

## 10 Welding

### WorldSkills Occupational Sta

Section	WSOS 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	2	M M	Fillet weld sizes in accordance with specifications and drawings? Fillet welds free from undercut?	
A2	Visual Assessment of Fillet Weld	2	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	Butt welds free from undercut or underfill?	

A6	Visual Assessment of Test Plate 10mm - Team 1	1	M	Butt weld joint free from excessive face reinforcement	
			M	Butt Joint weld widths uniform and regular?	
			M	Butt weld joint free from arc strike?	
			M	Butt weld joint free from excessive root concavity	
A7	Visual Assessment of Test Plate 16mm - Team 1	1	M	Butt weld joint free from excessive root reinforcement	
			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?	
A8	Visual Assessment of Test Plate 16mm - Team 1	1	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?	
			M	Butt weld joint free from arc strike?	
A9	Pressure Vessel – Team 1	3	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?	
			J	General - Surface slag, spatter and smoke has been removed from	
A10	Pressure Vessel – Team 2	3			0
					1
					2
					3
A11	Pressure Vessel – Team 3	3	M	General - Joints are free from linear misalignment?	
			J	General - Tie-ins at corners are smooth and continuous?	
					0
					1
					2
					3
			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?	
			M	Fillet joints free from undercut?	
			M	Fillet Joint weld sizes in accordance with the specifications and d	
			M		

A12	Pressure Vessel – Team 4	3	M	Butt Joint weld widths uniform and regular?	
			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?	
A13	Pressure Vessel – Team 5	3	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	
A14	Pressure Vessel – Team 6	3			
			M	Corner Joint weld metal completely free from surface porosity or	
			M	Corner welded joints free from undercut?	
			J	Corner welds exhibit a full radius contour?	
A15	Aluminium Structure - Team 1	4			0 1 2 3
			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?	
			M	Joints are free from linear misalignment	

A17	Aluminium Structure - Team 3	4	M	Fillet weld leg lengths are in accordance with the specifications?	0 1 2 3
			M	All fillet welds free from burn through?	
			M	Weld joints are completely welded?	
A18	Aluminium Structure - Team 4	4	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?	
A20	Stainless Steel Structure - Team 1	4	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	4	M	Welded joints are free from undercut?	0 1 2 3
			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	4	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	4	M	All butt and corner joints display penetration/root fusion?	

A24	Stainless Steel Structure - Team 5	4	M	Welded joints are free from excessive penetration?	0 1 2 3
			M	The root penetration is free from contamination (oxidation/sugarin	
			J	Corner welds exhibit a full radius contour?	
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	4	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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Standards			
	WSOS Marks	Aspect Marks	Variation
	10.00	10.80	0.80
	10.00	12.70	2.70
	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	17.00	3.00
Total Variation			9.20

Mark
55.00

	15.00
	9.00
	21.00

Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSOS 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	yes/no	1		0.40

Criterion A      Total Mark      55.00

Allow 2.5 mm or less	yes/no	2		0.40
Allow 2 mm variation in width	yes/no	4		0.40
Assessment shall only be carried out on plate surface adjacent to	yes/no	4		0.40
Allow 0.5mm maximum. Zero mark if 100% penetration is not visible	yes/no	4		0.40
Allow 2 mm maximum. Zero mark if 100% penetration is not visible	yes/no	4		0.40
Undercut - 0.5 mm maximum depth allowed. Underfill - 0 mm or less	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	yes/no	5		0.40
Allow 0.5mm maximum. Zero mark if 100% penetration is not visible	yes/no	4		0.40
Allow 2 mm maximum. Zero mark if 100% penetration is not visible	yes/no	4		0.40
One defect = 1.0 marks, 2 defects = 0.6 marks, 3 or more defects = 0.2 marks	Defects =	4	1	1.50
1 visible arc strike = 1 defect. Do not assess underside of plate		2		1.00
See 2022 assessment document Skill 10				
unacceptable or not presented - does not meet the industry standard				
acceptable - meets the minimum industry standard - Most defects are visible				
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 2022 assessment document Skill 10		2		1.00
unacceptable or not presented - does not meet the industry standard				
acceptable - meets the minimum industry standard - Weld is visible				
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 = 0.7 marks, 2 defects = 0.4 marks, 3 or more defects = 0.2 marks				
One defect = 0.7 marks, 2 defects = 0.4 marks, 3 or more defects = 0.2 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 marks, 3 or more defects = 0.5 marks	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				
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 = 0.6 marks, 2 defects = 0.4 marks, 3 or more				
One defect = 0.7 marks, 2 defects = 0.4 marks, 3 or more	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 = 0.6 marks, 2 defects = 0.4 marks, 3 or more				
One defect = 0.7 marks, 2 defects = 0.4 marks, 3 or more	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 2022 assessment document Skill 10		5		1.50
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 -				
One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more	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 var	Defects =	6	1	0.80
One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more				
Greater than 1.5 mm. Each weld outside the variation = 1	Defects =	6	1	0.80
One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more				
- 1 visible pore = 1 defect	Defects =	6	1	0.80
One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more				
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 One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more	Defects =	1	1	0.80
- less than or equal to 10mmL = 1 defect (accumulative) One defect = 0.4 marks, 2 defects = 0.2 marks, 3 or more	Defects =	6	1	0.60
Fully formed bead may not terminate greater than or equal to 10mmL	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% of the depth of the groove Greater than 3 mm. Each weld outside the variation = 1 defect One defect = 0.6 marks, 2 defects = 0.3 marks, 3 or more	% Penetration = Defects =	3		2.00
		6		0.80
See 2022 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 = 0.5 marks, 2 defects = 0.3 marks, 3 or more 1 visible arc strike = 1 defect. Do not assess underside of Allow 1.0 mm variation. Each weld outside the variation = 1 defect One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more - 1 visible pore/inclusion = 1 defect One defect = 0.3 marks, 2 defects = 0.2 marks, 3 or more	Defects = Defects = Defects =	2 6 6	1 1 1	0.70 0.80 0.50
Disregard depth of 0.5mm or less Greater than 1.5 mm. Each weld outside the variation = 1 defect One defect = 0.5 marks, 2 defects = 0.3 marks, 3 or more (-0 /+1.0 mm). Each weld outside the variation = 1 defect One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more	yes/no Defects = Defects =	2 6 1		0.50 0.70 0.80
- less than or equal to 10mmL = 1 defect (accumulative) One defect = 0.4 marks, 2 defects = 0.2 marks, 3 or more Fully formed bead may not terminate greater than or equal to 10mmL Allow 1 mm variation	Defects = yes/no yes/no	6 6 3	1	0.60 0.50 0.50
100% = 2.0 marks, >or=90% = 1.5 marks, >or=75% = 1.0 marks, >or=50% = 0.4 marks, <50% = 0 marks	% Penetration =	3	3	2.00

Zero mark if the total amount of penetration is less than 75  
Greater than 2.5 mm. Each weld outside the variation = 1  
One defect = 0.5 marks, 2 defects = 0.3 marks, 3 or more  
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 2022 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 -

	Defects =	6		0.70
	Defects =	6		0.70
		6		1.00
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSOS 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)	WSOS 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

Criterion B  
Total Mark 15.00

Criterion C  
Total Mark 9.00

One defect 2.5 mm or less = 0.70 mark. Two defects 2.5 mm or less = 1.40 mark.  
Zero mark if hold point on root pass stop/start has not been witnessed  
Disregard first and last 20mm

Zero mark if hold point on root pass stop/start has not been witnessed

A defect greater than 2.5mm = zero marks

One defect 2.5 mm or less = 0.70 mark. Two defects 2.5 mm or less = 1.40 mark.

Zero mark if hold point on root pass stop/start has not been witnessed

Disregard first and last 20mm

yes/no

5

2.00

yes/no

3

1.50

Defects =

5

1

1.00

Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSOS Section	Calculation Row (Export only)	Max Mark
Class D = 2 mark	Yes/no	2		2.00
Class C= 2 marks	Yes/no	6		2.00
Class B= 2 marks	Yes/no	4		2.00
Class A= 1 marks. *Class A represents "No recordable in	Yes/no	7		1.00
Class D= 2 mark	Yes/no	2		2.00
Class C= 2 marks	Yes/no	4		2.00
Class B= 2 marks	Yes/no	4		2.00
Class A= 1 marks. *Class A represents "No recordable in	Yes/no	7		1.00
Class D = 2 mark	Yes/no	2		2.00
Class C= 2 marks	Yes/no	4		2.00
Class B= 2 marks	Yes/no	5		2.00
Class A= 1 marks. *Class A represents "No recordable in	Yes/no	7		1.00
If hold point for root pass stop/start has not been witnessed				
If hold point for cap pass stop/start has not been witnessed				

Criterion D      Total Mark      21.00



Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSOS Section	Calculation Row (Export only)	Max Mark
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSOS Section	Calculation Row (Export only)	Max Mark
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSOS Section	Calculation Row (Export only)	Max Mark
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSOS Section	Calculation Row (Export only)	Max Mark
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSOS Section	Calculation Row (Export only)	Max Mark

Criterion E    Total Mark    0.00

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
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