

Test Project and Competition Information Pack

TP03_40CA_AA_EN

Submitted by: Chief Expert
Name: Taha Benchiguer
Member Country: France

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1. PROJECT BRIEF

The main project will be a two part project, a solar panel tracker and also Power Generating Exercise Equipment.

These projects were selected by ballot by current MTC Experts from proposals posted on the MTC forum.

1.1. Solar Tracker System - Specifications

Preamble: This solar panel and tracker unit is a portable unit so that it can be typically used by 4WD operators and campers to maximize the charging capability of a solar panel.

- 1.1.a. Solar Panel Tracker must be capable of supporting one 30 watt solar panel (e.g. BP Solar 30 Watt 12Volt (BPSX30) panel dimensions are 595mm long x 502mm wide x 50mm depth and weight of 3.9 kg). Weight and size of panel will be included in all testing.
- 1.1.b. Complete unit must be portable and able to be collapsed for transporting. Unit must be lightweight and able to be packed in a transport enclosure. Erection and collapsing of the complete unit must be simple and quick.
- 1.1.c. Rigid to withstand wind gusts – one weight of 5 kgs to be placed or hung randomly, from any corner of the panel without unit becoming unstable to test the stability of the unit. Panel operation may be static but assembled and adjusted to typical operating configuration during this test.
- 1.1.d. Tracker operation must be capable of both northern and southern hemisphere operation.
- 1.1.e. Tracking east–west/west-east must be automated, and without any manual switching or intervention once in automated operating mode, and must track the sun path within +/- 5 degrees once in operation mode. Consider tracking range of 160 degrees. The path of the sun will be simulated or calculated to test this function.
- 1.1.f. North-south elevation may be manually adjusted to suit the longitude that the panel is installed. Consider the angle to be able to be adjusted between 0 and 80 degrees.
- 1.1.g. At the end of a day's operation, the tracker must self-park to face the panel towards the rising sun for morning operation.
- 1.1.h. Power to operate the panel must be obtained from the solar panel and can be stored in a battery.
- 1.1.i. The control unit must be assembled during the Competition.
- 1.1.j. Unit must have an indicator to indicate that the unit is in operation mode.
- 1.1.k. The unit must have an indicator to indicate the power output of the panel. This indicator may operate only when required.
- 1.1.l. Unit must have an ON-OFF switch to isolate the battery.
- 1.1.m. The unit should have a flashing beacon to indicate its presence, so that people will not trip over it. During day hours the beacon should have an orange flashing light. During night hours the beacon should have a red flashing light. The operation of the beacon should be automatic.
- 1.1.n. A CAD generated 3D model of the complete unit is to be created during the Competition and a printout to be included in the portfolio. CAD generated manufacturing drawings of all components also to be included in the portfolio.
- 1.1.o. A CAD generated electrical and electronic drawing to be included in the portfolio.

- 1.1.p. Complete operating instructions including erection and collapsing instructions are to be prepared. How to setup the unit to suit different longitudes and different seasons (with different lengths of daylight hours) and also a troubleshooting guide must also be included.
- 1.1.q. A poster is also to be displayed explaining to the public how each unit operates and explaining the reason for using solar trackers to maximize the power output of solar panels.

1.2. Power Generating Exercise Equipment - Specifications

Preamble: Each MTC team is to construct one complete exercise unit during the Competition. This unit must be capable of generating power while being used. This power can be used to charge a battery and this stored power can be used to power radios and lights.

- 1.2.a. The unit capable of generating the most power will obtain maximum marks for power output performance. The assessment of power output of the exercise machine would include the participation and support of members of a local gym, who would test all units. Each test rider would test each unit for a specified time (5 minutes) and all results averaged – all units to be tested by every test rider.
- 1.2.b. The power generated must be stored in a battery. The battery must be capable of storing at least the power generated during 30 minutes of constant operation at maximum output
- 1.2.c. The unit can require only human energy to generate the power and could include hand and arm operation and/or feet and leg operation. Only one person is to operate the unit at any one time.
- 1.2.d. When operating the unit the person can sit, stand or lie down – the operating position of the person will not be considered or assessed.
- 1.2.e. The unit must be easily adjustable to suit persons of different heights and weights. The unit should be able to be operated by persons from 2 metres to 1.5 metres in height with a maximum person weight of 100 kgs.
- 1.2.f. The unit must have and a visual display indicating speed of exercising and amount of power being created. The speed can either indicates revs/minute or strokes per minute or a percentage of maximum power output.
- 1.2.g. All chains, pulleys and rotating components must be adequately guarded. Any mechanism that is capable of pinching any part of a person must also be guarded to prevent injury.
- 1.2.h. The unit must not have any sharp edges or corners.
- 1.2.i. The unit is to be lightweight and easily moved to a different location. The unit does not need to be collapsed when moving the unit.
- 1.2.j. A CAD generated 3D model of the unit is to be created during the Competition and a printout to be included in the portfolio.
- 1.2.k. An advertising sales brochure is to be prepared including operating instructions and specifications. A poster is also to be displayed explaining to the public how each unit operates and indicating the power each unit generates.

2. ASSESSMENT CRITERIA

Refer to 1.7.13 of MTC 03 Technical Description

- 2.1. Portfolio - 5 marks
- 2.2. Surprise project - 30 marks
- 2.3. Main project - compliance to specification - 50 marks
- 2.4. Main Project - build cost - 15 marks

NOTE: Marks will be entered into WorldSkills CIS and converted to the 400-600 mark range.

3. COMPETITION REQUIREMENTS

Each team will produce at the event:

- 3.1. One (1) Solar Panel Tracker Unit and also one (1) Power Generating Exercise unit to meet the specifications contained in this information pack.
- 3.2. A surprise project - This project can consist of any combination of the skills outlined in the MTC Technical Description. This project will be selected by ballot by Experts at Expert meeting, just prior to Competition.

4. ACTIVITIES TO BE DONE BEFORE THE COMPETITION

- 4.1. The portfolio – details listed in portfolio assessment
- 4.2. Materials may be rough cut into billets, or lengths but may not be machined to size. Burrs or sharp edges are not to be removed
- 4.3. Manufacture of electronic circuit boards (if required), but these boards **must not** be mounted before the Competition

NOTE: Purchased items are not to be modified in any way prior to the Competition.

5. ACTIVITIES TO BE ATTEMPTED DURING THE COMPETITION

- 5.1. Manufacturing of all components
- 5.2. All shafts and mounting of drives
- 5.3. Electrical/electronic assembly – all individual components must be assembled during the Competition
- 5.4. Manufacture any guarding
- 5.5. Mechanical assembly of complete unit
- 5.6. Testing and commissioning the unit during the Competition
- 5.7. Surprise project to specification

6. EQUIPMENT/ITEMS PROVIDED BY THE ORGANISERS

- 6.1. All equipment, tooling and materials listed in updated Infrastructure List – see MTC forum & MTC Technical Description
- 6.2. Materials and machine tools and workshop equipment deemed necessary for the surprise project.
- 6.3. Testing equipment for the main project units and surprise project

7. ITEMS TO BE PROVIDED BY THE TEAMS

- 7.1. All OH&S equipment as specified in the Host Country's OH&S Guidelines – download from www.worldskills.org All OH&S and personal protective equipment must be worn at all times during familiarization and during the Competition. Penalties will apply for non conforming with the OH&S guidelines
- 7.2. It is the responsibility of the team to supply all the components and raw materials to manufacture the main projects.
- 7.3. This would include the following items, but your design may require you to supply additional components or materials
- 7.4. Motors – must not be modified before the Competition but may be modified during the Competition
- 7.5. Generator/alternator – must not be modified before the Competition but may be modified during the Competition
- 7.6. Batteries
- 7.7. Electronic circuit board – un-mounted (circuit board components must be assembled on the board at the Competition)
- 7.8. All electric and electronic components
- 7.9. Electric cables, connectors and couplings
- 7.10. Jigs, fixtures, formers and clamping devices
- 7.11. All materials with which to construct the main project and all other associated equipment and consumables (LED's, resistors, Circuit boards, sheet metal, screws, nuts, pipe flat bar etc)
- 7.12. Machining centre consumable tooling required for manufacturing project components.
- 7.13. All hand tools, cutting tools and measuring equipment.
- 7.14. Other manufacturing equipment you require that is not listed in the MTC Infrastructure List
- 7.15. Lathe and mill tools and hand tools for manufacturing the main projects
- 7.16. 30 watt solar panel (e.g. BP Solar 30 Watt 12 Volt (BPSX30) panel dimensions are 595mm long x 502mm wide x 50mm depth and weight of 3.9 kg)
- 7.17. Specified tooling list as specified

8. EQUIPMENT AND MATERIALS NOT PERMITTED

Refer to current MTC Technical Description

9. SURPRISE PROJECT – 30 MARKS

- 9.1. The surprise project main contain skills in manufacturing, design, assembly and quality not necessarily covered in the main project elements. The surprise project can consist of any combination of the skills outlined in the MTC Technical Description.
- 9.2. This project will be selected by ballot by Experts just prior to Competition and an evaluation scheme developed. Each Expert will be required to submit a surprise project proposal.
- 9.3. No surprise project documentation may be taken from the Competition site.
- 9.4. Teams can be awarded a maximum of 30 marks of marks in this section.

10. MAIN PROJECT - COMPLIANCE TO SPECIFICATION - 50 MARKS TOTAL

25 marks available for the Solar Panel Tracker unit

25 marks available for the Power Generating Exercise Equipment Unit

11. SOLAR PANEL TRACKER

11.1 Size of Solar Panel – Solar Panel Tracker

11.1.a. Assessment Process

“Solar Panel Tracker must be capable of supporting one 30 watt solar panel (e.g. BP Solar 30 Watt 12 Volt (BPSX30) panel dimensions are 595mm long x 502mm wide x 50mm depth and weight of 3.9 kg). Weight and size of panel will be included in all testing.”

- 0.5 mark if solar panel is 30 watt or greater output capacity
- 0 mark if less than 30 watt output capacity

11.1.b. Suggested Evaluation procedure (to be confirmed):

- Check the size of solar panel if 30watt panel or greater output capacity – refer to label fixed to panel – if in doubt of capacity refer to website to verify panel output.
- Panel may be of different brand to example provided and of different physical dimensions, but power output must be able to be verified.

11.2 Compact and Portable – Solar Panel Tracker

11.2.a. Assessment Process

“Complete unit must be portable and able to be collapsed for transporting.”

- 1 mark if complete unit can be collapsed to a rectangular volume of 1500mm (or less) combined length plus width plus height
- 0 mark if complete unit not able to be collapsed to specification

11.2.b. Suggested Evaluation procedure (to be confirmed):

- Unit must be in complete operation condition and all of unit is to be packed.
- Unit must be packed to a size of combined length, width and height of equal to or less than 1500mm
- Dimensions will be considered as a rectangular package and maximum sizes will be measured
- A transport enclosure is not required to be supplied by teams
- Straps, latches or belts may be used to restrain unit in collapsed condition

11.3 Assembly Time – Solar Panel Tracker

11.3.a. Assessment Process

“Unit must be lightweight and able to be packed in a transport enclosure. Erection and collapsing of the complete unit must be simple and quick.”

- Assembly time for solar tracker unit
- 3 marks to fastest time then reduce 2 marks (proportional) per minute slower than fastest time for other teams

Note: A spreadsheet approved and locked by the WorldSkills Marking Supervisor will be used.

11.3.b. Suggested Evaluation procedure (to be confirmed):

- The solar panel tracker unit is to be collapsed to a similar collapsed condition for previous test.
- All Straps, latches or belts must be secured
- Unit is then placed a distance of 1 metre away from team.
- The solar tracker is assembled into its normal operating configuration using only the maintenance tools supplied.
- The solar tracker unit must demonstrate operation.
- The assembly time will be timed.
- All three (3) members of the team can be involved in the assembly of the solar tracker unit.

11.4 Rigidity of Solar Panel Tracker Unit – Solar Panel Tracker

11.4.a. Assessment Process

“Rigid to withstand wind gusts – one weight of five (5) kgs to be placed or hung randomly, from any corner of the panel without unit becoming unstable to test the stability of the unit. Panel operation may be static but assembled and adjusted to typical operating configuration during this test.”

- 1 mark if tracker unit is able to withstand weight test on all four (4) corner of the solar panel
- 0 mark if tracker unit is not able to withstand weight test

11.4.b. Suggested Evaluation procedure (to be confirmed):

- The solar panel tracker unit is to be in normal operating condition and panel is in flat horizontal position (or as close as possible to this position) in both axes.
- One static weight of five (5) kgs is to be hung from each corner of the panel.
- Each corner will be tested separately.
- The order of test to be decided by Experts before the test and all units will be tested in similar order.
- If tracker unit collapses or tracker system is unable to support weight, unit is considered that it cannot support this weight and is not stable.

11.5 Northern and Southern Hemisphere Operation – Solar Panel Tracker

11.5.a. Assessment Process

“Tracker operation must be capable of both northern and southern hemisphere operation”

- 1 mark if unit can operate in both northern and southern hemispheres
- 0 mark if unit is not able to operate in both hemispheres

11.5.b. Suggested Evaluation procedure (to be confirmed):

- north south adjustment to be set in horizontal position
- east west adjustment to be set in horizontal position
- Simulated sun (light) is placed on left side of tracker, and tracker must demonstrate operation.
- The simulated sun is then placed on other side of the tracker and tracker must then demonstrate operation
- The simulated sun is then placed back in original position and tracker must demonstrate operation
- This test will demonstrate operation with simulated sun moving from both left to right and then also from right to left
- A switch may be used to select northern or southern hemisphere operation. Switch to be clearly labelled

11.6 East-West/West-East Operation – Solar Panel Tracker

11.6.a. Assessment Process

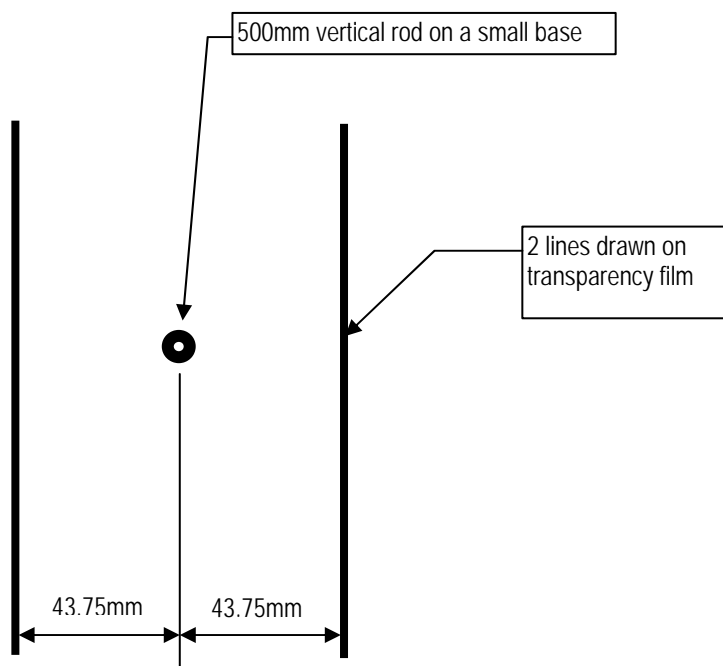
“Tracking east–west/west-east must be automated, and without any manual switching or intervention once in automated operating mode, and must track the sun path within +/- 5 degrees once in operation mode. Consider tracking range of 160 degrees. The path of the sun will be simulated or calculated to test this function.”

- 1.2 marks for each of the five (5) test positions if panel is aligned within specification of +/- 5 degrees (maximum marks 6 marks)

Note: If panel is not at least 30 watts or larger there will be no assessment in this section. Teams must present evidence that their solar panel is 30 watt or greater capacity. Reference to a manufacturer's catalogue or web site will be required.

11.6.b. Suggested Evaluation procedure (to be confirmed):

- Assume daylight hours to be 12 hours.
- Unit must track a simulated sun path. A UV light will be used to simulate the sun.
- The light will be positioned at 5 increments (simulating each 3 hour duration) i.e. at 6:00am, 9:00am; 12:00 noon; 3:00pm and 6:00 pm
- A maximum time of 5 minutes will be allowed for the tracker to move to new position.
- Sketch below is drawn onto some overhead transparency film with a 500mm high vertical rod and this was placed on the centre of the solar panel.
- When the simulated sun moves to a new position the shadow formed by the rod should not cross the lines which indicate 5 degrees.
- The panel may need to be shielded from other lights during this test
- When the simulated sun moves to a new position the shadow formed by the rod should not cross the lines.



11.7 North – South Axis Adjustment – Solar Panel Tracker

11.7.a. Assessment Process

“North-south elevation may be manually adjusted to suit the longitude that the panel is installed. Consider the angle to be able to be adjusted between 0 and 80 degrees”

- 2.5 marks if unit can be adjusted in the north south axis to specification
- Reduce marks by 1 mark for every 5 degrees less than specified. Not proportional marks only awarded in 0.5 increments
- 0 marks if unit cannot be locked or fixed in position

11.7.b. Suggested Evaluation procedure (to be confirmed):

- The north south adjustment will be checked using an inclinometer
- Angle of adjustment in north-south axis to be from horizontal through to 80 degrees (10 degrees from vertical)
- Unit must be able to be locked or fixed in position in at least every 5 degree increments

11.8 Self Parking – Solar Panel Tracker

11.8.a. Assessment Process

“At the end of a day’s operation, the tracker must self-park to face the panel towards the rising sun for morning operation.”

- 2 marks if unit can self park to face the rising sun
- 0 marks if unit cannot self park

11.8.b. Suggested Evaluation procedure (to be confirmed):

- The solar tracker unit is in normal operating condition
- The tracking sensor will be completely covered to simulate a no sunlight condition.
- The solar panel should park so that it faces the rising sun
- A period of ten (10) minutes is allowed to complete this self parking cycle

11.9 Unit Power – Solar Panel Tracker

11.9.a. Assessment Process

“Power to operate the panel must be obtained from the solar panel and can be stored in a battery”

- 0.5 marks if unit has battery and this battery is charged from solar panel
- 0 marks if unit has no battery OR battery is not charged from solar panel

11.9.b. Suggested Evaluation procedure (to be confirmed):

- All power to drive tracker must be connected to a battery (or batteries) that is charged by the solar panel
- Evidence of a battery charging circuit must be shown.
- In normal operation, voltage of battery is checked and compared with solar panel completely covered.

11.10 Indicator to indicate when Unit is in Operation Mode – Solar Panel Tracker

11.10.a. Assessment Process

“Unit must have an indicator to indicate that the unit is in operation mode.”

- 0.5 marks if unit has indicator to indicate that the system is in operation
- 0 marks if unit has no indicator or does not operate

11.10.b. Suggested Evaluation procedure (to be confirmed):

- The indicator must demonstrate that tracker system is operating
- In normal operation, the indicator is observed and will then compared with solar panel completely covered.
- Indicator can be visual or noise creating
- Indicator may hibernate and a switch is used to awaken the indicator
- Indicator and switch to be clearly labelled

11.11 Solar Panel Power Output Indicator – Solar Panel Tracker

11.11.a. Assessment Process

“The unit must have an indicator to indicate the power output of the panel. This indicator may operate only when required.”

- 0.5 mark if unit has an indicator to indicate the power output of the panel
- 0 marks if unit no indicator or indicator does not operate correctly

11.11.b. Suggested Evaluation procedure (to be confirmed):

- The solar tracker unit is in normal operating condition and power output on the indicator is observed
- The solar panel is covered by 50% of its surface and power output is observed
- The solar panel is cover completely and the power output of the panel is observed
- Indicator to be clearly labelled

11.12 Battery Isolation Switch – Solar Panel Tracker

11.12.a. Assessment Process

“Unit must have an ON-OFF switch to isolate the battery”

- 0.5 mark if switch fitted and can isolate the battery
- 0 marks if no switch or does not operate

11.12.b. Suggested Evaluation procedure (to be confirmed):

- The switch is physically checked for correct operation
- Circuit diagram is checked
- Switch to be clearly labelled

11.13 Flashing beacon – Solar Panel Tracker

11.13.a. Assessment Process

"The unit should have a flashing beacon to indicate the unit's presence, so that people will not trip over it. During day hours the beacon should have an orange flashing light. During night hours the beacon should have a red flashing light."

- 0.5 mark if both beacons flash correctly
- 0.5 mark if flashing beacon works in automatic mode
- 0 marks if not

11.13.b. Suggested Evaluation procedure (to be confirmed):

- An isolation switch must isolate both the orange and red beacon's operation.
- Both the orange beacon and the red beacon must flash.
- Once isolation switch or switches are off, the beacon operation should operate in automatic mode. During daylight hours the orange beacon should be on and red beacon off, while during night hours the red beacon should be on and the orange beacon should be off.
- Switches to be clearly labelled

11.14 3D assembly drawing – Solar Panel Tracker

A CAD generated 3D assembly drawing (3D model) of the complete unit is to be created during the Competition and a printout to be presented for assessment in a folder.

11.14.a. Assessment Process

- 1 mark if drawing is acceptable
- 0 mark if not acceptable or is incomplete

11.14.b. Suggested Evaluation procedure:

The drawing should be at least 90% complete and correct and:

- have title block with:
 - Name
 - Scale
 - Drawing number
 - Projection system
- border
- have parts/material list
- parts/material list to be referenced to drawing
- An assessment checklist to be developed by Experts before the Competition.

11.15 2D detail drawings – Solar Panel Tracker

CAD generated manufacturing drawings (2D detail drawings) of all components are to be created during the Competition and be presented for assessment in a folder.

11.15.a. Assessment Process

- 3 marks if drawings acceptable and for at least 90% of components
- 0 marks if not acceptable or is incomplete

11.15.b. Suggested Evaluation procedure:

The drawings should be at least 90% complete and correct and:

- *have title block with:*
 - *Name*
 - *Scale*
 - *Drawing number*
 - *Projection system*
 - *material*
- *drawing border*
- *have appropriate views*
- *dimensioned and toleranced with surface finish symbols where appropriate*
- *sections (if required)*
- *notes (if required)*
- *guards are not required to be drawn*
- *An assessment checklist to be developed by Experts before the Competition.*

11.16 Electrical/Electronic Circuit Drawing – Solar Panel Tracker

11.16.a. Assessment Process

- 0.5 mark if drawing acceptable and meets assessment checklist
- 0 mark if not acceptable

11.16.b. Suggested Evaluation procedure:

The drawing should be at least 90% complete and correct and:

- *have title block with:*
 - *drawing title*
 - *drawing number*
 - *drawing border*
- *Standard electrical/electronic symbols with component values*
- *block representation also accepted if electrical/electronic graphics library not available*
- *Drawing must be CAD/electronically generated*
- *An assessment checklist to be developed by Experts before the Competition.*

12. POWER GENERATING EXERCISE EQUIPMENT

12.1 Power Output - Power Generating Exercise Equipment

12.1.a. Assessment Process

"The unit capable of generating the most power will obtain maximum marks for power output performance. The assessment of power output of the exercise machine would include the participation and support of members of a local gym, who would test all units. Each test rider would test each unit for a specified time (5 minutes) and all results averaged – all units to be tested by every test rider"

- Unit developing the most power to get 12 marks
- Marks for other units then reduced by 1 mark per 5% (proportionally) under this value

Note: A spreadsheet approved and locked by the Worldskills Marking Supervisor will be used.

12.1.b. Suggested Evaluation procedure (to be confirmed):

- Every unit will be tested by all test riders for a period of 5 minutes each
- Power recordings done every 30 seconds with output averaged. Volts and current will be recorded.
- Highest and also the lowest power output readings for each unit will be excluded from the power output calculations.

12.2 Battery - Power Generating Exercise Equipment

12.2.a. Assessment Process

"The power generated must be stored in a battery. The battery must be capable of storing at least the power generated during 30 minutes of constant operation at maximum output"

- 1 mark if battery is connected and is able to store 30 minutes of power generated
- 0 marks if unit has no battery or battery is not capable of storing 30 minutes of power created

12.2.b. Suggested Evaluation procedure (to be confirmed):

- Average power output to be recorded for 30 minutes of constant operation. This will be calculated as $\text{watts} = \text{Volts} \times \text{amps}$
- The battery must be capable to store this power. The battery identification label will be used to indicate battery capacity
- If unit does not produce power, then nil marks for this section

12.3 Adjustable for Different Sized People - Power Generating Exercise Equipment

12.3.a. Assessment Process

"The unit must be easily adjustable to suit persons of different heights and weights. The unit should be able to be operated by persons from 2 metres to 1.5 metres in height with a maximum person weight of 100 kgs."

- 1 mark if unit can be adjusted to suit specification
- 0 marks if unit is not adjustable

12.3.b. Suggested Evaluation procedure (to be confirmed):

- Unit must be capable of being adjusted for use by a person 2 metres and also a person 1.5 metres.
- A person of 100kg will operate the unit to check weight bearing.
- Test riders will be measured and weighed.
- Unit must withstand weight of the riders during operation

12.4 Power Output Indicator - Power Generating Exercise Equipment

12.4.a. Assessment Process

"The unit must have and a visual display indicating speed of exercising and amount of power being created. The speed can either indicates revs/minute or strokes per minute or a percentage of maximum power output"

- 0.5 mark if unit has a visual speed indicator and meets specification
- 0.5 mark if unit has a visual power output indicator to specification
- 0 marks if unit is has no speed or power indicator

12.4.b. Suggested Evaluation procedure (to be confirmed):

- Visual display unit to indicate a speed (accurate +/-10%) – speed will be checked during test
- Amount of Power will be checked during testing and checked against power output indicator

12.5 Guarding - Power Generating Exercise Equipment

12.5.a. Assessment Process

"All chains, pulleys and rotating components must be adequately guarded. Any mechanism that is capable of pinching any part of a person must also be guarded to prevent injury"

- 3 marks if no rotating component or component that could cause injury
- reduce marks by 1 mark for each area not complying (3 Experts must agree to confirm an area that could cause injury)

12.5.b. Suggested Evaluation procedure (to be confirmed):

- All exposed components will be checked or edges that may be touched by operator in normal operating condition. Comparison to guarding of a normal bicycle.
- All chains and pulleys to be checked with a rod 12mm in dia and 75mm long (simulating a finger). If rod touches any rotating component causing a pinch point

12.6 Sharp edges - Power Generating Exercise Equipment

12.6.a. Assessment Process

"The unit must not have any sharp edges or corners"

- 1 mark if no sharp edges are found
- Reduce marks by 0.25 marks for each sharp edge found (3 Experts must agree to confirm a sharp edge)

12.6.b. Suggested Evaluation procedure (to be confirmed):

- All exposed components will be checked or edges that may be touched by operator in normal operating condition.
- 3 Experts must confirm the sharp edge
- A sharp edge is considered an edge that could cause laceration with contact with the body

12.7 Weight - Power Generating Exercise Equipment

12.7.a. Assessment Process

"The unit is to be lightweight and easily moved to a different location. The unit does not need to be collapsed when moving the unit."

- 3 marks for lightest unit
- marks reduced by 1 mark for every three (3) kgs (proportional) heavier than lightest unit

Note: A spreadsheet approved and locked by the Worldskills Marking Supervisor will be used.

To be considered for assessment for this test, the unit must be capable of equal to or excess of 50% of the power produced by highest power output unit

12.7.b. Suggested Evaluation procedure (to be confirmed):

- *Unit must be complete with battery and in normal operating configuration.*
- *Unit does not need to be collapsed to weigh unit*

12.8 3D Assembly drawing - Power Generating Exercise Equipment

12.8.a. Assessment Process

"A CAD generated 3D assembly drawing (3D model) of the complete unit is to be created during the Competition and a printout to be presented for assessment in a folder."

- 3 marks if drawing is acceptable
- Reduce mark by 0.5 mark for every major error identified.

12.8.b. Suggested Evaluation procedure:

The drawing should be at least 90% complete and correct and:

- *have title block with:*
 - *Name*
 - *Scale*
 - *Drawing number*
 - *Projection system*
- *border*
- *have parts/material list*
- *parts/material list to be referenced to drawing*
- *3 Experts to agree on quality of model from an assessment checklist developed by Expert group before the Competition*

13. MATERIAL & PRODUCTION COSTS – 15 MARKS

Note: all costs to be calculated in Canadian dollars (\$CAD)

Working hours: **\$CAD37.50/person/hour**

Note: When one member of the team is working, all team members will be costed therefore team cost would be **\$CAD112.50/hour**

Labour and equipment use costs when working on the surprise project are included with main project labour and equipment costs.

13.1 Additional price for equipment use:

Note

- All workshop machines are to be booked (reserved) with printed booking sheets
- Machines are not to be used unless team's booking has been approved
- The minimum booking time for each machine or consultancy is fifteen (15) minutes.
- Actual machine usage time will be assessed to the accuracy of the time keeping system

For using a conventional mill and lathe: **\$CAD28.75/hour**

For using the CNC mill **\$CAD47.50/hour**

For using workshop equipment, e.g. welding, computer, grinding, sheet metalwork, drilling and saw **\$CAD18.75/hour**

Consultant or training **\$CAD75.00/hour**

Note: After using a machine, the machine must be cleaned, i.e. swarf removed from working area of the machine. Each machine will be inspected by an Expert after each team's use of that machine and a penalty of **\$CAD9.40** (representing 15 minutes of cleaning time) will be applied if machine is not cleaned. If a machine is considered not cleaned a group of three (3) Experts will be called to inspect that machine. Their decision is final.

Equipment use cost only to be applied to equipment supplier by Canadian organisers. No cost for using portable equipment provided by teams.

13.2 Raw materials

Each team will provide weight of raw materials used and also cost of raw material using cost per kilogram listed below.

Currency conversion rates will be fixed as at 1st July 2009, as listed on <http://www.xe.com/ucc/> and these rates will be posted on the MTC forum.

The list of raw material details including weight and cost is to be presented in Spreadsheet format and to be included in the Portfolio

Cost for raw materials to be applied:

- Mild steel – **\$CAD0.90/kg**
- Aluminium - **\$CAD1.30/kg**
- Brass - **\$CAD4.70/kg**
- Stainless steel - **\$CAD3.55/kg**
- Plastic - **\$CAD2.50/kg**

- For each purchased item without a catalogue price or internet e-catalogue printout and receipt, an Expert will search for a typical catalogue price and that will be charged at double the price.
- Materials bought into the Competition may be rough cut or sawn but not machined to finished size – a cutting cost will be incurred if material is in finished size.
- Sheet metal may be cut to a finished size and may be folded or bent and bought into the Competition. Each straight cut will incur a cost of **\$CAD9.40** for each cut and a fold or bend will incur a cost of **\$CAD9.40** for each bend. All sheet materials will be inspected before the Competition.
- Pipe or tube, flats or rounds may be bent and bought into the Competition but a cost of **\$CAD9.40** for each bend will be applied.
- Materials that are bought into the Competition and are not cut to size, bent or folded will not incur the costs above but will be costed at workshop rates.

13.3 Purchased items:

For each used purchased item a receipt or a current catalogue price (without discounts or goods and services taxes applied). A printout of a website or e-catalogue is acceptable if website address and date are included on printout.

The list of purchased items and their costs is to be presented in Spreadsheet format and to be included in the Portfolio

- Motors and generator basic units must not be modified in any way before the Competition, and their cost will not be considered in project cost. Motors and the generator can be modified during the Competition.
- Geared motors are permitted but must not have any pulley, sprocket or drive coupling pre assembled on the shaft.
- All electronic/electric control components, eg motor controllers. Individual components may be bought into the Competition and must not be assembled. All circuit boards must be assembled during the Competition.

Note: If any raw material or purchased item is used in the main project and not included in either of the lists above, or costs not included in the lists, the cost will be estimated by a team of Experts and double the cost will be added.

14. COST CALCULATIONS.

Step 1

The total cost of equipment, materials and labour will be modified by project compliance to specification.

Final Build cost = $\frac{\text{total cost}}{\% \text{ compliance to specification}}$

Note: see Section 10 for 'Compliance to Specification'

Example:

- If total cost is **\$CAD2,500** and compliance is 100% then build cost would be **\$CAD2,500**
- If total cost is **\$CAD2,500** and compliance is 80% then build cost would be **\$CAD3,125**
- If total cost is **\$CAD2,500** and compliance is 60% then build cost would be **\$CAD4,167**
- If total cost is **\$CAD2,500** and compliance is 40% then build cost would be **\$CAD6,250**
- If total cost is **\$CAD2,500** and compliance is 20% then build cost would be **\$CAD12,500**
- If total cost is **\$CAD2,500** and compliance is 0% then no marks awarded for cost section.

Step 2

The build costs will then be compared between teams. The cheapest team will receive 15 marks. For every 10% more expensive than the cheapest cost, deduct 1 mark proportionally.

A spreadsheet approved and locked by the WorldSkills Marking Supervisor will be used.

15. PORTFOLIO (MAXIMUM MARKS AVAILABLE = 5 MARKS)

From MTC TD

1.3.8 Documentation - Document the process including header page, index, and descriptive overview of the task, hard copy of any programs, instructions for setting up and assembly, and any relevant drawings.

Note: The portfolio is to be presented before the start of the Competition and the portfolio will be assessed on Day 1 of the Competition.

Judges Note:

When assessing the portfolio using the criteria below, it is sufficient to award marks for inclusion of the information when it comes up to the minimum requirements, rather than consider the actual detail contained within it.

Marks are awarded for each item as **if acceptable** – full marks or **if not acceptable** - zero marks (there will be no graduated marks)

The minimum requirements will be decided by the Experts prior to the Competition and fully documented before any assessment of the portfolio.

15.1 Operating Instructions – Solar Panel Tracker

To include:

- Operating specifications and performance of tracker.
- Erection and collapsing instructions for the solar tracker.
- Transporting the unit
- Setup of the unit to suit different longitudes, hemispheres and different seasons (with different lengths of daylight hours).
- Operating checks including power output meter
- Isolating the battery
- Routine maintenance tasks or adjustments
- Presented in folder

- 0.75 mark if the operating manual is complete and meets minimum requirements

- 0 mark if not complete or does not meet minimum requirements

15.2 Troubleshooting Guide – Solar Panel Tracker

To include:

- Troubleshooting procedures if tracker is not operating correctly, i.e. insufficient light, faulty equipment, faulty battery etc.
- Replacing battery and electronic control unit
- Replacing the solar panel from frame
- Presented in folder

- 0.25 mark if the troubleshooting guide is complete and meets minimum requirements

- 0 mark if incomplete or does not meet minimum requirements

15.3 Poster – Solar Panel Tracker

To include:

- Team member profiles
- Minimum size 500mm x 700mm
- Explanation of basic operation of the unit
- 3D model drawing of complete tracker unit
- Advantages of using solar trackers to maximize the power output of solar panels.
- Performance specifications of team's tracker unit

- Poster in English language (may also have duplicate in team's language)
- Poster complete and displayed to the public during the Competition.

- 1 mark if the poster is complete and meets minimum requirements
- 0 mark if incomplete or does not meet minimum requirements

15.4 Cost of Raw Materials and Purchased Items for Solar Panel Tracker

Note: these figures will be checked and then used in the calculations for manufacturing costs during the Competition.

To be presented in both printout and also electronic format.

15.5 Lists of Raw Materials – Solar Panel Tracker

Each team will provide weight of raw materials used and also cost of raw material using cost per kilogram listed below.

The list of raw material details including weight and cost is to be presented in Spreadsheet format .

Cost for Raw materials to be applied:

- Mild steel – **\$CAD0.90/kg**
- Aluminium - **\$CAD1.30/kg**
- Brass - **\$CAD4.70/kg**
- Stainless steel - **\$CAD3.55/kg**
- Plastic - **\$CAD2.50/kg**

Purchased items – Solar Panel Tracker

For each used purchased item a receipt or a current catalogue price (without discounts or goods and services taxes applied). A printout of a website is acceptable if website address and date are included on printout.

A list of purchased items and their costs is to be presented in Spreadsheet format

- 1 mark if the spreadsheet contains all raw materials and purchased items and is complete and meets minimum requirements
- 0 mark if incomplete or does not meet minimum requirements

15.6 Advertising Sales brochure - Power Generating Exercise Equipment

To include:

- Minimum 200 posters to be supplied for distribution to the public.
- List of units advantages
- Explanation of basic operation of the unit
- 3D model drawing of exercise unit
- Performance specifications of team's unit
- Power saved during a typical exercise session
- Brochures in English language (may also have duplicate copies in team's language)
- Brochures made available for distribution to the public

- 0.5 mark if the brochure is complete and meets minimum requirements
- 0 mark if incomplete or does not meet minimum requirements

15.7 Poster - Power Generating Exercise Equipment

To include:

- Minimum size 500mm x 700mm
 - Explanation of basic operation of the unit
 - 3D model drawing of exercise unit
 - Performance specifications of team's unit
 - Poster in English language (may also have duplicate in team's language)
 - Poster complete and displayed to the public during the Competition.
- 0.5 mark if the poster is complete and meets minimum requirements
 - 0 mark if incomplete or does not meet minimum requirements

15.8 Cost of Raw Materials and Purchased Items - Power Generating Exercise Equipment

Note: these figures will be checked and then used in the calculations for manufacturing costs during the Competition.

To be presented in both printout and also electronic format.

15.9 Lists of Raw Materials - Power Generating Exercise Equipment

Each team will provide weight of raw materials used and also cost of raw material using cost per kilogram listed below.

The list of raw material details including weight and cost is to be presented in Spreadsheet format.

Cost for raw materials to be applied:

- Mild steel – **\$CAD0.90/kg**
- Aluminium - **\$CAD1.30/kg**
- Brass - **\$CAD4.70/kg**
- Stainless steel - **\$CAD3.55/kg**
- Plastic - **\$CAD2.50/kg**

15.10 Purchased Items - Power Generating Exercise Equipment

For each used purchased item a receipt or a current catalogue price (without discounts or goods and services taxes applied). A printout of a website is acceptable if website address and date are included on printout.

A list of purchased items and their costs is to be presented in Spreadsheet format

- 1 mark if the spreadsheet contains all raw materials and purchased items and is complete and meets minimum requirements
- 0 mark if incomplete or does not meet minimum requirements