



Maintenance of Railway Signal Equipment BRICS-FS-24

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Test Project International Finals-Onsite

May, 2025

Catalogue

1. Form of Participation2
2. Competition Content
3. Project Modules and Time Requirements
3.1 Project modules and time requirements
3.2 Background
3.3 Railway signal equipment maintenance skills assessment platform
3.3.1 Assessment of theoretical knowledge of railway signal specialty
3.3.2 Operation process of the rail transit interlocking software operation platform
3.3.3 Operation process of railway signal equipment maintenance software assessment platforme
3.3.4 Operation process of railway signal equipment fault troubleshooting and handling
assessment platform
3.4 Task content
Module A: Theoretical knowledge assessment of railway signal major7
Module B track traffic interlocking software operation assessment
Module C: Railway signal equipment maintenance software assessment 10
Module D: Assessment of troubleshooting and handling of railway signal equipment faults 14
4. Scoring Criteria

1. Form of Participation

Team competition (2 Contestants and 1-2 Experts)

2. Competition Content

The competition consists of four modules, which are completed in sequence. The organizer provides the participants with task description, circuit diagram, equipment layout, equipment operation instructions, and other technical conditions such as data sources to ensure the independence and fairness of each task module. The competition consists of the following task modules:

Module A: Railway signal professional theoretical knowledge assessment;

Module B rail transit interlocking software operation assessment;

Module C: Railway signal equipment maintenance software assessment;

Module D: Railway signal equipment fault investigation and handling assessment;

Only if it cannot be completed at the competition site and approved by the chief expert, the competition task and scoring criteria can be changed.

Participants may be disqualified if they do not comply with occupational health and safety requirements or put themselves and other participants at risk.

After the participants complete the module, the results will be graded.

3. Project Modules and Time Requirements

3.1 Project modules and time requirements

The railway signal equipment maintenance skills competition consists of four modules,

which require the contestants to complete within 3 hours and 30 minutes. The specific project module name and time requirements refer to Table 1.

No.	Module name	Completion time of each module
1	Module A: Theoretical knowledge assessment of railway signal specialty	40 min
2	Module B: Operation assessment of rail transit interlocking software	20
3	Module C: Railway signal equipment maintenance software assessment	80 min
4	Module D: Assessment of troubleshooting and handling of railway signal equipment faults	90 min

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Table I	LIST OI	project	modules	and time	requirements
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The competition schedule is shown in Table 2.

Table 2	Competition	schedule
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Date	Time Arrangement	Content description				
11.3	09:00-10:30	Welcome experts, participants to the ceremony, referee meeting; introduction of competition rules and scoring standards; familiarization with the competition site; players' drawing lots				
	10:30-11:30	opening ceremony				
	11:30-12:30	lunch				
	12:30-13:00	The players enter the field and prepare for the game				

	13:00-13:40 (40 groups)	Module A: Theoretical knowledge assessment of railway signal specialty	
	14:00-17:30 (Groups 1-20)	Module B: Interlocking system operation software assessment Module C: Railway signal equipment maintenance software assessment Module D: Assessment of troubleshooting and handling of railway signal equipment faults	Includes score and fault recovery time
11.4	08:00-11:30 (Groups 21-40)	Module B: Interlocking system operation assessment Module C: Railway signal equipment maintenance software assessment Module D: Assessment of troubleshooting and handling of railway signal equipment faults	Includes score and fault recovery time
	12:00-14:00	Decryption and score summary	
	14:30-15:30	Results are announced	
	15:30-16:30	closing ceremony	

3.2 Background

To strengthen the team of highly skilled talents in the railway industry, enhance the foundational capabilities of vocational education and training, and promote the modernization of vocational education and training, we will follow the development laws of market economies in BRICS countries and the requirements of the railway industry. We will reform the internal management system to improve resource utilization efficiency and operational standards, adjust the professional structure, optimize talent cultivation models, enhance our service capabilities and levels for society and the economy, establish a sustainable

development strategy, pursue a distinctive development path, and boost market competitiveness and continuous innovation capabilities.

The competition integrates the talent demand of railway signal industry and emerging industrial technologies into the competition content, promotes the teaching reform and school-enterprise cooperation in vocational colleges, guides the innovation of talent training mode of railway signal majors, improves the quality of talent training, and promotes the integration of vocational education with social practical needs.

To further enhance students' professional skills and occupational qualities, trainees must complete assignments on the railway signaling theory knowledge assessment platform, perform route arrangement, turnout blocking, and guiding total lock operations on the rail transit computer interlocking operation platform; use the virtual scenario assessment platform for railway signaling equipment to conduct maintenance and troubleshooting of signaling equipment; and use the comprehensive practical training platform for railway signaling equipment to handle faults.

Please complete the work content in Module A, B, C and D within the specified time, a total of 3 hours and 30 minutes.

3.3 Railway signal equipment maintenance skills assessment platform

3.3.1 Assessment of theoretical knowledge of railway signal specialty

Account login-> Assessment platform test paper issued-> Answer the test paper-> Submit the test paper

3.3.2 Operation process of the rail transit interlocking software operation platform

Account login-> Railway signal equipment assessment and management platform issues BRICS-FS-24_Maintenance of Railway Signal Equipment_Test Project

— 5 —

the test paper-> complete the test paper-> submit the test paper.

3.3.3 Operation process of railway signal equipment maintenance software assessment platform

Account login \rightarrow Railway signal equipment assessment and management platform issues the test paper \rightarrow Complete the troubleshooting and maintenance work order \rightarrow Submit the test paper.

3.3.4 Operation process of railway signal equipment fault troubleshooting and handling assessment platform

Fault handling: power supply of equipment \rightarrow check the status of equipment \rightarrow judge the type of fault \rightarrow view the circuit diagram \rightarrow conduct electrical characteristic test \rightarrow fault handling \rightarrow result verification

Switching machine equipment installation: switching machine equipment accessories installation-> equipment wiring-> equipment installation-> circuit conduction-> equipment power supply-> result verification

3.4 Task content

Module A: Theoretical knowledge assessment of railway signal major

The system solution of the theoretical knowledge assessment module of railway signal specialty is based on the theoretical knowledge of signal specialty, covering the basic theory of signal, construction technology and the principle of core equipment;



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填空题
在股道有中间道岔的情况下,接车进路的最末一个道岔区段是指 中间道岔区段。
ZYJ7型电液转辙机开关滚轮在动接点凸轮上时,常开接点应_______。
当道岔被挤时, SH6型转换锁闭器应能可靠断开<u>表示接点</u>。
ZYJ7型电波转辙机油路系统内无空气,转换时应保证有足够的<u>工作压力</u>,转换速度应能做到主、副机
协调同步。
$700x 型电动转辙机属于 滚珠丝杠 传递的三相交流电动转辙机。
选择题
直向通过速度大于160km/h的道岔转换设备,尖轨密贴段,有(A)mm及以上水平间隙时不得接通道岔表
示。
  (A)5
           (B)6
                      (c)4
                                 (D) 2
道岔第一连接杆处,尖轨与基本轨间有(B)mm及以上间隙时,道岔不得锁闭。
                   (C) 4.5
             (B)4
  (A) 5
                                  (D)8
四线制道岔(三相交流除外)表示电路中二极管的技术指标是(A)。
  (A)反向电压不小于 500V, 正向电流不小于 300mA
  (B)反向电压不大于 500V, 正向电流不大于 300mA
  (C)反向电压不小于1000V,正向电流不小于300mA
  (D)反向电压不大于1000V,正向电流不大于300mA
判斷题
ZPW-2000A发送器、接收器的电源为交流,电压值为24V±0.5V。 (×)
在ZPW-2000A轨道电路任一处用标准分路电阻分路轨面,通过分路电阻的电流为机车信号短路电流。
(1)
电气绝缘节-机械绝缘节间轨道电路的传输长度与电气绝缘节-电气绝缘节间轨道电路的传输长度不相同。
(X)
防止重复开放信号试验:只需开放信号后,切断一次进路内道岔表示,信号不得自行重复开放。
(X)
一送多受轨道电路,同一道岔区段最多不应超过3个接收端。 ( √ )
向答题
正常解锁的三点检查都有哪些?
  答: 正常解锁的三点检查是顺序占用并出清本区段的前一个区段; 占用并出清本区段; 占用本区段的
后一个区段。
ZPW-2000A低频频率有多少种?频率各是多少?
  答: 18种: 10.3 Hz、11.4 Hz、12.5 Hz、13.6 Hz、14.7 Hz、15.8 Hz、16.9 Hz、18 Hz、19.1 Hz、
20. 2 Hz. 21. 3 Hz. 22. 4 Hz. 23. 5 Hz. 24. 6 Hz. 25. 7 Hz. 26. 8 Hz. 27. 9 Hz. 29 Hz.
电气化区段轨道电路设置扼流变压器的目的是什么?
  答: (1) 能使牵引电流顺利通过绝缘节;
     (2) 为了保证信号电流不会流入相邻轨道电路;
     (3) 对轨道电路参数进行调整。
```

Figure 1 Railway signal professional theoretical knowledge assessment platform

Module B: Operation Assessment of Rail Transit Interlocking Software

The contestants should complete the computer interlocking operation assessment on the rail transit computer interlocking operation assessment platform (Figure 2) according to the requirements of the examination questions. The tasks include the following:

Track alignment, track unlocking, track modification operation, guide master lock, button lock, turnout operation, poor track setting and other operations assessment.

Task description: This module is provided by the organizing committee to complete the interlocking operation assessment on the computer interlocking operation assessment platform of rail transit.



Figure 2 Computer interlocking operation assessment platform for rail transit

Interlocking software operation assessment							
order number	question types	Sample questions					
1	Establish positive departure route class	The alignment IG is directed to the upward throat forward departure track					
2	Establish reverse departure routes	The layout of the IG line is for reverse departure from the throat at the upper level					
3	Establish reverse train entry routes	Arrange the upper row throat to receive trains in reverse to the IG track					
4	shunting route	Arrange the SI-D9 shunting route					
5	Reopen the signal	Reopen the XI-SF signal					
6	General understanding	Cancel the SI-D7 route					
7	to cancel a route	Cancel the departure route of XI-SF					
8	switch closed up	3# turnout construction, how to operate the interlocking					
9	Guide the main lock	Lock all switches in X throat					
10	Release the guide master lock	The S boot signal that releases the S boot master lock					
11	Guide the way	Arrange the upper row throat to receive the train in reverse and enter the IG route					
12	Switch reverse operation	Move the 15 switches to reverse position					
13	Button unlock	Arrange the SII-X path					
14	Adapt the formula	Arrange the X4-S route					
15	Poor routing	The IAG branch is not set properly					

Table 3 Operation assessment questions of interlocking software

Module C: Railway Signal Equipment Maintenance Software Assessment

The contestants should complete the railway signal equipment maintenance operation in

accordance with the task requirements on the virtual scene assessment platform of railway signal equipment. The tasks include the following: ZPW-2000A track circuit maintenance, station signal machine maintenance, ZDJ9 turnout machine maintenance, TYJL-III interlocking machine maintenance, Dinghan power screen maintenance.

Specific requirements:

- 1) Check the work order;
- 2) Select the parts to be repaired;
- 3) Record the status of the equipment;
- 4) Faulty equipment shall be repaired;
- 5) Maintenance status record;
- 6) Upload operation records.

Task description: The organizing committee will provide the virtual simulation scene uniformly in this module, and the contestants will complete the signal equipment maintenance operation based on the provided simulation system.

BRICS-FS-24 Maintenance of Railway Signal Equipment Test Project

2.对标记"×"的项目进行检修,将检修情况记录在"维修状况"中; 3.如果项目为测量项请在"结果判断"栏填写测量值。									
操作项	操作分项	操作分项 结果\判断 维修状况							
	810DG移频设备外观检查。	主发送器外观良好,指示灯正常 备发送器外观良好,指示灯正常 接收器外观良好,指示灯正常 衰耗器外观良好,指示灯正常	<pre>K</pre> K	已检修 未检修	5				
轨道设备检修作业单	810DG轨道参数测量。	接受器电源电压: 功 出 电 压: 载 频 值: 低 频 值: 轨 入 电 压: 主 轨 出电压:	Enter V Enter V Enter Hz Enter V Enter V Enter V	1					
	8-10DG发送端模拟网络盘参数测量。	设备侧电压: 防雷侧电压: 电缆侧电压:	Enter v Enter v Enter v	1					
	/	/		/					
	1	1		1					

Figure 3 ZPW-2000 indoor equipment maintenance list







r of TYJL-III interlocking machine

8 Power supply screen maintenance order

Module D: Assessment of Troubleshooting and Handling of Railway Signal Equipment Faults

Switching machine equipment accessories installation

Based on the circuit diagram (Figure 9) and wiring diagram (Figure 10) of the turnout equipment, participants should complete the installation of the turnout equipment components on the comprehensive railway signaling equipment training platform. During the task, ensure that the wiring is standardized, complete, and secure, with consistent contact point lengths. The coil windings must be evenly and tightly wound, with no inter-turn short circuits or broken wires. The contact groups should have clear on/off states and good contact, and the wiring must match the diagrams.

1. Task requirements

Switching machine accessories installation and wiring (manual wire ring);

2. List of railway signal equipment installation

No.	Name	Specifications and models	Unit	Quantity	Remarks
1	Seven core hard blue wire	1.5 square meters	rice	50	
2	ribbon	3*150	root	100	de la
5	Number plate	According to the arrangement of exam questions	group		2

Table 4 List of railway signal equipment installation

3. Results verified

The wiring is standard, complete and firm, the length of the contact is consistent, the coil winding should be uniform and tight, there is no inter-turn short circuit or broken wire, the contact group should ensure the clear on/off state, good contact, consistent drawings, and the equipment can work normally.

Power on the signal equipment for debugging

According to the circuit schematic diagram (Figure 8) and wiring diagram (Figure 9) of the signal equipment, the participants complete the power-on debugging of the signal equipment on the comprehensive training platform of railway signal equipment. Please conduct mixed power test before power supply, deal with the faulty parts, and ensure the normal operation of the signal equipment.

1. Task requirements

- 1) Conduct mixed power test before transmission;
- 2) Conductivity test on the signal control circuit;
- 3) Power supply of equipment;

4) Interlocking software drives signal equipment;

- 5) Record the electrical parameters of signal equipment
- 2. Result verification

The turnout action is normal, the positioning indication and the reverse indication are normal, and the status is consistent with the interlocking; the signal light is normally lit, and the display is consistent with the interlocking; the ZPW-2000 equipment works normally, the track relay is normally attracted, and the working state is consistent with the interlocking.



Figure 9 Switching machine circuit diagram

5	4	3	2	1	0	06	05	04	03	02	01
FBJ JPXC-1000	DBJ JPXC-1000	2DQJ JYJXC-160	1DQJ JWJXC-Н 125 80	BB BD1-7	RD1 5A	1 2-1	1 2 -11 *	1	1	1 4-12	1 3-4
72 82	72 82	72 82	72 82		1 06-8	2 6-31 KZ	2 3-112 *	2	2	2 5-12	2 3-1
71 81	71 81	71 132 4-4 81 142 1	71 32 7-31 81 42		2 9-11	3 2-31 KE	3 3-123 *	3	3	3 5-23	3 2-3
73 83	73 83	73131 2-21 83 141 2-4	73 31 06-3 83 41		RD2 5A	4 3 15	4 3-113 #	4	4	4	4
52 62	52 62	52133 5-1 62143 4	52 33 62 43		1 06-10 pc-p	5	5 3-122	5	5	5	5
51 61	51 61	51 61	51 61		2 9-31	6	6	6	6	6	6
53 63	53 63	53112 × 63122 05-5	53 12 9-21 # 63 22		RD3 5A	7	7	7	7	7	7
32 42	32 42	32 42	32 42	32 10-31 42 2-13	1 06-12	8 DC-A	8	8	8	8	8
31 41	31 41	31 111 6-11 41 121 6-21*	31 11 05-1* 41 21 3-131	31 06-18 DJF 220 41 RD4-2	2 9-51	9	9	9	9	9	9
33 43	33 43	33 43	33 43		RD4 0.5A	10 BC-B ×	10	10	10	10	10
12 05-5 55	12 02-1 22	12 113 05-4 22 123 05-3	12 13 1-42 22 23 10-41		1 06-17 1 0.17220	11	11	11	11	11	11
11 21 21 11 4-11 IOZ 21 11 01-17 IOZ	11 5-11 01-17 IOZ 21 5-23 IOZ	11 21	11 21		2 1-41	12 DC-C *	12	12	12	12	12
13 23 4-21	13 23 02-3	13 3 6-32 23 4 01-1	13 3 01-3 23 4 3-141			13	13	13	13	13	13
3 2 4 3-122	3 2 4 6-13 3-132	3 1 01-2 4 2 6-42	3 1 6-1 KZ 4 2 7-32	3 4		14	14	14	14	14	14
1 3-133 2 3	1 3-113 2 3	1 2	1 2	1 2		15	15	15	15	15	15
10	9	8	7	6		16	16	16	16	16	16
R1: RXYC-75/1Kg	nro ,		BHJ JWXC-1700	1DQ.IF . IV.IXC-480		17 DJZ22	17	17	17	17	17 5-21 IDZ
	72 82	72 82	72 82	72 82		18 DJF220	18	18	18	18	18
	71 81	71 81	71 81	71 32 3-3 81 42 3-2							
	73 83	73 83	73 83	73 31 06-2 83 41 1 K2		NA 1		*******		2-10-22-64	M 14 15
	52 62	52 62	52 62	52 33 62 43		壮: 1、	图甲市 → ボロエめ	有具配药	5米用0.50	■ "截囬肑	
	51 RD3-2 * 61 6-22 *	51 61	51 61	51 61		Z.	迫用于甲	机双双机	21](牢守))	的理出失望	2电路的10%。
	53 63	53 63	53 63	53 12 9-41 63 22 9-61 ×		I DF I					
	32 42	32 42	32 2-2 42	32 42							
31 1-32 8-1 41 2-53 8-5	31 RD2-2 * 41 6-12 *	31 41	31 6-4 41	31 11 3-111 41 21 3-121							
	33 43	33 43	33 43	33 43							
	12 22	12 22	12 22	12 13 4-4 22 23 5-1							
	11 RD1-2 * 21 2-12 *	11 21	11 21	11 21							
	13 23	13 23	13 23	13 3 2 23 4 7-31							
	3 4	3 4	3 2 4 9-2	3 1 2-1 41 KZ 4 2 3							
	1 7-1 2 7-4	1 2	1 9-1 2 3	1 2							选择

Figure 10 Internal wiring diagram of the switch machine

The contestants should complete the troubleshooting of railway signal equipment in accordance with the task requirements on the virtual scene assessment platform of railway signal equipment. The tasks include the following: ZPW-2000A track circuit fault troubleshooting, signal lamp circuit fault troubleshooting, turnout control circuit fault troubleshooting.

Trace the process

- 1) Check the interlocking fault phenomenon;
- 2) Check the status of related equipment;
- 3) Check the circuit diagram;
- 4) Select the instrument for electrical measurement;
- 5) Analyze electrical characteristics;
- 6) Troubleshooting;
- 7) Upload operation records;

1. Signal light red light fault handling

Faults can be identified using the alarm information and fault symptom prompts from the computer interlocking operation platform of rail transit systems on either the virtual scenario assessment platform or the comprehensive training platform for railway signaling equipment. Fault symptoms can be viewed on the interlocking interface shown in Figure 11, and electrical faults can be investigated based on the circuit diagrams of signal machines.



Figure 11 Red light fault interlock interface



Figure 12 Signal circuit

2. Handling of turnout positioning failure

Faults can be investigated on the virtual scenario assessment platform or the comprehensive training platform for railway signaling equipment, based on alarm information and fault symptom prompts from the computer interlocking operation platform of rail transit. Fault symptoms can be viewed on the interlocking interface shown in Figure 13, and electrical faults can be investigated based on the circuit diagram of the signal machine.



Figure 13 Switching machine loss table interface



14 Turntable circuit diagram

3. Track circuit fault handling

Based on the alarm information and fault symptom prompts from the computer interlocking operation platform of rail transit, perform fault diagnosis on the virtual scenario assessment platform or the comprehensive training platform for railway signaling equipment. Fault symptoms can be identified by referring to the interlocking interface in Figure 15, and electrical faults can be investigated using the track circuit schematic diagram in Figure 16.



15. Orbit red light band interlocking interface



Figure

16. Schematic diagram of track circuit

Fault handling operation assessment					
No.	Question types	Sample Questions			
1	Red light fault	DJ hitch			
2	Green light fault	LXJ-4 front contact fault			
3	Yellow light fault	ZXJ-3 front contact fault			
4	Red and white light faults	LXJ-73_YXJ-31 is disconnected			
5	Green and yellow light fault	LXJ-72_ZXJ-41 is disconnected			
6	Double yellow light fault	ZXJ-33_2DJ-31 is disconnected			
7	Track circuit fault	FQJ-13_01-5 is disconnected			
8	Positioning indicates a fault	1DQJ-21_2DQJ-131 is disconnected			
9	The inverted position indicates a fault	1DQJ-21_2DQJ-131 is disconnected			
10	Start circuit fixed rotor reversal fault	GJ_41-03-4 broken			

Table 5 Signal equipment troubleshooting questions

4. Scoring Criteria

Module	Content	Value
A	Railway signal professional theory knowledge assessment	20.00
В	Operation assessment of rail transit interlocking software	10.00
С	Evaluation of railway signal equipment maintenance software	30.00
D	Assessment of troubleshooting and handling of railway signal equipment	40.00
Total		100.00

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Table	h	Scoring	('riteria	1
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