

SWB6859EV01G

Complete Vehicle Maintenance Manual

Functional group: 17



SUNWIN Bus Sales Department

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Foreword

This Manual is formulated in accordance with the requirements of the *Implementation Management Measures for the Disclosure of Automotive Maintenance Technology Information*.

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I. Safety Precautions

1. High-Voltage Electrical Warning

1.1 The voltage of the power battery in new energy electric vehicles exceeds 500V. Please follow the maintenance procedures step by step to avoid potential safety accidents.

"Danger" indicates that failure to follow the prescribed procedures will result in serious injury or death;

"Warning" indicates a direct danger, which may lead to serious personal injury if the prescribed operating procedures are not followed;

1.2 The high-voltage wire is covered with an orange-red insulated threaded tube.

1.3 A current exceeding 10mA is a dangerous current, and the person who is electrocuted will have difficulty getting rid of the charged object. The current can damage the body's muscle function and nervous system. When an electric current passes through the chest, it can cause the chest muscles to malfunction, affecting breathing and ultimately leading to suffocation.

1.4 If an electric shock accident occurs and the person is unable to escape the current alone, the power supply must be disconnected before moving the person, because the person is also live before the power supply is disconnected. Regardless of whether the electric shock injury is severe or not, seek medical attention promptly and report the accident.

1.5 If the injured person's heart or breathing stops, immediate cardiopulmonary resuscitation shall be performed and 120 shall be dialed.

2. Safety Protection Requirements

2.1 Personal safety protection requirements

2.1.1 Maintenance personnel must wear necessary safety protective equipment, such as insulated gloves (both high-voltage electrician gloves and gloves for battery electrolyte acid-base protection), insulated shoes, insulated mats, and protective goggles, etc. The voltage resistance level must be greater than 1.5 times the highest voltage being measured, and no metal jewelry shall be worn.

2.1.2 Before using protective equipment, the integrity of the insulated gloves is subject to inspection for any damage or cracks to ensure they are intact. Insulated protective gear such as insulated shoes shall not be used in wet conditions, and both the inner and outer surfaces must be kept clean and dry to ensure safety.

2.1.3 When maintaining the high-voltage electrical system of a vehicle, a safety watch must be assigned to oversee the entire maintenance process.

2.1.4 It is strictly prohibited for untrained personnel to carry out high-voltage maintenance, and all dangerous operations with a sense of luck are prohibited to avoid safety accidents.

2.1.5 When repairing power battery packs with electrolyte leakage, protective glasses shall be worn to prevent electrolyte from splashing into the eyes.

2.1.6 Touching the live parts inside the high-voltage wire harness connectors with fingers is prohibited to prevent electric shock.

2.1.7 When measuring high voltage with a multimeter, attention must be paid to selecting the correct range. The multimeter used for testing shall have an accuracy of no less than 0.5 level, be capable of measuring direct current voltage, have a range not less than or equal to 1000V, and the "right-hand,

single-hand operation" principle shall be followed. During measurement, the alligator clip needs to stay attached to one terminal of the circuit first, and then the other probe can be used to connect to the terminal to read the value.

2.2 Safety protection requirements for vehicle components

2.2.1 Precautions shall be taken to prevent small metal tools or iron bars from coming into contact with live parts of connectors.

2.2.2 It is prohibited to directly short-circuit the positive and negative electrodes of the battery. Ensure that no metal or other conductive objects, except for the battery post tightening bolts and conductive strips, come into contact with the positive or negative electrode of the battery.

2.2.3 It is prohibited to charge the battery without the installation of proper charging protection devices (such as lithium-ion battery protection circuit boards, and battery management systems, etc.).

2.2.4 It is prohibited to connect batteries from different manufacturers or different series in series or parallel.

2.2.5 Overcharging and overdischarging of batteries are prohibited.

2.2.6 Under no circumstances should battery cells be disassembled or dissected.

2.2.7 In the event of abnormal incidents or fires, maintenance personnel shall immediately disconnect the high-voltage circuit, while others should use fire extinguishers or yellow sand for extinguishing. Priority should be given to using carbon dioxide fire extinguishers, followed by dry powder extinguishers. Non-professional "firefighters" are strictly prohibited from using water to extinguish electrical fires.

3. Safety Maintenance Performance Standard

3.1 Before performing maintenance on vehicle high-voltage electrical systems, set up safety isolation barriers around the vehicle and place high-voltage warning signs to alert relevant personnel.

3.2 When troubleshooting the high-voltage system, the vehicle ignition key must be in the OFF position (with the vehicle in an uncharged state), and manually disconnect the maintenance switch, which shall be overseen by a safety watch.

3.3 After disconnecting the high-voltage maintenance switch for 5 minutes, the entire vehicle's high-voltage load end shall be measured with a multimeter to ensure that there is no electricity before commencing the maintenance.

3.4 Before reconnecting power to the vehicle upon the completion of maintenance, it shall be ensured that no personnel are still working on the vehicle to prevent any danger. Upon confirmation of safety by the safety watch, the maintenance personnel can restore the high-voltage power supply.

3.5 When live commissioning is required, there must be a safety watch present.

3.6 During the disassembly and assembly of the power battery pack assembly, the exposed high-voltage wire joints shall firstly be insulated for protection purpose. Care must be taken not to damage the wiring harness during the disassembly and assembly process to prevent electric leakage.

3.7 Flushing high and low-voltage components with water is strictly prohibited.

4. Site Requirements, Equipment and Facilities

4.1 Maintenance working positions shall have clear ground marking lines to provide maintenance personnel with sufficient working space, access ways, and lighting.

4.2 Objects obstructing vehicle entry and exit, as well as flammable materials, shall not be placed in vehicle entry and exit lanes or in areas where personnel need to perform any operation.

4.3 Firefighting equipment storage areas need to be set up near the maintenance working positions in accordance with electric vehicle maintenance management requirements.

5. Safety Signs

5.1 Warning signs for the maintenance area of new energy vehicles shall be hung prominently on the vehicle body or fence.

5.2 The warning sign for maintenance with the power disconnected in new energy vehicles should be hung at the high-voltage disconnecting point.

Typical potential hazard signs are described in the table below:

Table of Hazard Identification Symbols

Hazard symbol	Hazard classification	Symbol description
	Attention	Pay attention to safety
	Warning	Be careful of electric shock
	Warning	Pay attention to high temperatures
	Warning	Flammable materials
	Warning	Explosive or flammable gas atmosphere
	Warning	Caution! Mechanical injury
	Warning	Be careful of high temperature burns
	Attention	Protective conductor terminal (grounding)
	Prohibition	No burning

	Note	Gas mask must be worn
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II. Maintenance Intervals

1. Terminology

1.1 Vehicle maintenance

Operations conducted to maintain the overall technical condition or working capability of a vehicle, including cleaning, lubrication, tightening, adjustment, oil replenishment, or replacement of consumables.

1.2 Potential equalization (Equipotential)

All components constituting the potential equalizing current circuit shall be able to withstand the maximum current in the event of a single-point failure. The resistance between any two exposed conductive parts in the potential equalizing circuit that can be simultaneously touched by a person shall not exceed 0.1Ω .

1.3 BMS

Battery Management System: A system that controls the input and output power of the battery, monitors the battery's status (temperature, voltage, state of charge), and provides communication interfaces for the battery.

1.4 SOC

State of Charge of Battery: The percentage of remaining capacity of a battery after discharging compared to its full charge capacity.

1.5 Enclosure protection class (IPXX)

A coding system that indicates the protection level of the enclosure against human access to hazardous parts, ingress of solid objects or water, and additional information related to these protections.

2. Definition of Operation Types

2.1 Cleaning

Operations that use appropriate manpower or dust removal equipment and facilities to clean surface dust, dirt, and other debris from related components to maintain cleanliness.

2.2 Inspection

Operations that mainly rely on sensory perception or the use of simple inspection tools to observe and assess the technical condition of assemblies and components.

2.3 Testing

Measurements that are conducted on vehicles or specific assembly systems using vehicle-mounted instruments or specialized equipment.

2.4 Replenishment

Operations during maintenance that involve replenishing insufficient oil or fluids in specified assembly components according to technical requirements.

2.5 Inspection and replacement

Operations that involve inspecting, adjusting, tightening, and replacing non-compliant assemblies or components as per technical requirements.

2.6 Replacement

Operations that involve replacing assemblies, components (including turnover parts), or fluids (including antifreeze) with refurbished or brand-new items of the same type.

2.7 Verification

Operations that involve verifying and calibrating assemblies or components using specified testing instruments or equipment according to technical requirements.

2.8 Adjustment

Operations that entail adjusting and setting clearances, strokes, relative positions, or performance parameters of specified parts, mating parts, or devices using appropriate instruments or tools according to technical requirements.

2.9 Lubrication

Operations that involve adding lubricating oil or grease to components as specified.

2.10 Tightening

Operations that consist of tightening the fasteners of specified assemblies or components using various tools to the specified torque values as per technical requirements.

2.11 Calibration

Operations that involve setting components and functions of vehicles using electrical system diagnostics tools according to technical requirements.

2.12 Sorting out

Operations that involve inspecting the wear of the outer sheath of high-voltage lines and wire harnesses on vehicles, as well as their installation and fixation, and carrying out repairs in accordance with technical requirements.

3. Maintenance Classification, Intervals, and Key Points

3.1 Maintenance classification

New energy system maintenance is classified by operation level as:

- 1) Running-in maintenance;
- 2) Elementary maintenance;
- 3) Secondary maintenance (semi-annual);
- 4) Secondary maintenance (annual);
- 5) Special maintenance.

3.2 Maintenance intervals

The maintenance intervals for each level of the new energy system are shown in Table 1.

Maintenance cycle

Maintenance classification	km interval	Interval time
Running-in maintenance	$\leq 5,000\text{km}$	The time interval between leaving the factory and maintenance should not exceed 30 days
Level I maintenance	$\leq 7,500\text{km}$	≤ 45 days
Level II maintenance (semi-annual)	$\leq 30,000\text{km}$	≤ 180 days
Level II maintenance (annual)	$\leq 60,000\text{km}$	≤ 365 days
Special maintenance	Not within the above maintenance intervals	

3.3 Key points of maintenance operations

Except for the running-in maintenance, prior to conducting any level of maintenance, the chassis shall be cleaned to remove mud, dirt, and deposits. During the execution of each level of maintenance, a higher-level maintenance operation shall include the operation type and technical requirements of the lower-level maintenance.

3.3.1 Maintenance principles

Periodic maintenance, regular inspection, and repair on technical condition.

3.3.2 Running-in maintenance

It mainly includes cleaning, inspection, testing, tightening, lubrication, and replacement. Cleaning the surface of components to remove dust and oil, inspecting the condition of new energy system equipment, high and low-voltage wiring harnesses, and connectors, checking the chassis bolt tightness, and performing mechanical lubrication.

3.3.3 Elementary maintenance

It mainly includes cleaning, inspection, testing, tightening, lubrication, and replacement. Inspecting the levels of oil and water, adding grease lubricant, tightening exposed connectors, checking the condition of new energy system equipment, high and low-voltage wiring harnesses, and connectors, and conducting a chassis bolt tightness check.

3.3.4 Secondary maintenance (semi-annual)

It mainly includes cleaning, inspection, testing, tightening, lubrication, replacement, and adjustment. Cleaning the surface of components to remove dust and oil, inspecting the condition of new energy system equipment, high and low-voltage wiring harnesses, and connectors, checking the chassis bolt tightness, and performing mechanical lubrication, as well as performing brake system testing, inspecting and adjusting component clearances, and tire rotation.

3.3.5 Secondary maintenance (annual)

It mainly includes cleaning, inspection, testing, tightening, and adjustment. Cleaning the surface of components to remove dust and oil, inspecting the condition of new energy system equipment, high and low-voltage wiring harnesses, and connectors, checking the chassis bolt tightness, and performing mechanical lubrication, as well as performing brake system testing and insulation performance testing.

3.3.6 Special maintenance

It refers to the special maintenance arrangements beyond the annual cycle, primarily concerning the drive motor and axles. Cleaning, inspecting, adjusting, and replacing components according to specific technical requirements.

III. Maintenance Tools

1. The maintenance tools are as follows:

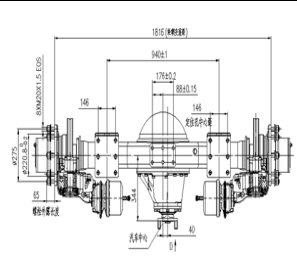
S/N	Tool type	S/N	Tool type
1	Pneumatic gun	7	240Nm torque wrench
2	13mm socket	8	290Nm torque wrench
3	24mm socket	9	420Nm torque wrench
4	27mm socket spanner	10	550Nm torque wrench
5	24Nm torque wrench	11	620Nm Torque Wrench
6	80Nm torque wrench	12	Grease gun

IV. Maintenance Component Diagram and Maintenance Intervals

1. Air Compressor Maintenance Diagram and Maintenance Intervals

			/	
Fig. Air Compressor Outline Drawing	Fig. 1 Air Compressor Filter	Fig. 2 Air Compressor Silencer	Fig. 3 Air Compressor Lubricating Oil	Fig. 4 Air Compressor Oil Filter
First maintenance	/	/	5,000 km/1 month Replacing	5,000 km/1 month Replacing
Level I maintenance	7,500 km/1.5 months Cleaning	7,500 km/1.5 months Cleaning	/	/
Level II maintenance (semi-annual)	30,000 km/6 months Cleaning	30,000 km/6 months Cleaning	30,000 km/6 months Replacing	30,000 km/6 months Replacing
Level II maintenance (annual)	60,000km/12 months Replacing	60,000km/12 months Replacing	60,000km/12 months Replacing	60,000km/12 months Replacing

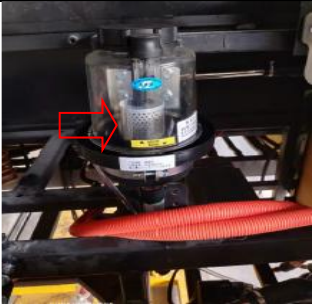
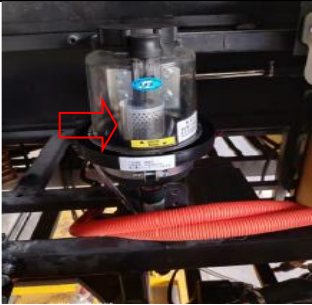
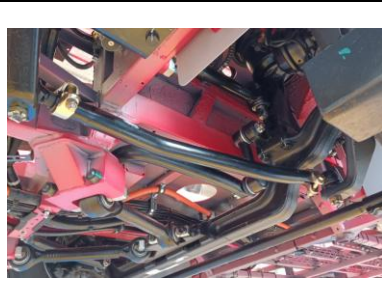
2. Rear Axle Maintenance Diagram and Maintenance Intervals

	
Fig. Rear Axle Outline Drawing	Fig. 2 Final Drive
First maintenance	5,000 km/1 month Oil change
Level I maintenance	7,500 km/1.5 months Inspecting
Level II maintenance (semi-annual)	30,000 km/6 months Oil change
Level II maintenance (annual)	60,000km/12 months Oil change

3. Drive Shaft Maintenance Diagram and Maintenance Intervals

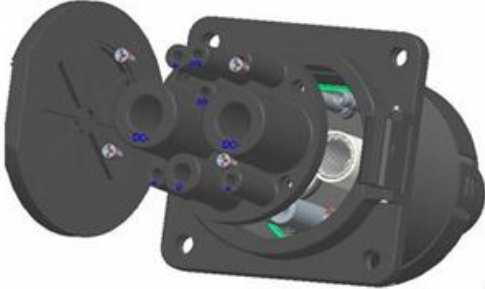
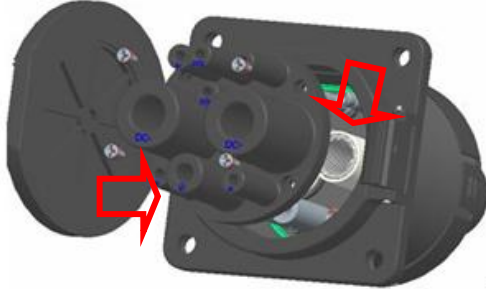
		
Fig. Drive Shaft Outline Drawing	Fig. 1 Axle-end Universal Joint	Fig. 2 Motor-end Universal Joint
First maintenance	5,000 km/1 month Refilling	5,000 km/1 month Refilling
Level I maintenance	7,500 km/1.5 months Refilling	7,500 km/1.5 months Refilling
Level II maintenance (semi-annual)	30,000 km/6 months Refilling	30,000 km/6 months Refilling
Level II maintenance (annual)	60,000km/12 months Refilling	60,000km/12 months Refilling

4. Steering System Maintenance Diagram and Maintenance Intervals

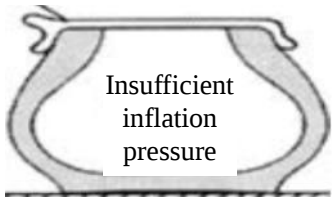
			
Fig. Steering Fluid Reservoir	Fig. Steering Filter Element	Fig. Power Steering Fluid	Fig. Steering Drag Link Ball Joint
First maintenance	5,000 km/1 month Replacing	5,000 km/1 month Replacing	5,000 km/1 month Inspecting
Level I maintenance	/	/	7,500 km/1.5 months Inspecting
Level II maintenance (semi-annual)	/	30,000 km/6 months Replacing	30,000 km/6 months Inspecting
Level II maintenance (annual)	60,000km/12 months Replacing	60,000km/12 months Replacing	60,000km/12 months Inspecting

Note: When replacing the power steering fluid or the filter element, it is necessary to put the protection of the wiring harness around the reservoir in the first place to prevent oil from dripping onto the harness.

5. Charging Interface Maintenance/Replacement

	
Fig. Charging Interface	Fig. 1 Connector Replacement
Level I maintenance	7,500 km/1.5 months Inspecting/cleaning
Level II maintenance (semi-annual)	30,000 km/6 months Inspecting/cleaning
Level II maintenance (annual)	60,000km/12 months Inspecting/cleaning

6. Wheel Bolt Inspection

		
Fig. Tire	Fig. 1 Wheel Bolts	Fig. 2 Tire Pressure
First maintenance	5,000 km/1 month Checking/tightening	5,000 km/1 month Inspecting
Level I maintenance	7,500 km/1.5 months Checking/tightening	7,500 km/1.5 months Inspecting
Level II maintenance (semi-annual)	30,000 km/6 months Checking/tightening	30,000 km/6 months Inspecting
Level II maintenance (annual)	60,000km/12 months Checking/tightening	60,000km/12 months Inspecting

7. Radiator Tank Cleaning

	
Fig. Radiator Tank	Fig. 1 Radiator Tank Cleaning
Level I maintenance	7,500 km/1.5 months Cleaning
Level II maintenance (semi-annual)	30,000 km/6 months Cleaning
Level II maintenance (annual)	60,000km/12 months Cleaning

8. Air Bottle Water Draining

	
Fig. Air Bottle	Fig. Air Bottle Water Draining
Maintenance cycle	1 week Water drainage

9. Dryer Replacement

	
Brake pipeline system	Air dryer
Level II maintenance (annual)	60,000 Km / 12 Month Replacing

10. ATS Coolant Change

	
Fig. Expansion Tank Coolant	Antifreeze
Special maintenance	120,000 Km / 24 Months Replacing

Power Battery Coolant Change

	
Fig. Expansion Tank Coolant	Antifreeze
Special maintenance	120,000 Km / 24 Months Replacing

11. Chassis Bolt Inspection

Chassis Bolts	Front V-type thrust rod bolts	1. First Maintenance: 5,000 km/1 Month (Tightening) 2. 7,500 km/1.5 Months (Inspection) 3. 30,000 km/6 Months (Tightening)
	Front ball pin type suspension rod bolts	
	Front longitudinal thrust rod bolts	
	Stabilizer bar bolts	
	Front & rear shock absorber bolts	
	Front & rear air bags	
	Steering drag link ball joint nuts	
	Steering gear swing arm bolts	
	Rear cantilever bolts	
	Rear stabilizer bar bolts	
	Rear stabilizer bar suspension rod bolts	
	Cotter pin	
	Upper longitudinal thrust rod bolts on rear axle	
	Lower V-type thrust rod bolts on rear axle	
	Splint bolts	

V. Bolt Tightening Torque Chart

1. Standard Tightening Torque for Wheel Bolts

- a) First torque tightening: Use a 550N·m pneumatic dual-axis torque wrench to pre-tighten the nuts in sequence (at 280N·m)
- b) Second torque tightening: After pre-tightening the nuts by one full turn, tighten the five sets of nuts again to the specified torque (550N·m) using a pneumatic dual-axis torque wrench

2. Standard Tightening Torques for Other Bolts

Table 1 Tightening Torque Specifications for Threaded Fasteners

Thread Specification	Performance grade 4.8	Performance grade 8.8	Performance grade 10.9
	Tightening torque, N·m	Tightening torque, N·m	Tightening torque, N·m
M6	4±1	10±1.5	13±2
M8	8±1.5	24±4	32±5
M8×1	8.5±1.5	24±4	35±5
M10	18±3	48±8	65±10
M10×1	20±3	55±10	70±12
M10×1.25	18±3	55±10	75±12
M12	35±6	85±15	110±15
M12×1.25	40±6	90±15	120±20
M12×1.5	35±6	90±15	120±20
M14	60±10	140±25	180±25
M14×1.5	65±10	150±25	190±30
M16	95±15	220±35	270±40
M16×1.5	100±15	240±35	290±45
M18	/	290±45	420±60
M18×1.5	/	300±45	430±60
M20	/	430±60	530±80
M20×1.5	/	450±60	550±80
M22	/	580±90	/
M24	/	740±110	/
Note: The range of specified torque values includes the error of the fastening tool			

Table 2 Tightening Torque Specifications for DTFLOCK Hex Flange Locknut Fasteners

Thread Specification	Performance grade 8.8	Performance grade 10.9
	Tightening torque, N·m	Tightening torque, N·m
M12	75±6	110±10
M12×1.25	80±6	120±10
M12×1.5	80±6	120±10
M14	120±10	180±15
M14×1.5	130±10	190±15
M16	190±15	270±20
M16×1.5	200±15	290±20
M18	270±25	380±30
M18×1.5	300±25	430±30
M20	380±30	530±40
M20×1.5	430±30	580±40
M22	530±40	720±50
M22×1.5	580±40	780±60
M24	660±50	900±70
M24×2	720±50	990±70

Table 3 Tightening Torque Specifications for Tire Fasteners

Tire installation position	Nut type	Nut thread specification	Tightening torque, N·m	Applicable wheels (Reference)
Front axle	Spherical surface	M20×1.5	420~490	6.5-20, 6.75×22.5
		M24×1.5	420~490	7.00T-20, 7.50V-20, 8.25×22.5
	Flat surface	M20×1.5	550±25	6.75×22.5, 7.5×22.5
		M22×1.5	620~680	8.25×22.5, 9.00×22.5
Rear axle	Spherical surface	Inner nut M20×1.5	420~490	6.5-20, 6.75×22.5, 7.00T-20, 7.50V-20, 8.25×22.5
		Outer nut M30×1.5	420~490	
	Flat surface	M20×1.5	550±25	6.75×22.5, 7.5×22.5
		M22×1.5	620~680	8.25×22.5, 9.00×22.5

VI. Maintenance Material Model List

S/N	Location of components	Model	Consumption per maintenance
1	Rear Axle (differential gear)	GL-5	10L
2	Filter element of air compressor	/	2
3	Power steering fluid	ATF220	6L
4	Power steering fluid reservoir filter element	/	1
5	Lubricating points on the chassis	2# Lithium based grease	/
6	Coolant (ATS + Power Battery)	-15°C	30L+28L
7	Dryer	WABCO	1

VII. Appendix (Maintenance Plan and Record Form)

Appendix 1: Vehicle Maintenance Schedule

Appendix 2: Vehicle Maintenance Record Form