

Technical Description

Welding

Manufacturing and Engineering Technology



WorldSkills International, by a resolution of the Competitions Committee and in accordance with the Constitution, the Standing Orders and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

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Stefan Praschl
Chair of the Competitions Committee



Michael Fung
Vice Chair of the Competitions Committee

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1 INTRODUCTION

1.1 NAME AND DESCRIPTION OF THE SKILL COMPETITION

1.1.1 The name of the skill competition is

Welding

1.1.2 Description of the associated work role(s) or occupation(s).

Welding is a critical process that is controlled by both National and International standards and specifications to control the quality of the deposited weld metal and the skill of the welder.

A welder prepares and joins a range of metals and metallic alloys using mainly processes where an electric arc is the heat source. Electric arc processes utilize a gas shield or a flux to protect the molten weld area from contamination by the surrounding atmosphere. A welder needs to be able to interpret engineering drawings, standards and symbols and correctly translate these requirements into accurate structures and fabrications.

Welders need to have a thorough knowledge and understanding of safe working practices, personal protection equipment and the hazards and practices associated with welding and fabrication industries. They need to gain specific knowledge of a wide range of welding equipment and processes as well as an understanding of how welding will affect the structure of the material being welded well. They need to be familiar with electricity and how it is utilized for welding.

Welders join sections, pipe and plate and fabricate large and small pressure vessels. A welder prepares, assembles and joins a wide range of metals and metal alloys using various welding processes including manual metal arc welding/shielded metal arc welding metal arc gas shielded welding/gas metal arc welding, Tungsten arc gas shielded welding/gas tungsten arc welding and flux cored arc welding. A welder will use mainly processes where the heat utilized for welding will be an electric arc to join a range of materials including the commonly joined and fabricated materials – carbon steel, stainless steels, aluminium and copper and their associated alloys. They must be able to select the correct equipment, process variables and welding technique depending upon the material being joined.

Welders may use thermal cutting processes and should be able to identify the correct preparation for joining as applied to the type, thickness and intended use of the joint. They use grinding and cutting equipment to prepare welded joints. Modern methods of joining, as well as those noted above, include mechanized processes such as submerged arc, plasma arc, stud welding and laser welding.

A welder can work in a unit or factory which produces fabrications and/or structures for industries as diverse as civil engineering, mechanical engineering, transport, marine engineering, construction, service, and leisure industries. Welders also work on site preparation, construction, and the repair and maintenance of structures. A welder can work in many locations and situations, ranging from a bench in a factory, to shipyards, power stations and off-shore structures. Welders also work in engineering, construction, power generating, and petro-chemical plants. The working environment may include hazardous environments such as off shore, extreme weather conditions and also confined spaces where access to the joint to be welded is restricted.

The modern welder may specialize in one or a number of welding processes and environments. He or she may also be asked to work in exotic alloys such as duplex and super duplex stainless steels and cupronickels. Welders are required to carry out the finest work where faults and failure may have the most serious consequences in terms of cost, safety and environmental damage.

1.1.3 Number of Competitors per team

Welding is a single Competitor skill competition.

1.1.4 Age limit of Competitors

The Competitors must not be older than 22 years in the year of the Competition.

1.2 THE RELEVANCE AND SIGNIFICANCE OF THIS DOCUMENT

This document contains information about the standards required to compete in this skill competition, and the assessment principles, methods and procedures that govern the competition.

Every Expert and Competitor must know and understand this Technical Description.

In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

1.3 ASSOCIATED DOCUMENTS

Since this Technical Description contains only skill-specific information it must be used in association with the following:

- WSI – Competition Rules
- WSI – WorldSkills Standards Specification framework
- WSI – WorldSkills Assessment Strategy
- WSI Online resources as indicated in this document
- WorldSkills Health, Safety, and Environment Policy and Regulations
- [ISO 5817-Welding—Fusion-welded joints in steel, nickel, titanium and their alloys.](#)
- [ISO 9606-Qualification testing of welders Part 1: steels.](#)
- [ISO 10042-Welding—Arc-welded joints in Aluminium and it's alloys.](#)
- [ISO 9017-Destructive tests on welds in metallic materials- fracture tests.](#)
- [ISO 15608-Welding – Guidelines for metallic materials grouping system.](#)
- [ISO 17635- Non-destructive testing of welds – General rules for metallic materials.](#)
- [ISO 10025- Hot rolled products of structural steels. General Technical delivery conditions.](#)
- [ISO 2553-Welding and allied processes – Symbolic representation on drawings – Welded joints.](#)
- [AWS A2.4-Standard Symbols for welding Brazing, and Non-Destructive Examination.](#)
- [AWS A3.0-Standard Welding Terms and Definitions.](#)

Note: Where a conflict arises, the ISO standards shall have precedence. If no ISO standard is applicable, then the relevant AWS standard shall be used

2 THE WORLDSKILLS STANDARDS SPECIFICATION (WSSS)

2.1 GENERAL NOTES ON THE WSSS

The WSSS specifies the knowledge, understanding and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSSS).

The skill competition is intended to reflect international best practice as described by the WSSS, and to the extent that it is able to. The Standards Specification is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standards Specification is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards Specification. This is often referred to as the “weighting”. The sum of all the percentage marks is 100.

The Marking Scheme and Test Project will assess only those skills that are set out in the Standards Specification. They will reflect the Standards Specification as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme and Test Project will follow the allocation of marks within the Standards Specification to the extent practically possible. A variation of five percent is allowed, provided that this does not distort the weightings assigned by the Standards Specification.

2.2 WORLDSKILLS STANDARDS SPECIFICATION

SECTION		RELATIVE IMPORTANCE (%)
1	Work organization and management	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The standards and legislation relating to the health, safety, security and hygiene in the welding industry • The range, use and maintenance of personal protective equipment used in the industry for any given circumstances • The selection and use of safety equipment related to specific or hazardous tasks • ISO A and/or E (American and European) drawing representation • Technical terms and symbols used in drawings and plans • Terminology and safety data supplied by manufacturers • The requirements and effects of welding production for the environment and sustainability issues • Basic mathematical manipulation and unit conversion • Geometrical principles, techniques and calculations 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Work safely with regard to themselves and others. • Select, wear, and maintain PPE as required • Recognize hazardous situations and take appropriate actions with regard to their own and others safety • Follow correct procedural processes when working in hazardous environments • Locate and identify dimensions and weld symbols • Adhere to manufacturers' safety data sheets • Maintain a clean working environment • Complete work within agreed timescales • Make essential connections for specific welding procedures. 	

2	Preparation and assembly techniques	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The interpretation of fabrication or engineering drawings and weld symbols • The classification and specific uses of welding consumables including: <ul style="list-style-type: none"> • Coding and designation of welding rods • Diameters and specific use of welding wire • Choice and preparation of welding electrodes • How surface contamination can influence the finished weld characteristics • The correct machine settings to be aligned to: <ul style="list-style-type: none"> • Welding polarity • Welding position • Material • Material thickness • Filler material and feed speed • Any fine adjustments needed to machine hardware, TIG electrode shape, wire type and diameter etc. • The methods of edge preparation to align with joint profile, strength and material • Methods of distortion control in steels, alloys and aluminium 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Set up welding equipment to manufacturer's specification including (but not limited to) <ul style="list-style-type: none"> • Welding polarity • Welding amperage • Welding voltage • Wire feed speed • Travel speed • Travel/electrode angles • Mode of metal transfer • Prepare material edges in line with specification and drawing requirements • Set up and operate appropriate controls to minimize and correct distortion • Carry out appropriate procedures to control heat input 	

3	Welding materials	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The mechanical and physical properties of: <ul style="list-style-type: none"> • carbon steels • aluminium and its alloys • stainless steels; • Correct alignment of process with material being used • Selection of welding consumables • Correct storage and handling of welding consumables • Terminology, characteristics, and safe use of welding and purging gases • The effects of welding on the structure of the material 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Use materials with consideration to their mechanical and physical properties • Store welding consumables correctly with reference to type, use and safety considerations • Select and prepare materials with reference to drawing material list • Select methods used in shielding the weld area from contamination • Select gasses used for shielding and purging 	
4	SMAW (111) and GMAW (135) Process	25
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Drawing weld symbol interpretation • Weld positions, weld angles and travel speeds • The techniques for efficient stops/starts • The techniques utilised to deposit single sided root penetration welds • The techniques utilised to deposit defect free butt and fillet welds 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Make welded joints in relation to international specifications • Interpret welding terminology to complete task to specification • Perform welding of carbon steel material in all positions (except vertical down) on pipe and plate Deposit single sided full penetration root pass welds • Deposit full penetration butt and fillet welds on pipe and plate • Perform stop/starts 	
5	FCAW-G (136) Process	10
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Drawing weld symbol interpretation • Weld positions, weld angles and travel speeds • The techniques for efficient stop/starts • The techniques utilised to deposit defect free butt and fillet welds 	

	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Make welded joints in relation to international specifications • Interpret welding terminology to complete task to specification • Perform welding on carbon steel material in all positions (except vertical down) on pipe and plate • Perform stop/starts • Deposit full penetration butt and fillet welds on pipe and plate 	
6	GTAW (141) Process	15
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • Drawing weld symbol interpretation • Weld positions, weld angles and travel speeds • The techniques for efficient stops/starts • The techniques utilised to deposit defect free butt and fillet welds 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Make welded joints in relation to international specifications • Interpret welding terminology to complete task to specification • Perform welding on carbon steel, aluminium sheet and stainless-steel sheet material in all positions (except vertical down) on pipe and plate • Perform stop/starts • Deposit full penetration butt and fillet welds on pipe and plate • Deposit utilising a single pass on stainless steel and aluminium sheet, root and capping pass combination 	
7	Finishing, quality assurance, and testing	20
	<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • The international specifications for the control of weld quality • Specific terminology used in the welding industry • Imperfections/defects that may occur during welding • The importance of weld metal cleanliness in weld quality • Range of destructive and non – destructive testing • Welder certification test coupons in accordance with international standards 	
	<p>The individual shall be able to:</p> <ul style="list-style-type: none"> • Produce welds to meet drawing and legislative specifications • Recognize weld defects and take appropriate action to rectify them • Utilize correct techniques to ensure weld metal cleanliness is maintained • Dress welds using wire brushes, scrapers, chisels, etc. • Check completed work against drawing requirements to reflect accuracy, square and flatness where necessary • Carry out basic non – destructive testing and be familiar with more advanced testing methods • Complete a pressure vessel capable of withstanding hydrostatic pressure testing. 	
	Total	100

3 THE ASSESSMENT STRATEGY AND SPECIFICATION

3.1 GENERAL GUIDANCE

Assessment is governed by the WorldSkills Assessment Strategy. The Strategy establishes the principles and techniques to which WorldSkills assessment and marking must conform.

Expert assessment practice lies at the heart of the WorldSkills Competition. For this reason, it is the subject of continuing professional development and scrutiny. The growth of expertise in assessment will inform the future use and direction of the main assessment instruments used by the WorldSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

Assessment at the WorldSkills Competition falls into two broad types: measurement and judgement. For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

The Marking Scheme must follow the weightings within the Standards Specification. The Test Project is the assessment vehicle for the skill competition, and also follows the Standards Specification. The CIS enables the timely and accurate recording of marks, and has expanding supportive capacity.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed and developed through an iterative process, to ensure that both together optimize their relationship with the Standards Specification and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, in order to demonstrate their quality and conformity with the Standards Specification.

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI Skill Advisors in order to benefit from the capabilities of the CIS.

4 THE MARKING SCHEME

4.1 GENERAL GUIDANCE

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors' work as demonstrated through the Test Project, and the procedures and requirements for marking.

The Marking Scheme is the pivotal instrument of the WorldSkills Competition, in that it ties assessment to the standards that represent the skill. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards Specification.

By reflecting the weightings in the Standards Specification, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill and its assessment needs, it may initially be appropriate to develop the Marking Scheme in more detail as a guide for Test Project design. Alternatively, initial Test Project design can be based on the outline Marking Scheme. From this point onwards the Marking Scheme and Test Project should be developed together.

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards Specification, if there is no practicable alternative.

The Marking Scheme and Test Project may be developed by one person, or several, or by all Experts. The detailed and final Marking Scheme and Test Project must be approved by the whole Expert Jury prior to submission for independent quality assurance. The exception to this process is for those skill competitions which use an independent designer for the development of the Marking Scheme and Test Project. Please see the Rules for further details.

Experts and independent designers are required to submit their Marking Schemes and Test Projects for comment and provisional approval well in advance of completion, in order to avoid disappointment or setbacks at a late stage. They are also advised to work with the CIS Team at this intermediate stage, in order to take full advantage of the possibilities of the CIS.

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition using the CIS standard spreadsheet or other agreed methods.

4.2 ASSESSMENT CRITERIA

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived in conjunction with the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards Specification; in others they may be totally different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards Specification.

Assessment Criteria are created by the person(s) developing the Marking Scheme, who are free to define criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). It is advisable not to specify either the Assessment Criteria, or the allocation of marks, or the assessment methods, within this Technical Description.

The Mark Summary Form generated by the CIS will comprise a list of the Assessment Criteria.

The marks allocated to each Criterion will be calculated by the CIS. These will be the cumulative sum of marks given to each Aspect within that Assessment Criterion.

4.3 SUB CRITERIA

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a WorldSkills marking form. Each marking form (Sub Criterion) contains Aspects to be assessed and marked by measurement or judgement, or both measurement and judgement.

Each marking form (Sub Criterion) specified both the day on which it will be marked, and the identity of the marking team.

4.4 ASPECTS

Each Aspect defines, in detail, a single item to be assessed and marked together with the marks, or instructions for how the marks are to be awarded. Aspects are assessed either by measurement or judgement.

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it.

The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the skill in the Standards Specification. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1)

	CRITERIA								TOTAL MARKS PER SECTION	WSSS MARKS PER SECTION	VARIANCE	
	A	B	C	D	E	F	G	H				
STANDARDS SPECIFICATION SECTION	1	5.00								5.00	5.00	0.00
	2		2.00					7.50		10.00	10.00	0.50
	3							11.00		10.00	10.00	1.00
	4			5.00						5.00	5.00	0.00
	5				10.00	10.00	10.00			30.00	30.00	0.00
	6		8.00	5.00				2.50	9.00	24.50	25.00	0.50
	7			10.00				5.00		15.00	15.00	0.00
TOTAL MARKS		5.00	10.00	20.00	10.00	10.00	10.00	15.00	20.00	100.00	100.00	2.00

4.5 ASSESSMENT AND MARKING

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by judgement, measurement, or both. The same marking team must assess and mark all competitors, in all circumstances. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (See 4.6.)

4.6 ASSESSMENT AND MARKING USING JUDGEMENT

Judgement uses a scale of 0-3. To apply the scale with rigour and consistency, judgement must be conducted using:

- benchmarks (criteria) for detailed guidance for each Aspect (in words, images, artefacts or separate guidance notes)
- the 0-3 scale to indicate:
 - 0: performance below industry standard
 - 1: performance meets industry standard
 - 2: performance meets and in specific respects exceeds industry standard
 - 3: performance wholly exceeds industry standard and is judged as excellent

Three Experts will judge each Aspect, with a fourth to coordinate the marking and acting as a judge to prevent compatriot marking.

4.7 ASSESSMENT AND MARKING USING MEASUREMENT

Three experts will be used to assess each aspect. Unless otherwise stated only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect.

4.8 THE USE OF MEASUREMENT AND JUDGEMENT

Decisions regarding the selection of criteria and assessment methods will be made during the design of the competition through the Marking Scheme and Test Project.

4.9 COMPLETION OF SKILL ASSESSMENT SPECIFICATION

The skill assessment criteria are clear concise aspect specifications which explain exactly how and why a particular mark is awarded. The following table is a guide to the visual assessment of weld seams.

The level of imperfection assessment to be no less than that expected for the qualification of a welder to ISO 9606 Qualification of welders – fusion welding part 1: Steels and part 2: Aluminium and Aluminium alloys. The level of imperfection no less than level 'B' of ISO 5817 Welding – Fusion welded joints in steel, nickel titanium and their alloys (beam welding excluded) – Quality levels. For RT inspections of the test plates and pipe, digital RT shall be used where possible, but if not possible, double loaded film practices shall be used. Both practices to be performed IAW ISO 17635.

ISO 10042 Arc – welded joints in Aluminium and its weldable alloys – Guidance on Quality levels for imperfections

IMPERFECTION DESCRIPTION	EXPLANATION	LIMITS FOR IMPERFECTIONS
1. Cracks	Is the weld free of all cracks?	Not permitted
2. Weld starts and craters	Are weld bead craters and starts completely filled? (From crown to crater bottom, or crown of stop and crown of restart)	Task two (PV) ≤ 1.5 mm
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?	Greater than 99% of all slag and spatter to be removed
5. Grinding Marks	Is the weld surface free from grinding or other metal removal on the cap pass (es) and penetration, for the purpose of enhancing the finished weld?	No metal removal permitted from the finished weld
6. Visual Inclusions	Is the weld metal free of short, solid imperfections? (slag, flux, oxide or metallic inclusions)	Task two (PV) Incremental marking max. two defects
7. Surface or internal Porosity and Gas Pores	Is the weld metal free of porosity?	Task one (Coupon X-Ray) - See International Standard ISO 5817 Task one (Coupon destructive testing) - Incremental marking. Two defects Task two (PV) Incremental

IMPERFECTION DESCRIPTION	EXPLANATION	LIMITS FOR IMPERFECTIONS
		marking max. two defects Task three (AL) - Incremental marking max. two defects Task four (SS) - Incremental marking max. two defects
8. Undercut	Is the weld joint free from undercut?	≤ 0.5mm
9. Overlap (Over roll)	Is the weld joint completely free of overlap (over roll)?	Not permitted
10. Lack of Penetration	Is the joint free from lack of penetration or root fusion?	Task one (Coupon X-Ray) See International Standard ISO 5817 Task one (Coupon Visual) – Not permitted. Task three (AL) – Incremental marking Task four (SS) - Incremental marking
11. Excessive root concavity (shrinkage groove)	Is the weld penetration free of excessive root concavity “suck back”?	Task one - See International Standard ISO 5817
12. Excessive Penetration	Is the joint free of excessive penetration?	Task one (Coupon) - ≤ 2.0 mm Task two (PV)– N/A Task three (AL) - ≤ 3.0 mm Task four (SS) - ≤ 2.5 mm
13. Excessive Face Reinforcement (height)	Is the weld joint free of excessive face reinforcement?	Task one (Fillet)- ≤ 3.0 mm Task one (Butt) - ≤ 2.5 mm Task two (PV) - ≤ 2.5 mm Task three (AL) - ≤ 1.5 mm Task four (SS) - ≤ 1.5 mm
14. Incompletely filled groove	Is the butt weld groove completely filled?	Not Permitted
15. Linear Misalignment (high/low)	Is the joint free from linear (high/low) misalignment?	Task one - See International Standard ISO 5817 Task two (PV) - ≤ 1.0 mm Task three (AL) - ≤ 1.0 mm Task four (SS) - ≤ 1.0 mm
16. Fillet Weld Sizes	Are fillet sizes in accordance with specifications? (Measurement leg length)	Task one (Coupon) -0/+2 mm Task two (PV) -0/+2 mm Task three (AL) -0/+2 mm Task four (SS) -0/+1 mm

17. Full Radius Contour	Does the joint exhibit a full radius contour = to plate thickness?	Full radius contour
18. Excessive Width of Butt Weld Face	Are bead widths uniform and regular? (Measure narrowest portion vs. widest portion)	Task one (Coupon) - ≤ 2.0 mm Task two (PV) - ≤ 2.0 mm Task three (AL) - ≤ 1.5 mm Task four (SS) - ≤ 1.0 mm

4.10 SKILL ASSESSMENT PROCEDURES

Procedure for performing non-destructive testing

1. Specified procedures shall be used for all non-destructive testing;
2. The welded test coupons shall be radiographed in the as welded condition. (No removal of any excess weld metal.);
3. Radiography of the test coupons shall be performed in accordance with ISO 5817. Welds with no recordable imperfections will be an 'A' category pass;

Procedure for performing fracture tests on the Fillet welded coupon;

1. Each test piece shall be positioned for breaking in accordance with ISO 9017 Destructive tests on welds in metallic materials – Fracture tests;
2. Each coupon shall be visually assessed after breaking for lack of fusion, inclusions, and porosity;

Procedure for the hydrostatic pressure test

1. The Expert, whose Competitor's vessel is being tested, is allowed to witness the test;
2. Fill the vessel with water and ensure that all air is allowed to escape;
3. Plug vessel and pressurize to city pressure;
4. Ensure vessel is fully dry on outside;
5. If vessel exhibits a leak – Score one point and test is complete;
6. If no leaks are observed at city pressure, the vessel will be further pressurized in stages (minimum of FOUR stages) to the maximum pressure normally 69bar (1000 psi) dependant on pressure pump available;
7. Each hold point will be will be held for 60 seconds. If no leak is detected the pressure will be increased in stages until the vessel is pressurized to the maximum pressure;
8. If the vessel leaks at any stage in the hydrostatic test the marks will be awarded appropriate to the last successful hold point;
9. Drain all water from the vessel.

Note: If a leak is detected, it shall be highlighted with a metal marker.

5 THE TEST PROJECT

5.1 GENERAL NOTES

Sections 3 and 4 govern the development of the Test Project. These notes are supplementary.

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the skills in each section of the WSSS.

The purpose of the Test Project is to provide full, balanced and authentic opportunities for assessment and marking across the Standards Specification, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme and Standards Specification will be a key indicator of quality, as will be its relationship with actual work performance.

The Test Project will not cover areas outside the Standards Specification, or affect the balance of marks within the Standards Specification other than in the circumstances indicated by Section 2.

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work.

The Test Project will not assess knowledge of WorldSkills rules and regulations.

This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standards Specification. Section 2.1 refers.

5.2 FORMAT/STRUCTURE OF THE TEST PROJECT

The format of the Test Project is a series of standalone modules and must be validated as defined below.

5.3 TEST PROJECT DESIGN REQUIREMENTS

General Requirements

Overall, the Test Project shall be modular and are standalone assessments of the Competitors skill Materials and Equipment: Welding power sources:

- 111 SMAW, MMAW, 141 GTAW, TIG: AC/DC, 300 Amps Inverter-Type with Hi-Frequency, AC-Frequency (Hz) and Pulse controls;
- 135 GMAW, MAG, 136 FCAW: DC, 350 Amps with Pulse or Synergic control.

Welding accessories

- 111 SMAW, MMAW Welding cable and electrode holder;
- 141 GTAW, TIG gun and accessories, contact tips, diffusers, shielding gas accessories, regulator, hoses, remote variable amperage controls, foot or hand-operated, hose for purging;
- 135 GMAW, MAG gun and accessories, contact tips, diffusers, shielding gas accessories, regulator, hoses, etc.
- 136 FCAW gun and accessories, contact tips, diffusers, shielding gas accessories, regulator, hoses, etc.

During the Competition only the materials provided by the Competition Organizer may be used. Practice plates for the Competition.

The Competition Organizer shall provide two sets (four pieces each) of material for each of the test. Coupons and ten pieces each (100x50mm) of aluminium and stainless steel material in the thickness of the tasks, to be used for practice plates. These plates shall be made available to the Competitor for practice on the day set aside for testing the installations before the Competition and for adjusting the welding parameters during the Competition.

Dimensions of practice plates

The practice plates shall be the same width and thickness as the actual Test Project module pieces but they shall each be shorter by 20mm in length.

Basic materials

Steel groups according to CR ISO/TR 15608 (2005), Group one, two or three for low carbon steel; Group eight for stainless steel (300 series), and aluminium in the 5000 and 6000 series. Chosen material shall be listed on the infrastructure list with full detail of the material grouping and classification. MTR's shall be provided to the experts to review for accuracy and to approve before cutting of the material commences.

Plates

- High quality low carbon steel, 2 mm to 12 mm thick to ISO 10025;
- For pressure vessel, plates are to have through-thickness tested certification;
- Austenitic stainless steel, 1.5 mm to 6 mm thick e.g. 18/8 types X5CrNi 18;
- Aluminium, 1.5 mm to 6 mm thick e.g. 5000 or 6000 series.

Pipes

- High quality low carbon steel pipes to ISO 10025, dia. 40mm to 150mm, wall thickness 1.6mm to 10mm;
 - Stainless steel and aluminium, diameter 25mm to 50mm, wall thickness 1.6mm to 6mm.
- Test coupons shall be cut, milled or turned, so that they are smooth and parallel.

Module one: Test coupons general notes

- Time: allow three to four hours approximately;
- Quantity: three to five specimens, either Single V-groove butt joint welds or fillet welds;
- Welding processes: See Appendix 14.1;
- Welding positions: See Appendix 14.1;
- Drawings: See Appendix 14.3.
- For all test plates, 20mm at the start and finish will not form part of the inspection or marking process.
- The preparation for all butt weld test coupons shall be milled or turned at 30° to a featheredge. (No root face) See Appendix 14.2 for test coupon drawings.

Fillet weld notes

The Competitor shall submit the test coupons fully assembled to the Experts for stamping prior to welding.

The fillet weld coupon/s shall consist of two (2) pieces each 12mm in thickness, one-piece 125mm wide in length and the other 100mm wide, 250mm in length.

The fillet weld coupon shall have a leg dimension of 10mm, with an allowable tolerance of (+2mm – 0mm). The fillet welds must be completed with a minimum of two runs and a maximum of three runs.

The weld must be MULTI RUN with a maximum of THREE runs. Single run or welds with more than three runs will NOT be allocated any marks for that coupon.

- If the hold point was not conducted, all would be affected assessments shall receive no marks.
- Grinding for the intent to enhance the cap pass shall not be allowed. All aspects for the assessment of an enhanced cap pass shall not be evaluated and a zero mark awarded.
- One test plate coupon shall consist of two (2) pieces, each 10mm in thickness, 100mm wide and 250mm in length.
- The second test plate coupon shall consist of two (2) pieces, each 16mm x 150mm x 250mm.

10 mm Test Coupon notes

- Grinding for the intent to enhance the root pass or cap pass shall not be allowed. All aspects for the assessment of an enhanced root pass or cap pass shall not be evaluated and a zero mark awarded.
- GMAW (MAG) is the only semi -automatic process to be used for root pass runs. FCAW (136) shall not be considered for making root passes.

16 mm Test Coupon notes

- If GMAW (MAG) is drawn for the root pass, a stop/start will be required in the centre 75mm of the plate;
- If any semi- automatic processes (GMAW/MA/FCAW) are drawn for the fill and cap passes, a stop/start in the centre 75mm of the cap pass only will be required. A weave or the last pass of a multi-pass stringer bead cap is considered for the stop and restart.
- GTAW (141) shall not be used on the 16mm test coupon.
- GMAW (MAG) is the only semi -automatic process to be used for root pass runs. FCAW (136) shall not be considered for making root passes.
- If hold points were not conducted, all would be affected assessments associated with the hold point shall receive no marks.
- Grinding for the intent to enhance the root pass or cap pass shall not be allowed. All aspects for the assessment of an enhanced root pass or cap pass shall not be evaluated and zero marks awarded.

Pipe Test Coupon notes

- The pipe test coupon shall consist of two (2) pieces of 114.3mm dia x 8.56mm wall (4" SCH 80) carbon steel pipe.
- The fillet weld coupon shall contain a stop start in the middle 75mm of the joint. The stop start shall be located in either root or capping run to be decided by a jury vote at the Competition.
- The stop/start to be inspected and verified by stamping.
- Each of the two plate coupons shall be welded with a different process. If a combination process joint is selected from the table for the 16mm coupon as listed in Appendix 13.1 this rule shall not apply.
- The pipe coupon shall be welded with the process or processes selected from the table listed in Appendix 13.1.
- Grinding for the intent to enhance the root pass or cap pass shall not be allowed. All aspects for the assessment of an enhanced root pass or cap pass shall not be evaluated and zero marks awarded.

Module two: Pressure vessel notes

Description: A completely enclosed plate/pipe structure, which shall encompass all four of the process listed and all weld positions as described in this Technical Description.

- Time: seven to eight hours approximately;
- Size: Overall dimensional space, approximately 350mmx350mmx400mm;
- Plate thickness: 6.8 and 10 mm;
- Pipe wall thickness 3 to 10 mm;
- Pressure test minimum normally 1000psi (69 bar).

The pressure vessel shall not weigh more than 35kg in the welded condition.

The Experts reserve the right to amend the design test pressure of any pressure vessel prior to the start of the Competition.

Module three: Aluminium structure

Description: A partially enclosed structure of aluminium, which shall be welded with TIG (141).

- Time: two or three hours approximately;
- Size: Overall dimensional space approximately 200mm x 200mm x 250mm;
- Aluminium plate/pipe material thickness 1.5mm to 3mm.
- All seams shall be welded in one run/pass with filler metal. The deposit of second run with or without filler will result in NO marks being awarded for the entire structure.
- The Test Project module may be sawn in half, where necessary, to enable weld penetration inspection and marking to be carried out.
- Skewed aluminum plate seams referenced as square groove welds with the joint open to the inside of the project, shall be prepped to achieve a true square groove and shown as such on the drawing piece part.
- During assembly and welding of the aluminium structure, there shall be no gaps in any weld seam.

Module four: Stainless Steel structure

Description: A partially enclosed structure of stainless, which shall be welded with TIG (141).

- Time: two or three hours approximately;
- Size: Overall dimensional space approximately 150mm x 150mm x 200mm;
- Stainless steel plate/pipe material thickness 1.5mm to 3mm.
- Skewed stainless steel plate seams referenced as square groove welds with the joint open to the inside of the project, shall be prepped to achieve a true square groove and shown as such on the drawing piece part.

- This Test Project module may be sawn in half, where necessary, to enable weld penetration inspection and marking to be carried out.
- All seams shall be welded in one run/pass with filler metal. The deposit of a second run with or without filler will result in no marks being awarded for the entire structure.
- During assembly and welding of the stainless-steel structure, there shall be no gaps in any weld seam.

Competition specific instructions

Welding machines, tools and equipment usage

- It is a requirement that the Competition Organizer supplies welding machines that can be used in basic modes of operation;
- Welding machines may be used to their full technical potential;
- It is a requirement that the Competition Organizer makes available detailed operation manuals to all participating countries/regions at least six (6) months prior to the Competition;
- The welding machines provided shall have the capability to be operated using both standard amperage control and remote amperage control. Remote variable amperage devices shall be made available;

Remote hand-held and foot controls switching controls must be provided.

Grinding and the use of abrasive materials and equipment:

- Material removal is not permitted on any of the root penetration or cap weld surfaces. "Cap pass" shall be defined as the final layer of the weld that meets the weld size, grooves and fillets.

Restarts may be prepared before welding over them.

- Grinding the surfaces of the fillet coupon material before welding is permitted but the machined preparation angle shall remain at 90 degrees.
- Wire brushing:
 - Wire brushing, manual or powered, may be used on all weld surfaces of the test plates/pipes (Module one) and the pressure vessel (Module two).
 - Wire brushing is NOT permitted on any of the completed welds of the aluminium project (Module three) or the stainless-steel project (Module four).

Backing bars/plates and restraining devices

- No copper (Cu) chill plates, ceramic backing tapes/bars or un off tabs are to be used in the Competition;
- Purging equipment may only be used with the Gas Tungsten Arc Welding process on the stainless-steel project;
- Restraining devices shall not be used during welding of the test plates. Such devices include:
 - Clamps, jigs, fixtures or steel plates, tack welded to the test plates;
- Welding of the test plates is to be carried out without the aid of restraining devices; (except that the provided restraining material for the fillet weld coupons) this is so the Experts can assess the control of distortion;
- Only standard fixture or positioning aids (positioners), supplied by the Competition Organizer may be used when welding the test coupons. Depending on the selected projects they shall at all times be welded and ground 100% on the workbench. Only when instructed can a Competitor can grind a coupon while still located in the positioner as long as grinding does not throw sparks over the top of the weld cell. Competitor will be stopped immediately if grinding is being accomplished in an unsafe manner.

Weld cleaning of GTAW (TIG) projects

- The weld faces on the aluminium and stainless steel GTAW (TIG) projects are to be presented in the “as welded” condition. Cleaning, grinding, steel wool, wire brushing or chemical cleaning is NOT permitted on any of the welds except for the preparation of stop starts on the stainless-steel project.

Tack welds

- Tack weld inspection is a HOLD POINT
- The maximum length of any one tack weld for any project is 15 mm, except for the preparation of stop starts on the stainless-steel project.
- For pressure vessel, Stainless Steel, and Aluminium tacking, 15 mm tacks may be combined about the X, Y and Z axis;
- Tacking in module 1 and 2, i.e. fillet welds, test pipe, test plates, and pressure vessel, the Competitor may use any of the welding processes listed in this Technical Description for tack welding in any position;
- No tack welds shall be made on the inside of any project. If found during presentation, competitor will be asked to remove them. Time will not be compensated for this;
- For Fillet weld coupons Only, two sufficient tack welds will be placed on the strong back in such a manner that they can be easily removed and 2 tacks at each start and ending edge of the coupon;
- When tacking the test coupons, i.e. fillet welds, test pipe, test plates and pressure vessel, the Competitor may use any of the welding processes listed in this Technical Description.

Welding of test plates/pipes and fillet coupons

- Once welding has commenced, the test plates may not be separated and then re-tacked. Re-tacking may only take place, if root welding has not commenced.
- There shall be no gap present in the fillet weld joint between plates after tacking. If such condition exists, competitor will be asked to reassemble the coupon to remove the gap. Time will not be compensated for this.
- HOLD POINT: A stop start must be conducted in the centre 75mm of the root for the fillet weld coupon.
- HOLD POINT: A stop start must be conducted in the centre 75mm of the root and cap pass for the 16mm coupon. If SMAW/MMAW is chosen for the root pass, no root pass hold point will be conducted.
- HOLD POINT: The test pipe coupon shall be secured in the positioner provided and mark the 12 o'clock position before welding commences. This is to be confirmed by stamping and will also act as a reference point for any inspection or testing.
- If hold points are not conducted in the root pass or cap pass of any coupon, all aspects of the effected pass will be awarded zero marks except for RT aspects. Class D RT marks will automatically be given.
- If a Competitor welds a coupon with the incorrect process or in the incorrect position, no further inspection and testing will be carried out and no marks are awarded to that coupon.

Welding of the pressure vessel

If any of the joint configurations on the pressure vessel i.e. butt, fillet or outside corners are welded with the incorrect process or in the incorrect position, that joint configuration shall not be visually assessed, and no marks are awarded.

Welding of the Aluminium or stainless-steel structures

If any of the joints are welded in the incorrect position, no further inspection shall be carried out and no marks are awarded for the complete structure.

After tacking, inspection and verification by stamping there can be no further material removal, no grinding or filing shall be carried out on the structure.

Note: A Competitor who is seen to be carrying out an operation that compromises any of rules or guidelines of this Technical Description will be notified immediately, to carry out no further work on the project until the matter is brought to a conclusion. The Competitor shall not be penalized by any time penalty during any investigation.

5.4 TEST PROJECT DEVELOPMENT

The Test Project MUST be submitted using the templates provided by WorldSkills International (www.worldskills.org/expertcentre). Use the Word template for text documents and DWG template for drawings.

5.4.1 Who develops the Test Project or modules

The Test Project/modules are developed and submitted by skill Experts (submission is optional for first time Experts). The 30% change is made by an Independent Designer.

5.4.2 How and where is the Test Project or modules developed

The Test Project/modules are developed independently, however, discussion, collaboration, and Communication is encouraged through the Discussion Forum.

5.4.3 When is the Test Project developed

The Test Project is developed according to the following timeline:

TIME	ACTIVITY
At the previous Competition	Experts develop and propose Test Project modules. A panel of Experts validates each proposal and a vote for modules two to four is conducted for the selection of the modules to be used at the following competition. Experts indicate their preferred test coupon for the following Competition. The preferred coupons are listed as possible coupons for the following Competition in appendix 14.1
Issue of projects two, three and four	The selected Test Project modules two to four will be circulated immediately after the previous Competition
Prior to the Competition	The Skill Competition Manager will make the 30% change which is then revealed at the Competition between C-4 and Familiarization Day. The Skill Competition Manager will select the Test Coupons for the next Competition.
At the Competition	Competitors are notified of the Test Coupon selection in-between C-4 and Familiarization Day. The 30% change will be presented to the Experts and Competitors in-between C-4 and Familiarization Day.

5.5 TEST PROJECT VALIDATION

It must be demonstrated that the Test Project/modules can be completed within the material, equipment, knowledge and time constraints. This will be demonstrated by including the following information with submissions for any Test Project module for selection:

- A separate cutting list for all the required materials for the Test Project modules shall be included to assist the Competition Organizers;
- A photograph of the welded stainless steel and aluminium structures;
- A photograph of the pressure vessel under pressure test with the pressure attained visible, 1000psi (69 bar);
- Any additional instructions for Competitors to aid in the completion of the project

5.6 TEST PROJECT SELECTION

The Test Coupons for the Competition shall be selected from a standard list at Appendix 13.1. This standard list will detail the position of the coupon, the process for the root pass and the process for the fill and cap passes. The Skill Competition Manager will determine the coupons to be welded. Notification of the selected combinations will be done in-between C-4 and Familiarization Day (C-2).

All Test Project modules shall comply with the Technical Description. An Expert panel will validate each project submitted for selection prior to voting using the following project checklist.

Project submission is optional for first-time Experts.

Welding project selection criteria

SUBMITTED BY	PRESSURE VESSEL	ALUMINIUM STRUCTURE	STAINLESS STEEL STRUCTURE
Project Drawings ISO A Weld symbols as per AWS Electronic format			
Project Drawings ISO E Weld symbols as per ISO 2533 Electronic Format			
Material/Cutting list			
Photograph of completed tasks			
Pressure Vessel weight		NA	NA
Project Major Dimensions			
Additional instructions on drawings			

Module one - Test Coupons

The Test Coupons for the Competition will be selected from the standard list located in Appendix 14.1.

The Competitors and Experts will be presented with the Competition Skill Manager chosen coupons in-between C-4 and Familiarization Day (C-2). **Modules two, three and four - Pressure vessel, aluminium structure, and stainless-steel structure**

The pressure vessel, aluminium structure and stainless-steel structure shall be selected by a vote at the preceding Competition by those Experts who are eligible to vote. Any Expert (except first-time Experts) who fails to submit a Test Project module for proposal shall not be eligible to vote on the project selection.

Each module is to be selected individually and not as a complete package.

Time will be made available after the Test Project modules have been validated for selection, for those Experts who have projects to submit, to display the drawings and details of their submissions and to brief the remaining Experts on the details of their projects. The Welding Experts will then review the submissions and those who are eligible to vote will do so under the supervision of the Chief Expert.

The Test Project modules selected shall be submitted without delay to be held by the WorldSkills Technical Director until they are circulated on the WSI website as per paragraph 3.7.

The modules listed below are to be completed in the following order. Test order in module one is to be determined before C-2.

- Module one - Fillet weld (Day one)
Visual assessment, Destructive testing and competency and assembly assessment
- Module one - 10 mm Test plate (Day one)
Visual assessment, Radiographic testing, competency and assembly assessment.
- Module one - 16 mm Test Plate (Day one)
Visual assessment, Radiographic testing, competency and assembly assessment
- Module one - Test Pipe (Day one to two)
Visual assessment, Non-destructive testing and Competency and assembly assessment.
- Module two - Pressure Vessel (Day one to three)
Visual assessment, Pressure test and Competency and assembly assessment.
- Module three - Aluminium Structure (Day three to four)
Visual assessment and Competency and assembly assessment.
- Module four - Stainless Steel Structure (Day four)
Visual assessment and Competency and assembly assessment.

ALL WELDING OF VERTICAL OR SLOPING WELDS MAY ONLY BE DONE WITH AN UPWARD PROGRESSION.

MODULES THREE AND FOUR MUST BE WELDED IN ONE PASS ONLY WITH FILLER ADDED

5.7 TEST PROJECT CIRCULATION

The Test Project is circulated via the website as follows:

The drawings and associated information for three modules shall be made available via the WorldSkills International immediately after the previous Competition.

The test coupons nominated for the next Competition shall be made available as part of this Technical Description. The specific selection will be made by the Independent Test Project Designer.

5.8 TEST PROJECT COORDINATION (PREPARATION FOR COMPETITION)

Coordination of the Test Project will be undertaken by the Skill Competition Manager.

5.9 TEST PROJECT CHANGE AT THE COMPETITION

The Independent Test Project Designer shall develop the 30% change as required by WorldSkills.

5.10 MATERIAL OR MANUFACTURER SPECIFICATIONS

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and are available from www.worldskills.org/infrastructure located in the Expert Centre.

6 SKILL MANAGEMENT AND COMMUNICATION

6.1 DISCUSSION FORUM

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the skill specific Discussion Forum (<http://forums.worldskills.org>). Skill related decisions and communication are only valid if they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be the moderator for this Forum. Refer to Competition Rules for the timeline of communication and competition development requirements.

6.2 COMPETITOR INFORMATION

All information for registered Competitors is available from the Competitor Centre (www.worldskills.org/competitorcentre).

This information includes:

- Competition Rules
- Technical Descriptions
- Marking Schemes
- Test Projects
- Infrastructure List
- WorldSkills Health, Safety, and Environment Policy and Regulations
- Other Competition-related information

6.3 TEST PROJECTS [AND MARKING SCHEMES]

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).

6.4 DAY-TO-DAY MANAGEMENT

The day-to-day management of the skill during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team led by the Skill Competition Manager. The Skill Management Team comprises the Skill Competition Manager, Chief Expert and Deputy Chief Expert. The Skill Management Plan is progressively developed in the six months prior to the Competition and finalized at the Competition by agreement of the Experts. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).

7 SKILL-SPECIFIC SAFETY REQUIREMENTS

Refer to Host country or region WorldSkills Health, Safety, and Environment Policy and Regulations for Host country or region regulations.

Competitors, at a minimum, shall use during the Competition the following personal protective equipment. All safety equipment must comply with Host Country Health and Safety requirements.

- Safety Glasses;
- Body protection – flame retardant material;
- Foot protection – from dropping objects;
- Hand Protection – heat and arc radiation;
- Face protection – Head or Hand welding shield;
- Hearing Protection;
- Clear face shield (grinding, may be integrated in the welding head shield);
- Fume and particle protection.

8 MATERIALS AND EQUIPMENT

8.1 INFRASTRUCTURE LIST

The Infrastructure List details all equipment, materials and facilities provided by the Competition Organizer.

The Infrastructure List is available at www.worldskills.org/infrastructure.

The Infrastructure List specifies the items and quantities requested by the Experts for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Items supplied by the Competition Organizer are shown in a separate column.

At each Competition, the Experts must review and update the Infrastructure List in preparation for the next Competition. Experts must advise the Director of Skills Competitions of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

8.2 COMPETITOR'S TOOLBOX

Each Competitor is allowed a toolbox in the workshop with a maximum external volume of 0.54m³. For example, 1000mm x 600mm x 900mm. Competitors with toolboxes larger than this will be asked to remove them from the workshop and store them offsite.

8.3 MATERIALS, EQUIPMENT, AND TOOLS SUPPLIED BY COMPETITORS IN THEIR TOOLBOX








Non-consumable materials, equipment and tools to be supplied by the Competitor.

The Competitor shall bring tools and equipment in a toolbox and is encouraged to bring other new tools and devices that are being used in today's industry.

The following list as a minimum shall be supplied by the Competitor

DESCRIPTION	QUANTITY	PHOTO
Welding safety glasses		
Grinding goggles		
Welders helmet, speed lenses are permitted		
Safety boots with protective toes		
Ear protection		
Hand angle grinder with guard, maximum 125 mm (5 inch)		

DESCRIPTION	QUANTITY	PHOTO
Wire brush wheels to suit grinder		
Welding safety glasses		
Fire retardant clothing		
Chipping hammer (slag hammer)		
Inter-weld run cleaning, blade scrapers		
Chisels		
Scriber		
Files		
Wire brushes		

DESCRIPTION	QUANTITY	PHOTO
Hammer		
Weld gauge (fillet gauge)		
Metric steel ruler (tape measure)		
Square		
Chalk/soapstone		
Dividers		
G-clamps and/or c-clamps and quick gripping devices		
Power transformer (if required) and extension leads		

- Competitors may use their own SMAW, (MMAW), GTAW (TIG), GMAW (MAG) and FCAW hand pieces/torches, provided they are compatible with the Competition Organizer's equipment;
- The Competitor's equipment shall comply with safety regulations;
- Should any Competitor supplied equipment fail or become unserviceable during the competition, no additional time allowance shall be made;
- Other personal hand tools;

All working clothes and all tools shall comply with Host Country safety regulations. Alignment aids for setting up test samples may be used, provided they are removed prior to welding.

8.4 MATERIALS, EQUIPMENT, AND TOOLS SUPPLIED BY EXPERTS

Not applicable.

8.5 MATERIALS AND EQUIPMENT PROHIBITED IN THE SKILL AREA

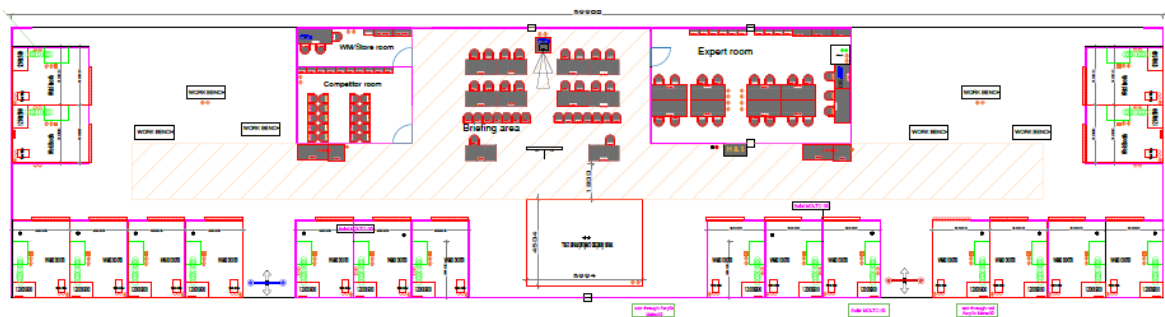
Any material that may be used to assemble a project or part of a project is not allowed to be brought to the Competition.

No additional consumables or practice materials are allowed to be brought to the Competition. Only items in section 8.3 are allowed.

8.6 PROPOSED WORKSHOP AND WORKSTATION LAYOUTS

Workshop layouts from previous competitions are available at www.worldskills.org/sitelayout.

Example workshop layout:



9 SKILL-SPECIFIC RULES

Skill-specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from skill competition to skill competition. This includes but is not limited to personal IT equipment, data storage devices, internet access, procedures and work flow, and documentation management and distribution.

TOPIC/TASK	SKILL-SPECIFIC RULE
Use of technology – USB, memory sticks	<ul style="list-style-type: none"> Competitors, Experts, and Interpreters are allowed to have memory devices in the workshop.
Use of technology – personal laptops, tablets and mobile phones	<ul style="list-style-type: none"> Competitors, Experts, and Interpreters are allowed to use personal laptops, tablets and mobile phones in the workshop.
Use of technology – personal photo and video taking devices	<ul style="list-style-type: none"> Competitors, Experts, and Interpreters are allowed to use personal photo and video taking devices in the workshop.
Equipment failure	<ul style="list-style-type: none"> If equipment or tools which are brought by the Competitor fail there will be no extra time allowed. If equipment or tools supplied by the Competition Organizer fail extra time will be allowed only if the Technician of the sponsor or supplying company specifies and proves it is not a "user error".
Health, Safety, and Environment	<ul style="list-style-type: none"> Refer to the WorldSkills Health, Safety, and Environment policy and guidelines document

10 VISITOR AND MEDIA ENGAGEMENT

Following is a list of possible ways to maximize visitor and media engagement for this skill:

- Try a trade;
- Display screens;
- Test Project descriptions and displays;
- Enhanced understanding of Competitor activity;
- Competitor profiles;
- Career opportunities;
- Daily reporting of competition status.

11 SUSTAINABILITY

This skill will focus on the sustainable practices below:

- Recycling;
- Use of 'green' materials;
- Use of completed Test Projects after Competition.
- By minimizing competition footprint via equipment selection, shift changes, and or competition layout.

12 REFERENCES FOR INDUSTRY CONSULTATION

WorldSkills is committed to ensuring that the WorldSkills Standards Specifications fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Standards Specification on a two-yearly cycle.

In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (<http://www.ilo.org/public/english/bureau/stat/isco/isco08/>)
- ESCO: (<https://ec.europa.eu/esco/portal/home>)
- O*NET OnLine (www.onetonline.org/)

The WSSS in Section 2 appears to relate most closely to *Welders, Cutters and Welder Fitters*:

<https://www.onetonline.org/link/summary/51-4121.06>

and/or *Welder*: <http://data.europa.eu/esco/occupation/7aedaa07-3884-4c5b-88f9-80997b2aa54b>

These links can also be used to explore adjacent occupations.

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Standards Specification in place for WorldSkills Kazan 2019.

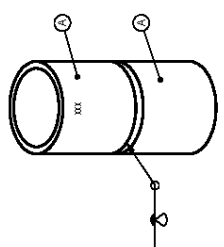
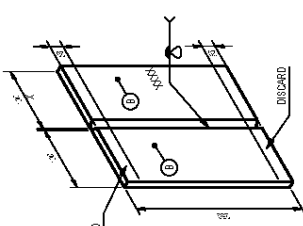
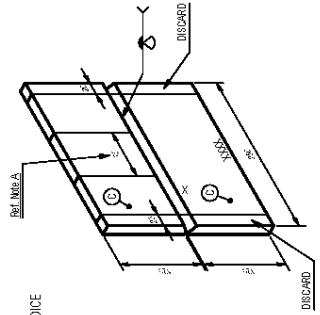
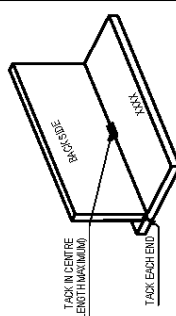
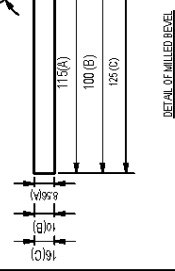

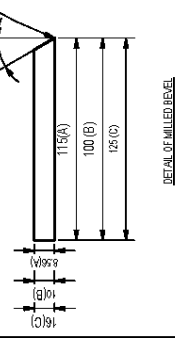
ORGANIZATION	CONTACT NAME
Miller Electric Mfg. L.L.C	Nick Peterson, Welding Engineer/Curriculum Developer
Vermeer Corporation	David Landon, Welding Engineering Manager

13 APPENDIX

13.1 POSSIBLE SELECTION OF COUPONS, WELD PROCESS AND POSITION

COUPON	ROOT PASS	FILL AND CAPPING	POSITION
Pipe	MAG/GMAW (135) TIG/GTAW (141)	MMA/SMAW (111) MAG/GMAW (135) TIG/GTAW (141)	PC/2G PH/5G H-LO45/6G
10mm Plate	MMA/SMAW (111)	MMA/SMAW (111)	PA/1G PC/2G PF/3G PE/4G
16mm Plate	MAG/GMAW (135)	MAG/GMAW (135) FCAW-G (136)	PA/1G PC/2G PF/3G PE/4Gri
Fillet Weld	MMA/SMAW (111) MAG/GMAW (135) FCAW (136)		PB/2F PF/3F PD/4F

13.2 COUPON DRAWINGS

1	2	3	4	5	6	7	8	9	10																																
A	B	C	D	E	F																																				
<p>PIPE TEST COUPON 1A: MATERIAL: CARBON STEEL PIPE 2 PCS Ø14.3 X 0.98 WALL X 115 LONG</p> <p>NOTE: THE NUMBER OF TACKS IS TO BE LIMITED WITH A MAXIMUM OF 4 TACKS.</p> 	<p>TEST PLATE COUPON 1B: MATERIAL: CARBON STEEL PLATE THICKNESS: 10 mm.</p> <p>X = YOUR CHOICE</p> 	<p>TEST PLATE COUPON 1C: MATERIAL: CARBON STEEL PLATE THICKNESS: 10 mm.</p> <p>X = YOUR CHOICE</p> 	<p>FILLET WELD COUPON 1D: MATERIAL: CARBON STEEL PLATE THICKNESS: 12 mm WELDING PROCESS: _____ WELDING POSITION: _____</p> <p>NOTE: 1. DEPOSIT A FILLET WELD ON THE FRONT SIDE OF THE JOINT WITH A 10 mm (±2.0/0) mm LEG LENGTH. 2. WELD TO BE DEPOSITED WITH A MINIMUM OF 2 RUNS AND A MAXIMUM OF 3 RUNS. 3. EDGE PREPARATION MUST REMAIN AT 30° TO THE PLATE FACE. NO CHAMFER AND GAP ALLOWED.</p> 	<p>TEST PLATE COUPON 1E: MATERIAL: CARBON STEEL PLATE THICKNESS: 10 mm.</p> <p>X = YOUR CHOICE</p> 	<p>TEST PLATE COUPON 1F: MATERIAL: CARBON STEEL PLATE THICKNESS: 10 mm.</p> <p>X = YOUR CHOICE</p> 	<p>WELDING PROCESS POSITION: _____ ROOT PASS: _____ FILL & CAP: _____</p> <p>EVALUATION: 1. VISUAL 2. X-RAY ENTIRE WELD JOINT</p>	<p>WELDING PROCESS POSITION: _____ ROOT PASS: _____ FILL & CAP: _____</p> <p>EVALUATION: 1. VISUAL 2. X-RAY ENTIRE WELD JOINT</p>	<p>WELDING PROCESS POSITION: _____ ROOT PASS: _____ FILL & CAP: _____</p> <p>EVALUATION: 1. VISUAL 2. X-RAY ENTIRE WELD JOINT</p>	<p>WELDING PROCESS POSITION: _____ ROOT PASS: _____ FILL & CAP: _____</p> <p>EVALUATION: 1. VISUAL 2. X-RAY ENTIRE WELD JOINT</p>																																
<p>NOTE: 1. ANY PROCESS AND ANY POSITION MAY BE USED FOR TACK WELDING. 2. ALL TACK WELDS EXCEPT CENTRE OF FILLET WELDS ARE TO BE NOT LONGER THAN 15 mm. A MAXIMUM OF 4 TACKS ARE TO BE MADE FOR TEST PIPE COUPON. 3. ALL PLATE OR PIPE COUPONS ARE TO BE TACK WELDED BEFORE ANY WELDING COMMENCES. 4. PROCESS INDICATED FOR ROOT WELD TO BE USED ONLY FOR ONE RUN, NOT FOR SECOND AND SUBSEQUENT PASSES. 5. ALL PLATE OR PIPE COUPONS MUST BE WELDED IN THE POSITION AS INDICATED FOR EACH TEST. 6. GRINDING IS NOT ALLOWED FOR THE CLEANING OF THE FINAL SURFACES OF BOTH CAP AND ROOT WELDS. 7. XXXX= COMPETITOR'S ID.</p>																																									
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<p>Test Project for the 44th WorldSkills Competition in Abu Dhabi, United Arab Emirates 2017. Copyright © 2017 WorldSkills International. All Rights Reserved.</p>																																									
<p>Skill 10: Arc/Welding, Shimming, Soudage Scale: N.T.S. Date: 07 June 2017 Paper: A3 Designed/Drawn by: Chih-Peng Chen TW Description: Module 1-Test Coupons (Plate/Pipe/Fillet) Rev: 6 Page: 1 of 1</p>																																									