2024 Belt & Road and BRICS Skills Development and Technology Innovation Competition

Arc Cup International Welding Competition of the 12th Welding Skills International Competition

Technical File

I. Competition Standards

ISO 9606-1, ISO 5817, ISO 6947, ISO 10042 and ISO 15608 standards will be complied with.

II. Qualifications for Competitors

Welders aged 18-35 or college students aged 16 or above are allowed to participate in the competition. At the time of registration, identification document (ID card or passport) shall be shown, which needs to meet the registration requirements.

III. Competition Projects

3.1 Single Welding Process

3.1.1 Welding process: competitors participating in single welding processes (111/SMAW, 135/GMAW, 141/GTAW, 311/OFW) are required to use any one or more of the enrolled process to weld.

3.1.2 Description of test pieces: each single process welding method should be applied to three welding pieces, namely plate butt joint welds, T-shaped plate fillet welds and pipe butt joint welds.

3.1.3 Dimensions of test pieces:

a) For 111/SMAW and 135/GMAW welding processes: Dimension of plate butt joint test pieces is 300mm×125mm×10mm; Dimension of T-joint fillet weld test piece is 150mm×125mm×10mm; Dimension of pipe butt joint weld test piece is Φ133mm×125mm×10mm.

b) For 141/GTAW and 311/OFW welding processes: Dimension of plate butt joint test piece is 300mm×125mm×5mm; Dimension of T-joint fillet weld test piece is 150mm×125mm×5mm; Dimension of pipe butt joint weld test piece is Φ60mm×125mm×4mm.

3.1.4 Material of test piece: material group 1.1(S235 steel for plates, 20# steels (ASTM/AISI 1020 steel) for pipes. Dimension and material name of test piece, please refer to Appendix 3.

3.2 Carbon Steel Structural Part Welding

3.2.1 Description of test pieces: Competitors for finished-products welding are required to apply four welding processes （111SMAW, 135GMAW, 141GTAW, 136FCAW） to weld a complete assembly. This test piece includes 10 types of weld position: pipe vertical fixed butt welding(PC), pipe horizontal fixed butt welding(PH), pipe and plate fillet welding(PB), plate fillet welding (PB, PF, PD), plate butt welding with vertical position(PF), plate butt welding with 45°position, plate fillet welding (PB), plate fillet welding (PF), plate fillet welding (PD).

3.2.2 Dimension of test piece: The whole dimension is about 300mm×230mm×375mm, the detailed dimension and structure are shown as

Appendix 5.

3.2.3 Materials of test piece: Material Group 1.1 (S235 steel for plates, 20# (ASTM/AISI 1020 steel) steels for pipes).

3.3 Aluminum Alloy Assembly Welding

3.3.1 Description of test pieces: A combined structure of V-groove plate butt joint parts

3.3.2 Dimension of test pieces: Dimension of test plate 1 is 250mm×100mm×8mm, Quantity of the test plate 1 is 2; Dimension of test plate 2 is 250mm×125mm×8mm, Quantity of the test plate 2 is 2; Dimension of the base plate is 250mm, Quantity of the base plate is 1. The whole dimension is about 250mm×250mm×208mm, the detailed structures are shown as Appendix 7.

3.3.3 Materials of test pieces: Material Group 22.1 (EN AW-5083).

3.3.4 Thickness of plates: 8mm.

3.4 Non-regulated Projects

3.4.1 Welding quality detection

3.4.2 Advanced welding equipment operation

3.4.3 Advanced welding skill performance (Advanced welding techniques, welding processes, welding materials, welding design and welding structure etc.)

3.4.4 Special welding and cutting skill performance

Such as ultra-thin test piece welding, high-precision welding, fast

welding, pressurized (water or gas) welding, blind spot welding, underwater welding, overlaying and special material welding (such as, aluminum and aluminum alloy, titanium and titanium alloy, Mg-Zn alloy, zirconium, magnesium alloy and Mg-Al alloy, stainless steel, galvanized pipe, galvanized sheet, red copper and nickel alloy, etc.).

IV. Competition Method

Only practical welding skill operation is conducted during the Welding Skills Competition.

4.1 According to ISO 6947, for three welding test pieces of project one (Single Process Welding), three positions will be randomly selected by lot from 11 welding positions of each welding process one day before the competition (Pipe and plate butt welding projects cannot be PC positions simultaneously). All welds are subject to visual tested. X-ray inspection will be conducted on the plate butt weld and pipe butt weld. Candidate task table of each welding process for project one is shown as Appendix 1. Welding process assessment standards of project one are shown as Appendix 2. Welding position drawing of project one is shown as Appendix 4.

4.2 For carbon steel structural part welding of project two, competitors are required to grasp multiple welding skills and apply four welding processes (111/SMAW, 135/GMAW, 141/GTAW and 136/FCAW) to weld a complete structural part in accordance with drawing requirements. All the structural part welds are subject to external assessment. There are three butt welds of siding

welding of structural part, including plate butt joint with vertical position and two plate butt joint with oblique positions. The three welds are subject to X-ray nondestructive testing (RT) to assess internal quality. The detection range is centered on the Y-type joint: within a radius of 50mm. Regulated assessment refers to Appendix 6.

4.3 For aluminum alloy assembly welding of project three, competitors are required to use the MIG welding process to finish welding aluminum alloy plates - plate butt weld at horizontal position and plate - plate butt at overhead position weld with obstacles. All the welds are subject to visual test (external assessment). The detailed technical requirement of Aluminum alloy assembly welding is shown as Appendix 7.

4.4 Project four (Welding Competition for Non-regulated Projects) requires the participants to prepare self-provided welding equipment, welding consumables and test piece.

V. Operation Regulations

There is no unified requirement for the processes of project four (Welding Competition for Non-regulated Projects), while project three, the aluminum welding competitor should operate according to the technical requirements of Appendix 7.

WPS for project one (Single Process Welding) will be given before the competition, while WPS for other projects won't be given. According to the requirement of different projects, the following rules of the welding

competition shall be followed:

5.1 General Requirements

5.1.1 Test pieces and welding materials provided by Organizing Committee shall be used.

5.1.2 Personal protective equipment must be worn and the operating instructions for fitting up shall be followed strictly. On site referee and working staff's supervision and warning must be accepted to guarantee personnel and equipment safety.

5.1.3 The auxiliary welding tools have to be prepared by the competitor themselves (see the regulations in Clause 5.1.8). Tools borrowing during competition are not permitted.

5.1.4 The competitors can be permitted into the competition site by draw paper and ID card (or passport) 30 minutes before the competition.

5.1.5 The competitors get their own test pieces and welding materials 15 minutes before the competition by their own draw paper. Competition will start on the starting signal from the referee. Over 15 minutes late will cause disqualification from the competition.

5.1.6 Operating time (Including tacking time):

Project One	Welding Process	Time
	Shielded metal arc welding (111/SMAW)	180min
	Gas metal arc welding (135/GMAW)	160min
	Gas tungsten-arc welding (141/GTAW)	160min

	Oxyacetylene welding (311/OFW)	140min
Project Two	Carbon Steel Structural Part	240min
Project Three	Aluminum alloy welding	120min
Project Four	Welding competition for non-regulated Projects	Depending on the requirement of each competition project

5.1.7 Welding machine, welding gun, electrode holder, wire and welding torch will be provided by organizing committee and are not allowed to bring by competitors.

5.1.8 The following tools should be brought by competitors: welder's helmet, hammer, shovel, file, wire brush, abrasive paper, saw blade, torch, tungsten electrode, angle grinder, locking pliers, angle iron, wrench, electric tools, and auxiliary tool for assembly of Carbon Steel Structural Part. See Appendix 8 for details.

5.1.9 Current test can only be done on test piece provided. Test piece fixture is not allowed for current test. Otherwise, violation will be imposed.

5.1.10 When affected by power failure or other external reasons, competitors can resort to the referees who can judge after verification.

5.1.11 Competitor' breaks, drinking and toilet time will also be counted as the competition time.

5.1.12 After finishing the welding, competitors shall clean slag and spatter of test piece surface without damaging the original weld. Electric tools

are not allowed but only manual cleaning being allowed. After cleaned, the test piece shall be submitted to the supervisor for check to make sure the test piece has been cleaned clearly. Otherwise, re-cleaning may be asked. The cleaned test piece shall be handed over to the designated place for sealing and signed by competitor and the supervisor. The supervisor shall take down the welding piece finishing time of competitors accurately.

5.1.13 Fair competition principle shall be followed. Damaging or disassembling equipment in the competition area is prohibited. Otherwise, disqualification will be caused.

5.1.14 During the competition, supervisors will be available as contact person for any problems that may encounter during competition. The competition will be continuously counted unless the competitor raises hand for problems and confirmed by the site supervisor. Otherwise, the competition will not be stopped.

5.1.15 When the stop signal for the competition is given, competitors shall stop operation immediately and leave the competition area.

5.1.16 Except for the stipulations of 5.1.13, in case any competitor violates the above regulations, the external assessment(VT) of the competition project shall be calculated as zero point upon confirmation by the supervisors.

5.2 Test Pieces Assembly Regulations

5.2.1 After receiving the test pieces, the competitors shall check if they meet the requirements before assembly and the replacement is not allowed

after assembly. Any dispute is up to the site jury to make the decision. **(Attention! Dimensional tolerances cannot be avoided. The organizer will prepare available test pieces as much as possible for competitors.)**

5.2.2 Competitors assemble the test pieces according to the stipulated time and place booth provided. After completion, the competitor will report to the on-site supervisor referee that the test piece is going to be on the shelf, and after the approval, the official welding operation will begin.

5.2.3 Project one - Single Welding Process: the gap, root face and anti-deformation are up to the competitors during butt weld assembly; gap and anti-deformation are not allowed for fillet weld assembly; the same welding process and welding material shall be adopted both in tacking and competition. It's up to competitors to choose the size of the tack welding materials.

5.2.4 Project one - Single Welding Process: The plates shall be tacked in both ends of the groove with length of tack weld in no more than 15mm. Run-on plate and run-off plate are not allowed to use at both ends of butt welding test pieces.

5.2.4 Project one - Single Welding Process: The tack weld number of t plate butt weld for a single welding process is 2, located on both ends of the inner side of the groove. The length of each tack weld shall not exceed 15mm. Arc starting plates and lead out plates are not allowed to use at both ends of butt welding test pieces.

5.2.5 Project one - Single Welding Process: Three positioning welds are

allowed for the T-shaped fillet weld of the plate, one tack weld with 25mm long at most shall be made within 50mm around the middle of back side of the weld, and the other two tack welds with 15mm long at most shall be made at both ends; there is no any requirement on the back side tack weld for 311/OFW welding process.

5.2.6 Project one - Single Welding Process: For the tack welding of T-shaped fillet weld, the vertical plate shall be fixed at the middle position of the bottom plate.

5.2.7 Project one - Single Process Welding: The tack weld for pipes butt weld shall be made in the front groove. For Ø133mm pipes, the quantity of tack welds shall be no more than 3 and the length of each tack weld shall be no more than 20mm each; For Ø60mm pipes, the quantity of tack welds shall be no more than 2 and the length of each tack weld shall be no more than 10mm each.

5.2.8 Project two - Carbon Steel Structural Part assembly welding: there is no gap for fillet welds and corner welds. There is no special requirement for the gap size of butt welds. The welding method and consumables specifications of assembly will be decided by the competitor.

5.2.9 Project two - Carbon Steel Structural Part assembly welding: Tack welding is prohibited at the center point of y-type weld. The length of tack weld shall not be greater than 15mm. There is no special requirement for the tack weld quantity. Auxiliary tools are allowed to take with the competitor.

5.2.10 If the test piece crippled during tacking, the competitor could apply self-repair while replacement is not allowed.

5.2.11 After the completion of assembly for all test pieces, the competitors shall report to the on-site judge who will check and approve the result of the assembly. Then the official welding operation could be carried out. (For the assembled test pieces that meet the above requirements, the on-site judge shall mark on them; The judge and competitors shall sign on the record sheet for confirmation.)

5.2.12 Without qualification check, the tacked test pieces are not allowed for official welding competition. After the formal welding begins, the test pieces cannot be split for positioned welding.

If any competitor violates the above regulations and jury has confirmed the violation terms, the appearance score of the his/her test piece shall be zero.

5.3 Practical Welding Requirements

5.3.1 After fixing the pipe on the holder, competitors shall inform the on-site supervisors to mark the position for 12 o'clock and the tack welding are not allowed at the overhead position (namely 5-7 o'clock); For the horizontal fixed position and 45° positioned welding, the vertical up position from 6 to 12 o'clock must be used for welding, in which the center of the arc starting point at 6 o'clock must be located between 5 and 7 o'clock, and the center of the arc stopping point must be located within a range of 15mm

around 12 o’clock. There is no requirement on the vertical fixing position (PC) of pipe, but it must be welded continuously in one direction.

5.3.2 After fixing test pieces, competitors raise hand to tell the judge to check and confirm according to the regulations. Without confirmation, competitors who start welding without passing the on-site judge's inspection and approval will be dealt with as a violation.

5.3.3 Except for the fillet weld, other welds shall be finished by one-side welding with back formation.

5.3.4 For single-layer welding of fillet weld, competitors should follow the corresponding regulations. For multi-layer welding of fillet welds, fillet weld welding runs include root run, which are 2 at least and 3 at most (3 at most for cap layer). The number of welding layers for butt welds (filler and cap layer) are subject to the competitors.

5.3.5 During welding, test pieces are not allowed to take off the fixture, move or change the welding position. (When test piece of plate butt is welded in overhead position PD, competitors are allowed to overturn test piece to facilitate polishing. In this case, the competitors are allowed to continue after finishing grinding and getting approved from jury.)

5.3.6 For Carbon Steel Structural Part of project two, the bottom plate shall be always located in horizontal position during welding.

5.3.7 Only single direction welding is allowed in butt welding for plate. Welding from the middle towards both ends or from both ends towards the

middle is not allowed. The direction of the rest layers shall be the same with that of the backing welding.

5.3.8 For gas welding (311/OFW), rightward welding shall be adopted. (During the welding, the wires and welding nozzle should be welded from left to right, with welding flame pointing to the parts which have been welded, filling wires locating at the back of the flame). If the mentioned operation method is not complied with, 15 scores will be deducted in terms of appearance test.

5.3.9 During the welding process, the waste test piece from welding will not be replaced, allowing the competitor to manually repair (with power tools) during the Competition. The front and back surfaces of the weld are not allowed to repair or remelt. Otherwise, 0 score will be given.

5.3.10 Except for the clause 5.3.8, if the competitor violates the above provisions, the test piece will be awarded as 0 points after the judge confirms on the spot.

5.4 Rules on Arc Stop and Restart

5.4.1 For project one, during root run and capping run welding (GMAW135), starting arc and stopping arc shall be made in the range of ±25mm along the center of weld bead length direction. Starting arc and stopping arc are required only on the last one of the capping runs when multi-pass welding.

5.4.2 The competitor shall raise up the hand and the supervisor shall be

informed for marking. Without check and confirmation from the supervisor, competitors are not allowed to restart arc for welding. Otherwise, 5 scores deduction will be given to the piece.

5.4.3 For project two - When welding Y-shape weld of structural part, the competitors shall weld at the vertical position (PF) by the electrode arc welding (SMAW) firstly for root run welding, and stop the arc at the center of the Y-shape weld, and after the on-site supervisors' confirmation and marking, the competitor weld the other two oblique welds. For the capping run welding, the competitors shall weld at the vertical position (PF) by the electrode arc welding (SMAW) firstly, and stop the arc at the center of the Y-shaped weld, and then inform the supervisor for marking, and then weld the other two oblique welds to cover the capping runs. Otherwise, 5 scores deduction will be given to each of the violation for the two arc stop requirements of the Carbon Steel Structural Part welding.

5.5 Grinding and Weld Cleaning Stipulations

5.5.1 After completion of welding project one, the weld surface can be manually cleaned with wire brush. However, the original shape of the weld on the back of the root pass and the surface of the capping pass are not allowed to be destroyed (Weld surface cleaning of Tungsten inert gas arc welding/141 is prohibited). After the welding of the Carbon Steel Structural Part of Project 2 is completed, the surface of the weld seam can be cleaned using an electric wire brush (Tungsten inert gas welding/141 weld seam surface cleaning is

prohibited). Otherwise 10 scores will be deducted. 0 score will be given to the test piece if there is obvious grinding mark.

5.5.2 Grinding and restarting arc is allowed at the interlayer runs and joints during welding process.

Other WPS parameters are not mandatory and are up to competitors.

VI. Assessment on Test Pieces

6.1 Assessment will be conducted according to competition regulations and assessment standards respectively. See Table 2.1-2.4 for the assessment standards of Project One, Table 6.1-6.5 for the assessment standards of Project Two and Table 7 for the assessment standards of Project Three;

6.2 For project one, assessment will not be done to the welding area of 20mm from each end for butt and fillet weld of plates;

6.3 If there is negative item during appearance assessment, namely 0 score, the test piece will not undergo internal radiographic testing and the score of RT is also 0.

6.4 The competitor will win with shorter welding operation time when the competitors obtain the same appearance and internal quality test scores.

VII. Competition Disciplines

7.1 Competitors shall follow the supervision of supervisors and comply with the technical files during competition. Supervisors are entitled to stop the competitors who violate disciplines. Those who ignore the supervision will be reported to Chief Jury and punishment will be given.

7.2 Silence shall be kept in the competition area. Noising and discussing are prohibited. Competitors can report to the supervisor when encountering problem. After getting consent, competitors can suspend. Otherwise, time for suspension will also be counted in.

7.3 Except for designated on-site jury and staff, other personnel, with the permission of the organizing committee, accompanied by the person in charge of the organizing committee, can only enter designated area of the competition site to observe the competition.

7.4 All people in the competition area shall not take photos of unsealed test pieces.

7.5 The persons who are allowed to enter the competition area shall abide by the regulations of the arena, shall not smoke, talk with the competitors, or hinder or interfere with the competition.

VIII. Welding Machines and consumables

8.1 Supply List for Manual Metal Arc Welding (111/SMAW)

No.	**Category**		
1	Machine	Type	ES WSM-400Plus
		Manufacturer	Aotai Electric Co., LTD
2	Consumables	Type	AWS E7015 (THJ507)
		Specification	Φ2.5mm, Φ3.2mm, Φ4.0mm
		Manufacturer	Tianjin Bridge Welding Materials Group Co.,Ltd.

8.2 Supply List for Gas Metal Arc Welding (135/GMAW)

No.	**Category**		
1	Machine	Type	ES MAG-350Pro Plus
		Manufacturer	Aotai Electric Co., LTD

2	Consumables	Type	AWS ER70S-6(THQ-50C) GMAW
		Specification	Φ1.2mm
		Manufacturer	Tianjin Bridge Welding Materials Group Co.,Ltd.
3	Gas	Type	M21（20%CO_2+80%Ar）

8.3 Supply List for Gas Tungsten Arc Welding (141/GTAW)

No.	Category		
1	Machine	Type	ES WSM-400Plus
		Manufacturer	Aotai Electric Co., LTD
2	Consumables	Type	AWS ER70S-6(THT50-6)
		Specification	Φ2.0mm, Φ2.4mm Tungsten: Φ2.4mm
		Manufacturer	Tianjin Bridge Welding Materials Group Co.,Ltd.
3	Gas	Type	I1（Argon）

8.4 Supply List for Oxygen Fuel Gas Welding (311/OFW)

No.	Category		
1	welding torch	Type	H01-6
		Enough welding nozzles (Gas nozzle size: 3, 4 and 5), gas lighter and cleaning pin. Competitors bring their own accessories; Site station equipment; Oxygen, acetylene, pressure gauge and gas pipe, welding material and torch	
2	Consumables	Type	AWS ER70S-6(THT50-6)
		Specification	Φ2.0mm, Φ2.4mm
		Manufacturer	Tianjin Bridge Welding Materials Group Co.,Ltd.
3	Gas	Type	Oxygen-acetylene gas(Acetylene purity 98%, oxygen purity 99.5%)

8.5 Supply List for Carbon Steel Structural Part Welding

No.	Category			
1	Equipment	135/GMAW1 36/FCAW	Type	ES MAG-350Pro Plus
			Manufacturer	Aotai Electric Co., LTD
		111/SMAW,1 41/ GTAW	Type	ES MAG-350Pro Plus
			Manufacturer	Aotai Electric Co., LTD
2	Consumables	111/SMAW	Type	AWS E7015 (THJ507)

			Specification	Φ2.5mm, Φ3.2mm, Φ4.0mm
		141/ GTAW	Type	AWS ER70S-6 (THT50-6)
			Specification	Φ2.0mm, Φ2.4mm Tungsten: Φ2.4mm
		135/GMAW	Type	AWS ER70S-6(THQ-50C) GMAW
			Specification	Φ1.2mm
		136/FCAW	Type	AWS E71T-1(THY-51BM)
			Specification	Φ1.2mm
		Manufacturer	Tianjin Bridge Welding Materials Group Co.,Ltd.	
3	Gas	Type		M21（20%CO_2+80%Ar）, I1 (Argon)

8.6 Supply List for Aluminum Alloy Welding

No.	**Category**		
1	Machine	Type	undetermined
		Manufacturer	undetermined
2	Consumables	Type	undetermined
		Specification	Φ1.2mm
		Manufacturer	undetermined
3	Gas	Type	I1（Argon） Purity:99.99%

Organizing Committee of Arc Cup

International Welding Competition

October, 2024

Appendix 1

Task Table of Candidate Welding Processes for Project One

Three welding positions for each welding process will be determined by drawing lots at random the day before the competition.

Welding process: 111/SMAW Welding material 1.1

P-BW	111 P BW 1.1 B t10 PC ss nb
	111 P BW 1.1 B t10 PE ss nb
	111 P BW 1.1 B t10 PF ss nb
P-FW	111 P FW 1.1 B t10 PB ml
	111 P FW 1.1 B t10 PC ml
	111 P FW 1.1 B t10 PD ml
	111 P FW 1.1 B t10 PE ml
	111 P FW 1.1 B t10 PF ml
T-BW	111 T BW 1.1 B t10.0 D133 PC ss nb
	111 T BW 1.1 B t10.0 D133 PH ss nb
	111 T BW 1.1 B t10.0 D133 H-L045 (6G uphill*) ss nb
Standards:	ISO 9606-1
Welding condition:	See WPS for the details of welding process regulations

Welding process: 135/GMAW Welding material 1.1

P-BW	135 P BW 1.1 S t10 PC ss nb
	135 P BW 1.1 S t10 PE ss nb
	135 P BW 1.1 S t10 PF ss nb
P-FW	135 P FW 1.1 S t10 PB ml
	135 P FW 1.1 S t10 PC ml
	135 P FW 1.1 S t10 PD ml
	135 P FW 1.1 S t10 PE ml
	135 P FW 1.1 S t10 PF ml
T-BW	135 T BW 1.1 S t10.0 D133 PC ss nb
	135 T BW 1.1 S t10.0 D133 PH ss nb
	135 T BW 1.1 S t10.0 D133 H-L045 (6G uphill*) ss nb
Standards:	ISO 9606-1
Welding condition:	See WPS for the details of welding process regulations

Welding process: 141/GTAW Welding material 1.1

P-BW	141 P BW 1.1 S t5.0 PC ss nb
	141 P BW 1.1 S t5.0 PE ss nb
	141 P BW 1.1 S t5.0 PF ss nb
P-FW	141 P FW 1.1 S t5.0 PB sl
	141 P FW 1.1 S t5.0 PC sl
	141 P FW 1.1 S t5.0 PD sl
	141 P FW 1.1 S t5.0 PE sl
	141 P FW 1.1 S t5.0 PF sl
T-BW	141 T BW 1.1 S t4.0 D60 PC ss nb
	141 T BW 1.1 S t4.0 D60 PH ss nb
	141 T BW 1.1 S t4.0 D60 H-L045 (6G uphill*) ss nb
Standards:	ISO 9606-1
Welding condition:	See WPS for the details of welding process regulations

Welding process: 311/OFW Welding material 1.1

P-BW	311 P BW 1.1 S t5.0 PC ss nb rw
	311 P BW 1.1 S t5.0 PE ss nb rw
	311 P BW 1.1 S t5.0 PF ss nb rw
P-FW	311 P FW 1.1 S t5.0 PB sl rw
	311 P FW 1.1 S t5.0 PC sl rw
	311 P FW 1.1 S t5.0 PD sl rw
	311 P FW 1.1 S t5.0 PE sl rw
	311 P FW 1.1 S t5.0 PF sl rw
T-BW	311 T BW 1.1 S t4.0 D60 PC ss nb rw
	311 T BW 1.1 S t4.0 D60 PH ss nb rw
	311 T BW 1.1 S t4.0 D60 H-L045 (6G uphill*) ss nb rw
Standards:	ISO 9606-1
Welding condition:	See WPS for the details of welding process regulations

Requirements of drawing lots for welding positions:

1. Draw lots in the order of pipe butt weld, plate butt weld, and plate T-shaped fillet weld;

2. When the pipe butt weld is drawn to the PC position, if the plate butt weld is also drawn to the PC position, the latter lottery position is invalid and re-draw plate butt weld position.

Appendix 2

Table 2.1.1 Assessment for Welding Process 111-Shielded Metal Arc Welding

Appearance Inspection (Butt Weld of Plate)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition External Assessment	Measure ments	Scores
Corresponding points	10	9	7	5	0		
Weld reinforcement, mm	0 ⩽ h ⩽ 2	2 ＜ h ⩽ 3	3 ＜ h ⩽ 4	4 ＜ h ⩽ 5	＞ 5 h, or ＜0		
Weld reinforcement height difference, mm	h ⩽ 1	1 ＜ h ⩽ 2	2 ＜ h ⩽3	3 ＜ h ⩽4	h＞4		
Weld reinforcement width, mm	15 ⩽ b ⩽ 17	17＜ b ⩽ 18	18＜ b ⩽ 19	19＜b ⩽ 20	15＜ b, or ＞20		
Weld reinforcement width difference, mm	b ⩽ 1	1＜ b ⩽ 2	2 ＜ b ⩽ 3	3 ＜ b ⩽ 4	b＞4		
Undercut, mm	No Undercut	Undercut depth≤0.5 & Undercut Length≤10	Undercut depth≤0.5 & Undercut Length≤20	Undercut depth≤0.5 & Undercut Length≤30	Undercut depth＞0.5 or Undercut Length ＞30		
Misalignment, mm				⩽0.5	＞0.5		
Root concavity				No	Yes		
Root convexity, mm				0-2	＞2		
Angular distortion, mm	0-1	1 ＜ h ⩽ 2	2 ＜ h ⩽3	3 ＜ h ⩽4	＞4		

Mechanical damage or arc abrasion				No	Yes		
Weld back forming	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score * 0.5							

Note: Welding not completed. lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.1.2 Assessment for Welding Process 111-Shielded Metal Arc Welding

Appearance Inspection (Butt Weld of Pipe)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition External Assessment	Measure ments	Scores
Corresponding points	10	9	7	5	0		
Front weld height, mm	0 ⩽ h ⩽ 2	2 ＜ h ⩽ 3	3 ＜ h ⩽ 4	4 ＜ h ⩽ 5	＞ 5 h, or ＜0		
Front weld height difference, mm	h ⩽ 1	1 ＜ h ⩽ 2	2 ＜ h ⩽3	3 ＜ h ⩽4	h＞4		
Front weld width, mm	14 ⩽ b ⩽ 16	16＜ b ⩽ 17	17＜ b ⩽ 18	18＜b ⩽ 19	14＜ b, or ＞19		
Front weld width difference, mm	b ⩽ 1	1＜ b ⩽ 2	2 ＜ b ⩽ 3	3 ＜ b ⩽ 4	b＞4		
Undercut, mm	No Undercut	Undercut depth≤0.5 & Undercut Length≤10	Undercut depth≤0.5 & Undercut Length≤20	Undercut depth≤0.5 & Undercut Length≤30	Undercut depth＞0.5 or Undercut Length ＞30		
Misalignment, mm				⩽0.5	＞0.5		
Root concavity				No concavity	concavity		
Root convexity, mm				0-2	＞2		
Angular distortion, mm	0-1	1 ＜ h ⩽ 2	2 ＜ h ⩽3	3 ＜ h ⩽4	＞4		

Mechanical damage or arc abrasion				No	Yes		
Weld back forming	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score * 0.5							

Note: Welding not completed. lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.1.3 Assessment for Welding Process 111-Shielded Metal Arc Welding

Appearance Inspection (Fillet Weld of Plate-Plate)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition External Assessment	Measure ments	Scores
Corresponding points	10	9	7	5	0		
Fillet weld size, mm	⩾9 z ⩽10	＞10 z ⩽11	＞11 z ⩽12	＞12 z ⩽13	＞13 z, or ＜9		
Fillet weld size difference, mm	⩽1	＞1，⩽2	＞2，⩽3	＞3，⩽4	＞4		
Undercut, mm	No Undercut	Undercut depth≤0.5 & Undercut Length≤10	Undercut depth≤0.5 & Undercut Length≤20	Undercut depth≤0.5 & Undercut Length≤30	Undercut depth＞0.5 or Undercut Length ＞30		
Verticality, mm				0-2	＞2.0		
Mechanical damage or arc abrasion				No	Yes		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score: 50							

Note: Welding not completed. lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.1.4 Assessment for Welding Process 111-Shielded Metal Arc Welding

Internal inspection (Butt Weld of Plate or Pipe)

Name	Internal assessment Group B	Internal assessment Group D	Internal assessment Unusable for competition	Measurements	Scores
Corresponding points	10	5	0		
Crack, incomplete penetration, lack of fusion	Not permissible	Not permissible	0 score will be given if there is any		
Frequent or many pores	Individual pores≤2pics	Individual pores≤4 pics	Many pores (≥4 pics) or Individual pore≥1/2σ(thickness)		
Elongated cavity/wormhole length: width ≥3:1	Not permissible	L≤4mm	L＞4mm		
Shrinkage cavity	Individual dot-like≤1pic	Individual dot-like≤2 pics	Penetrative or Individual ＞2 pics		
Inclusion	Individual dot-like≤2 pics	Individual dot-like≤4pics or strip-like≤4mm	or strip-like ＞4 pics or strip-like4mm		
Total score: 50					

1. Test pieces with cracks, incomplete penetration, lack of fusion or visible pores or inclusions are unqualified.;
2. Area of assessment is 10mm×10mm;
3. Individual pore of Φ≤0.5mm can be ignored, Φ 0.5-1mm will be counted as one dot, Φ 1-2mm as 2, Φ 2-3mm as 3, and so on;
4. Elongated cavity/wormhole: Length: width ≥ 3:1.

Table 2.2.1 Assessment for Welding Process 135- Gas Metal Arc Welding

Appearance Inspection (Butt Weld of Plate)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Competition! External Assessment Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
Weld reinforcement height (mm)	0.0 ≤ h ≤ 2.0	2.0 < h ≤ 3.0	3.0 < h ≤ 4.0	4.0 < h ≤ 5.0	> 5.0 h, or <0		
Weld reinforcement height difference, mm	h ≤ 1.0	1.0<h ≤ 2.0	2.0< h ≤3	3.0<h ≤4.0	h>4.0		
Weld reinforcement width(mm)	15 ≤ b ≤ 16	16 < b ≤ 17	17 < b ≤ 18	18 <b ≤ 19	15< b, or >19		
Weld reinforcement width Difference, mm	b ≤ 1.0	1.0<b ≤ 2.0	2.0<b ≤3 .0	3.0< b ≤4.0	b>4.0		
Undercut, mm	No Undercut	Undercut Depth≤0.5 & Undercut Length≤10	Undercut Depth≤0.5 & Undercut Length ≤20	Undercut Depth≤0.5 & Undercut Length≤30	Undercut Depth>0.5 or Undercut Length>30		
Misalignment, mm				≤0.5	>0.5		
Root concavity				No	Yes		
Root convexity ,mm				0-2	>2		

Angular deformation ,mm	0-1	1 ＜ h ≤ 2	2 ＜ h ≤3	3 ＜ h ≤4	＞4		
Mechanical damage or stray arc				No	Yes		
Weld back forming	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score* 0.5							

Note: Welding not completed. lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.2.2 Assessment for Welding Process 135-Gas Metal Arc Welding

Appearance Inspection (Butt Weld of Pipe)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Competition! External Assessment Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
Weld reinforcement height, mm	0.0 ≤ h ≤ 2.0	2.0 < h ≤ 3.0	3.0 < h ≤ 4.0	4.0 < h ≤ 5.0	> 5.0 h, or <0		
Weld reinforcement height difference, mm	h ≤ 1.0	1.0<h ≤ 2.0	2.0< h ≤3	3.0<h ≤4.0	h>4.0		
Weld reinforcement width mm	14 ≤ b ≤ 15	15 < b ≤ 16	16 < b ≤ 17	17 < b ≤ 18	b < 14mm, or b > 18		
Weld reinforcement width difference, mm	b ≤ 1.0	1.0<b ≤ 2.0	2.0<b ≤3 .0	3.0< b ≤4.0	b>4.0		
Undercut, mm	No Undercut	Undercut Depth≤0.5 & Undercut Length≤10	Undercut Depth≤0.5 & Undercut Length ≤20	Undercut Depth≤0.5 & Undercut Length≤30	Undercut Depth>0.5 or Undercut Length>30		
Misalignment, mm				≤0.5	>0.5		
Root concavity				No	Yes		
Root convexity ,mm				0-2	>2		

Angular deformation ,mm	0-1	1 ＜ h ≤ 2	2 ＜ h ≤3	3 ＜ h ≤4	＞4		
Mechanical damage or stray arc				No	Yes		
Weld back forming	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Weld appearance /Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score* 0.5							

Note: Welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.2.3 Assessment for Welding Process135 Gas Metal Arc Welding

Appearance Inspection (Fillet Weld of Plate-Plate)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Competition! External Assessment Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
Fillet weld size, mm	≥9 z ≤10	＞10 z ≤11	＞11 z ≤12	＞12 z ≤13	＞13 z, or ＜9		
Fillet weld size difference, mm	≤1	＞1，≤2	＞2，≤3	＞3，≤4	＞4		
Undercut, mm	No Undercut	Undercut Depth≤0.5 & UndercutLength≤10	Undercut Depth≤0.5 & UndercutLength ≤20	Undercut Depth≤0.5 & UndercutLength≤30	Undercut Depth＞0.5 or Undercut Length＞30		
Verticality, mm				0-2	＞2.0		
Mechanical damage orstray arc				No	Yes		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score: 50							

Note: Welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.2.4 Assessment for Welding Process135 Gas Metal Arc Welding

Internal inspection (Butt Weld of Plate or Pipe)

Name	Internal assessment Group B	Internal assessment Group D	Internal assessment Unusable for competition	Measurements	Scores
Corresponding points	10	5	0		
Cracks, incomplete penetration, lack of fusion	Not permissible	Not permissible	0 point will be given if there is any		
Frequent or many pores	Individual pores≤2 pics	Individual pores≤4 pics	Many pores ＞4 pics Or Individual pores≥1/2σ (thickness)		
Elongated cavity/wormhole length: width ≥ 3:1	Not permissible	L≤4mm	L＞4mm		
Shrinkage cavity	Individual dot-like≤1 pic	Individual dot-like≤2 pics	Penetrative or individual＞2 pics		
Inclusion	Individual dot-like≤2pics	Individual dot-like≤4 pics or strip-like≤4mm	Individual dot-like＞4 pics or strip-like＞4mm		
Total score: 50					

1. Test pieces with cracks, incomplete penetration, lack of fusion or visible pores or inclusions are unqualified.;
2. Area of assessment is 10mm×10mm;
3. Individual pore of Φ≤0.5mm can be ignored, Φ 0.5-1mm will be counted as one dot, Φ 1-2mm as 2, Φ 2-3mm as 3, and so on;
4. Elongated cavity/wormhole: Length: width ≥ 3:1.

Table 2.3.1 Assessment for Welding Process 141 – Gas Tungsten Arc Welding

Appearance Inspection (Butt Weld of Plate)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
Weld reinforcement, mm	0.0 ≤ h ≤ 1.0	1.0 <h ≤ 1.5	1.5 <h ≤ 2.0	2.0 < h ≤ 2.5	h> 2.5 或 h<0		
Weld reinforcement height difference, mm	h ≤ 1.0	1.0< h ≤ 1.5	1.5 < h ≤2.0	2.0 <h ≤2.5	h>2.5		
Weld width, mm	8.0≤ b≤ 9.0	9.0< b≤ 10.0	10.0< b≤ 11.0	11.0< b≤ 12.0	>12 or <8.0		
Weld reinforcement width difference, mm	b ≤ 0.5	0.5< b ≤ 1.0	1.0< b ≤1.5	1.5< b ≤2.0	b>2.0		
Undercut, mm	No Undercut	Undercut Depth≤0.3& Undercut Length≤10	Undercut Depth≤0.3 & Undercut Length≤15	Undercut Depth≤0.3 & Undercut Length ≤20	Undercut Depth>0.3 or Undercut Length>20		
Misalignment, mm				≤0.5	>0.5		
Root concavity, mm				No	Yes		
Root convexity, mm				≤2.0	>2.0		
Angular deformation (mm)	0-1	> 1， ≤ 2.0	> 2， ≤ 3.0	> 3， ≤ 4.0	> 4		
Mechanical damage or stray arc				No	Yes		

Weld back forming	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score * 0.5							

Note: Surface cleaning, remelting, welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.3.2 Assessment for Welding Process 141 - Gas Tungsten Arc Welding

Appearance Inspection (Butt Weld of Pipe)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
Weld reinforcement, mm	0.0 ≤ h ≤ 1.0	1.0 <h ≤ 1.5	1.5 <h ≤ 2.0	2.0 < h ≤ 2.5	h> 2.5 or h<0		
Weld reinforcement height difference, mm	h ≤ 1.0	1.0< h ≤ 1.5	1.5 < h ≤2.0	2.0 <h ≤2.5	h>2.5		
Weld width, mm	7.0≤ b≤ 8.0	8.0< b≤ 9.0	9.0< b≤ 10.0	10.0< b≤ 11.0	>11 或<7.0		
Weld reinforcement width difference, mm	b≤1.0	1.0< b≤1.5	1.5< b≤2.0	2.0< b≤2.5	b>2.5		
Undercut, mm	No Undercut	Undercut Depth≤0.3& Undercut Length≤10	Undercut Depth≤0.3 & Undercut Length≤15	Undercut Depth≤0.3 & Undercut Length ≤20	Undercut Depth>0.3 or Undercut Length>20		
Misalignment, mm				≤0.5	>0.5		
Root concavity, mm				No	Yes		
Root convexity by passing ball				The ball can pass through (inner diameter 0.85d)	The ball cannot pass through(inner diameter 0.85d)		
Angular deformation (mm)	0-1	>1, ≤2.0	>2, ≤3.0	>3, ≤4.0	>4		
Mechanical damage or				No	Yes		

stray arc							
Weld back forming	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score * 0.5							

Note: Surface cleaning, remelting ,welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.3.3 Assessment for Welding Process 141 - Gas Tungsten Arc Welding

Appearance Inspection (Fillet Weld of Plate-Plate)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Competition! External Assessment Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
Fillet weld size , mm	≥4 z ≤5	>5 z ≤6	>6 z ≤7	>7 z ≤8	>8 z, or <4		
Fillet weld size difference, mm	≤0.5	>0.5, ≤1.0	>1.0, ≤1.5	>1.5, ≤2.0	>2.0		
Undercut, mm	No Undercut	Undercut Depth≤0.3 & Undercut Length≤5	Undercut Depth≤0.3 & Undercut Length ≤10	Undercut Depth≤0.3 & Undercut Length≤15	Undercut Depth>0.3 or Undercut Length>15		
Angular deformation, mm				≤2	>2		
Mechanical damage or stray arc				No	Yes		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score: 50							

Note: Surface cleaning, remelting, welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.3.4 Assessment for Welding Process 141 - Gas Tungsten Arc Welding

Internal Assessment (Butt Weld of Plate or Pipe)

Name	Internal assessment Group B	Internal assessment Group D	Internal assessment Unusable for competition	Measurements	Scores
Corresponding points	10	5	0		
Cracks, incomplete penetration, lack of fusion	Not permissible	Not permissible	0 point will be given if there is any		
Frequent or many pores	Individual pores≤2 pics	Individual pores≤4 pics	Many pores (≥4 pics) or Individual pore≥1/2σ(thickness)		
Elongated cavity/wormhole length: width≥3:1	Not permissible	L≤4mm	L＞4mm		
Shrinkage cavity	Individual dot-like≤1 pic	Individual dot-like≤2 pics	Penetrative or individual＞2 pics		
Inclusion	Individual dot-like≤2 pics	Individual dot-like≤4 pics strip-like≤4mm	Individual dot-like＞4 pics or strip-like＞4mm		
Total score: 50					

1. Test pieces with cracks, incomplete penetration, lack of fusion or visible pores or inclusions are unqualified.;
2. Area of assessment is 10mm×10mm;
3. Individual pore of Φ≤0.5mm can be ignored, Φ 0.5-1mm will be counted as one dot, Φ 1-2mm as 2, Φ 2-3mm as 3, and so on;
4. Elongated cavity/wormhole: length: width ≥ 3:1.

Table 2.4.1 Assessment for Welding Process 311 - Oxygen-acetylene Flame Welding

Appearance Inspection (Butt weld of Plate)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition! External Assessment	Measure ments	Scores
Corresponding points	10	9	7	5	0		
Weld reinforcement, mm	0 ≤ h ≤ 2.0	2.0＜ h ≤ 2.5	2.5＜ h ≤ 3.0	3.0＜ h ≤ 3.5	h ＜-0.1 or h >3.5		
Weld reinforcement height difference, mm	h ≤ 1.0	1.0＜ h ≤ 1.5	1.5＜h ≤2 .0	2.0＜ h ≤3	h＞3.0		
Weld width	9.0≤ b≤ 10	10＜ b≤ 11	11＜ b≤ 12	12＜ b≤ 13	＞13 或 ＜9.0		
Face weld width difference	b ≤ 1.0	1.0 ＜ b ≤ 1.5	1.5 ＜ b ≤2.0	2.0 ＜ b ≤2.5	＞2.5		
Undercut, mm	No Undercut	Undercut Depth≤0.5 & Undercut Length≤10	Undercut Depth≤0.5 & Undercut Length≤20	Undercut Depth≤0.5 & Undercut Length≤30	Undercut Depth＞0.5 & Undercut Length＞30		
Angular distortion （mm）	0-1	＞1，≤2.0	＞2，≤3.0	＞3，≤4.0	＞4		
Back weld height, mm	0≤ h ≤ 0.5	0.5≤ h ≤ 1.0	1.5≤ h ≤ 2.0	2.0≤ h ≤ 2.5	h＞2.5 or ＜0		
root concavity				No	Yes		
mechanical damage				No	Yes		

Weld back forming	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score*0.5							

Note: Welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.4.2 Assessment for Welding Process 311- Oxygen-acetylene Flame Welding

Appearance Inspection(Butt Weld of Pipe)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
Weld reinforcement, mm	0 ≤ h ≤ 2.0	2.0＜ h ≤ 2.5	2.5＜ h ≤ 3.0	3.0＜ h ≤ 3.5	h ＜0 or h >3.5		
Weld reinforcement height difference, mm	h ≤ 1.0	1.0＜ h ≤ 1.5	1.5＜h ≤2 .0	2.0＜ h ≤3.0	h＞3.0		
Weld reinforcement width, mm	9.0≤ b≤ 10	10＜ b≤ 11	11＜ b≤ 12	12＜ b≤ 13	＞13 b, of ＜9.0		
Weld reinforcement width difference, mm	b ≤ 1.0	1.0 ＜ b ≤ 1.5	1.5 ＜ b ≤2.0	2.0 ＜ b ≤2.5	＞2.5		
Undercut, mm	No Undercut	Undercut Depth≤0.5 & Undercut Length≤10	Undercut Depth≤0.5 & Undercut Length≤20	Undercut Depth≤0.5 & Undercut Length≤30	Undercut Depth＞0.5 & Undercut Length＞30		
Angular distortion , mm	0-1.0	＞1.0，≤2.0	＞2.0，≤3.0	＞3.0，≤4.0	＞4.0		
Misalignment, mm				≤1	＞1		
Root convexity by passing ball				The ball can pass through (inner diameter 0.85d)	The ball cannot pass through (inner diameter 0.85d)		

Root concavity				No	Yes		
Mechanical damage				No	Yes		
Weld back forming	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score *0.5							

Note: Welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.4.3 Assessment for Welding Process 311- Oxygen-acetylene Flame Welding

Appearance Inspection (Fillet Weld of Plate-Plate)

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Competition! External Assessment Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
Fillet weld size, mm	6-7	＞7，≤ 8	＞8，≤ 9	＞9，≤ 10	＞10, ＜6		
Fillet weld size difference ,mm	≤ 1	＞1，≤ 2	＞2，≤ 3	＞3，≤ 4	＞4		
Undercut, mm	No Undercut	Undercut Depth≤0.5 & UndercutLength≤10	Undercut Depth≤0.5 & Undercut Length ≤20	Undercut Depth≤0.5 & UndercutLength≤30	Undercut Depth＞0.5 or Undercut Length＞30		
Angular deformation, mm				≤2	＞2		
Mechanical damage or stray arc				No	Yes		
Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score: 50							

Note: Welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 0 score for the test piece.

Table 2.4.4 Assessment for Welding Process 311- Oxygen-acetylene Flame Welding

Internal Assessment (Butt Weld of Plate or Pipe)

Name	Internal assessment Group B	Internal assessment Group D	Internal assessment Unusable for competition	Measurements	Scores
Corresponding points	10	5	0		
Cracks, incomplete penetration, lack of fusion, visible pores inclusions	Not permissible	Not permissible	0 point will be given if there is any		
Frequent or many pores	Individual pores≤2 pics	Individual pores≤4 pics	Many pores (＞4 pics) or individual pore≥1/2σ(thickness)		
Elongated cavity/wormhole length: width≥3:1	Not permissible	L≤4mm	L＞4mm		
Shrinkage cavity	Individual dot-like≤1 pic	Individual dot-like≤2 pics	Penetrative or individual＞2 pics		
Inclusion	Individual dot-like≤2 pics	Individual dot-like ≤4 pics or strip-like≤4mm	Individual dot-like＞4 pics or strip-like＞4mm		
Total score: 50					

1. Test pieces with cracks, incomplete penetration, lack of fusion are unqualified.;
2. Area of assessment is 10mm×10mm;
3. Individual pore of Φ≤0.5mm can be ignored, Φ 0.5-1mm will be counted as one dot, Φ 1-2mm as 2, Φ 2-3mm as 3, and so on;
4. Elongated cavity/wormhole: length: width ≥ 3:1.

Appendix 3

Specifications of Test Pieces for Project One

1. 111/SMAW, 135/GMAW

Material: S235

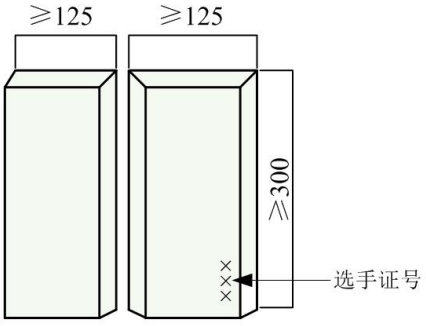
Thickness(t):10mm

Angle of bevel (α/2): $30^{\ 2}_{\ 0}$

Width(B):125 mm

Length(L):300mm

Gap(b) between test pieces, root face (p) and anti-deformation are free.



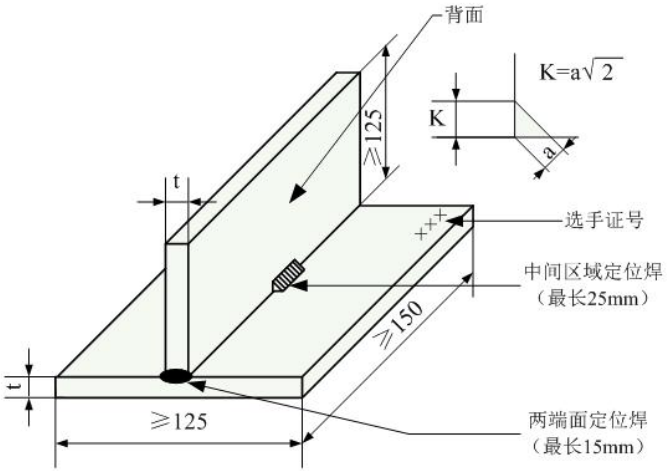
板对接接头（P BW）

Material: S235

t:10mm

B:125 mm

L:150mm



板角接接头（P FW）

Material: pipe:20#(ASTM/AISI 1020STEEL)

Φ133×10mm

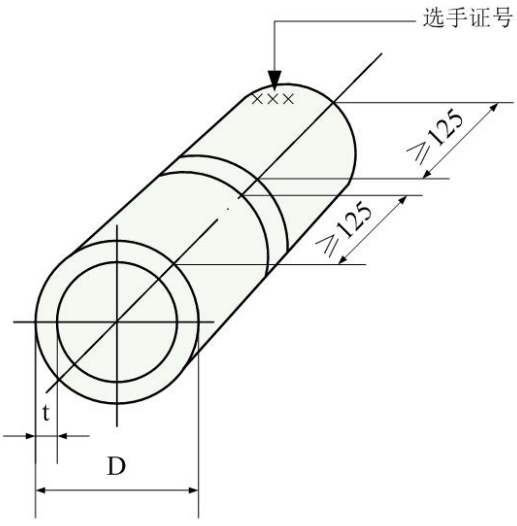
Angle of bevel (α/2): $30^{\ 2}_{\ 0}$

t:10 mm

L:125 mm

D:133 mm

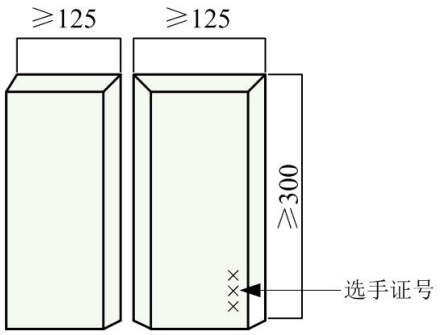
Gap(b) between test pieces, root face (p) and anti-deformation are free



管对接接头（T BW）

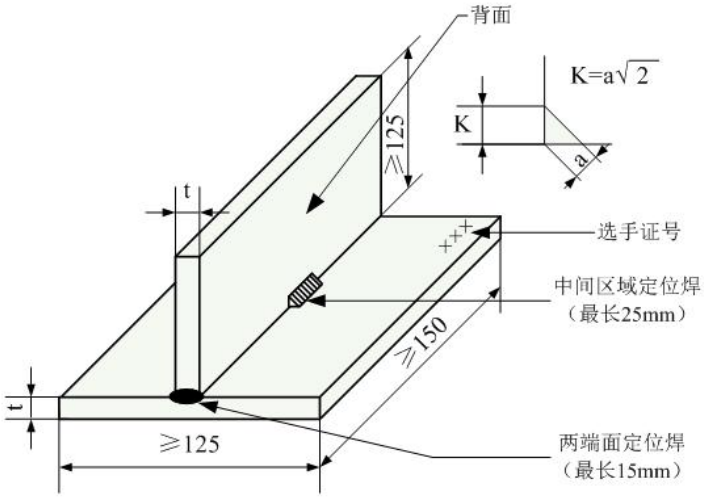
2. 141/GTAW, 311/OFW

Material:S235
Thickness(t):5mm
Angle of bevel (α/2): 30^{2}_{0}
Width(B):125 mm
Length(L):300mm
Gap(b) between test pieces, root face (p) and anti-deformation are free.



板对接接头（P BW）

Material:S235
t:5mm
B:125 mm
L:150mm



板角接接头（P FW）

Material: pipe:20#(ASTM/AISI 1020) Φ

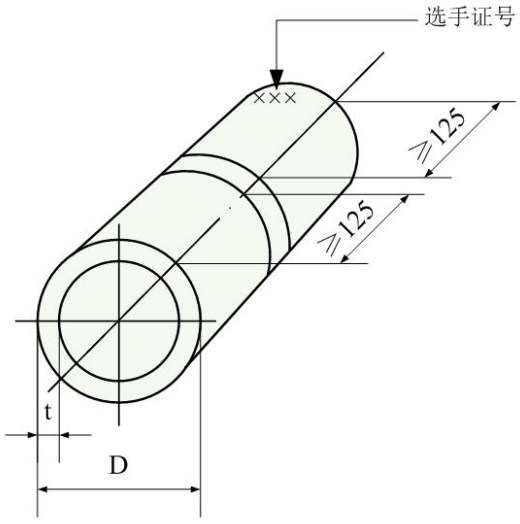
Angle of bevel (α/2): 30^{2}_{0}

t:4 mm

L:125 mm

D:60 mm

Gap(b) between test pieces, root face (p) and anti-deformation are free.



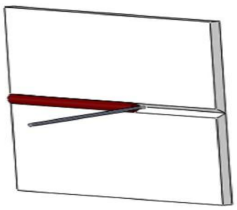
管对接接头（T BW）

Appendix 4

Welding Positions Drawing

I. Welding positions for plates(DIN EN ISO6947)

1. Butt weld for plates

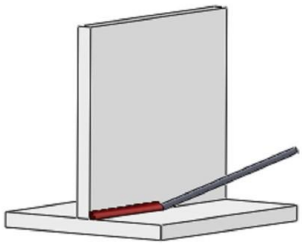


Horizontal welding PC (2G*)

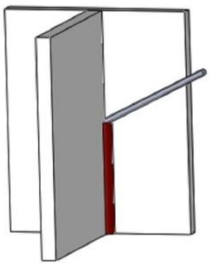
Overhead welding PE (4G*)

Vertical up welding PF (3G uphill*)

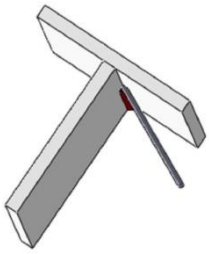
2、Fillet weld for plates



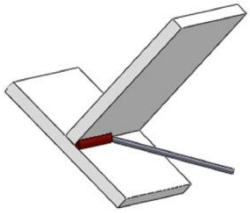
Horizontal vertical welding PB (2F*)



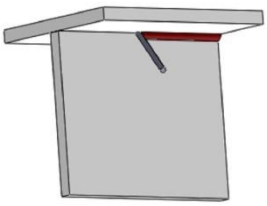
Vertical up welding PF(3F uphill*)



Overhead welding PE



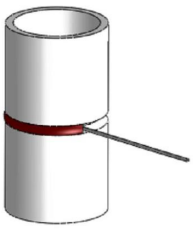
Horizontal welding PC



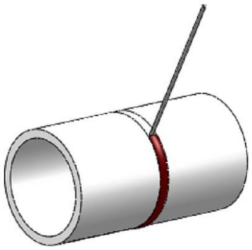
Overhead welding PD (4F*)

II. Welding positions for pipes (DIN EN ISO6947)

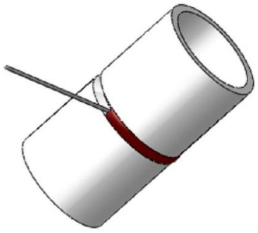
1、Butt welding for pipes



Pipe:fixed
Axis:vertical
Horizontal welding PC (2G*)



Pipe:fixed
Axis:horizontal
Upward welding PH (5G uphill*)



Pipe:fixed
Axis:45° tilt
Upward welding H-L045 (6G uphill*)

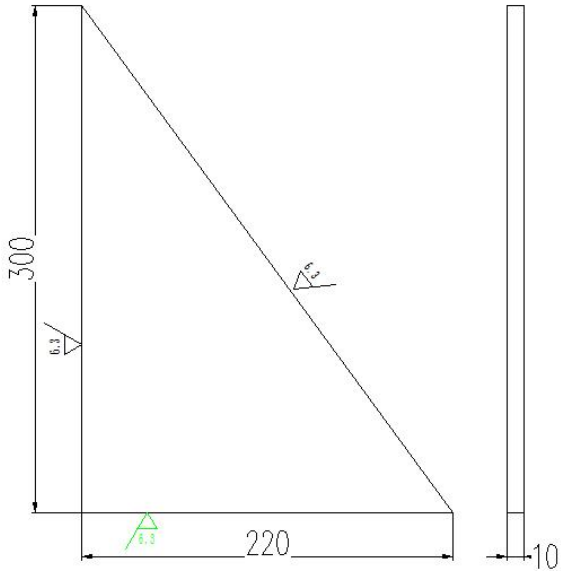
Appendix 5

Test Pieces Size and Welding Elements for Project Two

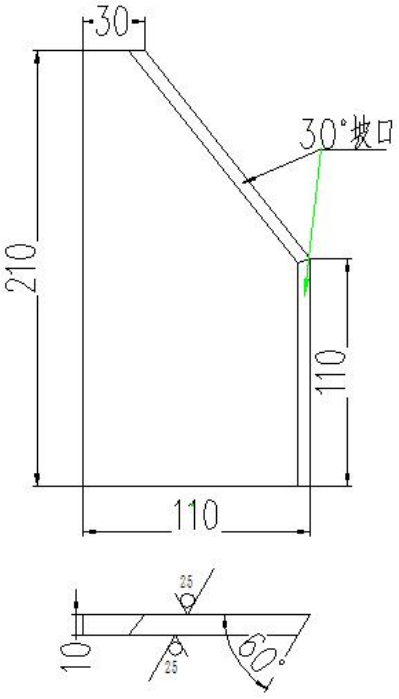
I. Specifications

No. of the drawing	Quantity	Material	Specifications
A	1	S235	triangle，a=220mm ,b=300mm
B	1	S235	The pentagon plate，a=30mm ,b=110mm，C=110mm,h=210mm, 30°groove
C	1	S235	The pentagon plate，a=30mm ,b=110mm，C=110mm,h=210mm, 30°groove
D	1	S235	Isosceles square plate, base a=157.5mm, bevel side b=124mm, 30° groove
E	1	S235	Rectangular plate a=150mm ,b=210mm
F	1	S235	Triangular plate, a=210mm, b=290mm, opening ϕ46mm, 45°groove
G	2	20#(ASTM/AISI 1020STEEL)	φ42×5 H=50 mm -30°groove
H	1	20#(ASTM/AISI 1020STEEL)	90°elbow, radius of curvature 1.5D, ϕ42×5mm, 30° groove
I	1	S235	Square steel plate a=60mm, thickness=10mm

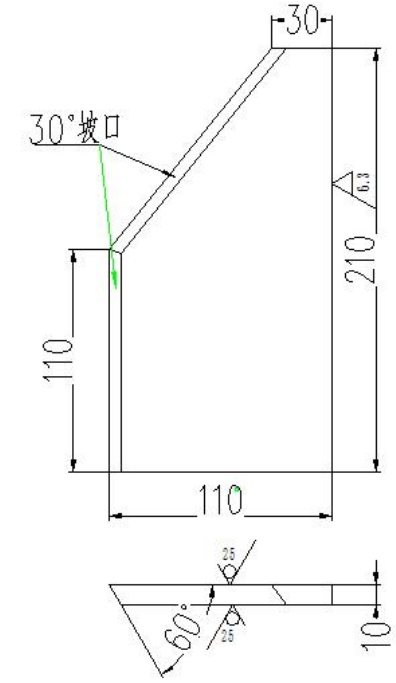
II. Structural Drawings



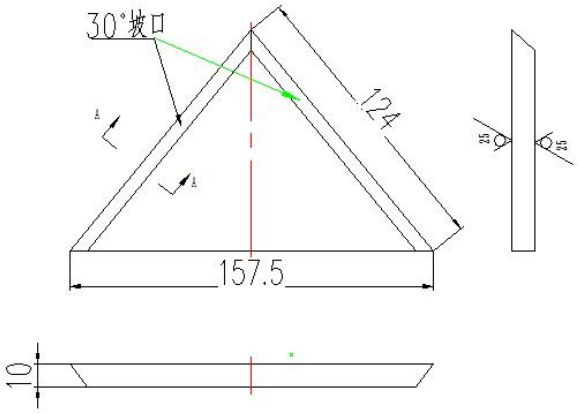
A



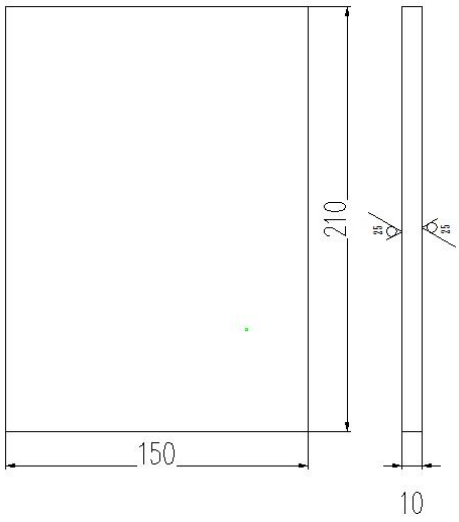
B


30
30°坡口
6.3
210
110
110
25
60°
25
10

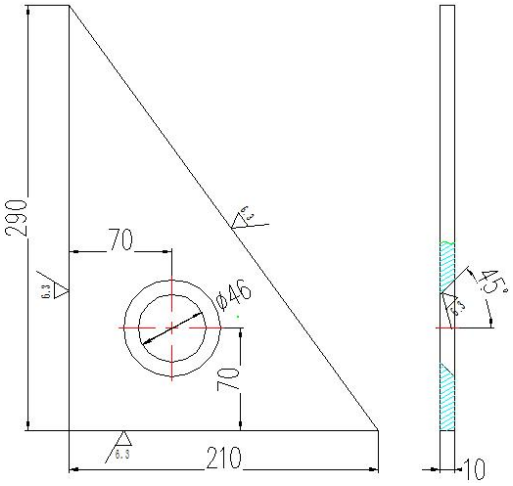
C


30°坡口
124
157.5
25
25
10

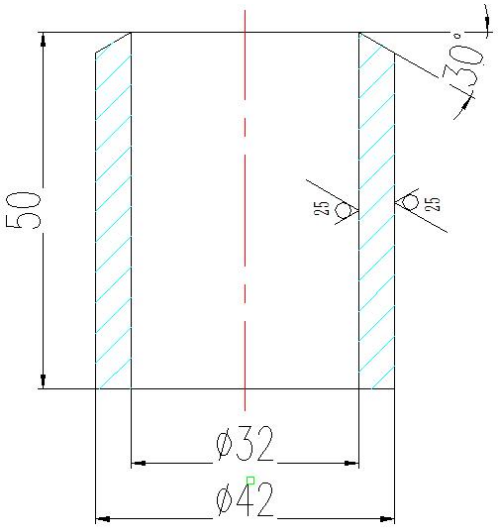
D


210
25
6.3
25
150
10

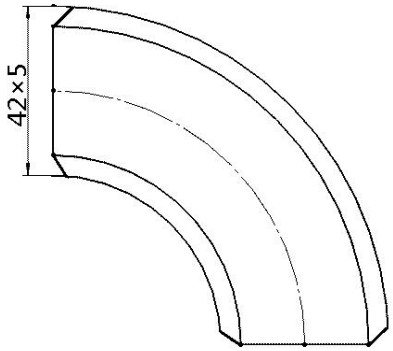
E


290
70
6.3
ϕ46
70
6.3
210
45°
6.3
10

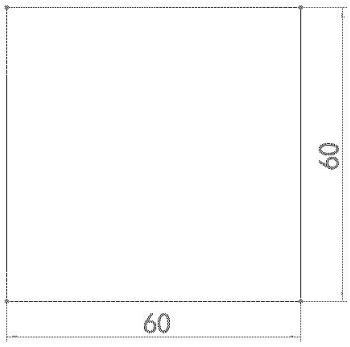
F



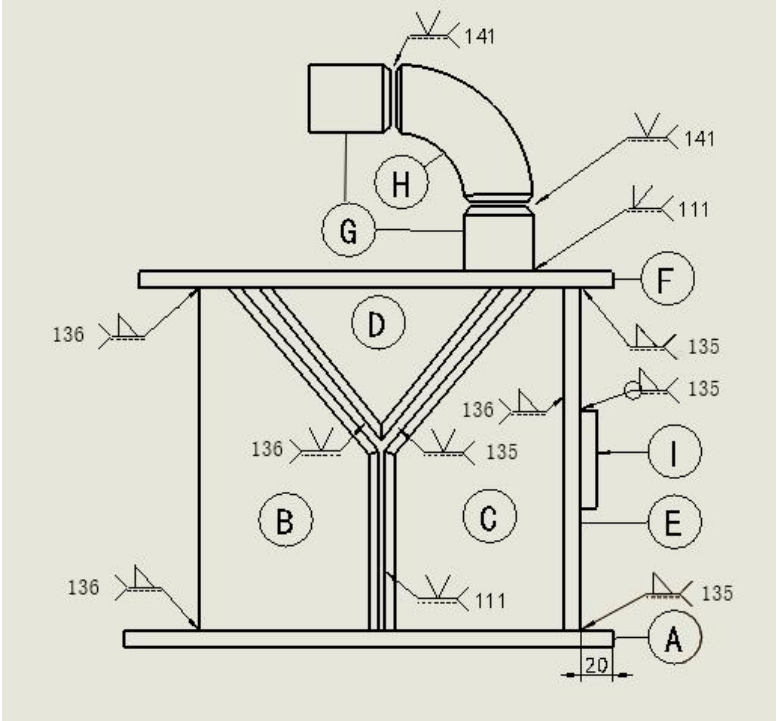
G

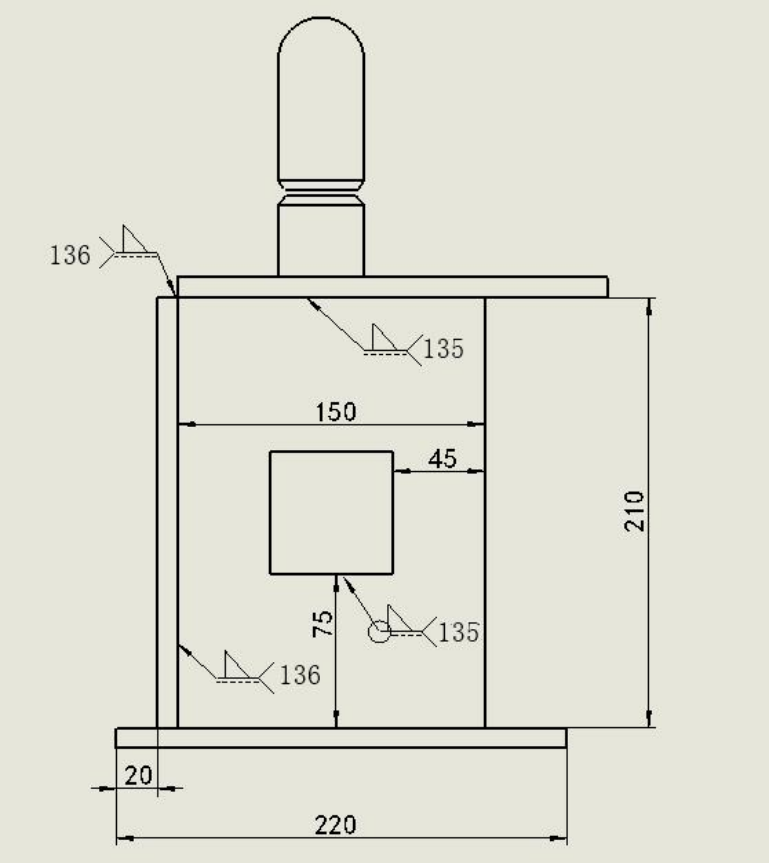


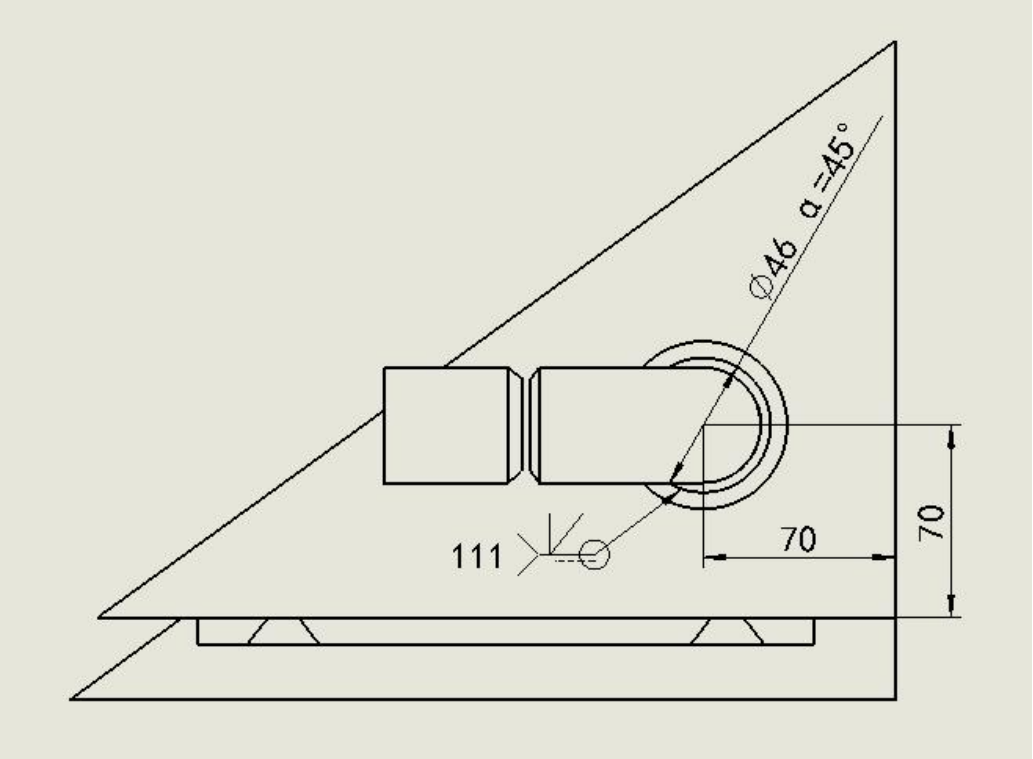
H



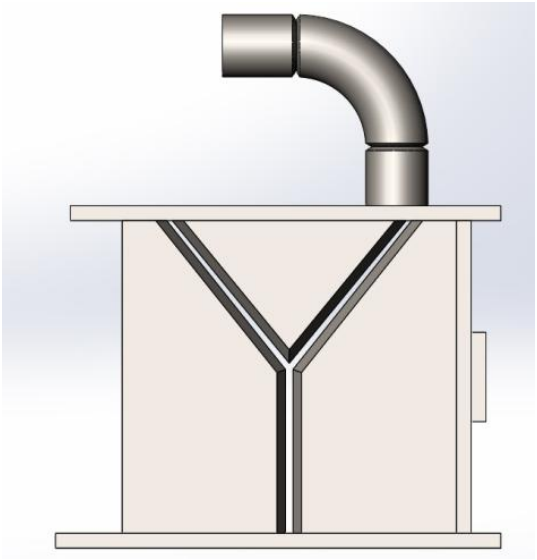
I

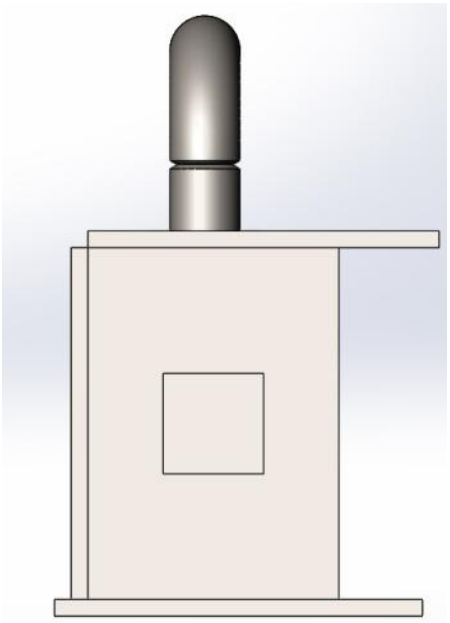

141
141
111
H
G
F
D
136
135
135
136
136
135
I
B
C
E
136
111
135
A
20

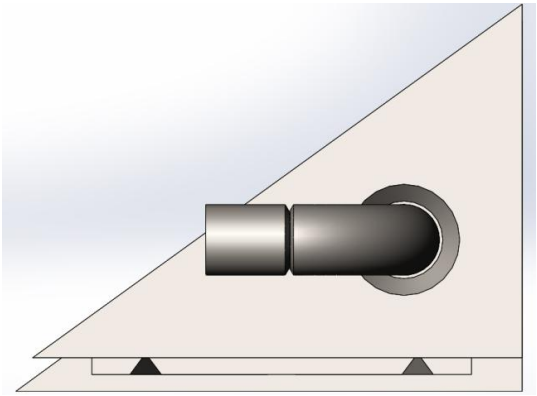

136
135
150
45
210
75
135
136
20
220

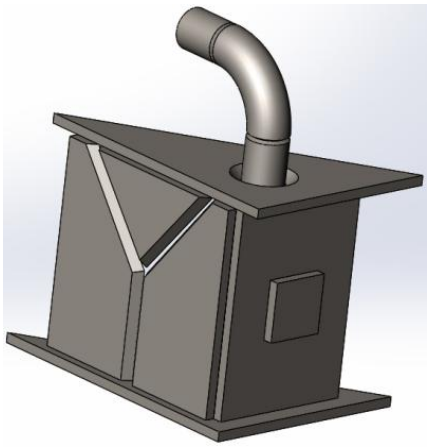

∅46 α=45°
111
70
70

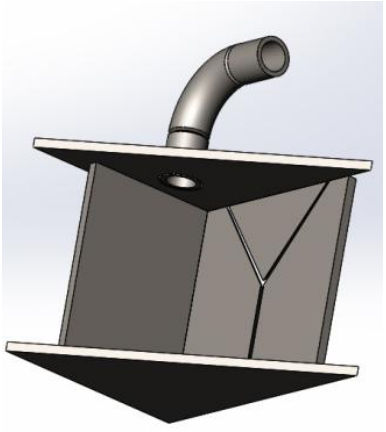
III. Three-dimensional Product Drawing

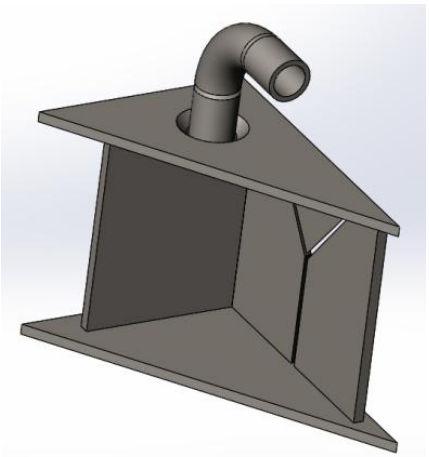












Appendix 6

Carbon Steel Structural Part Welding Assessment

1.The total score of the specimen appearance test is 200 points (see Annex 6 for the scoring standard);
2. One X-ray film will be made for internal quality testing of Y-welds, with a total of 50 points.
3.The total score of the Carbon Steel Structural Part is: 200 points (external assessment*50%) *90% + 50 points (internal assessment) *20%;
4.The test piece score is zero if the assembly or welding process is not consistent with the drawing requirements.

Table 6.1Assessment for Welding Process 111+135+136 - Y Type Weld

Appearance Assessment

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
					Welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 50 scores deducted.		
Weld reinforcement, mm	0 ≤ h ≤ 2.2	2.2＜ h ≤ 2.8	2.8＜ h ≤ 4.0	4.0＜ h ≤ 5.0	h ＞ 5.0 or h＜0		
Weld reinforcement height difference, mm	h ≤ 1 .0	1.0＜ h ≤ 2.0	2.0＜h ≤3 .0	3.0＜ h ≤4 .0	h＞4.0		
Weld reinforcement width difference, mm	b ≤ 1.0	1.0＜ b ≤ 2	2.0 ＜ b ≤3	3.0＜ b ≤4 .0	b＞4.0		
Undercut, mm	No	Undercut depth≤0.5 and the undercut length≤10	Undercut depth≤0.5 and the undercut length≤20	Undercut depth≤0.5 and the undercut length≤30	Undercut depth＞0.5 or the undercut length＞30		
Misalignment, mm	≤0.5	≤1.0	≤1.5	≤2.0	＞2.0		
Weld appearance/Consistency y(capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences, and mechanical damage		
Root concavity, mm	No			0.1≤h≤0.5	＞0.5		
Weld back forming	Beautiful shape, uniform and fine welding seam, consistent height and width	Well formed, even weld seam, smooth	Acceptable shape, straight welding seam	Bent welding seam, obvious height and width	Extremely obvious bending, large height difference and width difference		

Back weld undercut, mm	No	Undercut depth≤0.5 and the undercut length≤10	Undercut depth≤0.5 and the undercut length≤20	Undercut depth≤0.5 and the undercut length≤30	Undercut depth＞0.5 or the undercut length＞30		
back Weld appearance/Consistenc y y(capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences, and mechanical damage		
total score *0.5: 50points							

Table 6.2 Assessment for Welding Process 111 - Shielded Metal Arc Welding (Plate – pipe fillet weld)

Appearance Assessment

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
					welding not compeleted,lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 50 scores deducted.		
Weld foot size, mm	4.0≤z≤5.0	5.0＜z≤6.0	6.0＜z≤7.0	7.0＜z≤8.0	z＞8.0 or z＜4.0		
Weld foot size difference, mm	h≤ 1.0	1.0＜h≤ 2.0	2.0＜h≤ 3.0	3.0＜h≤ 3.5	h＞3.5		
Undercut, mm	No	Undercut depth≤0.5 and the undercut length≤10	Undercut depth≤0.5 and the undercut length≤ 20	Undercut depth≤0.5 and the undercut length≤30	Undercut depth＞0.5 or the undercut length＞30		
Weld back forming	Beautiful shape, uniform and fine welding seam, consistent height and width	Well formed, even weld seam, smooth	Acceptable shape, straight welding seam	Bent welding seam, obvious height and width	Extremely obvious bending, large height difference and width difference		
Weld appearance/Consistency y(capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences, and mechanical damage		
Total score: 50							

Table 6.3 Assessment for Welding Process 135 and 136 - Gas Metal Arc Welding and Flux Cored Arc Welding

Appearance Assessment

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
					Welding not compeleted,lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 50 scores deducted.		
Weld foot size, mm	9.0≤z≤10.0	10.0＜z≤11.0	11.0＜z≤12.0	12.0＜z≤13.0	z＞13.0 or z＜9.0		
Weld foot size difference, mm	h≤ 1.0	1.0＜h≤ 2.0	2.0＜h≤3.0	3.0＜h≤ 3.5	h＞3.5		
Undercut, mm	No	Undercut depth≤0.5 and the undercut length≤10	Undercut depth≤0.5 and the undercut length≤ 20	Undercut depth≤0.5 and the undercut length≤30	Undercut depth＞0.5 or the undercut length＞30		
Corner weld height difference, mm	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	＞4.0		
Weld appearance/Consistency y(capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences, and mechanical damage		
Total score: 50							

Table 6.4 Assessment for Welding Process 141 - Gas Tungsten Arc Welding

Appearance Assessment

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
					Welding not completed, lack of fusion, slag inclusion on surface, surface blowhole or crack will cause 50 scores deducted.		
Weld reinforcement, mm	0 ≤ h ≤ 1 .0	1.0＜ h ≤ 2.0	2.0＜h ≤ 3 .0	3.0＜ h ≤ 4.0	h ＞ 4.0 or h＜0		
Weld reinforcement height difference, mm	h ≤ 0.5	0.5＜ h ≤ 1.0	1.0＜h ≤1.5	1.5＜h ≤2.0	h＞2.0		
Weld width difference, mm	b ≤ 0.5	0.5＜ h ≤ 1.0	1.0＜h ≤1.5	1.5＜ h ≤2.0	h＞2.0		
Undercut, mm	No	Undercut depth≤0.5 and the undercut length≤10	Undercut depth≤0.5 and the undercut length≤ 20	Undercut depth≤0.5 and the undercut length≤30	Undercut depth＞0.5 or the undercut length＞30		
Weld appearance/Consistency y(capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences, and mechanical damage		
Total score: 50							

Table 6.5 Assessment for Welding Process 111+135+136 - Y Type Weld

Internal Assessment

Name	Internal assessment Group B	Internal assessment Group D	Internal assessment Unusable for competition	Measurements	Scores
Corresponding points	10	5	0		
Cracks, incomplete penetration, lack of fusion, visible-pores inclusions	Not permissible	Not permissible	0 point will be given if there is any defects		
Frequent or many pores	Individual pores≤2 pics	Individual pores≤4 pics	Many pores (≥4 pics) or individual pore≥1/2σ(thickness)		
Elongated cavity/wormhole length: width≥3:1	Not permissible	L≤4mm	L＞4mm		
Shrinkage cavity	Individual dot-like≤1 pic	Individual dot-like≤2 pics	Penetrative or individual＞2pics		
Inclusion	Individual dot-like≤2 pics	Individual dot-like≤4 pics or strip-like≤4mm	Individual dot-like＞4 pics or strip-like＞4mm		
Total score: 50					

1. Test pieces with cracks, incomplete penetration, lack of fusion or visible pores or inclusions are unqualified.;
2. Area of assessment is 10mm×10mm;
3. Individual pore of Φ≤0.5mm can be ignored, Φ 0.5-1mm will be counted as one dot, Φ 1-2mm as 2, Φ 2-3mm as 3, and so on;
4. Elongated cavity/wormhole: length: width ≥ 3:1.

Appendix 7

Technical file of aluminum alloy welding

I Competition rules:

The aluminum alloy welding will proceed with separate ranking as non-regulated project with scores included in the total team ranking. This project belongs to the assigned show. Any competitors who is good at aluminum welding could participate in it.

II Test name:

Aluminum alloy horizontal welding and overhead welding with balk board.

III Competition time: 120 minutes

IV Technical requirements:

1. Welding method: Metal Inert-Gas Arc Welding
2. Joint format: butt joint, assembly
3. Groove format: V groove
4. Position requirement of the tack welding on test plate: at the back of the groove, run-on plate, run-off plate and auxiliary clap fixture fixing is not allowed during welding. To complete the welding under the free state of test piece.
5. Specification and quantity of test piece: test plate 1 is 250mm*100mm*8mm, 2 pieces; test place 2 is

250mm*125mm*8mm, 2 pieces; base plate 250mm, 1piece.

6. Base metal and dumping material: base metal is EN AW-5083; welding rod is ER 5183 Φ1. 2.
7. Gas: ultra-pure Argon (purity: 99.99%)
8. Welding sequence: to weld after complete assembly with gap and anti-deformation customized.
9. Welding position: horizontal welding is single face welding with two faces shape; overhead welding is single face welding with base plate; angle welding position has to be butt joint firmly.
10. The competitor could dispose the surface oxidation film mechanically.
11. After tack welding, the basic and intermediate layer polishing is allowed while gap polishing is not allowed after capping.
12. Test piece welding process has to be completed on the welding support while height customized. Welding position and direction are not allowed to change during welding.
13. See the figure 7 for the detailed structure.
14. If the competitors violate the above requirements, the test piece is awarded 0 points.

VI. Assessment requirement:

1. Detection: 100% appearance.
2. Scoring standard: the full score is 110. Find Table 7 for the assessment.

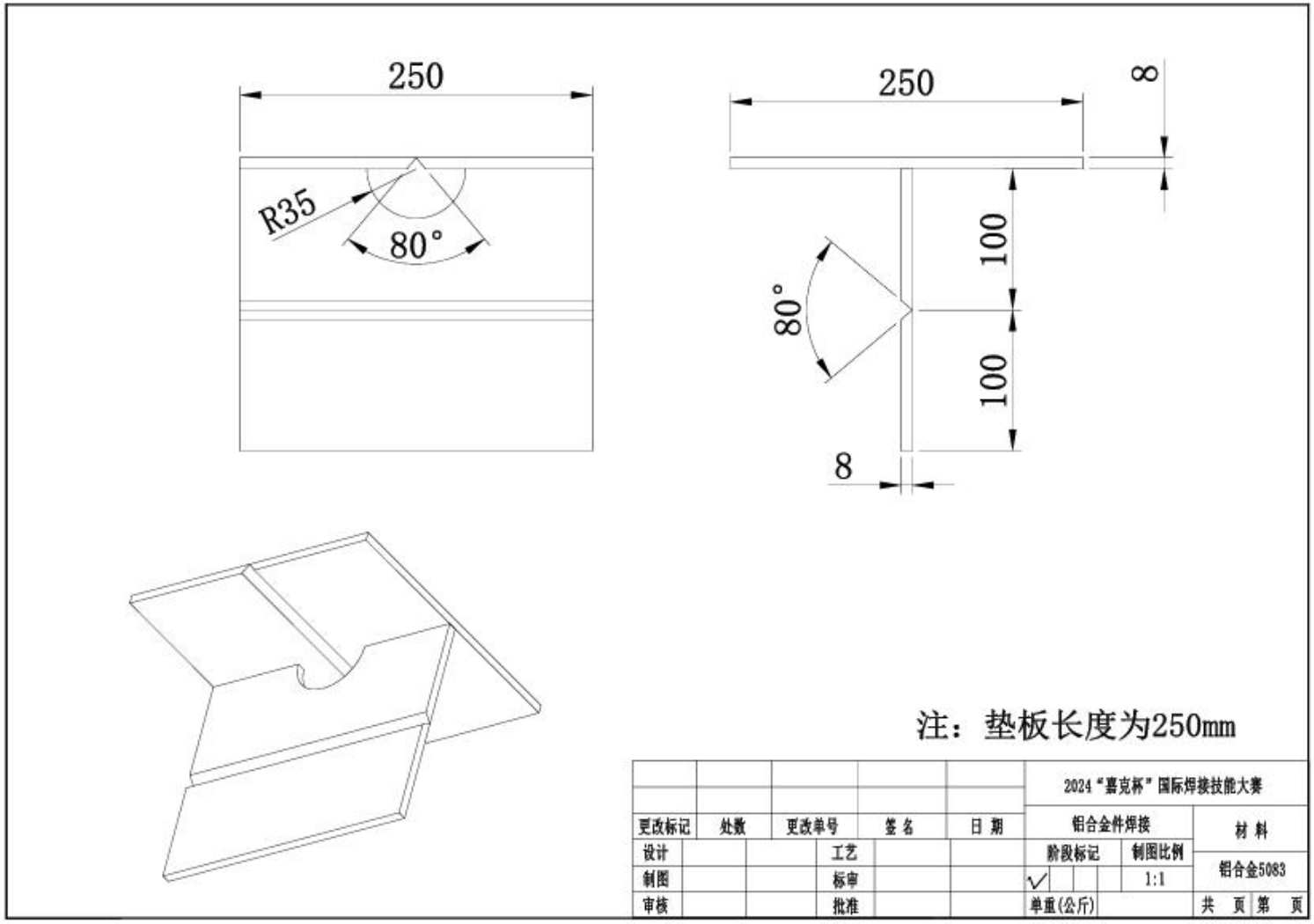
Table 7 Assessment for Metal Inert-Gas Arc Welding (Aluminum Alloy)

Appearance Assessment

Name	Assessment Group B External Assessment	Assessment Group C External Assessment	Assessment Group D External Assessment	Limited usability for the Competition! External Assessment	Unusable for the Competition! External Assessment	Measurements	Scores
Corresponding points	10	9	7	5	0		
					Welding not completed, lack of fusion, or crack will cause 0 score for the test piece		
Weld reinforcement, mm	0.≤ h ≤ 3.0	3.0 < h ≤ 3.8	3.8 < h ≤ 4.5	4.5 < h ≤ 5.0	h ＞ 5.0 or h＜-0.1		
Weld reinforcement height difference, mm	h ≤ 0.5	0.5< h ≤ 1.0	1.0 < h ≤2 .0	2 .0<h ≤3 .0	h＞3.0		
Weld reinforcement width difference, mm	b ≤ 1 .0	1.0＜ b ≤ 2.0	2.0＜ b ≤3 .0	3.0＜ b ≤4 .0	b＞4.0		
Pore	No Pore	Pore Φ≤1.5 Quantity: one	Pore Φ≤1.5 Quantity: two	Pore Φ≤1.5 Quantity: three	Pore Φ＞1.5 Or Quantity:＞three		
Undercut, mm	No undercut	No continuous undercut Undercut depth≤0.5	Continuous undercut depth≤0.8 Intermittent undercut depth≤0.5	Continuous undercut depth≤1.0 Intermittent undercut depth≤1.5	Undercut depth＞1.5		
Misalignment, mm	≤0.5		≤1.0		＞1.0		
Root concavity, mm	No	0.1≤h≤0.5 Concavity length≤10	0.1≤h≤0.5 Concavity length≤20	0.1≤h≤0.5 Concavity length≤60	＞0.5 Concavity length＞60		
Angular distortion, mm	0-2.0	2.1-3.0	3.1-4.0	4.1-5.0	＞5.0		
Back weld height, mm	0≤ h ≤ 2.2	2.3 ≤ h ≤ 3.0	3.0＜ h ≤ 4.0	4.0＜ h ≤ 5.0	h > 5.0 or h＜-0.1		
Mechanical damage or Stray Arc	No	One	Two	Three	No more than three		

Weld appearance/Consistency (capping run)	Excellent shape and beautiful appearance, uniform and exquisite weld, conformity of height and width.	Good shape, uniform and smooth weld	Moderate shape and smooth weld	Curved weld and obvious height and width differences	Very obvious curved weld and relatively large height and width differences		
Total score: 110							

Fig. 7 Drawing of Metal Inert-Gas Arc Welding (Aluminum Alloy)


250
R35
80°
250
8
100
80°
100
8
注：垫板长度为250mm
2024“嘉克杯”国际焊接技能大赛
更改标记
处数
更改单号
签名
日期
铝合金件焊接
材料
设计
工艺
阶段标记
制图比例
制图
标审
1:1
铝合金5083
审核
批准
单重(公斤)
共 页 第 页

Appendix 8

Equipment and Tools Provided by Competitors

No.	Item Name	Model	Pcs.
1	Safety protective glass	unlimited	unlimited
2	Welding helmet	unlimited	unlimited
3	Safety shoes	unlimited	unlimited
4	Protective suit	unlimited	unlimited
5	Earplugs	unlimited	unlimited
6	Gloves	unlimited	unlimited
7	Angle grinder	unlimited	unlimited
8	Straight grinder	unlimited	unlimited
9	C-clamp/f-clamp,etc	unlimited	unlimited
10	Cutting sheet, grinding sheet, grinding head	unlimited	unlimited
11	Steel wire brush	unlimited	unlimited
12	Bowl brush	unlimited	unlimited
13	Hammer	unlimited	unlimited
14	Emery cloth	unlimited	unlimited
15	Flashlight	unlimited	unlimited
16	Flat spade	unlimited	unlimited
17	Chisel	unlimited	unlimited
18	Scriber	unlimited	unlimited
19	File	unlimited	unlimited
20	Fillet weld gauge	unlimited	unlimited
21	Steel ruler	unlimited	unlimited
22	Try square	unlimited	unlimited
23	Compasses	unlimited	unlimited
24	Wrench	unlimited	unlimited
25	Tungsten electrode and tungsten holder	Φ2.4mm	unlimited
26	Nozzle and flow guide part	unlimited	unlimited
27	Hacksaw blade	unlimited	unlimited
28	Line cutting tool	unlimited	unlimited
29	Auxiliary tools for welding carbon steel structural part	unlimited	unlimited

Note：The organizer is not responsible for providing competitors with the items listed in the

table during the competition.