worldskills

Standards and Assessment Guide

Welding

v1.0

WorldSkills Standards and Assessment Guide

Skill 10 – Welding

Measurement

Measurement is used to assess accuracy, precision, and other performance that can be measured objectively. It is used where ambiguity must be avoided.

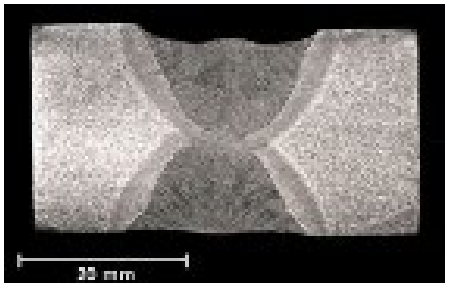
- The total mark over the four modules is 94.5.
- Measurement marking in TOTAL is 94.5% of the overall score.

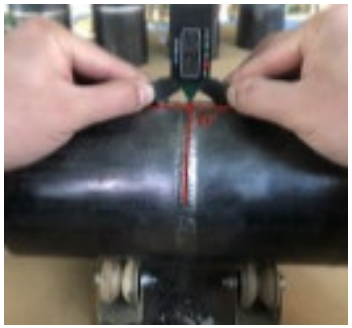
Module one

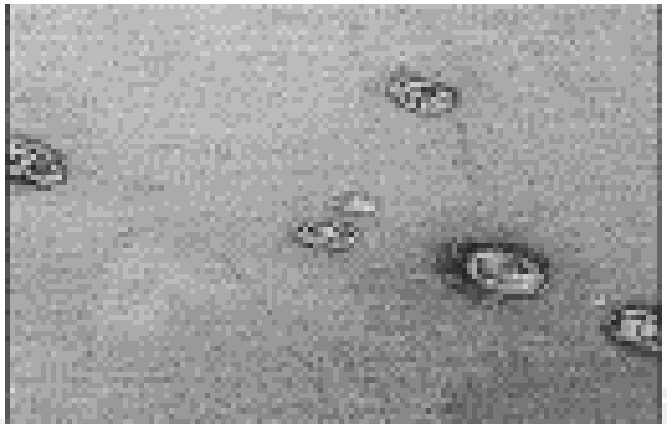
- The total mark over the four modules one is 42.2.
- Measurement marking in TOTAL is 100% of the overall score.

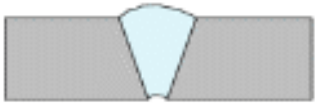
Aspect	WSOS section as per TD	Resource	Descriptor
Visual Assessment of Fillet Weld 1	1	Fillet Weld Sizes  	Fillet weld sizes in accordance with specifications and drawings. (-0/+2mm)
Visual Assessment of Fillet Weld 1	2	Undercut 	Fillet welds free from undercut. 0.5 mm maximum depth allowed.

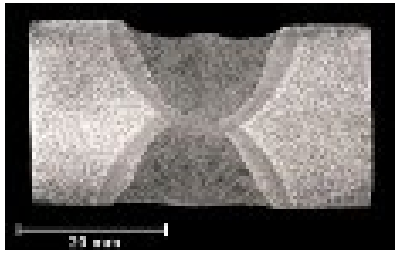
Visual Assessment of Fillet Weld 2	1	Fillet Weld Sizes  	Fillet weld sizes in accordance with specifications and drawings? (-0/+2mm)
Visual Assessment of Fillet Weld 2	2	Undercut 	Fillet welds free from undercut? 0.5 mm maximum depth allowed.

Visual Assessment of Test Pipe	1	Incompletely filled groove & undercut   	Butt welds free from undercut or underfill? Undercut - 0.5 mm maximum depth allowed. Underfill - 0 mm (flush) maximum depth

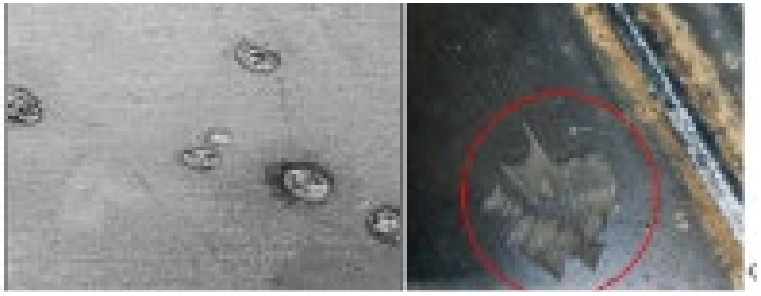
Visual Assessment of Test Pipe	1	Excessive Face Reinforcement (height) 	Butt weld joint free from excessive face reinforcement Allow 2.5 mm or less
Visual Assessment of Test Pipe	4* If FCAW-G (136) is used for fill and capping weld, here will be section 5.	Excessive Width variation of Butt Weld Face 	Butt weld Joint widths uniform and regular?（Measure narrowest portion vs. widest portion） Allow 2 mm variation in width

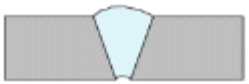
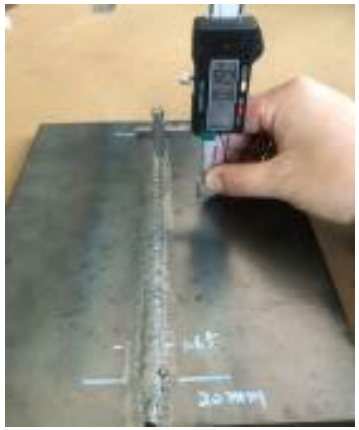
Visual Assessment of Test Pipe	4* If FCAW-G (136) is used for fill and capping weld, here will be section 5.	Stray Arc Strikes and stray grinding  	Butt weld joint free from arc strike? Not permitted (Projects shall be free from stray grinding for the intent to remove arc strikes.) Assessment shall only be carried out on pipe surface adjacent to face reinforcement

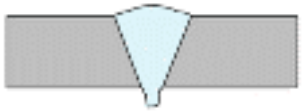
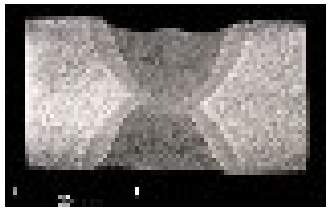
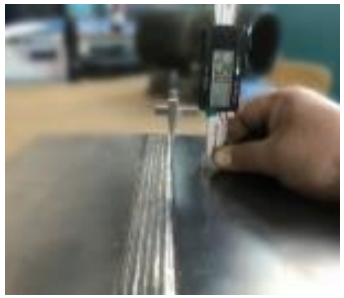
Visual Assessment of Test Pipe	6* If SMAW (111) is used for root weld, here will be section 4.	Excessive root concavity (shrinkage groove)  	Butt weld joint free from excessive root concavity Allow 0.5mm maximum. Zero mark if 100% penetration is not achieved.

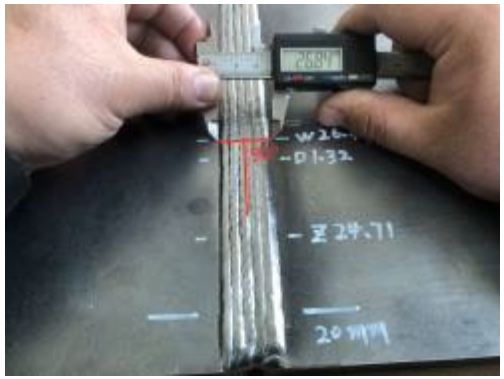
Visual Assessment of Test Pipe -	6* If SMAW (111) is used for root weld, here will be section 4.	Excessive Penetration  	Butt weld joint free from excessive root reinforcement Allow 2 mm maximum. Zero mark if 100% penetration is not achieved.
Visual Assessment of Test Plate 10mm	1	Incompletely filled groove & undercut  	Butt welds free from undercut or underfill? Undercut - 0.5 mm maximum depth allowed. Underfill - 0 mm (flush)

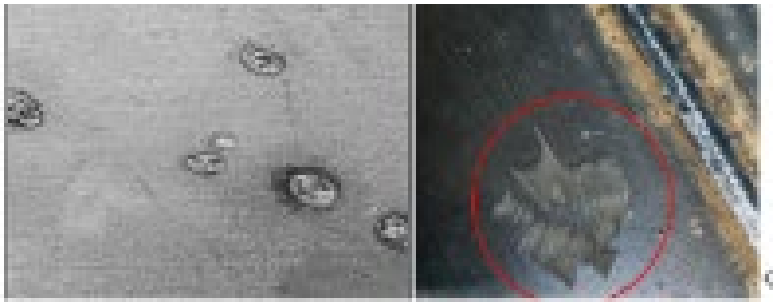
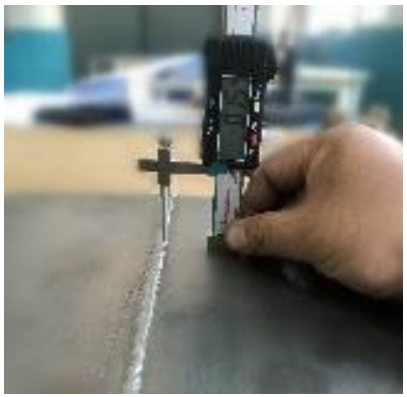
Visual Assessment of Test Plate 10mm	1	Excessive Face Reinforcement (height)  	Butt weld joint free from excessive face reinforcement Allow 2.5 mm or less Do not measure at the spatter

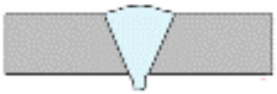
Visual Assessment of Test Plate 10mm	4	Excessive Width variation of Butt Weld Face  	Butt Joint weld widths uniform and regular? （Measure narrowest portion vs. widest portion） Allow 2 mm variation in width Do not measure at the spatter
Visual Assessment of Test Plate 10mm	4	Stray Arc Strikes and stray grinding 	Butt weld joint free from arc strike? Not permitted (Projects shall be free from stray grinding for the intent to remove arc strikes.) Assessment shall only be carried out on plate surface adjacent to face reinforcement

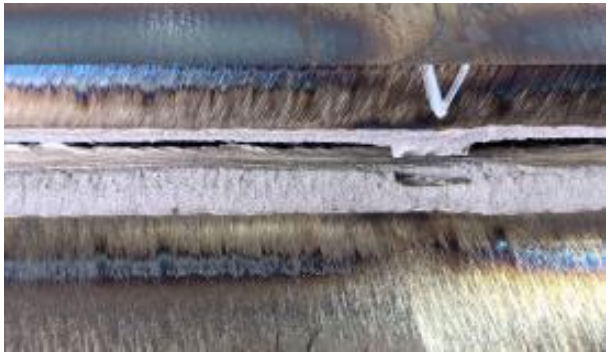
Visual Assessment of Test Plate 10mm	4	Excessive root concavity (shrinkage groove)  	Butt weld joint free from excessive root concavity Allow 0.5mm maximum. Zero mark if 100% penetration is not achieved.

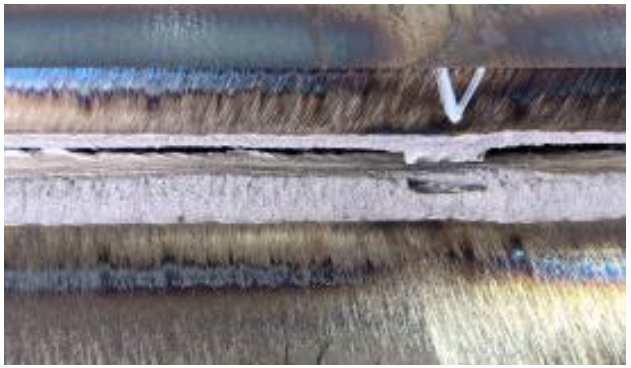
Visual Assessment of Test Plate 10mm	4	Excessive Penetration  	Butt weld joint free from excessive root reinforcement Allow 2 mm maximum. Zero mark if 100% penetration is not achieved.
Visual Assessment of Test Plate 16mm	1	Incompletely filled groove & undercut  	Butt welds free from undercut or underfill? Undercut - 0.5 mm maximum depth allowed. Underfill - 0 mm (flush) maximum depth allowed.

Visual Assessment of Test Plate 16mm	1	Excessive Face Reinforcement (height)  	Butt weld joint free from excessive face reinforcement Allow 2.5 mm or less
Visual Assessment of Test Plate 16mm	5	Excessive Width variation of Butt Weld Face 	Butt Joint weld widths uniform and regular? （Measure narrowest portion vs. widest portion） Allow 2 mm variation in width

Visual Assessment of Test Plate 16mm	5	Stray Arc Strikes and stray grinding 	Butt weld joint free from arc strike? Assessment shall only be carried out on plate surface adjacent to face reinforcement
Visual Assessment of Test Plate 16mm	4	Excessive root concavity (shrinkage groove)  	Butt weld joint free from excessive root concavity Allow 0.5mm maximum. Zero mark if 100% penetration is not achieved.

Visual Assessment of Test Plate 16mm	4	Excessive Penetration  	Butt weld joint free from excessive root reinforcement Allow 2 mm maximum. Zero mark if 100% penetration is not achieved.
Visual Assessment of Fillet Weld 1 Break Test	4	Completely fused at the root of the fillet weld 	The fillet weld is completely fused at the root of the joint? Zero mark if hold point on root pass stop/start has not been witnessed.

Visual Assessment of Fillet Weld 1 Break Test	3	Completely fused between individual runs of the fillet weld 	The fillet weld is completely fused between individual runs?
Visual Assessment of Fillet Weld 1 Break Test	4	porosity and inclusions of the fractured fillet weld 	The fractured fillet weld is free from porosity and inclusion? 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 = 0.40 mark. 3 or more defects 2.5 mm or less = 0 mark Zero mark if hold point on both root and pass stop/start has not been witnessed. Disregard first and last 20mm.

Visual Assessment of Fillet Weld 2 Break Test	5	Completely fused at the root of the fillet weld 	The fillet weld is completely fused at the root of the joint? Zero mark if hold point on root pass stop/start has not been witnessed.
Visual Assessment of Fillet Weld 2 Break Test	3	Completely fused between individual runs of the fillet weld 	The fillet weld is completely fused between individual runs?

Visual Assessment of Fillet Weld 2 Break Test	5	Porosity and inclusions of The fractured fillet weld 	The fractured fillet weld is free from porosity and inclusion? 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 = 0.40 mark. 3 or more defects 2.5 mm or less = 0 mark Zero mark if hold point on root pass stop/start has not been witnessed. Disregard first and last 20mm
Non Destructive (X-Ray) Test – Pipe Coupon	2		ISO 5817 - Quality level of imperfections - Class D? Mark 2.00
	6		ISO 5817 - Quality level of imperfections - Class C? Mark 4.00
	4		ISO 5817 - Quality level of imperfections - Class B? Mark 6.00

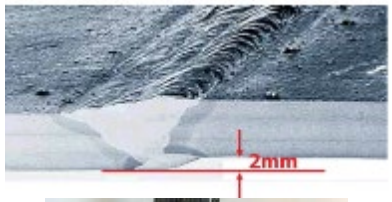
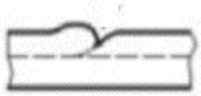
	7		ISO 5817 - Quality level of imperfections - Class A? Mark 7.00
Non Destructive (X-Ray) Test – 10mm Plate Coupon	2		ISO 5817 - Quality level of imperfections - Class D? Mark 2.00
	6		ISO 5817 - Quality level of imperfections - Class C? Mark 4.00
	4		ISO 5817 - Quality level of imperfections - Class B? Mark 6.00
	7		ISO 5817 - Quality level of imperfections - Class A? Mark 7.00

Non Destructive (X-Ray) Test – 16mm Plate Coupon	2		ISO 5817 - Quality level of imperfections - Class D? Mark 2.00
	6		ISO 5817 - Quality level of imperfections - Class C? Mark 4.00
	4		ISO 5817 - Quality level of imperfections - Class B? Mark 6.00
	7		ISO 5817 - Quality level of imperfections - Class A? Mark 7.00

Module two

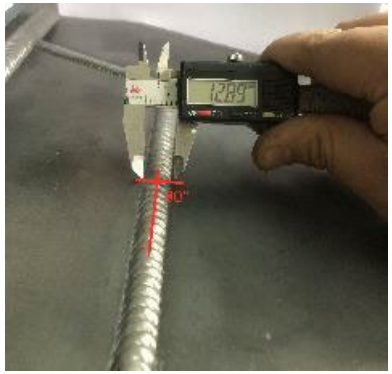
- The total mark over the module two is 37.8.
- Measurement marking in TOTAL is 90.74% of the overall score.

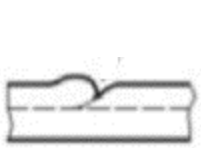
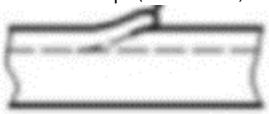
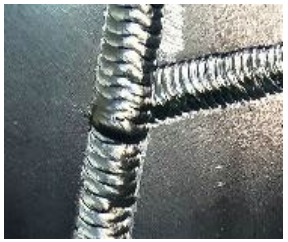
Aspect	WSOS section as per TD	Question	Descriptor
Pressure Vessel	4	Stray Arc Strikes and stray grinding  	General - Vessel is free from stray arc strikes? One defect = 1.0 marks, 2 defects = 0.6 marks, 3 or more defects= 0 mark. 1 visible arc strike = 1 defect. Do not assess underside of base plate. Project shall be free from stray grinding for the intent to remove arc strikes.

Pressure Vessel	2	Linear Misalignment (high/ low)  	General - Joints are free from linear misalignment? Allow 1mm maximum
Pressure Vessel	4	Weld starts and craters 	Fillet Joints - All stop/restarts smooth on the capping layer of the fillet joints? Allow 1.5 mm variation between stop/start

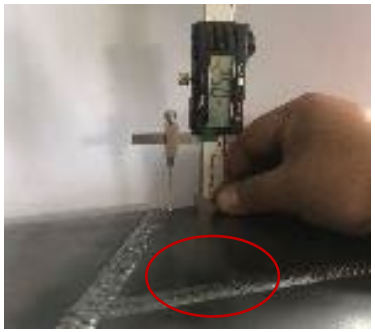
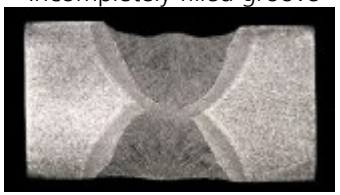
			
Pressure Vessel	4	Overlap (Over roll) 	Fillet joint weld metal completely fused into parent material and between individual runs? No overlap/cold lap Each continuous overlap/cold lap = 1 defect One defect = 0.7 marks, 2 defects = 0.4 marks, 3 or more defects = 0 mark
Pressure Vessel	3	Surface or internal Porosity and Gas Pores or Visual Inclusions 	Fillet joints completely free from surface porosity or inclusions? One defect = 0.7 marks, 2 defects = 0.4 marks, 3 or more defects = 0 mark 1 visible pore or inclusion = 1 defect

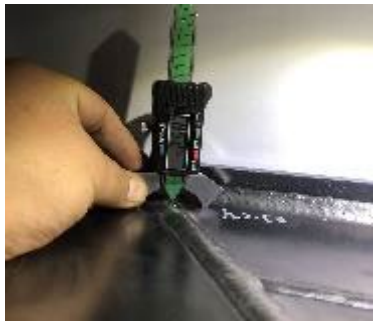
Pressure Vessel	2	Undercut 	Fillet joints free from undercut? Disregard depth of 0.5mm or less.
Pressure Vessel	1	Fillet Weld Sizes	Fillet Joint weld sizes in accordance with the specifications and drawings? (-0 / +2 mm). One defect = 1.5 marks, 2 defects =1.0 marks, 3 defects = 0.5 mark, 4 defects = 0 mark Less than or equal to 25mmL = 1 defect (accumulative)

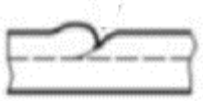
			
Pressure Vessel	4	Excessive Width variation of Butt Weld Face 	Butt Joint weld widths uniform and regular? Allow 2 mm variation in width. One weld outside variation = 0.75 marks, two welds = 0.5 marks, 3 or more = 0 marks. (Measure narrowest portion vs. widest portion)

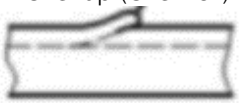
Pressure Vessel	4	Weld starts and craters  	Butt Joints - All stop/restarts are smooth on the capping layer of the butt welds? Allow 1.5 mm variation between stop/start
Pressure Vessel	5	Overlap (Over roll)  	Butt Joint weld metal completely fused into parent material and between individual runs? Each continuous overlap/cold lap = 1 defect. One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more defects = 0 mark

Pressure Vessel	4	Surface or internal Porosity and Gas Pores or Visual Inclusions 	Butt Joint weld metal completely free from inclusions or surface porosity? One defect = 0.7 marks, 2 defects = 0.4 marks, 3 or more defects = 0 mark 1 visible pore or inclusion = 1 defect
Pressure Vessel	4	undercut 	Butt Joints free from undercut? Disregard depth of 0.5mm or less

			
Pressure Vessel	7	Incompletely filled groove  	Butt Joint weld joint grooves completely filled?

Pressure Vessel	4	Excessive Face Reinforcement (height) 	Butt weld joints free from excessive face reinforcement? Greater than 2.5 mm.
Pressure Vessel	4	Excessive Width variation of corner Weld Face 	Corner weld bead widths uniform and regular? Allow 2 mm variation in width

Pressure Vessel	5	Weld starts and craters 	Corner Joints - All stop/restarts smooth on the capping layer of the corner joints? Allow 1.5 mm variation in height between stop/start

Pressure Vessel	4	Overlap (Over roll)  	Corner Joint weld metal completely fused into parent material and between individual runs? No overlap/cold lap Each continuous overlap/cold lap = 1 defect One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more defects = 0 mark

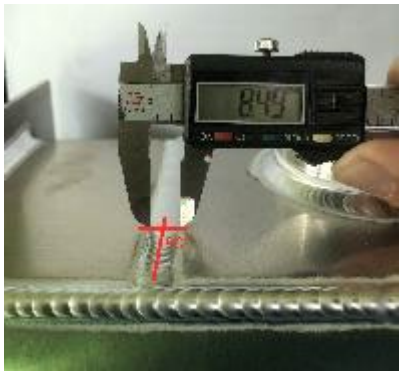
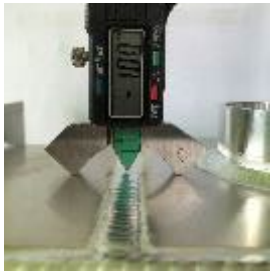
Pressure Vessel	4	Surface or internal Porosity and Gas Pores or Visual Inclusions 	Corner Joint weld metal completely free from surface porosity or inclusions? One defect = 0.7 marks, 2 defects = 0.4 marks, 3 or more defects = 0mark -1 visible pore or inclusion = 1 defect
Pressure Vessel	5	undercut 	Corner welded joints free from undercut? Disregard depth of 0.5mm or less
Pressure Vessel	1	pressure test	Vessel presented for pressure test 1mark

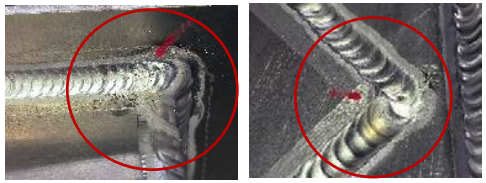
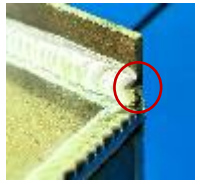
			
	7		No leaks observed at 10 Bar 2mark No leaks observed at 20 Bar 2mark No leaks observed at 30 Bar 2mark No leaks observed at 40 Bar 2mark No leaks observed at 50 Bar 2mark No leaks observed at 55 Bar 2mark No leaks observed at 60 Bar 2mark

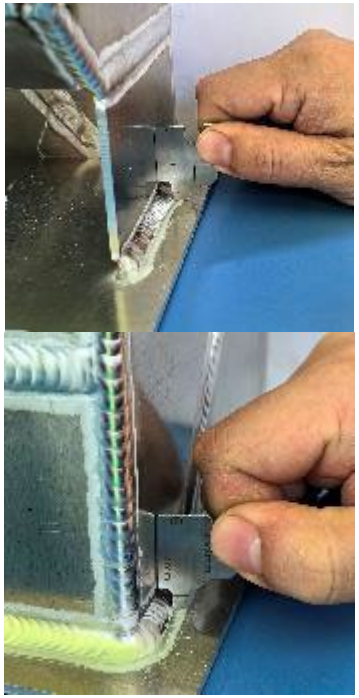
Module three

- The total mark over the module three is 10.
- Measurement marking in TOTAL is 90% of the overall score.

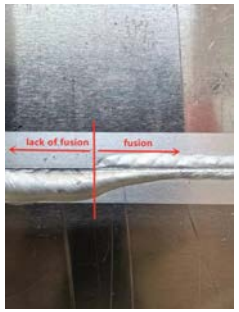
Aspect	WSOS section as per TD	Question	Descriptor
Aluminium Structure	6	Stray Arc Strikes and stray grinding 	Project is free from stray arc strike One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more defects = 0 mark 1 visible arc strike = 1 defect. Do not assess underside of base plate Projects shall be free from stray grinding for the intent to remove arc strikes.

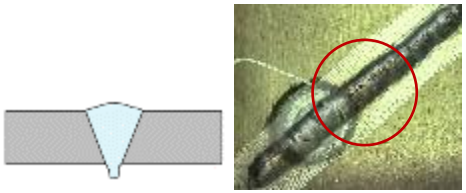
Aluminium Structure	6	Excessive Width variation of Butt Weld Face 	Butt weld bead widths uniform and regular? Allow 1.5 mm variation in width. Each weld outside the variation = 1 defect One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more defects = 0 mark
Aluminium Structure	6	Excessive Face Reinforcement (height) 	Butt weld joints free from excessive face reinforcement? Greater than 1.5 mm. Each weld outside the variation = 1 defect One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more defects= 0 mark

Aluminium Structure	3	Surface porosity and gas pores or Visual inclusions 	Weld metal is completely free from surface porosity or inclusions? - 1 visible pore = 1 defect One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more defects = 0 mark
Aluminium Structure	6	undercut 	Welded joints are free from undercut? Disregard depth of 0.5mm or less
Aluminium Structure	2	Linear Misalignment (high/ low) 	Joints are free from linear misalignment Allow 1mm variation

Aluminium Structure	6	Fillet Weld Sizes 	Fillet weld leg lengths are in accordance with the specifications? (-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 = 0 mark

Aluminium Structure	6	burn through 	All fillet welds free from burn through? less than or equal to 10mmL = 1 defect (accumulative) One defect = 0.4 marks, 2 defects = 0.2 marks, 3 or more defects = 0 mark
Aluminium Structure	6	Completely welded 	Weld joints are completely welded? Fully formed bead may not terminate greater than or equal to 3mm from end of plate

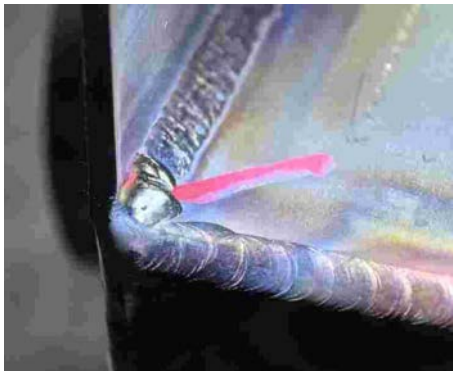
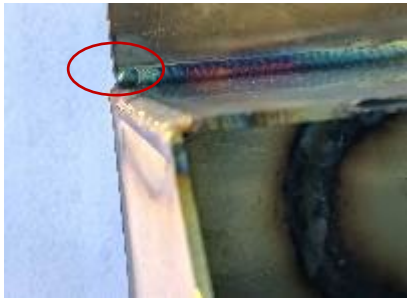
Aluminium Structure	3	penetration/root fusion   	All butt and corner joints display penetration/root fusion? 100% = 2.0 marks, >or=90% = 1.5 marks, >or=75% = 1.0 marks, >or=50% = 0.4 marks, <50% = 0 marks

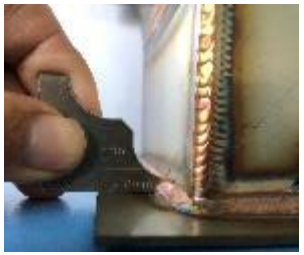
Aluminium Structure	6	Excessive Penetration 	Welded joints are free from excessive penetration? Zero mark if the total amount of penetration is less than 75 %. Greater than 3 mm. Each weld outside the variation = 1 defect One defect = 0.6 marks, 2 defects = 0.3 marks, 3 or more defects = 0 mark

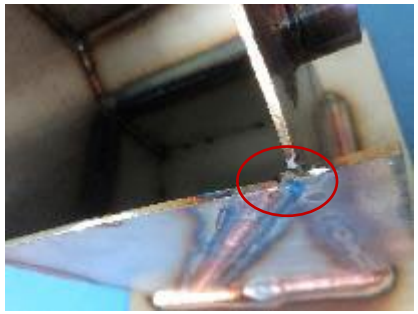
Module four

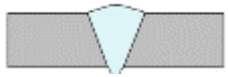
- The total mark over the module four is 10.
- Measurement marking in TOTAL is 90% of the overall score.

Aspect	WSOS section as per TD	Question	Descriptor
Stainless Steel Structure	6	Stray Arc Strikes and stray grinding 	Project is free from stray arc strikes? One defect = 0.5 marks, 2 defects = 0.3 marks, 3 or more defects = 0 mark 1 visible arc strike = 1 defect. Do not assess underside of base plate Projects shall be free from stray grinding for the intent to remove arc strikes.
Stainless Steel Structure	6	Excessive Width variation of Butt Weld Face 	Butt weld bead widths are uniform and regular?(Measure narrowest portion vs. widest portion) 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 defects = 0 mark

Stainless Steel Structure	3	Surface porosity and gas pores or Visual inclusions 	Weld metal is completely free from surface porosity or inclusions? 1 visible pore/inclusion = 1 defect One defect = 0.3 marks, 2 defects = 0.2 marks, 3 or more defects = 0 mark
Stainless Steel Structure	2	Undercut 	Welded joints are free from undercut? Disregard depth of 0.5mm or less

Stainless Steel Structure	6	Excessive face reinforcement(height) 	Butt weld joint is free from excessive face reinforcement? 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 defects = 0 mark
Stainless Steel Structure	6	Fillet Weld Sizes 	Fillet weld leg lengths are in accordance with the specifications? (-0 /+1.0 mm). Each weld outside the variation = 1 defect One defect = 0.6 marks, 2 defects = 0.4 marks, 3 or more defects = 0 mark
Stainless Steel Structure	6	burn through 	All fillet welds are free from burn through? less than or equal to 10mmL = 1 defect (accumulative) One defect = 0.4 marks, 2 defects = 0.2 marks, 3 or more defects = 0 mark

Stainless Steel Structure	6	Completely welded  	Weld joint is completely welded? Fully formed bead may not terminate greater than or equal to 2mm from end of plate
Stainless Steel Structure	2	Linear Misalignment 	Joints are free from linear misalignment Allow 1 mm variation

Stainless Steel Structure	3	penetration/root fusion 	All butt and corner joints display penetration/root fusion? 100% = 2.0 marks, >or=90% = 1.5 marks, >or=75% = 1.0 marks, >or=50% = 0.4 marks, <50% = 0 marks
Stainless Steel Structure	6	Excessive Penetration  	Welded joints are free from excessive penetration? 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 mark

Stainless Steel Structure	3	contamination (oxidation/sugaring) 	The root penetration is free from contamination (oxidation/sugaring) 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 defects = 0 mark

Judgement

Judgement is used to assess the quality of performance about which there may be small differences of view when applying the external benchmarks.

The resources section in the table below is for all kind of resources: a link to a youtube video or a website, a picture, a reference to a book, etc. It needs to be as detailed as possible.

Generic rules:

The assessment group comprise three Expert + one Expert. It is forbidden for Experts to assess their own compatriot Competitor.

The deviation of the three Experts may not exceed ONE mark: As long as the three Experts judge within 1 mark, the result can be determined for entering into CIS. If Experts have a larger deviation than 1, there must be brief discussion referenced to the descriptors, and a new vote.

- The total mark over the four modules is 5.5.
- Judgemental marking in TOTAL is 5.5% of the overall marks.

Aspect – Tie-ins at corners are smooth and continuous?

WSOS section as per TD	Points	Descriptor	Resource
1	0	Unacceptable or not presented - Welds do not meet together.	
	1	acceptable - Welds meet together	

	2	Welds maintain width	
	3	Welds maintain width and height	

Aspect - General - Surface slag, spatter and smoke have been removed from 99% of the joints and surrounding area?

WSOS section as per TD	Points	Descriptor	Resource
7	0	Unacceptable or not presented - Slag, spatter and smoke has not been removed.	 

	1	Acceptable - Most slag, spatter and smoke has been removed.	
	2	Slag, spatter and smoke has been removed.	

	3	Vessel completely free of any slag, spatter, smoke, and wire brushed.	 

Aspect - Pressure Vessel - Corner welds exhibit a full radius contour?

WSOS section as per TD	Points	Descriptor	Resource
5	0	Unacceptable or not presented - Joint not filled or with flat profile.	
	1	Acceptable - Radius profile with flat areas and/or excess weld at toes.	

	2	Radius profile with slight flatness in some areas.	
	3	Full radius profile equal to plate thickness.	

Aspect - Aluminium - Corner welds exhibit a full radius contour?

WSOS section as per TD	Points	Descriptor	Resource
6	0	Unacceptable or not presented - Joint not filled or with flat profile.	
	1	Acceptable - Radius profile with flat areas and/or excess weld at toes.	

	2	Radius profile with slight flatness in some areas.	
	3	Is excellent - Full radius profile equal to plate thickness.	

Aspect - Stainless Steel - Corner welds exhibit a full radius contour?

WSOS section as per TD	Points	Descriptor	Resource
6	0	Unacceptable or not presented - Joint not filled or with flat profile.	

	1	Acceptable - Radius profile with flat areas and/or excess weld at toes.	
	2	- Radius profile with slight flatness in some areas.	

	3	Is excellent - Full radius profile equal to plate thickness.