

NATIONAL SKILLS COMPETITION

Competitions Sub-Committee

INSTRUMENT MAKING

(IMIM#8)

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## INTRODUCTION

WorldSkills Jamaica , by a resolution of the National Organizing 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 National Skills Competition.

The Technical Description consists of the following:

- Section 1 – Technical/Competition Description (TD)
- Section 2 – Project Design Criteria (PD)
- Section 3 – Skill Management Procedures (SM)
- Section 4 – Workshop Setup (WS)
- Section 5 – Infrastructure List (IL)
- Section 6 – Appendices

Effective 01.04.07

Grace Mclean (GM)

Chairman, Competition Committee

01.04.07

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The National Skills Competition Committee has adopted the following minimum requirements for applicants' entry in the Skills Jamaica Competition.

The effective date will be that date on which this document is issued, subject to change by the National Skills Competition Steering Committee.

## **1. NAME AND DESCRIPTION OF TRADE**

1.1 The name of the trade is:

### **1.1.1. Instrument Making**

**1.2** Instrument making covers the manufacture of precision parts, mainly of metallic materials. The parts are then assembled to make apparatus devices, instruments and fixtures devices in accordance with the drawings and ISO-standards. The task includes all necessary settings, manufactures, adjustments, tests and maintenance.

**1.3 This technical description must be known to every candidate.**

1.4 Words implying masculine gender only shall include the feminine gender

## **2. SCOPE OF WORK AT COMPETITIONS**

2.1 The test project consists only of practical work.

2.2 The theoretical knowledge is limited to that necessary to carry out the practical work.

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## **2.3 PRACTICAL WORK**

3.1 The competitor has to carry out, independently, the following tasks:

Manufacturing and assembling components into precision devices in accordance with the drawings, which includes:

Material machining techniques

Assembly, regulation and control operations

3.2 Competitors must use the necessary and appropriate technical skills to complete the tasks.

3.3 The appropriate technical skills are:

Tracing, marking, forming with and without removal of material, joining, measuring and testing

Drilling, countersinking, tapping, reaming, turning, milling, grinding and filing

Assembly, gluing

## **3. SKILL MANAGEMENT PROCEDURES (SM)**

### **3.1 DOCUMENTS REQUIRED**

3.1.1 The Chief Expert will have available a current copy of all documents associated with this skill for the Competition.

3.1.2 The documents required are:

- Technical Description
- Competition Rules
- Health and Safety documents
- QAMS – all documents
- Any other documents referred to in the documents listed above.

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3.1.3 While it is understood that the Chief Expert will have a copy of these documents in there shall also be a complete set that is available for the experts and other competition workers.

3.1.4 The Chief Expert is expected to have a sound knowledge of the requirements and procedures specified in the documentation.

3.1.5 The Jury President is expected to have a thorough knowledge and understanding of the requirements and procedures specified in the documentation.

### **3.2 PRE-COMPETITION RESPONSIBILITIES**

3.2.1 In the period between one National Skills Competition and the next, the elected Chief Expert is responsible to ensure that the requirements of Section 2 – Project Design Criteria are complied with.

### **3.3 SKILL MANAGEMENT PROCEDURES FOR THE CHIEF EXPERTS**

The following speaks to the procedures prior to and during the Competition

3.3.1 The procedures specified below must be adhered to.

3.3.2 On arrival at the Competition site for the first time, the Chief Expert must:

- Welcome the experts and ensure introductions are made
- Inform them of their duties and responsibilities in terms of the Competition Rules and Standing Orders
- Ensure that the project is endorsed by all the experts and that a copy is signed by all the experts

3.3.3 The Chief Expert will then divide the experts into teams for the following activities:

- Verify that the material on site is appropriate and sufficient
- Verify again that the quantities of material as specified on the material list is accurate

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- Develop a program for the competitors to complete the modules
- Develop timetables for activities
- Set up equipment
- Confirm that the layout, work areas and equipment are in accordance with the workshop setup requirements
- Confirm that all machinery/equipment is in a safe working order
- Confirm that all workstations/machinery/equipment are in accordance with the plan, and that they are numbered
- Confirm that there is sufficient illumination
- Confirm that there is sufficient space for the competitors to work efficiently
- Confirm that the barriers are far enough removed from the competitors to ensure that there will be no interference, and if they are not, set up a roster among the experts to police the area during the Competition
- If necessary, set up duty rosters for activities during the Competition – e.g. keeping watch during lunch, preventing access of unauthorised persons, etc

3.3.4 The Chief Expert will then divide the experts into teams for purpose of marking and setting up marking schedules in accordance with the requirements.

3.3.5 Suggestions and comments for the revision and improvement of the Technical Description are to be provided to the Deputy Chief Expert in writing. The Deputy Chief Expert will reduce the information to a single typed document ready for discussion by all experts. Prior to leaving the Competition site, the Chief Expert, the Deputy Chief Expert and the Jury President will facilitate the discussion and revision of the Technical Description.

3.3.6 At any time that a unanimous decision is not achieved within a reasonable time, the Chief Expert will put the matter under discussion to the vote. A majority will be 50% of the experts present plus one. This decision will be final. In the event that an expert is absent at the time that the vote takes place, he/she has the right to be informed of the decision but the matter will not be raised again or voted

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upon again. The exception to this majority rule will be in the case of approval of the changes to the Technical Description, where the majority of 80% is required.

3.3.7 In the event that an extension of time is requested for the Competition to exceed the allotted hours, the matter must be discussed with the Jury President. All possible alternative solutions must be investigated before approval of an extension of time is requested, or will be approved.

3.3.8 Prior to the end of the Competition, the Jury President will facilitate the selection of the Chief Expert and Deputy Chief Expert for the next national Skills Competition.

3.3.9 Experts are eligible for selection as a Chief Expert if they:

- Have attended the National Skills Competition at least twice before (if less than 4 experts have been to the National Skills Competition before, this criterion may be relaxed at the discretion of the Jury President)
- Demonstrate a high degree of expertise in the skill
- Demonstrate leadership qualities.
- Are competent using a computer and the Internet – specifically to facilitate the Discussion Forum for their skill category.

3.3.10 The process by which selection will take place is by secret ballot and is as follows:

- Each expert present will list their choice of three experts in order of preference • The Jury President will allocate a score of three (3) points to each experts first preference, two (2) points to the second preference and one (1) point to the third preference
- The Jury President will then calculate total scores and announce the three highest scoring experts
- The expert with the highest score will be appointed Chief Expert for the next National Skills Competition
- If the first choice cannot attend, then the second choice will be Chief Expert
- If the first and second choice cannot attend, then the third choice will attend

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- If none of the choices can attend, then the jury president will appoint, or facilitate the appointment of a Chief Expert
  - The names of the selected experts will be entered into the provided documentation and signed by the Jury President and returned to the co-chair of the competitions committee.
- 3.3.11 Changes to the method of Competition design or suggestions offered for the next Competition design process or tasks must be written down and signed by 80% of the experts.
- 3.3.12 The Deputy Chief Expert's primary role is to ensure that the Technical Description is updated to reflect the technological advances of the skill category and include overall improvements for the preparation and running of the Competition. He/she will ensure that all changes to the Technical Description are entered, that all experts sign it, and that it is delivered to the co-chair of the competitions committee as a hard copy and digitally.
- 3.3.13 The Deputy Chief Expert also assists in the distribution and collection of the QAMS Audit Questionnaires and assists the Chief Expert where necessary.

### **3.4 HONESTY AND TRANSPARENCY**

- 3.4.1 The competitors that attend the National Skills Competition have the right to expect fair and honest treatment during the Competition in terms of the following:
- Instructions that are clear and unambiguous
  - Marking schedules that provide no advantage to an opposing competitor
  - All necessary equipment and material specified within the skill documentation that are required to complete the Competition
  - The assistance necessary from judges and officials to ensure that he is able to complete the project. (The assistance deemed necessary will be provided equally and at the same time to all competitors present)
  - No undue interference by officials or spectators that may hinder them in the completion of their project

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- 3.4.2 Every competitor has the right to expect and demand that no opposing competitors will receive undue or unfair assistance or intervention that may provide that opposing competitor with an unfair advantage.
- 3.4.3 All officials and judges present on the Competition site are expected to ensure that paragraphs 3.4.1 and 3.4.2 above are complied with and maintained.
- 3.4.4 It is the responsibility of the Chief Expert or his Deputy to ensure that all competitors, interpreters, officials and judges comply with and maintain the integrity of the Competition, and additionally ensure that all necessary steps are taken to ensure that:
- Outside influences do not unduly improve or decrease competitors' abilities to provide a worthy performance.
- 3.4.5 A briefing will be provided to all experts and competitors on the requirements for integrity during the Competition.
- 3.4.6 Additionally, the Chief Expert is expected to identify these and any other factors that may exist on the Competition site that may result in the contravention of paragraphs 3.4.1 and 3.4.2 above, and reduce them to a checklist for continuous reference.
- 3.4.7 In the event that any competitor, judge, official, observer or competitor compatriot is found to be attempting to gain or provide assistance in any form that may result in an unfair advantage, the Chief Expert is to immediately refer the matter to the Jury President.
- 3.4.8 The Chief Expert will receive nominations and appoint a Security Officer whose responsibility it will be to ensure that these requirements are carried out.
- 3.4.9 It will be explained to all experts and competitors that nothing is to come in or out of the site unless specified by the Chief Expert as being allowed after being briefed on this topic.

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3.4.10 Security checks will be carried out each day on experts and competitors (by experts and competitors) upon entry and exit to the site.

### **3.5 INFORMATION POLICY**

3.9.1 During the competition a modified project plan without measurements is to be made available to the public.

## **4. THEORETICAL KNOWLEDGE**

4.1 Interpretation and execution of drawings and sketches according to ISO standards.

4.2 Knowledge of materials and processes.

## **5. MATERIALS**

5.1 All work is to be carried out using materials and equipment normally used with the exception of supplied parts brought by the project designer.

5.2 The competitor may be required to work with any of the materials specified below:

- Steel
- Construction steel
- Free cutting steel
- Silver steel 2 - 10 mm diameter
- Plate 2 mm thick, cast iron
- Non-ferrous metals – brass, bronze aluminium alloys (hard and soft)
- Plastics
- Cutting fluid
- Auxiliary materials
- Glue

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## 6. WORKSHOP INSTALLATIONS

6.1 Each competitor will have a stable working table, 1500mm x 700 mm minimum, with a clean surface plate, bench vice 100mm minimum, working lamp minimum 300 lux and a print holder.

6.2 The general layout of the workshop venue will be as below, with sufficient space for the booth and for the competitors working area.

### 6.2.1 General requirements

The following machines and equipment will be made available for competitors:

- Universal milling machines min speed 3000 r.p.m. (2 for every 3 competitors), table size 500 x 300 mm, fully automatic feed, horizontal fast feed, machine lighting, cooling system, auxiliary tools adapted to the machines (cutter holder, precision vice, dividing head, rotate table, lighting minimum 300 lux etc.)
- Universal precision lathes min speed 3000 r.p.m (1 for every 2 competitors), distance between centres max. 600 mm, height of centers max. 200 mm, threading spindle, collet jaws 1 - 20 mm, cooling system, auxiliary tools adapted to the machines (3 & 4 jaw chuck, drill chuck with MT taper, lighting minimum 300 lux etc.)
- Bench drills (1 for every 3 competitors), diameter 13 mm/ MT3, speed 50- 5000 rpm, cooling system, lighting, power 1.5 kw, auxiliary devices adapted to the machines, e.g. parallel vice.
- Surface grinders (1 for evry 5 competitors), table size 200 x 500 mm, magnetic table, cooling system, fully automatic horizontal table drive, grinding wheels max. 180 mm, auxiliary tool adapted to the machines, e.g. diamond dresser

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- Tool stand grinder, 1 for 3 competitors, wheel size max. 150 mm, power .7kW coolant container; 3000 rpm
- 3-D measuring machine with operator
- Compressed air 5 kg/ cm<sup>2</sup> (gauge)
- Water containers
- Fire extinguisher

6.3 The personal working area for each competitor shall be at least 3m x 3m, and shall also allow for the equipment and machines specified in Sec. 6.4 below.

6.4 The following machines and equipment will be made available to each competitor:

Parallel vice, width of jaws 100 mm, ground jaws surfaces, distance between jaws max. 100 mm, with height regulation

Flat and profile files, wrenches, screwdrivers, saws

Pliers and special purpose pliers

Center punches, piercers, hammers, wetting stones, drills

Auxiliary materials

Measuring and control instruments

Vernier caliper, range 0 - 150 mm, .02 mm precision

Micrometers, ranges 0 – 25, 25 – 50, 50-75, and 75-100mm

Surface dial gauge, height 200 mm

Gauge blocks, ISO-tables

Limit plug gauges, dia. 1 – 20

Gauging rings M2 - M12

Surface control instrument (0.8 + 3.2 mm)

Centre gauge

Precision square, protractor (set)

Feeler gauges 0.01-0.10mm step 0.01mm, 0.1 -1mm step 0.1mm

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R gauge 2-20 mm 0.5 mm step

Screw gauge M5-16

Screw pitch gauge M2-16

Marking ink and stamp

Box for test project

- 6.5 The competitor must bring the remaining tools required to perform the technical skills listed in Sec. 3.3 in a toolbox. No special tools that could give the competitor an important advantage developed for competition only.

## 7. TEST PROJECT MARKING

- 7.1 The experts will decide together on the test project, the marking criteria and the dimensional tolerances and will prepare any changes to the material list.

### 7.2 MARKS:

#### Objective marking

Go	-	10points
No go and not finished	-	0 point

#### Subjective marking

Perfect	=	10 points
Very good	=	9 points
Good	=	8 points
Rather good	=	7points
Sufficient	=	6 points
Medium	=	5 points
Weak	=	4 points
Insufficient	=	3 points

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Very bad = 2 points

Zero = 1 point

### 7.3 RATING

Section	Item	Maximum Points
A	Function	30
B	Dimensions with close tolerances	35
C	Dimensions with wide tolerances	15
D	Flatness and angles	5
E	General execution (ex, roughness....)	10
F	Use of materials	5

**Points will also be awarded for creativity, innovation, speed etc. (This will be developed by the judges depending on the nature of the test project).**

## 8. COMPETITION PROCEDURE

- 8.1 Competitors will have three hours to familiarise themselves with machines, equipment and processes. The committee will provide a subject matter expert to demonstrate the operations and the competitors will be given the opportunity to practice.
- 8.2 The competitors will be given all competition documents including the marking criteria prior to the commencement of the competition.
- 8.3 The workstation and machines will be drawn by the competitor's themselves before their familiarisation with the machines.
- 8.4 The parts, material, drawings and marking sheets will put in box after each day's work and will put in the locker for security.

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- 8.5 Before the competition the experts should check all the materials, and a different stamp for identification will be used on each side of each competitor's material.
- 8.6 At least one stamp-mark must remain on each part of the competitor's material at the end of day for of the competition. Where there is no stamp mark on the competitor's materials or project parts, marking will not occur.
- 8.7 No sand paper may be used on any part of the project.
- 8.8 During the competition the candidates are not allowed to communicate with a compatriot expert alone.
- 8.9 The working hours for competition may only be changed before the end of the 1<sup>st</sup> day only.

## 9. JUDGING PROCEDURAL REQUIREMENTS

- 9.1 The experts that attend the competition will be divided into marking groups to deal with each section of the marking criteria.
- 9.2 No marking will be carried out in the case of **objective** marking without the attendance of **two or more experts**.
- 9.3 No marking will be carried out in the case of **subjective** marking without the attendance **all of the experts**.
- 9.4 During any objective marking, no expert will measure or mark any part of the project of a compatriot competitor (from his own country). The expert will be replace by the chief expert in this instance.

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9.5 Each expert has opportunity to check the results from other marking groups, once all marking and results is complete.

## **10. GENERAL SAFETY REQUIREMENTS**

10.1 All competitors will wear working clothing and safety shoes. Competitors shall also use safety glasses when using any machines, hand or power tools likely to cause dust, chip, or flying fragments.

10.2 Competitors may not wear gloves, finger rings or jewellery, or any loose wear (tie, scarf or long neck-chains) when operating machinery.

10.3 Competitors must keep their workspace clear of obstacles and the floor space clean of oil, material and equipment – any items likely to cause the competitor to trip, slip or fall.

10.4 Failure be the competitor to comply with safety directions or instructions will incur loss of marks for safety

10.5 The chief expert may identify additional risk factor or safety requirements, which will be complied with.

10.6 All machinery, equipment and safety clothing must comply with the safety rules.

10.7 Before the competition the competitors and experts shall be made aware that an emergency plan exists.