闭电源总开关并拆下蓄电池“+”、“-”接线柱上的电线。焊接电流回路严禁通过电器元件、油路、油缸、气路、运动面、转动轴承等零部件处。

When welding work:

When carrying out electric welding work on the vehicle, turn off the main power switch and remove the wires on the “+” and “-” terminals of the battery. Welding current loops are strictly prohibited through electrical components, oil circuits, fuel tanks, gas lines, moving surfaces, rotating bearings and other parts.





SHACMAN

1.6.2.

陕西重型汽车进出口有限公司
SHAANXI HEAVY DUTY AUTOMOBILE IMPORT & EXPORT CO.,LTD

电焊作业时：

装配康明斯电喷发动机的机型需摘除ECM插接器，BCM控制器，EBS控制器，和变速器TCU的所有电路连接。焊接搭铁点选择尽量远离车辆线束，远离搭铁点，并靠近焊接点。

When welding work:

Cummins EFI engine need to remove all circuit connections of ECM connector, BCM controller and ABS controller. The choice of welding ground point should be faraway from the wiring harness, away from the grounding point, and near the welding point.



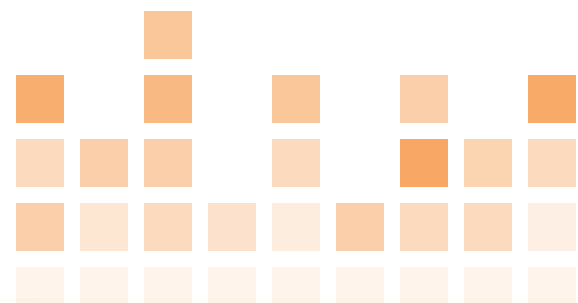
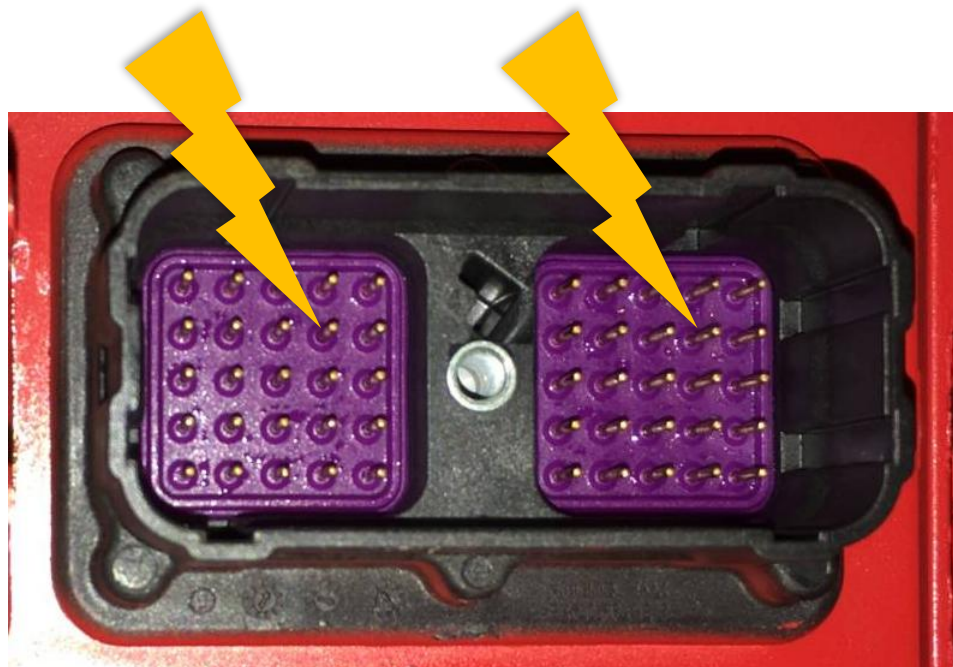


SHACMAN

1.6.3.

陕西重型汽车进出口有限公司
SHAANXI HEAVY DUTY AUTOMOBILE IMPORT & EXPORT CO.,LTD

- ◆ 在维修过程中不得用手碰触电子装置（如ABS、电控发动机ECU，BCM等）裸露的针脚，以免造成针脚歪斜、沾到油污或因人体静电作用，影响产品质量。
- ◆ Do not touch the bare pins of electronic devices (such as ABS, electronically controlled engine ECU, BCM, etc.) during the maintenance process to prevent the pins from being skewed, oil stained, or the electrostatic effect of the human body, which will affect the product quality.



起动机操作应遵守相关规范，康明斯发动机起动机单次启动时间不得超过12s。

The operation of the starter shall comply with relevant regulations. The time for a single start of a Cummins engine starter shall not exceed 12 s.



起动机操作应遵守相关规范，连续起动从第一次起动结束到第二次起动开始间隔时间不小于60s，发动机开始运转时说明起动成功，应立即松开点火钥匙，断开起动档。

The interval between the end of the first start and the second start shall not be less than 60 s. When the engine starts running, it means the start is successful. Immediately release the ignition key and disconnect the starter.



◆ 禁止在车辆启动后直接关闭电源总开关，以免造成电压不稳影响电器设备正常工作甚至损坏电器设备。

小心：蓄电池在整车电路还起稳定电压的作用，断开蓄电池的连接将会导致车辆电器设备间的干扰加剧从而引起故障。

It is forbidden to turn off the main power switch directly after starting the vehicle, so as to prevent the voltage instability from affecting the normal operation of the electrical equipment and even damaging the electrical equipment.

Caution: The battery also acts as a stable voltage in the circuit of the vehicle. Disconnecting the battery will cause the interference between the vehicle's electrical equipment to increase and cause a malfunction.



汽车电路检修时注意事项:

Precautions for maintenance of automotive electrical appliances:

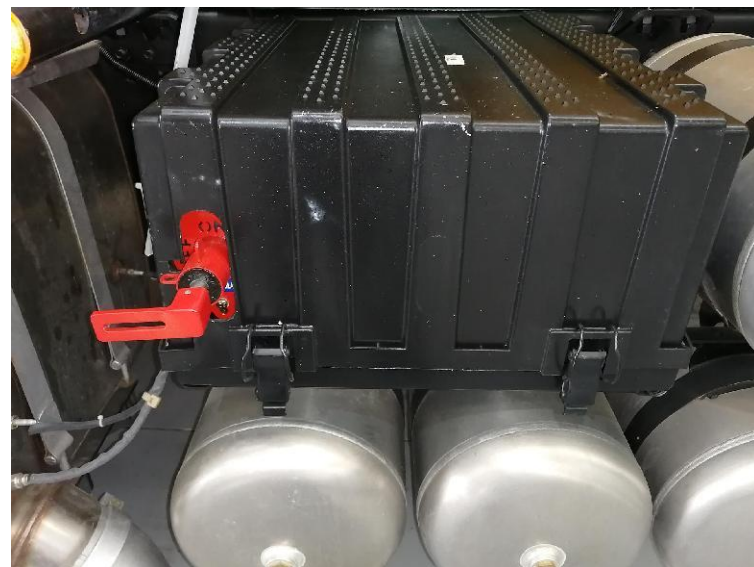
- ◆ 各插接器或保险不得带电插拔，以免插接时引起电弧烧蚀电线接头，影响连接质量.

Each plug connector or fuse must not be hot plug, so as not to cause arc burning wire joints when plugged, affecting the connection quality.



更换线束或已熔断的保险时需关闭电源（一般是钥匙电源，特殊的如常电保险需关闭电源总开关并摘除蓄电池正极接线端子，防止出现短路将触点烧蚀）。

The power supply must be turned off when replacing the wire harness or the fuse has been blown (usually a key power supply, in special circumstances , such as a normal power fuse, the power switch must be turned off and the battery positive terminal must be removed to prevent short circuit and ablation of contacts).





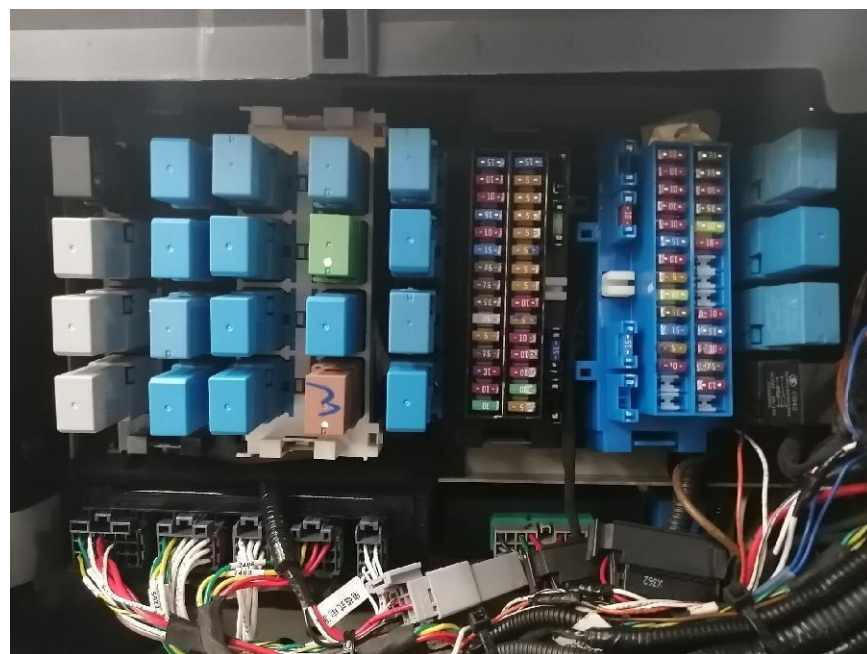
SHACMAN

1.8.3.

陕西重型汽车进出口有限公司
SHAANXI HEAVY DUTY AUTOMOBILE IMPORT & EXPORT CO.,LTD

小心：更换保险丝或继电器时严禁带电插拔，否则保险座触点烧蚀会导致保险无法插接或插接后接触电阻增大，工作时产生热量，有引起火灾的危险。

Caution: When replacing fuses or relays, it is strictly prohibited to insert or pull hot, otherwise the ablation of the fuse base will cause the fail to insert the fuse or increased contact resistance after plugging. The heat will be generated during the work, which may cause fire.



- ◆ 整车无电故障需关闭电源总开关后再进行检测。
- ◆ If the vehicle can not powered on, turn off the power switch and check it.

小心： 如果起动机30接线柱未接线，在检修时不关闭电源总开关极易发生电源短路事故。

Caution: If the terminal of the starter 30 is not wired, the main switch of the power supply is not turned off during inspection. A power short-circuit accident may easily occur.

