



# Sample Test Project

**District / Zonal Skill Competitions**

**Skill- CNC Milling**

*Category: Manufacturing & Engineering Technology*

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## Section - A

### *A. Preface*

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#### **Skill Explained:**

CNC-milling machines are machine tools which are used for the shaping of metal and other solid materials. CNC refers to a computer (“control”) that reads and stores instructions which is used to control and drives a machine tool, a powered mechanical device (“machining centre”). A machining center 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, premachined part, casting, or forgings.

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, CAD/CAM Software.

Large enterprises such as automobile plants, medium sized enterprises such as mould making and small enterprises in the maintenance field are few examples of where the CNC milling machinist professional plays a key, integral role to the success of the metalwork industries.

#### **Eligibility Criteria (for IndiaSkills 2018 and WorldSkills 2019):**

Competitors born on or after 01 Jan 1997 are only eligible to attend the Competition.

**Total Duration:** 4 to 5 Hrs

## Section - B

### B. Test Project

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The test project will cover –

- Do the machining operation by manual operated conventional machine in LEVEL\_1 of the competition
- Planning the operations and sequences
- Selection of proper clamping methods to clamp the part correctly & safely
- Selection of proper cutting tools & tool parameters
- Setting offset values for the cutting tools
- Executing the machining process to get the final part as per blue print.

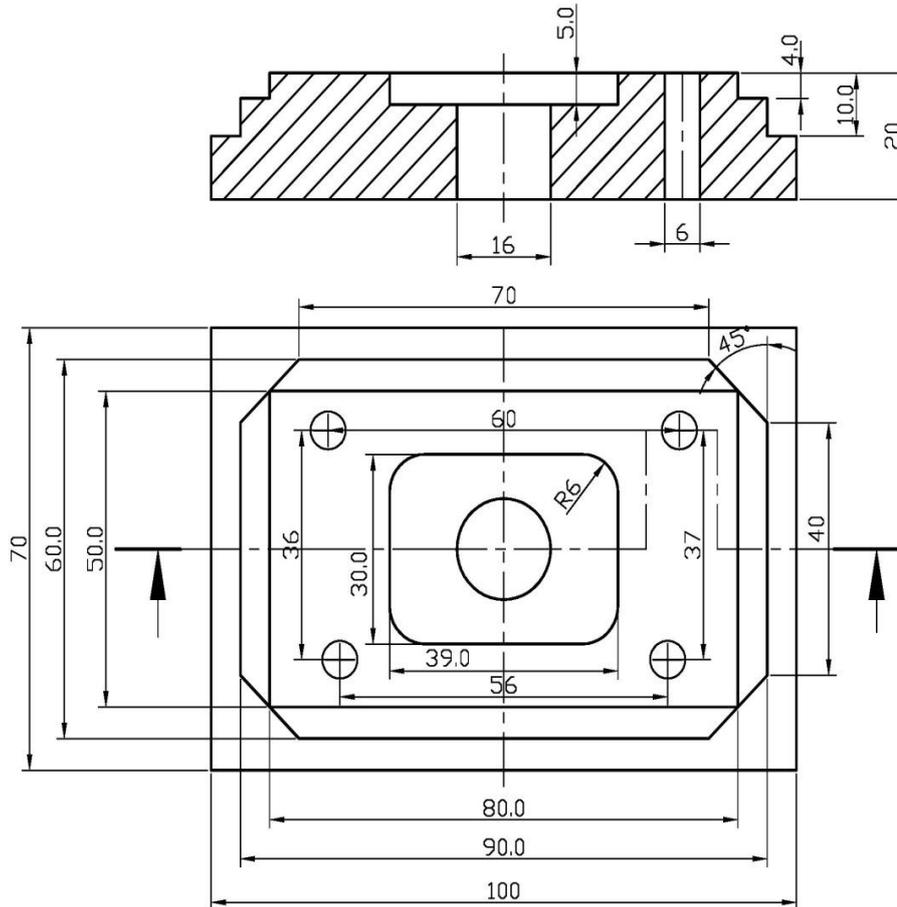
**Perform the following machining operations:**

**Level 1** (*Conventional Machining Process*)

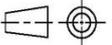
1. Facing
2. Roughing and finishing
3. External contours
4. Island milling
5. Pocket (rectangular)
6. Drilling

LEVEL\_1

| General Tolerance |       |
|-------------------|-------|
| 0                 | ±0,2  |
| 0.0               | ±0,1  |
| 0.00              | ±0,05 |



TIME\_ 5.0 Hrs

|   |             |           |          |     |         |
|---|-------------|-----------|----------|-----|---------|
| 1   | PROJECT     | 20X70X100 | steel    | 1   |         |
| ITEM  | DESCRIPTION | SIZE      | MATERIAL | QTY | REMARKS |
| SCALE 1:1   |             |           |          | DWN | V.D     |
| <br>CONVENTIONAL MILLING |             |           |          | CHD |         |
|   |             |           |          | APD |         |
|   |             |           |          |     |         |
| Sub : Practical   |             |           |          |     |         |

# Section – C

## C. Marking Scheme

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### Marking Scheme:

The Assessment is done by awarding points by adopting two methods - Measurement and Judgments

- **Measurement –**  
It is used to assess the aspect which is measurable. It is used to assess the accuracy & precision of the dimensions of the Test Project
- **Judgment –**  
It is used to assess other performance which can be measured in a robust way. It is used where there should be no ambiguity.

Judgments are made based on Industry expectations. It is used to assess the quality of performance, for which there may be small differences of view when applying the external benchmarks.

Aspects are criteria's which are judged for assessment

### ASSESSMENT AND MARKING USING JUDGEMENT

Judgment uses a scale of 0-3. The 0-3 scale to indicate:

- ❖ 0: performance below industry standard
- ❖ 1: performance meets industry standard
- ❖ 2: performance meets and, in specific respects, exceeds industry standard
- ❖ 3: performance wholly exceeds industry standard and is judged as excellent

### 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)**

The specific Marking Scheme will be finalized during the Skill Specific meet organized before the competitions

### **Marking Summary Form**

| <b>Main criteria</b>  | <b>Judgment</b> | <b>Measurement</b> | <b>Total</b> |
|-----------------------|-----------------|--------------------|--------------|
| Main dimensions       |                 | 50                 | 50           |
| Secondary dimensions  |                 | 25                 | 25           |
| Conformity to Drawing | 10              |                    | 10           |
| Surface finish        |                 | 10                 | 10           |
| Use of Material       |                 | 5                  | 5            |
| Grand Total           | 10              | 90                 | 100          |





## Judgment Marking Form

**Skill No:**

07

**Skill Name:**

CNC Milling

**Competitor No:**

**Competitor Name:**

**Sub Criterion: Conformity with drawing**

| Aspect ID | Max Mark | Aspect of sub Criterion - Description | Experts Score ( 0 to 3 ) |      |      | Mark Awarded |
|-----------|----------|---------------------------------------|--------------------------|------|------|--------------|
|           |          |                                       | Exp1                     | Exp2 | Exp3 |              |
| 1         | 2.00     | chamfering edges by m/c               |                          |      |      |              |
| 2         | 2.00     | chamfering edges by manual            |                          |      |      |              |
| 3         | 2.00     | Contour Damage                        |                          |      |      |              |
| 4         | 2.00     | Conformity with drawing _Face 1       |                          |      |      |              |
| 5         | 2.00     | Conformity with drawing _Face 2       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |
|           |          |                                       |                          |      |      |              |

10 Max mark for sub criterion

Max Mark Awarded

**Signatures confirming the accuracy of this result**

### Measurement Marking Form

Skill No: 07

Skill Name: CNC Milling

Competitor No: \_\_\_\_\_

Competitor Name: \_\_\_\_\_

Sub Criterion: Surface Quality

| Aspect ID | Max Mark | Aspect of sub Criterion – Description<br>Will be decided by the Jury | Experts Score<br>( 0 to 3 ) |      |      | Mark Awarded |
|-----------|----------|--|-----------------------------|------|------|--------------|
|           |          |  | Exp1                        | Exp2 | Exp3 |              |
| 1         | 2        |  |                             |      |      |              |
| 2         | 2        |  |                             |      |      |              |
| 3         | 2        |  |                             |      |      |              |
| 4         | 2        |  |                             |      |      |              |
| 5         | 2        |  |                             |      |      |              |
|           |          |  |                             |      |      |              |
|           |          |  |                             |      |      |              |
|           |          |  |                             |      |      |              |
|           |          |  |                             |      |      |              |

10 Max mark for sub criterion

Max Mark Awarded

Signatures confirming the accuracy of this result

### Mark Summary Form

**Skill No.** 07 **Skill Name:** CNC Milling

**Competitor No:** **Competitor Name:**

| Criterion ID       | Criterion Description   | MAX        | ACTUAL |
|--------------------|-------------------------|------------|--------|
| A                  | Main Dimension          | 50         |        |
| B                  | Secondary Dimension     | 25         |        |
| C                  | Conformity with Drawing | 10         |        |
| D                  | Surface quality         | 10         |        |
| E                  | Use of material         | 5          |        |
| <b>Grand Total</b> |                         | <b>100</b> |        |

| Results Confirmed By | SIGNED WITH DATE |
|----------------------|------------------|
| INDEPENDENT EXPERT   |                  |
| INDEPENDENT EXPERT   |                  |
| CHIEF EXPERT         |                  |

## Section - D

### D. Infrastructure List

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- Workshop Installation-Tools & Equipment positioned by Organizers
- Tool Kit-Tool & Equipment allowed to be brought by competitors for competitions

The above will be decided during the Skill Specific Workshop. The draft Infrastructure List details is as under mentioned

**The Infrastructure list quantity** can vary based on number of participants

| SI NO | Description                         | Qty | Remark |
|-------|-------------------------------------|-----|--------|
| 1     | work table                          |     |        |
| 2     | Chair                               |     |        |
| 3     | Computer                            |     |        |
| 4     | Working vice                        |     |        |
| 5     | Milling Machine CNC                 |     |        |
| 7     | compressed air                      |     |        |
| 8     | Air gun                             |     |        |
| 9     | Soft hammer                         |     |        |
| 10    | Cleaning waste                      |     |        |
| 11    | Cutting oil                         |     |        |
| 12    | Raw materials (for competition)     |     |        |
| 13    | Raw materials (for familiarization) |     |        |
|       | <b>CUTTING TOOLS</b>                |     |        |
| 14    | NC Centre Drills 90° Ø8.0           |     |        |
| 15    | NC Centre Drills 90° Ø10.0          |     |        |
| 16    | HSS Drills Ø5.00                    |     |        |
| 17    | HSS Drills Ø6.0                     |     |        |
| 18    | HSS Drills Ø6.8                     |     |        |
| 19    | Tap M8 Ø8.0                         |     |        |
| 20    | REAMER Ø7.0                         |     |        |
| 21    | End Mill (roughing) Ø8.0            |     |        |
| 22    | End Mill (roughing) Ø10.0           |     |        |
| 23    | End Mill (roughing) Ø12.0           |     |        |
| 24    | End Mill (roughing) Ø16.0           |     |        |
| 25    | End Mill (finishing) Ø8.0           |     |        |
| 26    | End Mill (finishing) Ø10.0          |     |        |
| 27    | End Mill (finishing) Ø12.0          |     |        |
| 28    | End Mill (finishing) Ø16.0          |     |        |

|    | <b>MEASURING INSTRUMENTS</b>        |  |  |
|----|-------------------------------------|--|--|
| 29 | Digital Vernier caliper 0-150 mm    |  |  |
| 30 | Dial Vernier caliper 0-150 mm       |  |  |
| 31 | Outside micrometers 0-25            |  |  |
| 32 | Depth micrometers 0-25              |  |  |
| 33 | Plain protractor                    |  |  |
| 34 | Dial indicators with magnetic stand |  |  |
| 35 | Universal dial (0.01mm)             |  |  |
| 36 | Straight edge 150 mm                |  |  |
| 37 | Scriber                             |  |  |

# Section – E

## **E. Instructions for candidates**

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The Participating Competitors must consider the following;

- Experts shall not be allowed to give any help to Competitors to interpret the Test Project except where agreed by the Jury before the start of the competition
- Competitors have the right to expect fairness, honesty, and transparency during the Competition
- Every Competitor has the right to expect that no other Competitor will receive unfair assistance or any intervention that may provide an advantage
- Interference by officials or spectators that may hinder or assist Competitors in the completion of their Test Project is forbidden
- Accredited personnel at the Competition shall ensure that the above principles of honesty, fairness and transparency are observed at all times
- When the Competition is over, Competitors shall be given time to exchange views and experiences with other Competitors and Experts.
- In case a Competitor has to withdraw due to illness or accident; marks will be awarded for the work completed.
- In the event of Competitor fall ill or has an accident must be informed to Expert (Jury member)

### **Check points for the competitor**

- ✓ Check the raw material size before start
- ✓ Deburr properly while clamping the work piece
- ✓ Check the clamping rigidity (clamping pressure)
- ✓ Use goggles (PPE)

- ✓ Work with safety shoes
- ✓ Never move the hand or body near the running spindle
- ✓ Check the cutting tool condition
- ✓ Use proper cutting parameter
- ✓ Make sure the finished part is bur free
- ✓ Calibrate the measuring instrument before use
- ✓ Plan the machining operation sequence

## Section – F

### **F. Health, Safety, and Environment**

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1. All accredited participants and supporting volunteers will abide by rules and regulations with regards to Health, Safety, and Environment of the Competition venue.
2. All participants, technicians and supporting staff will wear the required Personnel Protective equipment. Protective clothing must be selected according to the activity and related risk
3. When working with rotating machines, individuals must ensure that close-fitting clothing is worn, in order to avoid clothing becoming entangled in the equipment. Jewelry and long hair are a safety hazard and shall be taken off or covered.
4. All participants will assume liability for all risks of injury and damage to property, loss of property, which might be associated with or result from participation in the event. The organizers will not be liable for any damage; however, in case of Injury the competitor will immediately inform the immediate organizer for medical attention.