

10 Welding

WorldSkills Standards Specification

Section	WSSS Marks
1	Work organization and management
2	Preparation and assembly techniques
3	Welding materials
4	SMAW (111) and GMAW (135) Process
5	FCAW-G (136) Process
6	GTAW (141) Process
7	Finishing, quality assurance, and testing

Criteria

ID	Name
A	Visual Marking
B	Pressure Test

C	Destructive testing
D	Non Destructive Testing - Radiograph
E	
F	
G	
H	
I	

Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
A1	Visual Assessment of Fillet Weld	1	M M	Fillet weld sizes in accordance with specifications and drawings? Fillet welds free from undercut?	
A2	Visual Assessment of Fillet Weld	1	M M	Fillet weld sizes in accordance with specifications and drawings? Fillet welds free from undercut?	
A3	Visual Assessment of Test Pipe - Team 1	1	M M M	Butt welds free from undercut or underfill? Butt weld joint free from excessive face reinforcement Butt Joint weld widths uniform and regular?	
A4	Visual Assessment of Test Pipe - Team 2	1	M M M	Butt weld joint free from arc strike? Butt weld joint free from excessive root concavity Butt weld joint free from excessive root reinforcement	
A5	Visual Assessment of Test Plate 10mm - Team	1	M M M	Butt welds free from undercut or underfill? Butt weld joint free from excessive face reinforcement Butt Joint weld widths uniform and regular?	
A6	Visual Assessment of Test Plate 10mm - Team	1			

A7	Visual Assessment of Test Plate 16mm - Team	1	M	Butt weld joint free from arc strike?	
			M	Butt weld joint free from excessive root concavity	
			M	Butt weld joint free from excessive root reinforcement	
A8	Visual Assessment of Test Plate 16mm - Team	Any	M	Butt welds free from undercut or underfill?	
			M	Butt weld joint free from excessive face reinforcement	
			M	Butt Joint weld widths uniform and regular?	
A9	Pressure Vessel – Team 1	2	M	Butt weld joint free from arc strike?	
			M	Butt weld joint free from excessive root concavity	
			M	Butt weld joint free from excessive root reinforcement	
			M	General - Vessel is free from stray arc strikes?	0 1 2 3
			J	General - Surface slag, spatter and smoke has been removed from	
A10	Pressure Vessel – Team 2	2	M	General - Joints are free from linear misalignment?	0 1 2 3
			J	General - Tie-ins at corners are smooth and continuous?	
A11	Pressure Vessel – Team 3	2	M	Fillet Joints - All stop/restarts smooth on the capping layer of the	
			M	Fillet joint weld metal completely fused into parent material and b	
			M	Fillet joints completely free from surface porosity or inclusions?	
A12	Pressure Vessel – Team 4	2	M	Fillet joints free from undercut?	
			M	Fillet Joint weld sizes in accordance with the specifications and d	
			M	Butt Joint weld widths uniform and regular?	

A13	Pressure Vessel – Team 5	2	M	Butt Joints - All stop/restarts are smooth on the capping layer of the	
			M	Butt Joint weld metal completely fused into parent material and b	
			M	Butt Joint weld metal completely free from inclusions or surface p	
			M	Butt Joints free from undercut?	
			M	Butt Joint weld joint grooves completely filled?	
			M	Butt weld joints free from excessive face reinforcement?	
			M	Corner weld bead widths uniform and regular?	
			M	Corner Joints - All stop/restarts smooth on the capping layer of the	
			M	Corner Joint weld metal completely fused into parent material and	
			M	Corner Joint weld metal completely free from surface porosity or	
A14	Pressure Vessel – Team 6	2	M	Corner welded joints free from undercut?	0 1 2 3
			J	Corner welds exhibit a full radius contour?	
A15	Aluminium Structure - Team 1	4	M	Project is free from stray arc strike	
			M	Butt weld bead widths uniform and regular?	
			M	Butt weld joints free from excessive face reinforcement?	
A16	Aluminium Structure - Team 2	4	M	Weld metal is completely free from surface porosity or inclusions	
			M	Welded joints are free from undercut?	
A17	Aluminium Structure - Team 3	4	M	Joints are free from linear misalignment	
			M	Fillet weld leg lengths are in accordance with the specifications?	

A18	Aluminium Structure - Team 4	4	M	All fillet welds free from burn through?	
			M	Weld joints are completely welded?	
			M	All butt and corner joints display penetration/root fusion?	
			M	Welded joints are free from excessive penetration?	
A19	Aluminium Structure - Team 5	4	J	Corner welds exhibit a full radius contour?	0 1 2 3
A20	Stainless Steel Structure - Team 1	3	M	Project is free from stray arc strikes?	
			M	Butt weld bead widths are uniform and regular?	
			M	Weld metal is completely free from surface porosity or inclusions	
A21	Stainless Steel Structure - Team 2	3	M	Welded joints are free from undercut?	
			M	Butt weld joint is free from excessive face reinforcement?	
			M	Fillet weld leg lengths are in accordance with the specifications?	
A22	Stainless Steel Structure - Team 3	3	M	All fillet welds are free from burn through?	
			M	Weld joint is completely welded?	
			M	Joints are free from linear misalignment	
A23	Stainless Steel Structure - Team 4	3	M	All butt and corner joints display penetration/root fusion?	
			M	Welded joints are free from excessive penetration?	

A24	Stainless Steel Structure - Team 5	3	M J	The root penetration is free from contamination (oxidation/sugar) Corner welds exhibit a full radius contour?	0 1 2 3
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
B1	Pressure Vessel – Pressure Test	3	M M M M M M M M	Vessel presented for assessment test The vessel holds pressure at 10 Bar - Refer TD Section 4.9 The vessel holds pressure at 20 Bar - Refer TD Section 4.9 The vessel holds pressure at 30 Bar - Refer TD Section 4.9 The vessel holds pressure at 40 Bar - Refer TD Section 4.9 The vessel holds pressure at 50 Bar - Refer TD Section 4.9 The vessel holds pressure at 55 Bar - Refer TD Section 4.9 The vessel holds pressure at 60 Bar - Refer TD Section 4.9	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
C1	Visual Assessment of Fillet Weld Break Test	3	M M M	The fillet weld is completely fused at the root of the joint? The fillet weld is completely fused between individual runs? The fractured fillet weld is free from porosity and inclusion?	

C2	Visual Assessment of Fillet Weld Break Test	3	M M M	The fillet weld is completely fused at the root of the joint? The fillet weld is completely fused between individual runs? The fractured fillet weld is free from porosity and inclusion?	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
D1	Non Destructive (X-Ray) Test – Pipe Coupon	3	M M M M	ISO 5817 - Quality level of imperfections - Class D? ISO 5817 - Quality level of imperfections - Class C? ISO 5817 - Quality level of imperfections - Class B? Class A?	
D2	Non Destructive (X-Ray) Test – 10mm Plate Cou	3	M M M M	ISO 5817 - Quality level of imperfections - Class D? ISO 5817 - Quality level of imperfections - Class C? ISO 5817 - Quality level of imperfections - Class B? Class A?	
D3	Non Destructive (X-Ray) Test – 16mm Plate Cou	3	M M M M	ISO 5817 - Quality level of imperfections - Class D? ISO 5817 - Quality level of imperfections - Class C? ISO 5817 - Quality level of imperfections - Class B? Class A?	
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ification			
	WSSS Marks	Aspect Marks	Variation
	10.00	10.80	0.80
	10.00	9.70	0.30
	10.00	9.90	0.10
	25.00	26.10	1.10
	10.00	8.90	1.10
	15.00	14.60	0.40
	20.00	20.00	0.00
Total Variation			3.80

Mark
55.00
15.00

	9.00
	21.00

Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
(-0/+2mm) 0.5 mm maximum depth allowed.	yes/no	1		2.00
	yes/no	2		0.50
(-0/+2mm) 0.5 mm maximum depth allowed.	yes/no	1		2.00
	yes/no	2		0.50
Undercut - 0.5 mm maximum depth allowed. Underfill - 0 mm Allow 2.5 mm or less Allow 2 mm variation in width	yes/no	1		0.40
	yes/no	2		0.40
	yes/no	4		0.40
Assessment shall only be carried out on pipe surface adjacent to weld Allow 0.5mm maximum. Zero mark if 100% penetration is not allowed Allow 2 mm maximum. Zero mark if 100% penetration is not allowed	yes/no	4		0.40
	yes/no	6		0.40
	yes/no	6		0.40
Undercut - 0.5 mm maximum depth allowed. Underfill - 0 mm Allow 2.5 mm or less Allow 2 mm variation in width	yes/no	1		0.40
	yes/no	2		0.40
	yes/no	4		0.40

Criterion A Total Mark 55.00

Assessment shall only be carried out on plate surface adjacent to edge	yes/no	4		0.40
Allow 0.5mm maximum. Zero mark if 100% penetration is visible	yes/no	4		0.40
Allow 2 mm maximum. Zero mark if 100% penetration is visible	yes/no	4		0.40
Undercut - 0.5 mm maximum depth allowed. Underfill - 0 mm maximum	yes/no	1		0.40
Allow 2.5 mm or less	yes/no	2		0.40
Allow 2 mm variation in width	yes/no	5		0.40
Assessment shall only be carried out on plate surface adjacent to edge	yes/no	5		0.40
Allow 0.5mm maximum. Zero mark if 100% penetration is visible	yes/no	4		0.40
Allow 2 mm maximum. Zero mark if 100% penetration is visible	yes/no	4		0.40
One defect = 66%, 2 defects = 33%, 3 or more defects = 0 marks	Defects =	4	1	1.50
1 visible arc strike = 1 defect. Do not assess underside of plate				
See 2019 assessment document Skill 10		2		1.00
unacceptable or not presented - does not meet the industry standard				
acceptable - meets the minimum industry standard - Most welds				
meets the industry standard and exceeds it in some respects				
is excellent relative to and exceeds the industry standard -				
Allow 1mm maximum	yes/no	3		0.80
See 2019 assessment document Skill 10		2		1.00
unacceptable or not presented - does not meet the industry standard				
acceptable - meets the minimum industry standard - Weld				
meets the industry standard and exceeds it in some respects				
is excellent relative to and exceeds the industry standard -				
Allow 1.5 mm variation between stop/start	yes/no	4		1.00
No overlap/cold lap	Defects =	3	1	1.00
Each continuous overlap/cold lap = 1 defect				
One defect = 66%, 2 defects = 33%, 3 or more defects = 0 marks				
One defect = 66%, 2 defects = 33%, 3 or more defects = 0 marks	Defects =	4	1	1.00
1 visible pore or inclusion = 1 defect				
Disregard depth of 0.5mm or less.	yes/no	1		1.00
(-0 / +2 mm). One defect = 1.5 marks, 2 defects = 1.0 mark	Defects =	1	2	2.00
Less than or equal to 25mmL = 1 defect (accumulative)				
Allow 2 mm variation in width.	Defects =	4		1.00
One weld outside variation = 0.75 marks, two welds = 0.5 marks				

Allow 1.5 mm variation between stop/start	yes/no	4		0.80
No overlap/cold lap	Defects =	5	1	0.80
Each continuous overlap/cold lap = 1 defect				
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				
One defect = 66%, 2 defects = 33%, 3 or more defects = 0	Defects =	4	1	1.00
1 visible pore or inclusion = 1 defect				
Disregard depth of 0.5mm or less	yes/no	4		1.00
	yes/no	6		1.00
Greater than 2.5 mm.	yes/no	4		1.00
Allow 2 mm variation in width	yes/no	4		1.00
Allow 1.5 mm variation in height between stop/start	yes/no	4		0.80
No overlap/cold lap	Defects =	4	1	0.80
Each continuous overlap/cold lap = 1 defect				
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				
One defect = 66%, 2 defects = 33%, 3 or more defects = 0	Defects =	4	1	1.00
-1 visible pore or inclusion = 1 defect				
Disregard depth of 0.5mm or less	yes/no	5		0.80
See 2019 assessment document Skill 10		5		1.50
unacceptable or not presented - does not meet the industry standard				
acceptable - meets the minimum industry standard - Radiography				
meets the industry standard and exceeds it in some respects				
is excellent relative to and exceeds the industry standard - Radiography				
One defect = 66%, 2 defects = 33%, 3 or more defects = 0	Defects =	2	1	0.80
1 visible arc strike = 1 defect. Do not assess underside of				
Allow 1.5 mm variation in width. Each weld outside the variation = 1 defect	Defects =	6	1	0.80
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				
Greater than 1.5 mm. Each weld outside the variation = 1 defect	Defects =	6	1	0.80
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				
- 1 visible pore = 1 defect	Defects =	6	1	0.80
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				
Disregard depth of 0.5mm or less	yes/no	2		0.50
Allow 1mm variation	yes/no	3		0.60
(-0 /+2.0 mm). Each weld outside the variation = 1 defect	Defects =	1	1	0.80
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				

- less than or equal to 10mmL = 1 defect (accumulative) One defect = 66%, 2 defects = 33%, 3 or more defects = 0	Defects =	6	1	0.60
Fully formed bead may not terminate greater than or equal to 1 mm	yes/no	6		0.50
100% = 2.0 marks, >or=90% = 1.5 marks, >or=75% = 1.0 marks, >or=50% = 0.4 marks, <50% = 0 marks Zero mark if the total amount of penetration is less than 75% Greater than 3 mm. Each weld outside the variation = 1 defect One defect = 0.6 marks, 2 defects = 0.3 marks, 3 or more defects = 0	% Penetration =	3		2.00
	Defects =	6		0.80
See 2019 assessment document Skill 10 unacceptable or not presented - does not meet the industry standard acceptable - meets the minimum industry standard - Radiography meets the industry standard and exceeds it in some respects is excellent relative to and exceeds the industry standard -		6		1.00
One defect = 66%, 2 defects = 33%, 3 or more defects = 0	Defects =	2	1	0.70
1 visible arc strike = 1 defect. Do not assess underside of weld				
Allow 1.0 mm variation. Each weld outside the variation = 1 defect	Defects =	6	1	0.80
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				
- 1 visible pore/inclusion = 1 defect	Defects =	6	1	0.50
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				
Disregard depth of 0.5mm or less	yes/no	2		0.50
Greater than 1.5 mm. Each weld outside the variation = 1 defect	Defects =	6	1	0.70
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				
(-0 /+1.0 mm). Each weld outside the variation = 1 defect	Defects =	1	1	0.80
One defect = 66%, 2 defects = 33%, 3 or more defects = 0				
- less than or equal to 10mmL = 1 defect (accumulative) One defect = 66%, 2 defects = 33%, 3 or more defects = 0	Defects =	6	1	0.60
Fully formed bead may not terminate greater than or equal to 1 mm	yes/no	6		0.50
Allow 1 mm variation	yes/no	3		0.50
100% = 2.0 marks, >or=90% = 1.5 marks, >or=75% = 1.0 marks, >or=50% = 0.4 marks, <50% = 0 marks Zero mark if the total amount of penetration is less than 75% Greater than 2.5 mm. Each weld outside the variation = 1 defect One defect = 0.5 marks, 2 defects = 0.3 marks, 3 or more defects = 0	% Penetration =	3	3	2.00
	Defects =	6		0.70

Zero mark if the total amount of penetration is less than 75
Each weld with contamination = 1 defect
One defect = 0.5 marks, 2 defects = 0.3 marks, 3 or more

See 2019 assessment document Skill 10.
unacceptable or not presented - does not meet the industry
acceptable - meets the minimum industry standard - Radi
meets the industry standard and exceeds it in some respe
is excellent relative to and exceeds the industry standard -

		6		0.70
		6		1.00
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Vessel presented for pressure test	yes/no	1		1.00
No leaks observed at 10 Bar	yes/no	7		2.00
No leaks observed at 20 Bar	yes/no	7		2.00
No leaks observed at 30 Bar	yes/no	7		2.00
No leaks observed at 40 Bar	yes/no	7		2.00
No leaks observed at 50 Bar	yes/no	7		2.00
No leaks observed at 55 Bar	yes/no	7		2.00
No leaks observed at 60 Bar	yes/no	7		2.00
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Zero mark if hold point on root pass stop/start has not been	yes/no	4		2.00
	yes/no	3		1.50
A defect greater than 2.5mm = zero marks	Defects =	4	1	1.00
One defect 1.0 mm to 2.5 mm in size = 66%. Two defects				
Zero mark if hold point on root pass stop/start has not been				
Disregard first and last 20mm				

Criterion B Total Mark 15.00

Criterion C Total Mark 9.00

Zero mark if hold point on root pass stop/start has not been witnessed	yes/no	5		2.00
A defect greater than 2.5mm = zero marks	yes/no	3		1.50
One defect 1.0 mm to 2.5 mm in size = 66%. Two defects = 33%	Defects =	5	1	1.00
Zero mark if hold point on root pass stop/start has not been witnessed				
Disregard first and last 20mm				
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Class D = 1 mark	Yes/no	2		1.00
Class C= 2 marks	Yes/no	6		2.00
Class B= 2 marks	Yes/no	4		2.00
Class A= 2 marks. *Class A represents "No recordable in 100 welds"	Yes/no	7		2.00
Class D= 1 mark	Yes/no	2		1.00
Class C= 2 marks	Yes/no	4		2.00
Class B= 2 marks	Yes/no	4		2.00
Class A= 2 marks. *Class A represents "No recordable in 100 welds"	Yes/no	7		2.00
Class D = 1 mark	Yes/no	2		1.00
Class C= 2 marks	Yes/no	4		2.00
Class B= 2 marks	Yes/no	5		2.00
Class A= 2 marks. *Class A represents "No recordable in 100 welds"	Yes/no	7		2.00
If hold point for root pass stop/start has not been witnessed				
If hold point for cap pass stop/start has not been witnessed				
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark

Criterion D Total Mark 21.00

Criterion E Total Mark 0.00

Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
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Criterion F Total Mark 0.00

Criterion G Total Mark 0.00

Criterion H Total Mark 0.00

Criterion I Total Mark 0.00

Competition Total Mark 100.00