

Test Project – Construction Metal Work

WSC2013_TP42_fabrication_pre_EN Version 1.7

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1 INTRODUCTION

This document is intended as a guideline and rulebook so that competitors can complete the test project in an efficient manner. It does not cover every conceivable scenario that may occur during the competition. Competitors should not assume that they are free to complete an action or actions that are not stated in this document. Issues may arise that are not stated within this document. If a Competitor/Expert has any doubt with regard to any issue stated/not stated within this document, they should consult the CE/DCE/E to clarify all relevant issues.

2 GENERAL INSTRUCTIONS

- 2.1 All competitors must have relevant knowledge of the contents of the Technical Description.
- 2.2 The working time is 22 hours.
- 2.3 At the beginning of the Competition one hour will be devoted to work planning. This time is not part of the competition time.
- 2.4 The Competition consists of four modules. At the end of each day only the parts belonging to each individual module must be fabricated on the module, as per the drawing.
- 2.5 After a module has been submitted the competitor is not allowed to change the orientation or location of parts, by filing, grinding or cutting. The competitor is allowed to clean (wire brush) the module again at the end of each day.
- 2.6 If workshop machines are unavailable, competitors are free to construct any other module. Competitors are also free to construct any other module/parts during competition time.
- 2.7 Completion of modules:
 - 2.7.1 At the end of Day 1 all competitors are required to submit module 1 for assessment.
 - 2.7.2 At the end of Day 2 all competitors are required to submit module 2 for assessment.
 - 2.7.3 At the end of Day 3 all competitors are required to submit the assembled module 3 and this is required to be assembled to modules 1 and 2 for assessment.
 - 2.7.4 At the end of Day 4 all competitors are required to submit the assembled module 4, and this is required to be full assembled test project for assessment.
- 2.8 Regarding the 'Material List' accuracy is determined by the Competitor.
 - 2.8.1 All material supplied to complete the test project must be precisely controlled by the Competitor.
 - 2.8.2 All material must be marked in the most economical way, if not it will appear that the material was not adequately supplied.
- 2.9 No competitor is allowed to grind, hammer or weld onto the surface of the marking tables. The table is not to be considered as a 'blacksmiths anvil'.
- 2.10 The cleaning agents supplied with the marking tables are for the purpose of cleaning the surface of the table only. These cleaning agents are not to be used on the test project.
- 2.11 The project must be completed as per Fabrication Instructions in the following table.

3 FABRICATION INSTRUCTIONS

ITEM No.	PART No.	DESCRIPTION	FABRICATION INSTRUCTIONS
1	1.1,1.2,1.3,1.4 & 1.5	3mm STAINLESS STEEL PLATE	STRAIGHT EDGES GUILLOTINE CUT. OTHER EDGES MECHANICAL CUT & FORMED BY HYDRAULIC BREAK PRESS
2	2.1,2.2	5mm LOW CARBON STEEL PLATE	GUILLOTINE CUT OUTSIDE SHAPE, WITH INSIDE CIRCLE CUT BY MANUAL FUEL GAS. HOLES DRILLED TO DRAWING SPECIFICATIONS
3	2.3, 2.4, 2.5, & 2.6	6mm LOW CARBON STEEL PLATE	GUILLOTINE CUT & FORMED BY HYDRAULIC BREAK PRESS/BENDER
4	2.7, 3.5	4mm LOW CARBON STEEL PLATE	2.7 –GUILLOTINE CUT & FORMED WITH HYDRAULIC BREAK PRESS 3.5 – OUTSIDE EDGES GUILLOTINE CUT OR MECHANICAL CUT WITH INTERNAL SHAPE MANUAL OXY-FUEL GAS. RADIUS ARE DRILLED OR FLAME CUT. FORMED BY HYDRAULIC BREAK PRESS OR DIGIBENDER
5	2.8	Ø12mm BMS ROUND BAR	2.8 – BAND SAW/MECHANICAL CUT AND FORMED BY HEATING BENDING
6	2.9	Ø10mm BMS ROUND BAR	BAND SAW/MECHANICAL CUT AND FORMED BY HEATING BENDING
7	3.1 & 4.1	10mm LOW CARBON STEEL PLATE	3.1 & 4.1 – MANUAL OXY-FUEL GAS CUT 4.1 – PART DRILL AND TAPPED TO DRAWING SPECIFICATIONS
8	3.2, 3.3 & 3.4	2mm PERFORATED STAINLESS STEEL SHEET	SUPPLIED
9	4.2, 4.3, 4.4 & 4.5	Ø26.7mm SCH10 STAINLESS STEEL PIPE	BAND SAW CUT PIPE SHAPE USING A MECHANICAL DEVICE
10	4.6	Ø33.4mm SCH10 STAINLESS STEEL PIPE	PIPE SHAPE USING A MECHANICAL DEVICE
11	4.7, 4.8, 4.9 & 4.10	M8 x 1.25 HEX HEAD BOLT x 20mm long	SUPPLIED
12	5.1, 5.2,	6mm LOW CARBON STEEL PLATE	MANUAL OXY-FUEL GAS CUT WITH ALL HOLES DRILL TO DRAWING SPECIFICATIONS AND FORMED WITH HYDRAULIC BREAK PRESS/BENDER
13	5.5 & 5.6	6mm LOW CARBON STEEL PLATE	SUPPLIED COMPETITOR TO DRILL ALL HOLES TO DRAWING SPECIFICATIONS
14	5.3 & 5.12	Ø40mm BOSS WITH Ø12.2mm BORE	SUPPLIED
15	5.4 & 5.13	Ø40mm BOSS WITH Ø12.2mm BORE	SUPPLIED TO COMPETITOR PART DRILLED AND TAPPED TO DRAWING SPECIFICATIONS

ITEM No.	PART No.	DESCRIPTION	FABRICATION INSTRUCTIONS
16	5.7, 5.8 & 5.11	3mm STAINLESS STEEL PLATE	5.7 & 5.8 & 5.11 – GUILLOTINE & MECHINICAL CUT& FORMED WITH HYDRAULIC BREAK PRESS/BENDER
17	5.9 & 5.10	4mm LOW CARBON STEEL PLATE	MANUAL OXY-FUEL GAS CUT
18	6.1 & 6.2	Ø12mm BMS ROUND BAR	SUPPLIED
19	6.3 & 6.4	Ø12mm BMS ROUND BAR	SUPPLIED
20	6.5 & 6.6	Ø12mm BMS ROUND BAR	BANDSAW CUT& MECHANICAL CUT
21	7.1 & 7.2	M12 x 1.25 HEX HEAD x 20mm long	SUPPLIED – BOLTS MUST NOT BE OVER TIGHTENED

4 MEASUREMENT OF THE TEST PROJECT

- 4.1 The Test Project (modules) will be measured for evaluation using the competitors' measuring tools used to construct the test project (modules). This shall consist of engineer's square, vernier callipers, height gauges and feeler gauges that were used to complete the test project (refer to Technical Description, point 5.4).
- 4.2 Minimum marks will be awarded for all objective marking: minimum is 0.1 mark. Subjective marking (scale from 1-10): minimum is one mark and subject elements of the marking scheme if the following occurs:
- 4.2.1 The 'Fabrication Instructions' were disobeyed.
- 4.2.2 The material provided was distorted (changing the shape of the surface) by hammering, damage on the flame cut surface, grinding and welding on the measurement point(s).
- Note: Use of skilled heating and cooling is permitted on the workpiece to control distortion. However, excessive heating which may cause the surface of the material to burn is not permitted and will result in marks been deducted for Bending/Forming or for General Appearance on the subjective marking scale.**
- 4.3 A dimension can only be measured for a part no. / Module when the Test Project (module) is completed (including orientation) as per the drawing and the **Fabrication Instructions**.
- 4.4 Minimum marks will be awarded for all objective (0.1 marks) and subjectiv (1 mark out of 10 marks) elements attached to any spoiled pieces which have been re-welded and fabricated back onto the test project. A competitor must request extra material.

5 WELDING INSTRUCTIONS

- 5.1 Unless otherwise indicated all welds are symmetrical.
- 5.2 All completed welds must be completed as requested by the weld symbol on the drawing.
- 5.3 Failure to complete less than 75% of the welding indicated on each module from the drawing will result in the competitor being awarded minimum marks for welding quality (1 mark out of 10 marks) and welding procedure (0.1 marks) dimensional accuracy, technical perfection and all subjective marks that are associated to the unwelded part number.
- 5.4 The competitor may use either MAGS/GMAW (135), TAG/GTAW (141) or SAEE/MMAW (111) during the assembly process
- 5.5 No oil, anti-spatter, or any other cleaning or degreasing substance is allowed on completed test pieces.
- 5.6 Marks will be deducted if exposed welds are tampered with by grinding, filing or hammering. Cleaning and light polishing of welds is permitted, once the profile of the weld has not been tampered with.
- 5.7 For the welding of stainless steel, the weld may be brushed (mechanical or hand brushing), however the weld bead/profile must be visible.
- 5.8 Mill scale may be removed before welding; however grinding marks must not be visible on the welded part. Marks will be deducted for general appearance if excessive grinding marks are visible.

6 CUTTING INSTRUCTIONS

- 6.1 Thermal Cutting on the Test Project:
 - 6.1.1 All exposed edges / face must be left in the flame cut condition and must not be ground by a mechanical grinding device, hammered or filed. Edges may be de-burred to a maximum tolerance of 0.5mm.
 - 6.1.2 Cutting attachments or guides may be fitted to the hand torches for both straight and circular cutting, however power operated attachments must not be used on hand cutting torches.

7 MECHANICAL CUTTING

- 7.1 A mechanical cut is a part which may be:
 - 7.1.1 Cut using a mechanical cutting device (grinder).
 - 7.1.2 The Guillotine without the use of the backgauge.
 - 7.1.3 Band saw/drop down saw cut.
- 7.2 Tubes, round bar, T-section, box section etc. must be sawn or mechanical cut.

Note: A supplied edge may not be used for the assembly of the test project, including hidden edges.

8 DRILLING INSTRUCTIONS

- 8.1 All drilled holes must be de-burred on both sides at a depth of 0.25 mm + / - 0.1, refer to the sample plate.
- 8.2 The sample plate provided, indicating tolerance for drilling and countersinking cannot be removed from the drilling area, and it should not be altered with or obstructed.
- 8.3 As a measurement cannot be taken from the centre of a hole, the measurement will be that of the hole Centre plus half the diameter of the round bar which is passing through the hole.
- 8.4 Minimum subjective (1 mark out of 10 marks) and objective (0.1 mark) will be awarded to all parts attached to a drilled hole which has been drilled greater/smaller than that specified on the drawing or which has been deformed to an irregular shape by filing and grinding. Refer to Marking Criteria, drilling.

9 BENDING AND FORMING

9.1 Break Press

Flat plate that requires bending will be completed using the hydraulic break press and digit benders as stated on the fabrication instructions. The competitor must ensure that the correct vee-block for the material being formed. The shop master is responsible for setting up the vee block.

9.2 Heat bending

On the drawing Ø12 & Ø10 Round bar is to be formed. This will be completed using heat bending using the oxy-acetylene torch. No competitor is allowed to use **jigs (two piece of angle bar or flat bar is allowed to protect vice jaws)** or special clamps to complete this type of bending.

10 INSTRUCTIONS FOR HEALTH AND SAFETY

- 10.1 All regulations of health and safety, including standards of protection specified by WorldSkills Leipzig 2013 or Workshop Supervisors / experts, must be followed exactly. Any abnormality in the machinery or equipment must be immediately reported.
- 10.2 Safety glasses must be used in all material removal operations.
- 10.3 Clothing and shoes must comply with regulations of host country health and safety.
- 10.4 Any defect in machines or equipment must be reported immediately to the Chief Expert and WSS.
- 10.5 Refer of host country Health & Safety guidelines.

11 EXTRA MATERIAL

- 11.1 Competitors will be deducted a mark(s) (to a maximum of 4 marks) for any extra individual Part No. (that which is stated on the Material List) which they require to complete the test project due to the part been lost, damaged or inaccurately cut/formed by the competitor.
- 11.2 A spoiled part is also any material that was deemed to be cut incorrectly and then re-welded. Additional material will be granted when the competitor requests (with the knowledge of their compatriot expert) the extra part no. to be re-supplied and when the spoiled piece(s) are stamped with the name of the candidate and given to the Chief Expert
- 11.3 A mark will be deducted for each additional piece of material received from the Material List to a maximum of 4 points.
- 11.4 The size of the additional material supplied will be 30mm greater all-round than the individual spoiled part. This does not include the following parts: 3.2, 3.3, 3.4, 4.7, 4.8, 4.9, 4.10, 5.3, 5.12, 5.5, 5.6, 5.4, 5.12, 6.1, 6.2, 6.3, 6.4, 7.1 & 7.2 as these are supplied parts and will be resupplied to the sizes specified from the material list.
- 11.5 Competitors will be deducted no mark if they needs Pos. 4.7, 4.8, 4.9 and 4.10 including the washers.

12 FUNCTION DEFINITION

- 12.1 The function is defined as follows: (The rotating part shall be now referred to as Part 5)
- 12.1.1 Removing Part 7.1 & 7.2 (note: 7.1 & 7.2 maybe tightened with reasonable force such that the parts can be removed without damaging the threads on 5.4 & 5.13) and rotating Part 5 in an anti-clockwise direction about the hole centre containing Part 6.2.
 - 12.1.2 Part 7.1 & 7.2 are replaced and tightened (refer to note above) through the hole on 5.1 & 5.2 so that Part 5 is located at an angle of approximately 30⁰ to Datum A. When the Part is being secured, Part 5 should be resting at its lowest point, so that measurements can be accurately taken from 5.11.
 - 12.1.3 After completing the assessment of 5.11, Part 6.4 is then removed. The front 'bucket' is then rotated in a clockwise direction about the hole Centre containing Part 6.3; so that the bottom edge of Part 5.11 is approximately parallel to Datum A after fitting part 6.4 in the relevant hole.

Note: When completing the above function it is accepted that the Parts 7.1, 7.2 & 6.4 will be tight fitting. Gently use of a hammer is permitted to remove part 6.4. However, excessive force cannot be used to fit 6.4 and complete point '12.1.3' by excessive manipulation of other parts.

Full marks will be awarded if the function is completed for point '12.1.1' above and full marks for point '12.1.2'

Note: It is not permitted to bend or distort any of the round bars to achieve fit-up and to complete the function.

13 MARKING CRITERIA

13.1 Dimensional Accuracy

Checked as per number and locations indicated on the drawing, to specified tolerance. Where dimensional accuracy has been achieved by disobeying fabrication instructions, minimum marks will be awarded.

The tolerance range will be 0.09 mm bigger than on the assessment sheets and drawings written. Because the measurement tools also has a tolerance error.

Example: length of 100 ± 0.5 => 100.59 is correct, 100.60 is not correct
=> 99.41 is correct, 99.40 is not correct

13.2 Technical Perfection:

Flatness, squareness and parallelism to specified tolerances. These elements are assessed using measurement or competitor feeler gauges or official gauges (equipment) supplied by WorldSkills.

For the assessment of flatness, the feeler gauge blade must fit in under a part by a distance of approximately 10mm, for the part to be deemed outside the required tolerance.

13.3 Drilling:

Correct hole size and de-burring.

- I. $\varnothing 12.2$ mm hole size checked with $\varnothing 12.4$ mm shank.
- II. $\varnothing 12.5$ mm hole size checked with $\varnothing 12.7$ mm shank.
- III. $\varnothing 13$ mm hole size checked with $\varnothing 13.2$ mm shank.

No filing, grinding or deforming of holes is permitted. Deburring of all holes and countersinking, as per sample piece. Orientation of holes, P.C.D, and hole pitch to specified tolerance as indicated on the drawing. Refer to drilling instructions.

13.4 Weld symbols:

All welding to be completed as per the weld symbol. Unless stated all weld symbols are symmetrical and to ISO 2553 standard. Refer to Technical Description.

13.5 Welding quality and symbols:

Welds should be of uniform profile, regular bead size, smooth toe blend and specified size. Welds should be free of defects such as slag inclusions, porosity, lack of fusion, stop/start defects, undercut and cracks with all tools marks, slag and spatter removed.

13.6 Fit-up:

Location, alignment and fit up of parts to specified tolerances and as indicated on the drawing.

13.7 Flame cutting:

This refers to all oxy-fuel cut edges. Quality of cut surface / edges should be square to the plate surface, drag lines $85^\circ - 95^\circ$ to plate surface, no excessive melting of top edges, with clean smooth bottom edges. Grinding or filing of cut surfaces is not allowed. Edges may be de-burred to a tolerance to maximum of 0.5mm.

13.8 Forming, rolling and bending:

Materials are formed by rolled and bent using appropriate equipment with smooth surfaces by visual / touch inspection. No hammer, heat, deformation and bending marks on formed surfaces.

14 GENERAL APPEARANCE:

Overall appearance and finish of parts to complete each Module. Fabrication symmetry (position and orientation of parts) and joint alignment (visual consideration not included in any other previous criteria). Finished module is free from burrs, sharp edges and work marks

15 TEST PROJECT MARKING

Refer to Technical Description, point 5 Assessment.

16 FIRST COMPETITION DAY

16.1 Read the drawings and work plan for 60 minutes. You can make notes, do calculations, but DO NOT start working!

16.2 At the end of work planning approximately 30 minutes is allocated for question time.

16.3 The Chief Expert will answer any general questions.

16.3.1 The Competitor may ask any ambiguous questions not clear about the task.

16.3.2 If your question is related to the task, and within the task, you will be told so.

16.4 The Chief Expert will seek acknowledgement from all Competitors that they are ready, (understand the rules, understand the task, and have had questions clarified, understand their health and safety obligations).

17 GENERAL ISSUES

17.1 No materials (steel) or WSC drawings may leave the workshop area during the Competition.

17.2 No outside Instructor/trainer/teacher/lecturer(s)/spectators are allowed to converse with competitors other than their respective team leaders during the working time.

17.3 If a Competitor gets sick/accident(s), a CE/DCE/Expert must be informed immediately. Time allowances will be given these requests.

17.4 Any time allowances given for sickness/accident(s) made must be communicated to all other experts.

17.5 No time allowance will be given for a toilet break.

17.6 If a machine breaks, or you are held up for any reason, you must inform an Expert immediately. If in the view of the Chief Expert, you have lost time, an allocation will be made.

17.7 No Expert is allowed to come within 2m of a competitor while he is outside his working area.

17.8 No Expert is allowed to go into a competitor's area, without the attendance of the competitor's expert. This can only occur if an Expert observes a competitor working in an extremely dangerous manner where he is about to cause serious harm to his person.

17.9 No media team is allowed to enter a competitor's area with the attendance of the CE/DCE

18 FAIRNESS AND TRANSPARENCY

Refer to the FAIRNESS AND TRANSPARENCY rules from the Competition Rules.