CONTEST DESCRIPTION

Mechatronics

TEAM CANADA

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1 TECHNOLOGY

In response to the evolving labour market and changing skill needs, the Government of Canada has launched the new Skills for Success (*former Essential Skills*) model defining nine key skills needed by Canadians to participate in work, in education and training, and in modern society more broadly. SCC is currently working with Employment and Social Development Canada (ESDC) to bring awareness of the importance of these skills that are absolutely crucial for success in Trade and Technology careers. Part of this ongoing initiative requires the integration and identification of the Skills for Success in contest descriptions, projects, and project documents. The next phase and very important aspect of our Skills for Success (SfS) initiative is to provide a *Skills Report Card* to each competitor at the Skills Canada National Competition. The purpose of the report card is to inform the competitor about their current level of nine identified Skills for Success based on their competition scores. With this knowledge, the competitor will be made aware which skill may require improvement. Full implementation is expected in the next Skills Canada National Competition.

The following 9 skills have been identified and validated as key skills for success for the workplace in the legend below:

[1]Numeracy, [2]Communication, [3]Collaboration, [4]Adaptability, [5]Reading, [6]Writing, [7]Problem Solving, [8]Creativity and Innovation, [9]Digital

These Skills for Success have been identified in section 2.4 and/or 3.2 of your Contest Description and if applicable, in your Project and supporting documents.

2 CONTEST INTRODUCTION

2.1 Description of the associated work role(s) or occupation(s)

Mechatronics - Skills Competences Canada

2.2 Purpose of the Challenge

- The goal is to provide a team of two competitors with the opportunity to demonstrate certain skills and knowledge that every technician must have in the field of Manufacturing, Automation, and Technology.

- Mechatronics skills will be judged on a practical demonstration of abilities to complete the mechanical, electrical and pneumatic assembly of a manufacturing production system as well as creating and commissioning the controls based on a

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documented working sequence using Programmable Logic Controllers (PLCs) and a human-machine interface (HMI).

- ·This challenge is open to Mechatronics, Industrial Automation & Robotics, Instrumentation, Electro-Mechanical or related Technologies sectors.

2.3 Duration of contest

14 hours (6 + 1 hours over two days)

2.4 Skills and Knowledge to be tested.

- General Electrical and Mechanical knowledge
- Interpret and use electronic, electrical or mechanical schematics[5]
- Render operational and modify sequential mechanisms that have a PLC[4,9]
- Commission electrical, pneumatic and mechanical systems[7]
- Program PLCs and a HMI[1,9]
- Skillful troubleshooting techniques[7]
- Speed of execution
- Wiring skills
- System Optimization (increasing the system performance)[8]
- Professional workmanship
- Professional practices[4]
- Find information in industrial equipment efficiently[5]

3 CONTEST DESCRIPTION

3.1 List of documents produced and timeline for when competitors have access to the documents on the Skills/Compétences Canada website.

DOCUMENT	DATE OF DISTRIBUTION
Professional practice	January 2022
PLC Wiring	January 2022

3.2 Tasks that may be performed during the contest

- Unpack and prepare components including cutting cables to length, stripping of insulation and crimping of ferrules[1]
- Install mechanical modules with proper alignment[1]
- Wire solenoid valves and sensors according to schematics[5]

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- Plumb pneumatic tubing for cylinders, valves terminals and service unit according to schematics[5]
- Write PLC and HMI programs according to instructions[5,8]
- Conduct maintenance tasks by replacing various components in the system[4]
- Debug and troubleshoot the assembly to operate according to instructions[7]
- Optimize the system performance[8]

Skills for Success - [1]Numeracy, [4]Adaptability, [5]Reading, [7]Problem Solving, [8]Creativity and Innovation

4   EQUIPMENT, MATERIAL, CLOTHING

4.1   Equipment and material provided by <u>Skills/Compétences Canada</u>

- Three (3) Manufacturing Production Stations (MPS®): A model of a real production system from Festo Didactic.
- Pneumatic Tubing
- Wires
- Ferrules
- Tie-wraps
- Compressed Air
- A 120 VAC power bar will be provided to each team complete with electrical power (15 amps).
- Tubing cutter
- Workpieces (Cylinder and Meter Bodies)

4.2   Equipment and material provided by <u>the competitor</u>

- A PLC Programming Computer with PLC programming software and administrative rights. Only PLC software, and Windows will be allowed on this computer. Computers and PLCs must be free of all preprogrammed PLC files. Computers may be inspected by Judges prior to usage
- (Optional) A separate CAD-viewing Computer with AutoDesk Design Review (free) software for viewing 3D project files provided at the competition may be used.
- At least three PLC's **or** one master PLC and a distributed I/O system. The distributed I/O's must be placed in/on separate stations. All PLC's or distributed

I/O's need to have at least 16 digital inputs and 16 digital outputs but no more than 32 digital inputs or outputs each.

- At least one PLC/distributed I/O must have a minimum of two analogue inputs and one analogue output that are 0-10 V dc compatible. SysLink and D-sub cables (reference main sponsor) are used to connect the PLC's/distributed I/O to digital and analogue terminals.
- PLCs must be able to pass tag or data information over a network connection.
- One HMI device (screen size approx. 5-7" and with at least 16 colour) in a frame that can be assembled on the front or on top of the profile plate. The HMI must also be compatible with the PLC network/bus communication system.
- A power supply (120 VAC to 24VDC) rated at least 4.5 amps should be used to power each PLC and the MPS station.
- All PLC inputs shall be sinking inputs. The sensors and buttons shall switch (source) +24 VDC to each PLC input. Sensors from the stations are of PNP type.
- All PLC outputs shall be sourcing outputs. The output shall switch (source) +24 VDC to turn an individual load on. The load shall sink the current to 0 VDC (Ground).
- The PLC outputs should be rated to at least 400 mA. All digital I/Os are 24 VDC.
- Each team will have their own table. Mounting the PLC on a back-plate is recommended. See the *PLC Wiring* document posted on the Skills/Compétences Canada web site for more information
- SysLink cable connectors (IEEE 488) will be connected to the PLCs (6 cables in total)
- Each SysLink cable will connect 8 Inputs and 8 Outputs to the PLC. Two cables are required per station. One cable will connect from the PLC to the MPS station containing sensors and actuators. The other cable will connect from the PLC to the control panel, which contains operator devices such as pushbuttons, switches and pilot lights. These cables must be connected to the PLCs before the competition.
- Multimeter (VOM: Volt-Ohm-Milliammeter)
- Set of Screwdrivers, including:

- o Pozi Drive PZ0, PZ1
- o Philips #0, #1
- o Flat 1.2, 1.6, 2.5, 6 mm

- Set of metric Hex keys, including sizes 1.5, 2, 2.5, 3, 4, 5, 6, 8, and 10 mm
- Set of open-ended metric wrenches, including sizes 7, 8, 9, 10, and 19 mm
- Metric Socket wrenches and/or nut drivers
- Adjustable wrench
- Wire strippers for 0.2 mm^2 to 1.5 mm^2 (AGW 24 – 16)
- Side and flush cutters
- Measuring tape or ruler (metric) at least 200 mm long
- Ferrule crimping tool
- Dustpan and broom
- Long nosed pliers
- Standard pliers

Additional notes:
- o No Internet connection will be allowed on any computer or electronic device during the competition.
- o Competitors will be required to use the material and equipment provided by SCC. All other material and equipment will be removed from the skill area.

4.2.1 Toolboxes Guidelines

One of the objectives of SCC is the sustainability of the Competition. As a result, the toolboxes brought by Competitors will be restricted to the following maximum specifications.

The Competitor toolbox must not exceed 1.6 meters^3 in volume. It can be multiple toolboxes, but the total of all toolboxes must not exceed the maximum volume indicated. There is no exception to this rule. If the Competitor toolbox is larger than what is indicated, the Competitor with the guidance of the NTC, will need to remove items from the toolbox and those items will not be used during the competition. All tools must fit inside one or more toolboxes. Tools outside of a toolbox will not be permitted.

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4.3 Required clothing provided by <u>the competitor</u>

- Competitors shall be dressed in a clean and appropriate manner suiting work in a shop.
- The Mechatronics contest recommends wearing long pants, belt, socks. Close toe shoes are a must.
- Loose straps, baggy sleeves or any item deemed unsafe by competition judges will not be allowed.
- T-shirts, and polo shirts may be provided to competitors.
- Jewellery such as rings, bracelets and necklaces or any deemed unsafe by competition judges shall be removed.

5 HEALTH AND SAFETY

5.1 Safety program

SCC has implemented a comprehensive safety program as health and safety is an integral part of our competitions. Our safety program includes guidelines and procedures to make the work environment in each skill area safer.

5.1.1 Safety manual

As part of our program a safety manual has been created in order to monitor and document health and safety within each skill area. It includes a definite plan of action designed to prevent accidents. The safety manual will be provided for every skill and these instructions must be followed and respected by all participants and officials at the SCNC.

5.1.2 Safety workshop

During orientation, Competitors will participate in a Safety workshop and they will be expected to work and maintain a safe working area during the competition. Any Competitor breaking any health, safety, and environmental rules, may be required to undertake a second safety workshop. This will not affect the Competitor's competition time.

5.2 List of required personal protective equipment (PPE) provided by <u>competitors</u>

- Proper footwear as per section 4.3.
- Safety glasses will be mandatory during competition

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Note: Contestants who do not have the required protective gear will not be allowed to participate in the contest

5.3 List of required personal protective equipment (PPE) provided by <u>Skills/Compétences Canada</u>

- N/A

5.4 COVID-19 Protocol

The COVID-19 guidelines will be shared as soon as they are available.

The COVID-19 guidelines will be subject to change based on the BC COVID-19 guidelines in place at the time of the competition.

6 ASSESSMENT

6.1 Point breakdown

Note: This list is subject to change.

TASKS	/100
Professional Practice	20
Time Evaluation	20
I/O Check and Allocation	20
Expected functionality	40

7 CONTEST SPECIFIC RULES

Contest specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from contest to contest. Any additional contest rules will be reviewed during the competitor orientation.

TOPIC/TASK	CONTEST SPECIFIC RULE
Use of technology - personal laptops, tablets and mobile phones	• Competitors are not allowed to bring personal laptops tablets or mobile phones into the skill area. Only the PLC programming and CAD-viewing computers will be allowed in the skill area for the duration of the competition

	• National Technical Committee (NTC) members, interpreters and judges can use personal devices in the skill area
Use of technology - Internet	• Competitors are not allowed to access Internet in the skill area
Safety	• At the discretion of the National Technical Committee, any competitor can be asked to leave the skill area for not having the proper safety equipment and/or not acting in a safe manner

8 ADDITIONAL INFORMATION

8.1 Interpreter

If a competitor requires the help of an interpreter once onsite during the competition, the Skills/Compétences Canada Provincial/Territorial offices must advise Skills/Compétences Canada National Secretariat a minimum of 1 month prior to the competition or this service might not be guaranteed.

8.2 Ties

- Tiebreaker #1: In the event of a tie, the team with the highest score in "Expected Functionality" over the two days will be declared the winner.
- Tiebreaker #2: If a second tie occurs, the team with the highest score in "Time Evaluation" over the two days will be declared the winner.
- Tiebreaker #3: If a third tie occurs, the team with highest score in "I/O Check and Allocation" over the two days will be declared the winner.

8.3 Test Project change at the Competition

Where the Test Project has been circulated to Competitors in advance, NTC shall change a maximum of 30% of the work content. Please refer to the Competition Rules.

8.4 Competition rules

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Refer to the competition rules of the Skills Canada National Competition which can be found on our website.

9   TEAM CANADA EXPERT

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Contact the Skills/Compétences Canada national secretariat for any questions or concerns: Sophie Courchene at <u>sophiec@skillscanada.com</u>

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