Manufacturing Team Challenge

Technical Description

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WorldSkills UK National finals takes place in November of each year. Of the suite of competitions taking place annually there are a few that require a team of people to compete, though most competitions are for single entrants. The Manufacturing Team Challenge (MTC) is one of the competitions requiring team entrants.

The MTC requires a team of three people competing as complementary specialists, combining skills such as project management, electronics, programming, machining and computer aided design. Time, cost and quality are all factors in the competition; in addition to individual talents, participants must contribute to the team as a whole, showing self-awareness, interpersonal skills, and thinking outside the boundaries of their own area of expertise.

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1 General Information

1.1 Documentation and Sources of Information

The MTC requires a team of three people competing as complementary specialists, combining skills such as project management, electronics, programming, machining and computer aided design. Time, cost and quality are all factors in the competition; in addition to individual talents, participants must contribute to the team as a whole, showing self-awareness, interpersonal skills, and thinking outside the boundaries of their own area of expertise.

WorldSkills UK LIVE

MTC 20xx Briefing Video. The link will be emailed to all competition entrants directly. However, subscribing to **United Kingdom MTC** video channel on YouTube you can access this and other support videos.

More Information

For competition information, further resources including how to register, competition rules and steps for competing, visit:

https://worldskillsuk.org/champions/national-skills-competitions/tools-and-resources

WorldSkills UK LIVE MTC Google Classroom

To join the Classroom go to classroom.google.com, click on Join and enter using code **7v4g6q2**

Contents:

- WorldSkills UK LIVE Guide to the MTC competition.
- WorldSkills UK LIVE MTC Portfolio B support video link: https://www.youtube.com/watch?v=5gzjH6F96UM
- Template spreadsheet for all raw materials.
- Example competition booking sheets.
- Flowcode 8 instructional video links, for those seeking support with programming.
- Google resources video link to help use the google classroom.

1.2 Notes

This document is designed as a guide to the training and selection of a team. It is not an exhaustive list and many other factors may be considered.

During the competition and qualifier work, the test project is designed to assess:

- knowledge
- understanding
- design skills
- ability to work under pressure and redesign or adapt schedules
- test core skills
- assess a team's ability to work together.

The specification list in section 2 gives a guide to the assessment areas and requirements that the brief is designed to fit.

It also gives a map to the criteria for 2016 BTEC L3 national qualifications in Engineering and City and guilds 2850-20 and 7682-20 qualifications.

This is not exhaustive but provides good guidance to the areas which commonly occur between the competition and with these qualifications.

The sum total of any marking scheme will be 100, therefore the brief will be designed to give a total of 100 marks, distributed as follows:

Element	Marks	Weighting
Main Project	40 – 45	40 – 45%
Costings	5 – 10	5 – 10%
Portfolio A	10	10%
Portfolio B	10 – 15	10 – 15%
Surprise Projects	30	30%
	100 Marks	**100%**

2 The National Competition: Specification and Cross-referencing Map to BTEC L3 National and City & Guilds Engineering Qualifications

Criteria Number	Criteria Teams will demonstrate they are able to:	BTEC L3 National 2016 Specification for Engineering map Unit	 Criteria	City & Guilds 2850-20 Map Unit	 Learning outcome	City & Guilds 7682-20 map Unit	 Learning outcome
A1	observe all relevant health and safety rules of the competition and venue	Unit 2: Delivery of engineering processes safely as a team	A.P1 A.P2 A.M1 A.D1 C.P5 C.P6 C.P7 C.P8 C.M3 C.D3	201	1	201 202	1 2 1 2
A2	use machinery in a safe manner and reinstate machinery to a clean condition after use	Unit 2: Delivery of engineering processes safely as a team	A.P1 A.P2 A.M1 A.D1 C.P5 C.P6 C.P7 C.P8 C.M3 C.D3	205 206	1 (1) 3 (8) 2(6)	201 202	1 2 1 2
A3	prepare and maintain the work area, with good housekeeping evident.	Unit 2: Delivery of engineering processes safely as a team	A.P1 A.P2 A.M1 A.D1 C.P5 C.P6 C.P7 C.P8 C.M3 C.D3	201	1	201 202	1 2 1 2
A4	work effectively as a team	Unit 2: Delivery of engineering processes safely as a team	C.P5 C.P6 C.P7 C.P8 C.M3 C.D3	201 203	4 1	202	1 2
A5	schedule work in an effective manner accounting for team member strengths, weaknesses and skills	Unit 2: Delivery of engineering processes safely as a team	C.P8 C.M3 C.D3	201	4	202	1 2
A6	design a product to be constructed within time and cost limits	Unit 3: Engineering product design and manufacture	A2 A5			262	1 2
		Unit 39: Modern manufacturing systems	All criteria may be used, depending upon the project.				
		Unit 40: Computer aided manufacturing and planning	C.P5 C.P6 C.M3 C.D3				
A7	understand project specifications	Unit 3: Engineering product design and manufacture	A1 A3 C1			203 262	1 2 1 2
A8	clarify uncertainty in a design brief	Unit 3: Engineering product design and manufacture	A3 C1	201	2 (3,4)	203 262	1 2 1 2
A9	understand test parameters of a product	Unit 3: Engineering product design and manufacture	B4				
A10	select appropriate materials for a design specification	Unit 3: Engineering product design and manufacture	A4	202 203	1 2 2		
		Unit 25: Mechanical behaviour of metallic materials	All criteria may be used, depending upon the project.				
		Unit 26: Mechanical behaviour of non-metallic materials	All criteria may be used, depending upon the project.				
A11	develop a prototype product and test against the required standards	Unit 3: Engineering product design and manufacture	B4 B5 C1				
A12	use information from a prototype to refine and develop an end product	Unit 3: Engineering product design and manufacture	B4 B5 C1 C3 D1 D2			262	1 2
		Unit 21: Electronic measurement and testing circuits	All criteria may be used, depending upon the project.				
A13	use manufacturing techniques to minimise production cycle time of a product	Unit 3: Engineering product design and manufacture	A6 B5	203	3	262	1 2
		Unit 39: Modern manufacturing systems	All criteria may be used, depending upon the project.				
A14	commission a product and check it's function	Unit 3: Engineering product design and manufacture	B4 B5				
		Unit 21: Electronic measurement and testing circuits	All criteria may be used, depending upon the project.				
A15	create designs to meet a specification	Unit 3: Engineering product design and manufacture	B1 B2 B3 B5 C1 D1 D2			262	1 2
		Unit 12:Pnuematic and hydraulic systems	All depending upon project solution				
A16	use appropriate calculations to inform the design process	Unit 1: Engineering principles	All criteria may be used, depending upon the project.	202 221	3 4 1 2 3		
		Unit 7: Calculus to solve engineering problems	All criteria may be used, depending upon the project.				
		Unit 8: Further engineering mathematics	All criteria may be used, depending upon the project.				
		Unit 27: Static mechanical principles in practice	All criteria may be used, depending upon the project.				
		Unit 28: Dynamic mechanical principles in practice	All criteria may be used, depending upon the project.				
A17	create 2D mechanical drawings to ISO standards	Unit 2: Delivery of engineering processes safely as a team	B.P3 B.M2 B.D2	201	3	204 261	1 2 1 2
		Unit 3: Engineering product design and manufacture	C2				
		Unit 10:Computer aided design in engineering	A.P1 A.P2 A.M1 A.D1 B.P3 B.P4 B.M2 B.D2				
A18	create 3D mechanical drawings to ISO standards	Unit 3: Engineering product design and manufacture	C2	201	3	204 261	1 2 1 2
		Unit 10:Computer aided design in engineering	C.P5 C.P6 C.M3 C.M4 C,D3				
A19	create circuit schematics to best practice standards	Unit 2: Delivery of engineering processes safely as a team	B.P4 B.M2 B.D2			232	1 2
		Unit 3: Engineering product design and manufacture	C2				
A20	design and construct jigs and fixtures for manufacture			206 231	2 1 2 3 4	241 242	1 2 1 2
A21	use jigs and fixtures to reduce manufacture time			206 231	2 1 2 3 4	241 242	1 2 1 2

Criteria Number	Criteria Teams will demonstrate they are able to:	BTEC L3 National 2016 Specification for Engineering map Unit	 Criteria	City & Guilds 2850-20 Map Unit	 Learning outcome	City & Guilds 7682-20 map Unit	 Learning outcome
A22	minimise tooling and operations for manufacture of the product	Unit 39: Modern manufacturing systems	C.P5 C.P6 C.P7 C.M3 C.M4 C.D3				
A23	manufacture components to stated tolerances and specification	Unit 30: Mechanical measurement and inspection technology	All criteria may be used, depending upon the project.			203	1 2
A24	assemble components to create a final product in an effective manner	Unit 46: Manufacturing joining, finishing and assembly processes	All criteria may be used, depending upon the project.			205 206	1 2 1 2
A25	use a range of methods to join materials, such as bolts, fasteners, glue, weld and other suitable methods	Unit 3: Engineering product design and manufacture Unit 46: Manufacturing joining, finishing and assembly processes	A6 A1 A2 A3 A4	212	1 2 3 4		
A26	test run the product						
A27	use the product for the designed purpose						
A28	design control circuits	Unit 17: Power and energy electronics Unit 19: Electronic devices and circuits Unit 22: Electronic printed circuit board design and manufacture Unit 23: Digital and analogue electronic systems	All apply depending upon design solution All apply depending upon design solution All apply depending upon design solution All apply depending upon design solution	224	1 2 3		
A29	use PCB or other substrate to construct circuits	Unit 19: Electronic devices and circuits Unit 20: Analogue electronic circuits Unit 22: Electronic printed circuit board design and manufacture	B.P5 B.M5 C.P8 C.M7 C.D3 B.P2 B.M2 C.P5 C.M4 C,D2 All apply depending upon design solution			236	1 2
A30	program microprocessors, PLC's or computer systems and integrate them into the designed product	Unit 6: Microcontroller systems for engineers Unit 32: Computer system principles and practice Unit 35: Computer programming Unit 36: Programmable logic controllers	All, dependant upon the project B.P4 B.M2 C.P5 C.P6 C.M3 BC.D2 D.P7 D.P8 D.M4 D.D3 B.P2 B.P3 B.M3 B.M3 C.P4 C.P5 C.M4 C.M5 BC.D2 C.P3 C.P4 C.M3 CD.D3			240	1 2
Additional information referring to section A		Unit 5: A specialist engineering project. An MTC design and paperwork required, forms a strong base for the satisfaction of all unit 5 criteria. Unit 39: Modern Manufacturing Systems, provides a very good basis for techniques that can be applied to speed up, check and design a work schedule and working system for the MTC competition.		Most units make reference to reinstatement of the work area A2		Units 252, 253, 265, 266, 267 and 268 apply to sections A and D, dependant upon team design and finish requirements and surprise project design. But these units are more general	
B1	minimise labour costs involved in the manufacture of a product	Unit 4: Applied commercial and quality principles in engineering	B.P4 B.M2 B.D2 C.P6 C.M4 C,D3	203	3	262 264	1 2 1 2
B2	minimise machine usage costs involved in the manufacture of a product	Unit 4: Applied commercial and quality principles in engineering	B.P4 B.M2 B.D2 C.P6 C.M4 C,D3	203	3	262 264	1 2 1 2
B3	minimise raw material and component costs involved in the manufacture of a product	Unit 4: Applied commercial and quality principles in engineering	B.P4 B.M2 B.D2 C.P6 C.M4 C,D3	203	3	262 264	1 2 1 2
C1	create a full costing for a product	Unit 4: Applied commercial and quality principles in engineering	B.P4 B.M2 B.D2 C.P6 C.M4 C,D3			262 263 264	1 2 1 2 1 2
C2	create instructions for a product	Unit 3: Engineering product design and manufacture	C2			203 262 263	1 2 1 2 1 2
C3	create a maintenance manual for a product	Unit 3: Engineering product design and manufacture	C2			203 262 263	1 2 1 2 1 2
C4	create material for advertising a product such as pamphlets and videos	Unit 3: Engineering product design and manufacture	C2			203 262 263	1 2 1 2 1 2
C5	demonstrate through calculation the effectiveness of a product	Unit 1: Engineering principles Unit 7: Calculus to solve engineering problems Unit 8: Further engineering mathematics	All criteria may be used, depending upon the project. All criteria may be used, depending upon the project. All criteria may be used, depending upon the project.	202 221	3 4 1 2 3		
C6	develop an effective work plan.					262 263 264	1 2 1 2 1 2

Criteria Number	Criteria Teams will demonstrate they are able to:	BTEC L3 National 2016 Specification for Engineering map Unit	 Criteria	City & Guilds 2850-20 Map Unit	 Learning outcome	City & Guilds 7682-20 map Unit	 Learning outcome
D1	use turning techniques to make a given product or products	Unit 40: Manufacturing secondary machining processes	All criteria may be used, depending upon the project.	205	1 2 3	211	1 2
D2	use turning techniques to an accuracy of 0.05mm when machining diameters	Unit 30: Mechanical measurement and inspection technology	B.P2 B.P3 B.M2 B.M3 B.D2	205	1 2 3	211	1 2
		Unit 40: Manufacturing secondary machining processes	All criteria may be used, depending upon the project.				
D3	use turning techniques to an accuracy of 0.1mm when machining lengths	Unit 30: Mechanical measurement and inspection technology	B.P2 B.P3 B.M2 B.M3 B.D2	205	1 2 3	211	1 2
		Unit 40: Manufacturing secondary machining processes	All criteria may be used, depending upon the project.				
D4	use standard tooling when turning a product from steel or aluminium	Unit 40: Manufacturing secondary machining processes	B.M2	205	1 2 3	211	1 2
D5	make chamfer cuts as specified in the given drawings	Unit 40: Manufacturing secondary machining processes	All criteria may be used, depending upon the project.	205	1 2 3	211	1 2
D6	use turning techniques to give a required surface finish	Unit 40: Manufacturing secondary machining processes	All criteria may be used, depending upon the project.	205	1 2 3	211	1 2
D7	Interpret 2D and 3D engineering drawings and symbols	Unit 10:Computer aided design in engineering	All criteria may be used, depending upon the project.	206	1 (3)	211	1 2
D8	clean down and reinstate machinery to a given standard.			205	3 (8)	211	1 2
D9	use a bandsaw or cut-off saw to cut material to a given size with a tolerance of 1mm	Unit 44: Fabrication manufacturing processes	C.P4 C.P5 C.M3 BC.D2	212 217 218 219	4 1 1 2	205 222 223	1 2 1 2 1 2
D10	use a box and pan manual folding machine to bend metal to a given angle, with a 1 degree tolerance	Unit 44: Fabrication manufacturing processes	C.P4 C.P5 C.M3 BC.D2	212 217	4 2	205 222 223	1 2 1 2 1 2
D11	use a guillotine to cut metal to size with a 1mm tolerance	Unit 44: Fabrication manufacturing processes	C.P4 C.P5 C.M3 BC.D2	212 217 218 219	4 1 1 2	205 222 223	1 2 1 2 1 2
D12	use MIG or TIG to weld steel using a variety of joints	Unit 13: Welding Technology	All criteria apply	212 214 215	1 2 3 1 2 3 4 1 2 3 4	228 229	1 2 1 2
D13	form weld joints with no undercutting	Unit 13: Welding Technology	B.P4 B.M2 B.D2	212 214 215	3 (4) 4 (1) 4 (1)	228 229	1 2 1 2
D14	form weld joints with no porosity	Unit 13: Welding Technology	B.P4 B.M2 B.D2	212 214 215	3 (4) 4 (1) 4 (1)	228 229	1 2 1 2
D15	form weld joints with no cracking	Unit 13: Welding Technology	B.P4 B.M2 B.D2	212 214 215	3 (4) 4 (1) 4 (1)	228 229	1 2 1 2
D16	form a weld bead that does not deviate in size more than 2mm	Unit 13: Welding Technology	B.P4 B.M2 B.D2	212 214 215	3 4 4	228 229	1 2 1 2
D17	interpret welding drawings and symbols					228 229	1 2 1 2
D18	form solder joints that are bright, shiny and have no dry joints	Unit 19: Electronic devices and circuits	B.P5 B.M5 C.P8 C.M7 C.D3			236	1 2
		Unit 20: Analogue electronic circuits	B.P2 B.M2 C.P5 C.M4 C,D2				
		Unit 22: Electronic printed circuit board design and manufacture	All apply depending upon design solution				
D19	clean away solder splashes from circuit boards	Unit 19: Electronic devices and circuits	B.P5 B.M5 C.P8 C.M7 C.D3	224	1 2 3	236	1 2
		Unit 20: Analogue electronic circuits	B.P2 B.M2 C.P5 C.M4 C,D2				
D20	assemble electronic circuits and combination of schematics, layout diagrams and pictorial/written instructions	Unit 19: Electronic devices and circuits	B.P5 B.M5 C.P8 C.M7 C.D3	224	1 2 3	236	1 2
		Unit 20: Analogue electronic circuits	B.P2 B.M2 C.P5 C.M4 C,D2				
D21	test and commission an electronic circuit	Unit 21: Electronic measurement and testing of circuits	All criteria could apply	224	1 2 3	236	1 2
D22	perform programming tasks with given instructions	Unit 6: Microcontroller systems for engineers	All, dependant upon the project			240	1 2
D23	correctly orientate and fit components	Unit 20: Analogue electronic circuits	B.P2 B.M2 C.P5 C.M4 C,D2	224	1 2 3	236	1 2
		Unit 19: Electronic devices and circuits	B.P5 B.M5 C.P8 C.M7 C.D3				
D24	fit electronic components and circuit boards to a given enclosure	Unit 46: Manufacturing joining, finishing and assembly processes	All criteria may be used, depending upon the project.			236	1 2
D25	build an electronic circuit, turn a piece of metal or form a fabricated and welded part that conforms to the given schematic, layout diagram or drawing.	Unit 2: Delivery of engineering processes safely as a team	B.P3 B.M2 B.D2				
		Unit 3: Engineering product design and manufacture	C2				
		Unit 10:Computer aided design in engineering	A.P1 A.P2 A.M1 A.D1 B.P3 B.P4 B.M2 B.D2				
Additional information referring to section D				All units make reference to reinstatement of the work area D8		Units 252, 253, 265, 266, 267 and 268 apply to sections A and D, dependant upon team design and finish requirements and surprise project design. But these units are more general	

3 Assessment

There are three broad types of assessment. Objective, judgement and comparative.

3.1 Objective Assessment

This is marked on a simple yes or no criteria.

The brief will specify the assessment method in detail as to how the project or portfolio will be assessed. It will ask for the project to be able to demonstrate a particular function or ask for a particular element to be included in one of the portfolios.

If the criteria asked for can be demonstrated in the way asked for, or the portfolios contain the asked for information, the mark will be given.

Surprise projects also have most of their marks allocated this way.

It is extremely important to ensure that the project can do the required function in the stipulated way.

It is also critical to ensure that the portfolio contains exactly what has been asked for as a minimum.

Labelling each section with the heading from the brief is not necessary, but this does ensure that the information presented is the information being asked for, with attention drawn to the fact it has been included.

3.2 Judgement Assessment

This follows a set structure. Each judge will award:

0	Does not meet industry standard
1	Meets industry standard
2	Meets market standard
3	Meets and exceeds market standard

Each of these marks will be totaled to give the proportion of the available marks to be awarded.

E.G. Judge 1 awards a 2, Judge 2 awards a 3, judge 3 awards a 2. The total is 7 from a possible nine. Therefore 7/9ths of the marks available will be awarded.

3.3 Comparative assessment

This type of assessment is only used for the main project and costings.

The main project uses this type of assessment as follows:

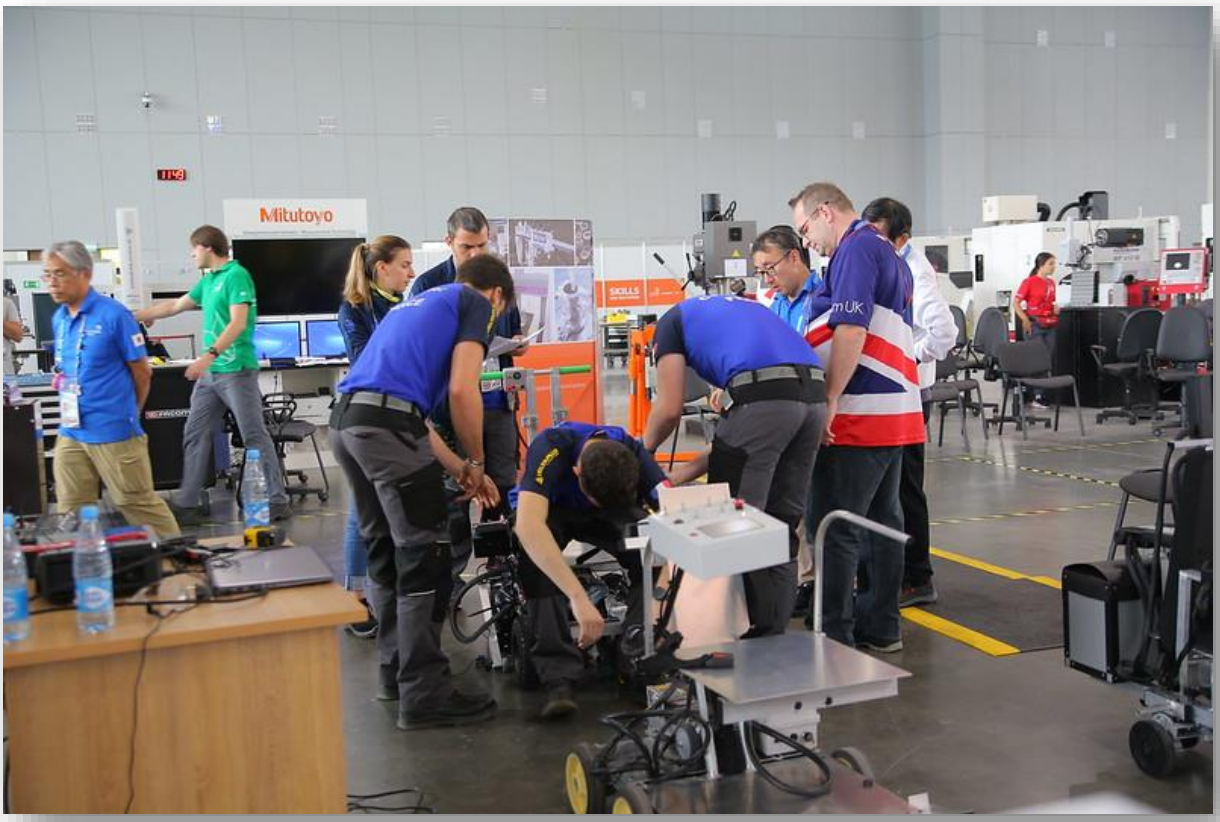
The best performing team will receive the full mark available. The lowest performing team will receive 0 marks. All other teams will be graded proportionally between the top and bottom teams.

Examples: Fastest to complete the time trial, lowest weight or heaviest weight lifted.

The costings section uses this type of assessment as follows:

The lowest cost, after adjustment by compliance, sets the benchmark value and receives full marks.

The benchmark value is then doubled. For teams costing twice the benchmark value, or more expensive, the score will be 0. Between the benchmark value and 2 x the benchmark value, the team will receive a proportional grade to this.



Compliance

This is the main project marks as a percentage. This adjusts the costings proportionally to the mark. The lower the score in the main project, the higher the costings become. See brief for details.

4. Competition

4.1 Costings

The costings marks will be calculated by comparing team's build cost, build time, machinery hire costs and compliance to project specifications.

Marking will be on the basis of product cost and will include Competitors' work time, materials used, components used, any consulting fees, and machine tool and tooling costs. Required tolerances must be met for a result to be valid.

Note: any penalties applied are applied to the costings. The list of penalties can be found in the brief.

Each team must make sure to record the time they start and finish each shift and clearly indicate what activity they are working on (for machine costs).

Main Project labour hours and machine usage hours will be costed at an hourly rate. This hourly rate will be calculated in Euros.

Hourly rates are:

€90.00/person/hour	Each Teams working time
€15.00/hour	For using workshop equipment, e.g. welding, grinding, sheet metalwork, pillar drill and saw
€25.00/hour	For using a lathe
€40.00/hour	Consultant and training

Sections of the portfolio must be done during the Competition and will be costed as working time.

There may be other forms of assessment for sub-categories of the Main Project such as cycle time where applicable which may also translate to cost per product item made and inclusion of specific items of documentation. Multiple awards may be made.

The time taken to complete any surprise projects will also count for machinery hire and labour costs, but not for raw material costs.

Compliance

This is the main project marks as a percentage. This adjusts the costings proportionally to the mark. The lower the score in the main project, the higher the costings become. See brief for details.

4.2 Raw Material Costs

The components for the main project that are supplied by the team must be fully costed. For most components this will be at a cost found on an online catalogue with a weblink inserted into the required spreadsheet that can be used to verify this cost.

For raw materials the cost is fixed and must be applied as follows:

€0.50/cm2	PCB
€0.50/Wh	Batteries: PB, NiCd, NiMh
€1/Wh	Batteries: Lithium
€7/Kg	Mild Steel
€10/Kg	Aluminium
€28/Kg	Stainless Steel
€37/Kg	Brass

All raw material purchased by length must be brought to the competition at least 50mm longer than the size required.

All raw material purchased by sheet must be brought to the competition at least 50mm oversize in two sides so that two cuts must be made.

The template spreadsheet given on the google classroom must be used correctly for marks to be given.

4.3 Time-keeping

Machines are to be booked and allocated in 15 minutes increments.

Standard machine booking sheets to be used during competition are provided on the google classroom for practice purposes.

Working hours and actual machine usage hours are calculated to the accuracy of the handwritten time-keeping system. Failure of a team to book off for lunch or a break will result in the cost of that time being incurred.

The minimum increment for consultant time is 15 minutes.

Time-keeping is handwritten by the Experts and teams are responsible for ensuring the correct bookings and times are recorded. The time-keeping is done with three-minute tolerances.

Standard time sheets to be used during competition are provided on the google classroom and will be provided at the competition.

After a machine usage, the Competitor or team must clean down the machinery. This is done during booked time and it will be costed. An Expert will check the cleanliness before the Competitor can leave the machine. Swarf trays are not required to be emptied, but all other areas should be free of swarf.

4.4 Portfolio A

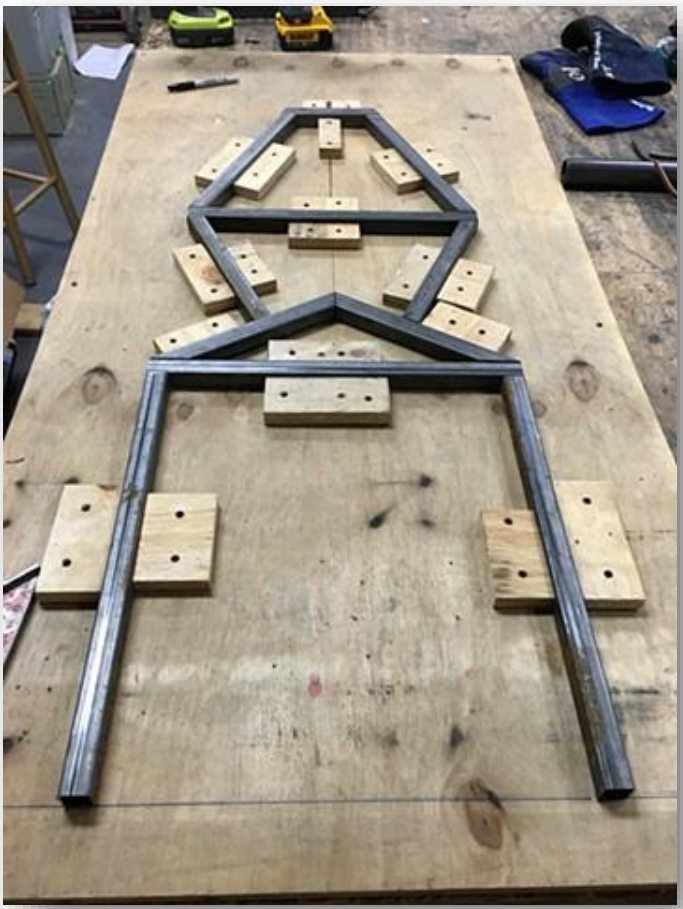
Portfolio A is to be presented on a memory stick, clearly labelled with the team name, on familiarisation day. The contents must include:

Video in the format listed in the brief. This will be checked and where it meets the requirements, displayed to the public during the competition.

Portfolio A in digital format containing all information asked for in the brief. This should be in PDF format.

Costings spreadsheet, containing a full list of all materials and components used in the construction of the product. This should be in Excel format.

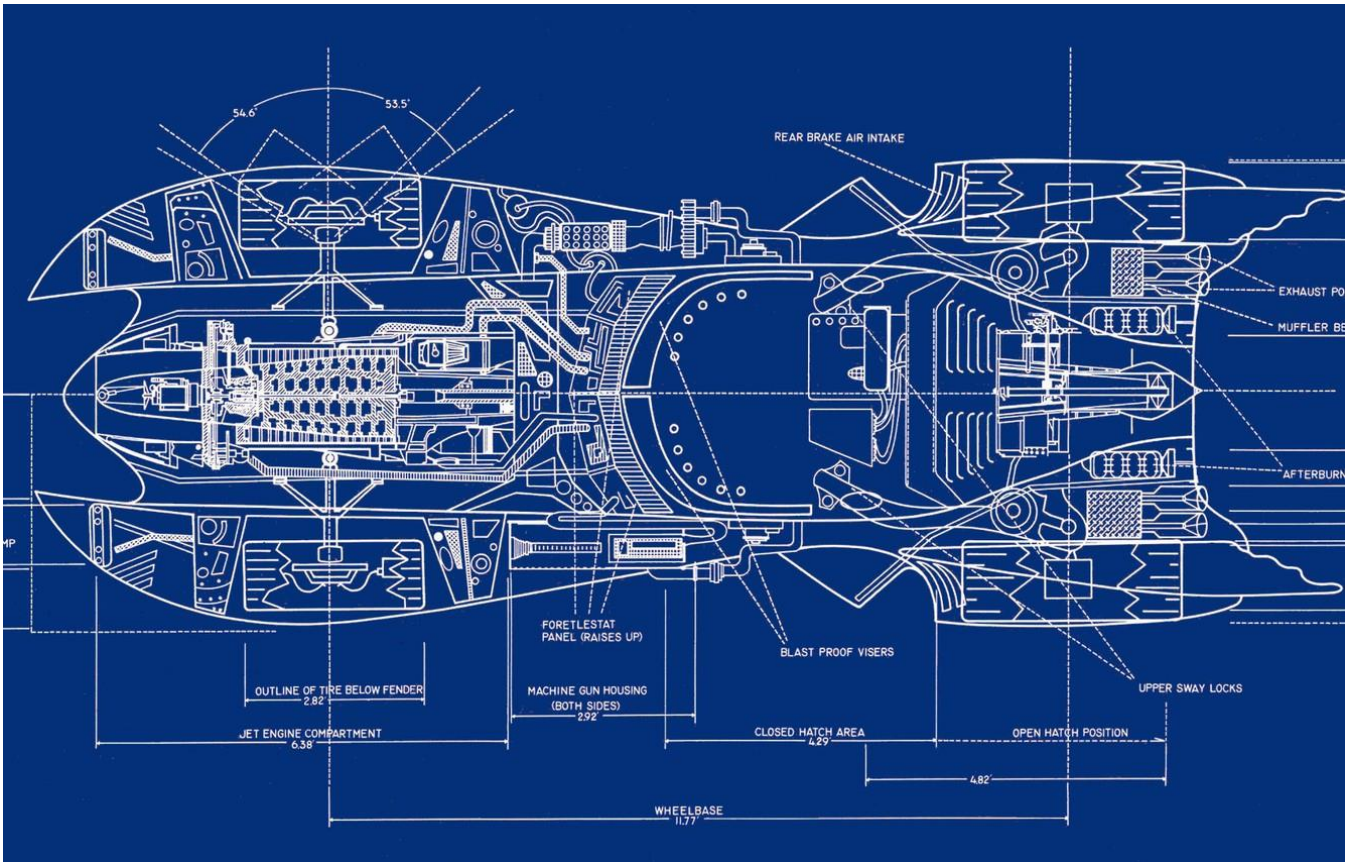
A full list and pictures of Jigs and Fixtures the team intend to use.



4.5 Portfolio B

Portfolio B is to be presented on familiarisation day as a printed copy on coloured paper, clearly labelled ‘Draft’ and with the team name visible. This includes:

- All 2D detail drawings
- All 3D assembly drawings
- All welding assembly drawings
- All electrical schematics
- Any other drawings the team wish to use during the competition



4.6 Toolbox Check

A toolbox check will be conducted to check: that materials are oversized as specified in section 4.2; all components brought have not been modified prior to competition; jigs and fixtures are coloured red and shown clearly in portfolio A. Any item found that is banned from the competition, modified in any way, or not meeting the oversize requirement will be removed or a time penalty added at the Judge’s discretion.

4.7 Test Project Design Requirements

The total working time for the Test Project and Surprise Projects will be a maximum of 16 team hours.

Design	• The task is to have all design work including process parts, jigs, and fixtures carried out in accordance with the instructions, specifications, drawings and parts, to the standard required by the brief.
Programme Generation	• Generate all programs required for the automated sections of the task during the competition time on software of the team's choice.
Manufacture	• Make any surprise projects as well as those parts needed for the working of the test project
Assembly	• Assemble the various components either purchased or manufactured during the competition as part of the task.
Optimisation	• Revise the manufacturing and assembly process to optimise cycle times and reduce the process cost.
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.

4.7 Test Project Design Requirements

Continued

Surprise Project

- The Surprise Test Projects will be of three categories:

1. Electronics

- The construction and commissioning of a kit, supplied with any combination of instructions, schematics or layout diagrams. The marking scheme shall test function, soldering quality, conformity to layout and neatness of work.

2. Fabrication & Weld

- Construction of a fabricated part or parts with some welding required. Teams will be free to choose from MIG and TIG welding. The part or parts shall be made of mild steel sheet to a maximum of #1.6mm and other mild steel extrusions, sections or components as supplied. The marking scheme shall test for conformity to drawing, work to set tolerances given on the drawings, weld quality, porosity, undercutting and weld cracking.

3. Manual Turning

- A single or pair of parts shall be turned as specified in the drawing given. Diameters will normally be asked to a tolerance of 0.05mm, lengths to a tolerance of 0.1mm. The part(s) maybe designed in a way to ask the machinist to carefully consider the order of work. The marking scheme shall test for conformity to drawing, conformity to tolerances and finish quality.

5. Competition Rules

- all competitors are required to wear appropriate PPE when on stand and when using any equipment.
- competitors must adhere to the health and safety regulations of the venue and of the stand.
- competitors are required to bring to competition all materials and tools required to build their project.
- the maximum time for all competition activities is 16-team hours, 48-man hours.
- teams must provide the full Portfolio A with costings spreadsheet and video on a clearly labelled USB stick on familiarisation day.
- teams must provide a draft copy of Portfolio B, printed on coloured paper and marked 'Draft' on familiarisation day, prior to toolbox check.
- teams may bring as many Draft copies of Portfolio B as required but must be supplied on coloured paper and marked 'Draft'.
- the Portfolio B being completed during the competition must be handed in for judges to mark by 12PM on day two of competition using only the USB stick provided.
- all surprise projects must be handed in for judges to mark by 5PM on day two of competition.
- judges may extend the working time at their discretion to account for equipment malfunctions, loss of power and other extenuating circumstances.
- no component may be modified prior to the start of competition.
- any component that can be made during the competition must be made and cannot be purchased as a component.
- any component that can be substituted for an item that can be made, must be. E.g. A linear actuator can be substituted for a lead screw assembly that can be manufactured during the competition.
- 25% of electronics may be preassembled by number of components. This does not include LCD panels which may be purchased outside of this count. This is to allow multi-component sensors etc to be used.
- the brief details Equipment and Materials not permitted. These items will not be allowed on stand.
- judges decisions are final.

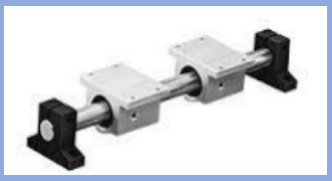
6. Guidance On Items Not Permitted To Be Used

The brief may contain specific items or materials that are not allowed, or which incur penalties for that competition only. That is a specific example that only applies to that competition and brief – competition briefs change with every cycle.

The following lists why some items are banned from all competitions regardless of the brief; the explanation attached to each should show why these are not allowed to be used. This should guide you as to what can and cannot be purchased and what should be made. If unsure on anything, please check as soon as you are able to, prior to the competition.

The bearing can be purchased as cannot be made, but the housing can be made, or a housing that would work can be made, therefore the complete assembly is a banned item.

This can be made, or a similar item can be made, during the competition.



In this case the assembly has two flanges which could be made and two bearing housings that could be made. It would not be allowed, only the bearings themselves and the guide rail if brought 50mm too long could be used.

This can be made, or a similar item can be made, during the competition.

6. Guidance On Items Not Permitted To Be Used

Continued

In this example the extrusion can be used and the screw also. But all other ancillary components would not be permitted and could be made, or similar made during the competition.

The extrusion here can be used as can the plastic cap. But again, the bracket could be made so would be banned.

Pulleys can be made during the competition. Only the bearing could be purchased.

This motor contains a braking system, bearings and a motor. Therefore it is a premanufactured unit. This makes a manufacturing competition an assembly competition and is therefore banned.

This is a premanufactured joystick board. This is allowed within the 25% premounted components, but does not count as a single item. So outside of the 25% it would not be allowed.

6. Guidance On Items Not Permitted To Be Used

Continued

These may cause a problem. In order to count in the 25% they would have to be disassembled and a count made of individual components within. If a team is not prepared to disassemble the product or it is not possible, due to being molded or glued, then the item would be banned.

Sub assembly clamps such as these can be made from metal with a pillar drill and bandsaw. As both are supplied in the competition they are a banned item.

Please bear in mind other items that contain pre-assembled electronics, such as RC solenoid motors and brushless DC motors.

If you wish to use an item and it is not on the list above, but you feel it may be able to be made during the competition, email the details and a picture, or weblink to the item to Daytun Unitt, who will confirm if it can or cannot be used, or if it can be used with an imposed time penalty.