



NATIONAL WELDER TRAINING STANDARD

DOCUMENT NO. NWTS-CP3-1-09

Code of Practice 3: Training of Master Welders (Theory and Practical)

2nd 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 Master Welder is defined as a person who has undergone a comprehensive programme of theoretical and practical training in arc welding; and has demonstrated theoretical and practical skills in accordance with recognised standards in all welding positions.

All NWTS documents may be downloaded at www.CSWIP.com

1.2 Structure of CP3

The route to achieving a qualification under CP3 is shown in Figure 1. It can be seen from Figure 1 that there is a direct link between CP3 and the International Tube Welder qualification under the International Institute of Welding (IIW) scheme¹. Therefore the outcome from the CP3 programme is both the NWTS and the IIW qualification. The latter ensures that the welder's knowledge and skill 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 CP3 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.

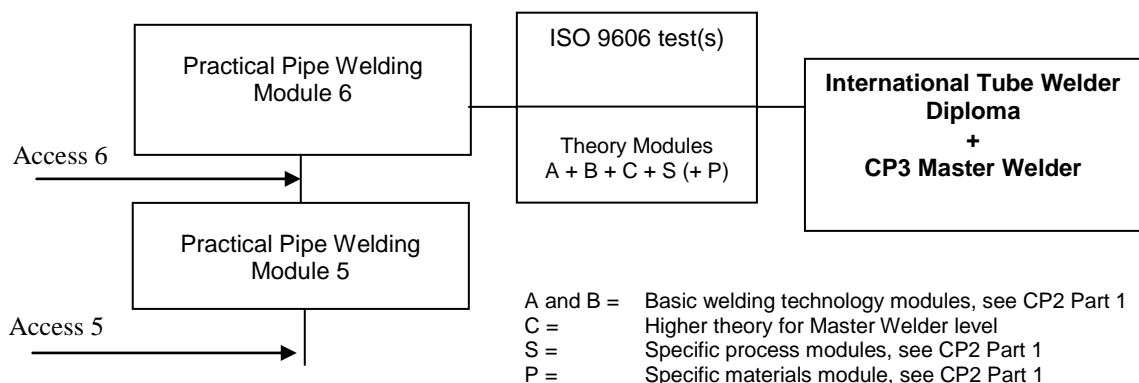


Figure 1 The overall structure of the training and examination under CP3.

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.

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

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 5: Either: Hold CP2 Plate Welder qualification, or demonstrate the required level of skill by passing the full examination as described in module 2 and in module 4, see CP2, Parts 1, 2 and 3

Access to 6: Demonstrate the required level of skill by passing the full examination as described in module 2 and in module 4, see CP2 Parts 1, 2 and 3, and by passing the tests as described in module 5.

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

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, email: twicertification@twi.o.uk.

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.
- 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 Fig 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.

1.5 Instruction Programme

The theoretical education given to the students aims at a basic understanding of the appropriate welding process and the materials behaviour including standards and safety regulations. The themes and keywords are given as 'scope' in the module descriptions, together with the 'objective' and the 'Learning outcomes. After each module a theoretical examination is required.

The practical training advised in this guideline will bring the students to the comprehensive skill, required for practical work in industry.

The recommended periods of time given in table C and in the practical part represent the average time required to attain the expected level of knowledge. The time needed may vary individually according to the capability of the student. A teaching hour will contain at least 50 minutes of direct teaching time. It is not obligatory to follow exactly the order of the topics given in this guideline.

2 Theoretical Education

Module C

The module C provides in addition to module A and B, theoretical education to the level of CP3 Master Welder and International Tube Welder. The matters to be dealt with and the recommended hours devoted to them are listed below. Details of Modules A and B, and other theoretical modules can be found in CP2 Part 1.

2.1 Items for the theoretical education

2.1.1 C.1 Welded joints in pipes (2hr)

Objective

- Know the different connections in pipe welding.

Scope

- Butt welds in pipes; in-line and at an angle; the importance of gas backing
- Tube to plate welds
- Branch connections (set-on, set-in and set-through)
- Adaptation of joint preparation methods for pipes.

Learning outcomes

1. Identify the following joint preparations: I-, V-, X-, and U- preparations.
2. Identify and sketch tube to plate welds, branch connections
3. Describe the different methods for joint preparation of pipes.

2.1.2 C.2 Materials other than non-alloy steel (2hr)

Objective

- Know about the most important other materials and their behaviour.

Scope

- Stainless steels and other alloys
- Aluminium alloys
- Copper alloys
- Nickel alloys
- Titanium and other special materials
- Typical problems when welding the above materials.

Learning outcomes

1. Know materials: stainless steels, other alloy steels and aluminium
2. Outline typical problems when welding stainless steels, other alloy steels, and aluminium.

2.1.3 C.3 Review and consequences of failures (2hr)

Objective

- Know why welds may fail, what the consequences could be and what the role of the welder might be.

Scope

- Revision of safety requirements of welded products
- Review of product failures due to bad performance of welding
- Implication of failure; product liability.

Learning outcomes

1. Give examples of failures and their consequences
2. Know the key role of the welder in avoiding failures.

2.1.4 C.4 international welding standards (1hr)

Objective

- Have basic knowledge about the harmonised system of International Standards.

Scope

- Role and operation of CEN and ISO; relationship with National Standards Organisations
- Standards for welding equipment and welding consumables
- Standards for welding practice
- Product Standards which contain welding requirements
- Standards for Quality and Co-ordination in welding.

Learning outcomes

1. Name the most important International and national standards for welding.

Total number of recommended hours for C: 7hr

3 Practical Training and Tests

3.1 General

This Guideline applies mainly to ferritic steels (group 1, 2, 3 and 11 according to CR/ISO TR 15608) and – where applicable – stainless steels (group 8 and 10 according to CR/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 principal approval of 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.

3.2 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).

3.3 Process 111 (MMA-welding) for ferritic and stainless steel

3.3.1 Module E 5

Objective

- To obtain experience in process 111 (MMA welding) and to be able to produce single sided butt welds in pipe in PA, PC and PH positions.

Scope

- See Table E 5.
- The average recommended time for the exercises is about 75hr.

Learning outcomes

- The student is capable to (in addition to 3.2):
 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 pipe as specified in table E 5 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

3.3.2 Module E 6

Objective

- To obtain experience in process 111 (MMA welding) and to be able to produce single sided butt welds in pipe in PH and H-L045 positions.

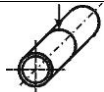


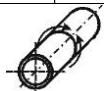
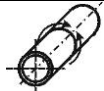

Scope

- See Table E 6
- The average recommended time for the exercises is about 75hr.


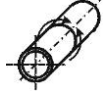
Learning outcomes

- The student is capable to (in addition to 3.2):
 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 pipes as specified in table E 6 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.

3.3.3 Training and test pieces for MMA welding of steel

E 5		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		
1	Introduction						
2	Butt weld	$t > 3$ $D \geq 100$	PA		ss nb		
3	Butt weld	$t > 3$ $D \geq 100$	PC		ss nb		
4	Butt weld	$t > 3$ $40 \leq D \leq 80$	PC		ss nb		
5	Butt weld	$t > 3$ $D \geq 100$	PH		ss nb		
6	Butt weld	$t > 3$ $40 \leq D \leq 80$	PH		ss nb		
7	Butt weld	$t > 3$ $40 \leq D \leq 80$	PH		Full penetration		

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 / diameter [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 3$ $D \geq 40$	PC		ss nb
2	Butt weld	$t > 3$ $D \geq 40$	PH		ss nb

E 6		Practical training				Material group 1, 2, 3, 8, 10, 11 (ISO/TR 1560)	
		Process 11					
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks		
1	Introduction						
2	Tube to plate	$t > 3$ $40 \leq D \leq 80$	PH		Free choice of joint preparation; full penetration		
3	Branch connection butt weld (set on)	$t > 3$ $D \geq 40$	H-L045		D = outside pipe diameter d = branch = 0,5 · D		
4	Butt weld	$t \geq 5$ $D \geq 100$	H-L045		ss nb		
5	Butt weld	$t > 3$ $40 \leq D \leq 80$	H-L045		ss nb		
6	Tube to tube flange	$t > 3$ $40 \leq D \leq 80$	H-L045				

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	Butt weld	$t > 3$ $40 \leq D \leq 80$	H-L045		ss nb
2	Butt weld	$t > 3$ $D \geq 100$	H-L045		ss nb

3.4 Process 135 and 136 (MAG-welding) for ferritic and stainless steel

3.4.1 Module M 5

Objective

- To obtain experience in the MAG welding process (135, 136 and 138) and to be able to make single sided butt welds in pipe in PA, PC and PH positions.

Scope

- See Table M 5.
- The average recommended time for the exercises is about 75hr.

Learning outcomes

- The student is capable to (in addition to 3.2):
 - Adjust the welding power source to fit the purpose
 - Control the welding power source efficiently

3. Make sound butt welds in different types of joints in pipes as specified in table M 5 in single and multi run techniques.
4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control

3.4.2 Module M 6

Objective

- To obtain experience in the MAG welding process (135,136 and 138) and to be able to produce single sided butt welds in pipe in H-L045 position.




Scope

- See Table M 6.
- The average recommended time for the exercises is about 50 hr.





Learning outcomes



- The student is capable to (in addition to 3.2):
 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 as specified in table M 6 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

3.4.3 Training and test pieces for MAG welding of steel



M 5	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				
2	Butt weld	t > 3 D ≥ 100	PA		process 135, 138 and 13 ¹ ss nb
3	Butt weld	t > 3 D ≥ 100	PH		process 135, 138 and 136 ¹ ss nb
4	Butt weld	t > 3 D ≥ 100	PC		process 135, 138 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 / diameter [mm]	Welding position	Sketch	Remarks
1	Butt weld	t > 3 D ≥ 100	PC		process 135 ss nb
2	Butt weld	t > 3 D ≥ 100	PC		process 136 ¹ ss nb
3	Butt weld	t > 3 D ≥ 100	PH		process 135 ss nb
4	Butt weld	t > 3 D ≥ 100	PH		process 136 ¹ ss nb

M 6	Practical training					Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)				
	Process 135 and 136									
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks					
1	Introduction									
2	Butt weld	t > 3 D ≥ 100	H-L045		process 135, 138 and 136 ¹ ss nb					
3	Branch connection butt weld (set on)	D ≥ 40 t > 3	H-L045		process 135, 138 and 136 ¹ D = pipe d = branch 0.5 D					

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	Butt weld	t > 3 D ≥ 100	H-L045		process 138. ss nb
2	Butt weld	t > 3 D ≥ 100	H-L045		process 136 ¹ , ss nb ¹

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

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

¹ Root run may be done with metal cored wire.

3.5 Process 141 (TIG-welding) for ferritic and stainless steel

3.5.1 Module T 5

Objective

- To obtain experience in process 141 (TIG-welding) and to be able to produce single sided butt welds in pipe in PA, PC, PH and H-L045 positions using relatively thin materials.
- Welding with consumable inserts is recommended in at least one exercise (not mandatory)

Scope

- See Table T 5.
- The average recommended time for the exercises is about 50hr.

Learning outcomes

- The student is capable to (in addition to 3.2):
 1. Adjust the welding power source to fit the purpose.
 2. Control the welding power source efficiently.
 3. Make sound butt welds in pipe as specified in table T 5.
 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

3.5.2 Module T 6

Objective

- To obtain experience in process 141 (TIG-welding) and to be able to produce single sided butt welds in PA, PC, PH and H-L045 position using relatively thick materials.





Scope



- See Table T 6
- The average recommended time for the exercises is about 50hr.






Learning outcomes


- The student is capable to (in addition to 3.2):
 1. Adjust the welding power source to fit the purpose
 2. Control the welding power source efficiently
 3. Make sound butt welds in pipe in different types of joints as specified in table T 6.
 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

3.5.3 Training and Test Pieces for TIG Welding of Steel

T 5	Practical training		Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)		
	Process 141, solid wire				
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	$t > 1$ $40 \leq D \leq 80$	PA		ss nb
3	Butt weld	$t > 1$ $40 \leq D \leq 80$	PC		ss nb
4	Butt weld	$t > 1$ $40 \leq D \leq 80$	PH		ss nb
5	Butt weld	$t > 1$ $40 \leq D \leq 80$	H-L045		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 / diameter [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 1$ D free choice	PC		ss nb
2	Butt weld	$t > 1$ D free choice	PH		ss nb

T 6		Practical training				Material group 1, 2, 3, 8, 10, 11 (ISO/TR 15608)	
		Process 141, solid wire					
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks		
1	Introduction						
2	Butt weld	$t > 5$ $40 \leq D \leq 80$	PA		ss nb		
3	Butt weld	$t > 5$ $40 \leq D \leq 80$	PC		ss nb		
4	Butt weld	$t > 5$ $40 \leq D \leq 80$	PH		ss nb		
5	Butt weld	$t > 5$ $40 \leq D \leq 80$	H-L045		ss nb		
6	Branch connection butt weld (set on)	$t > 3$ $40 \leq D \leq 80$	H-L045		D = pipe d = branch = 0,5 · D		

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	Butt weld	$t > 1$ D free choice	H-L045		ss nb

3.6 Process 141 (TIG-welding) for aluminium material groups.

3.6.1 Module TAI.5

Objective

- To obtain experience in process 141 (TIG-welding) and to be able to produce single sided butt welds in pipe in PA, PC, PH and H-L045 positions using relatively thick materials.

Scope

- See Table TAI.5.
- The average recommended time for the exercises is about 50hr.

Learning outcomes:

- The student is capable to (in addition to 3.2):
 - Adjust the welding power source to fit the purpose.
 - Control the welding power source efficiently.
 - Make sound single sided butt welds in pipe as specified in table TAI.5.

4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

3.6.2 Module TAI.6

Objective





- To obtain experience in process 141 (TIG-welding) and to be able to produce single sided butt welds in pipe in PC, PH and H-L045 positions using relatively thin materials.

Scope

- See Table TAI.6.
- The average recommended time for the exercises is about 50h.

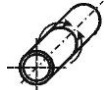

Learning outcomes

- The student is capable to (in addition to 3.2):
 1. Adjust the welding power source to fit the purpose.
 2. Control the welding power source efficiently.
 3. Make sound single sided butt weld in different types of joints in pipe as specified in table TAI.6.
 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

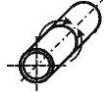



TAI 5	Practical training		Material group 21, 22, 23 (ISO/TR 15608)		
	Process 141				
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	t > 6 D = free choice	PA		ss nb
3	Butt weld	t > 6 D = free choice	PC		ss nb
4	Butt weld	t > 6 D = free choice	PH*		ss nb
5	Butt weld	t > 6 D = free choice	H-L045		ss nb

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

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


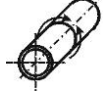
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Butt weld	$t > 6$ D = free choice	PH*		ss nb
2	Butt weld	$t > 6$ D = free choice	H-L045		ss nb

TAI 6 Practical training Material group 21, 22, 23 (ISO/TR 15608)

Process 141					
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	$t \leq 3$ D = free choice	PH*		ss nb
3	Butt weld	$t \leq 3$ D = free choice	PC		ss nb
4	Butt weld	$t \leq 3$ D = free choice	H-L045		ss nb
5	Branch connection butt weld (set on)	$t \leq 3$ D = free choice	H-L045		D = pipe d = branch = 0,5 · D

*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	Butt weld	$t \leq 3$ D = free choice	PC		ss nb
2	Butt weld	$t \leq 3$ D = free choice	PH*		ss nb

3.7 Process 311 (gas-welding) for ferritic steel

3.7.1 Module G 5

Objective

- To obtain experience in process 311 (gas welding) and to be able to produce single sided butt welds in pipe in PH, PC and H-L045 positions by leftward welding.

Scope

- See Table G 5
- The average recommended time for the exercises is about 50hr.

Learning outcomes

- The student is capable to (in addition to 3.2):
 1. Select the proper burner, the desired burning gas and the required pressures / flows.
 2. Adjust the welding equipment to fit the purpose
 3. Make sound butt welds in pipes as specified in table G 5.
 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.

3.7.2 Module G 6

Objective

- To obtain experience in process 311 (gas welding) and to be able to produce single sided butt welds in H-L045 position by leftward welding and in PH, PC and H-L045 by rightward welding.




Scope

- See Table G 6
- The average recommended time for the exercises is about 50hr.



Learning outcomes





- The student is capable to (in addition to 3.2):
 1. Select the proper burner, the desired burning gas and the required pressures / flows
 2. Adjust the welding equipment to fit the purpose
 3. Make sound butt welds in different types of pipes as specified in table G 6.
 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control.



3.7.3 Training and test pieces for gas welding of steel

G 5		Practical training				Material group 1 and 11 (ISO/TR 15608)	
		Process 311					
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks		
1	Introduction						
2	Butt Weld	$t > 1$ $D > 25$	PH		Leftward welding ss nb		
3	Butt Weld	$t > 1$ $D > 25$	PC		Leftward welding ss nb		
4	Butt weld	$t > 1$ $D > 25$	H-L045		Leftward welding 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 / diameter [mm]	Welding position	Sketch	Remarks
1	Butt Weld	$t > 1$ $D > 25$	PH		Leftward welding ss nb
2	Butt Weld	$t > 1$ $D > 25$	PC		Leftward welding ss nb

G 6		Practical training				Material group 1, 2, 3, 8, 10 and 11 (ISO/TR 15608)	
		Process 311					
No.	Type of weld	Recommended material thickness / diameter [mm]	Welding position	Sketch	Remarks		
1	Introduction						
2	Butt weld	$t > 3$ $D > 25$	PH		Rightward welding ss nb		
3	Butt weld	$t > 3$ $D > 25$	PC		Rightward welding ss nb		
4	Butt weld	$t > 3$ $D > 25$	H-L045		Rightward welding ss nb		
5	Branch connection butt weld (set on)	$t > 1$ $D \geq 40$	H-L045		$D = \text{pipe}$ $d = \text{branch} = 0,5 \cdot D$		

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	Butt weld	t > 1 D > 25	H-L045		Leftward welding ss nb
2	Butt weld	t > 3 D > 25	H-L045		Rightward welding ss nb

4 EXAMINATIONS AND TESTS

4.1 Theoretical examinations

If they have not already done so, candidates must successfully complete the theoretical examination described in CP2 Part 1. After module C there is a final theoretical examination of the multi-choice type. It will be set under the authority of TWI Certification Ltd.

The Module C examination, if taken alone, shall consist of 14 questions and have a duration of 15 minutes.

The theoretical examinations pass mark is 60% for each module. Failure in theoretical parts of the examinations requires re-examination in the part failed. A third failure requires re-entry into the module leading to the examination

4.2 Practical tests

Practical tests are the responsibility of an n 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. 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 TWI Certification Ltd approved laboratory. The Laboratory shall carry out the prescribed tests and return the report forms to the Authorised Examiner.

4.3 **Diplomas**

After successful completion of the theoretical examinations and practical tests, TWI Certification Ltd will award the relevant CP3 and IIW Diplomas. The diplomas state the scope of training and tests undertaken.