

# Test Project Manufacturing Team Challenge

## WSC2013\_TP03\_actual\_EN

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## 1 PROJECT BRIEF

To help with the recycling of aluminium cans and PET bottles it is proposed that we build a solar powered garbage bin to be placed in local parks.

The bin will be fully self contained and be able to crush and store aluminium drink cans and PET bottles. The machine will have to store these items separately for easy recycling.

The machine must be able to be powered by the sun with a battery for night time use.

## 2 ASSESSMENT CRITERIA

SECTION	CRITERIA	MARKS
A	Main project performances (including section B of portfolio)	50
B	Main project costs (including time to complete section B of portfolio)	15
C	Portfolio (section A only)	5
D	Surprise project	30
	<b>Total</b>	<b>100</b>

## 3 COMPETITION REQUIREMENTS

Each team will provide at the event

- Three (3) solar powered garbage bins
- Section B of the portfolio
- A surprise project – the surprise project will be released to Competitors just before the start of the Competition. This project can consist of any combination of the skills outlined in the MTC technical description. This project will be selected by experts prior to Competition.

## 4 ACTIVITIES TO BE DONE BEFORE THE COMPETITION

- Section A of the portfolio.
- Materials may be rough cut into billets, or length but may not be machined to size. Burrs or sharp edges are not to be removed. Refer to the Technical Description for further information.
- Manufacture of electronic circuit boards, but these boards may not have components 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**

- Section B of the portfolio, including drawings
- Manufacturing of all components of the solar powered garbage bins
- Electricity/electronic assembly – all individual components must be assembled during the Competition.
- Mechanical assembly of complete solar powered garbage bins
- Testing of solar powered garbage bins
- Surprise project.

## **6 EQUIPMENTS PROVIDED BY ORGANISERS**

- All equipment, tooling and materials in the infrastructure list – see MTC forum and technical description.
- All materials for surprise project as listed in the technical description.
- Testing equipment for solar powered garbage bin and surprise project.

## **7 ITEMS TO BE PROVIDED BY TEAMS**

Each team must provide and wear team identification (e.g. coloured shirt) and armbands that indicate their region. These must be worn at all times during the Competition.

It is the responsibility of the team to supply all the components and raw materials to manufacture the solar powered garbage bins. This may include but not limited to the following items:

- Electrical motors
- Battery
- Electronic circuit board – not mounted (circuit board components must be assembled on the board at the Competition).
- All electric and electronic components.
- Electric cables, connectors and couplings.
- Jigs, fixtures, formers and clamping devices.
- All materials with which to construct the solar powered garbage bin and all other associated equipments and consumables (sheet metal, screws, nuts, pins, pegs, etc...).
- Machining consumable tooling required for manufacturing the components.
- Lathe and mill tools and hand tools for manufacturing components.
- All hand tools, cutting tools and measuring equipments.
- All hand tools for assembly.
- All personal protective equipment.
- Standard tooling kit as described in the MTC technical description
- Other specific manufacturing equipment required that is not in the infrastructure list.
- Bearings (unmodified)
- Sprockets, pulleys, gears, couplings, chain and belts (as supplied and must not be altered)
- Hydraulic components and fittings not assembled
- Solar panel
- Locks
- Crushed Can/Bottle test gauge

## **8 EQUIPMENT AND MATERIALS NOT PERMITTED**

- Laptop or portable computers.
- PDAs e.g. Palm, IPAQ, etc
- Memory sticks/MP3 Player/Digital Storage.
- Walkman radio/CD Player.
- Electronic organizer/diaries.
- Wireless communication devices.
- Non approved CDs or floppy discs – approval by experts or delegate is required for all CDs and floppy discs.
- Any additional software not supplied by organisers unless approved by experts.
- Pre-programmed IC's
- Purchased items modified in any way prior to the Competition.
- Equipment that is similar or operates in similar manner as supplied equipment. Example – if metal cutoff saw is provided by organizers, then no team may provide own metal cut-off saw.
- During the Competition duration, no tools, equipment, stationary, components, manuals, drawings or digital storage devices may be removed from or brought into the Competition venue, unless approved by Chief Expert.

## **9 SURPRISE PROJECT**

The surprise project may contain skills in manufacturing, design, assembly and quality control 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. This project will be selected by experts prior to the Competition and an evaluation scheme developed. The surprise project will be released to Competitors just before the start of the Competition. Teams can be awarded a maximum of 30 marks in this section.

## 10 MAIN PROJECT

### 10.1 Solar Powered Garbage Bin

#### 10.1.1 Three (3) units produced

Teams are to produce 3 identical solar powered garbage bins

Maximum Marks: 4.5

#### Assessment procedure

Teams will be marked per working unit.

3 working units – 4.5 marks

2 working units – 3 marks

1 working units – 1.5 marks

0 working units – 0 marks

#### Evaluation process

Teams will be checked that they have three 3 working units of the same construction.

**Note:** If a team fails to produce 3 identical units.

We multiply the teams working hours by the factor of missing bins.

E.g.1) If a team only completed 2 bins and took 40 working hours to finish the competition (including Surprise project).

We would work out the costing as  $40 + 20\text{hrs}$  (time to complete a third bin) + material cost divided by % compliance to specification

E.g.2) If a team only completed 1 bin and took 22 working hours to finish the competition (including Surprise project).

We would work out the costing as  $22 + 44\text{hrs}$  (time to complete 2 more bins) + material cost divided by % compliance to specification

### 10.1.2 Crush Bottles and Cans

To be able to crush a 330ml German supplied cans (picture is not accurate)



and Coca Cola 500ml UK supplied PET bottles (picture is not accurate)



Maximum Marks: 2

#### Assessment procedure

If unit can crush 330ml German supplied can – 1 Mark

If unit can crush Coca Cola 500ml UK supplied PET bottle – 1 Mark

#### Evaluation process

Unit will be used to crush a 330ml German supplied can and a Coca Cola 500ml UK supplied PET bottle

**Note:** For a can/bottle to be considered crushed the volume or height of the crushed can/bottle must be < 50 % of a uncrushed can/bottle. Marking team to inspect 50% crushed

### 10.1.3 Capacity

Solar powered garbage bins are to be able to hold 50 crushed cans and 50 PET bottles without having to be emptied

Maximum Marks: 2

#### Assessment procedure

If unit can hold 50 aluminium cans without being emptied – 1 Mark

If unit can hold 50 PET bottles without being emptied – 1 Mark

#### Evaluation process

If the unit can complete the evaluation for 10.1.15 without having to be emptied, then it is considered to be able to hold 50 crushed cans and 50 PET bottles.

#### 10.1.4 Display

Unit is to have a visual display for when the unit is ready for use, when the unit is in use and when the unit needs to be emptied.

Maximum Marks: 4

##### Assessment procedure

Visual indicator for ready to use – 1 Mark

Visual indicator for in use – 1 Mark

Visual indicator for bottle container needs to be emptied – 1 Mark

Visual indicator for can container needs to be emptied – 1 Mark

##### Evaluation process

Unit will be inspected when ready for operation, when in operation and when it needs to be emptied.

When unit is on but not crushing ready to use indicator should be on

When unit is crushing in use indicator should be on and ready to use indicator should be off.

Visual indicator for containers to be emptied will be checked by filling the bins.

The bin full light should not come on before the cans/bottles are at least 75% of the height of the bin but before the bin over flows.

#### 10.1.5 Operator Height

Unit is to have the container opening and controls at a comfortable height for use.

**Note** :- Unit is to have only one container opening

Maximum Marks: 1

##### Assessment procedure

Container opening is to be between 600mm and 1200mm from the ground- 0.5 Mark

Controls are between 600mm and 1200mm from the ground- 0.5 Mark

##### Evaluation process

Experts will measure the height of the container opening and controls from the ground.

#### 10.1.6 Controls

Unit is to have an on/off switch as well as an emergency stop button.

Maximum Marks: 2

##### Assessment procedure

On / off switch – 0.5 Marks

Emergency stop – 1.5 Marks

##### Evaluation process

Unit will be inspected and the controls will be demonstrated for function.

Emergency stop button will be tested during crushing cycle.

Unit has to finish crushing cycle after emergency stop is reset.



### 10.1.7 Material selection

Unit is to detect if a can or bottle has been placed in crusher.  
Unit is to only have one opening for bottles and cans  
Crushed cans and bottled should then be placed in separate bins.

Maximum Marks: 3

#### Assessment procedure

Unit separates crushed cans and bottles – 3 Marks

#### Evaluation process

One can then one bottle will be placed in the garbage bin and crushed.  
This process will then be repeated.  
After 2 cans and 2 bottles have been crushed the storage containers will be checked that cans and bottles are separate

### 10.1.8 Operation

Unit is to have ability to tell that the storage bins are in place.  
Unit is not to operate without storage bin for aluminium cans or PET bottles in place.

Maximum Marks: 1

#### Assessment procedure

Unit does not run with one or both storage bins removed - 1 Mark

#### Evaluation process

Unit will demonstrate ability to run with storage containers in place.  
Then each storage container will be removed one at a time and the unit will be tested to see if it can run.

### 10.1.9 Storage

Unit is to be able to store PET or Aluminium containers separately for easy recycling.

Maximum Marks: 3

#### Assessment procedure

Unit has container for crushed bottles – 1.5 Marks  
Unit has container for crushed cans – 1.5 Marks

#### Evaluation process

Unit will be inspected for separate containers for storing crushed cans and bottles

### 10.1.10 Safety

All elements of the solar powered garbage bin in motion must be protected. Guarding must be in place to prevent crush injuries.

No electric conductive part should be apparent.

No sharp edges should be able to be touched

Maximum Marks: 3

#### Assessment procedure

All moving parts must be protected and not be accessible by anything bigger than a 12mm diameter rod 75mm long.

All the conductible parts of the electrical circuit must be protected to not be accessible at all.

All sharp edges are to be removed.

- 3 marks if no moving component or component that could cause injury.

- reduce marks by 0.5 mark for each area not complying (3 experts must agree to confirm an area that could cause injury)

#### Evaluation process

All exposed components will be checked including edges that may be touched by operator in normal operating condition.

All moving parts and gaps to be checked with a rod 12mm in diameter and 75mm long (simulating a finger).

If the rod touches any moving component it is to be considered a pinch point.

Guards must not be physically distorted or moved during this test.

### 10.1.11 Emptying

Unit must have easy to empty storage containers.

Maximum Marks: 3

#### Assessment procedure

3 marks for fastest time then reduce 1 mark (proportional) per 5 seconds slower than fastest time of the other teams.

Note: Marks will be calculated using calculations in the CIS scoring system

#### Evaluation process

Teams will start 1 meter from the solar powered garbage bin.

Teams will be timed to remove the storage containers, then empty and refit the storage containers.

Solar powered garbage bin must then crush one can or bottle. (Cycle needs to be started)

Teams then return 1 meter away.

Time stops as soon as the team is 1 meter away and the visual indicator for in use has come on.

### 10.1.12 Weight

Unit is to be as light as possible for easy transport and installation.

Maximum Marks: 3

#### Assessment procedure

3 marks for lightest unit then reduce 1 mark (proportional) per 3 kilograms heavier than the lightest unit.

Note: Marks will be calculated using calculations in the CIS scoring system

#### Evaluation process

Experts will weigh the complete units with the storage bins empty.

### 10.1.13 Tamper proof

Unit is to have motor, crushing mechanism, storage bins and battery (batteries) inside a lockable container(s) to reduce public interference with the unit.

Maximum Marks: 1

#### Assessment procedure

If unit has motor, crushing mechanism, storage bins and battery (batteries) inside a lockable container(s). – 1 mark

If unit does not have the motor, crushing mechanism, storage bins and battery (batteries) inside lockable container(s). – 0 mark

#### Evaluation process

Unit will be inspected by experts to ensure all components are not able to be interfered with by the public.

#### 10.1.14 Unit Power

Power to operate the panel must be obtained from the solar panel and can be stored in a battery (batteries). Solar Panel(s) must be at least 0.3 meters square to be considered for this assessment. Teams are to provide points in the charge circuit that allow the measuring of current

Maximum Marks: 1.5

##### Assessment procedure

If unit has battery (batteries) and the battery (batteries) are charged from the solar panel(s) – 1.5 mark  
If unit has no battery OR battery is not charged from solar panel(s) – 0 mark

##### Evaluation process

Power to drive crusher must be connected to a battery (or batteries) that are charged by the solar panel. Solar Panel will be completely covered and the circuit will be checked for current. A light will then be shined on the solar panel and the circuit will be checked for current.

#### 10.1.15 Battery life

Unit must be able to crush cans or bottles without sunlight.

Maximum Marks: 3

##### Assessment procedure

If the unit can crush 100 cans or bottles– 3 marks  
If the unit can crush 66 cans bottles– 2 marks  
If the unit can crush 33 cans or bottles– 1 marks  
If the unit crushes less than 33 cans or bottles– 0 mark

##### Evaluation process

Teams are to crush 50 aluminium cans and 50 PET bottles.  
Experts are to randomly select the order of can and bottle crushing.  
E.g. Expert says bottle – bottle – can – bottle – etc.  
Crushing is to take no more than 60 minutes  
The amount of items crushed is to be counted after 60 minutes.

### 10.1.16 Maintenance

Unit must have easy to replace battery (batteries)

Maximum Marks: 3

#### Assessment procedure

3 marks for fastest time then reduce 1 mark (proportional) per 5 seconds slower than fastest time for other teams.

Note: Marks will be calculated using calculations in the CIS scoring system

#### Evaluation process

Teams will start 1 meter from the solar powered garbage bin.

Teams will be timed to remove the battery (batteries) and display

Then carry the battery (batteries) and display 1 meter away.

Then carry the battery (batteries) and display back to the solar powered garbage bin and reinstall the battery (batteries) and display.

Solar powered garbage bin must then crush one can (cycle needs to be started).

Teams then return 1 meter away.

Time stops as soon as the team is 1 meter away and the visual indicator for in use has come on.

## 11 ASSESSMENT ORDER

- 10.1.1 Three (3) units produced

**Teams are to number their units 1-3. Experts will then randomly select a unit number to be used for all further testing.**

- 10.1.7 Material selection
- 10.1.5 Operator Height
- 10.1.6 Controls
- 10.1.10 Safety
- 10.1.12 Weight
- 10.1.13 Tamper proof
- 10.1.16 Maintenance
- 10.1.8 Operation
- 10.1.9 Storage
- 10.1.15 Battery Life
- 10.1.3 Capacity
- 10.1.2 Bottles and Cans
- 10.1.4 Display
- 10.1.11 Emptying
- 10.1.14 Unit power

## 12 MATERIALS AND PRODUCTION COSTS

NOTE: all costs to be calculated in euro (€)

### 12.1 Working hours

NOTE: when one member of a team is working, all the team members will be counted, therefore team cost would be 90€/hour. Labour and equipment costs when working on the surprise project are to be included with the main project labour and equipment costs.

### 12.2 Additional cost for using equipment

- For using workshop equipment, E.g. welding, computer, grinding, sheet metalwork, drilling and saw: 15€/hour
- For using a conventional mill and lathe: 25€/hour
- For using a CNC mill: 35€/hour
- Consultant or training services: 60€/hour

The minimum time for each machine is fifteen (15) minutes.

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 22.50€ (representing 15 minutes of cleaning time) will be applied if machine is not cleaned. If a machine is considered not cleaned, experts will be called to inspect that machine – three experts must agree. Their decision is final. Equipment use cost only to be applied to equipment supplied by the organizers. No cost for using portable equipment provided by teams.

### 12.3 Raw materials

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 and to be included in section A of portfolio. Extrusions and profile will be priced by length. Cost must be verified by experts to reflect commercial cost. Cost for raw materials to be applied:

- Mild sheet – 7€/kg
- Aluminum – 10€/kg
- Brass – 37€/kg
- Stainless steel – 28€/kg
- Plastic – 20€/kg
- PCB – 0.50€/cm<sup>2</sup>
- Batteries Pb, NiCd, NiMh etc - 0,5€/Wh
- Batteries Lithium – 1.5€/Wh

NOTE: Currency conversion rates will be fixed at **Tuesday, 2nd April 2013** and will be taken from <http://www.xe.com/>. These exchange rates will be posted on the MTC discussion forum on this date.

## 12.4 Cost Calculations

Costing will be broken up into the following groups

Working hours – 7.5 marks - For every 10% more expensive than the team with the lowest calculated working hour cost (see note below) - 0.5 mark will be deducted proportionally.

•Additional cost for using equipment - 5 marks - For every 10% more expensive than the team with the lowest additional equipment cost (see note below) - 0.33 mark will be deducted proportionally.

•Raw materials – 2.5 marks - For every 10% more expensive than the team with the lowest calculated raw materials cost (see note below) - 0.17 marks will be deducted proportionally.

**Note:** For all groups the following calculation will be made

### Step 1

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

$$\text{Final Cost} = \frac{\text{Total Cost}}{\% \text{ compliance to specification}}$$

Example

- If total cost is €2,500 and compliance is 100% then build cost would be €2,500
- If total cost is €2,500 and compliance is 80% then build cost would be €3,125
- If total cost is €2,500 and compliance is 60% then build cost would be €4,167
- If total cost is €2,500 and compliance is 40% then build cost would be €6,250
- If total cost is €2,500 and compliance is 20% then build cost would be €12,500
- If total cost is €2,500 and compliance is 0% then no marks awarded for cost section.

**Note:** Marks will be calculated using calculations in the CIS scoring system

## 13 PORTFOLIO ASSESSMENT

The portfolio will consist of two sections, section A and section B:

The section B includes documentation prepared during the Competition. The time taken to complete this section will be costed as part of the main project. Assessment of section B is included in the main project assessment.

Section A: This section will be presented prior to the Competition and will be assessed during the Competition. All portfolios are to be in the English language.

The section A is to be in electronic format but presented in both hard copy and electronic form, and should include:

- Team member details
- Team preparation
- Poster display
- Design calculations
- Computer generated 3 day Competition manufacturing schedule
- List of all materials and components and their costs (with evidence) provided by the team.
- Operation and troubleshooting manual

NOTE: When assessing the portfolio using the above criteria, 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).



### 13.1 Details of team and team members

Maximum Marks: 0.25 marks

This section should contain the following details for each team member:

- Your country
- Name
- Date of birth
- Home location
- Educational and vocational background
- Employer's name and business location

- 0.25 mark if the team details are complete and meet minimum requirements
- 0 mark if incomplete or does not meet minimum requirements

### 13.2 Team preparation

Maximum Marks: 0.25 marks

This section should contain the following details for each team member:

- Worldskills regional Competitions results
- Specific role and skills provided by each member of the team
- Details of training undertaken by individuals or the team in preparation for the Competition.

- 0.25 mark if the team preparation is complete and meets minimum requirements
- 0 mark if incomplete or does not meet minimum requirements

### 13.3 Poster display

Maximum Marks: 1.0 mark

A poster is also to be displayed explaining to the public how each unit operates and explaining the reason for using solar powered garbage bin.

To include:

- Minimum size 500mm x 700mm
- Explanation of basic operation of the solar powered garbage bin
- 3D model drawing of solar powered garbage bin
- Performance specifications of team's solar powered garbage bin
- Poster in English language (may also have duplicate in team's language)
- Poster complete and displayed to the public during the Competition.

- 1.0 mark if the poster is complete and meets minimum requirements
  - Minimum poster size – 0.15 marks
  - Explanation of basic operation of the solar powered garbage bin – 0.2 marks
  - 3D model drawing of solar powered garbage bin – 0.2 marks
  - Performance specifications of team's solar powered garbage bin – 0.15 marks
  - Poster in English language (may also have duplicate in team's language) – 0.15 marks
  - Poster complete and displayed to the public during the Competition. – 0.15 marks

### 13.4 Calculations

Maximum Marks: 1.0 mark

Design calculations must include:

- solar powered garbage bin force required for crushing
  - solar powered garbage bin battery size
  - Theory calculation of weight of the complete solar powered garbage bin
  - Estimated cost of complete solar powered garbage bin
- 1 mark if calculations are complete and meets minimum requirements
- solar powered garbage bin force required for crushing – 0.25 marks
  - solar powered garbage bin battery size – 0.25 marks
  - Theory calculation of weight of the complete solar powered garbage bin – 0.25 marks
  - Estimated cost of complete solar powered garbage bin – 0.25 marks

### 13.5 Computer generated 3 day Competition manufacturing schedule

Maximum Marks: 0.5 mark

A computer generated manufacturing schedule for the 3 days Competition, including the activities involved within the section B of the portfolio, is to be presented in printout format and electronic format. This manufacturing plan will need alteration after the surprise project is known to the teams. A spreadsheet format is acceptable.

- 0.5 Marks if the manufacturing schedule is complete and meets minimum requirements – must include working hours, machine requirements and tasks for all team members
- 0 mark if incomplete or does not meet minimum requirements

### 13.6 List of all materials and components provided by the team

Maximum Marks: 1.0 mark

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 and to be included in section A of the portfolio. Refer to the raw material cost section to know the prices applied. Extrusions and profile sections will be priced by length. Cost must be verified by experts to reflect commercial cost. Cost for raw materials to be applied:

- Mild sheet – 7€/kg
- Aluminum – 10€/kg
- Brass – 37€/kg
- Stainless steel – 28€/kg
- Plastic – 20€/kg
- PCB – 0.50€/cm<sup>2</sup>
- Batteries Pb, NiCd, NiMh etc - 0,5€/Wh
- Batteries Lithium – 1.5€/Wh

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

A list of purchased items, raw materials and their costs is to be presented in Spreadsheet format.

**Note** :- Solar Panel, are excluded from costing to make it even for all countries.

- 1 mark if the spreadsheet contains all raw materials and purchased items and is complete and in spreadsheet format and meets minimum requirements – drawings will be checked for materials and components.

- 0 mark if incomplete or does not meet minimum requirements

### 13.7 Operation and troubleshooting manual

Maximum Marks: 1.0 mark

A operation and troubleshooting manual for the solar powered garbage bin is to be provided

Should include

- Set up of solar powered garbage bin
- Operation of solar powered garbage bin
- Emptying of the storage containers
- Replacement of battery
- Replacement of crushing components
- Safe operating procedures
- Presented in a folder

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

- Set up of solar powered garbage bin – 0.15 marks
- Operation of solar powered garbage bin – 0.15 marks
- Emptying of the storage containers – 0.15 marks
- Replacement of battery – 0.15 marks
- Replacement of crushing components – 0.15 marks
- Safe operating procedures – 0.15 marks
- Presented in a folder – 0.1 marks

## 14 PORTFOLIO ASSESSMENT PART B

### 14.1 2D detail drawings

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

Maximum Marks: 6.0 marks

#### Assessment process

- 6 marks if drawings acceptable and for at least 90% of components

#### Evaluation process

NOTE: only manufactured items by the team during the Competition must be drawn in 2D.

#### **STEP 1**

- Count the number of drawings required for all manufactured components - check solar powered garbage bin
- all manufactured components
- Count the number of drawings presented and calculate the % of drawings submitted
- 0.8 marks if more than 90% of drawings are presented
- 0.2 marks if drawings are presented in a folder (may be in a one drawing folder with all drawings)

#### **STEP 2**

Select FIVE (5) drawings randomly (independent expert to select) - assess these drawings only – each drawing 0.6 marks maximum. Marking is to be recorded on a chart which is to be verified by all members of the marking team.

Mark Allocation for drawings 1 to 5

0.25 marks if drawing has title block drawing title, drawing number and drawing border

0.25 marks if drawing contains correct views and projection

0.25 marks if drawing is accurate to the solar garbage bin.

0.25 marks if drawing has appropriate dimensions with tolerances, and machine finishes (where required)

### 14.2 Electrical/Electronic Circuit Drawing

Maximum Marks: 1.0 mark

#### Assessment process

- 1 marks if drawing acceptable and meets assessment checklist

#### Evaluation process

NOTE: labeled block representation is accepted as well as electrical/electronic graphics library

- 0.2 marks if drawing has drawing title, drawing number and drawing border
- 0.2 marks if drawing uses electrical/electronic symbols or block representation with component values
- 0.2 marks if drawing is CAD/electronically generated
- 0.2 marks if drawing to contains battery, motor, & switches
- 0.2 marks if drawing contains electronic charge circuit.

### 14.3 3D Assembly drawing

Maximum Marks: 3.0 marks

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

- 3 marks if drawing is acceptable

#### Evaluation process

- 0.2 marks if drawing has drawing title, drawing number, and drawing border
- 0.4 marks if drawing is CAD/electronically generated – i.e. drawing created on the computer and not a freehand drawing.
- 0.4 marks if drawing has parts/material list and parts/material list to be referenced to drawings
- 0.5 marks if drawing contains 90% of manufactured components
- 0.5 marks if drawing has solar powered garbage bin frame - should contain the frame or base – this should be included in the drawing.
- 0.5 marks if drawing has crushing mechanisms – all hydraulics or gear systems should be shown
- Purchased items may be drawn as a block and not drawn in detail.
- 0.3 marks if drawing has storage containers and guarding for the solar powered garbage bin
- 0.2 marks if drawing is presented in folder (may be in a one drawing folder with all Drawings )