Test Project

Module D – Fault Finding and Repair of Vehicle

Rail Vehicle Technology

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Introduction to Test Project

Rail vehicles are an important means to carry passengers. Before they leave the factory, the vehicles need to be assembled and commissioned; during their running, faults should be fixed; after the operation ends each day, routine maintenance should be performed; and after they reach the end of their operation period, periodic maintenance is required. Rail vehicle technicians should ensure safe and smooth operation of the vehicles each day.

A real metro vehicle with a set of vehicle simulation equipment is provided at the workstation, consisting of vehicle mechanical parts, electrical control system, network system, passenger information system and fire alarm system, etc. The vehicle, however, may have various issues, vehicle technicians should thus carry out inspection, maintenance and commissioning according to the process standards to make it meet the requirement for normal use.

Description of project and tasks

The time allocated to the Fault Finding and Repair of Vehicle Test Project is 180 minutes.

The Competitor should complete all tasks within the time allocated to the Module.

First, make preparations according to requirements.

Second, complete the three (3) tasks listed below:

- D1 Vehicle Mechanical Parts Inspection
- D2 Assembly and Connection of Vehicle Harness
- D3 Vehicle Electrical Function Test and Fault Handling

Note: During operations, strictly adhere to the operation safety rules. Task D1 does not need to be performed in sequence and only needs to be completed within the specified time period according to the competition schedule (time limit: 60 minutes). Task D3 may be carried out only after Task D2 has been completed.

Lastly, after all tasks listed in this Test Project are completed, the Competitor should clean and organize the site and submit the relevant materials and Record Sheets to the Experts.

Preparations

Before starting the operation tasks, the Competitor need to analyze all tasks and count and check equipment, tools and materials in the workstation according to the standards and requirements set out in the WSC2026_WM61_D Fault Finding and Repair of Vehicle Work Manual. In the case of any problem, the Competitor need to solve it immediately.

1. Read carefully this Test Project to understand the operation tasks;
2. Count and check all equipment, tools and materials in the workstation and fill the problems uncovered in the Fault finding and repair of vehicle pre-operation inspection Record Sheet (Fill all problems at once). If any equipment, tools or material is found missing or unqualified, submit the Record Sheet to the Experts to apply for replacement or supplementation.
3. Submit the Record Sheet (with name and country of the Competitor filled at the corresponding blanks) to the Experts.

Note: The WSC2026_TP61_D_R02_Vehicle Fault Example Description Table clarifies the types of defects, and any defects not described in the Table are considered normal.

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D1 Vehicle mechanical parts inspection

Task D1 requires the Competitor to inspect the real vehicle according to the standards and requirements of the WSC2026_WM61_D Fault Finding and Repair of Vehicle Work Manual. Main work items include:

1. Inspection of external devices of the real vehicle.
2. Inspection of internal devices of the real vehicle (only the No. 2 end).
3. For the faults uncovered during inspection, maintenance is not required, but the Competitor needs to record the faults in the D1 Vehicle mechanical parts inspection Record Sheet.
4. After completing all items involved in task D1, the Competitor needs to report the operation status to the Experts and submit the Record Sheet (D1). Only with the Experts' approval can the Competitor proceed to the next task.

Note: This task has a time limit of 60 minutes.

Note: The WSC2026_TP61_D_R02_Vehicle Fault Example Description Table clarifies the types of defects, and any defects not described in the Table are considered normal.

D2 Assembly and connection of vehicle harness

Electrical connection between cars or core modules of the vehicle is generally made via wire harnesses with heavy-duty connectors. Before conducting an electrical test, check the connection status between devices. In the case of a missing wire harness, assemble and connect one according to the Schematic Diagram and the Wiring Table. Task D2 requires the Competitor to assemble and connect the connection harnesses between the power supply module and the intermediate car cabinet of the vehicle simulation equipment according to the standards and requirements set out in the WSC2026_WM61_D Fault Finding and Repair of Vehicle Work Manual. The wiring table is set out below:

STARTING EQUIPMENT	STARTING TERMINAL	WIRE NUMBER	WIRE TYPE	WIRE DIAMETER	ENDING EQUIPMENT	ENDING TERMINAL
99-XP271.17a	1	340175	Black	1.5	34-A01X1a	1
	2	340134	Black	1.5		2
	3	PE	Yellow and green	1.5		3
	4	340151	Black	1.0		4
	5	340161	Black	1.0		5
	6	4000PW	Black	1.0		6
	7	/	/	/		7
	8	/	/	/		8

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1. After completing the work involved in task D2, the Competitor need to report the operation status to the Experts. Only with the Experts' approval can the Competitor proceed to the next task.
2. The Competitor may give up this task and apply to the Experts that the equipment be restored by the Experts or designated technicians, in which case no marks will be awarded for this task. (The Competitor must leave the workstation and is not allowed to enter it within 5 minutes)

D3 Vehicle electrical function test and fault handling

Task D3 requires the Competitor to complete vehicle electrical function tests according to the standards and requirements set out in the WSC2026_WM61_D Fault Finding and Repair of Vehicle Work Manual. Main work items include:

1. Conduct electrical function tests according to operation standards; the operation items include:

   (a) Train activation function test
   (b) Cab occupation function test
   (c) Compressor start test
   (d) Pantograph function test
   (e) External lighting function test
   (f) Door function test
   (g) Brake system function test
   (h) Traction system function test

2. The test is aimed at troubleshooting and resolving faults, thus does not require strict adherence to every step set out in the Work Manual.
3. Record the electrical faults found during the test in the D3 Vehicle electrical function test and fault handling Record Sheet and submit the Record Sheet to the Experts (or designated persons) for review. Faults may only be repaired after approval is granted.

Note: Multiple submissions for review are allowed until all electrical faults are handled; however, a maximum of two submissions is permitted for each single fault.

Note: Fault repair is strictly prohibited before approval is granted.

Note: If power-off is required, only the Train Activation knob needs to be switched off.

Note: The Competitor may give up faults, in which case the Experts or designated technicians will restore the equipment. (The Competitor must leave the workstation and is not allowed to enter it within 2 minutes)

Note: The WSC2026_TP61_D_R02_Vehicle Fault Example Description Table clarifies the types of defects, and any defects not described in the Table are considered normal.

4. After completing all items involved in task D3, the Competitor needs to report the operation status to the Experts and submit the Record Sheet (D3). Only with the Experts' approval can the Competitor proceed to the next task.

Post-operation Site Cleaning

After all tasks are completed, Competitors should clean the site and return the tools.

1. Turn the Train Activation Knob of the vehicle simulation equipment to Off position;
2. Arrange the equipment neatly and clean the site;
3. Return tools and remaining materials, and check that they have all been returned.

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Instructions to the Competitor

Instructions

1. The Competitor should not bring any device irrelevant to the Competition to the workstation.
2. Tools, electrical components and materials for the skill competition are all provided at the workstation for the Competitor's free access.
3. During the Competition, for matters irrelevant to the Competition contents, such as use of the washroom, or report of equipment, facilities, tooling, or tool faults, the Competitor can seek help from the Experts.
4. The Competitor may refer to the reference documents for the skill competition provided.

Operation safety rules

1. Put on proper personal protective equipment according to operation requirements;
2. Take site safety protection measures and confirm that no safety hazards exist;
3. Before performing operations with power off, confirm that the Train Activation Knob is switched off and hang the No Switching On plate;
4. Before performing operations with power on, turn on the power supplies after confirming that no safety hazards exist;
5. Do not operate in a violent or an unsafe manner, including but not limited to forcibly pulling, dragging, smashing, throwing, and other violent behaviors, as well as behaviors that may cause personnel injuries or damage to equipment;
6. All the tools or materials used during operations should be placed in the tool trolley or on the rubber tool mat only.

Note: If a Competitor fails to comply with the operation safety rules and is considered to be have operated in a dangerous manner or have caused a safety hazard in the workplace, or equipment damage or personal injuries, marks will be deducted. In serious cases, the Competitor may be disqualified from the Competition.

Record Sheets

The Record Sheets to be filled out during completion of this Test Project are:

1. Fault finding and repair of vehicle pre-operation inspection Record Sheet
2. D1 Vehicle mechanical parts inspection Record Sheet
3. D3 Vehicle electrical function test and fault handling Record Sheet

Note: Record Sheets will be provided separately.

References

WSC2026_WM61_D Fault Finding and Repair of Vehicle Work Manual

WSC2026_TP61_D_R02_Vehicle Fault Example Description Table

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Fault finding and repair of vehicle pre-operation inspection Record Sheet

Country/Region:_____ Competitor:_____

Instructions:

1. Record abnormal equipment/tools/materials only and mark the corresponding options with "☒". After inspection of all equipment/tools/materials, sign at the bottom of the Record Sheet;
2. If an item needs to be replaced or claimed, submit this Record Sheet to an Expert (or designated person). For replacement of an item, the original one needs to be provided as well. The Expert have the right to reject requests for items that are not abnormal;
3. The Review Result column will be filled in by the Expert (or designated person) who should sign at the bottom of the Record Sheet after requests have been reviewed and handled.

No.	Equipment/Tool/Material Name & Specification	Problem Description	Request	Review Result
1			Replacement☐ Claim for new item☐	Approved☐ Rejected☐
2			Replacement☐ Claim for new item☐	Approved☐ Rejected☐
3			Replacement☐ Claim for new item☐	Approved☐ Rejected☐
4			Replacement☐ Claim for new item☐	Approved☐ Rejected☐

Expert (or designated person):

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D1 Vehicle mechanical parts inspection Record Sheet

Country/Region:_____ Competitor:_____

Instructions:

1. In the Inspection Result column, mark the corresponding option with "☒" as per actual operation results;
2. In the Fault Description column, describe fault type only, such as loose fastener, stains, and foreign objects; no record is required if the inspection result is normal.

No.	Inspection Item	Inspection Result	Fault Description
D1-1 Inspection of Vehicle External Devices:			
1	Inspection of the cab hood and anti-climbers at No. 2 end	Normal ☐ Abnormal ☐	
2	Inspection of the coupler at No. 2 end	Normal ☐ Abnormal ☐	
3	Inspection of vehicle No. 2 end No. 2 side and cab side devices	Normal ☐ Abnormal ☐	
4	Inspection of the primary suspension at No. 2 end No. 2 side	Normal ☐ Abnormal ☐	
5	Inspection of the axle-end speed sensors and brake shoes at No. 2 end No. 2 side	Normal ☐ Abnormal ☐	
6	Inspection of the air spring, height adjustment valve, and lifting device at No. 2 end No. 2 side	Normal ☐ Abnormal ☐	
7	Inspection of the smart valve	Normal ☐ Abnormal ☐	
8	Inspection of the high-voltage box	Normal ☐ Abnormal ☐	
9	Inspection of the traction inverter	Normal ☐ Abnormal ☐	
10	Inspection of the low-voltage box	Normal ☐ Abnormal ☐	

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11	Inspection of the auxiliary brake unit	Normal ☐ Abnormal ☐	
12	Inspection of the gateway valve	Normal ☐ Abnormal ☐	
13	Inspection of the primary suspension at No. 1 end No. 1 side	Normal ☐ Abnormal ☐	
14	Inspection of the axle-end speed sensors and brake shoes at No. 1 end No. 1 side	Normal ☐ Abnormal ☐	
15	Inspection of the air spring, height adjustment valve, and lifting device at No. 1 end No. 1 side	Normal ☐ Abnormal ☐	
16	Inspection of cab side devices at No. 1 end No. 1 side	Normal ☐ Abnormal ☐	
17	Inspection of the cab hood and anti-climbers at No. 1 end	Normal ☐ Abnormal ☐	
18	Inspection of the coupler at No. 1 end	Normal ☐ Abnormal ☐	
19	Inspection of vehicle No. 1 end No. 2 side and cab side devices	Normal ☐ Abnormal ☐	
20	Inspection of the primary suspension at No. 1 end No. 2 side	Normal ☐ Abnormal ☐	
21	Inspection of the axle-end speed sensors and brake shoes at No. 1 end No. 2 side	Normal ☐ Abnormal ☐	
22	Inspection of the air spring, height adjustment valve, and lifting device at No. 1 end No. 2 side	Normal ☐ Abnormal ☐	
23	Inspection of the air reservoir module	Normal ☐ Abnormal ☐	
24	Inspection of the air compressor	Normal ☐ Abnormal ☐	
25	Inspection of auxiliary inverters	Normal ☐ Abnormal ☐	
26	Inspection of the reactor	Normal ☐ Abnormal ☐	

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27	Inspection of the battery box	Normal ☐ Abnormal ☐	
28	Inspection of the braking resistor	Normal ☐ Abnormal ☐	
D1-2 Inspection of Vehicle Internal Devices:			
1	Inspection of cab interior at No. 2 end	Normal ☐ Abnormal ☐	
2	Inspection of the battery voltmeter, duplex pressure gauge, and speedometer at No. 2 end	Normal ☐ Abnormal ☐	
3	Inspection of console panels, PA control box, and master controller at No. 2 end	Normal ☐ Abnormal ☐	
4	Inspection of the cab extinguisher at No. 2 end	Normal ☐ Abnormal ☐	
5	Inspection of cab side doors at No. 2 end	Normal ☐ Abnormal ☐	
6	Inspection of the cab electrical cabinet at No. 2 end	Normal ☐ Abnormal ☐	
7	Inspection of cab partition door at No. 2 end	Normal ☐ Abnormal ☐	
8	Inspection of camera, roof cover plate, lights, and air outlet grille at No. 2 end	Normal ☐ Abnormal ☐	
9	Inspection of the cab seat at No. 2 end	Normal ☐ Abnormal ☐	
10	Inspection of passenger compartment cameras and handrails at No. 2 end	Normal ☐ Abnormal ☐	
11	Inspection of passenger compartment door and vertical cover plates at No. 2 end	Normal ☐ Abnormal ☐	
12	Inspection of passenger compartment seats at No. 2 end	Normal ☐ Abnormal ☐	
13	Inspection of the floor and panes at No. 2 end	Normal ☐ Abnormal ☐	

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14	Inspection of passenger compartment interior signs at No. 2 end	Normal ☐ Abnormal ☐	
15	Inspection of dynamic maps and loudspeakers at No. 2 end	Normal ☐ Abnormal ☐	
16	Inspection of the passenger compartment lighting and A/C air outlet grilles at No. 2 end	Normal ☐ Abnormal ☐	
17	Inspection of passenger compartment extinguishers at No. 2 end	Normal ☐ Abnormal ☐	
18	Inspection of passenger compartment electrical cabinets at No. 2 end	Normal ☐ Abnormal ☐	
19	Inspection of the passenger compartment gangway at No. 2 end	Normal ☐ Abnormal ☐	
Supplemental description (if necessary):			

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D3 Vehicle electrical function test and fault handling Record Sheet

Country/Region:_____Competitor:_____

Instructions:

1. Record faults as per the requirements of the Record Sheet. For Fault Type, mark the correct option with "☒";
2. Before fixing a fault, submit the Record Sheet to an Expert (or designated person), and the fault can be fixed only with approval (If the fault is set automatically via machine, it should be reset by the Expert or designated technicians). If the fault found is not correct, the Expert (or designated person) has the right to reject the request, and the Competitor can fill in the backup line and apply again;
3. If a fault is rejected twice, no marks will be given for the fault, and the fault will be fixed by the Experts or designated technicians instead (the Competitor must leave the workstation and is not allowed to enter it within 2 minutes);
4. The Review Result column is filled by the Expert (or designated person) and confirmed with his/her signature.

No.	Fault Phenomenon	Fault Position and Description	Review Result	Reviewed by
Example	*When pressing the Panto Down button in Car A1, the panto of Car B1 cannot be lowered normally.*	*Wire XX of Car XXX has an open circuit between contact XXX and contact YYY* *Wire XXX of Car XX is incorrectly connected to contact YYY, wire YYY is incorrectly connected to contact XXX* *Contact XXX and contact YYY of Car XX are short circuited*	/	/
Fault 1			Approved☐ Rejected☐	
Fault 1 (backup)			Approved☐ Rejected☐	

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Fault 2			Approved☐ Rejected☐	
Fault 2 (backup)			Approved☐ Rejected☐	
Fault 3			Approved☐ Rejected☐	
Fault 3 (backup)			Approved☐ Rejected☐	
Fault 4			Approved☐ Rejected☐	
Fault 4 (backup)			Approved☐ Rejected☐	

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Fault 5			Approved☐ Rejected☐	
Fault 5 (backup)			Approved☐ Rejected☐	
Fault 6			Approved☐ Rejected☐	
Fault 6 (backup)			Approved☐ Rejected☐	
Fault 7			Approved☐ Rejected☐	
Fault 7 (backup)			Approved☐ Rejected☐	

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