



**NATIONAL WELDER TRAINING STANDARD**

**DOCUMENT NO. NWTS-CP2-2-09**

**Code of Practice 2: Training of Craftsman Welders**

**Part 2: Fillet Welding Practical**

2<sup>nd</sup> 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](http://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

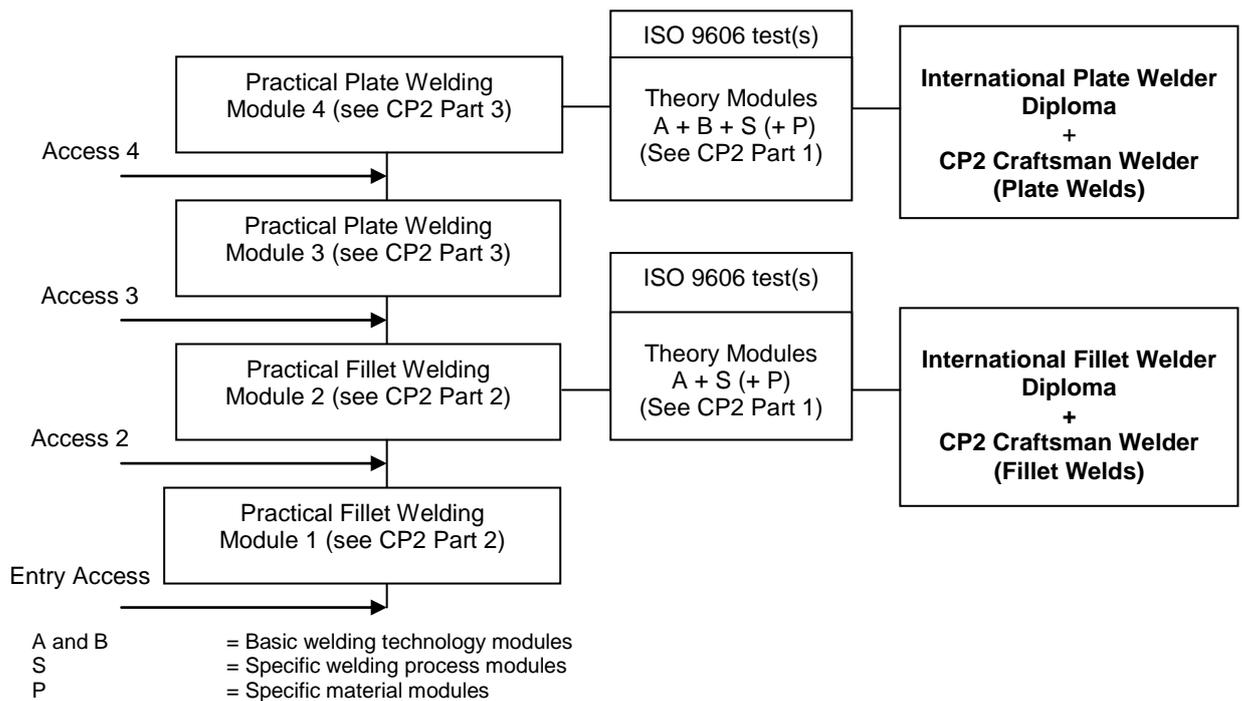
The route to achieving a qualification under CP2 is shown in Figure 1. It can be seen from Figure 1 that there is a direct link between CP2 and the International Welder qualification under the International Institute of Welding (IIW) scheme<sup>1</sup>. Therefore, the outcome from the CP2 programme is 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.

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<sup>1</sup> 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](http://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 2, covers only the practical fillet 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 (e.g. ISO 9606) valid under the scope for the Diploma he/she wants.
- Three 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 to another system. The decision about the range of using 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 E 1**

- **Objective**

1. To obtain basic experience in process 111 (MMA welding) and to be able to produce fillet welds in plate in PA, PB, PF and PG positions.

**Scope**

- See Table E 1
- The average recommended time for the exercises is about 90hr.

**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 welds in different types of joints in plates as specified in Table E 1 in single and multi run technique
4. Perform flame and / or plasma cutting in the range of 3 – 15 mm (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 2**

**Objective**

- To obtain experience in process 111 (MMA welding) and produce fillet welds in plate in PD position and tube-to-plate joints in PB, PD and PH positions.

**Scope**

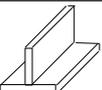
- See Table E 2
- The average recommended time for the exercises is about 50hr.

**Learning outcomes**

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

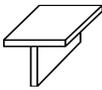
1. Adjust the welding power source to fit the purpose
2. Control the welding power source efficiently
3. Make sound fillet welds in different types of joints as specified in Table E 2 in single and multi run technique.
4. Visually inspect his/her own work and take appropriate action resulting from that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

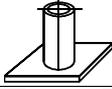
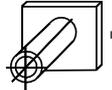
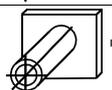
### 3.3 Training and Test Pieces for MMA Welding of Steel

<b>E 1</b>		<b>Practical training</b>				<b>Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)</b>				
		<b>Process 111</b>								
No.	Type of weld	Recommended material Thickness [mm]	Welding position	Sketch	Remarks					
1	Introduction				Both rutile and basic electrodes shall be used in both single and multi run welding.					
2	Bead on plate	Unlimited	PA / PF / PC							
3	Fillet weld, T-joint	$t > 3$	PA							
4	Fillet weld, T-joint	$t > 3$	PB		Welding around the corner					
5	Fillet weld, T-joint	$t > 3$	PF							
6	Fillet weld, corner joint	$t > 3$	PF							
7	Fillet weld, T-joint	$t > 8$	PB		Iron powder electrodes Welding around the corner					
8	Fillet weld, T-joint	$t > 3$	PG							

**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	Fillet weld, T-joint	$t > 3$	PB		
2	Fillet weld, T-joint	$t > 8$	PF		

<b>E 2</b>		<b>Practical training</b>				<b>Material group 1, 2, 3, 8, 10, 11 (ISO (TR) 15608)</b>				
		<b>Process 111</b>								
No.	Type of weld	Recommended material thickness/ diameter [mm]	Welding position	Sketch	Remarks					
1	Introduction				Both rutile and basic electrodes shall be used in both single and multi run welding.					
2	Fillet weld, T-joint	$t > 8$	PD		Welding around the corner					

E 2		Practical training		Material group 1, 2, 3, 8, 10, 11 (ISO (TR) 15608)		
Process 111						
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks	
3	Fillet weld, tube to plate	$t > 3$ $D \geq 40$	PB			
4	Fillet weld, tube to plate	$t > 3$ $D > 150$	PH			
5	Fillet weld, tube to plate	$t > 3$ $40 \leq D \leq 80$	PH			
6	Fillet weld, tube to plate	$t > 3$ $D \geq 40$	PD			

**Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorised examiner.**

No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Fillet weld, tube to plate	$t > 3$ $D \geq 40$	PD		
2	Fillet weld, tube to plate	$t > 3$ $D \geq 40$	PH		

#### 4 Process 135, 136 and 138 (MAG-Welding) for Ferritic and Stainless Steel

In certain cases the training, examination and issuing of diplomas may be limited to any one of the three processes.

##### 4.1 Module M 1

###### Objective

- To obtain basic experience in the MAG welding process (135, 136 and 138) and to be able to produce fillet welds in plate in PA, PB, PD, PF and PG positions.

###### Scope

- See Table M 1
- The average recommended time for the exercises is about 90hr.

###### 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 fillet welds in different types of joints in plates as specified in Table M 1 in single and multi run technique
- Perform flame cutting in the range of 3 – 15 mm (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 2

### Objective

- To obtain experience in relevant MAG welding process (135, 136 and 138) and produce fillet welds in tube to plate joints in PB, PH and PD positions.

### Scope

- See Table M 2
- The average recommended time for the exercises is about 90 h.

### 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 fillet welds in different types of joints in tube to plate connections as specified in Table M 2 in single and multi run technique.
- Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

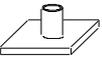
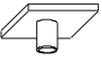
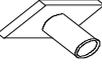
## 4.3 Training and Test Pieces for MAG Welding of Steel

M 1		Practical training				Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)	
		Process 135, 136 and 138					
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks		
1	Introduction				Wherever possible (136), both rutile and basic wires shall be used in both single and multi run		
2	Bead on plate	Unlimited	PA / PF / PG		Process 135		
3	Fillet weld, T-joint	$t > 1$	PA		Single layer, 135-D		
4	Fillet weld, T-joint	$t > 1$	PB		Single layer, 135-D. welding around the corner		
5	Fillet weld, T-joint	$t > 1$	PG		Single layer, 135-D		
6	Fillet weld, corner joint	$t > 1$	PG		Single layer, 135-D Full penetration not required		
7	Fillet weld, T-joint	$t > 8$	PB		Process 135, 136 and 138 welding around the corner		
8	Fillet weld, T-joint	$t > 8$	PF		Process 135, 136 and 138		
9	Fillet weld, T-joint	$t > 8$	PD		Process 135, 136 and 138 welding around the corner		

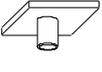
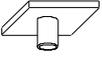
**Welding and evaluation of test pieces according to the appropriate part of ISO 9606; only visual testing required**

No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Fillet weld, T-joint	$t > 1$	PB		Single layer, 135-D
2	Fillet weld, T-joint	$t > 8$	PB		Process 136 multi run
3	Fillet weld, T-joint	$t > 1$	PF		Single layer, 135-D
4	Fillet weld, T-joint	$t > 8$	PF		Process 136 multi run

**M 2 Practical training Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608) Process 135, 136 and 138**

No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Introduction				Wherever possible (136), both rutile and basic flux cored wires shall be used in both single and multi run welding.
2	Fillet weld, Tube to plate	$t > 3$ $D \geq 40$	PB		Process 135
3	Fillet weld, Tube to plate	$t > 3$ $D \geq 40$	PH		Process 135, 136 and 138
4	Fillet weld, Tube to plate	$t > 3$ $D \geq 40$	PD		Process 135, 136 and 138
5	Fillet weld, Tube to plate	$t > 3$ $D \geq 40$	PD		Plate horizontal, pipe approx. 60° position.

**Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorised examiner.**

No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Fillet weld, Tube to plate	$t > 3$ $D \geq 40$	PD		Process 135
2	Fillet weld, Tube to plate	$t > 3$ $D \geq 40$	PD		Process 136
3	Fillet weld, Tube to plate	$t > 3$ $D \geq 40$	PH		Process 135
4	Fillet weld, Tube to plate	$t > 3$ $D \geq 40$	PH		Process 136

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

### 5.1 Module MAI.1

#### Objective

- To obtain basic experience in the MIG welding process (131) and to be able to produce fillet welds in plate in PA, PB, PF and PG positions.

#### Scope

- See Table MAI.1.
- The average recommended time for the exercises is about 75 hr (reduced time, experience assumed).

#### 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 fillet welds in different types of joints in plates as specified in Table MAI.1 in single and multi run technique.
- 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.2

#### Objective

- To obtain experience in the MIG welding process (131) and produce fillet welds in plate in PD position and intube-to-plate joints in PB, PH and PD positions.

#### Scope

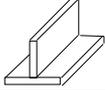
- See Table MAI.2.
- The average recommended time for the exercises is about 75 h (reduced time, experience assumed).

#### Learning outcomes

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

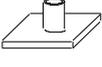
- Adjust the welding power source to fit the purpose.
- Control the welding power source efficiently.
- Make sound fillet welds in different types of joints as specified in Table MAI.2 in single and multi run technique
- Visually inspect his/her own work and take appropriate action resulting from that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

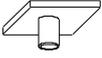
MAI.1	Practical training				
	Material group 21, 22, 23 (ISO/TR 15608)				
No.	Process 131				
	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				

MAI.1	Practical training					Material group 21, 22, 23 (ISO/TR 15608)				
	Process 131									
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks					
2	Bead on plate	Unlimited	PA / PF / PG		Single run					
3	Fillet weld, T-joint	$t > 3$	PA		Single run					
4	Fillet weld, T-joint	$t > 3$	PB		Single run					
5	Fillet weld, T-joint	$t > 3$	PG		Single run					
6	Fillet weld, corner joint	$t > 3$	PG		Full penetration not required, single run					
7	Fillet weld, T-joint	$t > 8$	PB		Multi run welding around the corner					
8	Fillet weld, T-joint	$t > 8$	PG		Single run					
9	Fillet weld, T-joint	$t > 8$	PF		Multi run, welding around the corner					

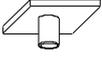
**Welding and evaluation of test pieces according to the appropriate part of ISO 9606; only visual testing required.**

No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Fillet weld, T-joint	$t > 8$	PB		Multi run
2	Fillet weld, T-joint	$t > 3$	PF		Single run

MAI.2	Practical training					Material group 21, 22, 23 (ISO/TR 15608)				
	Process 131									
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks					
1	Introduction									
2	Fillet weld, T-joint	$t > 8$	PD		Multi run welding around the corner					
3	Fillet weld, tube to plate	$t > 3$ $D \geq 60$	PB							

MAI.2	Practical training		Material group 21, 22, 23 (ISO/TR 15608)		
	Process 131				
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
4	Fillet weld, tube to plate	t > 3 D ≥ 60	PH*		
5	Fillet weld, tube to plate	t > 3 D ≥ 60	PD		

\*According to ISO 6947:2011 welding position PF for tubes has been changed to test position PH covering PE, PF and PA.

Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorized examiner.					
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Fillet weld, tube to plate	t > 3 D ≥ 60	PD		
2	Fillet weld, tube to plate	t > 3 D ≥ 60	PH*		

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

### 6.1 Module T 1

#### Objective

- To obtain basic experience in process 141 (TIG welding) and to be able to make fillet welds in plate in PA, PB and PF positions.

#### Scope

- See Table T 1
- The average recommended time for the exercises is about 50 hr.

#### 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 fillet welds in different types of joints as specified in Table T 1
- Perform gas or plasma cutting in the range of 3 – 15 mm (not tested).
- 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 2

### Objective

- To obtain experience in process 141 (TIG-welding) and produce fillet welds in plate in PD position and in tube to plate joints and pipe in PB, PD and PH positions.

### Scope

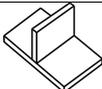
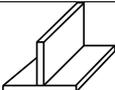
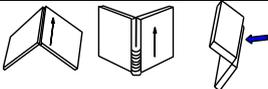
- See Table T 2
- The average recommended time for the exercises is about 50hr.

### Learning outcomes

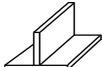
The student is capable to (in addition to 2.2):

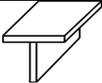
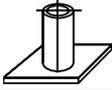
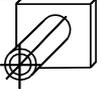
- Adjust the welding power source to fit the purpose.
- Control the welding power source efficiently.
- Make sound fillet welds in different types of joints as specified in Table T 2.
- Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

## 6.3 Training and Test Pieces for TIG Welding of Steel

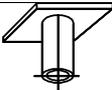
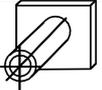
T 1	Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)				
	Process 141				
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				Remelting (dressing) the top layer is not permitted.
2	Bead on plate	Unlimited	PA, PF, PC		
3	Fillet weld, T-joint	$t > 1$	PA		
4	Fillet weld, T-joint	$t > 1$	PB		
5	Fillet weld, T-joint	$t > 1$	PF		
6	Outside fillet weld, corner joint	$t > 1$	PA, PF, PC		Full penetration weld

**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	Fillet weld, T-joint	$t > 1$	PB		
2	Fillet weld, T-joint	$t > 1$	PF		

T 2		Practical training				Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)	
No.	Type of weld	Recommended material thickness/ diameter [mm]	Welding position	Sketch	Process 141, solid wire		
					Remarks		
1	Introduction						
2	Fillet weld, tube to plate	$t > 1$	PD				
3	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PB				
4	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PD				
5	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PH				

Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorised examiner.

No.	Type of weld	Recommended material thickness/ diameter [mm]	Welding position	Sketch	Remarks
1	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PD		
2	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PH		

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

### 7.1 Module TAI.1

#### Objective

- To obtain basic experience in process 141 (TIG welding) and to be able to make fillet welds in plate in PA, PB and PF positions.

#### Scope

- See Table TAI.1.
- 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 fillet welds in different types of joints as specified in Table TAI.1.
- 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.2

### Objective

- To obtain experience in process 141 (TIG-welding) and produce fillet welds in plate in PD and in tube-to-plate joints in PB, PD and PH positions.

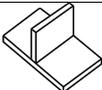
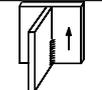
### Scope

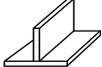
- See Table TAI.2.
- The average recommended time for the exercises is about 50hr.

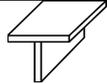
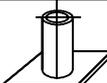
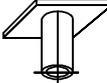
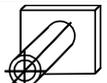
### Learning outcomes

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

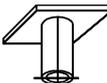
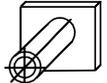
- Adjust the welding power source to fit the purpose.
- Control the welding power source efficiently.
- Make sound fillet welds in different types of joints as specified in Table TAI.2.
- Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

TAI 1	Practical training					Material group 21, 22, 23 (ISO/TR 15608)				
	Process 141									
No.	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks					
1	Introduction				Re-melting (dressing) the top layer is not permitted.					
2	Bead on plate	Unlimited	PA, PF, PC							
3	Fillet weld, T-joint	$t > 1$	PA							
4	Fillet weld, T-joint	$t > 1$	PB							
5	Fillet weld, T-joint	$t > 1$	PF							
6	Outside fillet weld, corner joint	$t > 1$	PA, PF, PC		Full penetration weld					

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	Fillet weld, T-joint	$t > 1$	PB		
2	Fillet weld, T-joint	$t > 1$	PF		

TAI 2	Practical training		Material group 21, 22, 23 (ISO/TR 15608)		
No.	Process 141				
	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Introduction				Re-melting (dressing) the top layer is not permitted.
2	Fillet weld, T-joint	$t > 1$	PD		
3	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PB		
4	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PD		
5	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PH*		

\*According to ISO 6947:2011 welding position PF for tubes has been changed to test position PH covering PE, PF and PA.

Qualification tests according to the appropriate part of ISO 9606 examined by an independent authorized examiner.					
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PD		
2	Fillet weld, tube to plate	$t > 1$ $40 \leq D \leq 80$	PH*		

## 8 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**

- a) Checking of the welder's identity (e.g. driving licence)
- b) Checking of the WPS and handing it over to the welder
- c) 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)
- d) Checking the tack welds in the test piece
- e) Identification of the welding consumables (acc. to WPS)

### 2. **During the test**

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

### 3. **After welding**

- a) 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
- b) That the acceptance levels are fulfilled, ISO 5817, ISO 10042
- c) Signing of the welder's certificate.

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.