



2010 NATIONAL COMPETITION

WELDING

**Pre-Competition Information
for Competitors**

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INTRODUCTION

Congratulations on qualifying for a WorldSkills New Zealand national competition. The pathway to success includes a careful study of these instructions. **Please read these instructions fully and retain them for the competition days.**

A WorldSkills New Zealand competition will give you a ranking against your peers according to the skills you demonstrate on the day. You are judged according to your ability to achieve set goals and are awarded marks according to how well you achieve those goals. Unlike standard competency assessments if you perform better than the industry standard demands [the minimum mark], then you will be rewarded for that effort.

Enclosed in the package is the objective marking criteria for the visual assessment of weld seams. This is used by the judges to mark every single weld seam throughout the three-day competition. This document should be an important part of your training program.

We hope to see a very high standard of workmanship throughout the competition.
Good luck.

THE COMPETITION

The National Competitions as you already know will run for three (3) competition days. The following is an outline of the agenda. You will be required to complete the projects in the order listed in the 18 hours allocated over the three (3) days. Meal breaks are compulsory.

Objective: To provide a competition where New Zealand's best young welder will emerge by demonstrating excellence in selected modern welding processes -both in practical skills and skill related knowledge.

The competition must be fair and equitable to all those participating.

Skill Range: The international trade description for Trade 10 Welding quotes the range of skills necessary as those required in the welding of components, structures, plates and tanks, using the following range of processes:

- Oxy-acetylene welding (OAW) 311
- Manual metal arc welding (MMAW) 111
- Metal inert gas welding (MIG) 131
- Metal active gas welding (MAG) 135
- Flux cored arc welding active gas (FCAW) 136
- Tungsten inert gas welding (TIG) 141

WELDING POSITIONS REFERENCE (ISO 6947)

- * (PA) Position A or Downhand (Flat)
- * (PB) Position B or Horizontal Vertical (Fillet)
- * (PC) Position C or Horizontal Vertical (Butt)
- * (PD) Position D or Horizontal Overhead (Fillet)
- * (PE) Position E or Overhead
- * (PF) Position F or Vertical Up
- * (PG) Position G or Vertical Down

Competition Schedule

The maximum working time for this competition is 18 hours. As a competitor you should keep track of time yourself. The timetable for the day of competition is shown below.

Day of Arrival (22 September)

3.00pm – 5.00pm	Arrival, draw for work stations and instructions. Test welding Machines, confirm project
5.00pm – 6.00pm	Opening Ceremony

Day 1 (23 September)

9.00am – 9.30am	Familiarisation
9.30am	Commence work on competition project (Test Plates)
Competitors take breaks at different times.	Morning Break
	Continue work on Test Plates
Morning and afternoon breaks – 15 mins	Lunch break
	Continue work on Test Plates
Lunch ½ hr	Finish Test Plates/Start Ali or S/S Project
	Afternoon Break
	Continue work on competition project
5.30pm	Stop work on competition project
5.30-5.45pm	Competition Debrief

Day 2 (24 September)

8.00am	Continue Work on S/S or Ali Project
Competitors take breaks at different times.	Stop work on S/S and Ali projects. Morning Break.
	Start work on Pressure Vessel
Morning and afternoon breaks – 15 mins	Lunch break
	Continue work on Pressure Vessel
Lunch ½ hr	Afternoon Break
	Continue work on Pressure Vessel
4.30pm.	Stop work on competition project
4.30 – 4.45pm	Competition Debrief

Day 3 (25 September)

8.30am -	Continue work on Pressure Vessel
Competitors take 15 min break at different times	Morning Break
	Continue work on Pressure Vessel
12.45am	Stop work on competition project
1.00pm	Lunch
1.30pm	Clean Up.
3.05pm	Competition Debrief

Day 4 (26 September)

	Morning free
11am	Awards Ceremony

Objective Marking Criteria; Visual Assessment of Weld Seams

Imperfection Description	1. EXPLANATION	Limits for Imperfections
1. Cracks	Is the weld free of all cracks?	Not permitted
2. Weld starts and craters (Crater pipe)	Are weld bead craters and starts completely filled?	No crater depressions
3. Stray Arc Strikes	Are stray arc strikes absent?	Not permitted
4. Slag and Spatter Removed	Is all surface slag and spatter removed from the joint and surrounding area?	All slag and spatter to be removed
5. Grinding Marks	Is the weld surface free of grinding marks?	No marks permitted
6. Visual Inclusions (slag, flux, oxide or metallic inclusions)	Is the weld metal free of short, solid imperfections?	≤12 defects with a surface ≤2mm in any 100mm of weld
7. Worm Holes (elongated cavities)	Is the weld metal free of visual Worm-holes or cavities?	Not permitted
8. Surface or internal Porosity and Gas Pores	Is the weld metal free of porosity?	≤4 gas pores $\varnothing \leq 1.6\text{mm}$ & no gas pores $\varnothing \geq 3\text{mm}$
9. Undercut	Is the weld joint free from undercut?	≤ 0.5mm
10. Overlap (Overroll)	Is the weld joint completely free of overlap (overroll)?	Not permitted
11. Lack of Penetration	Is the joint free from lack of penetration or root fusion? Discard 1st and last 15mm on X-Ray test plates)	Not permitted
12. Excessive root concavity (shrinkage groove)	Is the weld penetration free of excessive root concavity "suck back"?	≤ 0.5mm
13. Excessive Penetration	Is the joint free of excessive penetration?	2mm plate ≤ 1.5mm 3mm plate ≤ 2.0mm

		10mm plate \leq 2.5mm
14. Excessive Face Reinforcement (height)	Is the weld joint free of excessive face reinforcement?	2mm plate \leq 1.5mm 3mm plate \leq 2.0mm 10mm plate \leq 2.5mm
15. Incompletely filled groove (sagging)	Is the butt weld groove completely filled?	\leq 0.5mm
16. Angular Misalignment	Is the joint free from angular misalignment?	$< 5^\circ$
17. Linear Misalignment (high/low)	Is the joint free from linear (high/low) misalignment?	2mm plate \leq 0.5mm 3mm plate \leq 0.5mm 10mm plate \leq 2mm
18. Fillet Weld Sizes	Are fillet sizes in accordance with specifications?	Leg, -0/+2mm Throat, -0/+2mm
19. Full Radius Contour	Does the joint exhibit a full radius contour = to plate thickness?	Radius = -0/+2mm
20. Excessive Width of Butt Weld Face	Does the width of the weld metal face comply within the set limits?	1.5mm plate \leq 5mm 3mm plate \leq 10mm 10mm plate \leq 22mm

Marking Scale Summary

All competitors who compete in this skill category will be judged according to the same criteria. A summary of the different project sections and the number of marks allocated to each section is shown below.

Section	Task	Maximum Possible Marks
T1/S1	Test Plate vertical pos 220 marks max	10
T1/S2	Test Plate overhead pos 220 marks max	10
T1/S3	Test Plate horizontal pos 220 marks max	10
T2	Aluminium Structure 260 marks max	15
T3	Stainless Steel Structure 260 marks max	15
T4	Pressure Vessel 620 marks max	40
	TOTALS 1800 marks max	100

SKILLS LIST

- Job Planning and Time Management :- using and implementing planned welding sequences on projects.
- Assembly of Projects to Drawings :- (print reading and interpretation).
- Working in a safe manner :- you will be required to wear appropriate eye wear at all times and you must follow standard safe working practices.
- Welding of seams in all positions :- you will be required to produce all types of weld joints, fillets, butts and corners, in all positions with full penetration and no internal defects on all projects.
- Compliance to judges' instructions :- competitors will be required to follow verbal instructions during the course of the competition.
- Presentation of completed work :- all welds are to have smooth even profiles with no surface defects.
* Grinding or chiseling of the finished weld surface is not acceptable and points will be deducted for these types of markings.

The cleaning, finishing and presentation of the completed work is to be very high and of professional standard.

7. Allowance for distortion :- competitors should have good knowledge and practice of how to prevent misalignment and distortion of plates, especially on the T.I.G. sheet Aluminium/ Stainless Steel / AS1796 certificate test plate projects.
8. No copper chill plates or ceramic backing tapes/bars are to be used.
9. The Weld Faces on the Aluminium and Stainless Steel TIG (GTAW) projects are to be presented in the as welded condition. No cleaning, (sanding, grinding, steel wool or wire brushing etc).
10. Purging equipment may be used on the GTAW (TIG) stainless steel project.
11. Acetone (or a suitable degreaser) will be available from the judges for cleaning sticky - tape marks off the GTAW (TIG) stainless steel project.
12. Tack welds on pressure vessel, and GTAW projects are to be no longer than 15mm.
13. No tack welds on inside of pressure vessel.
Competitors are to present pressure vessel to judges before top plate is tacked into position.
14. Grinding is to be limited to the removal of isolated irregularities (including stop/restarts) and for not more than 20% of run length in total.
15. Back grinding is not permitted

THE USE OF COLD CHISELS IS ALLOWED TO REMOVE DEFECTIVE/EXCESS WELD METAL

EQUIPMENT TO BE SUPPLIED BY THE COMPETITOR

Competitors are responsible for their own tools. It should be noted that all power tools and machinery must comply with OSH regulations and have adequate safety guards and be in what is deemed to be safe operating condition. At the discretion of the officials any suspect piece of equipment may be prevented from being used.

Following is a list of tools and equipment each competitor will be required to bring to the competition. It is only a guideline and you may bring any other tools of trade that you use in the day to day undertaking of your occupation.

1. The competitor will need to supply general tools and equipment to enable the following projects to be completed.

- * Assembly and manual arc, gas metal arc, flux cored arc, gas tungsten arc welding of a steel project
- * Assembly and manual arc, gas metal arc welding of steel test plates
- * Assembly and G.T.A. welding of a stainless steel project
- * Assembly and G.T.A. welding of an aluminium project

2. Competitors should bring tools and equipment as listed.

- Safe working clothes and footwear
- Safety glasses, leather gloves and other safety apparel (including EAR MUFFS)
- Clear grinding shield
- Welding shield
- Chipping
- Engineers hammer
- Cold chisels
- Plate square
- Steel rule/tape measure
- Clamps e.g. G type / magnetic etc
- Hard marking chalk

- Scriber
- Fillet gauges
- Steel wool
- Divider
- Spring clips
- Power Grinders e.g. 80-100 mm/**with a current electrical inspection tag attached.**
- Wire brush wheels to suit grinders
- Cut off disks
- Electrode wire cutter
- AC / DC current Tong tester
- Scouring pads for cleaning T.I.G. jobs
- Power blade scrapers
- Purging equipment and apparatus for T.I.G. welding
- Other personal hand tools

3. The following equipment is prohibited for use in the competition, and is not limited to:

- Chills or backing bars
- Handpieces or torches of a different design/make than that of the competition equipment
- Any consumables not supplied for the competition
- Any material not supplied for the competition

Although personal hand tools are allowed, unauthorised work aids, which may give an unfair advantage, will not be permitted.

EQUIPMENT AND MATERIALS TO BE SUPPLIED BY THE ORGANISERS

Each competitor is to have access to the following equipment:

- 1 ea. AC/DC power unit, current intensity 250 A, for MMAW (SMAW), with welding accessories, and/or,
- 1 ea. AC/DC power unit, water or air cooled, current intensity 300 A, for TIG/GTAW welding, with welding torch, foot control or hand remote control and accessories, and,
- 1 ea. DC power unit, current intensity 350 A, for MIG/MAG and FCAW complete with accessories.

Note Machines need not have a pulse capability, however, all machines may be used to their full potential.

Other equipment required:

- Cutting equipment (thermal or mechanical), for the purpose of preparing bend test specimens.
- Bend test equipment (i.e. Press).
- Purging equipment for the Stainless Steel project
- Weld measuring gauges.
- Calculator.
- Oven or hotbox for the baking of electrodes.
- Workbench (es)

Consumables:

The following range of welding consumables is to be made available as required for the projects:

- **For Manual Metal Arc Welding**
 - Basic coated stick electrodes, dia. 2.5; 3.2 and 4.0mm
AWS A5.1 E7018
- **For Flux Cored Arc Welding**
 - Rutile-flux cored wire, dia. 1.2mm.
AWS A5.20 E71T-1/1M and or E81T-1/1M
- **For Gas Metal Arc Welding:**

- Low carbon steel wire electrodes, dia. 0.8mm, 0.9mm and 1.0mm
AWS A5.18 ER70S-6 or E70C-6.

- Stainless steel wire electrodes, dia. 0.8mm, 0.9mm and 1.0mm
AWS A5.9 ER308LSi or ER316LSi

- Aluminium wire electrodes, dia. 1.2mm
AWS A5.10 ER5356 or ER5183 or E4043

- Contact tips to suit wire diameters

- **For Tungsten Inert Gas Welding**

- Filler rods, dia. 1.6 and 2.4

- AWS A5.18 R70S-2 or R70S-4.

- AWS A5.10 R5356 or R4043 or R5183. (To suit base material)

- AWS A5.9 R308L or R316L. (To suit base material)

- Tungsten electrodes – 1.6 and 2.4mm dia.

- Collets and ceramics to suit.

- **Gas:**

- Oxy/Acetylene (as required for thermal cutting)

- Argoshield Universal shielding gas (or equivalent)

- Argon shielding gas (with a splitter and separate flow meter for purging)

- CO2 shielding gas (if reqd for FCAW)