

TECHNICAL DESCRIPTION

INFORMATION NETWORK CABLING



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WorldSkills International, by a resolution of the Technical Committee and in accordance with the Constitution, the Standing Orders and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

The Technical Description consists of the following:

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Technical Committee Chair

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1. INTRODUCTION

1.1 Name and description of skill

1.1.1 The name of the skill is

Information Network Cabling

1.1.2 Description of skill

Information Network Cabling is a technology which constructs the infrastructure of all the telecommunication networks such as cellular phones, Local Area Network (LAN), CATV, and internet. This technology is something which cannot be removed from our life, and it is a crucial vocational training field in all countries/regions.

In all countries/regions, this skill is provided by telecommunications' companies or network companies.

This technology is not just cabling, but it is a foundation which constructs all networks. According to one piece of data, it is said that 70% of obstacles within a network if due to cabling. The quality of cabling will control the quality of a network. In other words, the level of skills of an Information Network Cabling specialist will affect the level of quality of a network such as the speed of the Internet.

Competitors in this skill shall understand the requirements of communications cabling design and installation at Layer 1 of the ISO standard. The Competitor will be required to install fibre optic and copper cabling to International standards.

1.2 Scope of application

1.2.1 Every Expert and Competitor must know this Technical Description.

1.2.2 In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

1.3 Associated documents

1.3.1 As this Technical Description contains only skill-specific information it must be used in association with the following:

- WSI - Competition Rules
- WSI - Online resources as indicated in this document
- Host Country - Health and Safety regulations

2. COMPETENCY AND SCOPE OF WORK

The Competition is a demonstration and assessment of the competencies associated with this skill. The Test Project consists of practical work only.

2.1 Competency specification

The Competitor must be competent in completing the following modules to ISO En 11801 and equivalent TIA/EIA cabling standards:

Information Network technology

Competitors must know and understand the information network technology such as:

- Ethernet technology
- LAN technology
- Office/Home network technology

Planning

Competitors must know and understand the installation method in the field such as:

- Building cabling (include backbone and horizontal)
- Residential and office cabling (office and house cabling)
- Outside plant cabling

Cabling

Competitors must understand and be able to do such as:

- Bending radius
- Connection number table
- Labelling
- Tension
- Cable management
- Installation Raceway/Duct/TO
- Procedure of cabling in the field
- How to pulling cable

Optical Fibre Structured Cabling Systems

Competitors must know and understand the optical fibre structured cabling system such as:

- Cables and connecting hardware
- Optical fibre cable
 - Optical fibre cable classification
- Optical fibre connector
 - Various Connectors
- Planning and installing cable
 - Planning optical fibre structured cabling system
 - Installing optical fibre cable
 - Building cabling (include backbone and horizontal)
 - Residential cabling (office and house cabling)

Competitors must understand and be able to complete tasks such as:

- Optical fibre cable preparation
 - Cable jacket removing
 - Cable buffer removing

- Optical fibre cable splicing
 - Fusion splicing
 - Mechanical splicing
 - Cable preparation
 - Optical fibre strand preparation
 - Optical fibre strand splicing
 - Optical fibre splice closing
 - Store optical fibre
 - Protection by heat shrink tube
- Optical fibre cable termination
 - Installable optical connector
 - Inspection and cleaning
- Optical closure installing
 - Store cable into a tray
 - Cable entry/out and fixing
 - Cable buffer management
- Optical enclosure installing
 - Store cable into a tray
 - Cable entry/out and fixing
 - Cable buffer management

Copper structured cabling system

Competitors must know and understand the copper structured cabling system such as:

- Copper cable(Twisted pair cable: xTP (Cat.5e, Cat.6, Cat.6A, Cat.7))
- Connecting hardware
- Planning and installing cable
 - Installing cable
 - Installing cable setup for horizontal
 - Pulling horizontal cable in conduit and raceway
 - Installing backbone in vertical pathway
 - Installing backbone for horizontal

Competitors must understand and be able to do such as:

- Cable termination
 - Pretermination
 - Remove jacket of multiple twisted cable
 - Remove jacket of xTP cable
 - Remove jacket of coaxial cable
 - Copper insulation displacement (IDC) termination
 - Termination of RJ45 modular jack (U/UTP, SF/UTP, S/FTP)
 - Termination of RJ45 modular plug (Cat.5e, Cat.6)
 - Termination of connecting block(110 block)
- Coaxial cable termination
- Telecommunication outlet installing
- Patch panel installing

19 inch rack and cable rack installation

Competitors must understand and be able to do such as:

- Installation of 19' rack
- Patch panel mounting
- Cabling and management

Troubleshooting

Competitors must understand and be able to do such as:

- Optical fibre troubleshooting
- Copper cable troubleshooting

Measurement

Competitors must understand and be able to do such as:

- Optical fibre testing
 - Optical loss test set (OLTS)
 - Optical time domain reflectometer (OTDR)
 - Test equipment selection
- Testing copper cable
 - Field testing 100-ohm balanced twisted-pair cable
 - 50/75 ohm coaxial cable
 - Measurement using DTX-1800

Wireless technology

Competitors must understand and be able to do the wireless technology such as:

- Installation an access point of Wi-Fi

Network Application

Competitors must understand and be able to do the network application such as:

- Installation Wi-Fi application Wi-Fi
- Installation Network application (CCTV, security, Camera, etc.)

Measurement

Competitors must understand and be able to do such as:

- Optical fibre testing
 - Optical loss test set (OLTS)
 - Optical time domain reflectometer (OTDR)
 - Test equipment selection
- Testing copper cable
 - Field testing 100-ohm balanced twisted-pair cable
 - 50/75 ohm coaxial cable
 - Measurement using DTX-1800

Safety Procedures

Competitors must understand and be able to do the safety procedures such as:

- Common Safety Practices
 - First aid
 - Designating work site
 - Tools and equipment
 - Ladder Safety
- Personal Protective Equipment
 - Eye protection
 - Gloves
 - Fall protection
 - Clothing
- Hazardous Environments
 - Electrical hazard
 - Lightning hazard
 - Optical fibre hazard
 - Chemical hazard
- Safety Planning
 - Work site analysis
 - Hazard prevention and control
 - Health and safety

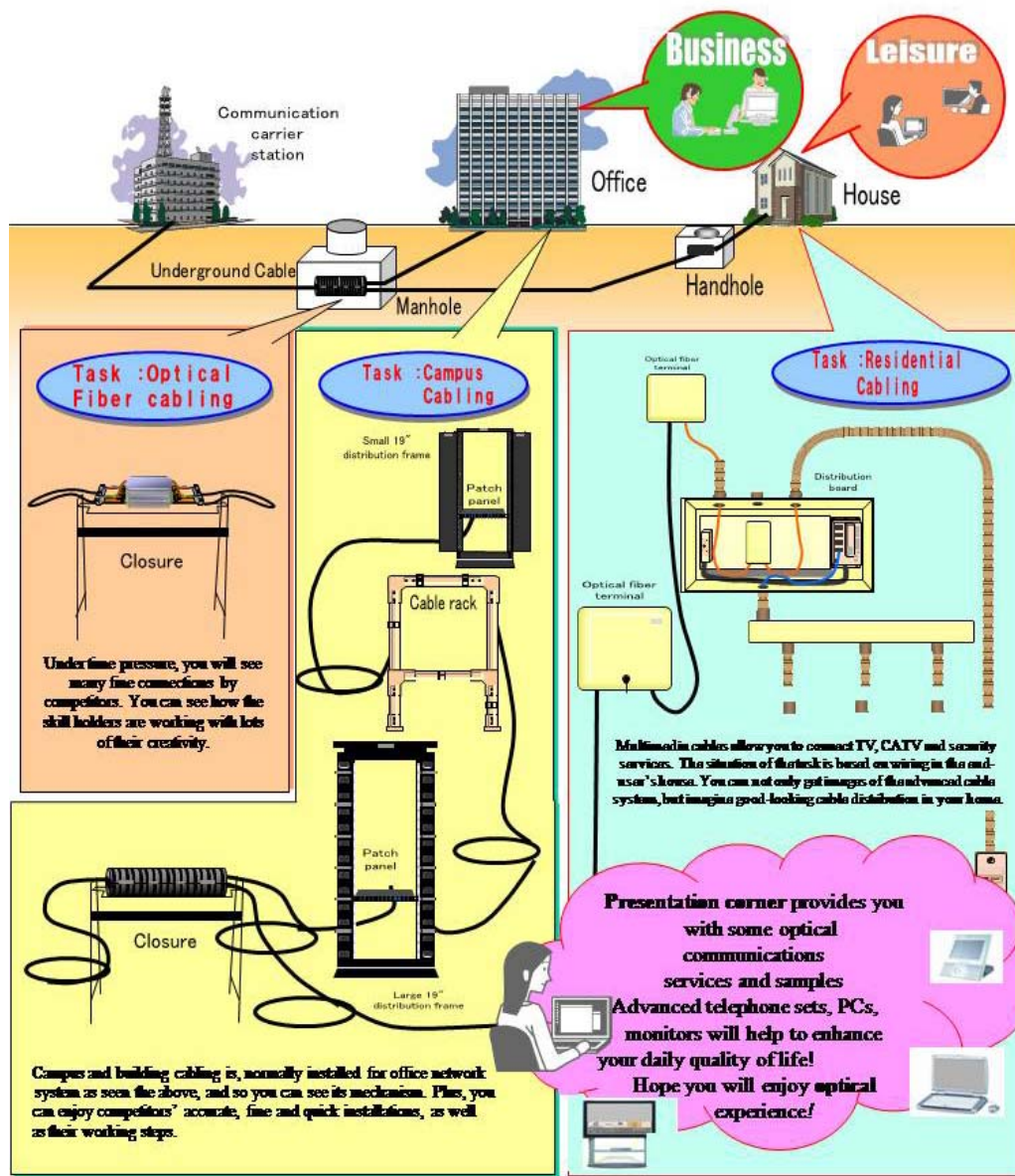


Fig. Competency and scope of work

2.2 Theoretical knowledge

2.2.1 Theoretical knowledge is required but not tested explicitly.

- Preparation and execution of Network Cabling's exercises must be to ISO En and TA/EIA standards.
- The Competitor must have an appropriate level of knowledge and understanding of both the industry and Competition safety standards.
- The Competitor must have the knowledge to select the appropriate materials and consumables during the Competition.

2.2.2 Knowledge of rules and regulations is not examined.

2.3 Practical work

To summarise the basic concepts and the novelty of this Test Project, it is as follows:

1. Test Project modules simulate the telecommunication network
2. Test Project modules which cover installation technologies regarding overall networks such as fibre optic cables and copper cables
3. Evaluating the capabilities of troubleshooting
4. Introducing Test Projects incorporating wireless technology (such as Wi-Fi)
5. Introducing Test Projects constructing high-speed Ethernet such as 10GE and LAN
6. Test Projects of Installing or utilising various network applications

The Competitor shall carry out the following tasks:

Termination

- Terminate balanced-twisted pair cables in: outlets, patch panel, RJ modular plugs and jacks, etc.
- Terminate a coaxial cable
- Terminate/connect optical fibre

Installation/Cabling

- Install cable distribution racking systems
- Install fibre cables, balanced-twisted pair cables, coaxial cable
- Install FO closures, termination box, TO, patch panels, etc
- Install wireless network
- Install some applications for Ethernet

Testing and troubleshooting

All testing shall be done with a cable analyser based on the standards in the Test Project for both copper and fibre cabling:

- Certification test of copper cable's network
- Certification test of fibre cable's network

3. THE TEST PROJECT

3.1 Format / structure of the Test Project

The format of the Test Project is a series of standalone modules.

3.2 Test Project design requirements

Module 1: Optical fibre cabling

- Plan and design cabling system
- Install FO distribution box, termination box, TO and enclosure/FO closure
- Fibre optic cabling
- Cable management
- Measurement

Module 2: Structure cabling

- Plan and design cabling system
- Install FO distribution box, termination box, TO and patch panel.
- Install to 19"inch rack (include patch panel, switching HUB).
- Install to cable rack
- xTP cabling
- Fibre optic cabling
- Cable management
- Measurement

Module 3: Home & office network cabling

- Install DD box, TO.
- Install application such as Ethernet, Wi-Fi, CCTV, network camera, etc.
- xTP and Fibre cabling
- Cable management
- Measurement

Module 4: Speed test

- Speed and quality test of fibre optic splicing / copper terminations

Module 5: Troubleshooting for copper and/or fibre cabling

- Detecting obstacles that and finding out the cause in Optical Fibre and Twist Pair Cable Link.

3.3 Test Project design requirements

All Test Project proposals shall comply with this Technical Description and the Test Project checklist. In addition, at the time of the proposal of all the Test Project modules, the proposer must check if their proposals can be enforced and also indicate the details.

3.4 Test Project development

The Test Project MUST be submitted using the templates provided by WorldSkills International (<http://www.worldskills.org/competitionpreparation>). Use the Word template for text documents and DWG template for drawings.

3.4.1 Who develops the Test Project / modules

The Test Project / modules are developed by:

The Test Project / modules are developed and validated by all eligible Experts.

3.4.2 How and where is the Test Project / modules developed

The Test Project / modules are developed independently jointly with other Experts, the Chief Expert and the Deputy Chief Expert as per the timeline shown below.

This is done by creating four groups each of at least three (3) Experts (if possible) to be responsible for the development of each module. Each team will be allocated a day's module to design. Each team will be allocated a team leader.

3.4.3 When is the Test Project developed

The Test Project is developed:

The Test Project/modules are developed according to the following timeline:

Time	Activity
12 months before the Competition Chief Expert, Deputy Chief Expert and Jury President	<p>Test Project groups (a minimum of 2) will be selected at the previous Competition. The function is to take responsibility of modules and create Test Project scripts and marking schemes required for the Competition.</p> <p>Agreement will be made through the use of the forum. The 50% +1 rule will apply.</p> <p>In the event of these sub-groups failing to produce the required projects a team consisting of the CE, DCE and team leaders will produce the Test Project.</p>

Time	Activity
Not less than 12 months before the Competition	Chief Expert, Deputy Chief Expert and Jury President will contact all available Experts for submission of proposals. The Infrastructure List will be developed in consultation with the Competition Organiser.
Not less than 6 months before the Competition	The Test Project is finalised by all Experts and sent to the Technical Director. The Test Project will be circulated by the Technical Director on the WSI website.
At the Competition	Experts will be required to bring proposed changes to the Test Project to the Competition for selection for the final Test Project. By C-4 all Experts will agree on a 30% change to the Test Project. Only material included in the Infrastructure List may be used for the 30% change.

3.5 Test Project marking scheme

Each Test Project must be accompanied by a marking scheme proposal based on the assessment criteria defined in Section 5.

3.5.1 The marking scheme proposal is developed by the person(s) developing the Test Project. The detailed and final marking scheme is developed and agreed by all Experts at the Competition.

3.5.2 Marking schemes should be entered into the CIS prior to the Competition.

3.6 Test Project validation

The CE, DCE and the WSS will decide together that it is possible for all modules to be completed. Time, Competitor skill and materials will be taken into consideration.

3.7 Test Project selection

The Test Project is selected as follows:

Refer to section 3.4.2 and 3.4.3.

3.8 Test Project circulation

The Test Project is circulated via WorldSkills International website as follows:

The Test Project will be circulated 6 months before the current Competition on the WSI website.

3.9 Test Project coordination (preparation for Competition)

Coordination of the Test Project will be undertaken by:

Coordination of the Test Project will be undertaken by the Chief Expert and the Deputy Chief Expert.

3.10 Test Project change at the Competition

As documented in 3.4.3 a 30% change will be made to the Test Project at the Competition.

3.11 Material or manufacturer specifications

Material and manufacturer specifications are available on the Infrastructure List which can be viewed by going to this link - <http://www.worldskills.org/infrastructurelists>.

4. SKILL MANAGEMENT AND COMMUNICATION

4.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration and decision making regarding the skill must take place on the skill-specific Discussion Forum (<http://www.worldskills.org/forums>). All skill-related decisions and communication are only valid if they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be moderator for this forum. Refer to Competition Rules for the timeline of communication and competition development requirements.

4.2 Competitor information

All information for registered Competitors is available from the Competitor Centre (<http://www.worldskills.org/competitorcentre>).

This information includes:

- Competition Rules
- Technical Descriptions
- Test Projects
- Other Competition-related information

4.3 Test Projects

Circulated Test Projects will be available from [worldskills.org](http://www.worldskills.org) (<http://www.worldskills.org/testprojects>) and the Competitor Centre (<http://www.worldskills.org/competitorcentre>).

4.4 Day-to-day management

The day-to-day management is defined in the Skill Management Plan that is created by the Skill Management Team led by the Chief Expert. The Skill Management Team comprises the Jury President, Chief Expert and Deputy Chief Expert. The Skill Management Plan is progressively developed in the six months prior to the Competition and finalised at the Competition by agreement of the Experts. The Skill Management Plan can be viewed in the Expert Centre (<http://www.worldskills.org/expertcentre>).

5. ASSESSMENT

This section describes how the Experts will assess the Test Project / modules. It also specifies the assessment specifications and procedures and requirements for marking.

5.1 Assessment criteria

This section defines the assessment criteria and the number of marks (subjective and objective) awarded. The total number of marks for all assessment criteria must be 100.

Section	Criterion	Marks		
		Subjective (if applicable)	Objective	Total
A	Knowledge	0	10	10
B	Cabling	0	35	35
C	Functionality	0	15	15
D	Process	10	15	25
E	Speed	0	10	10
F	Safety	0	5	5
Total =		10	90	100

Subjective marking

Scores are awarded on a scale of 1 to 10.

5.2 Skill assessment specification

The skill assessment criteria are clear concise aspect specifications which explain exactly how and why a particular mark is awarded. For each criterion, it is based on the "skill standards" which is discussed and released in advance on discussion forum. In addition, if the criterion needs to be modified due to changes in Test Project modules etc. then it can be re-discussed during the Competition.

Each assessment criteria includes the following:

A - Knowledge

Assessing the knowledge of standards, measurement methods and standard cabling.

B - Cabling

Assessing the condition of each cabling, route, design etc. It mainly includes the following things:

- The fixation of cable is good or bad
- The condition of cable management
- Whether the cabling is based on the standard or Competition standard or not etc.

C - Functionality

Assessing the quality of the Network Cabling using measuring devices. As for the quality, it includes the following things:

- Wire-map results
- Certification test results
- Optical fibre Loss results
- Making an inspection sheet

D - Process

Evaluating during the Competition whether the Test Projects have been performed in the correct procedure or not. General evaluating points are as follows:

- Work tasks performed in a professional manner
- If the cabling process is similar to real cabling field
- Handling cables and materials
- If the procedure does not give a bad effect on the Network quality
- Whether there is no competition rules violation etc.

E – Speed

- Number of successful connections (to required standard)
- Completion of the task in the allocated time

F - Safety

- All tasks performed in accordance with relevant Health and Safety standards.

5.3 Skill assessment procedures

Process of marking

- The Experts will be divided into marking groups to assess each section of the marking criteria.
- Every completed module will be marked on the same day in which it was completed.
- To ensure transparency, each Competitor is provided the same evaluation sheet as used by the Experts.
- The Experts agree that a majority vote is needed to:
 - Change scoring system (within limits specified in the Technical Description)
 - Change Competition sequence or content
 - Agree on a solution for disputes concerning points awarded etc.

6. **SKILL-SPECIFIC SAFETY REQUIREMENTS**

Refer to Host Country Health & Safety documentation for Host Country regulations.

Skill-specific safety requirements are:

- All Competitors must use safety glasses when using any hand, power or machine tools or equipment likely to cause or create chips or fragments that may injure the eyes.
- Experts will use the appropriate personal protective equipment (PPE) when inspecting, checking or assessing a Competitor's Test Project.

7. **MATERIALS & EQUIPMENT**

7.1 Infrastructure List

The Infrastructure List details all equipment, materials and facilities provided by the Competition Organiser.

The Infrastructure List is online (<http://www.worldskills.org/infrastructure/>).

The Infrastructure List specifies the items & quantities requested by the Experts for the next Competition. The Competition Organiser will progressively update the Infrastructure List specifying the actual quantity, type, brand/model of the items. Items supplied by the Competition Organiser are shown in a separate column.

At each Competition, the Experts must review and update the Infrastructure List in preparation for the next Competition. Experts must advise the Technical Director of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

7.2 Materials, equipment and tools supplied by Competitors in their toolbox

- In an attempt to reduce the Competition carbon footprint toolboxes should not exceed a volume of 0.13 cubic metres, approximately 570mm x 570mm x 400mm in size. However, fusion splicer, measuring equipment, or other specified equipments does not have to be included in this toolbox.
- See point in section 7.4 about fabrication of jigs and special fixtures.
- Competitors MUST NOT bring any equipment or tools that are listed on Infrastructure List, with the exception of the equipment and tools listed on List B.

- Competitors must bring the equipment and tools which they are accustomed to shown in List A.
- The equipment and tools on List B maybe brought by Competitors. If you were to bring your own, you must inform SMT and WSS 6 months prior to the competition. In this case, WSS shall provide the number of equipments or tools excluding the competitors who are bringing their own.
- List A and List B will be announced at the proposal of Test Project, 12 months before the Competition.

7.3 Materials, equipment and tools supplied by Experts

None

7.4 Materials & equipment prohibited in the skill area

The Competitors are not allowed to bring their own tables, chairs and special jigs or fixtures.

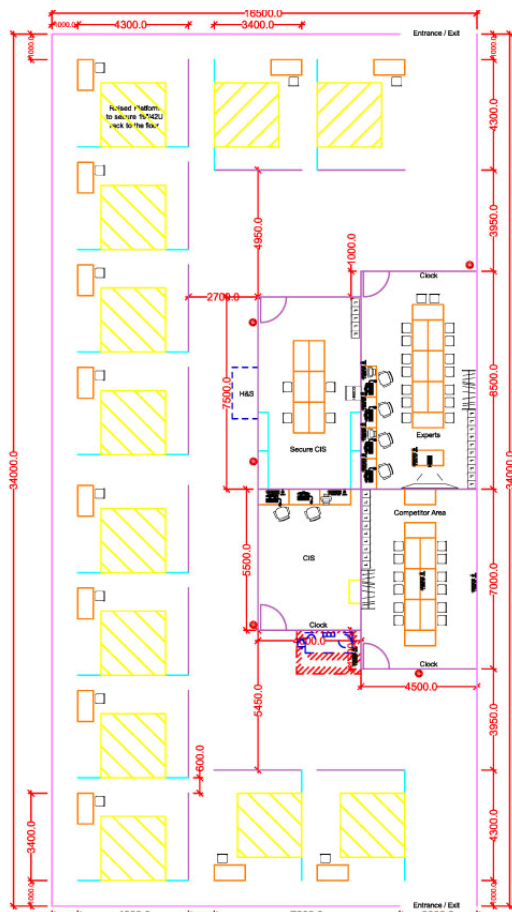
Jigs and special fixtures may be fabricated by the Competitor using the materials supplied in the Infrastructure List during Competition time.

If the Competitor wants to use special jigs or tools, then it must be posted on the Discussion Forum prior to the Competition with a picture and explanation of its use. A majority of Experts must agree.

7.5 Proposed workshop and workstation layouts

Workshop layouts from London are available at:
http://www.worldskills.org/index.php?option=com_halls&Itemid=540

Workshop layout:



8. MARKETING THE SKILL TO VISITORS AND MEDIA

8.1 Maximising visitor and media engagement

The following is a list of possible ways to maximise visitor and media engagement for this skill.

- Try a trade
- Display screens
- Test Project descriptions
- Enhanced understanding of Competitor activity
- Competitor profiles
- Career opportunities
- Daily reporting of competition status

8.2 Sustainability

- Recycling
- Use of 'green' materials
- Use of completed Test Projects after Competition