



NATIONAL WELDER TRAINING STANDARD

DOCUMENT NO. NWTS-CP2-3-09

Code of Practice 2: Training of Craftsman Welders

Part 3: Plate Welding Practical

2nd^t Edition – July 2015

Issued under the authority of:



**The
Welding
Institute**

The Welding Institute, Professional Division under the guidance of the



Association for Welding and Fabrication Training and Education

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1 General

1.1 Structure of the Standard

This Code of Practice is one of three which together will form a national standard for the training of welders, covering practical training for skills, essential job knowledge, welder approval and requirements for training organisations. The three codes are:

- CP1 Training of Welding Operatives**
- CP2 Training of Craftsman Welders**
- CP3 Training of Master Welders**

For the purpose of this Code, a Craftsman Welder is defined as a person who has undergone a programme of theoretical and practical training in arc welding; and has demonstrated theoretical knowledge and practical skills in accordance with recognised standards, in a range of welding positions.

All NWTs documents are downloadable from www.cswip.com

1.2 Structure of CP2

CP2 is in three parts:

- Part 1 Theoretical knowledge
- Part 2 Fillet welding practical
- Part 3 Plate welding practical

The route to achieving a qualification under CP2, is shown in Figure 1. It can be seen from Figure 1 that there is a direct link between CP2 and the International Welder qualification under the International Institute of Welding (IIW) scheme¹. Therefore, the outcome from the CP2 programme is both the NWTs and the IIW qualification. The latter ensures that the welder's knowledge and skills is recognised throughout the world.

The NWTs is implemented under the authority of TWI Certification Ltd, the UK Authorised National Body (ANB) for IIW and EWF.

Both CP2 and IIW qualifications are issued for specific welding processes and materials according to the precise content of the course and examinations taken by the candidate.

¹ The IIW scheme is exactly the same as the pre-existing European Welding Federation (EWF) scheme. Successful participants receive diplomas from both schemes

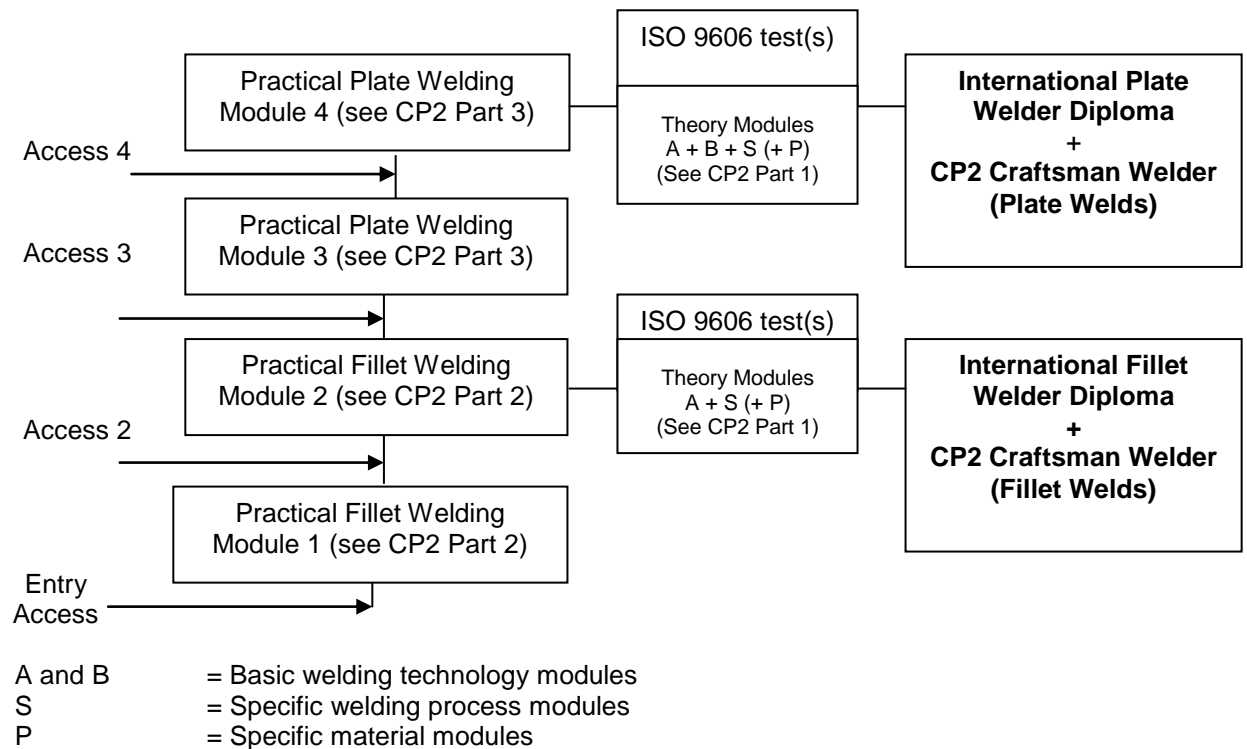


Figure 1 The overall structure of the training and examination under CP2.

Where indicated ISO 9606 (or equivalent) qualification certificates are issued to successful candidates.

1.3 Access to the Course

Only training providers approved by TWI Certification Ltd via the Certification Scheme for Welder Training organisations (see www.cswip.com) are permitted to conduct NWTS courses and course attendance is mandatory.

Applicants must possess sufficient knowledge of, or education in, metalworking to follow the course. They must also have a level of health, and physical and mental capability, to undergo the training for which they are applying.

Successful completion of one module qualifies for participation in the next module. With existing knowledge and proven skill, the program may be entered at a higher level, provided that the candidate demonstrates a capability (practically and theoretically) to meet the entry requirements as described below.

- Access to 2: Demonstrate the required level of skill by passing the tests as described in module 1.
- Access to 3: Demonstrate the required level of skill by passing the full examination as described in module 2.
- Access to 4: Demonstrate the required level of skill by passing the full examination as described in module 2 and passing the tests as described in module 3.

Practical skill may be proven by adequate and valid ISO 9606 or equivalent certificates.

This document, CP2 Part 3, covers only the Practical Plate Welding Modules shown in Figure 1.

As an option to normal welder qualification tests, training organisations can offer the alternative of a 'test object'. This requires candidates to produce a small fabricated structure containing the test geometries and materials required. These test objects have some similarities to fabrications that are used to test candidates in welding skill competitions and therefore may be advantageous if any of the training organisation's students are considering entering a welding competition. For more details, please contact TWI Certification Ltd, at Granta Park, Great Abington, Cambridge, CB21 6AL.

1.4 IW Diploma via the Alternative Route

The Alternative Route allows those who have gained the knowledge and expertise of the instruction programme in this Guideline and who can demonstrate their capability in all respects, to proceed to examination without compulsory attendance at an approved training course.

1.4.1 Entry requirements

- Any candidate who can show a welder qualification (i.e. ISO 9606) valid under the scope for the Diploma he/she wants.
- 3 years of experience as a welder.

1.4.2 Evaluation process

- To perform the theoretical examinations, related to the level of the IW Diploma that the candidate is seeking.
- To perform the practical examinations that are defined in this Guideline for the level of the IW Diploma that the candidate is applying for, including the lower levels examinations. See Figure 1.

Re-examination in the case of candidate failure in the theoretical examination(s) or in the practical exam(s):

- For theoretical examinations candidates are allowed to have two more attempts (in total three attempts). In case of failure on the third attempt the candidate must take the theoretical module(s) that he/she failed.
- For practical exams candidates are allowed to have one more attempt. In case of failure on the second attempt the candidate must take the practical module he/she has failed.

2 Practical Training and Tests

2.1 General

The recommended periods of time (hours) shown represent the average time required to gain the expected skills. The time needed may vary according to the capability of the student.

This Guideline applies mainly to ferritic steels (group 1, 2, 3 and 11 according to ISO/TR 15608) and – where applicable – stainless steels (group 8 and 10 according to ISO/TR 15608) and may be used as a basis for other materials until the moment a corresponding guideline exists. The application of this program to other materials than given with the exercises may require slight changes to the work pieces and / or the positions to be welded. Such changes require approval from TWI Certification Ltd.

If an existing welding simulation system is suitable to be used in welding training sessions for a special process, they have to be approved by TWI Certification Ltd. In the case of an approved simulation system, the training provider can decide if they will use it. The recommended training hours depend on each system and can be different from one system to another. The decision about the range of use of a simulation system is up to the training provider and TWI Certification Ltd must approve it.

2.2 All Modules

In all modules the following Learning Outcomes apply:

1. Assemble and tacking the joint.
2. Take the necessary precautions to avoid distortion prior to, during and after welding.
3. Follow the welding symbols and the (p)WPS (related to the proposed weld).
4. Perform safe welding according to the (p)WPS (or welding instruction).
5. Select the appropriate type of consumable and the desired size according to the (p)WPS (or welding instruction).

3 Process 111 (MMA-Welding) for Ferritic and Stainless Steel

3.1 Module E3

Objective

- To obtain basic experience in process 111 (MMA welding) and to be able to produce single sided and both sided butt welds in plate in PA and Pc positions with and without gouging and grinding.

Scope

- See Table E 3
- The average recommended time for the exercises is about 75hr.

Learning outcomes

The student is capable to (in addition to 2.2):

1. Adjust the welding power source to fit the purpose.
2. Control the welding power source efficiently
3. Make sound fillet and butt welds in different types of joints in plates as specified in table E 3 in single and multi-run technique.
4. Perform grinding and/or gouging (not tested)
5. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.]

3.2 Module E 4

Objective

- To obtain experience in process 111 (MMA welding) and to be able to produce fillet welds in corner joints in PF position, T-butt joints in PB and PF positions, single and both sided welds in PF position and single sided butt welds in plate in PC and PE positions.

Scope


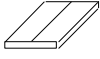
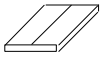

- See Table E 4.
- The average recommended time for the exercises is about 75hr.

Learning outcomes



The student is capable to (in addition to 2.2):


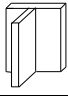



1. Adjust the welding power source to fit the purpose.
2. Control the welding power source efficiently.
3. Make sound butt welds in different types of joints in plates as specified in table E 4 in single and multi run technique.
4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.


3.3 Training and test pieces for MMA welding of steel

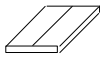

E 3		Practical training				Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)	
						Process 111	
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks		
1	Introduction						
2	Grinding, flame gouging and arc gouging	Optional					
3	Fillet weld, corner joint	$t > 8$	PF				
4	Butt weld	$t > 8$	PA		bs with grinding or gouging		
5	Butt weld	$t > 3$	PA		ss nb		
6	Butt weld	$t > 3$	PC		ss nb		

Welding and evaluation of test pieces according to the appropriate part of ISO 9606; only visual testing required.

No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 3$	PA		ss nb
2	Butt weld	$t > 3$	PC		ss nb

E 4		Practical training				Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)	
						Process 111	
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks		
1	Introduction						
2	Fillet weld, corner joint	$t > 8$	PF				
3	T-butt weld	$t > 8$	PF				
4	Butt weld	$t > 3$	PE		ss nb		
5	Butt weld	$t > 8$	PF				
6	Butt weld	$t > 3$	PF				

E 4	Practical training Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)				
No.	Process 111				
	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
7	Double bevel T-butt weld	$t > 8$	PB		

Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorised examiner.					
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 3$	PE		ss nb
2	Butt weld	$t > 3$	PF		ss nb

4 Process 135 and 136 (MAG-Welding) for Ferritic and Stainless Steel

4.1 Module M 3

Objective

- To obtain experience in the MAG welding process (135 and 136) and to be able to produce butt welds in plate in PA, PC and PG positions with and without gouging.

Scope

- See table M 3
- The average recommended time for the exercises is about 75hr.

Learning outcomes

The student is capable to (in addition to 2.2):

- Adjust the welding power source to fit the purpose.
- Control the welding power source efficiently.
- Make sound butt welds in different types of joints in plates as specified in Table M 3 in single and multi run technique.
- Perform grinding and/or gouging (not tested).
- Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

4.2 Module M 4

Objective

- To obtain experience in the MAG welding process (135 and 136) and to be able to produce single sided butt welds in plate in PB, PD, PE and PF positions.

Scope

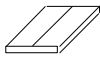

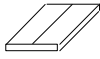
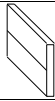
- See table M 4
- The average recommended time for the exercises is about 75hr.

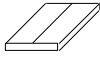
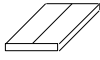
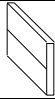

Learning outcomes

The student is capable to (in addition to 2.2):







1. Adjust the welding power source to fit the purpose.
2. Control the welding power source efficiently.
3. Make sound single sided butt welds in different types of joints in plates as specified in Table M 4 in single and multi run technique.
4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.





4.3 Training and test pieces for MAG welding of steel

M 3	Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)				
	Process 135 and 136				
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	$t > 1$	PA		Process 135 ss nb 135-D for root run
3	Butt weld	$t > 1$	PG		Process 135 ss nb 135-D for root run
4	Butt weld	$t > 8$	PA		Process 135 ss nb and 136 bs with grinding or gouging or process 136 ¹ ss nb and 136 bs with grinding or gouging
5	Butt weld	$t > 5$	PC		Process 135 and 136 ¹ ss nb

Welding and evaluation of test pieces according to the appropriate part of ISO 9606; only visual testing required.					
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 1$	PA		Process 135 ss nb 135-D for root run
2	Butt weld	$t > 8$	PA		Process 136 ¹ ss nb
3	Butt weld	$t > 1$	PC		Process 135 ss nb 135-D for root run
4	Butt weld	$t > 8$	PC		Process 136 ss nb

Remark: for group 8 and 10, bs with grinding or gouging is allowed.

M 4	Practical training				
	Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)				
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	$t > 1$	PE		Process 135 ss nb 135-D for root run
3	Butt weld	$t > 5$	PE		Process 136 ¹ ss nb
4	Butt weld	$t > 8$	PF		Process 135 ss nb and 136 bs with grinding or gouging or process 136 ¹ ss nb and 136 bs with grinding or gouging
5	Single bevel butt weld, T-joint	$t > 5$	PB		Process 135 and 136 bs with grinding or gouging
6	Single bevel butt weld, T-joint	$t > 5$	PD		Process 135 and 136 ¹ ss nb
7	Single bevel butt weld, T-joint	$t > 5$	PF		Process 135 and 136 ¹ ss nb

Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorised examiner.					
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 1$	PF		Process 135 ss nb 135-D for root run
2	Butt weld	$t > 8$	PF		Process 136 ¹ ss nb
3	Butt weld	$t > 1$	PE		Process 135 ss nb 135-D for root run
4	Butt weld	$t > 8$	PE		Process 136 ¹ ss nb

Remark: for group 8 and 10, bs with grinding or gouging is allowed.

¹ Root run may be done with metal cored wire (138).

5 Process 131 (MIG-Welding) for Aluminium Material Groups

5.1 Module MAI.3

Objective

- To obtain experience in the MIG welding process (131) and to be able to produce single sided butt welds with backing and double sided butt welds with root opening in plate in PA and PF positions.

Scope

- See Table MAI.3.
- The average recommended time for the exercises is about 60 hr (reduced time, experience assumed).

Learning outcomes

The student is capable to (in addition to 2.2):

1. Adjust the welding power source to fit the purpose.
2. Control the welding power source efficiently.
3. Make sound butt welds in different types of joints in plates as specified in table MAI.3 in single and multirun technique.
5. Perform grinding and/or gouging (not tested).
6. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

5.2 Module MAI.4

Objective

- To obtain experience in the MIG welding process (131) and to be able to produce single sided butt welds with backing in plate in PC and PE positions and double sided butt welds with root opening in plate in PB, PC, PD, PE and PF positions.





Scope

- See Table MAI.4.
- The average recommended time for the exercises is about 60 hr (reduced time, experience assumed).



Learning outcomes:

The student is capable to (in addition to 2.2):






1. Adjust the welding power source to fit the purpose.
2. Control the welding power source efficiently.
3. Make sound butt welds in different types of joints in plates as specified in table MAI.4 in single and multi run technique.
4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.



MAI.3	Practical training					Material group 21, 22, 23 (ISO/TR 15608)
						Process 131
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks	
1	Introduction					
2	Butt weld	t > 6	PA		ss mb	
3	Butt weld	t > 6	PF		ss mb	
4	Butt weld	t > 6	PA		bs with or without grinding	
5	Butt weld	t > 6	PF		bs with or without grinding	



Welding and evaluation of test pieces according to the appropriate part of ISO 9606; only visual testing required.

No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 6$	PA		ss mb
2	Butt weld	$t > 6$	PF		bs with or without grinding

Remark: During test welding the use of pulsed current is prohibited.

MAI.4	Practical training					Material group 21, 22, 23 (ISO/TR 15608)
						Process 131
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks	
1	Introduction				When welding bs, it is not necessary to weld the back side in the defined position	
2	Butt weld	$t \leq 3$	PE		ss mb	
3	Butt weld	$t \leq 3$	PC		ss mb	
4	Butt weld	$t > 6$	PE		bs with or without grinding	
5	Butt weld	$t > 6$	PC		bs with or without grinding	
6	Single bevel butt weld, T-joint	$t > 6$	PB		bs with or without grinding	

MAI.4	Practical training			Material group 21, 22, 23 (ISO/TR 15608)	
	Process 131				
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
7	Single bevel butt weld, T-joint	t > 6	PD		bs with or without grinding
8	Single bevel butt weld, T-joint	t > 6	PF		bs with or without grinding

Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorized examiner.					
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t \leq 3$	PC		ss mb
2	Butt weld	$t > 6$	PE		bs with or without grinding

6 Process 141 (TIG-Welding) for Ferritic and Stainless Steel

6.1 Module T 3

Objective

- To obtain experience in process 141 (TIG-welding) and to be able to produce single sided butt welds in plate in PA and PC positions.

Scope

- See Table T 3.
- The average recommended time for the exercises is about 50hr.

Learning outcomes

The student is capable to (in addition to 2.2):

- Adjust the welding power source to fit the purpose.
- Control the welding power source efficiently.
- Make sound butt welds according to Table T 3.
- Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

6.2 Module T 4

Objective

- To obtain experience in process 141 (TIG-welding) and to be able to produce single sided butt welds in plate in PE and PF position.

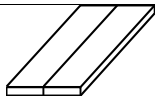
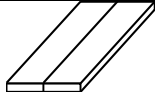
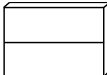
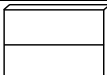
Scope

- See Table T 4.
- The average recommended time for the exercises is about 50hr.

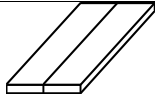
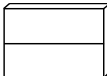
Learning outcomes



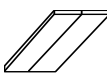
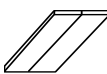
The student is capable to (in addition to 2.2):


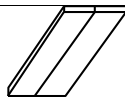
1. Adjust the welding power source to fit the purpose.
2. Control the welding power source efficiently.
3. Make sound butt welds according to Table T 4.
4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

T 3	Practical training				
	Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)				
	Process 141, solid wire				
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	$t > 1$	PA		ss nb
3	Butt weld	$t > 5$	PA		ss nb
4	Butt weld	$t > 1$	PC		ss nb
5	Butt weld	$t > 5$	PC		ss nb

Welding and evaluation of test pieces according to the appropriate part of ISO 9606; only visual testing required.

No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 1$	PA		ss nb
2	Butt weld	$t > 1$	PC		ss nb

T 4	Practical training				
	Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)				
	Process 141, solid wire				
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	$t > 1$	PF		ss nb
3	Butt weld	$t > 5$	PF		ss nb
4	Butt weld	$t > 1$	PE		ss nb
5	Butt weld	$t > 5$	PE		ss nb

Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorised examiner.					
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 1$	PF		ss nb
2	Butt weld	$t > 1$	PE		ss nb

7 Process 141 (TIG-Welding) for Aluminium Material Groups

7.1 Module TAI.3

Objective

- To obtain experience in process 141 (TIG-welding) and to be able to produce double sided butt welds in plate in PA, PC, and PF positions.

Scope

- See Table TAI.3.
- The average recommended time for the exercises is about 50hr.

Learning outcomes

The student is capable to (in addition to 2.2):

- Adjust the welding power source to fit the purpose.
- Control the welding power source efficiently.
- Make sound double sided butt welds in plate connections according to Table TAI.3.
- Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

7.2 Module TAI.4

Objective

- To obtain experience in process 141 (TIG-welding) and to be able to produce single sided butt welds in plate in PA, PC, PF and PE position.

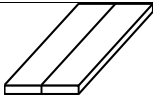
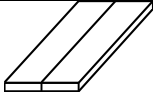
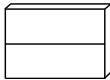

Scope

- See Table TAI.4.
- The average recommended time for the exercises is about 50h.

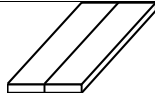

Learning outcomes

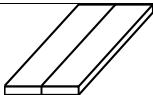
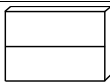
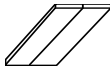

The student is capable to (in addition to 2.2):

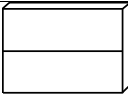
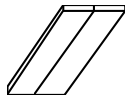
- Adjust the welding power source to fit the purpose.
- Control the welding power source efficiently.
- Make sound single sided butt welds in plate according to Table TAI.4.
- Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

TAI 3	Practical training		Material group 21, 22, 23 (ISO/TR 15608)		
No.	Process 141				
	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	$t \leq 3$	PA		bs without grinding or gouging
3	Butt weld	$t > 6$	PA		bs without grinding or gouging
4	Butt weld	$t \leq 3$	PC		bs without grinding or gouging
5	Butt weld	$t > 6$	PF		bs without grinding or gouging

Welding and evaluation of test pieces according to the appropriate part of ISO 9606; only visual testing required.

No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t \leq 3$	PA		bs without grinding or gouging
2	Butt weld	$t > 6$	PF		bs without grinding or gouging

TAI 4	Practical training		Material group 21, 22, 23 (ISO/TR 15608)		
No.	Process 141				
	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	$t \leq 3$	PA		ss nb
3	Butt weld	$t > 6$	PC		ss nb
4	Butt weld	$t > 1$	PE		ss nb
5	Butt weld	$t \leq 3$	PF		ss nb

Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorized examiner.					
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 6$	PC		ss nb
2	Butt weld	$t \leq 3$	PE		ss nb

8 Process 311 (Gas-Welding) for Ferritic Steel

8.1 Module G 3

Objective

- To obtain basic experience in process 311 (Gas welding) to produce butt welds in plate in PA, PC, PF and PE positions.

Scope

- See Table G 3
- The average recommended time for the exercises is about 50hr.

Learning outcomes

The student is capable to (in addition to 2.2):

- Select the proper burner, the desired burning gas and the required pressures / flows.
- Adjust the welding equipment to fit the purpose.
- Make sound butt welds in plates as specified in Table G 3.
- Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

8.2 Module G 4

Objective

- To obtain experience in process 311 (gas welding) and to be able to produce butt welds in plate in PE position by leftward welding and in PA, PC and PF positions by rightward welding.

Scope


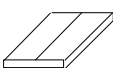

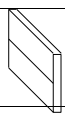
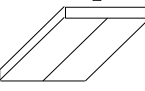
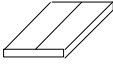
- See Table G 4.
- The average recommended time for the exercises is about 50hr.

Learning outcomes

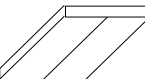
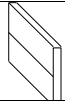
The student is capable to (in addition to 2.2):

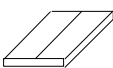

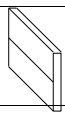
- Select the proper burner, the desired burning gas and the required pressures / flows.
- Adjust the welding equipment to fit the purpose.
- Make sound butt welds in plates as specified in Table G 4.
- Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

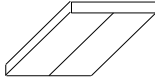

8.3 Training and test pieces for Gas welding of steel

G 3	Practical training					Material group 1 and 11 (ISO/TR 15608)
No.	Process 311					
	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks	
1	Introduction					
2	Bead on plate	Unlimited	PA			
3	Butt weld	$t > 1$	PA		Leftward welding	
4	Butt weld	$t > 1$	PF		Leftward welding	
5	Butt weld	$t > 1$	PC		Leftward welding	
6	Butt weld	$t > 1$	PE		Leftward welding	
7	Flame cutting	$t > 5$				

Welding and evaluation of test pieces according to the appropriate part of ISO 9606; only visual testing required.

No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks	
1	Butt weld	$t > 1$	PA		Leftward welding	
2	Butt weld	$t > 1$	PC		Leftward welding	

G 4	Practical					Material group 1 and 11 (ISO/TR 15608)
No.	Process 311					
	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks	
1	Introduction					
2	Single V-butt weld	$t > 3$	PA		Rightward welding	
3	Single V-butt weld	$t > 3$	PF		Rightward welding	
4	Single V-butt weld	$t > 3$	PC		Rightward welding	

Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorised examiner.					
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 1$	PE		Leftward welding
2	Single V-butt weld	$t > 3$	PF		Rightward welding

9 Practical Tests

Practical tests are the responsibility of an Examiner/Examining Body who/which may be either TWI Certification Ltd's Authorised Examiner or a third party approved by TWI Certification Ltd, according to the needs of the student, the relevant industry or any contracting parties.

It is the responsibility of the Examiner to verify compliance with ISO 9606 or equivalent, in particular with respect to:

1. *Before starting test*

- Checking of the welder's identity (e.g. driving licence)
- Checking of the WPS and handing it over to the welder
- Checking of the test piece
 - Parent material (identification)
 - Dimensions (thickness, length and diameter)
 - Joint preparation (acc. to WPS)
 - Welding position
 - Stamping (welder's and examiner's stamps)
- Checking the tack welds in the test piece
- Identification of the welding consumables (acc. to WPS)

2. *During the test*

- Welding parameters (acc. to WPS) e.g.
 - Current
 - Polarity
 - Voltage
 - Wire feed speed
 - Stand-off distance
 - Gas flow rate
- Interruption of root- and capping run
- Possible permission for repair (**Note Weld imperfections on capping runs must not be removed**)
- Weld time (reasonable)
- Interruption of the test (if welder's capability to carry out the test is insufficient)

3. *After welding*

- Make sure that the required test for the particular approval test are carried out (test reports)
 - Visual inspection, ISO 17637
 - Radiography, ISO 17636
 - Fracture tests, ISO 9017
 - Macro examination, ISO 17639
 - Bend tests, ISO 5173
 - Magnetic particle testing, ISO 17638
 - Penetrant testing, ISO 3452-1
 - Transverse tensile test, ISO 4136
 - That the acceptance levels are fulfilled, ISO 5817, ISO 10042
 - Signing of the welder's certificate. The certificate shall be typed and at least in English.
- Test specimens shall be prepared according to the requirements of ISO 9606 from the

authenticated test pieces by a laboratory approved by TWI Certification Ltd. The Laboratory shall carry out the prescribed tests and return the report forms to the Authorised Examiner.

After successful completion of the theoretical examinations (see CP2 Part 1) and practical tests, TWI Certification Ltd will award the relevant CP2 and IIW Diplomas. The diplomas state the scope of the training and tests undertaken.