**TECHNICLA DESCRIPTION SKILL: 07 Name: CNC MILLING**

1. **NAME AND DESCRIPTION OF THE SKILL COMPETITION**

1.1The name of the skill competition is

**CNC Milling**

1.2 Description of the skill associated work role

Computer Numerical Control (CNC) technology has reached the stage of having become universal. Most people cannot imagine how important these technologies are in their lives. It is present in products and objects of everyday life as e.g. cars, airplanes, components of machines of all types, moulds for tools used for household machines, medical prosthetics, cell phones, and toys etc.

CNC-milling machines are machine tools which are used for the shaping of metal and other solid materials. These machines exist in two basic forms: horizontal and vertical.

CNC refers to a computer (“control”) that reads and stores instructions. This numerical information generally “G and M” codes (a programming language) is then

used to control and drives a machine tool, a powered mechanical device (“machining centre”). A machining centre is used to fabricate components using cutting tools for removal of material.

To form the finished part, the cutting process can be started from a solid block, pre-machined part, casting, or forgings.

For those scenarios, the skill requires the CNC-milling machinist to read and interpret complex technical drawings and work to a high degree of precision .A programme is required to operate the machine tool, can be generated manually or using Computer Aided Design Computer Aided Manufacture (CAD/CAM) software.

To achieve the finished part, the CNC-milling machinist professionals undertake a sequence of essential activities:

* Interpret engineering drawings and follow the specifications;
* Generate a process and programme (logical process plan) with a CAD/CAM system and/or G and M-codes
* Set up the tooling, work holding device and work piece on the CNC-milling centre;
* Manipulate cutting conditions, based on the properties of the material and tooling used;
* Operate, inspect and maintain the accuracy of dimensions within the specified tolerances.
* Optimize the process taking into account the production type: large quantities of one part, small batches or one-of-a-kind items.

Today a wide range of industries require CNC-milling machinist’s professionals to programme, operate, and keep sophisticated machining centre’s running in an efficient and reliable way. Large enterprises such as automobile plants, medium sized enterprises such as mould making and small enterprises in the maintenance field are some of many examples of where the CNC-milling machinist professional plays a key, integral role to the success of the metalwork industries.

**2. SKILLS STANDARDS SPECIFICATION**

2.1 The individual needs to know and understand:

* The extent and impact of CNC-milling on modern life and industry
* Quality standards for materials and quality of metals
* Standards for the environment, safety, hygiene, and prevention of accidents at work
* Computer operating systems
* Mathematics, especially accurate and detailed calculations, and trigonometry
* Properties and behaviors of materials, especially steel and aluminum
* Principles of technical design and process planning
* CNC equipment technology (Vertical & Horizontal Machining ) –programming and operating
* Programming by hand or CAM system software
* Cutting technology according to the cutting parameters, the material, and cutting tools
* Health and safety regulations, legislation, and best practice

**drawings and follow drawings and follow the specification 10**

The individual needs to know and understand:

* ISO 1 and/or ISO 3 (European and American) drawing representation
* Technical terms and symbols used in drawings and plans
* Standards, standards symbol and tables
* Interpret and apply engineering drawings and follow the specification
* Locate and identify main dimensions and secondary dimensions
* Locate and identify ISO standards for surface finish
* Locate and identify ISO standards for geometrical form and positional tolerances

The individual shall be able to:

* Identify and set the different machining features
* Correctly identify the most efficient work holding solution to clamp the base material into the machine that best suits the operational requirements
* Correctly select the cutting tools for machining the required material and operation
* Define the cutting parameters as a function of the operation sequence, material type, and type of operation

The individual needs to know and understand:

* Programming as the creation of a logical process plan
* Different methods and techniques to generate a programme (CAM/CAD or manual)
* CAM system programming
* Skill related software
* Select the best methods according to the production type and part specification
* Effectively use skill specific software and related hardware
* Generate a programme using a CAD/CAM system
* Range of tools and gauging instruments and their applications
* The main measuring techniques Select appropriate measuring tools or gauging instruments and use them correctly
* Make measurements on threaded elements
* The different steps that lead to the setup of the machine
* The different modes of machine operation
* Identify and designate the functional parameters for operation on the CNC-milling machine

Perform the following machining operations:

* + Facing
  + Roughing and finishing
  + External contours
  + Island milling
  + Pocket (circular and rectangular)
  + Canned cycles
  + Through hole boring
  + Reaming
  + Tapping
  + Drilling

3.0 **THE ASSESSMENT STRATEGY AND SPECIFICATION**

Expert assessment practice lies at the heart of the Competition. Assessment at the Competition falls into two broad types: measurement and judgement.For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

The Marking Scheme must follow the weightings within the Standards Specification. The Test Project is the assessment vehicle for the skill competition, and also follows the Standards Specification.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed and developed through an iterative process, to ensure that both together optimize their relationship with the Standards Specification and the Assessment Strategy.

They will be agreed by the Experts in order to demonstrate their quality and conformity with the Standards Specification.

4.0 THE MARKING SCHEME

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors’ work as demonstrated through the Test Project, and the procedures and requirements for marking

The Marking Scheme is the pivotal instrument of the Competition, in that it ties assessment to the standards that represent the skill. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards Specification.

The Marking Scheme and Test Project may be developed by one person, or several, or by all Experts. The detailed and final Marking Scheme and Test Project must be approved by the whole Expert Jury prior to submission for independent quality assurance

In addition, Experts are encouraged to submit their Marking Schemes and Test Projects for comment and provisional approval well in advance of completion, in order to avoid disappointment or setbacks at a late stage.

5.0 COMPLETION OF SKILL ASSESSMENT SPECIFICATION

**A – Main dimensions (50 out of 100 marks)**

Dimensions range from 0.02 to 0.04; Reamed bores: IT7; Hollow out bores: IT7; inside thread and outside thread: IT6

Form and positional tolerances as per DIN ISO 1101

**B – Secondary dimensions (25 out of 100 marks)**

Dimensions with general tolerance should be +/-0.04 oriented of the nominal size; e.g. 73.8 mm

Should be in between 73.76 mm and 73.84 mm.

Depth of hole and thread: 0/+2 mm; e.g. Depth size 16 should be 16.00 mm to 18.00 mm

Depth of bore: 0/+0.5 mm; e.g. Depth size 22 should be 22.00 to 22.50 mm

Radius: +/– 0.2; e.g. R12 should be R11.8 mm to 12.2 mm

Angle: +/–0.5°; e.g. 30° should be 29.5° to 30.5°

**C – Surface quality (10 out of 100 marks)**

Surface quality = Ra 0.8 to 3.2

**D – Conformity with drawing (10 out of 100 marks)**

D1 Chamfering edges by machine 2 marks

D2 Chamfering edges manual 1 mark

D3 Contour damage 1 mark

D4 Conformity with drawing – face one 2 marks

D5 Conformity with drawing – face two 2 marks

D6 Conformity with drawing – face three 2 marks

E- Material Usage **(5 out of 100 marks)**

**6.0 SKILL-SPECIFIC SAFETY REQUIREMENTS**

• 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 safety equipment when inspecting, checking, or working with a Competitor's project

• The documentation ‘Safety and Fairness’ will be prepared by the Experts;

• The Competitor must comply with the machine manufacturer’s safety instructions.